EASTERN

DC-9 STRUCTURAL REPAIR

REVISION CHECK SHEET

All revisions to this Manual will be accompanied by a numbered transmittal sheet. Place the date on which the revision was received opposite the matching number on this page. By use of this sheet you will be able to tell when you have received a revision. If you find that you have not received a certain revision, it is your responsibility and duty at that time to contact the Manual Library requesting the revision by the Manual and Revision Number. Address your request for missing revisions to the Manuals Library, Base Administration, Miami. If necessary to teletype use symbol: MIAGG - MANUALS LIBRARY. This check sheet to remain in Manual. DO NOT REMOVE.

REV. NO.	DATE REC.	REV. NO.	DATE REC.	REV. NO.	DATE REC.	REV. NO.	DATE REC.
1	1/11	14	9/2	27	12/30	40	
2	1/13/66	15	9/2	28	12/30	41	
3		16	9/3	29	1/17/67	42	
4	1/20/66	17	8/31	30	1/17	43	
5		18	9/3	31		44	
6	1/28/66	19	9/19	32		45	
7	2/3/66	20	10/11	33		46	
8	2/10/66	21	10/11	34		47	
9	3/17/66 RD	22	10/11	35		48	
10	4/8/66 RD	23	10/11	36		49	
11	4/27/66	24	11/15	37		50	
12	9/2	25	12/19	38		51	
13	9/2	26	12/30	39		52	

Revision Check Sheet No. 1

REV. NO.	DATE REC.	REV. NO.	DATE REC.	REV. NO.	DATE REC.	REV. NO.	DATE REC.
53		70		87		104	
54		71		88		105	
55		72		89		106	
56		73		90		107	
57		74		91		108	
58		75		92		109	
59		76		93		110	
60		77		94		111	
61		78		95		112	
62		79		96		113	
63		80		97		114	
64		81		98		115	
65		82		99		116	
66		83		100		117	
67		84		101		118	
68		85		102		119	
69		86		103		120	

DC-9

STRUCTURAL REPAIR MANUAL

PUBLISHED BY

DOUGLAS AIRCRAFT CO., INC. LONG BEACH, CALIF., U. S. A.

Printed in U.S.A.

TO: ALL HOLDERS OF THE DC-9 STRUCTURAL REPAIR MANUAL

CONCERNING: REVISION 5, DATED DEC 1/66

SUMMARY:

Chapter Section Subject	
Introduction:	Added "How to Use the Manual" illustrations and added new entries to airplane identification list.
51-00	Deleted definition of interim repairs. Revised airplane structural component index illustrations. Deleted explanation of model and type variations (now in illustration form). Miscellaneous revisions to other illustrations.
51-01	Added section on airplane exterior negligible damage repair.
51-10-1	Added extrusion information.
51-10-3	Added new aircraft cleaner and new stripper to list of approved cleaning materials.
51-21-0	Added note to safety precautions.
51-23-0	Added section on integral fuel tank leak detection and repair.
51-40-0	Revised fuselage station diagram illustrations.
51-70-1	Deleted reference to interim repairs.
51-70-2	Added three adhesives to list.
52-20-0	Revised passenger aft entrance stairwell door illustration.
52-30-0	Revised upper cargo door illustration.
52-60-0	Revised passenger aft entrance door stairway illustration.
53-05	Added information on ADF sense antenna metal element panel repair and wing-to-fuselage upper fillet crack repair.
53-10-1	Revised fuselage structure illustrations.
53-10-2	Revised fuselage structure illustrations.
53-10-3	Revised fuselage structure illustrations.

Chapter Section Subject	
53-11-2	Revised fuselage structure illustrations.
53-11-3	Revised fuselage structure illustrations.
53-21-0	Revised cargo compartment illustration.
53-30-0	Revised fuselage plating illustrations.
53-31-0	Revised fuselage plating illustrations.
53-50-0	Revised illustrations in cones, fillets, and fairings section.
53-51-0	Revised illustrations in cones, fillets, and fairings section.
54-02	Added paragraph and illustration on pylon glass fiber trailing edge repair.
54-10-0	Revised nacelle/pylon main frame illustrations.
54-20-0	Revised nacelle/pylon auxiliary structure illustrations.
54-30-0	Revised nacelle/pylon plating illustrations.
55-03	Added paragraph and illustration on bonding Mylar covers to the vertical stabilizer.
55-10-0	Revised horizontal stabilizer plating and structure illustrations.
55-11-0	Revised horizontal stabilizer plating and structure illustrations.
55-20-0	Revised elevator plating and structure illustrations.
55-21-0	Revised elevator plating and structure illustrations.
55-30-0	Revised vertical stabilizer structure and plating illustrations.
56-10-0	Revised flight compartment window illustrations.
56-20-0	Revised cabin compartment window illustrations.
57-00	Revised wing index illustration.
57-03	Revised flap and aileron trailing edge repair information.
57-07	Added information on flap expansion joint cover repair.
57-10-1	Revised wing main frame illustrations.

Chapter Section Subject	
57-10-2	Revised wing front and rear spar illustrations.
57-11-1	Revised trapezoidal panel structure illustration.
57-11-2	Revised wing reap spar illustration.
57-20-0	Revised wingtip structure illustration.
57-30-1	Revised wing leading edge plating illustration.
57-30-2	Revised wingtip plating illustration.
57-50-2	Revised aileron illustrations.
57-50-3	Revised flaps and vanes illustrations.
57-50-8	Revised slat illustrations.
57-50-9	Revised flap hinge fairings, plating, and structure illustrations.
Alphabetical Index	Revised to reflect changes made by this revision.

NOTE: Remove all temporary revisions (yellow pages) dated prior to Dec 1/66.

Remove		Insert	
Subject	Page	Subject	Page
Intro. Eff.	1	Intro. Eff.	1
Intro.	vi thru xxvii	Intro.	vi thru xxxix
51-Eff.	1 thru 6	51-Eff.	1 thru 6
51-Cont.	1 thru 3	51-Cont.	1 thru 3
51-Sect. App.	1	51-Sect. App.	1 and 2
51-00	1 thru 4B, 5 thru 6B, 7 thru 10, 13 and 14	51-00	1 thru 4A, 5 thru 6B, 7 thru 10, 13 and 14
None		51-01	1

Remove		Insert	
Subject	Page	Subject	Page
51-10-1	1 thru 6B, 11 and 12, 21 and 22, 26A thru 28, 33 thru 36, 39 and 40, 41 and 42, 46A thru 48D, 51 and 52	51-10-1	1 thru 6B, 11 and 12, 21 and 22, 26A thru 28A, 33 thru 36, 39 and 40, 41 and 42, 46A thru 48E, 51 and 52
51-10-3	29 and 30	51-10-3	29 and 30
51-10-5	1 and 2	51-10-5	1 and 2
51-21-0	1 and 2	51-21-0	1 and 2
None		51-23-0	1 thru 4
51-40-0	4A thru 4C	51-40-0	4A thru 4C
51-70-1	7 and 8, 9 and 10	51-70-1	7 and 8, 9 and 10
51-70-2	3 and 4	51-70-2	3 and 4
52-Eff.	1 and 2	52-Eff.	1 and 2
52-Cont.	1 and 2	52-Cont.	1 and 2
52-Type Var.	1	52-Type Var.	1
52-Sect. App.	1	52-Sec. App.	1
52-06	1 and 2	52-06	1 and 2
None		52-10-0	3 thru 6
52-20-0	3 thru 7	52-20-0	3
52-30-0	7	52-30-0	7
52-60-0	3 thru 6	52-60-0	3 thru 6
53-Eff.	1 thru 5	53-Eff.	1 thru 5
53-Type Var.	1 thru 9	53-Type Var.	1 thru 10
None		53-05	17 thru 20
53-10-1	5 thru 8	53-10-1	5 thru 8
53-10-2	2C and 7 thru 12	53-10-2	2C and 7 thru 12
53-10-3	5 and 6, 13 thru 16, 19 and 20	53-10-3	5 and 6, 13 thru 16, 19 and 20
53-11-2	7	53-11-2	7
53-11-3	1 and 2, 15 thru 18, 23	53-11-3	1 and 2, 15 thru 18, 23 and 24
53-21-0	7 thru 8A	53-21-0	7 thru 8A
53-30-0	6C thru 10, 15 and 16	53-30-0	6C thru 10, 15 and 16

Remove		Insert	
Subject	Page	Subject	Page
53-31-0	7 thru 10	53-31-0	7 thru 10
53-50-0	1 and 2, 7 thru 10	53-50-0	1 and 2, 7 thru 10
53-51-0	1 and 2, 7 and 8	53-51-0	1 and 2, 7 and 8
54-Eff.	1	54-Eff.	1
54-Cont.	1	54-Cont.	1
None		54-02	5 thru 7
54-10-0	1 thru 11	54-10-0	1 thru 11
54-20-0	1 thru 3	54-20-0	1 thru 3
54-30-0	1 thru 9	54-30-0	1 thru 9
55-Eff.	1 and 2	55-Eff.	1 and 2
55-Type Var.	1	55-Type Var.	1
55-03	7 thru 10	55-03	7 thru 13
55-10-0	1 thru 8	55-10-0	1 thru 8
55-11-0	1 thru 8	55-11-0	1 thru 8
55-20-0	1 thru 9	55-20-0	1 thru 9
55-21-0	1 thru 9	55-21-0	1 thru 9
55-30-0	3, 4, and 9 thru 11	55-30-0	3, 4, and 9 thru 11
56-Eff.	1	56-Eff.	1
56-Cont.	1	56-Cont.	1
56-Sect. App.	1	56-Sect. App.	1
56-10-0	1 thru 3	56-10-0	1 thru 3
56-20-0	1 and 2	56-20-0	1 and 2
57-Eff.	1 thru 4	57-Eff.	1 thru 4
57-Cont.	1 and 2	57-Cont.	1 and 2
57-Sect. App.	1 and 2	57-Sect. App.	1 and 2
None		57-Type Var.	1 and 2
57-00	3	57-00	3
57-03	5, 6 and 9 thru 11	57-03	5, 6 and 9 thru 11
None		57-07	1 thru 3
57-10-1	1 thru 6	57-10-1	1 thru 6
57-10-2	1 thru 5	57-10-2	1 thru 5
57-11-1	5 and 6	57-11-1	5 and 6
57-11-2	3 thru 5	57-11-2	3 thru 5
57-20-2	1 and 2	57-20-2	1 and 2
57-30-1	1 thru 3	57-30-1	1 thru 3
57-30-2	1 and 2	57-30-2	1 and 2
57-50-2	1 thru 9	57-50-2	1 thru 9

Remove		Insert	
Subject	Page	Subject	Page
57-50-3	1 thru 4, 7 and 8	57-50-3	1 thru 4, 6A thru 8
57-50-8	1 thru 6	57-50-8	1 thru 6
57-50-9	3 and 4	57-50-9	3 and 4
57-50-9	7 and 8	57-50-9	6A, 7 and 8
Alpha-Eff.	1	Alpha-Eff.	1
Alpha	3, 4 and 9 thru 12	Alpha	3, 4 and 9 thru 12

Introduction

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date
Title		
Record of Revisions		
*Intro-Eff	1	Dec 1/66
Intro	i	Sep 1/65
Intro	ii	Sep 1/65
Intro	iii	Jun 1/66
Intro	iv	Sep 1/65
Intro	v	Sep 1/65
*Intro	vi	Dec 1/66
*Intro	vii	Dec 1/66
*Intro	viii	Dec 1/66
*Intro	ix	Dec 1/66
*Intro	x	Dec 1/66
*Intro	xi	Dec 1/66
*Intro	xii	Dec 1/66
*Intro	xiii	Dec 1/66
*Intro	xiv	Dec 1/66
*Intro	xv	Dec 1/66
*Intro	xvi	Dec 1/66
*Intro	xvii	Dec 1/66
*Intro	xviii	Dec 1/66
*Intro	xix	Dec 1/66
*Intro	xx	Dec 1/66
*Intro	xxi	Dec 1/66
*Intro	xxii	Dec 1/66
*Intro	xxiii	Dec 1/66
*Intro	xxiv	Dec 1/66
*Intro	xxv	Dec 1/66
*Intro	xxvi	Dec 1/66
*Intro	xxvii	Dec 1/66
*Intro	xxviii	Dec 1/66
*Intro	xxix	Dec 1/66
*Intro	xxx	Dec 1/66
*Intro	xxxi	Dec 1/66
*Intro	xxxii	Dec 1/66
*Intro	xxxiii	Dec 1/66
*Intro	xxxiv	Dec 1/66
*Intro	xxxv	Dec 1/66
*Intro	xxxvi	Dec 1/66
*Intro	xxxvii	Dec 1/66
*Intro	xxxviii	Dec 1/66
*Intro	xxxix	Dec 1/66

*The asterisk indicates pages revised or added by the current revision.

PREFACE

The DC-9 Structural Repair Manual (one of "Seller's instructions" as defined in purchase agreement for DC-9 airplanes) has been prepared to provide structural personnel with detailed instructions for structural repair of the airplane. Information and instructions contained herein are based upon structural repair experience of the Douglas Aircraft Company, Inc., and Airline Operators. Structural repair instructions contained herein are FAA approved.

The DC-9 Structural Repair Manual conforms, basically, to the ATA Specification for Manufacturers' Technical Data No. 100, dated February 1, 1964.

Progressive improvement changes to the airplane prevent the inclusion of provisions with respect to very recent changes and, therefore, reference should be made to the Douglas Service Bulletins, the Douglas Service Magazine, and Service Letters as a supplement to the information contained herein until such time as revisions can be issued reflecting such late modification of the airplane. Structural repair personnel should consult the Douglas Aircraft Company if there is any doubt as to whether or not a particular manual contains the latest revisions. The Douglas Aircraft Company, Inc., reserves the right to make changes to this manual to reflect improved methods of repair by reason of developments in the state of the art or by reason of changes to the airplane.

DOUGLAS AIRCRAFT COMPANY, INC.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

VOLUME I

VOLUME II

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

The DC-9 Structural Repair Manual has been prepared in accordance with the Air Transport Association Specification No. 100. The contents of the manual provide the structural repair mechanic with the information to maintain the original structural integrity of the airplane.

The data herein is coordinated with, and supplements, that which is contained in the Maintenance and Overhaul Manuals for the DC-9 airplanes. In addition, manual style of presentation for illustrated materials is intended for use as a supplement for the DC-9 Non-Destructive Testing Manual.

Chapters appearing in the Structural Repair Manual are assigned the same chapter number as chapters for the identical subjects appearing in the Overhaul and Maintenance Manuals for the DC-9 airplane. The major subjects covered in this manual are: Structures, Doors, Fuselage, Nacelles/Pylons, Stabilizers, Windows, and Wings. The ATA three-dash-number system is used throughout the manual. The first number in each instance indicates the chapter number; the second number, the subject; and the third number, where applicable, a subbreakdown of the subject.

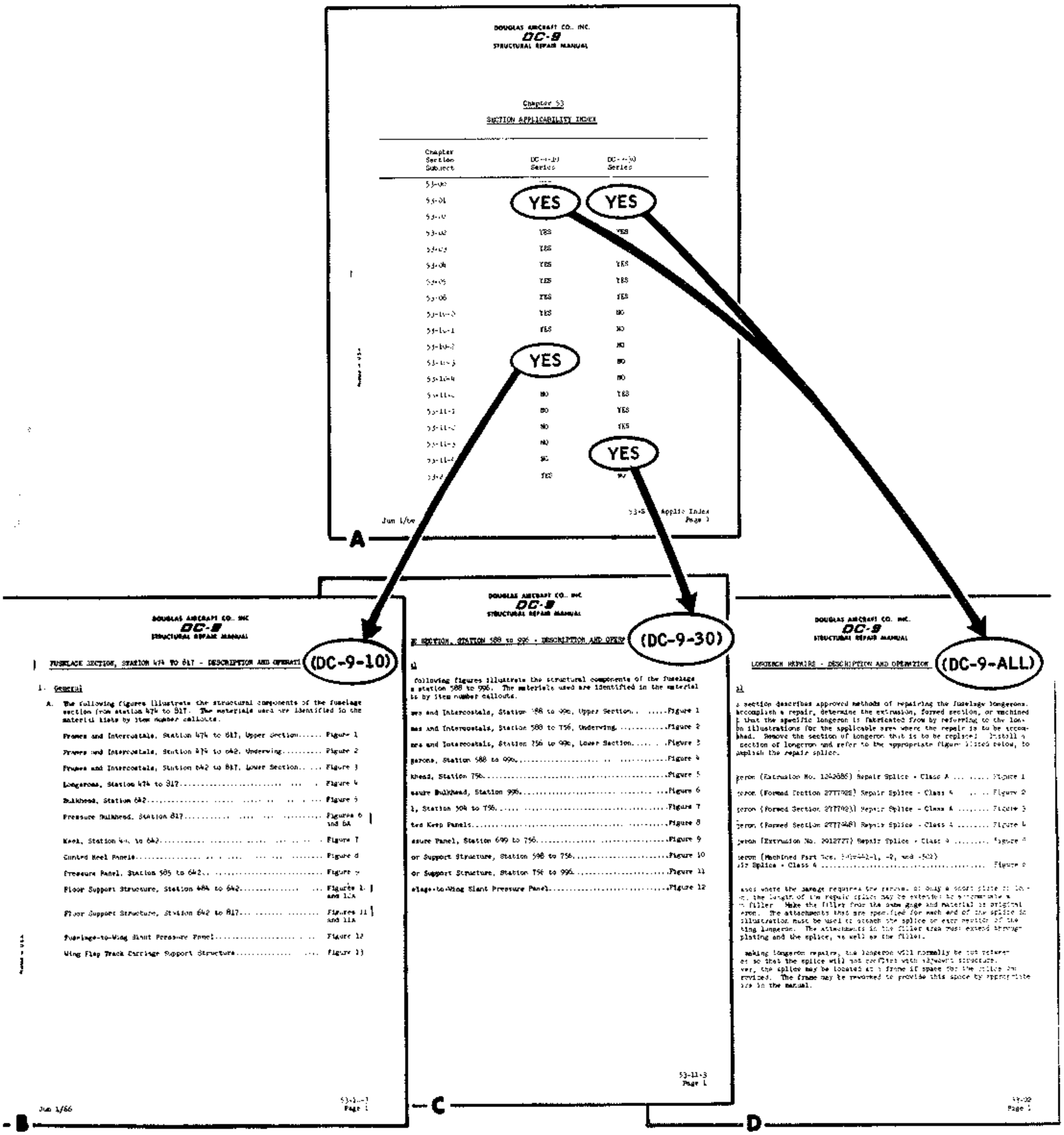
Each chapter presents the various structural components of the airplane in illustrated format. The illustrations depict the types and gages of materials used in original construction. Specific detailed repairs and general repair information are presented in textual and illustrated examples for the repair of components of each chapter. Repair information beyond the scope of the manual which requires specific engineering is not presented in the manual. Such matter may often require the issuance of Douglas Service Bulletins and special repair drawings.

Specific processes and procedures, applicable for general use in accomplishment of the airplane repairs, are presented in Chapter 51, Structures. Repairs listed as Class A, Class B, and Interim are defined in Section 51-00 of the chapter. Damage classified as negligible, repairable, or requiring replacement or specific engineering is also defined within this section.

When structural variations exist due to customer requirements, or revisions to structure, a list of type designations is presented near the front of each chapter. The type designation list is coded to indicate the type of structure applicable to each airplane affected by the variation. An airplane effectivity index is included in the introduction pages in the manual. This index lists airplanes by customer, factory serial number, fleet number, fuselage number, and registration number.

HOW TO USE THE MANUAL - -

APPLICABILITY OF SECTIONS TO AIRPLANE SERIES



A THE SECTION APPLICABILITY INDEX AT THE BEGINNING OF EACH CHAPTER LISTS EVERY SECTION WITHIN THE CHAPTER. "YES" OR "NO" AFTER EACH SECTION LISTING INDICATES WHETHER THE SECTION APPLIES TO DC-9-10 SERIES AIRPLANES, TO DC-9-30 SERIES AIRPLANES, OR TO BOTH.

B SECTIONS THAT PERTAIN TO ONLY DC-9-10 SERIES AIRPLANES HAVE (DC-9-10) IN THEIR SECTION TITLES.

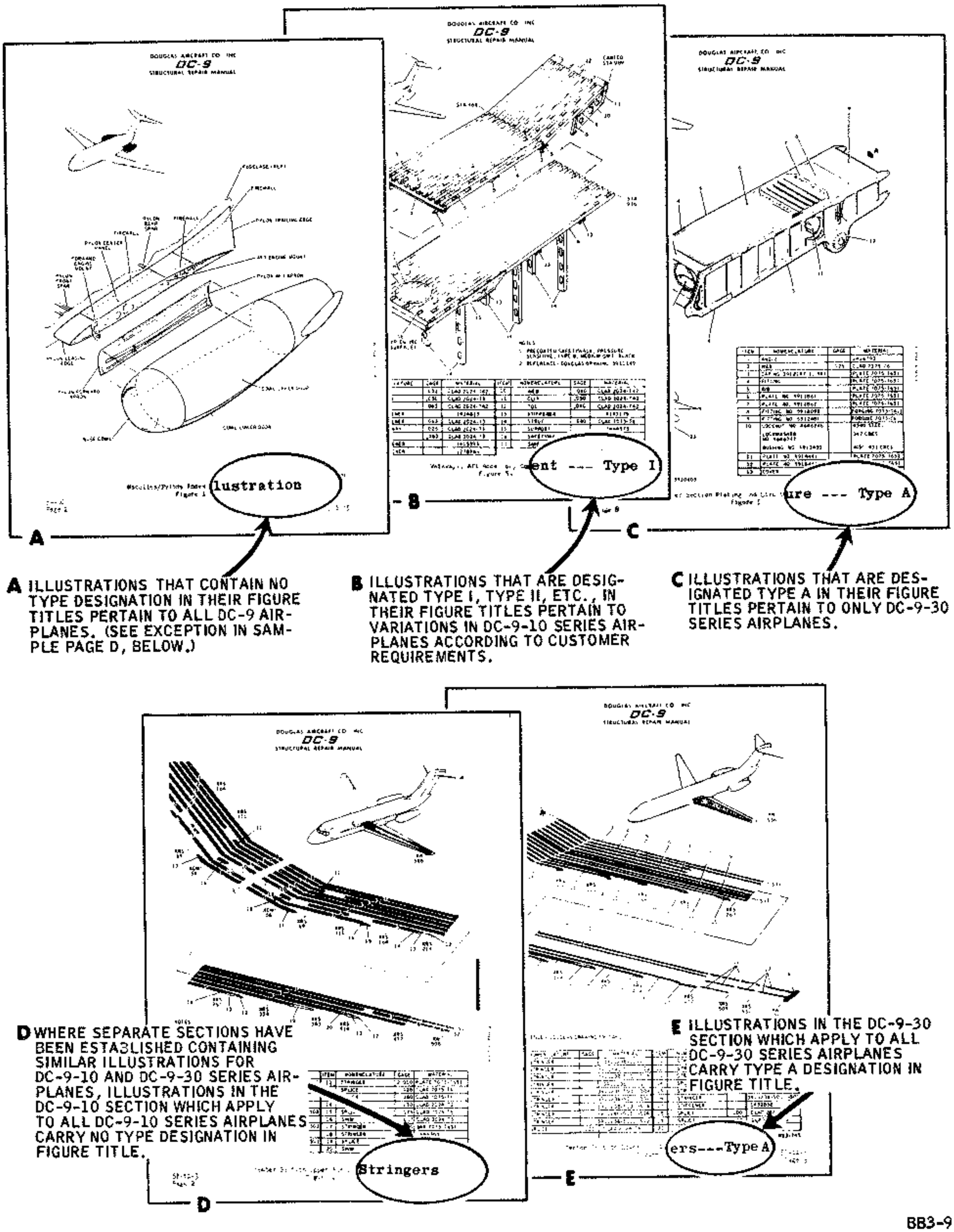
C SECTIONS THAT PERTAIN TO ONLY DC-9-30 SERIES AIRPLANES HAVE (DC-9-30) IN THEIR SECTION TITLES.

D SECTIONS THAT PERTAIN TO ALL DC-9 AIRPLANES (ANY SERIES) HAVE (DC-9-ALL) IN THEIR SECTION TITLES.

BB3-964

How to Use the Manual
Figure 1 (Sheet 1)

HOW TO USE THE MANUAL--
AIRPLANE SERIES AND TYPE DESIGNATIONS IN ILLUSTRATIONS



A ILLUSTRATIONS THAT CONTAIN NO TYPE DESIGNATION IN THEIR FIGURE TITLES PERTAIN TO ALL DC-9 AIRPLANES. (SEE EXCEPTION IN SAMPLE PAGE D, BELOW.)

B ILLUSTRATIONS THAT ARE DESIGNATED TYPE I, TYPE II, ETC., IN THEIR FIGURE TITLES PERTAIN TO VARIATIONS IN DC-9-10 SERIES AIRPLANES ACCORDING TO CUSTOMER REQUIREMENTS.

C ILLUSTRATIONS THAT ARE DESIGNATED TYPE A IN THEIR FIGURE TITLES PERTAIN TO ONLY DC-9-30 SERIES AIRPLANES.

D WHERE SEPARATE SECTIONS HAVE BEEN ESTABLISHED CONTAINING SIMILAR ILLUSTRATIONS FOR DC-9-10 AND DC-9-30 SERIES AIRPLANES, ILLUSTRATIONS IN THE DC-9-10 SECTION WHICH APPLY TO ALL DC-9-10 SERIES AIRPLANES CARRY NO TYPE DESIGNATION IN FIGURE TITLE.

E ILLUSTRATIONS IN THE DC-9-30 SECTION WHICH APPLY TO ALL DC-9-30 SERIES AIRPLANES CARRY TYPE A DESIGNATION IN FIGURE TITLE.

How to Use the Manual
Figure 1 (Sheet 2)

HOW TO USE THE MANUAL--
AIRPLANE SERIES AND TYPE DESIGNATIONS IN ILLUSTRATIONS (CONT.)

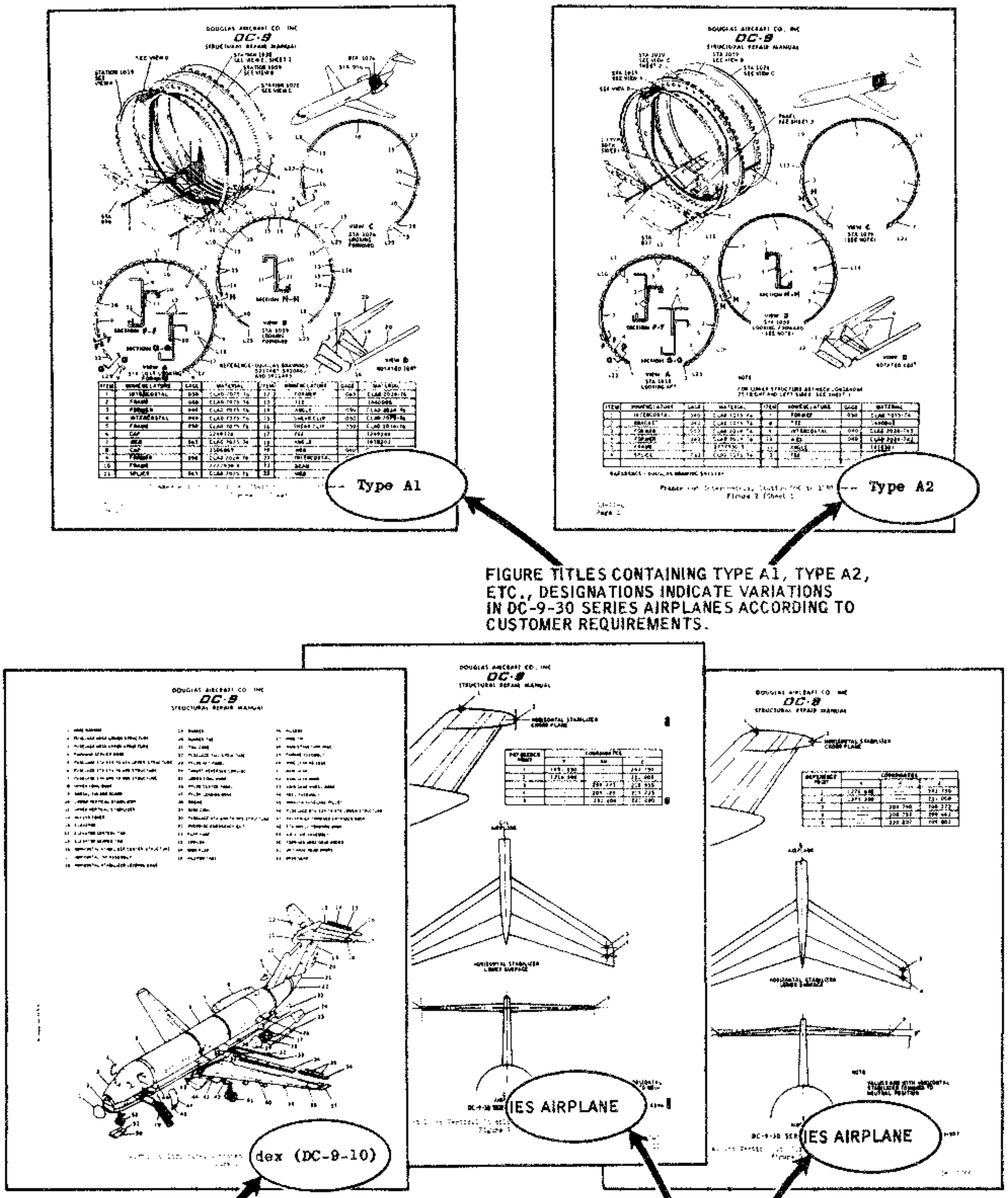


FIGURE TITLES CONTAINING TYPE A1, TYPE A2, ETC., DESIGNATIONS INDICATE VARIATIONS IN DC-9-30 SERIES AIRPLANES ACCORDING TO CUSTOMER REQUIREMENTS.

EXAMPLE OF AIRPLANE SERIES INDICATED IN FIGURE TITLE.

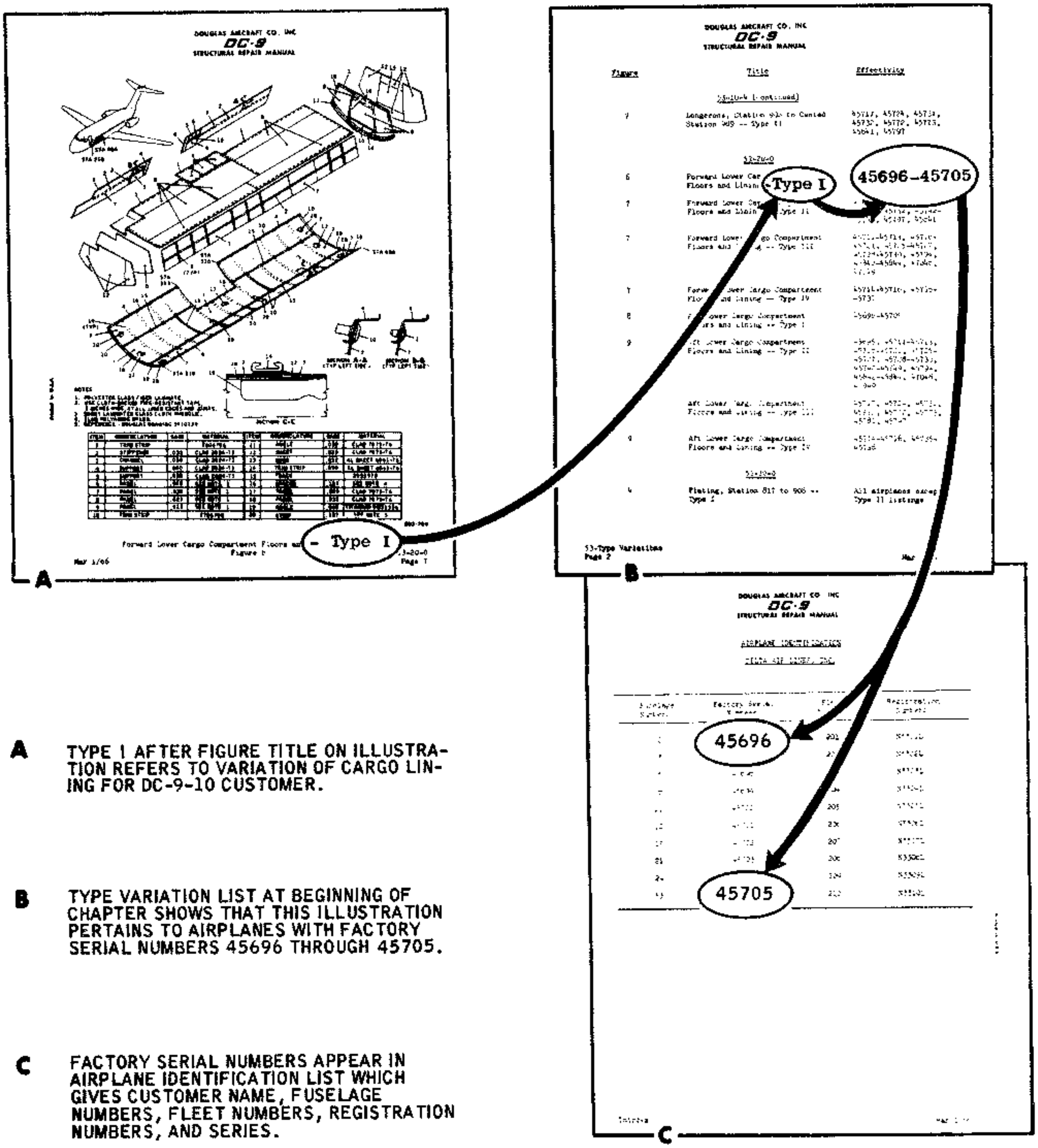
EXAMPLES OF AIRPLANE SERIES INDICATED IN BOLDFACE TYPE IN BODY OF ILLUSTRATION

883-968

How to Use the Manual
Figure 1 (Sheet 3)

HOW TO USE THE MANUAL --

TYPE DESIGNATION TO EFFECTIVITY TO AIRPLANE IDENTIFICATION



A TYPE I AFTER FIGURE TITLE ON ILLUSTRATION REFERS TO VARIATION OF CARGO LINING FOR DC-9-10 CUSTOMER.

B TYPE VARIATION LIST AT BEGINNING OF CHAPTER SHOWS THAT THIS ILLUSTRATION PERTAINS TO AIRPLANES WITH FACTORY SERIAL NUMBERS 45696 THROUGH 45705.

C FACTORY SERIAL NUMBERS APPEAR IN AIRPLANE IDENTIFICATION LIST WHICH GIVES CUSTOMER NAME, FUSELAGE NUMBERS, FLEET NUMBERS, REGISTRATION NUMBERS, AND SERIES.

BB3-969

How to Use the Manual
Figure 1 (Sheet 4)

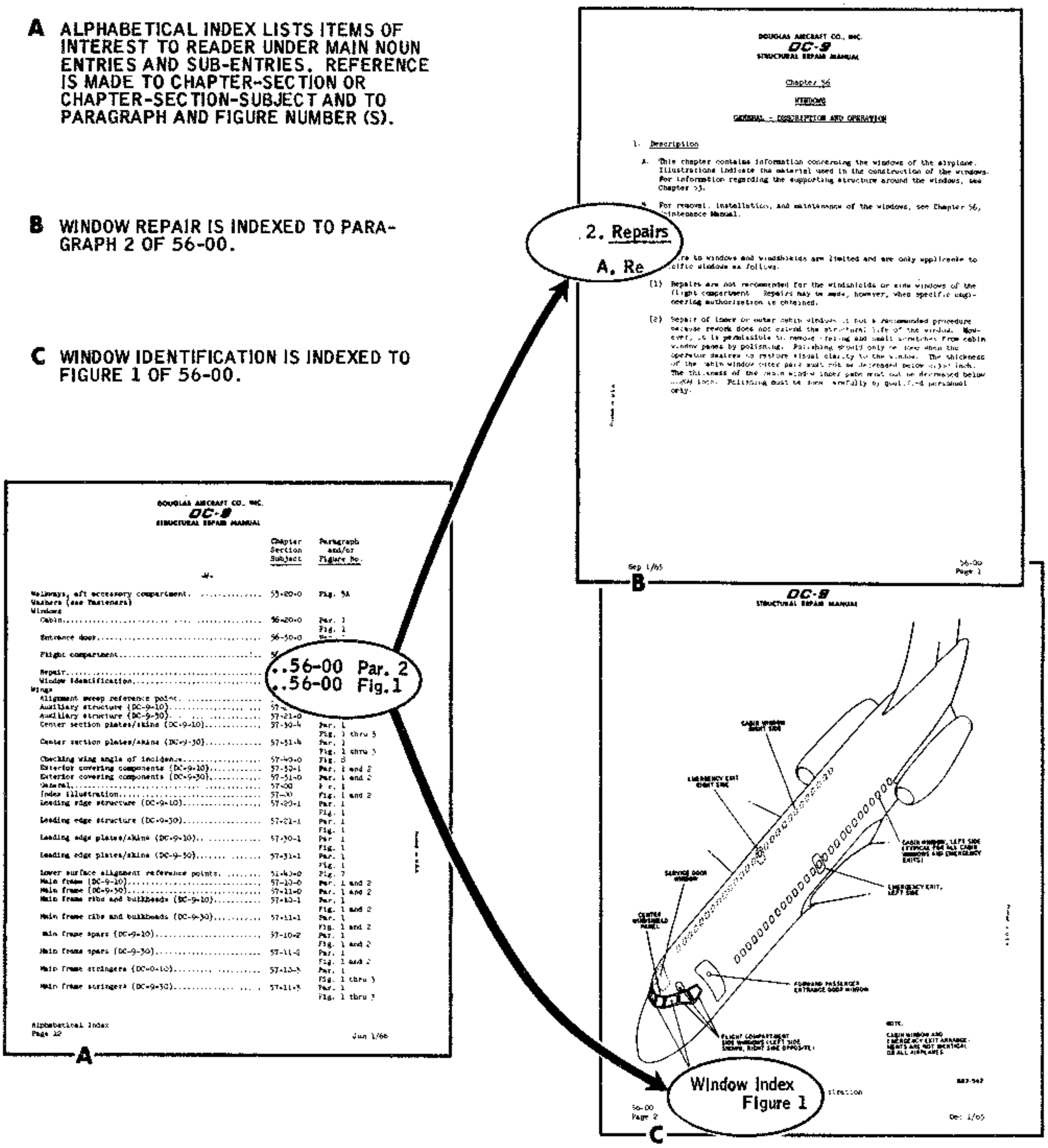
HOW TO USE THE MANUAL - -

ALPHABETICAL INDEX

A ALPHABETICAL INDEX LISTS ITEMS OF INTEREST TO READER UNDER MAIN NOUN ENTRIES AND SUB-ENTRIES. REFERENCE IS MADE TO CHAPTER-SECTION OR CHAPTER-SECTION-SUBJECT AND TO PARAGRAPH AND FIGURE NUMBER (S).

B WINDOW REPAIR IS INDEXED TO PARAGRAPH 2 OF 56-00.

C WINDOW IDENTIFICATION IS INDEXED TO FIGURE 1 OF 56-00.



BB3-970

How to Use the Manual
Figure 1 (Sheet 5)

AIRPLANE IDENTIFICATION

AERONAVES DE MEXICO

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
125	47059			10
139	47085			10

AIRPLANE IDENTIFICATION

AEROVIAS VENEZOLANAS, S. A. (AVENSA)

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
89	47056			10
109	47060			10

AIRPLANE IDENTIFICATION

AIR CANADA

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
4	45711	701	CF-TLB	10
6	45712	702	CF-TLC	10
9	45713	703	CF-TLD	10
19	45725	704	CF-TLE	10
36	45726	705	CF-TLF	10
43	45727	706	CF-TLG	10
91	45845	707	CF-TLH	30
112	45846	708	CF-TLI	30
113	47019	709	CF-TLJ	30
126	47020	710	CF-TLK	30
133	47021	711	CF-TLL	30
144	47022	712	CF-TLM	30

AIRPLANE IDENTIFICATION

ALITALIA-LINEE AEREE ITALIANE

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
136	47038			30

AIRPLANE IDENTIFICATION

ALLEGHENY AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
42	47049		N6140A	10
118	47050		N6141A	30
131	47051		N6142A	30
142	47052		N6143A	30

AIRPLANE IDENTIFICATION

ANSETT-ANA

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
81	47004		VH-CZB	30
86	47003		VH-CZA	30

AIRPLANE IDENTIFICATION

BONANZA AIR LINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
14	45728		N945L	10
16	45729		N946L	10
37	45730		N947L	10

AIRPLANE IDENTIFICATION

CARIBBEAN-ATLANTIC AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
108	47098		N1938R	30

AIRPLANE IDENTIFICATION

CONTINENTAL AIR LINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
23	45842	961	N8961	10
28	45843	962	N8962	10
33	45844	963	N8963	10
35	47048	964	N8964	10
79	45826	901	N8901	*10
97	47010	902	N8902	*10
102	47011	903	N8903	*10
115	47012	904	N8904	*10
129	47013	905	N8905	*10
141	47014	906	N8906	*10

* Cargo version

AIRPLANE IDENTIFICATION

DELTA AIR LINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
2	45696	201	N3301L	10
3	45697	202	N3302L	10
5	45698	203	N3303L	10
8	45699	204	N3304L	10
11	45700	205	N3305L	10
12	45701	206	N3306L	10
15	45702	207	N3307L	10
21	45703	208	N3308L	10
24	45704	209	N3309L	10
53	45705	210	N3310L	10
61	45706	211	N3311L	10
70	45707	212	N3312L	10
77	45708	213	N3313L	10
78	45709	214	N3314L	10
100	45710	231	N3315L	30
106	47025	232	N3316L	30
119	47026	233	N3317L	30
132	47027	234	N3318L	30
145	47028	235	N3318L	30

AIRPLANE IDENTIFICATION

EASTERN AIR LINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
26	45742	901	N8901E	10
29	45743	902	N8902E	10
31	45744	903	N8903E	10
32	45745	904	N8904E	10
38	45746	905	N8905E	10
40	45747	906	N8906E	10
47	45748	907	N8907E	10
48	45733	916	N8916E	30
50	45749	908	N8908E	10
57	45770	909	N8909E	10
58	45771	910	N8910E	10
60	45734	917	N8917E	30
67	45825	911	N8911E	10
68	45829	912	N8912E	10
73	45833	918	N8918E	30
75	45830	913	N8913E	10
76	45831	914	N8914E	10
84	45832	915	N8915E	10
85	45834	919	N8919E	30
95	45835	920	N8920E	30
96	45836	921	N8921E	30
103	45837	922	N8922E	30
104	45838	923	N8923E	30

AIRPLANE IDENTIFICATION

EASTERN AIR LINES, INC. (CONTINUED)

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
116	45839	924	N8924E	30
117	45840	925	N8925E	30
124	45863	926	N8926E	30
130	45864	927	N8927E	30
137	45865	928	N8928E	30
138	45866	929	N8929E	30

AIRPLANE IDENTIFICATION

HAWAIIAN AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
20	45717		N901H	10
22	45724		N902H	10

AIRPLANE IDENTIFICATION

IBERIA, LINEAS AEREAS DE ESPANA

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
121	47037			30
134	47076			30
148	47077			30

AIRPLANE IDENTIFICATION

KLM ROYAL DUTCH AIRLINES

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
17	45718		PH-DNA	10
18	45719		PH-DNB	10
27	45720		PH-DNC	10
44	45721		PH-DND	10
55	45722		PH-DNE	10
63	45723		PH-DNF	10

AIRPLANE IDENTIFICATION

KOREAN AIRLINES

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
135	45827			30

AIRPLANE IDENTIFICATION

NORTH CENTRAL AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
143	47067		N951N	30

AIRPLANE IDENTIFICATION

NORTHEAST AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
107	47053	970	N970NE	30
110	47054	971	N971NE	30
122	47057	972	N972NE	30
123	47058	973	N973NE	30
150	47066	974	N974NE	30

AIRPLANE IDENTIFICATION

OZARK AIR LINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
30	45772		N970Z	10
39	45773		N971Z	10
46	45841		N972Z	10
147	47033			10

AIRPLANE INDENTIFICATION

PACIFIC SOUTHWEST AIRLINES CORP.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
99	47006		N981PS	30

AIRPLANE INDENTIFICATION

SAUDI ARABIAN AIRLINES CORP.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
83	47000		HZ-AEA	10
94	47001		HZ-AEB	10
105	47002		HZ-AEC	10

AIRPLANE IDENTIFICATION

SCANDINAVIAN AIRLINES SYSTEM

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
149	47094			30

AIRPLANE IDENTIFICATION

SOUTHERN AIRWAYS, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
111	47063	91	N91S	10
120	47064	92	N92S	10
146	47078	93	N93S	10

AIRPLANE IDENTIFICATION

SWISS AIR TRANSPORT COMPANY, LTD.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
34	45731		HB-IFA	10
41	45732		HB-IFB	10
64	45785		HB-IFC	10
90	45786		HB-IFD	10
127	45787		HB-IFE	10

AIRPLANE IDENTIFICATION

TRANS AUSTRALIAN AIRWAYS

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
87	47007		VH-TJJ	30
98	47008		VH-TJK	30

Printed in U.S.A.

AIRPLANE IDENTIFICATION

TRANS-TEXAS AIRWAYS, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
1	45695			10
88	47043			10

AIRPLANE IDENTIFICATION

TRANS WORLD AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
7	45714	1051	N1051T	10
10	45715	1052	N1052T	10
13	45716	1053	N1053T	10
25	45735	1054	N1054T	10
45	45736	1055	N1055T	10
49	45737	1056	N1056T	10
54	45738	1057	N1057T	10
56	45739	1058	N1058T	10
62	45740	1059	N1059T	10
66	45741	1060	N1060T	10
71	45775	1061	N1061T	10
72	45776	1062	N1062T	10
80	45777	1063	N1063T	10
82	45778	1064	N1064T	10
92	45779	1065	N1065T	10
93	45780	1066	N1066T	10
101	45781	1067	N1067T	10
114	45782	1068	N1068T	10
128	45783	1069	N1069T	10
140	45784	1070	N1070T	10

AIRPLANE IDENTIFICATION

WEST COAST AIRLINES, INC.

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
52	45794		N9101	10
65	45795		N9102	10
74	45796		N9103	10

AIRPLANE IDENTIFICATION

WILLIAM J. BRENNAN

Fuselage Numbers	Factory Serial Numbers	Fleet Numbers	Registration Numbers	Series
51	45797			10
59	45798		N4905A	10
69	45799		N4915A	10

CHAPTER 51

STRUCTURES

Printed in U.S.A.

Chapter 51

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date
Title		
*51-Eff.	1-6	Dec 1/66
*51-Cont.	1	Dec 1/66
*51-Cont.	2	Dec 1/66
*51-Cont.	3	Dec 1/66
*51-Sect. App.	1	Dec 1/66
*51-Sect. App.	2	Dec 1/66
*51-00	1	Dec 1/66
51-00	2	Jun 1/66
*51-00	3	Dec 1/66
*51-00	4	Dec 1/66
*51-00	4A	Dec 1/66
*51-00	5	Dec 1/66
*51-00	6	Dec 1/66
*51-00	6A	Dec 1/66
*51-00	6B	Dec 1/66
51-00	7	Sep 1/66
*51-00	8	Dec 1/66
*51-00	8A	Dec 1/66
*51-00	9	Dec 1/66
51-00	10	Jun 1/66
51-00	11	Sep 1/66
51-00	12	Jun 1/66
*51-00	13	Dec 1/66
51-00	14	Jun 1/66
*51-01	1	Dec 1/66
51-10-0	1	Jun 1/66
*51-10-1	1	Dec 1/66
51-10-1	2	Dec 1/65
*51-10-1	3	Dec 1/66
*51-10-1	4	Dec 1/66
*51-10-1	5	Dec 1/66
*51-10-1	6	Dec 1/66
*51-10-1	6A	Dec 1/66
*51-10-1	6B	Dec 1/66
51-10-1	7	Sep 1/65
51-10-1	8	Sep 1/65
51-10-1	9	Sep 1/65
51-10-1	10	Sep 1/65
*51-10-1	11	Dec 1/66
51-10-1	12	Jun 1/66
51-10-1	13	Dec 1/65
51-10-1	14	Sep 1/65
51-10-1	15	Sep 1/65
51-10-1	16	Sep 1/65
51-10-1	16A	Mar 1/66
51-10-1	17	Sep 1/65
51-10-1	18	Mar 1/66
51-10-1	19	Sep 1/65
51-10-1	20	Sep 1/65
*51-10-1	21	Dec 1/66
51-10-1	22	Sep 1/65
51-10-1	23	Sep 1/65
51-10-1	24	Sep 1/65
51-10-1	25	Sep 1/65
51-10-1	26	Sep 1/65
51-10-1	26A	Mar 1/66
*51-10-1	26B	Dec 1/66
*51-10-1	27	Dec 1/66
*51-10-1	28	Dec 1/66
*51-10-1	28A	Dec 1/66
51-10-1	29	Sep 1/65
51-10-1	30	Sep 1/65
51-10-1	31	Sep 1/65
51-10-1	32	Dec 1/65
*51-10-1	33	Dec 1/66
51-10-1	34	Dec 1/65
*51-10-1	34A	Dec 1/66
*51-10-1	35	Dec 1/66
51-10-1	36	Sep 1/65
51-10-1	37	Sep 1/65
51-10-1	38	Sep 1/65
*51-10-1	39	Dec 1/66
51-10-1	40	Jun 1/66
51-10-1	40A	Jun 1/66
51-10-1	41	Dec 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
*51-10-1	42	Dec 1/66	51-10-3	9	Dec 1/65
51-10-1	43	Sep 1/65	51-10-3	10	Dec 1/65
51-10-1	44	Sep 1/65	51-10-3	11	Mar 1/66
51-10-1	45	Sep 1/65	51-10-3	12	Mar 1/66
51-10-1	46	Dec 1/65	51-10-3	13	Dec 1/65
51-10-1	46A	Mar 1/66	51-10-3	14	Mar 1/66
*51-10-1	46B	Dec 1/66	51-10-3	15	Mar 1/66
51-10-1	47	Sep 1/65	51-10-3	16	Mar 1/66
*51-10-1	48	Dec 1/66	51-10-3	17	Dec 1/65
*51-10-1	48A	Dec 1/66	51-10-3	18	Mar 1/66
51-10-1	48B	Dec 1/65	51-10-3	18A	Mar 1/66
51-10-1	48C	Dec 1/65	51-10-3	19	Mar 1/66
*51-10-1	48D	Dec 1/66	51-10-3	20	Dec 1/65
*51-10-1	48E	Dec 1/66	51-10-3	21	Dec 1/65
51-10-1	49	Dec 1/65	51-10-3	22	Dec 1/65
51-10-1	50	Dec 1/65	51-10-3	23	Mar 1/66
51-10-1	51	Dec 1/65	51-10-3	24	Mar 1/66
*51-10-1	52	Dec 1/66	51-10-3	25	Mar 1/66
51-10-2	1	Jun 1/66	51-10-3	26	Mar 1/66
51-10-2	2	Dec 1/65	51-10-3	27	Dec 1/65
51-10-2	3	Dec 1/65	51-10-3	28	Mar 1/66
51-10-2	4	Dec 1/65	*51-10-3	29	Dec 1/66
51-10-2	5	Dec 1/65	*51-10-3	30	Dec 1/66
51-10-2	6	Jun 1/66	51-10-3	31	Mar 1/66
51-10-2	7	Dec 1/65	51-10-3	32	Dec 1/65
51-10-2	8	Dec 1/65	51-10-4	1	Jun 1/66
51-10-2	9	Dec 1/65	51-10-4	2	Sep 1/65
51-10-2	10	Dec 1/65	51-10-4	3	Sep 1/65
51-10-2	11	Mar 1/66	51-10-4	4	Sep 1/65
51-10-2	12	Mar 1/66	51-10-4	5	Sep 1/65
51-10-2	13	Mar 1/66	51-10-4	6	Sep 1/65
51-10-2	14	Mar 1/66	51-10-4	7	Sep 1/65
51-10-2	15	Mar 1/66	51-10-4	8	Sep 1/65
51-10-2	16	Mar 1/66	51-10-4	9	Sep 1/65
51-10-2	17	Mar 1/66	51-10-4	10	Sep 1/65
51-10-2	18	Mar 1/66	51-10-4	11	Sep 1/65
51-10-3	1	Jun 1/66	51-10-4	12	Sep 1/65
51-10-3	2	Mar 1/66	51-10-4	13	Sep 1/65
51-10-3	3	Mar 1/66	51-10-4	14	Sep 1/65
51-10-3	4	Mar 1/66	51-10-4	15	Sep 1/65
51-10-3	4A	Mar 1/66	51-10-4	16	Sep 1/65
51-10-3	5	Dec 1/65	51-10-4	17	Sep 1/65
51-10-3	6	Dec 1/65	51-10-4	18	Sep 1/65
51-10-3	7	Dec 1/65	51-10-4	19	Sep 1/65
51-10-3	8	Dec 1/65	51-10-4	20	Sep 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
51-10-4	21	Sep 1/65
51-10-4	22	Sep 1/65
51-10-4	23	Sep 1/65
*51-10-5	1	Dec 1/66
51-10-5	2	Sep 1/65
51-10-5	3	Sep 1/65
51-10-5	4	Sep 1/65
51-10-5	5	Sep 1/65
51-10-5	6	Sep 1/65
51-10-5	7	Sep 1/65
51-10-5	8	Sep 1/65
51-10-5	9	Sep 1/65
51-10-5	10	Sep 1/65
51-10-5	11	Sep 1/65
51-10-5	12	Sep 1/65
51-20-0	1	Jun 1/66
51-20-0	2	Sep 1/65
51-20-0	3	Sep 1/65
51-20-0	4	Sep 1/65
51-20-0	5	Sep 1/65
51-20-0	6	Dec 1/65
51-20-0	7	Dec 1/65
51-20-0	8	Dec 1/65
51-20-0	9	Sep 1/65
51-20-0	10	Sep 1/65
51-20-0	11	Sep 1/65
51-20-0	12	Sep 1/65
51-20-0	13	Sep 1/65
51-20-0	14	Sep 1/65
51-20-0	15	Sep 1/65
51-20-0	16	Sep 1/65
51-20-0	17	Sep 1/65
51-20-0	18	Sep 1/65
51-20-0	19	Sep 1/65
51-20-0	20	Sep 1/65
51-20-0	21	Sep 1/65
51-20-0	22	Sep 1/65
51-20-0	23	Sep 1/65
51-20-0	24	Sep 1/65
51-20-0	25	Sep 1/65
51-20-0	26	Sep 1/65
51-20-0	27	Sep 1/65
51-20-0	28	Sep 1/65
*51-21-0	1	Dec 1/66
51-21-0	2	Sep 1/66
51-21-0	3	Sep 1/66
51-22-0	1	Sep 1/66
51-22-0	2	Sep 1/66
51-22-0	3	Sep 1/66
51-22-0	4	Sep 1/66
51-22-0	5	Sep 1/66
51-22-0	6	Sep 1/66
51-22-0	7	Sep 1/66
51-22-0	8	Sep 1/66
51-22-0	9	Sep 1/66
51-22-0	10	Sep 1/66
*51-23-0	1	Dec 1/66
*51-23-0	2	Dec 1/66
*51-23-0	3	Dec 1/66
*51-23-0	4	Dec 1/66
51-30-0	1	Jun 1/66
51-30-0	2	Sep 1/65
51-30-0	3	Dec 1/65
51-30-0	4	Sep 1/65
51-30-0	5	Sep 1/65
51-30-0	6	Dec 1/65
51-30-0	7	Dec 1/65
51-30-0	8	Dec 1/65
51-30-0	9	Dec 1/65
51-30-0	10	Mar 1/66
51-30-0	11	Mar 1/66
51-30-0	12	Mar 1/66
51-30-0	13	Mar 1/66
51-30-0	14	Mar 1/66
51-30-0	15	Mar 1/66
51-30-0	16	Mar 1/66
51-30-1	1	Jun 1/66
51-30-1	2	Sep 1/65
51-30-1	3	Sep 1/65
51-30-1	4	Sep 1/65
51-30-1	4A	Dec 1/65
51-30-1	5	Dec 1/65
51-30-1	6	Sep 1/65
51-30-1	7	Sep 1/65
51-30-1	8	Mar 1/66
51-30-1	8A	Mar 1/66
51-30-1	9	Mar 1/66
51-30-1	10	Dec 1/65
51-30-1	11	Dec 1/65
51-30-1	12	Sep 1/65
51-30-1	13	Sep 1/65
51-30-1	14	Sep 1/65
51-30-1	15	Sep 1/65
51-30-1	16	Dec 1/65
51-30-1	16A	Dec 1/65
51-30-1	17	Sep 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
51-30-1	18	Sep 1/65	51-30-2	32	Sep 1/65
51-30-1	19	Sep 1/65	51-30-2	33	Sep 1/65
51-30-1	20	Dec 1/65	51-30-3	1	Jun 1/66
51-30-1	21	Dec 1/65	51-30-3	2	Sep 1/65
51-30-1	22	Dec 1/65	51-30-3	3	Sep 1/65
51-30-1	23	Dec 1/65	51-30-3	4	Dec 1/65
51-30-1	24	Dec 1/65	51-30-3	5	Sep 1/65
51-30-1	25	Dec 1/65	51-30-3	6	Sep 1/65
51-30-2	1	Jun 1/66	51-30-3	7	Sep 1/65
51-30-2	2	Sep 1/65	51-30-3	8	Mar 1/66
51-30-2	3	Sep 1/65	51-30-3	9	Sep 1/65
51-30-2	4	Sep 1/65	51-30-3	10	Sep 1/65
51-30-2	5	Dec 1/65	51-30-3	11	Sep 1/65
51-30-2	6	Sep 1/65	51-30-3	12	Sep 1/65
51-30-2	7	Sep 1/65	51-30-3	13	Sep 1/65
51-30-2	8	Sep 1/65	51-30-3	14	Sep 1/65
51-30-2	9	Sep 1/65	51-30-3	15	Sep 1/65
51-30-2	10	Sep 1/65	51-30-3	16	Sep 1/65
51-30-2	11	Sep 1/65	51-30-4	1	Jun 1/66
51-30-2	12	Sep 1/65	51-30-4	2	Sep 1/65
51-30-2	13	Sep 1/65	51-30-4	3	Sep 1/65
51-30-2	14	Sep 1/65	51-30-4	4	Sep 1/65
51-30-2	15	Dec 1/65	51-30-4	5	Sep 1/65
51-30-2	16	Dec 1/65	51-30-4	6	Sep 1/65
51-30-2	16A	Dec 1/65	51-30-4	7	Sep 1/65
51-30-2	16B	Dec 1/65	51-30-4	8	Sep 1/65
51-30-2	16C	Dec 1/65	51-30-4	9	Sep 1/65
51-30-2	17	Dec 1/65	51-30-4	10	Sep 1/65
51-30-2	18	Sep 1/65	51-30-4	11	Sep 1/65
51-30-2	19	Sep 1/65	51-30-4	12	Sep 1/65
51-30-2	20	Dec 1/65	51-30-4	13	Sep 1/65
51-30-2	20A	Sep 1/66	51-30-4	14	Sep 1/65
51-30-2	20B	Dec 1/65	51-30-5	1	Jun 1/66
51-30-2	21	Dec 1/65	51-30-5	2	Dec 1/65
51-30-2	22	Dec 1/65	51-30-5	3	Jun 1/66
51-30-2	23	Sep 1/65	51-30-5	4	Dec 1/65
51-30-2	24	Dec 1/65	51-30-5	5	Dec 1/65
51-30-2	25	Dec 1/65	51-30-5	6	Dec 1/65
51-30-2	26	Dec 1/65	51-30-5	7	Dec 1/65
51-30-2	26A	Dec 1/65	51-30-5	8	Jun 1/66
5-130-2	26B	Dec 1/65	51-30-5	9	Jun 1/66
51-30-2	27	Sep 1/65	51-30-5	10	Jun 1/66
51-30-2	28	Sep 1/65	51-30-5	11	Jun 1/66
51-30-2	29	Sep 1/65	51-30-5	12	Dec 1/65
51-30-2	30	Sep 1/65	51-30-5	13	Dec 1/65
51-30-2	31	Sep 1/65	51-30-5	14	Dec 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
51-30-5	15	Dec 1/65
51-30-5	16	Jun 1/66
51-30-5	17	Dec 1/65
51-30-5	18	Dec 1/65
51-30-5	19	Dec 1/65
51-30-5	20	Dec 1/65
51-40-0	1	Jun 1/66
51-40-0	2	Sep 1/66
51-40-0	3	Sep 1/66
51-40-0	4	Sep 1/66
51-40-0	4A	Sep 1/66
*51-40-0	4B	Dec 1/66
*51-40-0	4C	Dec 1/66
51-40-0	5	Sep 1/65
51-40-0	6	Sep 1/66
51-40-0	7	Sep 1/66
51-40-0	8	Sep 1/66
51-40-0	8A	Sep 1/66
51-40-0	8B	Sep 1/66
51-40-0	8C	Sep 1/66
51-40-0	9	Sep 1/66
51-40-0	10	Sep 1/66
51-40-0	11	Sep 1/66
51-40-0	12	Sep 1/66
51-40-0	12A	Sep 1/66
51-40-0	12B	Sep 1/66
51-40-0	13	Sep 1/66
51-40-0	14	Sep 1/66
51-50-0	1	Sep 1/66
51-50-0	2	Sep 1/66
51-50-0	3	Sep 1/66
51-50-0	4	Sep 1/66
51-50-0	4A	Sep 1/66
51-50-0	4B	Sep 1/66
51-50-0	4C	Sep 1/66
51-50-0	4D	Sep 1/66
51-50-0	4E	Sep 1/66
51-50-0	4F	Sep 1/66
51-50-0	5	Sep 1/66
51-50-0	6	Sep 1/66
51-50-0	6A	Sep 1/66
51-50-0	6B	Dec 1/65
51-50-0	6C	Dec 1/65
51-50-0	6D	Dec 1/65
51-50-0	6E	Dec 1/65
51-50-0	7	Dec 1/65
51-50-0	8	Sep 1/65
51-50-0	9	Dec 1/65
51-50-0	10	Jun 1/66
51-50-0	11	Sep 1/65
51-50-0	12	Sep 1/65
51-50-0	13	Dec 1/65
51-60-0	1	Jun 1/66
51-60-0	2	Sep 1/65
51-60-0	3	Sep 1/65
51-60-0	4	Sep 1/65
51-60-0	5	Sep 1/65
51-60-0	7	Dec 1/65
51-60-0	9	Mar 1/66
51-60-0	10	Dec 1/65
51-60-0	11	Sep 1/65
51-60-0	12	Sep 1/65
51-60-0	13	Sep 1/65
51-60-0	14	Sep 1/65
51-60-0	15	Sep 1/65
51-60-0	16	Sep 1/65
51-70-0	1	Jun 1/66
51-70-1	1	Jun 1/66
51-70-1	2	Sep 1/65
51-70-1	3	Sep 1/65
51-70-1	4	Sep 1/65
51-70-1	5	Sep 1/65
51-70-1	6	Sep 1/65
*51-70-1	7	Dec 1/66
51-70-1	8	Sep 1/65
*51-70-1	9	Dec 1/66
51-70-1	10	Sep 1/65
51-70-2	1	Jun 1/66
51-70-2	2	Dec 1/65
*51-70-2	3	Dec 1/66
51-70-2	4	Dec 1/65
51-70-2	5	Dec 1/65
51-70-2	6	Dec 1/65
51-70-2	7	Jun 1/66
51-70-2	8	Jun 1/66
51-70-2	8A	Jun 1/66
51-70-2	9	Dec 1/65
51-70-2	10	Dec 1/65
51-70-2	10A	Dec 1/65
51-70-2	11	Mar 1/66
51-70-2	12	Sep 1/65
51-70-2	13	Sep 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
51-70-2	14	Mar 1/66			
51-70-2	15	Mar 1/66			
51-70-2	16	Mar 1/66			
51-70-2	16A	Mar 1/66			
51-70-2	17	Mar 1/66			
51-70-2	18	Mar 1/66			
51-70-2	19	Mar 1/66			
51-70-2	20	Mar 1/66			
51-70-3	1	Jun 1/66			
51-70-3	2	Sep 1/65			

*The asterisk indicates pages revised or added by the current revision.

Chapter 51

TABLE OF CONTENTS

Chapter 51

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
51-00	YES	YES
51-01	YES	YES
51-10-0	YES	YES
51-10-1	YES	YES
51-10-2	YES	YES
51-10-3	YES	YES
51-10-4	YES	YES
51-10-5	YES	YES
51-20-0	YES	YES
51-21-0	YES	YES
51-22-0	YES	NO
51-23-0	YES	NO
51-30-0	YES	YES
51-30-1	YES	YES
51-30-2	YES	YES
51-30-3	YES	YES
51-30-4	YES	YES
51-30-5	YES	YES
51-40-0	YES	YES
51-50-0	YES	YES

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
51-60-0	YES	YES
51-70-0	YES	YES
51-70-1	YES	YES
51-70-2	YES	YES
51-70-3	YES	YES

Chapter 51

STRUCTURES

GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. The DC-9 Structural Repair Manual describes two types of general permanent repairs and one type of interim repair for the structural maintenance of the airplane. These repairs are designed for the correction of incidental damage to the structure. They are defined as follows:

(1) Class A Repairs: These repairs are provided for general use for the defined components of the airplane. They fully restore the structural integrity of the airplane and provide the best possible appearance and aerodynamic cleanness.

(2) Class B Repairs: These repairs are simpler to perform than Class A repairs. They afford the same structural integrity as the Class A repairs; but, in the interest of economy and the saving of time, often sacrifice appearance and aerodynamic cleanness. They may be replaced at a later time by a Class A repair or remain as a permanent installation at the discretion of the operator.

B. Other types of special repairs are also permissible. However, these repairs are not within the scope of this manual due to their restricted usage or the need for specific engineering. They are defined as follows:

(1) Restricted Life Repairs: These repairs are used primarily to expedite the return of an airplane to a place where a permanent repair can be made. They are temporary in usage, often using materials which must be replaced by permanent Class A or Class B repair materials. Specific engineering information is required.

(2) Extensive Engineering Reworks: This type of repair includes damage which is too extensive to be considered general. It involves both major damage repair and major structural replacement. Specific engineering information is required.

2. Special Douglas Procedures and Processes

A. Many of the Douglas fabrication procedures, assembly methods, and process requirements are similar to industry-wide standards. It is not the intent of the sections of this chapter to duplicate industry standards, but it is the intent to show the Douglas variations and specific recommendations used in the fabrication and assembly of the airplane so that a repair may be done in the same manner, where possible, as at the factory.

3. Classification of Damage

A. Negligible Damage: Damage not sufficiently serious to require removal, replacement, or splicing of a structural member is negligible. Scratches, gouges, nicks, dings, and dents fall into this category.

(1) Scratches, Gouges, Nicks, or Dings: This type of damage is negligible if it can be rounded out and polished without causing a detrimental effect. See the instructions for allowable cleanup of scratches, gouges, nicks, and dings in the applicable section of each specific chapter.

(2) Dents: This type of damage is negligible if it is smooth, shallow, free from cracks or abrasions, and without adjacent sheared rivets or elongated holes.

B. Repairable Damage: This damage is repairable from an economic standpoint, without the aid of extensive engineering. Repairable damage is outlined in the repair sections of this manual.

C. Damage Requiring Replacement: If damage is either too extensive to allow repair or is not repairable from an economic standpoint, replacement of the damaged structural components is recommended.

D. Damage Requiring Specific Engineering: If damage is of such complexity that repair is beyond the scope of repair instructions in the manual, specific engineering is required.

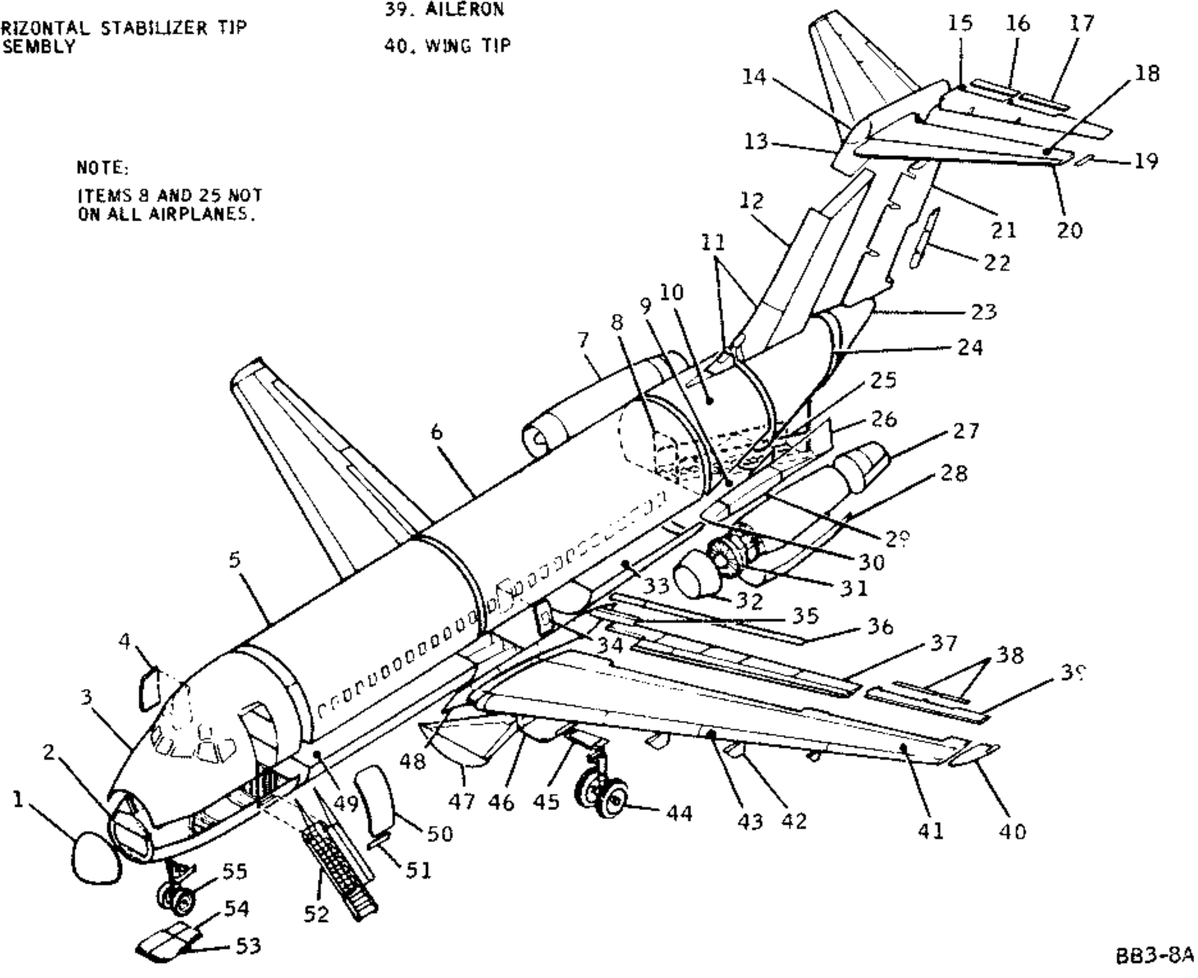
4. Airplane Structural Components

A. An index of the airplane structural components is provided in Figure 1.

5. Airplane Station, Longeron, and Stringer Arrangements

A. The airplane station numbering system, and longeron and stringer arrangements are illustrated in Figures 2 through 6. These illustrations serve as an aid to complement the structural material indentification illustrations in the manual. A comparison of DC-9-10 and DC-9-30 series fuselage stations is presented in Figure 7.

1. RADOME
2. FUSELAGE NOSE LOWER STRUCTURE
3. FUSELAGE NOSE UPPER STRUCTURE
4. FORWARD SERVICE DOOR
5. FUSELAGE STA 229 TO 474 UPPER STRUCTURE
6. FUSELAGE STA 474 TO 817 UPPER STRUCTURE
7. UPPER COWL DOOR
8. PASSENGER AFT ENTRANCE STAIRWELL DOOR
9. FUSELAGE STA 817 TO 908 LOWER STRUCTURE
10. FUSELAGE STA 817 TO 908 UPPER STRUCTURE
11. DORSAL FIN
12. VERTICAL STABILIZER
13. VERTICAL STABILIZER TIP
14. REMOVABLE TIP FAIRING
15. ELEVATOR
16. ELEVATOR CONTROL TAB
17. ELEVATOR GEARED TAB
18. HORIZONTAL STABILIZER AFT SECTION
19. HORIZONTAL STABILIZER TIP ASSEMBLY
20. HORIZONTAL STABILIZER LEADING EDGE
21. RUDDER
22. RUDDER TAB
23. TAIL CONE
24. FUSELAGE TAIL STRUCTURE
25. PASSENGER AFT ENTRANCE DOOR STAIRWAY
26. PYLON AFT PANEL
27. THRUST REVERSER COWLING
28. LOWER COWL DOOR
29. PYLON CENTER PANEL
30. PYLON LEADING EDGE
31. ENGINE
32. NOSE COWL
33. FUSELAGE STA 642 TO 817 LOWER STRUCTURE
34. OVERWING EMERGENCY EXIT
35. FLAP VANE
36. SPOILER
37. WING FLAP
38. AILERON TABS
39. AILERON
40. WING TIP
41. WING MAIN STRUCTURE
42. FLAP HINGE FAIRINGS
43. WING LEADING EDGE
44. MAIN GEAR
45. MAIN GEAR OUTBOARD DOOR
46. MAIN GEAR INBOARD DOOR
47. KEEL
48. WING-TO-FUSELAGE FILLET
49. FUSELAGE STA 229 TO 474 LOWER STRUCTURE
50. PASSENGER FORWARD ENTRANCE DOOR
51. FORWARD STAIRWELL DOOR
52. PASSENGER FORWARD ENTRANCE STAIRWAY
53. FORWARD NOSE GEAR DOORS
54. AFT NOSE GEAR DOORS
55. NOSE GEAR



NOTE:
ITEMS 8 AND 25 NOT ON ALL AIRPLANES.

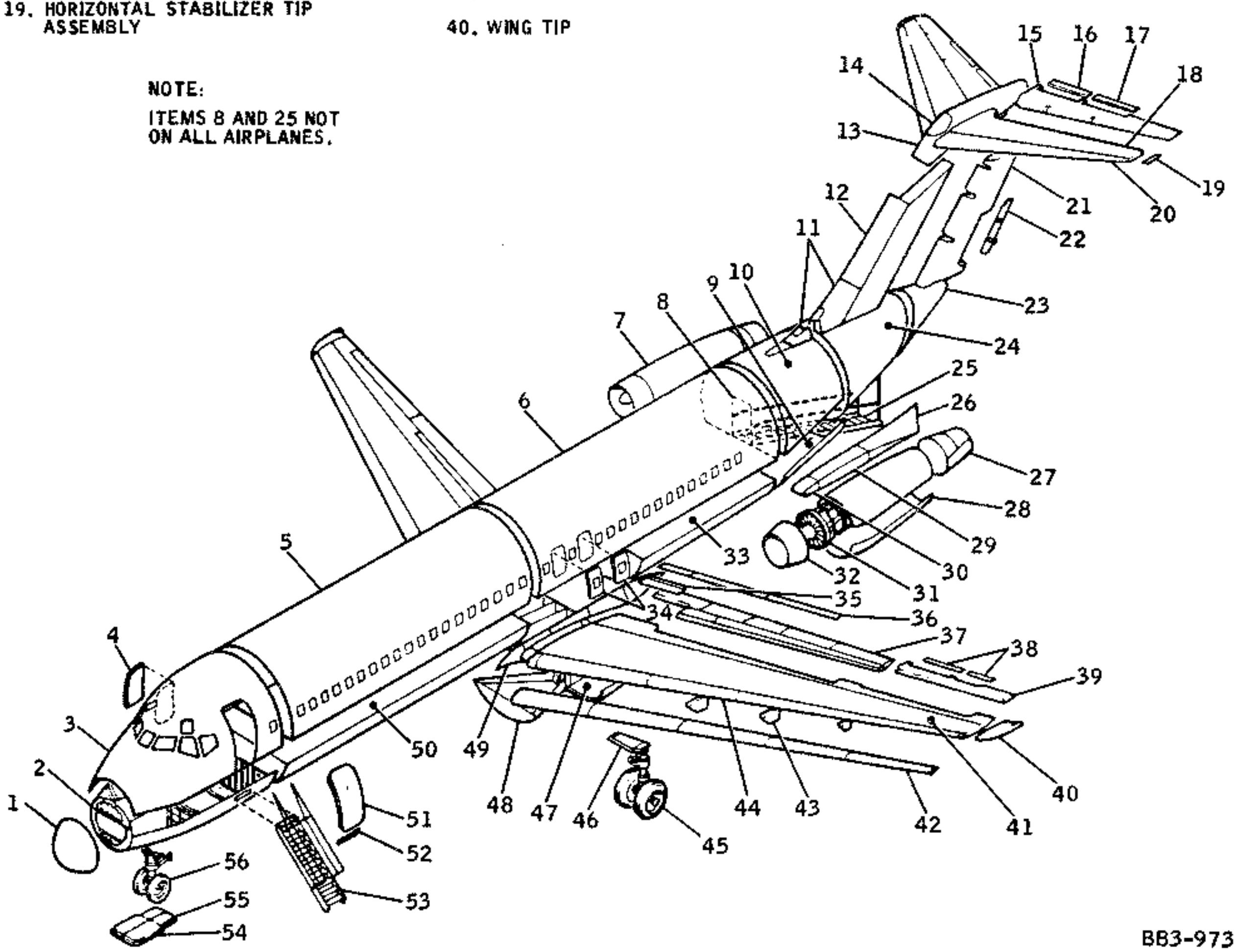
BB3-8A

Airplane Structural Component Index (DC-9-10)
Figure 1

Printed in U.S.A.

1. RADOME
2. FUSELAGE NOSE LOWER STRUCTURE
3. FUSELAGE NOSE UPPER STRUCTURE
4. FORWARD SERVICE DOOR
5. FUSELAGE STA 229 TO 588 UPPER STRUCTURE
6. FUSELAGE STA 588 TO 996 UPPER STRUCTURE
7. UPPER COWL DOOR
8. PASSENGER AFT ENTRANCE STAIRWELL DOOR
9. FUSELAGE STA 996 TO 1087 LOWER STRUCTURE
10. FUSELAGE STA 996 TO 1087 UPPER STRUCTURE
11. DORSAL FIN
12. VERTICAL STABILIZER
13. VERTICAL STABILIZER TIP
14. REMOVABLE TIP FAIRING
15. ELEVATOR
16. ELEVATOR CONTROL TAB
17. ELEVATOR GEARED TAB
18. HORIZONTAL STABILIZER AFT SECTION
19. HORIZONTAL STABILIZER TIP ASSEMBLY
20. HORIZONTAL STABILIZER LEADING EDGE
21. RUDDER
22. RUDDER TAB
23. TAIL CONE
24. FUSELAGE TAIL STRUCTURE
25. PASSENGER AFT ENTRANCE DOOR STAIRWAY
26. PYLON AFT PANEL
27. THRUST REVERSER COWLING
28. LOWER COWL DOOR
29. PYLON CENTER PANEL
30. PYLON LEADING EDGE
31. ENGINE
32. NOSE COWL
33. FUSELAGE STA 756 TO 996 LOWER STRUCTURE
34. OVERWING EMERGENCY EXITS
35. FLAP VANE
36. SPOILER
37. WING FLAP
38. AILERON TABS
39. AILERON
40. WING TIP
41. WING MAIN STRUCTURE
42. WING SLAT
43. FLAP HINGE FAIRING
44. WING LEADING EDGE
45. MAIN GEAR
46. MAIN GEAR OUTBOARD DOOR
47. MAIN GEAR INBOARD DOOR
48. KEEL
49. WING-TO-FUSELAGE FILLET
50. FUSELAGE STA 229 TO 588 LOWER STRUCTURE
51. PASSENGER FORWARD ENTRANCE DOOR
52. FORWARD STAIRWELL DOOR
53. PASSENGER FORWARD ENTRANCE STAIRWAY
54. FORWARD NOSE GEAR DOORS
55. AFT NOSE GEAR DOORS
56. NOSE GEAR

NOTE:
ITEMS 8 AND 25 NOT ON ALL AIRPLANES.



BB3-973

Airplane Structural Component Index (DC-9-30)
Figure 1A

Printed in U.S.A.

6. General Aids in Use of the Manual

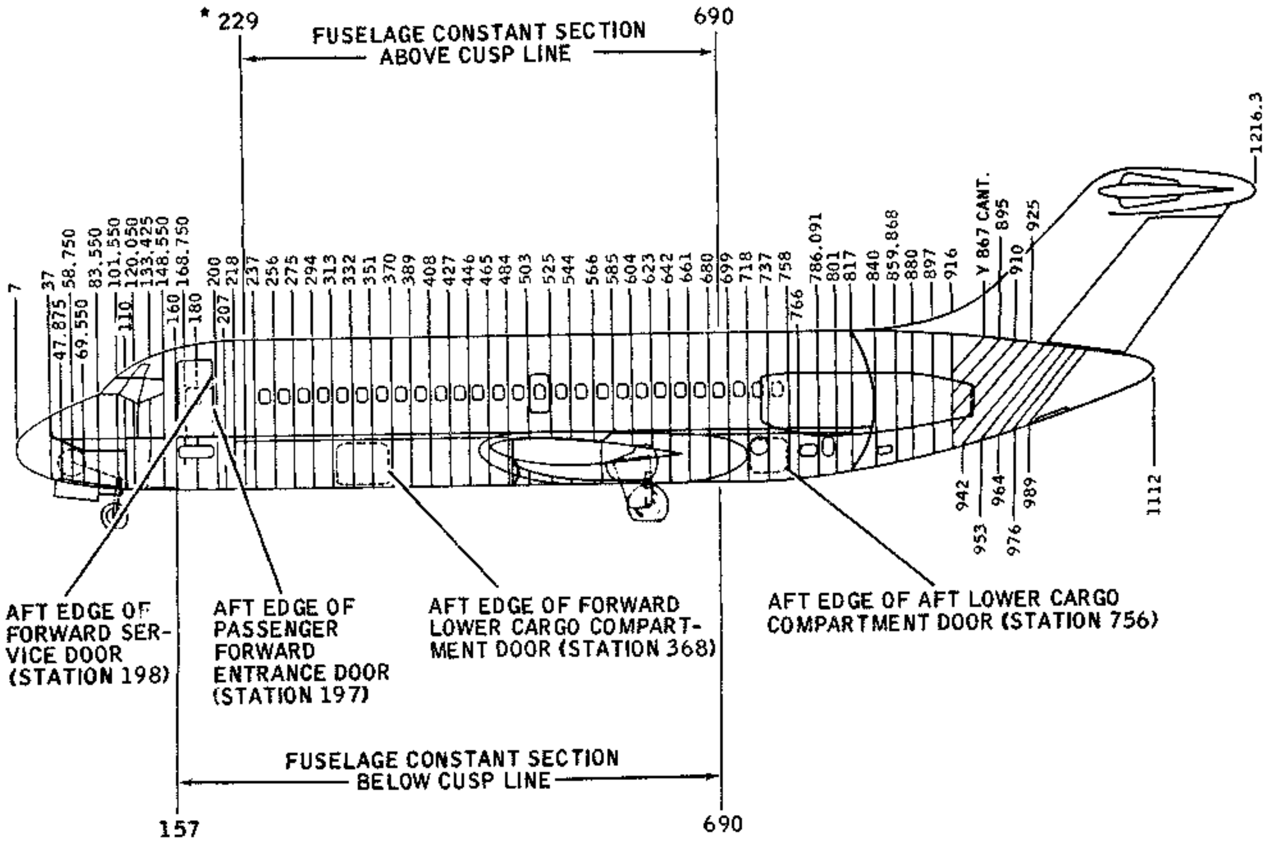
A. Material identification illustrations in the manual include location spot views to aid in determination of the location of the area shown. In each of the spot views, usually located in the upper portion of an illustration, depending on layout requirements, the area depicted on the illustration is designated by appropriate shading or arrows. Douglas standard extruded and formed sections are identified by the Douglas standard number in the material lists of the illustrations. Illustrated examples, including all dimensional data and material information, for these Douglas standard parts are shown in 51-10-1.

B. A plastic location grid is provided with the manual in an envelope on the inside of the front cover. This grid, when superimposed over the letterhead of any printed page, will allow the user of the manual to identify any spot on a material identification illustration by the grid zone numbering system. If it is necessary to describe an area of structural damage in correspondence or by telephone with Douglas Service Department representatives, the grid can be placed over the page which shows the structure for the area of structural damage.

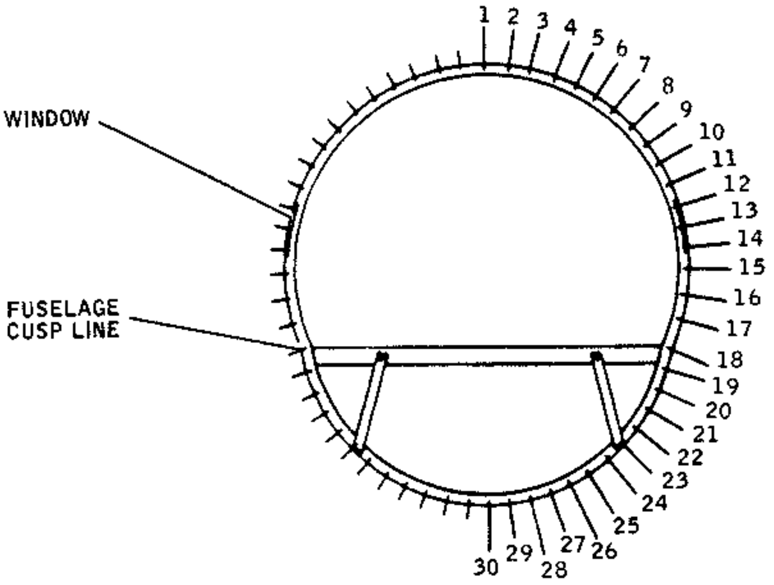
C. The repairs outlined in the manual may be used in addition to, or in combination with, other repairs in the same area. The repair samples as designed for the manual may vary in size and shape, providing all specified edge distances, overlaps, fastener requirements, and general repair requirements of the chapter affected are followed.

D. The term "plating" used throughout the manual is intended as all inclusive terminology for the external covering of the airplane. Plating, therefore, will include skin sheet stock, plate stock, aluminum honeycomb structure, or glass fiber sheet, if any of these components comprise the material of the airplane external surfaces.

E. The letter "S" is used in certain wing illustrations to designate wing stringers; for example, S1, S2, etc. The letter "L" is used in certain fuselage illustrations to indicate longeron numbers; for example, L1, L2, etc.



NOTE:
* WINDOW AT STATION 229 NOT ON ALL AIRPLANES.

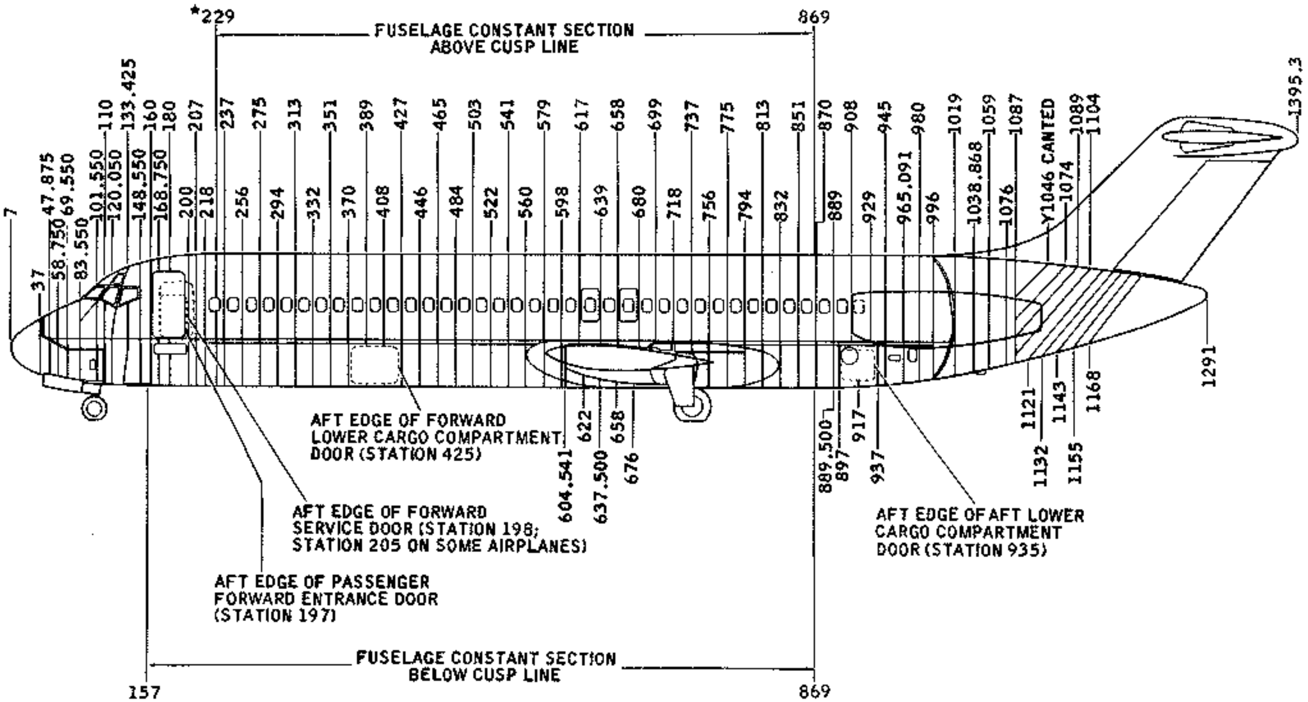


FUSELAGE LONGERON NUMBERING ARRANGEMENT

DC-9-10 SERIES AIRPLANES

BB3-68B

Fuselage Station Numbers and Longeron Arrangement
Figure 2 (Sheet 1)



FUSELAGE CONSTANT SECTION ABOVE CUSP LINE

AFT EDGE OF FORWARD LOWER CARGO COMPARTMENT DOOR (STATION 425)

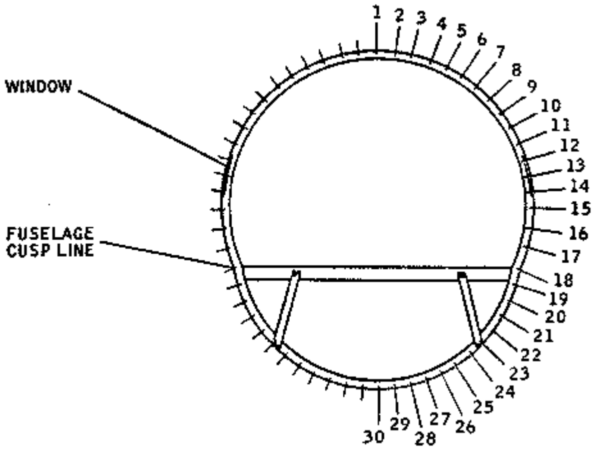
AFT EDGE OF FORWARD SERVICE DOOR (STATION 198; STATION 205 ON SOME AIRPLANES)

AFT EDGE OF PASSENGER FORWARD ENTRANCE DOOR (STATION 197)

AFT EDGE OF AFT LOWER CARGO COMPARTMENT DOOR (STATION 935)

FUSELAGE CONSTANT SECTION BELOW CUSP LINE

NOTE:
*WINDOW AT STATION 229 NOT ON ALL AIRPLANES.

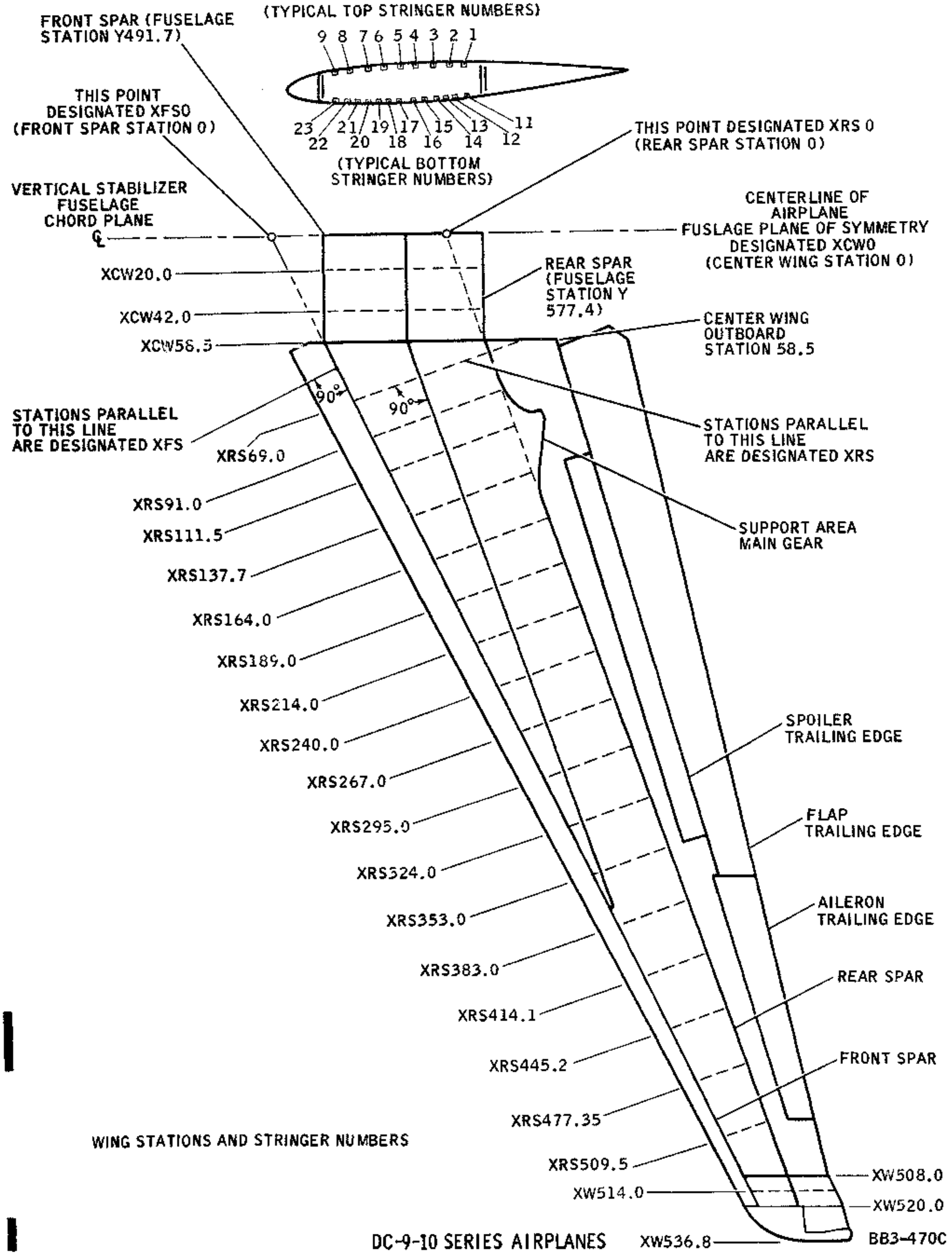


FUSELAGE LONGERON NUMBERING ARRANGEMENT

DC-9 30 SERIES AIRPLANES

BB3-947A

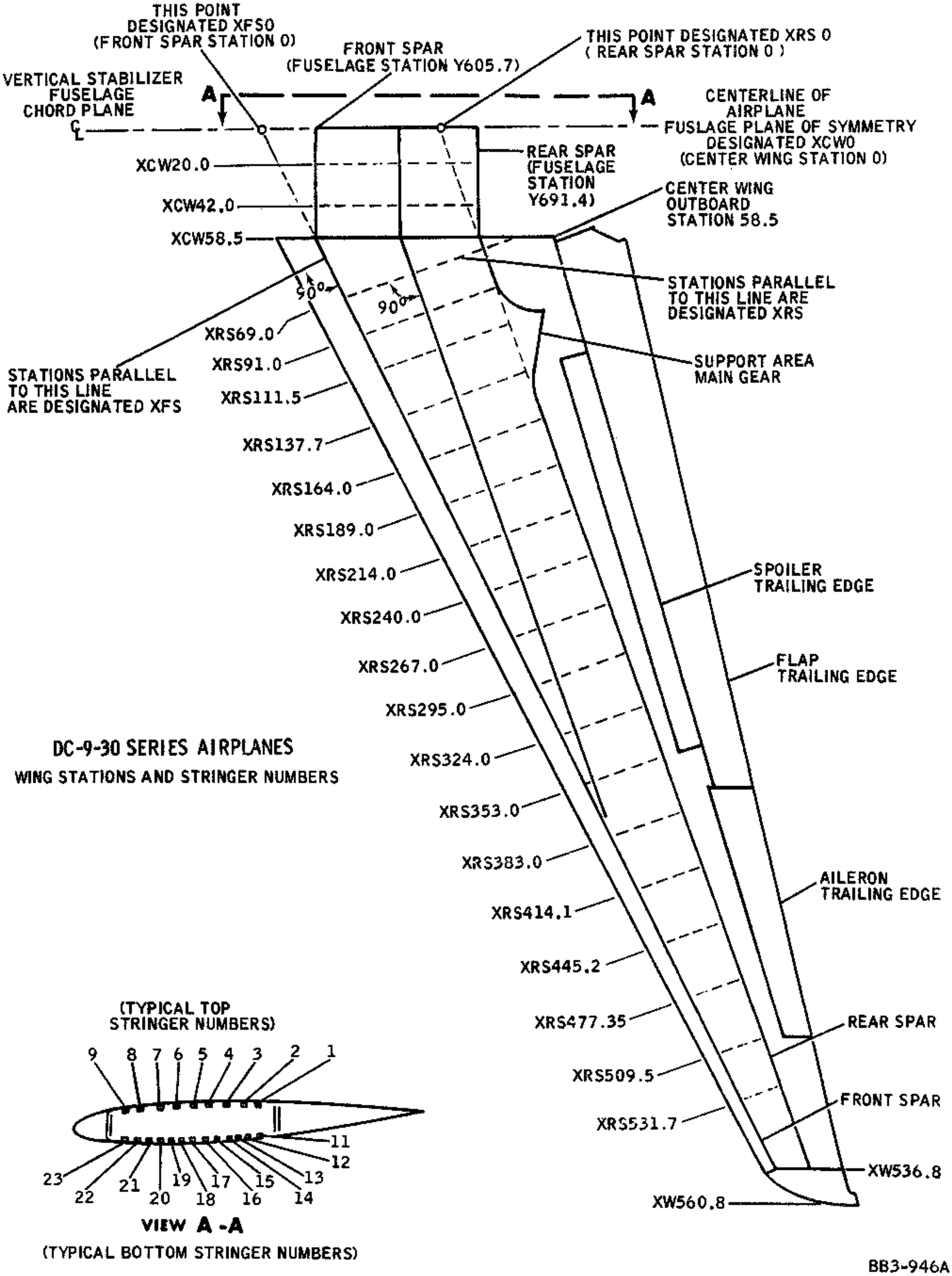
Fuselage Station Numbers and Longeron Arrangement
Figure 2 (Sheet 2)



WING STATIONS AND STRINGER NUMBERS

DC-9-10 SERIES AIRPLANES

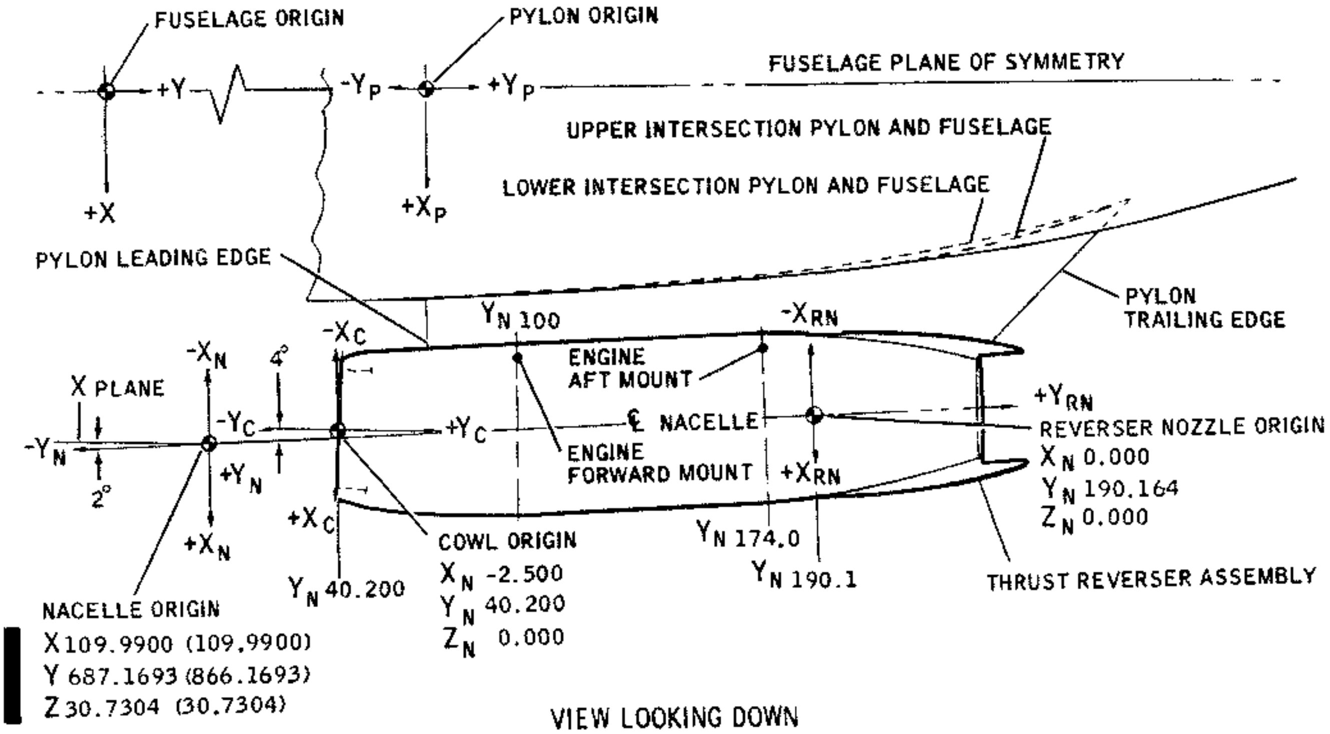
Wing Station Numbers and Stringer Arrangement
Figure 3 (Sheet 1)



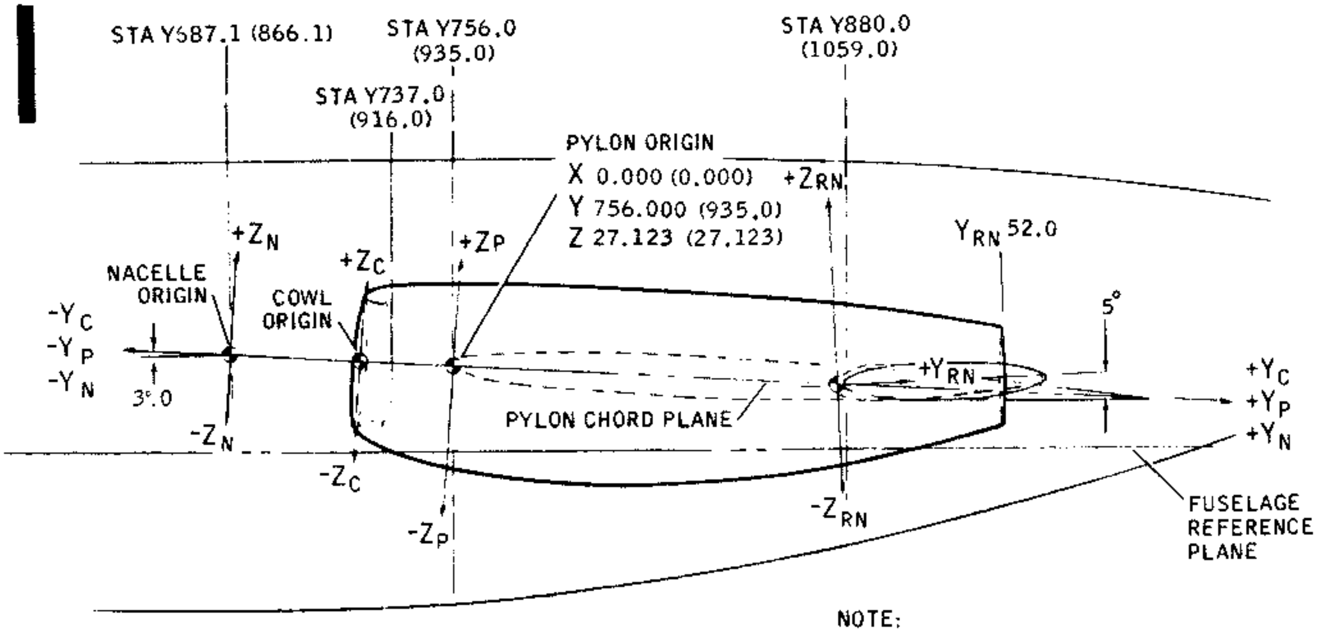
DC-9-30 SERIES AIRPLANES
WING STATIONS AND STRINGER NUMBERS

BB3-946A

Wing Station Numbers and Stringer Arrangement
Figure 3 (Sheet 2)



VIEW LOOKING DOWN
(IN PYLON PLANE)

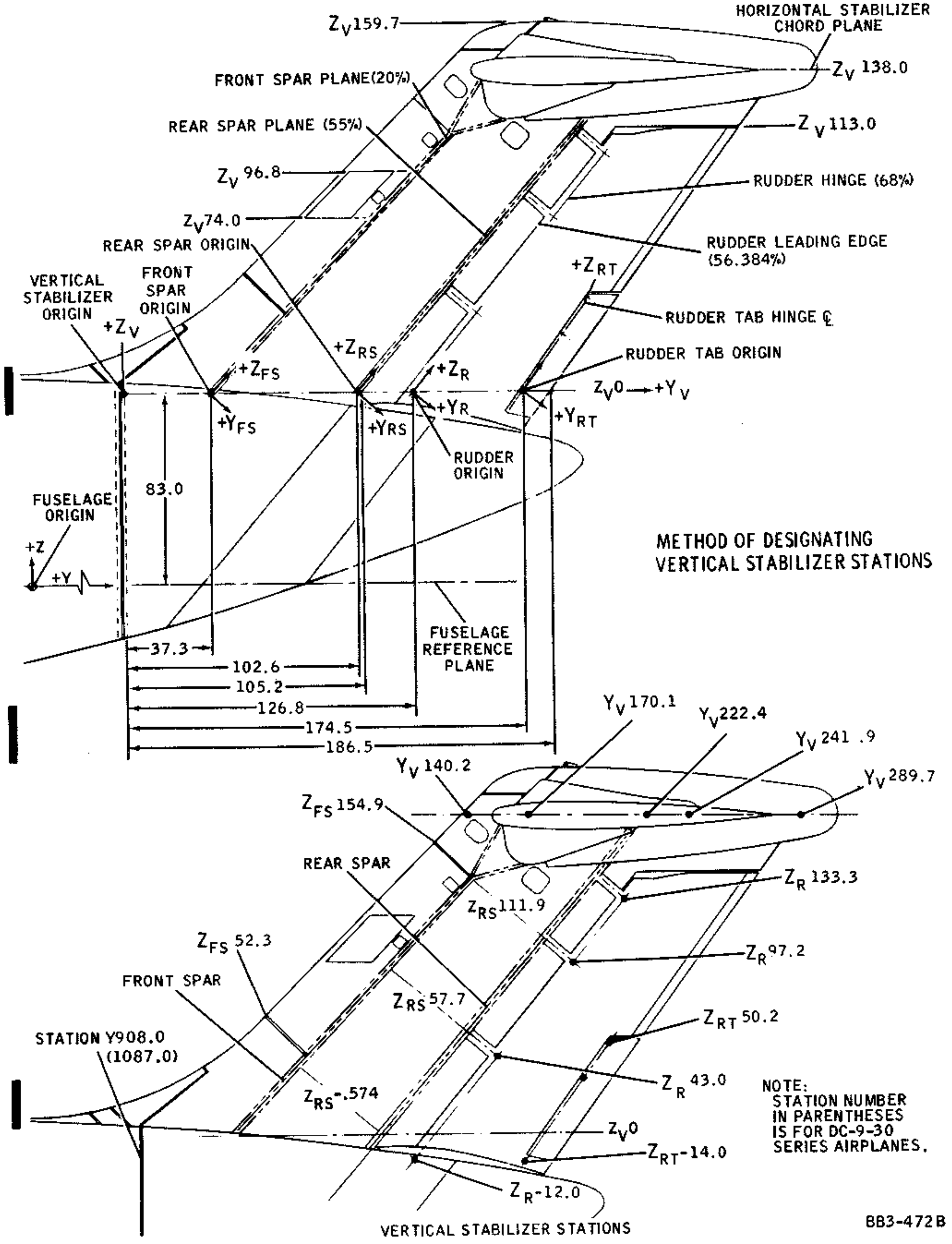


NOTE:
STATION NUMBERS IN PARENTHESES
ARE FOR DC-9-30 SERIES AIRPLANES.

VIEW LOOKING INBOARD

BB3-471A

Nacelles/Pylons Station Identification
Figure 4

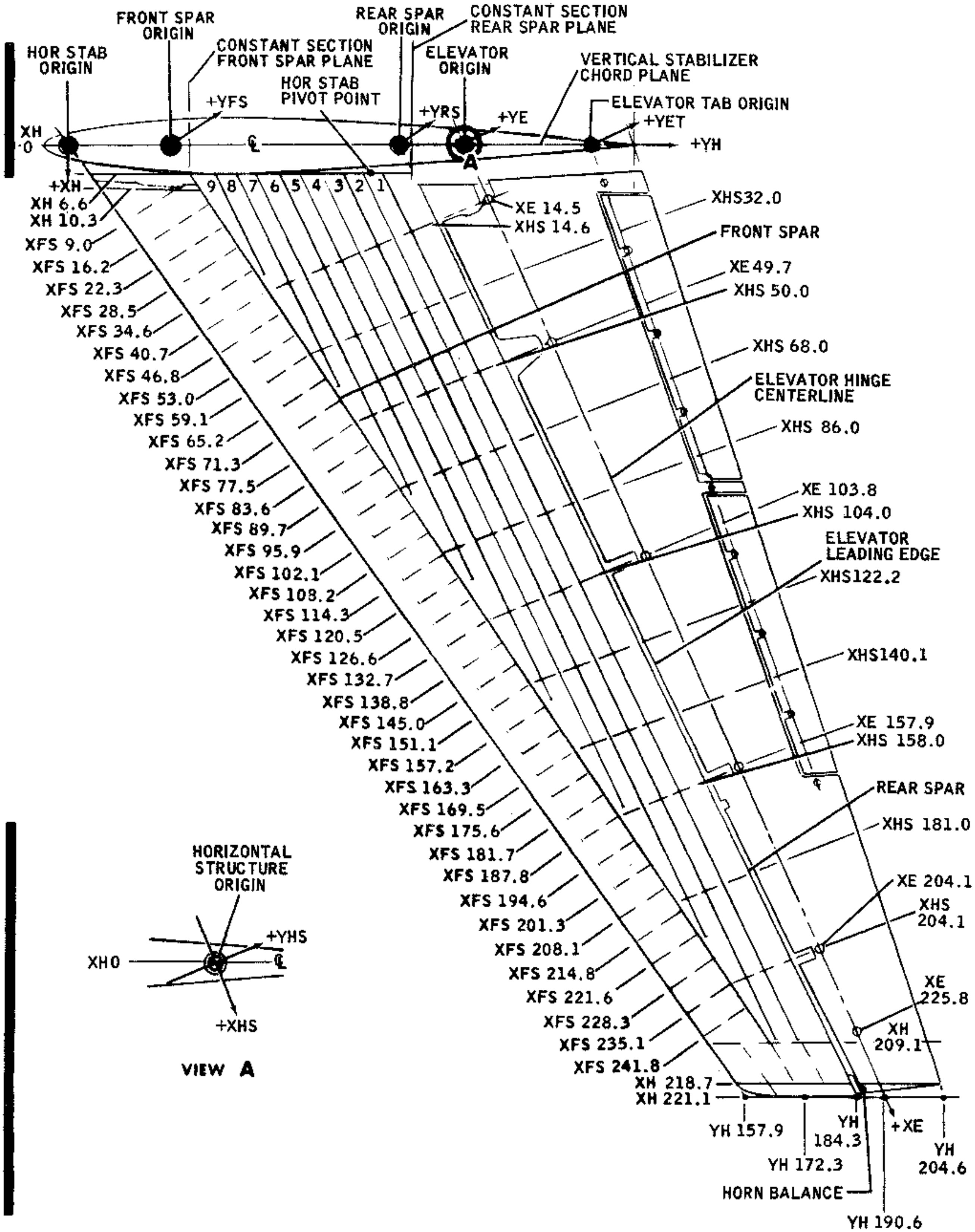


METHOD OF DESIGNATING VERTICAL STABILIZER STATIONS

NOTE:
STATION NUMBER IN PARENTHESES IS FOR DC-9-30 SERIES AIRPLANES.

VERTICAL STABILIZER STATIONS

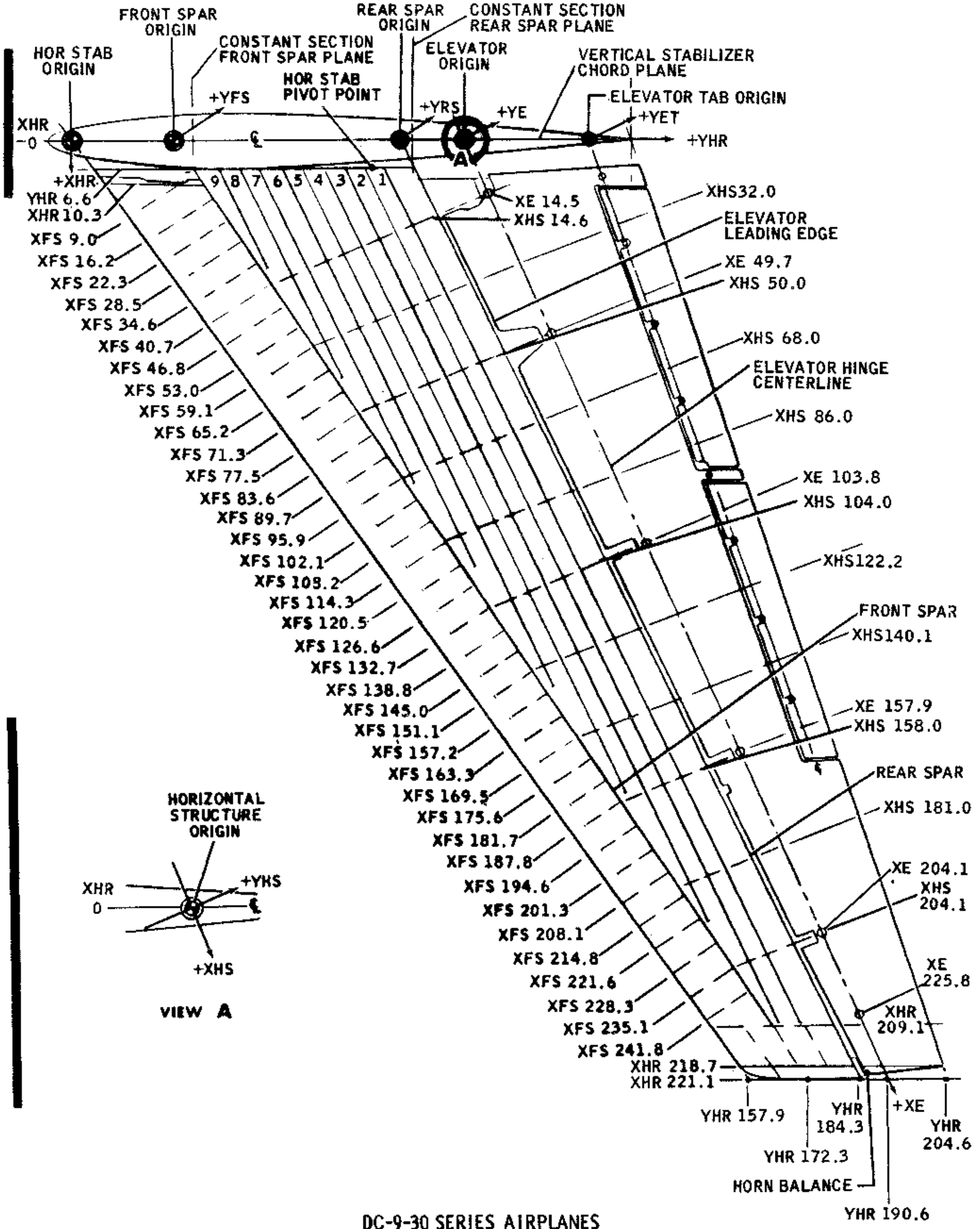
Vertical Stabilizer Station Identification
Figure 5



DC-9-10 SERIES AIRPLANES

BB3-473B

Horizontal Stabilizer Station Identification
Figure 6 (Sheet 1)



Horizontal Stabilizer Station Identification
Figure 6 (Sheet 2)

Fuselage Nose Section

DC-9-10 Station No.	DC-9-30 Station No.
7.000	7.000
37.000	37.000
41.000	41.000
47.875	47.875
53.250	53.250
58.750	58.750
64.150	64.150
69.550	69.550
76.550	76.550
83.550	83.550
94.550	94.550
101.550	101.550
120.050	120.050
123.425	123.425
125.800	125.800
133.425	133.425
141.238	141.238
148.550	148.550
160.000	160.000
168.750	168.750
180.000	180.000
200.000	200.000
207.000	207.000
218.000	218.000
229.000	229.000

Station Numbers are Identical for Series 10 and Series 30 in this area

Fuselage Station Conversion Comparison, DC-9-10 and DC-9-30 Airplanes
Figure 7 (Sheet 1)

Fuselage Forward Center Section

DC-9-10 Station No.	DC-9-30 Station No.	
237.000	237.000	Series 10 and Series 30 Stations are the same in this area
256.000	256.000	
275.000	275.000	
294.000	294.000	
-------	313.000	There is an increase of 114 inches in fuselage length in this area
-------	332.000	
-------	351.000	
313.000	370.000	
332.000	389.000	
351.000	408.000	
370.000	427.000	
389.000	446.000	
-------	465.000	
-------	484.000	
-------	508.000	
408.000	522.000	All Series 30 stations are 114 inches greater than Series 10 stations in this area
427.000	541.000	
446.000	560.000	
465.000	579.000	
484.000	598.000	

Fuselage Station Conversion Comparison, DC-9-10 and DC-9-30 Airplanes
Figure 7 (Sheet 2)

Fuselage Aft Center Section

DC-9-10 Station No.	DC-9-30 Station No.	
503.000	617.000	All Series 30 stations are 114 inches greater than Series 10 stations in this area
525.000	639.000	
544.000	658.000	
566.000	680.000	
585.000	699.000	
604.000	718.000	
623.000	737.000	
642.000	756.000	
661.000	775.000	
680.000	794.000	
-------	813.000	There is an increase of 65 inches in fuselage length in this area
-------	832.000	
-------	851.000	
699.000	870.000	
-------	889.500	
718.000	897.000	
737.000	916.000	All Series 30 stations are 179 inches greater than Series 10 stations in this area and from Station 737 (916) to the furthest aft points of the fuselages
758.000	937.000	
766.000	945.000	
786.090	965.090	
801.000	980.000	
817.000	996.000	
824.375	1003.375	

Fuselage Station Conversion Comparison, DC-9-10 and DC-9-30 Airplanes
Figure 7 (Sheet 3)

Fuselage Aft Center Section (Continued)

DC-9-10 Station No.	DC-9-30 Station No.	
840.000	1019.000	All Series 30 stations are 179 inches greater than Series 10 stations in this area and from Station 737 (916) to the furthest aft points of the fuselages
859.868	1038.868	
865.750	1044.750	
873.000	1052.000	
880.000	1059.000	
885.625	1064.625	
891.375	1070.375	
897.000	1076.000	
902.250	1081.250	
908.000	1087.000	

Fuselage Tail Section

DC-9-10 Station No.	DC-9-30 Station No.	
916.000	1095.000	All Series 30 stations canted or vertical are 179 inches greater than Series 10 stations in this area
1112.000	1291.000	

Fuselage Station Conversion Comparison, DC-9-10 and DC-9-30 Airplanes
Figure 7 (Sheet 4)

Canted Stations

DC-9-10 Station No.	DC-9-30 Station No.	
867.376	1046.376	All Series 30 stations canted or vertical are 179 inches greater than Series 10 stations in this area
895.107	1074.107	
910.009	1089.009	
925.937	1104.937	
942.225	1121.225	
953.604	1132.604	
964.019	1143.019	
976.225	1155.225	
989.407	1168.407	
989.895	1168.895	

Fuselage Station Conversion Compairson, DC-9-10 and DC-9-30 Airplanes
Figure 7 (Sheet 4)

AIRPLANE EXTERIOR NEGLIGIBLE DAMAGE REPAIR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Damage of a negligible nature (see Section 51-00, paragraph 3A) occurring to airplane external components may be repaired by the application of Scotch No. 425 tape (Minnesota Mining and Manufacturing Co., 6411 Randolph St., Los Angeles, Calif.) or equivalent, to cover the damage. The restrictions listed in paragraph 2 must be adhered to.

2. Repair Restrictions

A. The following restrictions apply:

(1) Repairs of this type are designated Interim Repairs (unless specific repairs within the various sections of the manual are designated otherwise) and have a time limit of 50 hours. At the expiration of this period, the requirements of Section 51-00, paragraph 1 A (3), must be complied with.

(2) Where the effect of the tape as an aerodynamic barrier is important, it shall not be used to span a distance greater than one-half inch or a total area greater than one square inch. For this use, the tape must be applied to the side normally facing the airstream.

(3) Tape shall extend past the damage at least one inch on all sides.

(4) Repairs of this type must not be used in pressure or pressure boundary areas, in areas of heat concentration, in areas containing fluids, or in areas where a degradation of radar or radio transmission or reception will result.

STRUCTURAL MATERIALS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section contains airplane materials, processes, and inspections used in construction and repair of the airplane structure. This section is divided into subsections as follows:

(1) Section 51-10-1, Extrusions and Formed Sections

(2) Section 51-10-2, Forming, Heat Treatment, and Metal Handling

(3) Section 51-10-3, Corrosion Control and Prevention

(4) Section 51-10-4, Drilling, Countersinking, and Dimpling

(5) Section 51-10-5, Structural Inspection.

B. Section 51-10-1 provides information on extrusions and formed sections used for the airplane structure. This section contains illustrated material and dimensional data of extrusions and formed sections. Included in the dimensional data are sizes, radii, and thicknesses. The material data reflects the heat-treated condition of the extrusion or formed section.

C. Section 51-10-2 provides the requirements for heat treatment, hot forming, shaping, scarfing, beveling, and bend radii of materials used in airplane structure.

D. Section 51-10-3 provides descriptive and procedural data for the identification, inspection, removal, and treatment of corrosion, and the protective measures to avoid corrosion.

E. Section 51-10-4 provides dimensional and procedural data for the preparation of attach holes in structural repair parts prior to their installation and attachment. Information is provided on drilling, reaming, countersinking, and dimpling.

F. Section 51-10-5 provides information for inspection of the airplane structure. Techniques and procedures for the various methods of inspection are provided.

EXTRUSIONS AND FORMED SECTIONS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. This section contains illustrated examples of Douglas Standard Extrusions and Formed (Rolled) Sections used in the construction of the airplane. Extrusions of like type are grouped together on the same illustration for convenience. Each illustrated example of extrusions or formed sections indicates the material from which the section is made and all dimensional data. The following extrusions and formed sections are covered in this section.

B. These extrusions and formed sections may be purchased from the Douglas Aircraft Company, Parts Sales Dept., 3855 Lakewood Blvd., Long Beach, Calif.

C. Whenever a Douglas Standard Extrusion or Formed Section is listed in the material identification illustrations in Chapters 52 through 57, the material and shape will be identified in this section. An index of the extrusions and formed sections is provided in paragraphs 2 through 5 of this section.

2. Metallic Extrusion Index

A. The following index lists each airplane metallic extrusion in numerical order, and references the figure number in which the extrusion is illustrated:

Extrusion Number	Figure	Extrusion Number	Figure
101818	10, Sheet 1	1179365	27, Sheet 1
130909	25, Sheet 1	1179685	25, Sheet 1
136967	28	1180406	24
137058	27, Sheet 5	1199970	1, Sheet 2
137449	13	1199981	7
138008	1, Sheet 2	1205311	1, Sheet 6
167890	1, Sheet 2	1207380	7
167891	8	1210320	27, Sheet 3
179364	1, Sheet 1	1221366	27, Sheet 1
1025503	1, Sheet 2	1223583	1, Sheet 2
1045544	1, Sheet 1	1230406	32, Sheet 1
1054839	10, Sheet 1	1232807	6
1059659	1, Sheet 6	1238984	1, Sheet 1
1059661	27, Sheet 1	1240697	1, Sheet 6
1059671	10, Sheet 1	1242368	7
1074862	27, Sheet 1	1242517	1, Sheet 3
1074863	6	1242520	1, Sheet 4
1081111	1, Sheet 1	1242525	1, Sheet 6
1081131	3	1242526	1, Sheet 3
1093703	1, Sheet 2	1242527	1, Sheet 6
1093741	32, Sheet 1	1242754	27, Sheet 3
1093742	32, Sheet 1	1242886	15
1093770	1, Sheet 2	1242933	1, Sheet 5
1093791	29	1242936	1, Sheet 5
1103715	27, Sheet 1	1242937	1, Sheet 4
1105658	13	1243092	1, Sheet 1
1105662	6	1243284	7
1105665	6	1243286	27, Sheet 1
1106624	1, Sheet 2	1243327	1, Sheet 2
1109080	1, Sheet 2	1243443	4
1110959	5	1243637	1, Sheet 2
1114110	27, Sheet 1	1243695	24
1114111	1, Sheet 1	1243775	18
1119206	1, Sheet 1	1243787	1, Sheet 4
1125529	24	1244084	1, Sheet 3
1125531	5	1245072	1, Sheet 1
112558	32	1245399	1, Sheet 2
1125597	1, Sheet 1	1245828	31
1152357	18	1245829	31
1152368	27, Sheet 1	1245835	27, Sheet 1
1152375	4, and	1248307	27, Sheet 4
	1, Sheet 7	1248529	31
1168458	1, Sheet 2	1249108	6

Extrusion Number	Figure
1249237	27, Sheet 5
1249240	27, Sheet 2
1249243	4, and 1, Sheet 3
1249328	1, Sheet 4
1249578	1, Sheet 4
1249581	1, Sheet 4
1250422	18
1250426	10, Sheet 1
1276248	1, Sheet 1
1277788	27, Sheet 3
1278964	27, Sheet 4
1285511	4, and 1, Sheet 6
1285512	4
1285733	27, Sheet 3
1286227	31
1286684	10, Sheet 2
1286845	1, Sheet 5
1287283	5
1287425	1, Sheet 4
1289882	10, Sheet 1
1290178	1, Sheet 4
1291250	21
1291820	6
1294834	1, Sheet 4
1298026	27, Sheet 5
1298097	1, Sheet 5
1313006	27, Sheet 5
1325054	1, Sheet 4
1325136	1, Sheet 4
1325214	27, Sheet 2
1325309	7
1325737	1, Sheet 3
1325738	1, Sheet 4
1325739	27, Sheet 2
1328429	31
1328571	27, Sheet 4
1328773	24
1329331	1, Sheet 6
1329632	10, Sheet 2
1329663	1, Sheet 1
1329769	27, Sheet 4
1329780	1, Sheet 1
1329805	32, Sheet 1
1329806	27, Sheet 1
1329812	1, Sheet 5

Extrusion Number	Figure
1329982	5
1329984	27, Sheet 3
1330635	27, Sheet 5
1332462	7
1332779	1, Sheet 3
1332780	27, Sheet 2
1333421	10, Sheet 1
1334723	1, Sheet 1
1361666	7
1362783	27, Sheet 5
1362856	27, Sheet 5
1363992	27, Sheet 4
1371977	32, Sheet 1
1372665	1, Sheet 5
1375211	15
1383060	27, Sheet 3
1383079	19
1387619	10, Sheet 2
1392883	24
1397514	5
1414813	27, Sheet 2
1414967	1, Sheet 3
1415392	21
1415595	1, Sheet 3
1415615	1, Sheet 7
1415741	1, Sheet 6
1415989	10, Sheet 1
1415997	1, Sheet 3
1416036	1, Sheet 3
1416793	27, Sheet 2
1417054	35B
1417096	6
1417159	10, Sheet 1
1417718	10, Sheet 2
1417984	27, Sheet 4
1418173	1, Sheet 5
1418201	1, Sheet 3
1418203	1, Sheet 3
1418367	6
1418516	7
1418683	27, Sheet 4
1418684	27, Sheet 4
1418821	1, Sheet 6
1418822	1, Sheet 6
1418887	8
1418898	27, Sheet 5
1418915	1, Sheet 7
1418990	1, Sheet 7

Extrusion Number	Figure	Extrusion Number	Figure
1419056	1, Sheet 4	1544620	1, Sheet 5
1419073	31	1555219	5
1419098	27, Sheet 4	1555251	1, Sheet 7
1419292	22	1555273	5
1419314	1, Sheet 7	1615917	4
1419315	1, Sheet 4	1616528	35
1419316	1, Sheet 4	1619970	1, Sheet 2
1419317	1, Sheet 6	1640517	1, Sheet 1
1419318	27, Sheet 5	1641009	31
1419366	27, Sheet 3	1642531	32, Sheet 1
1419385	27, Sheet 4	1642532	27, Sheet 5
1419412	10, Sheet 1	1642725	1, Sheet 5
1419650	1, Sheet 4	1642726	27, Sheet 2
1430813	27, Sheet 4	1642914	27, Sheet 5
1430824	27, Sheet 1	164646	2
1430858	35	1646170	27, Sheet 2
1430871	27, Sheet 3	1647068	35
1430882	19	1647128	34
1440004	27, Sheet 2	1648361	22
1440013	10, Sheet 1	1651402	24
1440048	27, Sheet 1	1651447	24
1440049	27, Sheet 5	1652272	33, Sheet 3
1448912	10, Sheet 1	1653031	18
1448936	6	1654677	5
1453926	1, Sheet 6	1666735	18A
1464517	5	1666744	27, Sheet 2
1464542	1, Sheet 6	1700632	27, Sheet 1
1464575	1, Sheet 3	1701177	25, Sheet 2
1464579	1, Sheet 6	1702466	1, Sheet 6
1464708	1, Sheet 2	1704438	25, Sheet 3
1464709	1, Sheet 3	1714099	32, Sheet 1
1465089	1, Sheet 2	1716225	27, Sheet 3
1468513	27, Sheet 4	1761367	27, Sheet 3
1475407	29	1766648	32, Sheet 1
1475473	27, Sheet 1	1858549	1, Sheet 3
1480301	24	1858605	1, Sheet 3
1482282	27, Sheet 5	2272071	20
1498966	7	2272677	19
1499044	35	2415144	1, Sheet 1
1499324	25, Sheet 1	2415533	25, Sheet 2
1503777	32, Sheet 1	2418534	27, Sheet 2
1503998	1, Sheet 5	2431257	27, Sheet 3
1514793	27, Sheet 2	2464541	6
1528377	27, Sheet 3	2500429	7
1532213	31	2505326	18
1533590	5	2505340	27, Sheet 3
1533937	31	2505668	18
1544604	27, Sheet 4	2506195	27, Sheet 2
1544612	27, Sheet 4	2506869	32, Sheet 1
1544614	27, Sheet 1		

Extrusion Number	Figure	Extrusion Number	Figure
2506870	32, Sheet 2	2772779	18B
2602999	3	2772780	18B
2610250	33, Sheet 2	2777734	35A, Sheet 1
2610338	15	2777896	11
2611323	25, Sheet 1	2777897	22
2612329	7	2777927	4, and
2613001	20		1, Sheet 6
2613679	22	2777950	25, Sheet 3
2613680	31	2777951	25, Sheet 3
2613702	30	2777964	33, Sheet 2
2613776	33, Sheet 1	2777968	30
2613825	33, Sheet 1	2777974	33, Sheet 4
2613900	27, Sheet 2	2777975	33, Sheet 2
2614462	11	2777976	33, Sheet 1
2614618	22	2911391	22
2614730	20	2912045	1, Sheet 5
2614737	21, Sheet 2	2912046	33, Sheet 1
2615114	27, Sheet 4	2912047	33, Sheet 1
2615336	25, Sheet 1	2912063	6
2615551	27, Sheet 3	2912064	5
2615760	33, Sheet 1	2912065	6
2616291	27, Sheet 5	2912066	5
2616292	10, Sheet 1	2912081	33, Sheet 1
2616608	1, Sheet 3	2912094	10, Sheet 2
2620678	27, Sheet 4	2912096	10, Sheet 2
2640547	27, Sheet 3	2912099	14
2640548	27, Sheet 5	2912118	5
2640729	33, Sheet 3	2912200	33, Sheet 2
2641313	25, Sheet 1	2912293	6
2641454	14	2912306	25, Sheet 3
2642053	12	2912308	33, Sheet 2
2644853	27, Sheet 5	2912310	33, Sheet 2
2643899	24	2912311	20
2644854	27, Sheet 5	2912368	21
2645335	25, Sheet 3	2912397	1, Sheet 5
2645505	27, Sheet 5	2912399	26
2647332	17	2912427	33, Sheet 3
2649174	32, Sheet 1	2912428	33, Sheet 2
2651332	16	2912429	33, Sheet 2
2652479	22	2912466	1, Sheet 6
2655233	21	2912538	27, Sheet 2
2655915	23	2912553	21
2655916	23	2912554	4
2664541	6	2912598	19
2703016	10, Sheet 1	2912727	15
2704877	15	2912758	1, Sheet 5
2706708	25, Sheet 1	2912813	1, Sheet 5
2718854	27, Sheet 3	2912830	29
2772660	26	2913088A	21

Extrusion Number	Figure	Extrusion Number	Figure
2913105A	21	2919148	25, Sheet 4
2913108	4	2919253	10, Sheet 2
2913226	27, Sheet 5	2919261	33, Sheet 4
2913237A	10, Sheet 1	2919708	29
2913245A	10, Sheet 1	2919896	33, Sheet 4
2913434	25, Sheet 2	2920057	25, Sheet 4
2913436	25, Sheet 2	2921949	35A, Sheet 1
2913484	25, Sheet 1	2921948	20
2913494	25, Sheet 3	2923195	20
2913513	10, Sheet 1	2955644	25, Sheet 1
2913581	33, Sheet 2	2955883	25, Sheet 1
2913627	1, Sheet 1	2955978	26
2913654	18	2956031A	21
2913655	25, Sheet 2	2956910	1, Sheet 5
2913786	27, Sheet 4	2958748	25, Sheet 3
2914033	21	2958750	25, Sheet 4
2914046	25,Sheet 2	3911230	35A, Sheet 1
2914057	32, Sheet 1	3911232	35A, Sheet 1
2914150	33, Sheet 1	3911234	35A, Sheet 1
2914095	25, Sheet 3	3911236	35A, Sheet 2
2914151	33, Sheet 1	3911238	35A, Sheet 2
2914191	32, Sheet 1	3911240	35A, Sheet 3
2914217	9	3912303	25, Sheet 4
2914254	25, Sheet 1	3912878	33, Sheet 3
2914255	33, Sheet 1	3919064	25, Sheet 4
2914520	32, Sheet 2	3919229	33, Sheet 3
2914521	32, Sheet 2	3919248	35A, Sheet 4
2914624	27, Sheet 2	3919249	35A, Sheet 4
2914763	25, Sheet 2	4594047	20
2914765	25, Sheet 2	4594694	22
2914793	25, Sheet 4	4613768	1, Sheet 5
2914912	32, Sheet 1	4616560	5A
2914913	26	4651558	33, Sheet 2
2914935	25, Sheet 3	4911204	33, Sheet 4
2914976	25, Sheet 3	4911205	33, Sheet 4
2914983	32, Sheet 1	4911207	33, Sheet 3
2915085	25, Sheet 1	4911242	33, Sheet 4
2915844	7	4911243	33, Sheet 4
2915910	21	4912121	33, Sheet 3
2916129	25, Sheet 1	4912718	33, Sheet 4
2916132	33, Sheet 3	4913094	25, Sheet 3
2916625	33, Sheet 1	4913414	21
2917568	25, Sheet 3	4913966	33, Sheet 1
2917577	33, Sheet 3	4914686	33, Sheet 2
2918090	33, Sheet 3	4914837	25, Sheet 4
2918996	35A, Sheet 1	4917997	25, Sheet 2
2919038	33, Sheet 3	4919230	33, Sheet 3
2919136	31	4919231	33, Sheet 3

3. Elastic Extrusion Index

A. The following index lists each airplane elastic extrusion in numerical order and references the figure number in which the extrusion is illustrated:

Extrusion Number	Figure	Extrusion Number	Figure
1714303	35B	2917162	35B
2707761	35B	2958600	35B
2913623	35B	2958601	35B
2916009	35B	4744637	35B
2916291	35B	4923882	37

4. Metallic Formed Section Index

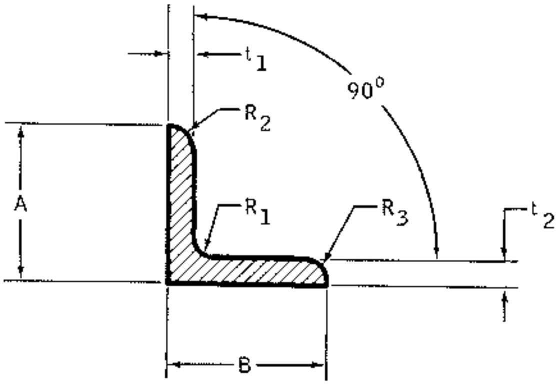
A. The following index lists each airplane metallic formed section in numerical order and references the figure number in which it is illustrated.

Formed Section Number	Figure	Formed Section Number	Figure
1001122	36, Sheet 1	2777930	36, Sheet 2
1104821	36, Sheet 1	2777948	36, Sheet 2
1109618	36, Sheet 1	2912282	36, Sheet 2
1243425	36, Sheet 1	2912412	36, Sheet 2
1244347	36, Sheet 1	2912901	36, Sheet 2
1250475	36, Sheet 1	2914646	36, Sheet 2
1329537	36, Sheet 1	2914777	36, Sheet 2
1335556	36, Sheet 1	2915786	36, Sheet 2
1350576	36, Sheet 1	2916423	36, Sheet 2
1350577	36, Sheet 1	2916874	36, Sheet 2
1383066	36, Sheet 3	2916875	36, Sheet 3
2497751	36, Sheet 1	2917095	36, Sheet 3
2706706	36, Sheet 1	2917981	36, Sheet 3
2711050	36, Sheet 3	2958602	36, Sheet 3
2777922	36, Sheet 2	2958603	36, Sheet 3
2777923	36, Sheet 2	3914726	36, Sheet 3

5. Elastic Formed Section Index

A. The following index lists each airplane elastic formed section in numerical order and references the figure number in which the extrusion is illustrated:

Formed Section Number	Figure	Formed Section Number	Figure
2766959	37	4616493	37
2916319	37	4913095	37
3913179	37	4914344	37
3913180	37	4913975	37
4616492	37	4914718	37
		4923882	37

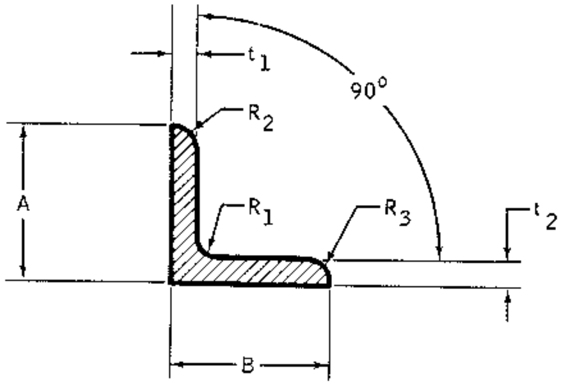


A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
1.250	2.500	0.125	0.125	0.188	0.093	0.093	0.453	2014-T6511	2415144
0.500	0.500	0.040	0.040	0.016	0.010	0.010	0.038	2024-T3511	1640517
0.625	0.625	0.051	0.051	0.062	--	--	0.062	2024-T3511	1045544
0.625	0.750	0.051	0.051	0.063	0.062	0.062	0.067	2024-T3511	179364
0.625	0.750	0.063	0.063	0.063	0.063	0.063	0.082	2024-T3511	1245072
0.750	1.125	0.062	0.062	0.062	0.031	0.031	0.113	2024-T3511	1119206
1.000	1.500	0.062	0.062	0.062	0.031	0.031	0.152	2024-T3511	1125597
0 875	0.875	0.063	0.063	0.094	0.063	0.063	0.107	2024-T3511	1243092
1.125	1.875	0.064	0.064	0.094	0.010	0.010	0.190	2024-T3511	1329663
0.750	0.875	0.063	0.063	0.125	0.063	0.063	0.100	2024-T3511	1276248
0.625	0.875	0.063	0.063	0.125	0.062	0.062	0.092	2024-T3511	1114111
1.000	0.750	0.063	0.063	0.125	0.062	0.062	0.100	2024-T3511	1081114
1.188	1 000	0.094	0.188	0.188	0.032	0.032	--	7075-T6511	2913627
0.750	1 250	0.063	0.063	0.125	0.063	0.063	0.124	2024-T3511	1238984
1.000	0.875	0.063	0.063	0.125	0.063	0.063	0 116	2024-T3511	1334723
1.000	1.250	0.062	0 062	0 125	0.010	0.010	0.138	2024-T3511	1329780

Printed in U.S.A.

BB3-1

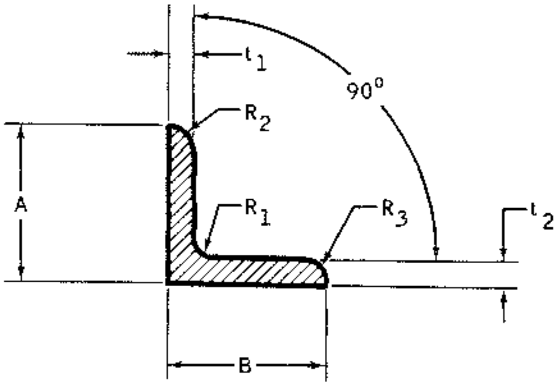
Extrusions -- 90-Degree Angle
Figure 1 (Sheet 1)



A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
1.250	1.250	0.063	0.063	0.188	0.063	0.063	0.159	2024-T3511	1243637
1.500	1.500	0.063	0.063	0.188	0.063	0.063	0.191	2024-T3511	1245399
1.000	1.000	0.076	0.076	0.125	0.062	0.062	0.148	2024-T3511	1168458
1.000	3.000	0.078	0.078	0.093	0.030	0.030	0.306	2024-T3511	1619970
0.750	0.750	0.094	0.094	0.094	0.094	0.094	0.130	2024-T3511	1199970
1.250	1.500	0.094	0.094	0.156	0.093	0.093	0.250	2024-T3511	1243327
1.000	1.000	0.094	0.094	0.188	0.094	0.094	0.180	2024-T3511	167890
1.875	2.625	0.125	0.125	0.125	0.062	0.062	0.549	2024-T3511	1223583
0.875	1.375	0.125	0.125	0.125	--	--	0.269	2024-T3511	1093703
1.000	1.250	0.125	0.125	0.125	0.125	0.125	0.262	2024-T3511	1025503
1.375	1.375	0.125	0.125	0.125	0.062	0.062	0.330	2024-T3511	1093770
1.250	1.250	0.250	0.250	0.188	0.125	0.125	0.560	2024-T3511	167891
2.000	2.500	0.312	0.312	0.250	0.125	0.125	1.320	2024-T3511	1106624
1.500	0.875	0.062	0.093	0.062	0.062	0.062	0.170	2024-T3511	1109080
0.750	0.750	0.050	0.050	0.030	0.025	0.025	0.073	7075-T6511	1465089
0.750	1.000	0.051	0.051	0.125	FULL	FULL	0.098	7075-T6511	1464708

BB3-2

Extrusions -- 90-Degree Angle
Figure 1 (Sheet 2)

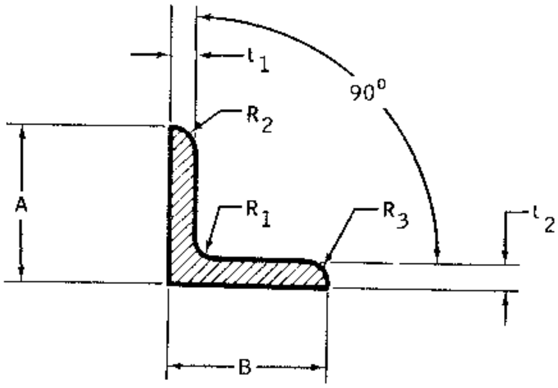


A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
0.750	1.250	0.051	0.051	0.125	FULL	FULL	0.111	7075-T6511	1464709
1.000	1.000	0.062	0.062	0.062	0.031	0.031	0.121	7075-T6511	1242526
0.750	0.750	0.063	0.063	0.094	0.063	0.063	0.091	7075-T6511	1244084
0.875	0.875	0.063	0.063	0.094	0.063	0.063	0.107	7075-T6511	1415595
0.875	2.250	0.063	0.063	0.093	0.010	0.010	0.195	7075-T6511	1464575
0.750	0.750	0.062	0.062	0.125	FULL	FULL	0.093	7075-T6511	2616608
1.000	0.750	0.063	0.063	0.125	0.063	0.063	0.108	7075-T6511	1242517
1.000	0.875	0.063	0.063	0.125	0.063	0.063	0.116	7075-T6511	1332779
0.875	1.125	0.063	0.063	0.125	0.063	0.063	0.124	7075-T6511	1416036
1.000	1.250	0.062	0.062	0.125	0.010	0.010	0.138	7075-T6511	1249243
1.000	1.000	0.076	0.076	0.125	0.063	0.063	0.148	7075-T6511	1414967
2.000	2.188	0.080	0.080	0.094	0.063	0.063	0.329	7075-T6511	1858605
0.750	2.250	0.080	0.080	0.093	0.063	0.063	0.154	7075-T6511	1858549
0.875	1.125	0.093	0.093	0.093	0.031	0.031	0.179	7075-T6511	1418203
1.000	1.125	0.093	0.093	0.093	0.031	0.031	0.191	7075-T6511	1418201
1.250	1.250	0.094	0.094	0.094	0.047	0.047	0.227	7075-T6511	1325737

Printed in U.S.A.

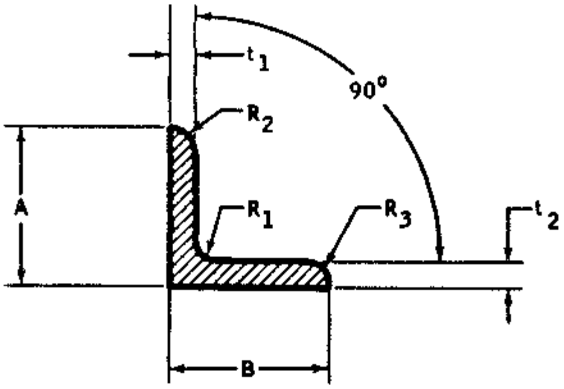
BB3-3

Extrusions -- 90-Degree Angle
Figure 1 (Sheet 3)



A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
1.625	1.750	0.093	0.093	0.093	0.030	0.030	0.306	7075-T6511	1325136
1.000	2.250	0.093	0.093	0.093	0.016	0.016	0.296	7075-T6511	1287425
0.750	1.000	0.093	0.093	0.125	0.093	0.093	0.154	7075-T6511	1249581
0.875	1.000	0.094	0.094	0.125	0.094	0.094	0.167	7075-T6511	1294834
1.250	1.000	0.094	0.094	0.125	0.094	0.094	0.202	7075-T6511	1243787
1.562	2.250	0.093	0.093	0.125	0.031	0.031	0.350	7075-T6511	1419056
1.000	1.500	0.094	0.094	0.156	0.094	0.094	0.228	7075-T6511	1291078
1.000	1.000	0.094	0.094	0.188	0.094	0.094	0.183	7075-T6511	1249578
1.000	1.250	0.125	0.125	0.125	0.125	0.125	0.262	7075-T6511	1242520
2.500	4.000	0.125	0.125	0.125	0.010	0.010	0.800	7075-T6511	1249328
1.250	1.500	0.125	0.125	0.156	0.125	0.125	0.327	7075-T6511	1325738
1.250	1.750	0.125	0.125	0.156	0.125	0.125	0.358	7075-T6511	1419316
2.125	2.125	0.125	0.125	0.188	0.125	0.125	0.516	7075-T6511	1419650
1.250	1.250	0.125	0.125	0.188	0.125	0.125	0.298	7075-T6511	1242937
1.500	1.500	0.125	0.125	0.188	0.125	0.125	0.360	7075-T6511	1325054
1.500	2.000	0.125	0.125	0.188	0.125	0.125	0.423	7075-T6511	1419315

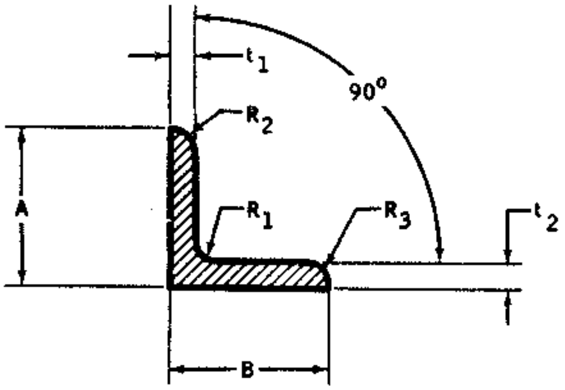
Extrusions -- 90-Degree Angle
Figure 1 (Sheet 4)



A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
1.000	2.500	0.125	0.125	0.250	0.010	0.010	0.440	7075-T6511	1329982
1.188	1.500	0.188	0.188	0.188	0.188	0.188	0.465	7075-T6511	1544620
1.500	1.500	0.188	0.188	0.188	0.188	0.188	0.521	7075-T6511	1242936
2.625	3.375	0.188	0.188	0.188	0.040	0.040	1.110	7075-T6511	1642725
2.000	2.500	0.188	0.188	0.250	0.188	0.188	0.809	7075-T6511	1329812
3.500	7.000	0.310	0.310	0.250	0.031	0.031	3.480	7075-T6511	4613768
3.500	3.500	0.312	0.312	0.375	0.250	0.250	2.530	7075-T6511	1372665
2.250	1.250	0.060	0.190	0.188	FULL	0.031	0.432	7075-T6511	2912045
1.062	1.000	0.062	0.125	0.125	0.031	0.031	0.187	7075-T6511	2912758
3.250	0.875	0.093	0.125	0.156	0.010	0.010	0.407	7075-T6511	1286845
3.250	1.625	0.093	0.187	0.091	0.031	0.031	0.590	7075-T6511	1298097
2.500	1.125	0.093	0.218	0.125	0.031	0.031	0.467	7075-T6511	1418173
1.875	1.000	0.093	0.250	0.125	0.031	0.031	0.391	7075-T6511	2912813
1.875	1.000	0.125	0.375	0.125	0.031	0.031	0.566	7075-T6511	1503998
1.875	1.125	0.125	0.375	0.125	0.031	0.031	1.080	7075-T6511	2956910
2.000	1.500	0.125	0.375	0.125	0.030	0.030	0.766	7075-T6511	2912397
1.500	1.000	0.125	0.125	0.156	0.125	0.125	0.295	7075-T6511	1242933

BB3-5A

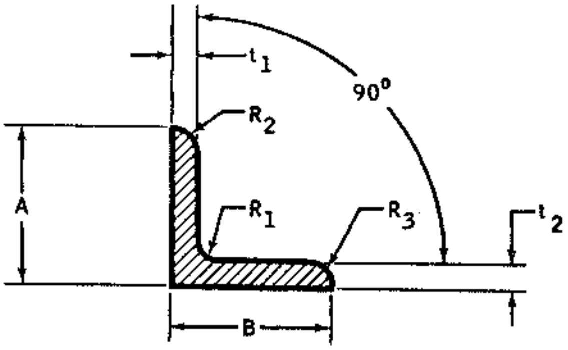
Extrusions -- 90-Degree Angle
Figure 1 (Sheet 5)



A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
2.750	2.000	0.250	0.937	0.375	0.062	0.125	2.380	7075-T6511	1285511
0.625	0.750	0.051	0.051	0.062	0.062	0.062	0.067	7075-T6511	1242525
0.625	1.000	0.063	0.063	0.125	0.063	0.063	0.100	2024-T3511	1329331
3.250	1.032	0.093	0.500	0.156	0.030	0.030	--	7075-T6511	1702466
0.750	1.000	0.093	0.093	0.125	0.093	0.093	0.154	2024-T3511	1059659
0.875	0.875	0.094	0.094	0.094	0.094	0.094	0.154	2024-T3511	1240697
0.750	0.750	0.094	0.094	0.094	0.094	0.094	0.130	7075-T6511	1242527
0.875	0.875	0.094	0.094	0.094	0.094	0.094	--	7075-T6511	1418821
2.062	1.000	0.100	0.125	0.188	FULL	FULL	--	7075-T6511	2912466
1.250	2.000	0.094	0.094	0.125	0.010	0.010	0.300	7075-T6511	1464579
0.750	0.875	0.125	0.125	0.125	0.125	0.125	--	7075-T6511	1419317
1.000	1.000	0.125	0.125	0.188	0.125	0.125	0.235	7075-T6511	1415741
1.250	2.000	0.188	0.188	0.188	0.188	0.188	0.568	2014-T3511	1205311
1.250	2.000	0.250	0.250	0.188	0.031	0.031	0.766	7075-T6511	1464542
1.125	0.750	0.070	0.090	0.125	FULL	FULL	--	7075-T6511	2777927
0.875	0.875	0.094	0.188	0.094	0.094	0.016	--	7075-T6511	1418822
1.750	2.500	0.188	0.188	0.188	0.188	0.188	0.756	2024-T4	1453926

BB3-6A

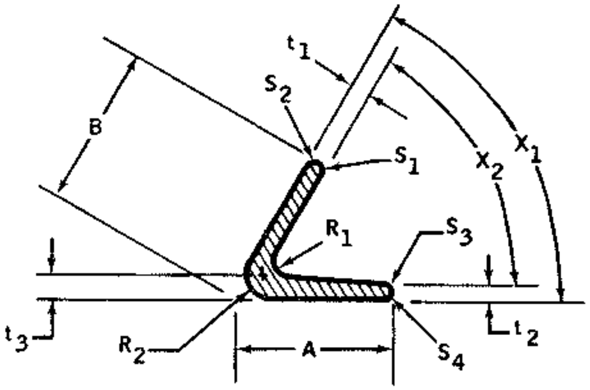
Extrusions -- 90-Degree Angle
Figure 1 (Sheet 6)



A	B	t_1	t_2	R_1	R_2	R_3	AREA	MATERIAL	EXTRUSION
1.000	1.000	0.125	0.156	0.093	0.156	0.156	0.255	7075-T6511	1415615
4.094	1.188	0.125	0.188	0.188	0.032	0.032	1.262	7075-T6511	1418990
2.750	0.938	0.156	0.500	0.125	0.031	0.031	0.820	7075-T6511	1555251
2.000	1.500	0.188	0.250	0.156	0.032	0.032	0.709	7075-T6511	1418915
2.375	1.750	0.188	0.562	0.125	0.062	0.062	1.430	2024-T3511	1152375
2.000	1.500	0.188	0.188	0.188	0.188	0.188	0.615	7075- T6	1419314

BB3-7A

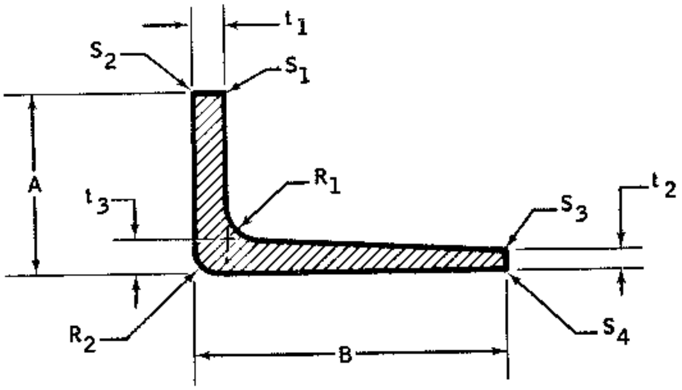
Extrusions -- 90-Degree Angle
Figure 1 (Sheet 7)



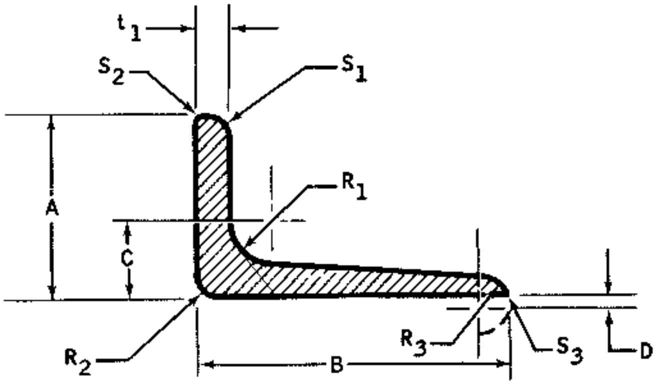
A	B	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	X_1	X_2	AREA	MATERIAL	EXTRUSION
1.375	1.813	0.094	0.050	0.125	0.125	0.031	0.031	0.031	0.015	0.031	87°34'	--	--	7075-T6511	1645646

BB3-29

Extrusions -- Tapered Leg, Closed Bevel Angle
Figure 2



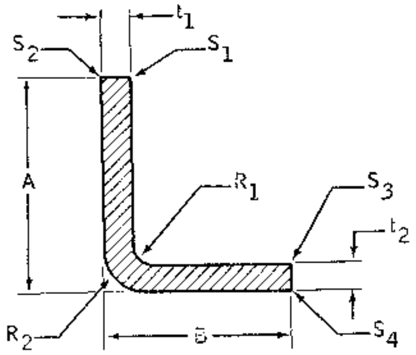
A	B	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
1.125	2.000	0.218	0.062	0.125	0.250	0.031	0.031	0.031	0.031	0.031	0.031	2014-T6511	2602999



A	B	C	D	t_1	R_1	R_2	R_3	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
1.000	2.500	0.437	--	0.218	0.250	--	0.093	0.218	--	--	0.548	2024-T3511	1081131

BB3-28

Extrusions -- Tapered Leg, 90-Degree Angle
Figure 3

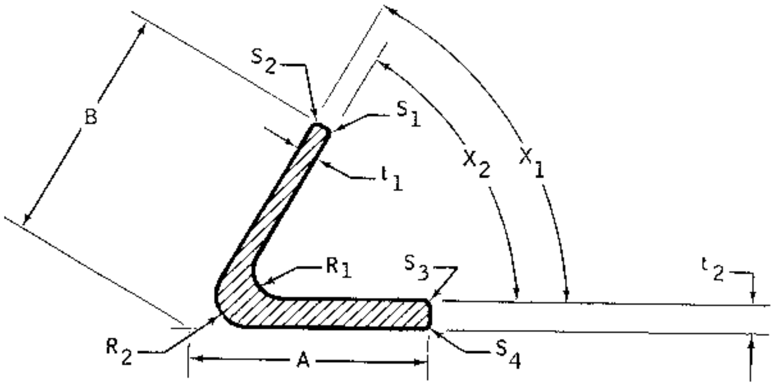


A	B	t_1	t_2	R_1	R_2	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
2.375	1.750	0.188	0.562	0.125	0.062	0.062	0.062	0.062	0.062	1.430	2024-T3511	1152375
2.000	1.000	0.125	0.125	0.250	0.062	0.062	0.062	0.062	0.062	0.348	2024-T3511	1243443
1.250	1.000	0.062	0.062	0.125	0.030	--	0.030	--	0.030	0.138	7075-T6511	1240243
1.500	1.500	0.125	0.125	0.125	0.031	0.031	0.125	0.031	0.125	0.356	2024-T3511	2943108
0.375	0.781	0.093	0.125	0.125	--	FULL	FULL	--	0.313	--	2024-T3511	2912554
2.750	2.000	0.250	0.937	0.375	0.062	0.062	0.062	0.125	0.125	2.380	7075-T6511	1285511
1.125	0.750	0.070	0.090	0.125	0.062	FULL	FULL	FULL	FULL	--	7075-T6511	2777927
2.094	1.547	0.250	0.688	0.063	0.188	0.063	0.063	0.063	0.063	1.420	7075-T6511	1615917
2.500	1.875	0.250	0.750	0.375	0.125	0.062	0.062	0.125	0.125	1.840	7075-T6511	1285512

Printed in U.S.A.

BB3-9

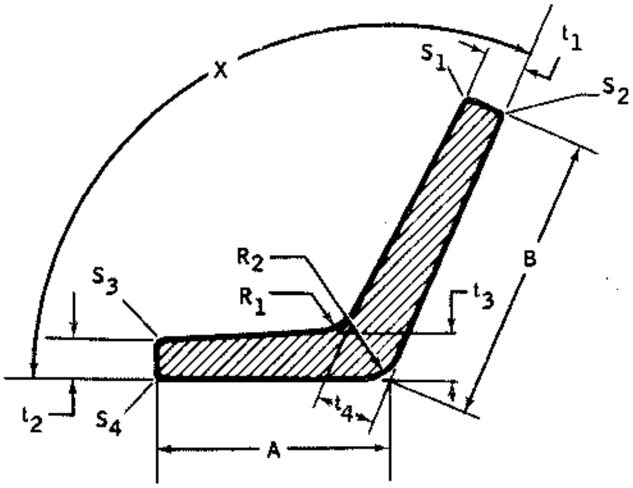
Extrusions -- Large Corner Radius, 90-Degree Angle
Figure 4



A	B	t_1	t_2	R_1	R_2	S_1	S_2	S_3	S_4	X_1	X_2	AREA	MATERIAL	EXTRUSION
0.875	1.375	0.062	0.062	0.063	--	0.031	0.031	0.031	0.031	66°	--	0.139	2024-T3511	1555273
0.750	1.000	0.063	0.063	0.125	0.010	FULL	--	FULL	--	--	88°25'	0.108	7075-T6511	1464517
1.688	1.500	0.094	0.094	0.094	0.063	0.031	0.031	0.031	0.031	66°	--	0.350	7075-T6511	1555219
0.969	2.188	0.108	0.108	0.125	--	0.030	0.030	0.030	0.030	85°30'	--	--	7075-T6511	1654677
1.375	1.750	0.125	0.188	0.125	0.125	0.031	0.031	0.030	0.030	--	80°02'	0.434	7075-T6511	1397514
0.875	1.062	0.064	0.064	0.062	--	0.062	--	0.062	--	77°	--	0.119	2024-T3511	1125531
0.625	0.750	0.051	0.051	0.062	--	0.031	--	0.031	--	79°45'	--	0.068	2024-T3511	1110959
1.000	1.000	0.093	0.093	0.093	0.031	0.031	0.031	0.031	0.031	87°25'	90°	0.206	2014-T6511	2912066
1.688	1.375	0.070	0.060	0.125	0.031	0.031	0.031	0.031	0.031	83°	90°	--	7075-T6511	2912118
1.000	1.125	0.093	0.062	0.093	0.031	0.031	0.031	FULL	--	82°40'	90°	0.216	2014-T6511	2912064
1.312	1.875	0.156	0.125	0.125	0.030	0.030	0.030	0.030	0.030	83°15'	--	--	7075-T6511	1533590
2.250	2.344	0.375	0.500	0.375	--	0.031	0.031	0.031	0.031	--	80°45'	1.826	7075-T6511	1287283

BB3-10

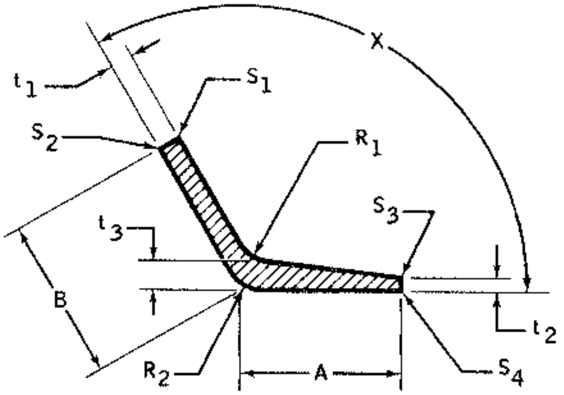
Extrusions -- Constant Leg, Closed Bevel Angle
Figure 5



A	B	t_1	t_2	t_3	t_4	R_1	R_2	S_1	S_2	S_3	S_4	X	AREA	MATERIAL	EXTRUSION
3.594	4.562	0.625	0.625	0.750	0.625	0.812	0.688	0.062	0.062	0.062	0.062	113°38"	--	7075-T6	4616560

BB3-707

Extrusions -- Open Bevel Angle, Tapered Legs
Figure 5A

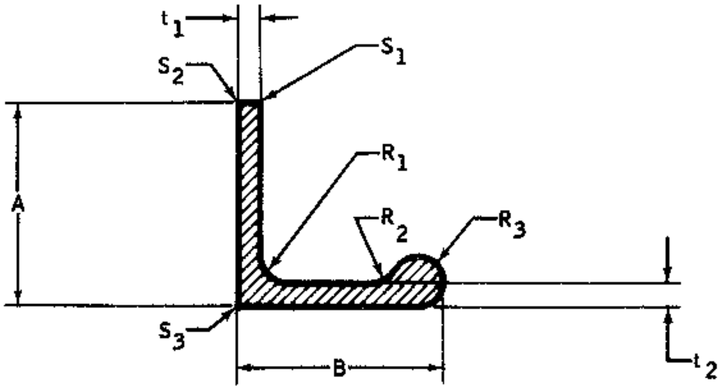


A	B	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	X	AREA	MATERIAL	EXTRUSION
2.000	2.000	0.093	0.093	0.093	0.093	0.030	0.010	0.030	0.010	0.030	92°30'	0.365	7075-T6511	1249108
1.000	1.000	0.093	0.093	0.093	0.125	--	0.093	--	0.093	--	100°	0.141	2024-T3511	1232807
1.125	0.875	0.093	0.093	0.093	0.093	0.031	0.031	0.031	0.031	0.031	112°30'	0.214	7075-T6511	1417096
2.000	1.688	0.250	0.250	0.250	0.250	0.031	0.031	0.031	0.031	0.031	94°30'	0.873	7075-T6511	2664541
2.375	1.750	0.312	0.312	0.312	0.500	--	0.312	0.031	0.312	0.031	95°	1.230	7075-T6511	1448936
1.638	1.455	0.060	0.050	0.100	0.375	0.250	FULL	FULL	FULL	FULL	101°20'	--	2024-T3511	2912293
1.562	1.750	0.250	0.375	0.375	0.250	0.250	0.062	0.062	0.062	0.062	98°	0.941	2024-T3511	1105665
1.125	1.000	0.187	0.125	0.125	0.125	0.187	0.031	0.031	0.031	0.031	98°	0.304	7075-T6511	1418367
2.000	2.500	0.125	0.125	0.125	0.125	0.031	0.031	0.031	0.031	0.031	95°	0.550	7075-T6511	1291820
1.750	2.562	0.093	0.093	0.093	0.093	--	--	--	--	--	98°	0.395	2024-T3511	1074863
2.000	2.000	0.250	0.250	0.250	0.250	--	0.125	--	0.125	--	97°38'	0.948	2024-T3511	1105662
2.000	1.688	0.250	0.250	0.250	0.250	0.031	0.031	0.031	0.031	0.031	94°30'	0.873	7075-T6511	2464541
1.000	1.125	0.093	0.062	0.156	0.093	0.031	0.031	0.031	FULL	FULL	101°	0.192	2014-T6511	2912063
1.000	1.000	0.093	0.062	0.187	0.093	0.031	0.031	0.031	FULL	FULL	95°	0.206	2014-T6511	2912065

Printed in U.S.A.

BB3-13

Extrusions -- Open Bevel Angle
Figure 6

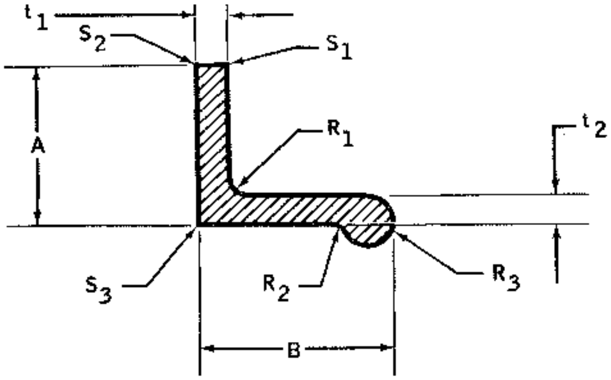


A	B	t_1	t_2	R_1	R_2	R_3	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
1.000	0.875	0.062	0.062	0.094	0.094	0.094	0.062	--	--	0.133	2014-T6511	2612329
0.500	0.500	0.040	0.040	0.060	0.060	0.060	0.040	0.010	0.010	0.047	2024-T3511	1207380
0.625	0.875	0.050	0.050	0.075	0.075	0.075	0.050	--	--	0.085	2024-T3511	1242368
0.875	1.250	0.078	0.078	0.117	0.117	0.117	0.078	--	--	0.191	2024-T3511	1199981
0.625	0.750	0.051	0.051	0.125	0.062	0.062	--	--	--	0.078	7075-T6511	2500429
0.875	1.000	0.078	0.078	0.117	0.117	0.117	0.010	0.010	0.010	0.172	7075-T6511	1361666
1.000	1.000	0.093	0.093	0.125	0.125	0.125	FULL	--	0.031	--	7075-T6511	1418516
1.125	1.750	0.094	0.094	0.117	0.117	0.117	0.094	0.010	0.010	0.288	7075-T6511	1498966
0.875	1.250	0.078	0.078	0.117	0.117	0.117	0.078	0.010	0.010	0.211	7075-T6511	1332462
1.250	1.375	0.125	0.125	0.125	0.125	0.156	0.125	0.010	0.010	0.385	7075-T6511	1325309
0.938	1.000	0.064	0.064	0.064	0.094	0.094	--	--	--	0.140	2024-T3511	1243284
0.750	0.875	0.062	0.062	0.094	0.094	0.094	FULL	FULL	0.031	0.112	7075-T6511	2915844

Printed in U.S.A.

BB3-14B

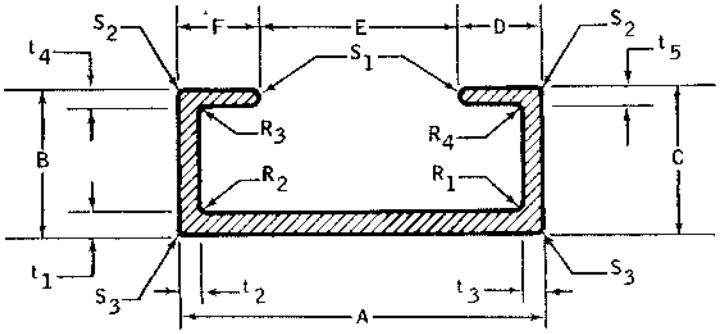
Extrusions -- Standard Bulb Angle
Figure 7



A	B	t_1	t_2	R_1	R_2	R_3	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
0.562	1.500	0.050	0.050	0.100	0.075	0.075	--	--	--	0.112	2024-T3511	168008
1.218	0.750	0.072	0.072	0.062	0.062	0.094	FULL	FULL	0.031	--	7075-T6511	1418887

BB3-30

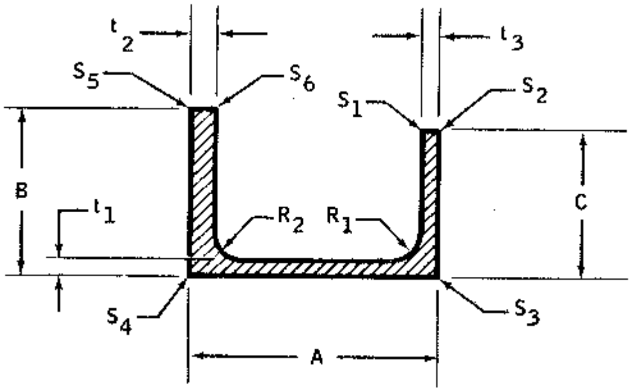
Extrusions -- Reversed Bulb Angle
Figure 8



A	B	C	D	E	F	t_1	t_2	t_3	t_4	t_5	R_1	R_2	R_3	R_4	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
1.000	0.250	0.250	0.250	0.500	0.250	0.040	0.040	0.040	0.040	0.040	0.031	0.031	0.031	0.031	FULL	0.010	0.010	--	6061-T6511	2914217

BB3-32

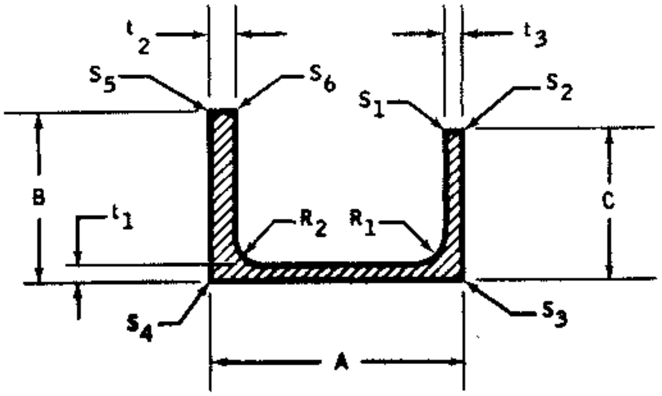
Extrusions -- Return Flange Channel
Figure 9



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.000	1.000	1.000	0.094	0.094	0.094	0.125	0.125	0.094	--	--	--	--	0.094	0.361	2014-T6511	1440013
3.812	2.625	2.625	0.156	0.156	0.156	0.438	0.438	--	--	--	--	--	--	--	2014-T6511	1448912
0.875	1.125	1.125	0.125	0.125	0.125	0.093	0.093	--	--	--	--	--	--	0.363	2024-T3511	101818
0.912	1.438	1.438	0.081	0.081	0.081	0.125	0.125	--	--	--	--	--	--	0.300	2024-T3511	1250426
1.250	0.625	0.625	0.094	0.094	0.094	0.125	0.125	0.094	0.010	0.010	0.010	0.010	0.094	0.220	2024-T3511	1333421
1.422	1.406	1.406	0.215	0.110	0 110	0.188	0.188	--	--	--	--	--	--	--	2024-T3511	2703016
1.636	1.438	0.750	0.094	0.150	0.150	0.125	0.125	0.030	0.030	0.188	0.188	0.030	0.030	--	2024-T3511	2913237A
1.625	2.781	0.812	0.312	0.468	0.125	0.188	0.188	0.030	0.030	0.250	0.250	0.030	0.030	--	2024-T3511	2913245A
2.500	1.000	1.000	0.094	0.094	0.094	0.125	0.125	0.094	--	--	--	--	0.094	0.408	2024-T3511	1059671
2.375	2.500	2.500	0.188	0.188	0.188	0.188	0.188	0.031	0.031	0.031	0.031	0.031	0.031	1.331	7075-T6511	1289882
3.750	1.000	1.000	0.062	0.125	0.125	0.188	0.188	0.125	--	--	--	--	0.125	0.468	2024-T3511	1054839
1.000	0.875	0.875	0.063	0.063	0.063	0.125	0.125	0.063	0.016	0.016	0.016	0.016	0.063	0.170	7075-T6511	1419412
1.250	1.125	1.125	0.078	0.078	0.078	0.125	0.125	0.078	0.010	0.010	0.010	0.010	0.078	0.265	7075-T6511	1415989
1.375	1.000	1.000	0.094	0.094	0.094	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	--	7075-T6511	2616292
1.562	2.188	2.188	0.094	0.094	0.094	0.094	0.094	FULL	--	0.016	0.016	FULL	--	0.541	7075-T6511	1417159
1.737	2.375	1.000	0.312	0.395	0 250	0.156	0.156	0.030	0.030	0.218	0.218	0.030	0.030	--	7075-T6511	2913513

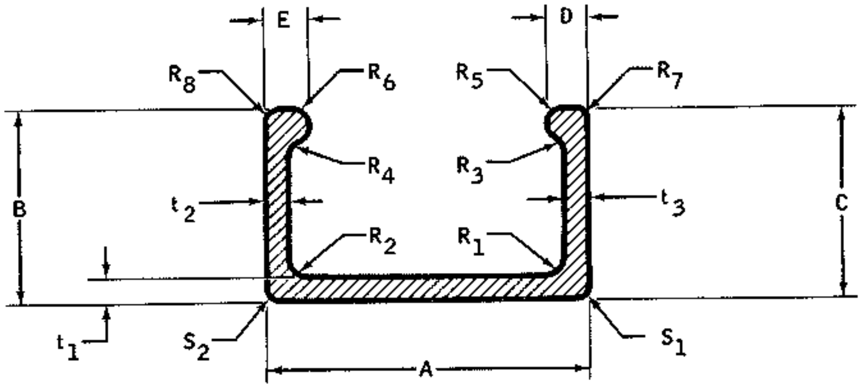
BB3-18

Extrusions -- C-Channel
Figure 10 (Sheet 1)



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.250	1.000	0.100	0.125	0.125	0.125	0.188	0.188	0.030	0.030	0.030	0.030	0.030	0.030	--	7075-T6511	2912094
2.250	1.375	1.375	0.125	0.312	0.312	0.188	0.188	0.030	0.030	0.030	0.030	0.030	0.030	--	7075-T6511	2912096
2.250	1.000	1.000	0.125	0.312	0.312	0.125	0.125	--	--	--	--	--	--	0.829	7075-T6511	1387619
3.437	1.500	1.500	0.093	0.188	0.188	0.188	0.188	0.031	0.031	0.031	0.031	0.031	0.031	0.851	7075-T6511	1286684
1.000	1.250	1.250	0.125	0.125	0.125	0.125	0.125	0.125	0.010	0.010	0.010	0.010	0.125	0.406	2024-T3511	1329632
3.000	1.750	1.750	0.156	0.156	0.156	0.125	0.125	0.156	0.010	0.010	0.010	0.010	0.156	0.962	2024-T3511	1417718
2.875	1.250	1.250	0.125	0.375	0.375	0.188	0.188	0.063	0.063	0.063	0.063	0.063	0.063	--	7075-T6	1616373
1.620	1.438	0.750	0.125	0.371	0.170	0.125	0.125	--	--	0.188	0.188	--	--	--	2024-T3511	2919253

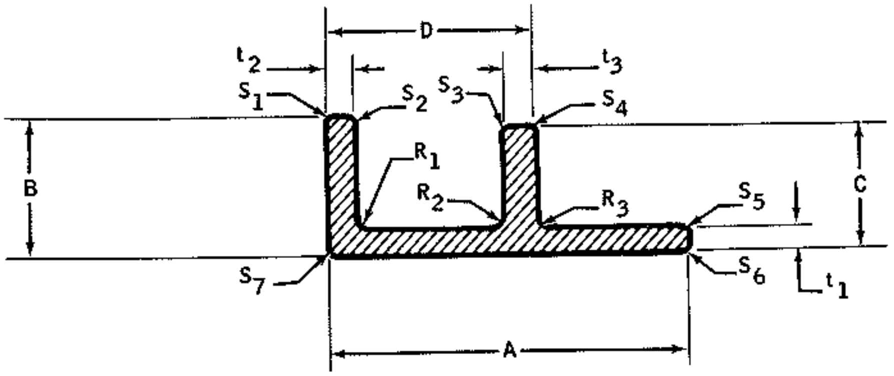
Extrusions -- C-Channel
Figure 10 (Sheet 2)



A	B	C	D	E	t_1	t_2	t_3	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	AREA	MATERIAL	EXTRUSION
5.000	0.920	0.920	0.237	--	0.125	0.125	0.125	0.072	0.072	0.072	--	0.072	FULL	--	--	0.819	7075-T6511	2777896
6.000	0.875	0.875	0.237	0.237	0.080	0.093	0.093	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072	--	7075-T6511	2614462

BB3-31

Extrusions -- Bulb Channel
Figure 11

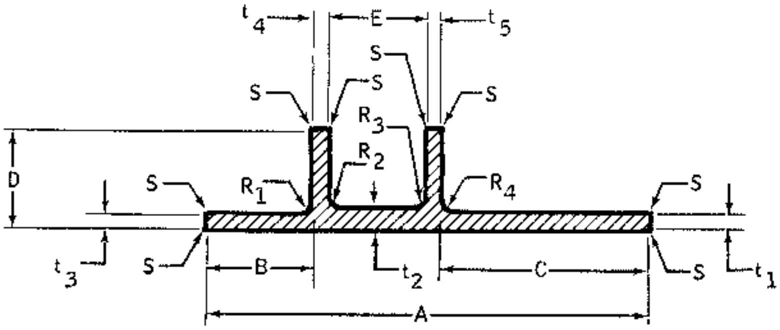


A	B	C	D	t_1	t_2	t_3	R_1	R_2	R_3	S_1	S_2	S_3	S_4	S_5	S_6	S_7	AREA	MATERIAL	EXTRUSION
3.312	1.000	1.000	2.000	0.188	0.125	0.125	0.063	0.063	0.063	0.032	0.032	0.032	0.032	0.032	0.032	0.032	--	7075-T6511	2642053

BB3-45

Extrusions -- F-Section
Figure 12

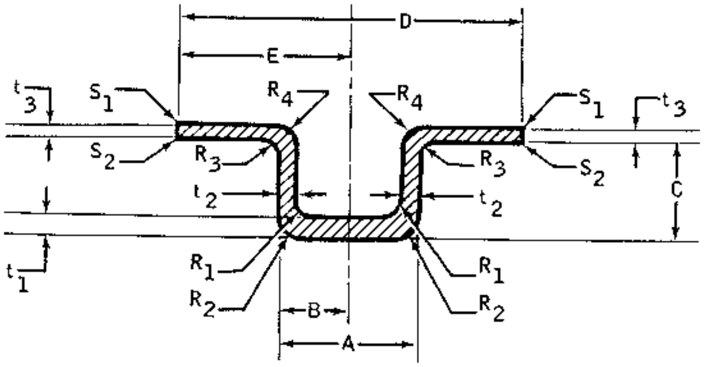
Printed in U.S.A.



A	B	C	D	E	t_1	t_2	t_3	t_4	t_5	R_1	R_2	R_3	R_4	S	AREA	MATERIAL	EXTRUSION
2.468	0.750	0.750	1.312	0.719	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	--	0.619	2024-T3511	1105658
1.750	0.628	--	1.562	0.391	0.051	0.051	0.051	0.051	0.051	0.094	0.094	0.094	0.094	--	0.251	2024-T3511	137449

BB3-46

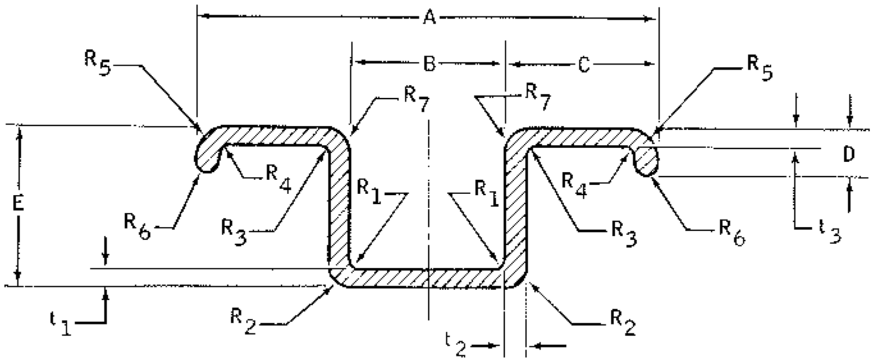
Extrusions -- F-Section, Special
Figure 13



A	B	C	D	E	t_1	t_2	t_3	R_1	R_2	R_3	R_4	S_1	S_2	AREA	MATERIAL	EXTRUSION
0.670	0.335	0.700	2.188	1.093	0.174	0.060	0.066	0.150	0.150	0.090	0.090	0.031	0.031	--	7075-T6511	2912099
0.808	0.404	0.988	2.780	1.390	0.738	0.120	0.250	0.125	0.125	0.093	0.063	0.063	0.063	0.604	7075-T6511	2641454

BB3-47

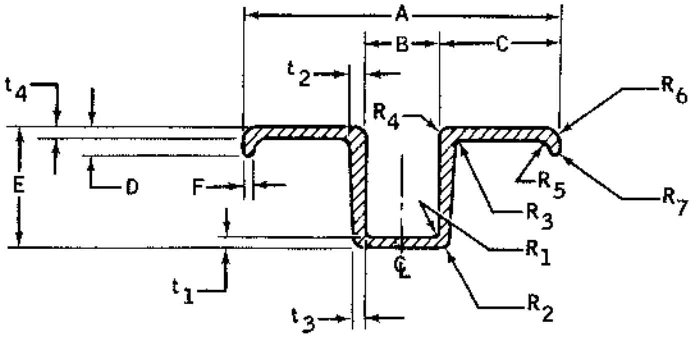
Extrusions -- Hat Section
Figure 14



A	B	C	D	E	t_1	t_2	t_3	R_1	R_2	R_3	R_4	R_5	R_6	R_7	AREA	MATERIAL	EXTRUSION
2.240	0.750	0.745	0.205	0.750	0.080	0.080	0.080	0.090	0.090	0.090	0.062	0.125	0.062	--	--	7075-T6511	2912727
3.000	0.937	1.031	0.311	0.750	0.125	0.093	0.125	0.093	0.093	0.125	0.062	0.218	0.093	--	0.536	7075-T6511	1242886
2.625	0.813	0.906	0.188	1.000	0.081	0.062	0.062	0.062	0.093	0.125	0.062	0.125	0.047	--	0.312	7075-T6511	1415997
2.750	0.875	0.937	--	1.000	0.125	0.125	0.125	0.093	0.062	0.093	0.062	0.125	0.125	--	0.611	7075-T6511	1375211
2.625	0.813	0.906	0.188	1.000	0.152	0.062	0.062	0.062	0.093	0.125	0.062	0.125	0.047	--	0.366	7075-T6511	2610338
2.687	0.813	0.937	0.250	1.000	0.210	0.081	0.091	0.091	0.063	0.125	0.078	0.125	FULL	--	--	7075-T6511	2704877

883-48

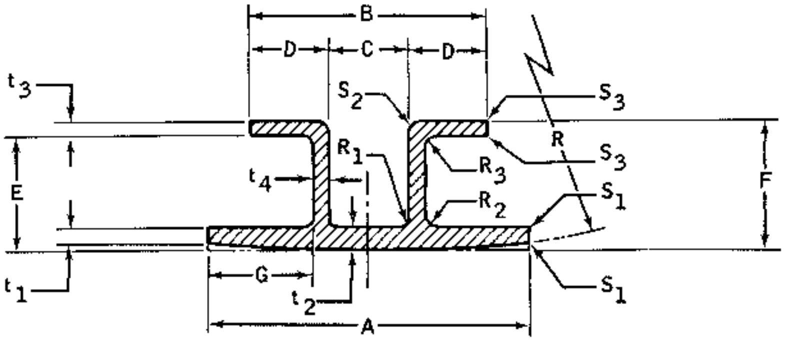
Extrusions -- Hat Section, Bulb
Figure 15



A	B	C	D	E	F	t_1	t_2	t_3	t_4	R_1	R_2	R_3	R_4	R_5	R_6	R_7	AREA	MATERIAL	EXTRUSION
2.500	0.775	0.862	0.250	1.500	0.063	0.125	0.100	0.063	0.100	0.093	0.093	0.093	0.093	0.093	0.156	FULL	--	7075-T6511	2651332

BB3-53

Extrusions -- Hat Section, Tapered Leg, Bulb
Figure 16

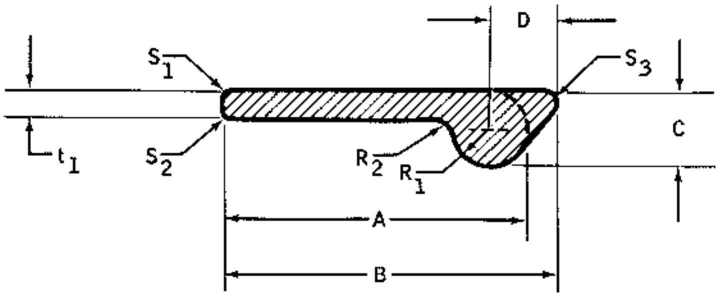


Printed in U.S.A.

A	B	C	D	E	F	G	t_1	t_2	t_3	t_4	R	R_1	R_2	R_3	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
2.750	2.750	0.531	--	0.910	--	--	0.468	0.468	0.468	0.139	--	0.125	0.188	0.062	0.062	0.062	0.062	--	7075-T6511	2647332

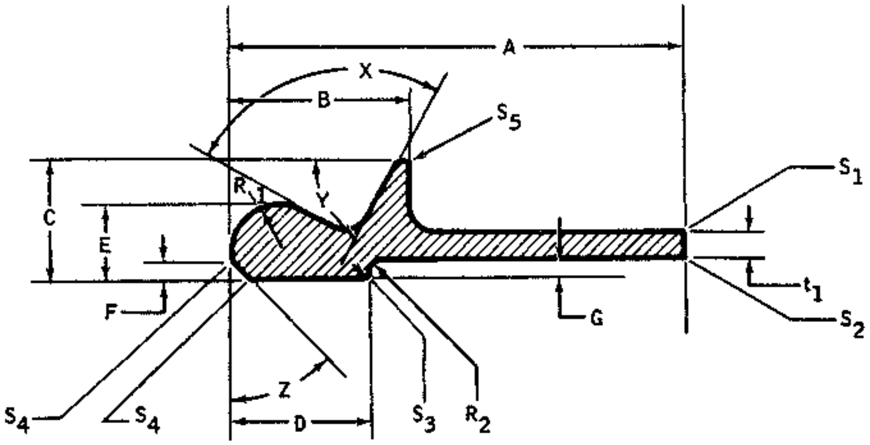
BB3-54

Extrusions -- Hat Section, Special
Figure 17



A	B	C	D	t_1	R_1	R_2	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
0.938	--	--	--	0.060	0.125	0.125	FULL	--	--	--	2014-T6511	1653031
1.625	--	--	--	0.156	0.250	0.250	0.010	0.010	--	0.394	2014-T6511	1243775
0.688	--	--	--	0.040	0.062	0.031	--	--	--	0.036	2024-T3511	1250422
1.125	--	--	--	0.050	0.062	0.062	FULL	--	--	--	2024-T3511	2505668
0.937	--	--	--	0.050	0.093	0.093	0.010	0.010	--	--	2024-T3511	2505326
0.875	--	--	--	0.062	0.093	0.093	0.062	--	--	0.074	2024-T3511	1152357
--	1.645	0.250	0.200	0.090	0.125	0.375	--	--	0.032	--	2024-T3511	2913654

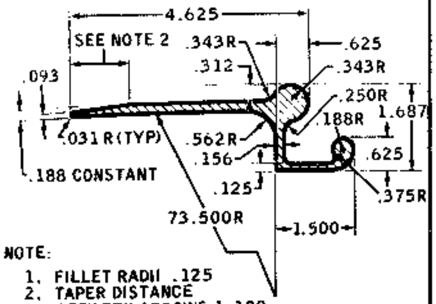
Extrusions -- Hinge
Figure 18



A	B	C	D	E	F	G	t_1	R_1	R_2	S_1	S_2	S_3	S_4	S_5	X	Y	Z	AREA	MATERIAL	EXTRUSION
1.500	0.600	0.400	0.468	0.250	0.060	0.071	0.083	0.156	0.030	0.030	0.030	0.020	0.030	0.025	90°	60°	45°	0.21	2014-T6	1666735

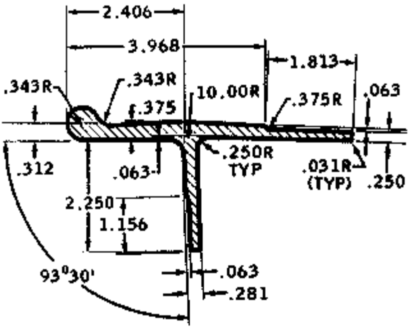
BB3-706

Extrusions -- Offset Hinge, Special
Figure 18A



NOTE:
1. FILLET RADII .125
2. TAPER DISTANCE BETWEEN ARROWS 1.188

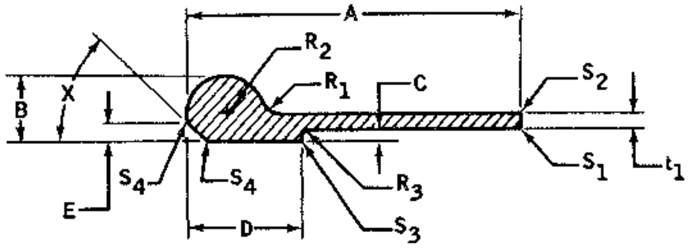
2772779 7075-T6



2772780 7075-T6

683-986

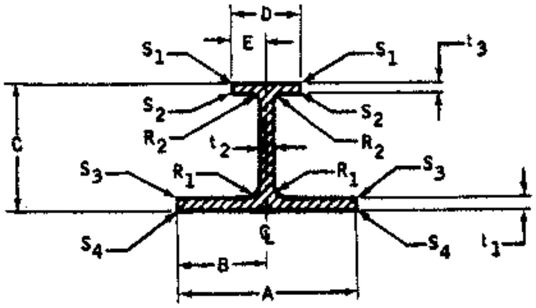
Extrusions -- Miscellaneous Hinges
Figure 18B



A	B	C	D	E	t_1	R_1	R_2	R_3	S_1	S_2	S_3	S_4	X	AREA	MATERIAL	EXTRUSION
1.093	0.250	0.064	0.406	0.045	0.051	0.093	0.156	0.032	--	--	0.010	0.010	45°	0.120	2024-T3511	1430882
1.468	0.250	0.125	0.468	0.045	0.051	0.093	0.156	0.005 0.015	FULL	--	0.010	0.010	45°	--	2024-T3511	1383079
0.902	--	0.084	0.277	--	0.050	0.172	0.090	0.005 0.015	0.020 0.005	0.020 0.005	0.020 0.005	--	--	0.072	2024-T3511	2912598
1.281	0.250	0.032	0.390	0.045	0.094	0.093	0.156	0.032	--	--	0.010	0.010	45°	--	2024-T3511	2272677

BB3-34

Extrusions -- Offset Hinge
Figure 19

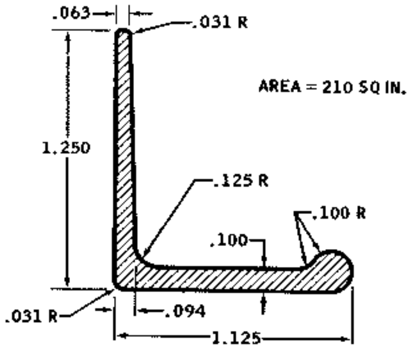


A	B	C	D	E	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
1.750	0.875	1.750	1.000	0.500	0.150	0.125	0.125	0.125	0.125	0.032	0.032	0.032	0.032	--	7075-T6511	2912311
2.375	1.188	2.063	1.250	0.412	0.439	0.073	0.095	0.093	0.093	0.032	0.032	0.032	0.032	--	7075-T6511	2613001
2.250	1.125	10.000	2.250	1.125	0.188	0.125	0.125	0.188	0.188	FULL	--	FULL	--	1.935	2014-T6511	4594047
2.000	1.000	2.000	2.000	1.000	0.094	0.094	0.094	0.125	0.125	--	0.093	0.093	--	0.552	2024-T4	1331354
2.125	1.063	1.250	2.125	1.063	0.094	0.094	0.094	0.125	0.125	--	0.094	0.094	--	--	7075-T6511	2923195
2.250	1.125	1.812	1.500	0.750	0.188	0.125	0.250	0.125	0.125	0.063	0.063	0.063	0.063	0.968	7075-T6511	2272071
2.500	1.125	2.500	1.000	0.500	0.125	0.125	0.188	0.125	0.125	0.031	0.031	0.031	0.031	--	7075-T6511	2614730
2.250	1.125	5.000	2.000	1.000	0.200	0.210	0.200	0.125	0.125	FULL	FULL	FULL	FULL	1.816	7075-T6511	2921948

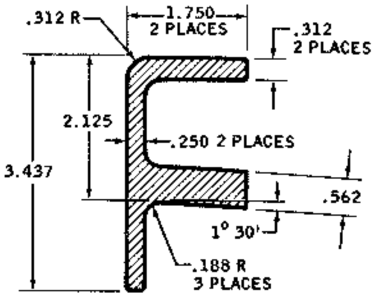
BB3-35C

Extrusions -- I-Section
Figure 20

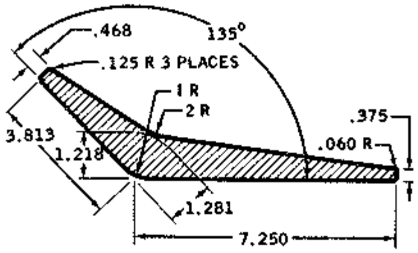
Printed in U.S.A.



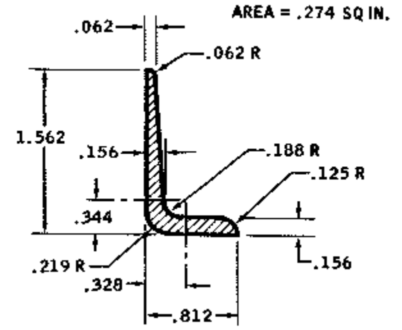
1291250 7075-T6511



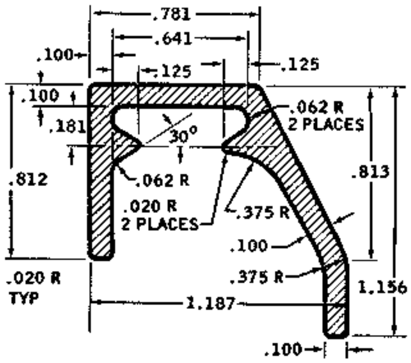
2912368 7075-T6511



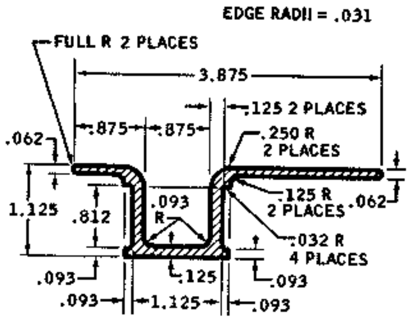
2914033 7075-T6511



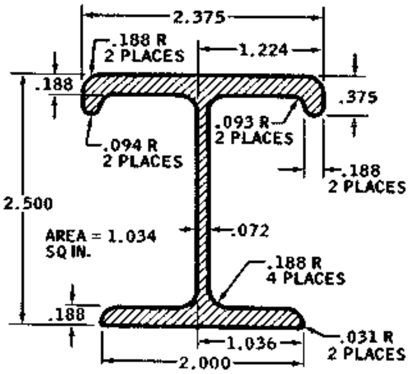
1328429 7075-T6511



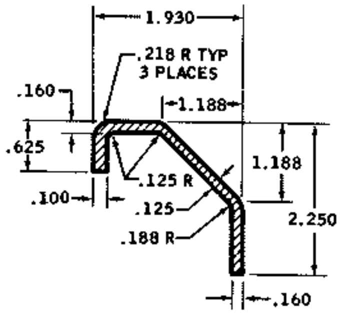
2912553 2024-T3511



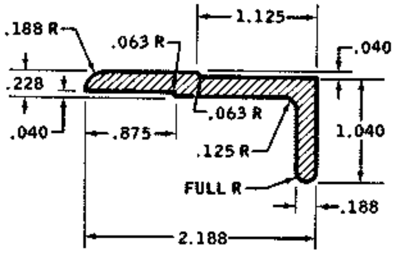
2915910 7075-T6511



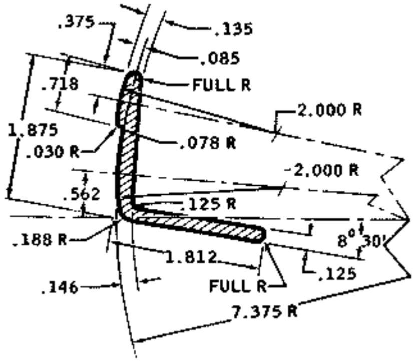
1415392 7075-T6511



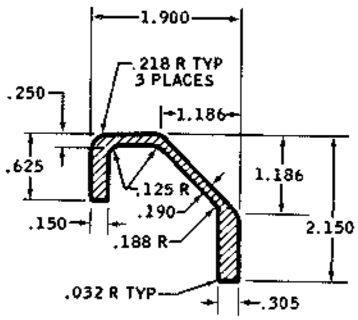
2913088A 7075-T6511



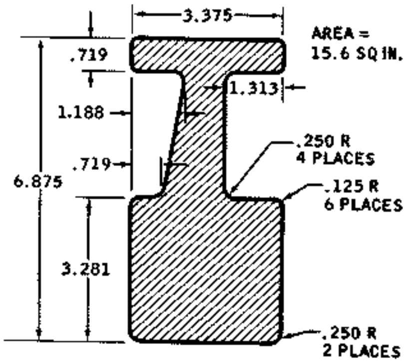
2956031A 7075-T6511



2655233 7075-T6511



2913105A 7075-T6511

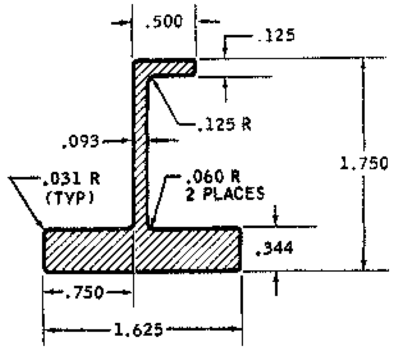


4913414 7075-T6511

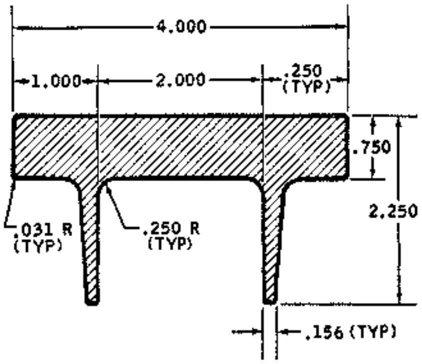
BB3-55

Printed in U.S.A.

Extrusions -- Miscellaneous Angle, Channel, & I-Section
Figure 21 (Sheet 1)



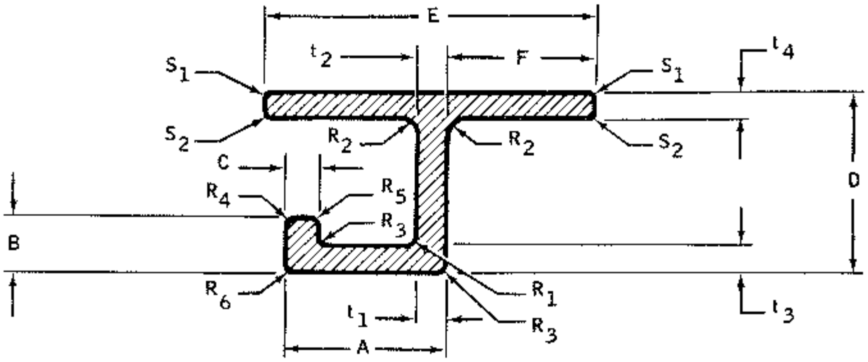
2614737 7075-T6



2923282 7075-T6511

B83-971

Extrusions -- Miscellaneous Angle, Channel & I-Section
Figure 21 (Sheet 2)

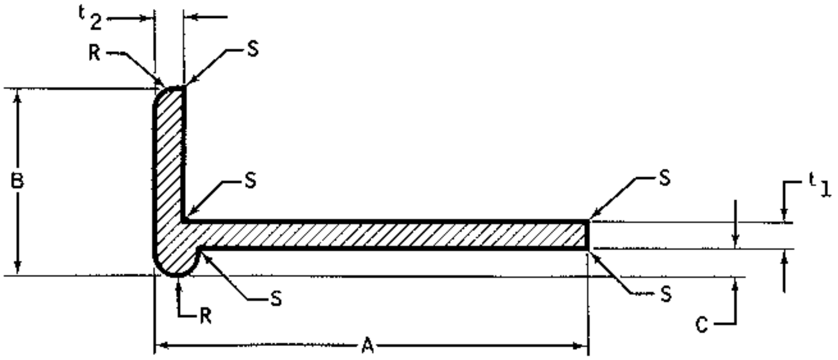


A	B	C	D	E	F	t_1	t_2	t_3	t_4	R_1	R_2	R_3	R_4	R_5	R_6	S_1	S_2	S_3	AREA	MATERIAL	EXTRUSION
1.000	0.250	0.125	3.950	2.125	1.015	0.094	0.094	0.125	0.125	0.125	0.188	0.125	FULL	--	0.031	0.031	0.031	0.031	0.771	2014-T6511	4594694
2.000	--	--	0.903	1.812	--	0.060	0.060	0.060	0.060	0.060	0.125	--	--	--	0.016	0.016	0.016	0.016	--	7075-T6511	2652479
0.812	0.312	--	1.125	--	--	0.125	0.125	0.125	--	0.062	--	0.062	0.062	--	0.031	0.031	--	--	--	7075-T6511	1419292
0.500	0.125	--	4.930	2.063	0.938	0.094	0.188	0.125	0.188	0.125	0.250	--	0.031	--	0.031	0.031	0.031	0.031	--	7075-T6511	2911391
0.920	0.237	--	5.000	1.938	1.008	0.125	0.125	0.093	0.125	0.072	0.072	0.072	0.072	--	0.072	FULL	--	0.072	0.946	7075-T6511	2777897
0.500	--	--	5.906	2.063	0.938	0.094	0.188	0.125	0.193	0.125	0.250	--	0.031	0.031	0.031	0.031	0.031	0.031	--	7075-T6511	2614618
0.312	--	--	0.812	2.375	1.000	0.050	0.050	0.050	0.050	0.093	0.093	--	0.030	--	0.030	0.030	0.030	0.030	--	7075-T6511	1648361
0.562	--	--	1.500	1.625	0.750	0.125	0.125	0.160	0.125	0.125	0.090	--	--	0.030	0.030	0.030	0.030	0.030	--	7075-T6511	2613679

Printed in U.S.A.

BB3-36

Extrusions -- J-Section
Figure 22

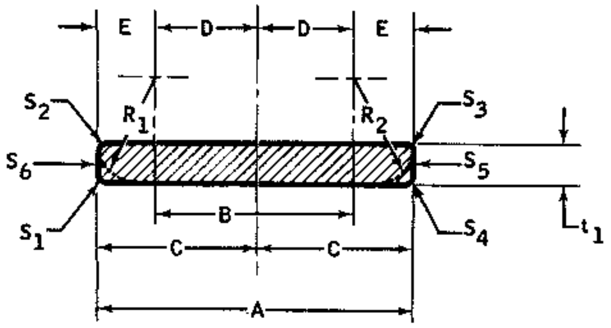


A	B	C	t_1	t_2	R	S	AREA	MATERIAL	EXTRUSION
0.719	0.219	0.032	0.032	0.032	0.032	0.010	--	6063-T6511	2655915
0.719	0.219	0.063	0.032	0.032	0.032	0.010	--	6063-T6511	2655916

BB3-37

Extrusions -- Molding
Figure 23

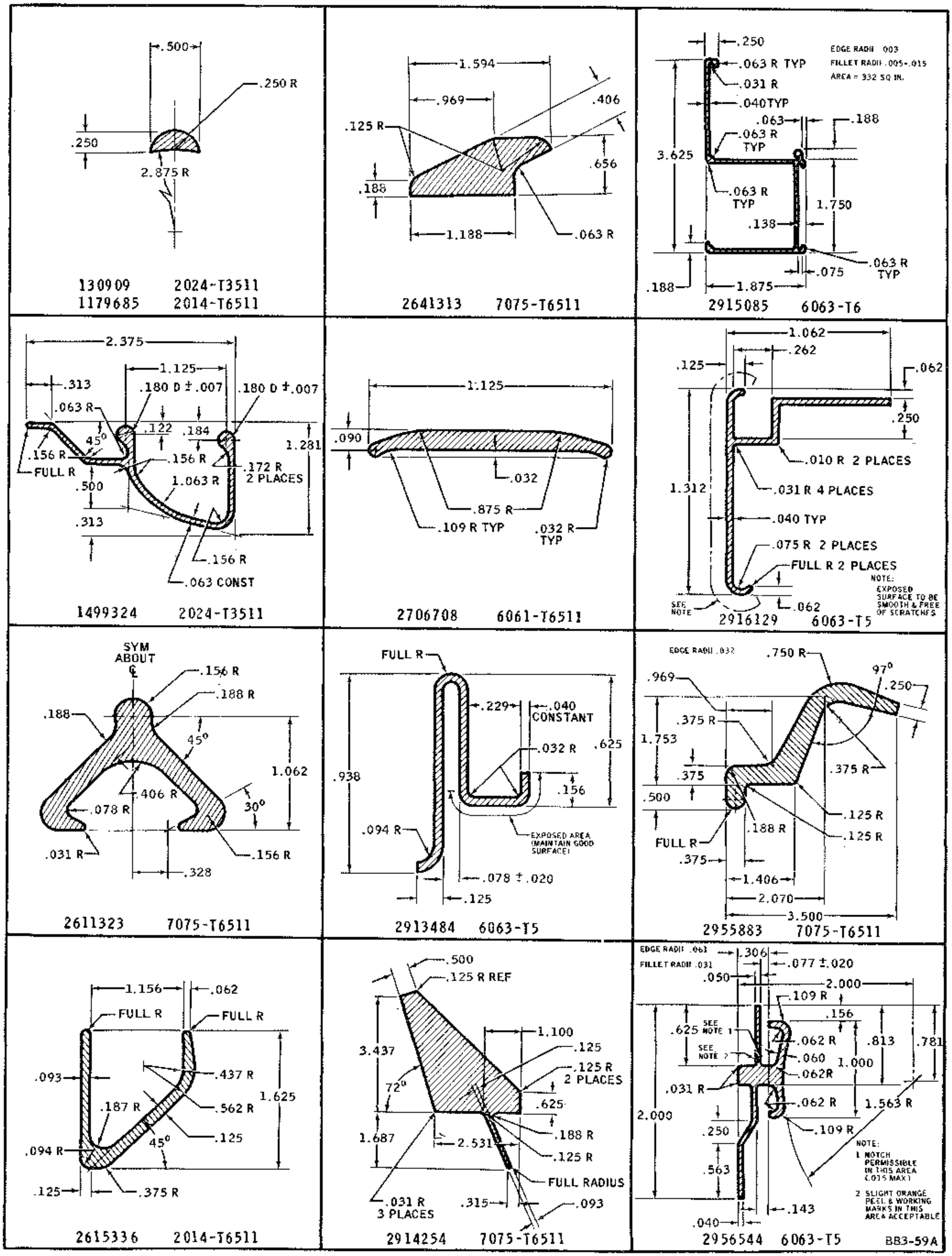
Printed in U.S.A.



A	B	C	D	E	t_1	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
0.437	--	--	--	0.109	0.064	0.250	0.250	--	--	--	--	--	--	0.028	2024-T3511	1180406
0.562	--	--	--	--	0.091	--	--	--	--	--	--	0.062	0.062	--	2024-T3511	1243695
5.000	--	--	--	--	0.125	0.125	0.125	--	--	--	--	--	--	0.056	2024-T3511	1125529
0.625	0.312	--	--	--	0.125	0.156	0.156	--	--	--	--	--	--	--	2024-T3511	1328773
1.000	--	--	0.218	--	0.081	0.750	0.750	--	0.016	0.016	--	--	--	--	7075-T6511	1392883
0.562	--	--	--	--	0.100	--	--	0.125	0.030	0.030	0.125	--	--	--	7075-T6511	2643899
0.667	--	--	--	--	0.156	--	--	0.093	0.032	0.032	0.093	--	--	--	7075-T6511	1651402
0.470	0.126	--	--	--	0.188	0.156	0.156	--	--	--	--	--	--	--	7075-T6511	1480301
1.000	--	--	--	--	0.156	--	--	0.188	--	--	--	--	--	--	7075-T6511	1651447

BB3-38

Extrusions -- Spacer
Figure 24



130909 2024-T3511
1179685 2014-T6511

2641313 7075-T6511

2915085 6063-T6

1499324 2024-T3511

2706708 6061-T6511

2916129 6063-T5

2611323 7075-T6511

2913484 6063-T5

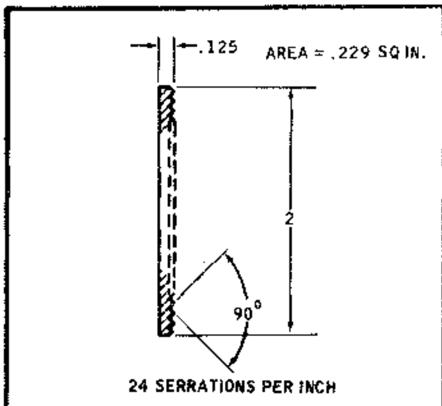
2955883 7075-T6511

2615336 2014-T6511

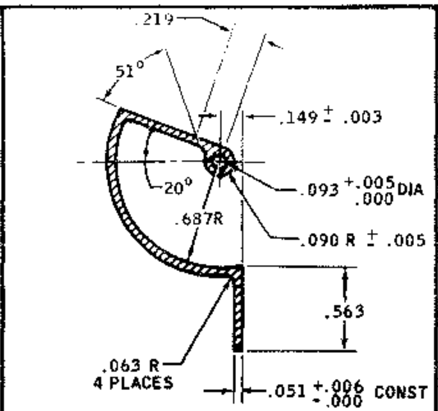
2914254 7075-T6511

2956544 6063-T5

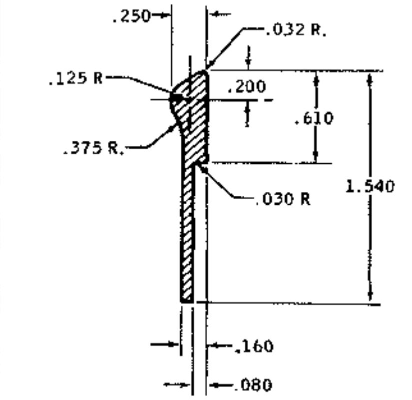
Extrusions -- Special Shape
Figure 25 (Sheet 1)



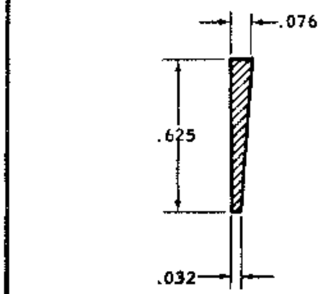
1077509 2024-T3511



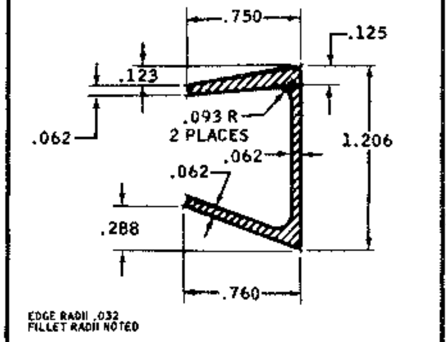
2415533 6061-T6511



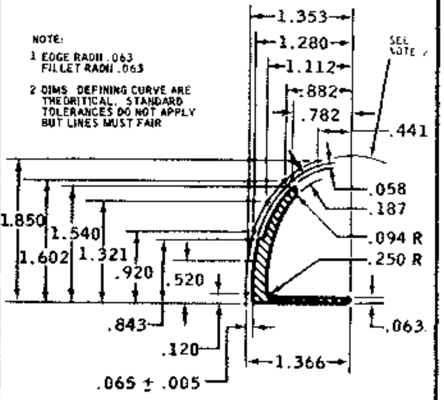
2913655 2024-T3511



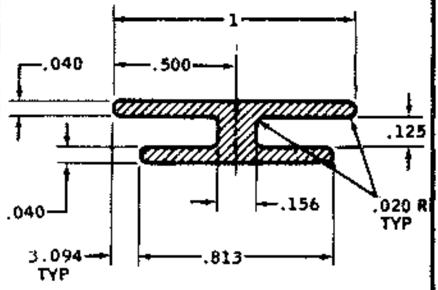
1152325 2024-T3511



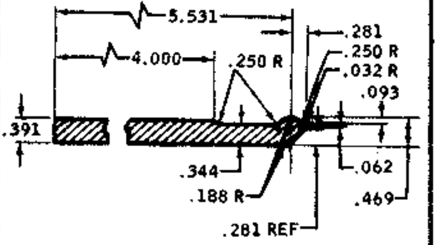
2914765 7075-T6511



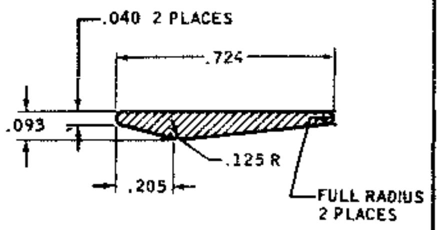
2914046 7075-T6511



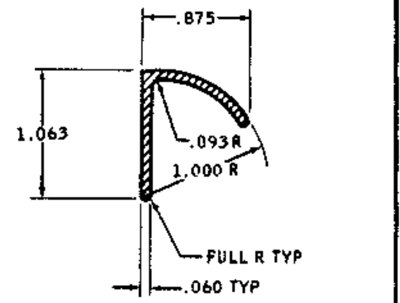
1336084 6061-T6511



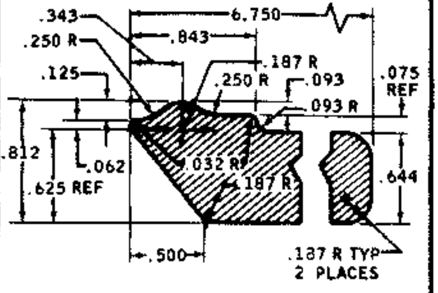
2913434 2024-T3511



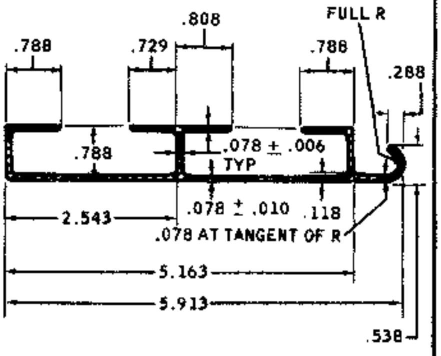
2914763 6061-T6511



1701177 6061-T6



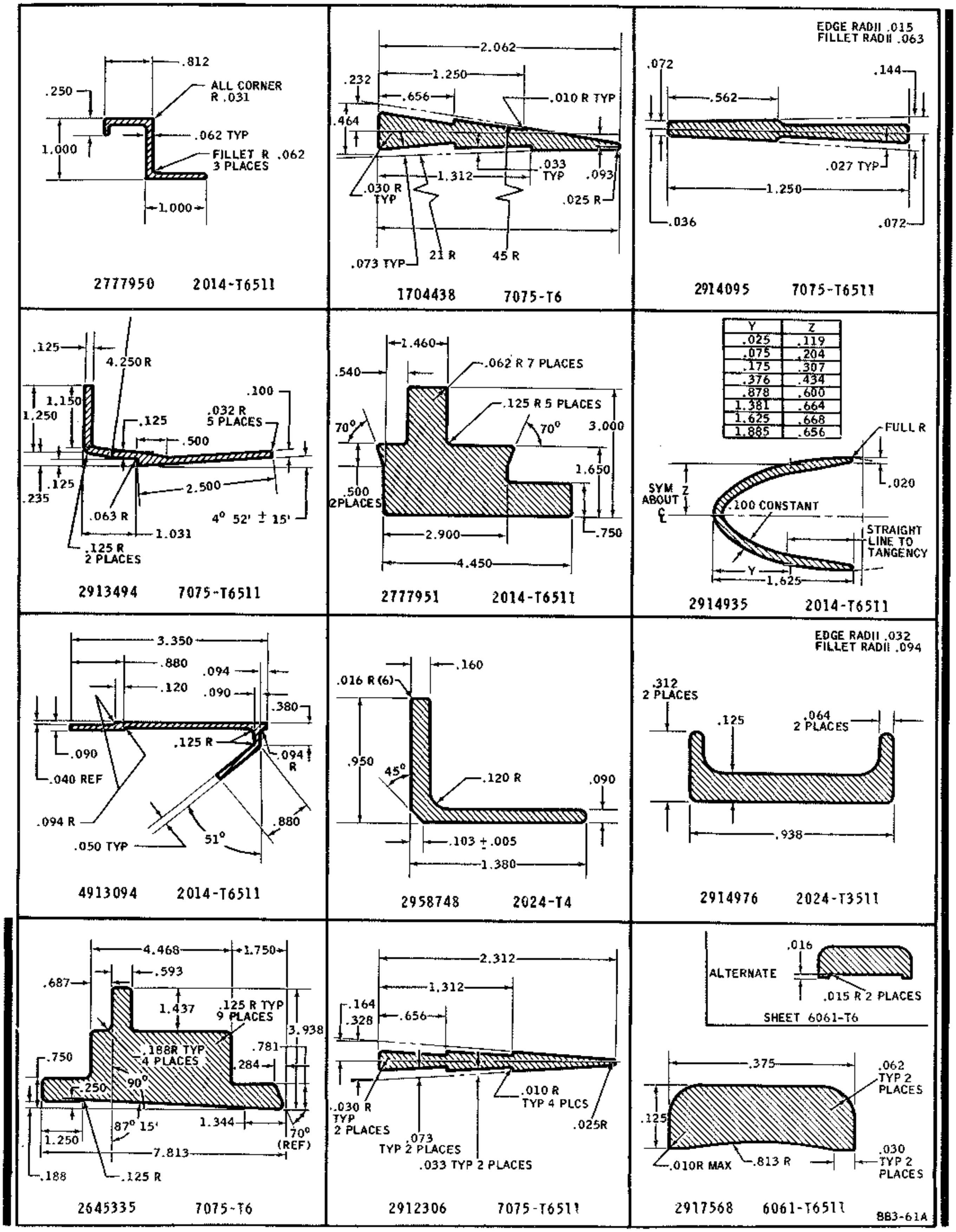
2913436 2024-T3511



4917997 2014-T6511

883-608

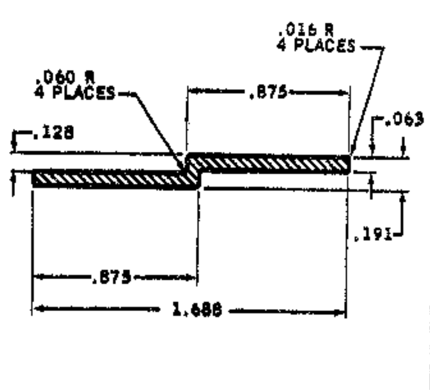
Extrusions -- Special Shape
Figure 25 (Sheet 2)



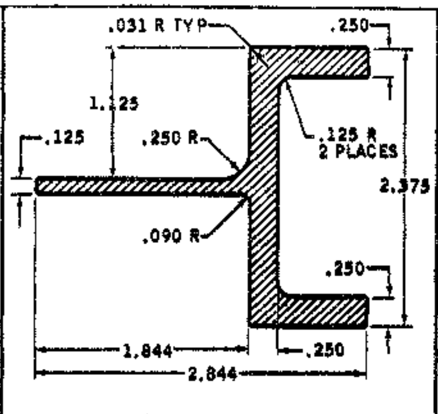
Y	Z
.025	.119
.075	.204
.175	.307
.376	.434
.878	.600
1.381	.664
1.625	.668
1.885	.656

Extrusions -- Special Shape
Figure 25 (Sheet 3)

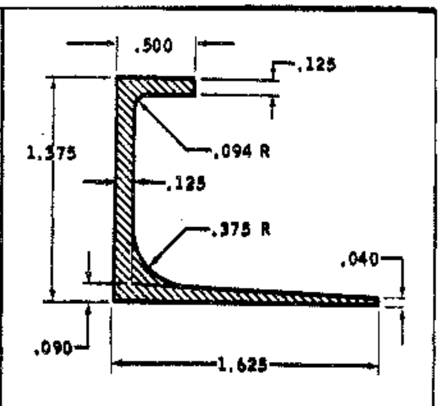
Printed in U.S.A.



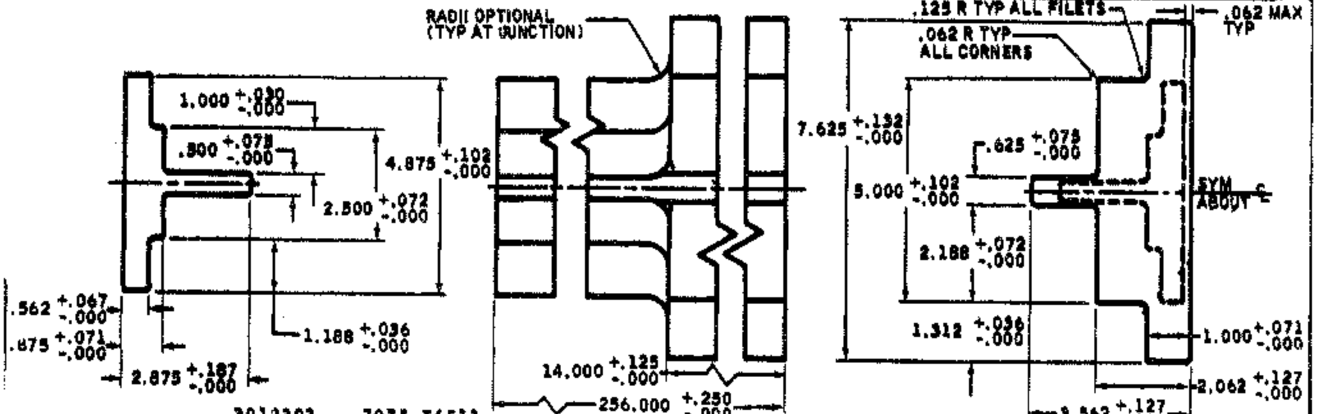
2958750 2024-T4



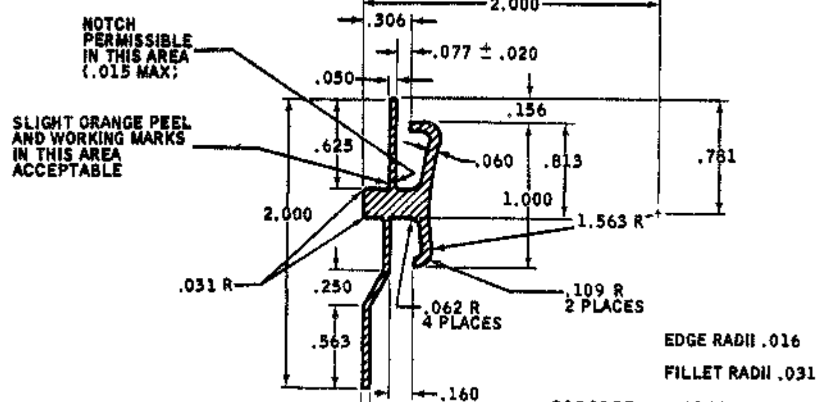
3919064 7075-T6511



2919148 7075-T6511



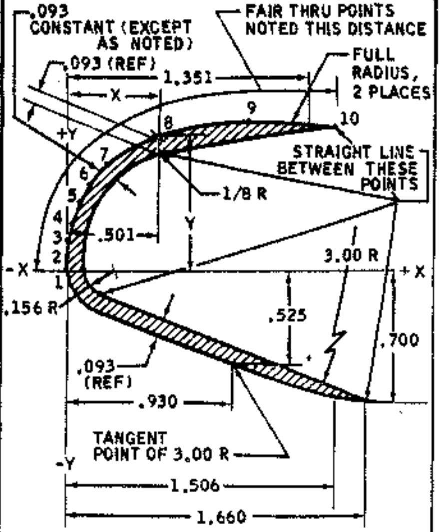
3912303 7075-T6511



EDGE RADII .016

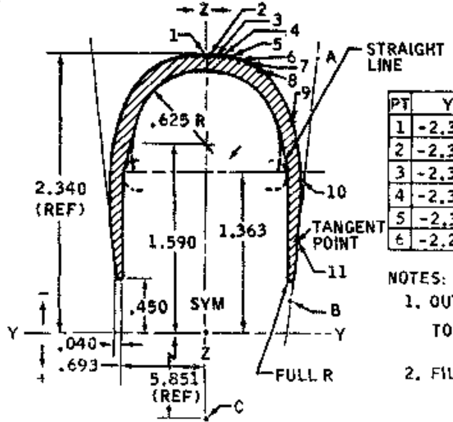
FILLET RADII .031

2920057 6063-T5



PT	X	Y
1	0.000	0.000
2	.003	+.084
3	.013	+.167
4	.032	+.262
5	.070	+.371
6	.129	+.474
7	.226	+.584
8	.519	+.745
9	1.007	+.821
10	1.495	+.799

4914837 7075-T6511 BB3-588A



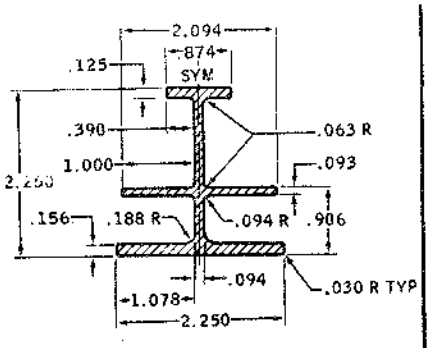
PT	Y	Z	PT	Y	Z	PT	Y	Z
1	-2.340	0.000	7	-2.206	0.465	A	-2.325	0.949
2	-2.337	.097	8	-2.099	.577	B	.291	.713
3	-2.332	.139	9	-1.806	.728	C	+5.851	0.000
4	-2.322	.196	10	-1.318	.800			
5	-2.303	.273	11	- .799	.771			
6	-2.264	.371						

NOTES:

1. OUTSIDE CONTOUR TO FAIR BETWEEN POINTS
   TOLERANCES $^{+.015}_{-.000}$
2. FILLET R .125

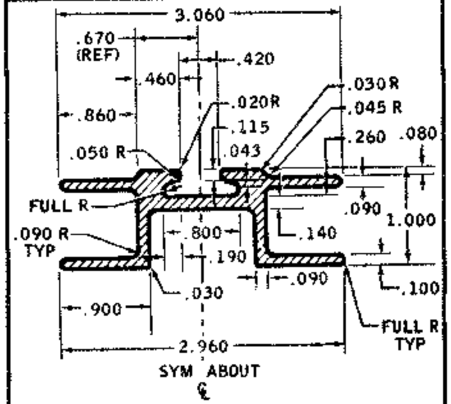
2914793 7057-T6511

Extrusions -- Special Shape
Figure 25 (Sheet 4)

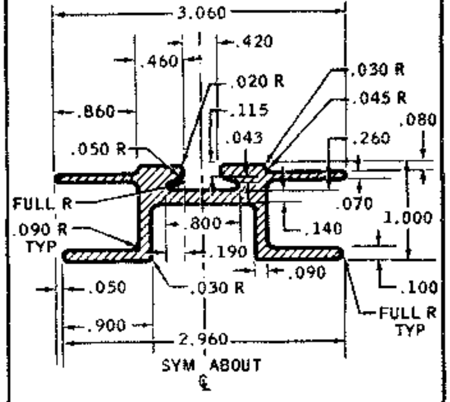


AREA = 1.802 SQ IN.

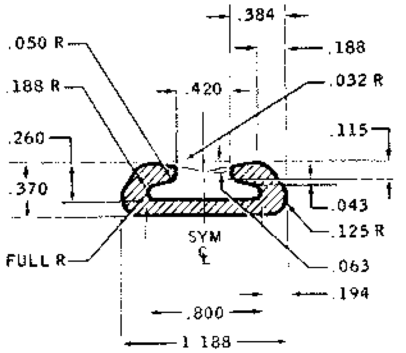
2912399 7075-T6511



2772660 7075-T6511



2914913 7075-T6511

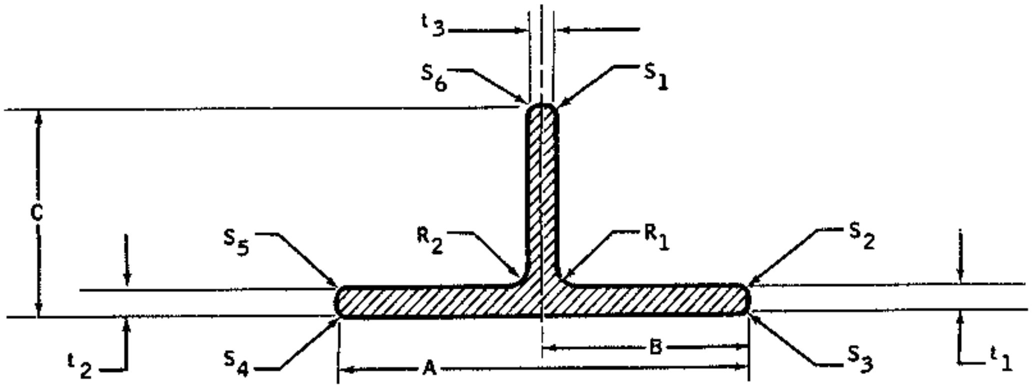


2955978 7075-T6511

BB3-58B

Printed in U.S.A.

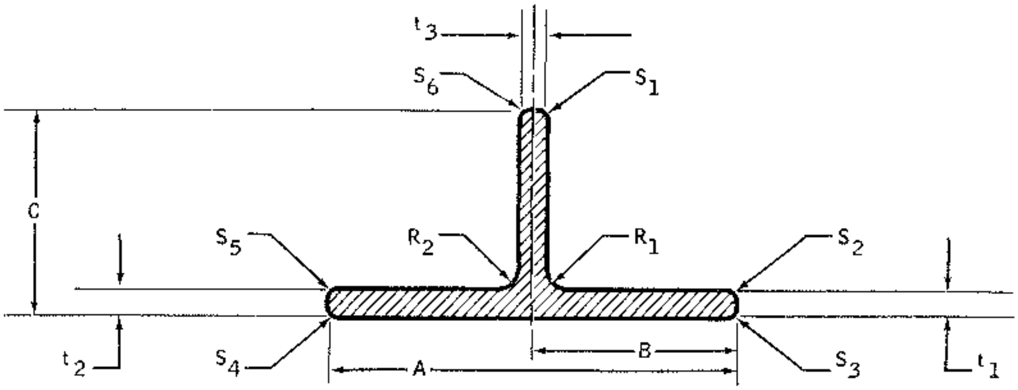
Extrusions -- Track
Figure 26



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.250	1.125	2.000	0.250	0.250	0.188	0.156	0.156	0.032	0.032	0.032	0.032	0.032	0.032	0.890	2014-T6511	1544614
2.000	1.000	0.750	0.051	0.051	0.051	0.094	0.094	--	--	--	--	--	--	0.141	2024-T3511	1114110
1.500	0.750	1.125	0.062	0.062	0.062	0.062	0.062	0.032	0.032	0.032	0.032	0.032	0.032	0.164	2024-T3511	137058
2.375	1.188	1.000	0.064	0.064	0.064	0.064	0.064	--	--	--	--	--	--	0.214	2024-T3511	1243286
2.312	1.031	1.437	0.072	0.062	0.062	0.125	0.125	--	0.032	--	--	--	--	0.239	2024-T3511	1221366
2.250	1.125	2.000	0.062	0.062	0.062	0.188	0.188	0.031	0.031	0.031	0.031	0.031	0.031	0.275	2024-T3511	1430824
3.000	1.500	1.625	0.093	0.093	0.093	0.062	0.062	0.010	0.010	0.030	0.030	0.010	0.010	0.423	2024-T3511	1329806
1.625	0.608	1.375	0.093	0.093	0.093	0.093	0.093	--	--	--	--	--	--	0.274	2024-T3511	1074862
4.000	1.641	1.500	0.093	0.093	0.093	0.093	0.093	--	--	--	--	--	--	0.511	2024-T3511	1103715
3.656	1.828	1.062	0.094	0.094	0.094	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.444	2024-T3511	1475473
2.500	1.250	1.250	0.094	0.094	0.094	0.125	0.125	0.047	0.094	0.010	0.010	0.094	0.047	0.346	2024-T3511	1245835
2.000	1.000	3.000	0.094	0.094	0.094	0.156	0.156	--	--	--	--	--	--	0.472	2024-T3511	1179365
2.250	1.125	2.125	0.125	0.125	0.125	0.125	0.125	0.062	0.062	0.062	0.062	0.062	0.062	0.533	2024-T3511	1152368
4.375	2.000	1.250	0.093	0.093	0.125	0.062	0.062	--	--	--	--	--	--	0.552	2024-T3511	1039661
1.750	0.875	1.812	0.060	0.060	0.060	0.093	0.093	--	--	--	--	--	--	0.155	7075-T6511	1700632
1.750	0.875	1.000	0.062	0.062	0.062	0.094	0.094	0.031	0.031	0.031	0.031	0.031	0.031	0.169	7075-T6511	1440048

BB3-20

Extrusions -- T-Section
Figure 27 (Sheet 1)

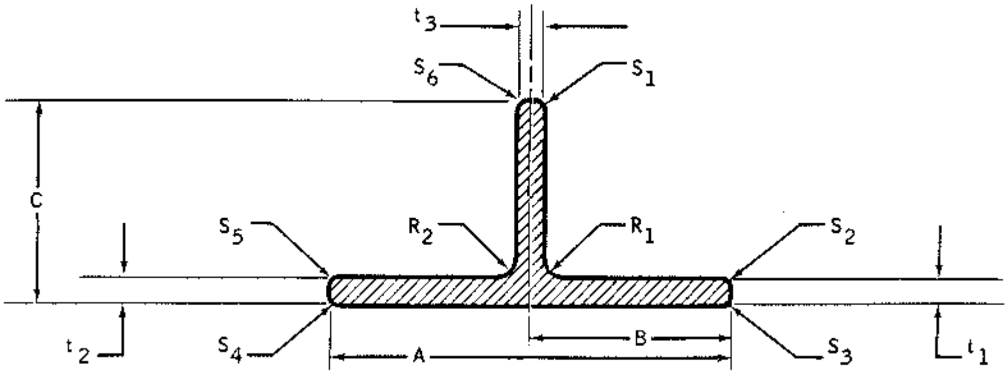


A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.062	1.031	1.660	0.062	0.062	0.062	0.188	0.188	0.032	0.032	0.032	0.032	0.032	0.032	--	7075-T6511	2912538
2.625	1.312	2.250	0.075	0.075	0.090	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.398	7075-T6511	1666744
1.875	0.937	1.000	0.078	0.078	0.078	0.125	0.125	FULL	0.078	0.010	0.010	0.078	FULL	0.222	7075-T6511	1332780
1.780	0.890	2.875	0.078	0.078	0.078	0.125	0.125	0.016	0.016	0.016	0.016	0.016	0.016	0.367	7075-T6511	2506195
2.000	1.000	1.250	0.078	0.078	0.078	0.125	0.125	0.039	0.078	--	--	0.078	0.039	0.231	7075-T6511	1414813
1.642	0.821	1.125	0.080	0.080	0.080	0.093	0.093	FULL	0.031	0.031	0.031	0.031	FULL	0.220	7075-T6511	2613900
3.000	1.500	1.625	0.093	0.093	0.093	0.062	0.062	0.010	0.010	0.030	0.030	0.010	0.010	0.423	7075-T6511	1249240
3.184	1.385	2.500	0.090	0.090	0.090	0.090	FULL	FULL	FULL	FULL	FULL	FULL	FULL	--	7075-T6511	1642726
4.000	2.359	1.500	0.094	0.094	0.094	0.094	0.094	0.010	0.010	0.010	0.010	0.010	0.010	0.512	7075-T6511	1325739
4.719	2.359	2.187	0.125	0.125	0.125	0.093	0.093	0.062	0.062	0.062	0.062	0.062	0.062	0.850	7075-T6511	1440004
3.500	1.750	3.750	0.125	0.125	0.125	0.090	0.090	0.060	0.060	0.060	0.060	0.060	0.060	0.900	7075-T6511	1640170
2.250	1.125	3.000	0.125	0.125	0.125	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.656	7075-T6511	1416793
3.000	1.500	2.500	0.125	0.125	0.125	0.125	0.125	0.063	0.125	0.010	0.010	0.125	0.063	0.670	7075-T6511	1325214
3.625	1.813	2.562	0.125	0.125	0.125	0.187	0.187	0.031	0.031	0.031	0.031	0.031	0.031	0.770	7075-T6511	1514793
7.000	3.500	2.170	0.125	0.125	0.125	0.188	0.188	0.031	0.031	0.031	0.031	0.031	0.031	1.130	7075-T6511	2418534
4.343	2.296	2.937	0.156	0.156	0.156	0.156	0.156	FULL	0.031	0.031	0.031	0.031	FULL	--	7075-T6511	2914624

Printed in U.S.A.

BB3-21

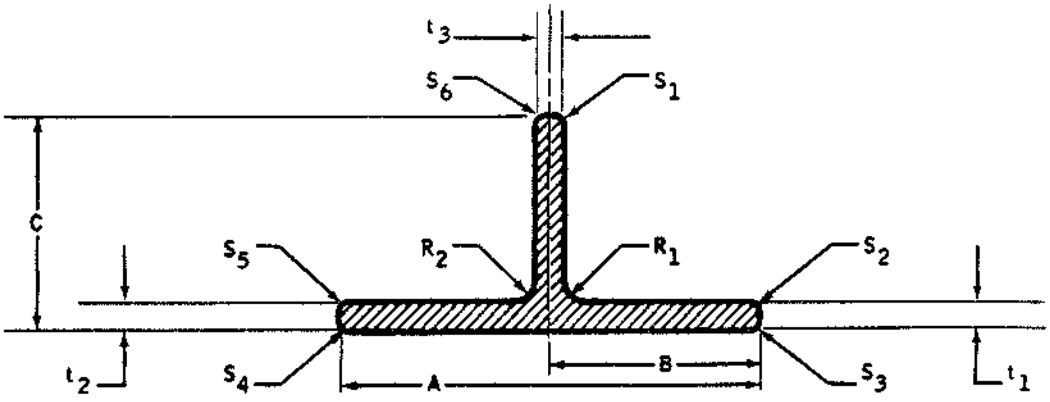
Extrusions -- T-Section
Figure 27 (Sheet 2)



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.625	1.313	1.938	0.250	0.250	0.250	0.188	0.188	0.031	0.031	0.031	0.031	0.031	0.031	1.090	7075-T6511	1383060
3.031	1.453	2.781	0.078	0.078	0.156	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.720	7075-T6511	2431257
2.969	1.482	2.000	0.125	0.125	0.090	0.090	0.090	0.016	0.016	0.016	0.016	0.016	0.016	--	7075-T6511	1761367
2.250	1.125	3.125	0.125	0.125	0.078	0.062	0.062	FULL	0.031	0.031	0.031	0.031	FULL	--	7075-T6511	2615551
2.125	1.062	4.094	0.188	0.188	0.125	0.188	0.188	0.032	0.156	0.032	0.032	0.156	0.032	0.892	7075-T6511	1419366
2.500	1.250	3.250	0.250	0.250	0.090	0.090	0.090	FULL	0.030	0.030	0.030	0.030	FULL	--	7075-T6511	1716225
4.188	2.093	4.250	0.250	0.250	0.125	0.250	0.250	0.010	0.010	0.010	0.010	0.010	0.010	1.574	7075-T6511	1329984
2.344	1.172	2.156	0.250	0.250	0.156	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.898	7075-T6511	2505340
2.375	1.250	1.375	0.375	0.375	0.125	0.093	0.093	0.031	0.031	0.031	0.031	0.031	0.031	1.020	7075-T6511	1430871
2.000	1.000	2.875	0.375	0.375	0.125	0.125	0.125	0.062	0.032	0.032	0.032	0.032	0.062	1.070	7075-T6511	1528377
3.500	1.438	3.000	0.500	0.500	0.375	0.375	0.375	0.031	0.031	0.031	0.031	0.031	0.031	2.688	7075-T6511	1285733
4.500	2.438	3.125	0.625	0.625	0.125	0.090	0.090	0.032	0.032	0.032	0.032	0.032	0.032	3.160	7075-T6511	2640547
2.687	1.343	3.062	0.750	0.750	0.375	0.500	0.500	--	--	--	--	--	--	2.990	7075-T6511	1242754
1.655	0.750	2.250	0.063	0.063	0.063	0.094	0.094	FULL	FULL	FULL	FULL	FULL	FULL	--	2024-T3511	2718854
1.750	0.875	1.625	0.094	0.094	0.094	0.125	0.125	0.047	0.094	--	--	0.094	0.047	0.310	2024-T3511	1210320
2.000	1.000	1.000	0.125	0.125	0.125	0.125	0.125	0.062	0.125	0.010	0.010	0.125	0.062	0.358	2024-T3511	1277768

BB3-22

Extrusions -- T-Section
Figure 27 (Sheet 3)

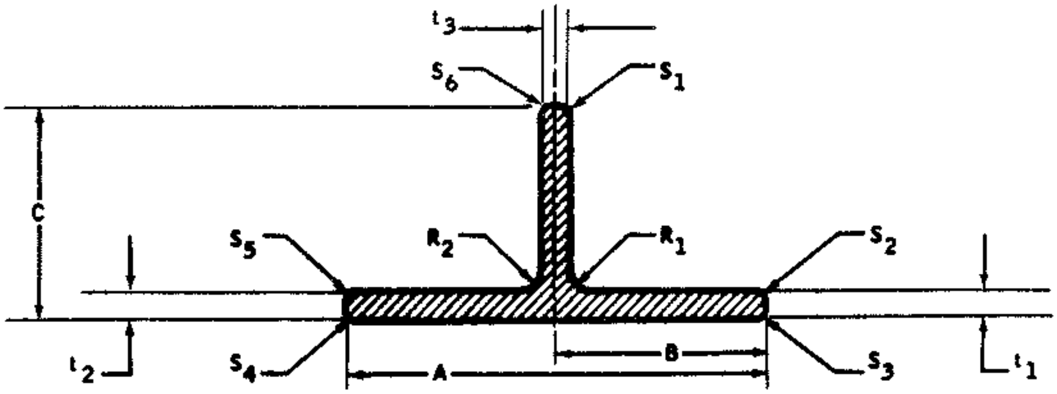


A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
2.500	1.250	1.250	0.125	0.125	0.125	0.125	0.125	0.063	0.125	0.010	0.010	0.125	0.063	0.452	2024-T3511	1278964
2.500	1.250	2.000	0.188	0.186	0.188	0.188	0.188	0.094	0.188	0.010	0.010	0.186	0.094	0.807	2024-T3511	1329769
1.375	0.688	0.250	0.094	0.094	0.094	0.062	0.062	0.010	0.047	--	--	0.094	0.010	0.238	7075-T6511	1248307
1.625	0.813	1.375	0.094	0.094	0.094	0.125	0.125	0.047	0.094	0.010	0.010	0.094	0.047	0.287	7075-T6511	1468513
1.875	0.938	3.125	0.094	0.094	0.094	0.125	0.125	FULL	FULL	FULL	FULL	FULL	FULL	0.661	7075-T6511	1418683
1.875	0.938	2.500	0.125	0.125	0.125	0.125	0.125	FULL	FULL	FULL	FULL	FULL	FULL	0.530	7075-T6511	1419098
2.000	1.000	1.125	0.125	0.125	0.125	0.125	0.125	0.063	0.063	0.063	0.063	0.063	0.063	0.377	7075-T6511	1417984
2.500	1.250	1.250	0.125	0.125	0.125	0.125	0.125	0.063	0.125	0.031	0.031	0.125	0.063	0.452	7075-T6511	1363992
2.375	1.187	3.000	0.156	0.156	0.156	0.188	0.188	FULL	FULL	FULL	FULL	FULL	FULL	0.821	7075-T6511	1419385
2.500	1.250	2.000	0.188	0.188	0.188	0.188	0.188	0.094	0.188	0.010	0.010	0.188	0.094	0.807	7075-T6511	1328571
4.375	2.188	1.625	0.125	0.125	0.188	0.188	0.188	0.062	0.062	0.062	0.062	0.062	0.062	0.880	7075-T6511	1544604
2.500	1.750	1.813	0.156	0.156	0.093	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	--	7075-T6511	2913786
5.625	2.094	1.312	0.265	0.265	0.188	0.188	0.188	0.030	0.030	0.030	0.030	0.030	0.030	--	7075-T6511	2615114
3.718	1.859	5.156	0.437	0.437	0.156	0.094	0.094	0.063	0.063	0.063	0.063	0.063	0.063	0.236	7075-T6511	1544612
1.813	0.907	3.500	0.625	0.625	0.125	0.125	0.125	FULL	0.012	0.125	0.125	0.125	--	1.485	7075-T6511	2620678
3.000	1.500	3.375	0.688	0.688	0.188	0.188	0.188	0.062	0.062	0.062	0.062	0.062	0.062	2.564	7075-T6511	1430813
1.875	0.891	1.125	0.094	0.094	0.094	0.125	--	FULL	FULL	FULL	--	--	FULL	--	7075-T6	1418684

Printed in U.S.A.

BB3-23A

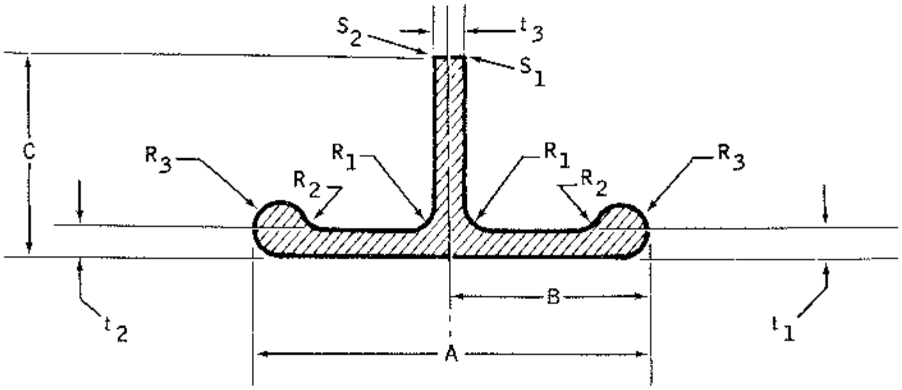
Extrusions -- T-Section
Figure 27 (Sheet 4)



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
5.375	2.688	3.500	1.000	1.000	0.125	0.125	0.125	FULL	0.060	0.060	0.060	0.060	FULL	5.750	7075-T6511	2644854
2.000	1.000	1.250	0.094	0.094	0.094	0.125	0.125	0.047	0.094	--	--	0.094	0.094	0.299	2024-T3511	1482282
1.500	0.750	1.125	0.062	0.062	0.062	0.062	0.062	0.031	0.031	0.031	0.031	0.031	0.031	0.164	2024-T4	137058
1.750	0.874	1.500	0.125	0.125	0.125	0.125	0.125	0.062	0.062	0.062	0.062	0.062	0.062	0.390	7075-T6	1418898
2.875	1.437	1.062	0.185	0.156	0.125	0.125	0.125	--	--	--	--	--	--	0.569	7075-T6	1362856
1.750	0.875	1.000	0.090	0.090	0.090	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	0.239	7075-T6	1440049
2.000	1.000	1.250	0.125	0.125	0.125	0.125	0.125	FULL	0.125	--	--	0.125	FULL	0.389	7075-T6	1419318
5.000	2.538	3.375	0.469	0.469	0.156	0.250	0.250	0.031	0.031	0.062	0.062	0.031	0.031	--	7075-T6	2645505
4.000	2.188	3.313	0.485	0.485	0.125	0.090	0.090	0.032	0.032	0.032	0.032	0.032	0.032	--	7075-T6	2640548
5.750	2.219	1.437	0.265	0.265	0.188	0.188	0.188	0.030	0.030	0.030	0.030	0.030	0.030	--	2024-T3511	2913226
1.500	0.750	1.250	0.078	0.078	0.078	0.125	0.125	FULL	0.078	--	--	0.078	FULL	0.212	2024-T3511	1313006
1.750	0.875	2.000	0.160	0.160	0.160	0.125	0.125	FULL	FULL	FULL	FULL	FULL	FULL	--	7075-T6	2616291
3.625	1.875	1.250	0.090	0.090	0.125	0.090	0.090	0.030	0.030	0.060	0.060	0.030	0.030	--	7075-T6	1642532
1.875	0.937	2.437	0.687	0.687	0.125	0.125	0.125	0.031	0.031	0.031	0.031	0.031	0.031	--	7075-T6	1642914
1.625	0.812	1.375	0.094	0.094	0.094	0.125	0.125	0.047	0.094	--	--	0.094	0.047	0.275	7075-T6	1298026
2.625	1.312	4.562	0.500	0.500	0.125	0.250	0.250	0.062	--	--	--	--	0.062	--	7075-T6	1362783
8.190	4.095	5.250	0.250	0.250	0.190	0.188	0.188	0.060	0.060	0.060	0.060	0.060	0.060	--	7075-T6	2644853
2.000	1.000	1.000	0.094	0.094	0.094	0.125	0.125	Full	0.094	--	--	0.094	Full	0.275	2024-T4	1330635
1.375	0.687	2.000	0.093	0.093	0.093	0.062	0.062	--	--	0.030	0.030	--	--	0.306	7075-T6	1249237

BB3-24C

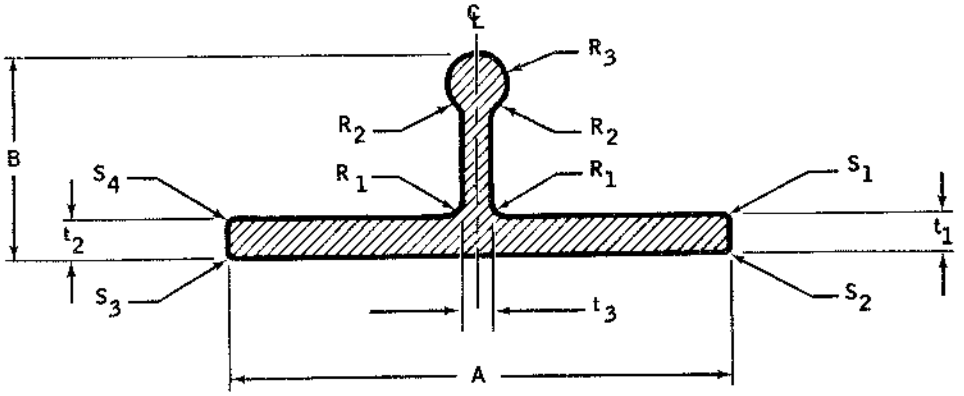
Extrusions -- T-Section
Figure 27 (Sheet 5)



A	B	C	t_1	t_2	t_3	R_1	R_2	R_3	S_1	S_2	AREA	MATERIAL	EXTRUSION
2.250	1.125	2.470	0.125	0.125	0.125	0.125	0.125	0.125	--	--	0.625	2024-T3511	136967

BB3-42

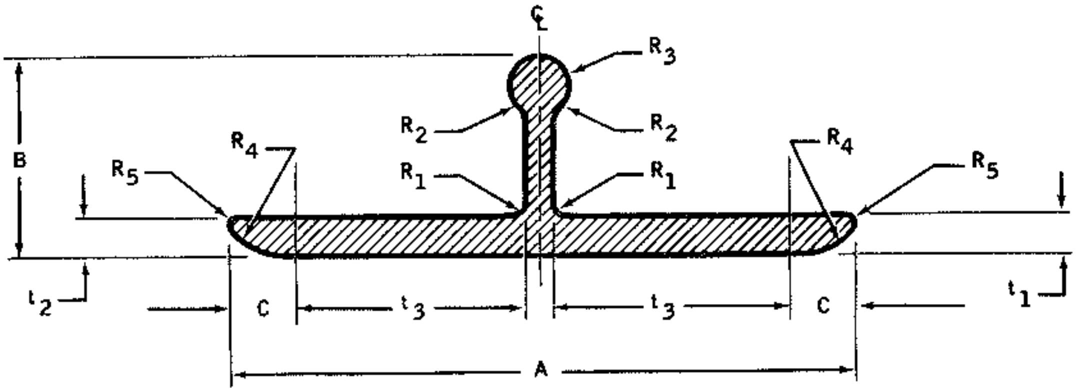
Extrusions -- T-Section, Bulb
Figure 28



A	B	t_1	t_2	t_3	R_1	R_2	R_3	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
1.937	0.875	0.081	0.081	0.094	0.093	0.062	0.125	--	--	--	--	0.261	2024-T3511	1093791
1.500	0.875	0.070	0.070	0.064	0.125	0.125	0.125	FULL	FULL	FULL	FULL	--	7075-T6511	2912830
2.375	0.875	0.070	0.070	0.064	0.125	0.125	0.125	FULL	FULL	FULL	FULL	0.277	7075-T6511	1475407
1.500	0.438	0.040	0.040	0.125	0.093	0.063	0.125	FULL	FULL	FULL	FULL	--	6063-T5	2919708

BB3-39A

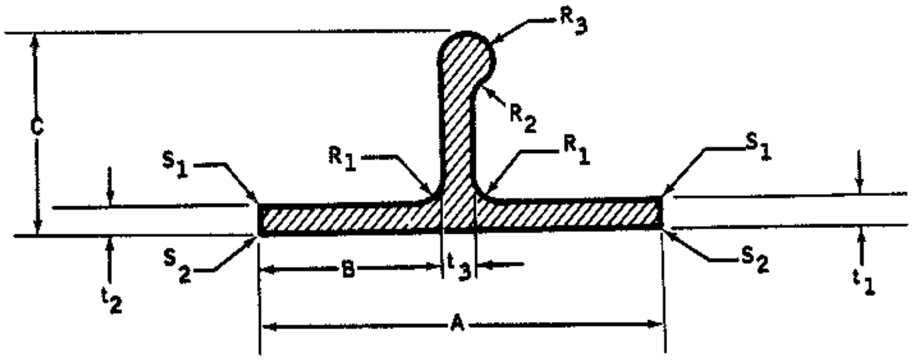
Extrusions -- T-Section, Standard Leg, Bulb
Figure 29



A	B	C	t_1	t_2	t_3	R_1	R_2	R_3	R_4	R_5	AREA	MATERIAL	EXTRUSION
1.688	1.500	0.250	0.080	0.080	0.080	0.125	0.125	0.125	1.000	FULL	0.487	7075-T6511	2777968
1.750	1.500	0.281	0.094	0.094	0.094	0.188	0.125	0.156	1.000	FULL	--	7075-T6511	2613702

BB3-40

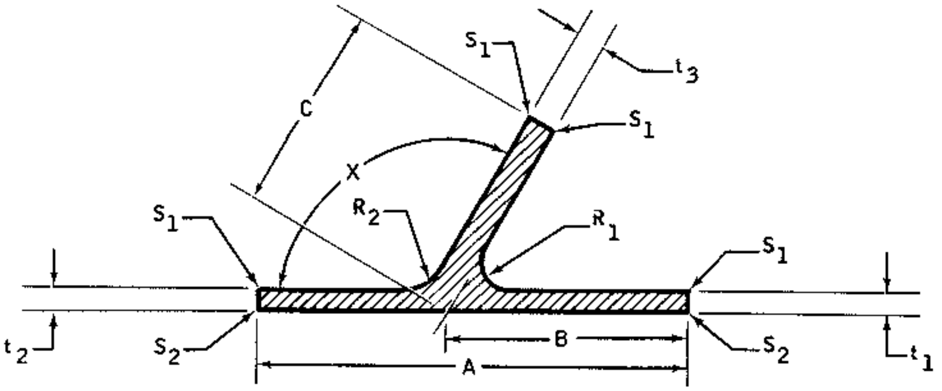
Extrusions -- T-Section, Standard Leg, Bulb, Special
Figure 30



A	B	C	t_1	t_2	t_3	R_1	R_2	R_3	S_1	S_2	AREA	MATERIAL	EXTRUSION
1.625	0.750	1.500	0.125	0.125	0.125	0.125	0.188	0.188	0.030	0.030	0.460	7075-T6511	1532213
2.125	1.000	1.500	0.125	0.125	0.125	0.125	0.125	0.125	FULL	FULL	0.462	7075-T6511	1419073
1.375	0.650	1.375	0.063	0.063	0.063	0.060	0.109	0.109	FULL	--	0.197	7075-T6511	2613680
1.500	0.703	1.375	0.093	0.093	0.093	0.062	0.156	0.156	FULL	--	--	7075-T6511	1641009
1.375	0.734	1.375	0.094	0.094	0.094	0.062	0.156	0.156	0.046	0.046	0.303	7075-T6511	1245828
2.375	1.141	1.375	0.093	0.093	0.093	0.062	0.156	0.156	--	0.030	0.398	7075-T6511	1245829
2.375	1.125	1.750	0.125	0.125	0.125	0.125	0.156	0.156	0.031	0.031	0.555	7075-T6511	1286227
1.625	0.750	1.500	0.156	0.156	0.125	0.125	0.188	0.188	0.030	0.030	0.506	7075-T6511	1533937
1.437	0.705	1.375	0.080	0.080	0.063	0.063	0.109	0.109	0.032	0.032	--	7075-T6511	2919136
2.375	1.131	1.375	0.093	0.093	0.093	0.062	0.156	0.156	--	0.030	0.398	7075-T6511	1248529

BB3-41B

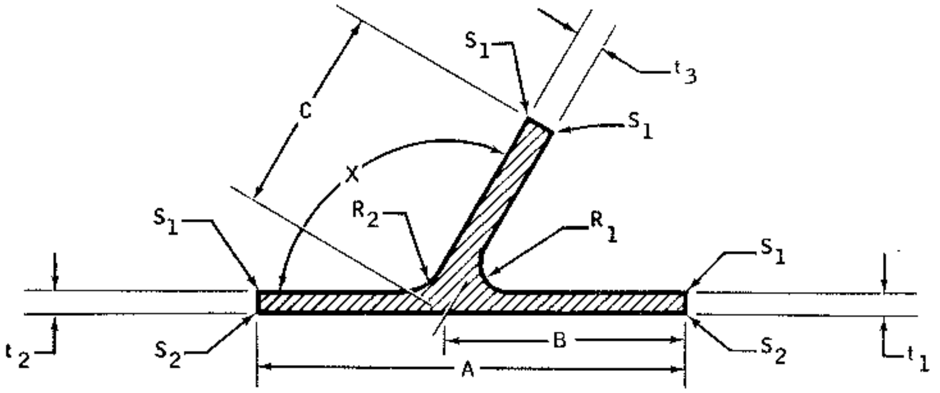
Extrusions -- T-Section, Standard Leg, Bulb, Unsymmetrical
Figure 31



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	X	AREA	MATERIAL	EXTRUSION
2.125	0.875	1.125	0.080	0.080	0.080	0.125	0.125	0.031	0.031	60°	0.250	7075-T6511	2914057
1.780	0.850	2.000	0.080	0.080	0.080	0.125	0.125	0.031	0.031	79°30'	0.302	7075-T6511	2914191
3.000	1.454	2.250	0.093	0.093	0.093	0.093	0.093	--	--	80°	--	2024-T3511	1371977
1.688	0.812	1.440	0.418	0.418	0.063	0.090	0.090	0.030	0.030	87°	--	2024-T3511	2914912
2.250	1.170	2.000	0.093	0.093	0.093	0.062	0.062	0.010	0.030	87°10'	0.388	2024-T3511	1329805
2.150	1.120	1.020	0.075	0.075	0.060	0.125	0.125	0.030	0.030	93°	--	2024-T3511	2914983
2.750	1.375	2.190	0.375	0.375	0.125	0.187	0.187	0.062	0.062	98°	1.280	7075-T6511	1766648
2.250	1.125	3.125	0.125	0.125	0.125	0.125	0.125	0.031	0.031	101°40'	--	7075-T6511	2506869
2.000	1.062	1.062	0.093	0.093	0.093	0.125	0.125	0.032	0.032	108°35'	0.279	2024-T3511	1230406
2.756	1.475	1.000	0.060	0.060	0.060	0.090	0.090	FULL	FULL	106°15'	--	2024-T3511	2649174
3.875	2.149	2.406	0.220	0.220	0.090	0.090	0.250	0.030	0.030	108°56'	--	7075-T6511	1714099
3.125	1.375	1.187	0.093	0.093	0.093	0.093	0.093	0.031	0.031	111°30'	0.391	7075-T6511	1503777
2.875	1.350	2.335	0.125	0.125	0.125	0.125	0.125	0.031	0.060	113°48'	--	7075-T6511	1642531
1.750	0.938	1.125	0.062	0.062	0.062	0.062	0.062	--	--	115°	0.179	2024-T3511	1125558
2.500	1.250	2.250	0.060	0.060	0.060	0.125	0.125	--	--	100°	0.289	2024-T3511	1093742
2.500	1.250	2.250	0.060	0.060	0.060	0.125	0.125	--	--	122°	0.294	2024-T3511	1093741

BB3-25

Extrusions -- T-Section, Beveled
Figure 32 (Sheet 1)

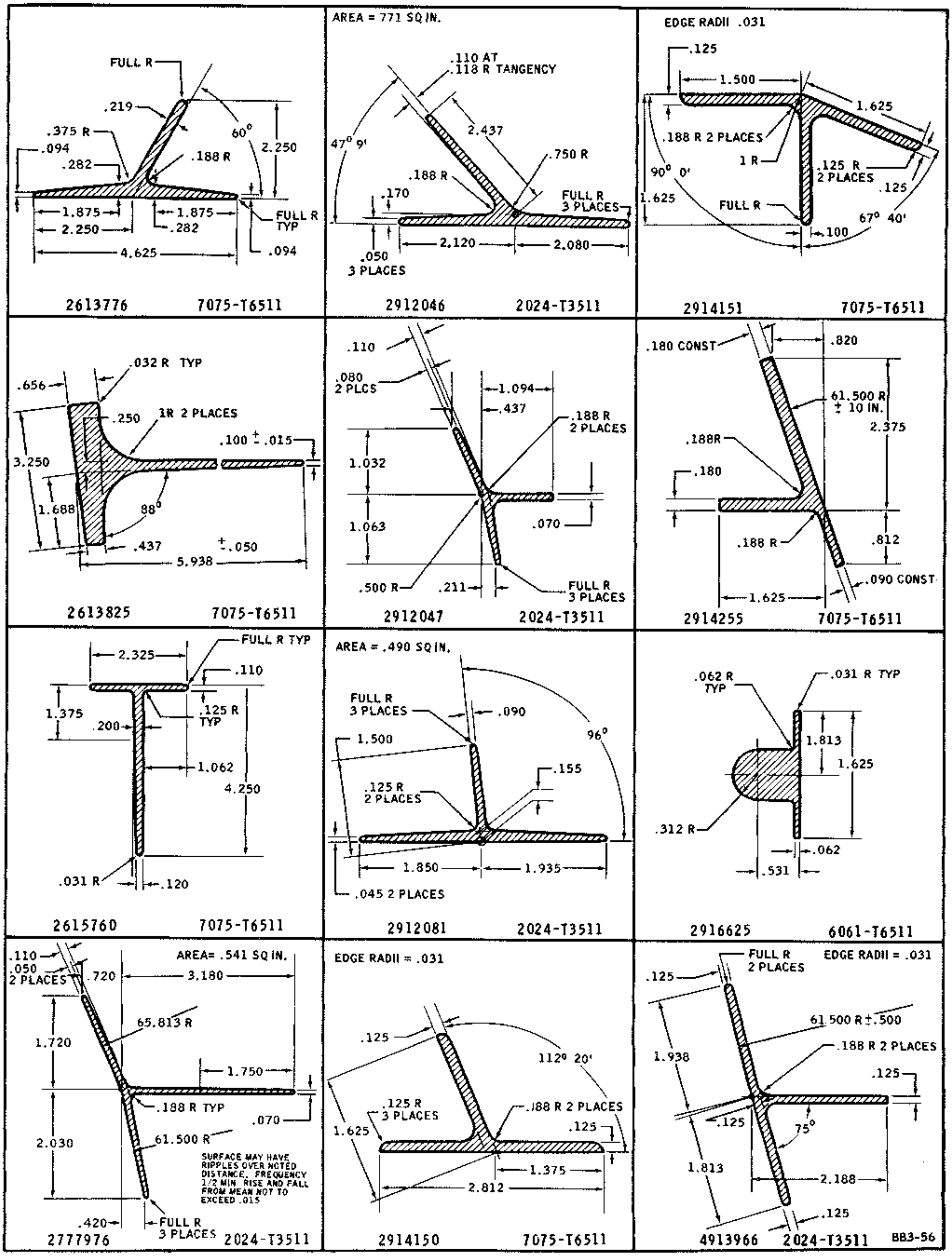


A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	X	AREA	MATERIAL	EXTRUSION
1.625	0.781	2.500	0.094	0.094	0.094	0.125	0.125	FULL	--	96°40'	--	2024-T3511	2777975
2.756	1.475	1.000	0.060	0.060	0.060	0.090	0.090	FULL	FULL	106°15'	--	7075-T6511	2914521
3.060	1.500	1.063	0.060	0.060	0.060	0.090	0.090	FULL	FULL	105°	--	7075-T6511	2914520
2.250	1.063	3.500	0.125	0.125	0.125	0.125	0.125	0.031	0.301	93°27'	--	7075-T6511	2506870

BB3-26

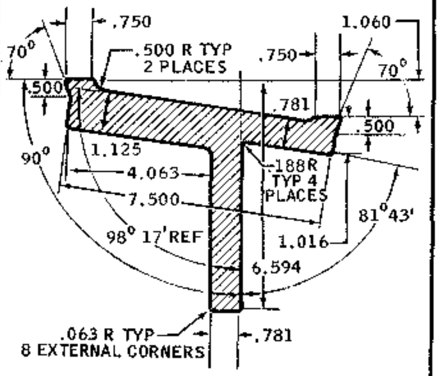
Extrusions -- T-Section, Beveled
Figure 32 (Sheet 2)

Printed in U.S.A.

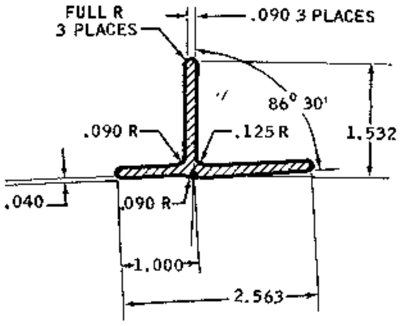


SURFACE MAY HAVE RIPPLES OVER NOTED DISTANCE. FREQUENCY 1/2 MIN. RISE AND FALL FROM MEAN NOT TO EXCEED .015

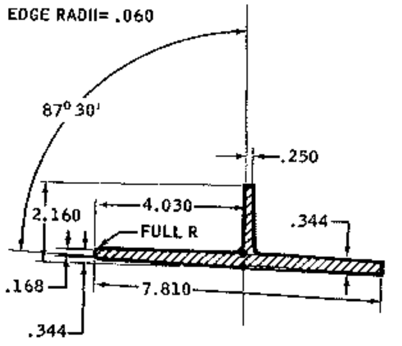
Extrusions -- T-Section, Miscellaneous
Figure 33 (Sheet 1)



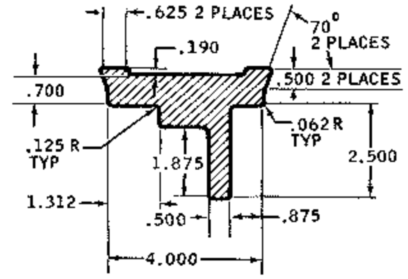
2610250 7075-T6511



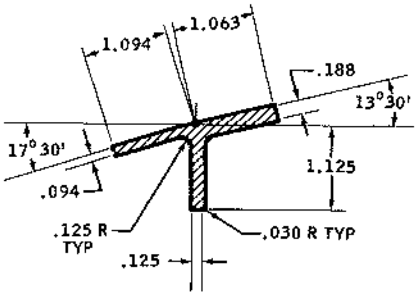
2912310 2024-T3511



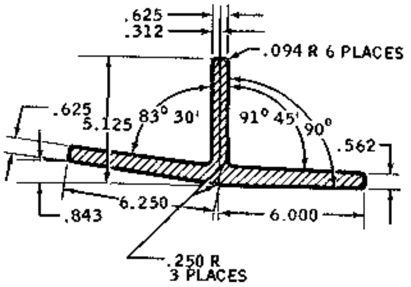
4914686 7075-T6511



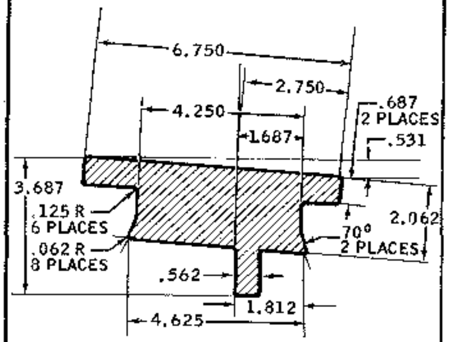
2777964 2014-T6511



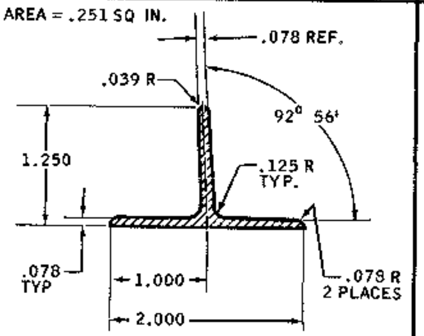
2912428 2014-T6511



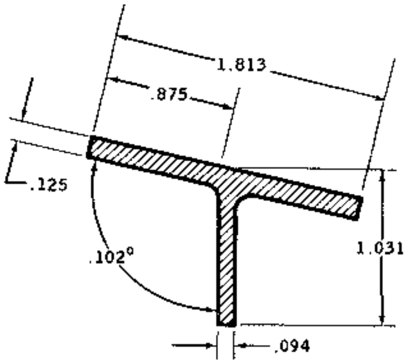
4919230 7075-T6511



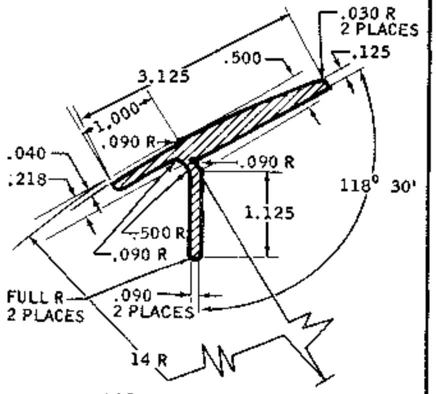
2912200 7075-T6511



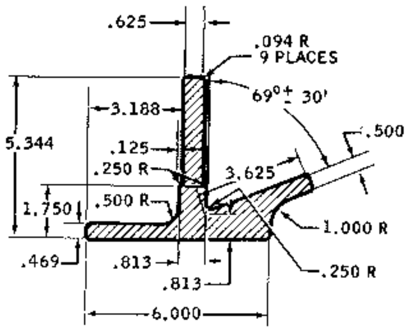
2913581 7075-T6511



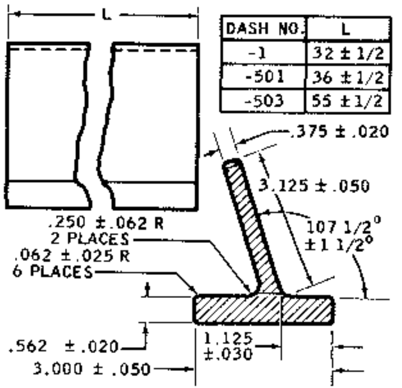
2912429 2014-T6511



2912308 2014-T6511



4651558 7075-T6511

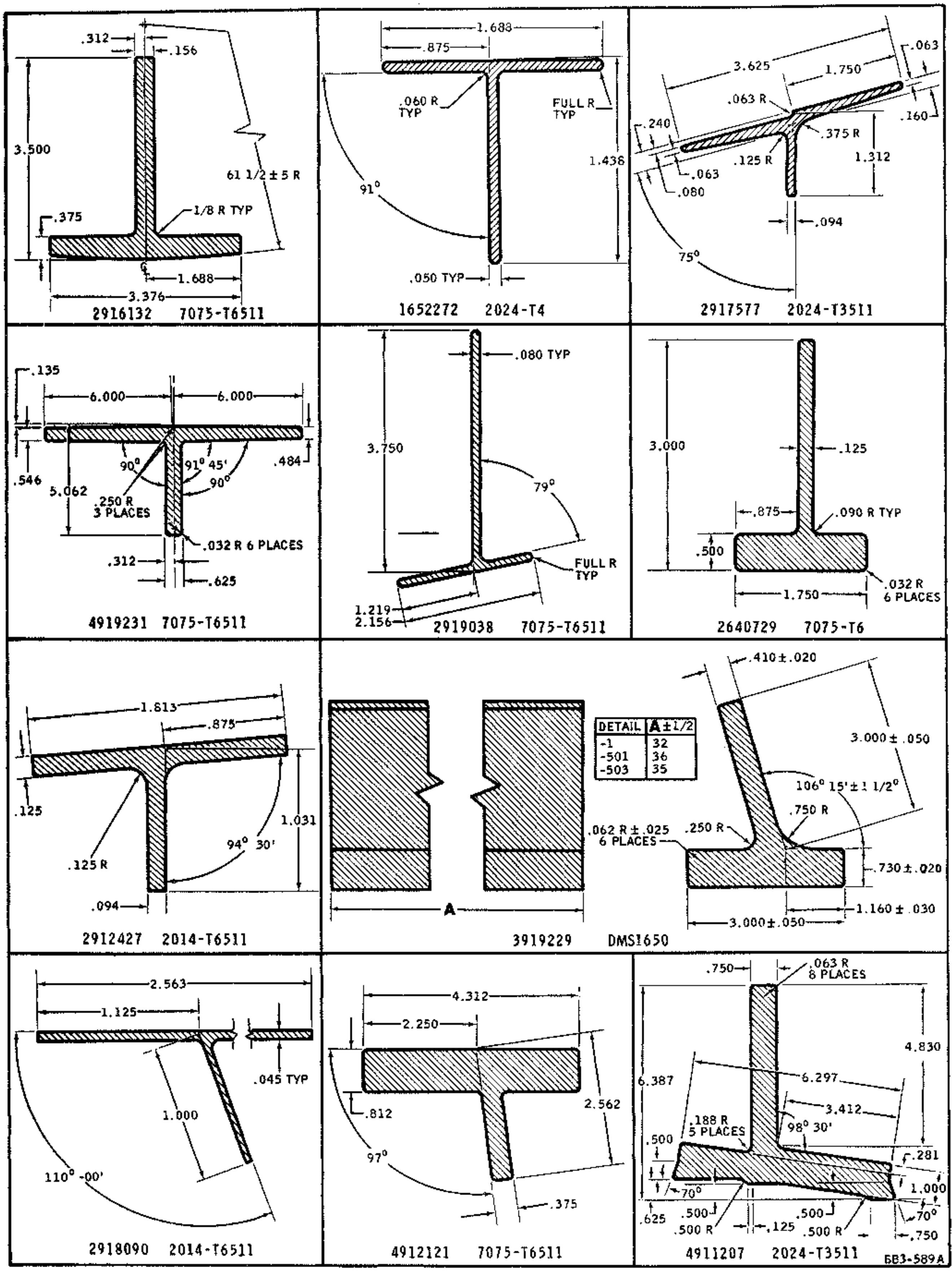


DASH NO.	L
-1	32 ± 1/2
-501	36 ± 1/2
-503	55 ± 1/2

3912878 TITANIUM DMS1650

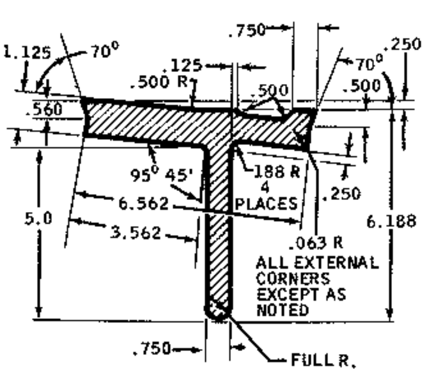
BB3-57A

Extrusions -- T-Section, Miscellaneous
Figure 33 (Sheet 2)

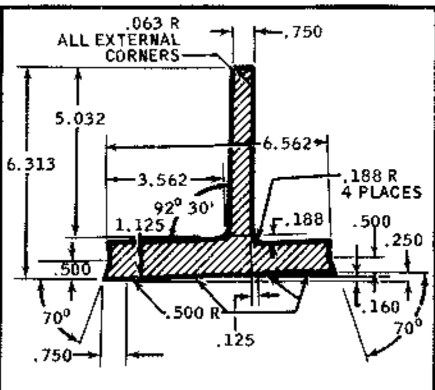


Extrusions -- T-Section, Miscellaneous
Figure 33 (Sheet 3)

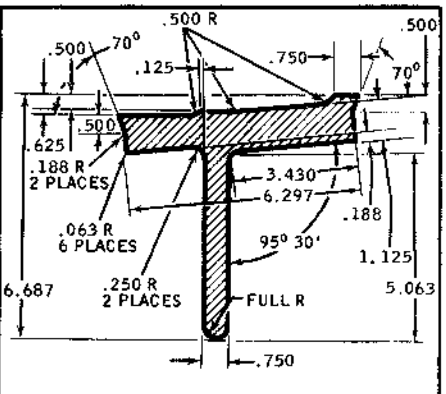
Printed in U.S.A.



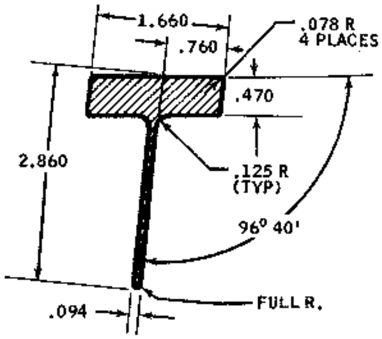
4911204 7075-T6511



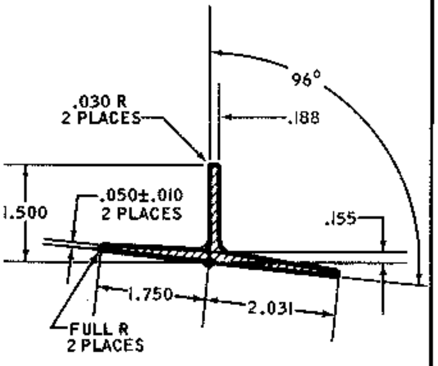
4911205 2024-T3511



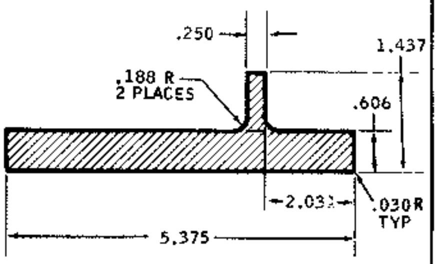
4912718 7075-T6511



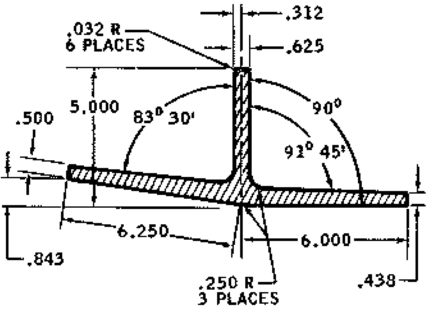
2777974 7075-T6511



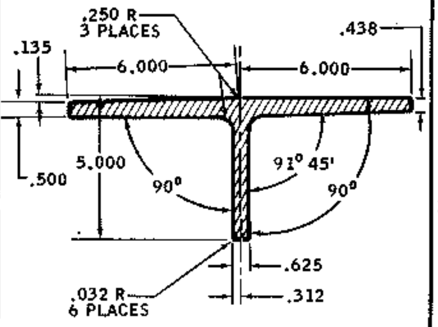
2919896 7075-T6511



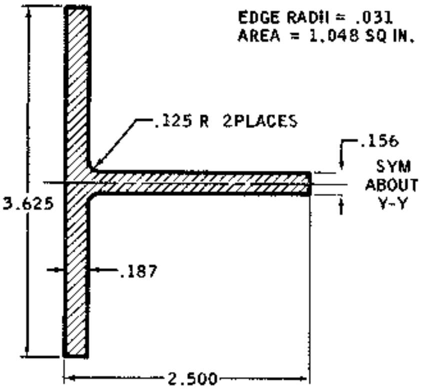
2919261 2024-T3511



4911242 7075-T6511



4911243 7075-T6511

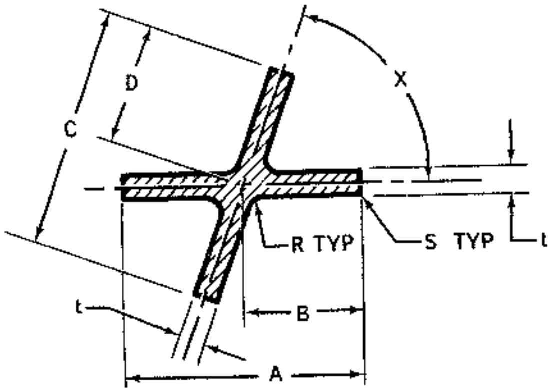


1418493 7075-T6

Printed in U.S.A.

BB3-708C

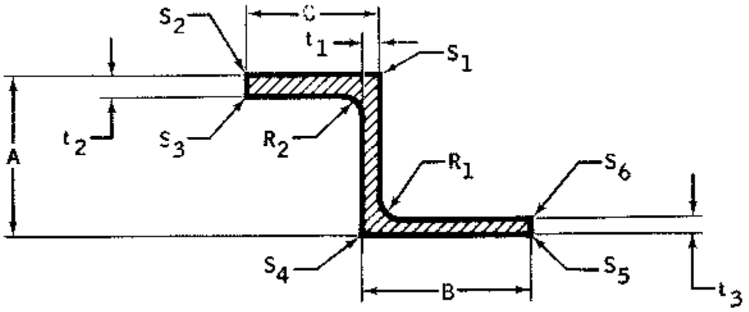
Extrusions -- T-Section, Miscellaneous
Figure 33 (Sheet 4)



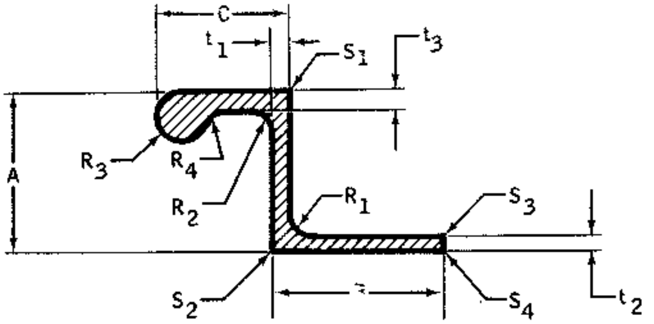
A	B	C	D	t	R	S	X	AREA	MATERIAL	EXTRUSION
1.562	0.781	1.562	0.781	0.090	0.188	--	86°15'	--	2014-T6511	1647128

BB3-44

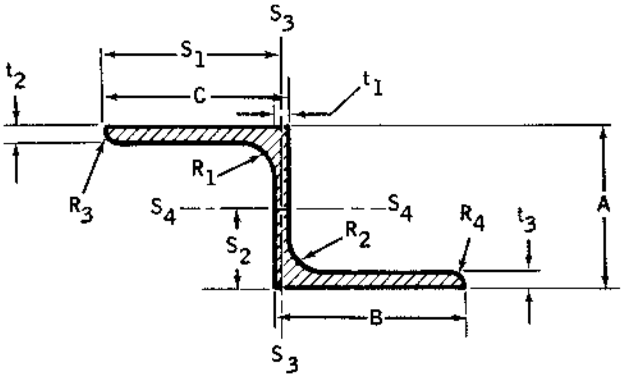
Extrusions -- X-Section
Figure 34



A	B	C	t_1	t_2	t_3	R_1	R_2	S_1	S_2	S_3	S_4	S_5	S_6	AREA	MATERIAL	EXTRUSION
1.500	0.938	0.750	0.094	0.156	0.125	0.090	0.125	0.031	0.031	0.031	0.060	0.060	0.031	0.352	7075-T6511	1616528
1.000	0.875	0.500	0.094	0.094	0.094	0.125	0.125	--	--	0.094	--	--	0.094	0.209	2024-T3511	1430858



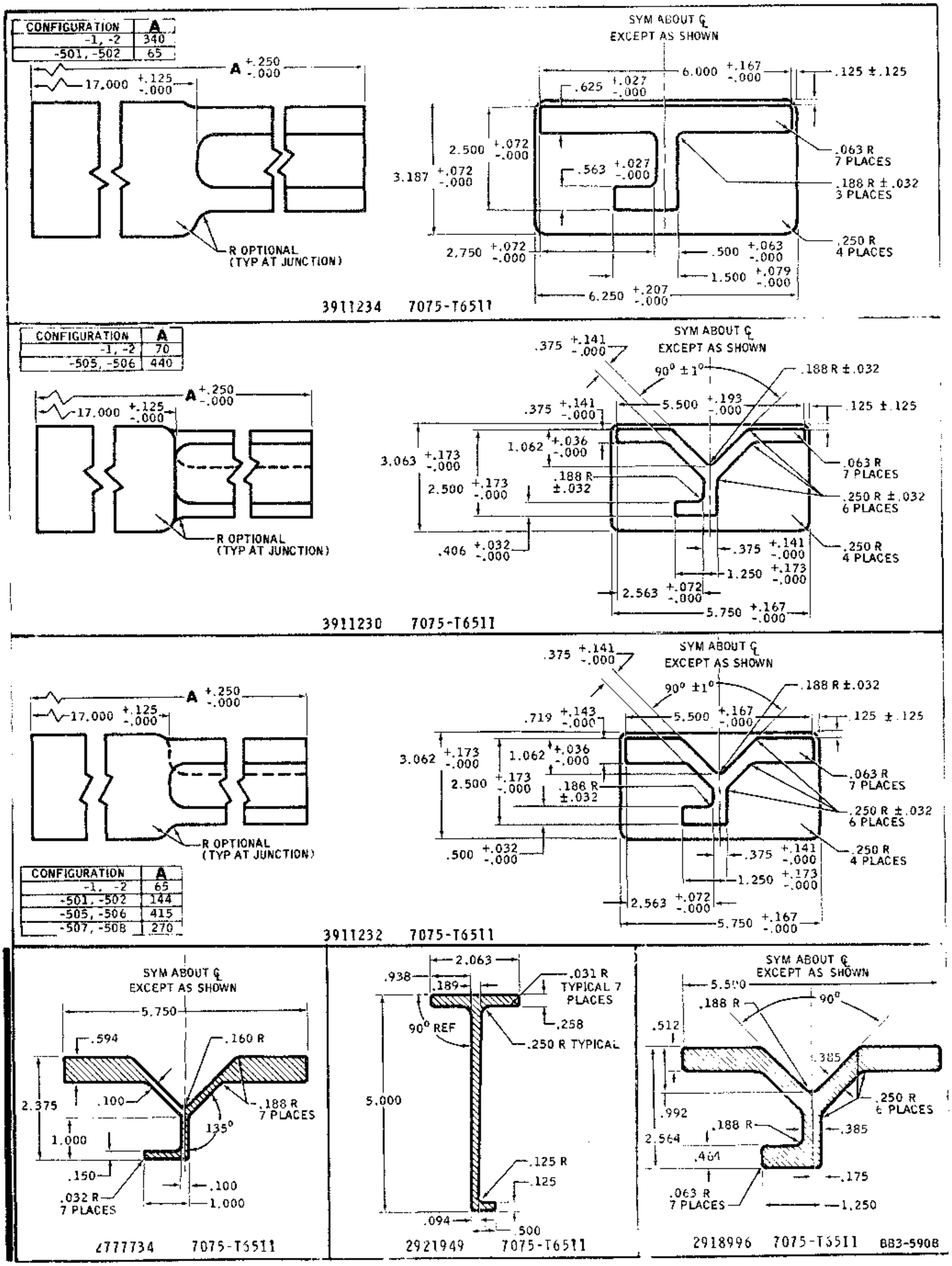
A	B	C	t_1	t_2	t_3	R_1	R_2	R_3	R_4	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
0.812	0.750	0.562	0.050	0.050	0.030	0.094	0.094	0.078	0.094	0.032	0.032	--	0.032	0.112	7075-T6511	1647068



A	B	C	t_1	t_2	t_3	R_1	R_2	R_3	R_4	S_1	S_2	S_3	S_4	AREA	MATERIAL	EXTRUSION
0.625	0.750	0.750	0.063	0.063	0.063	0.125	0.125	0.063	0.063	0.7185	0.3125	0.0148	0.0084	0.131	7075-T6	1499044

BB3-43A

Extrusions -- Z-Section
Figure 35



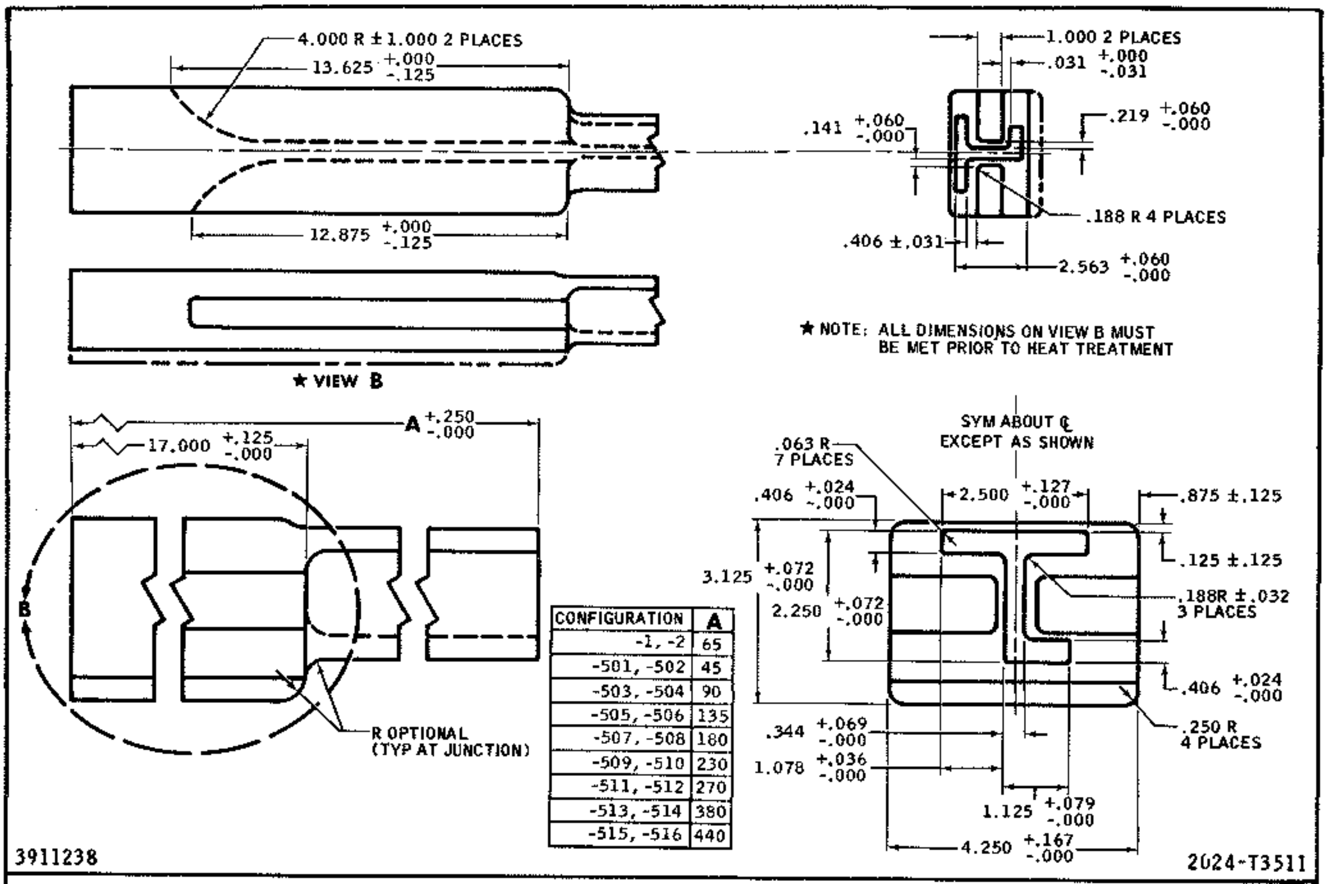
CONFIGURATION	A
-1, -2	340
-501, -502	65

CONFIGURATION	A
-1, -2	70
-505, -506	440

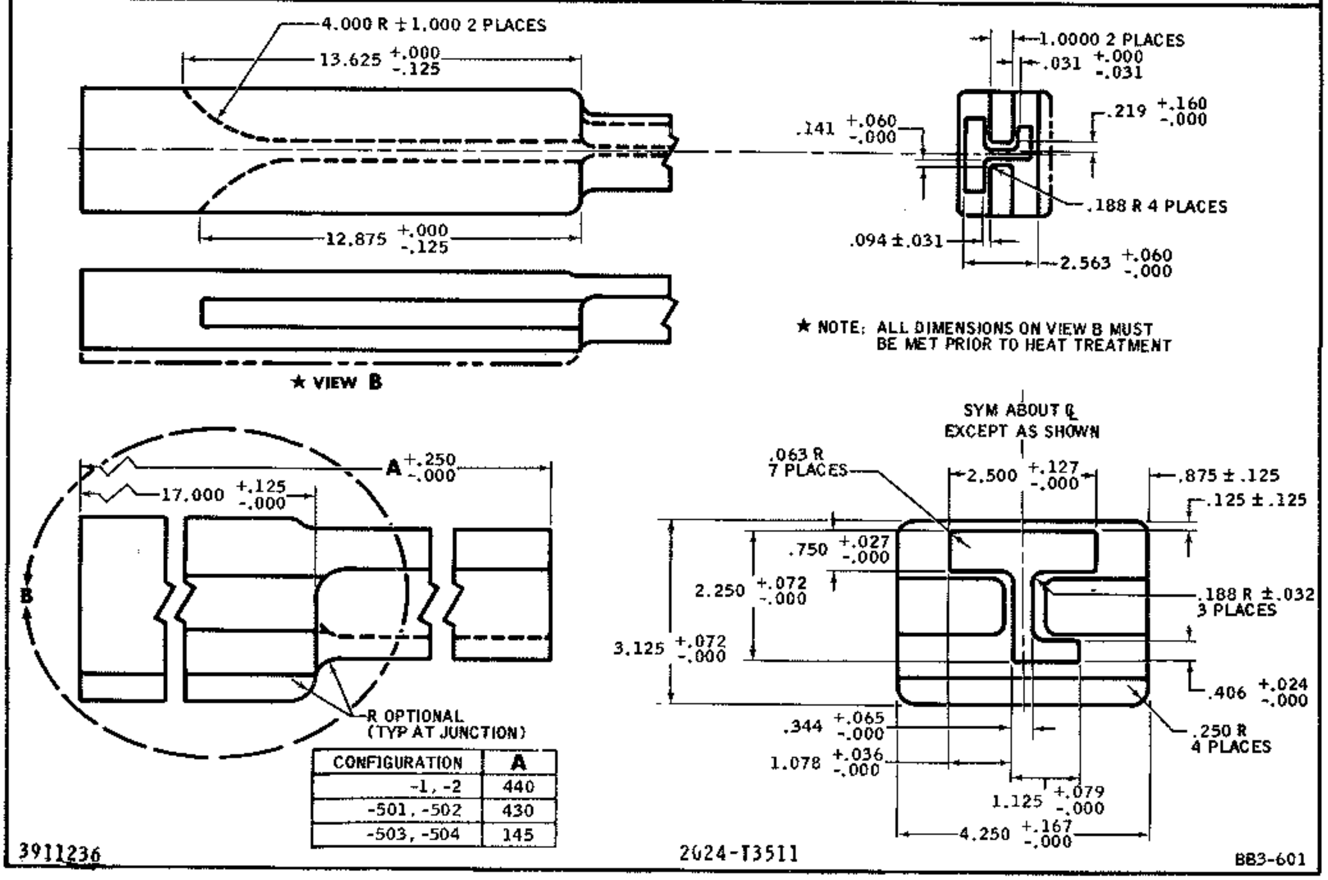
CONFIGURATION	A
-1, -2	65
-501, -502	144
-505, -506	415
-507, -508	270

Extrusions -- Special J- and Y-Shape
Figure 35A (Sheet 1)

Printed in U.S.A.

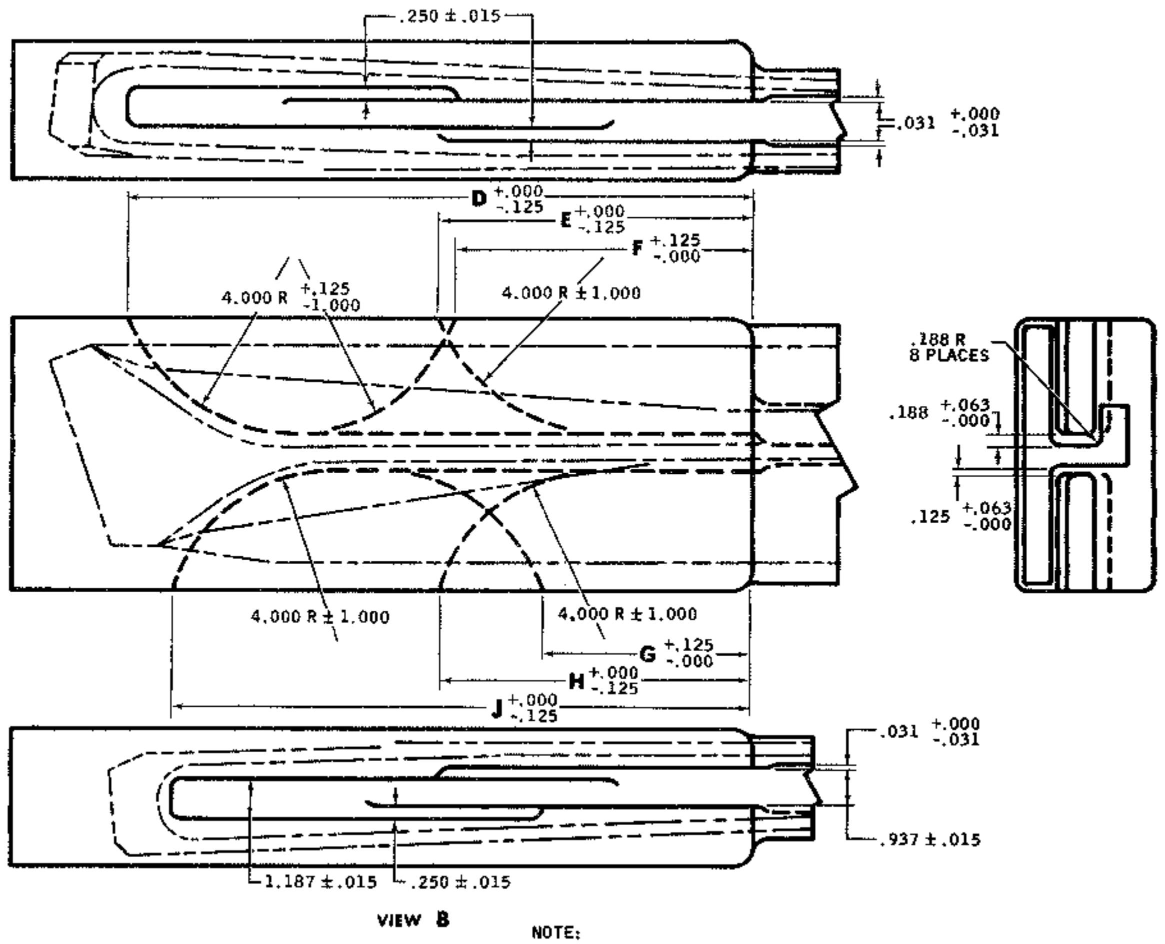


CONFIGURATION	A
-1, -2	65
-501, -502	45
-503, -504	90
-505, -506	135
-507, -508	180
-509, -510	230
-511, -512	270
-513, -514	380
-515, -516	440



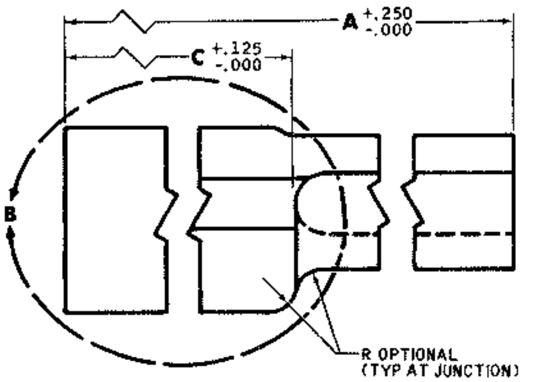
CONFIGURATION	A
-1, -2	440
-501, -502	430
-503, -504	145

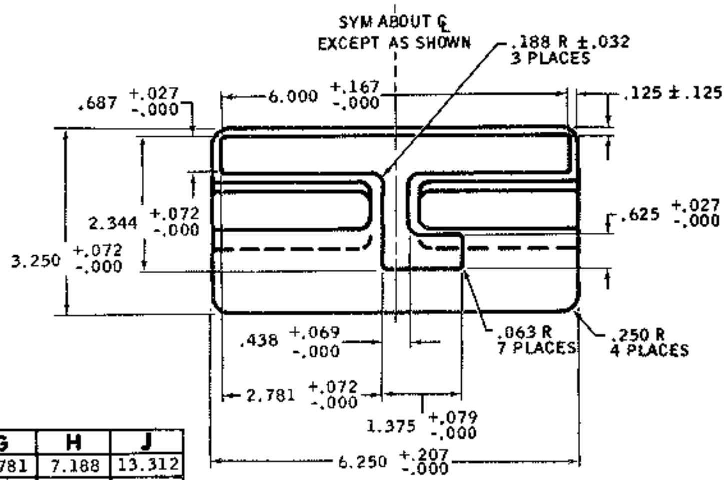
Extrusions -- Special J- and Y-Shape
Figure 35A (Sheet 2)



NOTE:

ALL DIMENSIONS ON VIEW B (ABOVE) MUST BE MET PRIOR TO HEAT TREATMENT.





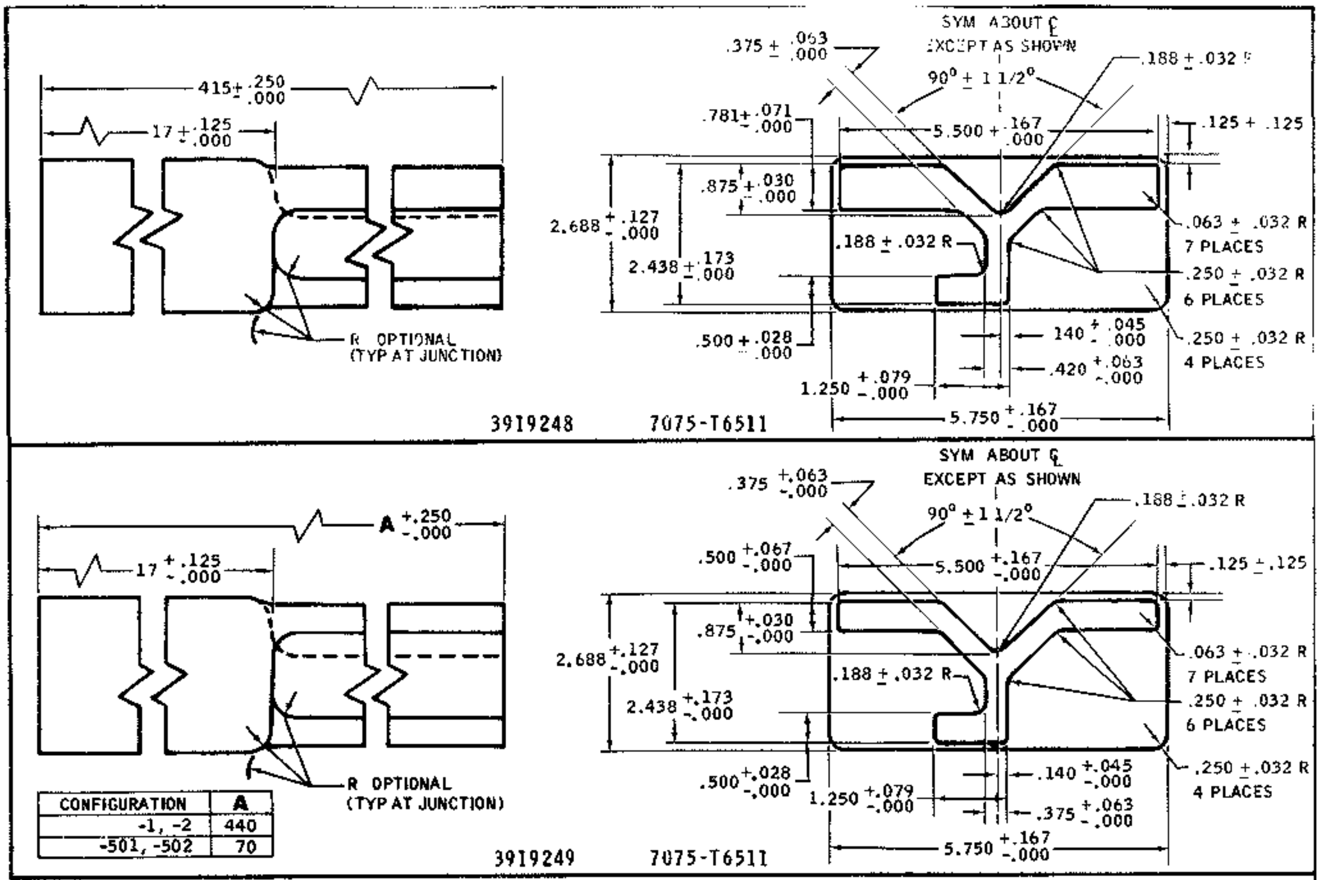
CONFIGURATION	A	C	D	E	F	G	H	J
-1, -2	340	17	14.375	7.188	6.750	4.781	7.188	13.312
-501, -502	65	17	14.375	7.188	6.750	4.781	7.188	13.312
-503, -504	340	21	18.375	11.188	10.750	8.781	11.188	17.312

3911240 2024-T3511

BB3-602

Printed in U.S.A.

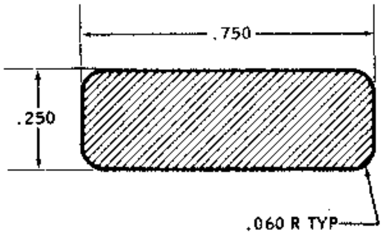
Extrusions -- Special J- and Y-Shape
Figure 35A (Sheet 3)



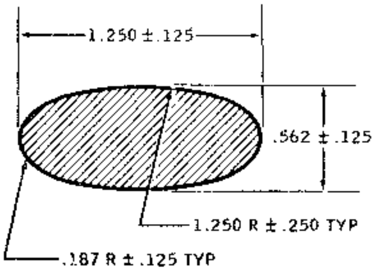
CONFIGURATION	A
-1, -2	440
-501, -502	70

383-972

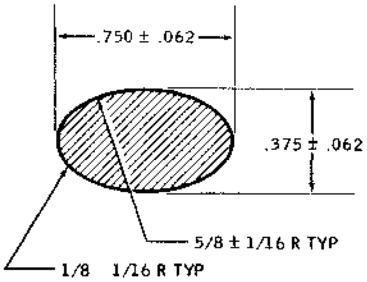
Extrusions -- Special J- and Y-Shape
Figure 35A (Sheet 4)



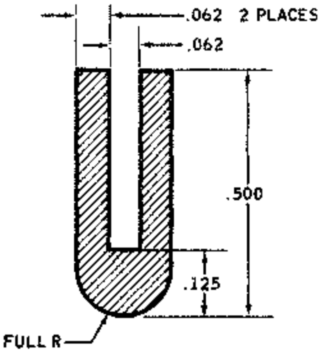
1714303 POLYAMIDE (NYLON), MIL-P-17091, TYPE I



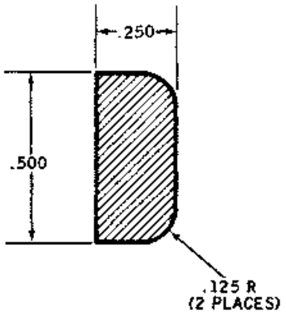
2707761 SILICONE RUBBER SPONGE, DMS1641



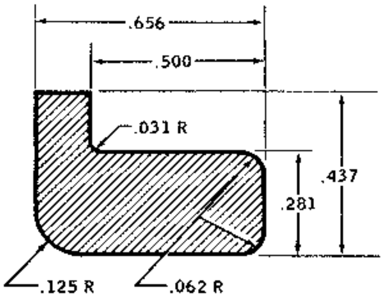
2913623 SILICONE RUBBER SPONGE, SOFT GRADE



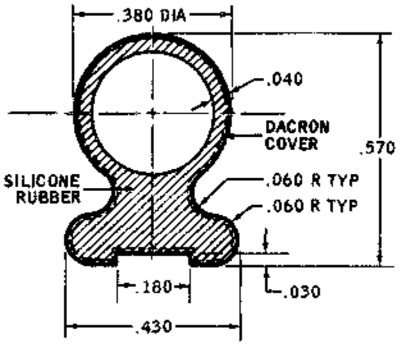
2916009 SYNTHETIC RUBBER MIL-R-6855



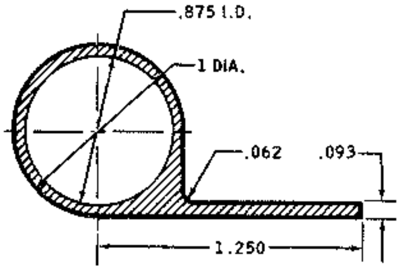
2916291 SILICONE RUBBER SPONGE SOFT GRADE



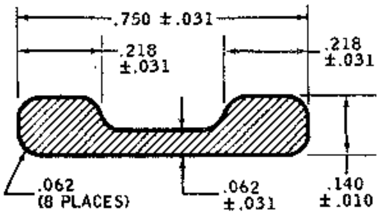
2917162 SILICONE RUBBER SPONGE, MEDIUM GRADE



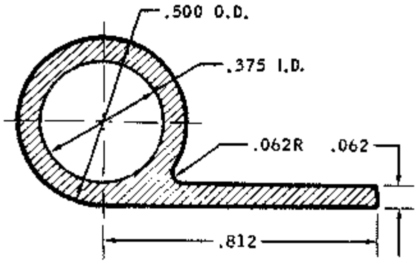
2958600 SILICONE RUBBER, MIL-R-5847 CLASS II, GRADE 60 WITH BONDED TRICOT-WEAVE DACRON COVERING



2958601 SILICONE RUBBER, MIL-R-5847, CLASS II, GRADE 60 WITH BONDED TRICOT-WEAVE DACRON COVERING



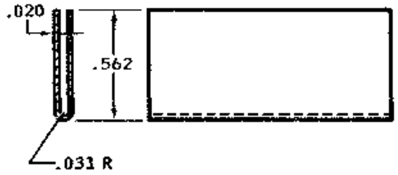
4744637 SILICONE RUBBER, SHORE DUROMETER HARDNESS 25 ± 5. AMS3352 SILICONE RUBBER (APPROVED SUBSTITUTE)



1417054 SILASTIC ELASTOMER

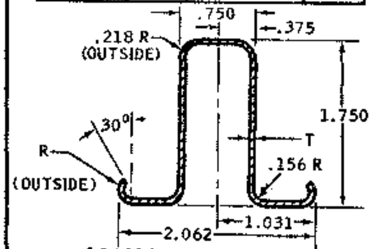
8B3-591A

Elastic Extrusions
Figure 35B

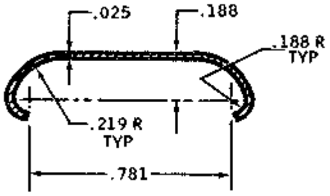


1001122 CLAD 2024-T4

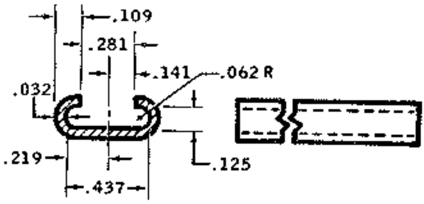
DASH NO.	T	AREA SQ. IN.	R
-2	.025	.138	.125
-3	.032	.175	
-6	.063	.359	.218



1244347 CLAD 2024-T4
1244347S CLAD 2024-0
1244347T 6061-T6

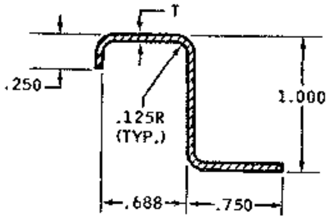


1350576 6061-T6

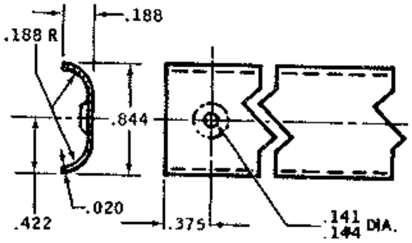


1104821 CLAD 2024-T4

DASH NO.	T	AREA SQ. IN.
BASIC	.032	.083
-2	.025	.067
-4	.040	.104
-5	.050	.135
-6	.063	.171

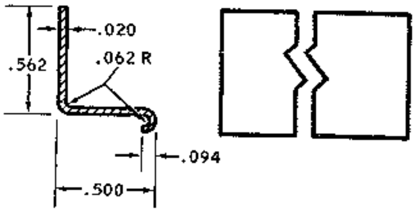


1250475 CLAD 7075-T6

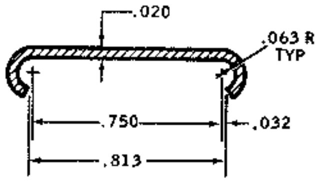


DIMPLE 100° X .272 DIA
TYPICAL ALL HOLES

1350577 (NO HOLES) CLAD 2024 T4
1350577B (WITH HOLES) CLAD 2024-T4

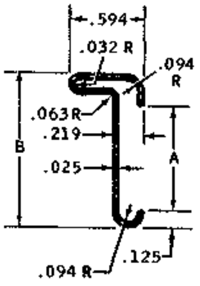


1109618 CLAD 2024-T4

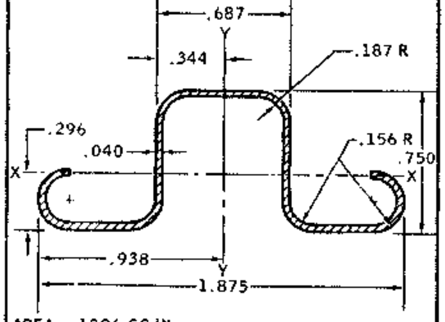


1329537 6061-T6

DASH NO.	A	B	WT. LB/IN
-3	.844	1.188	.0053
-5	.875	1.250	.0065
-7	.750	1.156	.0062
-9	.875	1.156	.0061
-11	1.063	1.313	.0064
-13	.813	1.156	.0062
-15	1.250	1.500	
-17	1.313	1.625	
-19	1.000	1.250	
-21	.813	1.250	
-23	.938	1.250	

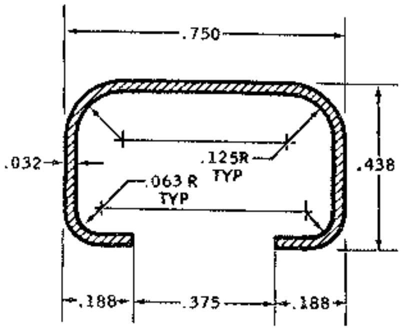


2497751 6061-T6

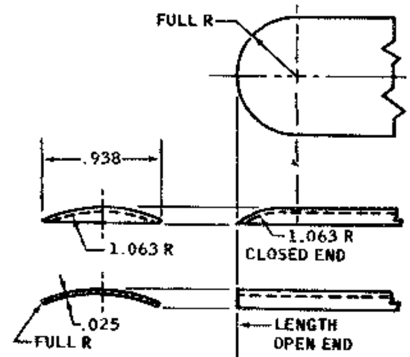


AREA= .1396 SQ IN.

1243425 CLAD 7075-T6



1335556 6061-T6

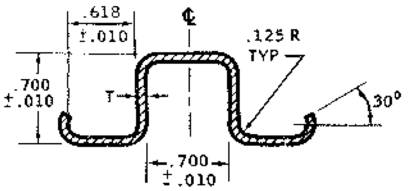


2706706 (OPEN END) 6061-T6
2706706A (CLOSED END) 6061-T6

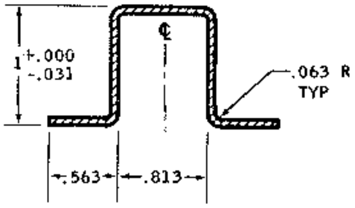
BB3-64

Metallic Formed Sections
Figure 36 (Sheet 1)

DASH NO.	T	AREA SQ IN
-1	.032	.111
-3	.040	.141
-4	.050	.178
-5	.063	.227

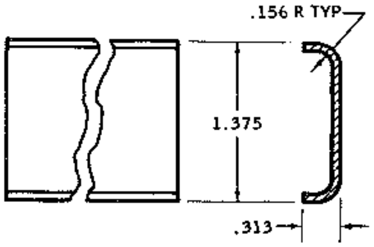


2777922 CLAD 7075-T6



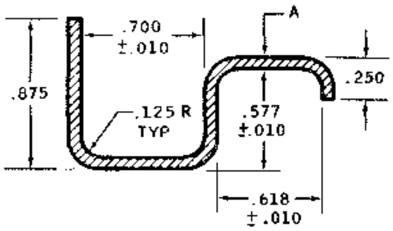
2912282 6061-T6

DASH NO.	T
-3	.032
-4	.040



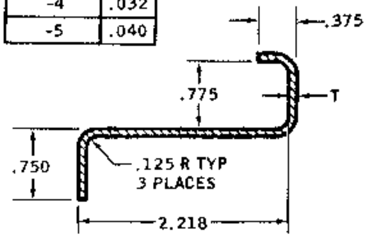
2914777 CLAD 2024-T3

DASH NO.	A
BASIC	.063
-5	.050

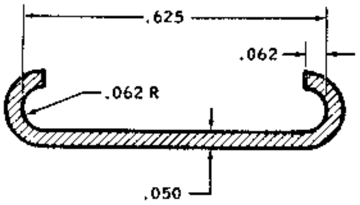


2777923 CLAD 7075-T6

DASH NO.	T
-2	.020
-3	.025
-4	.032
-5	.040

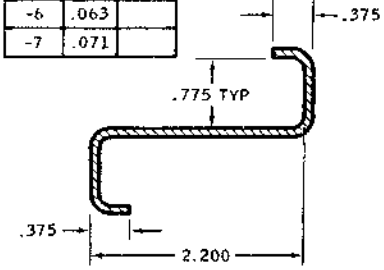


2912412 CLAD 7075-T6



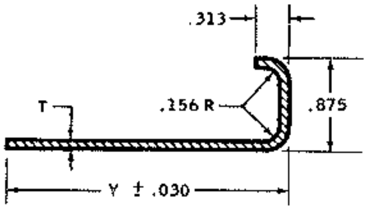
2915786 CLAD 2024-T42

DASH NO.	T	AREA SQ IN.
-5	.050	.215
-6	.063	
-7	.071	



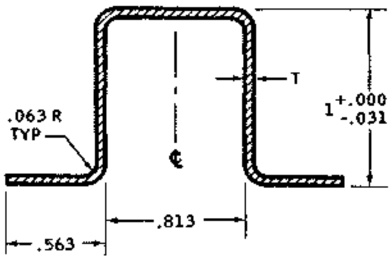
2777930 CLAD 7075-T6

DASH NO.	T	Y
-3	.032	2.770
-5	.040	2.770
-6	.050	2.687



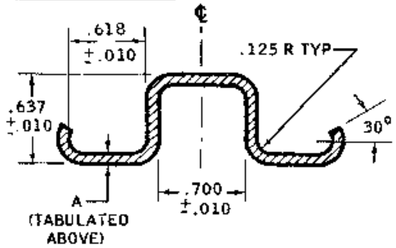
2912901 CLAD 7075-T6

DASH NO.	T
-2	.025

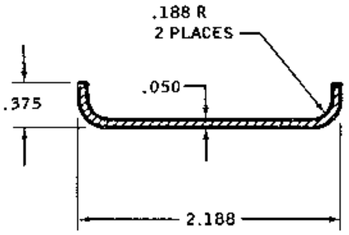


2916423 6061-T6

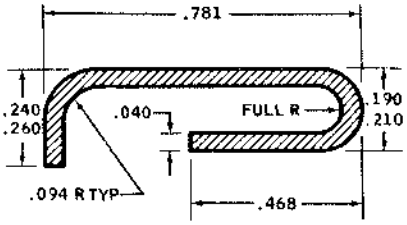
DASH NO.	A
BASIC	.063
-5	.050



2777948 CLAD 7075-T6



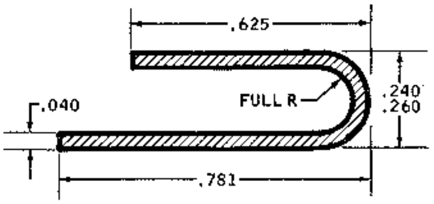
2914646 CLAD 2024-T3



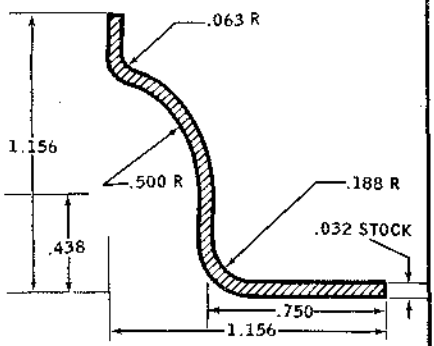
2916874 6061-T6

BB3-65

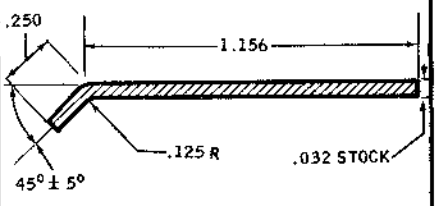
Metallic Formed Sections
Figure 36 (Sheet 2)



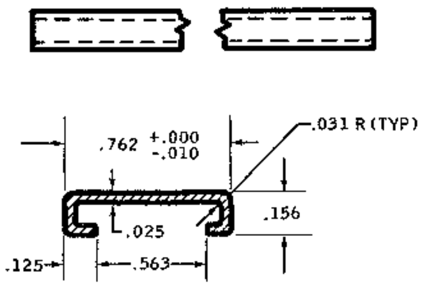
2916875 CLAD 6061-T6



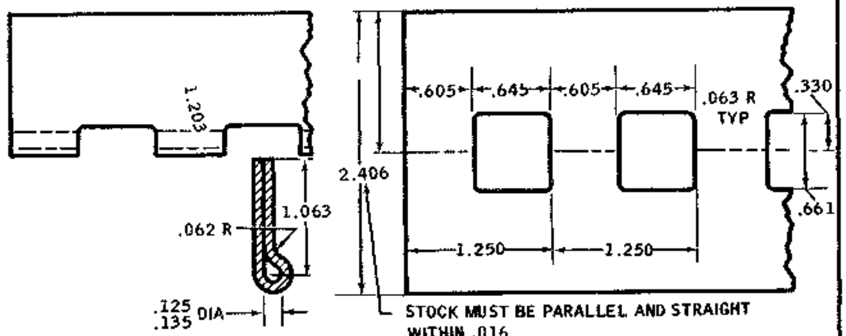
2958602 CLAD 2024-T42



2958603 CLAD 2024-T3

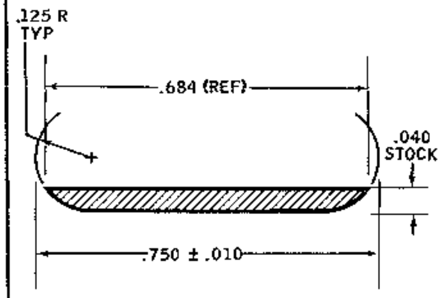


2917095 CLAD 2024-T42



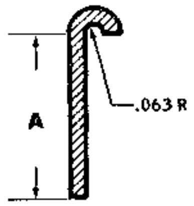
STOCK MUST BE PARALLEL AND STRAIGHT WITHIN .016

1383066 CLAD .032 18-8 CRES, MIL-S-5059, 1/4 H, COMP D



2917981 CLAD 2024-T3

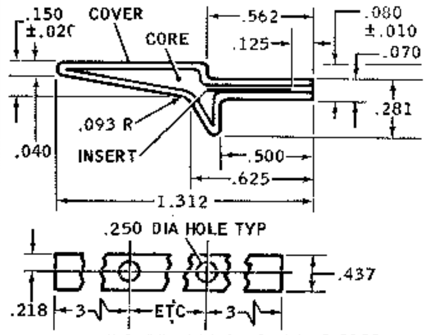
DASH NO.	A
-1	.500
-2	.688
-3	.750
-4	1.250
-5	.563
-6	1.000
-7	.375



2711050 CLAD 6061-T6

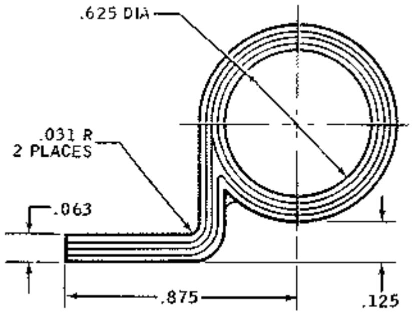
BB3-66A

Metallic Formed Sections
Figure 36 (Sheet 3)



INSERT: .008 CRES, MIL-S-5059, COND 1/2 H, COMP 301, NO. 28 FIN;
CORE: FLUORO-SILICONE RUBBER;
COVER: SILICONE-IMPREGNATED .020 TRICOT WEAVE DACRON FABRIC

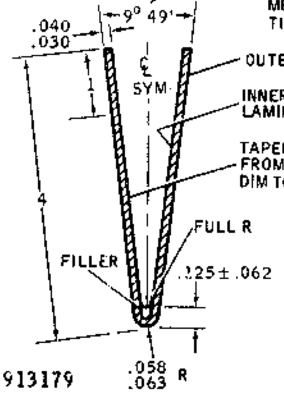
2766959



SILICONE RUBBER, REINFORCED GLASS CLOTH, 3-PLY

2916319

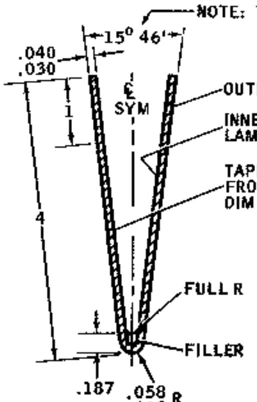
NOTE: TOLERANCE TO BE MET 1 INCH FROM TIP



NO. 120 GLASS FIBER LAMINATED OUTER SKIN, NO. 181 GLASS FIBER INNER LAMINATE, AND GLASS FIBER ROVING

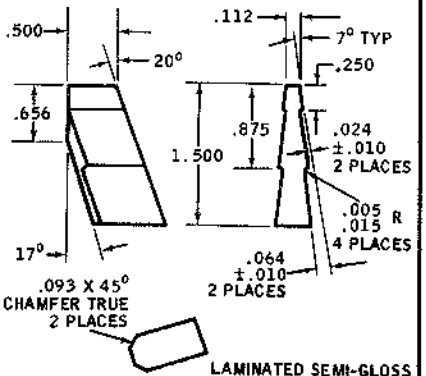
3913179

NOTE: TOLERANCE TO BE MET 1 INCH FROM TIP



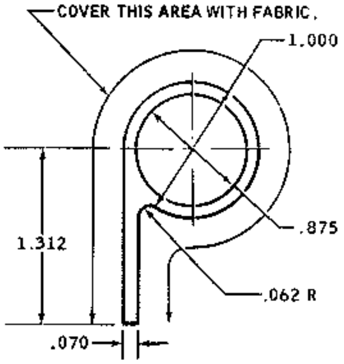
NO. 120 GLASS FIBER LAMINATED OUTER SKIN, NO. 181 GLASS FIBER INNER LAMINATE, AND GLASS FIBER ROVING

3913180



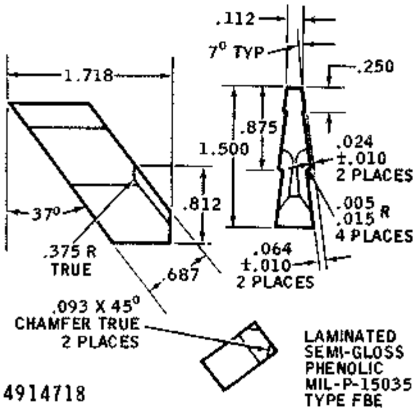
LAMINATED SEMI-GLOSS PHENOLIC MIL-P-15035 TYPE FBE

4913095



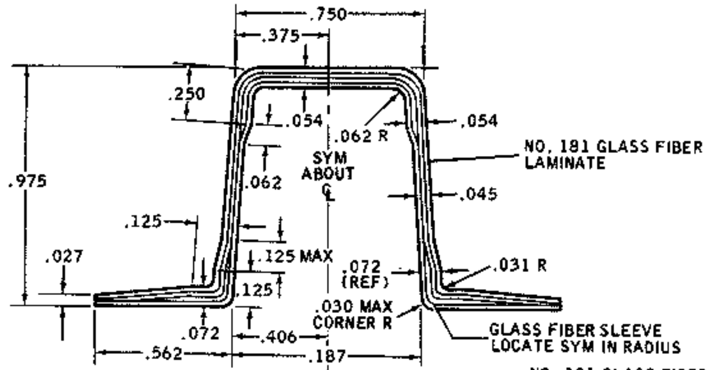
SILICONE RUBBER MIL-R-5847

4914344



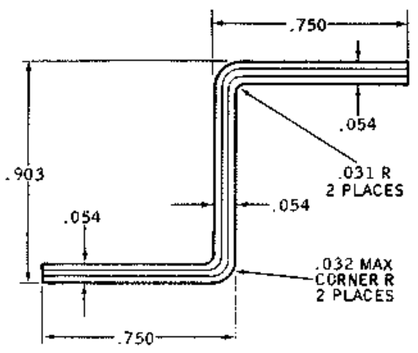
LAMINATED SEMI-GLOSS PHENOLIC MIL-P-15035 TYPE FBE

4914718

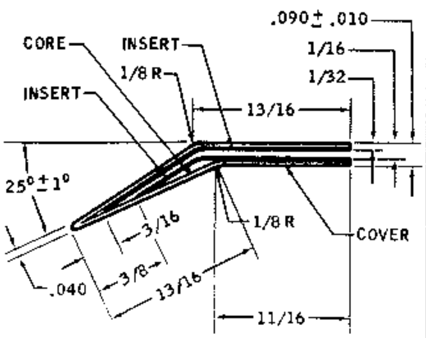


NO. 181 GLASS FIBER LAMINATE WITH STYLE 79001 SIZE NO. 5 GLASS FIBER SLEEVE

4616492



4616493 NO. 181 GLASS FIBER LAMINATE



COVER AND INSERT: .020 THICK, 151?? DACRON FABRIC.
CORE: SILICONE DC55.

4923882

883-592 A

Elastic Formed Sections
Figure 37

FORMING, HEAT TREATMENT, AND METAL HANDLING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section contains information pertinent to materials handling and heat treatment which should be considered during repair.

B. These considerations include heat-treatment requirements, cold work limitations, hot form considerations, special material process information and recommendations for storage and handling of materials.

C. Heat-treatment (including stress relieving) methods should be in accordance with normal industry standards with temperatures and pyrometry capable of accurately maintaining heat-treat conditions

CAUTION: IMPROPER MAINTENANCE OF TEMPERATURES AND ATMOSPHERIC CONDITIONS DURING HEAT TREATMENT CAN RESULT IN FAILURE OF PART.

D. Adequate inspection provisions should be made to assure that processed materials and reworked parts fully meet quality requirements before installation.

E. Identification of titanium material in this manual is by Douglas Material Specification (DMS) numbers. The DMS numbers are used in the manual for material identification because there are commercial types of titanium available with the same compositions which do not conform to DMS requirements. The following list is provided as a cross-reference of approved sources of material manufactured to DMS requirements:

Material	Approved Sources of Material			
	*TMCA	/Republic	**Reactive	//Crucible
DMS1536 (AMS4901)***	Ti 75-A	RS-70	MST-70	A-70
DMS1592 (AMS4911)***	Ti 6Al-4V	RS-120A	MST-6Al-4V	C-120AV

*Titanium Metals Corp. of America, 233 Broadway, New York 7, New York
/Republic Steel Corp., 1405 Republic Bldg., Cleveland 1, Ohio
**Reactive Metals Products, Div. of Bridgeport Brass Co., Warren Ave., Niles, Ohio, or 1418 N. Highland Ave., Hollywood 28, California
//Crucible Steel Co., No. 4 Gateway Center, P. O. Box 88, Pittsburgh 30, Pennsylvania, or 6033 E. Bandini Blvd., Los Angeles 22, California
***Materials produced to these specifications do not necessarily meet the Douglas Material Specifications.

2. Heat-Treatment General Requirements

A. During repair the heat-treat condition of the material may be changed to facilitate rework, or may be changed by the rework itself.

B. Materials which have changed their heat-treat condition, or aluminum parts which have been made from -0 material must be brought to the required temper condition before installation. Required material temper may be found by reference to Chapters 52 through 57 where the part may be identified in the illustrations together with the material, temper, and gage.

C. Parts in which the heat-treat condition has not changed during working, should be considered for possible need of stress relieving.

3. Forming

A. General Requirements

(1) Forming operations must be accomplished with proper consideration of temper, annealing, hot or cold working, subsequent heat treatment and adequate inspection; including hardness, dye-penetrant, and magnaflux, as necessary.

B. Bend Radii

(1) The following charts contain recommended minimum bend radii for power brake and hydropress forming of sheet metals for structural application.

(a) Aluminum alloys:

	Minimum Bend Radii (Inches)					
Gage	6061-0	2014-0, Clad 2014-0, 2024-0, Clad 2024-0, 6061-T4 7075-AQ, Clad 7075-AQ, 7075-0, Clad 7075-0	6061-T6	Clad 2014-T6 Clad 7075-T6	2014-AQ, Clad 2014-AQ, Clad 2014-T3, Clad 2014-T4, 2024-AQ, Clad 2024-AQ, 2024-T3, Clad 2024-T3, 2024-T4, Clad 2024-T4	2024-T36, Clad 2024-T36
.012	1/8	1/8	1/8	1/8	1/8	1/8
.016	1/8	1/8	1/8	1/8	1/8	1/8
.020	1/8	1/8	1/8	1/8	1/8	1/8
.025	1/8	1/8	1/8	3/16	1/8	1/8
.032	1/8	1/8	1/8	3/16	1/8	1/8
.040	1/8	1/8	1/8	5/16	3/16	3/16
.050	1/8	1/8	1/8	5/16	3/16	3/16
.063	1/8	1/8	1/8	7/16	1/4	1/4
.071	1/16	1/8	5/32	7/16	7/32	9/32
.080	3/32	1/8	5/32	1/2	5/16	7/16
.090	3/32	5/32	3/16	9/16	3/8	15/32
.100	3/32	3/16	7/32	21/32	13/32	17/32
.125	1/8	7/32	9/32	27/32	1/2	5/8
.160	5/32	9/32	11/32	1 1/16	21/32	3/4
.190	3/16	3/8	15/32	1 3/8	27/32	29/32
.250	9/32	5/8	3/4	2 inch	1 1/4	1 1/4
.375	13/32	1 3/8	1 1/2	---	1 7/8	1 7/8
.500	11/16	2 1/2	2 1/2	---	2 1/2	2 1/2

(b) Steel:

	Minimum Bend Radii (Inches)
Gage	17-7 PH, Annealed
.010	1/32
.012	1/32
.016	1/32
.018	1/32
.020	1/32
.022	1/32
.025	1/32

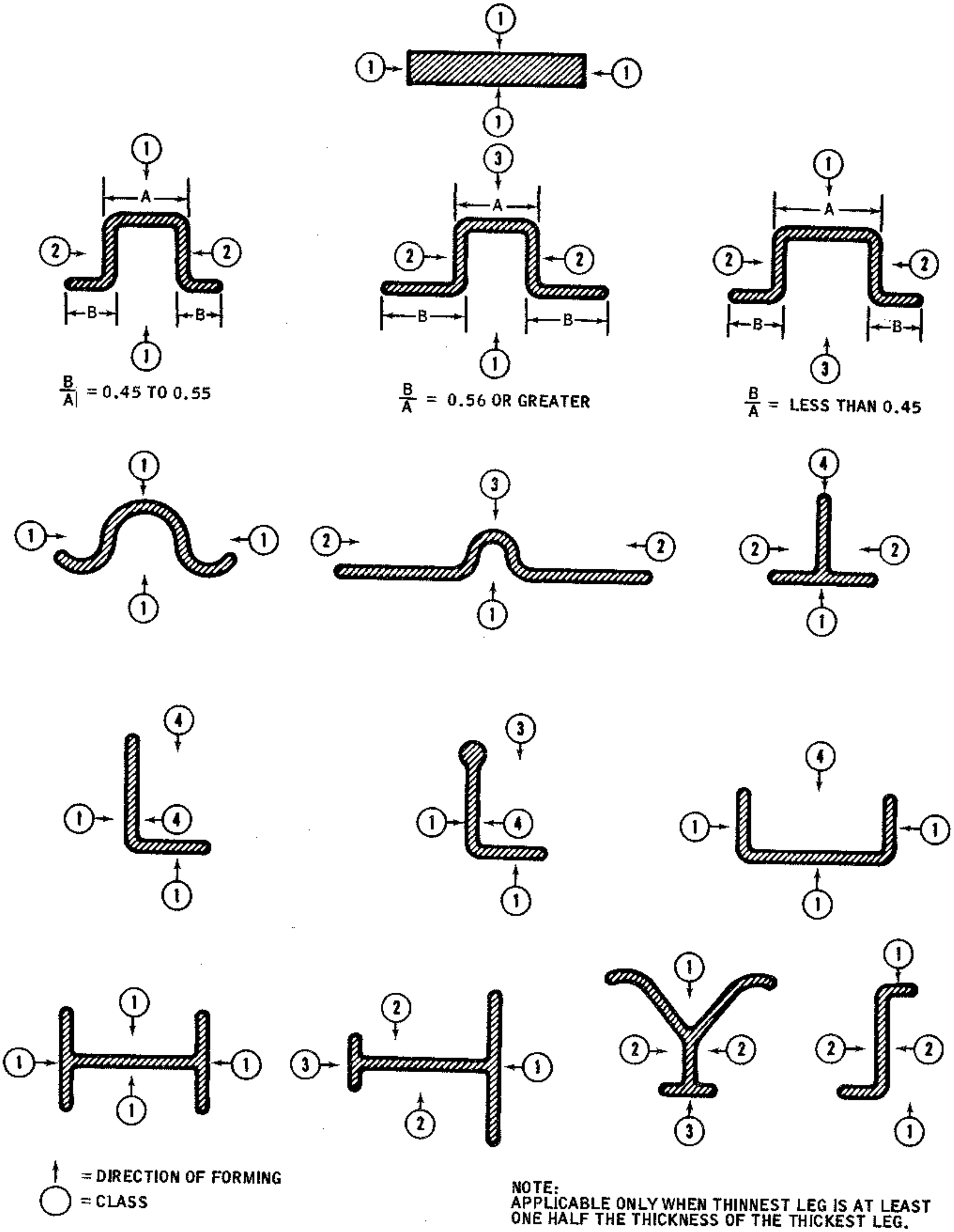
(Continued)

Gage	Minimum Bend Radii (Inches)
	17-7 PH, Annealed
.028	1/32
.032	1/32
.036	1/32
.040	1/16
.045	1/16
.050	1/16
.063	1/16
.071	3/32
.080	3/32
.090	3/32
.100	1/8
.112	1/8
.125	5/32
.160	5/32
.188	3/16
.250	1/4

(c) Titanium alloys:

Gage	Minimum Bend Radii (Inches)	
	DMS 1536	DMS 1592
.012	1/16	3/32
.016	1/16	3/32
.020	3/32	1/8
.025	3/32	5/32
.032	1/8	3/16
.036	1/8	7/32
.040	5/32	1/4
.045	5/32	1/4
.050	3/16	9/32
.063	7/32	3/8
.071	1/4	13/32
.080	9/32	15/32
.090	5/16	1/2
.125	7/16	11/16

NOTE: DMS1592 titanium (up to and including .081 gage) may also be formed to DMS1536 minimum bend radii by heating to a uniform temperature of 1000°F to 1100°F (538°C to 593°C) and then forming. If an unheated brake die is used, forming must be within 10 seconds. Stress relieve all titanium parts after forming by heat soaking for 1 hour at 1025°F to 1075°F (552°C to 579°C) for DMS1592, and 975°F to 1025°F (524°C to 552°C) for DMS1536.



NOTE:
APPLICABLE ONLY WHEN THINNEST LEG IS AT LEAST ONE HALF THE THICKNESS OF THE THICKEST LEG.

BB3-663

Classification of Forming
Figure 1

C. Contouring of Sections or Shapes

(1) Contouring of basic sections and shapes may be accomplished at room temperature for nonclad aluminum alloy in the -T6 condition, and nonclad 2014 and 2024 aluminum alloys within the limits shown in the applicable tables and as follows:

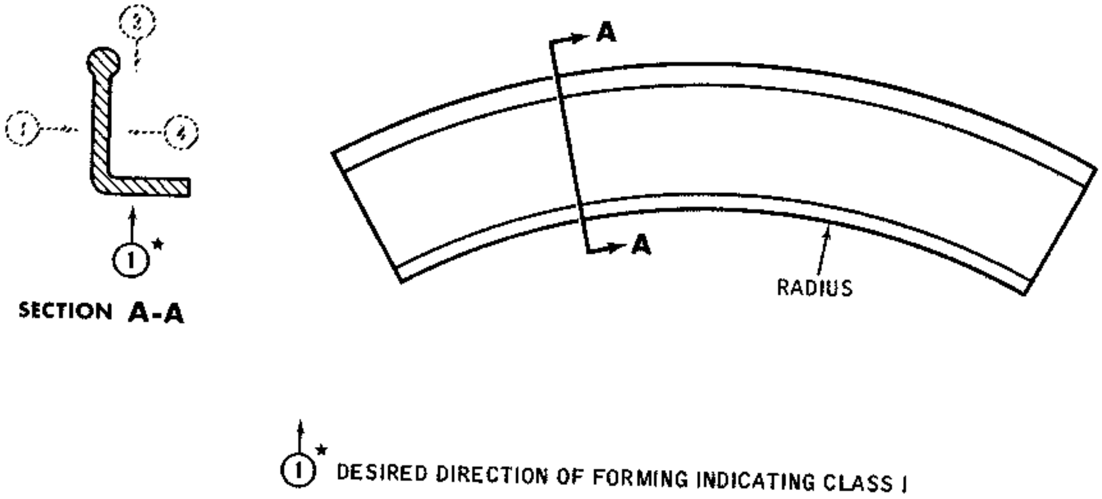
(a) Identify the corresponding section or shape of the material in Figure 1, and determine the class according to the arrow indicating the direction of the desired forming (see Figure 2 for example).

(b) Determine height in inches of section in plane bending (see Figure 3), and ascertain minimum forming radius in the following tables:

1) Minimum forming radii for 2014 and 2024 material is as follows:

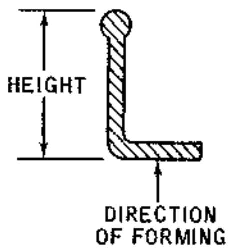
Height of Section (Fig. 3) In In.	Minimum Forming Radius in Inches (Measured at Inside Edge)							
	Class 1		Class 2		Class 3		Class 4	
	T3, T4	T6, T81	T3, T4	T6, T81	T3, T4	T6, T81	T3, T4	T6, T81
0.100	12.5	25	20	40	30	60.5	37.5	75
0.200	25	50	40	80	57.5	115	72.5	145
0.300	37.5	75	60	120	85	170	110	220

(Continued)

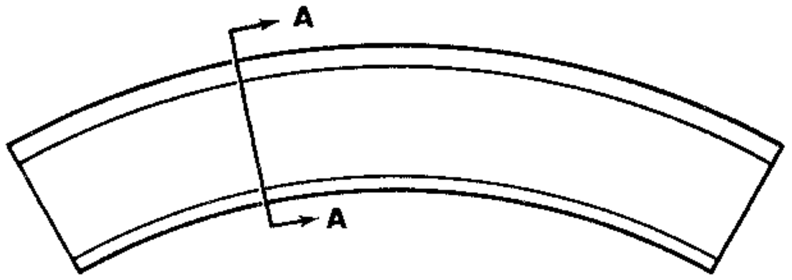


Example of Class Identification for
Minimum Forming Radius
Figure 2

Height of Section (Fig. 3) In In.	Minimum Forming Radius in Inches (Measured at Inside Edge)							
	Class 1		Class 2		Class 3		Class 4	
	T3, T4	T6, T81	T3, T4	T6, T81	T3, T4	T6, T81	T3, T4	T6, T81
0.400	50	100	80	160	112.5	225	145	290
0.500	60	120	100	200	140	280	180	360
0.600	72.5	145	120	240	170	340	217.5	435
0.700	85	170	140	280	197.5	375	252.5	505
0.800	99.5	195	160	320	225	450	290	580
0.900	110	220	180	360	252.5	505	325	650
1.000	120	240	200	400	280	560	360	720
1.250	150	300	250	500	350	700	450	900
1.500	180	360	300	600	420	840	540	1080
1.750	210	420	350	700	490	980	630	1260
2.000	240	480	400	800	560	1120	720	1440
2.500	300	600	500	1000	700	1400	900	1800
3.000	360	720	600	1200	840	1680	1080	2160
3.500	420	840	700	1400	980	1960	1260	2520
4.000	480	960	800	1600	1120	2240	1440	2880
4.500	540	1080	900	1800	1260	2520	1620	3240
5.000	600	1200	1000	2000	1400	2800	1800	3600
10.000	1200	2400	2000	4000	2800	5600	3600	7200



SECTION A-A



BB3-665

Determination of Height to Enable Identification
of Minimum Forming Radius
Figure 3

2) Minimum forming radii for 7075 material (-T6 condition) is as follows:

Height of Section (See Fig. 3) In In.	Minimum Forming Radius in Inches (Measured at Inside Edge)			
	Class 1	Class 2	Class 3	Class 4
0.100	30	50	70	90
0.200	60	100	140	180
0.300	90	150	210	270
0.400	120	200	280	360
0.500	150	250	350	450
0.600	180	300	420	540
0.700	210	350	490	630
0.800	240	400	560	720
0.900	270	450	630	810
1.000	300	500	700	900
1.250	375	625	875	1125
1.500	450	750	1050	1350
1.750	525	875	1225	1575
2.000	600	1000	1400	1800
2.500	750	1250	1750	2250
3.000	900	1500	2100	2700
3.500	1050	1750	2450	3150
4.000	1200	2000	2800	3600
4.500	1350	2250	3150	4050
5.000	1500	2500	3500	4500
10.000	3000	5000	7000	9000

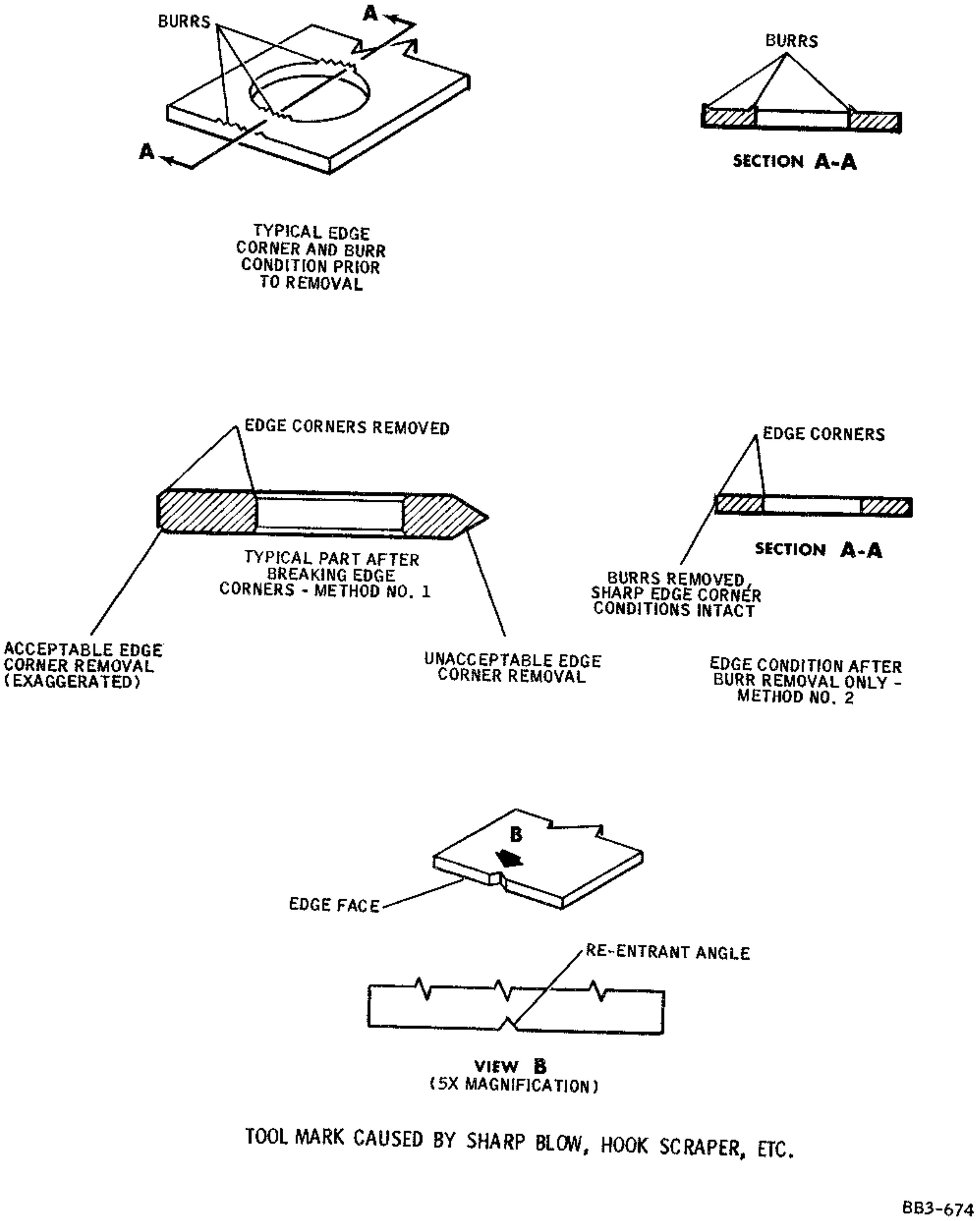
4. Edge Condition Requirements of Metal Parts

A. General Requirements

(1) The minimum requirements for smoothing various types of edge faces and breaking corners (see Figure 4) on sheet metal, extruded shapes, and machined parts are listed in paragraph 4.B. Special edge requirements for certain alloys and tempers are necessary to make sure of satisfactory service life. For reasons of personal safety in handling, for prevention of damage by placement of one part upon another during internal handling, or for general good appearance, no gages or grades of any material are exempted from at least a deburring operation.

(2) Operations on heat-treated aluminum alloys specified in paragraph 4.B., can be accomplished by means of a cutting tool, such as a carbide-tipped scraper or rotary file. Aluminum oxide cloth of 240-grit or finer can also be used, either manually or in a quill (split-rod) rotated by a 5000 rpm maximum drill motor, to perform operation required on edge faces.

NOTE: Shearing of high strength aluminum alloy is not recommended due to the tendency of the material to splitting. However, if it is necessary to use this method, an edge distance of at least three thicknesses of material should be allowed for machine trimming, or the part should be subjected to dye-penetrant inspection for evidence of splitting after the shearing operation.



Edge Conditioning of Parts
Figure 4

B. Edge Condition of Completed Parts

(1) Method of edge finishing completed parts may be determined for different materials by reference to the following:

Material (Final Temper Indicated)	Type of Edge or Surface on Completed Parts	Method
All parts made from thicknesses over 0.025 inch of titanium, bare and clad 2014-T6, 2024-T6, 2024-T81, 2024-T86, and 7075-T6	Sheared	1
	Blanked	1
	Routed	1
	Sawed	3
	Machined Corners	1
All parts made from materials and thicknesses not specifically enumerated above	Sheared	2
	Blanked	2
	Routed	2
	Sawed	3
	Machined Corners	1
All parts made from titanium, bare and clad 2014-T6, 2024-T6, 2024-T81, 2024-T86, 7075-T6, and steel, heat-treated to strengths above 180,000 psi	Tool marks	4

(2) Methods of edge finishing completed parts (See Figure 4):

Method No. 1. Removal of Edge Corners	Remove enough metal to eliminate sharp corners. Maintain the existing radii on edge corners. No sharp corners or re-entrant tool marks are permissible after removal. Sharp corners at the intersection of machined surfaces must be removed. Exception: Edge corner removal or radii are not required on all attachment holes. These are deburred per Method No. 2.
Method No. 2. Removal of Burrs	Remove burrs that project beyond the edge corners. No re-entrant tool marks are permissible after removal. Roll-deburring may be used on holes which will later be reamed, and on pin hole tabs which will subsequently be removed.
Method No. 3. Removal of Saw Marks	Remove all edge corners per Method No. 1. Remove all saw marks except on edges to be subsequently fusion welded, or when a saw cut finish is used. Exception: Clad progressive rolled sections may be deburred at the cut ends by wire brushing, provided that clad

(Continued)

Method No. 3. Removal of Saw Marks (Continued)	removal does not extend more than 1/16 inch beyond the cut edge and brush marks do not extend over 3/16 inch from the edge. Saw marks must be removed except as specified above.
Method No. 4. Removal of Tool Marks	Tool marks that have a sharp re-entrant angle must be removed. Tool marks must also be removed before heat-treatment of steels which are treated to strengths of 260,000 psi or higher.

5. Coining Holes and Material Edges

A. General

(1) Coining is used on the DC-9 airplane to redistribute stress concentrations around holes and cutouts, and along material edges in order to improve resistance to fatigue failure.

(2) Replacement parts are coined at the factory. However, it may be necessary for some coining to be accomplished during repair in order to duplicate the original structure.

(3) The benefits of coining are lost when a coined part is subjected to heat treatment, bending, or straightening. It is imperative that no attempt should be made to rework damaged parts in the coined area in this manner. Replacement with new parts is recommended.

B. Advantages of Coining

(1) Fatigue cracks primarily radiate from holes, cutouts, and material edges, where the stress concentrations are high. These holes may be bolt and rivet attachment holes, fuel transfer cutouts, or holes for passage of control lines or plumbing. Any edge which is subjected to cyclic variations of stress is susceptible to cracking.

(2) Coining in the form of an impressed concentric groove around a hole, or parallel to an edge, provides a detail redistribution of stress concentrations to lesser stressed areas of the material. Coining also induces a high compressive circumferential stress in the material around the hole edge, or a line of high compressive stress adjacent to the material edge, providing additional resistance to fatigue cracking.

(3) The directions of the principal stresses induced by coining holes are circumferential and radial with respect to the hole. Inside the coining circle, both principal stresses are compressive. Outside the coining circle, the circumferential stress is tension and the radial stress is compressive. (See Figure 5 for stress distribution.)

(4) The stresses induced by coining material edges are compressive on both sides of the coined groove as shown in Figure 6.

C. Coining

(1) Most metals in any heat-treat condition can be coined; however, it is not considered practical to coin both sides of material if the thickness is less than 0.067 inch, or one side of material if the thickness is below a minimum of 0.050 inch.

(2) While maximum benefits are to be gained by coining both sides of the material, coining of one side provides definite advantages over uncoined material. However, these advantages are reduced with heavier gage materials, which should be coined on both sides.

(3) Coining will increase the fatigue life of structural members only if the following requirements are fully met.

(a) Correct depth of groove to material thickness

(b) Correct distance between groove and material or hole edge

(c) Correct relationship between groove radius and material thickness in hole applications

(d) Minimum spacing of coined holes, and coined-to-uncoined holes.

(4) Coining is the last operation in preparation of the part, except for coining holes, when the following operations are permissible after coining.

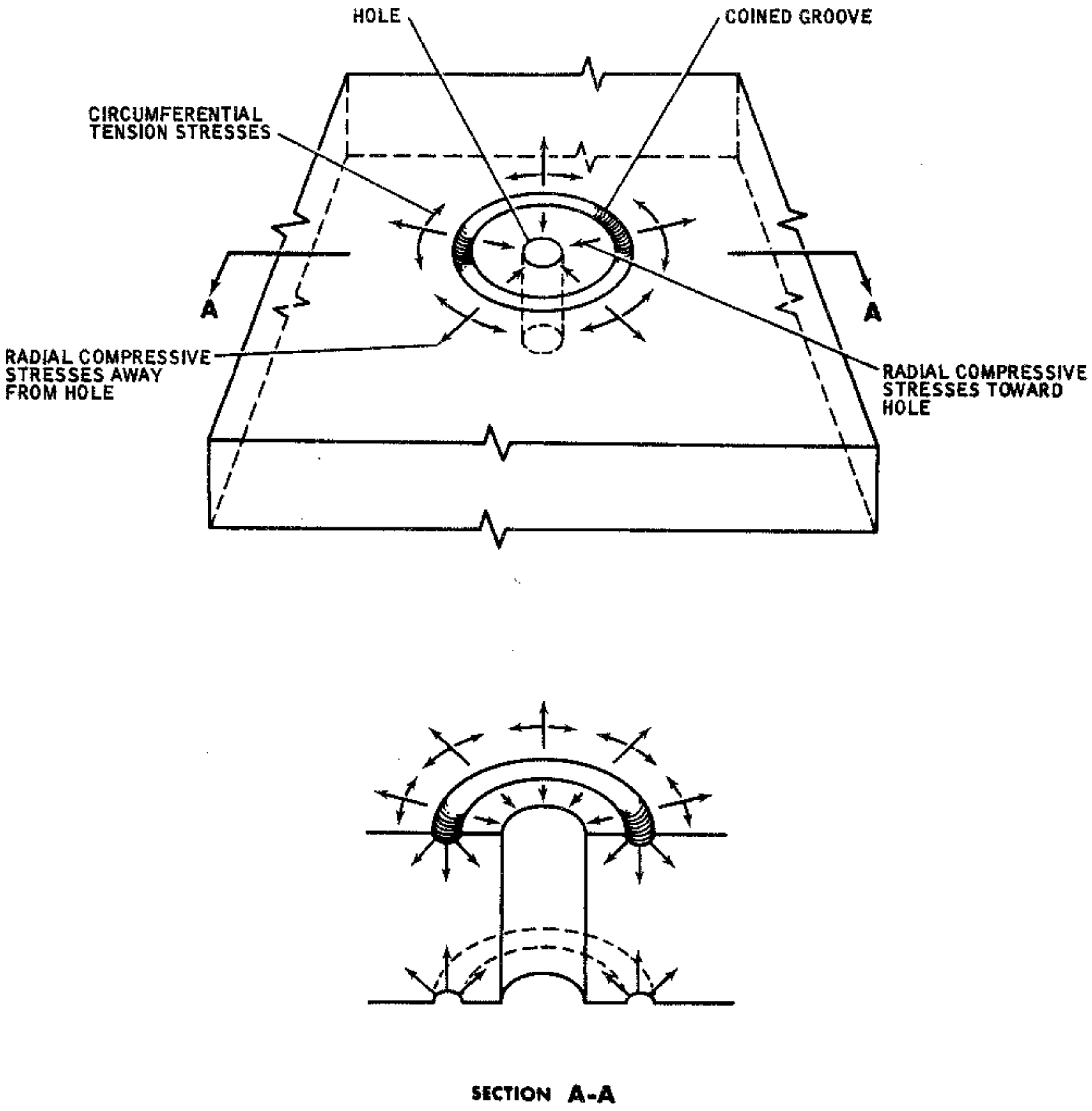
(a) Drill or ream the hole to size to remove material displaced by coining.

(b) Preparation of countersinks may be accomplished after coining only if specified in engineering instructions.

(5) Coining is accomplished at room termperature. Coining patterns (see Figure 7) may be made using dies under pressure, or by rolling.

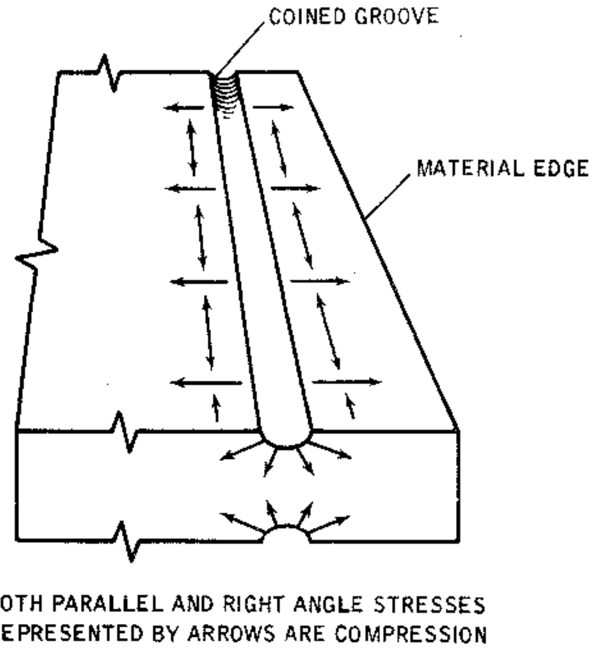
<u>CAUTION</u>: NO ATTEMPT SHOULD BE MADE TO HEAT TREAT, BEND, OR STRAIGHTEN PARTS AFTER COINING AS THE BENEFITS OF COINING WILL BE LOST AND THE MEMBER STRUCTURALLY WEAKENED.

(6) Incorrect coining can result in impaired strength of the member (see Figure 8). It is therefore essential for the process to be performed by an operator skilled in coining. Technical assistance and dies may be obtained by contacting the Customer Service Dept., Douglas Aircraft Company, Inc., 3855 Lakewood Blvd., Long Beach, Calif.



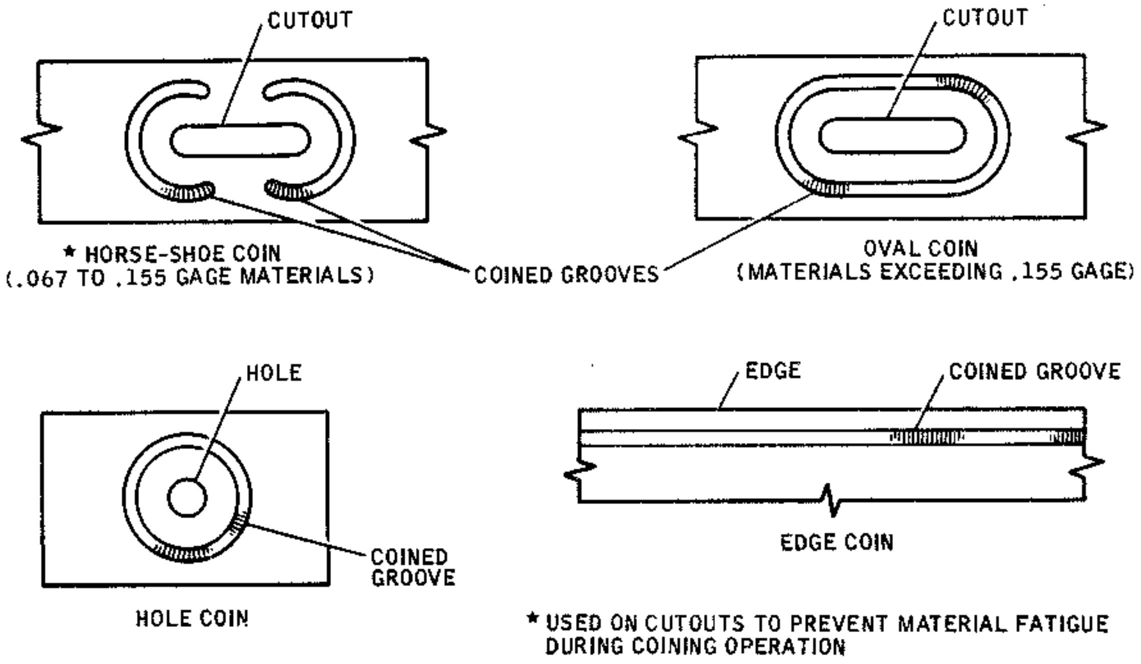
BB3-701

Typical Stress Distribution Induced by Coining Holes
Figure 5



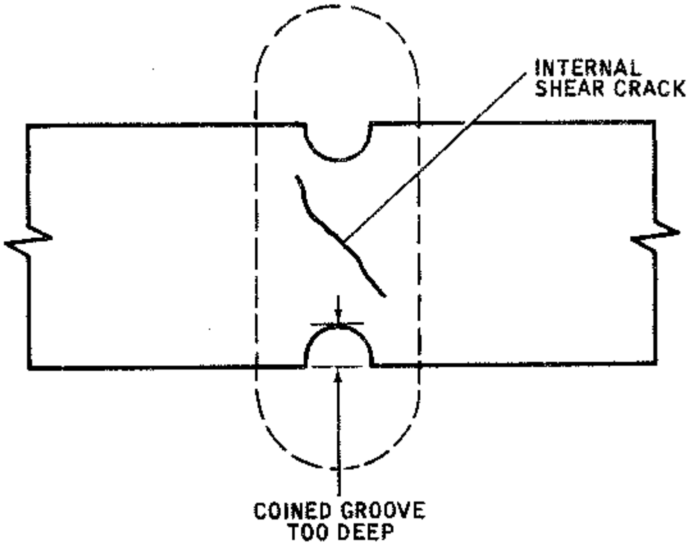
BB3-702

Typical Stress Distribution Induced by Coining Edges
Figure 6



BB3-703

Typical Coining Groove Patterns
Figure 7



Example of Structural Impairment Due to Incorrect Coining
Figure 8

6. Room Temperature Joggle Limitations for Clad Sheet

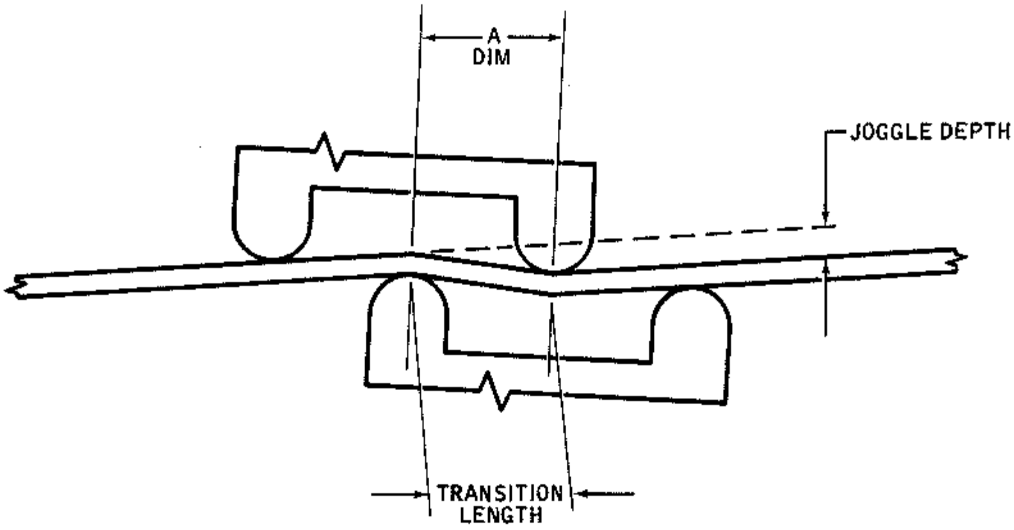
A. Clad sheet, 2014-T6, 2024-T6, 2219-T6, and 7075-T6, may be joggled at room temperature within the following limitations:

Sheet Thickness (Inches)		Joggle Depth (Inches)										Maximum Allowable Angle of Bend
			0.040	0.051	0.064	0.072	0.081	0.091	0.102	0.125	0.156	0.188	
0.016		3/16 7/32	3/16 7/32	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	17/32 19/32	17/32 19/32	17/32 5/8	----
0.020	A	3/16 7/32	3/16 7/32	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	17/32 19/32	17/32 19/32	17/32 5/8	53 degrees
0.025	Dimension	3/16 7/32	3/16 7/32	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	17/32 19/32	17/32 5/8	17/32 5/8	49 degrees
0.032	Transition	3/16 7/32	3/16 7/32	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	9/32 11/32	17/32 19/32	17/32 5/8	17/32 5/8	43 degrees
0.040	Length	3/16 7/32	3/16 7/32	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	9/32 11/32	17/32 19/32	17/32 5/8	17/32 5/8	37 degrees
0.051	(See Figure 9)	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	9/32 11/32	17/32 19/32	17/32 5/8	17/32 5/8	30 degrees
0.064		9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 5/16	9/32 11/32	9/32 11/32	9/32 3/8	17/32 19/32	17/32 5/8	17/32 5/8	23 degrees
0.072		9/32 5/16	9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	9/32 5/8	17/32 5/8	17/32 5/8	17/32 5/8	20 degrees
0.081		9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	9/32 11/32	17/32 5/8	17/32 5/8	17/32 5/8	17/32 5/8	----- -----	17 degrees
0.091		9/32 11/32	9/32 13/32	9/32 13/32	9/32 13/32	9/32 7/16	17/32 5/8	17/32 5/8	17/32 5/8	17/32 5/8	----- -----	----- -----	15 degrees

Sheet Thickness (Inches)	Joggle Depth (Inches)											Maximum Allowable Angle of Bend
		0.040	0.051	0.064	0.072	0.081	0.091	0.102	0.125	0.156	0.188	
0.102	9/32 13/32	9/32 13/32	9/32 7/16	9/32 7/16	17/32 21/32	17/32 21/32	17/32 21/32	17/32 21/32	----- -----	----- -----	----- -----	13 degrees
0.125	17/32 9/16	17/32 9/16	17/32 9/16	17/32 21/32	17/32 21/32	17/32 21/32	17/32 21/32	17/32 21/32	----- -----	----- -----	----- -----	12 degrees

A Dimension Transition Length (See Figure 9)

NOTE: Cold joggling is not permissible. If a transition length longer than the table fractional dimensions is needed, the dies may be shifted to vary the A dimension and provide the transition length needed. If a transition length shorter than the table fractional dimensions is needed, the material must be joggled in the -O condition.



BB3-715

Sheet Joggle Computation
Figure 9

CORROSION CONTROL AND PREVENTION - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. The following information is provided to assist in the identification and control of the various types of corrosion that may occur on DC-9 aircraft. Detailed procedures are given for treatment of assemblies and areas which are exposed to severe corrosive environments.

B. Corrosion prevention and control is of prime importance. Corrosion of parts may cause deterioration of the structure to the point where replacements must be made in order to prevent serious failures.

C. The aircraft is designed and manufactured with many built-in corrosion-preventive features. In addition to the use of noncorrosive materials wherever possible, corrosion-protective treatments and finishes are applied to the aircraft during the manufacturing process. The corrosion prevention systems employed are detailed in the following list.

Area	Part	Material	Treatment/Finish
Fuselage	Skins/plates	Clad aluminum alloy	Chromodized; FR primer, one coat interior surfaces only; organic coating on exterior surfaces per Engineering markings drawing. NOTE: Alodine is used only on interior surfaces of chem-milled external parts.
	Window belt panels and overwing-panels	Milled clad aluminum alloy	Anodized; FR primer interior and milled areas on exterior surfaces only
	Emergency exit exterior door panels	Milled clad aluminum alloy	Chromodized, exterior surfaces; Alodine No. 1200, interior surfaces; organic coating on exterior surfaces per Engineering markings drawing.

Area	Part	Material	Treatment/Finish
Fuselage (Continued)	Internal structural parts such as stringers, frames, doublers, etc.	Aluminum alloy (Clad when applicable)	Nonclad: anodized, clad: chromodized; FR primer one coat NOTE: All 7075 clad material involving primary structure is anodized also.
	Other structural parts	Titanium alloy	Chromodized; pretreatment coating, one coat; FR primer, one coat, interior surfaces.
		Corrosion resistant steel alloys	Chemically surface treated; FR primer, one coat
		Metal bonded assemblies and metal honeycomb assemblies	Alodine No. 1200 on all edges; FR primer on all surfaces except exterior surface loft line of aircraft
Wings	Integral fuel tank wing skins	Clad aluminum alloy	Sta. XCW 58.5 to XW 508.0: top skin, chromodized both sides; bottom skin, anodized both sides Bottom side of top skin and top side of bottom skin aft of rear spar; FR primer Bottom side of top skin and top side of bottom skin, Sta. XCW 0 to XCW 58.5: no primer Top side of top skin and bottom side of bottom skin, Sta. XCW 58.5: FR primer

Area	Part	Material	Treatment/Finish
Wings (Continued)	Casting, fittings, stringers, webs, and similar in-tank parts	Aluminum alloy	Anodized NOTE: As a general rule, FR primer is not applied to any part in fuel tanks
	Skin (except parts that form an exterior surface of the integral fuel tanks)	Clad aluminum alloy	Chromodized; FR primer one coat, interior surfaces; organic coating on exterior surfaces where specified by Engineering markings drawing
	Upper surface tank access doors	Aluminum alloy	Chromodized on outside surface; Alodine No. 1200 on inside surface; topcoat on inside surface
	Doors between station XCW 0 and XCW 58.5	Aluminum alloy	Alodine No. 1200 or anodize; FR primer, one coat on outside surface only
	Trailing edge internal structural parts	Aluminum alloy (Clad when applicable)	Nonclad: anodized, clad: chromodized; FR primer, one coat
	Nose cap assembly interior surfaces and detail parts	Aluminum alloy (Clad when applicable)	Alodine No. 1200 and one coat of FR primer on interior surface; FR primer on detail parts
	External doublers, lower wing	Clad aluminum alloy	Tri-acid etch; Alumilite No. 200; FR primer, one coat, to faying surfaces
	External doublers, lower wing	Clad aluminum alloy	Anodized; FR primer, one coat, to faying surfaces only
Pylons and Pods	Exterior surfaces (except area outboard of vertical firewall)	Clad aluminum alloy	Chromodized; FR primer, one coat, interior surfaces only; organic coating on exterior surfaces per Engineering markings drawing

Area	Part	Material	Treatment/Finish
Pylons and Pods (Continued)	Internal structural parts (inboard of firewall)	Steel alloys, titanium alloy	Chemically surface treated according to particular alloy; FR primer, one coat
	Area outboard of vertical firewall	Aluminum alloy	Chemically surface treated according to particular alloy; no organic finish; Alodine No. 1000 may be substituted for chromodize
	Area outboard of vertical firewall	Titanium alloy	Internal structural parts: chromodized; phenolic primer for dissimilar metal protection only
	Area outboard of vertical firewall	Noncorrosion-resistant steel alloys subject to temperatures less than 400°F (204°C)	Cadmium plated
	Area outboard of vertical firewall	Noncorrosion-resistant steel alloys subject to temperatures of more than 400°F (204°C)	Phenolic primer (except static mating surfaces subject to galling, which require silver plate)
	Area outboard of vertical firewall	Corrosion-resistant steel alloys subject to more than 400°F (204°C)	Chemically surface treated (except static mating surfaces subject to galling, which require silver plate)
	Area outboard of vertical firewall	Corrosion-resistant bushings	Checmically surface treated (do not cadmium plate); installed using phenolic primer
	Area outboard of vertical firewall	Magnesium alloy parts	Dichromate or anodic surface treatment according to type of magnesium alloy; two coats of FR primer

Area	Part	Material	Treatment/Finish
Tail section (aft fuselage and tail group)	Skin	Clad aluminum alloy	Chromodized; FR primer, one coat, interior surfaces; organic coating on exterior surfaces per Engineering markings drawing
	Loft line surfaces	Glass fiber laminates	Gray FR paint system
	Stringers, frames, brackets, etc.	Aluminum alloy	Chemically surface treated according to type of aluminum; FR primer, one coat
		Metal bonded and metal honeycomb assemblies	Alodine No. 1200 on all edges; FR primer on all surfaces except exterior surface loft line
Wheel well area, main and nose		Aluminum alloy parts	Chemically surface treated according to type of aluminum alloy; FR primer, one coat
		Magnesium parts	Dichromate or anodic surface treatment according to type of magnesium alloy; two coats of FR primer

Area	Part	Material	Treatment/Finish
Wheel well area, main and nose (continued)		Noncorrosion-resistant steel alloys	Cadmium plated; FR primer, one coat
Landing gear, main and nose		Aluminum alloys	Anodized; FR primer; gray FR topcoat NOTE: Nose gear bungee assembly is anodized. No organic coating required.
		Noncorrosion-resistant steel alloys	Low embrittlement cadmium plated; Cat-A-Lac primer and gray Cat-A-Lac topcoat
Nosewheel, main wheels, and hubs		Aluminum alloy	Anodized; two coats of zinc chromate primer; aluminized lacquer

2. Factors of Corrosion Control

A. The severity, cause, and type of corrosion are dependent upon many factors. The most common factors which effect the rate of corrosion are described in paragraphs 3 through 6.

3. Effect of Material Selection

A. A fundamental factor in corrosion is the susceptibility of the material itself to corrosion. High-strength, heat-treatable aluminum alloys are susceptible to intergranular corrosion as well as pitting and general attack. All magnesium alloys are highly susceptible to general and pitting attack when exposed to corrosive environment. Materials must be selected primarily on the basis of strucutral efficiency. Therefore, corrosion resistance is at times a secondary consideration at the design level. Use of more corrosion-resistant materials normally involves additional weight, which is considered to outweigh the cost of preventing corrosion by proper maintenance or by chemical surface treatments and finishes.

4. Effect of Heat-Treatment

A. Heat-treatment of the alloy is a vital factor in establishing resistance to corrosion, and one over which a definite control is exercised. To ensure proper heat-treatment, a rigid inspection procedure is maintained, both of the heat-treating processes and of the facilities used. To make certain that replacement parts meet the heat-treating specifications, it is essential that parts be procured either directly from the manufacturer or from approved sources, and that heat-treatment processes be controlled at the repair facility.

5. Effect of Geographical Locations

A. Exposure to salt water, moisture condensate, chemicals, and soil and dust in the atmosphere affect the degree of corrosion. The geographical flight routes and bases of operation will expose some airplanes to more corrosive conditions than others. Corrosion prevention and control requirements will, therefore, vary somewhat from one area to another.

6. Effect of Contamination

A. A corrosive action can result when a contaminating material comes in contact with a metal surface. The degree of corrosive action is determined by the composition of such contaminating materials and the length of time they remain in contact. The extent of corrosive attack can be minimized by frequent cleaning to remove contaminating deposits. In addition, anodic and and chemical treatments, as well as proper paint finishes, should be maintained in a clean and intact condition. The primary purpose of these coatings is to provide a barrier and to temporarily prevent the corrosive media from contacting the underlying metal, thereby allowing time for their removal by periodic washing.

7. Definition of Corrosion

A. Corrosion is the destruction of metals by chemicals or electrochemical action. It is to be distinguished from erosion, which is primarily destruction by mechanical action. The corrosion process converts the metal into a metallic compound such as oxide, hydroxide, or sulfate. It is somewhat the reverse of the process by which the metal is extracted from its ore. The corrosion process involves two chemical changes. The metal that is attacked, or oxidized, undergoes anodic change. The corrosive agent is reduced and undergoes cathodic change.

B. Corrosion may be of two general types. One type is a direct chemical attack, wherein the anodic and cathodic changes take place at the same point, such as the action of acid on metal. Another type is a galvanic attack, wherein the anodic and cathodic changes occur at perceptible distances apart. The latter type of corrosion necessarily involves an electrolyte through which current flows and mechanical contact through a structure to close the electrical circuit. This type of corrosion usually occurs whenever dissimilar metals are joined in a structure without proper protection. When such an area is wet with salt water or other electrolyte, the material undergoing anodic change begins to corrode. At the same time, hydrogen atoms are usually released in the area of the cathode.

C. Both types of corrosion normally depend on moisture to provide a conductive medium. A dry contaminant normally will not attack metal. Moisture in the air is often sufficient to start corrosion. When the airplane, constructed of many metals, is exposed to a corrosive environment such as exhaust gases, moisture, waste water, and spillage, all factors necessary for chemical or galvanic action are present. Since some areas of the airplane are exposed to more corrosive contaminants than other areas, the necessary control measures vary accordingly. Corrosive attack starts on the surface of the metal; if allowed to continue, the corrosion penetrates into the core of the metal. The most common types of corrosion are listed in paragraphs 8 through 13.

8. Surface Corrosion

A. Direct chemical attack, such as that caused by acid or caustic solutions, produces a uniform etching of the metal commonly referred to as "surface corrosion". On a polished surface this type of corrosion produces a general dulling of the metal with a white powder deposit or residue similar to dust. After the surface is polished with a dry cloth, it will usually regain its normal luster. However, if this corrosion is allowed to continue, the surface will become rough and appear frosted, and will eventually become pitted.

9. Pitting Corrosion

A. The most common type of corrosion on aluminum and magnesium alloys is pitting. Pitting first appears as a white, powdery deposit. However, buffing the surface reveals tiny pits or holes. In moderate to severe cases, the pits appear as well-defined hills and valleys when viewed through a magnifying lens. In the case of slight pitting, the corrosion can be removed by acid etch, cleaning, or buffing, as applicable.

B. Pitting of nonclad parts is cause for special concern. Here, in the absence of a layer of aluminum cladding, a loss of structural integrity can rapidly result.

C. Either chemical or galvanic action can cause pitting. Pitting often occurs in metals that are inherently resistant to uniform attack, but are susceptible to one or two chemicals.

D. Contact between a metal and a hygroscopic material such as asbestos, sponge, rubber, cork, wood, or certain plastics can cause pitting. Metals in contact with this type of material should be inspected whenever it is suspected that they have been contaminated with water.

E. Another cause of pitting is contact with chemical-laden moisture originating in engine exhaust, lavatories, batteries, windshield deicing compounds, and other non-natural sources. These are strong electrolytes and are capable of producing electrochemical action between dissimilar metals.

10. Intergranular Corrosion

A. Intergranular corrosion is an attack on the grain boundaries of a material. Each of these tiny grains has a clearly defined boundary, which from a chemical point of view, differs from the metal within the grain center. The grain boundary and grain center can react with each other as anode and cathode, similar to opposite poles of a battery when in contact with an electrolyte or conductive medium. Rapid selective corrosion at the grain boundary can occur with subsequent delamination.

B. Many alloys, including aluminum and steel, are susceptible to intergranular corrosion. High-strength aluminum alloys, such as 2014, 2024, and 7075, can develop intergranular corrosion if they have been improperly heat-treated and subsequently exposed to a corrosive environment. It has occurred in thick aluminum alloy wing skin countersinks, particularly where steel fasteners are involved, and on extrusions and forgings.

C. Control and prevention of intergranular corrosion depends largely upon proper heat-treatment during the manufacture of parts and upon preventive measures during service.

D. Intergranular corrosion may also result from a change in the original heat-treatment condition caused by exposure to high temperature produced during grinding or machining during overhaul.

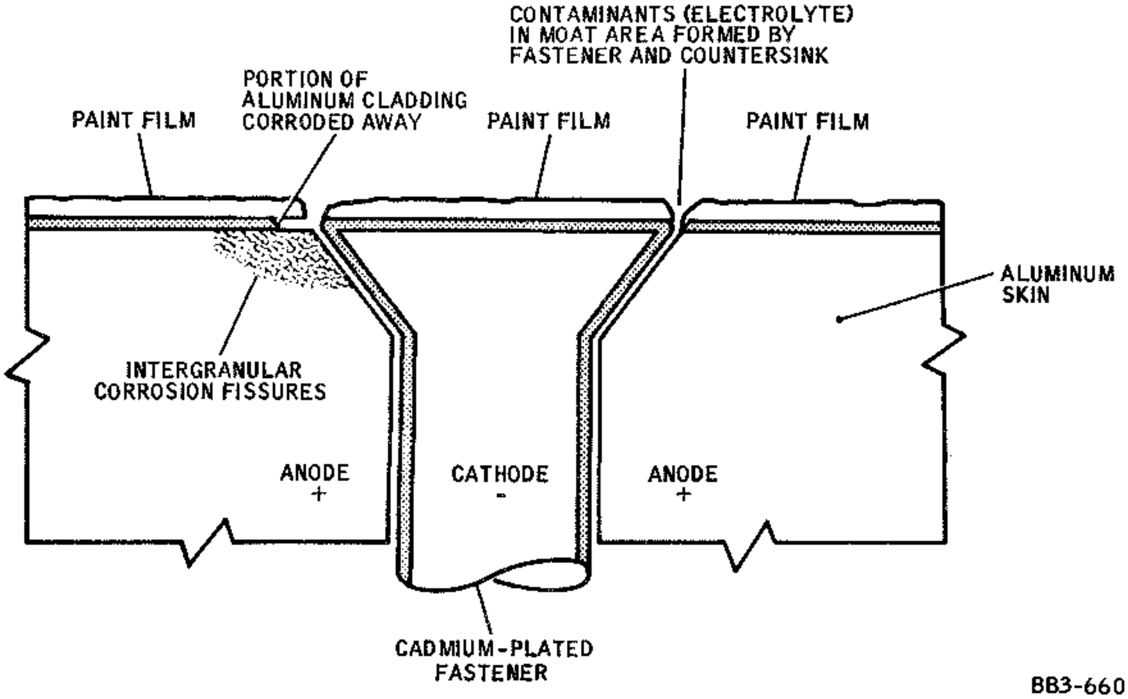
11. Exfoliation Corrosion

A. Exfoliation corrosion is an advanced form of intergranular corrosion which exhibits intself by lifting up the surface of a metal by the force of expanding corrosion prroducts accumulating at the grain boundaries just below the surface. Although it is most often seen on extruded sections where the grain thickness is usually less than in rolled form, exfoliation also occurs in sheet stock.

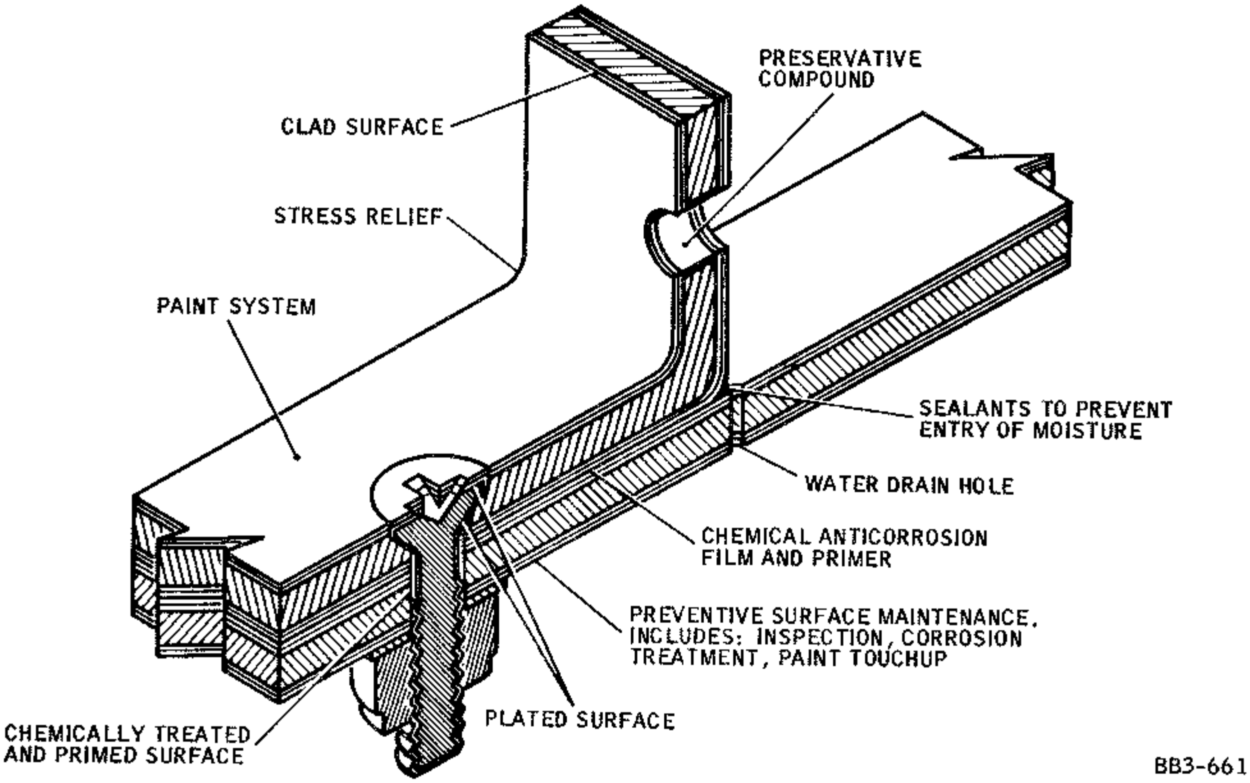
B. The principle dangers of exfoliation corrosion lie in the potential loss of strength as a result of corroding away of bearing surfaces and loss in effective cross section. Appearing more frequently in marine environments, it usually occurs on upper wing and control surfaces around fasteners. The corrosion rate is usually accelerated by the presence of a dissimilar metal such as steel fastener and a corrosive electrolyte such as salt water.

12. Galvanic or Dissimilar Metal Corrosion

A. Galvanic corrosion occurs when two different metals are in direct contact and exposed to an electrolyte such as water or water containing dissolved salts. When aluminum materials are attached with steel bolts or screws, galvanic corrosion can occur between the aluminum and steel in the presence of moisture. An electrical potential is set up, current flows between the two metals, and an effect similar to that which occurs in batteries is produced. The greater the electrical potential between the two metals, the more rapid is the attack; conversely, the lower the potential the less the attack. For example, magnesium in contact with copper will corrode faster than magnesium in contact with zinc, since the potential difference between copper and magnesium is greater than the potential difference between zinc and magnesium. See Figure 3 for an abbreviated list of metals shown in the order of decreasing activity.



Galvanic Aspects of Corrosion
Figure 1



Techniques and Treatments Used to Prevent Corrosion
Figure 2

	Category	1	1	2	3	3	4	4	4	4	4	5	6	6	6	7	7	8	9	9	10	11	11	11	12	12	12	12	13	13	13	13	13
Category	Metal or Alloy	Magnesium	Magnesium Alloy	Zinc	Clad 7075	Clad 6061	5052	Clad 2024	3003	6061-T6	7075-T6	Cadmium	2117-T4	2024-T4	2014-T6	Wrought Steel	Cast Steel	50-50 Solder	Lead	Tin	Mang. Bronze	Brasses	Alum. Bronze	Copper	Nickel	Inconel	Type 410	Type 431	18-8 Cres	Titanium	Monel	Silver	Graphite
1	Magnesium	0	0	1	2	2	3	3	3	3	3	4	5	5	5	6	6	7	8	8	9	10	10	10	11	11	11	11	12	12	12	12	12
1	Magnesium Alloy		0	1	2	2	3	3	3	3	3	4	5	5	5	6	6	7	8	8	9	10	10	10	11	11	11	11	12	12	12	12	12
2	Zinc			0	1	1	2	2	2	2	2	3	4	4	4	5	5	6	7	7	8	9	9	9	10	10	10	10	11	11	11	11	11
3	Clad 7075				0	0	1	1	1	1	1	2	3	3	3	4	4	5	6	6	7	8	8	8	9	9	9	9	10	10	10	10	10
3	Clad 6061					0	1	1	1	1	1	2	3	3	3	4	4	5	6	6	7	8	8	8	9	9	9	9	10	10	10	10	10
4	5052						0	0	0	0	0	1	2	2	2	3	3	4	5	5	6	7	7	7	8	8	8	8	9	9	9	9	9
4	Clad 2024							0	0	0	0	1	2	2	2	3	3	4	5	5	6	7	7	7	8	8	8	8	9	9	9	9	9
4	3003								0	0	0	1	2	2	2	3	3	4	5	5	6	7	7	7	8	8	8	8	9	9	9	9	9
4	6061-T6									0	0	1	2	2	2	3	3	4	5	5	6	7	7	7	8	8	8	8	9	9	9	9	9
4	7075-T6										0	1	2	2	2	3	3	4	5	5	6	7	7	7	8	8	8	8	9	9	9	9	9
5	Cadmium											0	1	1	1	2	2	3	4	4	5	6	6	6	7	7	7	7	8	8	8	8	8
6	2117-T4												0	0	0	1	1	2	3	3	4	5	5	5	6	6	6	6	7	7	7	7	7
6	2024-T4													0	0	1	1	2	3	3	4	5	5	5	6	6	6	6	7	7	7	7	7
6	2014-T6														0	1	1	2	3	3	4	5	5	5	6	6	6	6	7	7	7	7	7
7	Wrought Steel															0	0	1	2	2	3	4	4	4	5	5	5	5	6	6	6	6	6
7	Cast Steel																0	1	2	2	3	4	4	4	5	5	5	5	6	6	6	6	6
8	50-50 Solder																	0	1	1	2	3	3	3	4	4	4	4	5	5	5	5	5
9	Lead																		0	0	1	2	2	2	3	3	3	3	4	4	4	4	4
9	Tin																			0	1	2	2	2	3	3	3	3	4	4	4	4	4
10	Mang. Bronze																				0	1	1	1	2	2	2	2	3	3	3	3	3
11	Brasses																					0	0	0	1	1	1	1	2	2	2	2	2
11	Alum. Bronze																						0	0	1	1	1	1	2	2	2	2	2
11	Copper																							0	1	1	1	1	2	2	2	2	2
12	Nickel																								0	0	0	0	1	1	1	1	1
12	Inconel																									0	0	0	1	1	1	1	1
12	Type 410																										0	0	1	1	1	1	1
12	Type 431																											0	1	1	1	1	1
13	18-8 Cres																												0	0	0	0	0
13	Titanium																													0	0	0	0
13	Monel																														0	0	0
13	Silver																															0	0
13	Graphite																																0

NOTE: The larger the number the greater the tendency for galvanic corrosion. Stainless steel, nickel, and Inconel are considered in the passive condition on the chart.

Each metal on the chart is considered anodic to the subsequent metals below it on the chart, left hand column.

Table of Dissimilar Metal Categories
Figure 3

B. A metal of any one category when in direct contact with a metal of any other category can produce corrosion through galvanic action. The different metals within a category do not cause serious galvanic attacks when connected. Galvanic corrosion can usually be recognized by the presence of buildup of corrosion products at the joint between two metals. Measures to prevent galvanic corrosion of dissimilar metal include painting and plating. For example, steel components are cadmium plated to reduce the galvanic effect between steel and aluminum. Thus the metals in contact are aluminum and cadmium, and are not subject to serious galvanic attack.

13. Stress Corrosion Cracking

A. Cracking of metal caused by the simultaneous effects of both stress and corrosion is known as stress corrosion cracking. Stress corrosion manifests itself as a crack in the metal not necessarily accompanied by obvious corrosion. The stress can either be applied stress, or one resulting from preloading the part during installation. Stress corrosion cracking occurs in both aluminum and magnesium alloys as well as steel. It is usually recognized only after cracking has occurred, and normally requires replacement of the part.

14. Microbial Corrosion

A. Microbial corrosion in integral fuel tanks is caused by bacteria, fungi, or yeast in unclean kerosene-type jet engine fuel. Organisms commonly existing in the soil are carried by the air and ground water and may be found growing in the water layer that may exist in a fuel tank due to incomplete drainage. After a period of growth in the tank, a slimy mat of sludge-like deposit is formed, which may exclude oxygen and permit the existence of other organisms.

B. The corrosion mechanism is not fully understood, although several of the organisms are known to be capable of penetrating the top coating in a tank, permitting other bacteria and their metabolic products to attack the aluminum directly.

C. Microbial formations can be prevented by providing for complete water drainage of tanks, by periodic monitoring of the fuel distribution system, and by filtering and dewatering fuel during final transfer. In addition, it is recommended that contaminated fuel tanks be steam cleaned every 5000 hours. A magnifying glass should be used to determine the existence of any microbial corrosion.

15. Inspection for Corrosion

A. Unless proper inspection and maintenance are systematically performed, corrosion can seriously damage the airplane. All aircraft should be carefully inspected for signs of corrosion at each scheduled inspection period. Severe environmental conditions such as salt spray, humidity, and temperature may require increased frequency of corrosion inspections. In addition, areas most susceptible to corrosion should be inspected at frequent intervals.

B. The first appearance of corrosion on unpainted surfaces is in the form of white powder or spots. Areas where sand, dirt, and grime collect are particularly susceptible to corrosion. In conducting inspections for corrosion, particular attention must be given to the underside of the fuselage, upper surfaces of wings, wing flaps, ailerons, and actuating mechanisms. Areas subjected to battery electrolyte and exhaust gases require close attention and frequent maintenance.

C. There will be less corrosion on painted, plated, or aluminum clad surfaces than on unprotected surfaces. However, corrosion will attack protected metal as moisture and contaminants may permeate the barrier coat when it has been damaged. In such cases, the affected areas are generally characterized by a scaly or blistered appearance, or sometimes by discoloration of the paint. Corrosion on aluminum alloys and plated steel surfaces can often be recognized by dulling or pitting of the area, and sometimes by white or red powdery deposits.

D. In making inspections on interior surfaces and lap joints, particular attention must be given to areas and sections where foreign matter or moisture may accumulate. Areas underneath floor panels, and faying surfaces which entrap moisture require frequent inspection. Special inspection is recommended in areas where magnesium alloys are used. Areas where dissimilar metals are used require close inspection.

E. Organic materials such as sponge rubber, soundproofing, and insulated materials can retain moisture. The extent of corrosion of metal in contact with organic material can be determined by tests and visual inspection. A sharp-pointed instrument can be used to make this examination. Probing with a sharp instrument to discover corrosion in contacting metal should be accomplished with care to avoid further damage.

Printed in U.S.A.

16. Preventive Maintenance Procedures for Corrosion Control

A. Cleanliness through frequent washing is the best approach for corrosion prevention. Clean, dry air will not corrode metals at a destructive rate. Corrosion problems are caused by moisture and contaminants, such as exhaust gases, waste water, and salt water encountered in service. Recommended procedures for corrosion prevention are described in paragraphs 17 through 19.

17. External Cleaning of Airplane

A. Periodic cleaning should be performed to remove corrosive agents which are continually being deposited on the surfaces. Corrosion products which accelerate the corrosive action should be removed. Detergents, emulsifiable alkaline water-base cleaners, or solvent-type cleaners that do not affect paint should be used to clean the surface. See paragraph 43 for approved cleaning materials and Chapter 51 of Maintenance Manual for detailed instructions.

B. Surfaces should be thoroughly rinsed with clean water. If weather conditions do not permit the use of water due to freezing temperatures, surfaces should be cleaned with dry-cleaning solvent or kerosene. Surfaces should be wiped with a clean cloth or mop. Whether the airplane is in service or in storage, exterior surfaces should be washed often to maintain a clean surface. Contaminants on painted surfaces should be removed regularly to maintain protective finishes.

C. Areas in exhaust gas paths should be cleaned frequently with an approved cleaner to minimize damage to painted finishes and to prevent corrosion of unpainted surfaces. When washing the airplane, a close check should be maintained on the type and concentration of cleaning compound used, since the use of improper or improperly mixed cleaning compounds can cause damage. During hot weather, the airplane should be washed in a shaded are, when possible, to reduce streaking.

18. Maintaining Protective Finish

A. If the finish is cracked, chipped, or deteriorated, the first line of defense against corrosion is broken, and the structure is subject to attack. Maintaining the paint finish by local touchup, or repainting and replacing the paint finish at periodic intervals and regularly schedule maintenance cycles, is vital to prevention of corrosion. When paint and finishes have deteriorated, or corrosion deposits have accumulated and hardened, drastic cleaning procedures may be required. When any evidence of corrosion is found, surfaces should be cleaned and reworked as outlined in this section. The more frequently painted surfaces are thoroughly cleaned, the easier it will be to clean and protect them from corrosion. To minimize corrosion, the following procedures should be performed:

(1) Clean surfaces on a regularly scheduled basis.

(2) Keep surfaces protected with paint.

(3) Keep drain holes open and free of debris.

19. Emergency Anticorrosion Measures

CAUTION: THIS TECHNIQUE SHALL BE USED ONLY WHEN PROPER MATERIALS OR EQUIPMENT ARE NOT AVAILABLE, OR WHEN TIME WILL NOT PERMIT EXTENSIVE REPAIR MEASURES. PROPER PROTECTIVE MEASURES MUST BE TAKEN AS SOON AS POSSIBLE TO PREVENT FURTHER CORROSION.

A. Parts should be examined for corrosion and replaced with a serviceable part if damage is beyond repair. If patching is not required, loose paint and the powdery corrosion products should be scraped or removed. Affected areas should be washed with alkaline cleaning solution and thoroughly rinsed, or washed with methyl ethyl ketone (TT-M-261) or other solvent.

B. Surfaces should be painted with two coats of fluid-resistant (FR) primer. If FR primer is not available or cannot be applied because of time limitations, apply two coats of zinc chromate primer to reworked surface. If part is too corroded to withstand normal loads, structural repairs must be made.

20. Paint Finishes for Corrosion Protection

A. Fluid-resistant (FR) primer is used on aluminum, magnesium, and steel structural parts on the interior of the airplane where paint is specified for corrosion protection. FR primer is superior to zinc chromate primer and also has resistance to Skydrol 500A. Removal of FR primer is difficult with some strippers. Refer to the list of materials for Douglas-approved strippers. The procedure for removal of FR primer is detailed in paragraph 24.

21. Cleaning and Finishing Aluminum Alloy Parts Which Have Been in Service (Reworked Parts)

A. Clean/Finish

(1) Remove all grease, oil, or other deposits, using a solvent-type cleaner such as Stoddard solvent.

(2) If FR primer is flaking, has poor adhesion, has been softened by fluids, of if there is evidence of corrosion, remove primer as described in paragraph 24. If corrosion is present, refer to paragraphs 31 through 42 for procedures on treatment of corrosion before proceeding.

NOTE: If a bonding operation is required in the repair, clean and finish the part after the adhesive has cured.

(3) If aluminum alloy surface has been anodized, iridited, or alodine-treated, wipe surface thoroughly with methyl ethyl ketone (TT-M-261), using clean, white, cotton cloth. Then apply FR primer as described in paragraph 23.

(4) If aluminum alloy surface is bare (not treated), or has treatment other than anodizing, proceed as follows:

(a) Wipe surface thoroughly with methyl ethyl ketone (TT-M-261), using small, clean cotton cloth.

(b) Apply Cee-Bee 4 oxidization remover (Cee-Bee Chemical Co., 9520 E. Cee Bee Dr., Downey, Calif.), or equivalent, that has been thinned with water. For thinning, use three parts of water to one part of cleaner.

(c) Agitate solution on surface for 10 minutes with stiff bristle brush.

Printed in U.S.A.

(d) Wash off cleaner with wet cloth.

(e) Apply Alodine No. 1200 (American Chemical Paint Co., Ambler, Pa.) as described in paragraph 30, omitting step A (1).

(f) Apply FR primer as described in paragraph 23.

22. Cleaning and Finishing of Aluminum Alloy Repair Parts

NOTE: If a bonding operation is required in the repair, clean and finish the part after the adhesive has cured.

A. Clean/Finish

(1) If aluminum alloy repair part is anodized, wash part thoroughly with methyl ethyl ketone (TT-M-261). Then apply FR primer as described in paragraph 23.

(2) If aluminum alloy repair part is bare (not treated) or has treatment other than anodizing proceed as follows:

(a) Wash part thoroughly with methyl ethyl ketone (TT-M-261).

(b) Apply Cee-Bee 4 oxidization remover (Cee-Bee Chemical Co., 9520 E. Cee-Bee Dr., Downey, Calif.), or equivalent, thinned with water. For thinning, use three parts of water to one part of cleaner.

(c) Agitate solution on surface for 10 minutes with stiff brush.

(d) Wash off cleaner with clean water.

(e) Apply Alodine No. 1200 as described in paragraph 30, omitting step A. (1).

(f) Apply FR primer as described in paragraph 23.

23. Application of FR Primer

A. Mix/Apply

(1) Mix one part by volume of Cat-A-Lac 463-1-12 primer (Finch Paint and Chemical Co., 1536 West 228th St., Torrance, Calif.) to one part by volume of curing agent in a metal or glass container. Mix primer and curing agent separately before measuring.

(2) Stir mixture thoroughly and let stand for 30 minutes. Material will remain usable for 8 hours if stored in closed container.

(3) Apply mixed FR primer to prepared surface with brush or spray.

(4) Air dry or force dry FR primer with explosion-proof heat lamp, using 350-watt infrared bulb.

24. Removal of FR Primer From Aluminum Alloy

A. Remove

(1) Using Delchem E-Z Strip 19A stripper (Pennsalt Chemicals Corp., 2700 S. Eastern Ave., Los Angeles 22, Calif.), or Cee-Bee A-292 (Cee-Bee Chemical Co., 9520 E. Cee-Bee Dr., Downey, Calif.), apply thickened stripper heavily.

(2) Allow stripper to work undisturbed for approximately 15 minutes.

(3) Agitate worked area with bristle brush.

(4) If paint remains, apply fresh stripper without rinsing area. Allow stripper to work undisturbed for another 15 minutes.

(5) Repeat step (4) as necessary until all paint is removed.

(6) Remove all traces of stripper by scrubbing with water and wiping. Follow this operation by hand wiping, using technical grade toluene (TT-T-548) or methyl ethyl ketone (TT-M-261).

25. Finishing of Attachment Parts

A. Attachment parts such as bolts, pins, nuts, washers, screws, rivets, fasteners, and speed and self-locking nuts and clips require dissimilar material protection only in applications described in paragraphs 26 and 27.

26. Magnesium Dissimilar Metal Protection

A. Apply

(1) When one of the parts being joined is magnesium, fit the parts and perform all drilling and trimming operations.

(2) Disassemble parts and burr holes as necessary.

(3) While parts are disassembled, treat all bare magnesium surfaces (holes and edges) with Dow No. 19 treatment (Dow Chemical Co., Midland, Mich.) prior to painting.

(4) Install attachment parts such as nutplates and washers to magnesium with dissimilar metal protection as shown in Figure 4.

(5) At time of assembly, apply FR primer to magnesium bare spots and apply wet FR primer in hole or on attachment parts.

NOTE: Primer is not required for fastener installations when magnesium is joined to magnesium with 5056 (56S) aluminum rivets. Primer is not required when the attachment parts are installed with a faying surface seal.

Material Group	In Contact with Metals of Group			
	1	2	3	4
1	D	A	A	A
2	A	D	D	B
3	A	B	B	C
4	A	B	C	D

CODES

Material Groups:	1	Magnesium alloys
	2	Cadmium, zinc, aluminum alloys
	3	Lead, tin, and noncorrosion-resistant steels
	4	Copper alloys, chromium, nickel, silver, gold, platinum, titanium, cobalt, rhodium, corrosion-resistant steels, graphite
Protective Coatings:	A	Two coats on magnesium, one on other surface
	B	One coat on each surface
	C	One coat on material of Group 4
	D	No additional finish required

Table of Coating Requirements for Contacting Metal Surfaces
Figure 4

27. Attachment of Dissimilar Material other than Magnesium

A. Attachment parts used to join dissimilar metals with wet primer require coating as indicated in Figure 4.

28. Close-Tolerance and Interference-Fit Bolts and Pins

A. Close-tolerance and interference-fit bolts and pins should be installed with corrosion-preventive compound. Primer is not required when attachment parts are installed with a faying surface seal.

29. Prelubricated Fasteners

A. Fasteners such as huckbolts and hi-shear rivets do not require additional protective coatings.

30. Application of Alodine No. 1200

NOTE: Small individual scratches (except in fuel tank sump areas) or edges of sheet stock less than 1/2 inch thick do not require alodine treatment.

A. Apply

(1) Clean surface to be treated with clean, white, cotton cloth that has been well dampened with methyl ethyl ketone (TT-M-261) (MEK) or technical grade acetone (FS-O-A51). Darkened or oxidized surfaces should also be cleaned with a deoxidizer such as Cee-Bee 4 (Cee Bee Chemical Co., 9520 E. Ceebee Dr., Downey, Calif.)

(2) Pour 1 gallon (128 fluid ounces) of clean water in stainless-steel Koroseal-lines (or equivalent) or polyethylene container. Add 3 ounces of Alodine Make-up Powder No. 1200 (American Chemical Paint Co., Ambler, Pa.) and 1/2 fluid ounce of concentrated nitric acid (42° Baume). Stir vigorously until powder is dissolved. Add 1/8 fluid ounce of wetting agent Activol 1357 (Haas-Miller Corp., Fourth and Bristol St., Philadelphia 40, Pa.), or equivalent.

(3) Apply prepared Alodine No. 1200 solution to cleaned surface with brush.

Printed in U.S.A.

(4) Allow to dwell until brown color develops. Then rinse with water and allow surface to air-dry. To speed drying, surface may be blotted with clean, cotton cloth. Avoid rubbing as coating is soft and can be easily removed.

CAUTION: IF ALODINE NO. 1200 SOLUTION CONTACTS MATERIAL OTHER THAN ALUMINUM ALLOYS, WASH AND WIPE CONTAMINATED SURFACES IMMEDIATELY. WHEN NOT IN USE, ALODINE NO. 1200 SHOULD BE KEPT IN CLOSED POLYETHYLENE CONTAINERS. BRUSHES SHOULD BE REMOVED FROM SOLUTION WHEN NOT IN USE. OBTAIN FRESH SOLUTION AT FREQUENT INTERVALS OR WHEN SOLUTION DARKENS OR BECOMES CONTAIMINATED. BRUSHES USED FOR APPLYING ALODINE NO. 1200 SHOULD BE ABLE TO WITHSTAND THE ACTION OF NITRIC ACID. NYLON BRUSHES ARE PREFERRED. IF ALODINE NO. 1200 CONTACTS THE SKIN, FLUSH SKIN WITH WATER AND WASH THOROUGHLY WITH SOAP AND WATER.

31. Treatment of Corroded Areas

A. There are two basic methods of corrosion removal -- mechanical and chemical. The method used depends upon the type of structure, its location, the type and severity of corrosion, and the availability of maintenance equipment. Mechanical means are generally used on moderate to heavy corrosion, particularly if the part involved has a relatively heavy cross sections or is skin of heavy gage. Lighter corrosion is removed by chemical means. Mechanical methods are recommended for heavily corroded areas on all nonclad aluminum alloys and on magnesium alloys. Procedures for reconditioning corroded areas and providing protection against further corrosion are given in paragraphs 32 through 42.

CAUTION: IN NO CASE SHOULD DEPTH OF CORROSION REMOVAL EXCEED LIMITS OF GOUGE REMOVAL INDICATED IN REPAIR SECTION OF EACH INDIVIDUAL CHAPTER.

32. Cleaning Prior to Removal of Corrosion

A. Clean

(1) To strip paint and remove exhaust deposits in readily accessible areas, apply a paint stripper or heavy-duty cleaner with nonmetallic brush. See paragraph 43 for approved paint strippers and cleaners.

(2) Allow stripper to remain on surface until all residues are softened. Wash off softened residues, using high-pressure hose if area can be flushed without trapping stripper. Otherwise, remove stripper with damp cloth. Repeat this procedure until all paint or exhaust deposits are removed. This includes recesses around rivets.

WARNING: WEAR RUBBER GLOVES, GOGGLES, AND PROTECTIVE COVERING WHILE WORKING WITH SOLUTIONS. IF SOLUTIONS ACCIDENTLY CONTACT SKIN OR EYES, FLUSH IMMEDIATELY WITH LARGE QUANTITIES OF CLEAR WATER. CONSULT A PHYSICIAN IF EYES ARE AFFECTED OR IF SKIN IS BURNED.

CAUTION: WHEN WORKING IN NOSE OR MAIN GEAR AREAS, COVER WHEELS TO PROTECT TIRES AND BEARINGS FROM THESE SOLVENTS. PREVENT CONTACT OF STRIPPERS WITH PLASTIC WINDOWS OR RADOMES.

33. Chemical Removal of Corrosion from Aluminum Alloy

WARNING: ACID CLEANERS MUST NOT BE ALLOWED TO CONTACT THE EYES OR SKIN. IF THIS OCCURS, THE ACID MUST BE WASHED OFF IMMEDIATELY WITH LARGE QUANTITIES OF WATER. PERSONNEL MUST WEAR GOGGLES AND PROTECTIVE RUBBER GARMENTS.

CAUTION: WHERE CORROSION IS REMOVED BY CHEMICAL MEANS, SPECIAL PRECAUTIONS MUST BE OBSERVED. ACID CLEANING MATERIALS MUST NOT BE ALLOWED TO CONTACT HIGH-STRENGTH STEELS OR TO DRIP OR SPLASH ONTO ADJACENT SURFACES OR RUN INTO SEAMS, SKIN JOINTS, FAYING SURFACES, OR RECESSES. WET CLOTHS SHOULD BE AVAILABLE TO REMOVE UNWANTED ACID. USE WATERPROOF PAPER AND MASKING TAPE TO PROTECT ADJACENT AREAS.

A. Remove Corrosion Products from Clad or Nonclad Aluminum Alloy

(1) Mix Cee-Bee B-4 (Cee-Bee Chemical Co., 9520 E. Cee-Bee Dr., Downey, Calif.) or equivalent, one part to three parts water.

(2) Apply mixture with a brush or soft cloth. Allow to remain for 5 or 10 minutes. Then scrub lightly with a bristle brush.

CAUTION: PHOSPHORIC ACID SOLUTION MUST BE USED WITH CARE TO AVOID BURNS.

(3) Rinse with clear water and dry at room temperature or with compressed air.

B. Remove Surface Oxidization from Clad Aluminum Alloy Skins, Stringers, Ribs, and Tubing

CAUTION: PARTICULAR CARE MUST BE TAKEN TO KEEP CHEMICAL ETCHANTS FROM RUNNING INTO FAYING SURFACES. NO CHEMICALS MUST BE ALLOWED TO PENETRATE INTO INTERNAL STRUCTURES. A WIPE-ON, WIPE-OFF TECHNIQUE IS DESIRABLE, ESPECIALLY FOR DUCTING, HAT SECTION STRINGERS, AND OTHER IRREGULARLY SHAPED PARTS.

(1) Mask off adjacent areas to protect them from acid.

(2) Using a brush or cloth, apply thickened phosphoric acid etchant (Cee-Bee B-4 solution or equivalent) to corroded areas.

(3) With a stiff bristle or aluminum wire brush, scrub pitted areas until all corrosion residue has been removed. Take care to clean around rivets and butts.

CAUTION: ALUMINUM WOOL (MIL-A-4864) CAN BE USED ON CLAD ALUMINUM IF USED WITH RESTRAINT. DO NOT USE STEEL WOOL OR STEEL WIRE BRUSHES.

(4) Wipe away etchant with damp cloths rinsed frequently in water. Do not leave etchant in contact with metal longer than 10 to 20 minutes.

(5) Repeat procedure until all corrosion is removed. Examine questionable areas with 10-power magnifying glass.

(6) Rinse area with clean water.

(7) Apply a chemical surface treatment and finish, as required.

34. Chemical Removal of Corrosion from Magnesium

A. Remove

(1) To chemically remove corrosion from magnesium assemblies, or from installed parts which are not readily removable, prepare chromic acid solution, 10 percent by weight, in distilled water.

(2) Remove all loose corrosion with stiff-bristle brush and mask off nearby operating mechanisms, joints, and plated steel.

(3) Apply chromic acid solution, hot if possible, sparingly to corroded area. Agitate with nonmetallic brush for 5 minutes.

(4) Rinse thoroughly with clean water. Repeat treatments as necessary, and allow surface to dry.

(5) Apply Dow No. 19 chemical surface treatment (Dow Chemical Co., Midland, Mich.) and organic finish to area involved.

35. Mechanical Removal of Corrosion

A. Remove Mild Surface Corrosion and Light Pitting by Hand Rubbing

NOTE: This method is particularly adaptable to cleaning contours of aluminum tubing, stringers, and similar items with recesses.

(1) Remove mild surface corrosion and light pitting with aluminum wool and aluminum oxide abrasive paper. Dip aluminum wool in kerosene before rubbing.

CAUTION: STEEL WOOL OR A STEEL WIRE BRUSH SHOULD NEVER BE USED FOR REMOVING CORROSION FROM ALUMINUM. STEEL PARTICLES, WHICH MAY BE INVISIBLE TO THE NAKED EYE, WILL BECOME IMBEDDED IN THE ALUMINUM AND THUS INVITE CORROSION IN THE PRESENCE OF MOISTURE.

B. Remove Light Surface Corrosion by Buffing

(1) Using a cloth or brush, spread a thin coat of polishing compound over a small area. Avoid coating too large an area if the compound is a type that solidifies too quickly.

(2) Attach a cotton pad or lamb's-wool cover to the buffing machine. When buffing, use a side-to-side motion to minimize heat generation since excessive heat can alter the heat treatment and cause corrosion susceptibility in the skin.

(3) Remove residue around rivets and seams by hand polishing with the same compound.

(4) After buffing, wash the area with a one-to-one mixture of water and petroleum base solvent. Since such mixtures settle into two levels, dip cloth through the lighter solvent into the water below.

(5) Wipe the surface dry and polish it with soft cloths.

C. Remove Deep Pitting and Intergranular Corrosion by Scraping

(1) Remove deep pitting and intergranular corrosion by using a carbide-tip scraper.

(2) Use a 10-power magnifying glass to determine if all corrosion has been removed.

(3) Scrape away an additional 0.002 inch of clean metal to ensure that removal was complete.

CAUTION: TO AVOID SETTING UP STRESS CONCENTRATIONS, BLEND SCRAPED AREA INTO SURROUNDING METAL TO FORM A SAUCER-SHAPED DEPRESSION.

(4) After scraping, polish first with No. 280 grit aluminum oxide abrasive paper and then with No. 400 grit.

(5) Apply the chemical surface treatment and final protective finish indicated for the area.

D. Remove Surface Corrosion from Large Areas by Abrasive Blasting

NOTE: Abrasive blasting may be considered only if a complete organic finish is to be applied. This is because of the possibility of removing cladding from aluminum and cadmium plating from fasteners.

(1) Remove general surface corrosion from relatively large areas, including fasteners, by using abrasive-air-blasting equipment such as "Vacu-Blast".

CAUTION: TO PREVENT PEENING OF CORROSION PRODUCTS INTO ALUMINUM SKINS, CONTAMINATION OF ABRASIVE SHOULD BE KEPT BELOW 2 PERCENT. ABRASIVES THAT HAVE BEEN USED ON STEEL MUST NEVER BE USED ON ALUMINUM.

NOTE: The abrasive material should be aluminum oxide or glass beads--never silicon carbide. Particle size of the abrasive should not be over 180 mesh (0.08 mm) for coarse, rapid removal of corrosion. For better control of corrosion removal, material in the 400-600 mesh (0.038 to 0.025 mm) range is desirable.

36. Chemical Treatment after Mechanical Removal of Corrosion (Surfaces to Be Repainted)

A. Apply Alodine No. 1200 in accordance with instructions given in paragraph 30.

37. Corrosion Removal on Steel Alloys (Below 200,000 PSI)

A. Apply

(1) For removing corrosion on steel alloy assemblies, or installed parts not readily removed, lightly apply phosphoric acid-type rust remover Turco WO-1 (Turco Products, Inc., Box 1055, Wilmington, Calif.) to rusted area with bristle brush or cloth until rust is removed. Avoid trapping rust remover in joints or in inaccessible areas. On cadmium-plated parts, contain rust remover to immediate area of corrosion, as remover will also strip plating.

NOTE: The final protective paint finish is applied immediately after drying of the chemical surface treatment. Before applying paint, the surface must be clean, dry, and free from any contamination. Do not attempt to remove the stained appearance resulting from the chemical surface treatment.

(2) Rinse away rust remover with water. Rinse again with denatured alcohol, and wipe dry.

(3) If replating of previously plated parts cannot be accomplished, apply two coats of FR primer and one coat of FR aluminized topcoat.

38. Removal of Minor Corrosion from High-Strength (200,000 to 240,000 PSI) Steels

NOTE: For parts that are extensively corroded, see Chapter 20 of DC-9 Overhaul Manual.

A. Clean

(1) Clean surface with Stoddard solvent.

(2) Blend out minor scratches, dings, and corrosion damage with No. 150 grade silicon carbide paper.

(3) Clean surface with methyl ethyl ketone (TT-M-261) or technical grade toluene (TT-T-548).

CAUTION: DO NOT USE CHEMICAL RUST REMOVERS OR OTHER ACIDIC MATERIALS THAT COULD CAUSE HYDROGEN EMBRITTLEMENT ON STEELS IN THIS HEAT-TREAT RANGE.

B. Apply

(1) Apply coat of Cat-A-Lac primer 463-6-1 (Finch Paint and Chemical Co., 1536 W. 228th St., Torrance, Calif.)

(2) Apply Cat-A-Lac topcoat 443-3-2.

39. Mechanical Removal of Corrosion Products from Steel Alloys

A. Remove

(1) Use files, steel wire brushes, or motor-driven steel wire wheels to remove pitting or severe corrosion on steel alloys.

(2) Blend the cleaned area into the surrounding zone with aluminum oxide abrasive paper to eliminate stress concentrations.

(3) Refinish as described in paragraph 37, step A. (3).

40. Corrosion Removal from Lower Wing Panels

CAUTION: TO PREVENT POSSIBLE DAMAGE TO HIGH-STRENGTH STEELS IN LANDING GEAR AREA, PLACE AIRPLANE ON JACKS AND RETRACT GEARS WITH DOORS CLOSED DURING CLEANING, CORROSION REMOVAL, AND REFINISHING PROCESSES OF LOWER WING PANELS.

A. Remove

(1) Mask off surfaces surrounding area to be cleaned and treated. Cover all openings.

(2) Clean area to be inspected as described in paragraph 17.

(3) After thoroughly rinsing the area as described in paragraph 17, carefully inspect for corrosion and mechanical damage.

(4) Repair damage by reworking cuts, gouges, pits, scratches, and other damage penetrating the protective cladding by blending and smoothing as described in General Repair Procedures and Processes sections of the chapter covering the component.

(5) Remove corrosion by deoxidizing cleaned surfaces with Cee-Bee 4 (Cee-Bee Chemical Co., 9520 E. Ceebee Dr., Downey, Calif.), or equivalent, as described in paragraph 30.A.(1). Deoxidizing action of brighteners will remove some of the anodizing from lower surfaces of wing, and cadmium plating from steel fasteners. Repainting as outlined in paragraph 8 below may then be required for corrosion protection.

<u>CAUTION</u>: IT IS ESSENTIAL THAT ACID MATERIALS SUCH AS BRIGHTENER USED IN CORROSION REMOVAL, AND THE ALODINE SOLUTION USED IN CHEMICAL TOUCHUP, DO NOT CONTACT HIGH-STRENGTH STEEL PARTS.

(6) Rinse deoxidized area thoroughly with water.

(7) Use bristle brush or fine aluminum oxide abrasive paper to clean heads of corroded steel fasteners. Touch up with FR primer and Cat-A-Lac gray topcoat.

(8) If the lower wing panels are to be painted, proceed as follows:

(a) Prepare Alodine No. 1200 (American Chemical Paint Co., Ambler, Pa.) as described in paragraph 30. Apply Alodine touchup solution to areas to be painted.

(b) Mix FR primer as described in paragraph 23. Apply full cross coat of FR primer to touchup area within 4 hours after application of Alodine solution.

(c) Allow FR primer to dry.

(d) Mix entire contents of Cat-A-Lac catalyst (unit attachment) into exterior enamel, Cat-A-Lac 433-3-2 gray topcoat (Finch Paint and Chemical Co., 1536 E. 228th St., Torrance, Calif.) while stirring. Place mixture on a paint shaker and shake 15 minutes.

NOTE: Do not divide catalyst and enamel into smaller amounts before mixing together.

(e) If paint shaker is not used for mixing, stir Cat-A-Lac enamel mixture thoroughly and let stand for 45 minutes before spraying.

NOTE: The material, when catalyzed, is usually thin enough for spraying. If the mixture is too thick for spraying, add TL-29 topcoat thinner (Finch Paint and Chemical Co.). The catalyzed enamel will remain usable for 8 hours if stored in a closed container. After 8 hours, discard unused catalyzed enamel.

(f) Apply full cross coat of the Cat-A-Lac enamel, using spray gun.

(g) Allow enamel topcoat to dry 24 hours before exposure to rain, fog, or damp atmospheric conditions.

41. Removal of Corrosion from Steel Cables

CAUTION: TO AVOID A REDUCTION IN CABLE STRENGTH, CLEANING ACIDS AND CAUSTIC SOLUTIONS SHOULD NOT BE USED.

NOTE: When aircraft cables are being inspected for corrosion, particular attenion must be paid to locations near pulleys and fairleads, and between cable strands, and to similar areas that are not readily accessible.

A. Remove

(1) Move cable to both extremeties of travel to expose its entire length of inspection.

(2) If cable shows evidence of corrosion or rust, first relieve its tension. Then wipe away any dirt and rust-preventive compound with cloth or soft bristle brush mointened with Stoddard solvent.

(3) If internal corrosion or rust is present, replace cable.

(4) If no internal corrosion or rust is present, clean cable with cloth or bristle brush moistened with Stoddard solvent. Steel wool, moistened with cleaning solvent, can also be used. Repeat procedure as required.

CAUTION: DO NOT ALLOW STEEL WOOL FIBERS TO REMAIN ON AIRCRAFT STRUCTURE. REMOVE SUCH MATERIAL COMPLETELY. FAILURE TO DO SO CAN CAUSE PAINT AND OTHER PROTECTIVE COATINGS TO DETERIORATE VERY QUICKLY.

(5) After cable is thoroughly cleaned of corrosion, apply a thin film of corrosion-preventive compound (MIL-C-16173B, Grade IV, or equivalent).

42. Treatment for Spilled Battery Electrolyte (30-Percent KOH)

CAUTION: THIRTY-PERCENT KOH IS STRONG CAUSTIC AND WILL CAUSE BURNS AND SEVERE EYE DAMAGE. PROTECTIVE EQUIPMENT SHOULD BE USED.

A. Apply

(1) Wipe spillage with damp cloth.

(2) Neutralize contaminated area by swabbing with 3- to 5-percent boric acid solution.

(3) Rinse contaminated area thoroughly with fresh water.

(4) Dry area by wiping, air blast, or mild heating.

43. Approved Cleaning Materials

A. Materials that have been approved for cleaning and maintaining external surfaces of Douglas commercial aircraft are listed below together with the name and address of the supplier. Instructions for their use are provided by the suppliers and can also be obtained from Douglas Customer Service Dept. upon request. Items on this list have been approved by Douglas for the purposes indicated when they are used in strict accordance with supplier's instructions. This list does not constitute an exclusive recommendation.

Type I -- General Exterior Aircraft Cleaners for Painted and Unpainted Surfaces

Vendor Material Name	Vendor Name and Address
Ardrox 6025	Brent Chemical Products, Ltd. Commerce Road, Brentford Middlesex, England
B & B Contact	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
B & B C-717	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
B & B 2020 N3	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
B & B 311-A	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
Brulin's Airshow WW	Brulin & Co., Inc. 2939-45 Columbia Ave. Indianapolis 7, Indiana or P. O. Box 4641 Bayshore Station Oakland 23, Calif.
Brulin's Formula 815 MX-99M	Brulin & Co., Inc. 2939-45 Columbia Ave. Indianapolis 7, Indiana or P. O. Box 4641 Bayshore Station Oakland 23, Calif.

Type I -- General Exterior Aircraft Cleaners for Painted and Unpainted Surfaces (Continued)

Vendor Material Name	Vendor Name and Address
Cee-Bee 280	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Cee-Bee A-693	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Cee-Bee A-694	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Delchem 2079-B	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022 or 3 Penn Center Philadelphia, Pa. 19102
Delchem 2271 Jet Wash	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022 or 3 Penn Center Philadelphia, Pa. 19102
Emulsoclean 22A	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Econo Pak 22A	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
HC^2-74M	HC^2 Company, Inc. 1220 Wilshire Blvd. Los Angeles 17, Calif.
Jet-Mulso No. 2	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.

Type I -- General Exterior Aircraft Cleaners for Painted and Unpainted Surfaces (Continued)

Vendor Material Name	Vendor Name and Address
Oakite 74-L	Oakite Products, Inc. 19 Rector Street New York 6, N. Y.
Oakite 74-LM2	Oakite Products, Inc. 19 Rector Street New York 6, N. Y.
Super Can-Du	Nuvite Chemical Compounds 213 Freeman St. Brooklyn 22, N. Y.
Sul-Kem No. 76	Sullivan Chemical Co. 1470 W. Ninth Street Long Beach, Calif. 90813
Texize 820	Texize Chemicals, Inc. Greenville, S. C.
Turco Jet Clean B	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.
Turco Jet Clean No. 9	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.

Type II -- Exhaust Deposit Cleaners

Vendor Material Name	Vendor Name and Address
Brulin's Airshow WW	Brulin & Co., Inc. 2939-45 Columbia Ave. Indianapolis 7, Indiana or P. O. Box 4641 Bayshore Station Oakland 23, Calif.
Brulin's Formula 815 MX-99M	Brulin & Co., Inc. 2939-45 Columbia Ave. Indianapolis 7, Indiana or P. O. Box 4641 Bayshore Station Oakland 23, Calif.
Cee-Bee 280	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.

Type II -- Exhaust Deposit Cleaners (Continued)

Vendor Material Name	Vendor Name and Address
Delchem 2271 Jet Wash	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022 or 3 Penn Center Philadelphia, Pa. 19102
Delchem 2079-B	
HC^2-74M	HC^2 Company, Inc. 1220 Wilshire Blvd. Los Angeles 17, Calif.
Jet-Mulso No. 2	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.
Major Cleen	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Navee 427	The Penetone Co. 74 Hudson Ave. Tenafly, New Jersey
Sul-Kem No. 76	Sullivan Chemical Co. 1470 W. Ninth Street Long Beach, Calif.
Turco Jet Clean No. 9	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.

Type III -- Paint Strippers for Exterior Aluminum Surfaces and High-Strength Steel Components

Vendor Material Name	Vendor Name and Address
B & B 44	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
B & B 44-1	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
B & B 1418	B & B Chemical Co., Inc. P. O. Box 796 Miami, Florida
Cee-Bee A-292	Cee-Bee Chemical Co., Inc. 9520 E. Cee-Bee Drive Downey, Calif.

Type III -- Paint Strippers for Exterior Aluminum Surfaces and High-Strength Steel Components (Continued)

Vendor Material Name	Vendor Name and Address
Delchem E-Z Strip 19A	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022 or 3 Penn Center Philadelphia, Pa. 19102
Pennchem E-Z Strip 19AC	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022
Pennchem E-Z Strip 19D-3	Pennsalt Chemicals Corp. 2700 S. Eastern Ave. Los Angeles, Calif. 90022
Turco No. 4669	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.
Turco No. 5092	Turco Products, Inc. P. O. Box 1055 Wilmington, Calif.

Type IV -- Metal Conditioner, Brighteners, and Oxidization Removers

CAUTION: ACID-CONTAINING COMPOUNDS SUCH AS BRIGHTENERS AND DEOXIDIZERS ARE EMBRITTLING TO HIGH-STRENGTH STEEL. THEY MUST NOT BE USED ON LANDING GEAR, FLAP TRACKS, OR GLASS WINDOWS. THESE COMPOUNDS WILL ALSO AFFECT ANODIZED ALUMINUM SURFACES.

Vendor Material Name	Vendor Name and Address
Cee-Bee B-4	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Cee-Bee B-55	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
B & B M-40	B & B Chemical Co. Box 796 Miami, Florida

Type IV -- Metal Conditions, Brighteners, and Oxidization Removers (Continued)

Vendor Material Name	Vendor Name and Address
Cee-Bee B-6	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.
Cee-Bee R-66m	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.

Type V -- Exterior Aluminum Surface Polish

Vendor Material Name	Vendor Name and Address
Cee-Bee Jet Sheen	Cee-Bee Chemical Co. 9520 E. Cee-Bee Drive Downey, Calif.

DRILLING, COUNTERSINKING, AND DIMPLING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Procedures and dimensional data for the preparation of holes in structural repair parts before installation of attachments are described in this section. The information covers drilling holes, reaming when applicable, and countersinking (and/or dimpling) to provide the required fit.

2. Drilling and Reaming Methods

A. To determine hole size for standard and oversize close tolerance bolts and screws, see Figure 1. For lockbolt hole sizes, see Figure 2. Hole sizes for nonflush standard and blind rivets are given in Figure 3. Hole sizes for various types of flush rivets are provided in the respective illustration applicable to each method.

B. Holes must be drilled normal to the attachment head bearing surface, unless otherwise specified. Predrilling, drilling, and/or reaming to the finished size may be required depending on the finish and tolerance to be attained. Two methods for drilling and reaming close tolerance holes are illustrated in Figure 4. Typical drilling and reaming tools are shown in Figure 5. See Figure 6 for recommended spindle speeds.

C. The following procedures are recommended to ensure that a high quality fit is obtained.

(1) Use equipment most capable of maintaining recommended spindle speed; speed may vary plus or minus 25 percent. Feed at rate of 0.003 to 0.005 inch per revolution.

(2) Support thin materials on back side to obtain round hole, to prevent damage to material, and to prevent tool breakage.

(3) Make certain that any lubricant or coolant used in machining operation does not affect adhesive quality of sealants or finishes in area.

(4) Spindle speeds for reaming should be approximately one-third speed specified for drilling (see Figure 6).

(5) When countersinking, use spindle speeds for drill-size diameters that are closest to maximum countersink diameter. Use stop countersinks equipped with pilots so that constant and continuous feed can be maintained.

RECOMMENDED HOLE SIZES

STANDARD, CLASS A HOLE SIZES PROVIDE THE HIGHEST QUALITY FIT AND MUST BE USED WHEN SPECIFIED BY BLUEPRINT AND/OR REPAIR.

CLASS B HOLE SIZES WILL APPLY IN ALL REPAIRS UNLESS OTHERWISE SPECIFIED.

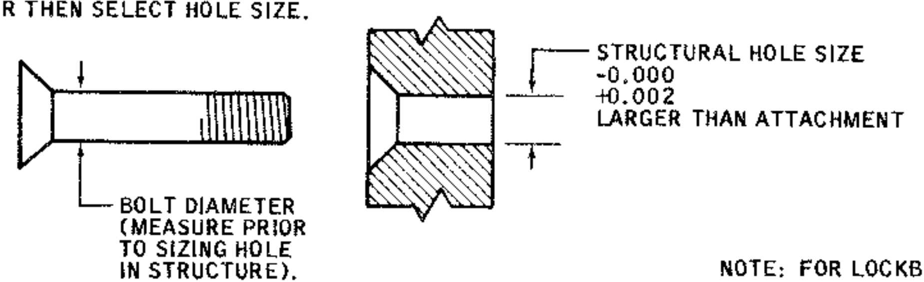
CLASS C HOLES ARE FOR GENERAL APPLICATIONS WHICH DO NOT REQUIRE CLOSE FIT AND MAY BE USED ONLY WHEN SPECIFICALLY SPECIFIED BY BLUEPRINT OR INDIVIDUAL REPAIR.

USE THE COLUMN FOR 1/64 OR 1/32 OVERSIZE HOLES WHEN THE USE OF OVERSIZE ATTACHMENTS IS INDICATED. THE OVERSIZE HOLE SIZES ARE PROVIDED FOR CLASS A FIT ONLY. FOR CLASS B APPLICATIONS, ADD 0.0010 TO THE MAXIMUM CLASS A DIAMETER GIVEN.

ATTACHMENT DIAMETER	STANDARD HOLE SIZES			OVERSIZE HOLE SIZES	
	CLASS A	CLASS B	CLASS C	1/64-INCH	1/32-INCH
NO. 10	0.1895 0.1905	0.1895 0.1915	0.190 0.194	*0.2025 0.2035	† 0.2180 0.2190
1/4	0.2495 0.2505	0.2495 0.2515	0.250 0.254	0.2650 0.2660	0.2805 0.2815
5/16	0.3120 0.3130	0.3120 0.3140	0.3125 0.3165	0.3275 0.3285	0.3430 0.3440
3/8	0.3745 0.3755	0.3745 0.3765	0.375 0.379	0.3900 0.3910	0.4055 0.4065
7/16	0.4370 0.4380	0.4370 0.4390	0.4375 0.4425	0.4525 0.4535	0.4680 0.4690
1/2	0.4995 0.5015	0.4995 0.5015	0.500 0.505	0.5150 0.5170	0.5305 0.5325
				* 0.2051 0.2061 FOR 4653154-3 OR 4653153S-3 OVERSIZE BOLTS	† 0.2208 0.2218 FOR 4653152S-3 OR 4653151S-3 OVERSIZE BOLTS

ALTERNATE METHOD:

DUE TO VARIATIONS IN DIAMETER OF ATTACHMENTS, MEASURE DIAMETER THEN SELECT HOLE SIZE.



NOTE: FOR LOCKBOLT HOLE SIZES SEE FIGURE 2

BB3-376

NAS Close Tolerance Bolt and Screw Hole Sizes,
Standard and Oversize
Figure 1

STANDARD NAS LOCKBOLT HOLE SIZES

Lockbolt Part No.	Head Type	Lockbolt Diameters				
		5/32	3/16	1/4	5/16	3/8
		Lockbolt hole sizes when all members are aluminum				
NAS1456 thru NAS 1462	Flush head (AN509)	0.1610 0.1635	0.1850 0.1880	0.2450 0.2480	0.3080 0.3105	0.3710 0.3730
NAS1465 thru NAS1472	Protruding Head	Lockbolt hole sizes when one or more members are steel, stainless steel or titanium (see below)				
NAS1475 thru NAS1482	Flush head (AN426)	0.1650 0.1660	0.1895 0.1905	0.2495 0.2505	0.3120 0.3130	0.3745 0.3755

OVERSIZE LOCKBOLT HOLE SIZES

Lockbolt Part No.	Head Type	Replacement for Standard Lockbolt Diameters				
			3/16	1/4	5/16	3/8
		Lockbolt hole sizes when all members are aluminum				
R3007-T6 thru -T12	Protruding Head		0.2005 0.2025	0.2595 0.2615	0.3225 0.3245	0.3835 0.3855
R3008-T6 thru -T12	Flush head (AN509)	Lockbolt holes sizes when one or more members are steel, stainless steel or titanium (see below)				
R3020-T6 thru -T12	Flush head (AN426)		0.2055 0.2065	0.2645 0.2655	0.3275 0.3285	0.3885 0.3895

* BLIND LOCKBOLT HOLE SIZES

Lockbolt Part No.	Head Type	Replacement for Standard Lockbolt Diameters	
		1/4	5/16
BL (Blind)	Protruding head	0.2610 0.2640	0.3440 0.3480

* For aluminum members only

Table of Lockbolt Hole Sizes
Figure 2

STANDARD NONFLUSH RIVET HOLE SIZES

Rivet Diameter	Final Hole Diameter	
	Standard	Liquid Tight
1/16	0.067 0.071	
3/32	0.098 0.106	
1/8	0.129 0.139	0.129 0.132
5/32	0.161 0.172	0.160 0.163
3/16	0.191 0.204	0.191 0.194
1/4	0.257 0.276	0.254 0.257
5/16	0.323 0.343	0.316 0.319
3/8	0.386 0.406	0.379 0.383

BLIND RIVET HOLE SIZES

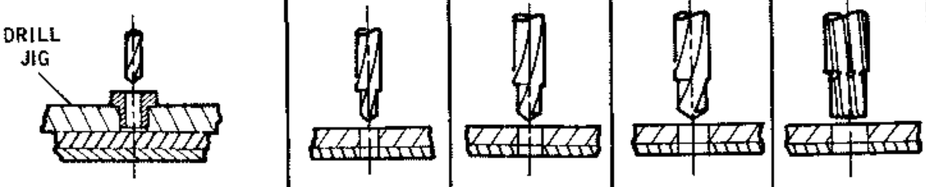
Rivet Diameter	Final Hole Diameter		
	Standard	Oversize	Bulbed Cherrylock
3/32	0.097 0.101		
1/8	0.129 0.132	0.137 0.141	0.144 0.147
5/32	0.160 0.164	0.177 0.181	0.177 0.181
3/16	0.192 0.196	0.206 0.210	0.206 0.210
1/4	0.256 0.261	0.269 0.273	
9/32	0.289 0.295		
9/32	0.294 0.300 (For Monel)		

Nonflush Standard and Blind Rivet Hole Sizes
Figure 3

METHOD NO. 1

SEQUENCE OF DRILLING AND REAMING OPERATIONS FOR CLOSE TOLERANCE HOLES

SEE FIGURE 1 FOR HOLE SIZE VARIATIONS ON NO. 10 OVERSIZE BOLTS

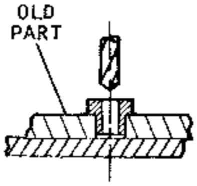
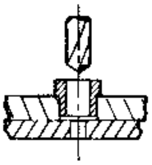
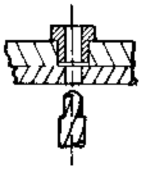
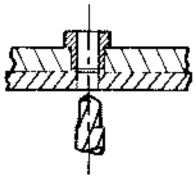
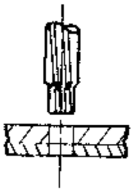


FIRST STEP	SECOND STEP	THIRD STEP	FOURTH STEP	FIFTH STEP
DRILL PILOT HOLE THROUGH PART, USING DRILL BUSHING	ENLARGE PILOT HOLE, USING PILOTED CORE DRILL	ENLARGE HOLE AGAIN, USING PILOTED CORE DRILL	ENLARGE HOLE AGAIN, USING PILOTED CORE DRILL	FINISH-REAM HOLE

BASIC HOLE SIZE	FINISHED HOLE SIZE		DRILL BUSHING SIZE		DRILL SIZE	PILOTED CORE-DRILL SIZE		PILOTED CORE-DRILL SIZE		PILOTED CORE-DRILL SIZE		PILOTED REAMER SIZE	
	MIN.	MAX.	O.D.	I.D.		O.D.	PILOT	O.D.	PILOT	O.D.	PILOT	O.D.	PILOT
NO. 10	.1895	.1905	.189	.129	No. 30 (.128)	.1735	.128					.1895	.172
+1/64	.2025	.2035	.202	.129	No. 30 (.128)	.1891	.128					.2025	.189
+1/32	.2180	.2190	.217	.129	No. 30 (.128)	.2020	.128					.2180	.201
1/4	.2495	2505	.248	.191	No. 11 (.191)	.2333	.191					.2495	.233
+1/64	.2650	.2660	.264	.191	No. 11 (.191)	.2489	.191					.2650	.248
+1/32	.2805	.2815	.280	.191	No. 11 (.191)	.2645	.191					.2805	.264
5/16	.3120	.3130	.311	.191	No. 11 (.191)	.2957	.191					.3120	.295
+1/64	.3275	.3285	.327	.191	No. 11 (.191)	.3114	.191					.3275	.311
+1/32	.3432	.3442	.342	.191	No. 11 (.191)	.2489	.191	.3270	.246			.3430	.326
3/8	.3745	.3755	.373	.191	No. 11 (.191)	.2489	.191	.3582	.246			.3745	.358
+1/64	.3900	.3910	.389	.191	No. 11 (.191)	.2489	.191	.3739	.246			.3900	.373
+1/32	.4055	.4065	.405	.191	No. 11 (.191)	.2489	.191	.3895	.246			.4055	.389
7/16	.4370	.4380	.436	.191	No. 11(.191)	.2489	.191	.3739	.246	.4207	.372	.4370	.420
+1/64	.4525	.4535	.452	.191	No. 11 (.191)	.2489	.191	.3739	.246	.4364	.372	.4525	.436
+1/32	.4680	.4690	.467	.191	No. 11 (.191)	.2489	.191	.3739	.246	.4520	.372	.4680	.451
1/2	.4995	.5005	.498	.191	No. 11 (.191)	.2489	.191	.3739	.246	.4832	.372	.4995	.483
+1/64	.5150	.5170	.514	.191	No. 11 (.191)	.2489	.191	.3739	.246	.4988	.372	.5150	.498
+1/32	.5305	.5325	.530	.191	No. 11 (.191)	.2489	.191	.3739	.246	.5144	.372	.5305	.514
LOCK BOLTS													
3/16	.185	.188	.184	.129	No. 30 (.128)	.186	.128						
1/4	.245	.248	.243	.191	No. 11 (.191)	.244	.191						
5/16	.308	.3105	.304	.191	No. 11 (.191)	.244	.191	.307	.244				
3/8	.371	.373											

BB3-390

Drilling and Reaming Methods for Class A Close-Tolerance Holes
Figure 4 (Sheet 1)

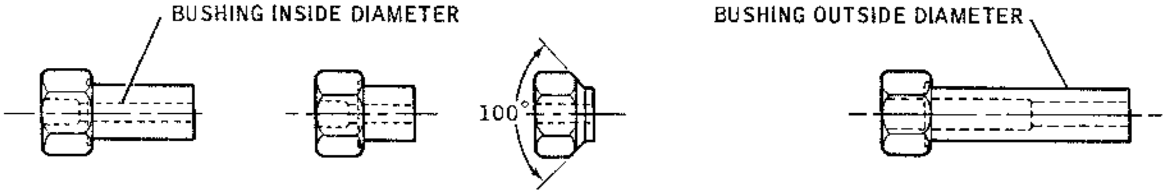
METHOD NO. 2	FIRST STEP	SECOND STEP		THIRD STEP	FOURTH STEP
SEQUENCE OF DRILLING AND REAMING OPERATIONS FOR DUPLICATING, IN NEW PARTS, EXISTING CLOSE TOLERANCE HOLES.		THIS METHOD FOR 7/16 AND 1/2 SIZE HOLES 	THIS METHOD FOR NO. 10 THROUGH 3/8 SIZE HOLES 		
SEE FIGURE 1 FOR HOLE SIZE VARIATIONS ON NO. 10 OVERSIZE BOLTS	DRILL PILOT HOLE THROUGH NEW PART, USING DRILL BUSHING.	ENLARGE PILOT HOLE, USING DRILL BUSHING	BACKDRILL, USING PILOTED CORE DRILL AND DRILL BUSHING	BACKDRILL AGAIN, USING PILOTED CORE DRILL. (USE DRILL BUSHING FOR PILOT SUPPORT)	FINISH-REAM HOLE

BASIC HOLE SIZE	FINISHED HOLE SIZE		DRILL BUSHING SIZE		DRILL SIZE	DRILL BUSHING SIZE		STANDARD DRILL OR PILOTED CORE-DRILL SIZE		DRILL BUSHING SIZE		PILOTED CORE-DRILL SIZE		PILOTED REAMER SIZE	
	MIN.	MAX.	O.D.	I.D.		O.D.	I.D.	O.D.	PILOT	O.D.	I.D.	O.D.	PILOT	O.D.	PILOT
No. 10	.1895	.1905	.189	.129	No. 30 (.128)	.189	.129	.1735	.128					.1895	.172
+1/64	.2025	.2035	.202	.129	No. 30 (.128)	.202	.129	.1891	.128					.2025	.189
+1/32	.2180	.2190	.217	.129	No. 30 (.128)	.217	.129	.2020	.128					.2180	.201
1/4	.2495	.2505	.248	.191	No. 11 (.191)	.248	.191	.2333	.191					.2495	.233
+1/64	.2650	.2660	.264	.191	No. 11 (.191)	.264	.191	.2489	.191					.2650	.248
+1/32	.2805	.2815	.280	.191	No. 11 (.191)	.280	.191	.2645	.191					.2805	.264
5/16	.3120	.3130	.311	.191	No 11 (.191)	.311	.191	.2957	.191					.3120	.295
+1/64	.3275	.3285	.327	.191	No. 11 (.191)	.327	.191	.3114	.191					.3275	.311
+1/32	.3430	.3440	.342	.191	No. 11 (.191)	.342	.191	.2489	.191	.342	.246	.3270	.246	.3430	.326
													.246		
3/8	.3745	.3755	.373	.191	No. 11 (.191)	.373	.191	.2489	.191	.373	.246	.3582	.246	.3745	.358
+1/64	.3900	.3910	.389	.191	No. 11 (.191)	.389	.191	.2489	.191	.389	.246	.3739	.246	.3900	.373
+1/32	.4055	.4065	.405	.191	No. 11 (.191)	.405	.191	.2489	.191	.404	.246	.3895	.246	.4055	.389
7/16	.4370	.4380	.436	.191	No. 11 (.191)	.436	.312	5/16(.312)		.436	.312	.4207	.312	.4370	.420
+1/64	.4525	.4535	.452	.191	No. 11 (.191)	.452	.312	5/16(.312)		.452	.312	.4364	.312	.4525	.436
+1/32	.4680	.4690	.467	.191	No. 11 (.191)	.467	.312	5/16(.312)		.467	.312	.4520	.312	.4680	.451
1/2	.4995	.5005	.498	.191	No. 11 (.191)	.498	.375	3/8 (.375)		.498	.375	.4832	.375	.4995	.483
+1/64	.5150	.5170	.514	.191	No. 11 (.191)	.514	.375	3/8 (.375)		.514	.375	.4988	.375	.5150	.498
+1/32	.5305	.5325	.530	.191	No. 11 (.191)	.530	.375	3/8 (.375)		.530	.375	.5144	.375	.5305	.514
LOCK BOLTS															
3/16	.185	.188	.184	.129	No. 30 (.128)	.184	.129	.186	.128						
1/4	.245	.248	.243	.191	No. 11 (.191)	.243	.191	.244	.191						
5/16	.308	.3105	.304	.191	No. 11 (.191)	.304	.191	.244	.191	.304	.244	.307	.244		
3/8	.371	.373													

BB3-391

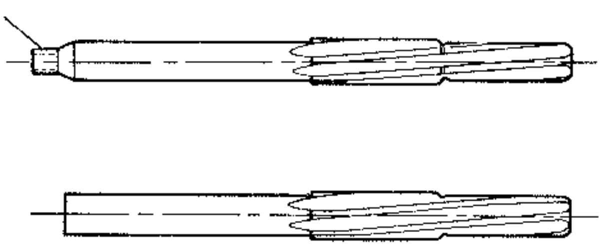
Drilling and Reaming Methods for Class A Close-Tolerance Holes
Figure 4 (Sheet 2)

Printed in U.S.A.



TYPICAL BUSHINGS

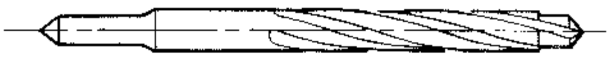
LENGTH OPTIONAL



NOTE:

PILOT LENGTH SHOULD
EQUAL ONE-HALF
TOTAL FLUTE LENGTH

TYPICAL REAMERS



LENGTH OPTIONAL

NOTE:

PILOT LENGTH SHOULD
EQUAL O.D. OF DRILL

TYPICAL CORE DRILLS

BB3-392

Typical Drilling and Reaming Tools
Figure 5

Drill Diameter	Material				
	Magnesium Aluminum	Stainless Steel	180,000- to 200,000-psi Steel	145,000 psi and under-Steel	Titanium DMS 1536
	Spindle Speed in Revolutions per Minute				
1/8	3500	1200	900	2500	1200
5/32	3500	1150	800	2500	1150
11/64	3500	950	700	1750	950
3/16	3500	800	600	1750	800
7/32	2500	600	450	1500	600
1/4	2500	600	450	1500	600
5/16	2500	500	400	1200	500
3/8	1500	400	300	1000	400
7/16	1500	350	250	800	350
1/2	1200	300	200	700	300
9/16	1200	250	175	650	250
5/8	1200	200	140	500	200
3/4	1000	200	140	500	200

Spindle Speeds for Drilling
Figure 6

3. Dimpling and Countersinking Methods

A. This section describes several dimpling and countersinking methods for flushing of structural attachments. Determine figure number which applies to a specific method from the following cross-reference:

Method Title	Figure No.
Countersinking Method for Rivets	7
Dimpling Method for Rivets	8
Combination Dimpling and Countersinking Method for Rivets	9
Countersinking Method for NACA-Type Rivets	10
Combination Dimpling and Countersinking Method for NACA-Type Rivets	11
Countersinking Method for Shear Head Rivets (NAS 1097)	12
Countersinking Methods for Flush Bolts and Screws	13
Dimple Method for Flush Bolts and Screws	14
Combination Dimpling and Countersinking Method for Flush Bolts and Screws	15
Countersinking Method for Rivet-Head Screws	16
Dimpling Method for Rivet-Head Screws	17
Combination Dimpling and Countersinking Method for Rivet-Head Screws	18
Dimpling Method for Deicer Rivets	19

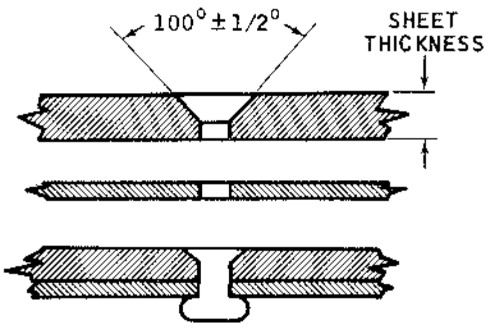
B. Dimpling operations require strict observation and compliance with several requirements. Procedures listed below are provided as a guide and must be followed (when applicable) to ensure high quality dimples.

(1) Holes must be carefully prepared prior to dimpling, as follows:

(a) Drill holes to size that is specified as hole diameter before drilling. Refer to applicable dimpling method illustration.

(b) Drilling operation must be accomplished with good equipment, held normal to material surface.

(c) Material must not be rifled, nicked, or gouged around periphery of hole.



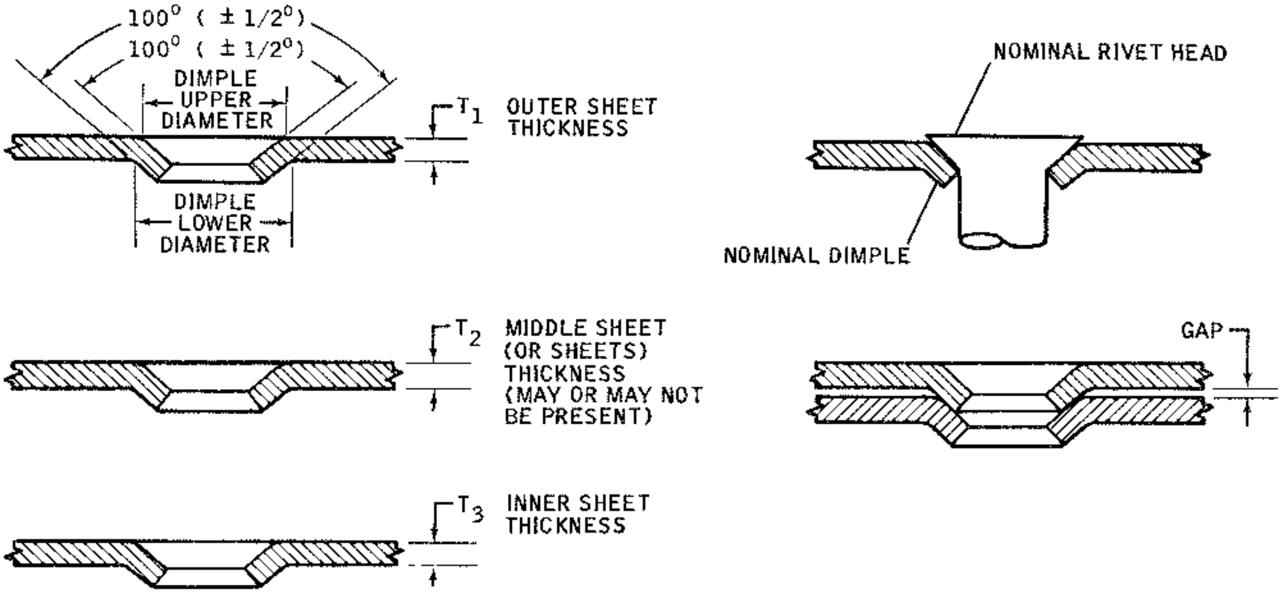
NOTES:

1. COUNTERSINK DIMENSIONS PROVIDED WILL POSITION THE MANUFACTURED RIVET HEAD FLUSH-TO-HIGH, AFTER DRIVING. THIS MAY NECESSITATE SHAVING, DEPENDING UPON SURFACE REQUIREMENTS.
2. TO COUNTERSINK FOR NACA AND SHEAR HEAD RIVETS SEE THE APPROPRIATE ILLUSTRATION.
3. REFERENCE - DOUGLAS METHODS DRAWING 5076260-4.

RIVET SIZE	FINAL HOLE DIAMETER		SHEET THICKNESS MINIMUM	CSK DIAMETER (± 0.005)
	STANDARD	LIQUID TIGHT		
1/16	0.067 0.071		0.032	0.100
3/32	0.098 0.102		0.040	0.165
1/8	0.129 0.135	0.129 0.132	0.050	0.211
5/32	0.161 0.166	0.160 0.163	0.063	0.272
3/16	0.191 0.199	0.191 0.194	0.071	0.339
1/4	0.257 0.263	0.254 0.256	0.100	0.462
5/16	0.323 0.329	0.316 0.319	0.125	0.550
3/8	0.386 0.406	0.379 0.383	0.160	0.680

BB3-377

Countersinking Method for Rivets
Figure 7



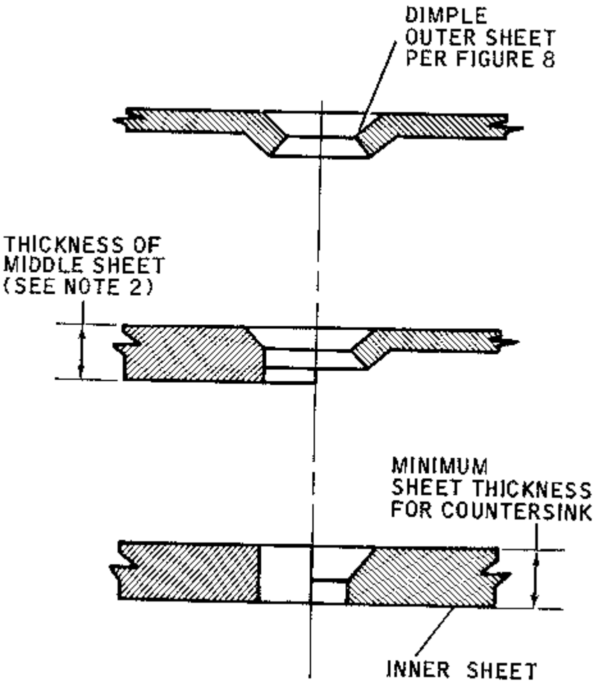
DIMENSIONAL DATA					
RIVET SIZE	HOLE DIAMETER BEFORE DIMPLING	SHEET THICKNESS (T_1, T_2, OR T_3) (MAXIMUM)	GAP	DIMPLE DIAMETERS	
				UPPER (+0.002 -0.004)	LOWER (+0.004 -0.002)
1/16	0.067 0.071	0.040	0.0005 0.005	0.109	0.114
3/32	0.098 0.102	0.050		0.174	0.179
1/8	0.128 0.135	0.063	0.0005 0.010	0.217	0.227
5/32	0.159 0.166	0.071		0.276	0.295
3/16	0.191 0.199	0.090		0.342	0.361
1/4	0.257 0.263	0.125	0.0005 0.016	0.465	0.483

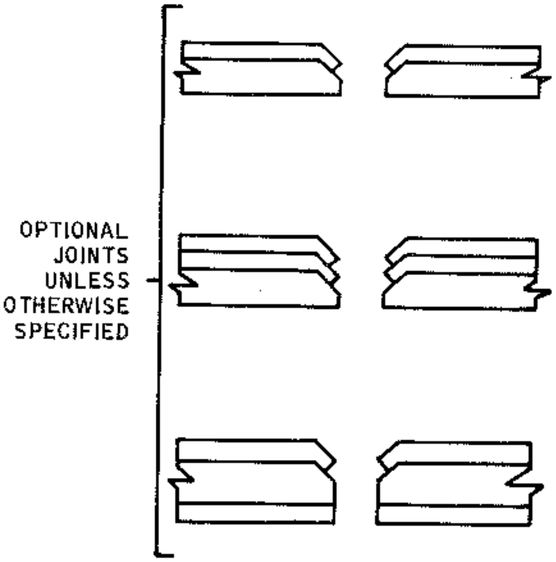
NOTES:

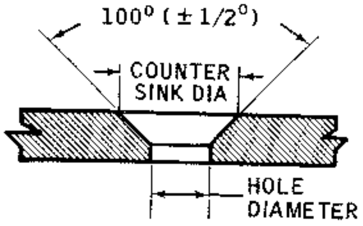
1. DIMPLE DIMENSIONS ARE THE SAME FOR INNER, MIDDLE, AND OUTER SHEETS. THE DIAMETERS WILL VARY SLIGHTLY DEPENDING ON SHEET THICKNESS.
2. DIMPLE DIMENSIONS PROVIDED WILL POSITION THE MANUFACTURED RIVET HEAD FLUSH TO HIGH AFTER DRIVING IN ALL BUT THE LIGHTER GAGES. THIS MAY NECESSITATE SHAVING DEPENDING UPON SURFACE REQUIREMENTS.
3. REFERENCE - DOUGLAS METHODS DRAWING 5076260-2.

BB3-378

Dimpling Method for Rivets
Figure 8







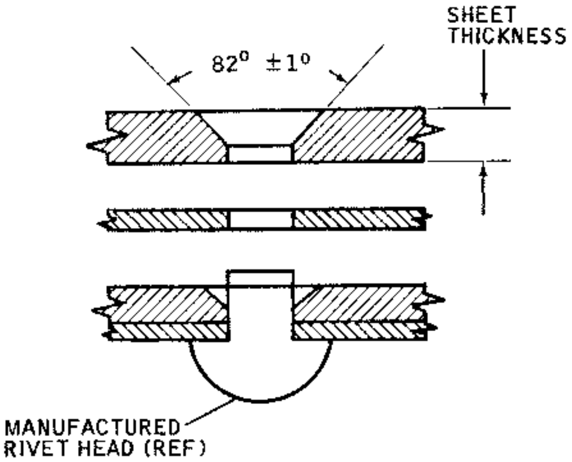
DIMENSIONAL DATA			
RIVET SIZE	HOLE DIAMETER	MIN SHEET THICKNESS FOR COUNTERSINK	COUNTERSINK DIAMETER (±0.005)
1/16	0.067 0.071	0.032	0.122
3/32	0.098 0.102	0.040	0.172
1/8	0.129 0.135	0.050	0.220
5/32	0.161 0.166	0.063	0.288
3/16	0.191 0.199	0.080	0.354
1/4	0.257 0.263	0.100	0.476
3/16	0.323 0.329	0.125	0.573

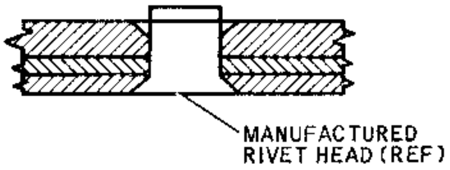
NOTES:

1. FOR ATTACHMENT OF ANCHOR NUTS, USE 3/32-INCH RIVETS ONLY. DIMPLE OUTER SHEETS UP TO AND INCLUDING .025 AND COUNTERSINK OUTER SHEETS .032 AND OVER.
2. MIDDLE SHEET (OR SHEETS WHEN PRESENT) MAY BE DIMPLED PER FIGURE 8 OR COUNTERSUNK, DEPENDING ON THICKNESS OF SHEET.
3. COUNTERSINK INNER OR MIDDLE SHEET (AS APPLICABLE) IN ACCORDANCE WITH TABULATED DIMENSIONS.
4. REFERENCE - - DOUGLAS METHODS DRAWING 5076260-3.

BB3-379

Combination Dimpling and Countersinking Method for Rivets
Figure 9





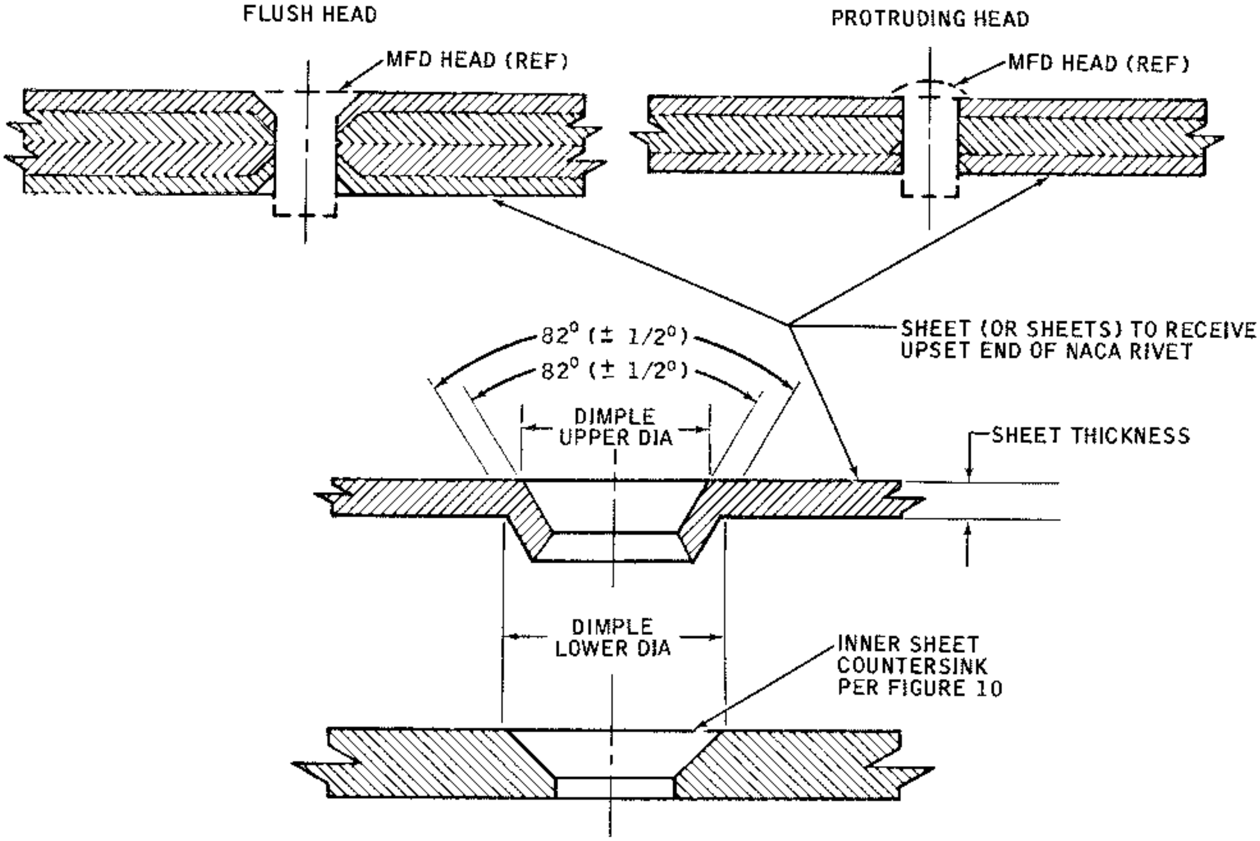
NOTES:

1. RIVET IS UPSET INTO THE COUNTERSINK AND MUST BE SHAVED WHERE FLUSHNESS IS REQUIRED.
2. FOR METHOD TO FLUSH MANUFACTURED HEAD REFER TO APPROPRIATE ILLUSTRATION.
3. REFERENCE - DOUGLAS METHODS DRAWING 5076260-10.

RIVET SIZE	HOLE DIAMETER		SHEET THICKNESS MINIMUM	COUNTERSINK DIAMETER (±0.005)
	STANDARD	LIQUID TIGHT		
1/16	0.067 0.071		0.025	0.095
3/32	0.098 0.106		0.032	0.141
1/8	0.129 0.134	0.129 0.132	0.040	0.189
5/32	0.161 0.166	0.160 0.163	0.050	0.236
3/16	0.192 0.197	0.191 0.194	0.063	0.288
1/4	0.255 0.260	0.254 0.257	0.090	0.400
5/16	0.316 0.321	0.316 0.319	0.100	0.460

BB3-380

Countersinking Method for NACA-Type Rivets
Figure 10



DIMENSIONAL DATA

RIVET SIZE	HOLE SIZE BEFORE DIMPLING	DIMPLE UPPER DIAMETER (+ 0.002 - 0.004)	DIMPLE LOWER DIAMETER (+ 0.004 - 0.002)	SHEET THICKNESS (MAXIMUM)
3/32	0.098 0.102	0.150	0.155	0.025
1/8	0.129 0.133	0.195	0.205	0.032
5/32	0.161 0.165	0.240	0.259	0.040

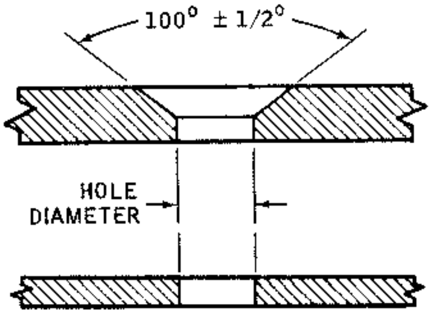
1. FOR USE WHERE DIMPLE IS REQUIRED ON UPSET END OF NACA RIVETS.
2. RIVET IS UPSET INTO DIMPLE AND MUST BE SHAVED WHERE FLUSHNESS IS REQUIRED.
3. SEE FIGURE 7 OR 9 FOR METHOD TO FLUSH MANUFACTURED HEAD.
4. REFERENCE - DOUGLAS METHODS DRAWING 5076260-18.

BB3-381

Combination Dimpling and Countersinking Method
for NACA-Type Rivets
Figure 11

NOTES:

1. COUNTERSINKING DIMENSIONS PROVIDED WILL POSITION THE MANUFACTURED HEAD FLUSH TO HIGH AFTER DRIVING. THIS MAY NECESSITATE SHAVING DEPENDING UPON SURFACE REQUIREMENTS.
2. *MINIMUM THICKNESS APPLIES UNLESS OTHERWISE SPECIFIED.
3. REFERENCE - DOUGLAS METHODS DRAWING 5076260-23

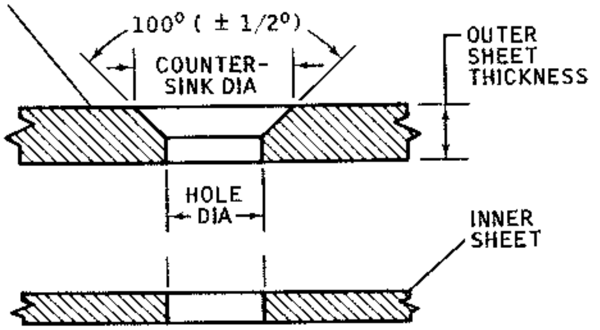


DIMENSIONAL DATA FOR SHEAR HEAD RIVETS ONLY			
RIVET SIZE	HOLE DIAMETER	SHEET THICKNESS MINIMUM*	COUNTERSINK DIA (±0.005)
1/8	0.129 0.134	0.040	0.180
5/32	0.161 0.166	0.050	0.231
3/16	0.192 0.197	0.063	0.288
1/4	0.257 0.263	0.071	0.381

BB3-382

Countersinking Method for Shear Head Rivets (NAS 1097)
Figure 12

DIMENSIONAL DATA			
BOLT AND SCREW SIZE	HOLE DIAMETER	COUNTERSUNK OUTER SHEET THICKNESS (MINIMUM)	COUNTERSINK DIAMETER (± 0.005)
4-40	0.128 0.135	0.063	0.225
6-32	0.159 0.166	0.071	0.288
8-32	0.166 0.173	0.080	0.338
10-32	0.1895 0.1905	0.090	0.391
1/4-28	0.2495 0.2505	0.125	0.512
5/16-24	0.3120 0.3130	0.160	0.640
3/8-24	0.3745 0.3755	0.188	0.767
7/16-20	0.4370 0.4380	0.200	0.895
1/2-20	0.4995 0.5015	0.224	1.022
9/16-18	0.5620 0.5640	0.258	1.150
5/8-18	0.6245 0.6265	0.286	1.277

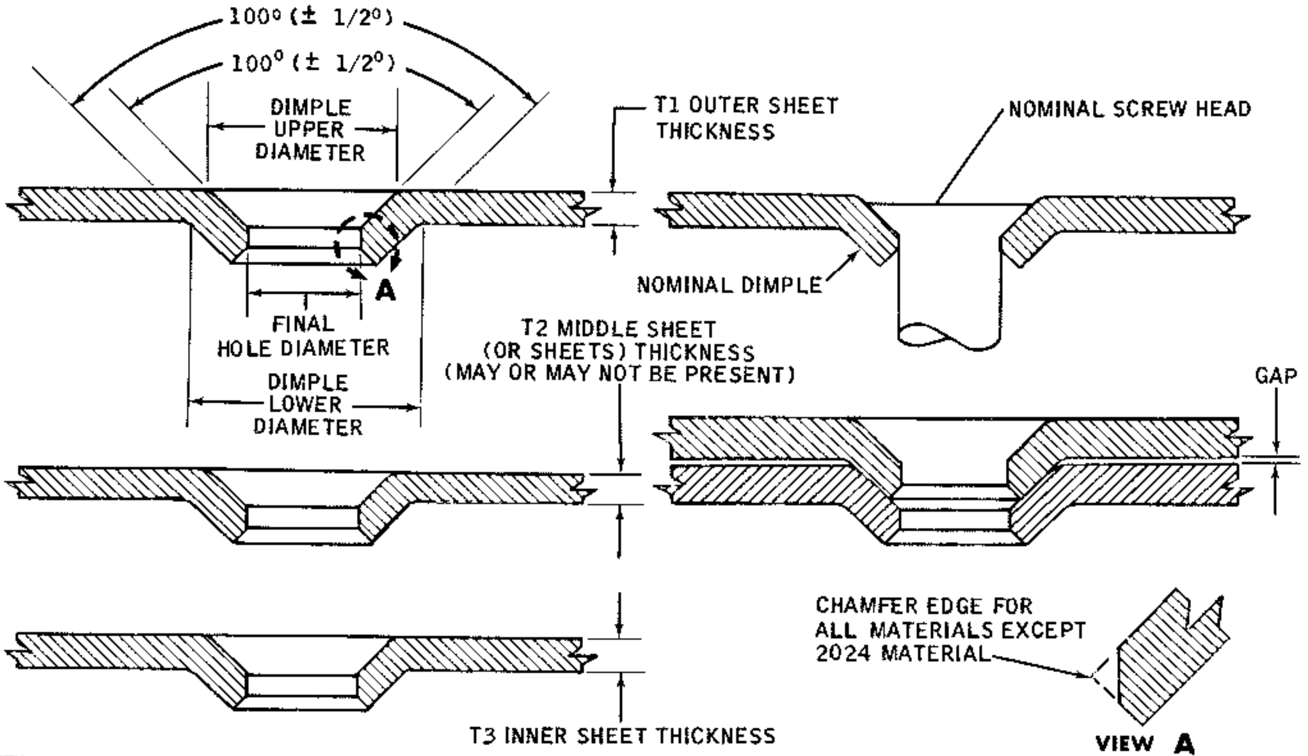


NOTES:

1. COUNTERSINK DIMENSIONS PROVIDED WILL POSITION THE SCREW HEAD FLUSH TO LOW.
2. REFER TO FIGURE 1 FOR ALLOWABLE HOLE SIZE VARIATIONS.
3. REFERENCE - DOUGLAS METHODS DRAWING 5076260-8.

BB3-384

Countersinking Method for Flush Bolts and Screws
Figure 13



DIMENSIONAL DATA

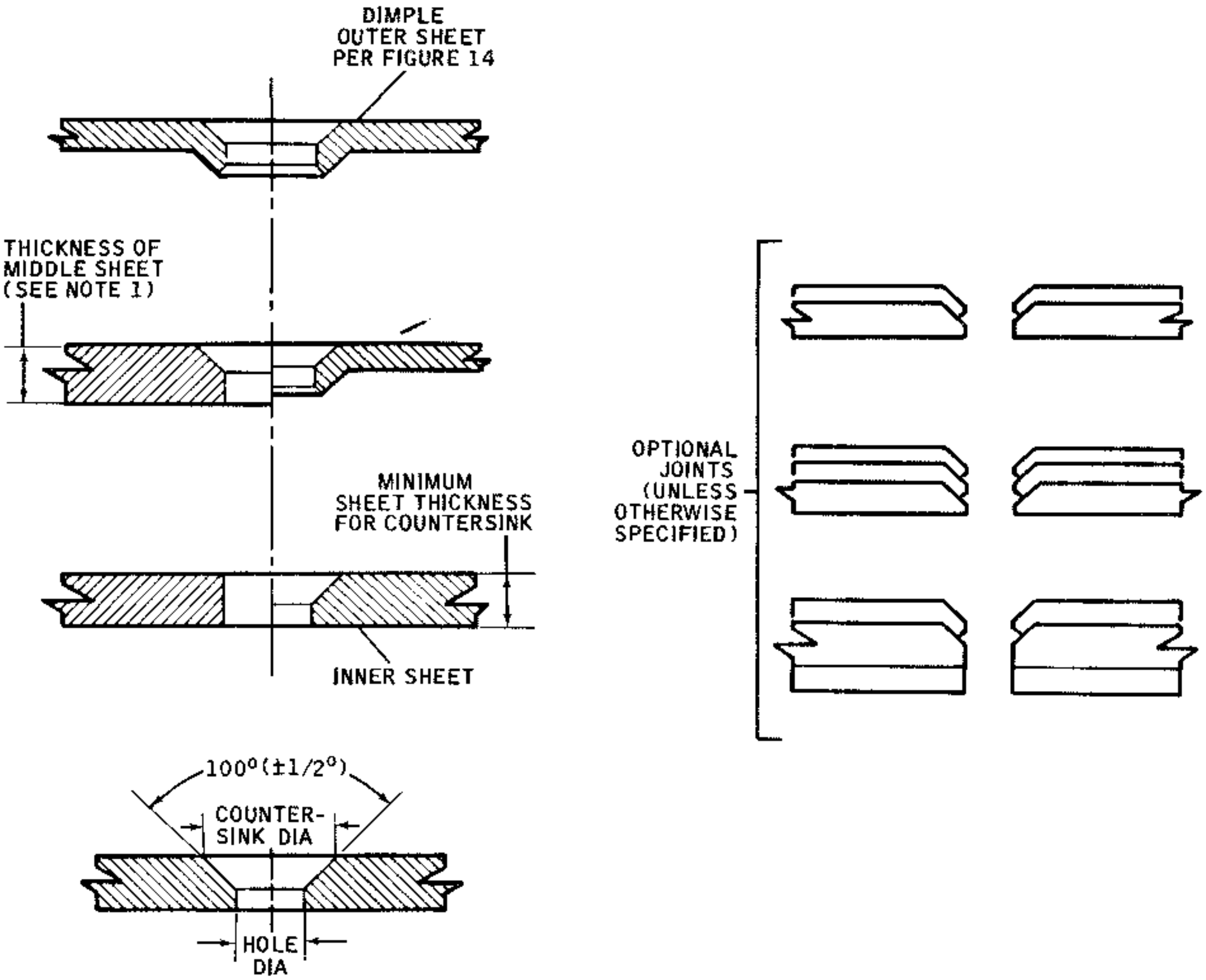
SCREW SIZE	HOLE DIA BEFORE DIMPLING	HOLE DIA BEFORE DIMPLING (2024 ONLY)	FINAL HOLE DIA (EXCEPT 2024)	SHEET THICKNESS (T1, T2, OR T3) MAX	GAP	DIMPLE DIAMETERS	
						UPPER (+ 0.002, -0.004)	LOWER (+ 0.004, -0.002)
4-40	USE METHOD FOR 1/8-INCH RIVETS IN FIGURE 8.				0.0005 0.010		
6-32	USE METHOD FOR 5/32-INCH RIVETS IN FIGURE 8.						
8-32	0.106 0.112	0.171 0.179	0.166 - 0.173	0.071		0.332	0.345
10-32	0.128 0.135	0.194 0.202	0.1895 - 0.1905	0.090		0.385	0.398
1/4-28	0.166 0.173	0.275 0.284	0.2495 - 0.2505	0.125	0.0005 0.016	0.506	0.525
5/16-24	0.205 0.214	0.373 0.382	0.3120 - 0.3130	0.125		0.632	0.651
3/8-24	0.261 0.271	0.435 0.444	0.3745 - 0.3755	0.160		0.760	0.779

NOTES:

1. DIMPLE DIMENSIONS ARE THE SAME FOR INNER, MIDDLE, AND OUTER SHEETS. THE DIAMETERS WILL VARY SLIGHTLY DEPENDING ON THICKNESS OF MATERIALS.
2. DIMPLE DIMENSIONS PROVIDED WILL POSITION THE SCREW HEAD FLUSH TO LOW AFTER INSTALLATION.
3. A COUNTERSUNK WASHER, NUT, NUTPLATE, ETC, MUST BE USED WHERE IT IS NECESSARY TO USE A NUT AGAINST THE DIMPLED BOTTOM SHEET.
4. DIMPLING OF EXTRUSION IS PERMITTED ONLY WHEN SPECIFIED.
5. SEE FIGURE 1 FOR OVERSIZE HOLE DIAMETERS FOR SCREWS AND BOLTS.
   SEE FIGURE 2 FOR LOCKBOLT HOLE SIZES.
6. REFERENCE - DOUGLAS METHODS DRAWING 5076260-5.

BB3-385

Dimple Method for Flush Bolts and Screws
Figure 14



NOTES:

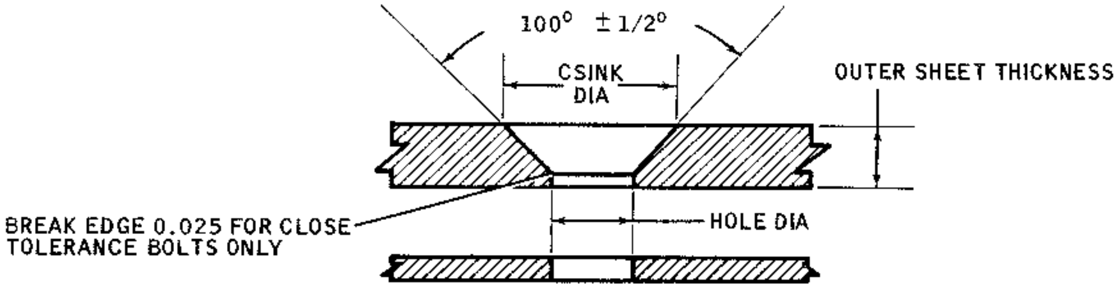
1. MIDDLE SHEET (OR SHEETS, WHEN PRESENT) MAY BE DIMPLED PER FIGURE 14 OR COUNTERSUNK, DEPENDING ON THICKNESS OF SHEET.
2. DIMPLING OF EXTRUSION IS PERMITTED ONLY WHEN SPECIFIED.
3. COUNTERSINK INNER OR MIDDLE SHEET (AS APPLICABLE) IN ACCORDANCE WITH TABULATED DIMENSIONS.
4. SEE FIGURE 1 FOR ALLOWABLE HOLE SIZE VARIATIONS FOR OVERSIZE SCREWS AND BOLTS. SEE FIGURE 2 FOR LOCKBOLT HOLE SIZES.
5. REFERENCE - DOUGLAS METHODS DRAWING 5076260-7.

DIMENSIONAL DATA

SCREW SIZE	HOLE DIAMETER	MINIMUM SHEET THICKNESS FOR COUNTERSINK	COUNTERSINK DIAMETER (± 0.005)
4-40	0.128 0.135	0.050	0.220
6-32	0.159 0.166	0.063	0.288
8-32	0.1635 0.1645	0.080	0.338
10-32	0.1895 0.1905	0.090	0.391
1/4-28	0.2495 0.2505	0.125	0.518
5/16-24	0.3120 0.3130	0.160	0.644
3/8-24	0.3745 0.3755	0.188	0.772

BB3-386

Combination Dimpling and Countersinking Method for
Flush Bolts and Screws
Figure 15



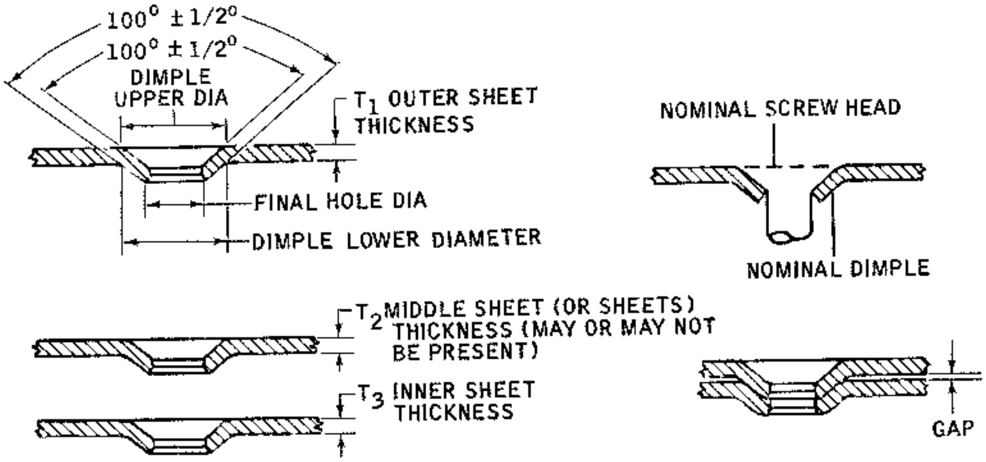
SCREW SIZE	* HOLE DIAMETER	COUNTERSINK OUTER SHEET THICKNESS MINIMUM	COUNTERSINK DIAMETER (± 0.005)
NO. 10	0.1895 0.1905	0.080	0.362
1/4	0.2495 0.2505	0.112	0.485
5/16	0.3120 0.3130	0.125	0.573
3/8	0.3745 0.3755	0.160	0.703
7/16	0.4370 0.4380	0.184	0.846
1/2	0.4995 0.5005	0.208	0.965

NOTES:

1. COUNTERSINK DIMENSIONS PROVIDED WILL POSITION THE SCREW HEAD TO BE FLUSH TO LOW.
2.* SEE FIGURE 1 FOR ALLOWABLE HOLE SIZE VARIATIONS.
3. THIS METHOD IS APPLICABLE FOR DOUGLAS 4919303 THROUGH 4619308 SERIES FASTENERS.
4. REFERENCE - DOUGLAS METHODS DRAWING 5076260-20.

BB3-387

Countersinking Method for Rivet-Head Screws
Figure 16



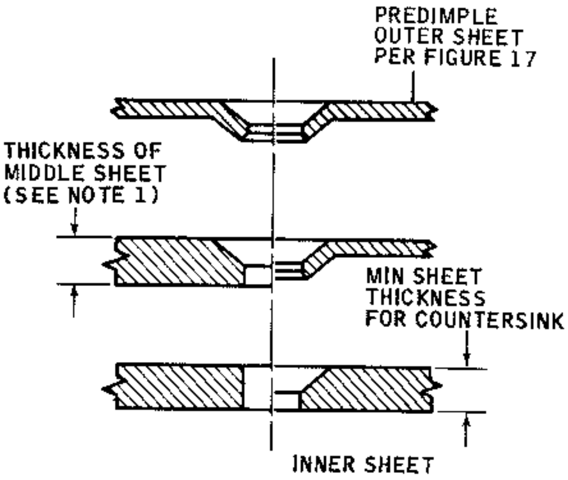
DIMENSIONAL DATA					DIMPLE DIAMETERS	
SCREW SIZE	HOLE DIA BEFORE DIMPLING	FINAL HOLE DIA	SHEET THICKNESS (T_1, T_2, OR T_3) MAX	GAP	UPPER (+0.002, -0.004)	LOWER (+0.004 -0.002)
10-32	0.128 0.135	SEE NOTE 5	0.070	0.0005 0.010	0.361	0.374
1/4-28	0.166 0.173	SEE NOTE 5	0.100	0.0005 0.017	0.484	0.503
5/16-24	0.205 0.214	SEE NOTE 5	0.100		0.572	0.591
3/8-24	0.261 0.271	SEE NOTE 5	0.125		0.702	0.721
7/16	0.281 0.291	SEE NOTE 5	0.160		0.845	0.864

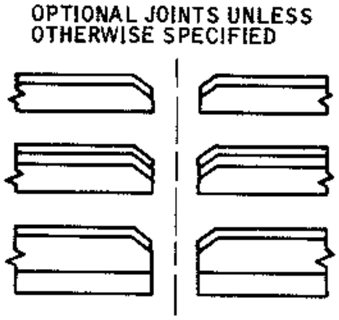
NOTES:

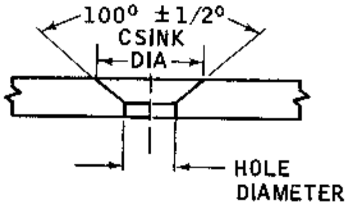
1. DIMPLE DIMENSIONS ARE THE SAME FOR INNER, MIDDLE, AND OUTER SHEETS. THE DIAMETERS WILL VARY SLIGHTLY DEPENDING ON SHEET THICKNESS.
2. DIMPLE DIMENSIONS PROVIDED WILL POSITION THE SCREW HEAD FLUSH TO LOW.
3. A COUNTERSUNK WASHER, NUT OR NUTPLATE MUST BE USED WHERE IT IS NECESSARY TO USE A NUT AGAINST THE DIMPLED BOTTOM SHEET.
4. DIMPLING OF EXTRUSION IS PERMITTED ONLY WHEN SPECIFIED.
5. SEE FIGURE 1 FOR RECOMMENDED OVERSIZE HOLE DIAMETERS WHEN REQUIRED.
6. REFERENCE - DOUGLAS METHOD DRAWING 5076260-21.

BB3-388

Dimpling Method for Rivet-Head Screws
Figure 17







DIMENSIONAL DATA

SCREW SIZE	HOLE DIAMETER *	MINIMUM SHEET THICKNESS FOR COUNTERSINK	COUNTERSINK DIAMETER (± .005)
10-32	0.1895 0.1905	0.090	0.367
1/4-28	0.2495 0.2505	0.125	0.496
5/16-24	0.3120 0.3130	0.125	0.584
3/8-24	0.3745 0.3755	0.160	0.714
7/16	0.4370 0.4380	0.188	0.857

Printed in U.S.A.

NOTES:

1. MIDDLE SHEET (OR SHEETS, WHEN PRESENT) MAY BE DIMPLED PER FIGURE 17 OR COUNTERSUNK, DEPENDING ON THICKNESS OF SHEET.
2. DIMPLING OF EXTRUSION IS PERMITTED ONLY WHEN SPECIFIED.
3. COUNTERSINK INNER OR MIDDLE SHEET (AS APPLICABLE) IN ACCORDANCE WITH TABULATED DIMENSION.
4. *SEE FIGURE 1 FOR ALLOWABLE HOLE SIZE VARIATIONS.
5. REFERENCE - DOUGLAS METHODS DRAWING 5076260-22.

BB3-389

Combination Dimpling and Countersinking Method
for Rivet-Head Screws
Figure 18

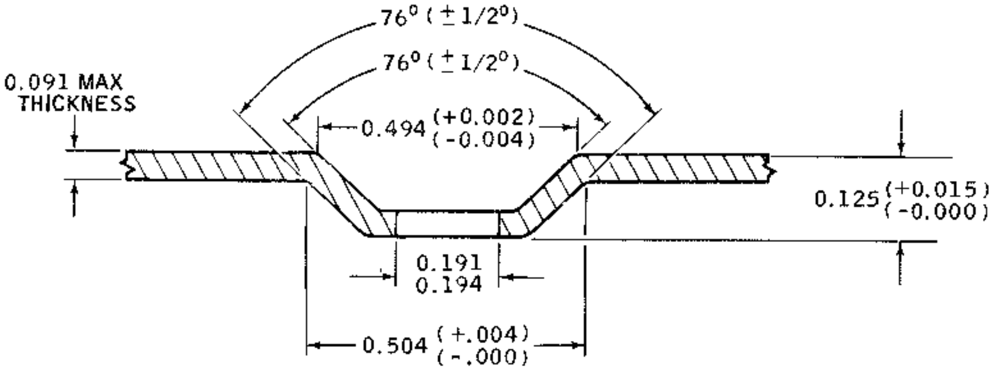
(d) Each hole must be deburred on side where dimple will protude to remove any sharp edges or burrs. Both sides of material may be deburred. Combined depths of material removed must not exceed 25 percent of total sheet thickness.

(e) Any foreign material in area of holes to be dimpled must be removed.

(f) If ordinary methods of deburring fail to prevent radial cracks, it will be necessary to polish edges before dimpling.

(2) Dimpling of sheet stock requires careful adherence to following requirements (as applicable).

(a) Some materials require that dimpling be accomplished at elevated temperatures. Refer to Figure 20 to determine requirements for specific materials.



DIMENSIONAL LIMITATIONS:

NOTES:

1. FOR USE WITH 2594254 RIVET.
2. HOLE SIZE BEFORE DIMPLING IS $\substack{0.129\\0.132}$ INCH.
3. USE FOR SINGLE THICKNESS OF 6061 OR 7075 MATERIAL ONLY.
4. DIMPLE MUST BE FORMED AT ELEVATED TEMPERATURE 375 (± 25)°F (190 ± 14°C).
5. REFERENCE - DOUGLAS METHODS DRAWING 5076260-19.

BB3-383

Dimpling Method for Deicer Rivets
Figure 19

Material Designation	Sheet Temperature	
	Minimum	Maximum
2024-T3, and T4	See note 1	
2024-T6, and T81	See note 2	450°F
2014-T6	300°F	400°F
7075-T6	300°F	400°F
6061-T6	See note 1	
Magnesium	300°F	400°F
Stainless steel (up to and including one-half hard)	See note 1	
Titanium (DMS 1536)	600°F	800°F

<u>NOTE</u> 1: Dimpling does not require elevated temperature, except for deicer rivet dimples.

<u>NOTE</u> 2: Elevated temperature may be required, if material is contoured or partially work hardened from forming. If in doubt, use elevated temperature.

Temperature Requirements for Dimpling
Figure 20

(b) When elevated temperatures are required, adequate means to measure and control temperature must be employed. Temperatures below that which is specified are likely to produce minute circumferential cracks around dimple. Temperatures higher than specified will tend to anneal material and also induce corrosion.

(c) Many different types of equipment available for hot dimpling makes it impractical to attempt specific instructions in this manual. However, before dimpling a structural part, a test panel of similiar material and gage should be dimpled to ensure that correct temperature and dwell time has been selected.

(d) Temperature of material may be determined by use of Tempilstik or Tempilaq (Tempil Corporation, 132 West 22nd St., New York, N.Y. 10011). Either of these two materials when applied to area to be heated will melt and change colors when critical temperature is reached. Apply a stripe of Tempilaq or Tempilstik from edge of hole outward for approximately 1 inch on opposite side of sheet from which heat is to be applied. When heat is applied from both sides, apply Tempilaq or Tempilstik to side that female die contacts.

NOTE: Shake Tempilaq bottle before each use to ensure proper mixing of contents.

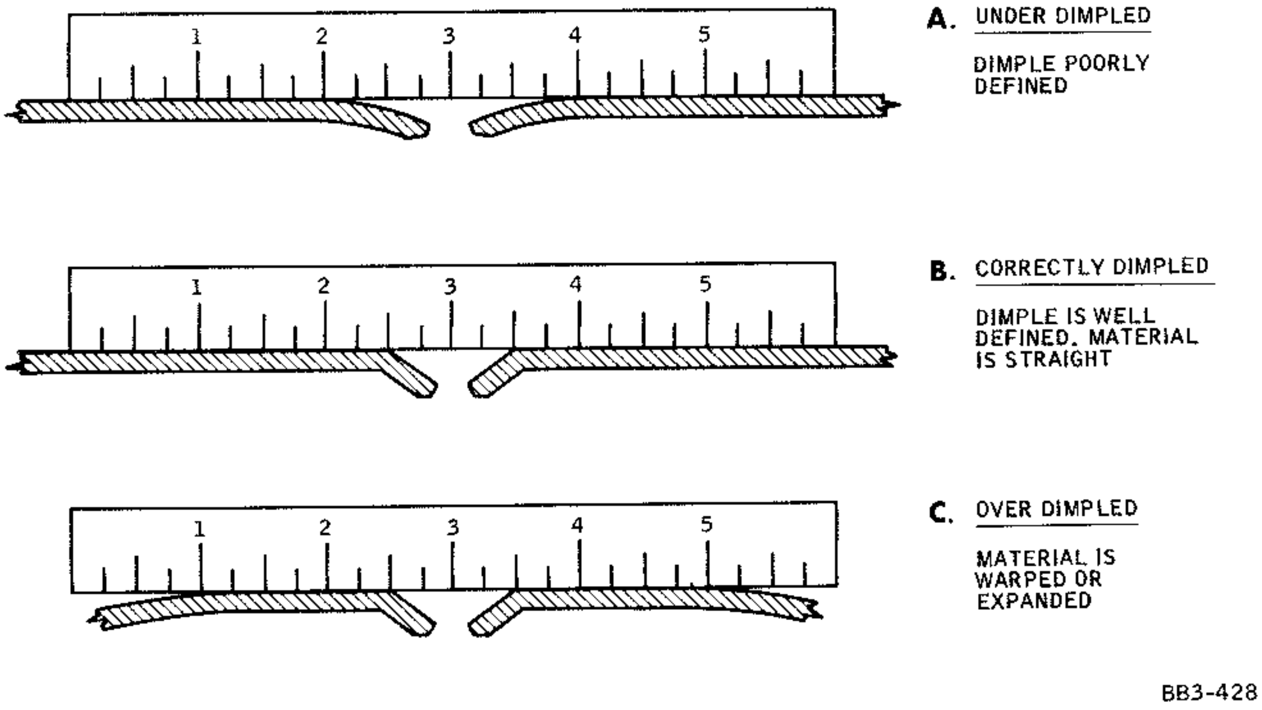
(e) Heating equipment should be brought to operating temperature. Then heater dies should be placed flat and tight against sheet to allow optimum heat transfer to material. When Tempilaq or Tempilstik melts in area of dimple, energize dimpling equipment to form dimple.

(f) Dimpling equipment must be in good condition and free from all foreign matter.

(g) See Figure 21 for examples of dimples. Inspect dimples as job progresses to make certain that dimples are of satisfactory quality.

(h) Dimples must not be reversed, flattened, or redimpled to another size.

(i) Remove Tempilaq or Tempilstik from sheet immediately after dimpling is complete.



Dimple Checking Method
Figure 21

STRUCTURAL INSPECTION - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Careful inspection of the airplane to determine possible structural damage is necessary because of many contributing causes. In spite of the structural integrity and safety factors inherent in the airplane structures, the airplane is constantly subjected to adverse weather conditions and damage resulting from human factors. The structures may become damaged as a result of stress induced by a rough landing, high "g" pullouts during flight, heavy gusts of wind, high yaw conditions, or hail storms. Damage on the ground may be caused by contact with work stands, with serving trucks, or with other objects. This section of the manual outlines recommended inspection steps and techniques to ensure a well-maintained, structurally sound airplane.

B. A detailed inspection of airplane system components and structure following hard or overweight landings, overspeed, or rough air conditions is outlined in Chapter 5-51-0 and 5-52-0, DC-9 Maintenance Manual.

C. Material identification illustrations throughout the manual also serve as a supplement for nondestructive testing procedures. For complete radiographic structural inspection techniques, refer to the DC-9 Nondestructive Testing Manual.

2. Visual Inspection

A. Visual Examination: Determine extent of external damage by visually observing complete airplane exterior. Do not assume damage is confined to local area. The visible damage can be transmitted through structural members to areas not designed to withstand excessive loads. Observe all plating for signs of buckling. Check all structural joining points and fitting attach areas for evidence of distortion, cracks, and loose or sheared fasteners. Any evidence of loose or sheared fasteners requires a close inspection of all structures near the damaged area. Remove fillets, hatches, inspection cover plates, and doors. Check for warped or deformed structure on interior of airplane structure near damaged area. Operate movable control surfaces. If airplane is on jacks or other securing supports, operate landing gear. Check moving components for signs of binding.

B. Visual Check of Outer Plating: Buckling does not necessarily mean airframe is weakened, but it is reason for close examination of structure. The airframe may flex slightly under normal loads. However, when the airplane has sustained damage or has been subjected to severe flight loads, any buckling requires close inspection for structural failure. Check mild buckling even though it might not appear extensive. Severe buckling can be a sign of structural damage and lead to fatigue failure due to repeated flexing during flight.

C. Detailed Visual Check: After a close visual inspection of the external structure and examination of plating buckling, visually inspect following:

(1) Check substructure, frame, bulkheads, longerons, and beams for damage.

(2) Check for sheared or pulled fasteners.

(3) Check holes used for fastening structures for cracks, misalignment, and elongation.

(4) Inspect fittings and splices for cracks or shifting of position.

(5) Carefully observe joining points of major subassemblies or areas of heavy weight concentration. Observe wing-to-constant section joints, wing pylon area, and landing gear fittings closely.

(6) Check vertical stabilizer and horizontal stabilizer attachments.

(7) Check flap and aileron attachments to wing.

(8) Check rudder and elevator attachments to stabilizers.

NOTE: If there is visual evidence of cracks, refer to paragraph 3 for information on special methods of detecting cracks and fatigue.

(9) Check integral fuel tank areas for evidence of leak stains.

3. Inspection Techniques

A. Methods of Inspection: Rigid inspection procedures are necessary to ensure proper structural maintenance of today's long-range, high-speed, heavy-load-carrying airplanes. To detect flaws, cracks, and signs of fatigue invisible to the naked eye, inspection equipment and chemical detecting methods are very helpful. The use of magnifying devices, flourescent dye penetrants, ultrasonic and X-ray equipment, magnetic particle equipment, and measuring and hardness testing tools and machines, increases the ease of detecting sources of damage.

(1) Magnifying Devices: When the naked eye detects the possibility of a crack, the use of a pocket microscope may remove the doubt one way or other. The use of a pocket microscope may, however, be inconclusive. The next logical step is to resort to the use of a dye-penetrant method of detection, or the use of some other magnifying device.

(a) The Boroscope: One of the most useful devices is an optical instrument called a Boroscope. The Boroscope is quite good for visual inspection of internal surfaces of piping, tubing, and holes in structural parts. It operates on various sources of current depending on the type of lamp used in the instrument. Some operate simply with batteries and miniature lamps. Others operate on 110-volt, 60-cycle, ac power and are more complex in design. Light passing through a system of prisms and lenses produces a good, flat, visual field of the area under observation.

NOTE: Douglas suggests that until full familiarity with the Boroscope is attained, erroneous readings may result.

(b) The Otoscope: Another direct visual aid which provides illumination and a comparatively small amount of magnification is the otoscope. This tool is widely used in the medical profession. It is a portable instrument similar to a flashlight in appearance. It operates with two flashlight-type dry cell batteries. The otoscope is useful for scanning straight into shallow areas that are recessed and dark.

(2) Nonflourescent Dye Penetrants: Through the use of nonflourescent dye penetrants, commercially available, flaws open to the surface can be located in metal parts. Among the discontinuities that can be detected are porosity (not necessarily a flaw) and surface cracks in castings, forgings, and wroght materials. Laps in forgings also show up, as do grinding cracks in machined-parts, and cracks from heat treatment. The nonflourescent method requires no electricity, lights, or special booths. It can be used directly on the airplane. Proceed as follows:

(a) Thoroughly clean and dry part to be inspected. Remove paint, dirt, scale, oil, grease, and vapor. Degrease or clean part with an approved cleaner from a field kit (Spotcheck, Magnaflux Corp., Chicago, Illinois, or equivalent).

(b) Brush or spray the penetrant on part. Normally, a dwell time of 10 to 15 minutes is needed to allow solution to seep into cracks. Where extremely fine cracks exist, or when the part is cold, a 30-minute soak time is needed.

(c) Remove all visible traces of penetrant. Use a dry cloth and then clean with approved cleaner. Dry test surface carefully. Do not flood surface with cleaner. Do not dry part with compressed air.

(d) Shake developer container well. Apply a thin, even coat of developer, free of runs and laps. Apply one coat only. Repeated applications tend to mask small indications.

(e) Inspect penetrant markings. Solid lines indicate cracks, and scattered spots indicate pits or porosity. A line of dots reveals a very tight crack or partially welded lap. The amount of penetrant which bleeds to the surface generally indicates depth of defect.

(3) Flourescent Dye Penetrants: Another nondestructive test for defects that are open to the metal surface is the flourescent-type of dye penetrant (Zyglo, Magnaflux Corp., Chicago, Illinois, or equivalent). The surface is inspected under black light, causing the penetrant to glow. This method is suitable for inspection of aluminum, magnesium, brass, copper, cast iron, stainless steel, tungsten, plastics, molded rubber, and glass. However, it should not be used on absorbent materials such as wood. Among the defects this test can detect are shrinkage cracks and porosity, cold shuts, fatigue cracks, heat treatment cracks, and seams. It also can detect forging laps, lack of bond between joined metals, and leaks through welds and castings. Small parts also can be given flourescent inspection by means of fixed equipment. A portable light can be used over the surface of large parts attached to the airplane. The use of flourescent dye penetrants involves precleaning, application of penetrant, removal of excess penetrant and drying, use of a developer, and inspection. The following procedure is recommended:

(a) Thoroughly clean and dry part to be inspected. Remove paint, dirt, scale, oil, grease, and vapor. Degrease or clean part with an approved cleaner from a field kit (Spotcheck, Magnaflux Corp., Chicago, Illinois, or equivalent). Parts must be cleaned of all strong caustic and acid materials. When removing paint, remember that if primer has seeped into minute cracks, solvent may not remove it all, therefore accurate inspection by the penetrant method is unlikely.

(b) Apply a thin, even coat of penetrant, using a brush or spraying equipment. Figure 1 lists a few common materials and the penetrant dwell time required for inspection.

Material	Nature of Defect	Penetration Time in Minutes
Sheet stock and extrusions	Heat-treatment cracks, grinding cracks, fatigue cracks	15
Metal castings	Shrinkage cracks, age porosity, surface porosity, cold shuts	3 to 10
Forgings	Cracks, laps	30
Welds	Cracks and porosity, including flux	20

Material	Nature of Defect	Penetration Time in Minutes
Acrylic-type plastics	Fine cracks, leaks at joints and seals	5 to 10
Plastics	Cracks, crazing	1 to 5

Penetrant Dwell Times
Figure 1

(c) Wash part with a water spray bath, preferably under black light to ensure complete cleaning of surface and cavities. When piped water is not available, most of the penetrant can be removed with wet cloth and container of water followed by a second wash from a separate container and with another wet cloth. Although temperature of water is not critical, warm water 10° to 32.2°C (50° to 90°F) acts faster, and produces a cleaner job. Dry part thoroughly by wiping with paper or cloth towels.

(d) Apply developer. Either a dry developer or wet developer may be used, depending upon equipment at hand. The dry developer is a powder that must be applied to a thoroughly dry surface, as matting will occur otherwise. The wet developer can be used without prior drying operation, but requires use of a recirculating hot air dryer (5 to 10 minutes drying time at 65.6° to 93.3°C (150° to 200°F) is normally required).

(e) After letting the part stand for 15 minutes, inspect with black light under darkened lighting conditions, preferably in a booth. Regions containing no defects will be nonflourescent or dead purple under black light. Pores and leaks will show as glowing lines. Where a large defect has retained a quantity of penetrant, the indications will spread extensively on the surface. The relative size of defects can be interpreted after sufficient experience in using this method. During inspection with flourescent penetrants, indications on some parts will be extraneous, and may be ignored. Most sand castings will show general porosity and each pore will give a flourescent indication. Pores well scattered over the part are considered normal in castings. A heavy concentration of pores, particularly at a stress point, may develop into failure under fatigue loading and is basis for rejection. Any fit joint in a part, such as a gear pressed into a shaft will give an indication at joint, but this is considered normal. After inspection, clean all of developer from part by washing, and then drying.

(4) Ultrasonic Equipment

(a) Defects that are within a metal part may not always show on surface of part. When other inspection methods fail to reveal internal defects, these defects may be detected by pulse-echo ultrasonics.

This type of equipment produces inaudible sound waves greater than 50,000 on 1/2 megacycles per second. Of equal usefulness is the resonance-type ultrasonic equipment, designed to measure material thickness, with access to only one side of material.

(b) The characteristics of pulse-echo ultrasonic vibrations are such that they reflect from discontinuities occuring in medium through which they are being transmitted. The inaudible sound waves are produced by a crystal, and transmitted through material being inspected. A cathode-ray tube displays the received signal.

(c) Resonance-type ultrasonic equipment, used for measuring thickness employs the principle of vibration resonance which is related to density or thickness. Thickness signals are also printed on a cathode-ray tube.

(d) The Sonizon and Vidigage are resonance-type instruments. They are well suited for the measurement of wall or skin thicknesses where only one side of the part is accessible. They are also useful where other means of detection are difficult due to the size or shape of the part. Resonance equipment, when used for detection of defects is largely limited to flaws, whose planes are usually parallel to the plane of the part.

(e) There are other makes of resonance equipment that operate on the same principle. Measurement with these instruments is possible over a wide variation of surface conditions. Good readings are obtained with machined-surfaces, except in the case of very rough machining. Rough scale on hot-rolled or forged-surfaces may require smoothing with a portable sander or grinder. Graduated taper gages are most useful in making comparison thickness readings with resonance-type equipment. These gages should be made of material similar to the material being measured.

(f) When materials such as rubber, wood, and certain plastics capable of absorbing ultrasonic vibrations are bonded to metal, glass, or other resonant materials, the presence of a poor bond may be detected. This method may be a convenient way for checking corrosion, thinning of formed sections, and castings.

(g) The reflectoscope and immerscope are pulse-echo-type instruments. The basic difference between them and the resonance-type equipment is the method of indication. Instead of reading the point of resonance, time measurements of sound travel through the part are made. These pulse-echo-type instruments also may be used often for thickness measurement where only one side of the part is accessible and where the part is over 1/4-inch thick. In addition, they are highly useful for detection of cracks, folds, inclusions, laminations, partial welds, voids, segregations, shrinks, porosity, flaking, and other subsurface defects.

(h) These instruments are capable of straight-beam testing for detection of flaws, the planes of which are parallel to the plane of the part. They are also capable of angle-beam testing. Angle-beam testing may reveal flaws, the planes of which lie at an angle to the plane of the part (discontinuities in areas that cannot be reached with standard straight-beam L-wave testing), internal defects in plate and sheet stock, and some types of internal defects in tubing. They can detect internal defects in pipe and bar stock, such as inclusions and small cracks near the surface, cracks in parent metal resulting from welding, and some defects in the welds. Considerable experience is required in interpreting flaws by ultrasonic means. This is particularly true when using angle beam (short wave) methods.

(5) Portable X-Ray Equipment

(a) The use of X-ray equipment to locate defects is one of the most useful nondestructive test methods. Within limitations, portable X-ray equipment provides both economical and timesaving inspection of airplane structure, such as fuselage, wing and tail section internal structure. It also can be used for inspection of small parts of subassemblies that have internal flaws which would remain undetected otherwise. The use of X-ray equipment is limited by the characteristics of the type and design of the X-ray machine being used, and the operator's and reader's skill and experience. It is also limited by the density, thickness, and shape of the parts under inspection, and the accessibility of the structure being inspected in relation to the X-ray tube and film.

<u>WARNING:</u> FOLLOW ALL LOCAL, STATE, AND FEDERAL REGULATIONS WHEN USING X-RAY EQUIPMENT TO AVOID INJURY TO PERSONNEL.

(6) Magnetic Particle Equipment: The inspection of metal that can be magnetized by magnetic particle equipment is widely known by their trade names, Magnaflux and Magnaglo. This method of inspection is very useful in detection of flaws or cracks located on or near the surface of ferro-magnetic material. Magnetic particle inspection methods utilize the fact that the magnetic lines of force, or flux, of an applied field tend to pass through the metal rather than the surrounding air. If there is a surface crack or a defect near the surface, the distribution of the magnetic flux is disturbed and some of it is forced to pass out through the surface of the metal. Opposite magnetic poles form on either side of the crack. Thus, in this area, the field strength is increased by the presence of the flaw, and when fine particles of magnetic material (ferrous oxide powder) are applied to the part, they are attracted to these defective regions and form a pattern. In addition to cracks, the types of flaws that can be detected include seams, laps, nonmetallic inclusions near the surface, and folds. Several types of portable magnetic equipment are available that are very useful for field testing.

(7) Measuring and Hardness Testing Devices: The use of many modern measuring instruments and gages will be useful in the inspection of the airplane. Mechanical and optical micrometers for the measurement of thicknesses and many types of hardness testing equipment are available. For a description of hardness testing equipment, refer to paragraph 8.

4. Evaluation of Fire Damage

A. Method of Evaluation: When the airplane structure has been damaged by fire, it is necessary to evaluate completely the extent of the damage. Loss of tensile strength, lessening of resistance to corrosion, or complete loss of strength of the structure, can result from serious fire damage. Visual inspection of primer and metal surface discoloration, Eddy current-comparison tests, hardness testing, and tension testing of aluminum alloys, are good methods for inspecting degree of fire damage.

B. Hardness Testing: Hardness of a material enables it to resist permanent deformation, penetration, or abrasion. A close relationship exists between the hardness and the tensile strength of heat-treated steel. A similar relationship does not exist for other airplane materials such as aluminum, stainless steel, and magnesium. Hardness gives an indication only of temper for such materials. Before testing a material for hardness, remove all paint and foreign material. Anodizing, which is hard, and cladding, which is soft, must be removed at the point of penetrator contact. However, clad 7075-T6 material up to 0.090-inch thickness can be tested without removing the protective anodic or clad coating shown in Figure 2. Because of the tendency of the penetrator to cut through material of 0.036-inch gage and under, a true hardness reading is not obtained. Even though only portable hardness testers are described in the following paragraphs, a bench-type tester should be used whenever available, as the readings are generally more accurate. When using various testers, calibrate them frequently on test blocks furnished with instruments.

Thickness	Rockwell "B" Scale Reading	Rockwell "E" Scale Reading
0.036 and under	---	102-110
0.037-0.050	78-90	104-110
0.050-0.062	76-90	104-110
0.063-0.071	76-90	102-110
0.071-0.090	73-90	102-110

Rockwell Scale Hardness Readings
Figure 2

C. The Riehle Hardness Tester: The Riehle portable hardness tester is calibrated in Rockwell scales defined in Figure 3. The tool uses three different penetrators: a diamond Brale, either a steel ball 1/16-inch or 1/8-inch diameter. The standard anvils (flat, vee, and convex), furnished with the tool, can be supplemented with special purpose anvils of local manufacture, made from 1-inch-diameter, cold-rolled steel rod. When a part is to be tested for hardness, select proper anvil and penetrator, and then back off loading screw to prevent hitting the penetrator with part to be tested. The part is clamped between anvil and penetrator by a clamp adjusting knob. Rotation of bezel on load indicator brings its pointer over a black dot, after which the minor load is applied by means of loading screw, as indicated by pointer on SET position. Next, the bezel on the penetration indicator is rotated to bring its pointer to zero (outer scale) position. By means of the loading screw, the major load is applied by bringing the pointer of the load indicator to the required position. The pointer returns to SET position when the major load is removed by the loading screw, after which the hardness value is read on the indicator.

Designation	Penetrator	Major Load Kilograms	Load Indicator Position	Dial Figure
A	Brale	60	A	Black
D	Brale	100	B	Black
C	Brale	150	C	Black
F	1/16-inch ball	60	A	Red
B	1/16-inch ball	100	B	Red
G	1/16-inch ball	150	C	Red
H	1/8-inch ball	60	A	Red
E	1/8-inch ball	100	B	Red
K	1/8-inch ball	150	C	Red

Riehle Tester Scale Calibration
Figure 3

D. Barcol Impressor-Type Portable Hardness Tester: The Barcol impressor is a comparison hardness tester, not ordinarily used as a precise basis for material acceptance. Its application is limited to aluminum alloys, and it is particularly useful on parts inaccessible to a Riehle tool or on material too thick for a Webster hardness gage. Do not use the Barcol impressor on rough or uneven surfaces nor on aircraft steels. The impressor is a hand-held instrument which measures depth of penetration caused by a needle point. Force is applied by hand pressure, and a lever transfers resultant depth measurement to a dial. The dial indicates the hardness. A stop prevents excessive pressure from damaging needle. The instrument heel and the needle penetrator must rest on the same plane and be perpendicular to the part, to obtain accurate readings and to avoid breaking penetrator. To provide a basis for comparison, either calibrate the impressor on a strip of metal of a known Rockwell hardness, or take an edge-reading of material to be tested with a Riehle tester. In any case, use the lowest Barcol reading from the sample area as a minimum value. The impressor is not recommended for reliable testing of 7075-T6 material, since the hardness value of that temper is in the extreme upper range of the tester. However, in the inspection of 7075-T6 structure, which is suspected of damage due to heat, the impressor can be used to advantage. Test the part or sheet in question. At the lowest point Barcol reading, a 1-inch disk cut can be made for testing on a bench-type tester, or by a Riehle hardness tester.

E. Ernst Portable Hardness Tester: The Ernst portable hardness tester is a small, versatile instrument which requires access to one side of the material only. This test is recommended for use as a comparator only. It includes a diamond point penetrator and reads in either Rockwell or Brinell scales, depending on model. To ensure accurate readings, depress the handgrips with a steady and even force until the fluid column has stopped moving. The final position of the fluid indicates the hardness value directly on the scale. Do not use the Ernst tester on rough or uneven surfaces, nor on material not firmly supported, to prevent sagging.

F. Webster Portable Hardness Gage: The two types of Webster hardness gages commonly used, models B and B75, are portable testers or pliers. They are used as comparators on aluminum alloys only. When a sheet is too large to be tested by more accurate means, a Webster gage can be used, but the gage must first be calibrated by means of test strips made of the same material as that to be tested and known to have the correct Rockwell hardness. Both Webster models use a blunt needle penetrator actuated by a spring. The depth of penetration is measured, and the resulting value is indicated on a dial. The B model has a penetrator slightly more blunt than the B75, making possible a wider range of hardness values. On the other hand, the penetrator of the B75 model is more sensitive than the B type, thus covering a smaller range of hardness values, but making it well suited for testing 2024-T and 7075-T6 materials. Both models can be identified by the model designation, etched on the shank. Two adjustments can be made on Webster gages; the zero adjustment of the dial indicator, and the load spring adjustment. The zero adjustment can be checked by operating the gage against the bare anvil and noting whether or not the hand comes to rest on the zero line. The load spring adjustment can be checked in conjunction with a standard Rockwell tester. For the B model, set to read 17 to 18 on 2024-T3 material (Rockwell E-101).

For the B75 model, set to read 10 to 11.5 on 2024-T3 material (Rockwell E-101). Minor variations of these figures will be found, because of differences in gage and cladding thickness. When using the Webster gage, place part to be tested between anvil and penetrator, and exert pressure on the handle until the bottom is reached. Excessive pressure beyond this point is not necessary. Do not twist the part. Keep surfaces parallel to each other during test. Read hardness value directly from dial.

G. Primer Discoloration and Fire Damage: When fire damage to airplane structure is not extensive enough to produce buckling or distortion, careful comparison of the color of zinc chromate primer can be a guide to damage. Usually untinted primer is pale, greenish yellow; however, when subjected to 148.9°C (300°F) for a few minutes, the color changes to a light tan. Tinted primer is usually chrome green, and darkens when subjected to the same conditions as untinted primer. Therefore, the indication of untinted primer is more reliable than tinted primer in the lower temperature ranges, since the change is more obvious. Temperatures which discolor the primers will cause the physical properties of 2024-T and 7075-T6 materials to undergo changes. Any 7075-T6 material softens and weakens; 2024-T4 material becomes harder to a degree, since it ages artificially, until the temperature to which it is exposed reaches 204.4 to 232.2 C (400 to 450 F), depending on length of exposure, at which time it softens and weakens. Even though the strength of 2024-T4 material is increased by exposure to lower temperatures, normally its corrosion-resisting properties are seriously affected. Whenever doubt exists as to condition of these alloys, subject them to hardness and tension testing. Hardness values for aluminum alloys are indicated in Figure 4.

NOTES:

1. Even though no correlation exists between tensile strength and hardness of aluminum alloys, it has been established that loss in tensile strength occurs at a more rapid rate than loss in hardness. A difference of more than two points of Rockwell "E" scale between any two areas of a part manufactured from 2014-T, 7075-T6, or 7079-T6 materials indicates an appreciable strength loss. (Use of the Rockwell "E" scale is recommended. If the use of the Rockwell "B" scale is necessary, the difference should not exceed one point). Any part which falls below the minimum hardness of more than two points in the Rockwell "E" scale, even if hardness is above the minimum as specified in Figure 4, must be replaced or specimens must be removed from the doubtful areas with the lowest hardness readings, and sent to a laboratory for tension tests.
2. Normally, any 2024-T material which has been subjected to heat sufficient to discolor the primer must be replaced, due to the loss of corrosion resistance.
3. Large or thick aluminum alloy parts resist fire damage much better than do smaller or thinner parts. When parts are damaged, all apparently undamaged parts must be tested for hardness if they are adjacent to the damaged part.

Material	Rockwell "E" Scale Reading	Rockwell "B" Scale Reading
Clad 2014-T6	103-110	80-90
Non-clad 2014-T6	104-110	81-90
Non-clad 7075-T6	106-114	85-94
Clad 7075-T6	See Fig. 2	
Non-clad 7079-T6	104-114	81-93

Material Hardness Readings
Figure 4

REPAIR SEALING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Sealing is accomplished through the use of various sealant materials. In some applications, a two-part (accelerator (catalyst) and base) compound is used, while in other applications a single-part sealing compound is used. Tapes also are used as sealing devices.

B. Sealants are used to accomplish several functions such as dams, in insulating functions and obstructive devices to ensure against leakage of air, chemicals, and fluids. Sealants also are used as electrolytic barriers between dissimilar metals. Sealants are applied to faying surfaces, as fillets, and in butt joints.

C. Cleaning is required before application of repair sealants. A successful seal depends on utmost cleanness of the sealing area, therefore, thorough cleaning, as well as correct mixing and application of sealing material, is mandatory.

D. Besides temperature, another factor that affects the cure rate (and application life) of sealants is the relative humidity. At any given temperature, the application and curing time of mixed sealant, applied at high relative humidity of over 50 percent, will be much shorter than the time required when the sealant is applied at a low humidity of below 20 percent. At a humidity below 20 percent, the curing time will be greatly extended. When the application time and subsequent curing rates are critical factors, a preliminary test of the mixed materials is recommended.

2. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the following listed items.

Item	Name	Number	Manufacturer	Use
A	Clean white cotton wipers		Local supply	To apply cleaning compound and to clean area
B	Stiff fiber or nylon brush		Local supply	To scrub cleaning areas
C	Safety cans		Local supply	To store cleaning compound
D	Heavy-duty fast-drying stripper	Methyl ethyl ketone TT-M-261	Commercially available	To remove moderate amounts of dirt or contamination and to finish to bare metal

Item	Name	Number	Manufacturer	Use
E	Heavy-duty slow-drying stripper	Douglas No. 14 (ethyl acetate, Spec. No. TT-E-751)		To remove heavy deposits of dirt or contamination and to finish to bare metal
F	Light-duty solvent-type stripper	Douglas No. 15 (solvent No. TL-4119)	W.P. Fuller & Co. 222 N. Ave. 23., Los Angeles, Calif.	To remove light deposits of dirt or contamination
G	Explosion-proof flashlight		Local supply	To light source in hazardous areas
H	Inspection mirrors		Local supply	For viewing aid in confined areas
I	Neoprene rubber gloves		Local supply	For hand protection when applying compound
J	Plastic face shield			For face protection when applying compound
K	Spatula		Local manufacture	To apply sealant

3. Repair Sealants

A. Figure 1 lists the materials used in repair sealing and the nominal mixing ratios, cure rates, and storage life of various compounds.

4. Cleaning

A. Precautions

(1) Cleaning is the most critical operation in sealing. Contamination is the greatest deterrent to successful sealing. Oil from hair, hands, lubricants on tools, preservatives on materials, grease pencil marks, dust, dirt, chips, and moisture keep sealants from adhering properly. Compressed air used in an area to be sealed must be adequately filtered to remove oil, water, or other contaminants.

(2) Cleaning compounds used in sealing operations are solvents, and are harmful to the skin. Use neoprene rubber gloves and plastic face mask as well as adequate protective clothing for personnel protection.

<u>CAUTION</u>: DO NOT USE CLEANING SOLVENTS TO REMOVE SEALANTS FROM SKIN. IF SKIN IS EXPOSED TO SOLVENTS, WASH IMMEDIATELY WITH MILD SOAP AND WATER. PERSONNEL PROTECTIVE EQUIPMENT AND ADEQUATE VENTILATION MUST BE PROVIDED BEFORE BEGINNING CLEANING OPERATION.

B. Types of Cleaning Compound

(1) The light-duty solvent-type cleaning compound is a light naptha material which evaporates rapidly. It is best suited for light cleaning operations involving the removal of slight deposits of dirt or surface compound. It is safe to use on primed or painted surfaces.

(2) The heavy-duty cleaning compounds are strippers. Methyl ethyl ketone, the fast drying stripper, is used as a more exacting cleaner to remove moderate amounts of dirt or contamination and to finish down to bare metal. Ethyl acetate, the slow drying stripper, is used to remove heavy deposits of dirt, contamination, and to finish down to bare metal.

<u>NOTE</u>: Neither stripper will remove FR primer.

C. Application of Cleaning Compound

(1) Pour cleaner on cloth and wring out excess.

<u>NOTE</u>: Either stripper may be applied with a stiff fiber or nylon brush. For brush applications, pour slight amount of cleaner on immediate area. Wipe up excess immediately. Do not contaminate cleaner by dipping into container and allowing excess to run back into fresh supply.

(2) Clean area with cloth moistened with solvent-type cleaner and use brush or cloth, with stripper type cleaners using light, quick wiping action in short scrubbing strokes.

(3) Wipe area dry with clean cloth before cleaner evaporates and redeposits dirt.

<u>NOTE</u>: Cleaning compounds evaporate quite rapidly. Make certain they do not evaporate before wiping area dry.

(4) Continue cleaning action, refolding cleaning or drying cloth so a clean, unused area of the cloth is applied to surface. Change both cleaning and drying cloths as often as required to prevent recontamination from cloth.

TYPE SEALANT	MATERIAL (BASE)	ACCELERATOR (CATALYST)	SPECIFICATION OR SOURCE	MIXING RATIO BY WEIGHT	
				BASE	CATALYST
ALUMINIZED	CS-2410	CS-2410A	CHEM. SEAL CORP. OF AMERICA, 12910 PANAMA, LOS ANGELES, CALIF.	100	10
HIGH ADHESION	PR-1422B2	PR-1422A	MIL-S-8802, CLASS B, PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIF.	100	13.5
HIGH ADHESION	PR-1435B	PR-1435A	PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIF.	100	13.5
SILICONE RUBBER-BASED	RTV-1016	RTV-9910	GENERAL ELECTRIC CO., SILICONE DIV., 8555 E. FLORENCE, DOWNEY, CALIF.	100	6 TO 14 (VARIES WITH LOT AND DESIRED CURE RATE)
SILASTIC SILICONE PRIMER	RTV-1200	ONE PART	DOW CORNING CORP., 3033W. MISSION ROAD, ALHAMBRA, CALIF.		
CYCLEWELD	C-14	C-14A	CHRYSLER CORP., CYCLEWELD DIV., 5800 S. EASTERN, LOS ANGELES, CALIF.	100	7
SILASTIC ADHESIVE	NO. 140	ONE PART	DOW CORNING CORP.		
PERMANENT MASTIC TAPE	NO. PRC-620		PRODUCTS RESEARCH CO.		
MYLAR FOIL ADHESIVE TAPE 2-INCH WIDTH	NO. 113-LC		TAPE AND LABEL CONVERTERS, 3215 E. PICO, LOS ANGELES, CALIF.		
VINYL TAPE 2-INCH WIDTH	SCOTCH NO. 472		MINNESOTA MINNING AND MANUFACTURING CO.		

BB3-393

Repair Sealants
Figure 1 (Sheet 1)

SHELF LIFE (MONTHS)	APPLICATION TIME AND CURE RATE AT ROOM TEMPERATURE 25.0°C (77°F) AND 50% RELATIVE HUMIDITY)			ACCELERATED CURE RATE (HOURS)	STORAGE LIFE AT -23.5°C (-10°F) AFTER QUICK FREEZE AT -65°C (-85°F) (DAYS)	USAGE
	MINIMUM APPLICATION LIFE (HOURS)	TACK FREE TIME (HOURS)	CURE RATE AT ROOM TEMPERATURE (HOURS)			
6	2	24	48		10	PRESSURE SEALING SAFETY AND CORROSION SEALING WEATHER SEALING
6	2 1/2	30	72	1 AT ROOM TEMPERATURE FOLLOWED BY 8 AT 62.8°C (145°F)	10	PRESSURE SEALING WEATHER SEALING FUEL TANK
6	1/2					TAPER FILLET ON EXTERNAL DOUBLER
3 AT 4.9°C (40°F)	2 1/2 OR 7 TO 8	10 TO 12 OR 18	24 TO 48	1 AT ROOM TEMPERATURE FOLLOWED BY 2 TO 4 AT 93.3°C (200°F)	2 AT -12.2°C (10°F) OR 5 AT -65.0°C (-85°F)	ANTI-ICING SEALING SAFETY AND CORROSION SEALING
			1/2 MINIMUM			PRIMER FOR RTV-1016
		APPROXIMATELY 4	APPROXIMATELY 4 TO GEL STAGE	4 AT 48.9°C (120°F) AFTER GEL STAGE		HONEYCOMB LEAK REPAIR
						DOOR SEAL REPAIRS
						CABIN FLOOR SEALING
						PRESSURE SEALING
						CABIN FLOOR SEALING

BB3-425

Repair Sealants
Figure 1 (Sheet 2)

5. Removal of Defective Sealant

A. Protect adjacent area from dirt, tools, and foreign material by covering area with heavy paper or wiping cloths.

B. Remove defective sealant, using plastic or nonmetallic scrapers and stiff brush.

C. Taper both ends of existing sealant to ensure a minimum of 1/2-inch overlap of new sealant over existing sealant. Abrade overlap area to aid in adhesion of new sealant to existing sealant.

D. Immediately before application of new sealant, clean repair area thoroughly with heavy-duty cleaning compound. Do not saturate cleaning cloths with excess cleaning compounds that may enter voids, and contaminate area. Dry the cleaned area immediately with a clean, dry, lint-free, cotton cloth.

6. Application of RTV-1200 Primer

A. Silastic silicone primer No. RTV-1200 is applied to all surfaces where RTV silicone sealant is to be applied, and to all FR primed-surfaces to which sealant is to be applied.

B. Thoroughly clean and dry all surfaces to which primer and sealant are to be applied, using heavy-duty, fast-drying cleaning compound.

C. Pour small amount of primer into clean container and apply primer as brush coating. Do not allow primer to puddle, and do not apply excessive amounts.

NOTE: Keep RTV primer containers tightly sealed until material is to be used. This will minimize absorption of atmospheric moisture, which will cause poor adhesion of sealant. Primer which has absorbed an excessive amount of moisture will have a cloudy appearance and must be discarded immediately.

D. Check for excessive primer application. Excessive application is evident if the coating blushes to a milky appearance within 5 minutes after application. Immediately wipe such areas with a clean, dry cotton cloth, and remove milky appearance.

NOTE: After wiping, additional application of primer is not required.

E. Allow primer to dry for at least 30 minutes. Allow longer drying time if possible.

F. Carefully protect all primed surfaces from incidental handling.

7. Preparation of Sealant

A. Add accelerator to base compound. Mix material thoroughly. It is extremely important to avoid unmixed pockets of the accelerator and the base compound.

NOTE: If unfavorable storage conditions have caused the accelerator to dry out and cake, do not attempt to use it by adding solvent. Discard this accelerator.

B. When mixing quantities of materials less than 1 quart, use a clean metallic container and a metallic spatula.

C. When mixing quantities of materials more than 1 quart, a mechanical mixer is recommended. Mix slowly until an even color is obtained. Use care to avoid inclusion of air during mixing.

NOTE: A high-speed mechanical mixer will cause heat to be generated, thus reducing application life of sealant.

D. Repair kits of PR-1422, which contain a sufficient quantity of materials for limited application, are available. Since base compound and accelerator are in proper weight proportions in individual containers, add all the accelerator to container of base compound. Mix with metallic spatula. Make sure all the accelerator is emptied from its container.

NOTE: Under standard temperature conditions, application time, or usable life, of mixed PR-1422 can be adjusted by manufacturer to be suitable for use over a time range, from 15 minutes to 8 hours. To obtain a rapid cure of PR-1422, maintain metal surface temperature at not less than 24°C (75°F), nor more than 54°C (130°F), during application and curing cycles.

8. Application of Sealant

A. Faying Surface Seal (See Figure 3.)

(1) Apply sealant over one entire surface until uniform thickness of approximately 1/64 inch is obtained. Work out all air bubbles with a spatula.

(2) Join component parts and install required fasteners.

NOTE: If permanent fasteners cannot be installed before work life of sealant expires, secure parts with temporary fasteners until sealant has cured; then install permanent fasteners. Make certain parts do not shift and damage seal.

(3) Fair extruded sealant.

B. Fillet Seal (See Figure 3.)

(1) Using spatula (see Figure 2), spread sealant along seam in short increments (not over 3 feet).

(2) Work applied portion of sealant with spatula to fill in all voids, and to eliminate air bubbles.

NOTE: Working the sealant is of utmost importance. The quality of seal is dependent largely upon the thoroughness and care used in working out air bubbles. When working out air bubbles, open bubbles to form a cavity, and fill with fresh sealant. Make cavities large enough to facilitate thorough filling with fresh sealant.

(3) Form heavy fillets in layers, working each new layer before preceding layer has set up.

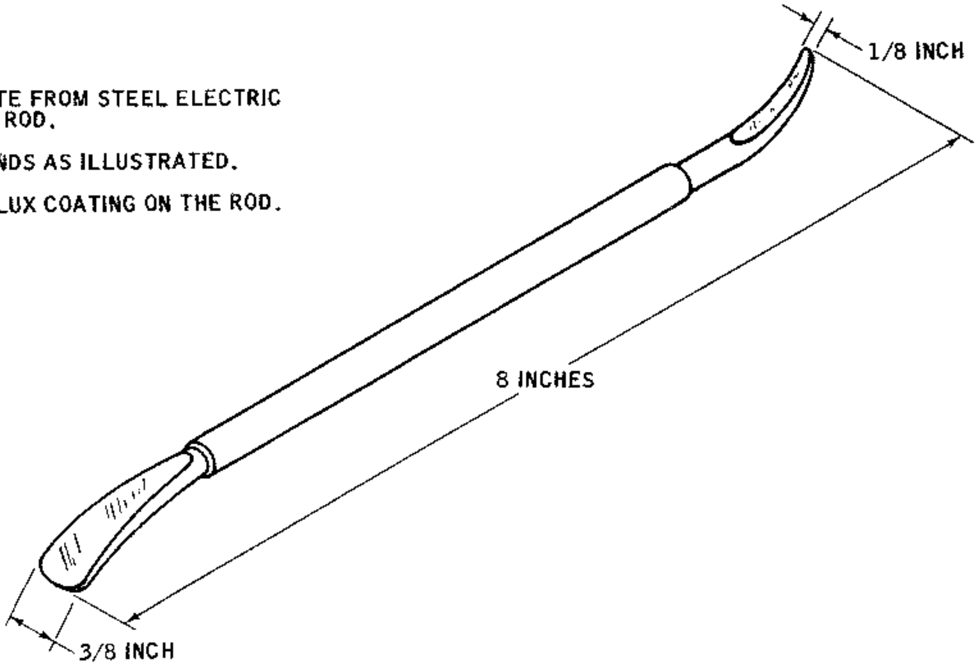
9. Typical Sealing

A. Typical Bolt, Stud Bolt, and Screw Sealing (See Figure 4.)

(1) Remove all cutting fluid, preservatives, lubricants, dyes, pencil marks, etc.

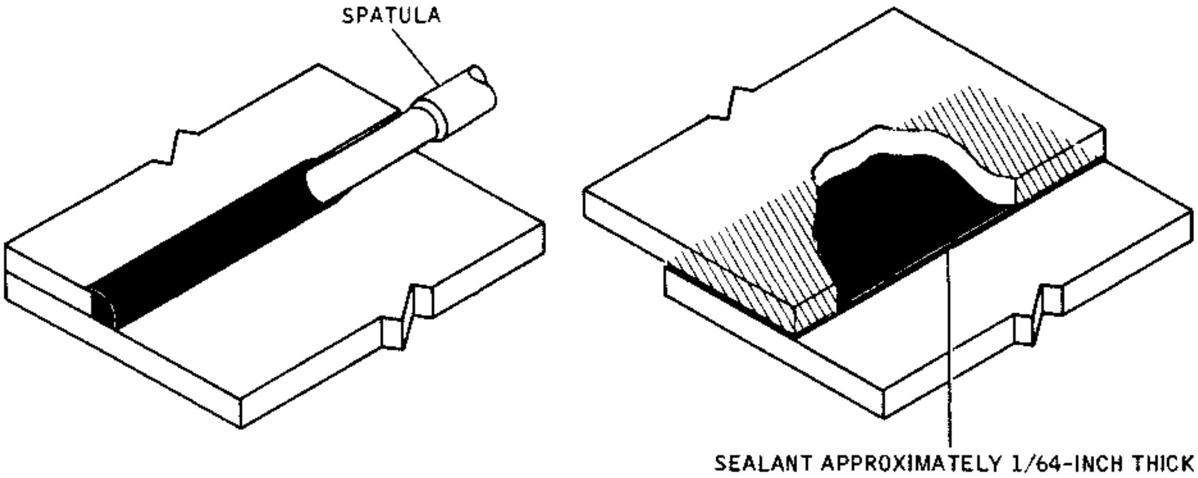
NOTES:

1. FABRICATE FROM STEEL ELECTRIC WELDING ROD.
2. FORGE ENDS AS ILLUSTRATED.
3. LEAVE FLUX COATING ON THE ROD.



BB3-395

Typical Fillet Seal Spatula
Figure 2



FORMING FILLET WITH SPATULA

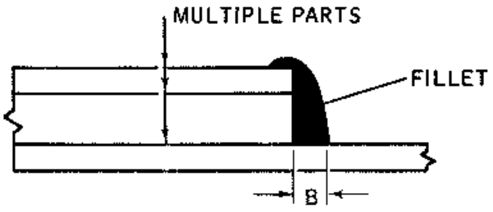
TYPICAL FAYING SURFACE SEAL

A DIMENSION = LESS THAN 1/4-INCH
B DIMENSION = 1/4-INCH

FINISHED FILLET
PART LESS THAN 1/4-INCH THICK

A DIMENSION = MORE THAN 1/4-INCH
B DIMENSION = 1/4-INCH MINIMUM

FINISHED FILLET
PART MORE THAN 1/4-INCH



B DIMENSION = 1/4-INCH MINIMUM

FINISHED FILLET
MULTIPLE PARTS BEING FILLETED

BB3-394

Typical Faying Surface and Fillet Seals
Figure 3

(2) Apply sealant on inside surface of attach hole. Build up a small bead around hole on side from which bolt or screw is to be inserted. Use enough sealant to ensure a ring of sealant will extrude around head of bolt or screw during final torque tightening. Seal flush screws with a bead of sealant applied in the dimple or countersink, after applying sealant on inside surface of hole.

(3) Insert bolts through seal boundaries from inside in every possible case. When bolts must be inserted from outside, or from one seal boundary to another, seal bolts, and coat both sides of all washers under the nut with sealant.

B. Typical Covered Nutplate Sealing

(1) Clean outside of cap before anchor nut is installed.

<u>CAUTION</u>: EXERCISE CARE IN CLEANING. KEEP ALL CLEANING SOLUTIONS OUT OF THE NUT. THE NUT CONTAINS A SPECIAL LUBRICANT ESSENTIAL TO PROPER ASSEMBLY.

(2) After anchor nut is installed, clean outside surface and apply a fillet of sealant from top of cap to surrounding structure. If two-part anchor nuts are installed, the fillet must cover metal cap and base completely.

C. Typical Splined Dome Nut Sealing

(1) Install splined dome nuts with a small fillet of sealant applied completely around faying surfaces and filling relief groove.

(2) When washers are used with splined dome nuts, press a clean washer firmly against the sealant applied above. Apply an additional bead of sealant on exposed side of washer and against spline.

D. Typical Lockbolt Sealing (See Figure 4.)

(1) Seal shanks of lockbolts passing through steel members in a sealed area by applying sealant on inside surface of hole and building up a small bead around hole on side bolt is to be inserted.

(2) Remove sealant from locking grooves before installing collar.

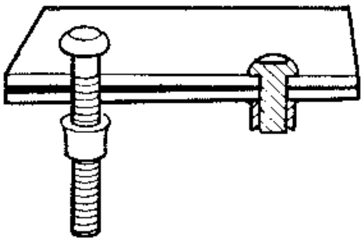
<u>CAUTION</u>: DO NOT CLEAN LOCKBOLTS OR COLLARS BEFORE INSTALLATION. THE SPECIAL LUBRICANT ON THE PARTS IS ESSENTIAL TO PROPER ASSEMBLY. DO NOT USE ANY SEALANT IN THE HOLE, ON THE LOCKBOLT, OR ON THE COLLAR EXCEPT IN CASES WHERE THESE PARTS ARE USED IN STEEL OR TITANUIM MEMBERS.

<u>NOTE</u>: Interference fit lockbolts do not require sealing.

E. Typical Rivet Sealing (See Figure 4.)

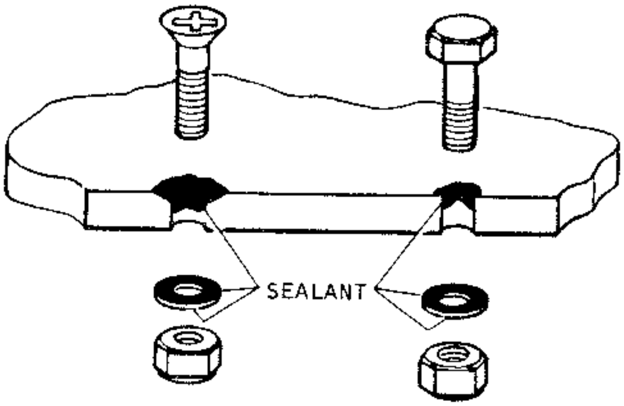
(1) When a rivet is properly upset, the rivet itself expands sufficiently to form a seal.

<u>CAUTION</u>: RIVETS MUST NEVER BE DIPPED IN SEALANT BEFORE THEY ARE INSTALLED.



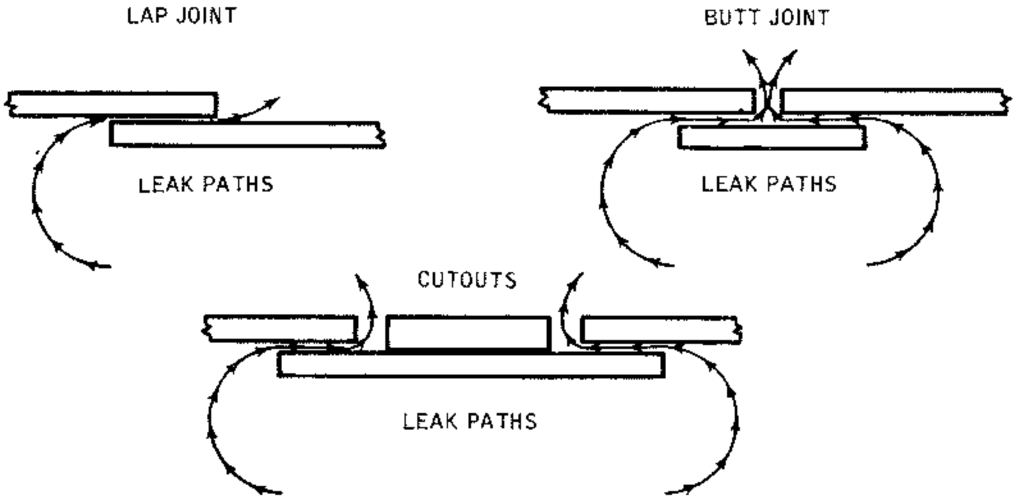
NOTE: INTERFERENCE FIT SEALS HOLE. LOCKBOLTS PASSING THROUGH A FAYING SURFACE SEALED AREA MUST HAVE THE HEAD SEATED AND SEALANT REMOVED FROM THE LOCKING GROOVES PRIOR TO INSTALLING THE COLLARS.

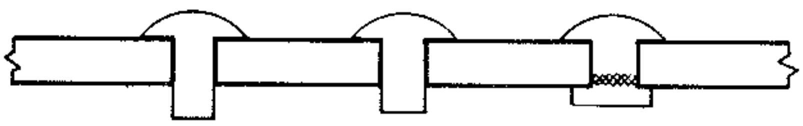
TYPICAL SEALING OF LEAK PATHS WITH LOCKBOLTS



NOTE: BOLT OR SCREW SEALS HOLE WITH THE AID OF SEALANT.

TYPICAL SEALING OF LEAK PATHS WITH BOLT OR SCREW





NOTE: RIVET SEALS HOLE BY SWELLING AND FILLING INSIDE OF HOLE. IN A PROPERLY UPSET RIVET THIS SWELLING IS AT A MAXIMUM AT THE UPSET END (NOTE SHADED PORTION). THE SWELLING WILL SEAL THAT END OF THE HOLE FOR A DISTANCE OF 1 TO 1 1/2 TIMES THE RIVET DIAMETER.

TYPICAL SEALING OF LEAK PATHS WITH RIVETS

BB3-396

Typical Sealing of Leak Paths with Fasteners
Figure 4

(2) When parts of a faying surface are drawn together, sealant will extrude from rivet holes. Use a clean, dry cotton cloth to wipe away any excess sealant before rivet is inserted, and again before rivet is upset.

NOTE: Remove cured sealant from countersinks and all fastener-bearing surfaces.

F. Typical Sealing of Metal-Bonded Honeycomb Assemblies

(1) Test for Leaks

(a) Submerge assembly completely in water heated to 73.9°C to 85°C (165°F to 185°F).

(b) Check for leaks as evidenced by bubbles.

(c) If leaks are immediately evident, mark location and immediately remove assembly from water.

CAUTION: EXERCISE CARE IN HANDLING HOT ASSEMBLIES. WEAR ADEQUATE FACE AND HAND PROTECTION.

NOTE: When removing assemblies from water, hold or turn assembly so all water can be drained from trap or pocket areas. Do not allow water to be absorbed through leak paths.

(2) Repair leaks in sealed areas by resealing.

Note: To accelerate the heat-curing cycle, use a test chip with PR-1422 spread approximately 1/4 inch thick. When the PR-1422 on the test chip has reached a hardness reading of 45 on a Rex shore hardness A gage, the sealant is properly cured.

(3) Repair leaks in glue lines as follows:

(a) Heat the assembly to 73.9°C to 85°C (165°F to 185°F) to remove any moisture.

(b) In a clean glass or metal container, mix together 100 parts, by weight, of Cycleweld C-14 and 7 parts, by weight, of C-14A accelerator.

NOTE: Avoid using absorbent containers. Mix only needed quantities of C-14. The pot life of C-14 is 30 to 40 minutes at 23.9°C (75°F).

(c) Remove assembly from heat application and apply the mixed C-14 to areas of glue line leaks while assembly cools to room temperature.

NOTE: Bubbles from the glue line leaking through the C-14 is an indication that internal pressure buildup in assembly has not been reduced enough to draw the C-14 into the void. The application must continue until assembly has reached the approximate ambient temperature.

(d) After completion of repair, remove excess C-14 by wiping with a clean, dry cotton cloth.

(e) Heat cure the C-14 at 49°C (120°F) for 4 hours after gelling.

G. Typical Structural Seam Sealing

(1) Figure 6 illustrates and describes typical sealing of structural seams.

H. Typical Sealing of Floor and Seat Tracks

(1) Figure 7 illustrates and describes typical sealing of floor and seat tracks.

I. Typical Pressure Sealing

(1) Figure 8 illustrates and describes typical pressure sealing.

J. Typical Seal-Type Taper Fillet on External Doubler (See Figure 9.)

(1) Clean fillet area with Douglas No. 14 stripper, or equivalent, followed by Douglas No. 15 stripper, or equivalent.

(2) Wipe area dry with clean, dry cotton cloth.

(3) Apply masking tape to area around doubler, leaving space of required taper length between tape and doubler.

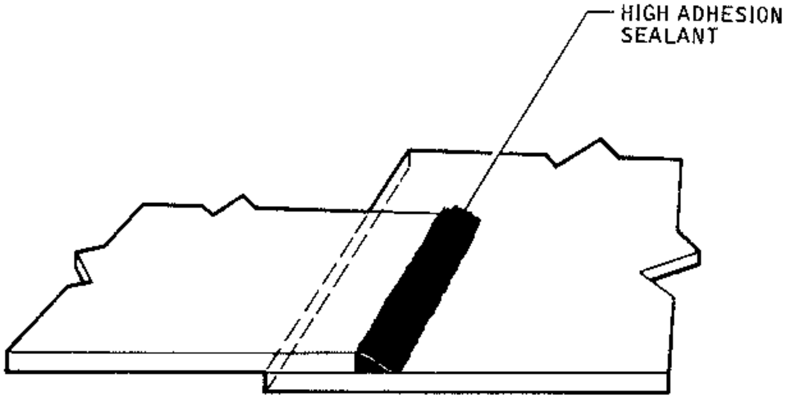
(4) Apply masking tape around edge of doubler.

(5) Mix 10 parts, by weight, of PR-1435A with 100 parts, by weight, of PR-1435B. Continue mixing operation until a homogeneous mixture is obtained.

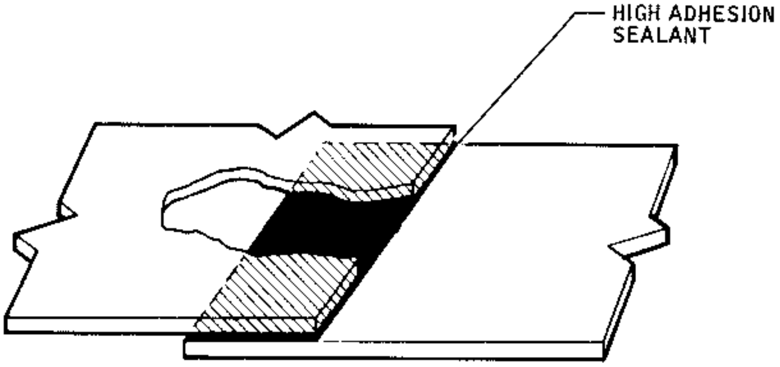
(6) Apply sealant to area between masking tapes and fair to desired taper.

NOTE: The sealing mixture has a pot life of 15 minutes and will cure at room temperature.

(7) Brush aluminum powder over surface, if color is desired.



SEAM SEALED BY INSTALLING A FILLET ALONG THE ENTIRE LENGTH OF THE SEAM. THE FILLET SHOULD BE INSTALLED ON THE SIDE OF THE STRUCTURE WHICH IS TO RETAIN THE FLUID, GAS OR VAPOR. THIS WILL RESULT IN THE RETAINED MATERIAL PUSHING THE FILLET AGAINST THE SEAM AND INCREASING THE EFFECTIVENESS AS A SEAL.



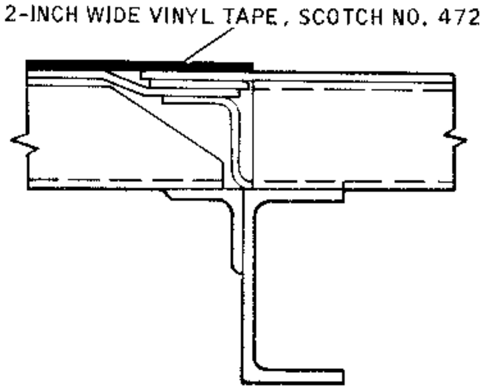
SEAM SEALED BY APPLYING SEALANT TO THE FAYING SURFACES OF THE SEAM.

NOTES:

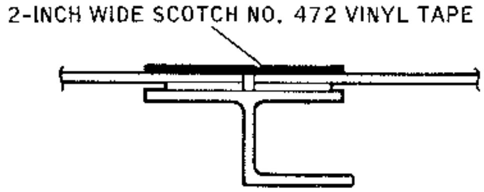
1. A FAYING SURFACE IS THE SURFACE AREA OF TWO PARTS THAT ARE IN DIRECT CONTACT WITH EACH OTHER.
2. A SEALANT DAM IS A SEAL APPLIED TO A PORTION OF A FAYING SURFACE TO PREVENT LEAKAGE THROUGH A SEAM FROM A SEALED TO AN UNSEALED AREA, OR TO LIMIT THE LENGTH OF A LEAK PATH IN A SEAM.
3. SINCE FASTENERS ARE ALWAYS INSTALLED THROUGH THE FAYING SURFACES, THE SEAM SEALS DESCRIBED ABOVE MUST BE ACCOMPANIED BY THE NECESSARY HOLE SEALING FASTENERS.

BB3-411

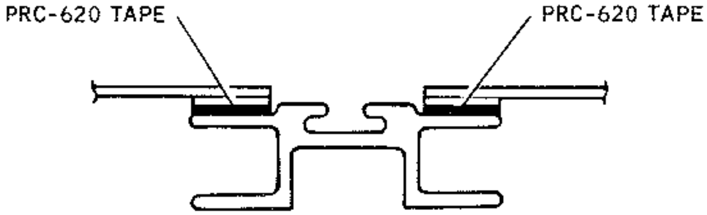
Typical Sturctural Seam Sealing
Figure 5



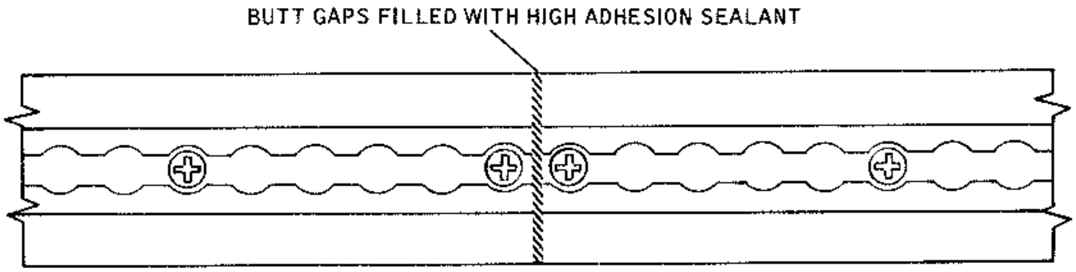
TYPICAL SEALING OF FLOOR PANEL LAP JOINTS



TYPICAL SEALING OVER FLOOR PANEL BUTT JOINTS



TYPICAL SEALING BETWEEN FLOOR PANELS AND SEAT TRACKS

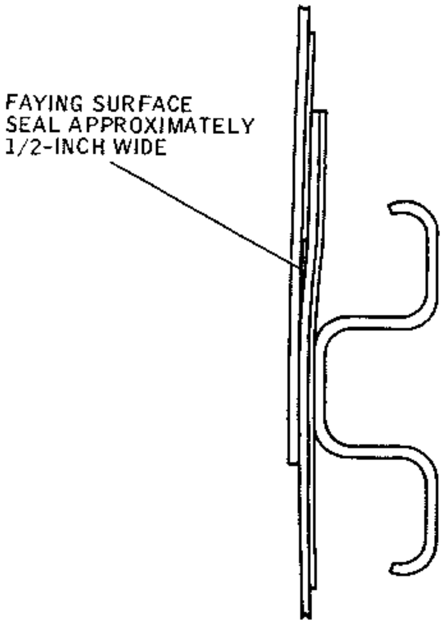


TYPICAL SEALING OF SEAT TRACK BUTT JOINTS

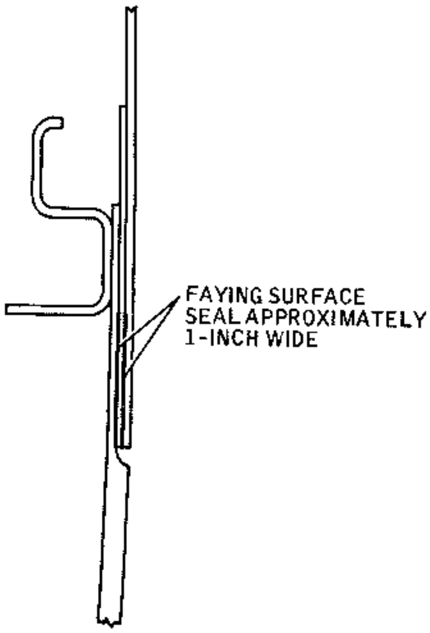
BB3-410

Typical Sealing of Floor and Seat Tracks
Figure 6

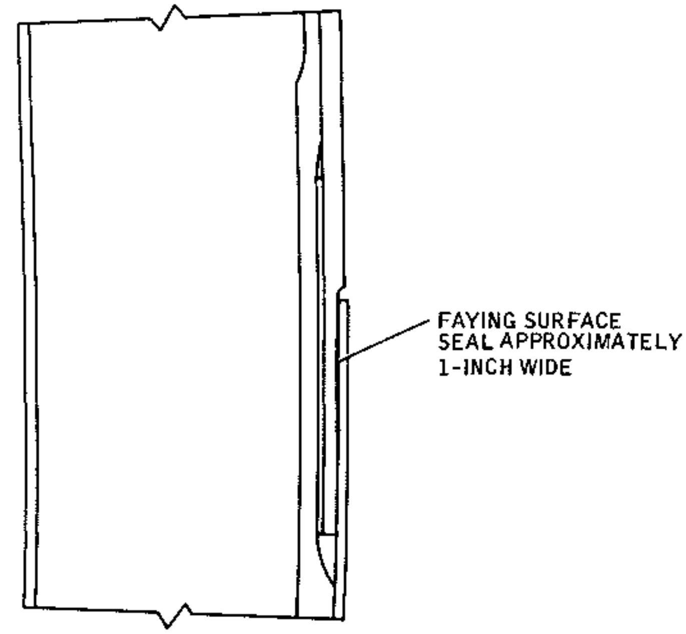
Printed in U.S.A.



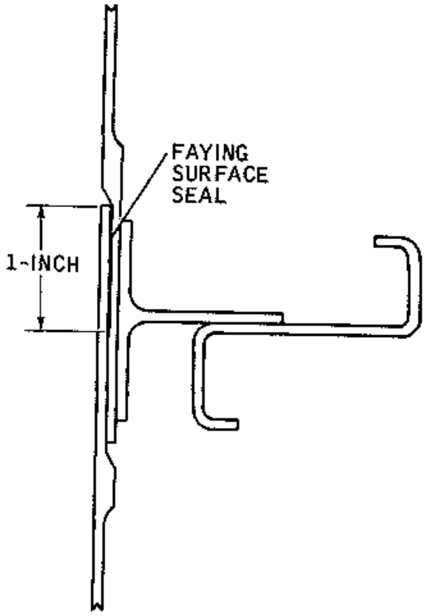
SCALLOPED DOUBLER



MEMBERS STEPPING UP
ONTO WINDOW BELT DOUBLER



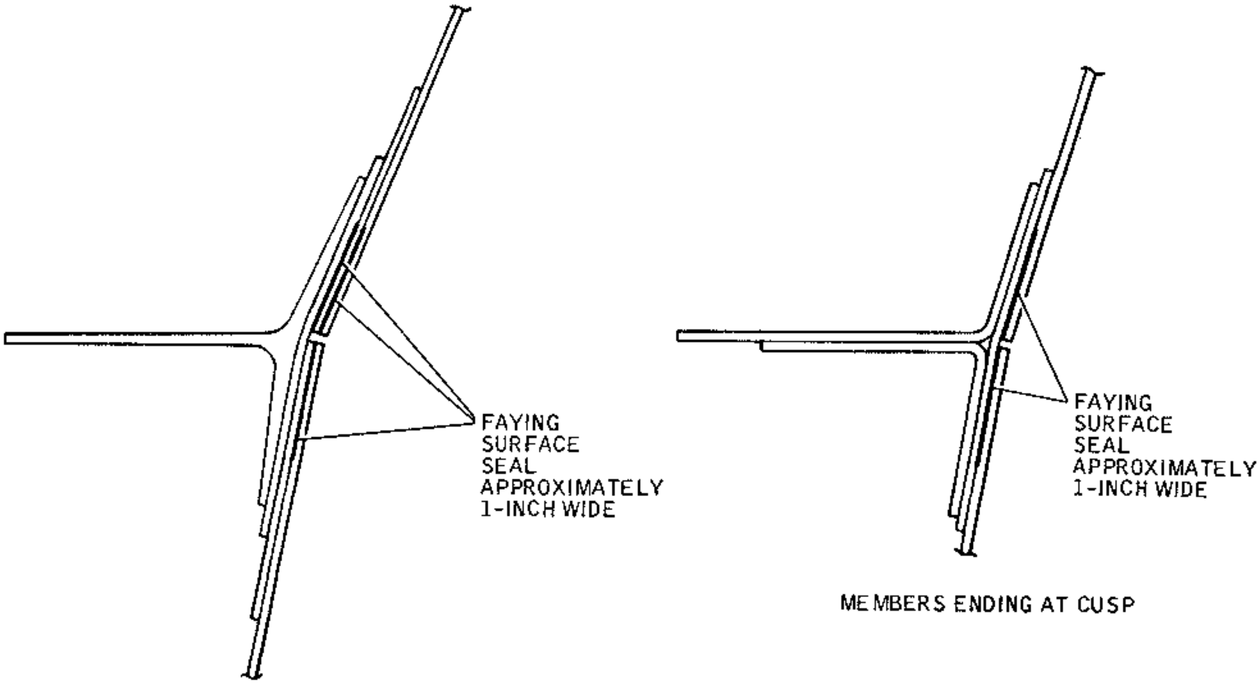
OUTER SKIN TO MATING MEMBER



LAP JOINTS OF WINDOW BELT
PANELS

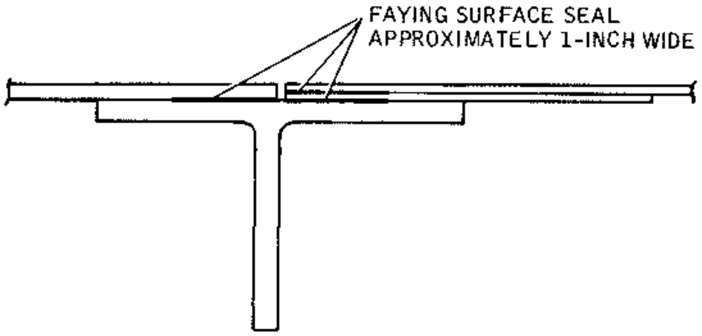
BB3-397

Typical Pressure Sealing
Figure 7 (Sheet 1)



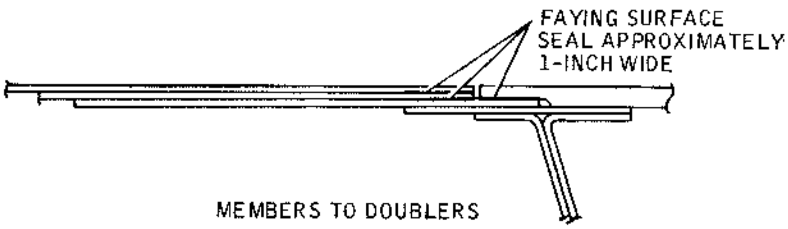
MEMBERS ENDING AT CUSP

MEMBERS ENDING AT CUSP



MEMBERS ENDING AT CENTER OF STATION FRAME

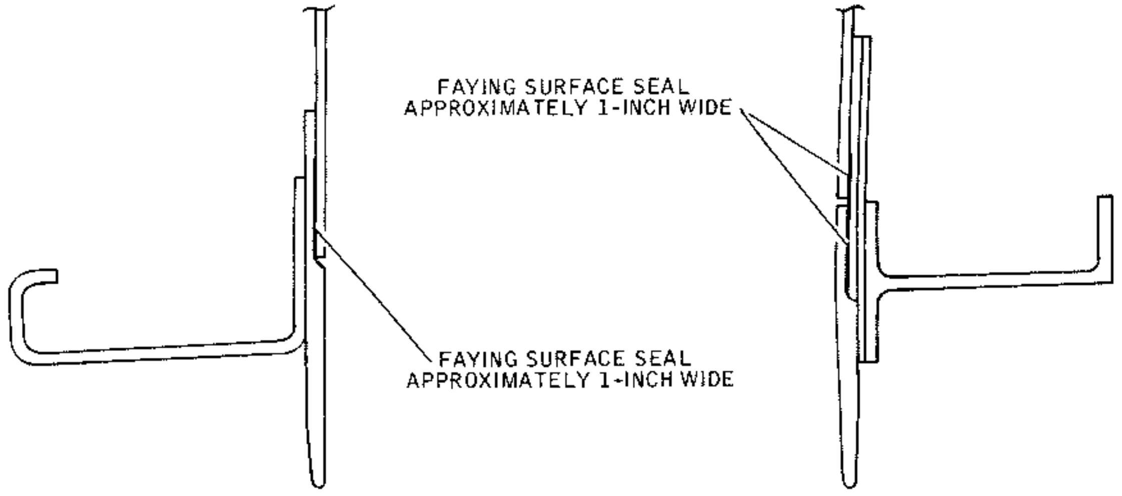
MEMBERS ENDING AT CENTER OF SPLICE



MEMBERS TO DOUBLERS

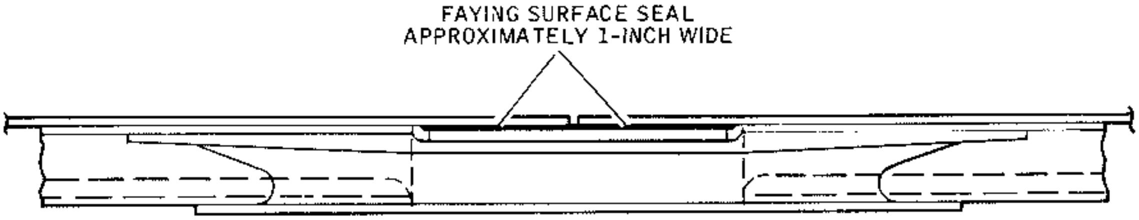
BB3-398

Typical Pressure Sealing
Figure 7 (Sheet 2)

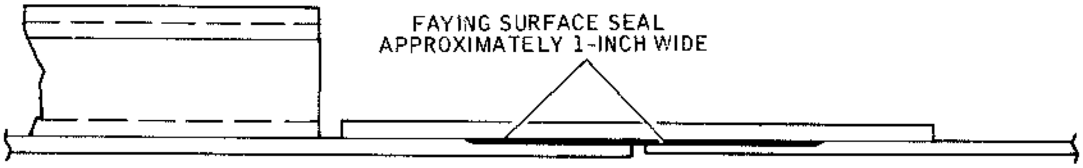


SKIN TO FLIGHT COMPARTMENT WINDOW DOUBLER

SKIN TO DOUBLER AND FLIGHT COMPARTMENT WINDOW DOUBLER TO DOUBLER



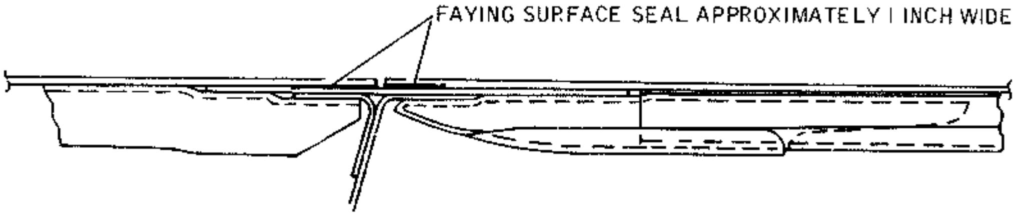
SKIN AND DOUBLER



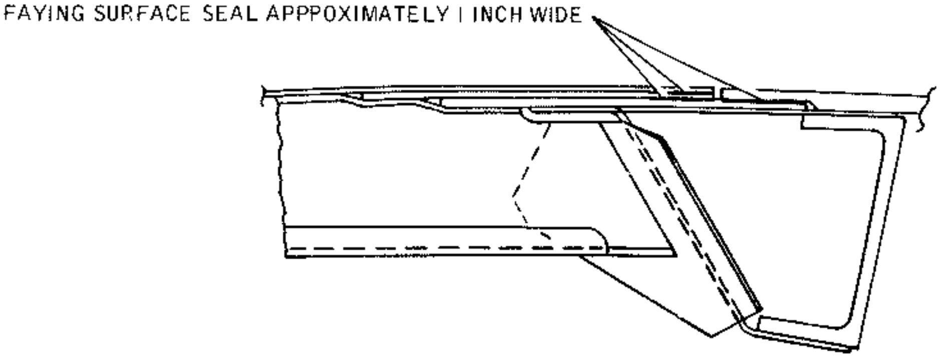
SKIN AND DOUBLER

BB3-399

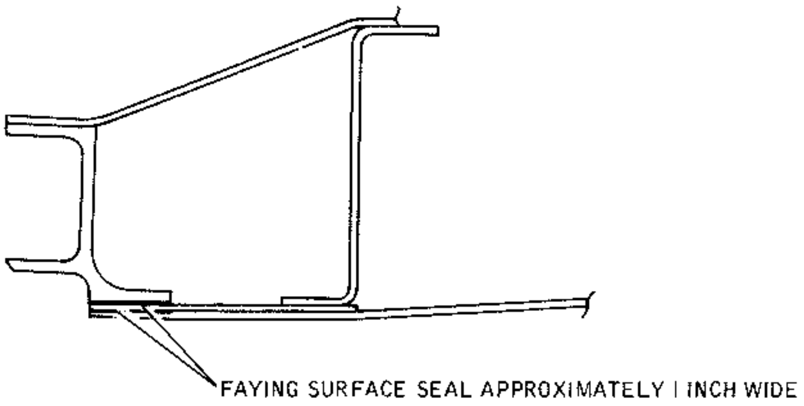
Typical Pressure Sealing
Figure 7 (Sheet 3)



FLIGHT COMPARTMENT SKIN BUTT JOINTS



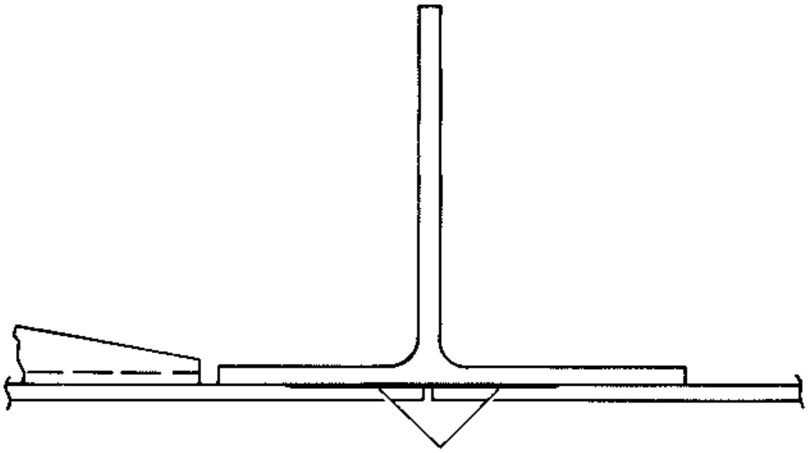
MEMBERS ENDING AT BUTT JOINT OF FLIGHT COMPARTMENT



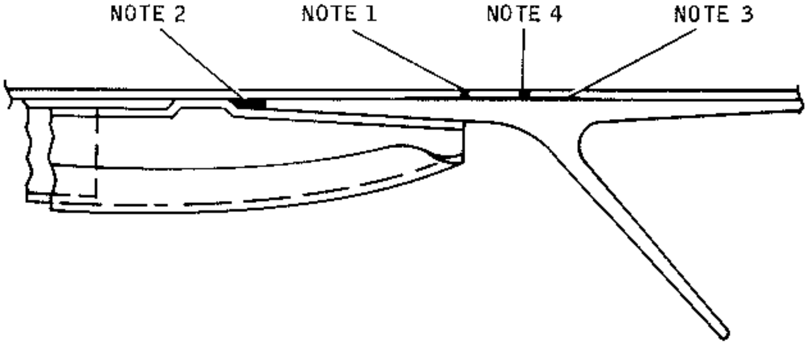
MEMBERS ENDING AT WINDSHIELD SILLS

BB3-400

Typical Pressure Sealing
Figure 7 (Sheet 4)



SKIN TO STATION FRAME



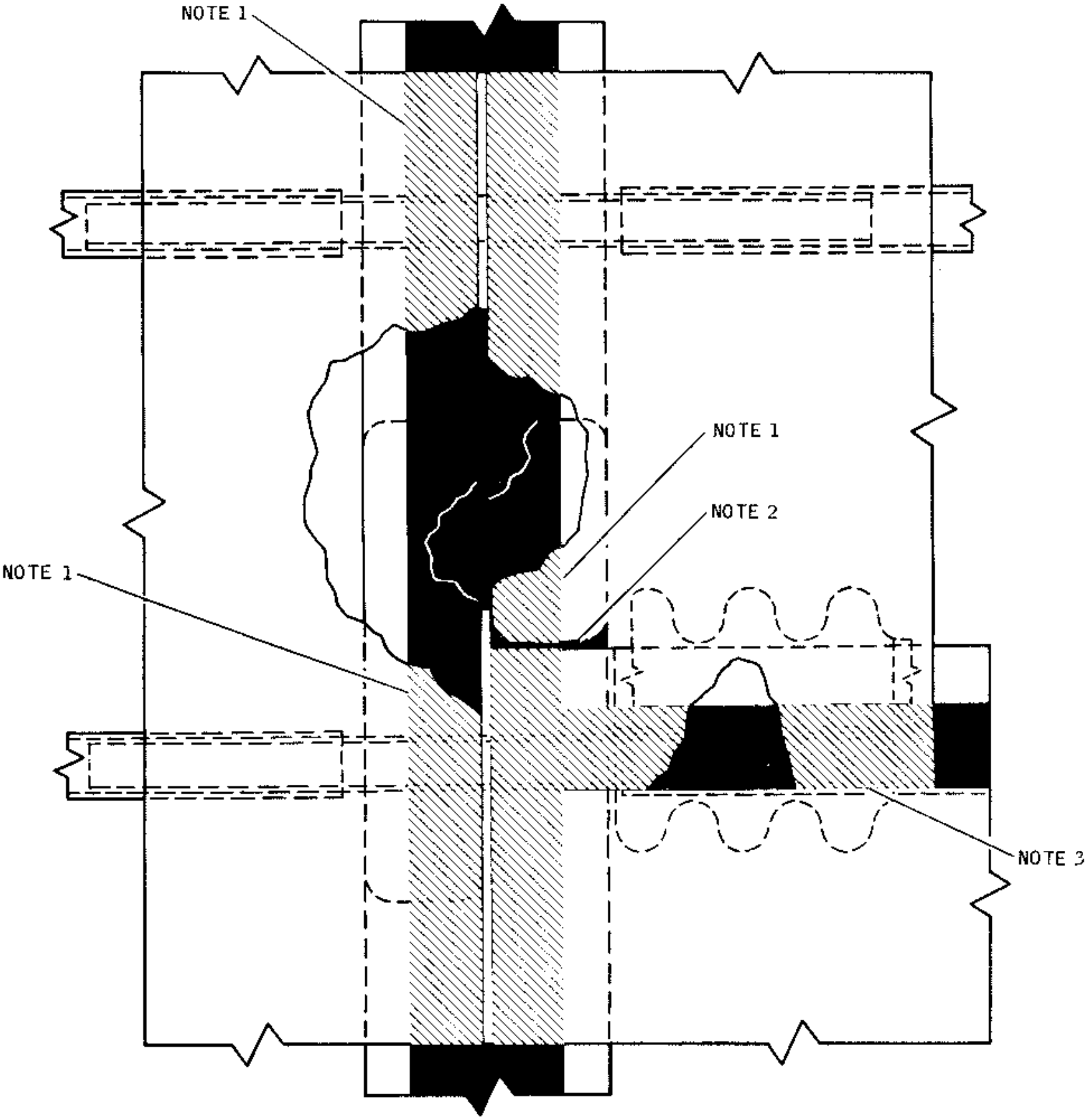
STATION 817 BULKHEAD ATTACH RING

NOTES:

1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN FORWARD SKIN AND STATION 817 BULKHEAD ATTACH RING FROM CUSP TO CUSP ACROSS TOP OF FUSELAGE.
2. FILLET SEAL ON EDGE OF STATION 817 BULKHEAD ATTACH RING FROM CUSP TO CUSP ACROSS BOTTOM OF FUSELAGE.
3. FAYING SURFACE SEAL APPROXIMATELY 1/4-INCH WIDE ON EDGE OF AFT SKIN TO STATION 817 BULKHEAD ATTACH RING FROM CUSP TO CUSP ACROSS BOTTOM OF FUSELAGE.
4. BUTT JOINTS BETWEEN PANELS FILLED WITH SEALANT AT STATION 817 FROM CUSP TO CUSP ACROSS TOP OF FUSELAGE.

BB3-401

Typical Pressure Sealing
Figure 7 (Sheet 5)



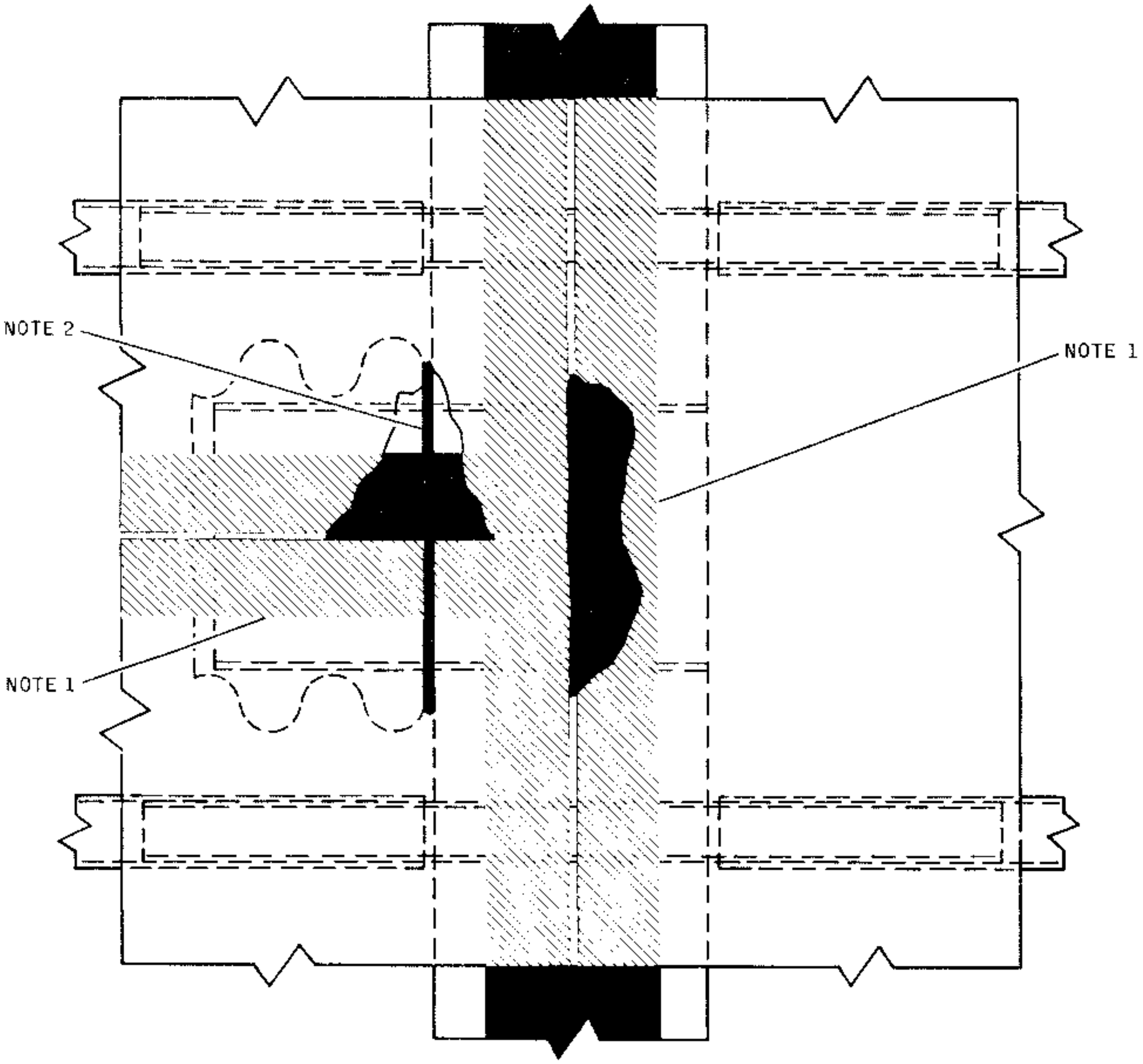
DOUBLERS, STRAPS, SHIMS, SKIN, AND FILLERS

NOTES:

1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE ON EDGES OF SKINS AND ON BOTH SURFACES OF SHIMS OR FILLERS.
2. GAPS BETWEEN DOUBLERS, STRAPS, SKIN, FILLERS, ETC., FILLED.
3. FAYING SURFACE SEAL APPROXIMATELY 1/2-INCH WIDE FROM EDGE OF SCALLOPED DOUBLER.

BB3-402

Typical Pressure Sealing
Figure 7 (Sheet 6)



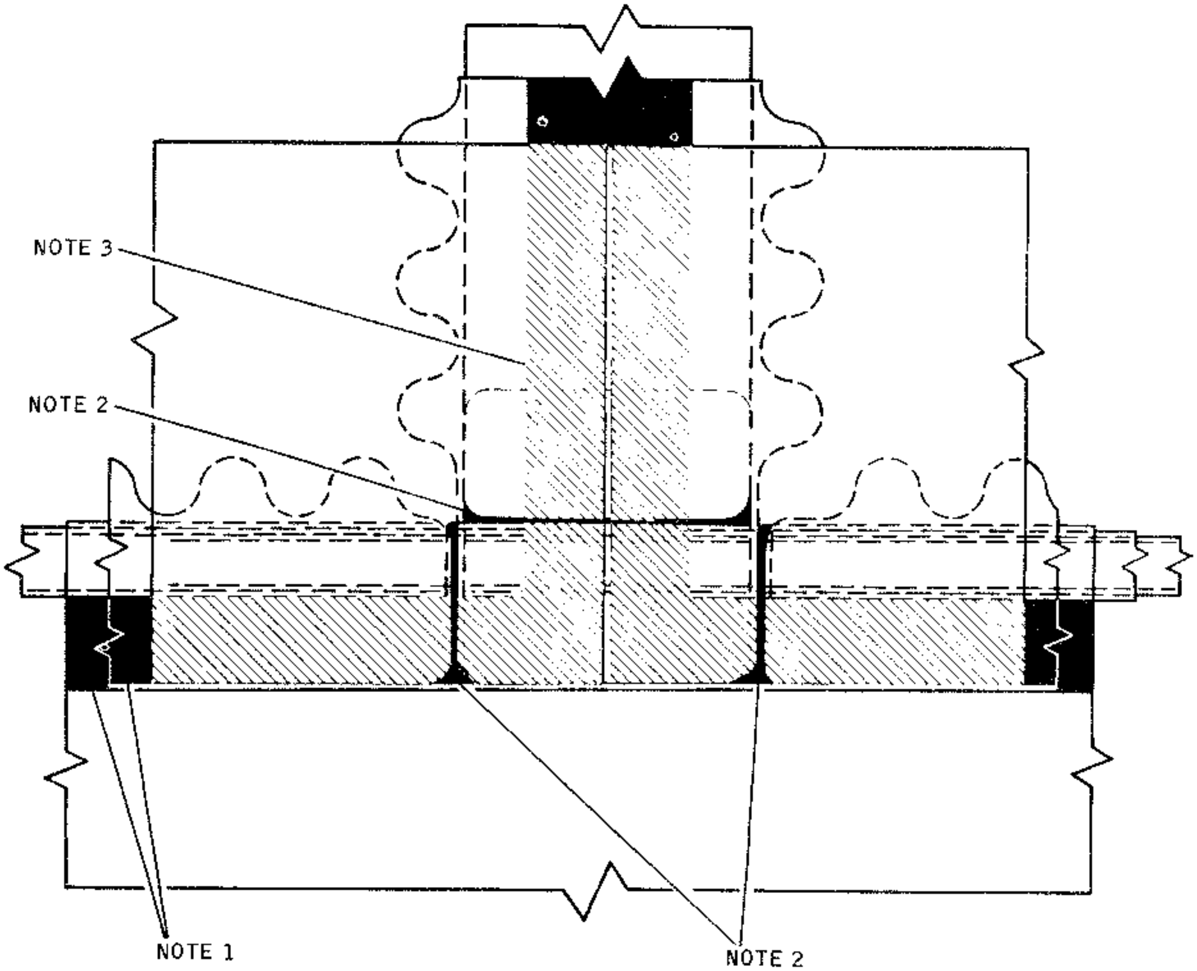
SKIN, DOUBLERS, AND STRAPS

NOTES:

1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE ON EDGES OF SKINS TO DOUBLERS OR STRAPS.
2. GAPS BETWEEN DOUBLERS AND STRAPS FILLED.

BB3-403

Typical Pressure Sealing
Figure 7 (Sheet 7)



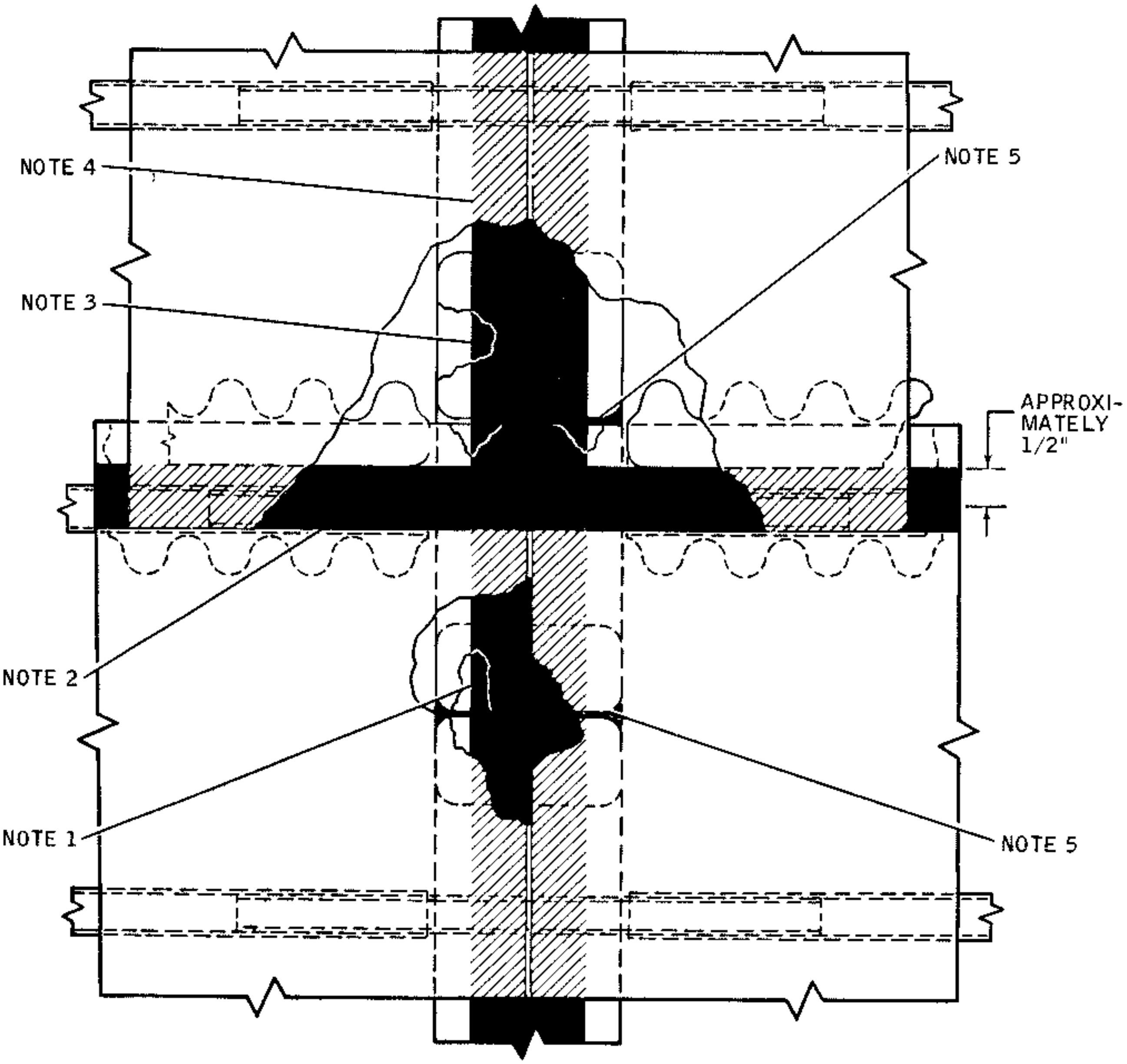
DOUBLERS AND WINDOW BELT PANEL MILL CUT-OUT

NOTES:

1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN ALL MEMBERS AT MILL CUT-OUT ON WINDOW BELT PANELS.
2. GAPS BETWEEN DOUBLERS FILLED.
3. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN SKINS AND DOUBLERS.

BB3-404

Typical Pressure Sealing
Figure 7 (Sheet 8)



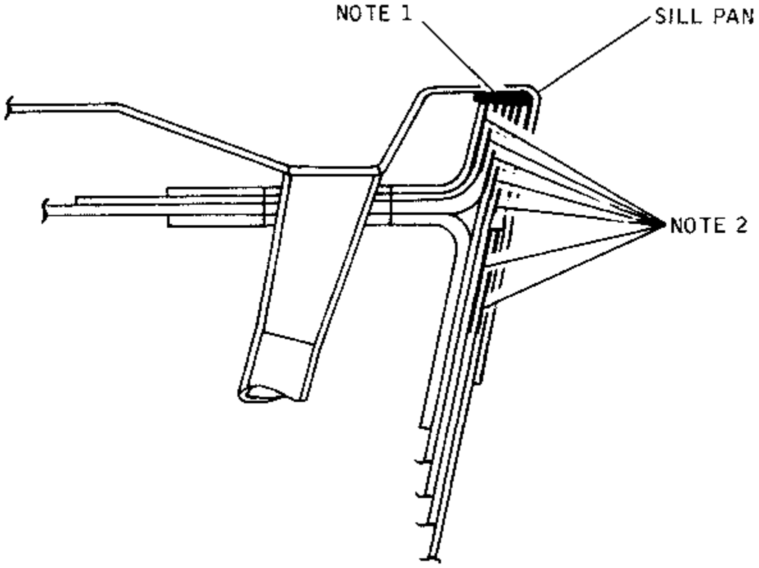
DOUBLERS, SHIMS, STRAPS, AND SKIN

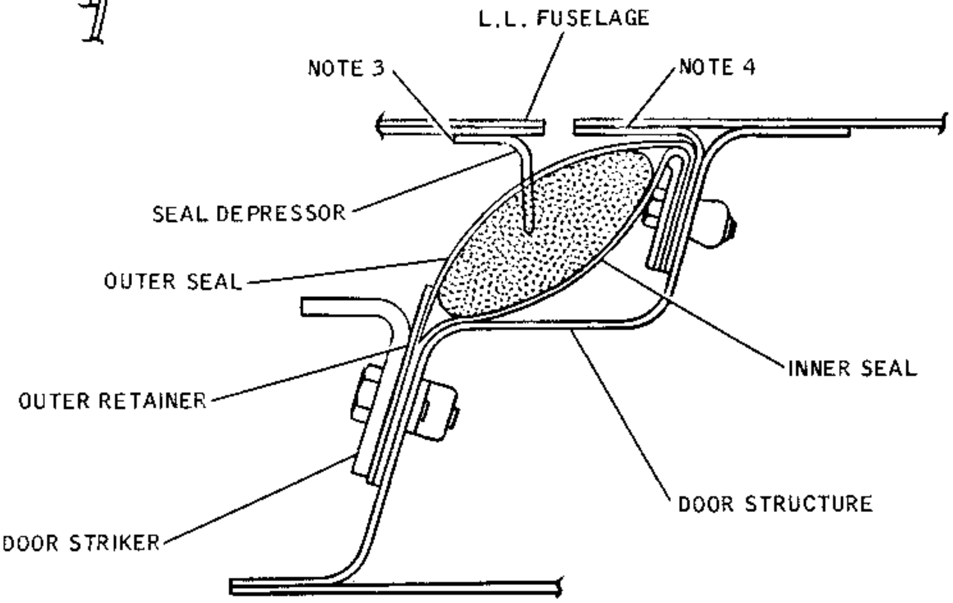
NOTES:

1. FAYING SURFACE SEAL ON SPLICE DOUBLER.
2. FAYING SURFACE SEAL APPROXIMATELY 1/2-INCH WIDE FROM EDGE OF SCALLOPED DOUBLER.
3. FAYING SURFACE SEAL ON SHIM TO DOUBLER.
4. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN SKIN AND STRAPS.
5. GAPS BETWEEN DOUBLERS AND STRAPS FILLED.

BB3-405

Typical Pressure Sealing
Figure 7 (Sheet 9)





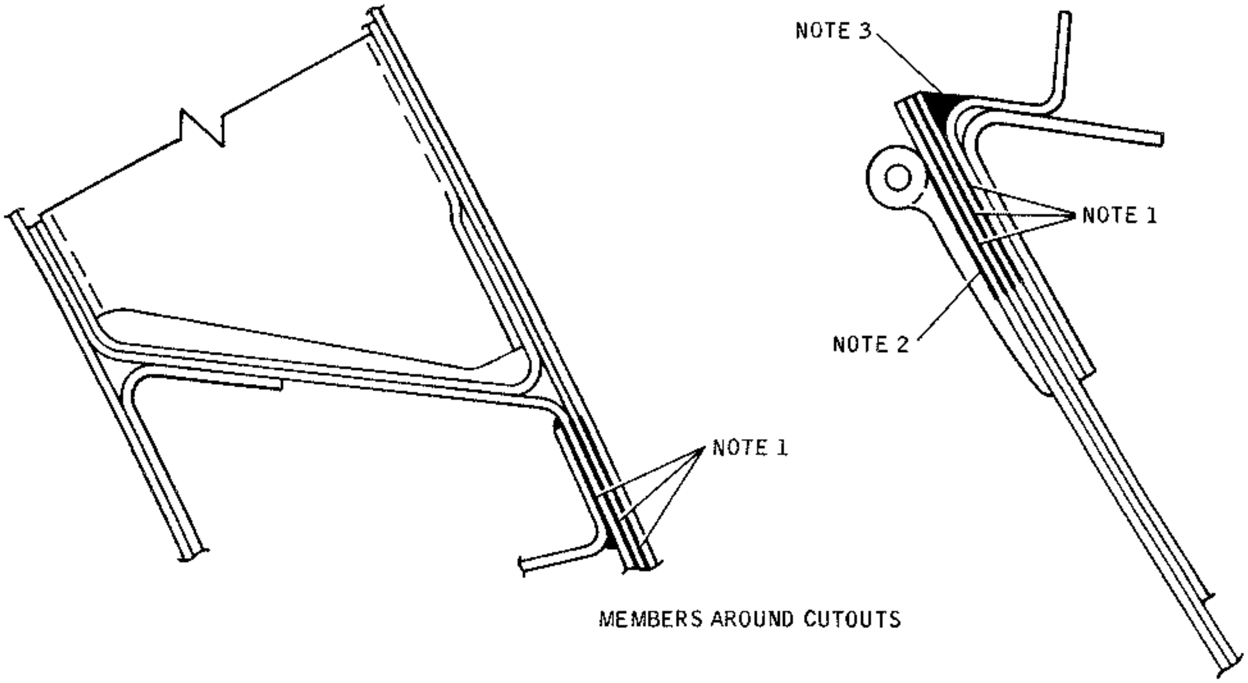
FORWARD SERVICE DOOR AND DOOR JAMB

NOTES:

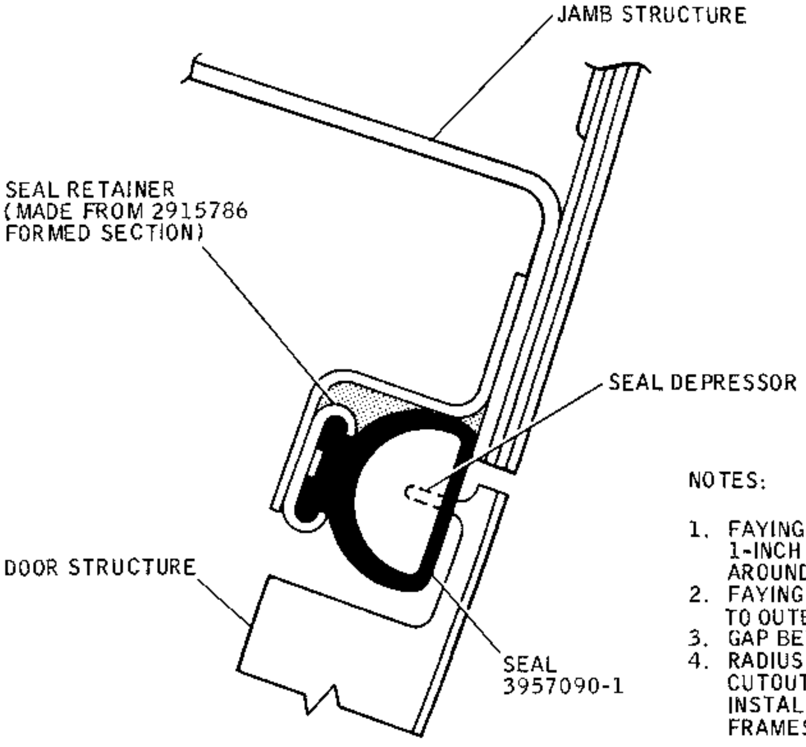
1. GAP BETWEEN SILL PAN AND TRIMMED EDGES AROUND DOOR CUTOUT FILLED.
2. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN ALL MEMBERS ACROSS BOTTOM OF JAMB AND BETWEEN UPPER FORWARD AND AFT ENDS OF SILL PAN TO OUTER SKIN, JAMB PAN, AND SEAL DEPRESSOR ANGLE.
3. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN ALL MEMBERS AROUND DOOR CUTOUT . VOIDS AND GAPS FILLED. 2-INCH STRIP NO. 113-LC MYLAR FOIL TAPE OVER ALL JOINTS OF SEAL DEPRESSOR ANGLES.
4. FAYING SURFACE SEAL BETWEEN PAN ASSEMBLY OR SEAL RETAINERS AND OUTER SKIN AROUND EDGE OF OUTER SKIN. 1/8-INCH FILLET SEAL ON DOOR JAMB SKIN LAPS. BUTT GAPS BETWEEN SEAL FRAMES FILLED WITH SEALANT.
5. DOUBLERS - FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN OUTER SKIN AND DOUBLER AROUND CUTOUT FOR WINDOW AND BETWEEN SKIN AND DOUBLER AROUND CUTOUT FOR HANDLE. FAYING SURFACE SEAL BETWEEN HOUSING PAN AND SKIN DOUBLER AROUND CUTOUT FOR HANDLE.

BB3-406

Typical Pressure Sealing
Figure 7 (Sheet 10)



MEMBERS AROUND CUTOUTS



STAIRWELL DOOR SEAL

NOTES:

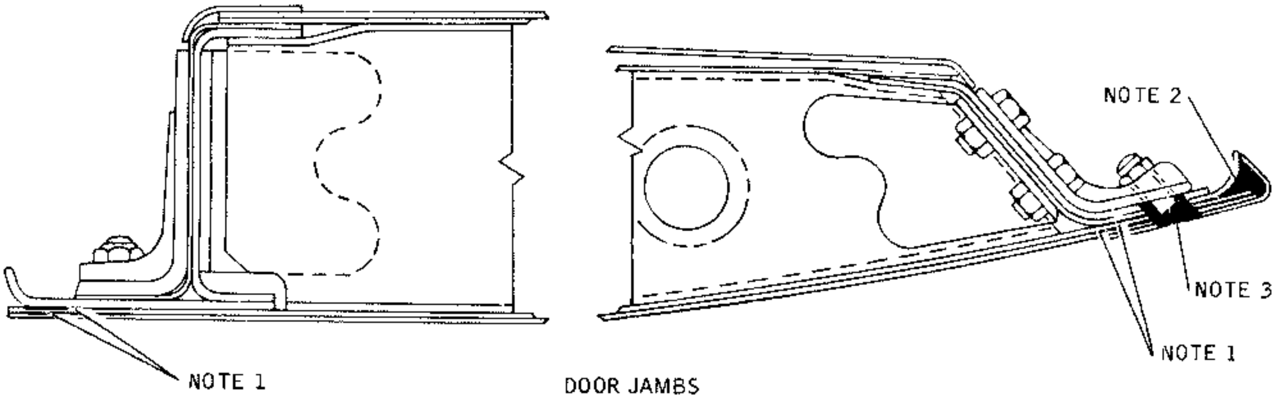
1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN ALL MEMBERS AROUND DOOR CUTOUTS.
2. FAYING SURFACE SEAL ON HINGE HALF TO OUTER SKIN.
3. GAP BETWEEN DEPRESSOR ANGLES FILLED.
4. RADIUS OF SEAL RETAINER ON STAIRWELL CUTOUT FILLED, AFTER BULB SEAL IS INSTALLED. BUTT GAPS BETWEEN SEAL FRAMES FILLED.

NOTE: DOUBLER — FAYING SURFACE APPROXIMATELY 1-INCH WIDE BETWEEN OUTER SKIN AND DOUBLER AROUND CUTOUT FOR WINDOW.

BB3-407

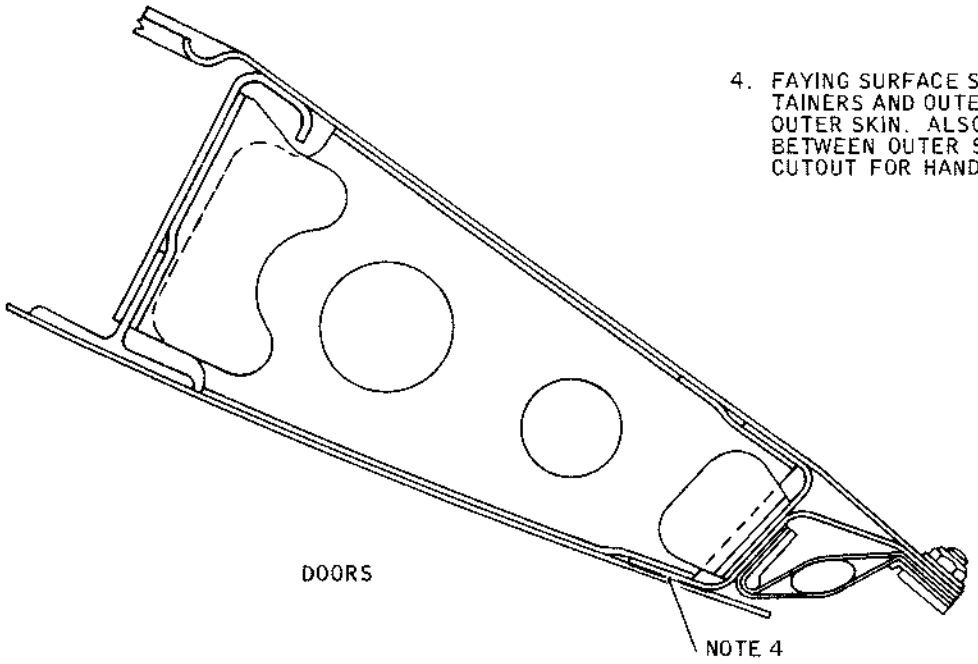
Printed in U.S.A.

Typical Pressure Sealing
Figure 7 (Sheet 11)



NOTES:

1. FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN MEMBERS AROUND CUT OUT. VOIDS AND GAPS FILLED. FAYING SURFACE SEAL ON BOTH SURFACES OF DOUBLERS AT UPPER FORWARD AND AFT CORNERS OF JAMBS.
2. RADIUS OF SEAL DEPRESSOR ANGLE FILLED WITHIN AREA COVERED BY SCUFF PLATE. VOID BETWEEN SEAL DEPRESSOR ANGLE AND SCUFF PLATE FILLED. GAPS BETWEEN SEAL DEPRESSOR ANGLES FILLED BEFORE SPLICES INSTALLED. FAYING SURFACE SEAL ON SEAL DEPRESSOR ANGLES.
3. HOLE AROUND SCREW FILLED WITH NO. CS-2410 ALUMINIZED SEALANT FLUSH WITH SURROUNDING SURFACES (AFTER FINAL ADJUSTMENT OF DOOR STOPS)
4. FAYING SURFACE SEAL BETWEEN SEAL RETAINERS AND OUTER SKIN AROUND EDGE OF OUTER SKIN. ALSO, FAYING SURFACE SEAL BETWEEN OUTER SKIN AND PAN AROUND CUTOUT FOR HANDLE.

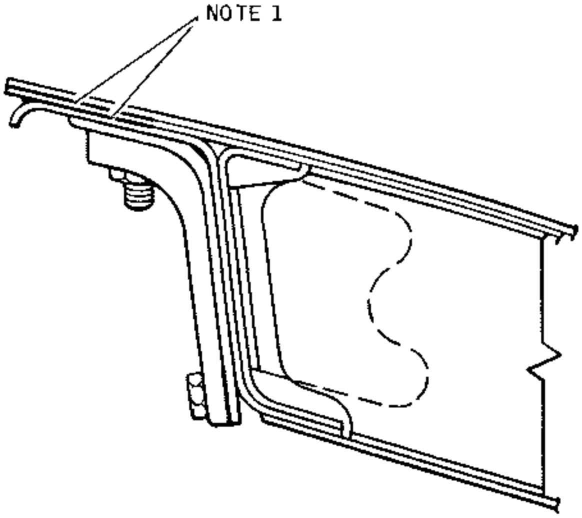


FORWARD AND AFT CARGO COMPARTMENT DOORS AND DOOR JAMBS

BB3-408

Typical Pressure Sealing
Figure 7 (Sheet 12)

Printed in U.S.A.



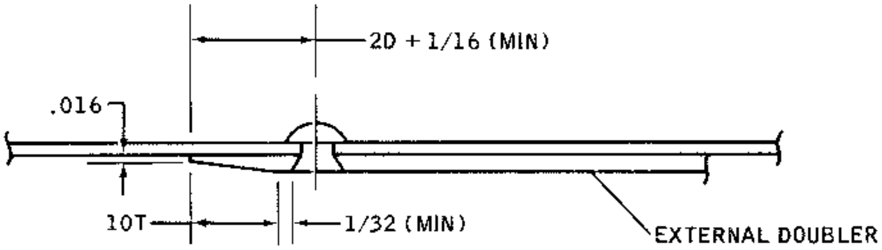
NOTE:

FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN MEMBERS AROUND DOOR CUTOUT. VOIDS AND GAPS FILLED. JOGGLES FILLED WHERE PAN STEPS UP ONTO STATION FRAMES AND DOUBLERS. ALSO, FAYING SURFACE SEAL APPROXIMATELY 1-INCH WIDE BETWEEN OUTER SKIN AND DOUBLER AROUND CUTOUT FOR HANDLE AND FAYING SURFACE SEAL BETWEEN FRAMES AND DOUBLERS AROUND HANDLE CUTOUT IN OUTER SKIN AND BETWEEN FRAMES AND INNER SKIN.

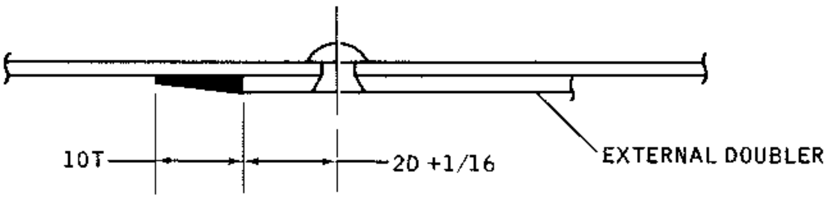
ELECTRICAL/ELECTRONIC DOOR AND DOOR JAMB

BB3-409

Typical Pressure Sealing
Figure 7 (Sheet 13)



MACHINE OR HAND TAPER



SEAL - TYPE TAPER

T = EXTERNAL DOUBLER GAGE

BB3-554

Typical Seal-Type Taper Fillet on External Doubler
Figure 8

SAFETY PRECAUTIONS FOR REPAIRING AND ENTERING INTEGRAL FUEL TANKS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

NOTE: The following instructions are recommended by Douglas Aircraft Co. to prevent injury to personnel and damage to the airplane. All governmental and airline safety practices should also be observed. Where practices recommended by these agencies assure adequate safety, such practices may be used in lieu of those recommended herein.

A. Any airplane that has been in service should be regarded as a potentially dangerous fire hazard. The airplane and the surrounding areas should be placarded accordingly. Defueling and purging operations must not be performed inside a hangar. The operation should be accomplished at least 50 feet from other airplanes, buildings, or spark-producing mobile equipment. The same precautions as used in fueling an airplane, including static grounding, should be observed. Spark producing equipment, such as electrical tools, vacuum cleaners, and soldering irons must be removed from the airplane prior to fueling, defueling, and purging operations. No other work may be performed on the airplane during these operations.

2. Safety Precautions

A. Only explosionproof lights may be used on the inside of the tanks. Electrical tools or other spark producing equipment must not be used on the inside of the tanks or on the airplane.

B. Fire control and prevention personnel must be notified prior to fueling, defueling, or purging operations. Frequent checks of the tanks in which work is being performed should be requested.

C. An airplane respirator and mask must be used when entering a fuel tank that has not been purged free of all fuel vapors. Oxygen masks must not be used. If the tank has been purged and certified safe by fire control and prevention personnel, adequate fresh air ventilation must be obtained while working inside the tank. In each case, a standby guard must be stationed outside the tank while work is being performed inside.

D. Prior to entering a tank which has been temporarily closed, or inactive, the tank must be air ventilated for approximately 5 minutes. The tank should not be entered until fire control and prevention personnel have determined that it is safe to do so.

3. Precautions for Preventing Contamination of Tanks

A. Clean, white overalls must be worn when entering tanks; head and shoe covers must also be worn. Use freshly laundered and dry cleaned overalls, with pant cuffs free of dirt and lint. No clothing made of synthetic material may be worn.

B. All cleaning equipment brought into the tanks must be thoroughly vacuumed. All air hoses that are to be used for ventilation, internally or externally, must be cleaned.

C. At the end of each working period, all fuel tanks in which work has been accomplished must be cleaned. Tanks must be closed when work is not being accomplished.

D. Every precaution must be exercised to prevent contamination of the integral fuel tanks while the tanks are open. All equipment used for air purging to maintain ventilation of the tanks must be equipped with air filters to prevent particles over 74 microns in size from entering the tanks.

CAUTION: DO NOT PLACE COMPRESSED AIR HOSES IN A TANK TO ACCOMPLISH AIR VENTILATION OR PURGING.

4. Precautions for Entering Tanks

A. Drain and Purge

(1) Drain and purge integral fuel tanks fueled with JP-4 to remove the flammable fuel vapors and any residual liquid fuel as follows:

(a) Defuel the tank where work will be accomplished by the use of airplane fuel pumps, the transfer unit, or by draining. Remove the residual fuel from the tank through the tank sump drain fitting. Drain the fuel lines to the tank where work is to be accomplished by removing a connector in the line.

(b) Close the motor-actuated tank fill valves for the tank and electrically disconnect the switches. Tag each valve and fuel pump switch with "DO NOT OPEN--TANK DEFUELED" labels. Continue air venting for 15 minutes.

(c) Remove the access covers and introduce an air section hose into the farthest corner of the tank. Continue air venting for 15 minutes.

(d) Completely remove residual fuel from all areas of the tank by either the suction tube method or by mopping up. Use a proper mask when entering a tank for this operation.

(e) Using the hot air blower-exhauster, ventilate the tank with hot air, 93°C (200°F) maximum, to eliminate such liquid fuel and vapors as may remain in the tank.

(f) Request the fire control and prevention personnel to determine whether the tank is safe before entering. Continue fresh air ventilation at all times.

(2) Integral fuel tanks fueled with kerosene do not require draining or purging of all the fuel tanks and fuel system lines prior to moving the airplane into a hangar. However, before working on or in a tank, drain and purge the tank as follows:

  (a) If work is to be performed in or on a fuel tank, defuel the tank, close and electrically disconnect the fuel tank fill valves, tag the valves and fuel pump switches with "DO NOT OPEN--TANK DEFUELED" labels. Drain the lines leading to the tank where work is to be accomplished.

  (b) Remove access covers and ventilate the tank, using an air suction hose. After approximately 15 minutes of ventilation, remove all residual fuel completely from all areas of the tank. Use either the suction tube method or defuel by mopping up. Use proper masks when entering the tanks for this operation.

  (c) Using the hot air blower-exhauster, ventilate the tank with hot air at 93°C (200°F) maximum temperature to eliminate the fuel vapors.

  (d) Request the fire control and prevention personnel to determine if the tank is safe to work in. Continue adequate ventilation at all times.

INTEGRAL FUEL TANK COATING REPAIR - DESCRIPTION AND OPERATION (DC-9-10, AIRPLANES 1 THROUGH 39 ONLY*)

1. General

   A. Integral fuel tanks may be repaired by the application of No. 823-010 two-part polyurethane coating (Desoto Chemical Co., 615 West Grove Ave., Orange, Calif.). The No. 823-010 two-part polyurethane coating is applicable for use in tanks previously coated with DV 1180 and/or EC776 and in tanks not previously coated.

2. Basic Coating Repair

   NOTE: The Alternate Coating Repair contained in paragraph 3 provides an inspection and repair procedure that can be accomplished without the thorough tank soap wash.

   A. Prepare

      (1) Defuel the tanks using approved defueling procedures (see Chapter 12, DC-9 Maintenance Manual).

      (2) Remove the necessary access doors to permit entry into the integral tanks.

      (3) Refer to 51-21-0 and observe the safety precautions prior to working inside the integral fuel tank areas.

      (4) Remove electrical fuel probes, compensators, densitometers, and plumbing as necessary for access to repair areas and as necessary to prevent contact with cleaning and coating materials.

      (5) Remove tank sump drain valves.

      (6) Seal fuel level control pilot valves, fuel level control pilot and selector, and fuel transfer level control pilot valve with plastic covers, or remove the components.

      (7) Plug all open fuel pipes and electrical connectors in the tank area.

   B. Clean and Flush

      (1) Use a small-capacity steam cleaner or pressure pot with a mixing head which will protect the fluid at a nozzle pressure of approximately 50 to 75 psig at a temperature of 60° to 71°C (140° to 160°F). Use Alumaloy "P" cleaner (Cee Bee Chemical Co., 9520 Cee Bee Drive, Downey, Calif.) or

---

*For factory serial numbers, see airplane identification list in the Introduction section of the manual.

Pennchem No. 333 cleaner (formerly Delco No. 333) (Pennsalt Chemical Corp., 2700 South Eastern Ave., Los Angeles, Calif.) mixed one part of cleaner by volume to five parts of water by volume.

CAUTION: DO NOT EXCEED 100 PSIG NOZZLE PRESSURE.

NOTE: To control nozzle pressure, it may be necessary to enlarge the hole through the spray nozzle.

(2) Clean tanks thoroughly, starting at the outboard end of each tank and proceeding inboard, as follows:

(a) Wash the upper portion of each tank section (all surfaces above 8 inches from lower skin surface) with clean hot water to remove residual fuel which might otherwise run off onto lower surfaces.

(b) Open cleaner feed valve and apply cleaning solution to all lower tank surfaces (8 inches up from the bottom skin panel). Permit cleaning solution to run off, then visually check area for cleanliness. Ensure that natural fuel traps and recesses are adequately cleaned. Repeat the cleaning if necessary.

(c) Before proceeding to the next section of the tank, close cleaner feed valve and rinse the areas with clean, hot water. Ensure that bulk of cleaning materials have been flushed inboard to drain holes.

(3) Thoroughly rinse each tank section with large volumes (approximately 300 gallons per tank) of clean tap water. Rinse the tank sections before cleaning solution has started to dry.

(4) Tanks will accumulate considerable water. In addition to normal drainage through fuel sump drain holes, use a small-capacity suction pump to assist in removal of water.

(5) When each tank has been cleaned, rinsed, and drained by sections, check the tanks thoroughly and ensure that all contamination and cleaning materials have been removed.

(6) When tanks are drained and before rinse water has started to dry on interior tank surfaces, wipe the tanks dry with clean, lint-free cloths. Air dry the tanks with blowers connected to outboard panel door accesses. Ensure that the air is oil free. Filter the air through four layers of cheesecloth, or equivalent, fastened over each blower outlet. Change the filters every 4 to 6 hours during drying operation.

(7) After the tank has been cleaned, rinsed, and thoroughly dried, check adhesion of sufficient areas of coating to ensure complete integrity of the coating of the entire tank. Check adhesion of the coating as follows:

(a) Use a plastic stylus and make a scratch approximately 2 inches long down to bare metal. These scratch marks must be identifiable for recoating. Scuff sanding may be used for this purpose.

(b) Apply a strip of 1-inch-wide Scotch No. 250 tape (Minnesota Mining and Manufacturing Co., 6023 Garfield Blvd, Los Angeles, Calif.) across the scribed area and press down firmly by hand, exerting approximately 4 pounds of pressure.

(c) Grasp the tape by one end and remove with an abrupt motion, maintaining an angle of approximately 90 degrees between the tape and the surface. Carefully check the area for removal of DV 1180 and/or EC 776 coating from the metal.

(d) Whenever adhesion failures are observed, continue tape testing all edges of the coating perpendicular to the coating edge, pulling away from the bared area.

NOTE: Close visual examination is required to detect adhesion failures on heavy films of coating that will not lift with the tape test. These areas must be removed using micarta scrapers to lift and peel coating. Films of coating that have evidence of moisture or fuel penetration discoloration, corrosion, blistering, etc., shall be referred to Engineering for disposition.

(8) Check bare areas for evidence of corrosion. If corrosion is evident, treat in accordance with 51-10-3.

(9) Lightly scuff sand approximately 1/2 inch of the intact DV 1180 surrounding the bare metal areas to be repaired, using No. 280 carborundum paper. Vacuum all sanding residue.

(10) Wipe the repair areas with clean, lint-free cloth dampened with ethyl acetate (TT-E-751). Wipe dry with clean, lint-free cloths. After drying, wipe all metal areas to be surface treated with No. 901 cleaner (Tec Chemical Co., 524 South Monterey Pass Road, Monterey Park, Calif.). Wipe dry with clean, lint-free cloths. Wipe repair areas with clean, lint-free cloth dampened with methyl ethyl ketone (TT-M-261). Wipe dry with clean, lint-free cloths.

CAUTION: USE CLOTHS DAMPENED WITH SOLVENT BUT NOT DRIPPING. LET TANK DRY FOR 1 HOUR WITH AIR CIRCULATION AFTER CLEANING.

NOTE: When cleaning and drying, ensure that only clean, lint-free cloths are used. Change the cleaning cloths often enough to ensure that the cleaning materials and soils are being removed and not just redeposited. Change the drying cloths often enough to thoroughly dry the areas in a minimum of time.

C. Apply Alodine No. 1200 Solution

(1) Mix the following in a polyethylene bottle: 2 ounces by weight of Alodine No. 1200 powder (Amchem Products Inc., Box 390, St. Joseph, Mo.); 6 cubic centimeters by volume of nitric acid (42° Baume, O-N-350; and 0.34 ounce by weight of Kloramine D-100 wetting agent (A. Ramsey & Sons, International Paint Co., Vancouver, Canada).

(2) Add tap water to make 1 gallon and agitate the solution thoroughly to ensure that the Alodine No. 1200 powder is dissolved.

(3) Date the bottle to note when mixed.

CAUTION: DO NOT USE ALODINE SOLUTION MORE THAN 72 HOURS OLD. WHEN NOT IN USE, KEEP THE SOLUTION IN CLOSED POLYETHYLENE CONTAINERS. AVOID SKIN CONTACT WITH THE SOLUTION OR INGREDIENTS. WEAR RUBBER GLOVES AND PROTECTIVE FACE DEVICES WHEN MIXING OR APPLYING. IF INGREDIENTS OR SOLUTION CONTACTS THE SKIN, FLUSH WITH WATER AND WASH THOROUGHLY WITH SOAP AND WATER.

(4) Apply Alodine No. 1200 solution using clean, lint-free cotton cloths or bleached, lint-free cheesecloth. Keep the Alodine solution wet and agitate the area in a circular motion for 5 minutes. Do not permit the solution to puddle and dry on metal surfaces.

(5) Wash with clean, lint-free cotton cloths and tap water, and then wipe dry using clean, dry, lint-free cotton cloths. Change the cloths and wash water frequently.

CAUTION: ALODINE RESIDUE WILL PREVENT TOPCOAT ADHESION. ALL RESIDUE MUST BE REMOVED.

(6) Dry tank with air circulation for 1 hour.

NOTE: Top coating must be applied within 24 hours after completion of the Alodine application.

D. Apply Fuel Tank Coating Material

NOTE: The fuel tank coating material is a two-part catalyzed material purchased as a kit and coded as a batch. When mixing, use the batch of base material and catalyst supplied as a kit. Never substitute the catalyst from another batch.

(1) Brush Application (Preferred for Spot Touch-Up)

(a) Mix the following parts by volume, agitating the base material while slowly adding the catalyst: four parts of base material No. 823-010; one part of catalyst No. 910-099; and one part of solvent reducer No. 010-005.

NOTE: Always add the catalyst to base material, never the reverse. All materials listed above are manufactured by Desoto Chemical Co., 615 West Grove Ave., Orange, California.

(b) Allow material to stand for 30 minutes, then reagitate thoroughly.

(c) Apply one uniform wet coat using good quality natural bristle brushes. Bend one-inch brushes 90 degrees to improve accessibility for brushing. Dry film thickness should be approximately 0.0010 to 0.0020 inch.

CAUTION: WEAR FRESH AIR BREATHING APPARATUS DURING COATING APPLICATION.

NOTE: Maximum pot life of brush material is 3 hours at 21.1° to 26.7°C (70° to 80°F). After maximum pot life, discard any unused catalyzed material.

(2) Spray Application

(a) Mix the material in parts by volume as follows, agitating the base material while slowly adding the catalyst: four parts of base material No. 823-010 and one part of catalyst No. 910-099.

(b) Allow material to stand for 30 minutes, then add approximately five parts, by volume, of solvent reducer No. 010-005.

(c) Strain material using four layers of bleached, clean, lint-free cheesecloth.

(d) Place material in a polyethylene inner liner such as No. 11000 cylindrical liner manufactured by Gardner Laboratories, Bethesda, Md., and place line in recirculating paint system pump tank (see Figure 1).

(e) Turn on air supply and immediately start tank agitator (2, Figure 1).

NOTE: Use moderate agitator speed only.

(f) Adjust pump regulator (5, Figure 1) to approximately 50 psig. Pump should stroke approximately once every 5 seconds.

(g) Open fluid outlet valve.

(h) Adjust fluid pressure regulator (8, Figure 1) to 60 to 70 psig.

(i) Adjust fluid relief valve (9, Figure 1) to 20 psig.

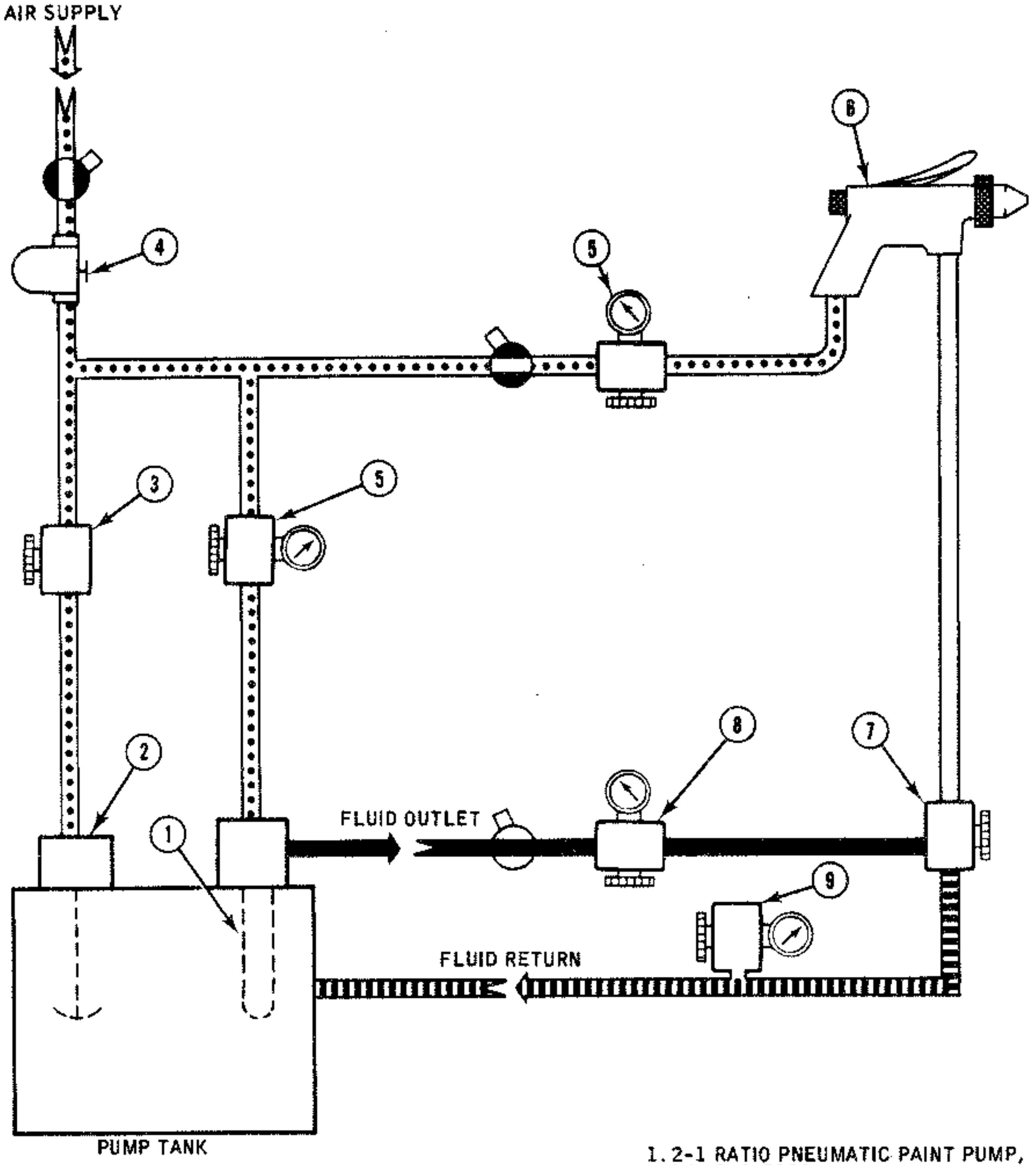
(j) Remove all air cap assemblies from spray gun (6, Figure 1).

(k) Adjust spray gun regulator (7, Figure 1) to emit 2 to 2-1/2 ounces of material per minute through fluid tip when spray gun trigger is completely on.

(l) Lock the spray gun regulator.

(m) Attach the required air cap, or extension, to spray gun.

(n) Adjust the air regulator to spray gun to 15 psig.



NOTES:

1. USE AIR CAP NO. 390 FOR FLAT OR EASILY ACCESSABLE AREAS. USE ANGULAR AIR CAP ASSEMBLY NO. GC-406-81F FOR APPLICATIONS UNDER HAT SECTIONS, J-SECTIONS, ETC. USE FLEXIBLE EXTENSION SPRAY ASSEMBLY NO. MBX-408IF FOR INTRICATE AND REMOTE AREAS.
2. ITEMS SHOWN ARE MANUFACTURED BY DEVILBISS CO., BOX 913, 300 PHILLIPS AVE, TOLEDO, OHIO. EQUIVALENT SUBSTITUTES MAY BE USED.

1. 2-1 RATIO PNEUMATIC PAINT PUMP, NO. QBG-5110
2. AGITATOR, NO. QSA-504
3. AIR PRESSURE REGULATOR
4. AIR FILTER NO. F02-600-AIT-AV
5. AIR REGULATOR AND GAGE, NO. HAA-504
6. SPRAY GUN, NO. P-EGA-502-390F (SEE NOTE 1)
7. SPRAY GUN REGULATOR NO. HGL-502
8. FLUID REGULATOR AND GAGE NO. HGA-503
9. FLUID RELIEF VALVE AND GAGE, NO. RVA-501

BB3-962

Fuel Tank Coating Spray System

(o) Using black plaster Kraft paper, or equivalent, try spray gun for desired pattern.

(p) Apply one uniform light cross coat. Dry film thickness should be 0.0010 to 0.0020 inch.

CAUTION: WEAR FRESH AIR BREATHING APPARATUS DURING COATING APPLICATION.

(3) Dry tank with heated air, maintaining an approximate structure temperature of 32.2°C (90°F) for 5 hours, or 15.6°C (60°F) for 24 hours, before fueling or adhesion testing.

NOTE: A straight line curve may be drawn between the above points to determine drying time for intermediate temperatures. In addition to the thorough pre-coat cleaning, the above curing procedure is necessary to obtain a quality coating with jet fuel resistance. The equipment removed from the tank may be installed as soon as entry into the tank will not cause scuffing of the applied material. Increased temperatures and/or higher humidity condition will appreciably reduce the cure period required to permit earlier entry into the tank. When coating has cured sufficiently to resist a fingernail scratch test, entry is permissible.

(4) As soon as tank entry can be made without causing scuffing, check coated surfaces for any evidence of the DV 1180 material curling at the feathered edges of the No. 823-010 material. Trim any curled edges with a micarta scraper, scuff sand lightly, and recoat with No. 823-010 catalyzed material.

(5) Clean brushes by washing in methyl ethyl ketone immediately after use.

(6) Clean spray equipment immediately after use as follows:

NOTE: The importance of quick and thorough cleaning cannot be overemphasized. All parts of the spray system that are in contact with the coating must be thoroughly cleaned as soon as possible after use.

(a) Manually lift pump head just above the material and turn pump on slowly so as to pump all material back into inner liner in tank.

(b) Remove pump and inner liner from pump tank.

(c) Clean inner tank using methyl ethyl ketone.

(d) Place 3 to 4 gallons of methyl ethyl ketone in a clean container.

(e) Lower pump into the methyl ethyl ketone, start pump, and circulate the fluid through the spray system at least 10 minutes.

(f) Change the methyl ethyl ketone and repeat solvent purging the entire system. Continue changing the methyl ethyl ketone and purging the system until methyl ethyl ketone shows no residuals or color.

NOTE: During the cleaning, open the spray gun regulator to permit full cleanout.

(g) After cleanout of the spray gun regulator, turn off air supply to spray gun and pump methyl ethyl ketone through throat of spray gun.

(h) Stop pump, disconnect spray gun, and position fluid outlets into container.

(i) Start pump and circulate methyl ethyl ketone into container.

(j) Stop pump and remove container.

(k) Dismantle spray guns and attachments and thoroughly clean each component with stiff bristle brushes and methyl ethyl ketone. Blow out all jet holes of air caps, fluid tips, etc., with compressed air.

NOTE: Do not use metal objects in clogged openings. Use wooden toothpicks or similar material. If coating has cured on the equipment, use FR primer stripper No. A-202 (Cee Bee Chemical Co.) or equivalent, for cleaning the parts. Use stripper for parts only. Do not use stripper to purge system or pump.

3. Alternate Coating Repair

A. Prepare

(1) Defuel the tanks using approved defueling procedures (see Chapter 12, DC-9 Maintenance Manual).

(2) Remove the necessary access doors to permit entry into the integral fuel tanks.

(3) Refer to 51-21-0 and observe the safety precautions carefully prior to working inside the integral fuel tank areas.

(4) Remove electrical fuel probes, compensators, densitometers, and piping as necessary for access to repair areas and to prevent contact with coating materials.

(5) Seal fuel level control pilot valves, fuel level control pilot and selector, and fuel transfer level control pilot valve with plastic covers, or remove the components.

(6) Plug all open fuel pipes and electrical connectors in the tank area.

B. Clean

(1) Using fingernails, plastic scraper, or similar suitable method and by close examination, check the coating system for evidence of looseness, flaking, bubbles, sponginess, or any indication of loss of adhesion or fluid penetration.

(2) Remove any loose or discrepant coating by mechanical means, such as micarta scrapers.

(3) Clean bare areas with clean, lint-free cloth dampened with ethyl acetate (TT-E-571) or methyl ethyl ketone (TT-M-261). Wipe dry with clean, lint-free cloths.

(4) Apply a strip of 1-inch-wide Scotch No. 250 tape to adjacent areas of the DV 1180/EC 776, and press down firmly by hand, exerting approximately 4 pounds of pressure.

(5) Grasp the tape by one end and remove with an abrupt motion, maintaining an angle of approximately 90 degrees between the tape and the surface. Carefully check area for removal of DV 1180/EC 776 from the metal. Continue testing of the coating until sound material is found around the periphery of the bare area.

(6) Check any bare areas for corrosion. If corrosion is found, treat in accordance with 51-10-3.

(7) Repair bare areas as follows:

(a) Wash the bare area and a minimum of 12 inches outside the bare area three times using clean, bleached, lint-free cheesecloth moistened with methyl ethyl ketone or ethyl acetate. Start each washing at the bare area center and work outward.

(b) Lightly scuff sand approximately 1/2 inch of the intact DV 1180/EC 776 surrounding the bare areas to be repaired using No. 280 carborundum paper. Vacuum all sanding residue.

(c) Wipe clean the repair areas with clean, lint-free cloths dampened with ethyl acetate. Wipe dry with clean, lint-free cloths. After drying, wipe clean all metal areas to be surface treated with a clean, lint-free cloth dampened with Tec No. 901 cleaner. Wipe dry with clean, lint-free cloths. Wipe clean repair areas with clean, lint-free cloths dampened with methyl ethyl ketone. Wipe dry with clean, lint-free cloths.

CAUTION: USE CLOTHS DAMPENED WITH SOLVENT BUT NOT DRIPPING. LET TANK DRY FOR 1 HOUR WITH AIR CIRCULATION AFTER SOLVENT CLEANING.

C. Apply Alodine No. 1200

(1) Prepare and apply Alodine No. 1200 solution as outlined in paragraph 2.C.

D. Apply Fuel Tank Coating Material

(1) Prepare and apply No. 823-010 fuel tank coating material as outlined in paragraph 2.D.

INTEGRAL FUEL TANK LEAK DETECTION AND REPAIR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Integral fuel tank leaks may be detected according to the following paragraphs of this Section.

2. Classification of Integral Wing Fuel Tank Leaks

A. A fuel tank leak may be classified into one of five types. These types are stain, seep, heavy seep, running, and dripping leaks, as shown in Figure 1. The wet area around a source of leakage is a fairly accurate measure of the degree of leakage. After inspection, in order to determine the degree of leakage accurately, clean and record the location of all suspicious wet areas for future evaluation.

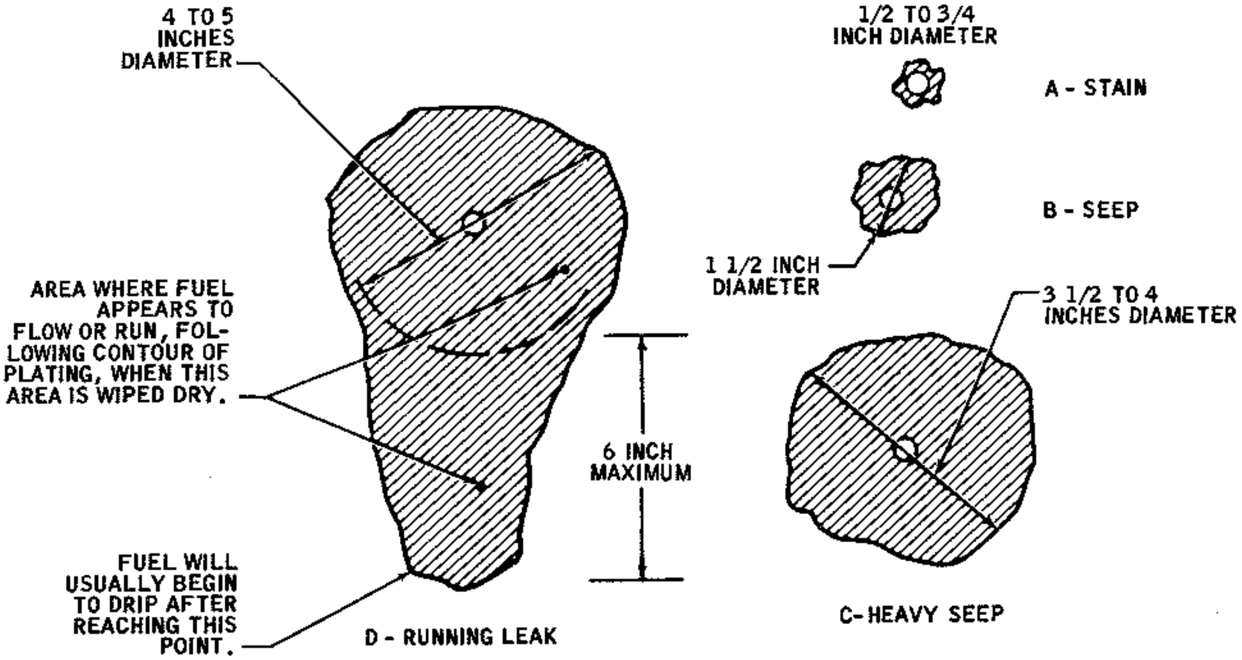
B. The classified leaks, other than a running or dripping leak, are not regarded as dangerous, and need not necessarily be repaired until such time as permanent repair can be accomplished. All dripping leaks and running leaks on the wing structure that permit fuel to run under the wing to the engine pylon, and similar areas, must be repaired immediately at a structural maintenance level.

WARNING: DRIPPING AND RUNNING LEAKS CONSTITUTE A FIRE HAZARD. STRICT ADHERENCE TO ALL FIRE SAFETY REGULATIONS WHEN WORKING IN OR ON INTEGRAL FUEL TANKS IS MANDATORY (SEE SECTION 51-21-0 FOR GENERAL FIRE AND SAFETY PRECAUTIONS).

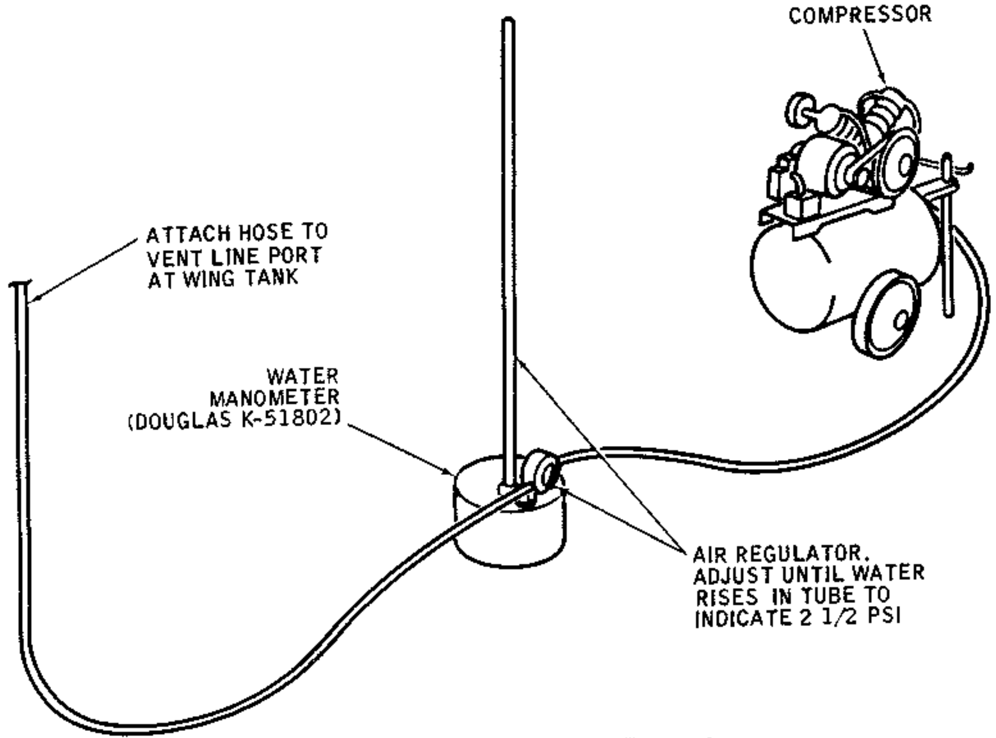
3. Determining the Source of a Leak

There is no location relationship between evidence of a leak on the outside of the tank structure, and the leak origin inside. When the seal on the intank side is broken, the fuel may enter the small spaces existing between structural members, and travel some distance before appearing as a stain on the out-tank side. Do not remove sealant, bolts, or rivets, nor disturb the original seal, without first pinpointing the source of the leak on the intank side.

To locate the source of the leak, use such materials and equipment as flashlights, spatulas, putty knives, filleting tools, scrapers, thermometers, mirrors, magnifying glasses, air nozzles, air nozzle adapters, and paint brushes (see Figure 1).



Wing Fuel Tank Leakage Yardstick
Figure 1



Wing Tank Pressure Test Setup
Figure 2

The procedure for detecting leaks is called "Blow Back Method of Leak Detection". This method requires patience and cooperation for its successful accomplishment. To obtain the best results, hold the air nozzle snugly against the area being tested. The leak may be due to poor sealant adhesion, faulty rivet installation, or a loose or improperly sealed bolt.

CAUTION: NEVER USE AIR FROM A MECHANICAL COMPRESSOR, INSIDE THE TANKS, UNLESS IT HAS PASSED THROUGH A FILTER WHICH HAS BEEN INSPECTED AND FOUND TO BE IN PROPER CONDITION. A WATER-TYPE FILTER MUST NOT BE USED DUE TO POSSIBLE CONTAMINATION.

Work in teams of two, and agree on a system of tapping signals before beginning. For example, use one tap to indicate the beginning of the operation, two taps, cease operations, and three taps, the appearance of bubbles on the out-tank side.

Cover the exterior of the tank structure at the area of the leak with Turco LAC-598 bubble fluid (Turco Products, Inc., P. O. Box 1055, Wilmington, Calif.) mixed in proportions of one part fluid to eight parts water. Using the air hose, blow all the seams, bolts, rivets, and fillets. Place the soft copper tip of the air nozzle directly on the surface of the sealant fillet and apply full line pressure of approximately 100 psi. Normal fillets will not be disturbed by this air pressure. If the sealant does not adhere, remove all that will peel off. Hold the rubber hose adapter end directly over the rivets. Check the entire area completely until bubbles appear on the out-tank surface.

4. Repair Sealing

A. Refer to Section 51-20-0 for removal of defective sealant and preparation of repair sealants.

5. Tank Leak Pressure Testing

A. The pressure test may usually be performed as soon as the tank can be closed after the application of the PR-1422 sealant repair. It is not necessary to wait until the sealant is cured UNLESS large voids exist where pressure would extrude the uncured sealant. The recommended testing pressure is 3 psi. Use a water manometer to check and control the air pressure in the tanks during the test (see Figure 2).

CAUTION: DO NOT USE A MERCURY MANOMETER. ALUMINUM ALLOY EXPOSED TO MERCURY WILL RESULT IN RAPID INTERGRANULAR CORROSION.

To pressure test the tank, proceed as follows:

Close all tank openings such as filler neck vent pipes. Do not close the fuel drain line which is used for the air pressure inlet. Use tight fitting plugs where threads are available. Use rubber expander tank test plugs on outlets without threads.

CAUTION: ATTACH RED STREAMERS TO ALL PLUGS AND TEST DOORS TO ASSURE THEIR REMOVAL, AFTER TESTING HAS BEEN COMPLETED.

B. Seal the access door openings using tank test doors.

C. Apply pressures to integral tanks as follows: 1.0 p.s.i. to areas outboard of STA XRS 477.350, and 3.0 p.s.i. to areas inboard of STA XRS 477.350. Maintain this pressure, apply bubble fluid to the original stained areas, and inspect the wing plating for evidence of escaping air.

WARNING: DO NOT REMOVE THE TEST COVER DOOR, OR ACCESS DOORS, UNTIL ALL PRESSURE HAS BEEN REMOVED FROM THE TANK.

NOTE: Use a hose and large volumes of water to wash the bubble fluid off the wing immediately after the test has been completed.

6. Sealant Topcoat Repair

A. If sealant topcoat repair is necessary, refer to Section 51-22-0.

FASTENERS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes procedures for installing bolts, screws, washers, rivets, lockbolts and special attachments. The procedures contain information pertinent to installation, including torque requirements, special tools, dimensional information, etc. Drilling, reaming, countersinking, and dimpling are not included, but can be found in 51-10-4. However, such information peculiar to a particular installation is included in the appropriate procedure. Consideration must be given during fastener installation to the prevention of electrochemical attack (see 51-10-3).

B. A list of airplane fastener oversize replacements is included in this section. However, where oversize replacements require special consideration such as special bolts or Hi-Shear blind attachments, this information can be found by referring to the appropriate installation procedure within this section. Standard attachments such as rivets are not listed, however, cherrylock rivets are preferred; oversize replacements will be made according to normal industry standards, with a preference for cherrylock rivets and with consideration of edge distance spacing as detailed in 51-30-2.

C. Information to enable correct determination of number of fasteners required to make a given repair is contained in paragraph 3.

D. The information contained in this section is not restricted to the attachments used on the DC-9 as built, but includes in addition information on those attachments that might normally be used during repair.

E. The procedures are arranged in the following sequence: bolts, screws, and washers; rivets; lockbolts; Hi-Shear blind attachments; and Hi-Lok attachments.

2. Airplane Fasteners and Oversize Replacements

A. Bolts and Screws

(1) Oversize flush (AN 509) head fasteners are as follows:

Standard Installation Fastener Series	1/64 Oversize	1/32 Oversize
NAS1203 thru NAS1210	NAS1703-( )R thru NAS1710-( )R	NAS1603-( )R thru NAS1610-( )R
NAS333CPA thru NAS340CPA	NAS1703-( )R thru NAS1710-( )R	NAS1603-( )R thru NAS1610-( )R

Standard Installation Fastener Series	1/64 Oversize	1/32 Oversize
NAS1503 thru NAS1510	NAS1703-( )R thru NAS1710-( )R	NAS1603-( )R thru NAS1610-( )R
NAS583 thru NAS590	NAS1703-( )R thru NAS1710-( )R	NAS1603-( )R thru NAS1610-( )R

(2) Oversize flush (MS20426) head fasteners are as follows:

Standard Installation Fastener Series	1/64 Oversize	1/32 Oversize
4619303	4653156-3	4651552-3
4619304	4653156-4	4651552-4

(3) Oversize flush (shear) head fasteners are as follows:

Standard Installation	1/64 Oversize
HT239PB-3 thru HT239PB-9	*HT247PB-3 thru *HT247PB-9

*Hi-Shear Corp., 2600 W. 247th St., Torrance, California

(4) Oversize hexagon head bolts are as follows:

Standard Installation Fastener Series	1/64 Oversize	1/32 Oversize
NAS1103 thru NAS1120	NAS2903 thru NAS2920	NAS3003 thru NAS3020
NAS1303 thru NAS1320	NAS2903 thru NAS2920	NAS3003 thru NAS3020

(5) Oversize 12-point head bolts are as follows:

Standard Installation Fastener Series	1/64 Oversize	1/32 Oversize
MS21250-04 thru MS21250-24	4912390-4 thru 4912390-24	4912391-4 thru 4912391-24
NAS624 thru NAS644	4653155-4 thru 4653155-24	4651553-4 thru 4651553-24

B. Lockbolts

(1) Oversize lockbolts are as follows:

Head Type	Standard Installation Fastener Number	1/64 Oversize		1/32 Oversize	
Pan	NAS1465	----		NAS1466	
	NAS1466	R3007-T6		NAS3003	Hex-head bolts
	NAS1468	R3007-T8		NAS3004	
	NAS1470	R3007-T10		NAS3005	
	NAS1472	R3007-T12		NAS3006	
Flush	NAS1475	----		2L200-T6	
	NAS1476	R3020-T6		*NAS1603	Flush-head bolts
	NAS1478	R3020-T8		*NAS1604	
	NAS1480	R3020-T10		*NAS1605**	
	NAS1482	R3020-T12		*NAS1606†	
Crown	2L200-T6	††HL63-6	Hi-Lok	*NAS1603	Flush-head bolts
	2L200-T8	††HL63-8		*NAS1604	
Shear	S3LPDT4	----		HL18PB-5	Hi-Lok
Shear	S3L100T4	----		HL19PB-5	
Prot.	S3SBEU4	----		NAS1198-5 xAN960-6	Rivet

* Countersink must be enlarged.
** Use only on minimum plate thickness of 0.135 inch.
† Use only on minimum plate thickness of 0.162 inch.
†† Use for shear application only.
x Use under bucked head.

C. Hi-Lok Fasteners

(1) Oversize Hi-Lok fasteners are as follows:

Head Type	Standard Installation Fastener Number	1/64 Oversize	1/32 Oversize
MS20426	HL525-5	----	HL19PB-6
	HL525-6	HL527-6	*NAS1603
	HL525-8	HL527-8	*NAS1604
	HL525-10	HL527-10	*NAS1605**
	HL525-12	HL527-12	*NAS1606†
Shear	HL18PB-5	----	HL18PB-6
	HL18PB-6	HL64PB-6	----
	HL18PB-8	HL64PB-8	----
	HL18PB-10	HL64PB-10	----
	HL18PB-12	HL64PB-12	----
Tension	HL20PB-5	----	HL18PB-6
	HL20PB-6	HL64PB-6	----
	HL20PB-8	HL64PB-8	----
	HL20PB-10	HL64PB-10	----
	HL20PB-12	HL64PB-12	----
Shear	HL19PB-5	----	HL19PB-6
	HL19PB-6	HL63PB-6	----
	HL19PB-8	HL63PB-8	----
	HL19PB-10	HL63PB-10	----
	HL19PB-12	HL63PB-12	----
AN509	HL21PB-5	----	HL21PB-6
	HL21PB-6	HL65PB-6	----
	HL21PB-8	HL65PB-8	----
	HL21PB-10	HL65PB-10	----
	HL21PB-12	HL65PB-12	----
Flat	HL518-6	HL508-6	----

* Countersink must be enlarged.
** Use only on minimum plate thickness of 0.135 inch.
† Use only on minimum plate thickness of 0.162 inch.

3. Determination of Number of Fasteners Required for Repair of Cracks

A. Riveted Repairs

(1) Number of rivets required may be determined as follows:

NOTE: This information is based on using the same gage and material to make the repair as used in manufacturing the cracked structural member.

(a) Determine the gage of the cracked structural member.

(b) Determine length of crack in inches.

(c) Determine ultimate tensile strength of the structural material from the following:

Material	Gage	Ultimate Tensile Strength
Clad 2024-T3	0.010 to 0.062	59,000
	0.063 to 0.249	62,000
Clad 2024-T4	0.010 to 0.062	58,000
	0.063 to 0.249	61,000
Clad 7075-T6	0.012 to 0.039	70,000
	0.040 to 0.062	72,000
	0.063 to 0.187	73,000
Clad 2014-T6	0.020 to 0.039	63,000
	0.040 to 0.500	64,000
Extrusion 2024-T42	Up to 0.750	57,000
Extrusion 2024-T3511	Up to 0.750	60,000
Extrusion 7075-T6511	Up to 0.250	78,000
	0.250 to 0.500	81,000
Extrusion 2014-T6511	Up to 0.500	60,000
	0.500 to 0.750	64,000
	Over 0.750	68,000

(d) Determine rivet allowable from Figure 1.

(e) Determine number of rivets required as shown in the example in Figure 2.

(2) Rivets should be arranged on either side of the crack, and in a pattern similar to the typical repair shown in Figure 2, maintaining minimum edge and spacing distances as shown in 51-30-2.

			CLAD 2024-T3															
				3/32		1/8			5/32			3/16			1/4			
		*SHEET GAGE	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	SHEET GAGE
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	169	169	169													.016
		.020	202	210	210	281	281	281	348	348	348							.020
		.025	211	263	263	351	351	351	434	434	434	522	522	522				.025
		.032	217	275	296	374	450	450	551	557	557	669	669	669	900	900	900	.032
		.036	217	275	296	381	485	507	564	626	626	753	753	753	1013	1013	1013	.036
		.040				386	492	528	575	696	696	804	836	836	1125	1125	1125	.040
		.045				388	494	531	585	741	783	821	940	940	1266	1266	1266	.045
		.050				388	494	531	593	751	811	836	1045	1045	1407	1407	1407	.050
		.063							596	755	815	862	1090	1180	1490	1797	1797	.063
		.071							596	755	815	862	1090	1180	1517	1929	2026	.071
		.080													1542	1960	2109	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	168	168	168													.016
		.020	210	210	210	281	281	281										.020
		.025	263	263	263	351	351	351	435	435	435							.025
		.032	336	336	336	450	450	450	557	557	557	669	669	669				.032
		.036	372	379	379	507	507	507	626	626	626	753	753	753	905	1013	1013	.036
		.040	387	420	420	563	563	563	696	696	696	836	836	836	1120	1126	1126	.040
		.045	401	473	473	633	633	633	783	783	783	940	940	940	1266	1266	1266	.045
		.050	413	523	526	675	703	703	870	870	870	1045	1045	1045	1407	1407	1407	.050
		.063	434	550	592	727	898	898	1039	1112	1112	1335	1335	1335	1797	1797	1797	.063
		.071	434	550	592	750	954	1012	1084	1253	1253	1469	1505	1505	2026	2026	2026	.071
		.080				770	980	1054	1122	1412	1412	1536	1696	1696	2282	2282	2282	.080
		.090				776	988	1062	1155	1463	1579	1593	1908	1908	2567	2567	2567	.090
		.100				776	988	1062	1182	1498	1617	1640	2073	2120	2697	2852	2852	.100
		.125							1192	1510	1630	1724	2180	2360	2899	3565	3565	.125
		.160							1192	1510	1630	1724	2180	2360	3075	3908	4206	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

			CLAD 7075-T6															
			3/32			1/8			5/32			3/16			1/4			
		*SHEET GAGE	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	SHEET GAGE
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	192	204	204													.016
		.020	202	255	255	338	342	347	423	423	423							.020
		.025	211	267	287	357	427	427	519	528	528	634	634	634				.025
		.032	217	275	296	374	476	512	551	677	677	764	813	813	1093	1093	1093	.032
		.036	217	275	296	381	485	521	564	714	761	786	915	915	1230	1230	1230	.036
		.040				386	492	528	575	728	786	804	1017	1101	1349	1408	1408	.040
		.045				388	494	531	585	741	800	821	1039	1125	1392	1584	1583	.045
		.050				388	494	531	593	751	811	836	1057	1145	1426	1760	1760	.050
		.063							596	755	815	862	1090	1180	1490	1893	2037	.063
		.071							596	755	815	862	1090	1180	1517	1929	2075	.071
		.080													1542	1960	2109	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	187	205	205													.016
		.020	253	255	255	279	342	342										.020
		.025	307	319	319	423	427	427	453	528	528							.025
		.032	353	408	408	522	546	546	668	677	677	744	812	812				.032
		.036	372	460	460	577	616	616	751	761	761	893	915	915	905	1150	1231	.036
		.040	387	490	526	612	704	704	819	871	871	1009	1046	1046	1190	1408	1408	.040
		.045	401	508	547	647	792	792	887	980	980	1126	1177	1177	1470	1583	1583	.045
		.050	413	523	563	675	860	879	940	1089	1089	1221	1308	1308	1690	1760	1760	.050
		.063	434	550	592	727	926	995	1039	1317	1393	1393	1672	1672	2105	2250	2250	.063
		.071	434	550	592	750	954	1026	1084	1373	1482	1469	1857	1885	2285	2537	2537	.071
		.080				770	980	1054	1122	1421	1534	1536	1942	2103	2446	2858	2858	.080
		.090				776	988	1062	1155	1463	1579	1593	2014	2181	2585	3215	3215	.090
		.100				776	988	1062	1182	1498	1617	1640	2073	2244	2697	3428	3572	.100
		.125							1192	1510	1630	1724	2180	2360	2899	3684	3964	.125
		.160							1192	1510	1630	1724	2180	2360	3075	3908	4206	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

* Thinnest sheet in single shear or middle sheet in double shear.
NOTE: (1) Allowables correspond to shear or bearing, whichever is lower.

Rivet Allowable Chart
Figure 1 (Sheet 1)

Printed in U.S.A.

			2024-T42 EXTRUSION (HEAT TREATED BY USER)															
		*SHEET GAGE	3/32			1/8			5/32			3/16			1/4			SHEET GAGE
			AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	141	141	141													.016
		.020	175	175	175	235	235	235	291	291	291							.020
		.025	211	219	219	293	293	293	363	363	363	436	436	436				.025
		.032	217	275	296	374	376	376	465	465	465	559	559	559	752	752	752	.032
		.036	217	275	296	381	423	423	523	523	523	629	629	629	846	846	846	.036
		.040			296	386	470	470	575	582	582	699	699	699	940	940	940	.040
		.045				388	494	529	585	654	654	786	786	786	1057	1057	1057	.045
		.050				388	494	529	593	727	727	836	874	874	1176	1176	1176	.050
		.063							596	755	815	862	1090	1100	1481	1481	1481	.063
		.071							596	755	815	862	1090	1100	1517	1670	1670	.071
		.080													1542	1881	1881	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	141	141	141													.016
		.020	175	175	175	235	235	235										.020
		.025	219	219	219	293	293	293	363	363	363							.025
		.032	281	281	281	376	376	376	465	465	465	559	559	559				.032
		.036	316	316	316	423	423	423	523	523	523	629	629	629	847	847	847	.036
		.040	351	351	351	470	470	470	582	582	582	699	699	699	941	941	941	.040
		.045	395	395	395	529	529	529	654	654	654	786	786	786	1058	1058	1058	.045
		.050	413	439	439	587	587	587	727	727	727	874	874	874	1176	1176	1176	.050
		.063	434	550	554	727	740	740	917	917	917	1100	1100	1180	1481	1481	1481	.063
		.071	434	550	554	750	834	834	1033	1033	1033	1240	1240	1240	1670	1670	1670	.071
		.080				770	940	940	1122	1164	1164	1398	1398	1398	1881	1881	1881	.080
		.090				776	988	1062	1155	1309	1309	1573	1573	1573	2116	2116	2116	.090
		.100				776	988	1062	1182	1455	1455	1640	1747	1747	2351	2351	2351	.100
		.125							1192	1510	1630	1724	2180	2184	2899	2939	2939	.125
		.160							1192	1510	1630	1724	2180	2184	3075	3762	3762	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

			7075-T6511 EXTRUSION															
		*SHEET GAGE	3/32			1/8			5/32			3/16			1/4			SHEET GAGE
			AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	192	192	192													.016
		.020	202	240	240	321	321	321	398	398	398							.020
		.025	211	267	287	357	401	401	496	496	496	596	596	596				.025
		.032	217	275	296	374	476	512	551	636	636	764	764	764	1028	1028	1028	.032
		.036	217	275	296	381	485	521	564	714	715	786	860	860	1156	1156	1156	.036
		.040				386	492	528	575	728	786	804	955	955	1285	1285	1285	.040
		.045				388	494	531	585	741	800	821	1039	1074	1392	1445	1445	.045
		.050				388	494	531	593	751	811	836	1057	1145	1426	1606	1606	.050
		.063							596	755	815	882	1090	1180	1490	1893	2024	.063
		.071							596	755	815	862	1090	1180	1517	1929	2075	.071
		.080													1542	1960	2109	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	187	192	192													.016
		.020	240	240	240	298	321	321										.020
		.025	300	300	300	401	401	401	453	496	496							.025
		.032	353	384	384	514	514	514	636	636	636	744	764	764				.032
		.036	372	432	432	577	579	579	715	715	715	860	860	860	905	1150	1157	.036
		.040	387	480	480	612	642	642	795	795	795	955	955	955	1190	1285	1285	.040
		.045	401	508	540	647	722	722	887	894	894	1074	1074	1074	1445	1445	1445	.045
		.050	413	523	563	675	802	802	940	994	994	1194	1194	1194	1606	1606	1606	.050
		.063	434	550	592	727	926	995	1039	1252	1252	1393	1504	1504	2024	2024	2024	.063
		.071	434	550	592	750	954	1026	1084	1373	1411	1469	1695	1695	2281	2281	2281	.071
		.080				770	980	1054	1122	1421	1534	1536	1910	1910	2446	2570	2570	.080
		.090				776	988	1062	1155	1463	1579	1593	2014	2149	2585	2891	2891	.090
		.100				776	988	1062	1182	1498	1617	1640	2073	2244	2697	3212	3212	.100
		.125							1192	1510	1630	1724	2180	2360	2899	3684	3964	.125
		.160							1192	1510	1630	1724	2180	2360	3074	3908	4206	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

* Thinnest sheet in single shear or middle sheet in double shear.
NOTE: (1) Allowables correspond to shear or bearing, whichever is lower.

Rivet Allowable Chart
Figure 1 (Sheet 2)

		*SHEET GAGE	2014-T6511 EXTRUSION															SHEET GAGE
			3/32			1/8			5/32			3/16			1/4			
			AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	175	175	175													.016
		.020	202	219	219	293	293	293	363	363	363							.020
		.025	211	267	273	357	366	366	452	452	452	544	544	544				.025
		.032	217	275	296	374	468	468	551	580	580	697	697	697	937	937	937	.032
		.036	217	275	296	381	485	521	564	652	652	784	784	784	1054	1054	1054	.036
		.040				386	492	528	575	725	725	804	871	871	1172	1172	1172	.040
		.045				388	494	531	585	741	800	821	979	979	1318	1318	1318	.045
		.050				388	494	531	593	751	811	836	1057	1089	1426	1465	1465	.050
		.063							596	755	815	862	1090	1180	1490	1845	1845	.063
		.071							596	755	815	862	1090	1180	1517	1929	2075	.071
		.080													1542	1960	2109	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	175	175	175													.016
		.020	219	219	219	293	293	293										.020
		.025	273	273	273	366	366	366	453	453	453							.025
		.032	350	350	350	468	468	468	580	580	580	614	614	614				.032
		.036	372	394	394	528	528	528	652	652	652	784	784	784	905	1055	1055	.036
		.040	387	438	438	586	586	586	725	725	725	871	871	871	1172	1172	1172	.040
		.045	401	492	492	647	659	659	815	815	815	979	979	979	1318	1318	1318	.045
		.050	413	523	547	675	732	732	906	906	906	1089	1089	1089	1465	1465	1465	.050
		.063	434	550	592	727	922	922	1039	1142	1142	1371	1371	1371	1845	1845	1845	.063
		.071	434	550	592	750	954	1026	1084	1287	1287	1469	1546	1546	2080	2080	2080	.071
		.080				770	980	1054	1122	1421	1450	1536	1742	1742	2344	2344	2344	.080
		.090				776	988	1062	1155	1463	1579	1593	1959	1959	2585	2637	2637	.090
		.100				776	988	1062	1182	1498	1617	1640	2073	2177	2697	2930	2930	.100
		.125							1192	1510	1630	1724	2180	2360	2899	3661	3661	.125
		.160							1192	1510	1630	1724	2180	2360	3075	3908	4206	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

		*SHEET GAGE	CLAD 2014-T6															SHEET GAGE
			3/32			1/8			5/32			3/16			1/4			
			AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	.016	188	188	188													.016
		.020	202	234	234	314	314	314	388	388	388							.020
		.025	211	267	287	357	392	392	484	484	484	582	582	582				.025
		.032	217	275	296	374	476	501	551	621	621	745	745	745	1003	1003	1003	.032
		.036	217	275	296	381	485	521	564	698	698	786	839	839	1129	1129	1129	.036
		.040				386	492	528	575	728	786	804	947	947	1275	1275	1275	.040
		.045				388	494	531	585	741	800	821	1039	1065	1392	1433	1433	.045
		.050				388	494	531	593	751	811	836	1057	1145	1426	1593	1593	.050
		.063							596	755	815	862	1090	1180	1490	1893	2008	.063
		.071							596	755	815	862	1090	1180	1517	1929	2075	.071
		.080													1542	1960	2109	.080
		.090													1550	1970	2120	.090
		.100													1550	1970	2120	.100
	DOUBLE SHEAR	.016	188	188	188													.016
		.020	234	234	234													.020
		.025	293	293	293	392	392	392	453	484	484							.025
		.032	353	375	375	501	501	501	621	621	621	744	746	746	905	1129	1129	.032
		.036	372	422	422	565	565	565	698	698	698	839	839	839	1120	1275	1275	.036
		.040	387	476	476	612	637	637	789	789	789	947	947	947	1113	1274	1274	.040
		.045	401	508	536	647	717	717	887	887	887	1065	1065	1065	1434	1434	1434	.045
		.050	413	523	563	675	796	796	940	986	986	1184	1184	1184	1593	1593	1593	.050
		.063	434	550	592	727	926	995	1039	1242	1242	1393	1492	1492	2008	2008	2008	.063
		.071	434	550	592	750	954	1026	1084	1373	1400	1469	1681	1681	2263	2263	2263	.071
		.080				770	980	1054	1122	1421	1534	1536	1895	1895	2446	2549	2549	.080
		.090				776	988	1062	1155	1463	1579	1593	2014	2132	2585	2868	2868	.090
		.100				776	988	1062	1182	1498	1617	1640	2073	2244	2697	3187	3187	.100
		.125							1192	1510	1630	1724	2180	2360	2899	3684	3964	.125
		.160							1192	1510	1630	1724	2180	2360	3075	3908	4206	.160
		.190													3100	3940	4240	.190
		.250													3100	3940	4240	.250

* Thinnest sheet in single shear or middle sheet in double shear.
NOTE: (1) Allowables correspond to shear or bearing, whichever is lower.

Rivet Allowable Chart
Figure 1 (Sheet 3)

		CLAD 7075-T6, CLAD 2024-T3, CLAD 2024-T42, CLAD 2014-T6															
		3/32			1/8			5/32			3/16			1/4			
	*SHEET GAGE	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	SHEET GAGE
100 MACHINE COUNTERSUNK	.020	132			147												.020
	.025	156			221			165									.025
	.032	178			272			300					306				.032
	.040	193			309			397	405		410		543				.040
	.050	206			340			479	517		584	629	758			891	.050
	.063	216			363			523	600		705	772	886		915	1217	.063
	.071				373			542	690		739	835	942		1059	1353	.071
	.080							560	720		769	935	992		1182	1473	.080
	.090							575	746		795	1015	1035		1292	1580	.090
	.100										818	1054	1073		1526	1672	.100
	.125										853	1090	1131		1773	1877	.125
	.160														1891	2000	.160
	.190														1970	2084	.190

		CLAD 2024-T3															
		3/32			1/8			5/32			3/16			1/4			
	*SHEET GAGE	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	SHEET GAGE
DIMPLED	.016	177															.016
	.020	209			299												.020
	.025	235			360			474	419								.025
	.032	257			413			568	600		722	681	744				.032
	.040	273			451			635	738		839	905	941		845	879	.040
	.050				484			693	840		940	1097	1110		1332	1359	.050
	.063							736	922		1012	1240	1236		1695	1727	.063
	.071							755	958		1045	1301	1291		1853	1883	.071
	.080										1074	1357	1340		1995	2025	.080
	.090										1098	1405	1382		2115	2150	.090
	.100														2220	2255	.100
	.125																.125
	.160																.160

		CLAD 7075-T6															
		3/32			1/8			5/32			3/16			1/4			
	*SHEET GAGE	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	AD	D	DD	SHEET GAGE
DIMPLED	.020				302												.020
	.025				383			462	530								.025
	.032				454			599	672		725	822	786				.032
	.040				505			695	775		891	1000	982		1108	1300	.040
	.050				548			778	864		1036	1153	1152		1508	1705	.050
	.063							840	930		1142	1267	1277		1803	2010	.063
	.071							867	957		1190	1315	1332		1930	2150	.071
	.080										1230	1358	1380		2044	2260	.080
	.090										1267	1398	1424		2145	2365	.090
	.100														2232	2455	.100
	.125																.125
	.160																.160

*Thinnest sheet for double-dimple joints, or upper dimple sheet for dimple-machine countersink joints.

NOTES: (1) Allowables are based on test ultimate 1.15 or 1.5 - test yield, whichever is least.
(2) All values comply with the minimum gage for countersunk rivets and maximum gage for dimpled rivets.

BASIC RIVET CODE

UNIVERSAL HEAD	MATERIAL	CODE	FLUSH HEAD	MATERIAL	CODE
MS20470 A	1100	BH	MS20426 A	1100	BA
MS20470 AD	2117	BJ	MS20426 AD	2117	BB
MS20470 B	5056	BK	MS20426 B	5056	BC
MS20470 DD	2024	CX	MS20426 DD	2024	CY
NAS1321 AD	2117	VL	MS20427 M	MONEL	BF
MS20615 M	MONEL	LN	NAS1097 AD	2117	LZ
			NAS1097 DD	2024	MC

Rivet Allowable Chart
Figure 1 (Sheet 4)

			SKIN GAGE	CRES SHEET 17-7PH, (MIL-S-25043) HT-150												SKIN GAGE
				R RIVETS (MONEL), ANNEALED							A-206 RIVETS					
				3/32	1/8	5/32	3/16	1/4	5/16	3/8	3/32	1/8	5/32	3/16	1/4	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	298,000 ALLOW BRG	.016	397							457					.016
			.020								572					.020
			.025		713						625	957				.025
			.032			1093						1105	1516			.032
			.036				1580						1705	2049		.036
			.040					2850					1720	2276		.040
			.045											2470	3446	.045
			.050						4500						3829	.050
			.063							6440					4420	.063
	DOUBLE SHEAR	298,000 ALLOW BRG	.016	457							457					.016
			.020	572							572					.020
			.025	715	957						715	957				.025
			.032	794	1225	1516					915	1225	1516			.032
			.036		1378	1705	2049				1029	1378	1705	2049		.036
			.040		1426	1895	2276				1144	1531	1895	2276		.040
			.045			2132	2561	3446			1250	1723	2132	2561	3446	.045
			.050			2186	2845	3829				1914	2369	3845	3829	.050
			.063				3160	4824	6064			2210	2985	3585	4824	.063
			.071					5437	6834	8167			3364	4041	5437	.071
			.080					5700	7700	9202			3440	4553	6126	.080
			.090						8662	10353				4940	6892	.090
			.100						9000	11503					7658	.100
			.125							12880					8840	.125

			SKIN GAGE	CRES SHEET 17-7PH, (MIL-S-25043) HT-170												SKIN GAGE
				R RIVETS (MONEL), ANNEALED							A-286 RIVETS					
				3/32	1/8	5/32	3/16	1/4	5/16	3/8	3/32	1/8	5/32	3/16	1/4	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	344,000 ALLOW BRG	.016	397							528					.016
			.020								625					.020
			.025		713							1105				.025
			.032			1093							1720			.032
			.036				1580							2365		.036
			.040											2470		.040
			.045					2850							3978	.045
			.050												4420	.050
			.063						4500	6440						.063
	DOUBLE SHEAR	344,000 ALLOW BRG	.016	528							528					.016
			.020	660							660					.020
			.025	794	1105						825	1105				.025
			.032		1414	1750					1056	1414	1750			.032
			.036		1426	1969	2365				1188	1591	1969	2365		.036
			.040			2186	2628				1350	1768	2187	2628		.040
			.045				2956	3978				1989	2461	2956	3978	.045
			.050				3160	4420				2210	2734	3285	4420	.050
			.063					5569	7000				3440	4139	5569	.063
			.071					5700	7889	9427				4665	6277	.071
			.080						8888	10623				4940	7072	.080
			.090						9000	11951					7956	.090
			.100							12880					8840	.100

NOTES:

(1) Values are based on edge distance - 2D.
(2) Bearing values are above heavy line; shear values, below.

Rivet Allowable Chart
Figure 1 (Sheet 5)

				TITANIUM SHEET, COMMERCIALLY PURE, DMS1536												
			SKIN GAGE	R RIVETS (MONEL), ANNEALED							A-206 RIVETS					SKIN GAGE
				3/32	1/8	5/32	3/16	1/4	5/16	3/8	3/32	1/8	5/32	3/16	1/4	
PROTRUDING HEAD RIVETS	SINGLE SHEAR	173,000 ALLOW. BRG.	.016	265							265					.016
			.020	332							332					.020
			.025	397	555						415	555				.025
			.032		711	880					531	711	880			.032
			.036		713	990	1189				597	800	990	1189		.036
			.040			1093	1321	1778			625	889	1100	1321	1778	.040
			.045				1486	2000				1000	1237	1486	2000	.045
			.050				1580	2223	2794			1105	1375	1652	2223	.050
			.063					2801	3520	4207			1720	2081	2801	.063
			.071					2850	3967	4741				2346	3156	.071
			.080						4470	5342				2470	3556	.080
			.090						4500	6010					4001	.090
			.100							6440					4420	.100
	DOUBLE SHEAR	173,000 ALLOW. BRG.	.016	265							265					.016
			.020	332							332					.020
			.025	415	555						415	555				.025
			.032	531	711	880					531	711	880			.032
			.036	597	800	990	1189				597	800	990	1189		.036
			.040	664	889	1100	1321				664	889	1100	1321		.040
			.045	747	1000	1237	1486	2000			747	1000	1237	1486	2000	.045
			.050	794	1111	1375	1652	2223			830	1111	1375	1652	2223	.050
			.063		1400	1732	2081	2801	3520		1046	1400	1732	2081	2801	.063
			.071		1426	1953	2346	3156	3967	4741	1179	1578	1953	2346	3156	.071
			.080			2186	2643	3556	4470	5342	1250	1778	2200	2643	3556	.080
			.090				2973	4001	5029	6010		2000	2475	2973	4001	.090
			.100				3160	4446	5587	6677		2210	2750	3304	4446	.100
			.125					5557	6984	8347			3438	4130	5557	.125
			.160					5700	8940	10684			3440	4940	7113	.160
			.190						9000	12688					8447	.190
			.250							12880					8840	.250

NOTES:

(1) Values are based on edge distance - 2D.
(2) Bearing values are above heavy line; shear values, below.

Rivet Allowable Chart
Figure 1 (Sheet 6)

			SKIN	TITANIUM SHEET, ANNEALED 6AL-4V, DMS1592												SKIN
				R RIVETS (MONEL), ANNEALED							A-286 RIVETS					
			GAGE	3/32	1/8	5/32	3/16	1/4	5/16	3/8	3/32	1/8	5/32	3/16	1/4	GAGE
PROTRUDING HEAD RIVETS	SINGLE SHEAR	244,000 ALLOW. BRG.	.016	374							374					.016
			.020	397							468					.020
			.025		713						585	783				.025
			.032			1093					625	1003	1241			.032
			.036				1580					1105	1396	1677		.036
			.040					2508					1551	1864	2508	.040
			.045					2821					1720	2097	2821	.045
			.050					2850	3940					2330	3135	.050
			.063						4500	5933				2470	3950	.063
			.071							6440					4420	.071
	DOUBLE SHEAR	244,000 ALLOW. BRG.	.016	374							374					.016
			.020	468							468					.020
			.025	585	783						585	783				.025
			.032	749	1003	1241					749	1003	1241			.032
			.036	794	1128	1396	1677				843	1128	1396	1677		.036
			.040		1254	1551	1864				936	1254	1551	1864		.040
			.045		1410	1745	2097	2821			1054	1410	1745	2097	2821	.045
			.050		1426	1939	2330	3135			1171	1567	1939	2330	3135	.050
			.063			2186	2936	3950	4965		1250	1975	2444	2936	3950	.063
			.071				3160	4452	5595	6687		2210	2754	3308	4452	.071
			.080					5016	6305	7534			3103	3728	5016	.080
			.090					5643	7093	8476			3440	4194	5643	.090
			.100					5700	7881	9418				4660	6270	.100
			.125						9000	11773				4940	7838	.125
			.160							12880					8840	.160

NOTES:

(1) Values are based on edge distance - 2D.
(2) Bearing values are above heavy line; shear values, below.

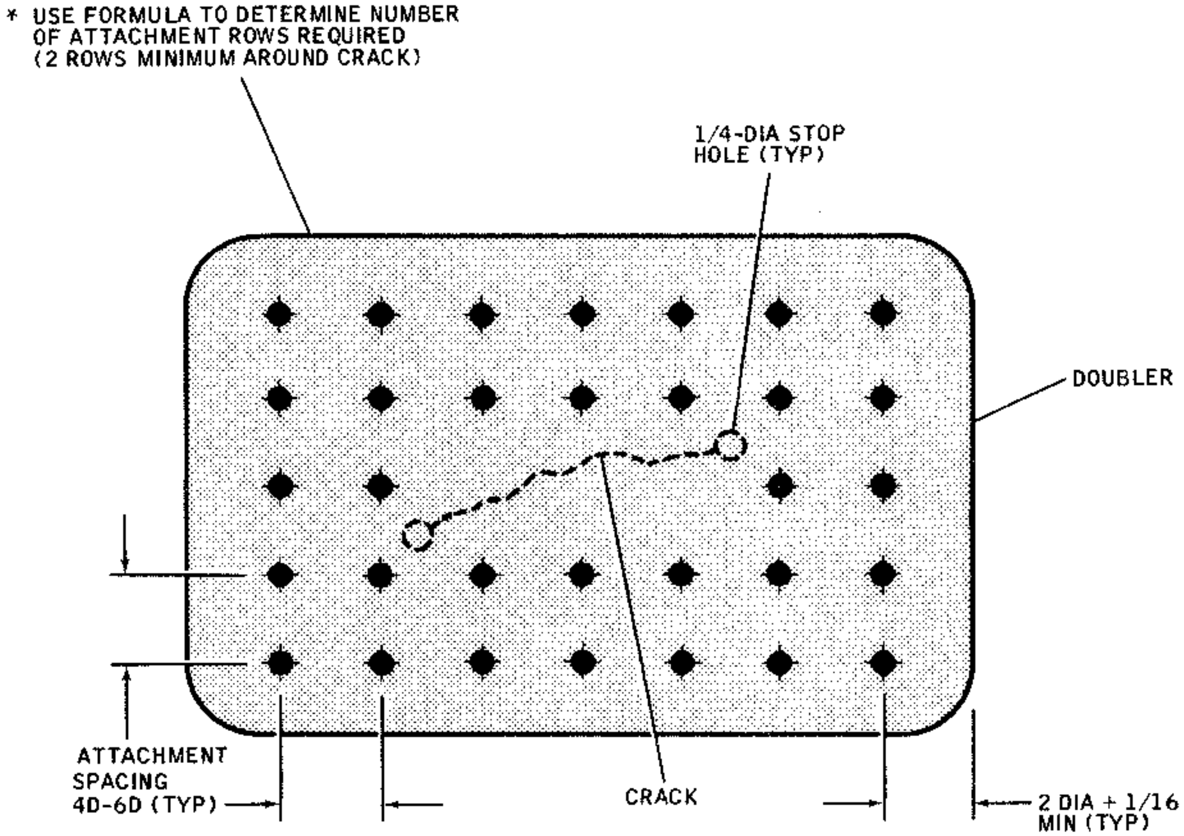
Rivet Allowable Chart

		TITANIUM SHEET, COMMERCIALLY PURE, DMS1536								
		R RIVETS (MONEL), ANNEALED								
	SHEET	TITANIUM - ROOM TEMP				TITANIUM - 400°F				SHEET
	GAGE	3/32	1/8	5/32	3/16	3/32	1/8	5/32	3/16	GAGE
DIMPLED	.012									
	.016									
	.020	285	405	520	635	225	355	450	560	.020
	.025	365	540	735	910	320	480	650	800	.025
	.032	420	650	910	1115	370	580	800	990	.032
	.036	440	715	1030	1270	390	635	910	1120	.036
	.040	455	765	1110	1380	400	675	980	1210	.040
	.045	465	805	1180	1480	415	710	1035	1300	.045

The above values are ultimate allowables which are lower than 1.5 times the yield values.

		TITANIUM SHEET, COMMERCIALLY PURE, DMS1536		
	SHEET	R RIVETS (MONEL), ANNEALED		
	GAGE	1/8	5/32	3/16
MACHINE COUNTERSUNK	.050	607		
	.063	713	890	
	.071		925	1215
	.080		955	1265
	.090		1000	1440
	.100		1030	1530
	.125		1093	1580

Rivet Allowable Chart
Figure 1 (Sheet 8)



FORMULA:

T EQUALS - - GAGE OF CRACKED STRUCTURAL MEMBER IN INCHES.
L EQUALS - - LENGTH OF CRACK IN INCHES.
Ut EQUALS - - ULTIMATE TENSILE ALLOWABLE FOR CRACKED MEMBER.
R EQUALS - - RIVET ALLOWABLE FOR RIVET SELECTED TO MAKE A REPAIR.
1.15 EQUALS - - RIVET DETERMINATION FACTOR.

EXAMPLE:

A 1.60-INCH CRACK IN CLAD 7075-T6 SKIN OF .071 GAGE. USING 5/32 AD RIVETS IN THE REPAIR.

$$\frac{T \times L \times Ut \times 1.15}{R} = \frac{0.071 \times 1.60 \times 73{,}000 \times 1.15}{596} = \text{16 RIVETS PER SIDE OF CRACK.}$$

BB3-556

Rivet Determination
Figure 2

4. Attachment of Materials with Nonparallel Surfaces

A. Attachment of materials where one or more members have a tapered surface must be accomplished with provision for the flush seating of the fasteners (see Figure 3 for examples).

B. Difference of attachment surfaces not exceeding 1/2-degree from parallel do not require consideration. However, differences exceeding 1/2-degree must be compensated for, using a method which does not result in reduced strength.

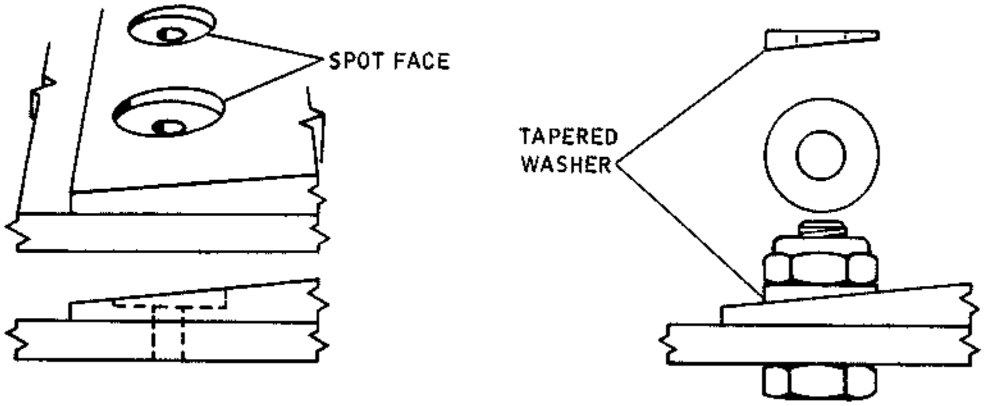
C. Although spotfacing is a common method of compensating for angular differences, it may be used only when specified in blueprint or engineering instructions. This is due to the reduction in strength of the material caused by the reduced thickness at the spotface.

D. Fasteners should be selected to duplicate original installation; and, in the case of threaded fasteners, the use of tapered shims, washers, or self-aligning nuts is recommended to attain flush-seating.

NOTE: The use of self aligning nuts is governed by considerations of size, strength, and angular limitations.

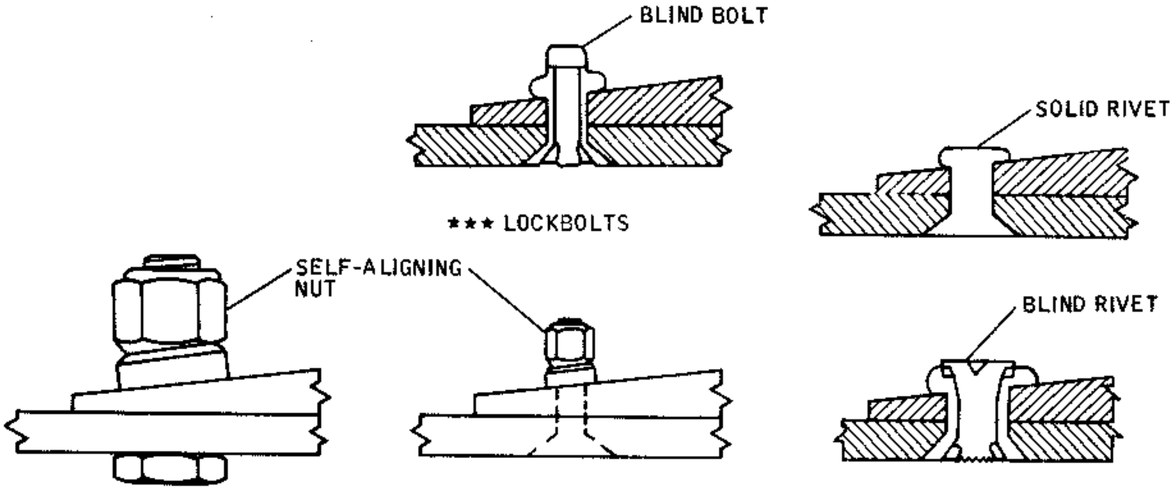
E. The use of solid rivets present little problem for installation in nonparallel surfaces (limited to 8 degrees maximum taper), but blind rivet and lockbolt selection must include consideration of the angular allowables to ensure compatibility with the taper of the material surface in which the fasteners are to be installed.

NOTE: Substitution of blind rivets and lockbolts to provide greater angular allowables may be made provided proper consideration is given to the fastener material and strength.



* SPOT FACING

TAPERED WASHERS OR SHIMS



*** LOCKBOLTS

** SELF-ALIGNING NUTS

** HI-LOK FASTENERS

*** RIVETS

* SPOT FACING IS ONLY PERMISSIBLE WHEN SPECIFIED IN BLUEPRINT, MANUAL, OR SERVICE INSTRUCTIONS.

** USED ON TAPERS OF 8° OR LESS (CHECK ANGULAR LIMITATIONS OF NUTS)

*** SELECTION OF LOCKBOLTS OR BLIND RIVETS IS RESTRICTED TO THOSE FASTENERS WITH SPECIFICATIONS PERMITTING INSTALLATION IN MATERIALS WITH NON-PARALLEL SURFACES.

BB3-713

Methods of Attaching Materials with Nonparallel Surfaces
Figure 3

BOLTS, SCREWS AND WASHERS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General Installation Practices

A. Proper installation of bolts and screws to ensure the best possible fastening of structural parts requires exacting control of installation methods. The quality and precision of manufacturing the heat treatment of the fastener, the drilling and reaming of the hole where a bolt is to be installed, and the tightening of the nut to the correct torque to secure the installation all have an effect upon proper installation. Proper countersinking or dimpling to ensure good seating, plating of the shanks to guard against contact with dissimilar metals, maintenance of proper edge distances, careful inspection to determine whether threads are in bearing and proper grip length of the fastener selected has been followed, and the proper use of washers also play an important part in good fastener installation.

2. Bolt and Screw Installation Requirements

A. General requirements for the installation of bolts and screws, and determining the location by reference to the section, figure, or paragraph number may be found by subject as follows:

Subject	Section	Figure No. or Paragraph No.
Recommended Bolt and Screw Hole Sizes in Repairs	51-10-4	Fig. 1
Drilling and Reaming of Bolt Holes	51-10-4	Par. 2
Countersinking and Dimpling for Screws	51-10-4	Par. 3
Nut and Bolt Combinations	51-30-1	Fig. 1
Torque Requirements for Bolts, Nuts, and Screws	51-30-1	Par. 6
Special Close-Tolerance Bolt Data	51-30-1	Par. 3
Oversize Fasteners	51-30-0	Par. 2
Bolt and Screw Substitutions in Repairs	51-60-0	Par. 4
Spindle Speeds for Drilling, Reaming and Countersinking of Various Metals	51-10-4	Par. 1

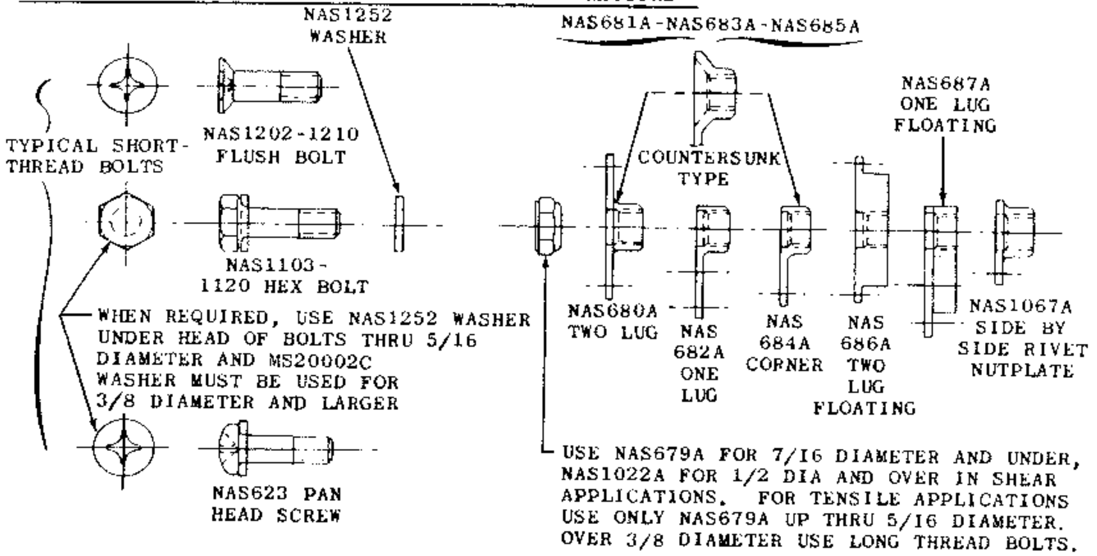
3. Special Close-Tolerance Bolt Data

A. Information to aid in the selection of the proper length and grip of special Douglas close-tolerance bolt number series 4619303 and 4619304 is presented in Figure 3, and in the following data:

	Flush-Head Bolt No. 4619303 (See Fig. 3)		Flush-Head Bolt No. 4619304 (See Fig. 3)	
Bolt Dash No.	Grip (-0.010) (-0.010)	Length (-0.031) (-0.016)	Grip (-0.010) (-0.010)	Length (-0.031) (-0.016)
- 3	0.188	0.531	0.188	0.656
- 5	0.312	0.656	0.312	0.781
- 7	0.438	0.781	0.438	0.906
- 9	0.562	0.906	0.562	1.031
-11	0.688	1.031	0.688	1.156
-13	0.812	1.156	0.812	1.281
-15	0.938	1.281	0.938	1.406
-17	1.062	1.406	1.062	1.531
-19	1.188	1.531	1.188	1.656
-21	1.312	1.656	1.312	1.781
-23	1.438	1.781	1.438	1.906
-25	1.562	1.906	1.562	2.031
-27	1.688	2.031	1.688	2.156
-29	1.812	2.156	1.812	2.281
-31	1.938	2.281	1.938	2.406
-33	2.062	2.406	2.062	2.531
-35	2.188	2.531	2.188	2.656
-37	2.312	2.656	2.312	2.781

	Flush-Head Bolt No. 4619303 (See Fig. 3)		Flush-Head Bolt No. 4619304 (See Fig. 3)	
Bolt Dash No.	Grip (-0.010) (-0.010)	Length (-0.031) (-0.016)	Grip (-0.010) (-0.010)	Length (-0.031) (-0.016)
-39	2.438	2.781	2.438	2.906
-41	2.562	2.906	2.562	3.031
-43	2.688	3.031	2.688	3.156
-45	2.812	3.156	2.812	3.281
-47	2.938	3.281	2.938	3.406
-49	3.062	3.406	3.062	3.531
-51	3.188	3.531	3.188	3.656
-53	3.312	3.656	3.312	3.781
-55	3.438	3.781	3.438	3.906
-57	3.562	3.906	3.562	4.031
-59	3.688	4.031	3.688	4.156
-61	3.812	4.156	3.812	4.281
-63	3.938	4.281	3.938	4.406
-65	4.062	4.406	4.062	4.531
-67	4.188	4.531	4.188	4.656
-69	4.312	4.656	4.312	4.781
-71	4.438	4.781	4.438	4.906
-73	4.562	4.906	4.562	5.031
-75	4.688	5.031	4.688	5.156

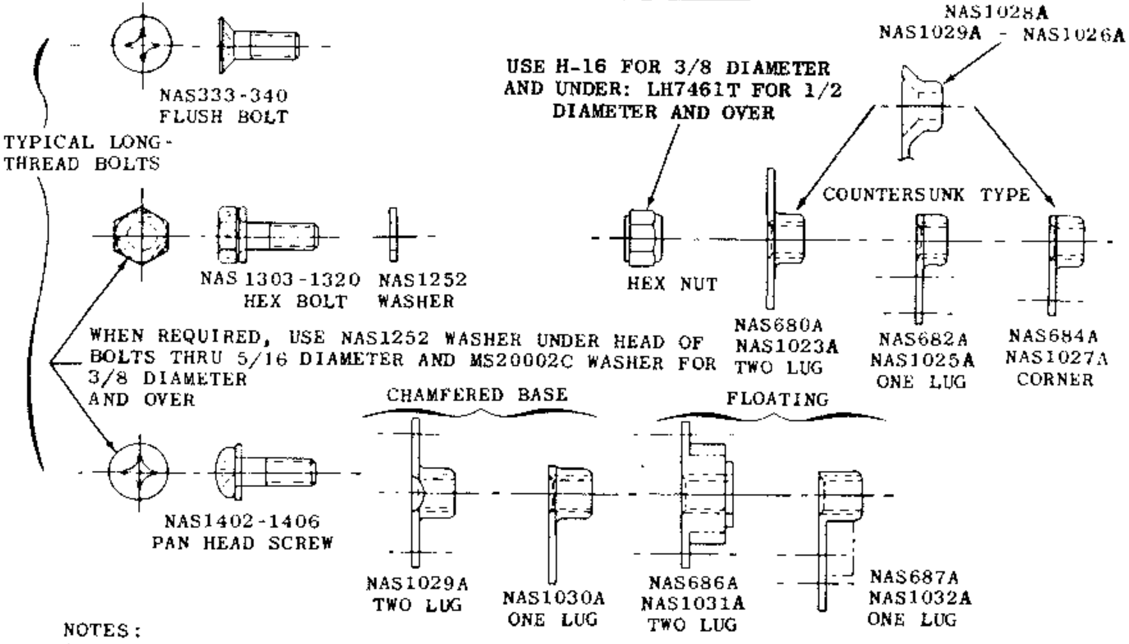
SHORT-THREAD BOLT AND LOW-HEIGHT NUT COMBINATIONS



NOTES:

1. BOLTS AND SCREWS HT 160,000 TO 180,000 PSI. DERATED TO 125,000 PSI IN TENSION.
2. PLAIN GANG CHANNELS WITH NAS688P THRU NAS691P NUTS.
3. COUNTERSUNK GANG CHANNELS WITH NAS693P THRU NAS695P NUTS.
4. COMBINATIONS LISTED ARE PREFERRED PARTS FOR USE UP TO 260°C (500°F) NUTS AND NUTPLATES ARE ALSO AVAILABLE IN 121°C (250°F) AND 427°C (800°F) CONFIGURATIONS.

LONG-THREAD BOLT AND REGULAR-HEIGHT NUT COMBINATIONS



NOTES:

1. BOLTS AND SCREWS HT 160,000 TO 180,000 PSI. DERATED TO 125,000 PSI IN TENSION.
2. PLAIN GANG CHANNELS WITH NAS1034P THRU NAS1038P NUTS.
3. COUNTERSUNK GANG CHANNELS WITH NAS1039P THRU NAS1041P NUTS.

BB3-477

Bolt and Nut Combinations
Figure 1

4. Special Oversize Bolts

A. Special Oversize Bolt Part Numbers

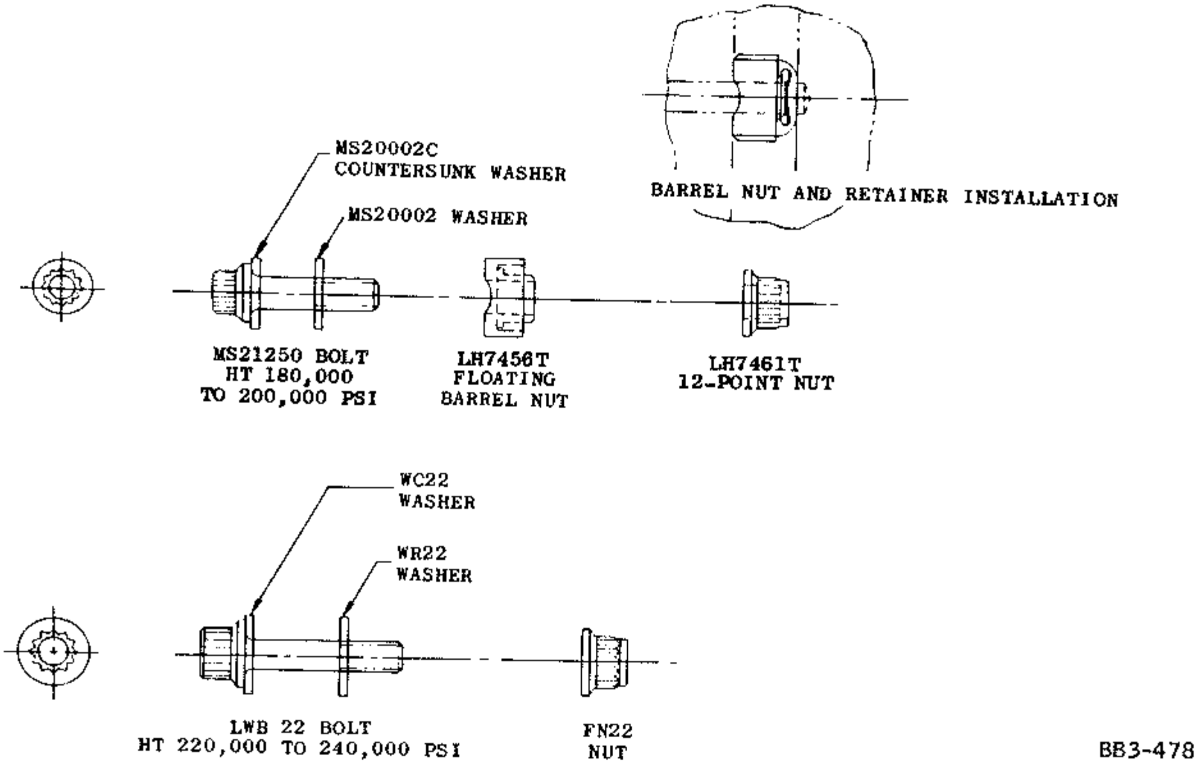
(1) Special oversize-diameter bolts which are usable for obtaining a high-quality fit in oversize hole can be obtained from Douglas Aircraft Co., Inc. These bolts are identical to the bolts used in standard installations in every respect except that the grip portion of the shank is 1/64 inch or 1/32 inch greater in diameter. The same quality of tightness, as recommended for standard installation bolts (see paragraph 6), is applicable for the oversize bolts. The following information lists the Douglas or MS bolt number used in standard installations, and the corresponding oversize diameter bolt part number.

Standard Installation Bolt Number	1/64 Inch Diameter Oversize Bolt Number	1/32 Inch Diameter Oversize Bolt Number
4619303	4653156-3	4651552-3
4619304	4653156-4	4651552-4
MS21250-05	4912390-4	4912391-4
MS21250-05	4912390-5	4912391-5
MS21250-06	4912390-6	4912391-6
MS21250-07	4912390-7	4912391-7
MS21250-08	4912390-8	4912391-8
MS21250-09	4912390-9	4912391-9
MS21250-10	4912390-10	4912391-10
MS21250-12	4912390-12	4912391-12
MS21250-14	4912390-14	4912391-14
MS21250-16	4912390-16	4912391-16
MS21250-18	4912390-18	4912391-18
MS21250-20	4912390-20	4912391-20
MS21250-22	4912390-22	4912391-22
MS21250-24	4912390-24	4912391-24
NAS624	4653155-4	4651553-4
NAS625	4653155-5	4651553-5

Standard Installation Bolt Number	1/64 Inch Diameter Oversize Bolt Number	1/32 Inch Diameter Oversize Bolt Number
NAS626	4653155-6	4651553-6
NAS627	4653155-7	4651553-7
NAS628	4653155-8	4651553-8
NAS629	4653155-9	4651553-9
NAS630	4653155-10	4651553-10
NAS632	4653155-12	4651553-12
NAS634	4653155-14	4651553-14
NAS636	4653155-16	4651553-16
NAS638	4653155-18	4651553-18
NAS640	4653155-20	4651553-20
NAS642	4653155-22	4651553-22
NAS644	4653155-24	4651553-24

B. Oversize Bolt Part Number Determination

(1) To determine the proper oversize bolt part number, it is necessary to refer to the coding systems of the various bolts for which oversize



External Wrenching Bolt and Nut Combinations
Figure 2

replacement bolts are available. The Douglas Standard bolt numbers and their coding systems are illustrated in paragraph 3 of this section. The coding system for MS bolts are shown in the Military Standard handbooks.

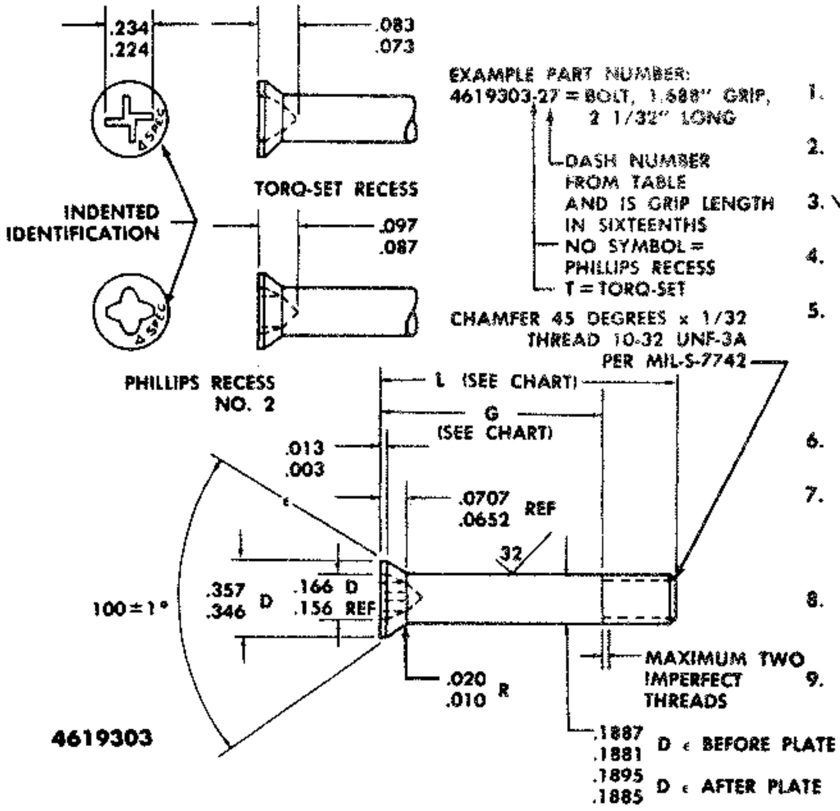
(2) Douglas oversize replacement bolts are manufactured to the same specifications as the standard bolt; the part number is listed opposite the oversize bolt part number in the accompanying list, except for oversize diameters of grip portions of the bolt shanks.

(3) Three considerations are necessary to determine the oversize bolt part number. The first consideration is the bolt series being replaced; second, the bolt size (diameter); and third, the bolt length (grip and threaded portion of the shank). The first dash number of the oversize bolt indicates the size (diameter). The second dash number of the oversize bolt is always the same as the number following the basic part number of the standard installation bolt series, and indicates the length (grip and threaded portion of the shank).

(4) Examples:

Standard Bolt	1/64 Oversize Bolt	1/32 Oversize Bolt
4619303-2	4653156-3-2	4651552-3-2

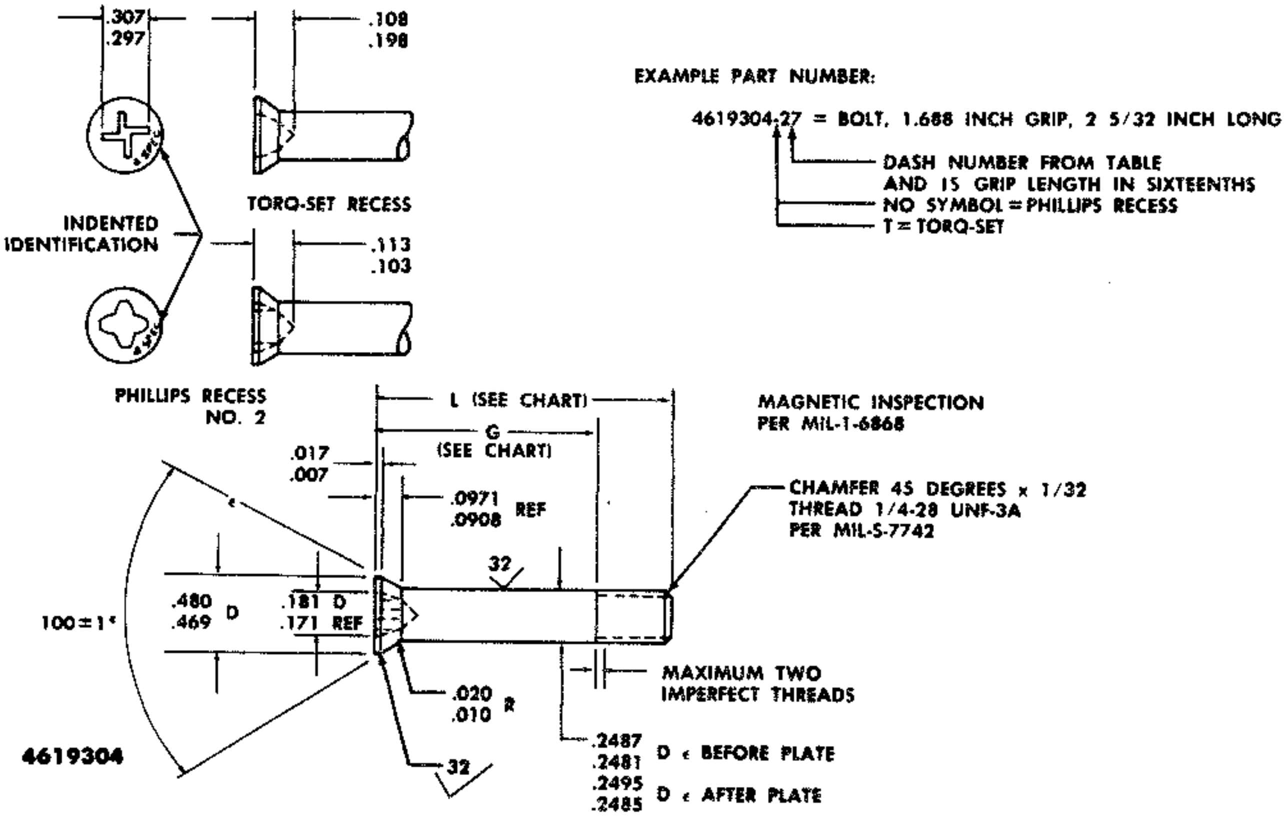
(Continued)



4619303

GENERAL NOTES:

1. This bolt must meet all the requirements of NAS498.
2. Cadmium plate entire bolt per Fed. QQ-P-416, TYPE I, CLASS C.
3. ✓ indicates surface roughness per MIL-STD-10.
4. All diameters marked thus (ε) to be concentric within .002 full indicator reading.
5. Bolts may be procured in 1/16-inch increments by specifying intermediate (even) dash numbers, thus increasing both the length and grip by 1/16 inch over tabulated values.
6. All machined surface roughness 125✓ per MIL-STD-10.
7. Dimensioning and gaging of the Phillips recess shall be in accordance with 1950 supplement to handbook H28, screw threads for Federal Services 1944.
8. Dimensioning and gaging of the torq-set recess shall be in accordance with NAS-1078 except as noted.
9. See chart for G and L dimensions.



4619304

BB3-498

Special Flush-Head Bolt Data
Figure 3

(4) Examples (Continued):

Standard Bolt	1/64 Oversize Bolt	1/32 Oversize Bolt
MS21250-16102	4912390-16-102	4912391-16-102

NOTE: Check the coding system of the bolt series being replaced to ensure correct replacement with equivalent bolts.

(5) Oversize replacement bolts are available as substitutes for standard installation fasteners not listed in paragraph 4.A.(1). Refer to 51-30-0 for approved NAS oversize replacements. Carefully check NAS oversize bolt lengths for coding to determine proper replacement lengths. Dash numbers of NAS oversize bolts may vary in length from equivalent dash numbers of other NAS bolts for which they can be substituted. For further information pertaining to the procurement of oversize replacement bolts, contact the Customer Service Department, Douglas Aircraft Company, Long Beach, Calif.

5. Washers

A. Use of Washers

(1) Washers are used to protect the structural material from marring by the bolt head or nut during the tightening operation. They also may be used for packing, for retaining soft materials such as insulation blankets, for prevention of chemical reaction between dissimilar materials, and as a locking device in the case of lockwashers.

(2) Washers should be installed to duplicate the original configuration with reference to size, location, and material, wherever possible. However, during repairs it may be necessary to deviate from the original installation; therefore, it is recommended that washers be installed in compliance with the instructions contained in this section.

(3) Washers are generally installed under the nut or bolt head, whichever is turned during the tightening operation. However, they may also be used for spacing (limit three) under castellated nuts or for overlong bolts.

(4) The use of lockwashers should closely follow the original installation for the repaired area, and generally should be installed with a steel washer, between the lockwasher and the structural material (see Figure 4) to protect thin material, or soft materials such as aluminum alloys from being marred by the lockwasher.

(5) Typical installation of washers is shown in Figure 4; this figure should be used as a guide when duplication of the original installation is not possible. Selection of washers should be based on the following considerations:

(a) When internal or external wrenching bolts are specified, countersunk washers must be used, unless a chamfer is called out in the part to accept the fillet radius of the bolt. For hex head bolts, and other protruding head bolts (160,000 psi and over) 3/8-inch diameter and over, countersunk washers must be used.

(b) Lockwashers must not be used for substitutions in structural applications.

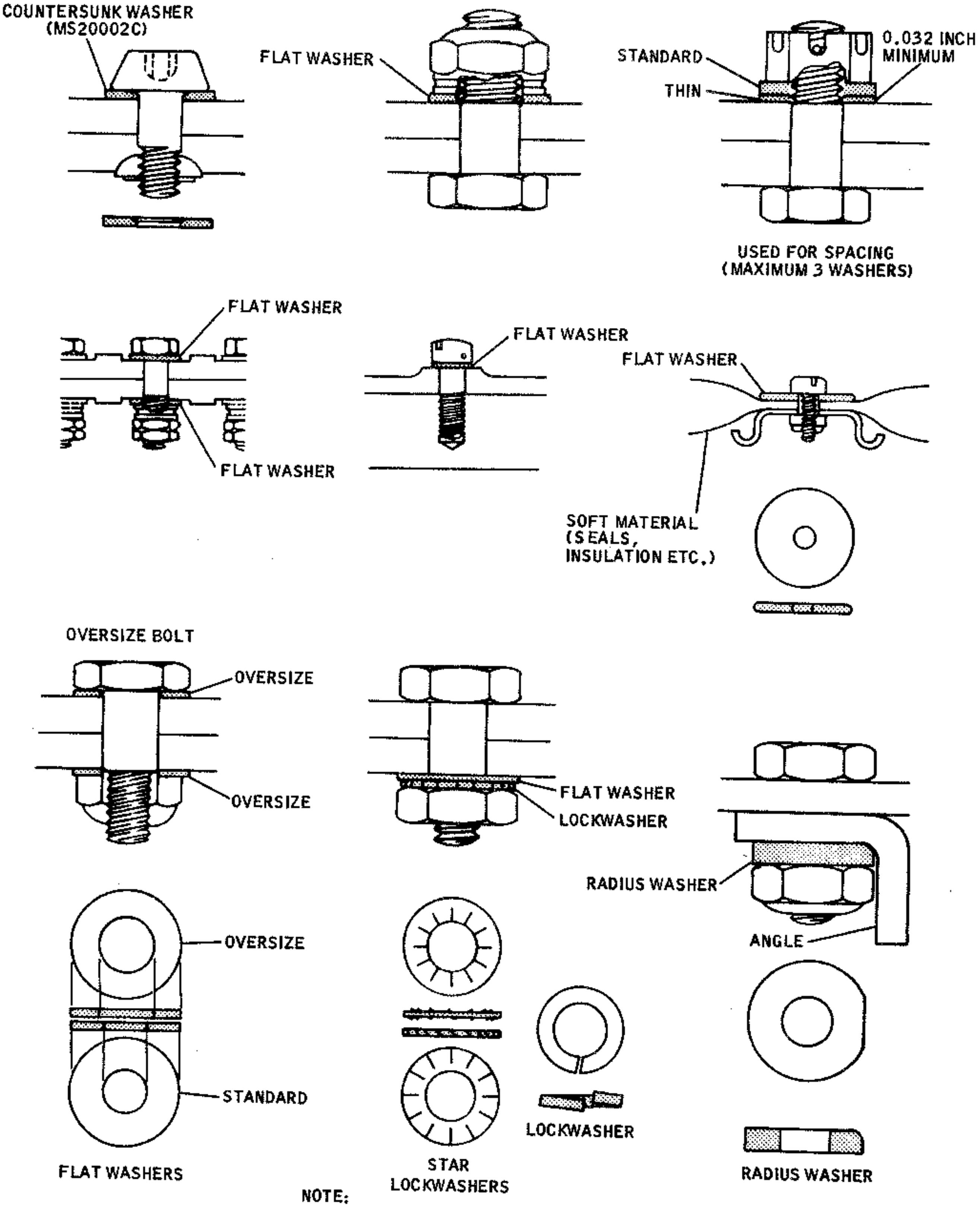
(c) Use of thin washers should be restricted to 0.032 inch minimum.

(d) Oversize high-tensile bolts (internal of external wrenching) 1/4-inch diameter and larger, and all other hex head bolts 3/8-inch diameter and larger require oversize washers.

NOTE: Plain washers (NAS1252, MS20002, etc.) may be reamed to oversize internal diameter.

(e) Washer strength and corrosion prevention requirements for the application must be fully met.

NOTE: MS20002 and NAS1252 flat washers are recommended for use on the DC-9 structure.



NOTE:
LOCKWASHERS ARE NOT TO BE USED FOR STRUCTURAL APPLICATIONS.

BB3-543A

Typical Washer Installations
Figure 4

B. Materials

(1) Since steel bolts are almost universally used, one washer would normally be installed under the turning head or nut, and be made from aluminum alloy for shear joints and thin aluminum alloy parts, and from steel for aluminum or steel structure tension joints (see Figure 5).

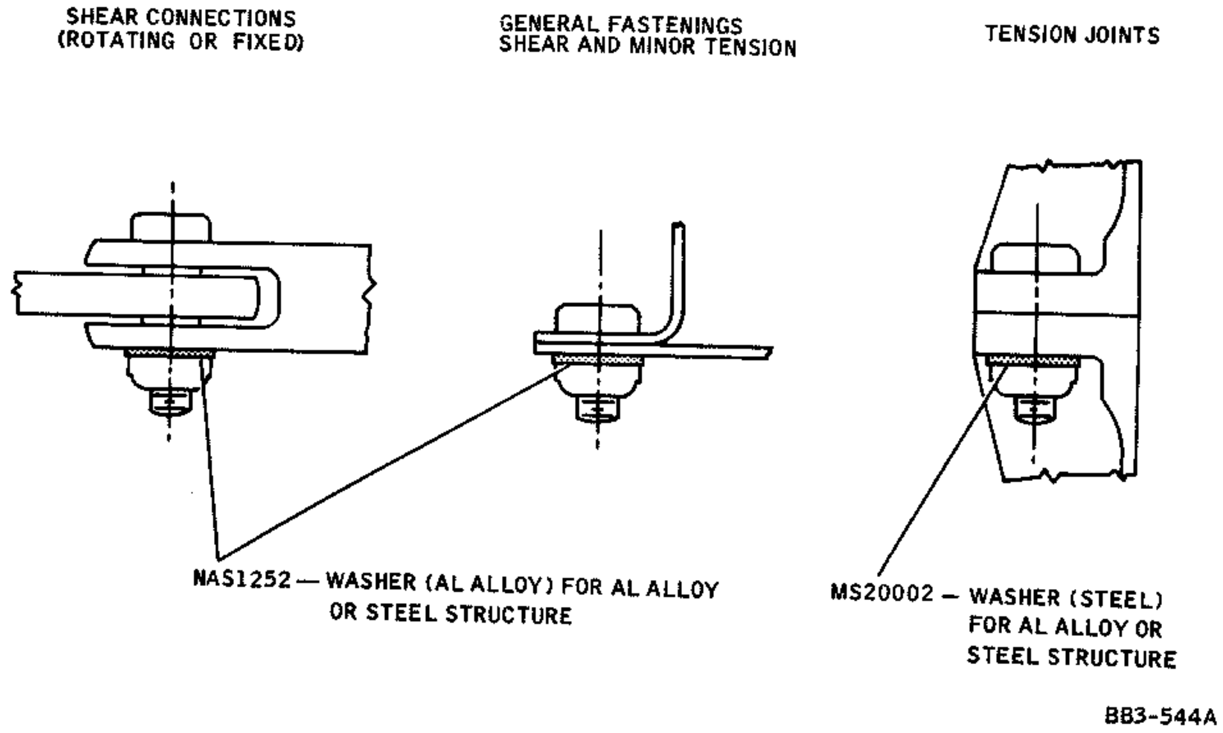
(2) High tension bolts commonly require the use of a MS20002C washer under the head (countersunk face to head), or a MS20002 washer under the high tension nut.

(3) Anodized washers (NAS1252) should be used to separate steel bolt heads, steel nuts, or steel washers from magnesium surfaces to prevent possible electrolytic chemical reaction.

C. Sizes

(1) Use standard sizes for bolt diameters; however, when using oversize bolts an oversize washer is required when used under the head, and it should be noted that a standard size is required for use under the nut (see Figure 4).

(2) When using a thin washer for packing, as for example under a castellated nut (see Figure 4), the thin washer should always be used with a washer of standard thickness with the thin washer placed next to the material.



Washer Material Determination
Figure 5

(3) Part numbers for oversize, or various thicknesses and materials, for washers may be determined by reference to the applicable AN, NAS, and MS manuals.

6. Torque Requirements for Nuts, Bolts, and Screws

A. General Torque Requirements

(1) The procedures for the installation of bolts, screws, and nuts described in this section and the adherence to the torque values listed in the applicable torque table are necessary to ensure correct installation.

WARNING: DO NOT USE THE TORQUE VALUES IN THIS SECTION FOR PYLON POWER PLANT AREAS. HIGH-TEMPERATURE NUTS, USED ON HIGH-HEAT-TREAT BOLTS IN HIGH-TEMPERATURE AREAS, REQUIRE A LOWER NUT TORQUE VALUE. REFER TO THE DC-9 MAINTENANCE AND OVERHAUL MANUALS FOR TORQUE VALUES SPECIFICALLY APPLICABLE TO THESE AREAS.

B. Installation of Bolts and Nuts

(1) When using self-locking nuts, the breakthrough torque of each nut of each individual attachment must be obtained to ensure proper torque. Breakthrough on nuts having either nylon or fiber inserts is obtained when the bolt thread breaks through the insert. Nuts having nylon or fiber inserts must not be lubricated when installed, because lubrication reduces the efficiency of the insert in providing a friction lock. On all steel nuts, breakthrough is obtained when the bolt thread is first visible. Add the value of the breakthrough torque to the minimum torque specified for the attachment to obtain the final torque value. Raised bolt ends and chamfers may necessitate the bolt shank extending slightly beyond the nut to accomplish a complete breakthrough.

(2) When inspecting self-locking nuts after they have been tightened, observe how far the end of the bolt or screw extends through the nut. Bolts or screws with round or chamfered ends must extend at least the full chamfer above the nuts. Flat-end bolts or screws must extend at least 1/32 inch through the nut.

C. Bolt Head Torque Requirements

(1) Any access door, cover plate, angle, channel, or other structural part attached with a series of bolts and/or screws in a specific repair which subsequently requires tightening to a specific torque value, must be tightened in such a manner as to load the part uniformly.

(2) Bolts and screws which may be installed fingertight (loose fit) shall be tightened from the head end and to the high value of the specified torque range. If the bolts are being installed in an interference fit (requiring driving force to install), tighten to a torque value which is the sum of the prevailing torque before the head seats and the minimum torque

value of the specified range. Final torque reading is based upon continuous rotation of the bolt head.

NOTE: Tighten with a torque wrench, torque controlled power screwdriver, or hand screwdriver. Do not use an impact wrench (nut runner).

D. Use of Torque Wrench and Adapters

(1) Adapters can be used with torque wrenches for tightening to the correct torque value in inaccessible locations. Using an acceptable torque wrench, convert torque readings by the formula shown in Figure 6.

(2) To ensure accurate torque values, it is necessary to calibrate torque wrenches at frequent intervals.

E. Nut Torque Values

(1) The following torque values apply to 12B, FN22, 2752, H16 (LH3849), LH7456T, LH7461T, H20 (48FLW and LH4011), and 42FW high-strength nuts used with bolts in the 160,000-to 180,000-psi heat-treat range. These values also apply to high-strength nuts when used with bolts in the 180,000- to 200,000-psi heat-treat range. These torque values apply to all installations whether in integral fuel tank areas or any other structural area, except pylon and cowl areas.

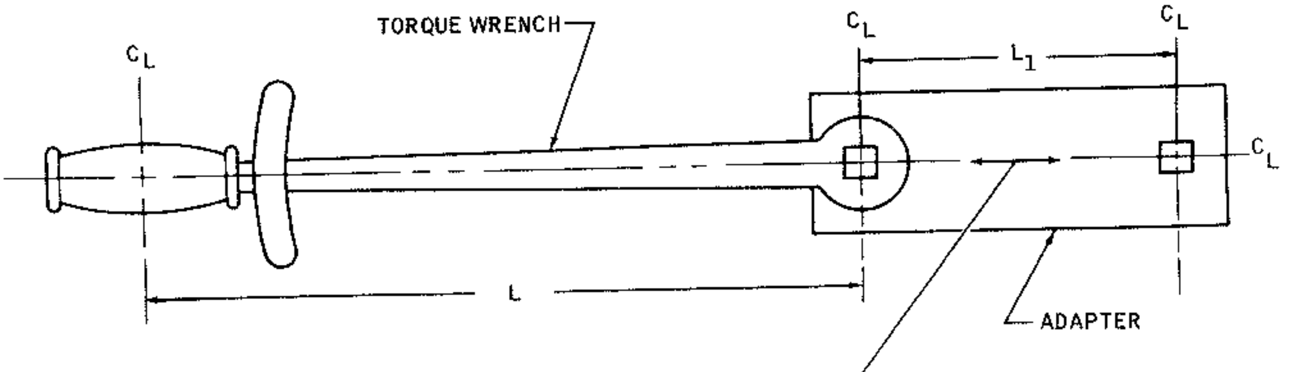
Bolt Size	Nut Thread	Torque Value
No. 10	1032	45-50 inch-pounds
1/4	428	85-115 inch-pounds
5/16	524	165-230 inch-pounds
3/8	624	260-320 inch-pounds
7/16	720	740-820 inch-pounds
1/2	820	800-1140 inch-pounds
9/16	918	1370-1640 inch-pounds
5/8	1018	1845-2120 inch-pounds
3/4	1216	320-340 foot-pounds
7/8	1414	340-410 foot-pounds
1	1614	510-760 foot-pounds
1 1/8	1812	690-965 foot-pounds
1 1/4	2012	1235-1510 foot-pounds

(2) The following torque values apply to NAS679, NAS1021, NAS1031, and AN310 nuts.

Bolt Size	Nut Thread	Torque Value
No. 6	632	8-10 inch-pounds
No. 8	832	12-15 inch-pounds
No. 10	1032	20-25 inch-pounds
1/4	428	50-70 inch-pounds

(Continued)

Printed in U.S.A.



TORQUE WRENCH MUST BE ATTACHED IN A STRAIGHT LINE WITH THE ADAPTER TO OBTAIN A PROPER READING

TORQUE READING CORRECTION FORMULA:

T_1 = DIAL READING
T = SPECIFIED TORQUE
T_1 (DIAL READING = $\frac{TL}{L+L_1}$

IMPORTANT:

WHEN SUBSTITUTING VALUES IN FORMULA:

USE INCH UNITS THROUGHOUT TO OBTAIN ANSWER IN INCH-POUNDS.
USE FOOT UNITS THROUGHOUT TO OBTAIN ANSWER IN FOOT-POUNDS.
WRENCH AND ADAPTER CENTERLINES MUST ALIGN.
WHEN TORQUING ALWAYS TORQUE FROM THE NUT IF POSSIBLE.
IF THE NUT IS COMPLETELY INACCESSIBLE AND IT IS NECESSARY TO TORQUE FROM THE BOLT HEAD, TORQUE TO THE MAXIMUM VALUE OF THE TORQUE RANGE.

BB3-479

Torque Wrench and Adapter Formula
Figure 6

(Continued)

Bolt Size	Nut Thread	Torque Value
5/16	524	100-140 inch-pounds
3/8	624	160-190 inch-pounds
7/16	720	450-500 inch-pounds
1/2	820	480-690 inch-pounds
9/16	918	800-1000 inch-pounds
5/8	1018	1100-1300 inch-pounds
3/4	1216	190-210 foot-pounds
7/8	1414	210-250 foot-pounds
1	1614	310-400 foot-pounds
1 1/8	1812	415-585 foot-pounds
1 1/4	2012	750-915 foot-pounds

<u>NOTE</u>: Use 60 percent of the torque value listed for NAS1022 and AN320 reduced-thread (shear) nuts.

F. Screw Torque Values

(1) Use the following torque values for the installation of high-heat-treated, Phillips recessed-head screws.

Screw Thread	Torque Value
1032	45-50 inch-pounds
428	80-100 inch-pounds
524	100-140 inch-pounds

7. Preload Indicating (PLI) Washers

A. Use of PLI Washers

(1) Preload-indicating (PLI) washers (for sizes see paragraph 7.G.) are installed in various installations on the airplane. PLI washers (see Figure 7) consist of two concentric steel rings sandwiched between two close-tolerance, high-heat-treated flat washers which are placed between the material and the nut or the head of the bolt, and which become a permanent part of the installation. As the nut or the head of the bolt is tightened, it compresses the inner washer, which is thicker than the outer washer, until the outer washer cannot be moved. This is the desired preload of the bolt.

B. Installation of Preload-Indicating Washers Under Nuts

(1) Install PLI washers in the following manner.

NOTE: PLI washers manufactured by the Standard Pressed Steel Co. must be used as a four-piece set, as packaged.

(a) Remove all chips and burrs from the bolt hole.

Printed in U.S.A.

(b) Place the flat washer over the end of the bolt and against the material.

(c) Place the inner and outer PLI washer over the bolt and on top of the flat washer.

(d) Place a second flat washer over the bolt and on top of the PLI washer.

NOTE: All inner PLI washers, 7/16 inch and larger, are waxed to reduce the force necessary to install the PLI washer. Do not remove the wax.

(e) Insert a scribe or a PLI-washer-wiggle tool in one of the three small holes of the outer washer, and wiggle or rotate the outer washer back and forth while tightening the nut (see paragraph 7.C. for information on the use of the PLI-washer-wiggle tool). The head of the bolt must be held stationary during the operation. When the outer washer comes in contact with the flat washer and cannot be moved, the bolt has reached the desired preload and must nut be tightened further.

NOTE: Do not overtighten. PLI washers are designed to preload at 80 percent of the bolt strength. Additional tightening of the nut after the outer washer has bottomed may overload the bolt. When a bolt has been tightened more than 1/8 (45 degrees) turn beyond the point where the PLI washer becomes immovable, the installation is not acceptable and the entire application, including the bolt and nut, must be replaced. Once a bolt is tightened using a PLI washer, it must not be loosened. If a nut is loosened, the used PLI washer must be replaced. If a loose PLI washer is discovered, remove the complete PLI-washer assembly and replace it with a new PLI-washer assembly. If this is not possible, retighten as described in paragraph 7.B. or 7.D., and replace the PLI-washer assembly at the earliest possible date.

C. Use of the PLI-Washer-Wiggle Tool

(1) The preloading of bolts to approximately 80 percent of their yield strength, as brought about by PLI washers, is highly effective in extending bolt life. However, for this to be accomplished, it is necessary that the position of binding of the outer ring be accurately determined. To aid rotation of the outer ring while a PLI washer is being tightened, a simple but effective wiggle tool has been designed (see Figure 8); a modified version of this tool, shown in View b, is especially useful in areas where access is difficult.

(2) During the tightening process, when the outer ring is being rotated, precaution should be taken to ascertain that the initial stoppage of the outer ring is not premature. Thus, in addition to resisting rotation, the outer ring should have no side play and show no tendency to rock about. Inserting the tool in either of the two additional holes may help in checking for these possibilities.

(3) After installation, a tapered gap may exist between the outer PLI washer and the flat washer. The gap must not be greater than indicated in the following list and in Figure 9.

Washer Size	Size	Gap
-3	3/16 inch	0.007
-4	1/4	0.0075
-5	5/16	0.0085
-6	3/8	0.009
-7	7/16	0.0095
-8	1/2	0.0105
-9	9/16	0.011
-10	5/8	0.012
-12	3/4	0.013
-14	7/8	0.0145
-16	1	0.016
-18	1 1/8	0.017
-20	1 1/4	0.0175
-22	1 3/8	0.0185
-24	1 1/2	0.020

(4) Although too little force can be used with such a tool when checking the outer ring for binding, the mechanic's judgment should be an adequate guide. However, by applying handle force as closely as possible to the washer, any excessive tendency for the tool to bend or rotate about point "x" (see Figure 8) can be avoided.

(5) Although these tools have been assigned the manufacturer's K number, it is not intended that they be furnished to the customers. Complete information for the manufacture of these tools is furnished in Figure 8. The wire diameter tolerance of +0.000, -0.002 ensures that the wire will not exceed the washer hole diameter.

D. Installing Preload-Indicating Washers Under Bolt Head

(1) The following procedure is for installing PLI washers under the head of the bolt when the nut remains stationery (this procedure is only used when specifically designated on the engineering drawings).

<u>NOTE</u>: PLI washers manufactured by the Standard Pressed Steel Co. must be used as a four-piece set, as packaged.

(a) Remove all chips and burrs from the bolt hole.

(b) Place an MS20002C washer over the end of the bolt with the countersunk face against the bolt head.

NOTE: When using a PLI washer set that includes a countersunk washer (62523 and 62524 series), the countersunk washer will be used instead of the MS20002C washer (see Figure 11).

Printed in U.S.A.

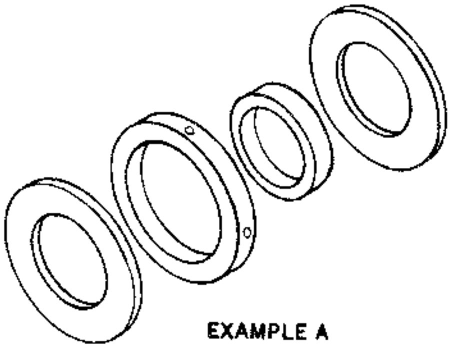
(c) Place the flat washer against the MS200002C washer.

<u>NOTE</u>: This step does not apply when using PLI washer set with countersunk washer.

(d) Place an inner and outer PLI washer over the bolt.

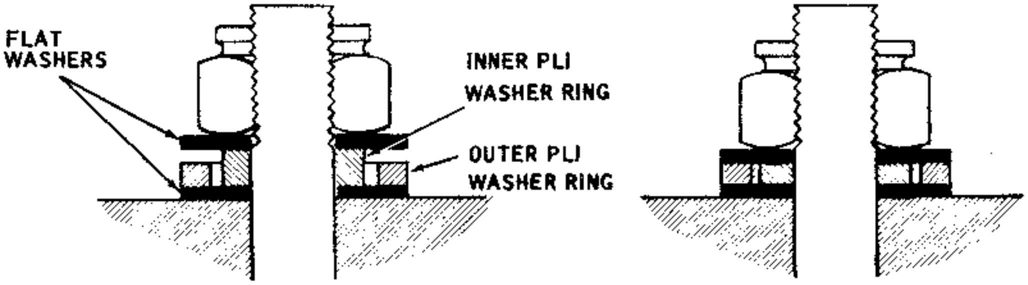
Printed in U.S.A.

PLI WASHER ASSEMBLIES CONSIST OF TWO LOOSELY FITTING CONCENTRIC RINGS SANDWICHED BETWEEN TWO HIGH-STRENGTH, STEEL WASHERS. SEE EXAMPLE A:



EXAMPLE A

AS THE NUT OR BOLT IS TIGHTENED, THE INNER WASHER COMPRESSES UNTIL THE OUTER WASHER CAN NO LONGER BE MOVED. WHEN THIS OCCURS THE DESIRED PRELOAD ON THE BOLTS HAS BEEN OBTAINED. SEE EXAMPLE B.

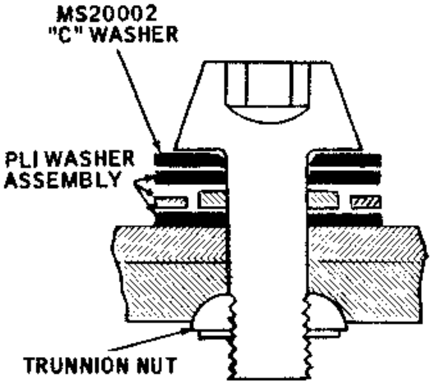


INITIAL POSITION OF PLI WASHER

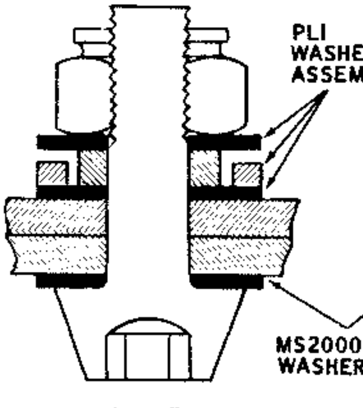
EXAMPLE B

POSITION AT DESIRED PRELOAD

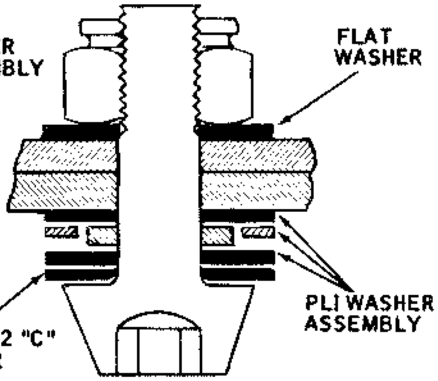
TYPICAL BOLTED CONNECTIONS, ALONG WITH THE LOCATION OF PLI WASHERS, FLAT WASHERS, AND MS20002 "C" WASHERS ARE SHOWN IN EXAMPLES C, D, AND E:



EXAMPLE C



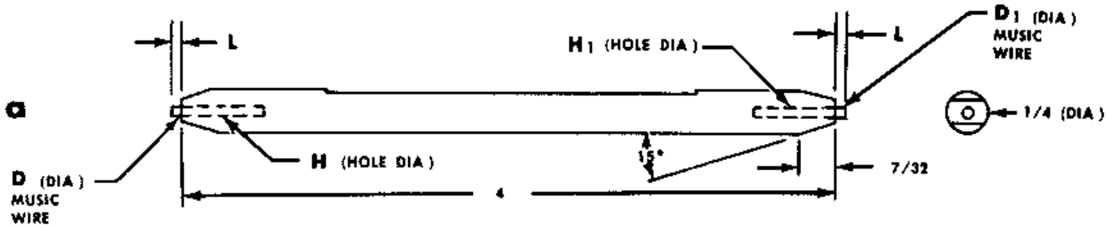
EXAMPLE D



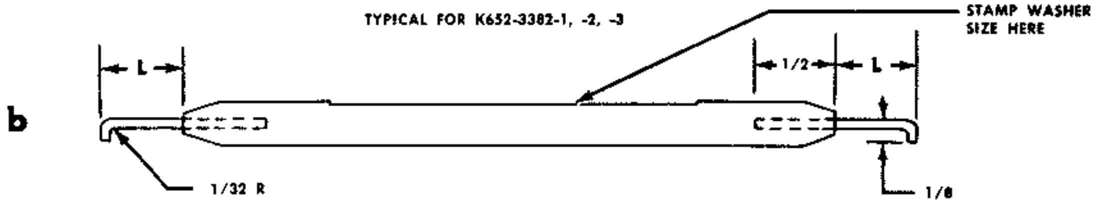
EXAMPLE E

BB3-480

PLI Washer Installation
Figure 7



TYPICAL FOR K652-3382-1, -2, -3



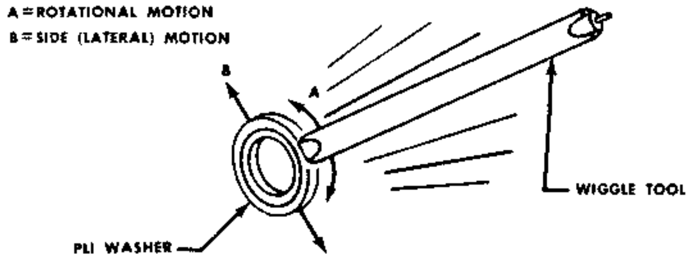
TYPICAL FOR K652-3382-11, -12, -13

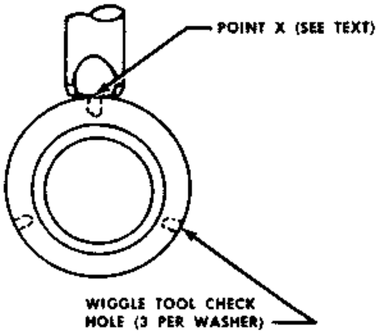
PLI WASHER WIGGLE TOOL

TOOL NUMBER	USED ON PLI WASHER	D	D1	H	H1	L (-1, -2, -3)	L (-11, -12, -13)
K652-3382-1GT AND -11	3/16, 1/4	.043	.047	.042	.046	1/16	1/2
K652-3382-2 AND -12	5/16 TO 5/8	.059	.076	.055	.075	1/16	1
K652-3382-3 AND -13	3/4 TO 1 1/2	.088	.120	.086	.116	1/16	3/4

Notes:

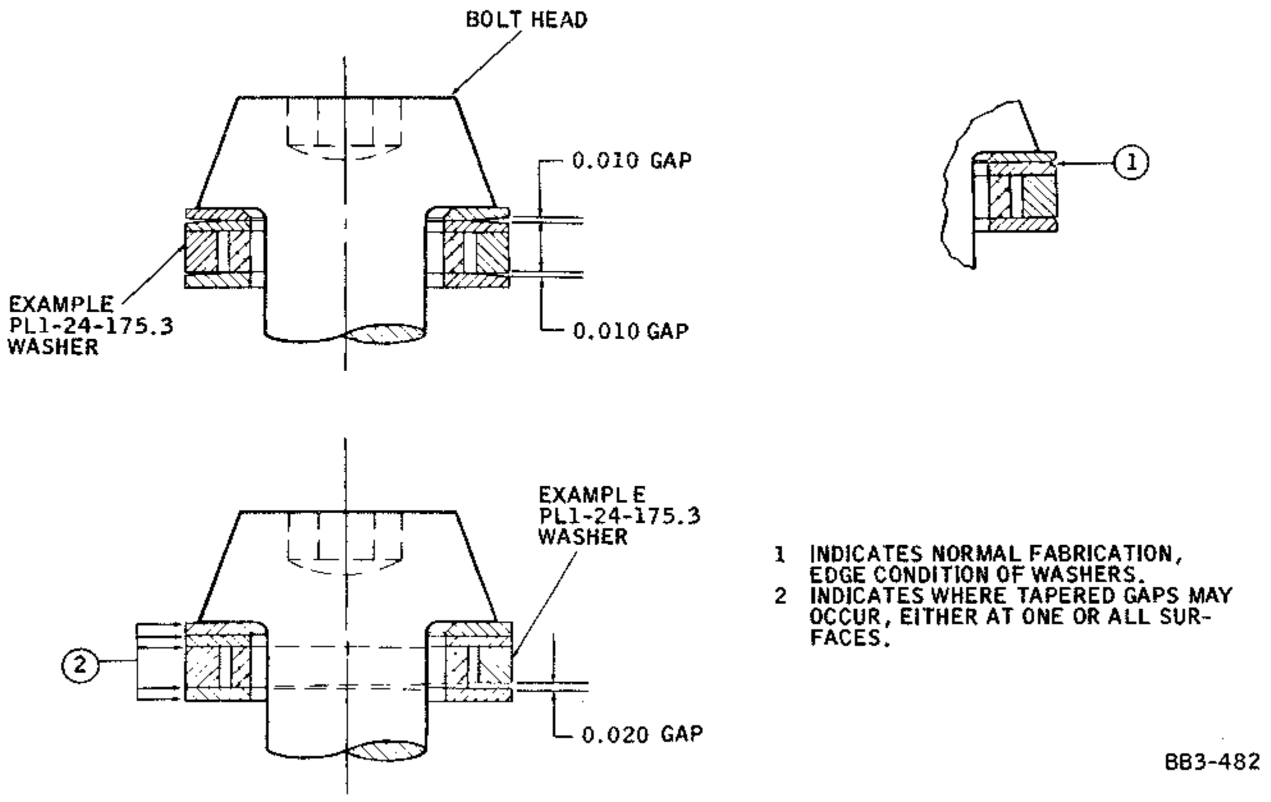
1. **Dimension apply to both tools, except L as noted**
2. **Tolerance = $^{+.000}_{-.002}$ except L = ±1/64**
3. **Break all sharp edges**
4. **Surface to be 125√**
5. **Cadmium Plate**





BB3-481

Use of the PLI-Washer-Wiggle Tool
Figure 8



1 INDICATES NORMAL FABRICATION, EDGE CONDITION OF WASHERS.
2 INDICATES WHERE TAPERED GAPS MAY OCCUR, EITHER AT ONE OR ALL SURFACES.

PLI Washer Gap Limitations
Figure 9

(e) Place the second flat washer against the PLI washer and insert the bolt in the hole.

(f) Tighten the bolt until the outer PLI washer can no longer be rotated. The bolt has reached the desired preload and must not be tightened further.

E. Sealing Preload-Indicating Washers in Integral Tank Areas

(1) Seal PLI washers in the integral fuel tank areas as illustrated in Figure 10, using PR-1422 sealant (Products Research Co., 2919 Empire Ave., Burbank, Calif.).

F. PLI Washer Standard Pressed Steel Part Number Coding (Standard Pressed Steel Co., Jenkintown, Pa.)

(1) Example: Standard size

PLI - 10 - 27.6

Preload 27,600 pounds

Bolt diameter in 1/16ths

Preload-Indicating Washer

(2) Example: Oversize

PLI 53256 - 6.25 - 9.2

Preload 9,200 pounds

6 = Bolt diameter in 1/16ths
.25 = 1/64 inch oversize (.5 = 1/32 inch oversize)

Oversize series number

Preload-Indicating Washer

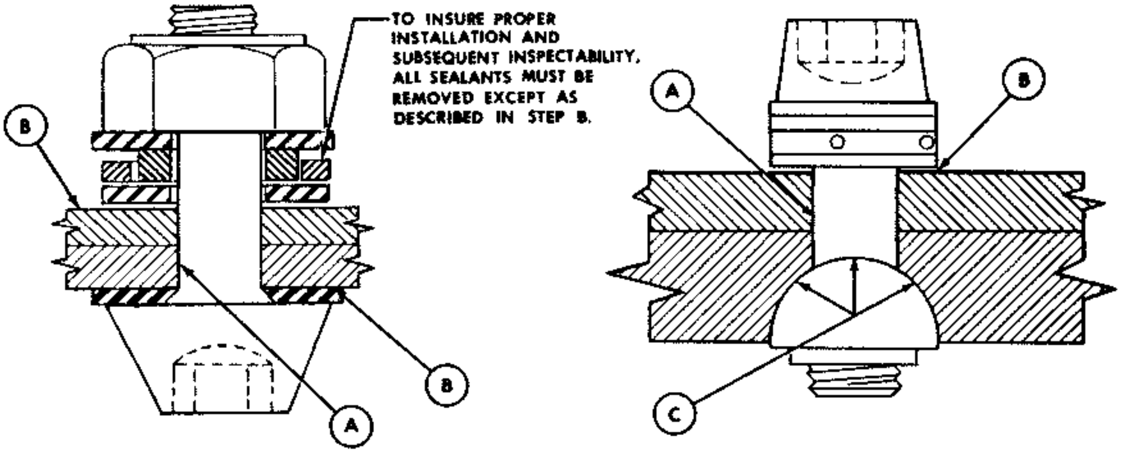
G. PLI Washer Identification, Size and Standard Pressed Steel Part Numbers

(1) PLI washer sets are color coded to indicate application as follows:

(a) 160,000 psi minimum - Natural cadmium (silver grey)

(b) 180,000 psi minimum - Blue

(2) Oversize washers may be identified as shown in Figure 12.



A. APPLY SEALANT INSIDE OF BOLT HOLE.

B. APPLY A FAYING SURFACE SEAL ON SIDE OF WASHER, NEXT TO STRUCTURE. IF ONE SIDE IS IN A "DRY" AREA, DO NOT SEAL THAT SIDE.

C. WHEN SEALING A BARREL NUT, SEAL THE SEATING SURFACE OF THE NUT WITH A FAYING SURFACE SEAL. IF A BARREL NUT IS IN A "DRY" AREA, DO NOT SEAL IT.

BB3-483

Sealing Preload-Indicating Washers in Integral Tank Areas
Figure 10

(3) PLI washer sets for 160,000 psi minimum application are as follows:

(a) PLI washer sets without countersunk washer (nut end)

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
10-32	PLI- 3- 2.1	53256-3.25- 2.1	64045-3.5- 2.1
1/4-28	PLI- 4- 3.6	53256-4.25- 3.6	64045-4.5- 3.6
5/16-24	PLI- 5- 5.9	53256-5.25- 5.9	64045-5.5- 5.9
3/8-24	PLI- 6- 9.2	53256-6.25- 9.2	64045-6.5- 9.2
7/16-20	PLI- 7- 12.4	53256-7.25- 12.4	64045-7.5- 12.4
1/2-20	PLI- 8- 17.0	53256-8.25- 17.0	64045-8.5- 17.0
9/16-18	PLI- 9- 21.6	53256-9.25- 21.6	64045-9.5- 21.6
5/8-18	PLI-10- 27.6	53256-10.25- 27.6	64045-10.5- 27.6
3/5-16	PLI-12- 40.3	53256-12.25- 40.3	64045-12.5- 40.3
7/8-14	PLI-14- 55.2	53256-14.25- 55.2	64045-14.5- 55.2
1 -12	PLI-16- 74.3	53256-16.25- 74.3	64045-16.5- 74.3
1 1/8-12	PLI-18- 93.4	53256-18.25- 93.4	64045-18.5- 93.4
1 1/4-12	PLI-20-117.8	53256-20.25-117.8	64045-20.5-117.8
1 3/8-12	PLI-22-145.1	53256-22.25-145.1	64045-22.5-145.1
1 1/2-12	PLI-24-175.3	53256-24.25-175.3	64045-24.5-145.3

(b) PLI washer sets with countersunk washer (bolt-head end)

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
10-32	62523- 3- 2.1	64046- 3.25- 2.1	64047- 3.5- 2.1
1/4-28	62523- 4- 3.6	64046- 4.25- 3.6	64047- 4.5- 3.6
5/16-24	62523- 5- 5.9	64046- 5.25- 5.9	64047- 5.5- 5.9
3/8-24	62523- 6- 9.2	64046- 6.25- 9.2	64047- 6.5- 9.2
7/16-20	62523- 7- 12.4	64046- 7.25- 12.4	64047- 7.5- 12.4
1/2-20	62523- 8- 17.0	64046- 8.25- 17.0	64047- 8.5- 17.0

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
9/16-18	62523- 9- 21.6	64046- 9.25- 21.6	64047- 9.5- 21.6
5/8-18	62523-10- 27.6	64046-10.25- 27.6	64047-10.5- 27.6
3/4-16	62523-12- 40.3	64046-12.25- 40.3	64047-12.5- 40.3
7/8-14	62523-14- 55.2	64046-14.25- 55.2	64047-14.5- 55.2
1 -12	62523-16- 74.3	64046-16.25- 74.3	64047-16.5- 74.3
1 1/8-12	62523-18- 93.4	64046-18.25- 93.4	64047-18.5- 93.4
1 1/4-12	62523-20-117.8	64046-20.25-117.8	64047-20.5-117.8
1 3/8-12	62523-22-145.1	64046-22.25-145.1	64047-22.5-145.1
1 1/2-12	62523-24-175.3	64046-24.25-175.3	64047-24.5-175.3

(4) PLI washer sets for 180,000 psi minimum application are as follows:

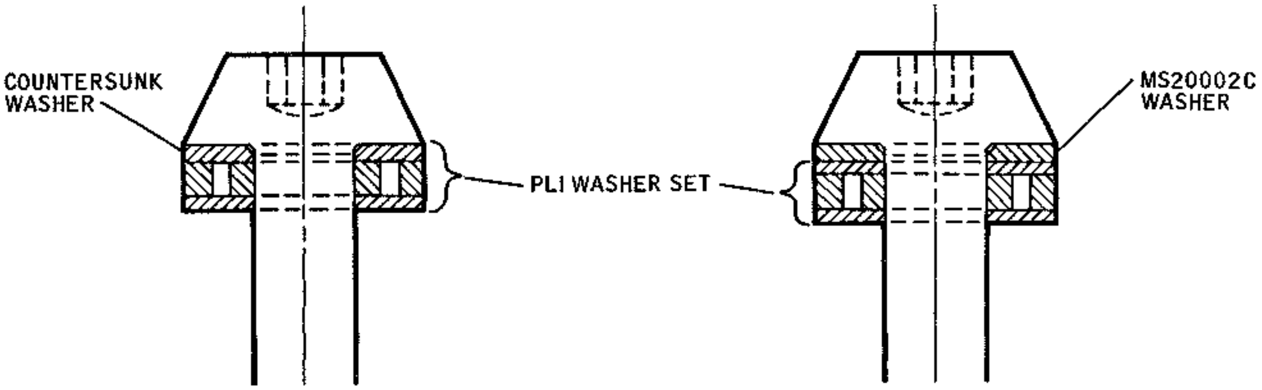
(a) PLI washer sets washer sets without countersunk washer (nut end)

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
10-32	PLI- 3- 2.3	62614- 3.25- 2.3	62615- 3.5- 2.3
1/4-28	PLI- 4- 4.3	62614- 4.25- 4.3	62615- 4.5- 4.3
5/16-24	PLI- 5- 6.9	62614- 5.25- 6.9	62615- 5.5- 6.9
3/8-24	PLI- 6- 10.7	62614- 6.25- 10.7	62615- 6.5- 10.7
7/16-20	PLI- 7- 14.4	62614- 7.25- 14.4	62615- 7.5- 14.4
1/2-20	PLI- 8- 19.6	62614- 8.25- 19.6	62615- 7.5- 19.6
9/16-18	PLI- 9- 24.9	62614- 9.25- 24.9	62615- 9.5- 24.9
5/8-18	PLI-10- 31.7	62614-10.25- 31.7	62615-10.5- 31.7
3/4-16	PLI-12- 46.5	62614-12.25- 46.5	62615-12.5- 46.5
7/8-14	PLI-14- 63.5	62614-14.25- 63.5	62615-14.5- 63.5
1 -12	PLI-16- 85.5	62614-16.25- 85.5	62615-16.5- 85.5
1 1/8-12	PLI-18-108.4	62614-18.25-108.4	62615-18.5-108.4
1 1/4-12	PLI-20-133.6	62614-20.25-133.6	26215-20.5-133.6

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
1 3/8-12	PLI-22-164.5	62614-22.25-164.5	26215-22.5-164.5
1 1/2-12	PLI-24-198.5	62614-24.25-198.5	26215-24.5-198.5

(b) PLI washer sets with countersunk washer (bolt-head end)

Bolt Size	Standard	1/64 Oversize	1/32 Oversize
10-32	62524- 3- 2.3	64043- 3.25- 2.3	64044- 3.5- 2.3
1/4-28	62524- 4- 4.3	64043- 4.25- 4.3	64044- 4.5- 4.3
5/16-24	62524- 5- 6.9	64043- 5.25- 6.9	64044- 5.5- 6.9
3/8-24	62524- 6- 10.7	64043- 6.25- 10.7	64044- 6.5- 10.7
7/16-20	62524- 7- 14.4	64043- 7.25- 14.4	64044- 7.5- 14.4
1/2-20	62524- 8- 19.6	64043- 8.25- 19.6	64044- 8.5- 19.6
9/16-18	62524- 9- 24.9	64043- 9.25- 24.9	64044- 9.5- 24.9
5/8-28	62524-10- 31.7	64043-10.25- 31.7	64044-10.5- 31.7
3/4-16	62524-12- 46.5	64043-12.25- 46.5	64044-12.5- 46.5
7/8-14	62524-14- 63.5	64043-14.25- 63.5	64044-14.5- 63.5
1 -12	62524-16- 85.5	64043-16.25- 85.5	64044-16.5- 85.5
1 1/8-12	62524-18-108.4	64043-18.25-108.4	64044-18.5-108.4
1 1/4-12	62524-20-133.6	64043-20.25-133.6	64044-20.5-133.6
1 3/8-12	62524-22-164.5	64043-22.25-164.5	64044-22.5-164.5
1 1/2-12	62524-24-198.5	64043-24.25-198.5	64044-24.5-198.5

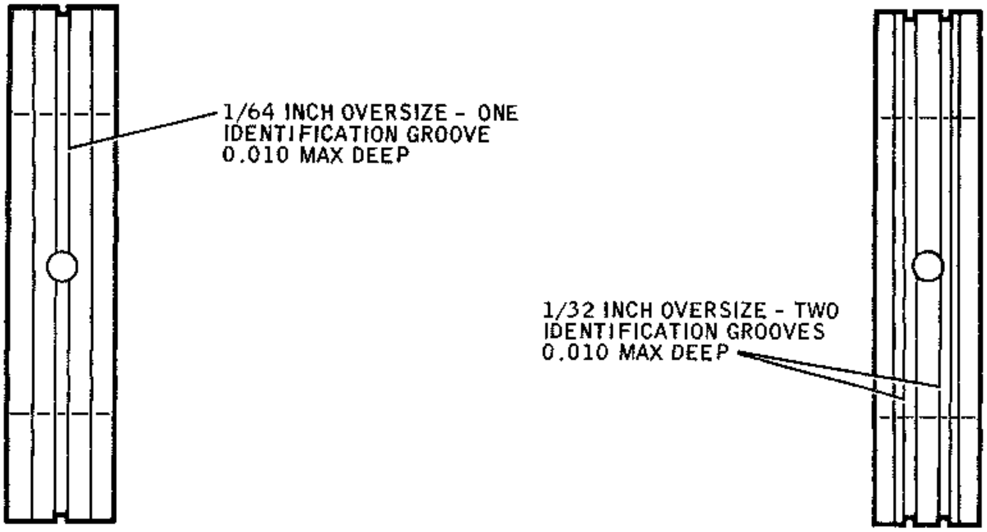


INSTALLATION OF PLI WASHER SET CONTAINING COUNTERSUNK WASHER

INSTALLATION OF STANDARD PLI WASHER SET WITH MS20002C WASHER

BB3-613

PLI Washer Installation Under Bolt Heads
Figure 11



BB3-603

Identification of Oversize PLI Washers
Figure 12

RIVETS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The following general and applicable detail requirements are recommended for determining acceptability of machine or hand-driven, solid rivet installations. When installing new or replacement rivets, the type, material, heat treatment, and size of rivets used must be the same as existing installations, unless otherwise noted in the manual.

B. Dimensions of the rivet holes, countersinks, or dimples must be within tolerances specified in 51-10-4.

C. The method for determining the diameter and height of perfect shop-formed rivet heads is shown in Figure 1. See paragraph 3 for recommended upset rivet dimensions. For allowable deviations, see the detail requirements, paragraph 4. A guide for determination of flush and raised head rivet lengths is illustrated in Figures 2 and 3. Where a rivet length is specified and difficulty is encountered producing a satisfactory upset, a rivet one increment longer or shorter may be used, but the upset head must meet the dimensional requirements of paragraph 3. The maximum and minimum values shown for diameters and heights of upset rivet heads are the absolute limits of acceptability. Values shown for nominal diameters and heights are those which are most desirable for satisfactory riveting.

D. Normally, the surface of the shop-formed heads will be smooth. However, some deviations are acceptable. Unsmooth surfaces made by course ground or sandblasted surfaces of the bucking bar are acceptable, when there is a possibility of bucking bar slippage or a tendency for rivets to clinch, due to the presence of sealants. A waffle pattern (see Figure 4), used for squeezer rivets when sealant is present, is also acceptable. The depth of the waffle pattern must not exceed 0.010 inch. The use of a waffle pattern on vibratory, or rivet gun tools and bucking bars is not permissible.

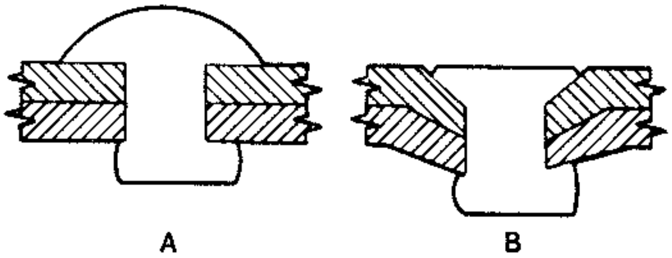
E. Where possible, when different materials are riveted together, the rivet should be for the softer material. Recommended practice places the manufactured head against the thinner material when using thin to thick plating, or the softer material when using soft to hard material combinations (see Figure 5). When a monel rivet is upset against aluminum, or an aluminum rivet is upset against a softer material such as plastic, glass fiber, plywood, etc., a washer must be used under the upset head to prevent eruption of the softer material (see Figure 5).

2. Rivet Spacing

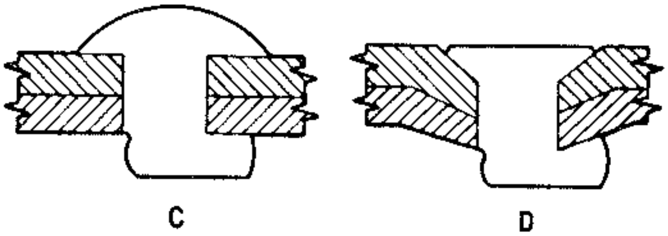
A. Unless otherwise specified in the manual or a Douglas blueprint, rivet edge and spacing distances should not be less than those shown in Figure 6. Rivets should be formed in a regular pattern, equally spaced between end rivets which should be located to tie into physical features of parts or end rivets of adjacent rivet runs.

CONCENTRICITY

THE HEAD OF THE RIVET MAY BE TANGENT TO THE SHANK. A AND B ARE ACCEPTABLE.

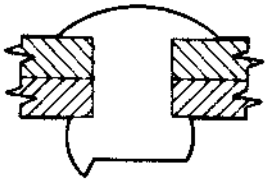


IF THE RIVET SHANK IS VISIBLE AS IN C AND D, THE RIVET IS UNACCEPTABLE AND MUST BE REPLACED.

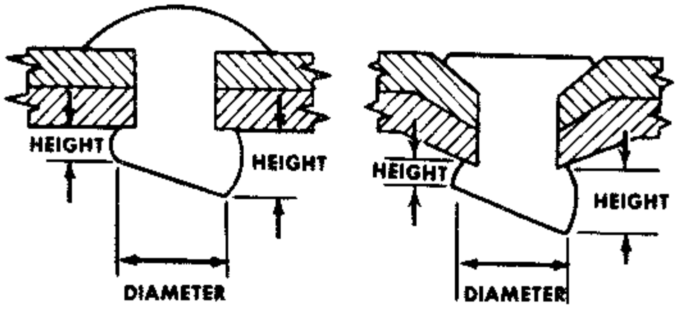


MALFORMED

THIS RIVET IS ACCEPTABLE. HOWEVER, THE STEPPED PORTION OF THE HEAD MUST NOT BE LESS THAN THE PERMISSIBLE MINIMUM HEAD THICKNESS.



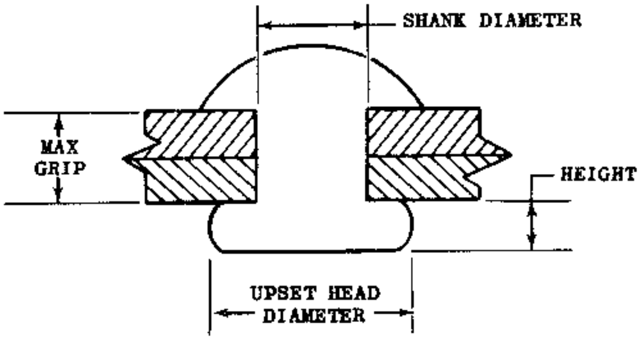
THIS IS AN EXAMPLE OF ACCEPTABLE LIMITS FOR MALFORMED SHOP HEADS. THE MEAN HEIGHT MUST NOT BE LESS THAN 1/3 OF THE RIVET SHANK DIAMETER.



BB3-449

Formed Rivet Heads
Figure 1

RAISED HEAD RIVETS



SEE FIGURE 1 AND PARAGRAPH 3 FOR UPSET HEAD DIMENSIONS (DIAMETER AND HEIGHT)

FOR RAISED HEAD RIVETS, THE GRIP DISTANCE IS THE DISTANCE FROM UNDERNEATH THE RAISED HEAD THROUGH THE MATERIAL THICKNESS.

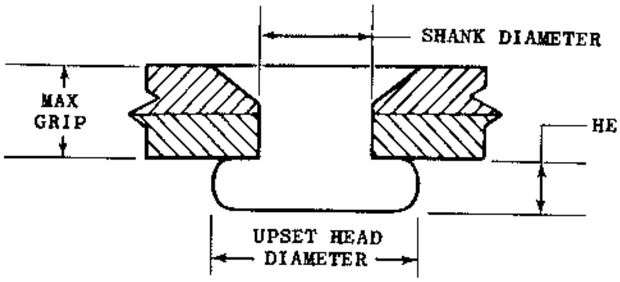
SHANK DIAMETER IN INCHES		3/32	1/8	5/32	3/16	1/4
*LENGTH OF RIVET IN INCHES	DASH NO. OF RIVET	MAX GRIP	MAX GRIP	MAX GRIP	MAX GRIP	MAX GRIP
1/8	-2	X	X	X	X	X
3/16	-3	.070	.031	X	X	X
1/4	-4	.133	.094	.055	.016	X
5/16	-5	.195	.156	.117	.078	X
3/8	-6	.253	.219	.180	.141	.062
7/16	-7	.305	.281	.242	.203	.125
1/2	-8	.353	.344	.305	.266	.188
9/16	-9	.398	.406	.367	.328	.250
5/8	-10	.443	.464	.430	.391	.312
11/16	-11	.490	.516	.492	.453	.375
3/4	-12	.542	.564	.550	.516	.438
13/16	-13	.604	.606	.602	.578	.500
7/8	-14	.665	.644	.650	.641	.562
15/16	-15	.725	.685	.692	.698	.625
1	-16	.788	.731	.730	.746	.688

*THE MAXIMUM GRIP LENGTH INDICATES THE MAXIMUM THICKNESS OF MATERIAL THROUGH WHICH A RIVET OF THE LENGTH SPECIFIED IN THE TABLE CAN BE FORMED PROPERLY.

BB3-450

Raised Head Rivet Length Determination Chart
Figure 2

FLUSH HEAD RIVETS



SEE FIGURE 1 AND PARAGRAPH 3 FOR UPSET HEAD DIMENSIONS (DIAMETER AND HEIGHT)

FOR FLUSH HEAD RIVETS, THE GRIP DISTANCE IS THE DISTANCE THROUGH THE MATERIAL THICKNESS INCLUDING BOTH SHANK AND MANUFACTURED HEAD.

SHANK DIAMETER IN INCHES		3/32	1/8	5/32	3/16	1/4
*LENGTH OF RIVET IN INCHES	DASH NO. OF RIVET	MAX GRIP	MAX GRIP	MAX GRIP	MAX GRIP	MAX GRIP
1/8	-2	X	X	X	X	X
3/16	-3	.039	X	X	X	X
1/4	-4	.102	.063	.024	X	X
5/16	-5	.164	.125	.086	.047	X
3/8	-6	.222	.188	.149	.110	.031
7/16	-7	.274	.250	.211	.172	.094
1/2	-8	.322	.313	.274	.235	.157
9/16	-9	.367	.375	.336	.297	.219
5/8	-10	.412	.433	.399	.360	.281
11/16	-11	.459	.485	.461	.422	.344
3/4	-12	.511	.533	.519	.485	.407
13/16	-13	.573	.575	.571	.547	.469
7/8	-14	.634	.613	.619	.610	.531
15/16	-15	.694	.654	.661	.667	.594
1	-16	.757	.700	.699	.715	.657

*THE MAXIMUM GRIP LENGTH INDICATES THE MAXIMUM THICKNESS OF MATERIAL THROUGH WHICH A RIVET OF THE LENGTH SPECIFIED IN THE TABLE CAN BE FORMED PROPERLY.

BB3-451

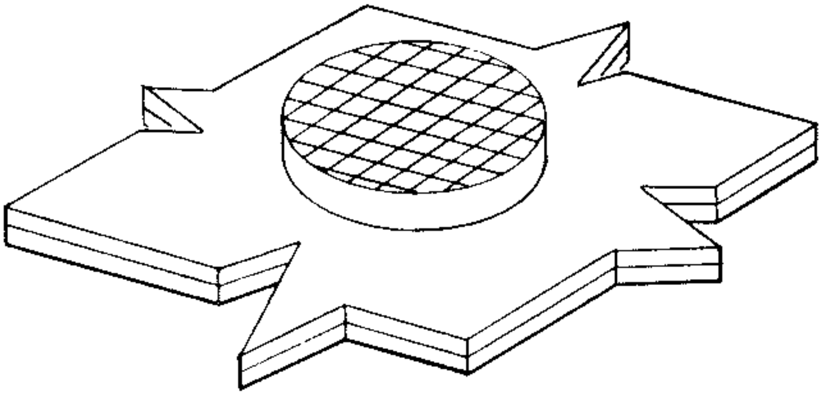
Flush Head Rivet Length Determination Chart
Figure 3

3. Upset Rivet Dimensions

A. Recommended upset rivet dimensions are listed in Figure 7.

4. Detail Requirements

A. In order to permit the use of a maximum number of serviceable rivets and to reduce hazards of damage caused by rivet rework, the following limitations have been established which may be applied when a small percentage of the rivets in the given joint show evidence of malformation as listed in the following paragraphs. When a check mark is shown in the main body of a rivet as illustrated in Figure 8, the rivet is unacceptable and must be replaced when encountered. The diameter and height of shop-formed heads must be within the limits set in paragraph 3. The height of malformed heads must also be within these limits. The following criteria govern the acceptability of rivets.



BB3-452

Waffle Pattern Rivet
Figure 4

(1) Cracks in Shop Heads

(a) Acceptable Cracks (See Figure 8.)

1) Rivets having fine-line cracks located on and around the outside edges of the shop head, are acceptable if conditions specified in Figure 8 are met.

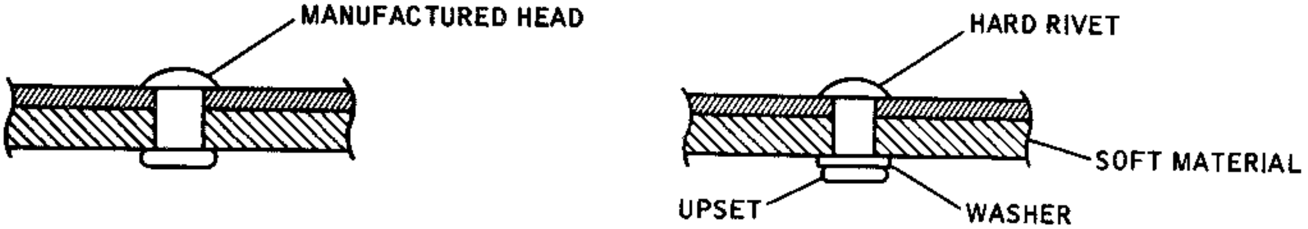
(b) Unacceptable Cracks (See Figure 8.)

1) Rivets having cracks in the outside edges of shop-formed heads resembling a wedge shape opening, or cracks which will permit a chip to fall out, are not acceptable and must be drilled out and replaced.

2) Cracks appearing in any other location on shop heads, other than the acceptable cracks shown in Figure 8, are not acceptable.

(c) Conditionally Acceptable Cracked Heads

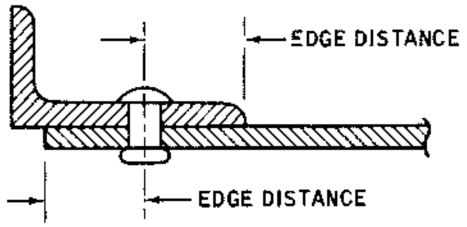
1) Rivets containing radial shear cracks in shop-formed heads (see Figure 8), or cracks in manufactured heads resulting from upsetting shop heads are acceptable, provided maximum depth of any crack does not exceed one-eighth of the nominal shank diameter (M=0.125D) and maximum width of any crack does not exceed one-sixteenth of the normal shank diameter (W=0.063D) (see Figure 9).



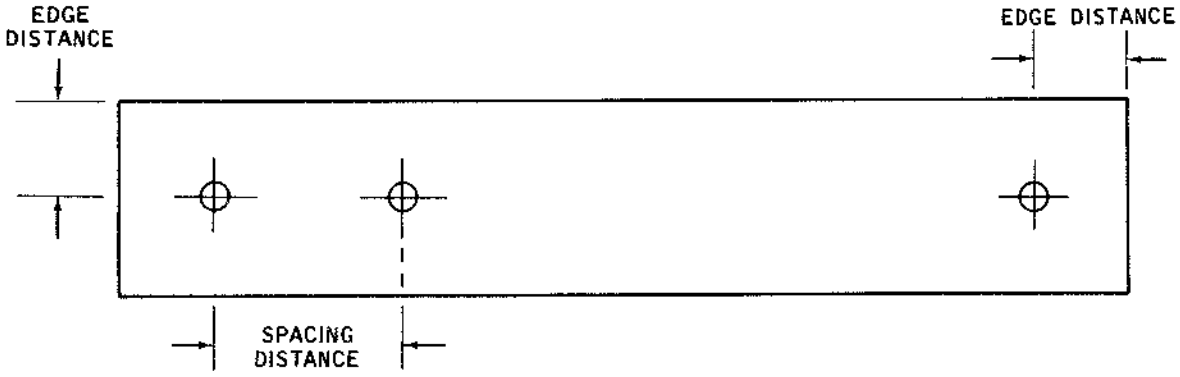
RIVETING MATERIALS OF DIFFERENT THICKNESS OR HARDNESS

USE OF WASHER WITH SOFT MATERIAL

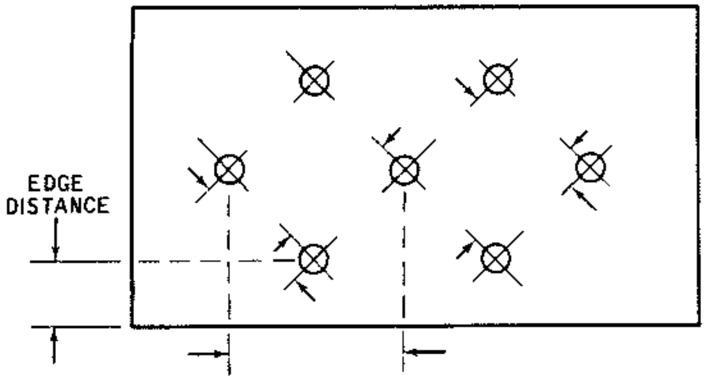
Riveting Dissimilar Materials
Figure 5



EDGE DISTANCE (MINIMUM)	GENERAL	2D +1/16 (2 RIVET DIAMETERS PLUS 1/16 INCH)
	CASTINGS	3D
	NUT PLATES	4D
	PLYWOOD	4D
	NON-METALIC MOLDINGS	3D



SPACING DISTANCES (SINGLE ROW)
RIVETS 5/32 INCH DIAMETER OR LESS - 4 DIAMETERS (MIN)
RIVETS 3/16 INCH DIAMETER OR GREATER - 3-1/2 DIAMETERS (MIN)
FOR CLOSER SPACING USE MULTIPLE ROW (SHOWN BELOW)
OF TWO OR MORE ROWS.



MIN SPACING DISTANCE
APPLIES IN ALL DIRECTIONS
AS INDICATED

NOTE: EDGE AND SPACING DISTANCES SHOWN ARE APPLICABLE UNLESS OTHERWISE SPECIFIED IN MANUAL OR DOUGLAS BLUEPRINTS

BB3-454

Minimum Rivet Edge and Spacing Distance
Figure 6

Recommended Dimensions for All D, Corrosion-Resistant Steel, Monel, and A-286 Rivets

Rivet Shank Diameter (D)	Upset Head Dimensions					
	Diameter			Height		
Nominal	Nominal	Maximum	Minimum	Nominal	Maximum	Minimum
3/32 .094	1/8 .125	9/64 .140	1/8 .125	1/16 .063	1/16 .063	3/64 .047
1/8 .125	11/64 .172	3/16 .187	5/32 .156	5/64 .078	5/64 .078	1/16 .063
5/32 .156	7/32 .219	15/64 .234	13/64 .203	3/32 .094	7/64 .109	5/64 .078
3/16 .187	17/64 .265	9/32 .281	15/64 .234	7/64 .109	1/8 .125	3/32 .094
1/4 .250	11/32 .344	3/8 .375	5/16 .312	5/32 .156	11/64 .172	1/8 .125
5/16 .312	7/16 .437	15/32 .569	25/64 .391	3/16 .187	13/64 .203	5/32 .156
3/8 .375	17/32 .531	9/16 .562	15/32 .469	7/32 .219	1/4 .250	3/16 .187

Recommended Dimensions for All A, AD, DD, and B Rivets

Rivet Shank Diameter (D)	Upset Head Dimensions					
	Diameter			Height		
Nominal	Nominal	Maximum	Minimum	Nominal	Maximum	Minimum
3/32 .094	9/64 .140	5/32 .156	1/8 .125	3/64 .047	1/16 .062	1/32 .031
1/8 .125	3/16 .187	13/64 .203	5/32 .156	1/16 .062	5/64 .078	3/64 .047
5/32 .156	15/64 .234	17/64 .265	13/64 .203	5/64 .078	7/64 .109	3/64 .047
3/16 .187	9/32 .281	5/16 .312	15/64 .234	3/32 .093	1/8 .125	1/16 .063
1/4 .250	3/8 .375	27/64 .423	5/16 .312	1/8 .125	11/64 .172	5/64 .078
5/16 .312	15/32 .468	33/64 .515	25/64 .391	5/32 .156	13/64 .203	7/64 .108
3/8 .375	9/16 .562	5/8 .625	15/32 .469	3/16 .187	1/4 .250	1/8 .125

Recommended Upset Rivet Dimensions
Figure 7

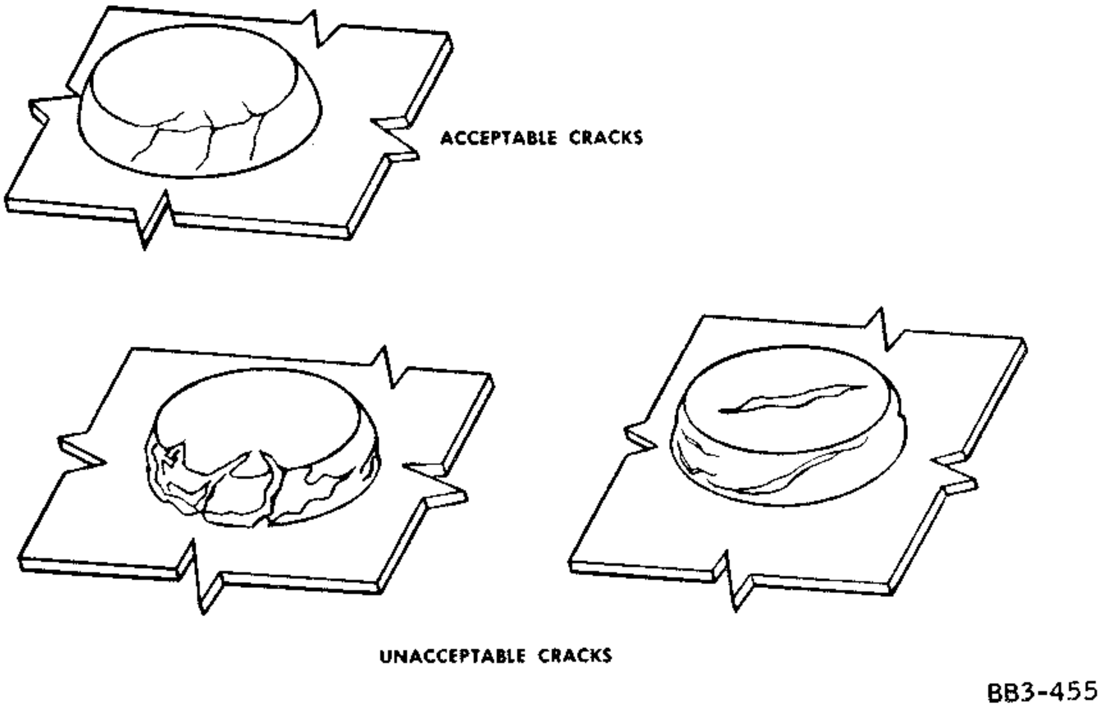
2) Rivets containing cracks running approximately in a radial direction are acceptable, provided the cracks do not extend within a circle concentric within 1 1/10 times the nominal shank diameter, and are not such a nature as to cause a piece of the rivet to chip off.

3) Both preceding conditions must be satisfied before the rivet is acceptable. These conditions are shown in Figure 9.

(d) Manufactured Head Set Damage

1) Cut or ringed heads are acceptable, providing the depth of the cut does not exceed one-fourth of the head height (see Figure 10), but they are not acceptable if the cut on one side of the head shows evidence of head shearing at the juncture of the head and shank. Head shearing is not likely on squeezer-formed rivets. Cut or ringed heads are not acceptable on flush-type rivets.

2) Do not use rivet offsets, where the offset is in excess of 10 degrees, regardless of the overall length of the set. The use of offsets or "C" sets in vibratory tooling is not permissible on machine-tapered surfaces, when the manufactured head falls on the taper. For these applications, use a 2704067 rivet (AM430 head) of the same alloy as the original blueprint-requirement rivet and drive the rivet head with a flush offset. A bucking bar may be placed against the head



Rivet Cracks
Figure 8

and the rivet gun flush set against the shank end to form the rivet. Special care must be exercised in the use of offsets and "C" sets in vibratory tooling to prevent head shearing.

3) Flattened heads on round AN430 or MS20470 head rivets caused by the use of a flat driver or bucking bar are acceptable, provided the height of the flattened head is not less than the minimum allowable dimension shown in paragraph 3 for shop-formed heads.

CAUTION: IF IT IS DIFFICULT TO MAINTAIN THE MINIMUM UPSET-RIVET TOLERANCES FOR MS20470 RIVETS, USE A FLAT SET OR GANG SQUEEZING ON A PARTICULAR JOB ONLY AFTER MAKING CAREFUL TRIALS TO BE CERTAIN THAT REWORK FOR EXCESSIVE FLATTENING OF HEADS WILL NOT OVERBALANCE ANY GAINS BY THE USE OF THIS METHOD.

(e) Open Heads

1) Open heads, partially and fully open, may be restruck, provided the gap is less than 0.002 inch. Otherwise, they must be drilled out and replaced (see Figure 11).

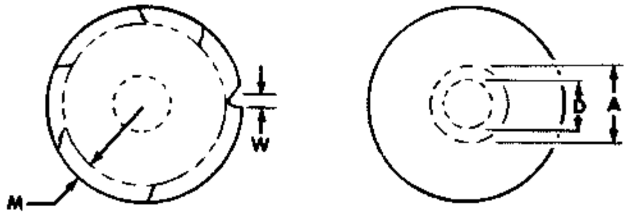


TABLE OF LIMITS

			NOMINAL SHANK DIAMETER = D							
			1/6 (0.062)	3/32 (0.094)	1/8 (0.125)	5/32 (0.156)	3/16 (0.187)	1/4 (0.250)	4/16 (0.312)	3/8 (0.375)
LIMITS ON CRACKS IN SHOP HEADS	A	MINIMUM DIAMETER OF AREA FREE FROM CRACKS A = 1.10	0.068	0.109	0.138	0.172	0.206	0.275	0.343	0.413
	M	MAXIMUM DEPTH OF RADIAL CRACKS M = 0.1250	0.008	0.012	0.016	0.020	0.023	0.031	0.039	0.047
	W	MAXIMUM WIDTH OF RADIAL CRACKS W = 0.0630	0.004	0.006	0.008	0.010	0.012	0.016	0.020	0.023

BB3-456

Conditions for Acceptance of Cracked Rivets
Figure 9

(f) Flush Rivet Heads

1) Flush rivet heads must not be below the surface of the plating before or after driving (see Figure 11).

2) Flush rivet heads may be trimmed (shaved) to within the required height tolerance, using the method described in paragraph 5.

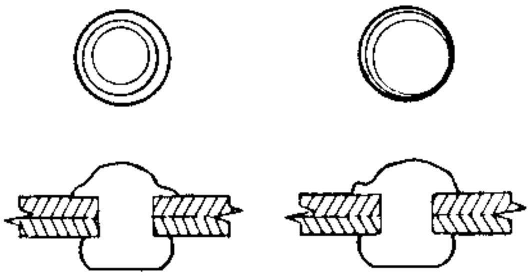
3) Flush or NACA rivets used for attaching nutplates, nut rings, and similar attachments for door landings, inspection covers, access doors, or in any area where the rivet head may result in fretting or improper fit of the parts, shall be shaved to -0.0005, -0.000.

(g) Plating Deformed by Pressure

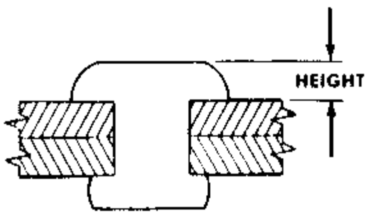
1) Plating deformed by pressure or open seams caused by pressure on rivets are not acceptable (see Figure 11).

(h) Plating Expanded Internally

1) Bulging plating, resulting from expanded rivets between the sheets, or when chips are trapped between the sheets, is not acceptable.



MARRED HEADS



FLATTENED HEAD

BB3-457

Marred and Flattened Rivet Heads
Figure 10

(i) Plating Damaged by Rivet Gun or Rivet Shaver

1) Sheets cut or marred around the rivet head are not acceptable.

(j) Countersinks and Dimples

1) Eccentric or oversized countersinks or dimples are not acceptable.

5. Trimming Flush-Head Rivets

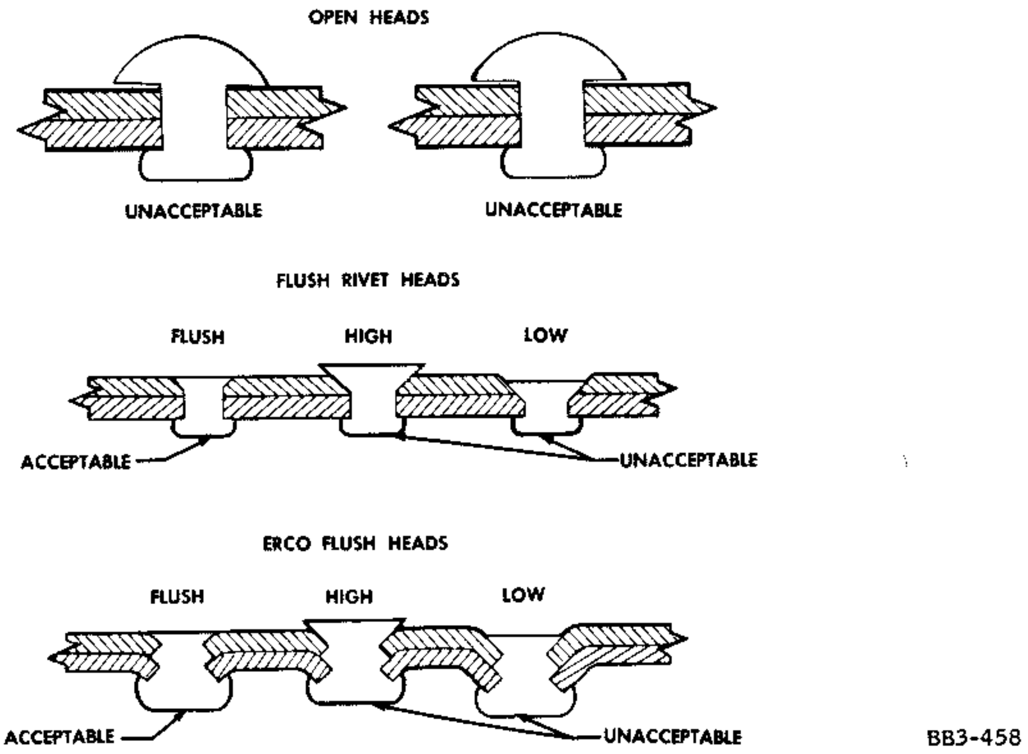
A. Fit the shaver with the appropriate cutting head. The recommended cutting-head size is approximately 1/16 to 1/8 inch larger in diameter than the rivet head to be shaved.

B. Check the shaver and its adjustments as follows:

(1) Inspect the cutter for symmetry of cutting edges and possible damage.

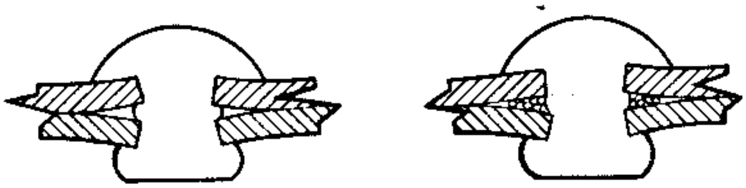
(2) Test the adjustment for marring, by pressing the tool firmly against a flat test sheet while the cutter is turning. Adjust to eliminate marring before performing the actual trimming operation.

(3) Place the tool in position over the rivet head to be trimmed, without contacting the sheet with any part of the tool except the padded legs.



Acceptable and Unacceptable Formed Rivets
Figure 11 (Sheet 1)

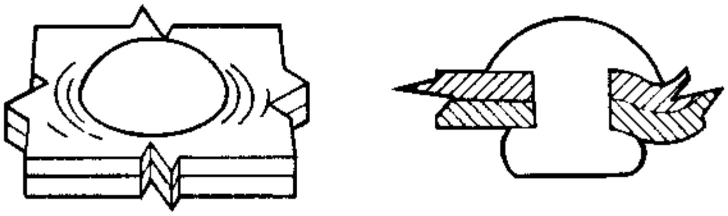
SKIN EXPANDED INTERNALLY



EXPANDED RIVET — CHIPS BETWEEN SHEETS

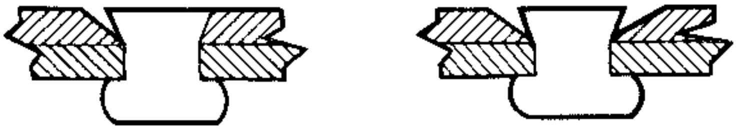
UNACCEPTABLE

SKIN DAMAGED BY RIVET GUN OR RIVET SHAVER



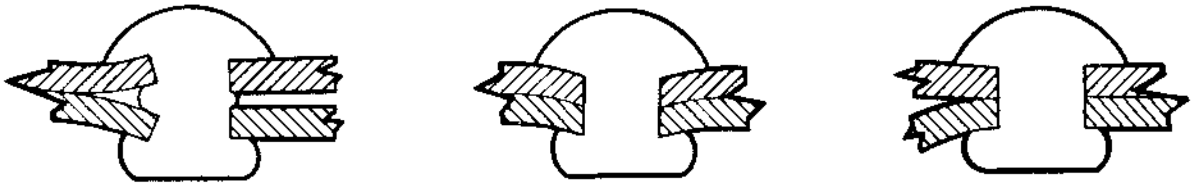
UNACCEPTABLE

ECCENTRIC OR OVERSIZE COUNTERSINKS



UNACCEPTABLE

SKIN DEFORMED BY PRESSURE



UNACCEPTABLE

BB3-459

Acceptable and Unacceptable Formed Rivets
Figure 11 (Sheet 2)

(4) Start the tool and slowly push it toward the sheet, until it has reached the limit of the adjustable stop.

(5) Relieve the pressure on the tool, and remove the shaver from the sheet.

6. Installation of Pull-Pin, Blind Rivets (Cherry and Olympic)

A. General Requirements

(1) All holes must be within the tolerances specified in 51-10-4. They must also be round, free from chips and burrs, and normal to the surface.

(2) Oversize blind rivets, which are colored blue, must be used in all dimpled applications.

(3) Countersinking, where applicable, must be in accordance with the countersingking limitations (see 51-10-4).

(4) Oversize blind rivets may be used to replace standard blind rivets if the holes are enlarged, provided the holes are within the tolerances specified for oversize rivets in 51-10-4.

(5) Cherry and olympic rivets are lubricated by the manufacturer with a special lubricant which must not be removed. Heat, degreasing, or solvent washing will remove this lubricant. This is not permissible.

(6) It is recommended that cherry and olympic rivets be stored in their orignal containers until used. Do not dump rivets in stock bins, open boxes, or absobent bags.

(7) Do not use dented, nicked, dirty, mixed, relubricated, reclaimed, or damaged rivets.

(8) Standard MS solid rivets may be used to replace cherry or olympic rivets subject to the following conditions:

(a) Clearance must be available for satisfactorily upsetting the AN rivets.

(b) Replacement must not be made in nonmetal material such as phenolic or plastic.

(c) Replacement must not be made where the vibration required to upset solid rivets might have a detrimental effect on instruments of other delicate equipment.

(9) When two or more sheets are to be fastened together, all burrs or chips, which might hold the sheets apart, must be removed (see Figure 12).

(10) Remove all burrs from the top surface of the material. Burrs will prevent the manufactured head of the rivet from seating (see Figure 12).

(11) Self-plugging rivets, one increment longer, may be used in any application when the grip length in question is at the maximum allowable grip range, and providing ample clearance is available to seat the rivet head before driving. Grip lengths of cherry 600, 700 and 800 series rivets are stamped into the pulling end of the pull pin. Grip lengths of cherry 9000 series rivets and cherrylock 2000 series rivets are stamped into the rivet head (see Figure 12A).

(12) In any application when the rivet passes through magnesium material, the 5056, B-type rivet must be used.

(13) To check the proper grip of the rivet, clamp the material together securely. Use a cherry or olympic rivet gage and insert the narrow portion of the gage into the hole, until the protruding tip catches on the underside of the sheet (see Figure 13). Read the grip length from the gage.

(14) The blind rivet part numbering system, rivet interchangeability, and grip length variations within the grip length dash number for cherry, olympic, MS and NAS rivets are as follows:

(a) Illustration of cherry, olympic, Military Standards, and National Aerospace Standards part numbering system.

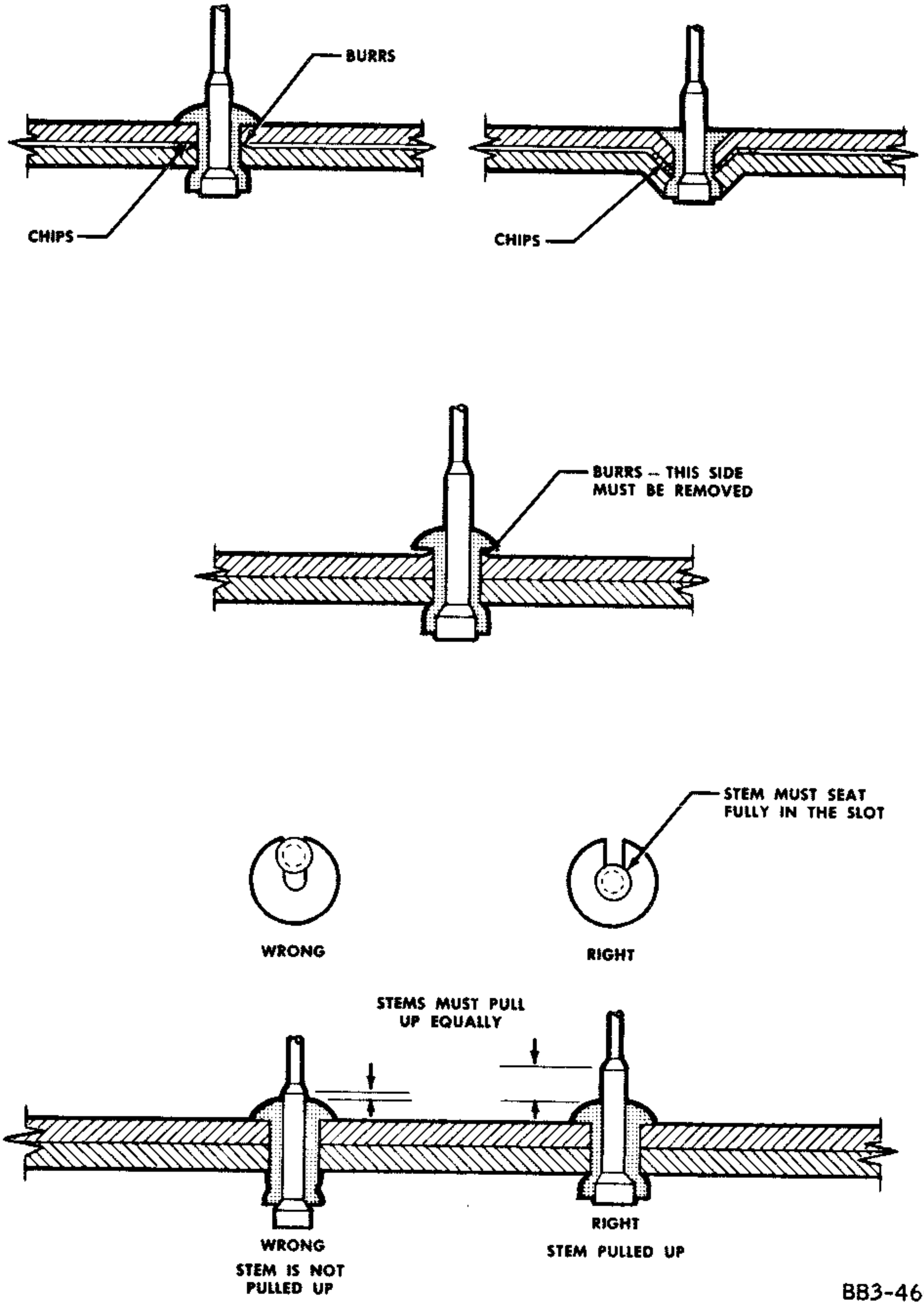
1) Cherrylock (CR) Part Numbering System.

CR 2163 - 6 - 4

4 — Maximum grip length in 1/16 inch

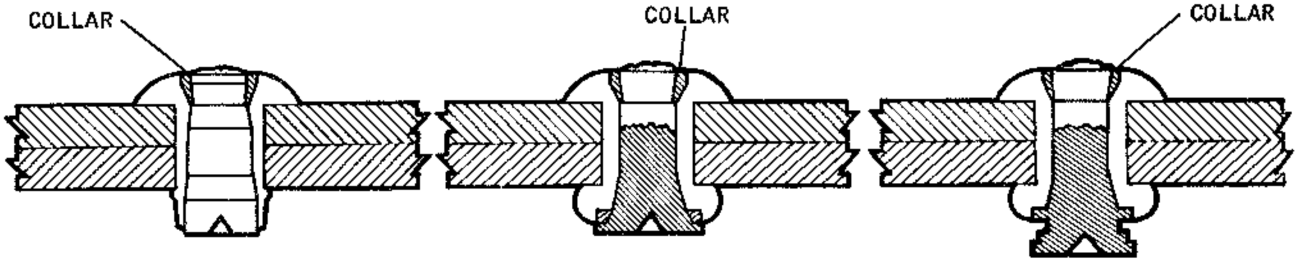
6 — Nominal shank diameter in 1/32 inch

2163 — Head Type -
2163, 2263, 2563, 2663 = Protruding head - Lock spindle - Standard
2162, 2262, 2562, 2662 = 100° Flush head - Lock spindle - Standard
2249 = Protruding head - Lock spindle - Bulbed
2248 = 100° Flush head - Lock spindle - Bulbed



BB3-460

Rivet Installation
Figure 12 (Sheet 1)



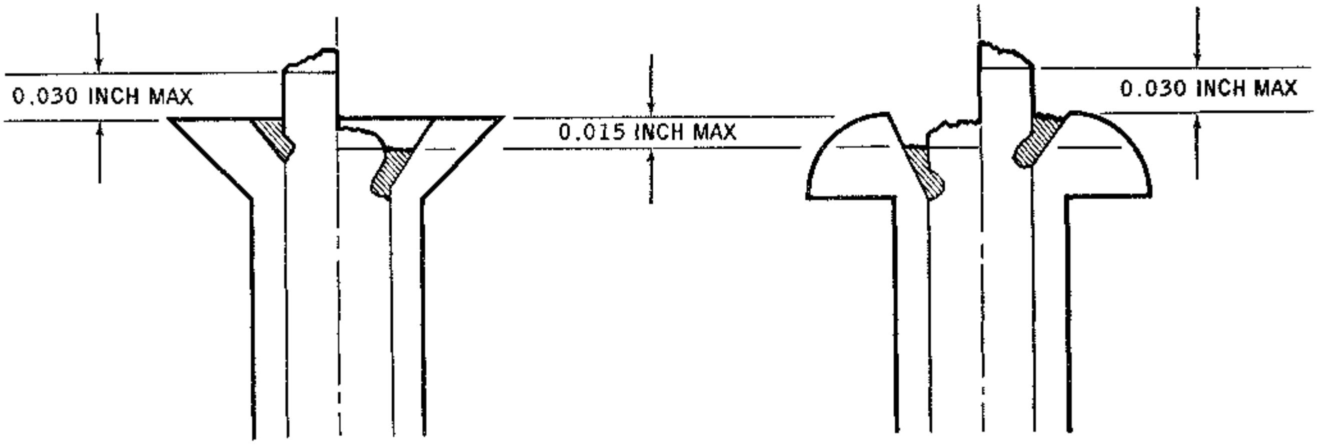
PULLING HEAD HAS INSERTED LOCKING COLLAR AND STEM HAS FRACTURED FLUSH WITH RIVET HEAD

SHEAR RING MAY NOT SHEAR IN MINIMUM GRIP

STANDARD

BULBED

BULBED



PIN FLUSHNESS

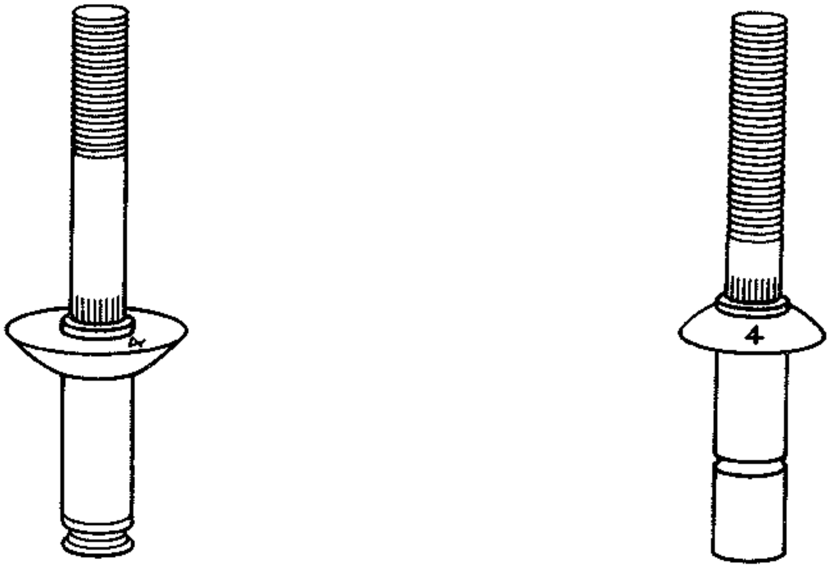
NOTE:

IF NECESSARY, STEMS MAY BE MILLED TO REDUCE PROJECTION PROVIDED TOLERANCES SPECIFIED ABOVE ARE MET PRIOR TO MILLING. DO NOT MILL THE HEAD OF THE RIVET OR THE LOCKING COLLAR, ONLY THE STEM.

INSTALLED CHERRYLOCK RIVETS

BB3-605

Rivet Installation
Figure 12 (Sheet 2)



CHERRY 9000 SERIES RIVET AND CHERRYLOCK 2000 SERIES

BB3-604

Grip Identification
Figure 12A

2) Cherry (CR) Part Numbering System.

CR (9) 163 R - 4 - 4

Nominal grip length in 1/32 inch

Nominal shank diameter in 1/32 inch

Special plating - R = Black and silver
B = Silver-plated

Series number - Designates rivet type and material (see 51-60-0 for rivet interchangeability)

3) Olympic (RV) Part Numbering System.

RV (2) 550 C - 4 - 2 S

Special plating - B = Bare finish
S = Silver-plated

Nominal grip length in 1/16 inch

Nominal shank diameter in 1/32 inch

The C denotes a small countersink in the head of the rivet to enable spin trimming of the stem.

Series number - Designates rivet type and material (see 51-60-0 for rivet interchangeability)

4) Military Standards (MS) Part Numbering System.

MS 20600 AD 4 K - 4

- 4 — Nominal grip length in 1/16 inch.
- K — K = Knob stem (cherry)
  W = Serrated stem (cherry) (olympic) (1)
  No letter = Type of stem is optional.
- 4 — Nominal shank diameter in 1/32 inch.
- AD — Shank material - AD = 2117T4 Aluminum alloy
  B = 5056 Aluminum alloy
  M = Monel
  MP = Monel, cadmium-plated
  P = Cadmium-plated
- 20600 — Series Number - Denotes type of rivet

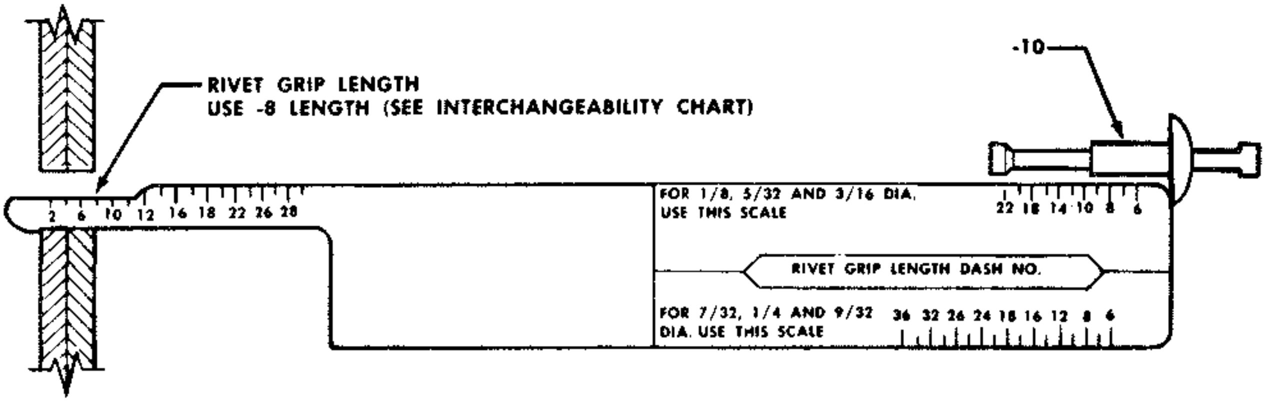
Protruding Head	100° Flush Head
20600 (Self-plugging)	20601 (Self-plugging)
20604 (Pull-thru)	20605 (Pull-thru)
20606 (Pull-thru)	

NOTE: (1) Cherry and olympic serrated-stemmed rivets do not have identical length dimensions.

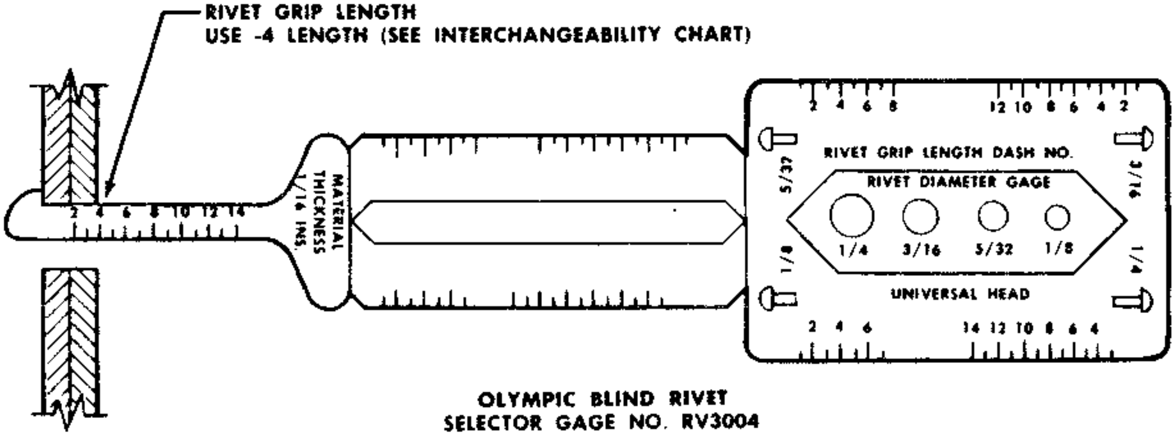
5) National Aerospace Standards (NAS) Part Numberins System.

NAS 1398 B 4 - 4

- 4 — Nominal grip length in 1/16 inch
- 4 — Nominal shank diameter in 1/32 inch
- B — Shank Material - B = 5056 Aluminum alloy
  C = A286 Stainless steel
  D = 2117T4 Aluminum alloy
  M = Monel
  S = Silver-plated
  W = Cadmium-plated
- 1398 — Head Type - 1398 Protruding head - Lock spindle
  1399 100° Flush head - Lock spindle



CHERRY RIVET SELECTOR
GAGE NO. 269 B1



OLYMPIC BLIND RIVET
SELECTOR GAGE NO. RV3004

Note:
The grip of a protruding head rivet is measured from the under side of the manufactured head; a flush rivet, from the top of the manufactured head.

BB3-461

Cherry and Olympic Rivet Selector Gages
Figure 13

(b) Rivet grip lengths are shown for cherry, olympic, Military Standards, and National Aerospace Standards parts numbering system blind rivets in Figure 14.

CHERRY SERIES 100 to 300 & 500 (1) / 600, 700 & 800 (2)	CHERRY SERIES 2000 & 9000 (1) / OLYMPIC, MS & NAS SERIES (1)	GRIP RANGE (1)		GRIP RANGE (2)	
DASH NUMBER	DASH NUMBER	MIN.	MAX.	MIN.	MAX.
-2	-1	-0-	0.062	Up To	0.062
-4	-2	0.063	0.135	Up To	0.125
-6	-3	0.126	0.137	0.062	0.187
-8	-4	0.188	0.250	0.125	0.250
-10	-5	0.251	0.312	0.187	0.312
-12	-6	0.313	0.375	0.250	0.375
-14	-7	0.376	0.437	0.312	0.437
-16	-8	0.438	0.500	0.375	0.500
-18	-9	0.501	0.562	0.437	0.562
-20	-10	0.563	0.625	0.500	0.625
-22	-11	0.626	0.687	0.562	0.687
-24	-12	0.688	0.750	0.625	0.750
-26	-13	0.751	0.812	0.687	0.812
-28	-14	0.813	0.875	0.750	0.875
-30	---	-----	-----	0.812	0.937
-32	---	-----	-----	0.875	1.000

NOTE: (1) See Grip Range (1). (2) See Grip Range (2).

Grip Variations For Blind Rivets
Figure 14

(15) For dimpled applications, the grip lengths will be equal to the total thickness of material and gaps between the sheets, plus the height of the dimple given in Figure 15.

Rivet Diameter	Dimple Height
1/8	0.026
5/32	0.034
3/16	0.046
1/4	0.064

Dimple Heights
Figure 15

(16) Use a standard cherry rivet pneumatic gun No. G15RB, G40, or G15RC, and hand tools No. G11, G-25B, or G-36, for installation of cherry or olympic blind rivets.

(17) Select the proper size and type pulling head, flush or protruding, for cherry rivets and install it on the gun. Adjust the draw bolt so that it will extend to the inside tip of the sleever (see Figure 16). The olympic pulling heads drive both flush and protruding head rivets and do not require any adjustment. If the rivet does not pull up, release the trigger and depress a second time. This allows the jaws to move forward to regrip the stem and complete the operation.

NOTE: For longer grip length rivets, it may be necessary to increase the distance between the drawbolt and sleeve so that the stroke of the gun will be long enough to break the stem. The pulling head for flush rivets is identified by the flatness of the end of the sleeve, while that for protruding head rivets will be concave to accomodate the curved rivet head. Exersize care in selecting correct pulling head for cherrylock rivets (see Figure 15A for selection of gun).

(18) The strength of any blind rivet is dependent upon proper installation. Therefore, it is important that the following rules be followed:

(a) When installing cherry knob stem rivets, the rivet stem must be completely inserted in the slot of the drawbolt (see Figure 12).

(b) The gun must be held at a right angle to the surface.

(c) Apply pressure to the gun to hold the material together, and seat the rivet securely in the hole while driving.

(d) The parts must be either spot riveted at approximately 6-inch intervals, or held together with plating clamps before starting to rivet all the holes.

(e) The line pressure to the gun must be a minimum of 75 psi (90 psi for cherrylock rivets).

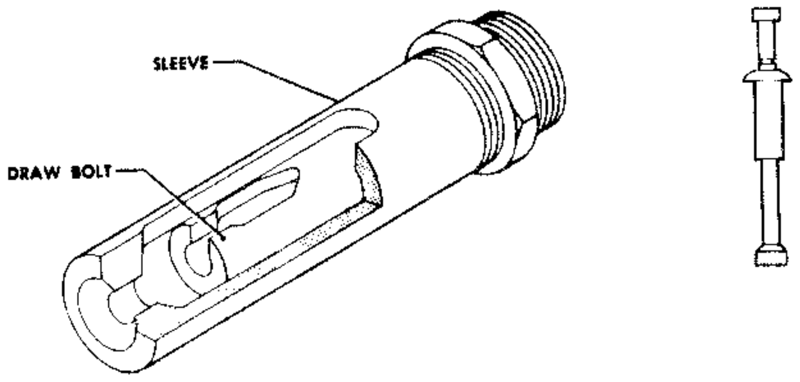
GUN NO.	AIR PRESSURE AT GUN MIN PSI	MAXIMUM RIVET DIAMETER AND MAXIMUM GRIP NO. WHICH CAN BE PULLED														
		ALUMINUM ALLOY 2162 AND 2163$^{(1)}$ 2262 AND 2263$^{(1)}$				MONEL 2538 AND 2539$^{(1)}$ 2562 AND 2563$^{(1)}$				A-286 2662 AND 2663$^{(1)}$ 2642 AND 2643$^{(1)}$				ALUMINUM ALLOY 2248 AND 2249$^{(1)}$		
		1/8	5/32	3/16	1/4	1/8	5/32	3/16	1/4	1/8	5/32	3/16	1/4	1/8	5/32	3/16
G15RC	90	-9	-9	-	-	-9	-	-	-	-9	-	-	-	-	-	-
										-	-	-	-			
G15DC (4)	90	-9	-9	-9	-	-9	-	-	-	-9	-	-	-	ALL	-	-
										-9	-	-	-			
G40C	90	-13	-13	-13	-13	-13	-13	-13	-	-13	-13	-13	-	ALL		
										-13	-13	-	-			
G40D	90	-17	-17	-17	-17	-17	-17	-17	-	-17	-17	-17	-	ALL		
										-17	-17	-	-			
G40E	90	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9$^{(2)}$	ALL		
										-9	-9	-9	-			
G86	90	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	$^{(3)}$ -13	-13	ALL		
										-13 $^{(3)}$	-13 $^{(3)}$	-13 $^{(3)}$	-13			
G11	HAND	-13	-13	-13	-	-13	-	-	-	-13	-	-	-	ALL	-	-
										-	-	-	-			
GS5	HAND	ALL				ALL				ALL				ALL		
										ALL						
G36	HAND	-13	-13	-13	-	-13	-	-	-	-13	-	-	-	ALL	-	-
										-	-	-	-			

NOTES:

(1) WHEN INSTALLING PROTRUDING HEAD RIVETS, GUN CAPACITY IS ONE GRIP LENGTH SHORTER THAN SHOWN.
(2) MAY REQUIRE 95 PSI AIR PRESSURE AT GUN.
(3) FOR GRIPS LONGER THAN SHOWN, USE G86D MODEL.
(4) USE A 220 ADAPTER ON A G40 GUN, IF G-15DC IS NOT CAPABLE.

BB3-606A

Gun Capacities Required for Cherrylock Rivets
Figure 15A



CHERRY 100, 300 AND 500 SERIES WITH KNOB STEM

RIVET DIA	CHERRY PULLING HEAD		OLYMPIC PULLING HEAD		DRIVING TOOLS	
	UNIVERSAL	COUNTERSINK	UNIVERSAL & COUNTERSINK	SERIES RV4200C	PNEUMATIC	HAND
3/32	G6H3B	G6H3C	RV355-3		G-15RB AND RC G-15DB AND DC	G-25-B G-11
1/8	G6H4B	G6H4C	RV355-4	RV1154-4•	G-15RB AND RC G-15DB AND DC	G-25-B G-11
5/32	G6H5B	G6H5C	RV355-5	RV1154-5•	G-15RB AND RC G-15DB AND DC	G-36
3/16	G6H6B	G6H6C	RV355-6	RV1154-6*	G-15RB AND RC G-15DB AND DC	G-36
1/4	H408B	H408C	RV355-8	RV1154-8•	G40C AND D	G-55
9/32	H409B	H409C	RV355-9	RV1154-9•	G40C AND D	G-55

NOTE: *SPECIAL OLYMPIC PULLING HEADS ARE REQUIRED FOR (RV4200C) SHORT BACKUP RIVETS.

CHERRY 600, 700 AND 800 SR SERIES WITH KNOB STEM

RIVET DIA	CHERRY PULLING HEAD		DRIVING TOOLS	
	UNIVERSAL	COUNTERSINK	PNEUMATIC	HAND
3/32	H803U	H803C	G-15	G-55
1/8	H904U	H904C	G-40	G-55
5/32	H905U	H905C	G-40	G-55
3/16	H906U	H906C	G-40	G-55
1/4	H908U	H908C	G-40	G-55

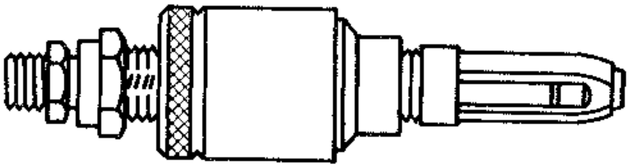
CHERRY 9000 SERIES AND OLYMPIC 200, 500 AND 800 SERIES WITH SERRATED STEM

RIVET DIA	CHERRY PULLING HEAD		OLYMPIC PULLING HEAD			DRIVING TOOLS	
			UNIVERSAL AND COUNTERSINK				
	UNIVERSAL	COUNTERSINK	SERIES 200 & 500	SERIES 800	SERIES RV4200C	PNEUMATIC	HAND
3/32	H9015U-3	H9015C-3	RV355-3	RV8840L-3	RV855L-3	G-15	G-36
1/8	H9015U-4	H9015C-4	RV355-4	RV8840L-4	RV855L-4	G-40	G-55
5/32	H9015U-5	H9015C-5	RV355-5	RV8840L-5	RV855L-5	G-40	G-55
3/16	H9015U-6	H9015C-6	RV355-6	RV8840L-6	RV855L-6	G-40	G-55
1/4	H9040-8	H9040-8	RV3340	RV8840L-8	----	G-40	G-55
9/32	H9040-9	H9040-9	RV3340	RV8840L-9	----	G-40	G-55

Printed in U.S.A.

BB3-462A

Cherry Rivet Pulling Head
Figure 16 (Sheet 1)



CHERRYLOCK SERIES 2000

RIVET DIA	CHERRY PULLING HEAD		DRIVING TOOLS	
	UNIVERSAL	COUNTERSINK	PNEUMATIC	HAND
1/8	H615A-4U H640A-4U	H615A-4C H640A-4C	G-15DC AND RC G-40	G-11 AND G-36 G-55
5/32 (1)	H615A-5U H640A-5U	H615A-5C H640A-5C	G-15DC AND RC G-40	G-11 AND G-36 G-55
3/16 (1)	H615A-6U H640A-6U	H615A-6C H640A-6C	G-15DC AND RC G-40	G-11 AND G-36 G-55
1/4	H640A-8U	H640A-8C	G-40	G-55

NOTE: (1) ALL 5/32 AND 3/16 RIVETS OF MONEL OR A286 MATERIAL REQUIRE THE LARGER GUN: (PNEUMATIC—G-40C, D OR E.); (HAND—G-55).

BB3-607

Cherry Rivet Pulling Head
Figure 16 (Sheet 2)

(19) The stems of hollow pull-thru rivets will pull out, thus giving maximum expansion. Rivet grip lengths longer than nominal may be used as follows:

(a) Wherever rivet plugs are used, they must be fully driven.

(b) Plugs may be driven down with a hammer or rivet gun, using a suitable type set to accommodate the type of plug used.

(c) Plugs must not be overdriven, as this can result in damage to the structural area.

(20) Stems of self-lugging rivets will snap off when the maximum pull has been exerted, thus leaving the mandrel in the rivet. This portion of the mandrel, extending from the top of each rivet, must be equal to ensure application of equal grip (see Figure 12).

(21) Trim the stems of the self-plugging rivets (except cherrylock) with the approved tools listed as follows:

NOTE: If necessary, protruding stems of satisfactorily installed cherrylock rivets may be milled if care is taken not to mill the head of the rivet or the locking collar.

(a) Cherry rivet No. 209 and olympic No. RV 57 flat ground diagonals

(b) Pneumatic stem cutter, A652-5533 YDT (see Figure 17)

(c) Cherry No. 301 sawtooth power stem trimmer (see Figure 17)

(d) The cherry No. 220B and the 225B power stem trimmer must be used whenever a C-type rivet is used and positive locking of the stem is required. This tool tends to burr the stem into the small countersink on the top of the rivet, thus giving added stem-locking security. Place the cutting head of the trimmer over the rivet stem, start the motor, and apply hand pressure to the lever until the stem is clipped off. A low RPM motor is recommended for this operation.

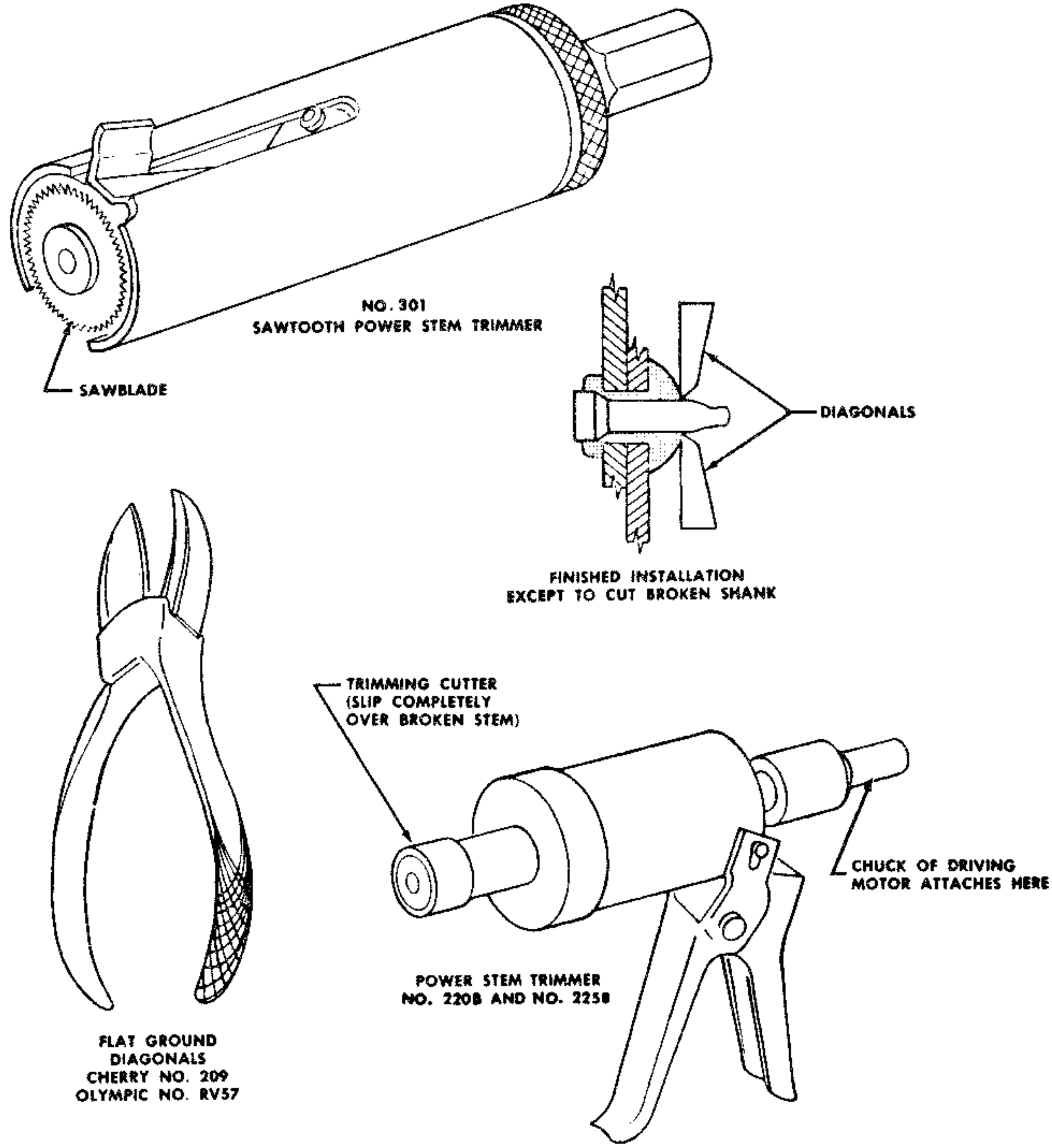
NOTE: The tool may only be used on the diameter rivet for which the eccentric, drive-type cutters are designed.

(22) Do not pound or hammer on the stems either before or after the stems have been trimmed.

(23) The clipped stem of rivets other than cherrylock must be trimmed flush with the rivet head, in all cases where the head will be exposed after completion of the airplane, or when subsequent injury to personnel or materials may result from untrimmed stems. Extreme care must be exercised when smoothing, to prevent loosening the stem.

(24) When the C-type head on rivets other than cherrylock is used, a maximum of 0.004 inch may be shaved from the head without affecting the locking of the pin. All other flush-head blind rivets may be shaved in the same manner as an AN426 rivet, to conform to surface requirements.

(25) The push-out valves for the stems of rivets other than cherrylock may be checked with a 10-pound cherry or olympic push-out gage. Do not use any other method or tool.



Pr...ed in U.S.A.

Tools for Trimming Rivets
Figure 17

B. Inspection Requirements

(1) Check the self-plugging rivets before the stem has been trimmed. Check the position of the mandrel with respect to the top of the head (see Figure 12).

(2) Where the upset end is visible, check the position of blind mandrel in the rivet shank. The blind mandrel must pull up into the rivet shank, expanding the shank against the underside of the material being joined, thus forming a "tulip bulb" on the rivet shank (see Figure 18).

(3) For gaps under the manufactured heads of blind rivets installed in convex surfaces, check as follows:

(a) When the manufactured head is installed from the convex or outside surface of radius-type hat sections or convex surfaces, the head must seat flat longitudinally only, or lengthwise of the convex surface (see Figure 18).

(b) Gaps under the manufactured rivet head, chordwise of the convex surface, will depend upon the radius of the convex surface and diameter of the rivet.

(4) For gaps under protruding head, blind rivets will be allowed on flat surfaces, provided 50 percent of the head is in bearing with the material, and the remaining portion of the head gap is less than 0.005 inch. Deformation or ridges on the top of the cherry rivet head are acceptable, if caused by the slot in the pulling head. Gaps under flush heads of cherrylock rivets must not exceed 0.003 inch and 40 percent of the rivet head circumference.

C. Removal of Self-Plugging Rivets other than Cherrylock Rivets

(1) Remove the stems of the self-plugging rivets by tapping lightly. Drill out the old rivet, using a drill one size smaller than the rivet size. Use extreme care in drilling, to keep the rivet from turning and thus enlarging the hole.

(2) Pry off the head, using a drift punch of the same diameter as the hole.

(3) Use the punch to drive out the rivet. When possible, support the back side of the material, to keep from damaging the part.

D. Removal of Cherrylock Rivets

(1) Remove cherrylock rivets as shown in Figure 18A.

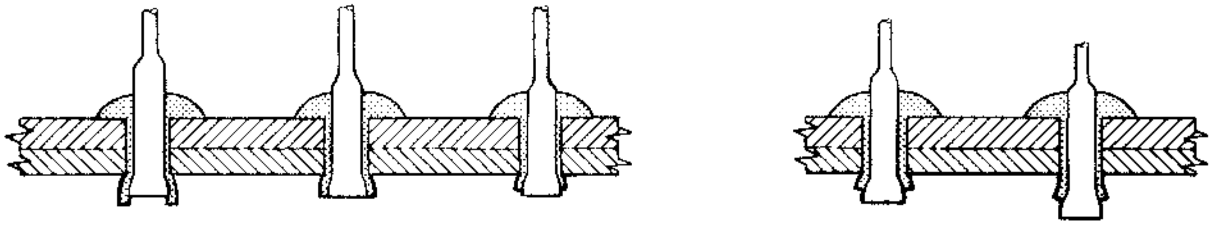
7. <u>Removal and Installation of NACA Rivets</u>

A. When it becomes necessary to remove and replace NACA rivets, the following is recommended:

(1) Remove all universal or round-head rivets from the manufactured head side, whenever possible (see Figure 19, and 20).

(2) Remove all slug rivets from the flush side.

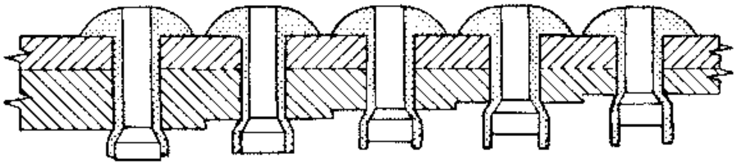
CHERRY RIVETS



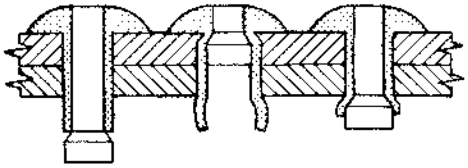
ACCEPTABLE

(STEM NOT PULLED UP)
NOT ACCEPTABLE

OLYMPIC RIVETS



ACCEPTABLE



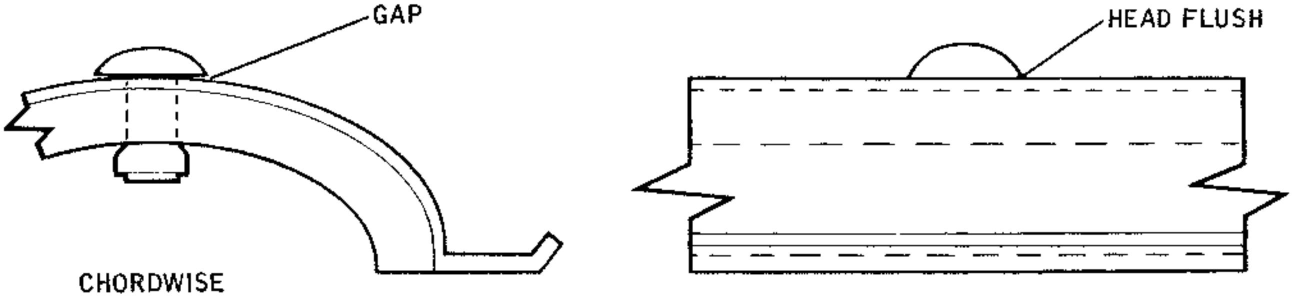
UNDERSIZE HOLE

OVERSIZE HOLE

GRIP LENGTH TOO SHORT

NOT ACCEPTABLE

CHERRY AND OLYMPIC RIVETS EXCEPT CHERRYLOCK



CHORDWISE

LENGTHWISE

ALL BLIND RIVETS

BB3-464A

Blind Rivet Installation
Figure 18 (Sheet 1)

IF THE GRIP MARKING INDICATES THE RIVET HAS BEEN INSTALLED IN THE PROPER GRIP, AND THE STEM AND COLLAR ARE FLUSH WITHIN PRESCRIBED LIMITS, BLIND HEADS TYPICAL OF THOSE ILLUSTRATED WILL BE OBTAINED.

STANDARD

BULBED

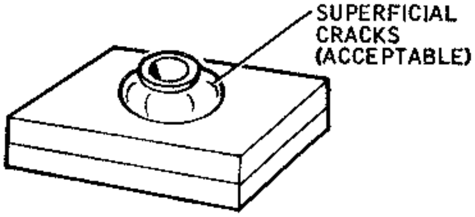
ACCEPTABLE

COLLAR DOES NOT SET

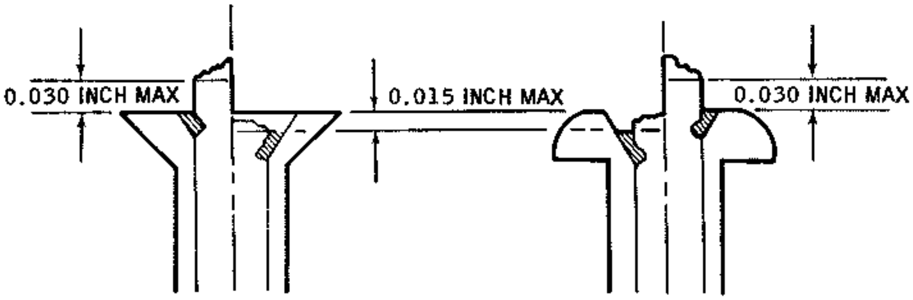
RIVET STEM BREAKS BELOW RIVET HEAD

UNACCEPTABLE

SUPERFICIAL SURFACE CRACKS WHICH MAY APPEAR IN THE RIVET SLEEVE ARE NOT DETRIMENTAL TO RIVET STRENGTH AND ARE ACCEPTABLE



PERMISSIBLE CRACKS



PIN FLUSHNESS INSTALLATION LIMITS

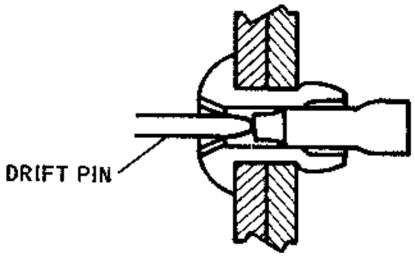
CHERRYLOCK RIVETS

BB3-608

Blind Rivet Installation
Figure 18 (Sheet 2)

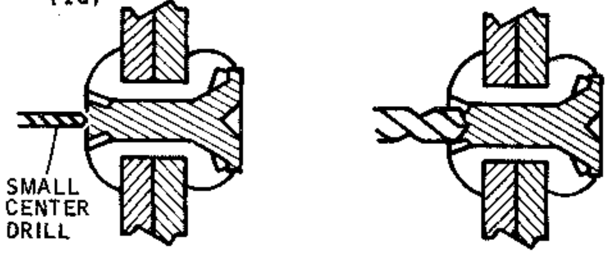
(1)

REMOVE THE LOCK BY DRIVING OUT THE RIVET STEM, USING A TAPERED STEEL DRIFT PIN.



(1a)

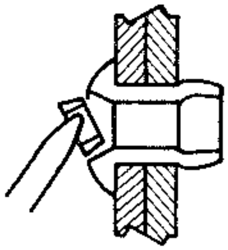
IF THE RIVETS HAVE BEEN INSTALLED IN THIN SHEETS, DRIVING OUT THE LOCKED STEM MAY DAMAGE THE SHEETS. IT IS RECOMMENDED THAT A SMALL CENTER DRILL BE USED TO PROVIDE A GUIDE FOR A LARGER DRILL ON TOP OF THE RIVET STEM, AND THE TAPERED PORTION OF THE STEM BE DRILLED AWAY TO DESTROY THE LOCK.



---

(2)

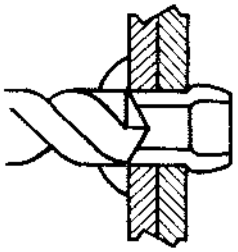
PRY THE REMAINDER OF THE LOCKING COLLAR OUT OF THE RIVET HEAD WITH THE DRIFT PIN



---

(3)

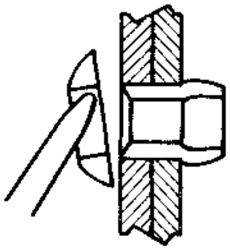
DRILL NEARLY THROUGH THE HEAD OF THE RIVET, USING A DRILL THE SAME SIZE AS THE RIVET SHANK.



---

(4)

BREAK OFF RIVET HEAD, USING A DRIFT PIN AS A PRY.



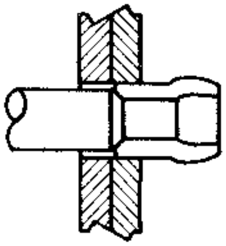
---

(5)

DRIVE OUT THE REMAINING RIVET SHANK WITH A PIN HAVING A DIAMETER EQUAL TO THE RIVET SHANK.

NOTE:

DO NOT DRILL COMPLETELY THROUGH THE RIVET SLEEVE TO REMOVE A RIVET AS THIS WILL TEND TO ENLARGE THE HOLE.



BB3-609

Removal of Cherrylock Rivets
Figure 18A

(3) Remove the rivets with a short, sharp drill, approximately 0.030 inch smaller than the rivet shank diameter. Drill into the rivet far enough to remove the head and punch out the rivet with a punch slightly smaller than the drill size. Exercise extreme care during this operation, to prevent damage to the holes or countersink.

(4) After the rivet has been removed, check the hole size and countersink for conformance with requirements detailed in 51-10-4. Holes within the dimensional tolerances require no further processing. Those holes from which slug rivets have been removed must again be countersink as described in 51-10-4. Hole sizes that arebeyond the limits must be reworked in accordance with 51-10-4.

8. Installation of Special Solid Repair Rivets

A. The special 82-degree head and special 100-degree head solid repair rivets are to be used only in existing countersunk rivet holes where a doubler is to be installed externally, unless otherwise noted in an individual repair. See Figure 21 for rivet part numbers. Prepare the countersinks in the external doubler and install the rivets as follows:

(1) Remove any chips, particles, or other foreign matter from the countersunk attachment holes and the surrounding area to be covered with the doubler.

(2) Apply a brush coating of torque dye or layout dye, Dykem Layout Red DX-296, or equivalent, (The Dykem Co., 2307 N. Eleventh St., St. Louis, Mo.), to the countersinks.

(3) Place the external doubler in position and fasten securely, using quick-release fastening clamps or bolts in the doubler attachment holes where the special head rivets are not required.

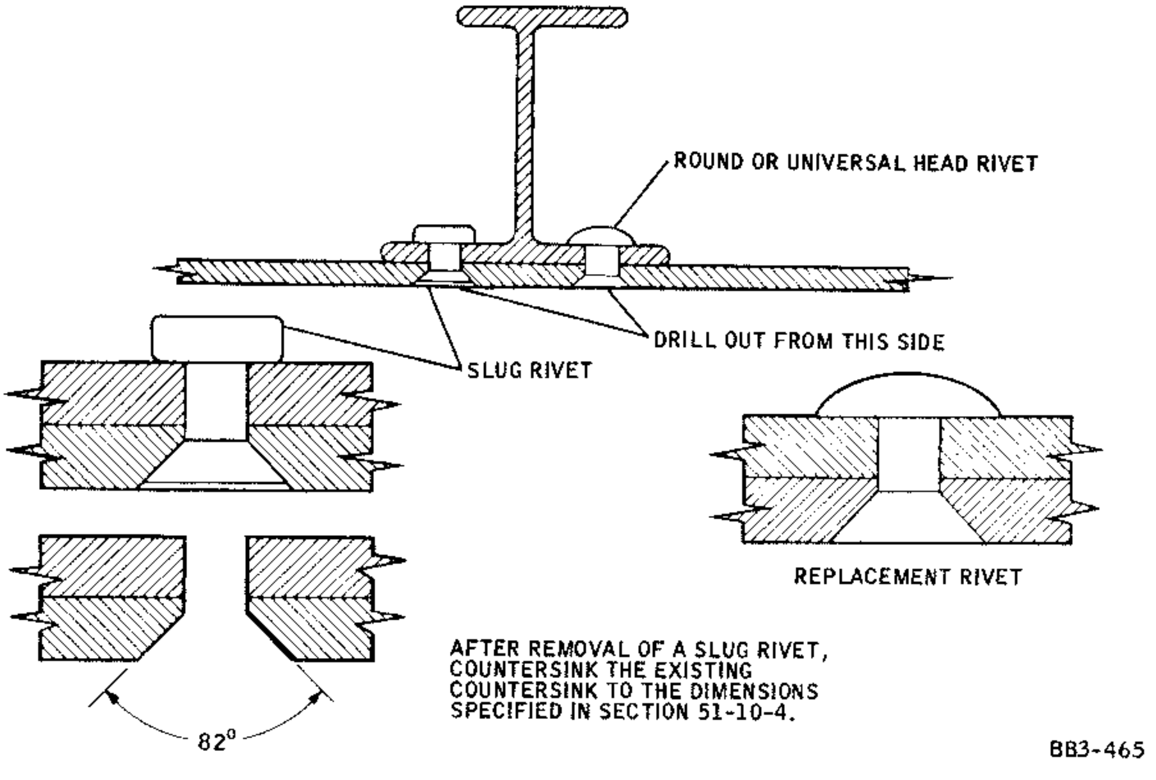
(4) Back drill the holes through the external doubler, using the existing countersunk holes as a template.

(5) From the external side, carefully countersink the holes in the external doubler down to the existing countersinks containing the dyed surface. Use a pilot on the countersink, and make certain the countersink being used has the same angle as the existing countersink, that is, 100 degrees or 82 degrees. When the dyed surface is reached, slowly continue to countersink until the dyed surface is completely removed. Do not countersink beyond the point where the dye is removed.

(6) Since the special solid repair rivets are 1/64 inch oversize, it will be necessary to ream the rivet holes accordingly. Refer to 51-10-4 for hole diameters.

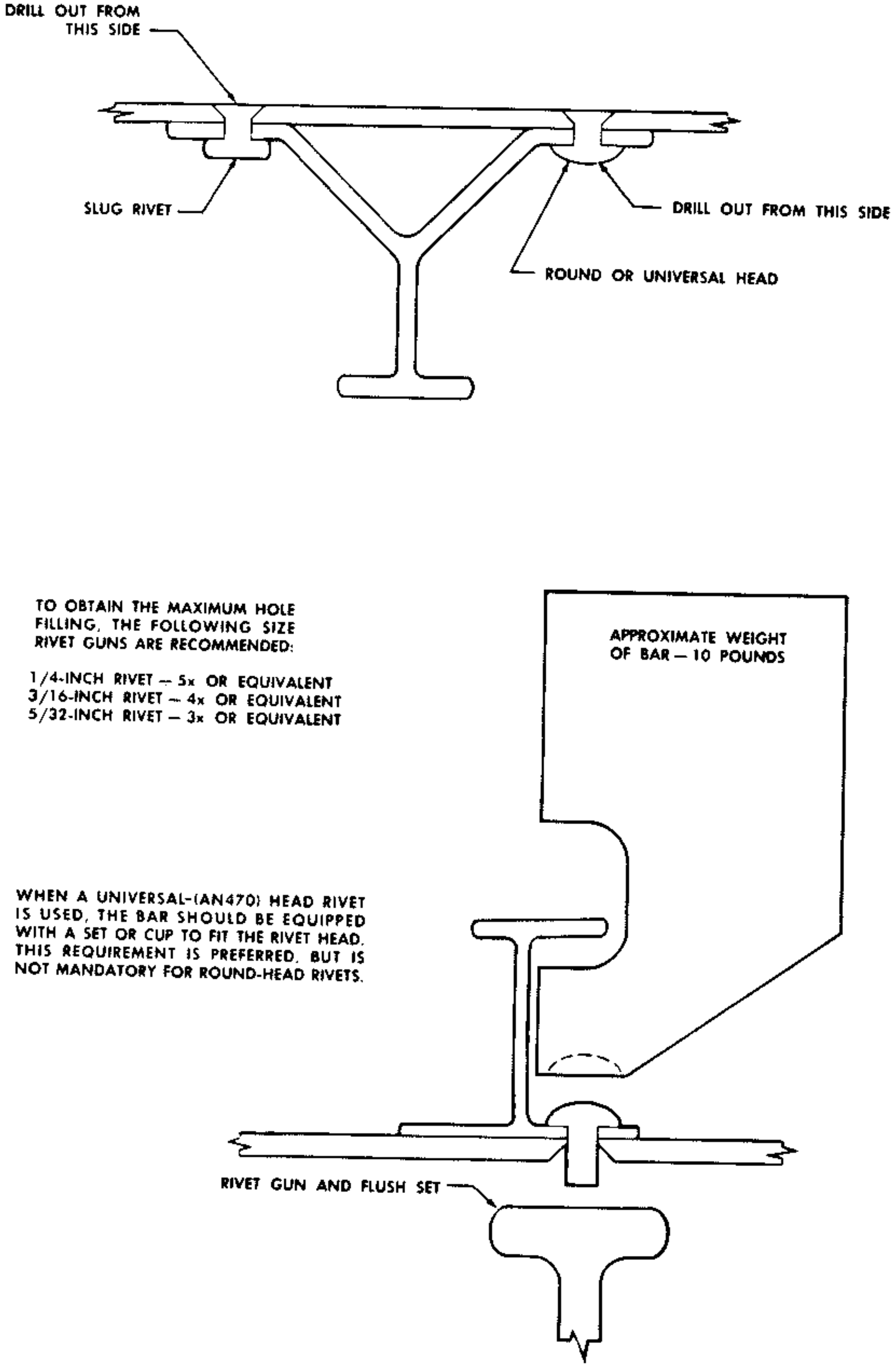
(7) When the attachment holes are complete, the doubler may be removed for tapering, cleaning, painting, or bonding, if required in the repair. Do not deburr the attachment holes in 0.025- or 0.032-gage doublers. On

BB3-465



AFTER REMOVAL OF A SLUG RIVET, COUNTERSINK THE EXISTING COUNTERSINK TO THE DIMENSIONS SPECIFIED IN SECTION 51-10-4.

Slug and Round-Head Rivet Removal
Figure 19



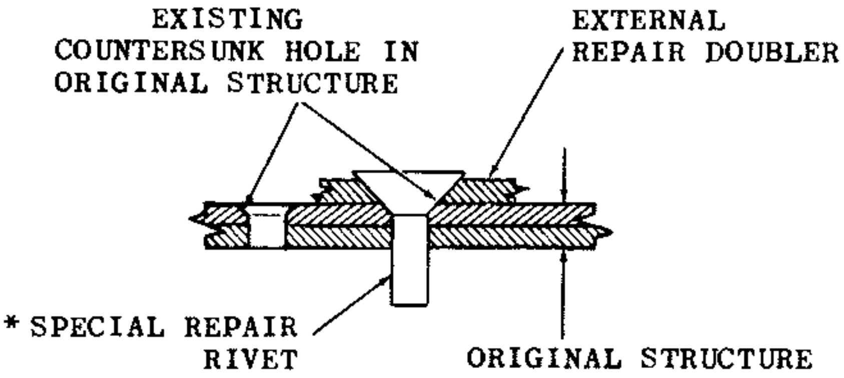
TO OBTAIN THE MAXIMUM HOLE FILLING, THE FOLLOWING SIZE RIVET GUNS ARE RECOMMENDED:

1/4-INCH RIVET — 5x OR EQUIVALENT
3/16-INCH RIVET — 4x OR EQUIVALENT
5/32-INCH RIVET — 3x OR EQUIVALENT

WHEN A UNIVERSAL-(AN470) HEAD RIVET IS USED, THE BAR SHOULD BE EQUIPPED WITH A SET OR CUP TO FIT THE RIVET HEAD. THIS REQUIREMENT IS PREFERRED, BUT IS NOT MANDATORY FOR ROUND-HEAD RIVETS.

Universal Rivet Installation
Figure 20

RIVET NOM DIA	RIVET HEAD	HOLE DIAMETER	OLYMPIC PART NUMBER (AD RIVET)	OLYMPIC PART NUMBER (DD RIVET)
1/8	100°	0.138 0.141	RV5017-AD4-16 †	D D TYPE NOT AVAILABLE
5/32	82°	0.176 0.179	RV5016-AD5-16 †	RV5016-DD5-16 †
	100°	0.176 0.179	RV5017-AD5-16 †	D D TYPE NOT AVAILABLE
3/16	82°	0.207 0.210	RV5016-AD6-16 †	RV5016-DD6-16 †
	100°	0.207 0.210	RV5017-AD6-16 †	D D TYPE NOT AVAILABLE
1/4	82°	0.270 0.274	RV5016-AD8-16 †	RV5016-DD8-16 †



*SPECIAL SOLID FLUSH HEAD REPAIR RIVETS MAY BE PURCHASED FROM DOUGLAS AIRCRAFT CO., PARTS SALES DEPT., 3855 LAKEWOOD BLVD., LONG BEACH, CALIF.

†RIVETS ARE AVAILABLE IN (-16'S) 1-INCH LENGTHS ONLY. CUT RIVETS TO DESIRED LENGTH ON INSTALLATION.

883-467

Special Solid Repair Rivets
Figure 21

doubler gages of 0.040 and thicker, break the sharp edge in the countersink from the feather-edge side, using a hand-held tapered reamer so that the hole is enlarged approximately 0.010 inch.

(8) Insert the special solid repair rivets into the prepared holes. If adhesive is being used in the joint, wipe the adhesive from the internal ends of the rivets. Using a sharp pair of diagonal wire cutters, remove the internal ends of the rivet shanks so the shanks protrude through the holes by 1 1/2 times the diameter of the rivet. The rivets may then be driven in the normal manner.

(9) Using a rivet shaver, shave the heads of the rivets until they are flush with the surrounding surface as described in paragraph 5.

9. Installation of Special Blind Repair Rivets

A. The special 82-degree head and special 100-degree head blind repair rivets are made with knob-pulling stems. Pulling guns and pulling heads capable of pulling cherry CR162, 100-degree flush-head rivets may be used to pull the special blind rivets. See Figure 22 for rivet part numbers.

B. The special 82-degree head and special 100-degree head blind rivets have been designed primarily for use in existing countersunk rivet holes where a repair doubler is to be installed externally. However, they may be used as substitute rivets for MS20601 blind rivets. If called for in a Class A or Class B repair, the rivets must be shaved flush.

C. Install the rivets as follows:

NOTE: If the rivets are not to be installed through an external repair doubler, omit steps (2) through (7).

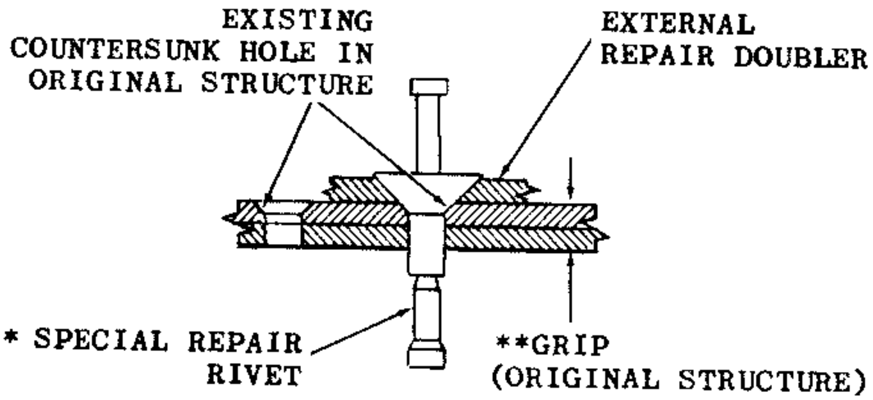
(1) Remove any chips, particles, or any other foreigh matter from the existing countersunk holes.

(2) Apply a brush coating of torque dye, Dykem Layout Red DX-296, or equivalent (The Dykem Co., 2307 N. Eleventh St., Saint Louis, Mo.) to the countersinks.

(3) Make a template of the existing holes to be used in the repair. Place the template over the external repair doubler, and drill out holes to the same diameter as the existing holes.

(4) Locate the external repair doubler in position, and secure it with pins, bolts, or rivets. Drill pilot holes for any other attachment holes required for the repair through which special blind rivets are not installed. Use these pilot holes to fasten the external repair doubler securely, using quick-release fastening clamps. If no other attachments than the special blind rivets are required for the repair, use several of the special blind rivet holes to secure the external repair doubler.

RIVET NOM DIA	RIVET HEAD	GRIP LENGTH **	CHERRY RIVET PART NUMBER	MAX GAGE EXTERNAL REPAIR DOUBLER
1/8	100°	UP TO 0.125	CR1782-4-4	0.071
		0.125-0.250	CR1782-4-8	0.071
5/32	82°	0.063-0.188	CR1822-5-6	0.125
		0.188-0.312	CR1822-5-10	0.125
	100°	0.063-0.188	CR1782-5-6	0.080
		0.188-0.312	CR1782-5-10	0.080
3/16	82°	0.063-0.188	CR1822-6-6	0.125
		0.188-0.312	CR1822-6-10	0.125
	100°	0.063-0.188	CR1782-6-6	0.090
		0.188-0.312	CR1782-6-10	0.090
1/4	82°	0.125-0.250	CR1822-8-8	0.160
		0.250-0.375	CR1822-8-12	0.160



*SPECIAL BLIND FLUSH-HEAD REPAIR RIVETS MAY BE PURCHASED FROM DOUGLAS AIRCRAFT CO., PARTS SALES DEPT., 3855 LAKEWOOD BLVD., LONG BEACH, CALIF.

BB3-468

Special Blind Repair Rivets
Figure 22

(5) From the external side of the repair, carefully countersink the holes in the external repair doubler down to the existing countersinks containing the dyed surface. Use a countersink with a pilot of the same diameter as the hole being countersunk and of the same degree of cutting angle as the existing countersink, that is, 100 degrees or 82 degrees. When the dyed surface is reached, slowly continue to countersink until the dyed surface is completely removed. Do not countersink beyond the point where the dye is removed.

(6) Since all the special blind repair rivets are 1/16 inch oversize, it will be necessary to ream the rivet holes accordingly. Refer to 51-10-4 for diameters.

(7) When the attachment holes are complete, the external repair doubler may be removed for tapering, cleaning, painting, or bonding, if required in the repair. Do not deburr attachment holes in 0.025- or 0.032-gage doublers. On doubler gages of 0.040 and thicker, break the sharp edge in the countersink from the feather-edge side, using a hand-held tapered reamer so that the hole is enlarged approximately 0.010 inch.

(8) Insert the special blind rivets into the countersunk holes. Pull the rivets, using the proper pulling head and pulling gun (see paragraph 6).

(9) If it is desired to have a flush surface, shave the head of the rivets as described in paragraph 5.

10. Douglas Special Deicing System Rivets

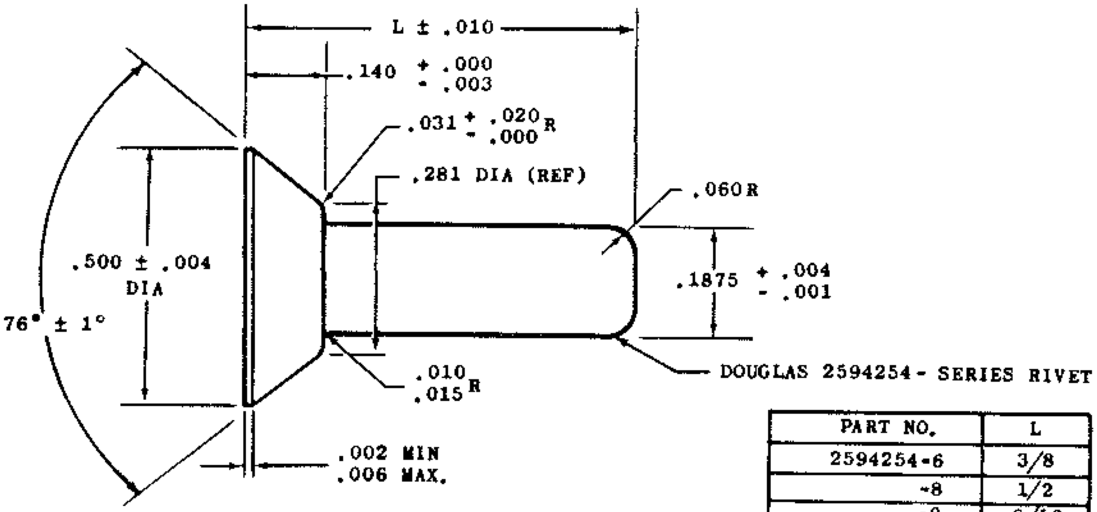
A. Special rivets used for insullator attachments in the deicing system are illustrated in Figure 23. A special oversize replacement rivet and the requirements for installation where oversize holes exist is also illustrated.

11. Use of NAS1097-Series Rivets

A. The NAS1097-series rivets may be used in structural areas other than integral fuel tank areas in place of MS20426-series rivets wherever MS20426 rivets are specified in repairs. Usage is limited to new repair rivet holes which have not been countersunk for MS20426 rivet installations as the countersunk dimensions vary. The recommended rivet-hole sizes and the required countersinking dimensions for the installation of NAS1097 rivets are illustrated in 51-10-4.

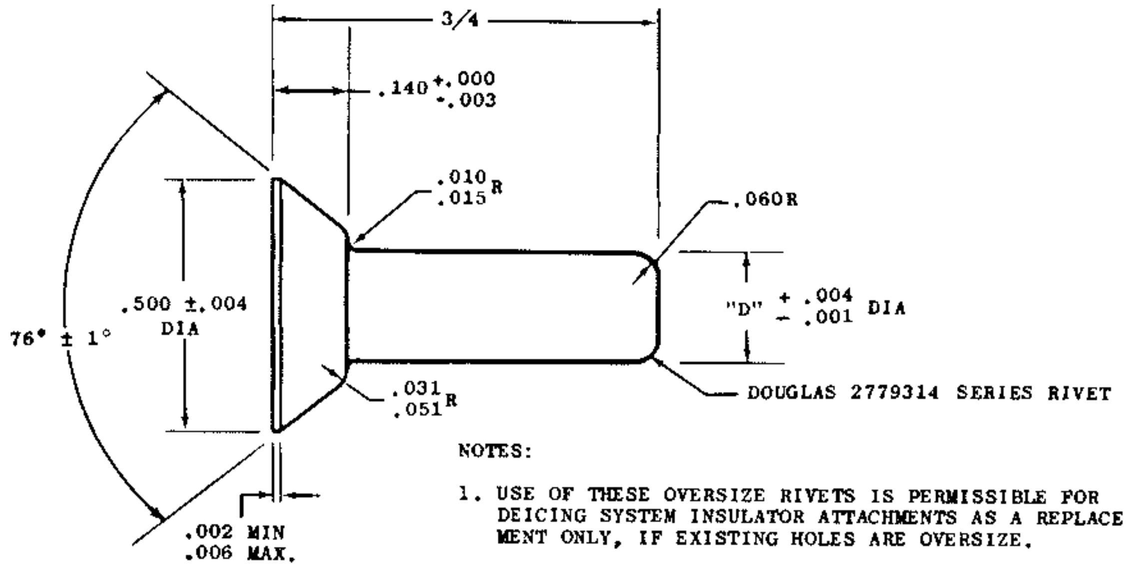
12. Dimpling and Countersinking Methods Used for Rivet Installation

A. Douglas methods used for rivet installations are presented in 51-10-4. An index of dimpling and countersinking methods is also provided in 51-10-4.



PART NO.	L
2594254-6	3/8
-8	1/2
-9	9/16
-10	5/8
-11	11/16
-12	3/4

STANDARD INSTALLATION 3/16-INCH,
76- DEGREE FLUSH SPECIAL DEICING SYSTEM
RIVET (2594254 SERIES).



PART NO.	"D" DIA
2779314-1	.218
2779314-501	.250

NOTES:

1. USE OF THESE OVERSIZE RIVETS IS PERMISSIBLE FOR DEICING SYSTEM INSULATOR ATTACHMENTS AS A REPLACEMENT ONLY, IF EXISTING HOLES ARE OVERSIZE.
2. RIVET MATERIAL (2117-T4) TO BE IN ACCORDANCE WITH MIL-R-5674A.
3. REAR EXISTING 2594254 RIVET HOLES TO $\frac{.223}{.226}$ DIAMETER TO INSTALL 2779314-1 RIVETS.
4. REAM EXISTING 2594254 RIVET HOLES TO $\frac{.254}{.257}$ DIAMETER TO INSTALL 2779413-501 RIVETS.
5. BEFORE INSTALLATION, CUT RIVET TO PROPER LENGTH.

OVERSIZE DEICING SYSTEM RIVET FOR
SPECIFIC REPAIRS (2779314 SERIES)

BB3-469

Douglas Special Deicing System Rivets
Figure 23

LOCKBOLTS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes procedures for installing lockbolts. Unless otherwise specified for the individual repair, preparation of the hole and installation of the lockbolt must be in accordance with these procedures.

2. Selection of Lockbolts

A. Lockbolt Identification

(1) Lockbolt identification may be made by reference to Figure 1 and the following:

Lockbolt	Size	Head Type	Material	Identification	Collar
NAS1416	3/16	Flush shear	Alloy steel	Depressed H	NAS1080C6
NAS1418	1/4				NAS1080C8
NAS1420	5/16				NAS1080C10
NAS1422	3/8				NAS1080C12
NAS1426	3/16	Protruding	Alloy steel	Depressed H	NAS1080C6
NAS1428	1/4				NAS1080C8
NAS1430	5/16				NAS1080C10
NAS1432	3/8				NAS1080C12
NAS1436	3/16	Flush shear	Alloy steel	Depressed H	NAS1080C6
NAS1438	1/4				NAS1080C8
NAS1440	5/16				NAS1080C10
NAS1442	3/8				NAS1080C12
NAS1446	3/16	Protruding	Alloy steel	Depressed H	NAS1080C6
NAS1448	1/4				NAS1080C8
NAS1450	5/16				NAS1080C10
NAS1452	3/8				NAS1080C12
NAS1465	5/32	Pan	Alloy steel	Depressed -	NAS1080-5
NAS1466	3/16				NAS1080-6
NAS1468	1/4				NAS1080-8
NAS1470	5/16				NAS1080P10
NAS1472	3/8				NAS1080P12
NAS1456	3/16	100° screw	Alloy steel	Depressed--	NAS1080-6
NAS1458	1/4				NAS1080-8
NAS1460	5/16				NAS1080P10
NAS1462	3/8				NAS1080P12

Lockbolt	Size	Head Type	Material	Identification	Collar
NAS1475 NAS1476 NAS1478 NAS1480 NAS1482	5/32 3/16 1/4 5/16 3/8	100° Rivet	Alloy steel	Depressed --	NAS1080-5 NAS1080-6 NAS1080-8 NAS1080P10 NAS1080P12
NAS1486 NAS1488 NAS1490 NAS1492	3/16 1/4 5/16 3/8	100° screw	Alloy steel	Depressed -	NAS1080-6 NAS1080-8 NAS1080-10 NAS1080-12
NAS1496 NAS1498 NAS1500 NAS1502	3/16 1/4 5/16 3/8	Pan	Alloy steel	Depressed -	NAS1080-6 NAS1080-8 NAS1080-10 NAS1080-12
R3001-T5 R3001-T6 R3001-T8 R3001-T10 R3001-T12	5/32 3/16 1/4 5/16 3/8	Pan	Alloy steel	Depressed -	LC-C5 LC-C6 LC-C8 7LC-C10 7LC-C12
R3002-T6 R3002-T8 R3002-T10 R3002-T12	3/16 1/4 5/16 3/8	100° screw	Alloy steel	Depressed -	LC-C6 LC-C8 7LC-C10 7LC-C12
R3014-T5 R3014-T6 R3014-T8 R3014-T10 R3014-T12	5/32 3/16 1/4 5/16 3/8	100° rivet	Alloy steel	Depressed --	LC-C5 LC-C6 LC-C8 7LC-C10 7LC-C12
R3007-T6 R3007-T8 R3007-T10 R3007-T12	3/16 1/4 5/16 3/8	Pan 1/64 oversize (R3001)	Alloy steel	Depressed .	LC-C6 LC-C8 LC-C10 LC-F12
R3008-T6 R3008-T8 R3008-T10 R3008-T12	3/16 1/4 5/16 3/8	100° screw 1/64 oversize (R3002)	Alloy steel	Depressed .	LC-C6 LC-C8 LC-C10 LC-F12
R3020-T6 R3020-T8 R3020-T10 R3020-T12	3/16 1/4 5/16 3/8	100° rivet 1/64 oversize (R3014)	Alloy steel	Depressed ⊕	LC-C6 LC-C8 7LC-C10 7LC-C12

Lockbolt	Size	Head Type	Material	Identification	Collar
(Self Broaching) 10LP-T6 10LP-T8	3/16 1/4	Pan	Alloy steel	Depressed 10	LC-C6 LC-C8
(Self Broaching) 10L509-T6 10L509-T8	3/16 1/4	100° screw	Alloy steel	Depressed 10	LC-C6 LC-C8
(Stump) ALSF-T6 ALSF-T8 ALSF-T10 ALSF-T12	3/16 1/4 5/16 3/8	Pan	Alloy steel	Depressed +	LC-C6 LC-C8 LC-C10 LC-C12
(Stump) ASCT509-T6 ASCT509-T8 ASCT509-T10 ASCT509-T12	3/16 1/4 5/16 3/8	100° screw	Alloy steel	Depressed X	LC-C6 LC-C8 LC-C10 LC-C12
(Tack) R3015-E5	5/32	Truss	7075	None	LC-F5
R3015-100-E5	5/32	100°	7075	None	LC-F5
2L200-T5 2L200-T6 2L200-T8	5/32 3/16 1/4	Crowned	Alloy steel	None	LC-C5 LC-C6 LC-C8
(Stump) 2LSP-T6 2LSP-T8 2LSP-T10 2LSP-T12	3/16 1/4 5/16 3/8	Pan	Alloy steel	Depressed -	LC-C6 LC-C8 LC-C10 LC-C12
(Stump) 2LS509-T6 2LS509-T8 2LS509-T10 2LS509-T12	3/16 1/4 5/16 3/8	100° screw	Alloy steel	Depressed -	LC-C6 LC-C8 LC-C10 LC-C12
ALPP-T6 ALPP-T8 R1028-T10 R1028-T12	3/16 1/4 5/16 3/8	Pan	Alloy steel	Depressed +	LC-C6 LC-C8 LC-C10 LC-F12

Lockbolt	Size	Head Type	Material	Identification	Collar
ANT509-T6 ANT509-T8 R1029-T10 R1029-T12	3/16 1/4 5/16 3/8	100° screw	Alloy steel	Depressed X	LC-C6 LC-C8 LC-C10 LC-F12
SALP-T6 SALP-T8 SALP-T10 SALP-T12	3/16 1/4 5/16 3/8	Protruding	Alloy steel	Depressed H	6LC-C6 6LC-C8 6LC C10 6LC-C12
SAL100-T6 SAL100-T8 SAL100-T10 SAL100-T12	3/16 1/4 5/16 3/8	Flush shear	Alloy steel	Depressed H	6LC-C6 6LC-C8 6LC-C10 6LC-C12
(Stump) SLSP-T4 SLSP-T5 SLSP-T6 SLSP-T8 SLSP-T10 SLSP-T12	1/8 5/32 3/16 1/4 5/16 3/8	Protruding	Alloy steel	Depressed H	DC-C4 DC-C5 6LC-C6 6LC-C8 6LC-C10 6LC-C12
(Stump) SLS100-T4 SLS100-T5 SLS100-T6 SLS100-T8 SLS100-T10 SLS100-T12	1/8 5/32 3/16 1/4 5/16 3/8	Flush shear	Alloy steel	Depressed H	DC-C4 DC-C5 6LC-C6 6LC-C8 6LC-C10 6LC-C12
S3L100-DT4	1/8	Flush shear	Alloy steel	Depressed $\overset{3}{\asymp}$	6DC-C4

(2) Collar identification may be made by reference to the following:

Basic NAS Number	Cherry and Huck Rivet Collar	Material	Identification	Sizes
NAS1080	LC-C	2024-T4	Green or yellow green	5/32 thru 3/8
NAS1080	LC-C Q	2024-T4	Black or dark grey	3/16 thru 3/8
NAS1080	LC-R	Mild Steel	Gold dichromate	3/16 thru 1/4
NAS1080D	LC-F	6061-T6	Plain grey	5/32 thru 3/8
---	DC-C4	2024-T4	Yellow	1/8
---	6DC-C4	2024-T4	Blue	1/8

Basic NAS Number	Cherry Rivet Collar	Material	Identification	Sizes
NAS1080P	7-LC-C*	2024-T4	Blue	3/16 thru 3/8
NAS1080C	6LC-C	2024-T4	Yellow gold	3/16 thru 3/8

*Use with lockbolts with five locking grooves.

NOTE: Lockbolt collars manufactured by the Cherry Rivet Company are identified by a raised bar or bars on the upper circumference of the collar.

B. Lockbolt Grip Length

(1) Exercise care in selection of proper grip length for application. Note that normal grip length will accomodate material thickness variations from coded nominal grip. See grip range tabulation, Figure 3, for nominal, minimum, and maximum material thicknesses for each grip length.

C. Lockbolt and Collar Designation Code

(1) Lockbolt

Example:

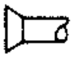
```
R3001    H     ( )     6    8
R3002    |      |      |    └─Grip length in 1/16 inch
R3007    |      |      |
R3008    |      |      └──Diameter in 1/32 inch
R3014    |      |
R3015    |      └──── Material T-heat-treated steel, cadimum plated
R3020    |
21426    └──────── Interference fit (N)- non-hole-filling type
2LP
2L200
  └────────── Basic head type
```

(2) Collar

Example:

```
LC     -( )    ( )
 |       |      └Diameter of collar in 1/32 inch
 |       |
 |       └─────Material - C--2024-T4 aluminum (anodized)
 |                        F--6061-T6 aluminum
 |                        R-- Mild steel (cadimum plated)
 |
 └─────────Basic designation - LC--Lockbolt collar
```

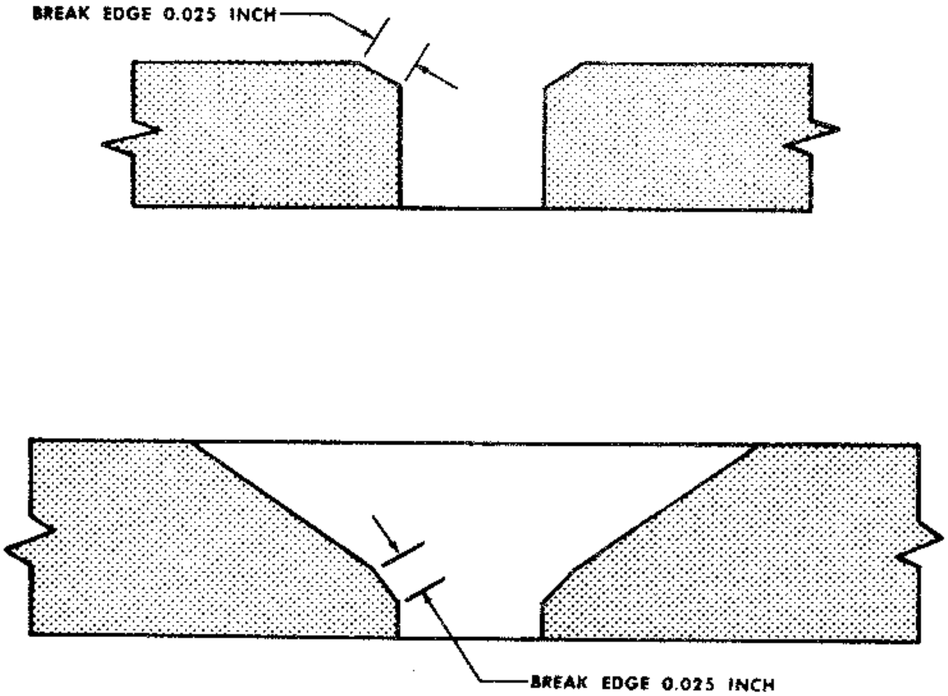
PIN IDENTIFICATION	HEAD IDENTIFICATION	COLLAR
 PAN HEAD	⊖ DEPRESSED DASH	(TYPICAL) 
NAS1465 (R3001-T5)		NAS1080-5 (LC-C5)
NAS1466 (R3001-T6)		NAS1080-6 (LC-C6)
NAS1468 (R3001-T8)		NAS1080-8 (LC-C8)
NAS1470 (R3001-T10)		NAS1080P10 (7LC-C10)
NAS1472 (R3001-T12)		NAS1080P12 (7LC-C12)
PAN HEAD (1/64 OVERSIZE) R3007-T6	⊙ DEPRESSED DOT	NAS1080-6 (LC-C6)
R3007-T8		NAS1080-8 (LC-C8)
R3007-T10		NAS1080-10 (LC-C10)
R3007-T12		NAS1080D12 (LC-F12)
 100° SCREW-TYPE HEAD	⊖ DEPRESSED DASH	NAS1080-6 (LC-C6)
NAS1456 (R3002-T6)		
NAS1458 (R3002-T8)		NAS1080-8 (LC-C8)
NAS1460 (R3002-T10)		NAS1080P10 (7LC-C10)
NAS1462 (R3002-T12)		NAS1080P12 (7LC-C12)
100° SCREW-TYPE HEAD (1/64 OVERSIZE) R3008-T6	⊙ DEPRESSED DOT	NAS1080-6 (LC-C6)
R3008-T8		NAS1080-8 (LC-C8)
R3008-T10		NAS1080-10 (LC-C10)
R3008-T12		NAS1080D12 (LC-F12)

PIN IDENTIFICATION	HEAD IDENTIFICATION	COLLAR
 MS20426 RIVET HEAD TYPE	⦶ DEPRESSED 2 DASHES	NAS1080-5 (LC-C5)
NAS1475 (R3014-T5)		
NAS1476 (R3014-T6)		NAS1080-6 (LC-C6)
NAS1478 (R3014-T8)		NAS1080-8 (LC-C8)
NAS1480 (R3014-T10)		NAS1080P10 (7LC-C10)
NAS1482 (R3014-T12)		NAS1080P12 (7LC-C12)
RIVET HEAD TYPE (1/64 OVERSIZE) R3020-T6	⊕ DEPRESSED CIRCLE WITH CROSS	NAS1080-6 (LC-C6)
R3020-T8		NAS1080-8 (LC-C8)
 STUMP PAN HEAD	⊕ DEPRESSED CROSS	NAS1080-6 (LC-C6)
ALSF-T6		
ALSF-T8		NAS1080-8 (LC-C8)
ALSF-T10		NAS1080-10 (LC-C10)
 TACK BOLT	○ NO IDENTIFICATION	NAS1080D5 (LC-F5)
R3015T-E5		
 BLIND LOCKBOLT	NO IDENTIFICATION	
 CROWNED HEAD	○ NO IDENTIFICATION	NAS1080-5 (LC-C5)
2L200-T5		
2L200-T6		NAS1080-6 (LC-C6)
2L200-T8		NAS1080-8 (LC-C8)

NOTES:
1. LC-R COLLARS ARE TO BE USED IN HIGH TEMPERATURE APPLICATIONS NOT EXCEEDING 221°C (450°F).
2. LOCKBOLTS MANUFACTURED BY CHERRY RIVET CORP. HAVE A DEPRESSED C ON THE HEAD IN ADDITION TO THE STANDARD MARKINGS.

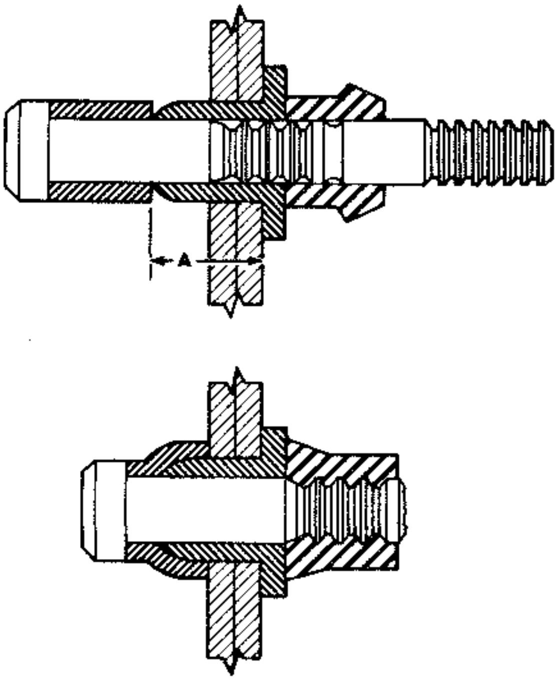
BB3-493

Lockbolt Identification Chart
Figure 1



BB3-492

Breaking Corner Edges to Seat Lockbolts
Figure 2



DASH NO.	GRIP RANGE		A± 0.010 INCH	
	MINIMUM	MAXIMUM (INCH)	BL-8	BL-10
-1	0.031	0.094	7/32	- - - -
-2	0.094	0.156	9/32	19/64
-3	0.156	0.219	11/32	23/64
-4	0.219	0.281	13/32	27/64
-5	0.281	0.344	15/32	31/64
-6	0.344	0.406	17/32	35/64
-7	0.406	0.469	19/32	39/64
-8	0.469	0.531	21/32	43/64
-9	0.531	0.594	23/32	47/64
-10	0.594	0.656	25/32	51/64
-11	0.656	0.718	27/32	55/64
-12	0.718	0.781	- - - -	59/64
-13	0.781	0.843	- - - -	63/64
-14	0.843	0.906	- - - -	1 3/64

BB3-494

Blind Series Lockbolt Grip Ranges
Figure 3

3. Hole Preparation for Lockbolts

A. Holes must be prepared to provide interference fit for lockbolts except when one or more members to be joined are steel, stainless steel, or titanium, in which case clearance fit holes are mandatory (see 51-10-4), Figure 2).

B. Hole preparation for lockbolts must be in accordance with instructions contained in 51-10-4.

C. Burrs must be removed and chips cleaned from between faying surfaces before installation.

D. To avoid difficulty in seating the protruding lockbolt head, break the edge of the hole with a 100-degree countersink (see Figure 2).

4. Countersinking for Lockbolts

A. Countersinks for lockbolts must be prepared in accordance with instructions contained in 51-10-4.

B. To avoid difficulty in seating flush-head lockbolts, break the edge of the countersink at the junction of the hole using a 60- or 80-degree countersink (see Figure 2).

5. Dimpling for Lockbolts

A. Dimpling for lockbolts must be in accordance with instructions contained in 51-10-4.

6. Lubrication of Lockbolts

A. Lockbolt collars are lubricated by the manufacturer and must not be stored in absorbent paper or cloth bags. The pins do not ordinarily require relubrication, if lubricant is removed from grip lengths of less than one-half of an inch. Pins with grip lengths of one-half inch and over must be relubricated by dipping the pin in lockbolt lubricant. Allow the pin to dry for 15 minutes.

B. Lubricated collars must be cleaned after installation with wash thinner Douglas No. 14, or equivalent, before applying fillets of sealing compounds or primer.

7. Installation of Lockbolts

A. Stump-Type Lockbolt Tooling

(1) Use the following driving tools on all stump-type lockbolts.

Size	Recommended Gun	Gun Set
3/16	5X	AT118M-3-L6
1/4	7X	AT118M-3-L8
5/16	7X or 9X	AT118M-3-L10
3/8	IR36 or 7X	AT118M-3-L12

(2) Use the following driving tools on lockbolt squeezer sets for all types of stumps.

Size	Squeezer Set
3/16	AT1185-L6
1/4	AT1185-L8
5/16	AT1185-L10
3/8	AT1185-L12

B. Pull-Type Lockbolt Tooling

(1) Hydraulic gun No. 146 or G-87 pneumatic-hydraulic gun is used to pull 3/8-inch-diameter lockbolts in R3001, R3002, and R3014 series. Oversize lockbolts are pulled with same nose assemblies as for standard lockbolts.

(2) SAL nose assemblies for pull-type lockbolts may be used for installing standard lockbolts.

C. Special Portable Power Tools

(1) Stump-Type Lockbolt Tooling

(a) Model No. A-81C Cleco pneumatic squeezer equipped with a special yoke design No. 90823 and shaft No. 90822 can be obtained from Jiffy Air Tool Mfg. Corp., 15220 S. San Pedro St., Gardena, Calif. Additional modification to this squeezer is necessary, as shown on Douglas Tooling Drawing C-343-90030-GTX.

(b) Model No. A-81A Cleco pneumatic squeezer, modified per Douglas Tooling Drawing C-343-90047-GT, with 3-inch jaws and dies for this tooling, can be obtained from Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles, 45, Calif.

(2) Other Lockbolt Installation Tooling

Tool	Source
Model X-Cell regulator valve (for self-releasing, two-cycle systems)	X-Cell Tool and Mfg. Co., 3334 W. Rosecrans Ave., Hawthrone, Calif.
Offset nose pieces for C- and Z-frame installations	Towsend Co., Cherry Rivet Div., 1224 E. Delhi Rd., Santa Ana, Calif.
Close-quarter hydraulic huck gun heads, 3/16- inch through 3/8-inch capacity, with standard and special noses	Huck Mfg., Co., 220 N. Daphne St., Hawthrone, Calif.
Pneu-Draulic pressure pump No. CP-805ARDR for power hydraulic source	Chicago Pneumatic Tool Co., 6935 E. Bandini Blvd., Los Angeles 22, Calif.
CP352 and CP353 installation guns with applicable nose assemblies	Chicago Pneumatic Tool Co.
Model 125, 126, and 146 hydraulic installation guns with applicable nose assemblies	Huck Mfg., Co.
RV72G installation gun with applicable nose assemblies	Olympic Screw and Rivet Corp., 11445 S. Dolan St., Downey, Calif.
Self-releasing nose assemblies collar splitters 42-6, 42-9 model 10 and model 12	Huck Mfg., Co.
Collar splitters No. 20024	Brown Line Corp., El Segundo, Calif.
Inspection gages AT536 and AT539	Aircraft Tools Co.
Inspection profile gages HG series	Huck Mfg. Co.
Huck tackbolt gun A93	Huck Mfg. Co.
Tackbolt noses	Huck Mfg. Co.

D. Installation Procedures

NOTE: In the following procedure, lockbolts require an interference fit.

(1) General Installation

(a) Insert shank of lockbolt selected in accordance with Figure 3 into a hole prepared in accordance with paragraph 3.

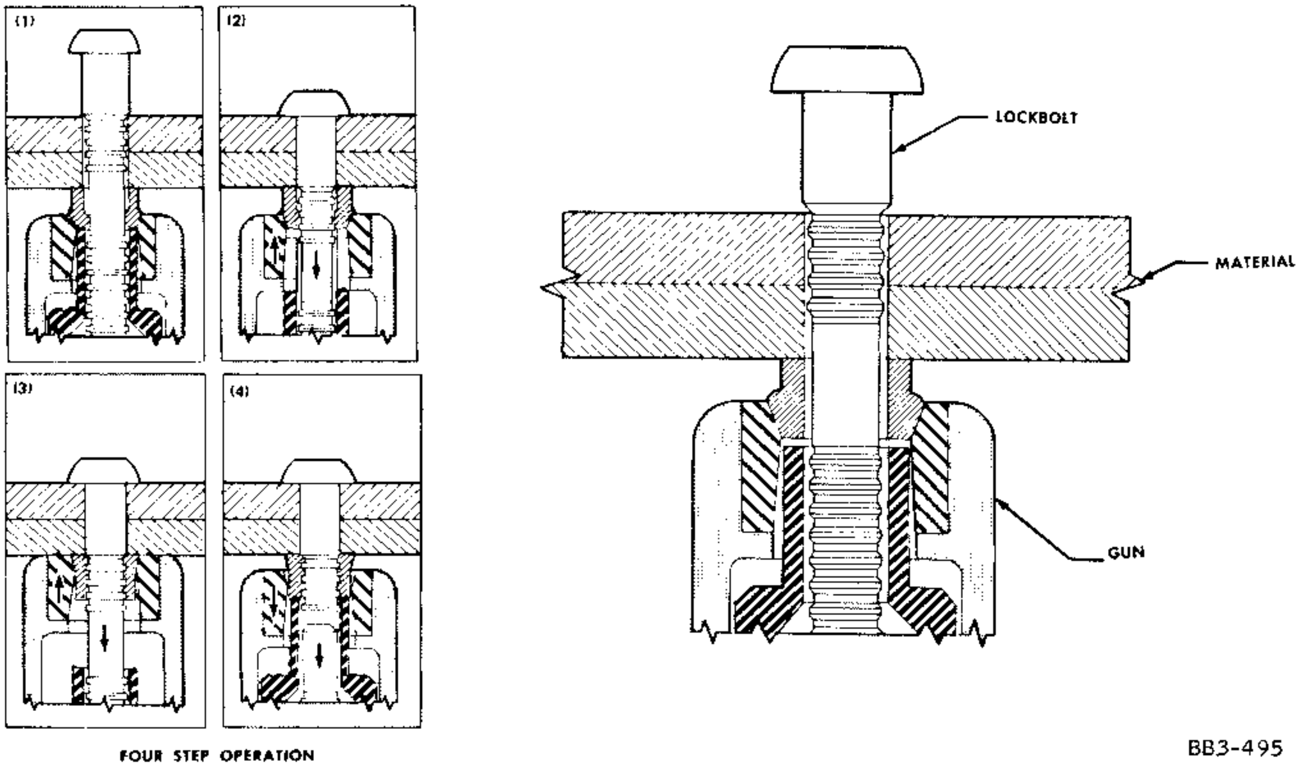
(b) Slip collar onto pin, and apply pulling gun as shown in Figure 4.

(c) With gun loosely supported, pull trigger. Gun will apply force required to draw lockbolt into place, swage collar, and break away shank.

(2) Stump-Type Lockbolt Installation

(a) Drive pin into hole with rivet gun until head is properly seated.

(b) Buck head with a suitable bar while swaging collar with tools indicated in paragraph 7.A.



Pull-Type Lockbolt Installation
Figure 4

(3) Touchup of Lockbolts

(a) Touch up broken ends of lockbolt pins, steel or 7075, as soon as possible after proper installation to avoid corrosion of broken pin.

(b) Touch up all pins inside fuel tanks by applying a coat of EC-776 (Minnesota Mining and Mfg. Co., 6411 Randolph St., Los Angeles, Calif.) to end of pin.

(c) In other structural areas apply a coat of FR primer (Finch Paint and Chemical Co., Torrance, Calif.) to end of pin.

(4) Acceptable Tapers of Installed Lockbolts

(a) A maximum of 7 degrees is acceptable under collar.

(5) Pin Projections

(a) To correct excessive grip length, NAS1252 washers may be used under head or collar, but only when correct grip length is not available.

(b) Washers must be used only under collar on flush lockbolts.

(c) If correct grip length is not available, a washer thickness of 0.032 to 0.064 inch is permissible. No more than two washers per lockbolt or total 0.064 inch is permissible.

(d) Use NAS1252 or Douglas Part No. 2704013, 7075-T6 washers, on all assemblies. These are identified by a pale yellow, No. 205 alumalite finish. Use NAS1252 or Douglas Part No. 2505787 washers against magnesium members, either under head or under collar. Do not use washers in integral fuel tank areas unless specified in manual.

(e) Install lockbolts through faying surfaces of sealant, driving lockbolt into hole, using a soft metal block in rivet gun. Remove all sealant from lockbolt locking groove with a clean cloth, not dampened with solvent, to produce fully swaged collars.

(f) Pull lockbolt into an interference-fit hole until head is seated, rather than drive it in with a hammer and soft metal block. Use a self-releasing nose 3/16-inch diameter, Part No. 99-198; 1/4-inch diameter, Part No. 99-199; 5/16-inch diameter, Part No. 99-276, and 3/8-inch diameter, Part No. 99-277, attached to standard pull guns.

<u>NOTE</u>: This method eliminates driving the lockbolt into the hole with a hammer, or rivet gun, and may prevent possible damage to the lockbolt or structure. Positive head seating is also obtained before swaging the collar. A pressure regulator must be used to control the pressure. The pressure must not be more than 60 psi for 3/16-inch diameters, 70 psi for 1/4- and 5/16-inch diameters, and 75 psi for 3/8-inch-diameter lockbolts.

(g) When head of a pull-type lockbolt is installed against a plastic material, a 0.032-inch NAS1252 or Douglas 2704013 washer must be placed under lockbolt head.

(h) When a stump-type lockbolt is required for preceding applications, washer may be omitted, provided collar is swaged onto lockbolt pin by a compression squeezer.

NOTE: Do not use any vibrating type of tool.

(6) Installation of Tackbolts

(a) Tackbolts are designed for tacking purposes only, and may be used as a temporary fastener to ensure metal-to-metal contact in faying surfaces of sealed areas. Install tackbolts with a noninterference fit. Where faying surface sealants are used, an approved type of air line-restrictor must be used to slow down drawbolt action of gun. See paragraph 2 for pin identification and corresponding collar.

(7) Inspection of Lockbolts

(a) Check holes to see that they conform to requirements of 51-10-4.

(b) Lockbolt head and collar must be seated against members, except as noted in paragraph 7.D.(5).

(c) Collar swage must meet applicable swage gage.

(8) Use of Pin Projection Gages

(a) Refer to Figure 5 for use of gages to check ALS, SLS and SAL-type lockbolts.

(b) Use a profile gage to simplify checking of pin and collar.

(c) If correct pin and collar have been used and driven collar is free from cracks, installation is satisfactory, provided lockbolt head has been formed. When collars of ALS stump-type lockbolts require further swaging, this must be performed with tools specified for ALS-type lockbolts. Reswaging of pull-type lockbolts is not permissible.

(d) Stump-type steel lockbolt pins must be magnetically inspected on a statistical sampling basis. Pull-type lockbolt pins do not require magnetic inspection.

(e) Heads of installed lockbolts must not be pounded to ensure seating. Any lockbolts which have been struck on head must be replaced.

SWAGE AND PIN PROJECTION PROFILE GAGES FOR STANDARD, PULL-TYPE LOCKBOLTS

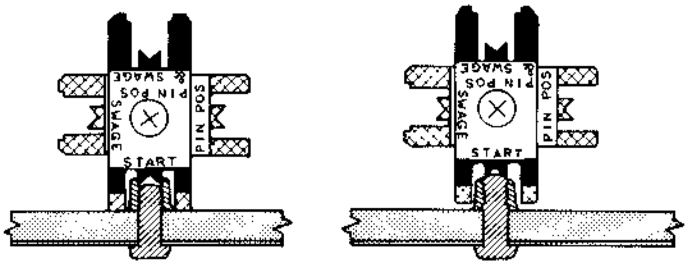
USE HG-85-7, FOR 5/32-INCH; HG-85-10, 3/16-INCH; HG-85-2, 1/4-INCH; HG-85-8, 5/16-INCH; AND HG-85-9, 3/8-INCH LOCKBOLTS

STEP 1

Use Start Position

a. If Red (▦) (or copper plate finish) touches the sheet see step 2

b. If Black (■) touches the pin see step 3



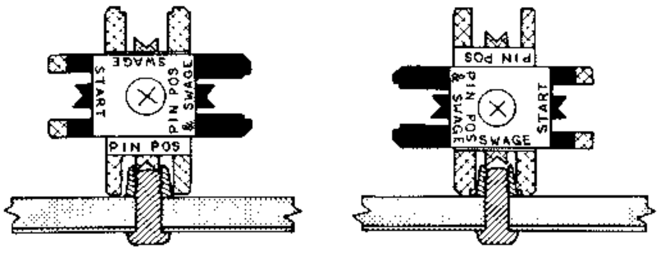
(a) (b)

STEP 2

Use Red (■) (Or Copper Plate Finish) Positions

a. Check pin position (legs must not touch the sheet)

b. Check swage (legs must touch the sheet)



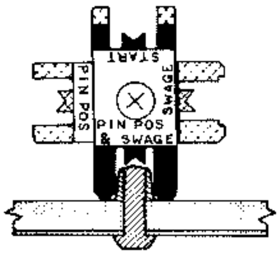
(a) (b)

STEP 3

Use Black (■) Position

a. Check pin position (legs must touch the sheet)

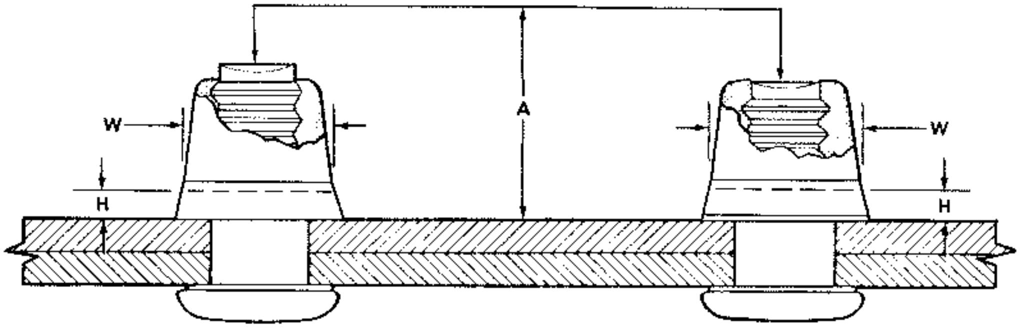
b. Check swage (legs must touch the sheet)



(a & b)

BB3-496

Lockbolt Pin Projection Gages
Figure 5 (Sheet 1)

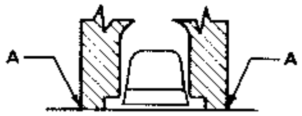


STUMP INSPECTION DIMENSIONS

GAGE NO.	PRODUCE	A	W	H
HG34D-1	ALS-E6	0.323-0.237	0.298	0.0595
HG34D-2	ALS-T6	0.289-0.217		0.0685
HG34D-3	ALS-E8	0.400-0.306	0.395	0.0805
HG34D-4	ALS-T8	0.372-0.300		0.0745
HG34D-5	ALS-E10	0.480-0.398	0.500	0.1075
HG34D-6	ALS-T10	0.450-0.383	0.487	0.0655
HG34D-7	ALS-E12	0.583-0.495	0.590	0.1575
HG34D-8	ALS-T12	0.546-0.479		0.1205

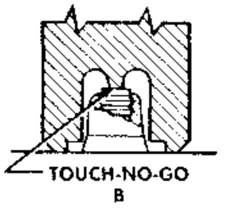
USE OF HG-34D GAGE

1. CHECKING SWAGING OF COLLAR.



A. CENTER THE GAGE ON THE COLLAR-STEP TOWARD THE COLLAR.
B. IF THE GAGE TOUCHES THE SHEET AT A, THE COLLAR IS SUFFICIENTLY SWAGED.
C. IF THE GAGE DOES NOT TOUCH THE SHEET AT A, THE COLLAR IS NOT SUFFICIENTLY SWAGED. REPLACE THE LOCKBOLT.

2. CHECKING PIN FOR MINIMUM GRIP.

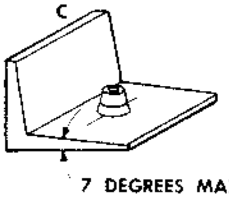


A. CENTER THE GAGE ON THE COLLAR-STEP TOWARD THE COLLAR.
B. IF POINT B DOES NOT TOUCH THE CENTER OF THE PIN, THE STUMP WILL BE DRIVEN WITHIN THE MINIMUM GRIP AND IS ACCEPTABLE.
C. IF POINT B TOUCHES THE CENTER OF THE PIN, THE STUMP WILL BE DRIVEN BEYOND THE MINIMUM GRIP. USE THE NEXT SHORTER STUMP.

3. CHECKING PIN FOR MAXIMUM GRIP.

A. REVERSE THE GAGE AND CENTER ON THE COLLAR.
B. IF POINT C TOUCHES THE CENTER OF THE PIN, THE STUMP WILL BE DRIVEN WITHIN THE MAXIMUM GRIP AND IS ACCEPTABLE.
C. IF POINT C DOES NOT TOUCH THE CENTER OF THE PIN, THE STUMP WILL BE DRIVEN BEYOND THE MAXIMUM GRIP. USE THE NEXT LONGER STUMP.

4. WHEN COLLAR IS INSTALLED AGAINST SLOPE OR RADIUS.



BB3-497

Lockbolt Pin Projection Gages
Figure 5 (Sheet 2)

8. Removal of Lockbolts

A. To remove collars, use a Huck Collar Splitter No. 42-6 for 3/16-inch; No. 42-8 for 1/4-inch; Model No. 10 for 5/32-inch; No. 42-10 for 5/16-inch; and No. 42-12 for 3/8-inch diameter lockbolts. The 20034 series collar-cutter nose assemblies attach to a CP-352 pull gun.

B. Where a clearance problem exists, a small chisel may be used to split the collar longitudinally. To protect the structure from damage during this operation, place a washer over the collar before splitting, backing up the opposite side of the collar with a bar of suitable size.

C. Prior to the removal of the pin, check for steel protrusions on the locking grooves caused by a chisel or huck collar splitter. These protrusions must be filed off to prevent damage to the hole. Proceed to back up the backside of the structure, and drive out the pin with a punch of a smaller diameter than the pin.

HI-SHEAR ATTACHMENTS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. It is recommended that installation of Hi-Shear blind attachments be accomplished by mechanics thoroughly familiar with all requirements and limitations of Hi-Shear attachments.

2. Selection of Hi-Shear Blind Bolts and Blind Nuts

A. Attachment Identification

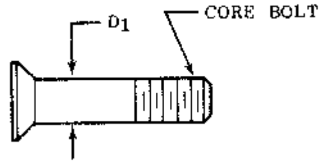
(1) Identification of attachments for a particular installation can be made by referring to Figures 1 and 2, and the following:

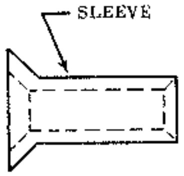
Assembly Number	Head Type	Maximum Temperature	Core Bolt	Components Sleeve	Expander
BB351	AN509	427°C (800°F)	BB301	BB321	BB341
BB352	Protruding	427°C (800°F)	BB302	BB322	BB341
BB365	AN509	593°C (1100°F)	BB309	BB335	BB341G
BB336	Protruding	593°C (1100°F)	BB316	BB336	BB341G
BB368	AN426	593°C (1100°F)	BB309	BB332	BB341G
BB371	AN426	427°C (800°F)	BB301F	BB501	BB341
BN359	Flush Hi-Shear head	427°C (800°F)	---	BN329	BB341
BN360	Flush shallow head	427°C (800°F)	---	BN330	BB341
BN372	Flush shallow head	593°C (1100°F)	---	BN502	BB341G
*BN155	Flush special	177°C (350°F)	---	BN125-1032	BB341-1032
*BN157	Flush special	177°C (350°F)	---	BN127-1032	BB341-1032

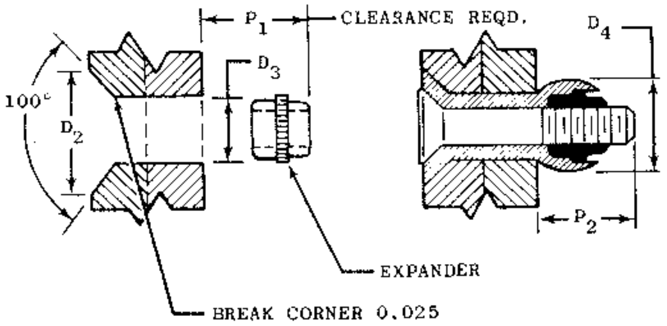
*Keylock blind nut (5056S aluminum alloy) is available in -1032 thread only.

B. Attachment Grip Length

(1) When selecting a blind attachment, emphasis should be placed on correct selection of grip length for the specific installation.



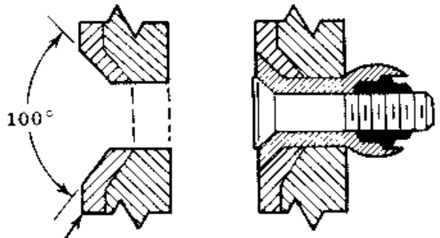




NOTE: FOR BLIND BOLT PARTS AND ASSEMBLY NUMBERS, SEE PARAGRAPH 2.

BB351 OR BB365 BOLT ASSY -AN509 HEAD

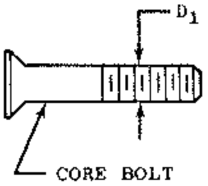
BB351 OR BB365 BOLT ASSY		D_1	D_2	D_3	D_4	P_1	P_2
-5	5/32	0.110 0.112	0.333 0.343	0.170 0.173	0.210	0.363	0.208
-6	3/16	0.122 0.124	0.386 0.396	0.197 0.201	0.253	0.434	0.239
-8	1/4	0.163 0.165	0.507 0.517	0.258 0.264	0.335	0.560	0.316
-10	5/16	0.216 0.218	0.635 0.645	0.339 0.345	0.438	0.687	0.414
-12	3/8	0.247 0.249	0.762 0.772	0.391 0.397	0.510	0.818	0.485

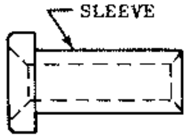


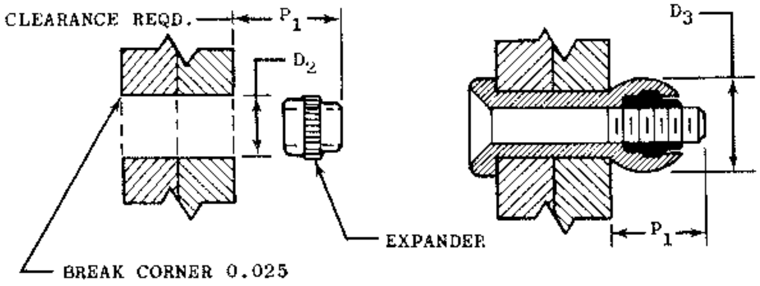
FOR DIMPLE/COUNTER SINK INFORMATION SEE SECTION 51-10-4.

BB368 OR BB371 BOLT ASSY - AN426 HEAD

BB368 OR BB371 BOLT ASSY		D_1	D_2	D_3	D_4	P_1	P_2
-5	5/32	0.110 0.112	0.282 0.292	0.170 0.173	0.210	0.378	0.208
-6	3/16	0.122 0.124	0.352 0.362	0.197 0.201	0.253	0.449	0.239







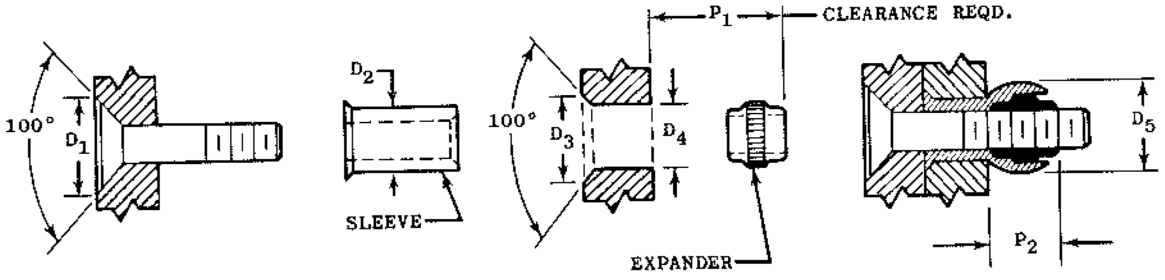
△ BB352 ONLY

BB352 OR BB366 BOLT ASSY - PROTRUDING HEAD

BB352 OR BB366 BOLT ASSY		D_1	D_2	D_3	P_1	P_2
-5	5/32	0.110 0.112	0.170 0.173	0.210	0.363	0.208
-6	3/16	0.122 0.124	0.197 0.201	0.253	0.434	0.239
-8	1/4	0.163 0.165	0.258 0.264	0.335	0.560	0.316
-10	5/16	0.216 0.218	0.339 0.345	0.438	0.687	0.414
-12	3/8	0.247 0.249	0.391 0.397	0.510	0.818	0.485
△ -14	7/16	0.309 0.311	0.469 0.476	0.600	0.929	0.543
△ -16	1/2	0.372 0.374	0.531 0.537	0.662	1.041	0.600

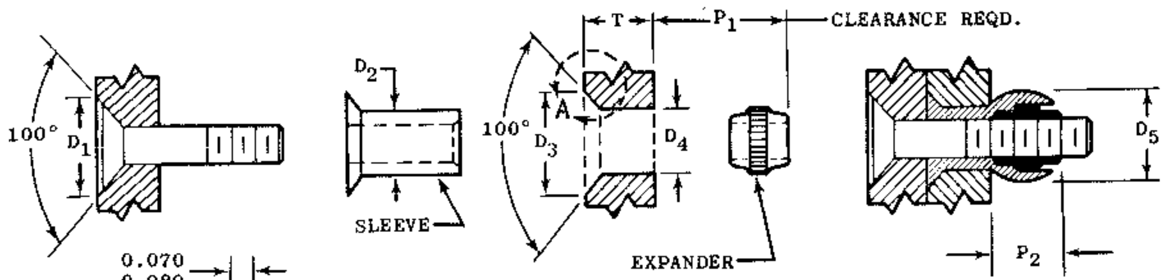
BB3-484

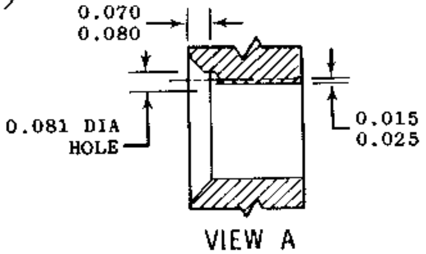
Hi-Shear Blind Bolt Installation and Dimensions
Figure 1



BN360 BLIND NUT ASSEMBLY — 100° COUNTERSINK

BN360	EXPANDER THREAD	D_1	D_2	D_3	D_4	D_5	P_1	P_2
832	8-32NC-3B	0.333 0.343	0.225 0.257	0.317 0.323	0.258 0.264	0.335	0.570	0.255
1032	10-32NF-3B	0.386 0.396	0.309 0.312	0.372 0.378	0.313 0.319	0.410	0.697	0.350
428	1/4-28UNF-3B	0.507 0.517	0.387 0.390	0.450 0.456	0.391 0.397	0.510	0.828	0.420
524	5/16-24UNF-3B	0.635 0.645	0.465 0.468	0.528 0.534	0.469 0.477	0.600	0.939	0.470
624	3/8-24UNF-3B	0.762 0.772	0.527 0.530	0.590 0.596	0.531 0.539	0.662	1.050	0.530
720	7/16-20UNF-3B	0.890 0.900	0.589 0.592	0.652 0.658	0.593 0.599		1.154	
820	1/2-20UNF-3B	1.017 1.027	0.651 0.654	0.714 0.720	0.655 0.662		1.264	





VIEW A
BN157 ONLY

NOTE: FOR BLIND NUT PARTS AND ASSEMBLY NUMBERS, SEE PARAGRAPH 2.

BN157 OR BN359 BLIND NUT ASSEMBLY — 100° COUNTERSINK

BN157	BN359	EXPANDER THREAD	D_1	D_2	D_3	D_4	D_5	P_1	P_2	T
1032		10-32NF-3B	0.386 0.396	0.309 0.312	0.474 0.479	0.313 0.319	0.410	0.697	0.350	0.080
	428	1/4-28UNF-3B	0.507 0.517	0.387 0.390	0.561 0.566	0.391 0.397	0.510	0.828	0.420	0.080
	524	5/16-24UNF-3B	0.635 0.645	0.465 0.468	0.668 0.673	0.469 0.477	0.600	0.939	0.470	0.090
	624	3/8-24UNF-3B	0.762 0.772	0.527 0.530	0.754 0.759	0.531 0.539	0.662	1.050	0.530	0.125

BB3-485

Hi-Shear Blind Bolt Installation and Dimensions (Rivet-Head Series)
Figure 2

Printed in U.S.A.

(2) The total thickness determined by measuring the total thickness of the parts to be attached, will be the grip length. Refer to Figure 3 for nominal, minimum, and maximum material thickness for each grip length.

C. Blind Bolt and Blind Nut Assembly Designation Code

(1) Blind Bolt

Example: BB531 - 8 - 12

12 — 12/16- or 3/4-inch grip length

8 — 8/32- or 1/4-inch nominal diameter

BB531 — Blind bolt assembly, which includes:

BB301-8-12 core bolt

BB321-8-12 sleeve

BB341-8 expander

(2) Blind Nut

Example: BN360 - 428 - 12

12 — 12/16- or 3/4 inch grip length

428 — 1/4-inch diameter nut

BN360 — Blind nut assembly, which includes:

BN330-428-12 sleeve

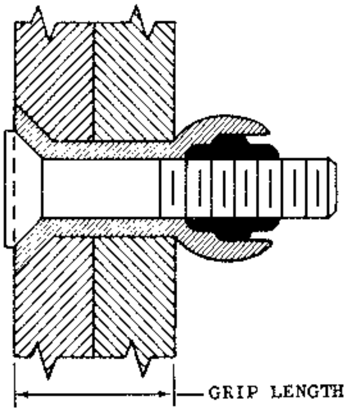
BB431-8 expander. Expander thread is 1/4-28UNF-3B.

3. Hole Preparation for Blind Attachments

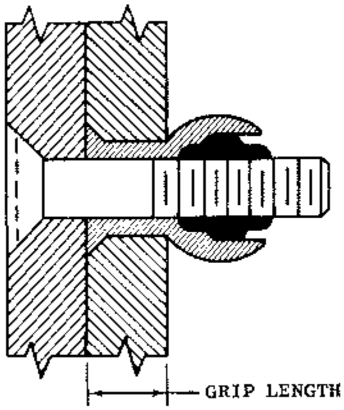
A. Hole preparation for blind attachments must be prepared in accordance with instructions contained in 51-10-4, and the surface must be free of chatter marks.

B. When these attachments are used in applications where a close-tolerance fit is required, it is recommended that sleeve diameters of each individual fastener be checked with a micrometer to determine necessary hole size required to meet desired fit. Select a drill or reamer that will produce a final hole of net fit to 0.001-inch clearance.

C. Before installation of the blind attachment, check the hole for proper size, finish, and alignment. Remove any burrs and clean the chips from between the faying surfaces.



BLIND BOLT



BLIND NUT

GRIP VARIATIONS FOR BLIND BOLTS AND BLIND NUTS

GRIP LENGTH		GRIP RANGE	
DASH NO.	DECIMAL EQUIVALENT	FROM	TO
-1	0.0625	0.032	0.092
-2	0.125	0.093	0.155
-3	0.1875	0.156	0.217
-4	0.250	0.218	0.280
-5	0.3125	0.281	0.342
-6	0.375	0.343	0.405
-7	0.4375	0.406	0.4675
-8	0.500	0.468	0.530
-9	0.5625	0.531	0.5925
-10	0.625	0.593	0.655
-11	0.6875	0.656	0.7175
-12	0.750	0.718	0.780
-13	0.8125	0.781	0.8425
-14	0.875	0.843	0.905
-15	0.9375	0.906	0.9675
-16	1.000	0.968	1.030
-17	1.0625	1.031	1.0925
-18	1.125	1.093	1.155
-19	1.187	1.156	1.217
-20	1.250	1.218	1.280
-21	1.312	1.281	1.342
-22	1.375	1.343	1.405
-23	1.4375	1.406	1.4675
-24	1.500	1.468	1.530
-25	1.5625	1.531	1.5925
-26	1.625	1.593	1.655
-27	1.6875	1.656	1.7175
-28	1.750	1.718	1.780
-29	1.8125	1.781	1.8425
-30	1.875	1.843	1.905

BB3-486

Grip Variations for Blind Bolts and Blind Nuts
Figure 3

4. Countersinking for Blind Attachments

A. Countersinks for blind attachments must be prepared in accordance with instructions contained in 51-10-4 and the information shown in Figures 1 and 2.

5. Dimpling for Blind Attachments

A. Dimpling for blind attachments must be in accordance with instructions contained in 51-10-4 and the information shown in Figures 1 and 2.

6. Power Units for Driving Tools

A. Make a periodic check (not to exceed 30 days) of all power units used for Hi-Shear attachment installations to ensure that full range of driving pressures can be obtained.

B. Calibrate air or hydraulic gages, which affect the driving pressures of the power unit, on a monthly basis. Refer to paragraph 7 for correct driving pressures. Start the electric motor to build up hydraulic pressure. Allow the power unit to run at least 3 minutes before using the gun.

CAUTION: DO NOT OPERATE POWER UNIT AT CONTINUOUS HIGH PRESSURES WHEN GUN IS NOT BEING USED.

7. Driving Pressures

A. The following driving pressures must be used for installation of Hi-Shear blind attachments.

Blind Bolt Size	Blind Nut Size	BG1750 Gun (PSI)	BG2500 Gun (PSI)
---	-440	500	---
---	-632	800	---
-5 (5/32)	---	500	250
-6 (3/16)	---	700	350
-8 (1/4)	-832 (8/32)	1100	650
---	-1032 (10/32)	1850	950
-10 (5/16)	---	1850	950
-12 (3/8)	-428 (1/4-28)	---	1450
-14 (7/16)	-524 (5/16-24)	---	1900
-16 (1/2)	-624 (3/8-24)	---	2250
---	-720 (7/16-20)	---	2250
---	-280 (1/2-20)	---	2250

Printed in U.S.A.

8. Selection of Driving Tools

A. For selection of the proper driving tool for a specific size or type of blind attachment, refer to:

(1) Blind bolt, Figure 4.

(2) Blind nut, Figure 5.

(3) Offset driving tools for blind bolts or nuts, Figure 6.

9. Assembly of Driving Tools to Gun

A. Adjust the pressure control knob on the power unit until the driving pressure is approximately 1000 psi. Cycle the gun by pressing the red and blue buttons on the gun alternately until the correct pressure is obtained.

B. Assemble driving tools to gun in accordance with Figure 7, steps 1 through 3 inclusive.

C. To disassemble tools from gun, refer to the note on Figure 7.

10. Installation of Blind Attachments with Power Tools

A. Before installation of blind attachments on assembly, make a test setup, using the same hole size and material thickness as the parts to be assembled. Install a blind attachment to check the required driving pressure of the power unit for an acceptable installation.

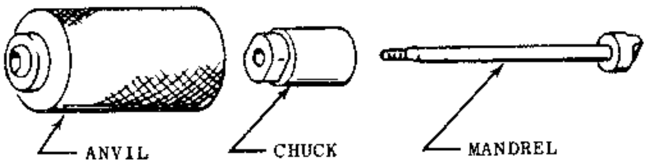
B. Adjust the pressure control knob on the power unit until the required driving pressure is indicated on the pressure gage. Cycle the gun until uniform correct pressure is obtained. Refer to paragraph 7 for driving pressures.

C. Install blind attachments in accordance with Figure 7, steps 4 through 6 inclusive.

CAUTION: DO NOT OPERATE POWER UNIT AT CONTINUOUS HIGH PRESSURES WHEN THE GUN IS NOT BEING USED.

11. Installation of Blind Attachments with Hand Tools

A. Before installation of blind attachments, make a test setup, using the same hole size and material as the parts being assembled. Install a blind attachment to check that the torque value of the torque wrench is correct for an acceptable installation. Refer to paragraph 12 for the correct driving tool and torque value for the blind attachment being installed. In addition to the driving tools, a torque wrench, socket, and socket wrench are required. Install blind attachments as shown on Figure 8.



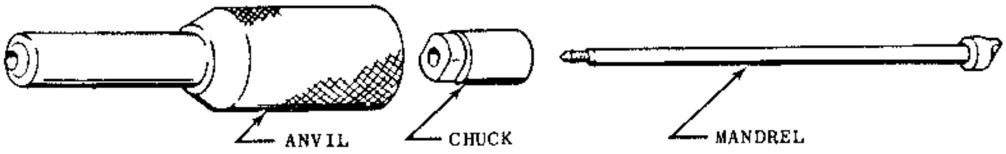
TYPICAL STANDARD DRIVING TOOLS FOR BLIND BOLTS

BB351, BB352, BB365, BB366 BLIND BOLTS

BLIND BOLT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-5 (5/32)	BG1750	A11-5	C1-5	M1-5	M2-5	----
-6 (3/16)	BG1750	A11-6	C1-6	M1-6	M2-6	----
-8 (1/4)	BG1750	A11-8	C1-8	M1-8	M2-8	M3-8
-10 (5/16)	BG1750	A11-10	C1-10	M1-10	M2-10	M3-10
-5 (5/32)	BG2500	A21-5	C2-5	M1-5	M2-5	----
-6 (3/16)	BG2500	A21-6	C2-6	M1-6	M2-6	----
-8 (1/4)	BG2500	A21-8	C2-8	M1-8	M2-8	M3-8
-10 (5/16)	BG2500	A21-10	C2-10	M1-10	M2-10	M3-10
-12 (3/8)	BG2500	A21-12	C2-12	M1-12	M2-12	M3-12
-14 (7/16)	BG2500	A21-14	C2-14	M1-14	M2-14	M3-14
-16 (1/2)	BG2500	A21-16	C2-16	M1-16	M2-16	M3-16

BB368 AND BB370 BLIND BOLTS

BLIND BOLT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL	
				0-1" GRIP RANGE	1-2" GRIP RANGE
-5 (5/32)	BG1750	A19-5	C1-5	M1-5	M2-5
-6 (3/16)	BG1750	A19-6	C1-6	M1-6	M2-6



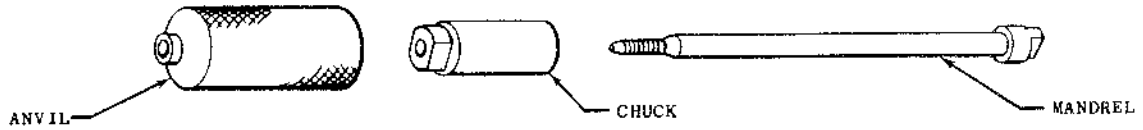
TYPICAL EXTENDED DRIVING TOOLS FOR BLIND BOLTS

BB351, BB352, BB365, BB366 BLIND BOLTS

BLIND BOLT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-5 (5/32)	BG1750	A12-5	C1-5	M3-5	M4-5	----
-6 (3/16)	BG1750	A12-6	C1-6	M3-6	M4-6	----
-8 (1/4)	BG1750	A12-8	C1-8	M3-8	M4-8	M5-8
-10 (5/16)	BG1750	A12-10	C1-10	M3-10	M4-10	M5-10
-5 (5/32)	BG2500	A22-5	C2-5	M3-5	M4-5	----
-6 (3/16)	BG2500	A22-6	C2-6	M3-6	M4-6	----
-8 (1/4)	BG2500	A22-8	C2-8	M3-8	M4-8	M5-8
-10 (5/16)	BG2500	A22-10	C2-10	M3-10	M4-10	M5-10
-12 (3/8)	BG2500	A22-12	C2-12	M3-12	M4-12	M5-12
-14 (7/16)	BG2500	A22-14	C2-14	M3-14	M4-14	M5-14
-16 (1/2)	BG2500	A22-16	C2-16	M3-16	M4-16	M5-16

BB3-487

Driving Tools for Blind Bolts
Figure 4



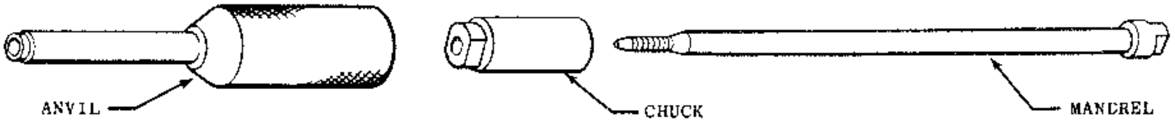
TYPICAL STANDARD DRIVING TOOLS FOR BLIND NUTS

BN155, BN360 AND BN372 BLIND NUTS

BLIND NUT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-440	BG1750	A17-440	C1-5	M1-5	M2-5	---
-632	BG1750	A17-632	C1-632	M1-632	M2-632	---
-832	BG1750	A17-832	C1-8	M1-8	M2-8	M3-8
-1032	BG1750	A17-1032	C1-1032	M1-1032	M2-1032	M3-1032
-440	BG2500	A27-440	C2-5	M1-5	M2-5	---
-632	BG2500	A27-632	C2-632	M1-632	M2-632	---
-832	BG2500	A27-832	C2-8	M1-8	M2-8	M3-8
-1032	BG2500	A27-1032	C2-1032	M1-1032	M2-1032	M3-1032
-428	BG2500	A27-428	C2-12	M1-12	M2-12	M3-12
-524	BG2500	A27-524	C2-14	M1-14	M2-14	M3-14
-624	BG2500	A27-624	C2-16	M1-16	M2-16	M3-16

BN157 AND BN359 BLIND NUTS

BLIND NUT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-832	BG1750	A15-832	C1-8	M1-8	M2-8	M3-8
-1032	BG1750	A15-1032	C1-1032	M1-1032	M2-1032	M3-1032
-832	BG2500	A25-832	C2-8	M1-8	M2-8	M3-8
-1032	BG2500	A25-1032	C2-1032	M1-832	M2-1032	M3-1032
-428	BG2500	A25-428	C2-12	M1-12	M2-12	M3-12
-524	BG2500	A25-524	C2-14	M1-14	M2-14	M3-14
-624	BG2500	A25-624	C2-16	M1-16	M2-16	M3-16



TYPICAL EXTENDED DRIVING TOOLS FOR BLIND NUTS

BN155, BN360 AND BN372 BLIND NUTS

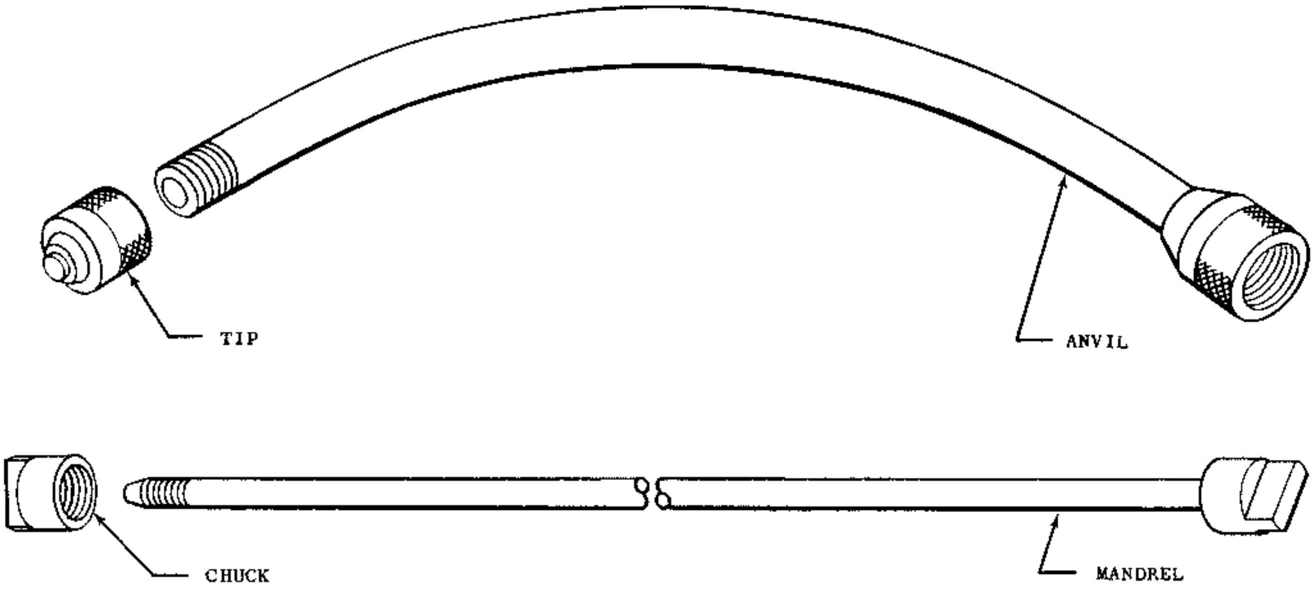
BLIND NUT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-832	BG1750	A18-832	C1-8	M3-8	M4-8	M5-8
-1032	BG1750	A18-1032	C1-1032	M3-1032	M4-1032	M5-1032
-832	BG2500	A28-832	C2-8	M3-8	M4-8	M5-8
-1032	BG2500	A28-1032	C2-1032	M3-1032	M4-1032	M5-1032
-428	BG2500	A28-428	C2-12	M3-12	M4-12	M5-12
-524	BG2500	A28-524	C2-14	M3-14	M4-14	M5-14
-624	BG2500	A28-624	C2-16	M3-16	M4-16	M5-16

EXTENDED DRIVING TOOLS USED WITH BG2500 GUN
FOR BN157 AND BN359 BLIND NUTS

BLIND NUT DASH NO.	GUN NO.	ANVIL	CHUCK	MANDREL		
				0-1" GRIP RANGE	1-2" GRIP RANGE	2-3" GRIP RANGE
-832	BG2500	A26-832	C2-8	M3-8	M4-8	M5-8
-1032	BG2500	A26-1032	C2-1032	M3-1032	M4-1032	M5-1032
-428	BG2500	A26-428	C2-12	M3-12	M4-12	M5-12
-524	BG2500	A26-524	C2-14	M3-14	M4-14	M5-14
-624	BG2500	A26-624	C2-16	M3-16	M4-16	M5-16

BB3-488

Driving Tools for Blind Nuts
Figure 5



TYPICAL OFFSET DRIVING TOOLS FOR BG2500 GUN

BB351, BB352, BB365, AND BB366 BLIND BOLTS

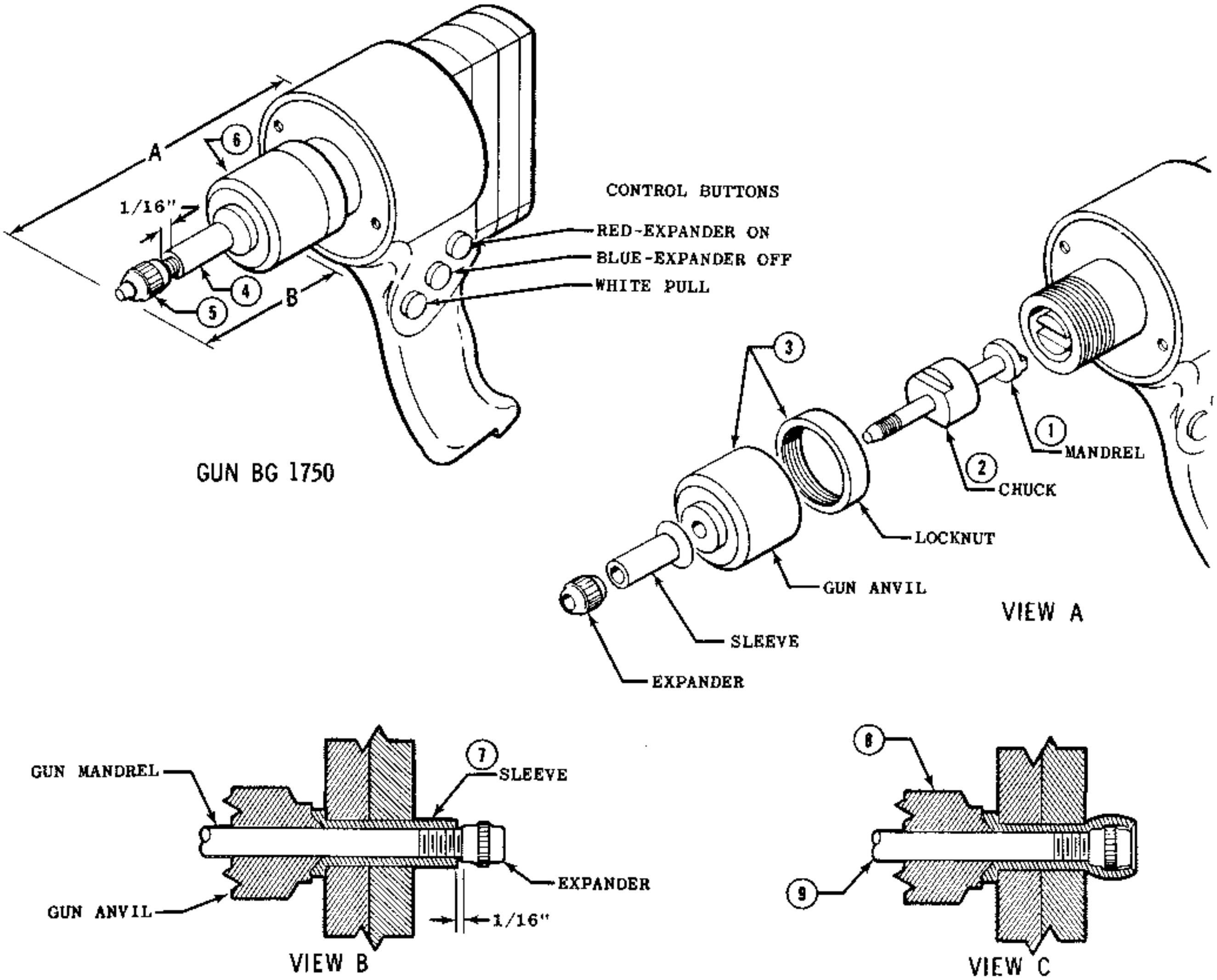
BLIND BOLT DASH NO.	GUN NO.	ANVIL	TIP	CHUCK	MANDREL	
					0-1" GRIP RANGE	1-2" GRIP RANGE
-5	BG2500	A211-1	T2-5	C2-5	M6-5	M7-5
-6	BG2500	A211-1	T2-6	C2-6	M6-6	M7-6
-8	BG2500	A211-2	T2-8	C2-8	M6-8	M7-8
-10	BG2500	A211-2	T2-10	C2-10	M6-10	M7-10

BN359, BN360 AND BN372 BLIND NUTS

BLIND NUT DASH NO.	GUN NO.	ANVIL	TIP	CHUCK	MANDREL	
					0-1" GRIP RANGE	1-2" GRIP RANGE
-832	BG2500	A211-2	T3-832	C2-8	M6-8	M7-8
-1032	BG2500	A211-2	T3-1032	C2-1032	M6-1032	M7-1032

BB3-489

Offset Driving Tools for Blind Bolts and Blind Nuts
Figure 6



SLEEVE AND EXPANDER INSERTED INTO HOLE BY INSTALLATION TOOL

EXPANDER PULLED UP INTO SLEEVE BY INSTALLATION TOOL

ASSEMBLY OF DRIVING TOOLS TO GUN

① POSITION CHUCK MIDWAY ON THE MANDREL AND INSERT MANDREL INTO GUN PISTON.

② SCREW CHUCK ONTO GUN PISTON; TIGHTEN BY HOLDING THE LUG END OF THE CHUCK WITH AN OPEN END WRENCH AND PRESSING THE RED CONTROL BUTTON ON THE GUN.

③ SCREW LOCKNUT AND ANVIL ONTO THREADED END OF THE GUN.

NOTE:
TO REMOVE TOOL, UNSCREW ANVIL FROM GUN END, GRIP LUG END OF CHUCK WITH AN OPEN END WRENCH, AND PRESS BLUE BUTTON TO UNSCREW CHUCK AND MANDREL.

INSTALLATION OF BLIND ATTACHMENTS

④ SLIDE THE SLEEVE OVER THE MANDREL WITH THE COUNTERSUNK END TOWARD THE GUN.

⑤ SCREW THE EXPANDER ON THE MANDREL BY PRESSING THE RED CONTROL BUTTON ON THE GUN.

⑥ ADJUST THE ANVIL UNTIL THE SLEEVE IS APPROXIMATELY 1/16 INCH FROM EXPANDER.

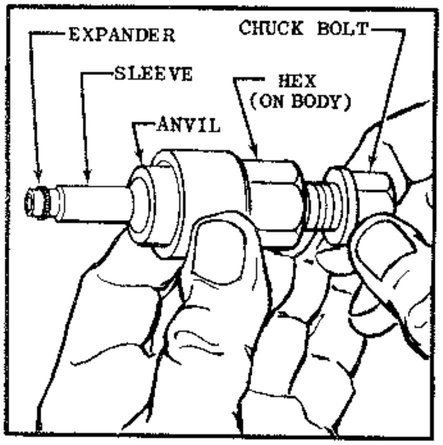
⑦ INSERT EXPANDER AND SLEEVE INTO THE PREPARED HOLE, UNTIL THE SLEEVE IS FIRMLY SEATED.

⑧ RETRACT EXPANDER INTO SLEEVE BY PRESSING THE RED CONTROL BUTTON ON THE GUN.

⑨ UNSCREW MANDREL BY PRESSING THE BLUE CONTROL BUTTON AND REMOVE FROM THE ASSEMBLY. INSTALL THE CORE BOLT TO COMPLETE THE OPERATION.

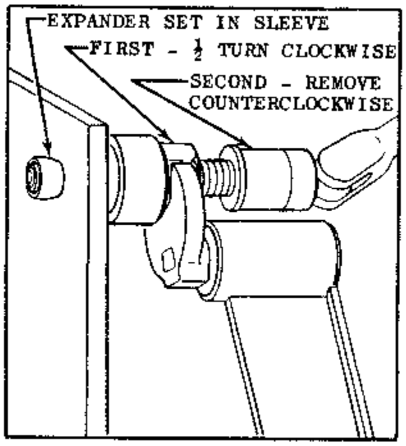
BB3-490

Power Tools for Blind Attachments
Figure 7



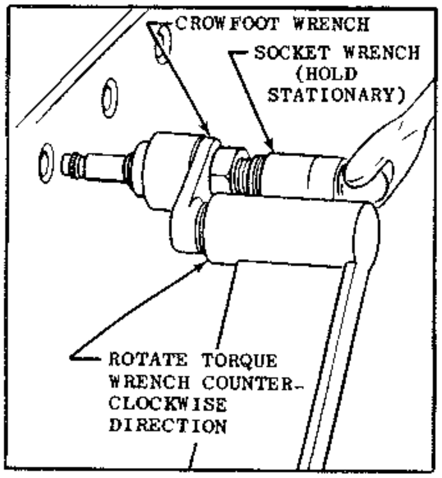
HAND TOOL'S CHUCK BOLT BEING TURNED TO ENGAGE LENGTH OF SLEEVE AND EXPANDER ON THE MANDREL.

VIEW A



INSTALLATION COMPLETE, WITH EXPANDER FULLY DRAWN INTO SLEEVE. HAND TOOL IS READY FOR REMOVAL.

VIEW C



HAND TOOL HOLDS THE SLEEVE AND EXPANDER, READY FOR INSTALLATION.

VIEW B

VIEW A

1. TURN THE CHUCK BOLT COUNTERCLOCKWISE TO FULLY ENGAGE BODY. SLIP THE SLEEVE ONTO THE MANDREL. INSTALL THE EXPANDER FINGER TIGHT ON THE THREADED END OF MANDREL.
2. TURN THE CHUCK BOLT CLOCKWISE TO SEAT ANVIL (ON THE BODY) FIRMLY ONTO THE HEAD OF THE SLEEVE.

VIEW B

3. INSERT THE EXPANDER AND SLEEVE INTO THE PREPARED HOLE AND HOLD THE SLEEVE FIRMLY AGAINST PARTS BEING ASSEMBLED.
4. HOLD THE CHUCK BOLT STATIONARY WITH A SOCKET WRENCH AND TURN THE HEX ON THE BODY COUNTERCLOCKWISE USING A TORQUE AND CROWFOOT UNTIL THE CORRECT TORQUE VALUE IS REACHED. REFER TO PARAGRAPH 11 FOR CORRECT TORQUE VALUE.

VIEW C

5. TO REMOVE TOOL, TURN THE HEX ON THE BODY CLOCKWISE A HALF TURN TO LOOSEN AND UNSCREW THE CHUCK BOLT FROM THE EXPANDER THREADS.

BB3-491

Hand Tools for Blind Attachments
Figure 8

12. Hand Driving Tools and Torque Values

A. Torque Values depend on the torque wrench and crowfoot adapter being used. The following torque values are applicable only for the crowfoot adapter listed.

Blind Attachment	Hand Tool Part Number	(3) 0-1 Inch Grip Range Mandrel Part Number	1-2 Inch Grip Range Mandrel Part Number	Crowfoot Adapter Part No.	Actual Torque Value In-Lbs.
(1) BB351-5 BB352-5	BH100-5-M2	M2-5	---	AN8506-6	65-75
(1) BB351-6 BB352-6	BH100-6-M2	M2-6	---	AN8506-6	85-95
(1) BB351-8 BB352-8	BH100-8-M2	M2-8	M3-8	AN8506-6	190-215
(1) BB351-10 BB352-10	BH100-10-M2	M2-10	M3-10	AN8506-6	295-320
(1) BB351-12 BB352-12	BH200-12-M2	M2-12	M3-12	AN8506-10	465-495
BB359-832	BH110-832-M2	M2-8	M3-8	AN8506-6	190-215
(2) BN157-1032 BN359-1032	BH110-1032-M2	M2-1032	M3-1032	AN8506-6	270-295
BN359-428	BH210-428-M2	M2-12	M3-12	AN8506-10	465-495
BN360-832	BH120-832-M2	M2-8	M3-8	AN8506-6	190-215
BN155-1032 BN360-1032	BH120-1032-M2	M2-1032	M3-1032	AN8506-6	270-295
BN360-428	BH220-428-M2	M2-12	M3-12	AN8506-10	465-495
BN361-428	BH230-428-M2	M2-12	M3-12	AN8506-10	465-495

NOTES: (1) Blind bolts BB365, BB366, BB368, and BB371 can be installed with the same hand driving tools and torque values.

(2) Blind nut BN155 can be installed with the same hand driving tool and torque value.

(3) When installation exceeds the 1-inch grip range, use M3 series mandrells in place of M2 series.

13. Removal of Blind Attachments

A. Drill the sleeve to a depth slightly beyond the head diameter. Use moderate pressure when drilling to prevent turning of the sleeve.

B. Pry off the head and drive out the sleeve, using a punch slightly smaller than the sleeve diameter.

14. Sources of Tools and Equipment

A. The following sources may be contacted for information concerning tools and equipment used for installation of Hi-Shear blind attachments.

Equipment	Source
Driving tools (anvils, chucks, mandrels, etc.)	Hi-Shear Corporation, 2600 W. 247th Street, Torrance, California
Hydraulic unit and gun (large) BG2500	Hi-Shear Corporation
Hydraulic unit and gun (small) BG1750	Hi-Shear Corporation
Hydraulic power unit B6701-3 (0919) manufactured by Douglas	Douglas Aircraft Co., 3855 Lakewood Blvd., Long Beach, California

HI-LOK ATTACHMENTS - DESCRIPTION AND OPERATION (DC-9-ALL)

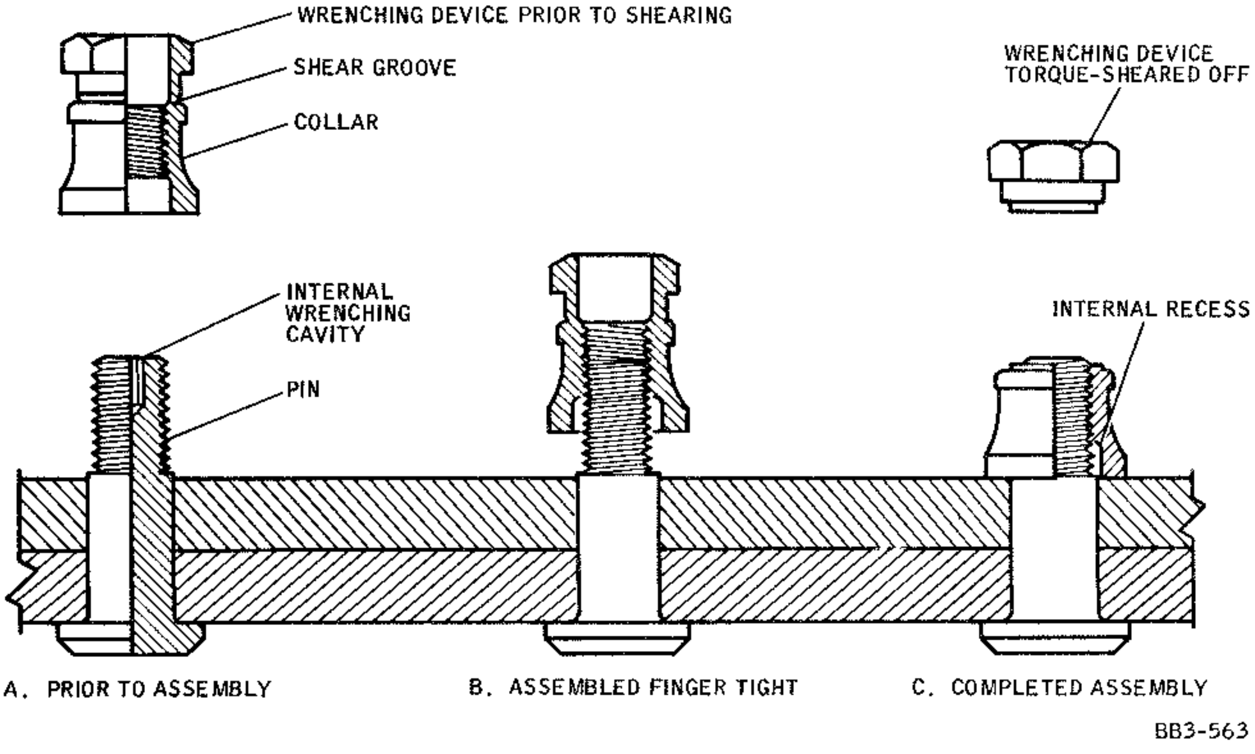
1. General

A. This section describes procedures for installing Hi-Lok attachments.

B. Hi-Lok fasteners consist of a threaded pin and corresponding threaded collar similar in application to a nut and bolt. The threaded end of the pin has a hexogonal wrenching cavity to allow installation from one side of the assembly. The collar wrenching device separates from the body of the collar at a predetermined wrenching torque value by shearing the material in the shear groove. (See Figure 1.)

C. Hi-Lok pins are installed in interference-fit holes, however, when one or more members to be joined are steel, stainless steel, or titanium, clearance-fit holes must be used (see 51-10-4, Figure 2).

D. Self-locking nuts (NAS679 series preferred) used with a NAS1252 washer, may be used with Hi-Lok pins in place of Hi-Lok collars (see Figure 2). In some areas with limited clearance, self-locking nuts and washers are preferable; and in areas such as integral tanks their use is mandatory. However, substitution of self-locking nuts for Hi-Lok collars is not acceptable on tapered surfaces or window installations. Torque values for self-locking nuts may be found by refering to 51-30-1.



Typical Hi-Lok Pin and Collar Assembly
Figure 1

2. Selection of Hi-Lok Attachments

A. Hi-Lok Attachment Identification

(1) Hi-Lok pins may be identified by the part number on the head of the pin, and by reference to Figures 3 and 4.

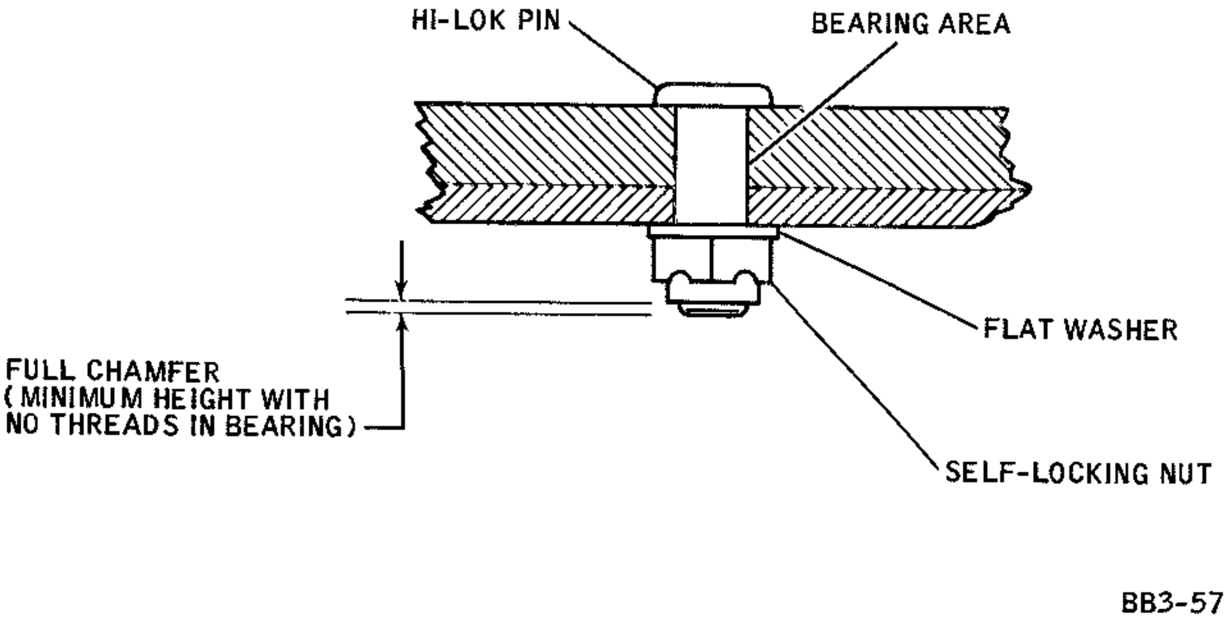
(2) Hi-Lok collar identification is as follows:

Hi-Lok Collar Part No.	Collar Identification	Collar Material
HL86	Natural Cadmium	303Se

<u>NOTE</u>: The HL86 collar is the only Hi-Lok collar recommended for use on the DC-9 airplane.

B. Pin Grip Length (See Figure 5.)

(1) Hi-Lok pins have a minimum grip length equal to maximum grip minus 1/16 inch and will accomodate material thickness variations from the coded nominal grip. Carefully measure the total thickness of the material in which the pin is to be installed, and determine the correct coded grip length required from the table contained in Figure 5.



Hi-Lok Pin with Self-Locking Nut and Flat Washer
Figure 2

Printed in U.S.A.

C. Hi-Lok Attachment Designation Code

(1) Pin

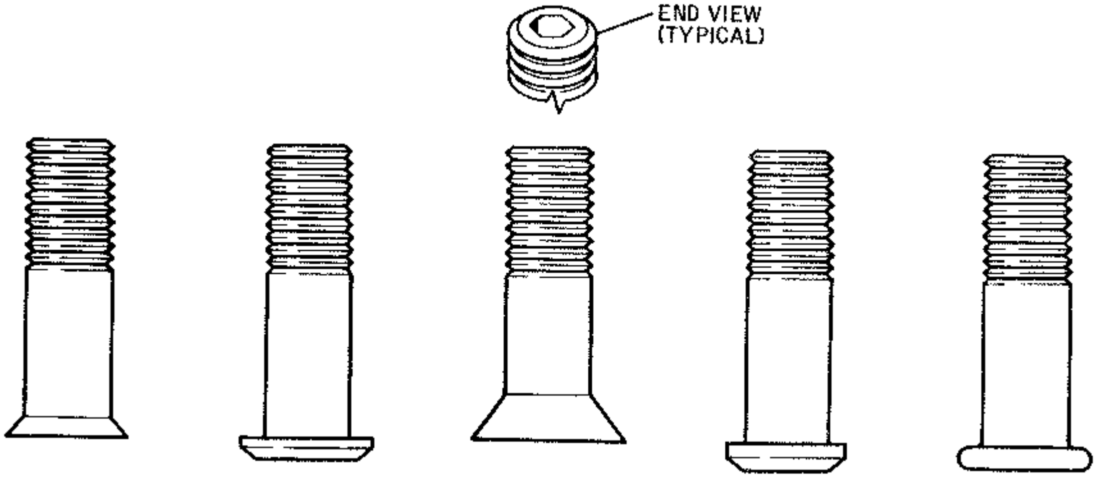
Example: HL 18 PB - 6 - 8

Nominal grip length in 1/16 inch
Nominal shank diameter in 1/32 inch
Type 2 cadmium-plated
Head type (see Figures 3 and 4)
Hi-Lok

(2) Collar

Example: HL 86 - 6

Nominal thread size in 1/16 inch
Material -303 Se stainless steel
Hi-Lok



a. FLUSH SHEAR HEAD

b. PROTRUDING SHEAR HEAD

c. FLUSH TENSION (AN509 AND MS20426) HEADS

d. PROTRUDING TENSION HEAD

e. PROTRUDING FLATHEAD

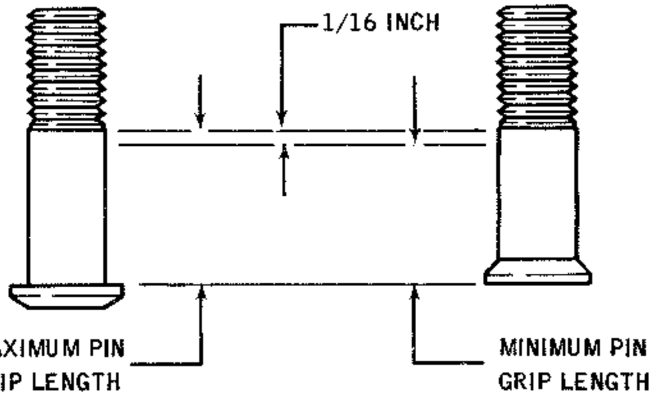
BB3-565

Hi-Lok Pin Types
Figure 3

HI-LOK PIN PART NO.	IDENTIFI-CATION	HEAD TYPE	PIN MATERIAL	FINISH
HL18 PB	HL18	PROTRUDING SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL19 PB	HL19	100° FLUSH SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL20 PB	HL20	PROTRUDING TENSION HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL21 PB	HL21	100° FLUSH (AN509) TENSION HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL62 PB	HL62	1/64 OVERSIZE PROTRUDING SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL63 PB	HL63	1/64 OVERSIZE 100° FLUSH SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL64 PB	HL64	1/64 OVERSIZE PROTRUDING TENSION HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL65 PB	HL65	1/64 OVERSIZE 100° FLUSH (AN509) TENSION HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL518 PB	HL518	FLAT SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL519 PB	HL519	100° FLUSH SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL525	HL525	100° FLUSH (MS20426) SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE
HL527	HL527	1/64 OVERSIZE 100° FLUSH (MS20426) SHEAR HEAD	ALLOY STEEL	TYPE 2 CAD. PLATE

BB3-573

Hi-Lok Pin Identification Chart
Figure 4



SECOND (GRIP) DASH NO.	GRIP RANGE	
	MINIMUM	MAXIMUM
-1	0	0.062
-2	0.063	0.125
-3	0.126	0.187
-4	0.188	0.250
-5	0.251	0.312
-6	0.313	0.375
-7	0.376	0.437
-8	0.438	0.500
-9	0.501	0.562
-10	0.563	0.625
-11	0.626	0.687
-12	0.688	0.750
-13	0.751	0.812
-14	0.813	0.875
-15	0.876	0.937
-16	0.938	1.000
-17	1.001	1.062
-18	1.063	1.125
-19	1.126	1.187
-20	1.188	1.250
-21	1.251	1.312
-22	1.313	1.375
-23	1.376	1.437
-24	1.438	1.500

BB3-566

Grip Length Range
Figure 5

3. Selection of Self-Locking Nuts and Washers for use with Hi-Lok Pins

A. Self-Locking Nut Selection

(1) The NAS 679 series self-locking nut is preferred for use with Hi-Lok pins; however, other self-locking nuts may be used with proper consideration of nut height, strength, and threads. Identification may be made by reference to the appropriate NAS, MS, or AN manual.

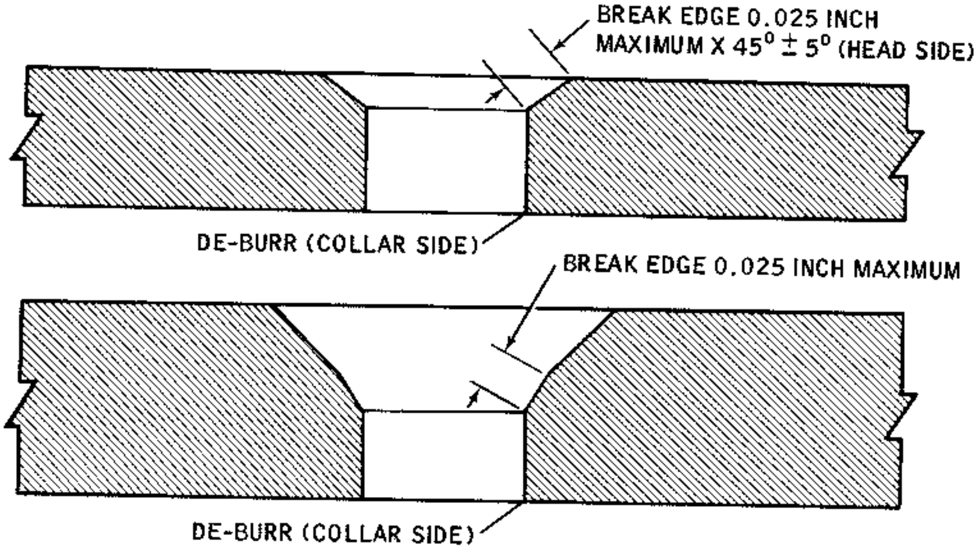
B. Washer Selection

(1) The NAS 1252 washer is the only washer recommended for use with the self-locking nuts in a Hi-Lok application. Identification may be made by reference to the National Aerospace Standards Manual.

4. Hole Preparation for Hi-Lok Pins

A. Hole preparation for Hi-Lok pins must be in accordance with instructions contained in 51-10-4.

NOTE: Interference-fit holes must be used except when one or more members to be joined are steel, stainless steel, or titanium, when clearance-fit holes will be used.



BB3-564

Breaking Corner Edges to Seat Hi-Lok Attachments
Figure 6

B. Burrs must be removed and chips cleaned from between faying surfaces before installation.

C. To avoid difficulty in seating the protruding Hi-Lok pin head, break the edge of the hole with a 100 degree countersink (see Figure 6).

5. Countersinking for Hi-Lok Pins

A. Countersinking for Hi-Lok pins must be prepared in accordance with instructions contained in 51-10-4.

B. To avoid difficulty in seating flush-head Hi-Lok pins, break the edge of the countersink at the junction of the hole using a 60 or 82 degree countersink (see Figure 6).

6. Dimpling for Hi-Lok Pins

A. Dimpling for Hi-Lok pins must be in accordance with instructions contained in 51-10-4.

7. Installation of Hi-Lok Attachments

A. General Installation Procedures

(1) Install pin in prepared hole. When installing pin in interference-fit hole, use a soft set to seat head or draw pin in with nut in order to avoid damage to cadmium plating.

NOTE: Protruding head pins may be installed from either direction with proper consideration as to clearance; however, the HL518 (special large head) should be installed on the side of the thinnest material to be joined where possible.

(2) Check that correct grip length has been selected. Threads are not permitted in bearing and the shank must not protrude to the extent that the collar or self-locking nut (installed with washer) will bottom on the shank. A 0.063-inch thick NAS1252 washer may be installed under the collar or head (on protruding head installations) to accomplish these requirements. When a self-locking nut is to be installed, a second NAS1252 washer (total two) may be used.

NOTE: Where a dimpled countersink is used, consideration must be given to the special countersink washer (2210378 or equivalent) which is required to be installed under the collar or nut as shown in Figure 7. For further information relative to the procurement of special washers, contact the Customer Service Department, Douglas Aircraft Company, Long Beach, California.

(3) In areas where sealant is required, use PR-1422 sealant (Products Research Co., 2919 Empire Ave., Burbank, Calif.) as illustrated in Figure 8 if installation is in clearance-fit hole. (See paragraph 1.C.)

<u>NOTE</u>: Sealant is not required when installation is made in interference-fit hole.

B. Manual Installation

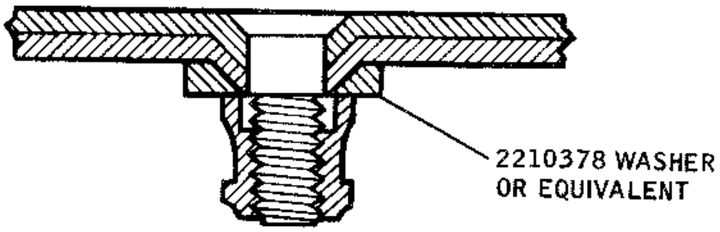
(1) Tools Required

(a) Tools required for manual installation may be determined by reference to Figures 9 and 10.

(b) If ratchet type tools are not available, use allen wrench for the wrenching cavity and an open end wrench or equivalent for the collar. See Figure 9 to determine correct sizes to use.

(2) Manual Collar Installation

(a) Install washer (NAS1252) or countersunk washer (2210378) if required. (See paragraph 7.A.(2).)



Countersink Washer Application
Figure 7

(b) Manually screw the collar onto the pin a minimum of two threads (see Figure 1), and tighten as illustrated in Figure 11 until the wrenching device shears off.

(3) Locknut Installation

(a) Apply sealant if required (see paragraph 7.A.(3)).

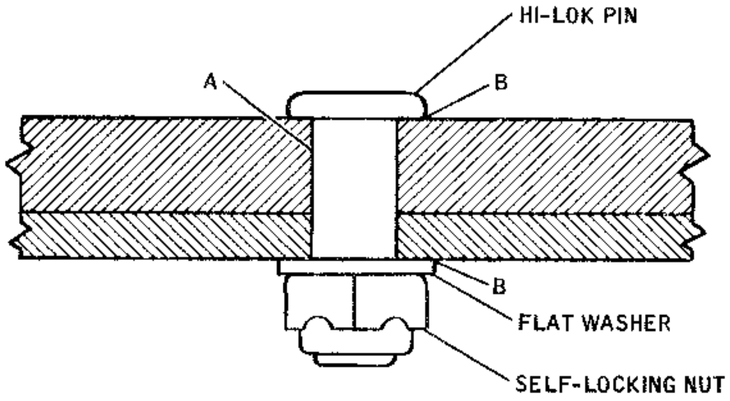
(b) Install NAS1252 washer (or washers if required by paragraph 7.A.(2)).

(c) Install locknut and tighten as shown in Figure 11 to the correct torque value (see 51-30-1 for torque values).

C. Installation of Hi-Lok Attachments with Power Tooling

(1) Power Installation Tooling

(a) A variety of power installation tooling is available, including automatic feed drivers. Listed as follows and illustrated in Figures 12 through 14 are typical tools which may be used for installation of Hi-Lok collars. and may be obtained from Hi-Shear Corporation, 2600 W. 247th Street, Torrence, California.



A. APPLY SEALANT INSIDE OF BOLT HOLE.

B. APPLY A FAYING SURFACE SEAL UNDER HEAD AND ON SIDE OF WASHER, NEXT TO STRUCTURE. IF ONE SIDE IS IN A "DRY" AREA, DO NOT SEAL THAT SIDE.

C. WHEN SEALING A BARREL NUT, SEAL THE SEATING SURFACE OF THE NUT WITH A FAYING SURFACE SEAL. IF A BARREL NUT IS IN A "DRY" AREA, DO NOT SEAL IT.

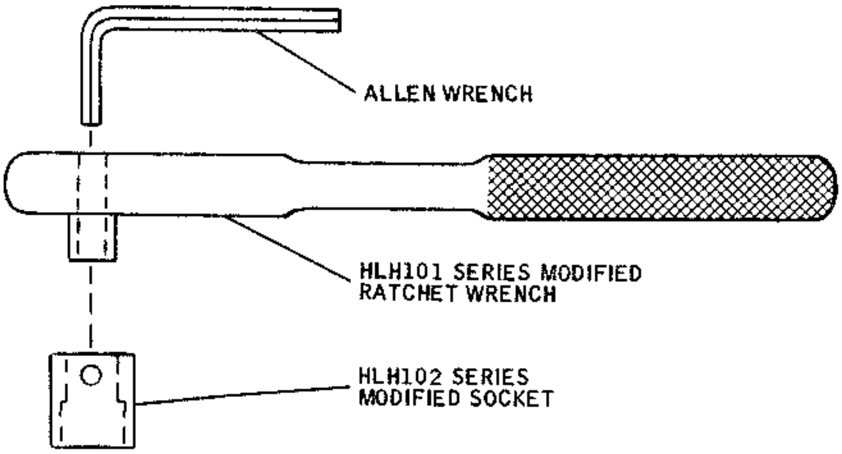
BB3-575

Sealing Hi-Lok Attachments
Figure 8

Hi-Lok Dash No.	Nominal Diameter	Allen Wrench	Rachet Wrench No.	Socket No.	Socket Hex. Size
-5	5/32	5/64	*HLH101-21	*HLH102-6	5/16
-6	3/16	5/64	*HLH101-21	*HLH102-6	5/16
-8	1/4	3/32	*HLH101-21	*HLH102-8	11/32
-10	5/16	1/8	*HLH101-23	*HLH102-10	7/16
-12	3/8	5/32	*HLH101-23	*HLH102-12	1/2

*Hi-Shear Corporation, 2600 W. 247th Street, Torrance, California

Manual Installation Tooling
Figure 9



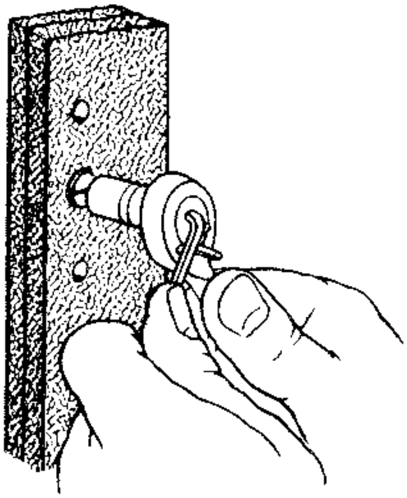
BB3-567

Printed in U.S.A.

Typical Manual Installation Tooling
Figure 10

Tools for installation in interference-fit holes:

Hi-Lok Size	Wrench Type	No.	Attachment	No.	Air Motor No.	See Figure
-5/-6	Straight rachet	HLR201-6	Finder pin	921401-6	17B2-20	12
-5/-6	20-degree rachet	HLR221-6	Finder pin	921401-6	17B2-20	12
-6	Straight rachet	HLR301-6	Finder pin	921401-6	17C3-12	12
-6	20-degree rachet	HLR321-6	Finder pin	921401-6	17C3-12	12
-6	1-inch offset	HLG115-6	---	---	OA2N	14
-6	2-inch offset	HLG125-6	---	---	921474-1	14
-8	Straight rachet	HLR301-8	Finder pin	921401-8	17C3-12	12
-8	20-degree rachet	HLR321-8	Finder pin	921401-8	17C3-12	12
-8	1-inch offset	HLG115-8	---	---	OA2N	14
-8	2-inch offset	HLG125-8	---	---	921474-1	14



BB3-570

Typical Manual Tooling Installation
Figure 11

Tools for installation in clearance-fit holes:

Hi-Lok Size	Wrench Type	No.	Attachment	No.	Air Motor No.	See Fig.
-5/-6	Straight rachet	HLR200-6	Hexagon wrench	*HLW230-6	17B2-20	12
-5/-6	20-degree rachet	HLR220-6	Hexagon wrench	*HLW230-6	17B2-20	12
-5/-6	Gear housing	HLG101	Socket	**HLW122-6	OA2N	13
-5/-6	Gear housing	HLG101	Extended socket	***HLW123-6	OA2N	13
-6	Straight rachet	HLR300-6	Hexagon wrench	*HLW330-6	17C3-12	12
-6	20-degree rachet	HLR320-6	Hexagon wrench	*HLW330-6	17C3-12	12
-6	Straight rachet	†HLR352	Socket	††HLS352-6	17C3-12	12
-6	20-degree rachet	HLR362	Socket	HLS352-6	17C3-12	12
-6	1-inch offset	HLG135-6	Hexagon wrench	HLW135-6	OA2N	14
-6	2-inch offset	HLG145-6	Hexagon wrench	HLW135-6	921474-1	14
-8	Straight rachet	HLR300-8	Hexagon wrench	*HLW330-8	17C3-12	12
-8	20-degree rachet	HLR320-8	Hexagon wrench	*HLW330-8	17C3-12	12
-8	Straight rachet	†HLR352	Socket	††HLS352-8	17C3-12	12
-8	20-degree rachet	†HLR362	Socket	††HLS352-8	17C3-12	12
-8	1-inch offset	HLG135-8	Hexagon wrench	HLW135-8	OA2N	14
-8	2-inch offset	HLG145-8	Hexagon wrench	HLW135-8	921474-1	14
-8	Gear housing	HLG101	Socket	**HLW122-8	OA2N	13
-8	Gear housing	HLG101	Extended socket	***HLW123-8	OA2N	13
-10	Straight rachet	HLR300-10	Hexagon wrench	*HLW330-10	17C3-12	12
-10	20-degree rachet	HLR320-10	Hexagon wrench	*HLW330-10	17C3-12	12
-10	Straight rachet	†HLR352	Socket	††HLS352-10	17C3-12	12
-10	20-degree rachet	†HLR362	Socket	††HLS352-10	17C3-12	12
-10	Gear housing	HLG101	Socket	**HLW122-10	OA2N	13

(Continued)

Printed in U.S.A.

Hi-Lok Size	Wrench Type	No.	Attachment	No.	Air Motor No.	See Fig.
-10	Gear housing	HLG101	Socket	***HLW123-10	0A2N	13
-12	Straight rachet	HLR300-12	Hexagon wrench	*HLW300-12	17C3-12	12
-12	20-degree rachet	HLR320-12	Hexagon wrench	*HLW300-12	17C3-12	12
-12	Straight rachet	†HLR352	Socket	††HLS352-12	17C3-12	12
-12	20-degree rachet	†HLR362	Socket	††HLS352-12	17C3-12	12
-12	Gear housing	HLG101	Socket	**HLW122-12	0A2N	13

*Includes HLT140-( ) replaceable tip.
**Use also HLW133-( ) hexagon wrench assembly, which includes HTL140-( ) replaceable tip.
***Use also HLW134-( ) extended hexagon wrench assembly which includes HLT140-( ) replaceable tip.
†Ratchet wrench used for all sizes with HLS352-( ) attachment socket.
††Also use HLW352-( ) extended hexagon wrench.

(2) Power Installation of Hi-Lok Collars

(a) Install washer or countersunk washer if required (see paragraph 7.A. (2)).

(b) Install collar with power tool as shown in Figure 15.

D. Checking Installed Hi-Lok Attachments

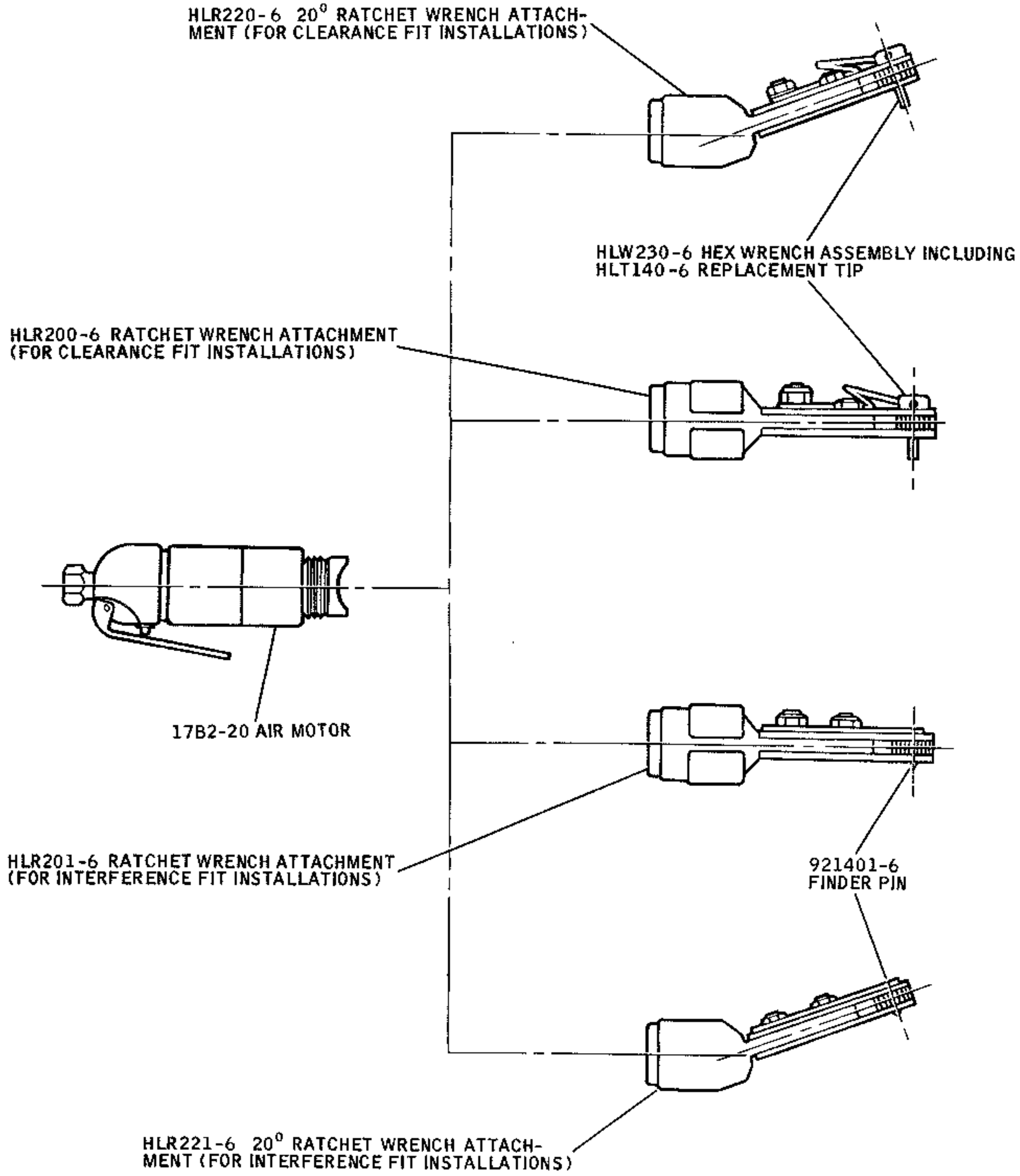
(1) Check that correct pin length has been installed. Refer to Figure 16 for minimum and maximum pin protrusion.

(2) Check that countersunk washer is installed between dimple and collar when applicable.

(3) Check that installed pin head is not dented, nicked or scratched, and that the cadmium plating is intact.

(4) Check that Hi-Lok heads, collars, or nuts and washers are tightly seated against the joining members.

NOTE: In interference-fit holes only, a gap under the flush head is acceptable provided 50 percent of the head is in bearing, and the gap is less than 0.0015 inch for pins through 1/4-inch diameter; diameters over 1/4 inch a gap not greater than 0.003 inch is acceptable, in less than 50 percent of a run, pattern, or cluster.

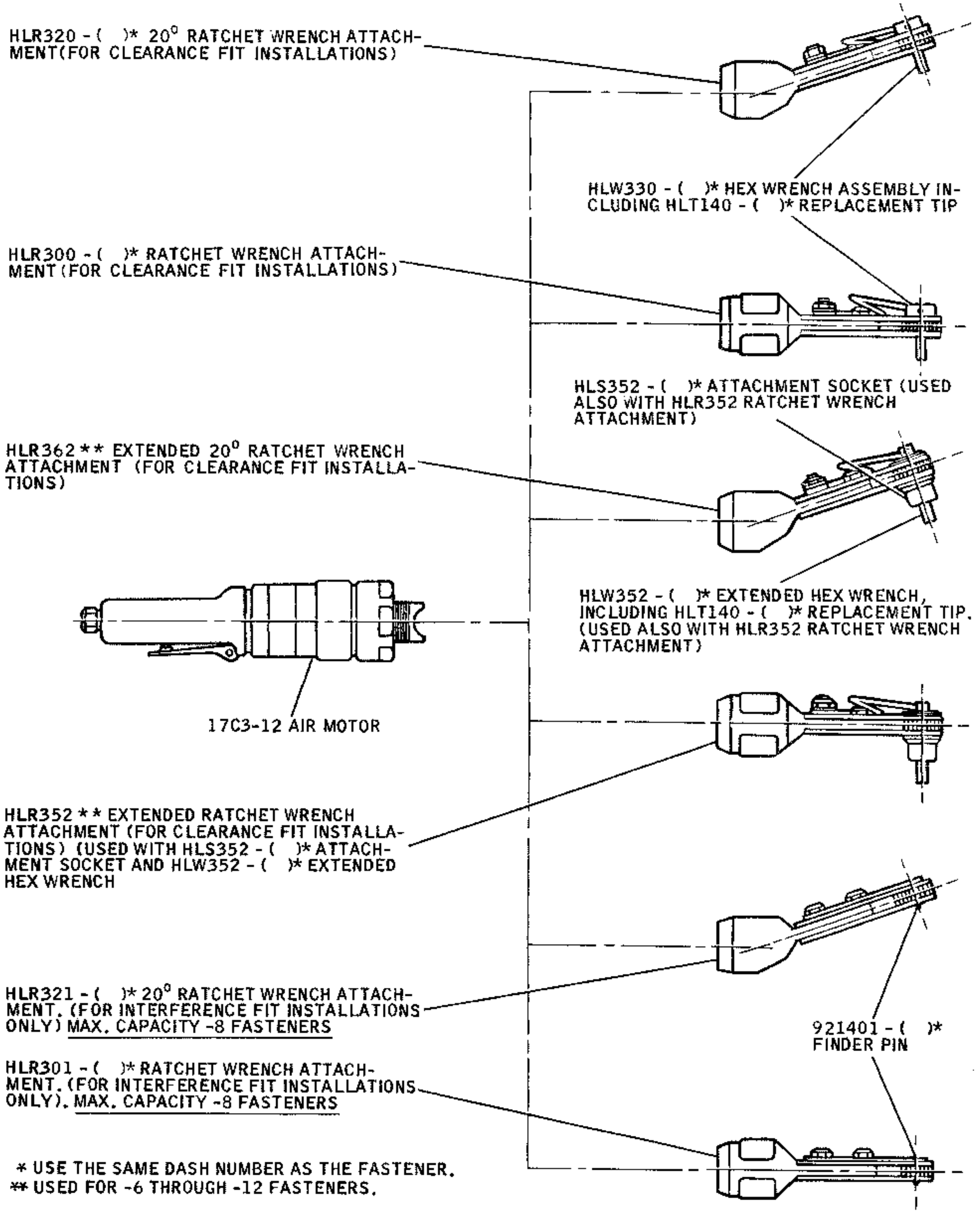


FOR - 5 (5/32) AND - 6 (3/16) FASTENERS

BB3-577

Printed in U.S.A.

Motor Ratchet Installation Tools
Figure 12 (Sheet 1)



* USE THE SAME DASH NUMBER AS THE FASTENER.
** USED FOR -6 THROUGH -12 FASTENERS.

FOR -6 (3/16) THROUGH -12 (3/8) FASTENERS

BB3-578

Motor Ratchet Installation Tools
Figure 12 (Sheet 2)

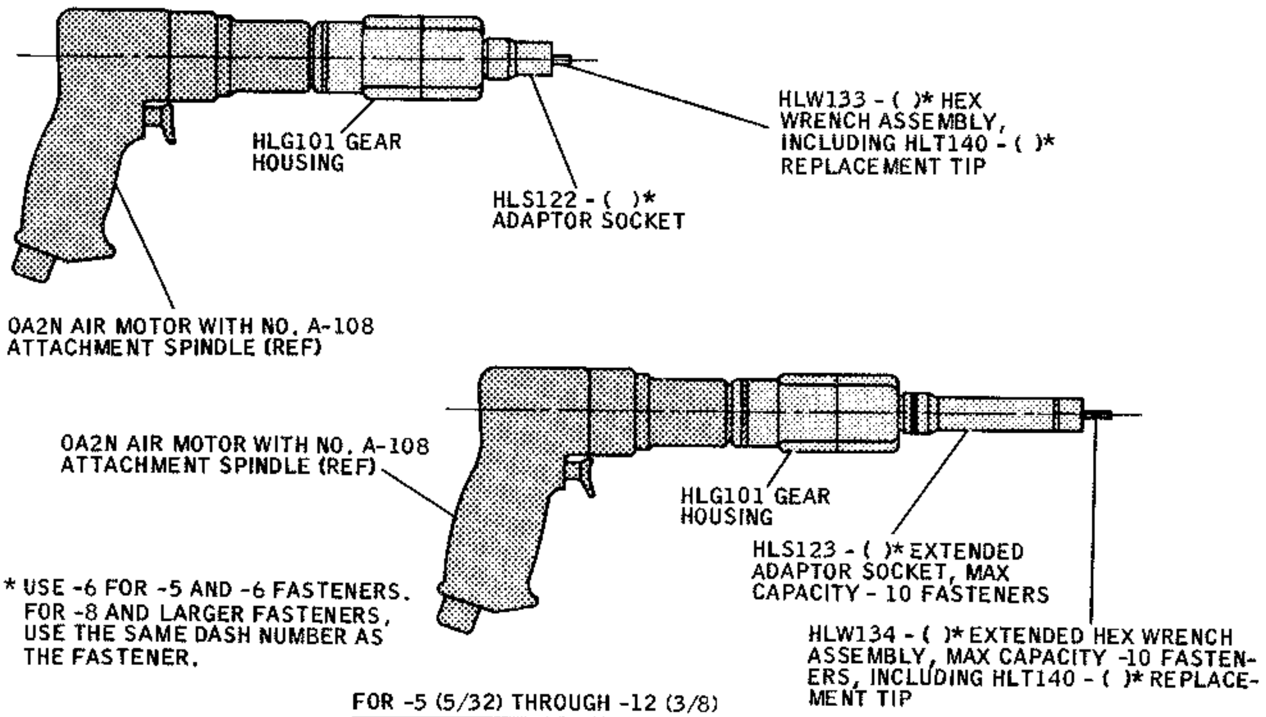
8. Removal of Hi-Lok Attachments

A. Hold pin from turning with allen wrench, and remove collar by rotating counter-clockwise with pliers, vise grips or equivalent (use wrench for locknuts) as shown in Figure 17.

NOTE: Alternate method may be used using tools listed in Figures 9 and 10.

B. Tap pin out of hole with a non-metallic faced mallet.

NOTE: Pins may be reused provided that the finish is not marred and the threads and wrenching cavity are in good condition. Collars must not be reused or retightened.

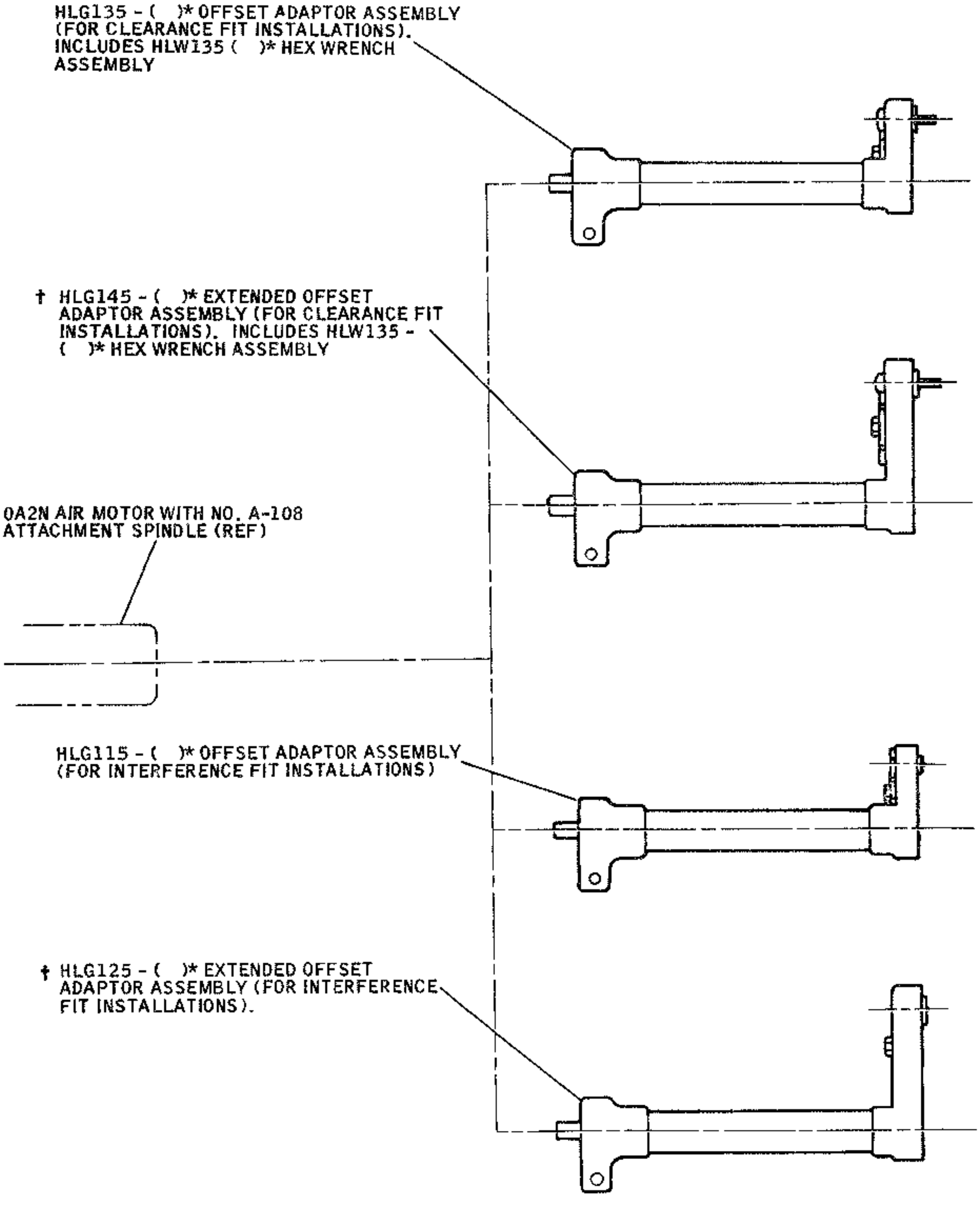


* USE -6 FOR -5 AND -6 FASTENERS. FOR -8 AND LARGER FASTENERS, USE THE SAME DASH NUMBER AS THE FASTENER.

FOR -5 (5/32) THROUGH -12 (3/8)
FASTENERS IN CLEARANCE-FIT HOLES ONLY

BB3-579

Clearance Fit Installation Tooling
Figure 13



* USE -6 FOR -5 AND -6 FASTENERS. USE -8 FOR -8 FASTENERS.

† USE WITH 921474-1 AIR MOTOR

USE FOR -6 (3/16) AND -8 (1/4) FASTENERS

BB3-580

Offset Installation Tools
Figure 14

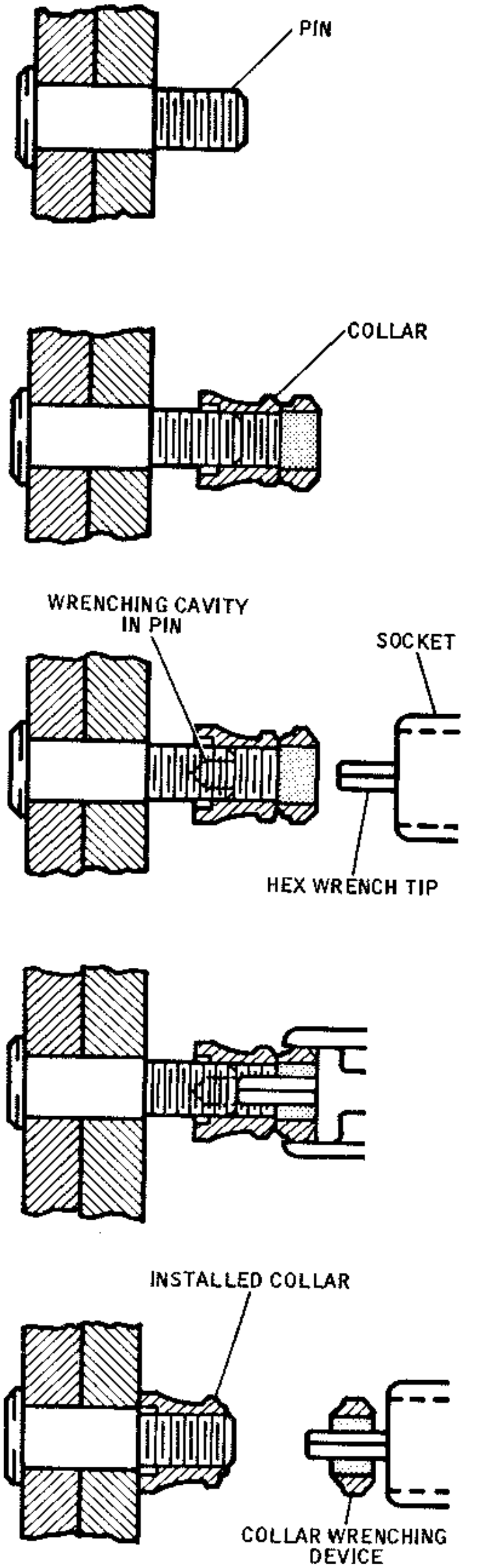
A. INSERT THE PIN INTO THE PREPARED HOLE.

B. MANUALLY SCREW THE COLLAR ONTO THE PIN A MINIMUM OF 2 THREADS.

C. INSERT THE HEX WRENCH TIP OF THE POWER DRIVER INTO THE WRENCHING CAVITY IN THE PIN.

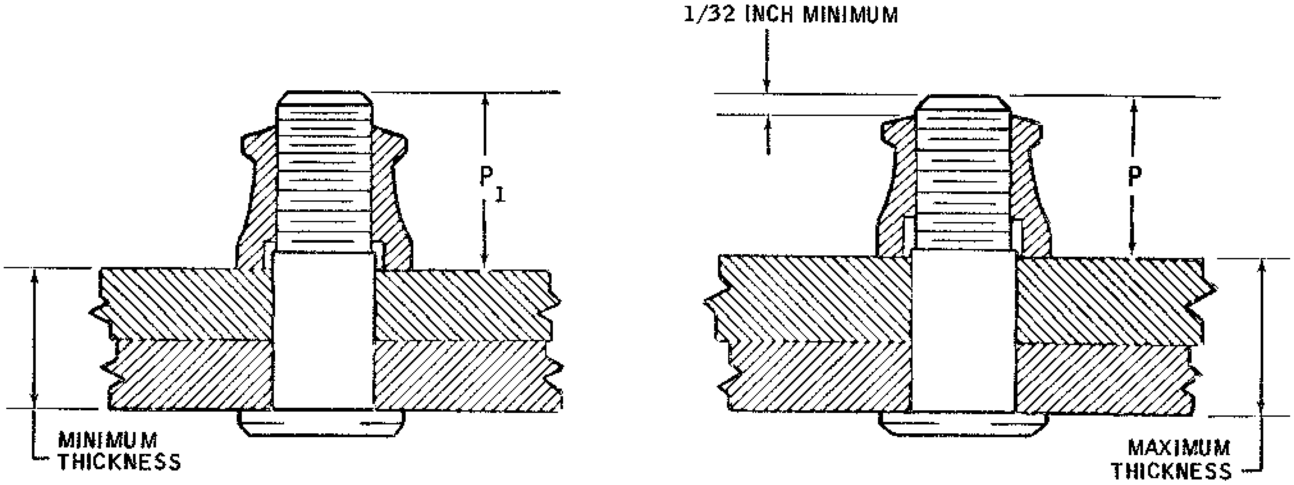
D. PRESS THE POWER DRIVER SOCKET FIRMLY AGAINST THE COLLAR AND ACTUATE THE DRIVER UNTIL THE COLLAR WRENCHING DEVICE SHEARS OFF.

E. WITHDRAW THE HEX WRENCH TIP FROM THE WRENCHING CAVITY.



BB3-569

Hi-Lok Installation with Power Tooling
Figure 15



MINIMUM GRIP

(MAXIMUM PROTRUSION)

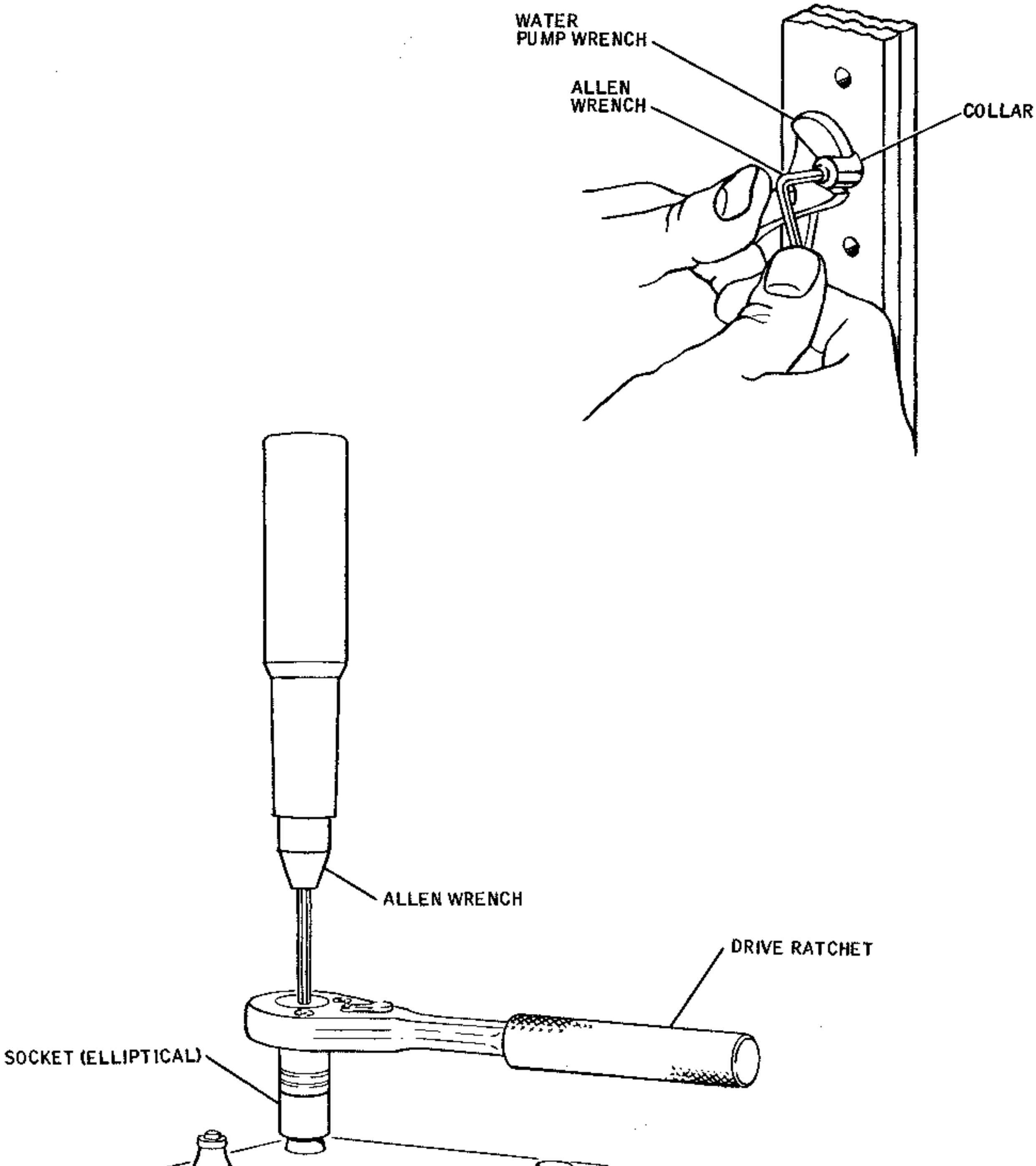
MAXIMUM GRIP

(MINIMUM PROTRUSION)

DASH NO.	NOMINAL DIAMETER	MINIMUM PROTRUSION "P"	MAXIMUM PROTRUSION "P_I"
-5	5/32	0.302	0.384
-6	3/16	0.315	0.397
-8	1/4	0.385	0.467
-10	5/16	0.490	0.572
-12	3/8	0.535	0.617

BB3-571

Pin Protrusion Limits
Figure 16



BB3-572

Typical Removal Procedures
Figure 17

TEMPORARY REVISION 51-6

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 51-30-5, Page 20. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Provides a section on installation of Huck blind bolts.
EFFECTIVITY:	All.

HUCK BLIND BOLTS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes procedures for installing Huck blind bolts when their use is specified by Douglas drawings, service instructions, or in the manual.

2. Hole Preparation

A. Drill holes perpendicular (90 degrees ± 1/2 degree) to the surface of the material unless otherwise specified on Douglas drawing. Holes should be drilled in accordance with instructions in 51-10-4 and the hole tolerances given below:

Nominal Diameter	Hole Size
5/32	.1645 to .1675
3/16	.199 to .202
1/4	.260 to .263
5/16	.312 to .315
3/8	.3745 to .3785

B. Countersinks shall be free from chatter marks and shall conform to the requirements of 51-10-4. They shall be within the countersink diameters given below:

MS Part Number	Huck Part Number	100° Countersink Diameter
MS90353-05	B100-T5	.333 to .343
MS90353-06	B100-T6	.386 to .396
MS90353-08	B100-T8	.507 to .517
MS90353-10	B100-T10	.635 to .645
MS90353-12	B100-T12	.762 to .772

3. Tool Selection

A. The pulling gun Model 200 (Huck Manufacturing Co., Los Angeles, Calif.) used to install 5/32- and 3/16-diameter blind bolts uses a shift valve cartridge that must be adjusted to a given shift pressure before using. See paragraph 4. The shift pressure drives the lock collar into the bolt prior to fracture of pin tail. The applicable nose assembly and pulling gun for a given size blind bolt should be selected from the following table:

Bolt Diameter	Nose Assembly	Pulling Gun
5/32	99-600	Model 200
3/16	99-589	Model 200
1/4	99-591	Model 287, 354, and G87
5/16	99-598	Model 287 and G87
3/8	**99-599	Model 287 and G87

**Install 103446 adapter to nose of 287 or G87 pulling gun in order to retain the 99-599 nose assembly.

4. Shift Pressure Adjustment

A. The shift valve cartridge setting kit 101300 is used to check or set the shift valve cartridge. Adjust the shift pressure in accordance with the list below and the following instructions:

MS Part Number	Vendor Part Number	Shift Pressure (PSI)
MS90354-05 MS90353-05	BP-T5 (5/32) B100-T5 (5/32)	2005 (± 100)
MS90354-06 MS90353-06	BP-T6 (3/16) B100-T6 (3/16)	3025 (± 150)

(1) Remove nose assembly and install nut. Install speed control valve (air restrictor) to the outlet for air hose. See Figure 1.

(2) Remove pipe plug and install pressure gage. See Figure 1.

(3) Depress trigger and turn adjusting screw until the required shift pressure is indicated on the pressure gage. The shift pressure is highest just before it drops momentarily and starts recycling. Release trigger.

NOTE: Adjustment of the shift pressure should be accomplished by personnel thoroughly familiar with operation of the pulling gun.

(4) Cycle gun several times to ensure repeatability of established shift performance.

5. Bolt Installation

A. Preparation

(1) Select applicable blind bolt to be installed. An example of blind bolt designations is as follows:

MS90354- 05 03

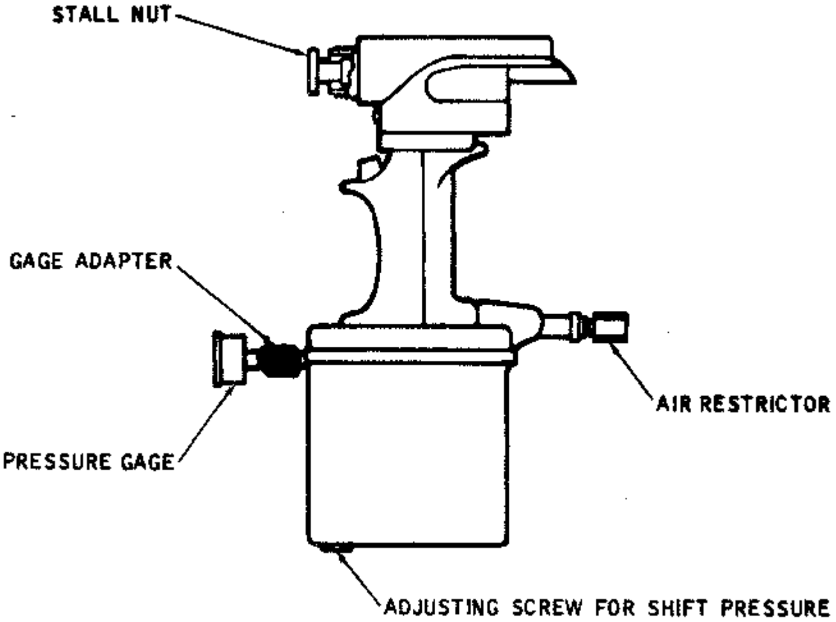
- 03 — Grip Length in 16ths (3/16)
- 05 — Diameter in 32nds (5/32)
- MS90354 — MS Part Number (Head Type)

MS90354 = Protruding Head
MS90353 = Flush Head

BP-T 5 -3

- -3 — Grip Lengths in 16ths (3/16)
- 5 — Diameter in 32nds (5/32)
- BP-T — Vendor Part Number (Head Type)

BP = Protruding Head
B100 = Flush Head



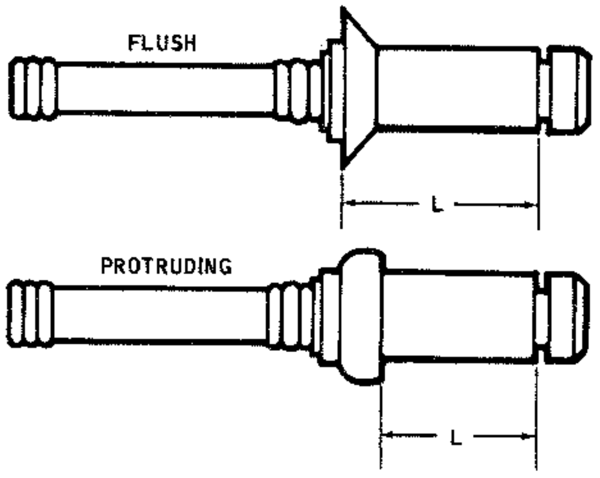
BB3-974

Model 200 Installation Gun Adjustment
Figure 1

GRIP LENGTH SELECTION

DASH NO.	GRIP RANGE		"L" DIMENSION ± .015				
			DIAMETER				
	MIN	MAX	5/32	3/16	1/4	5/16	3/8
1	.031	.095	.217				
2	.094	.157	.280	.303	.344	.381	.423
3	.156	.220	.342	.365	.406	.443	.485
4	.219	.282	.405	.428	.469	.506	.548
5	.281	.345	.467	.490	.531	.568	.610
6	.344	.407	.530	.553	.594	.631	.673
7	.406	.470	.592	.615	.656	.693	.735
8	.469	.532	.655	.678	.719	.756	.798
9	.531	.595	.717	.740	.781	.818	.860
10	.594	.657	.780	.803	.844	.881	.923
11	.656	.720	.842	.865	.906	.943	.985
12	.719	.782	.905	.928	.969	1.006	1.048
13	.781	.845	.967	.990	1.031	1.068	1.110
14	.844	.907	1.030	1.053	1.094	1.131	1.173
15	.906	.970	1.092	1.105	1.156	1.193	1.235
16	.969	1.032	1.155	1.178	1.219	1.256	1.298

NOTE: "L" DIMENSION IS USED TO DETERMINE THE GRIP BY THE SLEEVE LENGTH WHEN THE GRIP NUMBER IDENTIFICATION IS NOT STAMPED ON THE BLIND BOLT. MEASURE SLEEVE AS SHOWN BELOW AND REFER TO ABOVE TABLE FOR THE APPLICABLE GRIP RANGE.



GRIP MEASUREMENT

BB3-990

Grip Length Selection and Grip Measurement
Figure 2

(2) Measure total material thickness, regardless of whether Douglas drawing specifies the grip length or not.

(3) Select from Figure 2 the applicable grip length blind bolt.

B. Installation

(1) Insert blind bolt into prepared holes in the assembly or into nose assembly of pulling gun.

(2) Hold gun at right angle to work and lightly push downward on bolt head while depressing trigger of pulling gun.

NOTE: Installed blind bolts shall be free from gaps under the flush and protruding head surfaces designed for contact. Blind bolts may be upset on a maximum 6-degree taper (blind side).

(3) The maximum allowable pin protrusion and depression from head surface shall fall within the dimensions shown in Figure 3; the maximum allowable collar protrusion and depression shall fall within the limits shown in Figure 4.

(4) If necessary, mill collar and pin to maintain aerodynamic tolerances indicated in 51-50-0. (Do not damage or remove finish on head.) Before milling, the installed bolt shall meet the requirements of paragraph 2.B and Figures 3 and 4.

(5) After installation, the broken end of pin shall be touched up with FR primer 463-12-1 (Finch Paint & Chemical Co., Torrance, Calif.). See 51-10-3. Delay is permissible provided no noticeable corrosion has occurred.

6. Bolt Removal

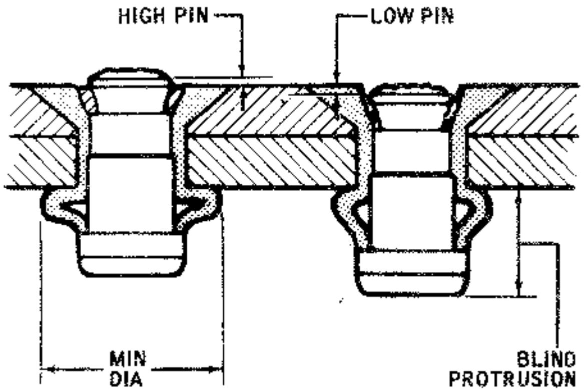
A. Removal Kit Selection

(1) Select kit number for the applicable bolt size from Figure 5.

NOTE: Removal kits are for both countersunk and protruding heads.

B. Lock Collar Removal

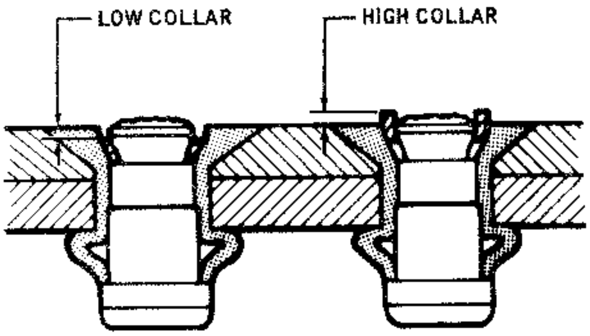
(1) Remove lock collar by placing drill bushing over the pin so that it rests squarely on the lock collar and drill to lock collar depth in accordance with Figure 6.



			REFERENCE WHEN BLIND SIDE IS VISIBLE	
DIA	MAX HIGH PIN	MAX LOW PIN	MIN BULB DIA	MAX BLIND PROTRUSION
5/32	.010	.010	.212	.215
3/16	.012	.012	.258	.260
1/4	.015	.015	.338	.340
5/16	.019	.019	.405	.410
3/8	.023	.023	.487	.510

BB3-991

Pin Position
Figure 3



DIA	HIGH COLLAR	LOW COLLAR
5/32	.017	.017
3/16	.022	.022
1/4	.029	.029
5/16	.037	.037
3/8	.045	.045

BB3-992

Collar Position
Figure 4

C. Pin Removal

(1) Position pin punch on the fastener and drive pin out. Remove remaining portion of lock collar with pointed-type tool. See Figure 7.

D. Sleeve Removal

(1) Adjust micro-limit tool to the dimensions shown in Figure 8. Place anti-rotation cap firmly against head of fastener and counterbore to the desired depth as shown in Figure 8.

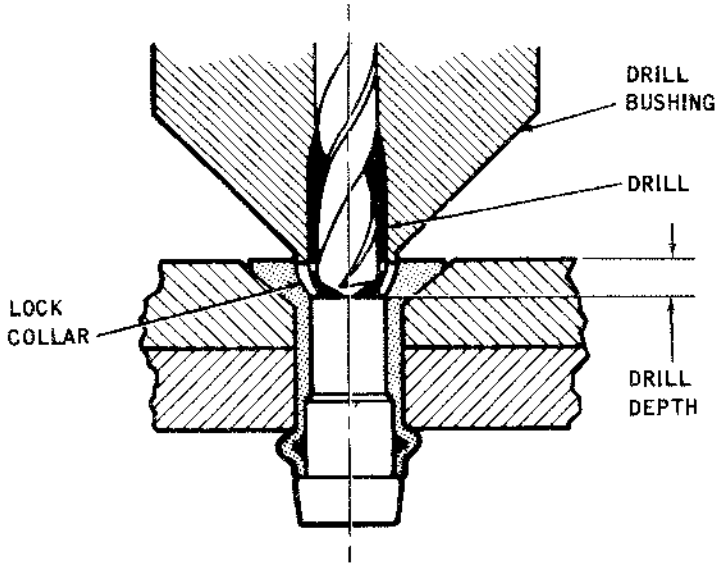
(2) Position sleeve punch in sleeve and drive out lower portion of the sleeve. Tip punch slightly and lift head out of fastener. See Figure 9.

CAUTION: EXERCISE CAUTION WHEN USING PUNCH FOR REMOVAL OF SLEEVE TO PREVENT DAMAGE TO HOLE WALL AND COUNTERSINK.

NOTE: If removal kits are not available, select a drill approximately .005-inch smaller than the minimum hole size given in paragraph 2.A.

NOMINAL DIAMETER	5/32	3/16	1/4	5/16	3/8
KIT NO.	105-50	105-60	105-80	105-11	105-120
DESCRIPTION	PART NO.	PART NO.	PART NO.	PART NO.	PART NO.
Micro-Limit Tool Assy.-See Fig. 8	103600	103601	103602	103603	103604
Micro-Limit Tool - See Fig. 8	103623	103623	103623	103623	103623
Cutter Holder - See Fig. 8	103610	103611	103611	103613	103613
Set Screw - See Fig. 8	501775	501775	501775	501775	501775
Cutter - See Fig. 8	103605	103606	103607	103608	103609
Anti-Rotation Cap - See Fig. 8	103620	103620	103621	103621	103622
Pin Punch - See Fig. 7	503010	503010	503012	503013	503014
Sleeve Punch - See Fig. 9	503012	503013	503015	503016	503017
Drill - See Fig. 6	502999	503000	503001	503003	503005
Drill Bushing - See Fig. 6	103615	103616	103617	103618	103619
Hex Key	502443	502443	502443	502443	502443

Removal Kit Selection Table
Figure 5

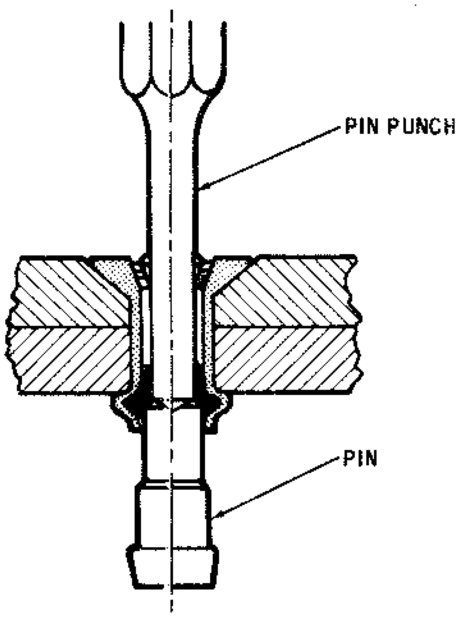


DRILL DEPTH

NOMINAL BOLT DIA	DRILL DEPTH
5/32	.050-.070
3/16	.070-.090
1/4	.090-.110
5/16	.110-.130
3/8	.130-.150

BB3-993

Lock Collar Removal
Figure 6

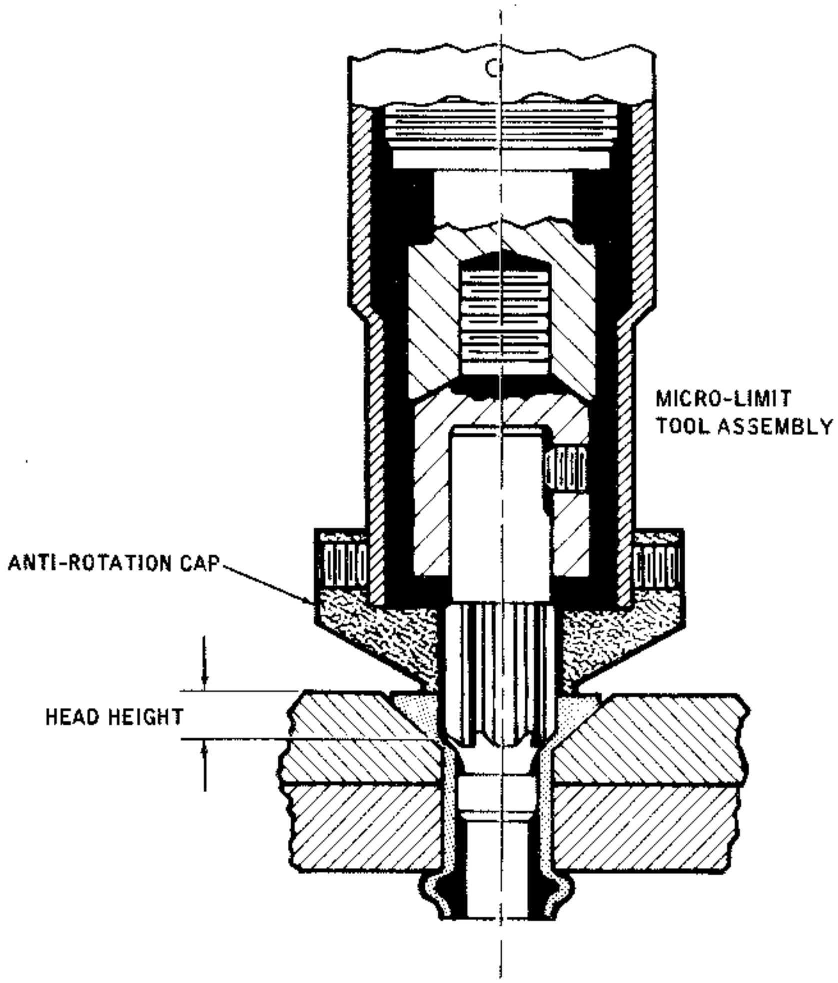


BB3-994

Pin Removal
Figure 7

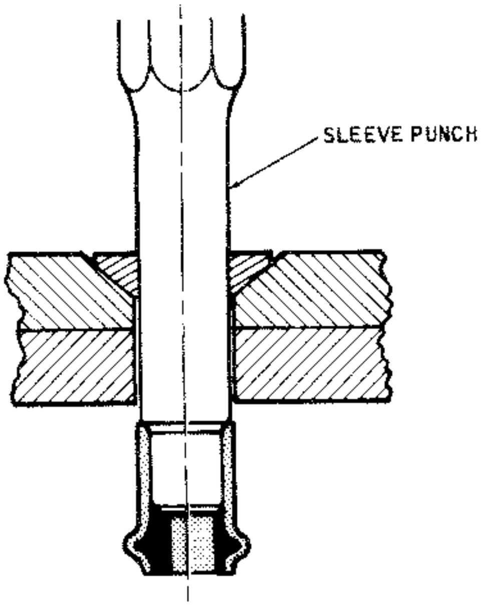
MICRO-TOOL ADJUSTMENT

HEAD HEIGHT	
PROTRUDING HEAD	COUNTERSUNK HEAD
5/32 = .055-.065	.055-.065
3/16 = .120-.130	.065-.075
1/4 = .125-.135	.090-.100
5/16 = .125-.135	.120-.130
3/8 = .190-.200	.150-.160



BB3-995

Drilling Sleeve
Figure 8



BB3-996

Sleeve Removal
Figure 9

ALIGNMENT CHECK PROCEDURES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

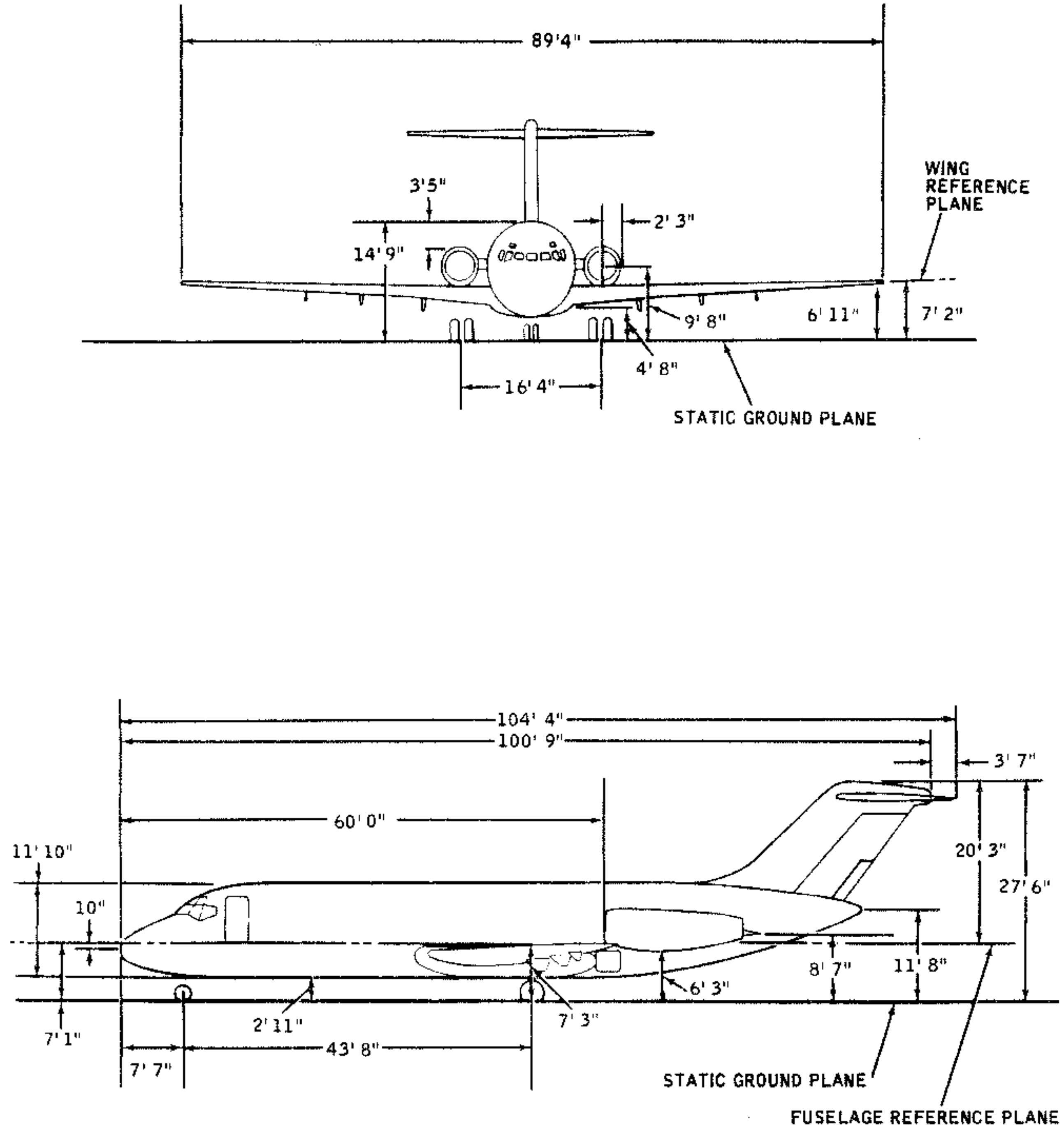
A. A misaligned condition can seriously affect the flying qualities of the airplane. Misalignment may not be apparent by casual observation, and may only be found by alignment checks using instruments.

B. Alignment checks should normally be made after any major structural repairs, or after the airplane has been subjected to severe conditions, such as heavy landings, extreme turbulence, overspeeding or violent maneuvers. Alignment should also be checked if any of the following conditions are observed: unusual flight characteristics, parallel biased waves of structural plating, wrinkling or buckling of structural plating, loose or distorted plating, areas of loose or sheared fasteners, areas of badly fitting panels and inspection plates.

C. Airplane dimensions are shown in Figure 1. This figure also shows fuselage reference and static ground planes with the airplane in its normal two degree nose-down position. It should be noted that for alignment purposes the airplane will be level with these two planes parallel. Alignment is considered in five areas for convenience of reference as follows: fuselage, wings, horizontal and vertical stabilizers, nacelles/pylons, main and nose landing gear. Reference points are related dimensionally to fuselage centerline, station lines (see Figure 2), and fuselage reference plane. These reference points are shown in the illustrations for the individual alignment areas. Coordinates are given for each reference point, the axes of the coordinates are shown in Figure 3. Other coordinates are used for greater convenience in certain areas and are shown in the appropriate illustrations.

2. Alignment

A. Alignment checks should be made with the airplane on an area of level, hard-surfaced ground. The airplane must be drained of fuel and oil, and all cargo must be removed. The airplane must also be level (refer to Chapter 8, Maintenance Manual), and leveling must be checked as shown in Figure 4. Auxiliary shoring fixtures, although not intended to support the weight of the airplane, should be applied, as necessary, to prevent any movement which might be caused by wind gusts. Since expansion and contraction of the airplane due to temperature changes can cause variations in measurements, alignment should ideally take place in an enclosed shaded area, and the airplane allowed to assume ambient temperature. However, since these conditions may not be available, the airplane should be allowed sufficient time to assume ambient temperature and, when in hot sunshine, should be turned to provide even exposure of the upper surfaces. The following checks assume accurate leveling of the airplane as a prerequisite.

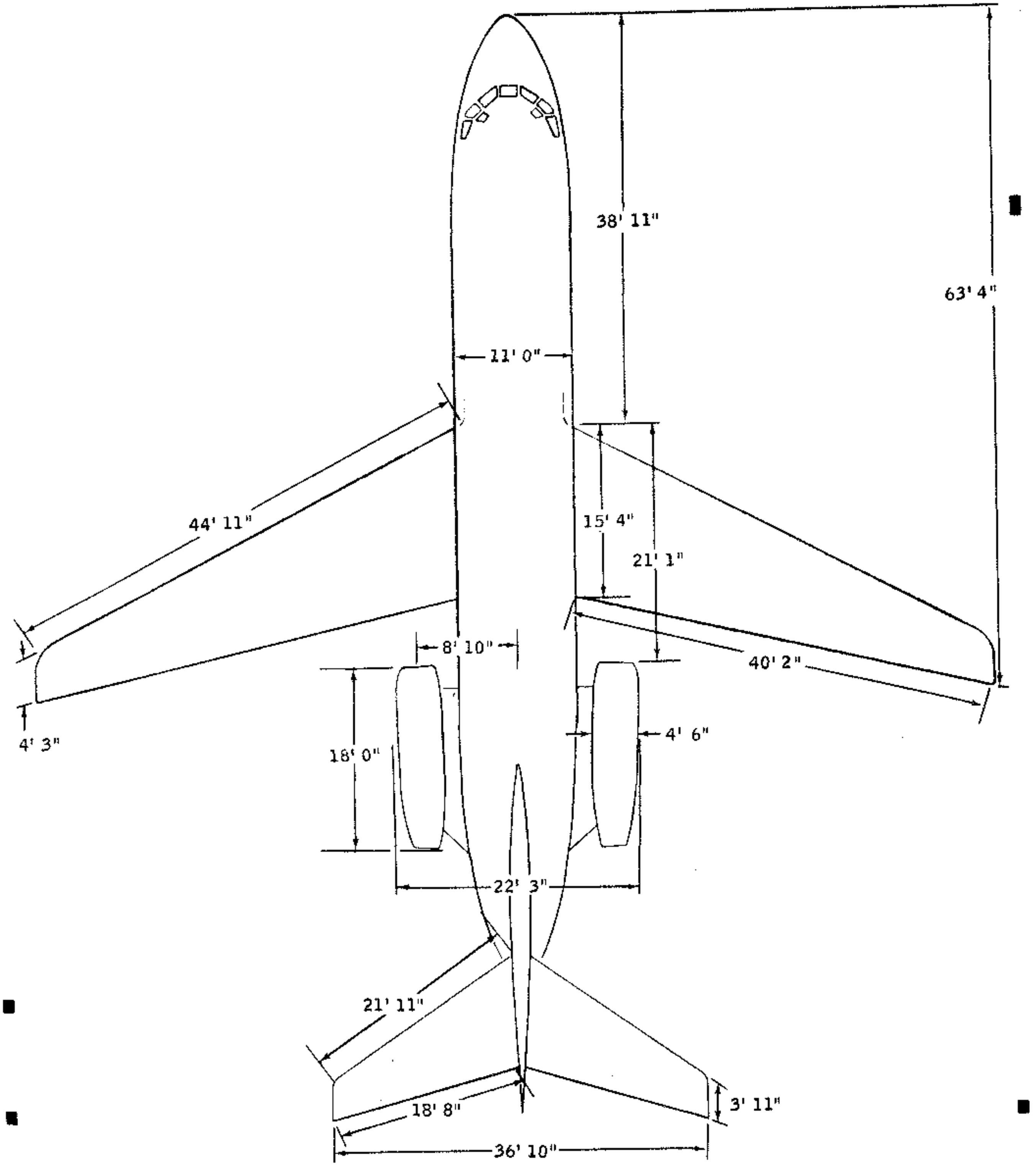


NOTE:
DIMENSIONS GIVEN ARE
TO THE NEAREST INCH

DC-9-10 SERIES AIRPLANES

BB3-4128

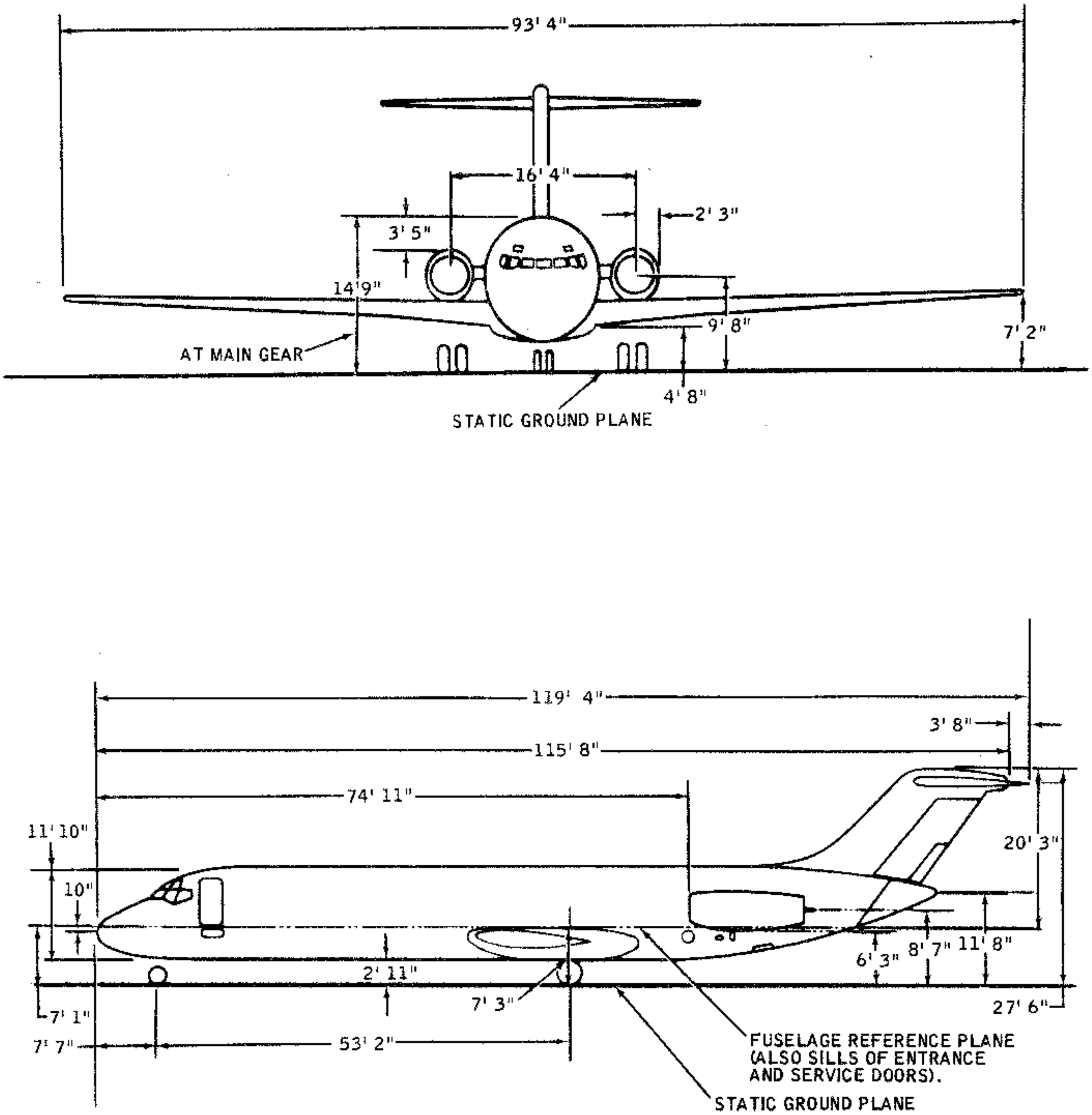
Airplane Dimensions
Figure 1 (Sheet 1)



DC-9-10 SERIES AIRPLANES

BB3-413B

Airplane Dimensions
Figure 1 (Sheet 2)

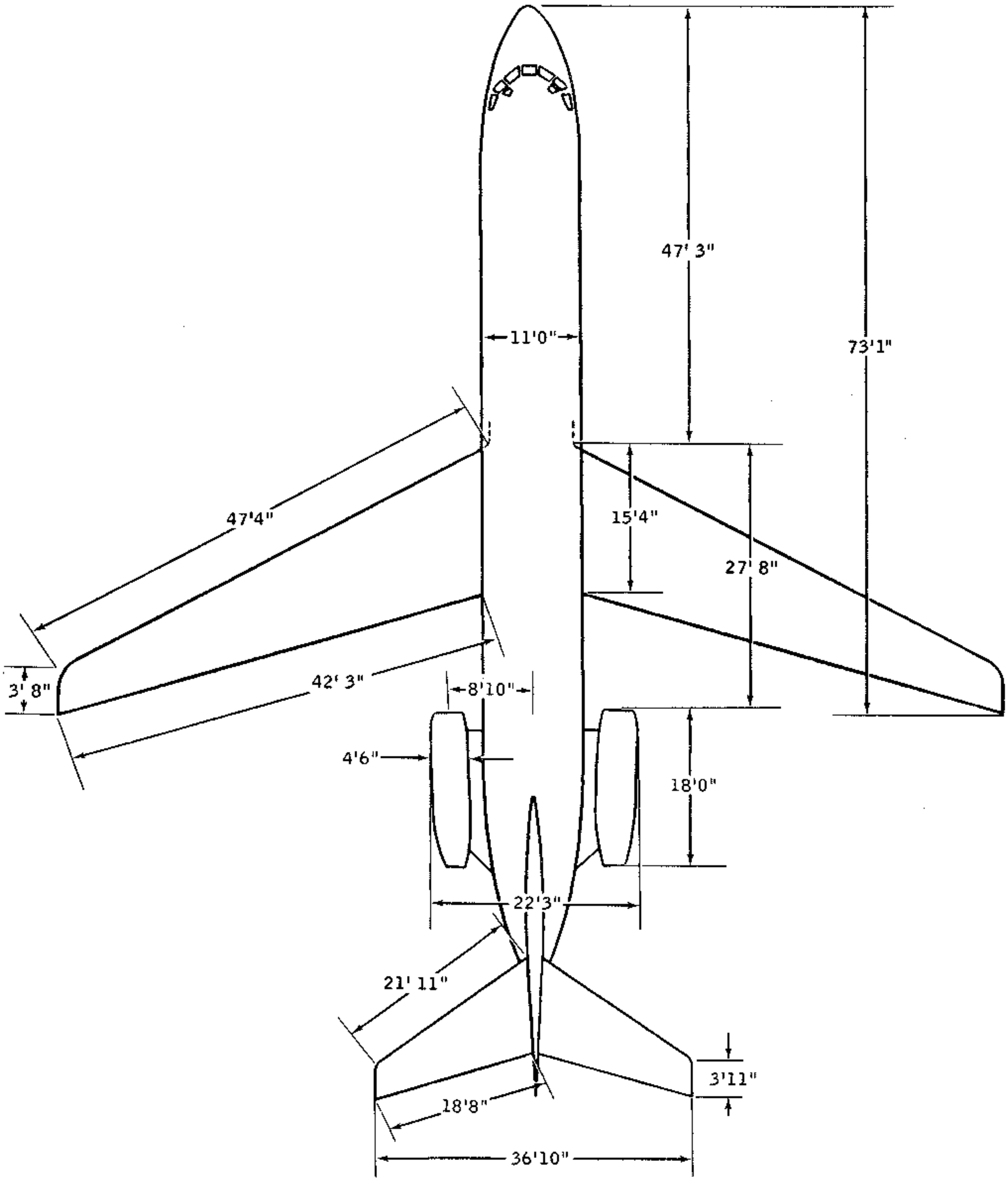


NOTE:
DIMENSIONS GIVEN ARE TO THE NEAREST INCH.

DC-9-30 SERIES AIRPLANES

BB3-950

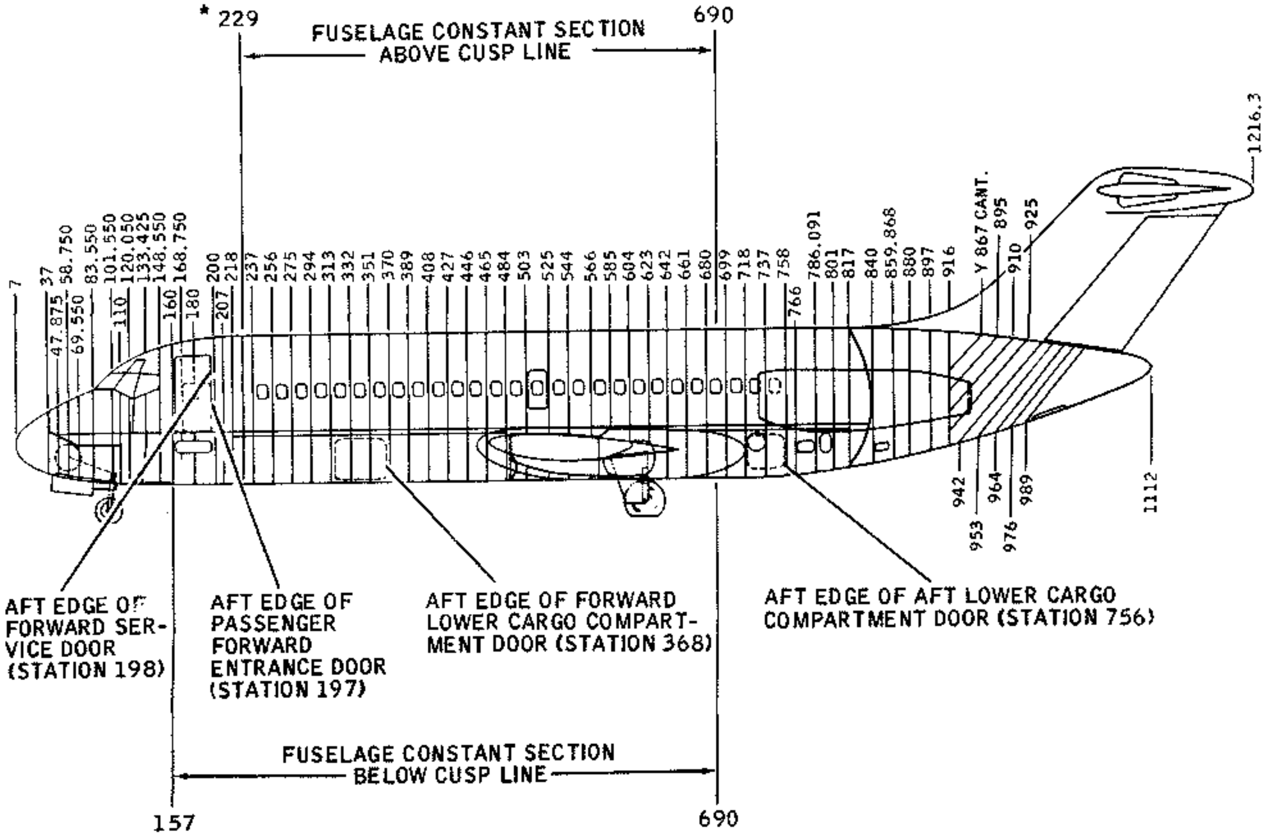
Airplane Dimensions
Figure 1 (Sheet 3)



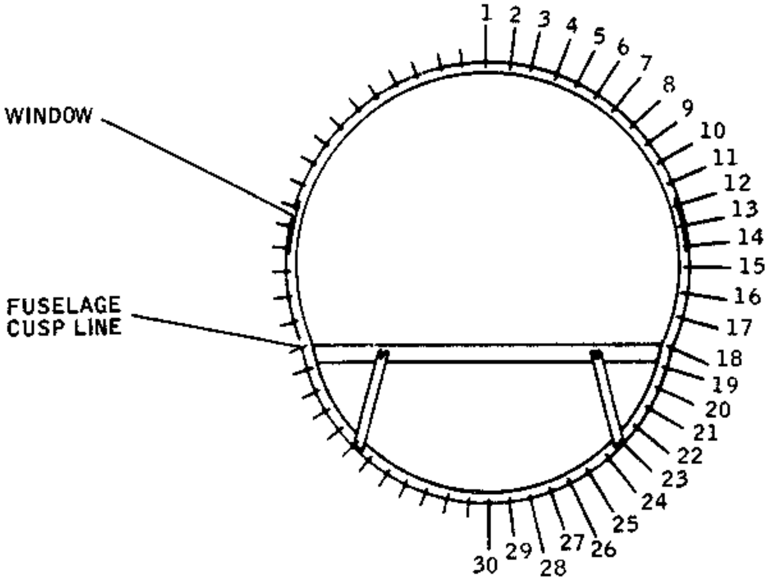
DC-9-30 SERIES AIRPLANES

BB3-951

Airplane Dimensions
Figure 1 (Sheet 4)



NOTE:
* WINDOW AT STATION 229 NOT ON ALL AIRPLANES.

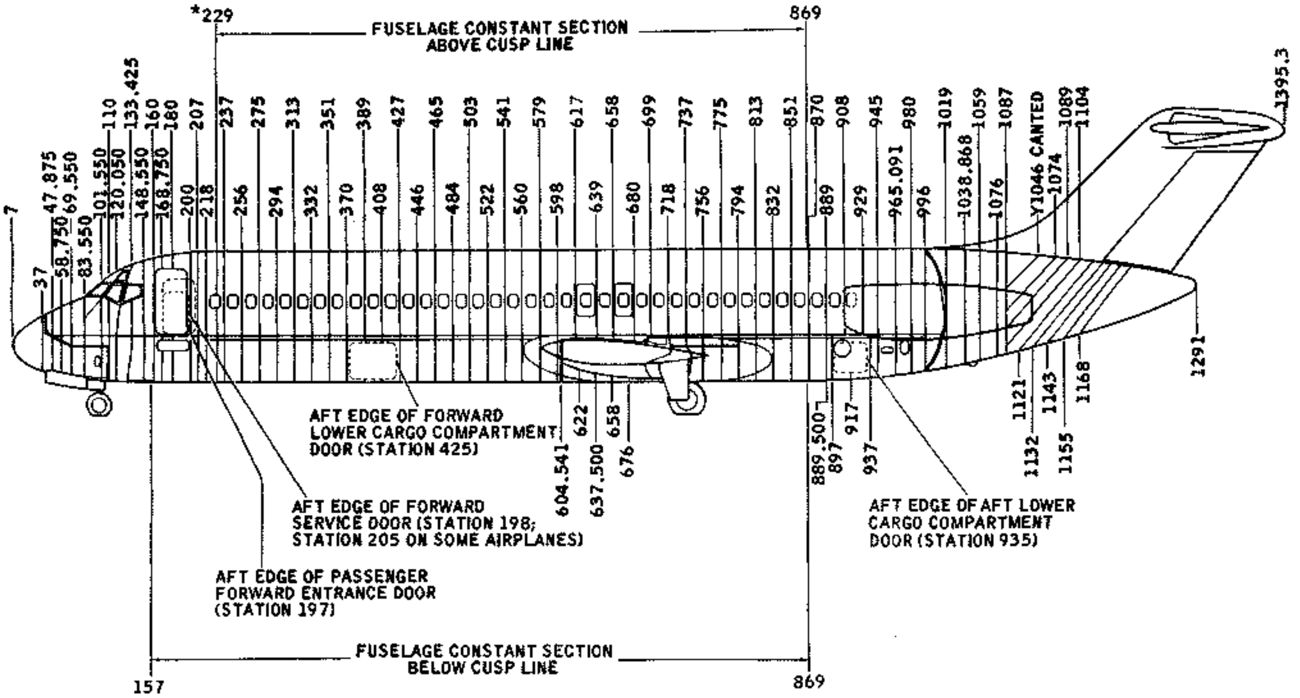


FUSELAGE LONGERON NUMBERING ARRANGEMENT

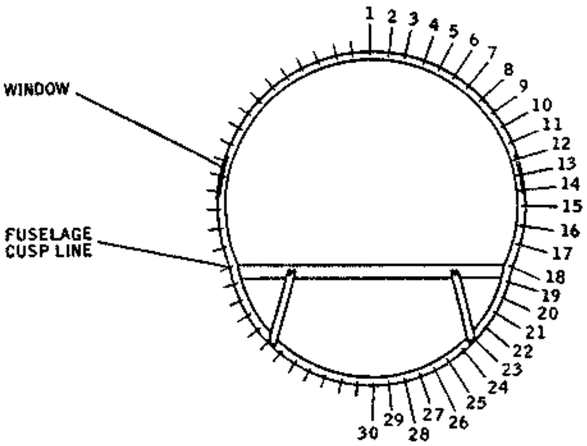
DC-9-10 SERIES AIRPLANES

BB3-68B

Fuselage Station Diagram
Figure 2 (Sheet 1)



NOTE:
*WINDOW AT STATION 229 NOT ON ALL AIRPLANES.



FUSELAGE LONGERON NUMBERING ARRANGEMENT

DC-9 30 SERIES AIRPLANES

BB3-947A

Fuselage Station Diagram
Figure 2 (Sheet 2)

(1) Check fuselage alignment.

  (a) Check alignment of fuselage by comparing fuselage reference plane to static ground plane, using reference points and table shown in Figure 5.

(2) Check wing alignment.

  (a) Check sweep by referencing wing tip to fuselage station (see Figure 6).

  (b) Check alignment of lower surface of wing by comparing reference points shown in Figure 7 with fuselage reference plane.

  (c) Check wing incidence at stations shown in Figure 8. Difference in incidence between left and right wings at like stations should not exceed 30 minutes.

(3) Check horizontal and vertical stabilizer alignment.

  (a) Check alignment of vertical stabilizer to perpendicular of airplane centerline (see Figure 9).

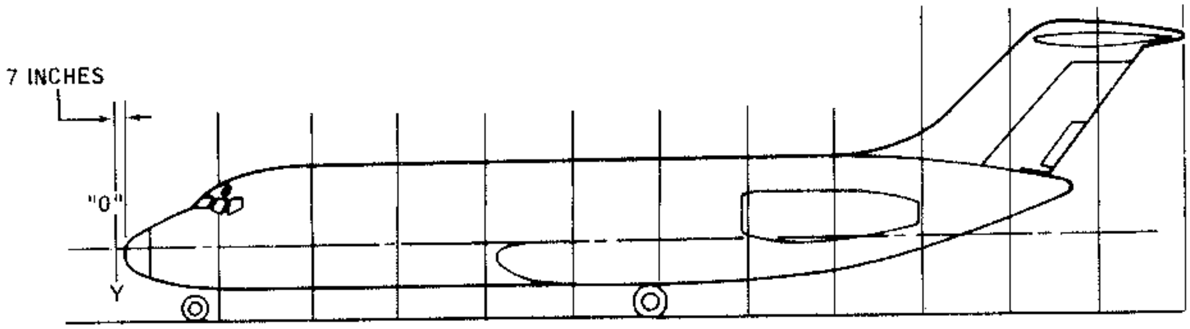
  (b) Check alignment of horizontal stabilizer (see Figure 9). Readings taken at horizontal stabilizer tips should be compared for Y stations to check absence of vertical stabilizer twist.

(4) Check alignment of nacelles/pylons.

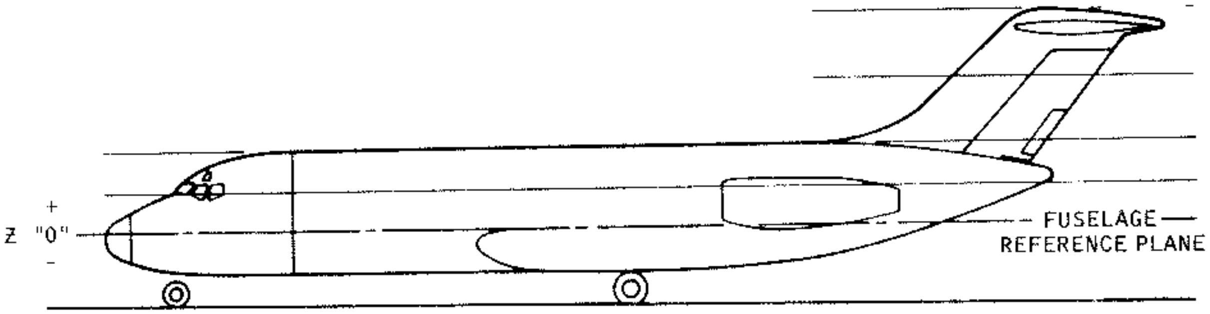
  (a) Remove cowls as necessary (see Maintenance Manual), and check alignment of nacelles/pylons using reference points shown in Figure 10.

(5) Check main and nose landing gear alignment.

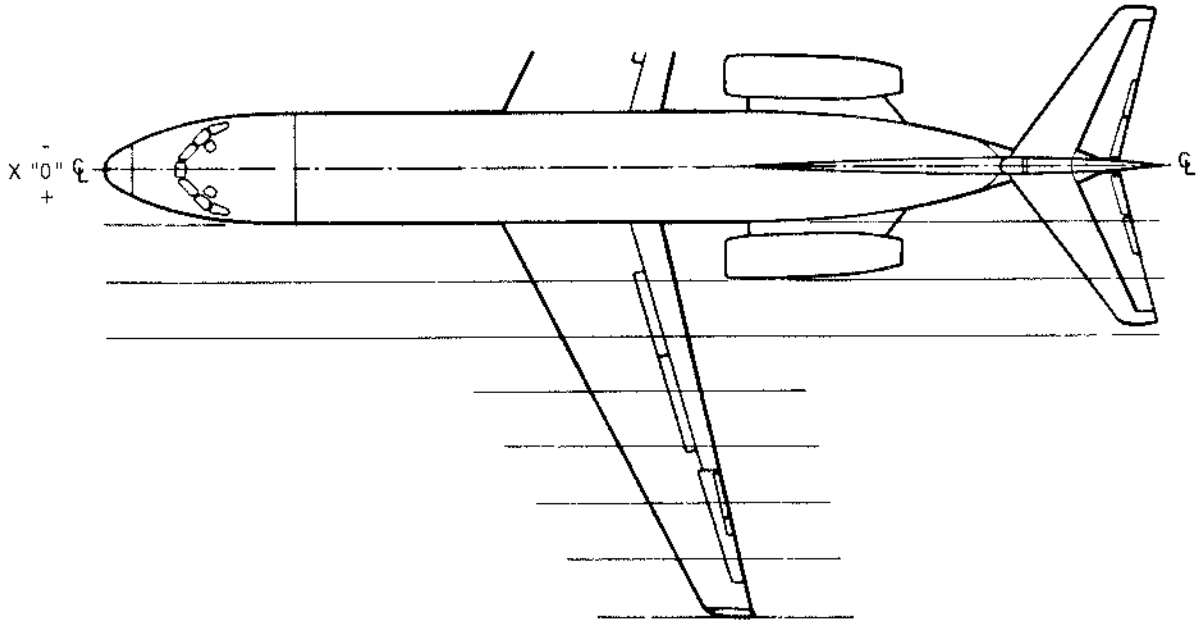
  (a) Check main and nose landing gear for alignment and tracking as shown in Figure 11.



COORDINATE Y-(STATION LINES) VERTICAL/LATERAL PLANE
MEASURED IN INCHES FROM POINT 7 INCHES FORWARD OF NOSE



COORDINATE Z - HORIZONTAL PLANE MEASURED IN INCHES
ABOVE (+) AND BELOW (-) FUSELAGE REFERENCE PLANE



COORDINATE X-VERTICAL/LONGITUDINAL PLANE MEASURED IN
INCHES LEFT (+) OR RIGHT (-) FROM CENTERLINE OF AIRPLANE

BB3-415A

Airplane Reference Coordinates
Figure 3

(1) Check fuselage alignment.

(a) Check alignment of fuselage by comparing fuselage reference plane to static ground plane, using reference points and table shown in Figure 5.

(2) Check wing alignment.

(a) Check sweep by referencing wing tip to fuselage station (see Figure 6).

(b) Check alignment of lower surface of wing by comparing reference points shown in Figure 7 with fuselage reference plane.

(c) Check wing incidence at stations shown in Figure 8. Difference in incidence between left and right wings at like stations should not exceed 30 minutes.

(3) Check horizontal and vertical stabilizer alignment.

(a) Check alignment of vertical stabilizer to perpendicular of airplane centerline (see Figure 9).

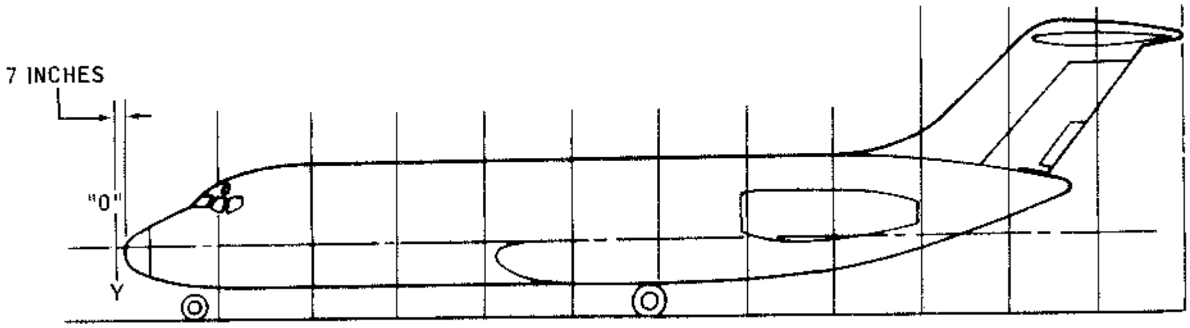
(b) Check alignment of horizontal stabilizer (see Figure 9). Readings taken at horizontal stabilizer tips should be compared for Y stations to check absence of vertical stabilizer twist.

(4) Check alignment of nacelles/pylons.

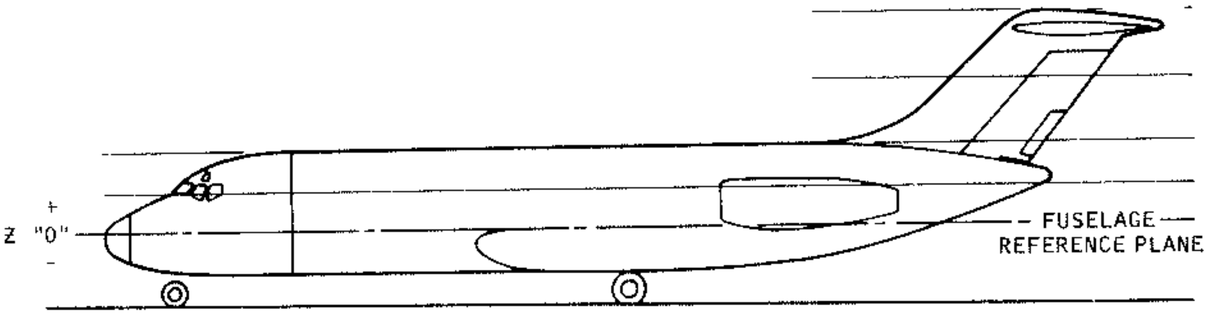
(a) Remove cowls as necessary (see Maintenance Manual), and check alignment of nacelles/pylons using reference points shown in Figure 10.

(5) Check main and nose landing gear alignment.

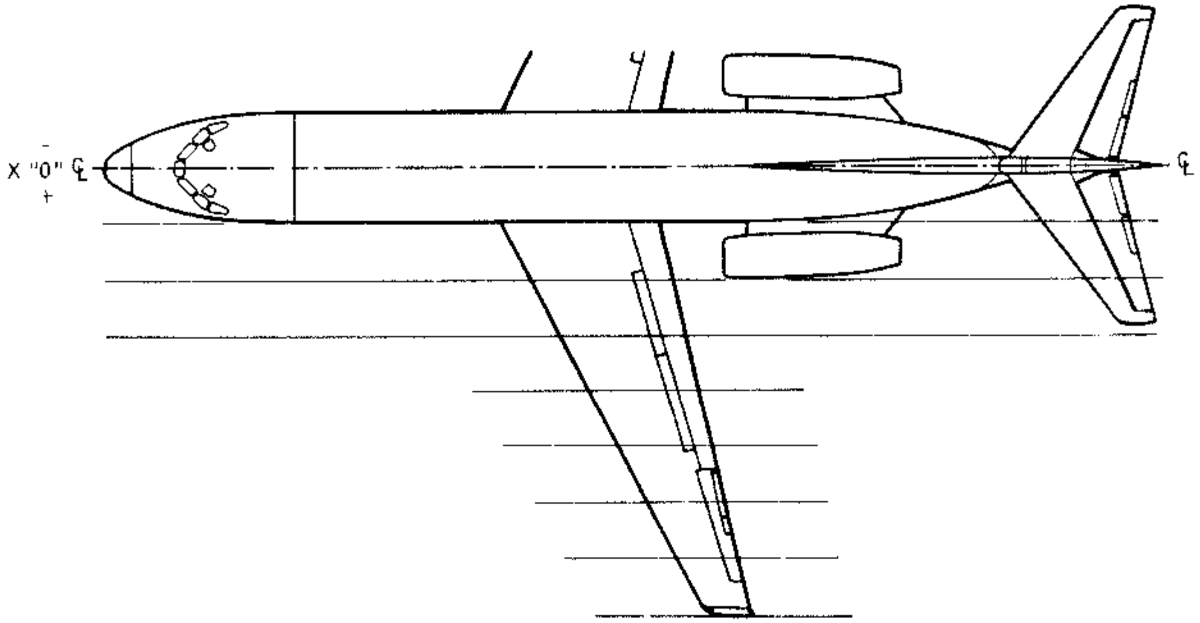
(a) Check main and nose landing gear for alignment and tracking as shown in Figure 11.



COORDINATE Y-(STATION LINES) VERTICAL/LATERAL PLANE
MEASURED IN INCHES FROM POINT 7 INCHES FORWARD OF NOSE



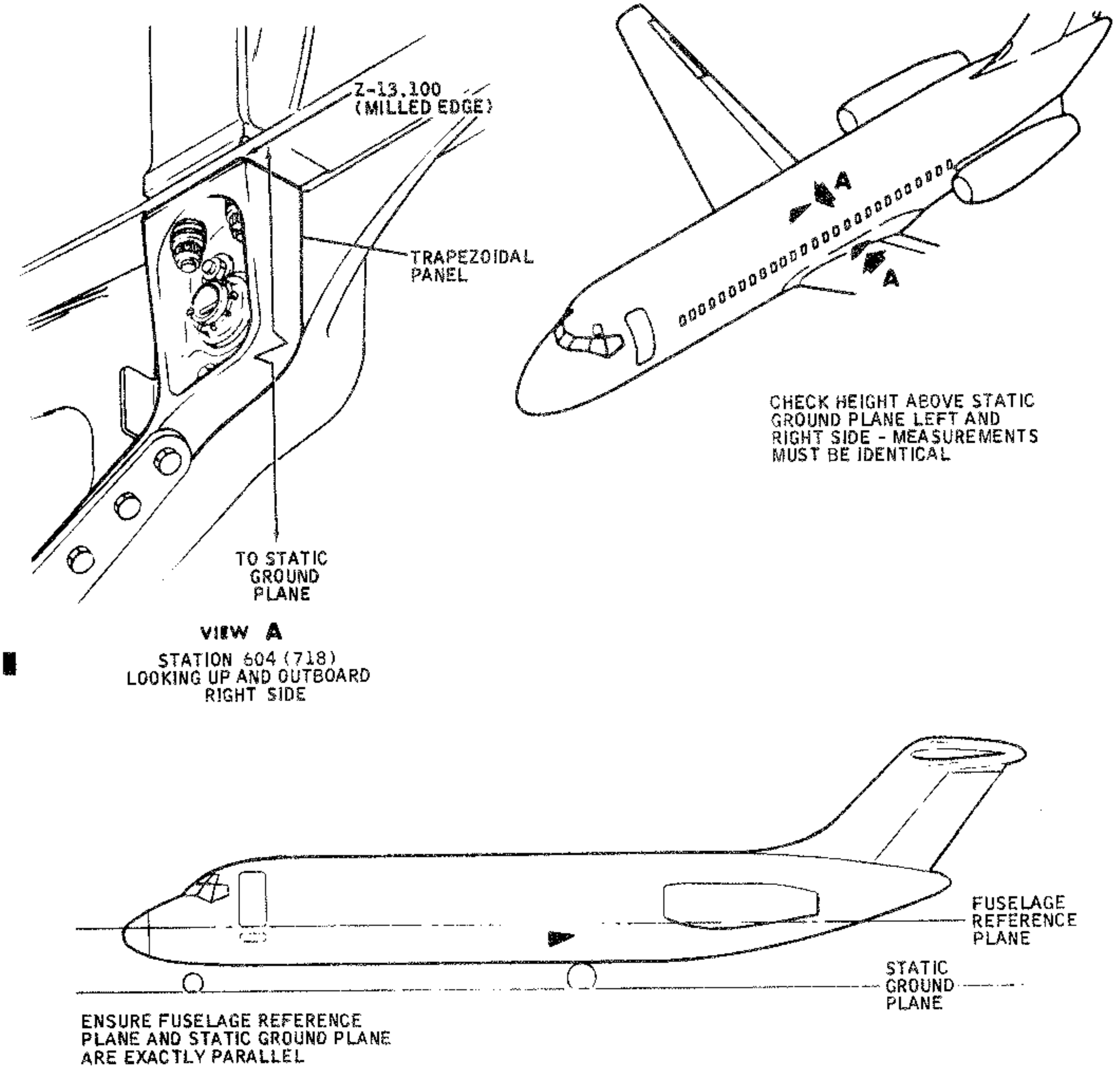
COORDINATE Z - HORIZONTAL PLANE MEASURED IN INCHES
ABOVE (+) AND BELOW (-) FUSELAGE REFERENCE PLANE



COORDINATE X-VERTICAL/LONGITUDINAL PLANE MEASURED IN
INCHES LEFT (+) OR RIGHT (-) FROM CENTERLINE OF AIRPLANE

BB3-415A

Airplane Reference Coordinates
Figure 3



VIEW A

STATION 604 (718)
LOOKING UP AND OUTBOARD
RIGHT SIDE

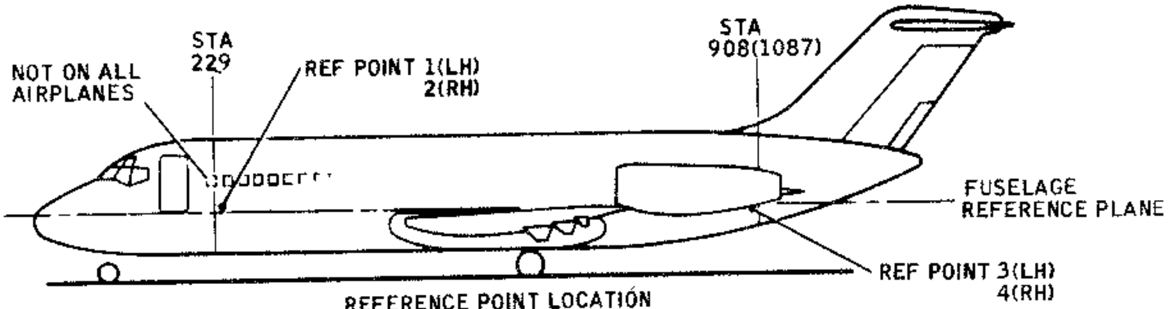
CHECK HEIGHT ABOVE STATIC GROUND PLANE LEFT AND RIGHT SIDE - MEASUREMENTS MUST BE IDENTICAL

ENSURE FUSELAGE REFERENCE PLANE AND STATIC GROUND PLANE ARE EXACTLY PARALLEL

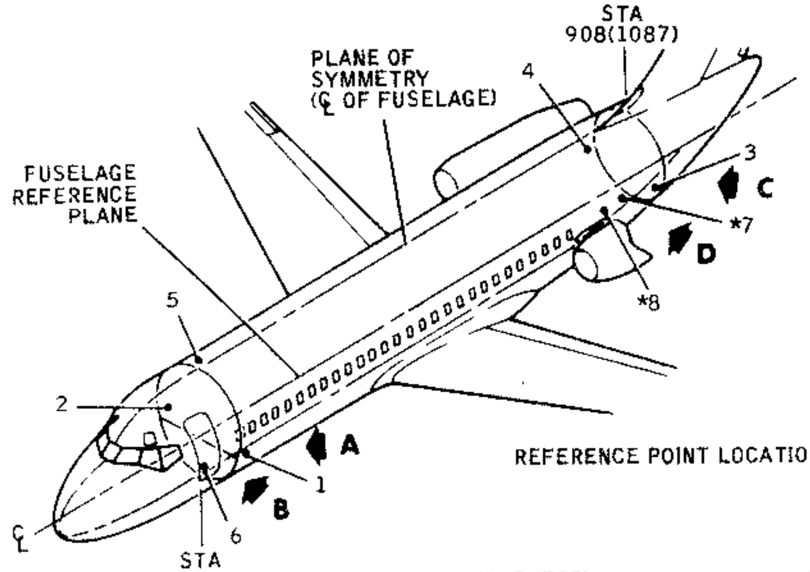
NOTE: STATION NUMBER IN PARENTHESES IS FOR DC-9-30 SERIES AIRPLANES.

BB3-416B

Checking Airplane Leveling
Figure 4

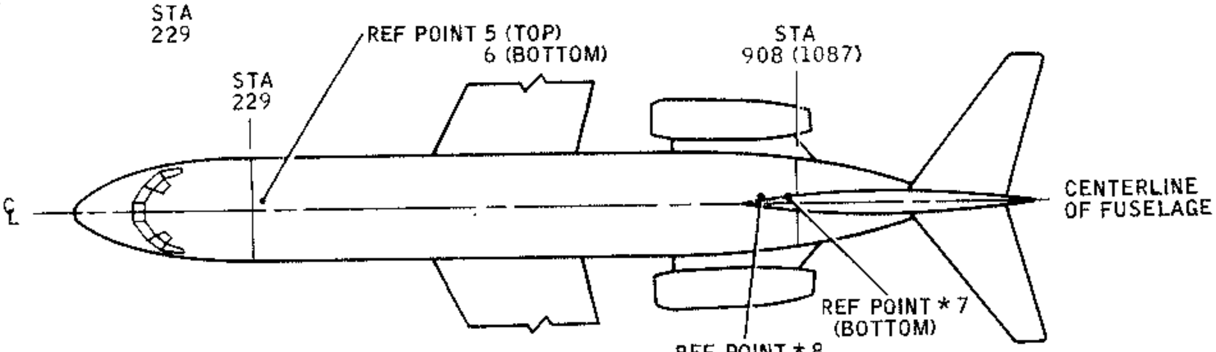


REFERENCE POINT LOCATION (SIDE VIEW)



SEE SHEET 2 FOR NOTES AND ADDITIONAL REFERENCE POINT VIEWS

REFERENCE POINT LOCATIONS



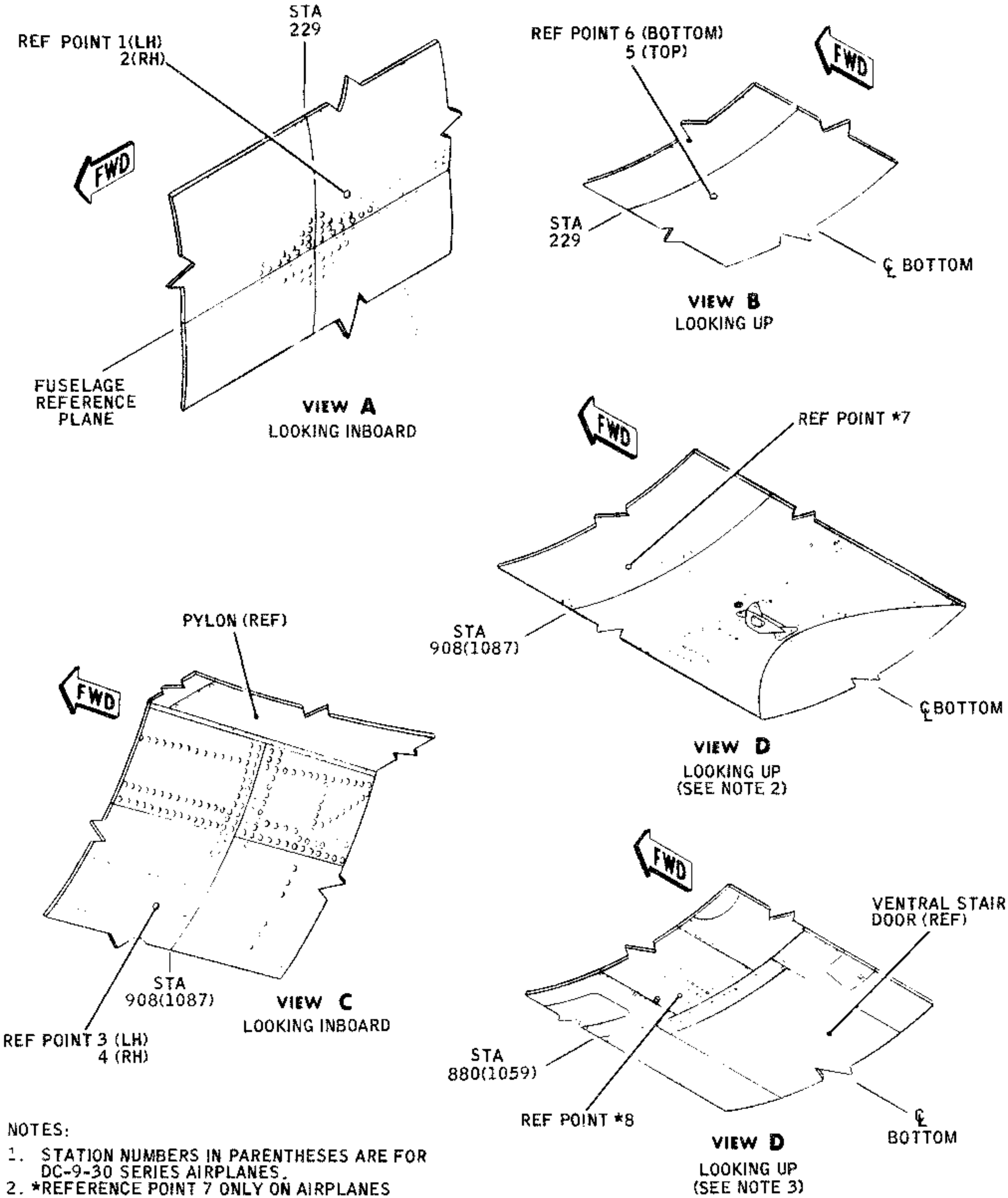
REFERENCE POINT LOCATION (PLAN VIEW)

DC -9-10 SERIES AIRPLANES								
REF POINT	1	2	3	4	5	6	*7	*8
X COORDINATE	—	—	—	—	-2.500	-2.500	-2.500	-2.500
Y COORDINATE	231.500	231.500	905.500	905.500	231.500	231.500	905.500	876.500
Z COORDINATE	+3.500	+3.500	0	0	—	—	—	—

DC-9-30 SERIES AIRPLANES								
REF POINT	1	2	3	4	5	6	*7	*8
X COORDINATE	—	—	—	—	-2.500	-2.500	-2.500	-2.500
Y COORDINATE	231.500	231.500	1084.500	1084.500	231.500	231.500	1084.500	1055.500
Z COORDINATE	+3.500	+3.500	0	0	—	—	—	—

BB3-417A

Fuselage Alignment Reference Points
Figure 5 (Sheet 1)

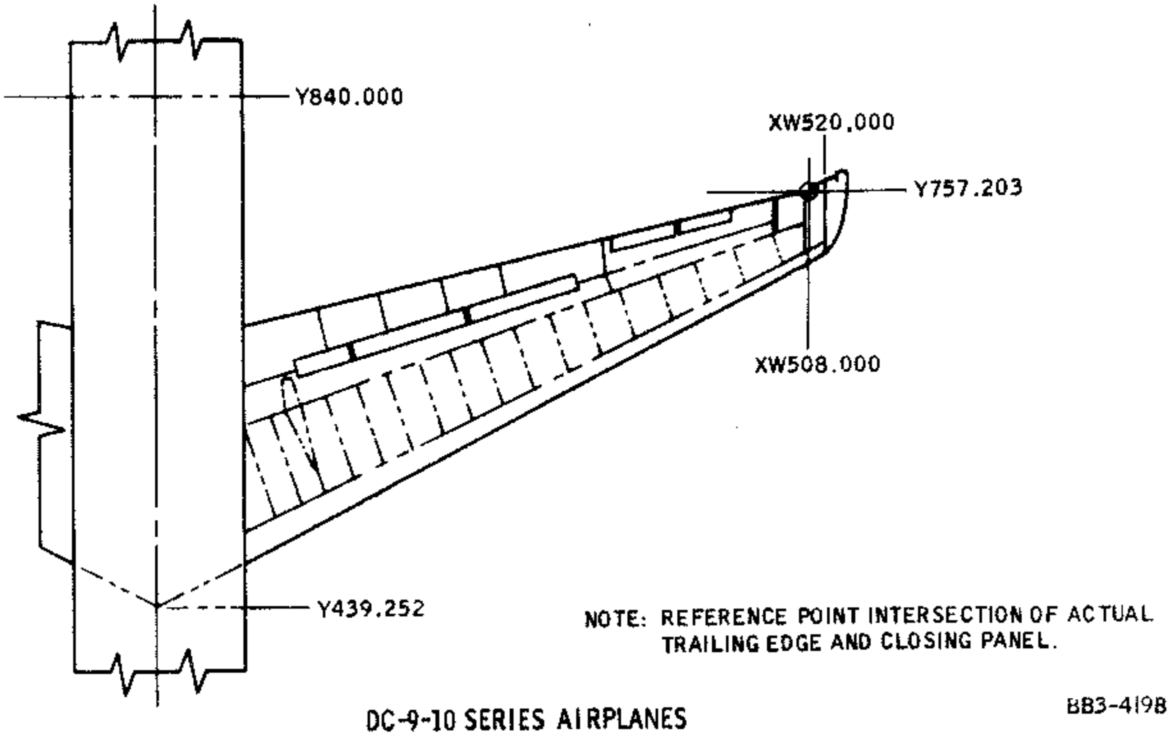


NOTES:

1. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
2. *REFERENCE POINT 7 ONLY ON AIRPLANES WITHOUT AFT PASSENGER ENTRANCE.
3. *REFERENCE POINT 8 ONLY ON AIRPLANES WITH AFT PASSENGER ENTRANCE.
4. ROUNDHEAD RIVETS ARE INSTALLED TO IDENTIFY REFERENCE POINTS.

BB3-955

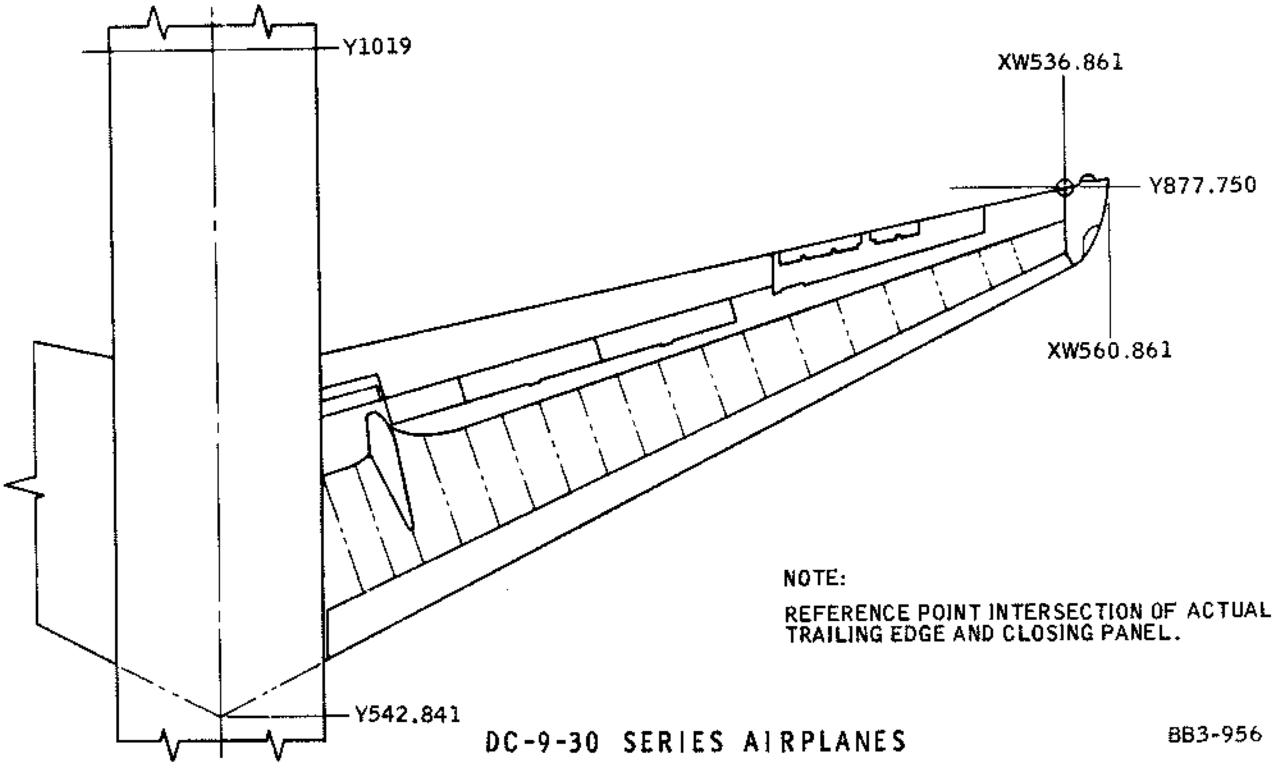
Fuselage Alignment Reference Points
Figure 5 (Sheet 2)



NOTE: REFERENCE POINT INTERSECTION OF ACTUAL TRAILING EDGE AND CLOSING PANEL.

DC-9-10 SERIES AIRPLANES

Wing Alignment Sweep Reference Point
Figure 6 (Sheet 1)



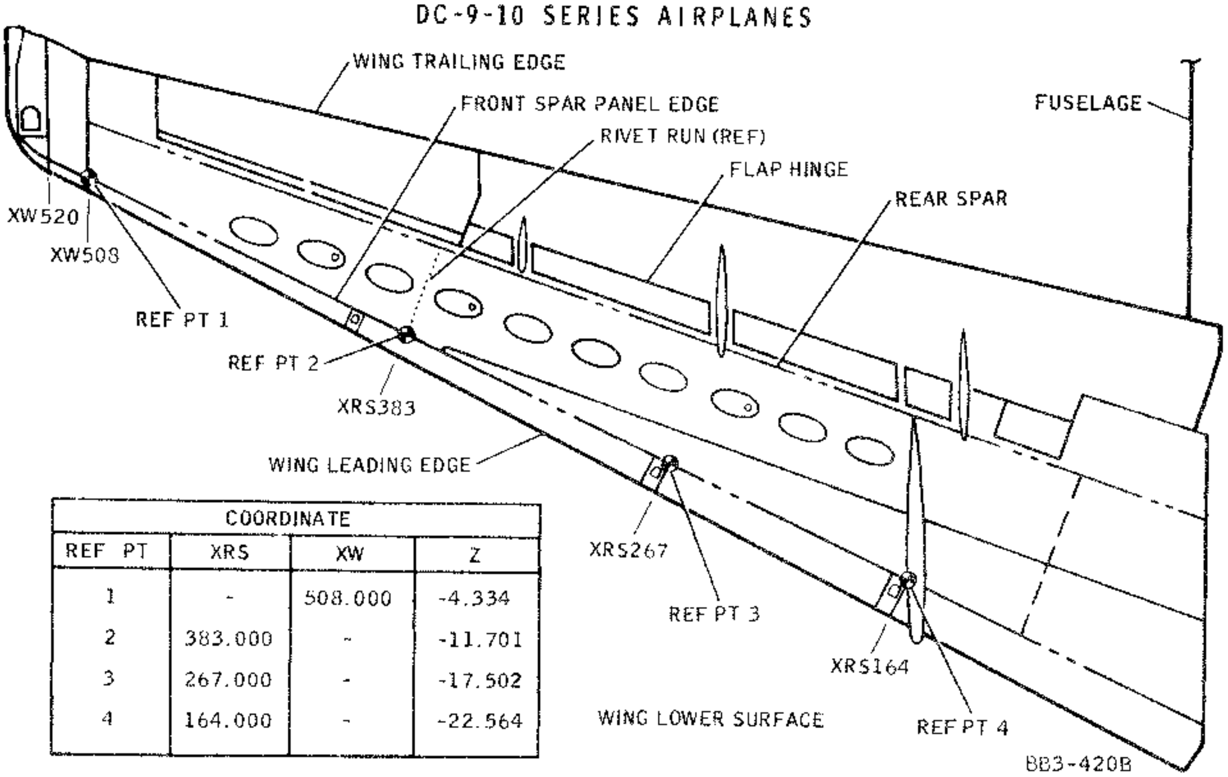
NOTE:

REFERENCE POINT INTERSECTION OF ACTUAL TRAILING EDGE AND CLOSING PANEL.

DC-9-30 SERIES AIRPLANES

Wing Alignment Sweep Reference Point
Figure 6 (Sheet 2)

DC-9-10 SERIES AIRPLANES



COORDINATE			
REF PT	XRS	XW	Z
1	-	508.000	-4.334
2	383.000	-	-11.701
3	267.000	-	-17.502
4	164.000	-	-22.564

Wing Lower Surface Alignment Reference Points
Figure 7 (Sheet 1)

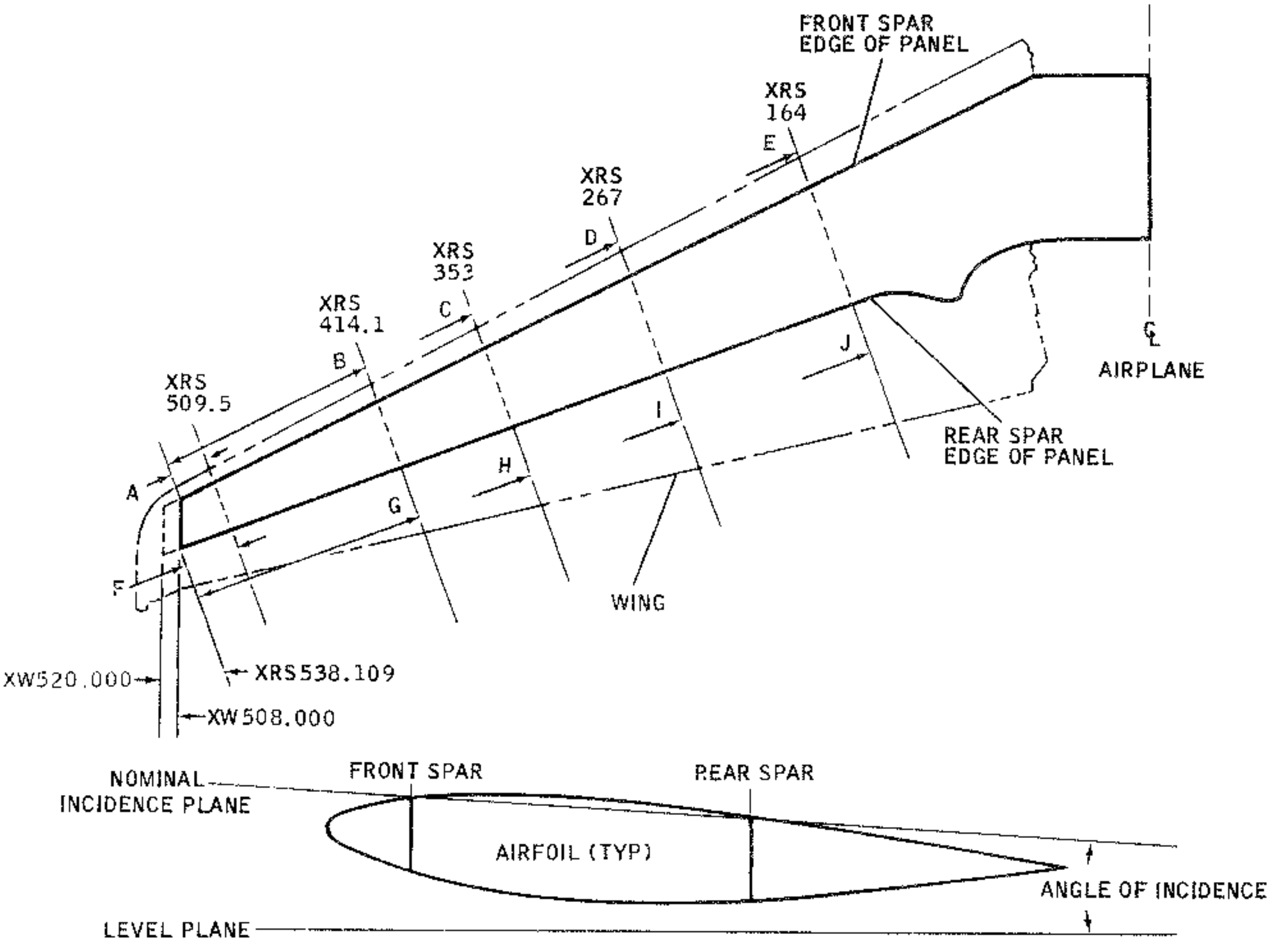
TO BE ADDED WHEN AVAILABLE

Wing Lower Surface Alignment Reference Points
Figure 7 (Sheet 2)

LOCATE STATIONS BY MEASURING INBOARD ON UPPER SURFACE FROM STATION XW508 ALONG PANEL EDGE

FRONT SPAR			REAR SPAR		
POINT	STATION	DIST FROM XW508	POINT	STATION	DIST FROM XW508
A	XRS509.5	1 FT 9 IN.	F	XRS509.5	2 FT 4 IN.
B	XRS414.1	9 FT 9-1/32 IN.	G	XRS414.1	10 FT 4 IN.
C	XRS353	14 FT 10-9/16 IN.	H	XRS353	15 FT 5-7/64 IN.
D	XRS267	22 FT 1-9/64 IN.	I	XRS267	22 FT 7-7/64 IN.
E	XRS164	30 FT 8-3/4 IN.	J	XRS164	31 FT 2-7/64 IN.

NOTE: XRS STATIONS ARE AT RIGHT ANGLES TO REAR SPAR



POINT	STATION	NOMINAL INCIDENCE
A-F	XRS509.5	0° 33' 36"
B-G	XRS414.1	0° 25' 57"
C-H	XRS353	0° 48' 24"
D-I	XRS267	1° 10' 02"
E-J	XRS164	1° 27' 18"

NOTE: THE DIFFERENCE BETWEEN ACTUAL AND NOMINAL INCIDENCE SHOULD NOT EXCEED 30 MINUTES AT XRS509.5 AND 15 MINUTES AT XRS 267

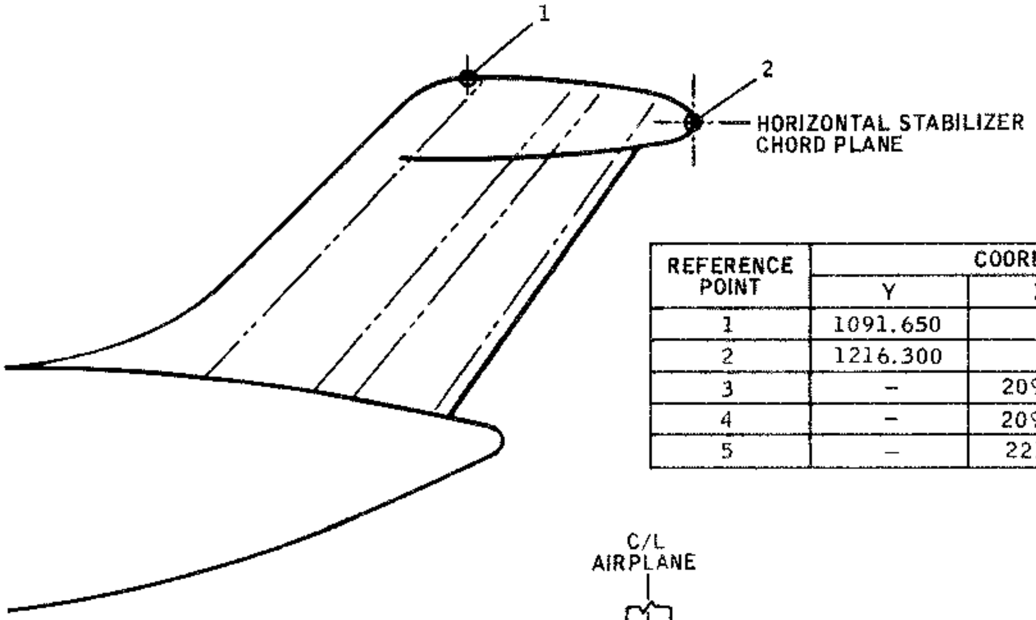
DC-9-10 SERIES AIRPLANES

BB3-421B

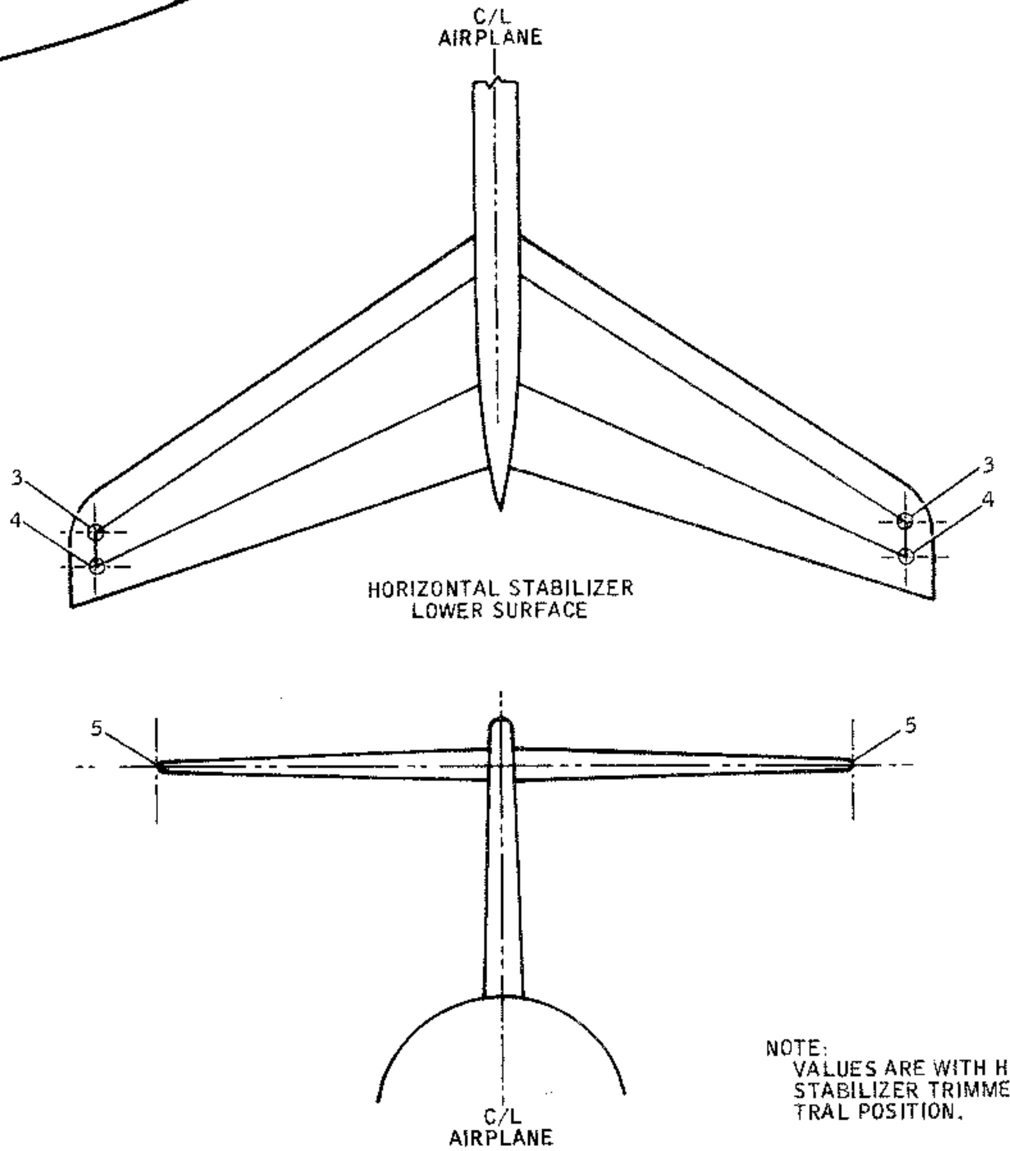
Checking Wing Angle of Incidence
Figure 8 (Sheet 1)

TO BE ADDED WHEN AVAILABLE

Checking Wing Angle of Incidence
Figure 8 (Sheet 2)



REFERENCE POINT	COORDINATES		
	Y	XH	Z
1	1091.650	-	242.750
2	1216.300	-	221.000
3	-	209.125	218.935
4	-	209.125	219.225
5	-	221.100	221.000

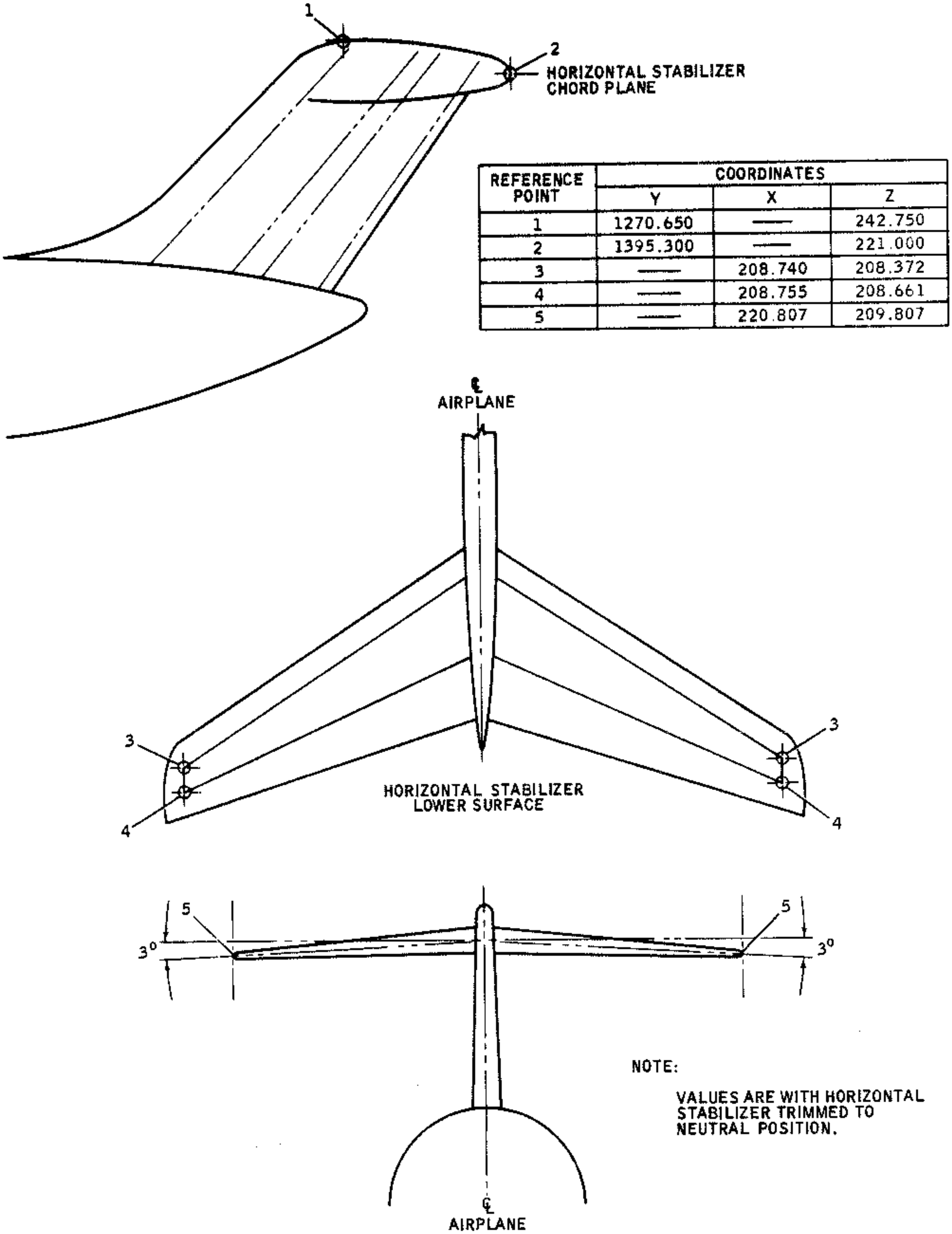


NOTE:
VALUES ARE WITH HORIZONTAL STABILIZER TRIMMED TO NEUTRAL POSITION.

DC-9-10 SERIES AIRPLANES

BB3-429A

Horizontal and Vertical Stabilizer Alignment
Reference Points
Figure 9 (Sheet 1)



REFERENCE POINT	COORDINATES		
	Y	X	Z
1	1270.650	——	242.750
2	1395.300	——	221.000
3	——	208.740	208.372
4	——	208.755	208.661
5	——	220.807	209.807

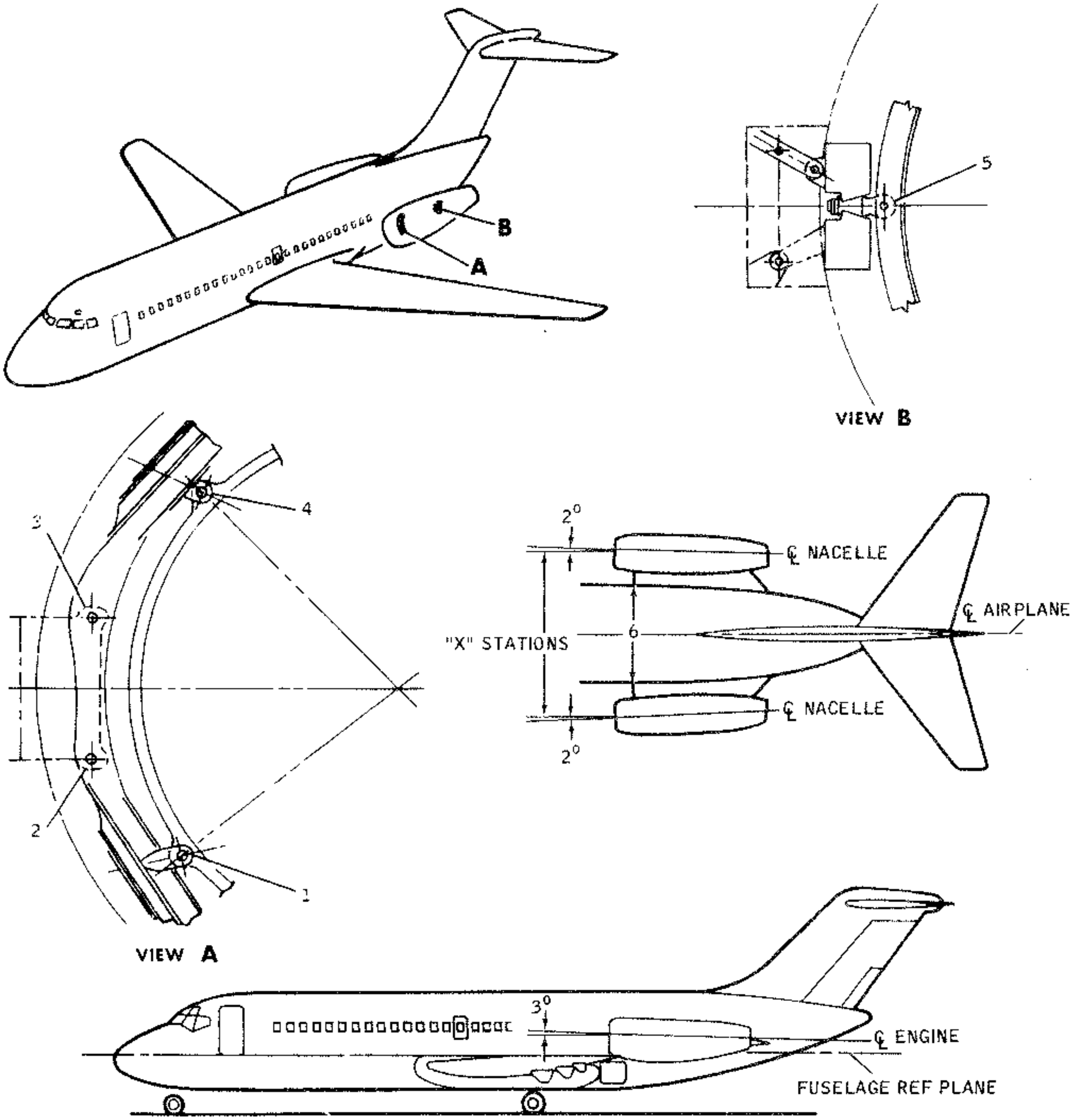
NOTE:

VALUES ARE WITH HORIZONTAL STABILIZER TRIMMED TO NEUTRAL POSITION.

DC-9-30 SERIES AIRPLANES

BB3-957

Horizontal and Vertical Stabilizer Alignment
Reference Points
Figure 9 (Sheet 2)



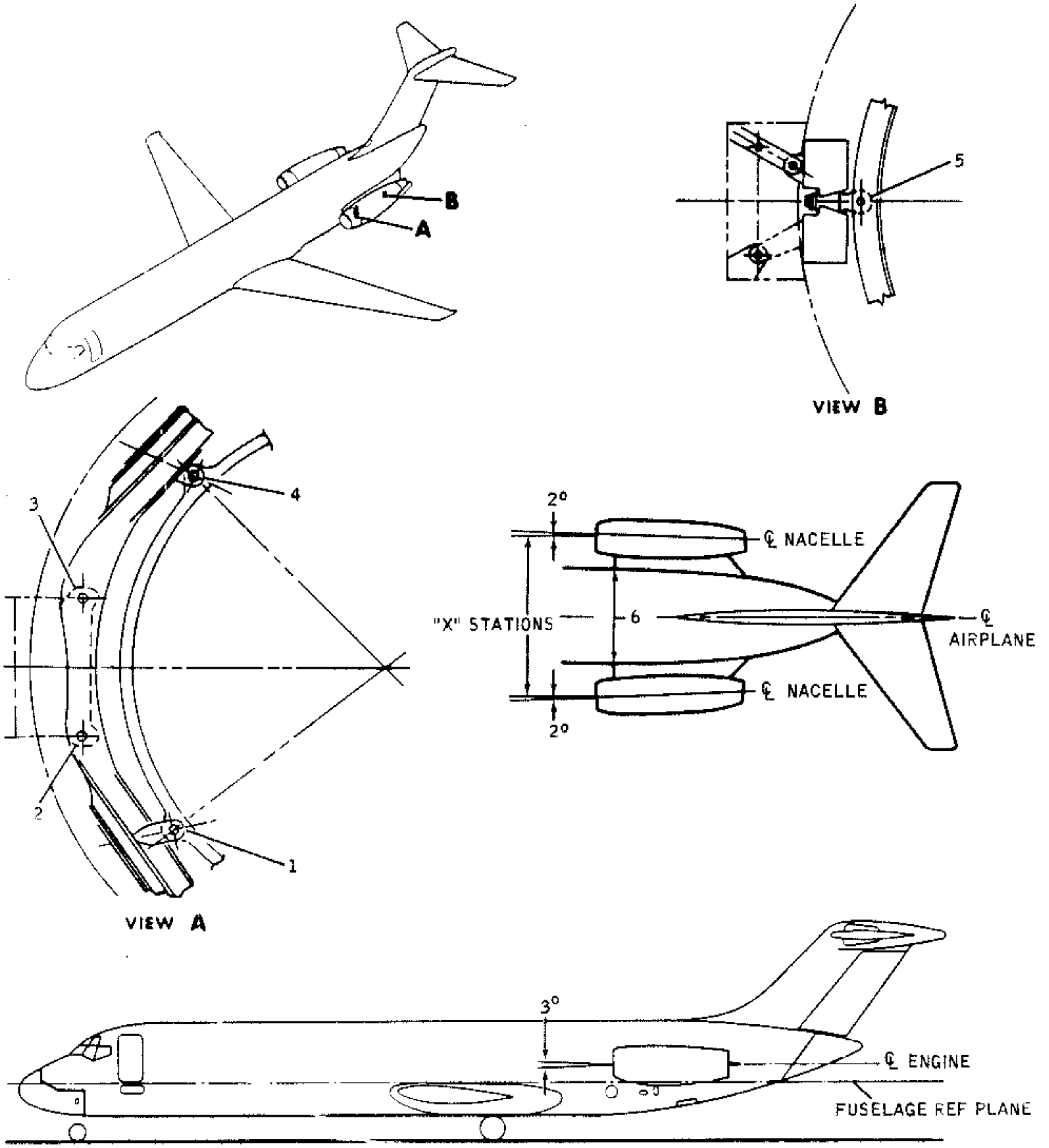
REFERENCE POINTS	COORDINATES		
	X	Y	Z
1	90.6427	*785.7812	13.3707
2	84.0762	*785.9214	20.427
3	84.2981	*786.467	30.688
4	92.3667	*787.2187	39.6484
5	82.4278	*860.1555	21.6646
6		756.0	

* "Y" COORDINATE TO ℄ OF MOUNT

DC-9-10 SERIES AIRPLANES

BB3-426A

Nacelles/Pylons Alignment Reference Points
Figure 10 (Sheet 1)



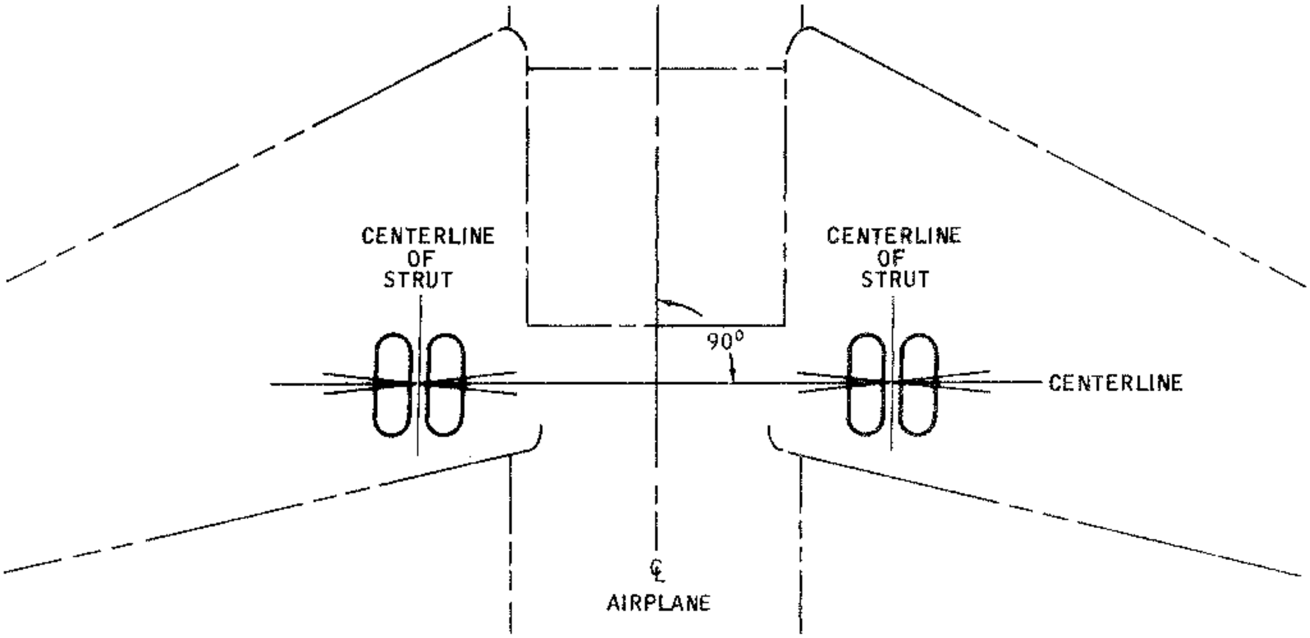
REFERENCE POINTS	COORDINATES		
	X	Y	Z
1	90.6427	★964.7812	13.3707
2	84.0762	★964.9214	20.427
3	84.2981	★965.467	30.688
4	92.3667	★966.2187	39.6484
5	82.4278	★1039.1555	21.6646
6		935.0	

★ "Y" COORDINATE TO ℄ OF MOUNT

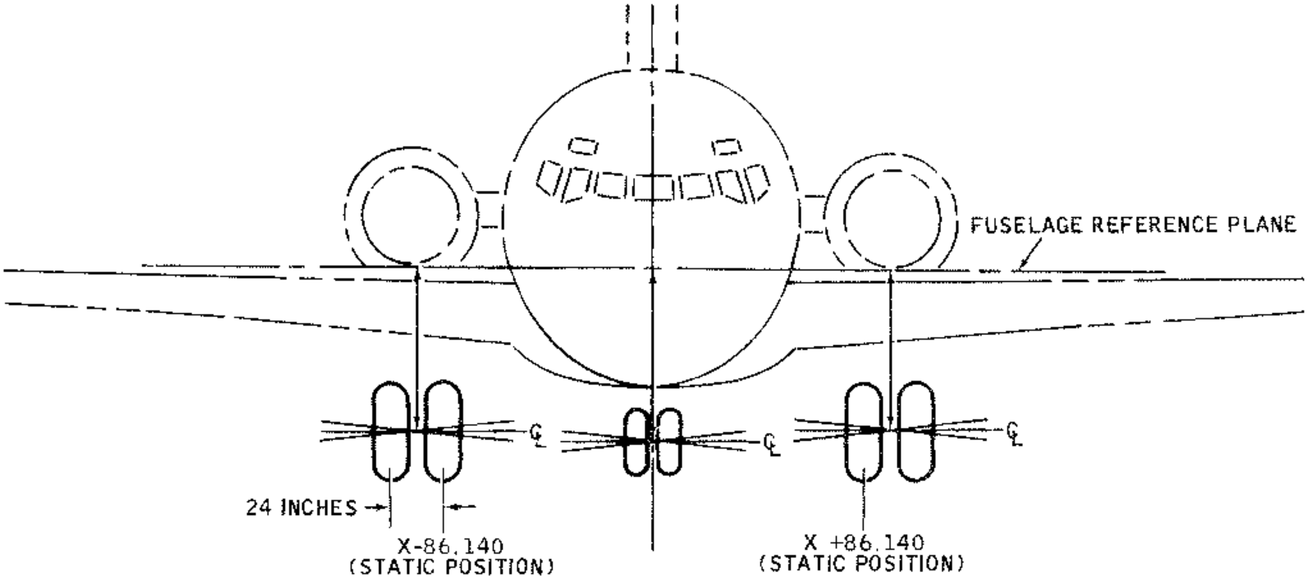
DC-9-30 SERIES AIRPLANES

BB3-958

Nacelles/Pylons Alignment Reference Points
Figure 10 (Sheet 2)



MAIN LANDING GEAR CENTERLINE SHOULD BE AT RIGHT ANGLES TO CENTERLINE OF AIRPLANE



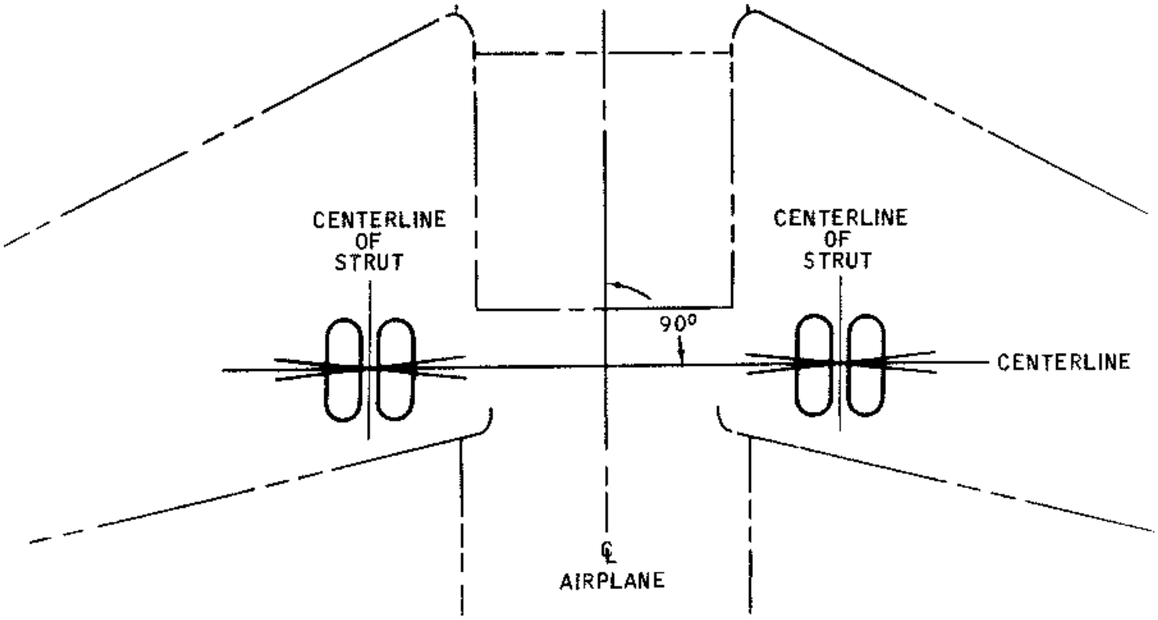
MAIN AND NOSE LANDING GEAR CENTERLINE SHOULD BE PARALLEL TO FUSELAGE REFERENCE PLANE

DC-9-10 SERIES AIRPLANES

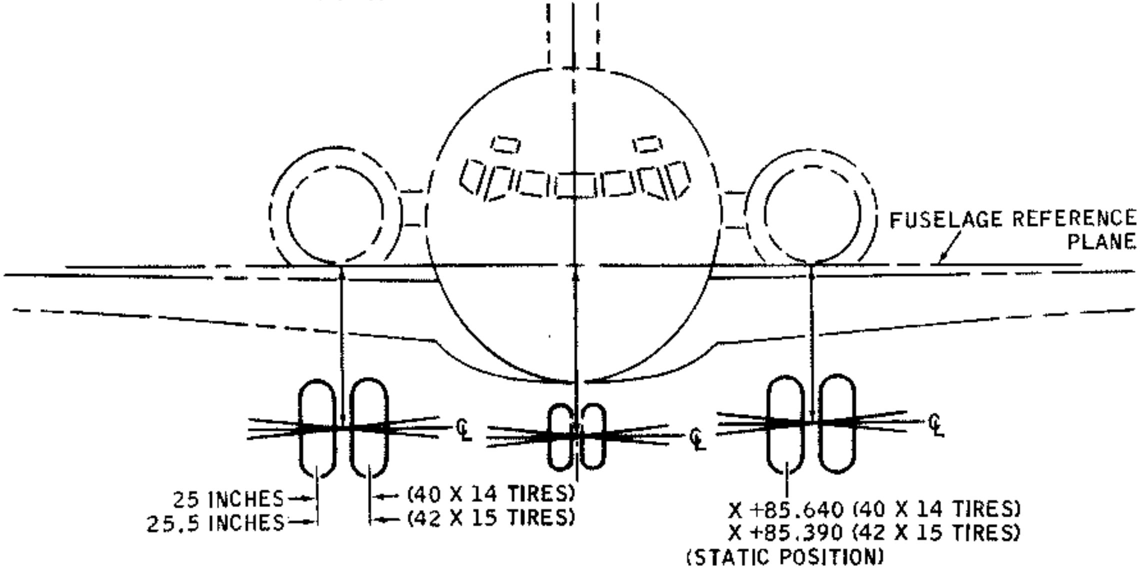
REFERENCE	CONDITION	COORDINATES		
MAIN GEAR	COMPRESSED	Z - 68.556	Y621.897	X98.058
	STATIC	Z - 69.553	Y621.967	X98.099
	EXTENDED	Z - 85.500	Y623.082	X98.752
NOSE GEAR	COMPRESSED	Z - 72.300	Y98.209	X0.000
	STATIC	Z - 73.800	Y97.998	X0.000
	EXTENDED	Z - 87.300	Y96.101	X0.000

883-427B

Main and Nose Landing Gear Alignment Reference Points
Figure 11 (Sheet 1)



MAIN LANDING GEAR CENTERLINE SHOULD BE AT RIGHT ANGLES TO CENTERLINE OF AIRPLANE



MAIN AND NOSE LANDING GEAR CENTERLINE SHOULD BE PARALLEL TO FUSELAGE REFERENCE PLANE

DC -9 -30 SERIES AIRPLANES

REFERENCE	CONDITION	COORDINATES		
MAIN GEAR	COMPRESSED	Z - 68.681	Y735.906	X98.063
	STATIC	Z - 69.678	Y735.976	X98.104
	EXTENDED	Z - 85.500	Y737.082	X98.752
NOSE GEAR	COMPRESSED	Z - 72.300	Y98.209	X0.000
	STATIC	Z - 73.800	Y97.998	X0.000
	EXTENDED	Z - 87.300	Y96.101	X0.000

BB3-959

Main and Nose Landing Gear Alignment Reference Points
Figure 11 (Sheet 2)

AERODYNAMIC CLEANNESS (DC-9-ALL)

1. Importance of Aerodynamic Cleanness

A. The DC-9 is designed to meet the demand for an intermediate transport airplane having increased speed with medium range and short field capabilities, improved safety, and economy of operation. To realize these performance capabilities, advantage is taken of the latest manufacturing techniques and aerodynamic design information to attain a smooth, streamlined airplane surface.

B. The aerodynamic cleanness level (or degree of surface smoothness) of the DC-9 follows in the progression of levels achieved by the Douglas-built family of transport airplanes. The resulting high level of aerodynamic cleanness, which approaches the ultimate level attainable, contributes greatly to the performance capabilities of the DC-9. Hence, it is increasingly important that this high cleanness level be maintained.

2. Aerodynamic Cleanness Surface Region Classification

A. Due to local flow conditions, there are regions on the airplane surface where a given type of distortion will more adversely affect airplane performance than others. These regions are classified under three categories in descending order of importance (see Figure 1). This illustration may serve as a guide as to the relative degree of workmanship that is necessary (as well as to the promptness in beginning corrective measures) to maintain the aerodynamic surface of the airplane. For example, patching a hole on the leading edge of the wing will require painstaking workmanship to restore the surface to its original contour and faired condition, since the work is to be accomplished in a Class I region. However, repairing the same hole near Fuselage Station 1100, which is a Class III region, does not require the degree of smoothness as does the Class I region.

NOTE: Control surfaces are not included in Figure 1, as aerodynamic cleanness is created by other important factors such as rigging. These tolerances are covered in the DC-9 Maintenance Manual. However, mismatch limits of the control surfaces are included in this section.

B. Boundary Locations for Aerodynamic Cleanness

(1) Class I Areas

(a) Fuselage - nose to Station 250

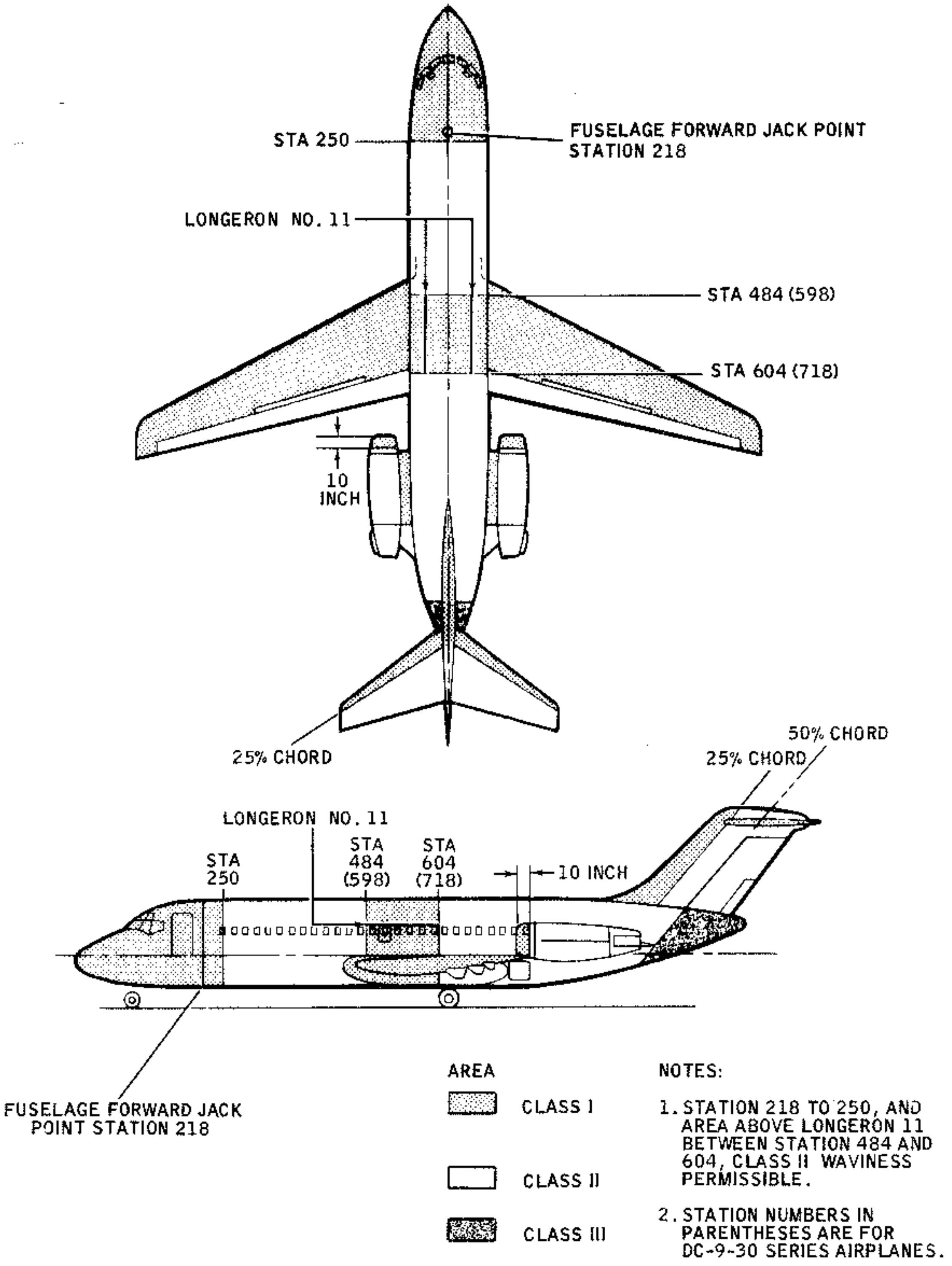
NOTE: Station 218 to 250, Class II waviness is permissible.

(b) Fuselage - Station 484 to 604 (above wing), (DC-9-10);
Fuselage -- Station 598 to 718 (above wing), (DC-9-30).

NOTE: Class II waviness is permissible for fuselage area above longeron 11.

(c) Wing - top and bottom, leading edge to spoilers, flaps and ailerons

CLASSIFICATION OF AREAS ACCORDING TO AERODYNAMIC CLEANNESS CONSIDERATIONS (CONTROL SURFACES EXCLUDED)



NOTES:

1. STATION 218 TO 250, AND AREA ABOVE LONGERON 11 BETWEEN STATION 484 AND 604, CLASS II WAVINESS PERMISSIBLE.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

BB3-331B

Aerodynamic Cleanness Diagram
Figure 1

(d) Vertical stabilizer - leading edge to 25 percent chord, including entire dorsal.

(e) Horizontal stabilizer - top and bottom, leading edge to 25 percent chord.

(f) Nose cowl - forward 10 inches.

(g) Pylon - top and bottom, leading edge to 10 inches aft of pylon rear spar, level with aft edge of cowl door.

(2) Class II Areas

(a) Fuselage - Station 250 to 484, DC-9-10; series; fuselage - Station 250 to 598, DC-9-30.

(b) Fuselage - Station 604 to vertical stabilizer rear spar, DC-9-10; fuselage - Station 718 to vertical stabilizer rear spar DC-9-30.

(c) Vertical stabilizer - aft of 25 percent chord.

(d) Horizontal stabilizer - top and bottom, aft of 25 percent chord.

(e) Cowl - aft of 10 inches from leading edge of nose cowl.

(f) Pylon - 10 inches aft of pylon rear spar (level with aft edge of cowl door) to trailing edge.

(3) Class III Areas

(a) Fuselage - aft of vertical stabilizer rear spar.

3. Types of Maintenance Items Affecting Aerodynamic Cleanness

A. In general, any distortion of the aerodynamic surface in excess of that on the originally manufactured airplane may be considered to be aerodynamically unclean. However, a certain degree of degradation of cleanness level is expected in normal service. This need not result in excessive airplane performance penalties, if the distortion is recognized and repairs are promptly effected. Some of the more pertinent types of distortion involved are as follows:

(1) Contour and waviness distortions of the aerodynamic surface may be caused in the normal course of airplane operation, or by improper handling in maintenance. Highly curved surfaces such as the engine intake lip and inlet ducting are regions where airplane performance may be considerably affected by such distortions. Also, removable doors and access panels are susceptible to waviness, due to rough handling. Care should be exercised in the handling of these items

(2) Distortions due to mismatching of adjacent edges may occur. These arise mainly from improper installation. Items such as access doors,

removable panels, surface patches, and repaced or modified structure should be inspected to make certain that the adjacent edges are closely matched. When edges cannot be matched satisfactorily, the exposed edges may be slightly rounded by filing.

(3) Proper installation of external screws and rivets, including the requirements for milling flush, and methods for countersinking and dimpling are described in 51-10-4. Proper seating and installation of rivets and bolts will further add to good surface smoothness. See 51-30-1 and 51-30-2 for information concerning installation of bolts and screws.

(4) Aerodynamic seals, such as used in control surface gaps, increase airplane performance quality by preventing leakage of the airstream through the gaps. It is not likely that the cost of maintaining such seals outweigh the airplane performance losses due to the removal of these seals. See 51-20-0 for information concerning aerodynamic surface sealing and weather sealing.

4. Other Items Affecting Aerodynamic Cleanness and Performance

A. Airflow leakage on the airplane has been kept to a minimum to obtain increased airplane performance. Any additional holes or removal of sealant during maintenance, unnecessarily degrades the airplane cleanness level, and thereby reduces airplane performance capability.

B. Drain holes and dams may vary, depending on the configuration of the airplane, and may be subject to change as a result of structural and system revisions; this section does not attempt to indicate the location of each of the drain holes and dams.

CAUTION: USE EXTREME CARE TO PREVENT THE INADVERTENT BLOCKING OF DRAIN HOLES AND THE UNSEALING OF DAMS, OR THE CREATION OF UNAUTHORIZED DRAIN HOLES OR DAMS. IT IS HIGHLY IMPORTANT THAT THESE HOLES REMAIN OPEN AND THE DAMS REMAIN INTACT TO ALLOW FOR PROPER DRAINAGE OF WATER CONDENSATION AND POSSIBLE FUEL LEAKAGE, AND TO PREVENT THE FLOW OF FLUIDS INTO CERTAIN AREAS OF THE AIRPLANE.

C. The lightening holes and cutouts for conduits, cables, and other airplane system installations are designed to serve as airflow passages in many parts of the structure. Do not block these passages when making repairs.

5. Aerodynamic Cleanness Recommended Standards

A. General

(1) The following standards are recommended to aid in determining that the airplane aerodynamic cleanness is satisfactory, and to provide a guide for optimum quality when repairs are made to areas which could affect aerodynamic cleanness.

(2) The correct method for checking the DC-9 external surfaces for contour, waviness, and mismatch is shown by illustration and description.

(3) Curved surfaces may be checked by use of a batten simulating the normal contour of the area being inspected. Flat surfaces may be checked with a precision straight edge not less than 3 feet in length, unless other methods of checking are specified.

(4) Checks may be made using a Starrett precision taper gage No. 270, or equivalent, at the maximum gap point between surface and batten, straight edge or string, and unless otherwise noted should be made in two directions. That is, fuselage and cowls should be checked circularly and longitudinally. Wings, stabilizers, flaps, and control surfaces should be checked chordwise and spanwise.

(5) Flush rivet heads should be fair within the following tolerances:

Area	Structure Except Engine Cowl	Engine Cowl
Class I	Flush to +0.002 inch	Flush to +0.002 inch -0.002 inch
Class II	Flush to +0.003 inch	Flush to +0.003 inch -0.003 inch Five percent allowance on single assembly Flush +0.003 to +0.005 inch
Class III	Flush to +0.004 inch	

B. Airplane (Except Nacelles/Pylons and Control Surfaces)

(1) Waviness

(a) Check waviness as shown in Figure 1A. Tolerances should not exceed the following:

Area	Tolerance Per Inch Between Wave Peaks	Maximum Tolerance
Class I	0.003 inch	0.064 inch
Class II	0.006 inch	0.090 inch
Class III	0.010 inch	0.128 inch

NOTE: When waviness measurements are taken across plating laps, add thickness of outer plate to maximum tolerance (see Figure 1A).

(2) Mismatch

(a) Butt Joint

1) Riveted or bolted butt joints should be fair within the following tolerances, plus difference of plate thickness (one gage maximum).

Area	Tolerance
Class I	0.015 inch
Class II	0.025 inch
Class III	0.032 inch

(b) Major Doors (Passenger Entrance, Service, Cargo, etc.). (Pressurized Condition.)

1) Major doors should be fair to surrounding plating within the tolerances listed in the figure for each individual door.

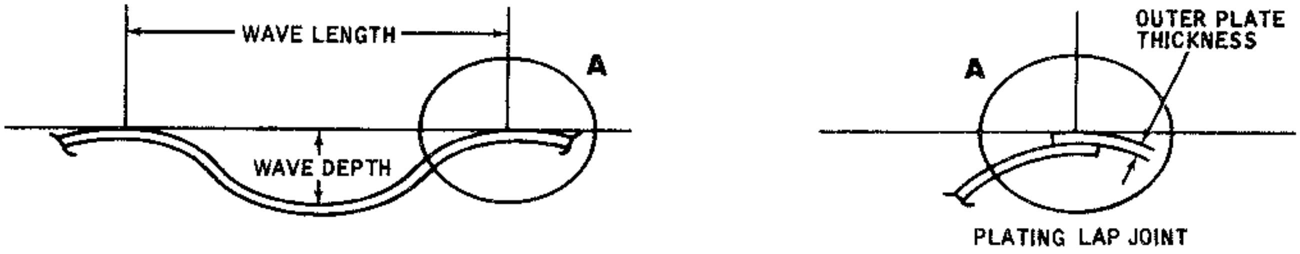
2) Inspection locations, and tolerances for the following doors are contained in the referenced figures:

Passenger Forward Entrance Door	Figure 1C
Passenger Forward Entrance Stairwell Door	Figure 1D
Electrical/Electronics Compartment Door	Figure 1E
Forward Service Door	Figure 1F
Overwing Emergency Exit Doors	Figure 1G
Forward Lower Cargo Compartment Door	Figure 1H
Aft Lower Cargo Compartment Door	Figure 1J

(c) Main and Nose Gear Doors (See Figure 1B).

1) Main and nose gear doors should be fair to surrounding plating within the following tolerances:

	Average	Maximum
All Main and Nose Gear Door Edges	±0.050 inch	±0.075 inch



SAMPLE PROBLEM:

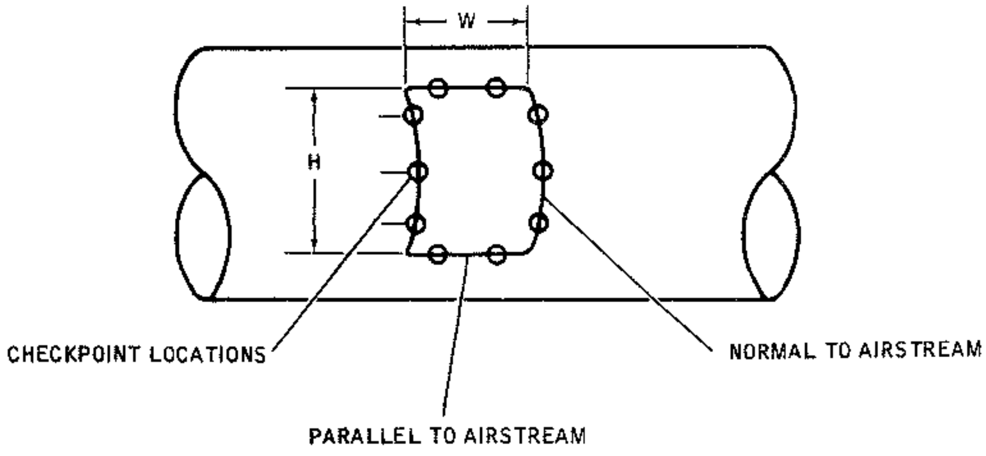
1. AREA	CLASS I
2. MEASURED WAVE LENGTH (PEAK TO PEAK)	20 INCHES
3. MEASURED WAVE DEPTH	0.050 INCH
4. TOLERANCE PER INCH FOR CLASS I AREA (FROM TABLE)	0.003 INCH
5. ALLOWABLE TOLERANCE (ITEM 2 X ITEM 4) 20 X 0.003 INCH	0.060 INCH

THEREFORE WAVE IS WITHIN TOLERANCE SINCE WAVE DEPTH 0.050 INCH (ITEM 3) IS WITHIN ALLOWABLE TOLERANCE 0.060 INCH (ITEM 5) AND DOES NOT EXCEED MAXIMUM TOLERANCE OF 0.064 INCH (DETERMINED IN TABLE).

NOTE: WHEN WAVINESS MEASUREMENTS ARE TAKEN ACROSS PLATING LAP JOINT, ADD THICKNESS OF OUTER PLATE TO ALLOWABLE TOLERANCE ALSO TO MAXIMUM TOLERANCE AS DETERMINED IN TABLE.

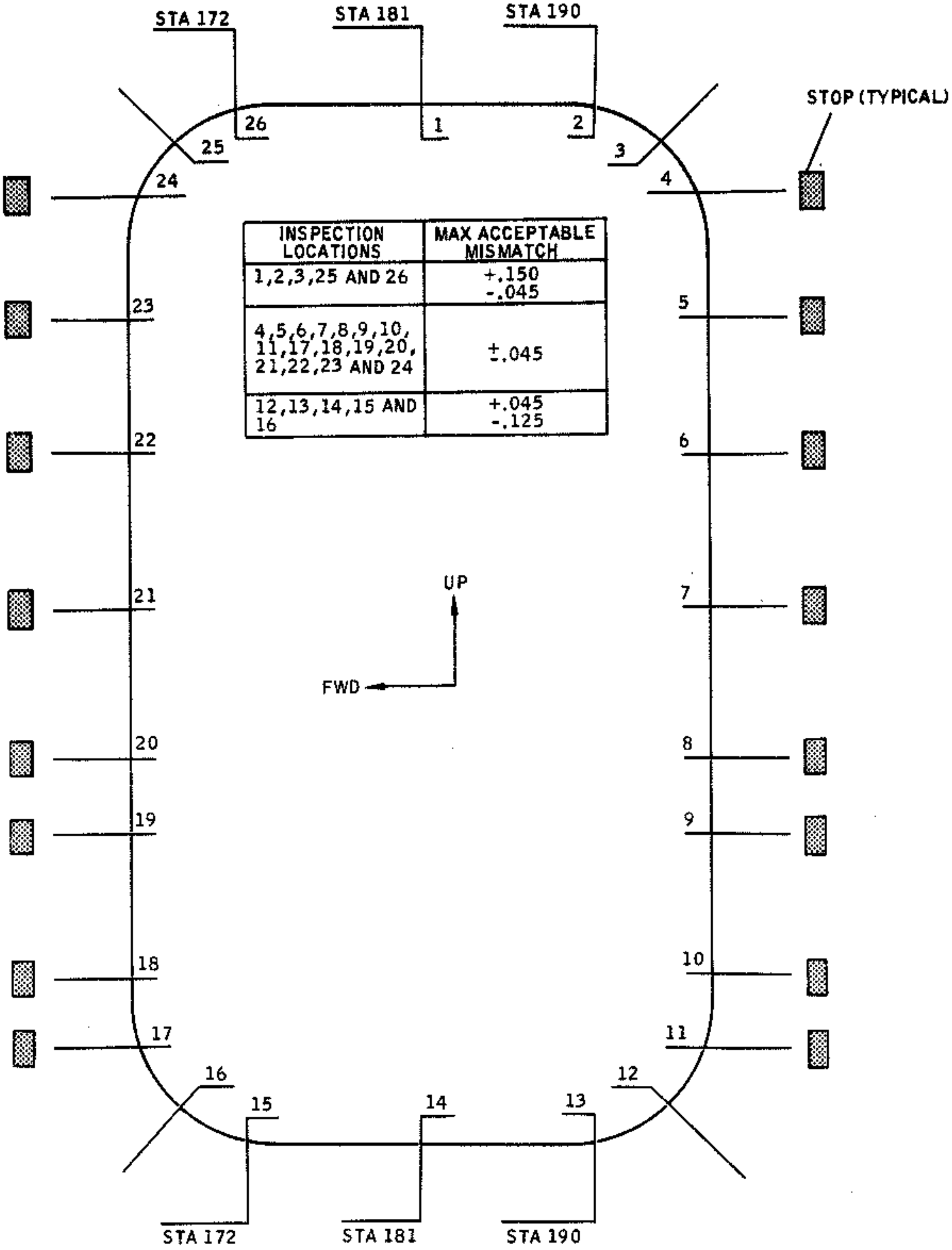
BB3-336

Determining Waviness
Figure 1A



BB3-337A

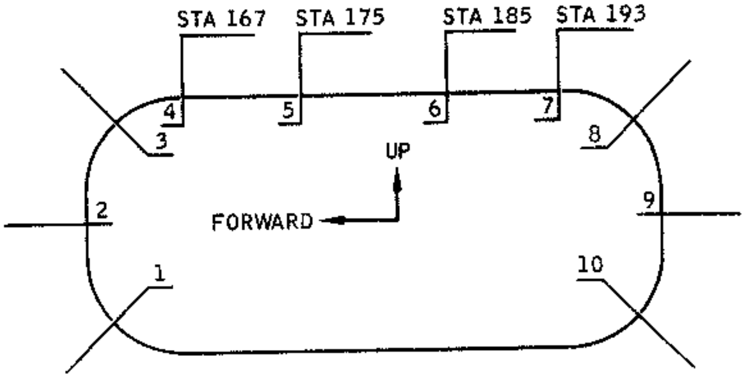
Determining Door Fairness
Figure 1B



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1,2,3,25 AND 26	+.150 -.045
4,5,6,7,8,9,10, 11,17,18,19,20, 21,22,23 AND 24	±.045
12,13,14,15 AND 16	+.045 -.125

BB3-925

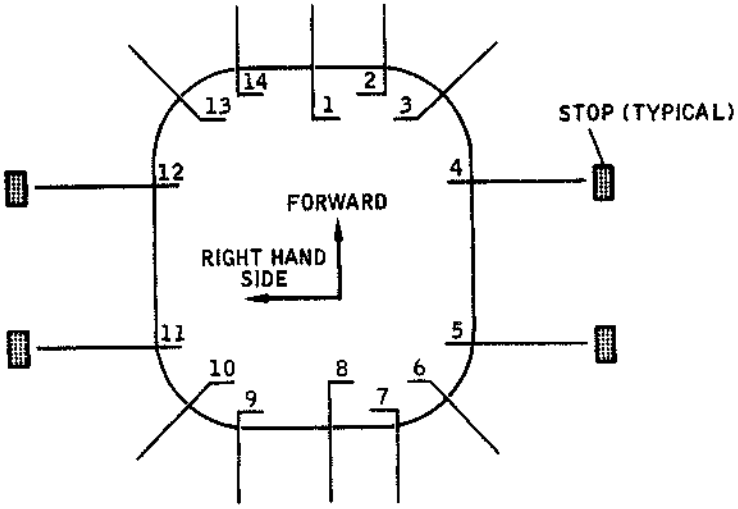
Determining Passenger Forward Entrance Door Fairness
Figure 1C



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1, 3, 4, 5, 6, 7, 8 AND 10	±.055
2 AND 9	±.060

BB3-926

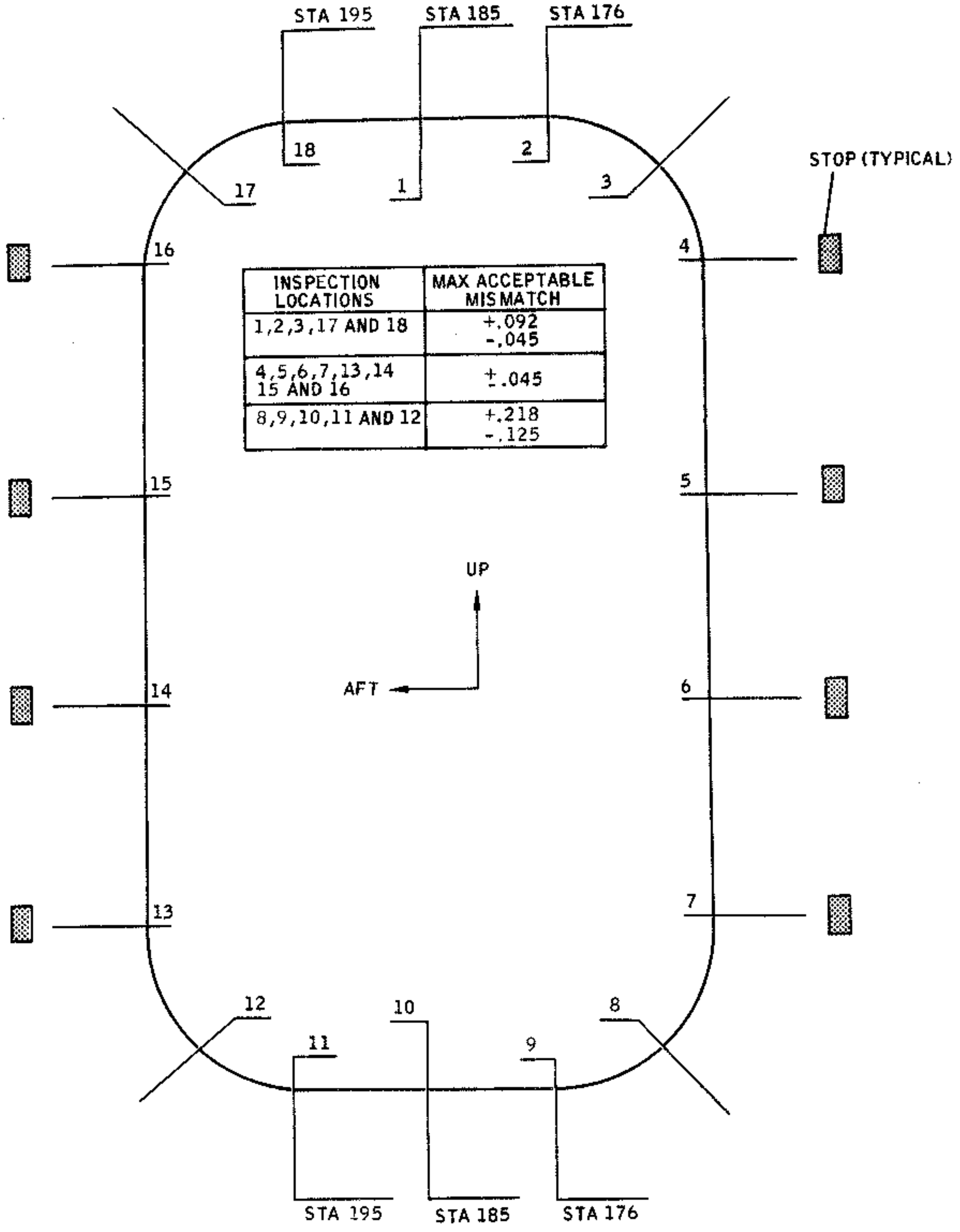
Determining Passenger Forward Entrance Stairway and Forward Stairwell Door Fairness
Figure 1D



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1, 2, 3, 6, 7, 8, 9, 10, 13, AND 14	± .055
4, 5, 11 AND 12	± .045

BB3-966

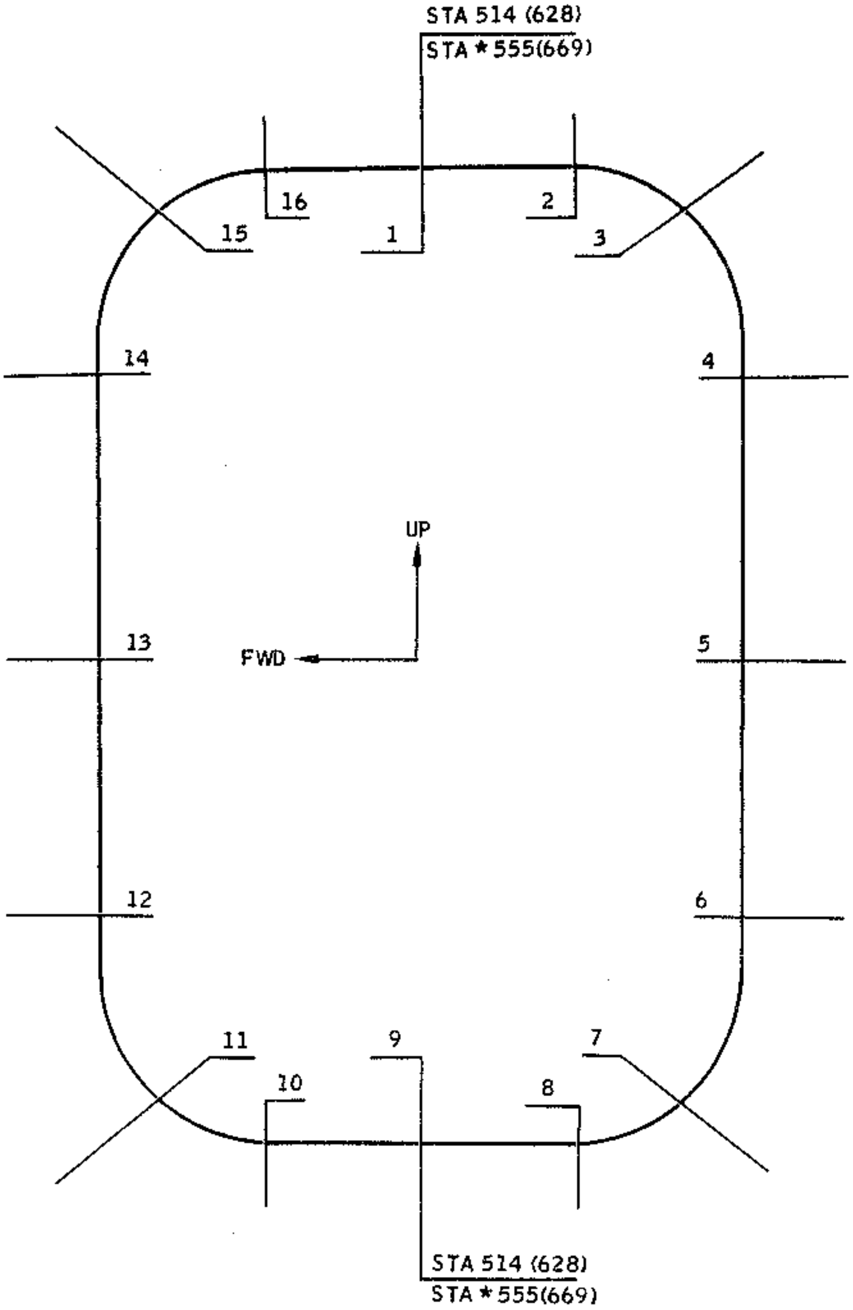
Determining Electrical/Electronics Compartment Door Fairness
Figure 1E



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1,2,3,17 AND 18	+.092 -.045
4,5,6,7,13,14 15 AND 16	±.045
8,9,10,11 AND 12	+.218 -.125

Determining Forward Service Door Fairness
Figure 1F

(LEFT DOOR SHOWN; RIGHT DOOR OPPOSITE)



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1,2,3,7,8,9,10, 11,15, AND 16	±.035
4,5,6,12, 13 AND 14	±.025

NOTES:

1. * EMERGENCY EXIT AT STATION Y555 NOT USED ON ALL DC-9-10 SERIES AIRPLANES
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES

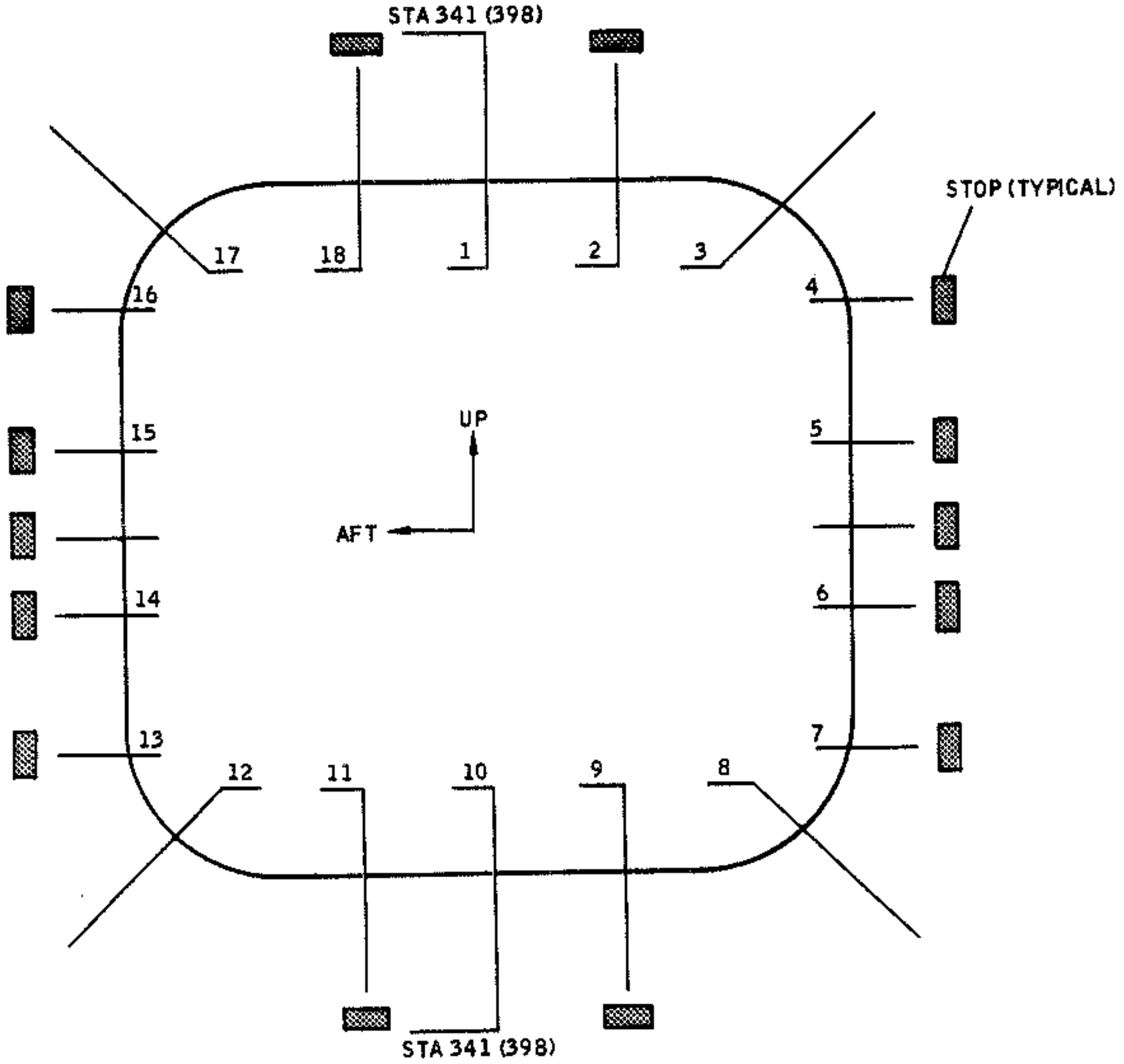
BB3-928

Determining Overwing Emergency Exit
Door Fairness
Figure 1G

INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1, 2, 3, 17 AND 18	±.090
4, 5, 6, 7, 13, 14 15, AND 16	±.055
8, 9, 10, 11 AND 12	+.090 -.312

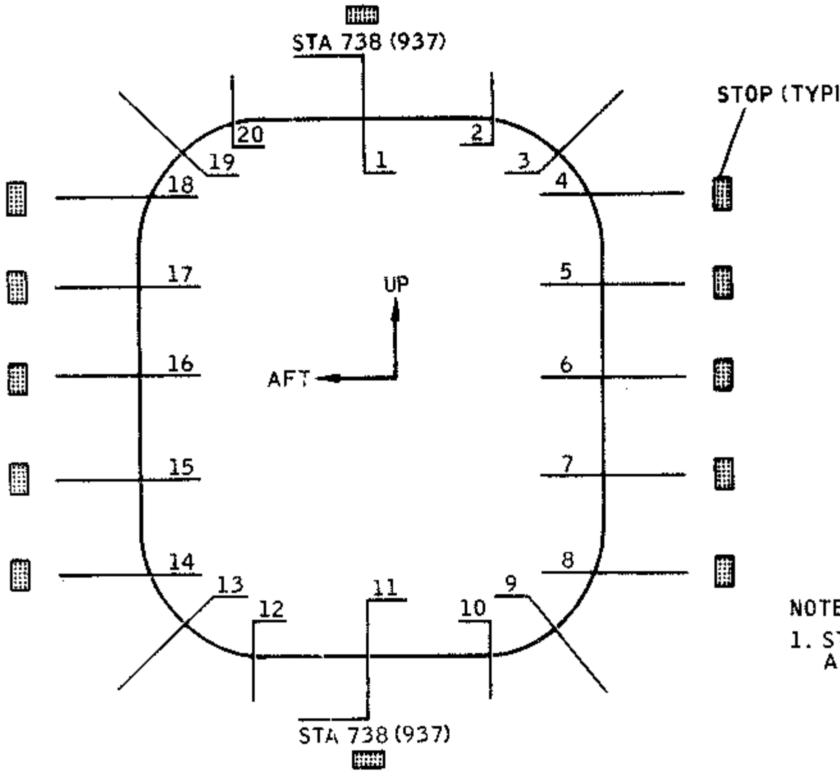
NOTE:

STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.



BB3-929

Determining Forward Lower Cargo
Compartment Door Fairness
Figure 1H



INSPECTION LOCATIONS	MAX ACCEPTABLE MISMATCH
1,2,3,19 AND 20	±.090
4,5,6,7,8,14,15,16,17 AND 18	±.055
10,11, AND 12	+.020 -.170
9 AND 13	+.045 -.170

NOTE:

1. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

BB3-930

Determining Aft Lower Cargo
Compartment Door Fairness
Figure 1J

(d) Access Doors and Inspection Plates

1) Access doors and inspection plates should be fair to surrounding plating within the following tolerances, plus difference of plate thickness (one gage maximum).

Area	Fuselage	Wing Fillets	Wing
Class I	±0.020 inch	±0.016 inch	±0.016 inch
Class II	±0.025 inch	±0.020 inch	-
Class III	±0.030 inch	-	-

(e) Radome

1) Radome when locked in position should be fair to the fuselage within a tolerance of ±0.045 inch (see Figure 2).

C. Nacelles/Pylons

(1) Waviness

(a) Nacelles/pylons plating waviness should not exceed the following tolerances:

Area	Deviation from Fairness
Class I	0.020 inch in 6 inches
Class II	0.040 inch in 6 inches

(2) Mismatch

(a) Butt Joint

1) Riveted, spotwelded, and bolted butt joints should be fair within the following tolerances:

Area	Pylon and Cowl Including Inlet Duct
Class I	±0.015 inch
Class II	±0.025 inch

(b) Air Inlet Duct to Engine Case Joint

1) Air inlet to engine case joint should be flush within ±0.032 inch, however, ±0.060 inch is acceptable locally but should not exceed five percent of circumference.

(c) Apron Leading and Trailing Edge Joints with Adjacent Plating

1) Apron leading and trailing edges should be fair with adjacent plating within a tolerance of ±0.032 inch average, with a maximum of ±0.062 inch.

(d) Cowl Doors, Access Doors, and Inspection Plates

1) Cowl doors, access doors, and inspection plates edges normal to airstream (see Figure 3) should be fair to adjacent plating within the following tolerances:

	Cowl Upper/Lower Doors		
Area	Leading Edge	Trailing Edge	Access Doors and Inspection Plates
Class I	-	-	±0.031 inch
Class II	±0.031 inch average ±0.062 inch maximum (maximum not to exceed 20 percent of periphery)	±0.062 inch	±0.062 inch

2) Cowl doors, access doors, and inspection plate edges parallel to airstream (see Figure 3) should be fair to adjacent plating within the following tolerances:

Area	Tolerance
Class I	0.031 inch
Class II	0.125 inch

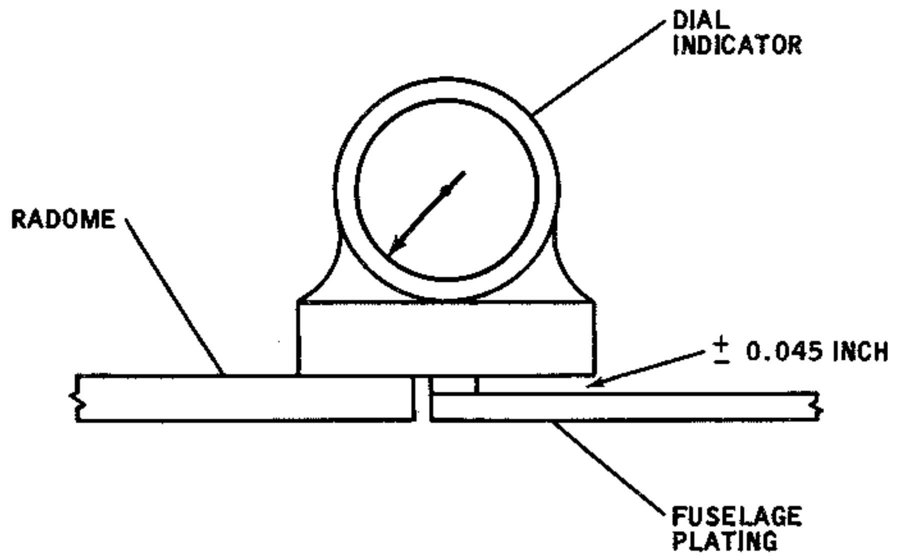
D. Control Surfaces

(1) Waviness

(a) Control Surfaces (Except Tabs)

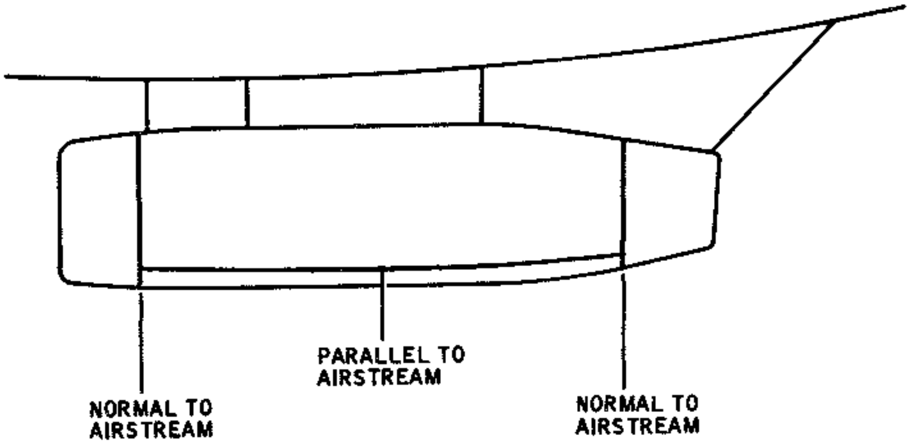
1) Check control surface waviness as shown in Figure 3A, and trailing edges as shown in Figure 3B. Waviness should be within the following tolerances:

	Tolerance per Inch Between Wave Peaks	Maximum Slope per Inch	Maximum Tolerance
Spanwise	0.003 inch	0.006 inch	0.064 inch
Chordwise	0.0026 inch	0.0052 inch	0.047 inch
Trailing Edge	0.0026 inch	0.0052 inch	0.126 inch (0.250 for Flaps)



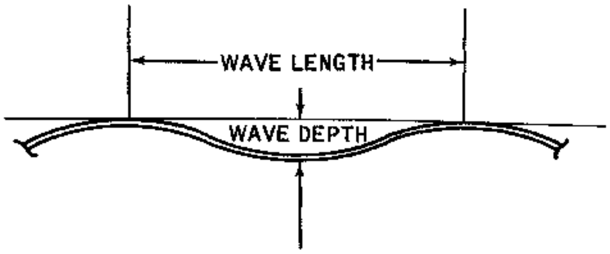
BB3-344

Checking Radome Mismatch
Figure 2



BB3-355

Access Door Edges
Figure 3



SAMPLE PROBLEM:

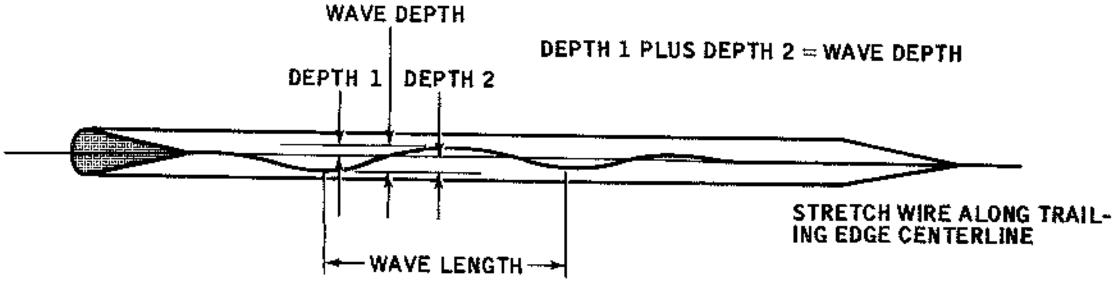
1. MEASURED WAVE LENGTH (PEAK TO PEAK)	20 INCHES
2. MEASURED WAVE DEPTH	0.050 INCH
3. TOLERANCE PER INCH (FROM TABLE)	0.003 INCH
4. ALLOWABLE TOLERANCE (ITEM 1 X ITEM 3) 20 X 0.003 INCH	0.060 INCH

THEREFORE WAVE IS WITHIN TOLERANCE SINCE WAVE DEPTH 0.050 INCH (ITEM 2) IS WITHIN ALLOWABLE TOLERANCE 0.060 INCH (ITEM 4) AND DOES NOT EXCEED MAXIMUM TOLERANCE OF 0.064 INCH (DETERMINED IN TABLE)

NOTE: USE FIVE INCH STRAIGHT EDGE FOR MEASURING SPANWISE BETWEEN RIBS OF AILERON

BB3-357

Determining Control Surface Waviness
Figure 3A



SAMPLE PROBLEM:

1. MEASURED WAVE LENGTH (PEAK TO PEAK)	40 INCHES
2. MEASURED WAVE DEPTH (DEPTH 1 PLUS DEPTH 2)	0.080 INCH
3. TOLERANCE PER INCH (FROM TABLE)	0.0026 INCH
4. ALLOWABLE TOLERANCE (ITEM 1 X ITEM 3) 40 X 0.0026 INCH	0.104 INCH

THEREFORE WAVE IS WITHIN TOLERANCE SINCE WAVE DEPTH 0.080 INCH (ITEM 2) IS WITHIN ALLOWABLE TOLERANCE 0.104 INCH (ITEM 4) AND DOES NOT EXCEED MAXIMUM TOLERANCE OF 0.126 INCH (DETERMINED IN TABLE)

BB3-358

Determining Control Surface Trailing Edge Waviness
Figure 3B

(b) Control Surface Tabs

1) Check control surface tabs as shown in Figure 6, waviness should be within the following tolerances:

	Tolerance per Inch Between Wave Peaks	Maximum Tolerance
Spanwise	0.003 inch	0.032 inch
Chordwise	0.0026 inch	0.032 inch

(2) Mismatch

(a) Aileron

1) Aileron may be checked for mismatch with wing as shown in Figure 4. Either method may be used, and fairness should be within the tolerances shown.

(b) Spoiler

1) Check spoiler for mismatch with wing as shown in Figure 5. Fairness should be within the tolerances shown.

(c) Flap

1) Check flap for mismatch with wing as shown in Figure 6. Fairness should be within the tolerances shown.

2) Check flap for mismatch with fillet fairing as shown in Figure 7. Fairness should be within the tolerances shown.

(d) Elevator

1) With elevator set in neutral position, check for mismatch with horizontal stabilizer as shown in Figure 8. Fairness should be within the tolerances shown.

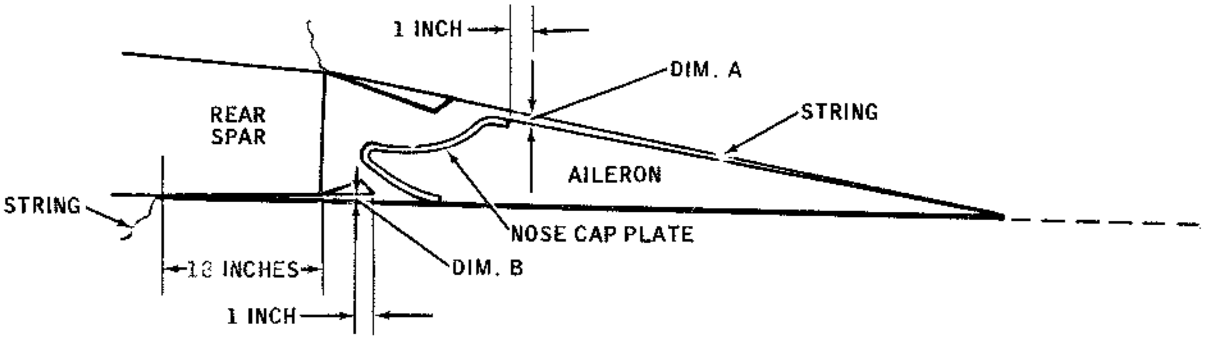
(e) Rudder

1) With rudder set in neutral position, check for mismatch with vertical stabilizer as shown in Figure 9. Fairness should be within the tolerances shown.

EXAMPLE I

WITH LOWER EDGE OF AILERON ALIGNED AS SHOWN, DIMENSIONS SHOULD BE AS FOLLOWS:

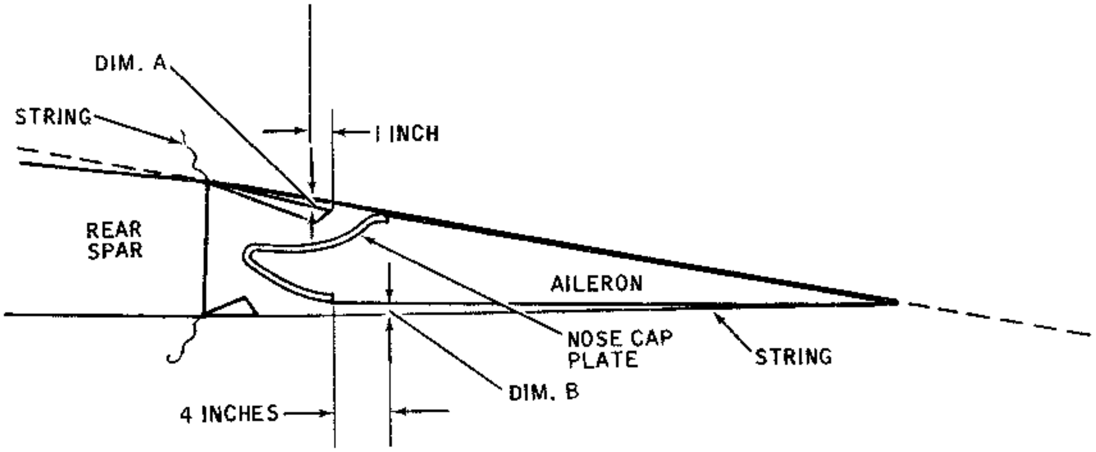
DIMENSION A - 0.125 INCH
DIMENSION B - 0.125 INCH



EXAMPLE II

WITH UPPER EDGE OF AILERON ALIGNED AS SHOWN, DIMENSIONS SHOULD BE AS FOLLOWS:

DIMENSION A - 0.125 INCH
DIMENSION B - 0.125 INCH



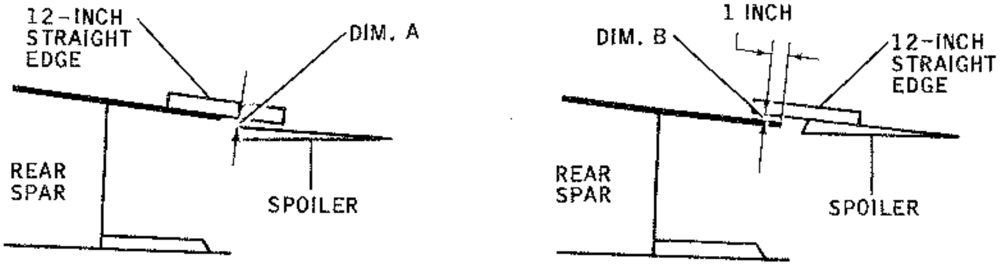
NOTE: USE STRING WRAPPED AROUND TRAILING EDGE TO FACILITATE CHECK

BB3-360

Checking Aileron to Wing Mismatch
Figure 4

CHECK DIMENSION A OR B AS SHOWN. DIMENSIONS SHOULD NOT EXCEED THE FOLLOWING:

DIMENSION A - 0.075 INCH
DIMENSION B - 0.075 INCH

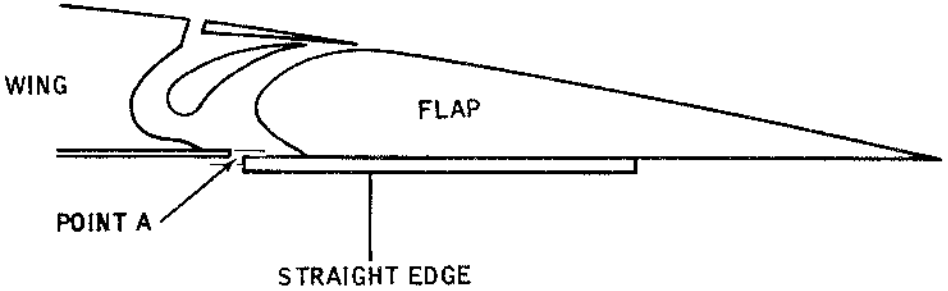


NOTE: USE 12 INCH STRAIGHT EDGE FOR CHECKING WITH A 6 INCH OVERLAP ON PROUD FACE

BB3-361

Checking Spoiler to Wing Mismatch
Figure 5

WITH STRAIGHT EDGE ALIGNED WITH LOWER SURFACE OF WING, FAIRNESS AT POINT A SHOULD BE WITHIN PLUS OR MINUS 0.125 INCH AT RIVET LINE

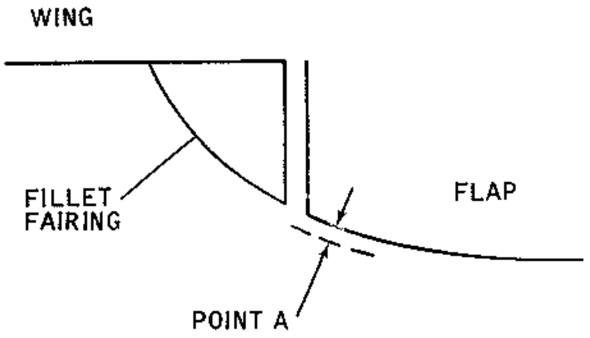


BB3-362

Checking Flap to Wing Mismatch
Figure 6

THIS PAGE INTENTIONALLY LEFT BLANK

FLAP SHOULD BE FAIR TO FILLET FAIRING AT POINT A WITHIN A TOLERANCE OF PLUS OR MINUS 0.375 INCH

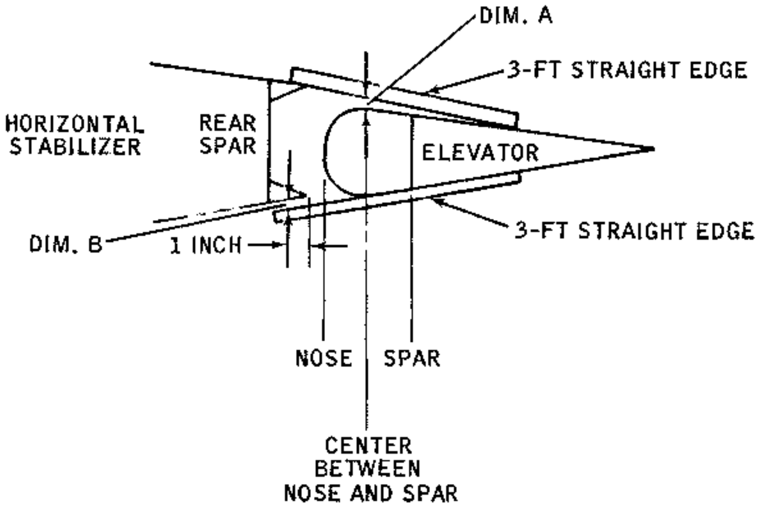


BB3-363

Checking Flap to Fillet Fairing Mismatch
Figure 7

OFFSET MAY OCCUR IN EITHER DIRECTION. TOLERANCES SHOULD NOT BE EXCEEDED EITHER WAY.

DIMENSION A - 0.063 INCH
DIMENSION B - 0.063 INCH

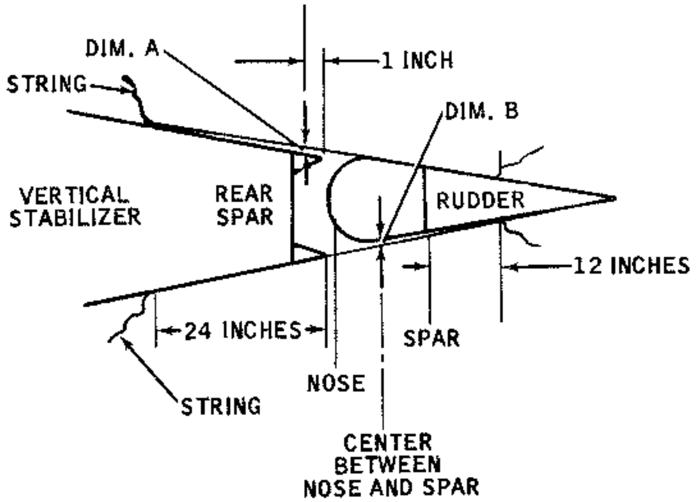


BB3-369

Checking Elevator to Horizontal Stabilizer Mismatch
Figure 8

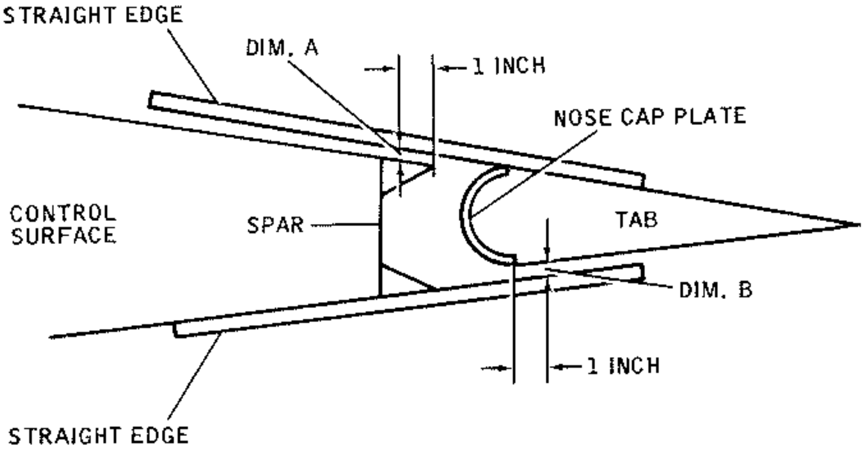
OFFSET MAY OCCUR IN EITHER DIRECTION. TOLERANCES SHOULD NOT BE EXCEEDED EITHER WAY.

DIMENSION A - 0.063 INCH
DIMENSION B - 0.063 INCH



BB3-370

Checking Rudder to Vertical Stabilizer Mismatch
Figure 9



OFFSET MAY OCCUR IN EITHER DIRECTION. TOLERANCES SHOULD NOT BE EXCEEDED EITHER WAY

BB3-371

Checking Tab to Control Surface Mismatch
Figure 10

(f) Control Surface Tabs

1) With control surface tabs set in neutral position, check for mismatch with adjacent surfaces (see Figure 10). Tabs should be fair to surfaces within the following tolerances:

Tab	Dimension A	Dimension B
Rudder tab	0.032 inch	0.016 inch
Elevator tab	0.064 inch	0.032 inch
Aileron tab	0.032 inch	0.016 inch

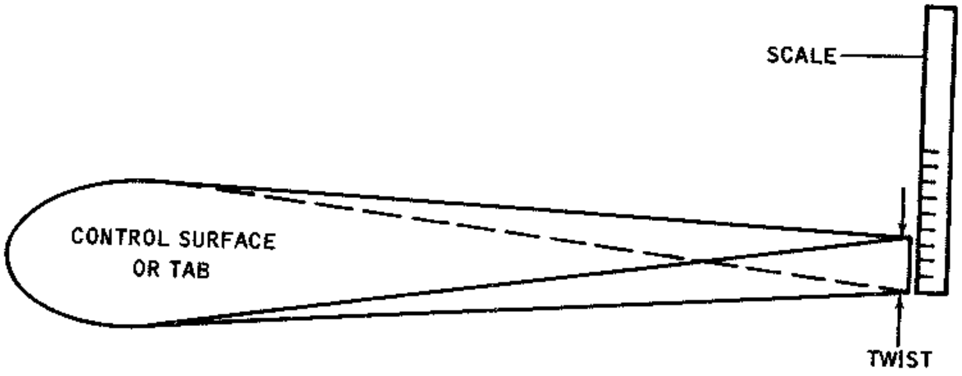
(3) Twist

(a) Control Surfaces and Tabs

1) Check control surface and tab twist as shown in Figure 11. Twist should not exceed the following:

	Twist	Trim Tab Twist	Control Tab Twist
Aileron	0.113 inch	0.028 inch	0.028 inch
Elevator	0.310 inch	0.050 inch (geared tab)	0.073 inch
Rudder	0.409 inch	0.080 inch	-

NOTE: Dimensions given assume no binding, leading, or other distorting factors during check.



BB3-372

Checking Control Surface and Tab Twist
Figure 11

SUBSTITUTION AND INTERCHANGEABILITY - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The materials and fasteners specified in the repair sections of the manual have been selected for desirability of use in the manufacture of the airplane and adaptability in effecting repairs. These materials and fasteners have been selected with consideration for physical, chemical, and mechanical properties, as well as resistance to corrosion and fatigue, weight-saving capabilities, durability, and ease with which they can be fabricated and installed. Therefore, it is recommended that the specified materials be used in repairs, whenever possible.

B. Since repair facilities may not have all the materials in stock, or special equipment needed for fabrication may not be available, certain substitutions may be made. Materials and fasteners which may be substituted can be found by referring to subsequent steps in this section and Figures 1 and 2.

2. Interchangeability of Parts

A. Inherently Interchangeable Parts

(1) Inherently interchangeable parts are machined parts which are completely dimensioned and toleranced and are therefore identical.

B. Parts Interchangeable Without Alteration

(1) The following parts are interchangeable without fabricating operations such as cutting, filing, drilling, reaming or bending, and without forcing which may harm or misalign the unit or adjoining parts.

Wingtips
Aileron, tabs
Ground spoiler panels
Flight spoiler panels
  (inboard to outboard)
Wing flaps and fixed vanes
Wing fuel tank access hole
  covers
Nose radome
Tail cone
Flight compartment windshield
  and window panels
Cabin windows
Horizontal stabilizer
  (complete unit)
Horizontal stabilizer tips
Elevators, tabs
Rudder, tabs
Nose cowl
Upper cowl door
Lower cowl door
Antenna masts, covers and
  fairings
Door locks and latches
Flush antennas (except for
  ADS antennas)
Pylon nose

C. Parts Interchangeable with Alteration of Adjoining Parts

(1) The following leading-edge sections are interchangeable without alteration to the sections themselves. However the adjoining leading-edge splice belts/doublers will require replacement. Plating gaps between leading-edge plate and fixed structure may vary between 1/32 inch and 3/16 inch and should be filled with aerodynamic sealant.

Wing leading edge sections
Horizontal stabilizer leading edge sections
Vertical stabilizer leading edge section
Vortilon leading/trailing edges

D. Parts Interchangeable with Alterations

(1) The following assemblies are interchangeable with regard to attachments, latches, hinges, and seal strikers, but may require trim and minor fitting with hand tools.

Emergency exit doors
Passenger forward entrance door
Forward service door
Forward lower cargo compartment door
Aft lower cargo compartment door
Major accessories compartment doors
Nose gear doors
Main gear doors

E. Parts Interchangeable with Fitting

(1) The following parts are distinguished from interchangeable parts in that some fitting is required during installation.

Wing-to-fuselage fillets
Wing leading edge splice belts
Vertical stabilizer splice doublers
Horizontal stabilizer splice belts
Horizontal stabilizer fairing
Pylons
Inspection doors
Interior doors
Vortilon fairing

3. Interchangeability of Materials

A. Interchangeability of materials (metals) may be found by reference to Figure 1.

B. Interchangeability of process materials may be found by reference to Figure 2.

4. Interchangeability of Fasteners

A. Bolts and Screws

(1) Flush-head fasteners used in the design and manufacture of the DC-9 have the Phillips-type recess. However, when repairs are made, substitution of fasteners with Hi-Torque or Torque-Set recesses is acceptable.

(2) All fasteners are of the closed-tolerance, ground and plated-shank types, heat treated to 160,000 psi or higher.

(3) Substitution of Douglas special flush-head fasteners, series 4619303 and 4619304 for flush-head fasteners listed in step (6) is permissible, using existing countersinks. However, this substitution may only be made for interior repairs since the head will protrude. The substituted item should be replaced with the correct fastener at the earliest convenient time.

(4) Bolts or screws may be used as a substitute for lockbolts when joining steel or titanium, or a combination, with aluminum where a pulling tool cannot be used. However, they are not recommended as a substitute for rivets. Correct substitution of bolts or screws for lockbolts may be determined by reference to the following list:

Standard Installation Lockbolt Number		Substitute Bolt or Screw Series
NAS1466 thru NAS1472	(R3001-T6) thru (3001-T12)	NAS1103 thru NAS1106
NAS1456 thru NAS1462	(R3002-T6) thru (R3002-T12)	NAS1203 thru NAS1206
NAS1476 thru NAS1482	(R3014-T6) thru (R3014-T12)	4619303 thru 4619306
2L200-T6		4719548
R3007-T6 thru R3007-T12		NAS2903 thru NAS2906
R3008-T6 thru R3008-T12		NAS1703 thru NAS1706
R3020-T6 thru R3020-T12		4653156-3 thru 4653156-6

NOTE: Douglas special bolts may be obtained by contacting the Customer Service Department, Douglas Aircraft Company, Long Beach, Calif.

(5) Use low-height nuts with short thread fasteners and regular-height nuts with long threads. Substitution of low-height nuts for regular-height nuts is permissible. However the reverse is not permissible.

(6) Flush (AN509) head fasteners listed below are interchangeable with proper consideration as to size, grip length, thread length (long or short), and type of recess.

Standard installation fastener series	Thread length	Head (Recess)
NAS1203 thru NAS1210	Short	Phillips
NAS333CPA thru NAS340CPA	Long	Phillips
NAS1503 thru NAS1510	Short	Hi-torque
NAS583 thru NAS590	Long	Hi-torque

(7) Flush (MS20426) head fasteners listed below are special fasteners and have no general interchangeability.

Standard installation fastener series	Thread length	Head (Recess)
4619303	Long	Phillips
4619304	Long	Phillips

(8) Flush (shear) head fasteners listed below are interchangeable.

Standard installation fastener series	Thread length	Head (Recess)	Substitute series	Thread length	Head (Recess)
HT239PB-3 thru HT239PB-9	Short	Hi-torque	HT8043-3 thru HT8043-9	Short	Hi-torque

(9) Hexagon head bolts listed below are interchangeable with proper consideration as to size, grip length, thread length (long or short), and type of recess.

Standard installation fastener series	Thread length
NAS1103 thru NAS1120	Short
NAS1303 thru NAS1320	Long

(10) Twelve-point head bolts listed below are interchangeable as follows:

NOTE: Standard installation series is preferred.

Standard installation fastener series	Substitute series
MS21250-04 thru MS21250-24	NAS624 thru NAS644

B. Rivets

(1) Substitution of rivets may be made, provided proper consideration is given to type, size, head style (flush or nonflush), features (standard or minimum pin clearance), and material.

NOTE: The use of blind-type rivets is restricted to applications where specified in repairs within the manual, Douglas service bulletins, or Douglas drawings.

(2) Cherrylock blind rivets (CR2248, CR2249, NAS1398, and NAS1399) are preferred for use on the DC-9 airplane. The CR2248 and CR2249 bulbed type blind rivets are preferred for thin sheet applications.

(3) Interchangeability of rivets may be determined by reference to the following list:

HEAD & TYPE	CHERRY NUMBER	OLYMPIC NUMBER	MS / NAS NUMBER or SPECIAL CHARACTERISTICS	RIVET MATERIAL	RIVET COLOR
UNIVERSAL (STANDARD CHERRYLOCK)	CR2163	----	NAS1398D	2017-T4	YELLOW
	CR2263	----	NAS1398B	5056-F	ORANGE
	CR2563S	----	NAS1398M	MONEL	SILVER
	CR2663	----	NAS1398C	A-286 CRES	FILM COATED
UNIVERSAL SELF-PLUGGING	CR157 / CR9157	RV250	MS20600B	5056	ORANGE
	CR163 / CR9163	RV200	MS20600AD	2117-T4	YELLOW
	CR179 / CR9179	RV2200	OVERSIZE SHANK	2117-T4	BLUE

HEAD & TYPE	CHERRY NUMBER	OLYMPIC NUMBER	MS / NAS NUMBER or SPECIAL CHARACTERISTICS	RIVET MATERIAL	RIVET COLOR
UNIVERSAL SELF-PLUGGING (Cont.)	CR363	RV270	----	STEEL	CAD-PLATED
	CR563 / CR9563	RV290	MS20600MP	MONEL	CAD-PLATED
	CR563R/ CR9563R	RV290S	MS20600M	MONEL	BLACK-SILVER
	CR579 / CR9579	RV2290	OVERSIZE SHANK	MONEL	CAD-PLATED
	CR579R/ CR9579R	RV2290S	OVERSIZE SHANK	MONEL	BLACK-SILVER
	CR6634	RV840	HIGH CLINCH	A-286 CRES	FILM COATED
	CR6636	----	HIGH CLINCH*	A-286 CRES	FILM COATED
	CR757	RV850	HIGH CLINCH	5056	ORANGE
	CR763	RV800	HIGH CLINCH	2017-T4	YELLOW
	CR863	RV890	HIGH CLINCH	MONEL	CAD-PLATED
	CR863R	RV890S	HIGH CLINCH	MONEL	BLACK-SILVER
	CR9279	----	OVERSIZE SHANK	5056	RED
*Soft stem					
100° (STANDARD CHERRYLOCK)	CR2162	----	NAS1399D	2017-T4	YELLOW
	CR2262	----	NAS1399B	5056-F	ORANGE
	CR2562S	----	NAS1399M	MONEL	SILVER
	CR2662	----	NAS1399C	A-286 CRES	FILM COATED
100° SELF-PLUGGING	CR156 / CR9156	RV251	MS20601B	5056	ORANGE
	CR162 / CR9162	RV201	MS20601AD	2117-T4	YELLOW
	CR178 / CR9178	RV2201	OVERSIZE SHANK	2117-T4	BLUE
	CR362	RV271	----	STEEL	CAD-PLATED
	CR562 / CR9562	RV291	MS20601MP	MONEL	CAD-PLATED
	CR562R/ CR9562R	RV291S	MS20601M	MONEL	BLACK-SILVER
	CR578 / CR9578	RV2291	OVERSIZE SHANK	MONEL	CAD-PLATED
	CR578R/ CR9578R	RV2291S	OVERSIZE SHANK	MONEL	BLACK-SILVER
	CR6624	RV841	HIGH CLINCH	A-286 CRES	FILM COATED
	CR6626	----	HIGH CLINCH*	A-286 CRES	FILM COATED
	CR756	RV851	HIGH CLINCH	5056	ORANGE
	CR762	RV801	HIGH CLINCH	2017-T4	YELLOW
	CR862	RV891	HIGH CLINCH	MONEL	CAD-PLATED
	CR862R	RV891S	HIGH CLINCH	MONEL	BLACK-SILVER
	CR9278	----	OVERSIZE SHANK	5056	RED
*Soft stem					
UNIVERSAL PULL-THRU	CR117 / CR9117	RV500	MS20604AD	2117-T4	YELLOW
	CR127 / CR9127	RV550	MS20604B	5056	ORANGE
	CR129 / CR9129	RV2500	OVERSIZE SHANK	2117-T4	BLUE
	CR317	RV570	----	STEEL	CAD-PLATED
	CR517P/ CR9517P	RV590P	MS20604MP	MONEL	CAD-PLATED

HEAD & TYPE	CHERRY NUMBER	OLYMPIC NUMBER	MS / NAS NUMBER or SPECIAL CHARACTERISTICS	RIVET MATERIAL	RIVET COLOR
100° PULL-THRU	CR116 / CR9116 CR126 / CR9126 CR128 / CR9128 CR316 CR516P / CR9516P	RV501 RV551 RV250 RV571 RV591P	MS20605AD MS20605B OVERSIZE SHANK ---- MS20605MP	2117-T4 5056 2117-T4 STEEL MONEL	YELLOW ORANGE BLUE CAD-PLATED CAD-PLATED
FABRIC PULL-THRU	CR100	----	FABRIC	2117-T4	YELLOW
TRUSS HEAD PULL-THRU	CR1484 / CR91484	RV503	MS20606AD	2117-T4	YELLOW
TRUSS HEAD SELF-PLUGGING	CR1984 / CR91984	RV203	----	2117-T4	YELLOW
FLAT PULL-THRU	CR1301	RV305	SPECIAL	2117-T4	YELLOW
100° SELF-PLUGGING	CR1782	----	SPECIAL HEAD REPAIR	2117-T4	YELLOW
82° SELF-PLUGGING	CR1822	----	SPECIAL HEAD REPAIR	2117-T4	YELLOW
100° SELF-PLUGGING	CR176	RV4215	SHORT BACKUP	2117-T4	YELLOW
UNIVERSAL SELF-PLUGGING	CR175	RV4206C	SHORT BACKUP	2117-T4	YELLOW
UNIVERSAL SELF-PLUGGING	---	RV4200C	SHORT BACKUP	2117-T4	YELLOW

HEAD & TYPE	CHERRY NUMBER	OLYMPIC NUMBER	MS / NAS NUMBER or SPECIAL CHARACTERISTICS	RIVET MATERIAL	RIVET COLOR
100° SELF-PLUGGING	---	RV4205C	SPECIAL SHORT BACKUP	2117-T4	YELLOW
UNIVERSAL BULBED (CHERRYLOCK)	CR2249	----	----	5056-F	RED
100° BULBED (CHERRYLOCK)	CR2248	----	----	5056-F	RED

C. Lockbolts

(1) Substitution of lockbolts may be made, provided proper consideration is given to size, head style (pan, rivet, crown, etc.), and material.

NOTE: If substitution of lockbolt is made in small countersink, it is recommended that protruding fasteners be replaced with proper flush attachments at the earliest convenient time.

(2) Blind lockbolts may be used for class A and class B repairs when the installation is blind, and for interim repairs when the installation is not blind providing they are replaced with standard pull-type lockbolts at the earliest convenient time.

(3) Lockbolts may be substituted for rivets, bolts and screws, and blind lockbolts may be substituted for blind rivets. However, it is not recommended that blind lockbolts be substituted for rivets, bolts and screws.

(4) Lockbolt interchangeability may be made by reference to the following list:

Lockbolt Number	Collar	NAS Equivalent Lockbolt	NAS Equivalent Collar
R3001-T5	LC-C5	NAS1465	NAS1080-5
R3001-T6	LC-C6	NAS1466	NAS1080-6
R3001-T8	LC-C8	NAS1468	NAS1080-8
R3001-T10	7LC-C10	NAS1470	NAS1080P10
R3001-T12	7LC-C12	NAS1472	NAS1080P12

Lockbolt Number	Collar	NAS Equivalent	
		Lockbolt	Collar
R3002-T6	LC-C6	NAS1456	NAS1080-6
R3002-T8	LC-C8	NAS1458	NAS1080-8
R3002-T10	7LC-C10	NAS1460	NAS1080P10
R3002-T12	7LC-C12	NAS1462	NAS1080P12
R3014-T5	LC-C5	NAS1475	NAS1080-5
R3014-T6	LC-C6	NAS1476	NAS1080-6
R3014-T8	LC-C8	NAS1478	NAS1080-8
R3014-T10	7LC-C10	NAS1480	NAS1080P10
R3014-T12	7LC-C12	NAS1482	NAS1080P12
R3007-T6	LC-C6	-------	NAS1080-6
R3007-T8	LC-C8	-------	NAS1080-8
R3007-T10	LC-C10	-------	NAS1080-10
R3007-T12	LC-F12	-------	NAS1080D12
R3008-T6	LC-C6	-------	NAS1080-6
R3008-T8	LC-C8	-------	NAS1080-8
R3008-T10	LC-C10	-------	NAS1080-10
R3008-T12	LC-F12	-------	NAS1080D12
R3020-T6	LC-C6	-------	NAS1080-6
R3020-T8	LC-C8	-------	NAS1080-8
R3020-T10	7LC-C10	-------	NAS1080P10
R3020-T12	7LC-C12	-------	NAS1080P12
(Self Broaching)			
10LP-T6	LC-C6	-------	NAS1080-6
10LP-T8	LC-C8	-------	NAS1080-8
(Self Broaching)			
10L509-T6	LC-C6	-------	NAS1080-6
10L509-T8	LC-C8	-------	NAS1080-8

Lockbolt Number	Collar	NAS Equivalent Lockbolt	NAS Equivalent Collar
(Stump)			
ALSF-T6	LC-C6	-------	NAS1080-6
ALSF-T8	LC-C8	-------	NAS1080-8
ALSF-T10	LC-C10	-------	NAS1080-10
ALSF-T12	LC-C12	-------	NAS1080-12
(Stump)			
ASCT509-T6	LC-C6	-------	NAS1080-6
ASCT509-T8	LC-C8	-------	NAS1080-8
ASCT509-T10	LC-C10	-------	NAS1080-10
ASCT509-T12	LC-C12	-------	NAS1080-12
(Tack)			
R3015-E5	LC-F5	-------	NAS1080D5
R3015-100-E5	LC-F5	-------	NAS1080D5
2L200-T5	LC-C5	-------	NAS1080-5
2L200-T6	LC-C6	-------	NAS1080-6
2L200-T8	LC-C8	-------	NAS1080-8
(Stump)			
2LSP-T6	LC-C6	NAS1496	NAS1080-6
2LSP-T8	LC-C8	NAS1498	NAS1080-8
2LSP-T10	LC-C10	NAS1500	NAS1080-10
2LSP-T12	LC-C12	NAS1502	NAS1080-12
(Stump)			
2LS509-T6	LC-C6	NAS1486	NAS1080-6
2LS509-T8	LC-C8	NAS1488	NAS1080-8
2LS509-T10	LC-C10	NAS1490	NAS1080-10
2LS509-T12	LC-C12	NAS1492	NAS1080-12
ALPP-T6	LC-C6	-------	NAS1080-6
ALPP-T8	LC-C8	-------	NAS1080-8
R1028-T10	LC-C10	-------	NAS1080-10
R1028-T12	LC-F12	-------	NAS1080D12

Printed in U.S.A.

Lockbolt Number	Collar	NAS Equivalent	
		Lockbolt	Collar
ACT509-T6	LC-C6	-------	NAS1080-6
ACT509-T8	LC-C8	-------	NAS1080-8
R1029-T10	LC-C10	-------	NAS1080-10
R1029-T12	LC-F12	-------	NAS1080C12
SALP-T6	6LC-C6	NAS1446	NAS1080C6
SALP-T8	6LC-C8	NAS1448	NAS1080C8
SALP-T10	6LC-C10	NAS1450	NAS1080C10
SALP-T12	6LC-C12	NAS1452	NAS1080C12
SAL100-T6	6LC-C6	NAS1436	NAS1080C6
SAL100-T8	6LC-C8	NAS1438	NAS1080C8
SAL100-T10	6LC-C10	NAS1440	NAS1080C10
SAL100-T12	6LC-C12	NAS1442	NAS1080C12
(Stump)			
SLSP-T6	6LC-C6	NAS1426	NAS1080C6
SLSP-T8	6LC-C8	NAS1428	NAS1080C8
SLSP-T10	6LC-C10	NAS1430	NAS1080C10
SLSP-T12	6LC-C12	NAS1432	NAS1080C12
(Stump)			
SLS100-T6	6LC-C6	NAS1416	NAS1080C6
SLS100-T8	6LC-C8	NAS1418	NAS1080C8
SLS100-T10	6LC-C10	NAS1420	NAS1080C10
SLS100-T12	6LC-C12	NAS1422	NAS1080C12

D. Hi-Shear Fasteners

(1) Hi-Shear fasteners are not recommended for substitution and should be used only in original applications.

E. Hi-Lok Fasteners

(1) Hi-Lok fasteners are the preferred substitute for other types of fasteners when joining aluminum, where the original installation cannot be

followed. Correct substitution of Hi-Lok fasteners for lockbolts may be determined by reference to the following list:

Standard Installation Lockbolt Number	Substitute Hi-Lok Fastener Series
NAS1465 (R3001-T5) thru thru NAS1472 (R3001-T12)	HL20PB
NAS1456 (R3002-T6) thru thru NAS1462 (R3002-T12)	HL21PB
NAS1475 (R3014-T5) thru thru NAS1482 (R3014-T12)	HL525
2L200-T5 thru 2L200-T8	HL19PB
R3007-T6 thru R3007-T12	HL64PB
R3008-T6 thru R3008-T12	HL64PB
R3020-T6 thru R3020-T12	HL527

Printed in U.S.A.

REPAIR BONDING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section of the structural repair manual provides information concerning repair bonding procedures and is divided into three subjects as follows:

(1) Repair of Reinforced Plastic Parts (See 51-70-1).

(2) Repair of Bonded Aluminum Assemblies (See 51-70-2).

(3) Miscellaneous Bonding Procedures (See 51-70-3).

REPAIR OF REINFORCED PLASTIC PARTS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The repair of reinforced plastic parts and assemblies is described in this section. Included is information on repair materials, cleaning of parts, mixing, application, and curing of resins.

B. The repairs covered in this section are to be used whenever individual repairs specify such applications.

2. Materials and Source

A. Figure 1 lists the repair materials that are approved for use in the repair of reinforced plastic parts; equivalent substitutes may be used instead of the items listed.

3. Repair Area Preparation and Cleaning

A. Any area to be repaired must be prepared and cleaned in accordance with the following requirements, as applicable.

(1) Remove all hardware and paint whenever repair resins to be used will require an oven cure.

(2) Wash rework area with acetone solvent to remove grease, dirt, or other foreign materials.

(3) Remove surface gloss and paint by scuff sanding area with medium grit sandpaper. Use care to prevent damage to glass cloth fibers.

(4) Remove all dust particles, after sanding, with a clean cloth dampened with acetone solvent.

4. Preparation and Mixing of Resins

A. Liquid resins are used to impregnate the glass cloth to form a bond in the repair area. Several resin systems are described; however, for repair of interior parts, Hetron 92 is required because of fire-retardent characteristics, but parts not used in interiors may be repaired with Epon 828. Both resins, Hetron 92 and Epon 828, may be prepared for coldset or heat-cured applications. Figure 2 indicates applicable catalyst, mixing proportions, and pot life for each resin system. Comply with applicable instructions and precautionary information, when preparing resins for application.

(1) Weigh required type and quantity of resin. Place in a clean nonabsorbent container.

Material	Source
Hetron 92 Resin	Durez Plastics Co., 3350 Wilshire Blvd., Los Angeles 5, Calif.
Epon 828 Resin	Shell Chemical Corp. 1008 West 6th Street Los Angeles 17, Calif.
Garako #100A (2% cobalt napthanate)	Thalco Glass Products Co., 6431 Flotilla Street
#10A Setting Fluid (60% methyl ethyl ketone peroxide in dimethyl pthalate)	Los Angeles 22, Calif.
Benzoil Peroxide Paste (BZP)	Ram Chemical Co., 210 East Olive Gardena, Calif.
HN-23 Hardener (Diethylene Triamine; DTA)	Furane Plastics 4516 Brazil Street Los Angeles 39, Calif.
Epocast H-991A	
RP-7A Hardener	Chemical Process Co., 901 Spring Street Redwood City, Calif.
APCO 320 Hardener	Applied Plastics 130 Penn Street El Segundo, Calif.
No. 120 Volan A Glass Cloth, MIL-C-9084	Thalco Glass Products 6431 Flotilla Street
No. 181 Volan A Glass Cloth, MIL-C-9084	Los Angeles 22, Calif.
Acetone Solvent	Inter Chemical Corporation Los Angeles, Calif.
Cellophane Sheet	E. I. Dupont Co., Wilmington, Del.
Sandpaper, Medium Grit	Local

Reinforced Plastics Repair Materials
Figure 1

(2) Add catalyst, setting agent, or hardener to resin as specified in Figure 2. After adding an ingredient, mix thoroughly before adding another.

WARNING: 1. DO NOT ALLOW #10A SETTING FLUID TO COME INTO CONTACT WITH GARAKO #100A CATALYST, UNTIL CATALYST IS THOROUGHLY MIXED INTO RESIN. AN EXPLOSION COULD RESULT.

2. WHEN USING EPOXY CATALYSTS, RUBBER GLOVES AND EYE PROTECTION MUST BE USED TO PREVENT SKIN CONTACT. IF CATALYST DOES CONTACT SKIN, WASH THOROUGHLY WITH WHITE VINEGAR.

Types of Resin System	Applicable Catalyst(s)	Parts by Weight Catalyst to Resin	Pot Life
Hetron 92 Coldset	Garako #100A and #10A Setting Fluid	1/2 or 1 to 100 1 to 100	20 to 30 minutes
Hetron 92 Heat-Cured	Benzoil Peroxide Paste	2 to 100	6 to 8 hours
Epon 828 Coldset	Hardener HN-23	8 to 100	20 to 30 minutes
Epon 828 Heat-Cured	Hardener, RP-7A or APCO 320	17 to 100	6 to 8 hours
Epocast H-991A	Hardener HN-23	6 to 100	20 to 30 minutes

Mixing of Resins
Figure 2

5. Pressure Application Methods

NOTE: Repair of reinforced plastic parts requires the application of pressure to repair area. Proper application of pressure assists in affecting a good bond and maintains the contour or alignment. Two methods of applying pressure are recommended.

A. Vacuum Bag Method

(1) Place repaired part in vacuum bag.

(2) Arrange bag so that as depressurization occurs the resultant external pressure will not be bridged.

NOTE: A minimum of 12-psi (24 inches of mercury) vacuum pressure is required to remove air from the bag.

(3) Hand squeegee the bag and laminate to remove any excess resin or pockets of air.

B. Mechanical Method

(1) Cover repair area with cellophane.

(2) Use pressure evenly and apply pressure with C-clamps or weights.

NOTE: If C-clamps or weights can not be used, stretch cellophane to exert uniform pressure and secure with tape.

6. Curing Procedures for Glass Fiber Repairs

A. Curing times and temperature for glass fiber repairs depend on type of resin mixture used. Curing times for resin mixtures and times and temperatures for heat cure mixed resin are given in the following steps:

(1) Coldset Resin Mixtures (Normal Cure Time): Coldset resin mixtures are cured under normal temperature conditions in a period of 16 hours.

(2) Coldset Resin Mixtures (Accelerated Cure Time): Cure cycle for coldset resin mixtures may be accelerated by allowing a minimum of 1 hour for material to gel. Then apply heat for 20 to 30 minutes, using heat gun or lamp capable of maintaining 92 (±8)° C (200 ±15° F) on entire repair area.

(3) Heat cure for Epon 828 is accomplished by application of 82 (±10)° C (180 ±15° F) for 3 hours, followed by 121 (±10)° C (250 ±15° F) for 2 hours.

7. Surface Pits and Indentation Repairs - Class A

A. Surface pits and indentations can be repaired as follows:

(1) Prepare area to be repaired (see paragraph 3).

(2) Prepare Epocast H-991A as described in paragraph 4.

(3) Fill surface pits or indentations which do not penetrate glass fabric with mixed material (see Figure 3).

(4) Cure material (see paragraph 6).

(5) Sand repaired area to provide smooth and faired surface, as required.

8. Blisters and Delamination Repairs - Class A

A. Blisters and delamination repairs (areas less than 1-inch diameter) may be repaired per the following instructions.

(1) Drill at least two 1/32-inch diameter holes into edges of blistered area.

(2) Prepare applicable coldset resin (see paragraph 4). Use hypodermic needle to inject resin into blistered or delaminated area (see Figure 3). Inject sufficient quantity to fill area.

(3) Apply pressure to blister and allow excess resin to exude out through 1/32-inch diameter holes. Wipe off excess resin.

(4) Apply pressure to area as described in paragraph 5, and cure as described in paragraph 6.

9. Edge Separation Repairs - Class A

A. Edge separations may be repaired as follows:

(1) Wash separated area (see paragraph 3).

(2) Prepare applicable coldset resin (see paragraph 4). Force resin between separated plies (see Figure 3). Make certain that area is completely filled.

(3) Apply pressure to area to expell excess material and to close separation. Ensure that proper contour is maintained.

(4) Maintain pressure to repair area as described in paragraph 5, and cure as specified in paragraph 6.

10. Hole Repairs - Class A

A. Holes (less than 3/8-inch diameter) may be repaired in accordance with following instructions and Figure 3.

NOTE: These instructions do not apply to holes to be redrilled in repaired area. See paragraph 11 for repair of holes larger than 3/8 inch, or for any portion to be redrilled.

(1) Remove one ply of glass cloth from each side of the part (removed cloth to extend beyond edge of hole at least 1/2 inch in all directions).

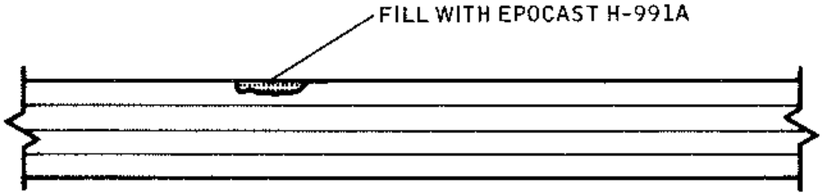
(2) Catalyze applicable coldset resin (see paragraph 4).

(3) Set aside a portion of catalyzed resin to be used later for replacement of laminations.

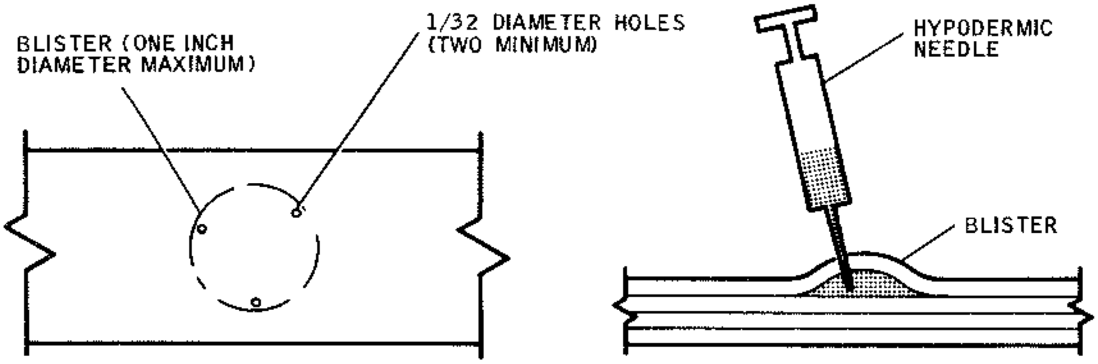
(4) Weigh remaining mixed resin and add 15 parts (by weight) of milled glass fibers to 100 parts (by weight) of catalyzed resin. Mix thoroughly.

(5) Fill hole with glass fiber resin mixture.

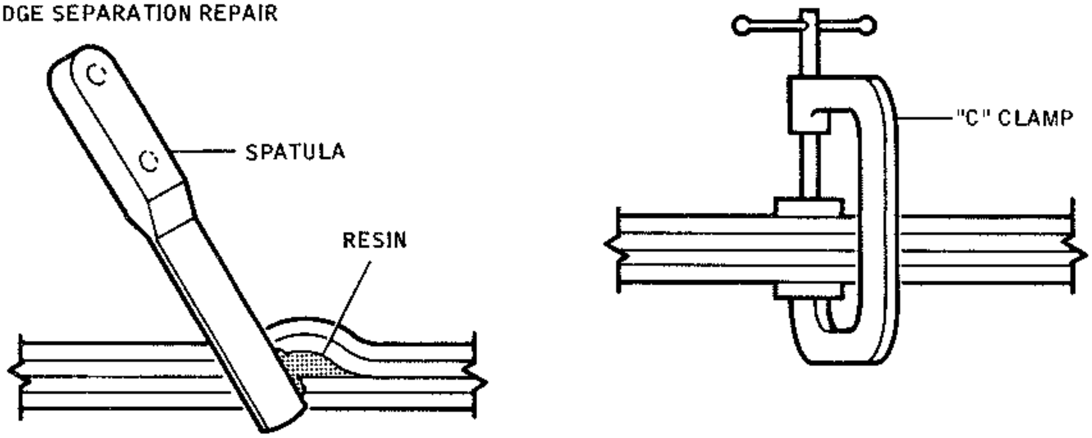
1. SURFACE INDENTATION REPAIR.



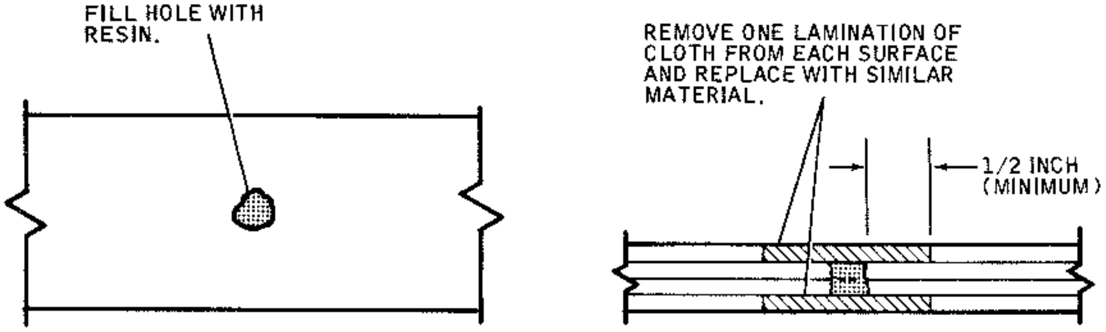
2. BLISTER REPAIR



3. EDGE SEPARATION REPAIR



4. HOLE REPAIR



BB3-439

Minor Repair Procedures - Class A
Figure 3

(6) Replace cut out plies with Number 181 glass cloth, and fully impregnate with catalyzed resin.

(7) Apply pressure to repair area as described in paragraph 5. Cure as specified in paragraph 6.

(8) Sand repaired area to obtain smooth and faired surface, if required.

11. Multiple Lamination Repairs - Class A

A. Multiple lamination repairs are accomplished as follows:

(1) Cut back and remove damaged plies of glass cloth. Each ply must be trimmed a minimum of 1/2 inch beyond trim line of ply below (see Figure 4). If damage extends through part, both sides of laminate must be cut back.

NOTE: If fluted cores are damaged, see paragraph 12 or 13.

(2) Prepare repair area (see paragraph 3).

(3) Cut pieces of glass cloth to replace damaged pieces. Each replacement cloth must be cut from same type of cloth being replaced.

(4) Prepare applicable resin (see paragraph 4).

(5) Lay in each succeeding layer of glass cloth. Apply resin to each layer as it is installed.

(6) Apply pressure to repair area as described in paragraph 5, and cure as specified in paragraph 6.

(7) Sand repaired area to provide a smooth and faired surface.

12. Fluted Core Repairs - Class A

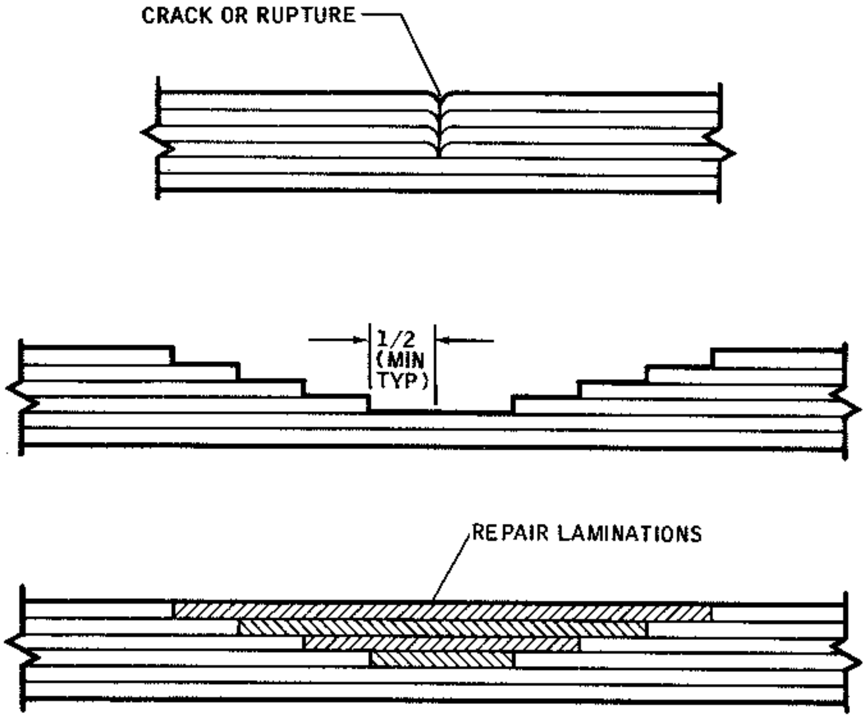
NOTE: Contact Douglas Aircraft Co., Inc., for specific repair instructions for Class A Fluted Core Repairs.

13. Fluted Core Repairs - Class B

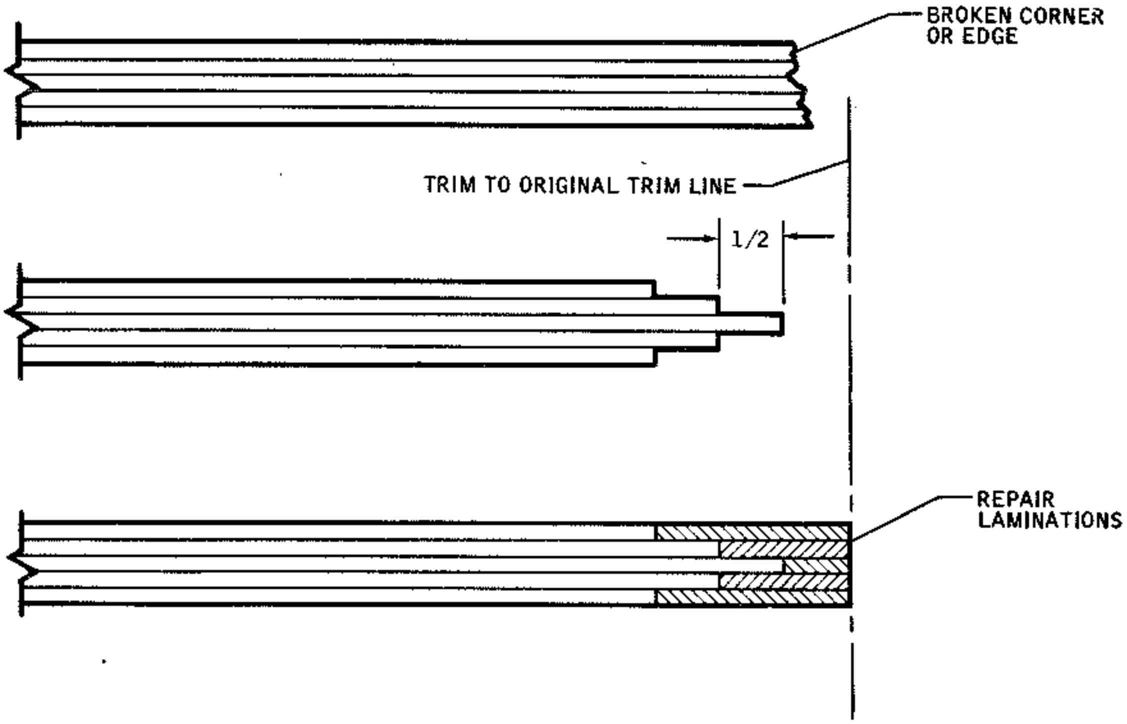
A. Interim repairs to fluted core glass fiber assemblies for areas less than 2 inches in diameter are made as follows:

(1) Remove epoxy enamel coating approximately 3 inches beyond damaged area in all directions.

(2) Prepare repair area as described in paragraph 3.



MULTIPLE LAMINATION REPAIR (DAMAGE TO ONE SURFACE ONLY)



CORNER OR EDGE REPAIR (DAMAGE EXTENDING THROUGH PART)

BB3-441

Printed in U.S.A.

Multiple Lamination Repairs - Class A
Figure 4

(3) Prepare Epon 828 coldset resin as specified in paragraph 4.

(4) Cut three plies of Number 181 glass fiber cloth. First ply must extend 1 inch beyond damaged area in each direction. The two succeeding plies should extend 1 inch beyond preceeding plies.

(5) Apply mixed resin to repair area and to each ply of repair cloth as it is placed in position.

(6) Cover repair area with cellophane and secure in place. Work air and excess resin from laminate to perimeter of repair.

(7) Cure repair area as specified in paragraph 6.

(8) Sand edges of repair to fair with original surface.

14. Glass Fiber Cloth Faced Honeycomb Repair - Class A

A. The following procedures cover repair of nonmetallic honeycomb core in glass fiber cloth-faced assemblies. (See Figure 6.)

(1) Remove plies of glass cloth to expose damaged honeycomb core (see paragraph 11).

(2) Cut out damaged section of honeycomb.

(3) Cut repair plug to fit removed section. Use material similar to existing part. Make certain that ribbon direction corresponds to original part.

(4) Prepare repair area (see paragraph 3).

(5) Mix applicable resin (see paragraph 4).

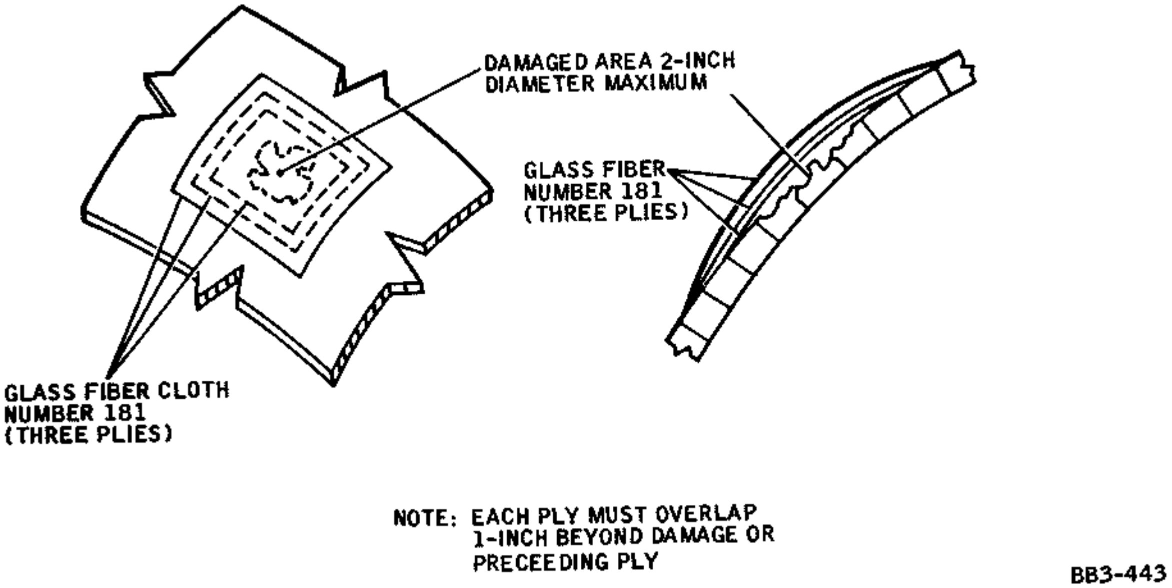
(6) Separate a portion of mixed resin and set aside to be used for replacement of laminations.

(7) Weigh remaining mixed resin and add 15 parts (by weight) of milled glass fibers to 100 parts (by weight) of catalyzed resin. Mix thoroughly.

(8) Apply heavy coat of glass fiber resin mixture to perimeter and bottom of hole and to plug. Press plug into place. Make certain ribbon direction of plug corresponds to direction in panel.

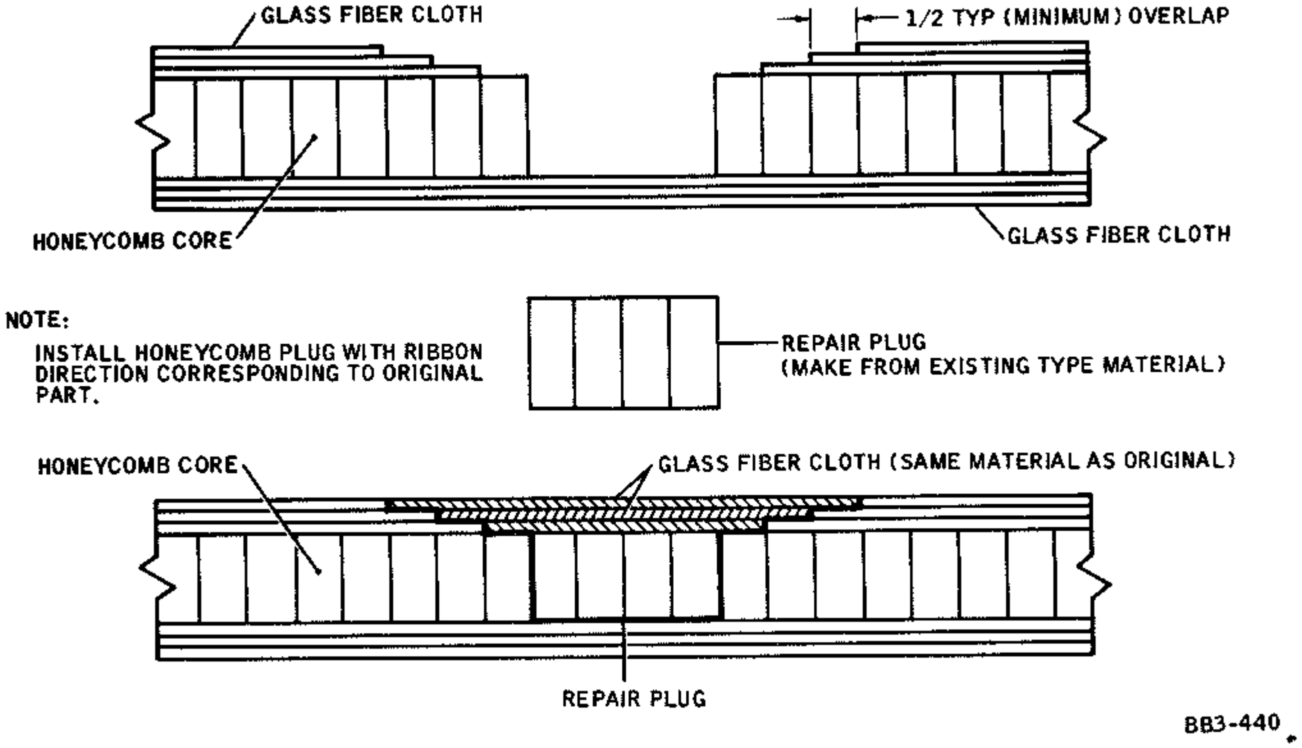
NOTE: Apply mixed resin so that resin will settle downward to mating parts to make a good bond, when plug is installed.

(9) Replace laminations which were removed, and complete repair per paragraph 11.



NOTE: EACH PLY MUST OVERLAP 1-INCH BEYOND DAMAGE OR PRECEEDING PLY

Fluted Core Repairs - Interim
Figure 5



NOTE:
INSTALL HONEYCOMB PLUG WITH RIBBON DIRECTION CORRESPONDING TO ORIGINAL PART.

Glass Fiber Cloth Faced Honeycomb Repair - Class A
Figure 6

REPAIR OF BONDED ALUMINUM ASSEMBLIES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. General information on the repair bonding of aluminum honeycomb panels and structural members is provided in this section. (Glass fiber layup to metal repairs are discussed in 51-70-3.)

B. Metal-to-metal bonding procedures described in paragraph 16 of this section will apply when metal bonding repair techniques are specified by individual repairs mentioned in other chapters of this manual.

C. Mechanical attachments are required to further secure bonded repairs if the repair parts are located in a position from which, if disloged, the parts could enter the engine. (Refer to Figure 4.)

2. Materials and Equipment Required

A. Figure 1 lists the materials that are approved for use in metal-to-metal bonding procedures; equivalent substitutes may be used for the items listed.

3. Repair Area Preparation and Cleaning

A. Faying surfaces of structural parts to be bonded must be thoroughly stripped and cleaned in accordance with the following requirements, as applicable.

(1) Remove all paint, including FR primer from all faying surfaces by one of the following methods:

WARNING: PREVENT STRIPPER FROM CONTACTING THE SKIN. IN THE EVENT OF AN ACCIDENT, WASH CONTAMINATED AREA WITH WATER IMMEDIATELY, AND OBTAIN MEDICAL TREATMENT.

CAUTION: ADEQUATE PRECAUTIONS MUST BE USED TO PREVENT STRIPPER OR WIPING CLOTHS FROM CONTACTING ANY GLUE LINES OR AREAS OTHER THAN THOSE TO BE BONDED.

(a) Use Del Chem EZ Strip 19A paint stripper to remove paint. Rinse thoroughly with tap water.

(b) Sand with aluminum oxide paper and rinse thoroughly with tap water.

(2) Wipe faying surface with Douglas stripping solvent No. 14, using a clean cloth.

(3) Wipe faying surface with Douglas stripping solvent, No. 15, using a clean cloth. Wipe dry with a clean, dry cloth.

(4) Mix a thick paste of aluminum oxide powder and clean water.

Paint stripper, noncresylic type, Delchem EZ-Strip 19A	Pennsalt Chemical Corp., 2700 Eastern Ave., Los Angeles, California
Wet or dry carborundum paper	Minnesota Mining & Manfuacturing Co. Los Angeles, California
Douglas stripper No. 14	W. P. Fuller Co., Los Angeles, California
Douglas stripper No. 15	
Aluminum oxide powdered abrasive	Buehler Ltd., 2120 Greenwood Ave., Evanston, Illinois
Adhesive, Lefkoweld No. 109	Leffingwell Chemical Co., Whittier, California
Hardener, LM-52	
Sealant, PR-1422B	Products Research Company 2919 Empire Ave., Burbank, California
Accelerator 1422A	
Sealant, Aluminized, Pro-Seal 735	Coast Pro-Seal & Manufacturing Co. Los Angeles, California
Accelerator 735A	
Adhesive, Epocast H-1337-B-1	Furane Plastics, Inc., Los Angeles, California
Hardener, 9615A	
Clear Nycote 12-7	Nycote Laboratories Los Angeles, California
Cellulose acetate foam, Strux CH-168	Strux Corporation Lindenhurst, Long Island, N.Y.
Tape, pressure sensitive Decalar No. 956	Permacel Tape Corporation New Brunswick, N. J.
Powdered polyethylene glycol Dow E400	Dow Chemical Co., 900 Wilshire Blvd., Los Angeles 17, California

Metal-to-Metal Bonding Repair Materials
Figure 1

(5) Apply paste to faying surfaces with clean cotton cloth. Rub paste, applying considerable pressure until entire faying surface is an even, dark grey color (approximately 50 strokes). Keep paste moist by dampening with water, as required.

(6) Remove aluminum oxide paste with clean cloth dampened with water.

(7) Keep bonding area completely free of contaminants. Bonding is to be completed within 24 hours after cleaning.

4. Preparation and Mixing of Cements and Adhesives

A. Liquid cements and adhesives are used to form a bond between faying surfaces of metallic structural members. Preparation of recommended bonding adhesives is described in this paragraph. These mixtures should be used when individual repairs specify their application.

B. Figure 2 indicates applicable catalyst, mixing proportions, and pot life for each type of adhesive. Make certain that material is used within the pot life noted. Comply with the following instructions when preparing any adhesives.

(1) Weigh required type and quantity of adhesive. Place in a clean nonabsorbent container.

(2) Add catalyst or hardener to adhesive, as specified in Figure 2. Mix thoroughly.

Type of Cement or Adhesive	Applicable Hardener or Catalyst	Parts by Weight Catalyst to Adhesive	Pot Life
Lefkoweld 109	Hardener IM-52	74 to 100	20 minutes (Maximum)
PR-1422	Accelerator 1422A	12 to 100	Specified on container
Pro-Seal 735	Accelerator 735A	12 to 100	Specified on container
Epocast H-1337-B-1	Hardener 9615A	100 to 100	60 minutes (Maximum)
Pro-Seal 501	Accelerator 501A	30 to 100	30 minutes
PR-1422B-2	Accelerator 1422A	1 to 7.5	120 minutes
PR-1422B	Accelerator 1422	1 to 7.5	30 minutes

Mixing of Cements and Adhesives
Figure 2

Printed in U.S.A.

5. Repairs for Cuts and Sharp Dings in Honeycomb Panel Skins

A. Cuts and dings, less than 3/8-inch diameter, in skins of honeycomb panels are repaired as follows (see Figure 3).

(1) Drill out damaged area to minimum diameter which will remove damage. Do not allow drill to extend into honeycomb further than necessary.

(2) Deburr hole. Make certain that a feather edge does not result.

(3) Prepare required amount of Pro Seal 735 in accordance with paragraph 4.

(4) Fill honeycomb in the drilled area with prepared Pro Seal 735. Fair material with panel surface.

(5) Cure repair at room temperature for 48 hours.

NOTE: The curing process may be accelerated by application of heat, 50 (±10)°C (120 ±10)°F, for 2 to 4 hours.

(6) Coat repair area with clear Nycote.

6. Repairs for Cuts or Punctures in Honeycomb Panels Skins, 1 Inch Diameter Maximum

A. Minimum distance allowed between repairs of this type, or between a repair of this type and another type of repair, must not be less than 1 1/2 inch. The sum of the diameters of a combination of repairs in a square foot area must not exceed 1 1/2 inch. No more than three repairs may be made in a one square foot area.

B. Cracks, punctures, or deep dings in honeycomb panels are repaired using fairing plugs as follows:

(1) Determine center of damaged area (1-inch diameter maximum). Using a 3/16-inch drill, drill into the honeycomb panel. Do not allow drill to damage opposite skin.

(2) Use a hole saw to remove the damaged area in the skin, 3/8-inch minimum, 1-inch maximum diameter. Deburr the hole. Make certain that a feather edge does not result.

(3) Prepare a MS20426AD4 rivet by cutting serrations as shown in Figure 3.

(4) Prepare a washer to fit the repair area. Make certain that the washer will have clearance around its perimeter when it is in place in the cutout.

(5) Prepare required amount of Lefkoweld No. 109 or Epocast H-1337-B-1 adhesive as described in paragraph 4.

(6) Fill the cavity in the honeycomb where the 3/16 drill was used, with the adhesive. Apply adhesive to the exposed edges of honeycomb, washer, and serrated rivet.

(7) Place the prepared washer into the repair area and insert the serrated rivet. Do not force washer deeper than necessary to obtain flush surface. Wipe excess adhesive from the repair area.

(8) Place piece of masking tape over plug to secure plug in position.

(9) Cure adhesive as follows:

(a) Mark metal surface (near repair) with 66° and 93°C (150° and 200°F) Tempilaq.

(b) Apply heat to repair area with an explosion-proof heat lamp, using a 350-watt infrared bulb, at a distance at which 66°C (150°F) Tempilaq melts. If 93°C (200°F) Tempilaq starts to melt, back lamp away. Do not allow temperatures over 93°C (200°F). After curing for 15 minutes, press parts together again to ensure seating.

(c) Continue application of heat for 1 hour, to complete curing.

(10) Apply appropriate finish over repair area to complete repair.

7. Repairs for Honeycomb Panels Using Cellular Cellulose Acetate Plug

A. Honeycomb panels which are cut or punctured, 1 1/2-inch maximum on one surface only, are repaired as follows (see Figure 3). This repair may be used on external surfaces, however, an external patch may sometimes be undesirable. For repairs to an external surface requiring a flush patch refer to paragraph 9.

B. The following procedures are to be followed when making a repair using cellulose acetate plug and repair patch (see Figure 3).

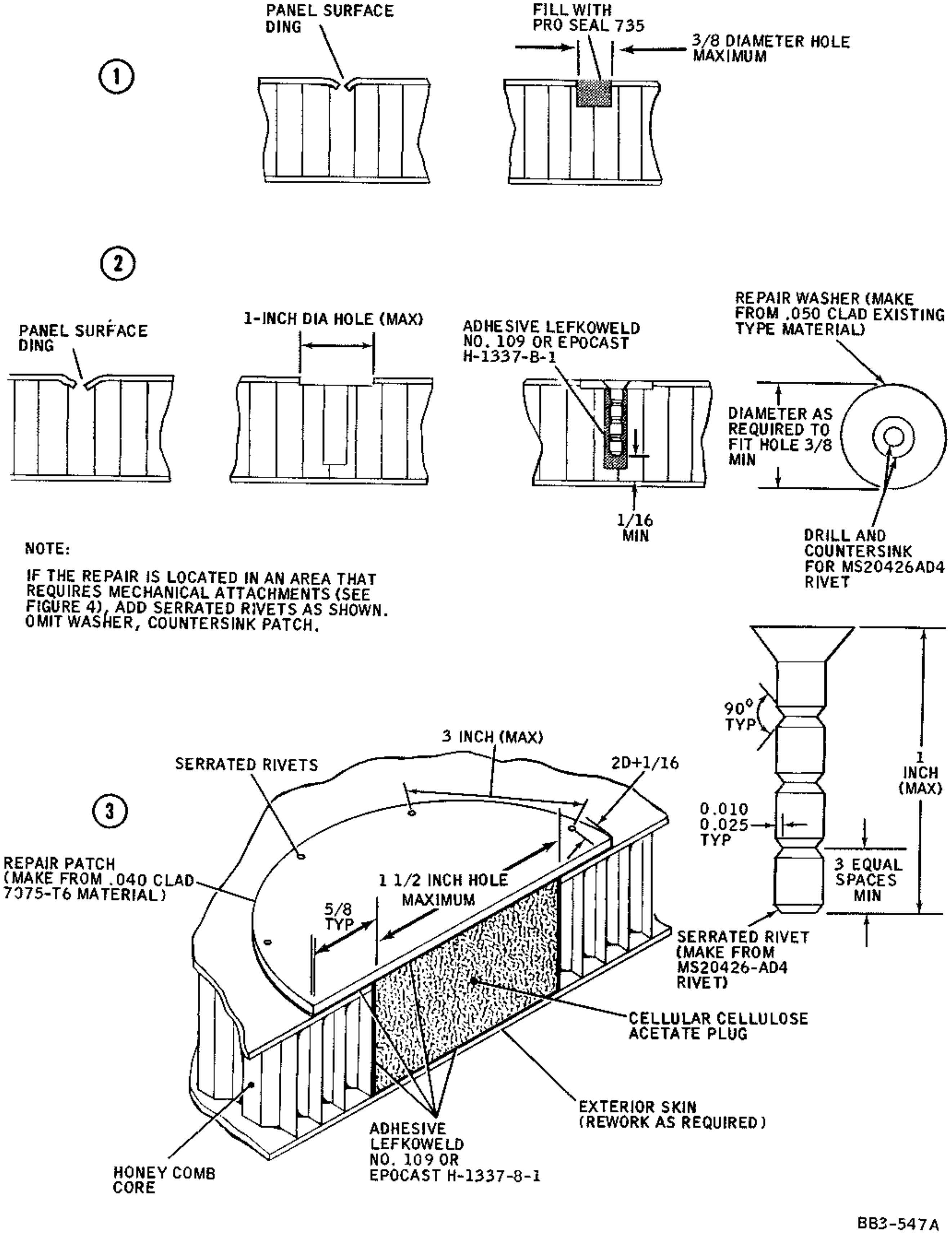
(1) Make minimum size cutout on surface of panel to remove damage. Edges of cutout must be burr free and 90 degrees to surface.

(2) Remove honeycomb from cutout area. Do not damage opposite skin. Do not remove original adhesive from inside of opposite skin.

(3) Prepare plug from cellular cellulose acetate to fit cavity where honeycomb was removed.

(4) Make repair patch as specified in Figure 3. Refer to Figure 4 to determine specific areas in which bonded repairs require use of mechanical attachments.

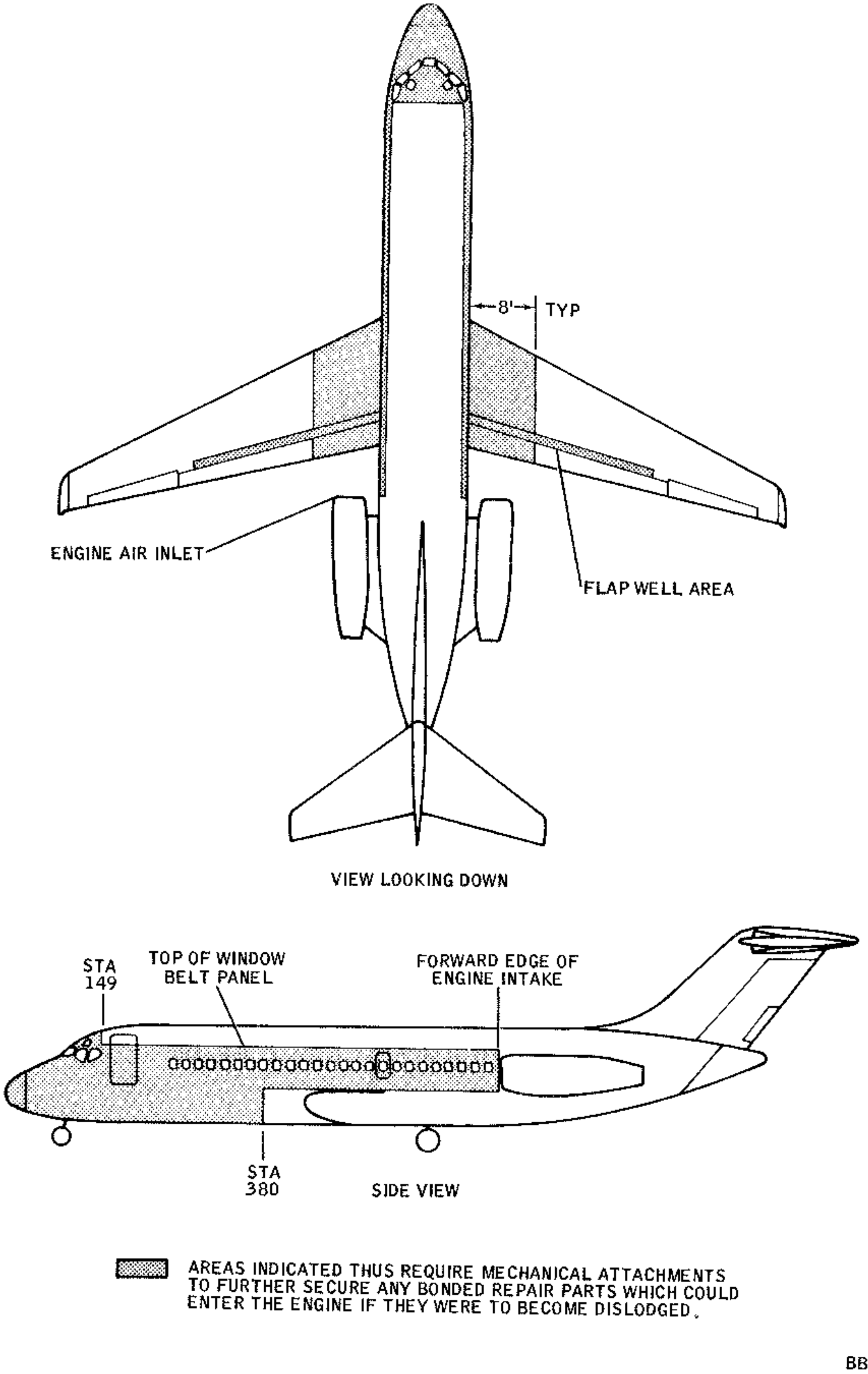
(5) Remove paint, including FR primer when applicable, and prepare rework area for bonding as described in paragraph 3.



NOTE:

IF THE REPAIR IS LOCATED IN AN AREA THAT REQUIRES MECHANICAL ATTACHMENTS (SEE FIGURE 4), ADD SERRATED RIVETS AS SHOWN. OMIT WASHER, COUNTERSINK PATCH.

Minor Repairs for Honeycomb Panel Skins - Class A
Figure 3



▨ AREAS INDICATED THUS REQUIRE MECHANICAL ATTACHMENTS TO FURTHER SECURE ANY BONDED REPAIR PARTS WHICH COULD ENTER THE ENGINE IF THEY WERE TO BECOME DISLODGED.

Areas Requiring Mechanical Attachments for Repairs (DC-9-10)
Figure 4

TO BE ADDED WHEN AVAILABLE

Areas Requiring Mechanical Attachments for Repairs (DC-9-30)

(6) Prepare required amount of Lefkoweld 109, or Epocast H-1337-B-1 adhesive as described in paragraph 4.

(7) Apply prepared adhesive to exposed edges of honeycomb, and apply 1/16-inch thickness of adhesive to entire cellulose acetate plug. Apply adhesive to faying surfaces of repair patch and panel surface.

(8) Insert plug into cavity and press repair patch into position on panel concentric with cutout.

(9) If repair requires mechanical attachments per Figure 4 make serrated rivets, fill cavities in honeycomb with adhesive and insert serrated rivets.

(10) Cure adhesive by applying heat 68 (±5)°C (155 ±10°F) for 1 1/2 hours.

<u>NOTE</u>: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

8. Repairs for Honeycomb Panels using Aluminum Honeycomb Core Plug

A. Honeycomb panels which require removal of damaged skin on one surface only are repaired as shown in Figure 5.

B. These repairs are generally applicable to internal skins of honeycomb panels, however, they may be used to repair external honeycomb skins if a plug-type patch is acceptable. For flush-type repairs to external skins, see paragraph 9.

C. Repair Procedures

(1) Cut out damaged skin.

(2) Remove honeycomb from cutout area.

(3) Carefully remove old adhesive from inner surface of opposite skin by sanding with 400 aluminum oxide paper. Use care not to damage skin.

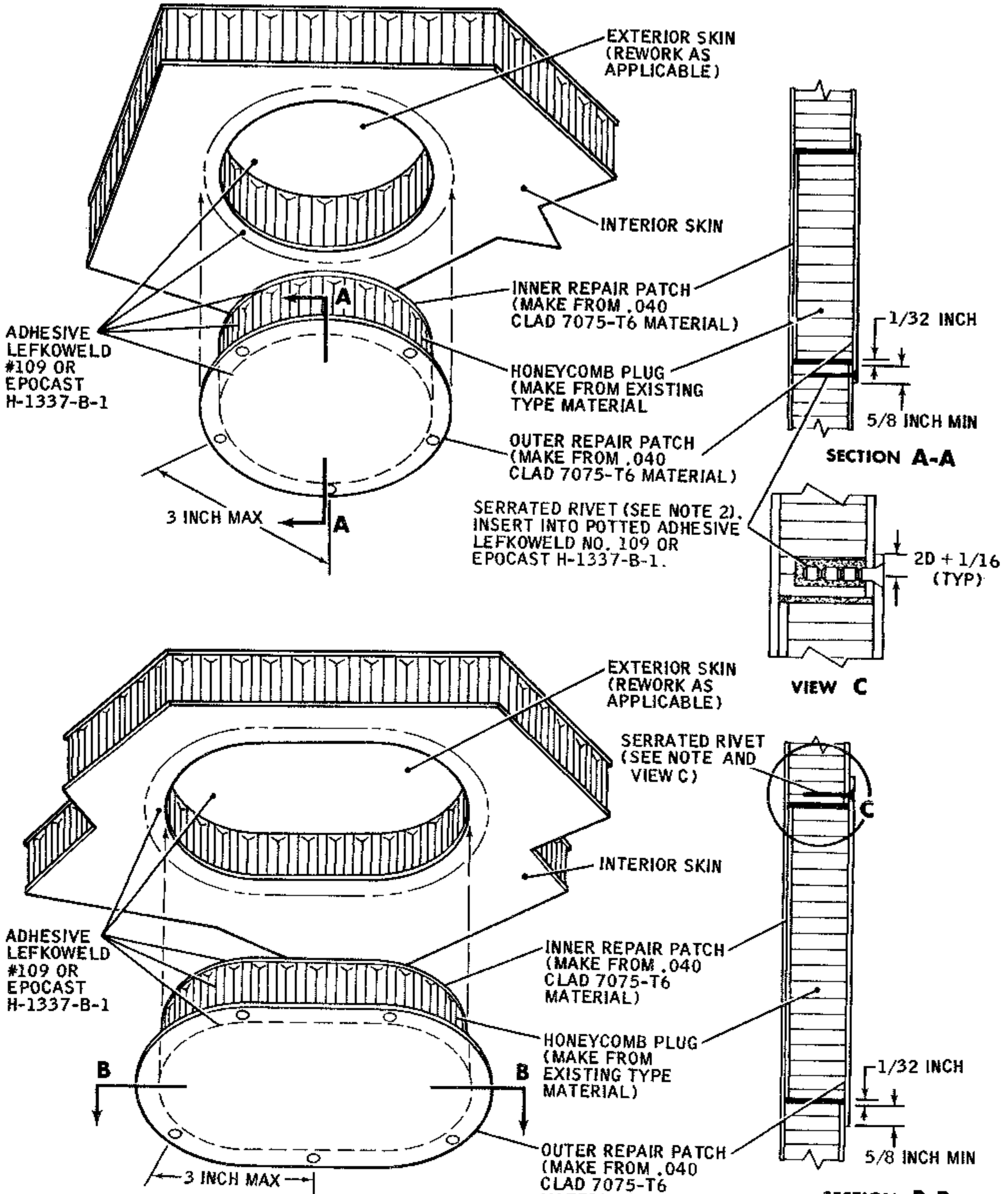
(4) Reform (or repair) opposite skin, when specified.

(5) Prepare repair plug from same material as original core. Make certain that ribbon direction corresponds to direction of original part.

(6) Make inner and outer repair patches (see Figure 5). Refer to Figure 4 to determine areas in which bonded repairs require mechanical attachments.

(7) Prepare bond faying surfaces of repair area as described in paragraph 3.

(8) Prepare required amount of adhesive, Lefkoweld 109, or Epocast H-1337-B-1, as described in paragraph 4.



NOTES:

1. THESE REPAIRS MAY BE USED FOR INTERIOR OR EXTERIOR HONEYCOMB PANEL SKINS. HOWEVER THE METHOD ILLUSTRATED IN FIGURE 6 IS PREFERRED FOR EXTERIOR SKINS.
2. IF THE REPAIR IS LOCATED IN AN AREA THAT REQUIRES MECHANICAL ATTACHMENTS (SEE FIGURE 4), MAKE SERRATED RIVETS AS SHOWN IN FIGURE 3 AND INSTALL AS SHOWN IN VIEW C ABOVE.

BB3-548A

Aluminum Honeycomb Panel Inner Skin Repairs - Class A
Figure 5

(9) Apply prepared adhesive to faying surfaces of inner and outer repair patches, existing inner and outer skins, and exposed edges of honeycomb core and plug.

(10) Insert inner repair patch and plug into cavity and place outer repair patch over plug. Make certain that required overlap is maintained completely around hole.

(11) If repair requires mechanical attachments per Figure 4 make serrated rivets, fill cavities in honeycomb with adhesive and insert serrated rivets.

(12) Cure repair adhesive by applying heat, 68 (±5)°C (155 ±10°F) for 90 minutes.

NOTE: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

9. Repairs for Honeycomb Panels Providing Flush Exterior Surface - Class A

A. Preferred (recommended) procedures for removing and replacing a section of damaged exterior skin of honeycomb panels and maintaining a flush surface are as follows:

(1) Cut out the interior skin, exterior skin, and honeycomb. (See Figure 6.)

NOTE: Cutout in exterior skin should be of minimum size to remove the damaged area. Cutout in interior skin should be large enough to remove any damage and must extend outward beyond cutout in exterior skin at least 9/16 inch in all directions.

(2) Deburr all cutouts. Do not chamfer edges.

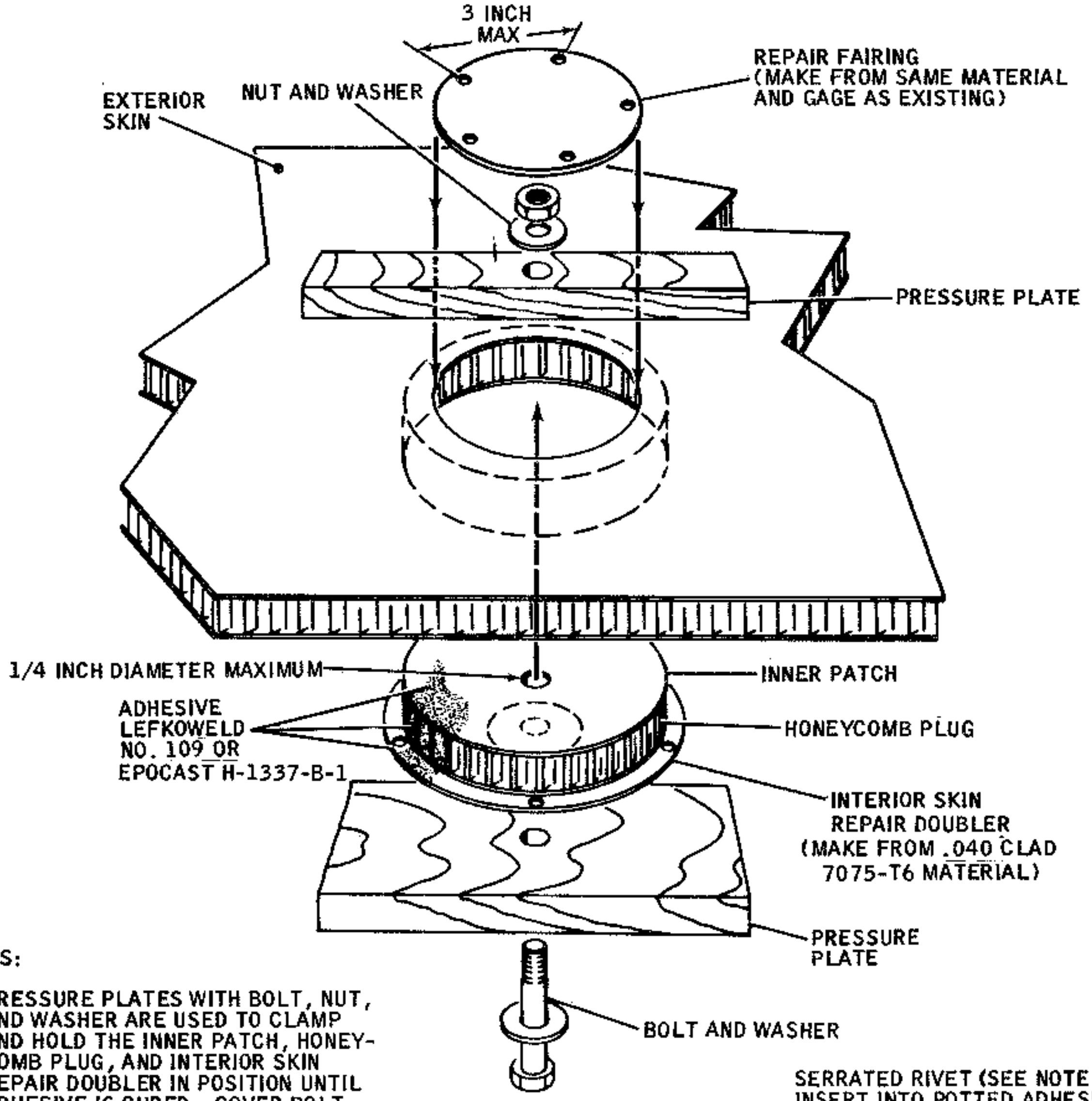
(3) Remove bonding material from interior of exterior skin in rework area with Number 400 aluminum oxide paper. Use light pressure only. Do not damage skin.

(4) Prepare repair honeycomb plug to fit cavity. Use same gage and material as original core. Make certain that ribbon direction corresponds to direction of original part.

(5) Make inner patch, interior skin repair doubler and repair fairing. (See Figure 6.) Refer to Figure 4 to determine specific areas in which bonded repairs require the use of mechanical attachments.

(6) Remove paint, including FR primer when applicable, and prepare rework area for bonding as described in paragraph 3.

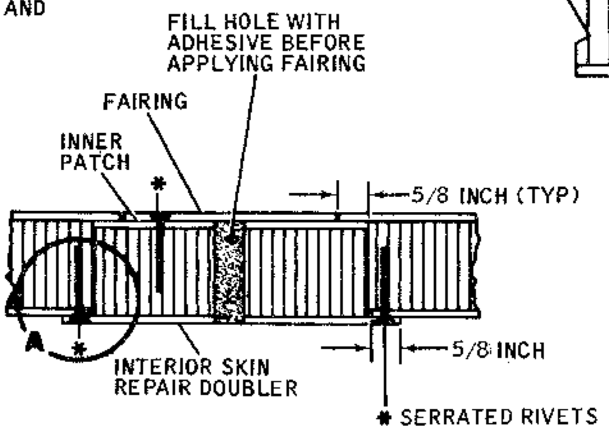
(7) Prepare required amount of Lefkoweld No. 109, or Epocast H-1337-B-1 adhesive in accordance with paragraph 4.

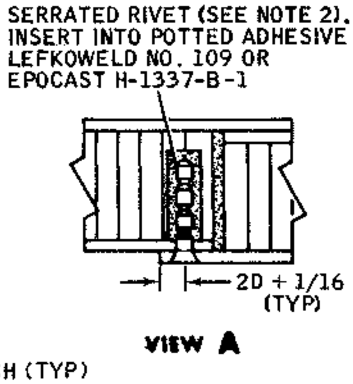


NOTES:

1. PRESSURE PLATES WITH BOLT, NUT, AND WASHER ARE USED TO CLAMP AND HOLD THE INNER PATCH, HONEYCOMB PLUG, AND INTERIOR SKIN REPAIR DOUBLER IN POSITION UNTIL ADHESIVE IS CURED. COVER BOLT HOLE WITH FAIRING.

2. IF THE REPAIR IS LOCATED IN AN AREA THAT REQUIRES MECHANICAL ATTACHMENTS (SEE FIGURE 4) ADD SERRATED RIVETS AS SHOWN IN FIGURE 3 AND INSTALL PER VIEW A





BB3-549A

Aluminum Honeycomb Panel Outer Skin Repairs - Class A
Figure 6

(8) Apply prepared adhesive to exposed edges of honeycomb plug, faying surface of inner patch, and interior skin repair doubler.

(9) Assemble repair parts into panel and apply pressure with a bolt or C-clamp.

(10) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

NOTE: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

(11) Remove bolt or C-clamp.

(12) Fill bolt hole with adhesive.

(13) Apply adhesive to faying surfaces of repair fairing.

(14) Place repair fairing into position. Press in firmly to obtain flush fitting.

(15) If the repair requires mechanical attachments per Figure 4, make serrated rivets, fill cavities in honeycomb with adhesive, and insert serrated rivets.

(16) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

NOTE: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

(17) Refinish repair surfaces.

10. Honeycomb Tab Trailing Edge Repairs - Class A

A. Procedures covering removal and replacement of small damaged sections of honeycomb tab trailing edges are as follows:

(1) Make minimum cutout needed to remove damaged area (see Figure 7). Maximum cutout depends on specific repair requirements and restrictions in the area affected.

(2) Cut the honeycomb 1/4 inch beyond the cutout in the skin.

(3) Make two repair rods. The first rod must butt flush to existing trailing edge rod ends. The second rod must extend 1/8 inch beyond each butt joint.

(4) Remove paint, including FR primer when applicable, and prepare rework area for bonding as described in paragraph 3.

(5) Place repair rods in position in trailing edge.

(6) Make skin patch to fit removed section.

(7) Prepare required amount of Lefkoweld No. 109 or Epocast H-1337-B-1 adhesive as described in paragraph 4.

(8) Fill rework area with adhesive.

(9) Cover uncured adhesive with Mylar sheet, and place trailing edge skin patch in position.

(10) Cover repair area with cellophane and apply plates and clamps to secure in place.

(11) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

(12) Remove trailing edge skin patch and Mylar.

(13) Sand cured adhesive filler to obtain a flush fit for skin patch, and also allow 0.005 to 0.010 inch for adhesive.

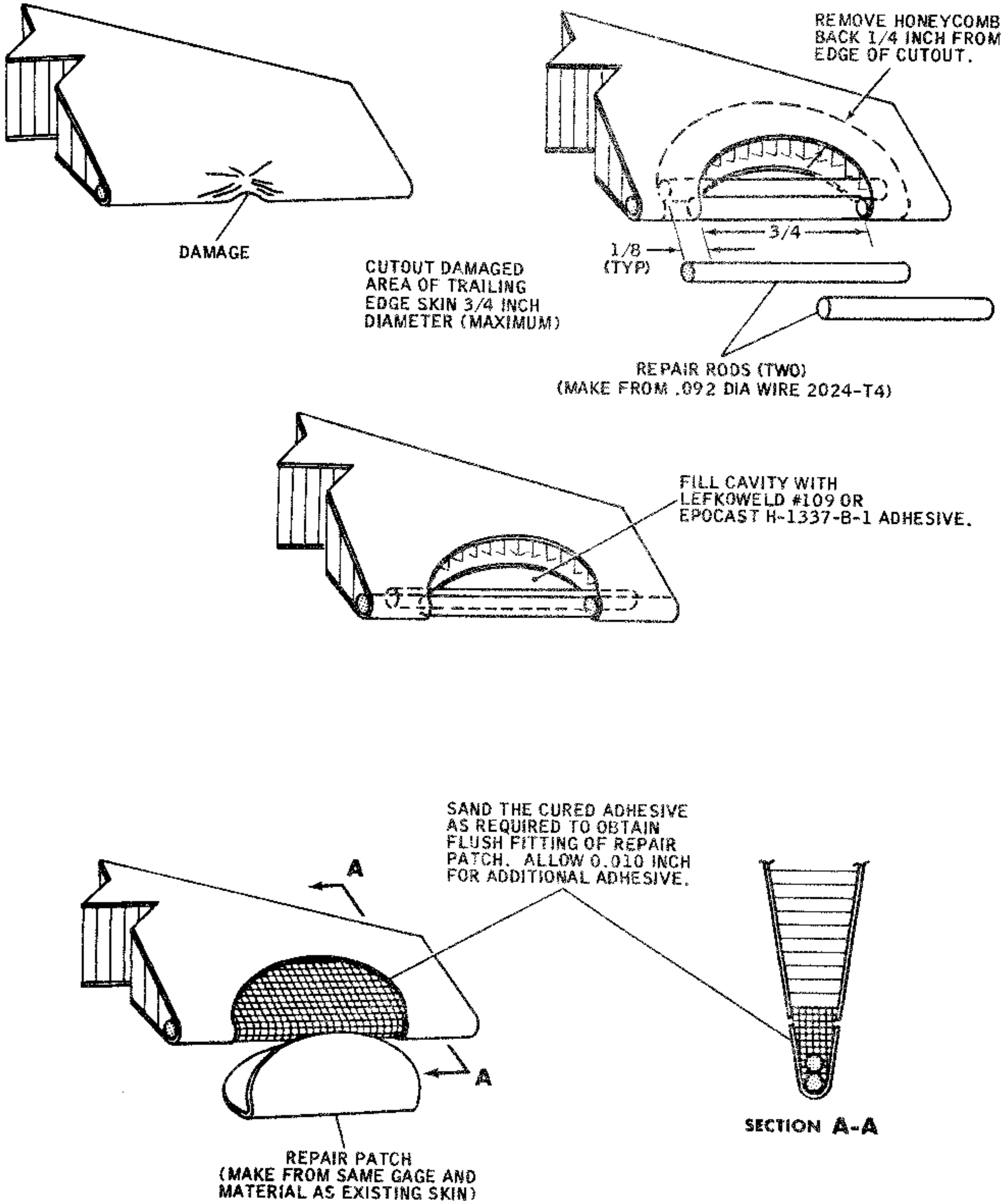
(14) Apply adhesive to faying surface of skin patch and adhesive filler.

(15) Place skin patch in position. Fair patch to trailing edge. Cover with cellophane and clamp between metal plates.

(16) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

(17) Remove clamps and refinish repair area.

(18) Rebalance repaired elevator or rudder tabs (see Chapter 55). Rebalance repaired aileron tabs (see Chapter 57).



BB3-551

Honeycomb Tab Trailing Edge Repairs - Class A
Figure 7

11. Honeycomb Tab Trailing Edge Corner Repairs - Class A

A. Procedures covering repairing of corner damage to tabs are as follows:

(1) Cut away damaged portion of trailing edge corner (see Figure 9).

(2) Remove trailing edge wire 1/4 inch beyond cutout in skin.

(3) Make repair insert to fit cutout area. Machine to accomodate existing doublers, ribs or skin. Allow 0.005 to 0.010 inch for adhesive.

(4) Place insert in position, and drill a minimum of two No. 40 holes through skins and insert. Make certain insert is butted to trailing edge wire.

(5) Counterskink for 3/32-inch rivets on both surfaces.

(6) Remove insert and prepare rework area for bonding as described in paragraph 3.

(7) Prepare required amount of Lefkoweld No. 109, or Epocast H-1337-B-1.

(8) Apply adhesive to faying surfaces of insert and tab.

(9) Install insert to align drilled holes, and install MS20426B3 rivets. Hand drive rivets and mill flush to both skins.

(10) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

NOTE: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

(11) Hand machine end of insert to fair.

(12) Apply alodine to reworked surface (see Section 51-10-3).

12. Honeycomb Tab Flush Surface Repairs - Class A

A. Procedures for making flush-type repairs to honeycomb tabs are as follows:

(1) Make cutout in skin of no more than 2-inch diameter, and remove damaged area (see Figure 9). Deburr edges. Do not allow a feather edge to result.

(2) Cut away honeycomb core to same outline as skin cutout.

NOTE: The depth may vary, as required, to remove damage to accommodate use of available thickness of honeycomb core. The honeycomb may be removed to opposite skin. Do not damage opposite skin.

(3) Make repair patch and disk, using same gage and material as existing skin.

NOTE: The disk may be omitted in cases where honeycomb was removed to the opposite skin.

(4) Make repair plug from same gage and type of aluminum honeycomb as existing core. Mill as described in paragraph 15 to ensure a flush surface when repair is completed. Make certain that ribbon in plug runs in same direction as existing core.

(5) Prepare faying surfaces in repair area for bonding as described in paragraph 3.

(6) Prepare required amount of Lefkoweld No. 109, or Epocast H-1337-B-1 adhesive as described in paragraph 4.

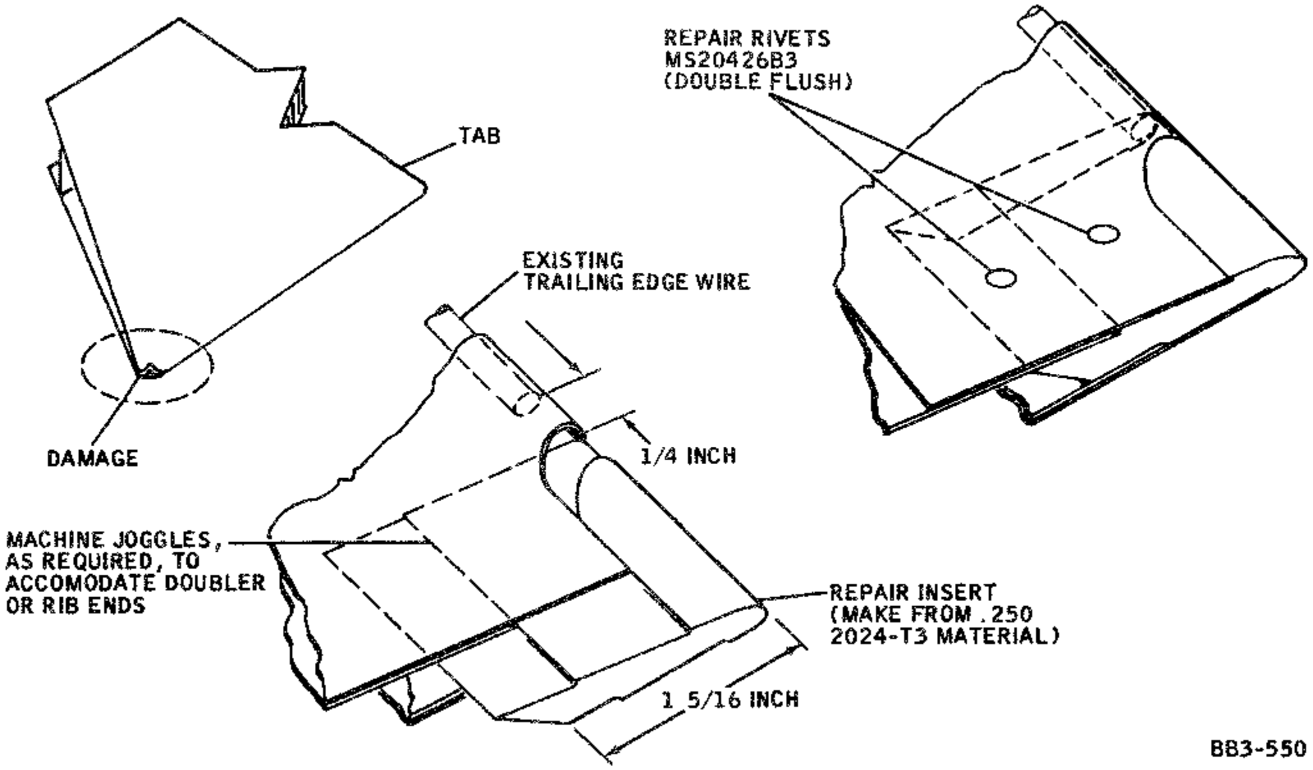
(7) Apply adhesive to faying surfaces of opposite skin or honeycomb core, repair disk, plug, and skin patch. Butter adhesive into the honeycomb around perimeter of plug and cutout.

(8) Place repair disk, plug, and skin patch in position firmly to ensure a good bond and flush surface.

(9) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

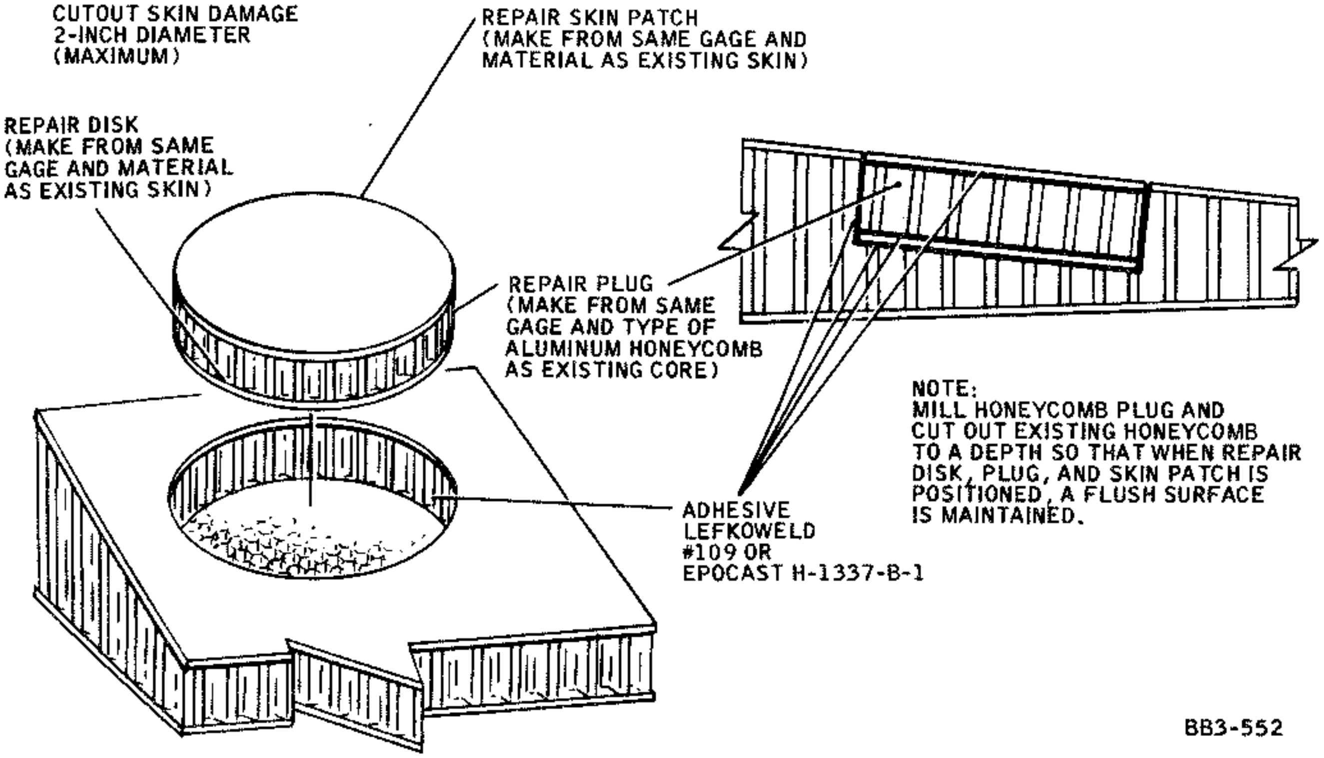
<u>NOTE</u>: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

(10) Refinish repaired surfaces.



B83-550

Honeycomb Tab Trailing Edge Corner Repairs - Class A
Figure 8



Honeycomb Tab Flush Surface Repairs - Class A
Figure 9

13. Aluminum Honeycomb Panel Repair - Interim (See Figure 10)

A. Interim repair of punctures, dings, or gouges less then 1/2 inch in honeycomb panels, tabs or spoilers may be accomplished as follows:

NOTE: This repair is limited to a period of 50 hours flight time. At the completion of this period, the repair must be removed and the damage examined for possible progression. If the damage has not progressed, the repair may be repeated and continued for additional 50-hour periods with removal and examination at the end of each period.

(1) Prepare surface area by wiping around damage with clean cloth dampened with methyl ethyl ketone (TT-M-261).

(2) Wipe area with clean cloth dampened with toluene.

(3) Dry area with clean, dry cloth.

(4) Prepare repair cover from chrome-colored Decalar pressure-sensitive tape No. 956. Cut tape to required size, allowing at least 1-inch overlap beyond damage perimeter.

(5) Remove protective film from adhesive side of tape.

Printed in U.S.A.

(6) Apply tape to damaged surface. Use fingers or roller to smooth tape and expel trapped air. Make certain tape overlaps at least 1 inch beyond damage in all directions.

(7) Allow tape to remain in place at least 30 minutes before handling to ensure proper adhesion.

14. Aluminum Panel Repair - Class B (See Figure 11)

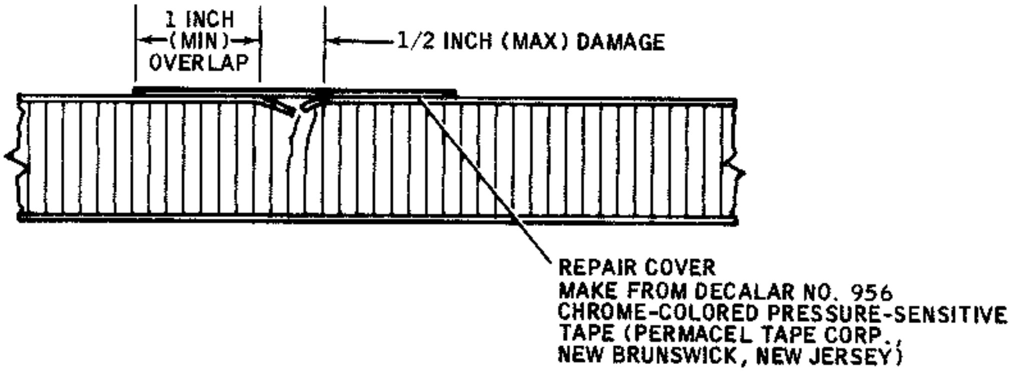
A. Fill dents in aluminum panels and leading edges as follows:

(1) Clean dented area, using methyl ethyl ketone (TT-M-261) on clean cloth.

(2) Wipe area using acetone on clean cloth.

(3) Lightly scuff-sand dented area, using fine-grit emery cloth. Wipe area with clean, dry cloth.

(4) Prepare filler material, Pro-Seal 735, as described in paragraph 4.



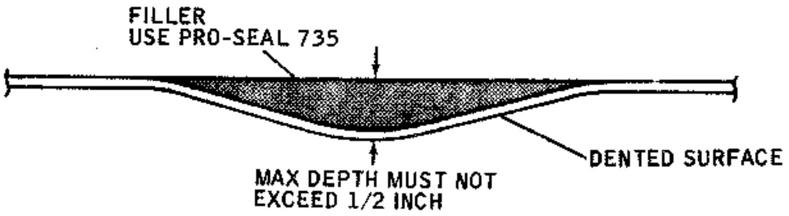
BB3-696

Aluminum Honeycomb Panel Interim Repair
Figure 10

(5) Apply filler material to dented area and fair with clean spatula or other suitable tool. Remove excess material.

(6) Cure dent filler material by allowing to set at room temperature 48 hours.

<u>NOTE</u>: The curing process may be accelerated by application of heat at 50 (±10°C) (120 ±10°F) for 2 to 4 hours.



BB3-553A

Aluminum Panel Repair - Class B
Figure 11

15. Stabilizing Aluminum Honeycomb Repair Core for Machining

A. Aluminum honeycomb is machined in the following manner:

(1) Apply layer of powdered polyethylene glycol to clean, flat metal plate.

(2) Using infrared lamp, oven, or hot plate, heat metal plate until powder melts at 55° to 61° C (131° to 142° F).

(3) When metal plate is wetted with film of melted polyethylene glycol, place aluminum honeycomb core on wetted surface and apply light pressure, using clean, flat board, or other flat object to ensure total contact of core with metal plate.

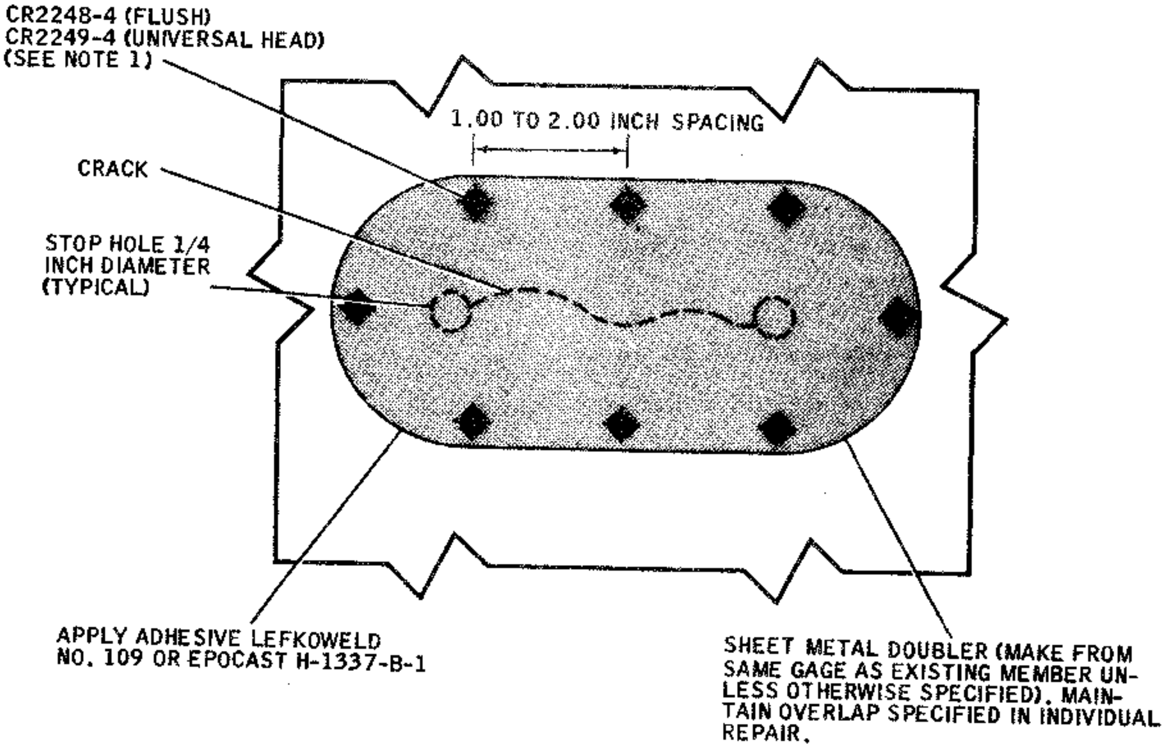
(4) Remove heat source and allow polyethylene glycol to solidify. Remove board, leaving honeycomb core adhered to metal plate.

(5) Perform light machining, as required. For more extensive machining of entire core, fill honeycomb cells with melted polyethylene glycol after core has been secured to metal plate. Machine core, as required. Do not use oil or other coolants for machining operation. To bandsaw, use very fine blade. To lightly sand, use either table belt sander or table disc sander. Exercise care to avoid heating core during machining operation.

(6) After machining, apply heat to melt polyethylene glycol out of core.

(7) Clean machined core for bonding, dipping core in clean, boiling water until all polyethylene glycol is dissolved.

<u>NOTE</u>: Polyethylene glycol may be filtered and reused, but will decompose with repeated use. Polyethylene glycol is nontoxic and will not irritate skin.



TYPICAL APPLICATION OF BONDED REPAIR

NOTES:

1. IF THE REPAIR IS LOCATED IN AN AREA THAT REQUIRES MECHANICAL ATTACHMENTS PER FIGURE 4, ADD THE CHERRY RIVETS AS NOTED.
2. IF THE BONDING ADHESIVE WILL BE SUBJECT TO TENSION OR PEEL LOADS, MECHANICAL ATTACHMENTS MUST BE USED AS SPECIFIED IN INDIVIDUAL REPAIRS.
3. GAPS BETWEEN THE FAYING SURFACES (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED 0.032 INCH.
4. CHERRY RIVETS MAY BE PURCHASED FROM THE TOWNSEND COMPANY, CHERRY RIVET DIVISION, SANTA ANA, CALIF.

BB3-659

Bonding of Sheet Metal Patches
Figure 12

16. Metal-to-Metal Bonding Procedures

A. The following procedures apply when bonding sheet metal patches to damaged structural members. Limitations and requirements of individual repairs must be followed, as applicable.

(1) Drill stop holes or remove damaged area as specified by individual repairs.

(2) Prepare patch as specified in individual repair.

(3) If mechanical attachments are required (see Figure 4 and Figure 12) prepare attachment holes, as required.

(4) Remove paint including FR primer when applicable, and prepare rework area for bonding as described in paragraph 3.

(5) Prepare required amount of Lefkoweld 109, or Epocast H-1337-B-1 adhesive as described in paragraph 4.

(6) Apply adhesive to faying surfaces of repair area.

(7) Place patch in position, align attachment holes as applicable, and install attachments as required by individual repair.

(8) Cure adhesive by applying heat, 68 (±5)°C (155 ±10°F), for 90 minutes.

NOTE: The adhesive will cure in 72 hours when maintained at a minimum of 21°C (70°F).

MISCELLANEOUS BONDING PROCEDURES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Miscellaneous bonding techniques applicable to the DC-9 Structural Repair Manual requirements are described in this section.

B. Repair bonding procedures covered in this section are to be used whenever individual repairs specify such applications.

2. Glass Fiber Layup to Metal Repairs

A. Glass fiber layup repairs are applied to metal surfaces when specified by individual repairs. The procedure requires use of adhesive (Lefkoweld No. 109, or Epocast H-1337-B-1) to bond the first layer of cloth to the metal. The following layups must be applied and impregnated with resin (Epon 828). Repair procedures are as follows:

(1) Cut to shape the required number of No. 120 or No. 181 glass cloth plies to be bonded, as specified in the individual repair.

(2) Clean metal faying surfaces, and prepare for bonding (see 51-70-2, paragraph 3).

NOTE: If the glass cloth is to be applied on both sides of the cracked member, clean both faying surfaces before beginning repair layup on either side.

(3) Mix required amount of adhesive (Lefkoweld No. 109 or Epocast H-1337-B-1) (see 51-70-2, paragraph 4).

(4) Apply adhesive to repair area approximately 1/32-inch thick. Work out all air bubbles and make certain that faying surface is completely wetted.

(5) Apply one coat of glass cloth to adhesive, press in place, and work out all trapped air.

(6) Mix required amount of resin (Epon 828) (see 51-70-1, paragraph 4).

(7) Apply mixed resin to glass cloth covering adhesive. Stipple surface with a brush to completely impregnate cloth with resin and to expel any trapped air.

(8) Apply next layer of dry, glass cloth over resin surface, apply mixed resin, and proceed as in step (7). Repeat procedure for each successive ply until correct number of plies are in place. Slit glass cloth as necessary in areas of lightening holes to facilitate forming.

(9) Cover repair with cellophane. Use pressure plates (wood or metal) to spread pressure evenly, and apply pressure with C-clamps, weights, or other applicable devices.

(10) Cut piece of cellophane sheet, about 2 inches square, and mark with 38°C (100° F), 68° C (155° F), and 93° C (200° F) Tempilaq, or equivalent. Place cellophane sheet on center of repair, with Tempilaq facing out.

(11) Cure repair, allowing 1 hour for resin to gel. Then apply heat, 68 (±5)° C (155 ±10° F) for 90 minutes. Use a 350-watt infrared bulb, at distance at which 68°C (155° F) Tempilaq just begins to melt.

<u>NOTE</u>: The 1 hour period for the resin to gel may be accellerated by cautious application of heat 38°C (100° F). Heat above this temperature may cause resin to boil or blister, in which case, the plies must be peeled off and new cloth and resin must be applied.

(12) Install any required attachment. There must be an aluminum washer next to any glass cloth.

(13) Apply applicable paint or corrosion protection required to complete repair.

CHAPTER 52

DOORS

Chapter 52

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Title					
*52-Eff.	1-2	Dec 1/66	52-02	8	Mar 1/66
*52-Cont.	1	Dec 1/66	52-02	9	Sep 1/65
52-Cont.	2	Jun 1/66	52-02	10	Sep 1/65
*52-T Var.	1	Dec 1/66	52-02	11	Mar 1/66
*52-Sect. App.	1	Dec 1/66	52-02	12	Sep 1/65
52-00	1	Jun 1/66	52-02	13	Mar 1/66
52-00	2	Sep 1/66	52-03	1	Jun 1/66
52-00	3	Sep 1/66	52-03	2	Sep 1/65
52-01	1	Jun 1/66	52-03	3	Sep 1/65
52-01	2	Sep 1/65	52-03	4	Sep 1/65
52-01	3	Mar 1/66	52-03	5	Sep 1/65
52-01	4	Sep 1/65	52-03	6	Sep 1/65
52-01	5	Sep 1/65	52-03	7	Mar 1/66
52-01	6	Dec 1/65	52-04	1	Jun 1/66
52-01	7	Mar 1/66	52-04	2	Sep 1/65
52-01	8	Dec 1/65	52-04	3	Jun 1/66
52-01	9	Dec 1/65	52-04	4	Sep 1/65
52-01	10	Dec 1/65	52-04	5	Mar 1/66
52-01	11	Mar 1/66	52-04	6	Sep 1/65
52-01	12	Dec 1/65	52-04	7	Mar 1/66
52-01	13	Dec 1/65	52-04	8	Jun 1/66
52-01	14	Dec 1/65	52-05	1	Jun 1/66
52-01	15	Dec 1/65	52-05	2	Sep 1/65
52-01	16	Dec 1/65	52-05	3	Sep 1/65
52-01	17	Mar 1/66	52-05	4	Sep 1/65
52-01	18	Dec 1/65	52-05	5	Mar 1/66
52-01	19	Dec 1/65	52-05	6	Mar 1/66
52-01	20	Sep 1/65	52-05	7	Mar 1/66
52-01	21	Sep 1/65	52-05	8	Sep 1/65
52-02	1	Jun 1/66	*52-06	1	Dec 1/66
52-02	2	Jun 1/66	52-06	2	Sep 1/66
52-02	3	Sep 1/65	52-06	3	Sep 1/66
52-02	4	Mar 1/66	52-06	4	Sep 1/66
52-02	5	Sep 1/65	52-06	5	Sep 1/66
52-02	6	Sep 1/65	52-10-0	1	Jun 1/66
52-02	7	Sep 1/65	52-10-0	2	Sep 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
*52-10-0	3	Dec 1/66			
*52-10-0	4	Dec 1/66			
*52-10-0	5	Dec 1/66			
*52-10-0	6	Dec 1/66			
52-20-0	1	Jun 1/66			
52-20-0	2	Sep 1/66			
52-20-0	3	Sep 1/66			
52-30-0	1	Jun 1/66			
52-30-0	2	Sep 1/66			
52-30-0	3	Sep 1/66			
52-30-0	4	Jun 1/66			
52-30-0	5	Jun 1/66			
*52-30-0	7	Dec 1/66			
52-40-0	1	Jun 1/66			
52-40-0	2	Sep 1/66			
52-40-0	2A	Sep 1/66			
52-40-0	2B	Sep 1/66			
52-40-0	2C	Sep 1/66			
52-40-0	3	Sep 1/65			
52-40-0	4	Sep 1/66			
52-40-0	5	Sep 1/66			
52-40-0	6	Sep 1/66			
52-40-0	7	Dec 1/65			
52-40-0	8	Sep 1/66			
52-50-0	1	Jun 1/66			
52-50-0	2	Dec 1/65			
52-50-0	3	Sep 1/66			
52-60-0	1	Jun 1/66			
52-60-0	2	Sep 1/66			
52-60-0	3	Dec 1/65			
*52-60-0	4	Dec 1/66			
*52-60-0	5	Dec 1/66			
*52-60-0	6	Dec 1/66			
52-70-0	1	Jun 1/66			
52-80-0	1	Jun 1/66			
52-80-0	2	Sep 1/65			
52-80-0	3	Jun 1/66			
52-80-0	4	Sep 1/66			
52-80-0	5	Sep 1/66			
52-80-0	6	Sep 1/66			

*The asterisk indicates pages revised or added by the current revision.

Chapter 52

TABLE OF CONTENTS

Chapter 52

TYPE VARIATIONS

The illustrations listed below, in numerical sequence by chapter, section, and subject, reflect structural differences in the doors. These differences are indicated as type variations. The effectivity of each type is indicated by fuselage serial numbers.

Figure	TITLE	Effectivity
	Section 52-10-0	
1	Passenger Forward Entrance Door Structure -- Type I	DC-9-10 airplanes 1 thru 51.
1	Passenger Forward Entrance Door Structure -- Type II	DC-9-10 airplanes 52 and subsequent.
	Section 52-40-0	
1A	Forward Service Door Structure -- Type A1	DC-9-30 airplanes 45733, 45734, 45833 - 45840, 45863 - 45866, 47038, 47098.
1A	Forward Service Door Structure -- Type A2	All other DC-9-30 airplanes.
	Section 52-80-0	
2	Main Gear Inboard Door Structure -- Type I	DC-9-10 airplanes 1 thru 56.
4	Main Gear Inboard Door Structure -- Type II	DC-9-10 airplanes 57 and subsequent.
5	Main Gear Inboard Door Structure -- Type A	DC-9-30 airplanes

Chapter 52

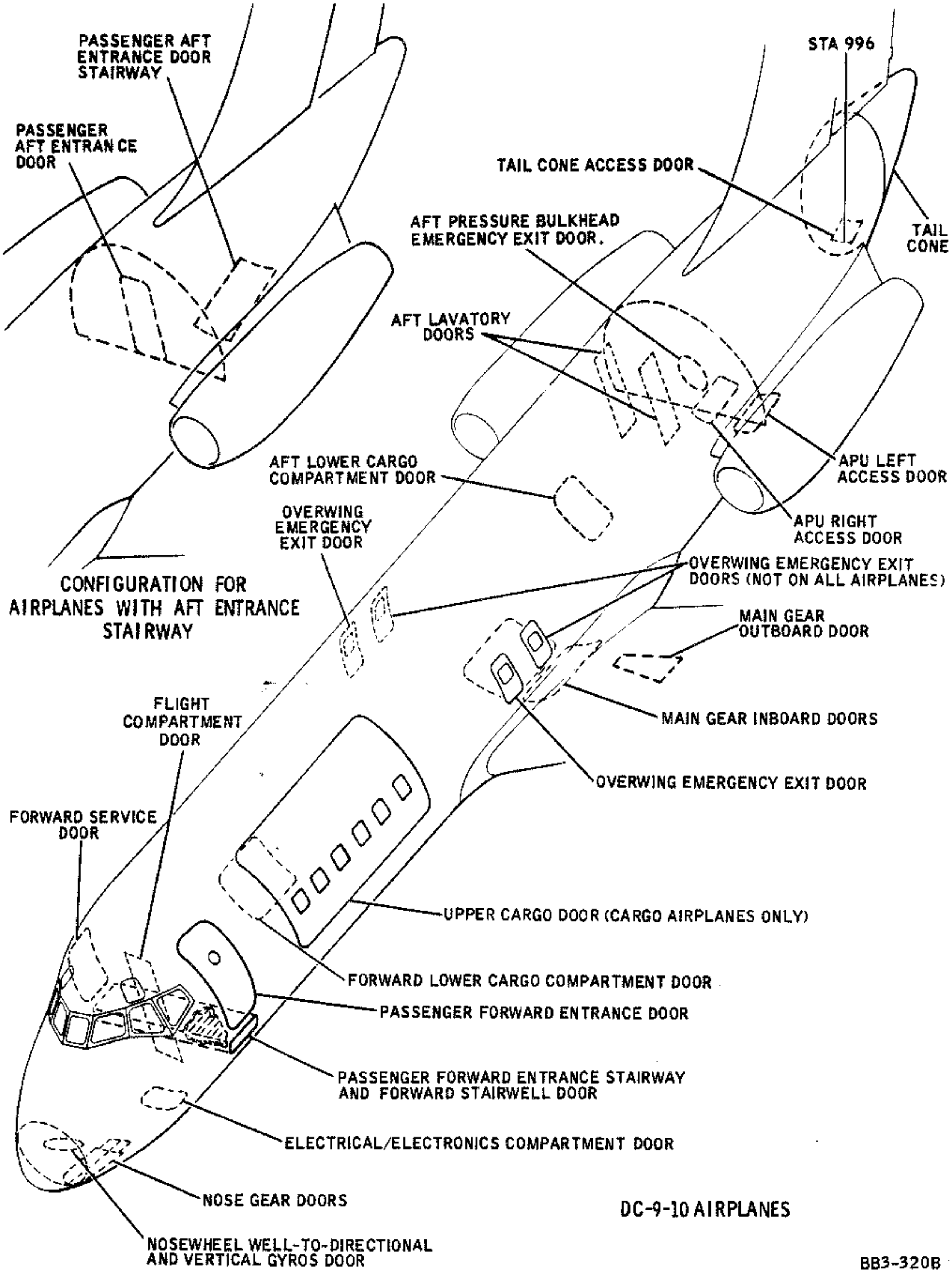
SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
52-00	YES	YES
52-01	YES	YES
52-02	YES	YES
52-03	YES	YES
52-04	YES	YES
52-05	YES	YES
52-06	YES	YES
52-10-0	YES	YES
52-20-0	YES	YES
52-30-0	YES	YES
52-40-0	YES	YES
52-50-0	YES	YES
52-60-0	YES	YES
52-70-0	YES	YES
52-80-0	YES	YES

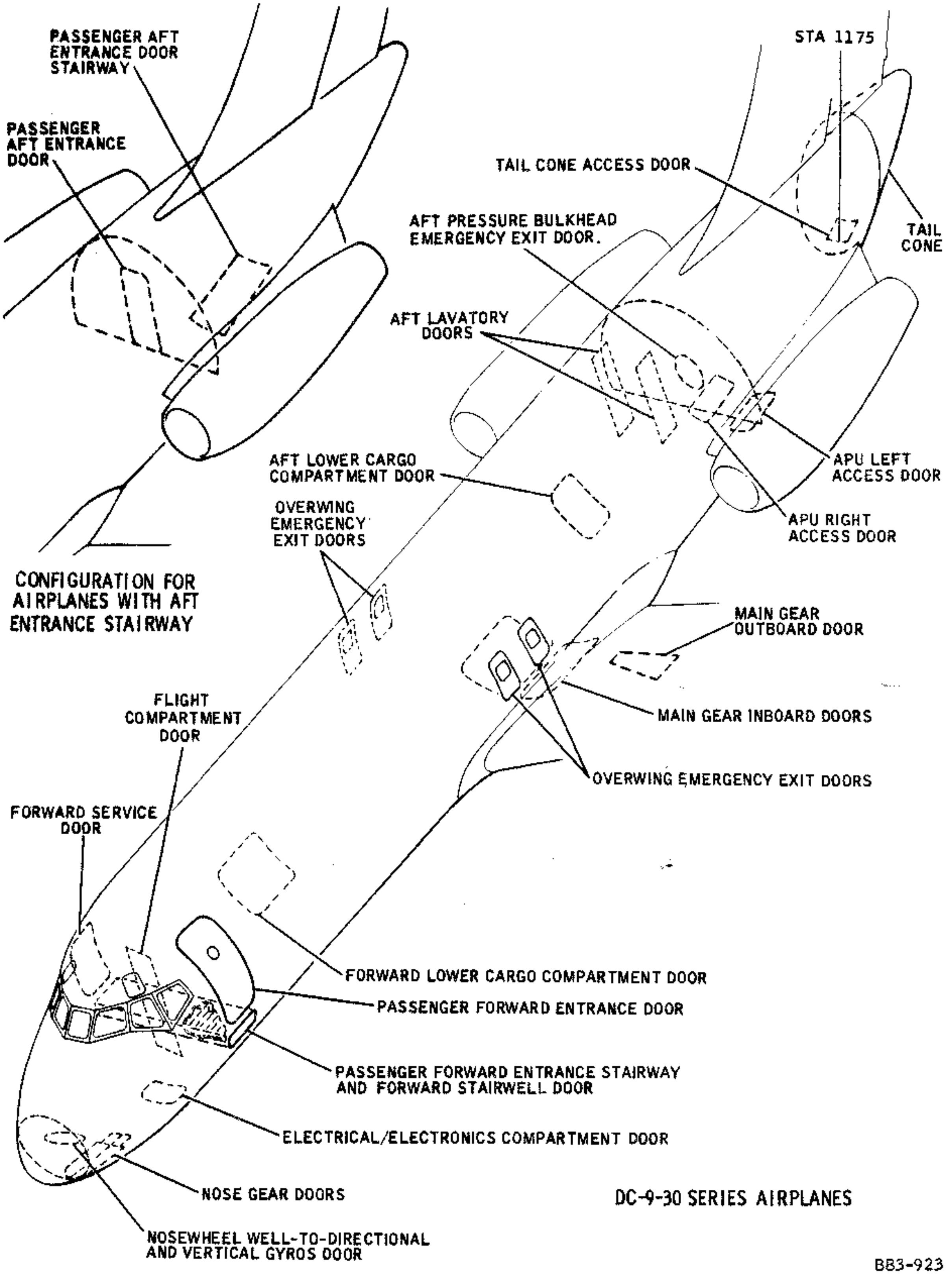
GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Repair instructions for doors used for entrance to, and exit from, the compartments of the fuselage are described in this chapter. Material identification illustrations indicate the type of material and gages of repairable structural components of door assemblies. Repair instructions are described for the most common types of damage. An explanation of the classification of repairs and damage is given in Chapter 51, Section 51-00. For location of the doors described in this chapter, refer to door index illustration, Figure 1. A repair index is outlined with each section of the door components.



Door Index Illustration
Figure 1 (Sheet 1)



Door Index Illustration
Figure 1 (Sheet 2)

GENERAL REPAIR PROCEDURES AND PROCESSES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The following requirements are necessary to accomplish the repairs outlined in this chapter, and are in addition to the specific repair requirements listed with the individual repair.

(1) The recommended edge distance for all attachments in the repair areas is two diameters plus 1/16 inch, unless otherwise noted. The minimum edge distance is two diameters.

(2) All repair materials must be of the same material and heat-treat condition as the part being repaired, unless otherwise noted. See Chapter 51 for recommended substitutions. If forming operations require repair material to be in the -O (soft) condition, the part must be heat treated to the appropriate -T condition after forming. The word "clad" is placed before aluminum alloy material designations in the manual to indicate material which has a thin protective layer of pure aluminum on its surface. Absence of the word "clad" preceding a material designation indicates that the material does not have this thin layer of aluminum.

(3) All metal repair parts must be cleaned and corrosion protected in accordance with Chapter 51, unless otherwise noted in the individual repair.

(4) All repair parts must be free from cracks, burrs, dings, and sharp edges. This requirement also applies to parts to which repair parts are being attached.

(5) All attachment holes must be prepared in accordance with recommended fastener hole sizes specified in the applicable section of Chapter 51.

(6) The minimum attachment spacing in repair areas is four diameters, unless otherwise noted.

(7) All repairs within the pressure boundary of the fuselage require sealing as described in the Repair Sealing Section of Chapter 51.

(8) Where external doublers are to be tapered for aerodynamic reasons, a seal-type taper may be substituted. Refer to Repair Sealing Section of Chapter 51.

(9) Mechanical attachments are required to further secure bonded repairs located in the areas defined in Figure 4, Section 51-70-2.

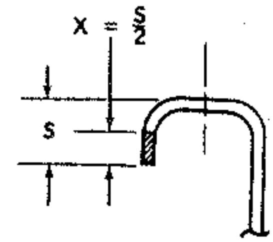
2. General Repairs

A. The repairs described in this section are of a general nature and may be used separately or in conjunction with specific repairs that are described in subsequent sections of the chapter. When applicable, specific repairs are preferred. Repairs involving more than one illustration must comply with the requirements of each illustration. The following repairs are outlined in this section:

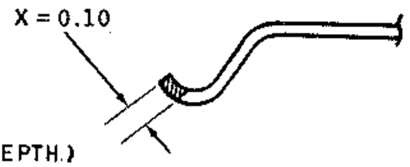
ALLOWABLE CLEANUP OF SCRATCHES, NICKS, AND DINGS IN DOOR STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
NICKS IN EXTRUSIONS, ROLLED, AND FORMED SECTIONS.

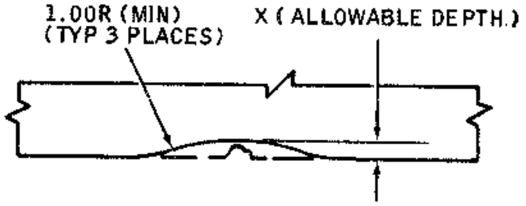
1. NICKS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. NICKS UP TO THE DEPTH SHOWN IN THE SKETCHES BELOW SHOULD BE ROUNDED OUT TO 1.00 INCH RADIUS.
3. NICKS DEEPER THAN THE LIMIT SHOWN IN THE SKETCHES BELOW MUST BE SPLICED OR REINFORCED AFTER THE NICK IS ROUNDED OUT.
4. NICKS IN A RADIUS AREA SHOULD BE REPAIRED AS A DING IN A RADIUS AREA AS DESCRIBED IN THE SKETCH ON SHEET 4, THE CRACKED MEMBER SPLICE REPAIR, THIS SECTION.



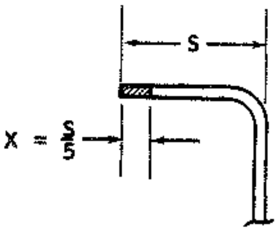
RETURN FLANGE
(ATTACHED AND UNATTACHED)



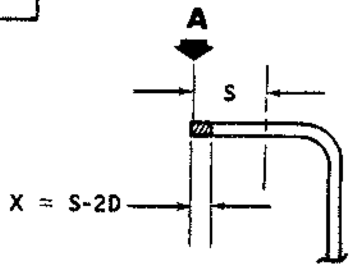
LIGHTENING HOLE



DETAIL OF NICK REMOVED
VIEW A (TYP)



STRAIGHT FLANGE
(UNATTACHED AND
BETWEEN ATTACHMENTS)



D = ATTACHMENT DIA
STRAIGHT FLANGE
(AT ATTACHMENTS)

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEAN UP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-324B

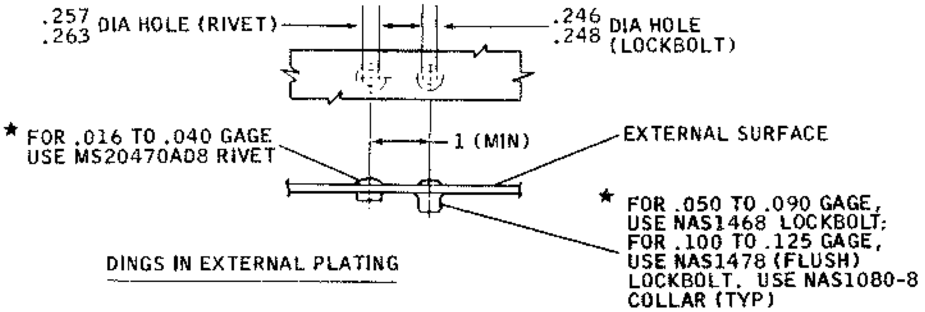
Cleanup of Scratches, Gouges, Nicks and Dings in Door Structure
Figure 1 (Sheet 1)

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN DOOR STRUCTURE

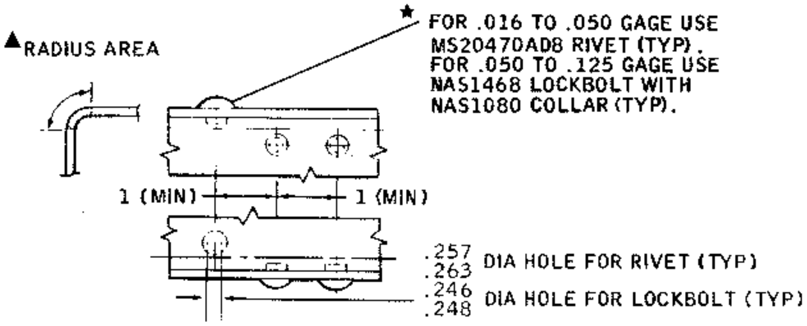
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
DINGS

1. DINGS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. DINGS THAT PENETRATE BEYOND THE CLAD AND ARE NOT LARGER THAN 0.250 INCH DIAMETER SHOULD BE REMOVED AND PLUGGED. SEE SKETCHES BELOW. SEE CHAPTER 51 FOR DING REPAIRS IN ALUMINUM HONEYCOMB PANELS.
3. DINGS LARGER THAN 0.250 INCH DIAMETER MUST BE REPAIRED. REPAIR IN SAME MANNER AS CRACKED MEMBERS, THIS SECTION.
4. THESE INSTRUCTIONS DO NOT APPLY TO MACHINED FITTINGS IN THE DOORS.



DINGS IN EXTERNAL PLATING



DINGS IN INTERNAL STRUCTURE

★ MS20470AD8 RIVET MAY BE USED IN PLACE OF LOCKBOLT IF MORE CONVENIENT.

▲ DINGS IN A RADIUS AREA REQUIRE THE SECTION TO BE REPAIRED AFTER THE DING IS DRILLED OUT. SEE THE ALUMINUM ALLOY TO ALUMINUM ALLOY (CRACKED MEMBER) REPAIRS, THIS SECTION. (ONLY 3 ATTACHMENTS REQUIRED WHERE 5 ARE CALLED OUT). DO NOT INSTALL A FASTENER IN THE DING CLEANOUT HOLE.

---

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-325

Printed in U.S.A.

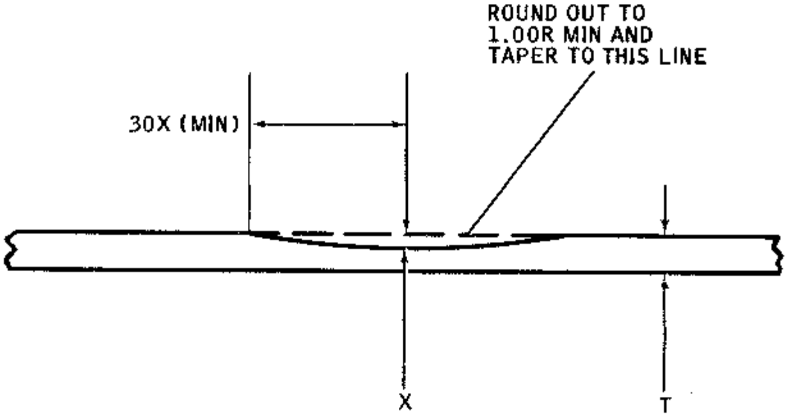
Cleanup of Scratches, Gouges, Nicks and Dings in Door Structure
Figure 1 (Sheet 2)

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN DOOR STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE

SCRATCHES AND GOUGES

1. SCRATCHES OR GOUGES THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. SCRATCHES OR GOUGES THAT PENETRATE BEYOND THE CLAD UP TO THE DEPTH SHOWN IN THE TABLE BELOW SHOULD BE ROUNDED OUT AND TAPERED. SEE SKETCH BELOW.
3. SCRATCHES OR GOUGES DEEPER THAN THE LIMIT SHOWN IN THE TABLE BELOW MUST BE REPAIRED. REPAIR IN THE SAME MANNER AS CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.



T = MATERIAL THICKNESS
X = ALLOWABLE DEPTH

MAX DEPTH OF X
NOT TO EXCEED 0.20T

NOTE: CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL)

BB3-326

Cleanup of Scratches, Gouges, Nicks and Dings in Door Structure
Figure 1 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR

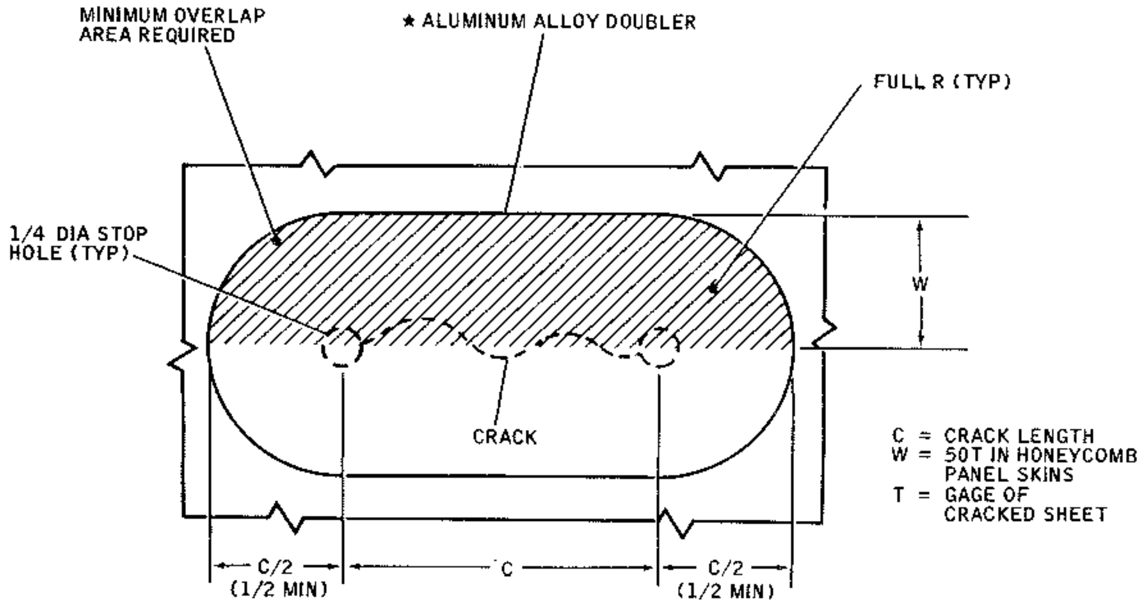
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE A BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
4. IF CRACKS ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE SKIN IN THE SHORTEST DIRECTION, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE SKIN SURFACE, THEN THE PANEL SHOULD BE REPLACED.
5. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE A

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125°F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-300A

Aluminum Alloy to Aluminum Alloy Repairs (Cracked Members)
Figure 2 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET

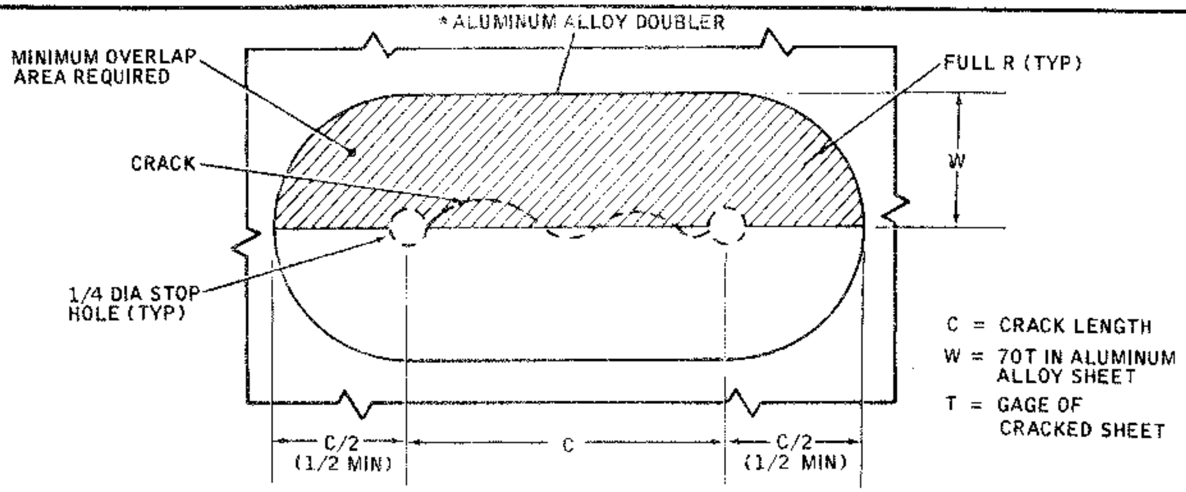
.010 TO .032 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE D BELOW
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 2, SHEET 3.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 35T AND THE DOUBLER GAGE SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI. USING FOLLOWING FORMULA, COMPUTE NUMBER OF RIVETS REQUIRED:

$$\frac{W \times C \times 500\ \text{PSI} \times 1.15}{R}$$

W = MIN OVERLAP
C = LENGTH OF CRACK
R = MIN RIVET ALLOWABLE FROM 51-30-0

5. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE D

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

* DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIUAL REPAIR.

BB3-301B

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

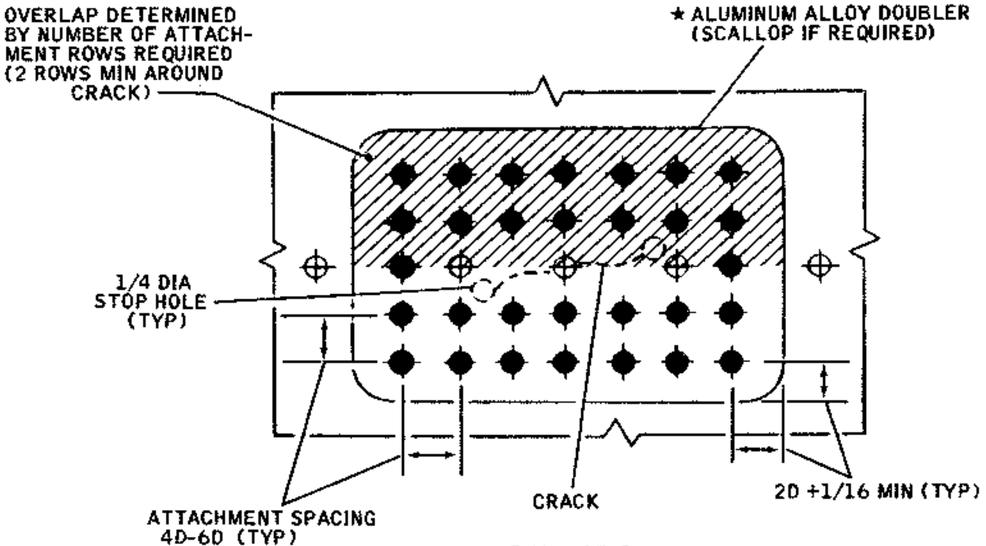
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET

.032 TO .090 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE IN THIS SECTION MAY ALSO BE USED. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE B

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F.).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-302A

Aluminum Alloy to Aluminum Alloy Repairs (Cracked Members)
Figure 2 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

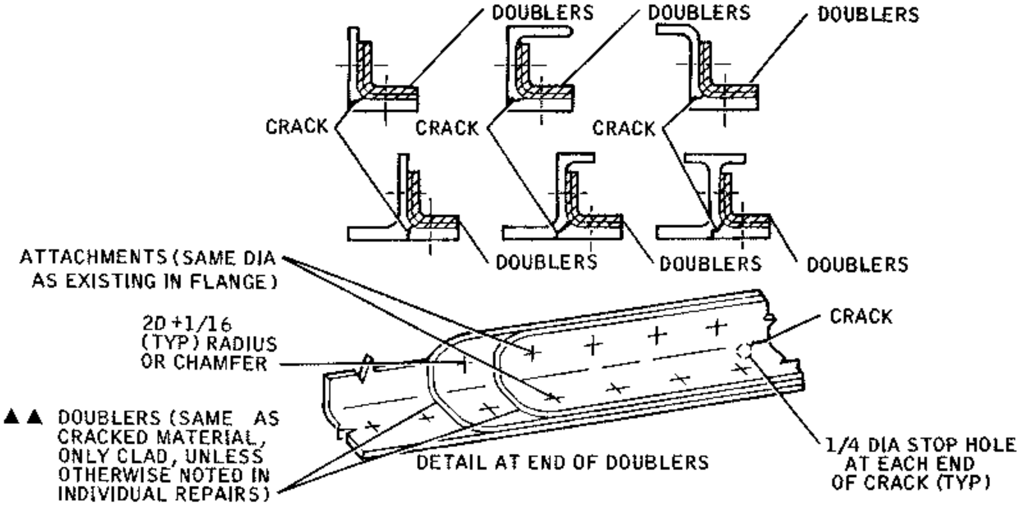
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY EXTRUDED, FORMED AND ROLLED SECTIONS

.016 TO .125 GAGE

1. REPAIR CRACKS PARALLEL TO THE ATTACHED FLANGE RADIUS OF EXTRUDED, FORMED, OR ROLLED SECTIONS, USING FORMED DOUBLERS. INSTALL WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE C.
2. THE ADHESIVE WILL CAUSE THE DOUBLERS TO ACT AS A SINGLE DOUBLER, LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. PICK UP AT LEAST ONE ROW OF ATTACHMENTS EACH SIDE OF CRACK AND PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK IN EACH ROW AT EACH END AS SHOWN IN DETAIL BELOW.
4. THE DOUBLERS SHOULD BE EQUAL IN GAGE, IF POSSIBLE. THE THINNEST DOUBLER SHOULD BE INSTALLED NEXT TO CRACKED MEMBER.
5. IF THE CRACK IS PERPENDICULAR TO A FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED, OR ADDITIONAL DOUBLERS ADDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.
6. TWO THIN FORMED DOUBLERS ARE USED IN ORDER TO GET A SMALLER BEND RADIUS AND TO GET A TAPERED EFFECT IN LOAD PICKUP.



EXAMPLE C

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

▲▲ FOR FORMED AND ROLLED SECTIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE EQUAL TO OR GREATER THAN THE CRACKED MEMBER GAGE, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR. FOR EXTRUSIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE AT LEAST ONE GAGE HEAVIER THAN THE THICKEST LEG ADJACENT TO THE CRACK.

BB3-303A

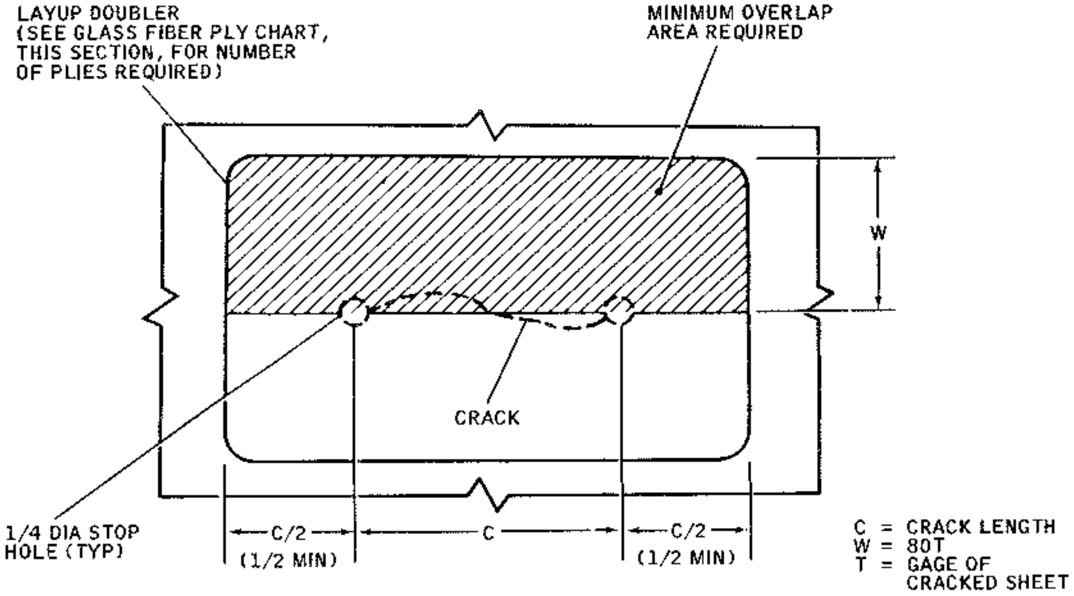
Aluminum Alloy to Aluminum Alloy Repairs (Cracked Members)
Figure 2 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE A BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR ATTACHMENTS
5. IF CRACKS ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE SKIN, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE SKIN SURFACE, THEN THE SKIN SHOULD BE REPLACED.



EXAMPLE A

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-304A

Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Members)
Figure 3 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

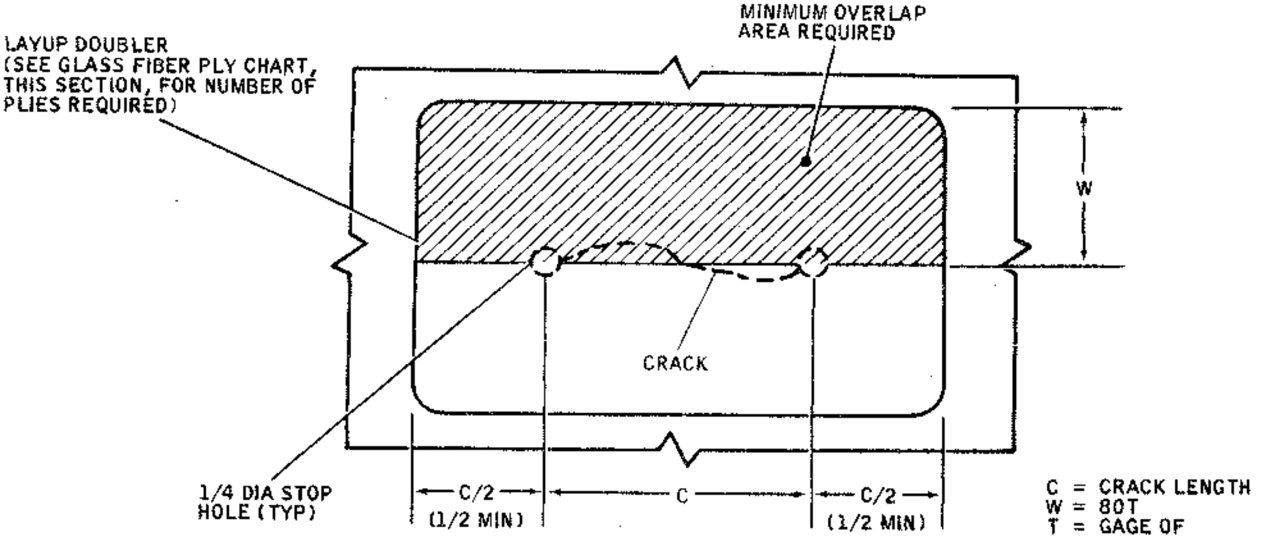
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.010 TO .032 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 3, SHEET 3.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 40T AND THE NUMBER OF PLIES SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI. USING FOLLOWING FORMULA, COMPUTE NUMBER OF RIVETS REQUIRED:

$$\frac{W \times C \times 250\ \text{PSI} \times 1.15}{R}$$

W = MIN OVERLAP
C = LENGTH OF CRACK
R = MIN RIVET ALLOWABLE PER 51-30-0

5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER IN THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE D

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-305B

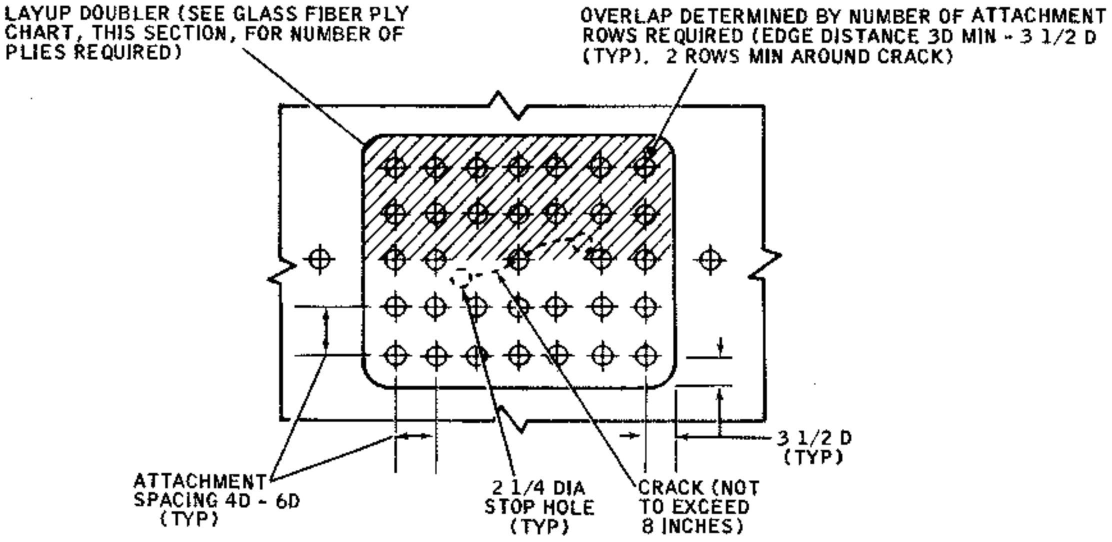
Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Members)
Figure 3 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.032 TO .050 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-3. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. DO NOT USE LAYUP DOUBLERS ON THE FUSELAGE PRESSURIZED DOOR PLATING.
5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE B

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-306A

Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Members)
Figure 3 (Sheet 3)

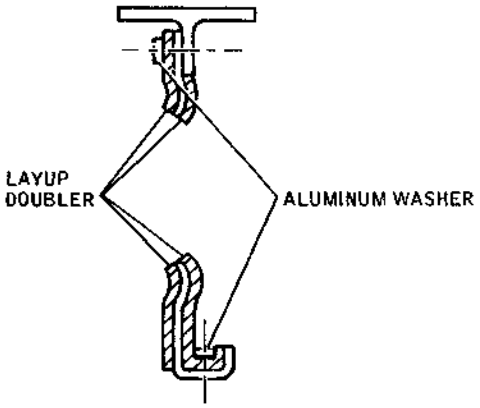
DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

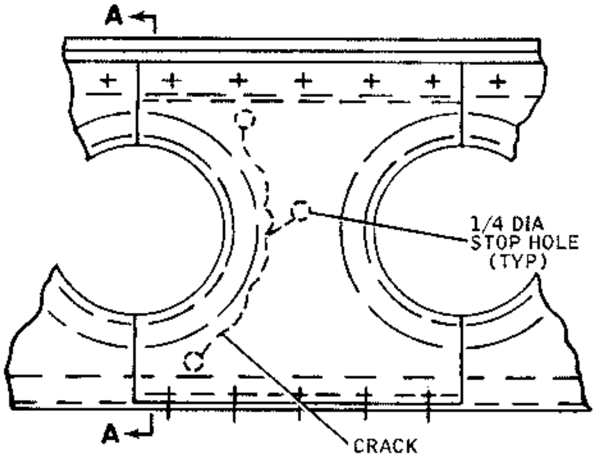
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY RIBS, INTERCOSTALS, AND STIFFENERS
.016 TO .080 GAGE
1. REPAIR LIGHTENING HOLE RADIUS CRACKS USING A LAYUP DOUBLER OVER BOTH SURFACES OF THE CRACKED MEMBER BONDED PER 51-70-3. SEE EXAMPLE C BELOW. 2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF THE MAIN CRACKS. 3. EXTEND THE DOUBLERS IN THE CRACK DIRECTION TO PICK UP ATTACHMENTS AS SHOWN. MAKE CERTAIN THAT ALUMINUM ALLOY WASHERS ARE INSTALLED ON THE GLASS FIBER SIDE OF THE REPAIR AT THE ATTACHMENTS. 4. EXTEND THE DOUBLERS ON BOTH SIDES OF THE CRACK TO THE APPROXIMATE CENTER OF THE LIGHTENING HOLE.

NOTE:

SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED IN DOUBLERS.



SECTION A-A



EXAMPLE C

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-307A

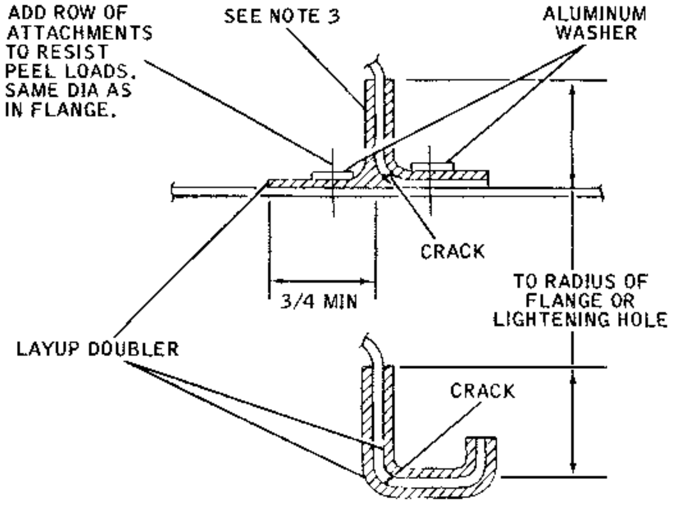
Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Members)
Figure 3 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY FORMED AND ROLLED SECTIONS
.016 TO .080 GAGE

1. REPAIR CRACKS PARALLEL TO THE FLANGE RADIUS OF FORMED OR ROLLED SECTIONS USING LAYUP DOUBLERS BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. IF THE CRACKED FLANGE IS ATTACHED, THEN PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK AT EACH END, AND ADD A ROW OF ATTACHMENTS AS SHOWN. MAKE BOTH DOUBLERS THE SAME LENGTH. INSTALL ATTACHMENTS AFTER CURING.
3. IF THE FLANGE IS NOT ATTACHED, THEN OVERLAP THE DOUBLERS BEYOND THE ENDS OF THE CRACK BY AT LEAST THREE INCHES.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE CRACK IS PERPENDICULAR TO THE FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.



EXAMPLE D

NOTES:

1. SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF CRACK.
3. IN .071 AND .080 GAGES, ADD ROW OF ATTACHMENTS SAME DIA AS THOSE IN FLANGE.

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-308A

Printed in U.S.A.

Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Members)
Figure 3 (Sheet 5)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

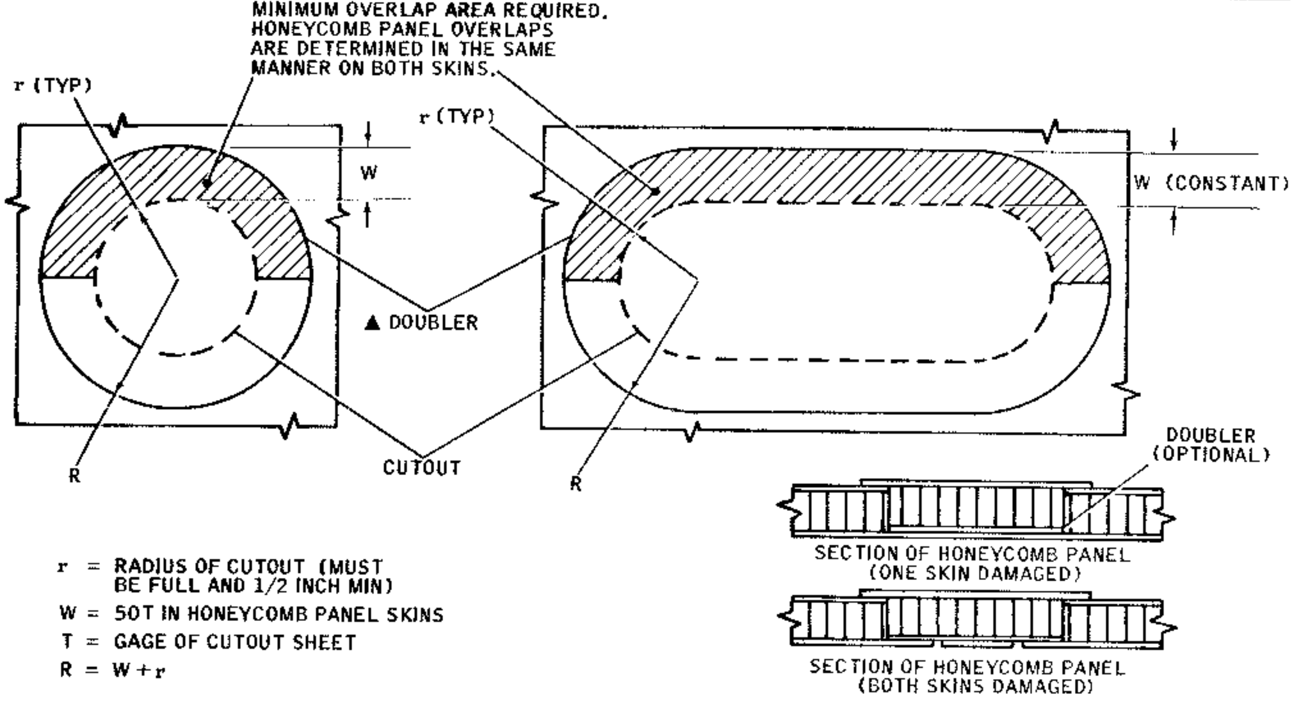
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE FROM A REPAIR PANEL OR ALUMINUM ALLOY DOUBLERS AND A REPAIR CORE BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
3. GLASS FIBER LAYUP SHOWN ON ANOTHER ILLUSTRATION, THIS SECTION, MAY BE USED AS A SUBSTITUTE FOR THE ALUMINUM ALLOY DOUBLERS. HOWEVER, ALUMINUM ALLOY DOUBLERS ARE PREFERRED.
4. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS), IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
5. IF DAMAGE IS LARGER THAN ONE-FOURTH THE DISTANCE ACROSS THE PANEL, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2 INCH MIN)

W = 50T IN HONEYCOMB PANEL SKINS

T = GAGE OF CUTOUT SHEET

R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-309A

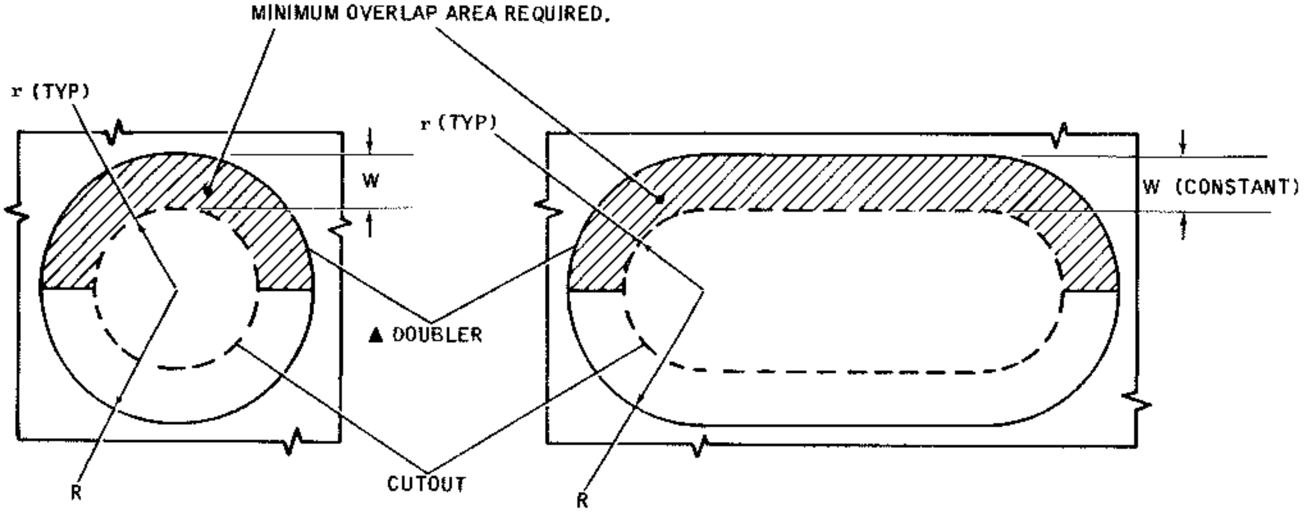
Aluminum Alloy to Aluminum Alloy Repairs (Damage Requiring Cutouts)
Figure 4 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR *

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.010 TO .016 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE DAMAGED MEMBER, THEN W = 50 T AND THE DOUBLER GAGE SHOULD BE HALVED. INSTALL AN ALUMINUM ALLOY SPACER IN THE CUTOUT.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2 INCH MIN)
W = 100 T IN ALUMINUM ALLOY SHEET
T = GAGE OF CUTOUT SHEET
R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHER WISE NOTED IN THE INDIVIDUAL REPAIR).

* THESE INSTRUCTIONS ALSO APPLY TO DAMAGED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-310A

Aluminum Alloy to Aluminum Alloy Repairs (Damage Requiring Cutouts)
Figure 4 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

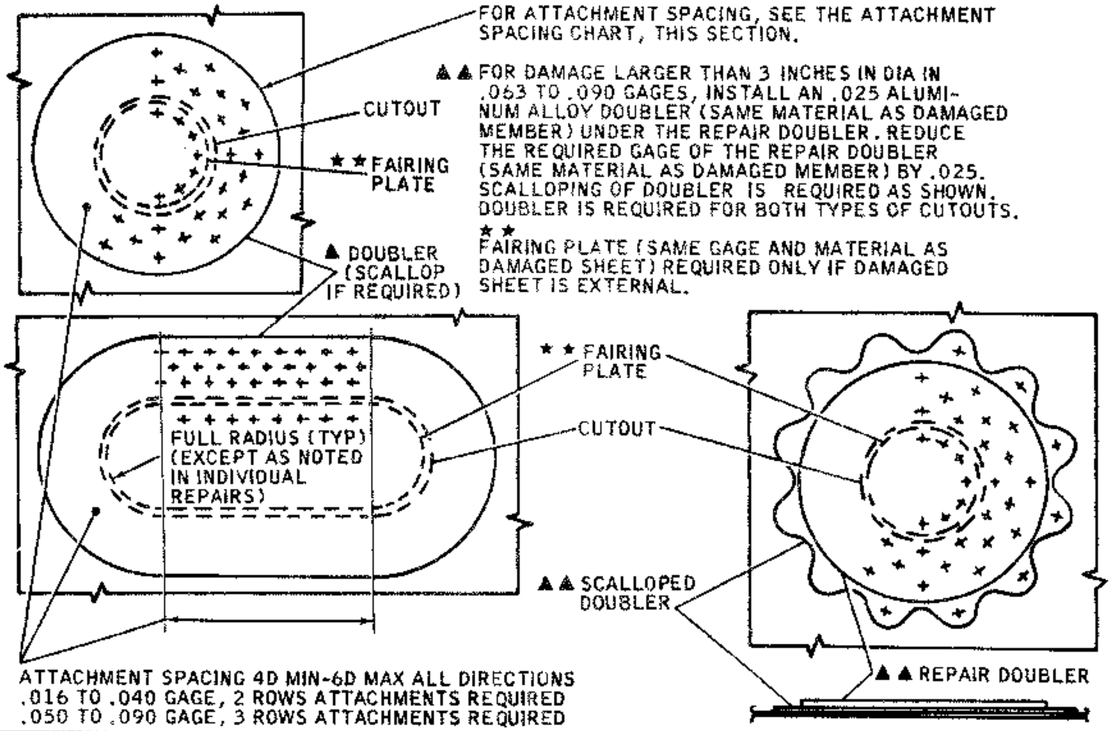
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM ALLOY SHEET

.016 TO .090 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS, BOND PER 51-70-2. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED, AND CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAXIMUM CUTOUT DIAMETER ALLOWABLE IS SHOWN ON THE ATTACHMENT SPACING CHART, THIS SECTION. EXTENSIVE DAMAGE REQUIRES A PRODUCTION-TYPE SPLICING OF THE SHEET OR REPLACEMENT OF THE SHEET TO THE NEAREST PRODUCTION SPLICE.
4. GLASS FIBER LAYUP DOUBLERS MAY ALSO BE USED IN CUTOUT REPAIRS UP TO .040 GAGE AS ILLUSTRATED ON ANOTHER ILLUSTRATION, THIS SECTION. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



FOR ATTACHMENT SPACING, SEE THE ATTACHMENT SPACING CHART, THIS SECTION.

▲▲ FOR DAMAGE LARGER THAN 3 INCHES IN DIA IN .063 TO .090 GAGES, INSTALL AN .025 ALUMINUM ALLOY DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) UNDER THE REPAIR DOUBLER. REDUCE THE REQUIRED GAGE OF THE REPAIR DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) BY .025. SCALLOPING OF DOUBLER IS REQUIRED AS SHOWN. DOUBLER IS REQUIRED FOR BOTH TYPES OF CUTOUTS.

★★ FAIRING PLATE (SAME GAGE AND MATERIAL AS DAMAGED SHEET) REQUIRED ONLY IF DAMAGED SHEET IS EXTERNAL.

ATTACHMENT SPACING 4D MIN-6D MAX ALL DIRECTIONS
.016 TO .040 GAGE, 2 ROWS ATTACHMENTS REQUIRED
.050 TO .090 GAGE, 3 ROWS ATTACHMENTS REQUIRED

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-311B

Aluminum Alloy to Aluminum Alloy Repairs (Damage Requiring Cutouts)
Figure 4 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

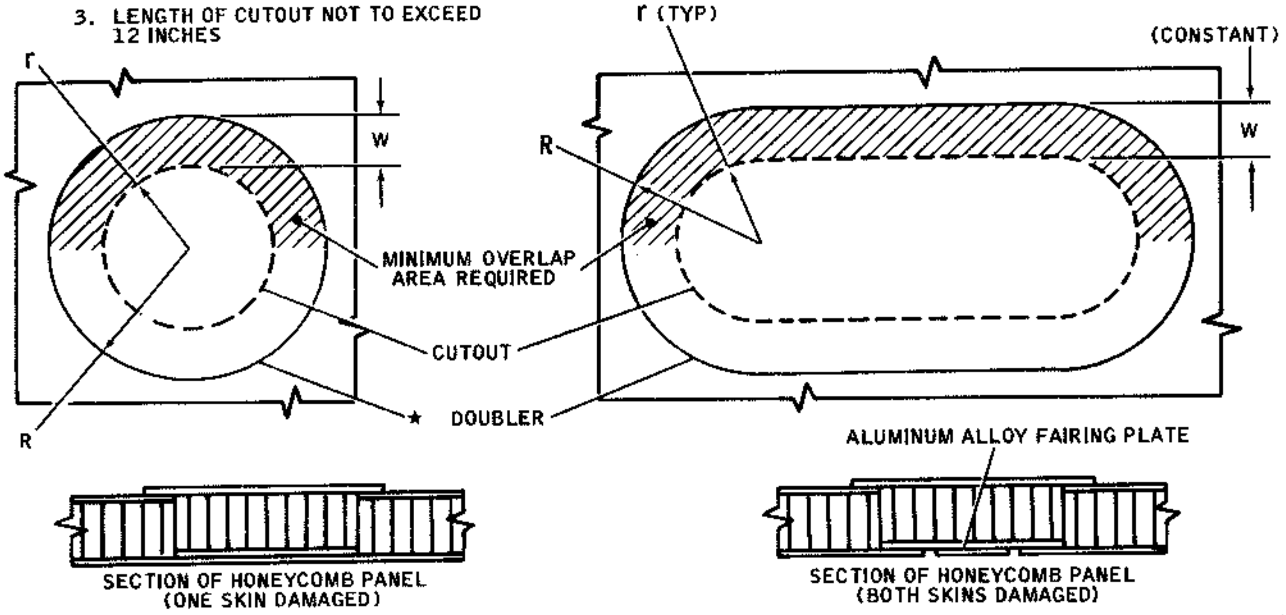
1. REPAIR SKIN CUTOUT DAMAGE. USING A REPAIR PLUG MADE WITH GLASS FIBER LAYUP DOUBLERS, AND REPAIR CORE BONDED PER 51-70-3. SEE SKETCHES BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE DAMAGE IS LARGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE SKIN, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THE PANEL SHOULD BE REPLACED.

NOTES:

1. HONEYCOMB PANEL OVERLAPS ARE DETERMINED IN THE SAME MANNER ON BOTH SKINS
2. RADIUS r NOT TO EXCEED 4 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 12 INCHES

r = RADIUS OF CUTOUT
W = 80T
T = GAGE OF CUTOUT SKIN
R = W + r

r MUST BE FULL RADIUS AND NOT LESS THAN 1/2 INCH



---

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER AND REPAIR CORE (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-312A

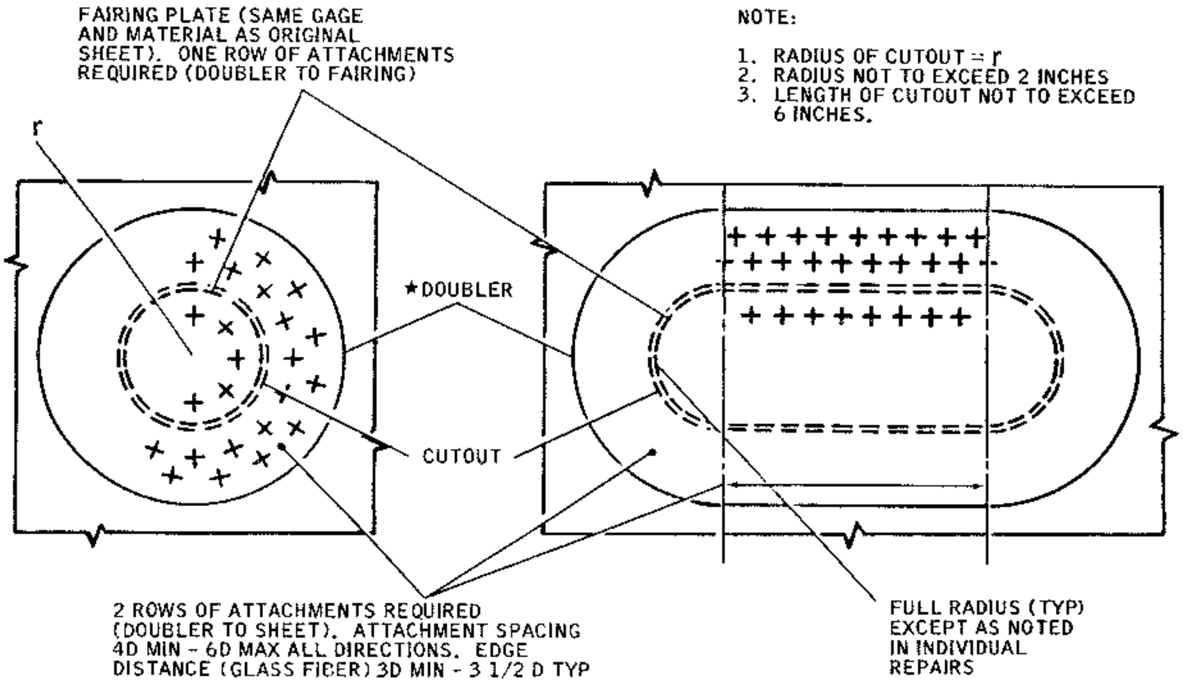
Glass Fiber Layup to Aluminum Alloy Repairs (Damage Requiring Cutouts)
Figure 5 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY DOOR MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .040 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER AND FAIRING PLATE WITH ATTACHMENTS, AND BOND PER 51-70-3. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAKE CERTAIN THAT A FAIRING PLATE IS ATTACHED AND BONDED IN THE CUTOUT. THE FAIRING PLATE WILL STIFFEN THE GLASS FIBER AND WILL SERVE AS SURFACE FOR LAYUP. INSTALL ATTACHMENTS AFTER CURING.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



NOTE:

1. RADIUS OF CUTOUT = r
2. RADIUS NOT TO EXCEED 2 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 6 INCHES.

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED DOOR MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-313A

Glass Fiber Layup to Aluminum Alloy Repairs (Damage Requiring Cutouts)
Figure 5 (Sheet 2)

B. Determine the number of 181 bidirectional glass cloth plies required for making glass cloth repairs as follows:

Damaged Aluminum Gage	Total Number of Plies
.016	3
.020	4
.025	5
.032	6
.040	7
.050	9
.063	11
.071	12
.080	14
.090	15

NOTES:

1. When applying the glass fiber cloth to both sides of the damaged aluminum alloy sheet, place half of the total plies on each side. If the total number of plies is an odd number, add one more ply.
2. For members with extreme curvature, it may be desirable to use the thinner bidirectional cloth Number 120. In this instance, double the number of plies specified above.
3. Arrange the pattern of the glass cloth so that the threads are parallel to, and 90 degrees from, the direction of the crack.
4. This chart is for use only when specified in other repairs of this manual.

Glass Fiber Ply Chart
Figure 6

3. Attachment Spacing Chart

A. Determine the number of equal spaces required in the first row of attachments around a repaired hole from the following chart. The repair hole diameter must be no smaller than the minimum diameters given in the eight equal spaces column of the chart.

Plating Repair Cutout Diameter (Inches)						Attachment Diameter
1 to 1-1/4	1-1/4 to 2	2 to 3-1/4	3-1/4 to 5-1/4	5-1/4 to 7	7 to 11	1/8
1 to 1-3/4	1-3/4 to 3	3 to 4	4 to 6-1/2	6-1/2 to 9	9 to 13-3/4	5/32
1 to 2	2 to 3	3 to 5	5 to 8	8 to 11	11 to 16-1/2	3/16
1-1/2 to 2-3/4	2-3/4 to 4	4 to 6-1/2	6-1/2 to 10-1/2	10-1/2 to 14-1/2	———	1/4
8 Equal Spaces	12 Equal Spaces	16 Equal Spaces	24 Equal Spaces	36 Equal Spaces	48 Equal Spaces	

Attachment Spacing Chart
Figure 7

NOTE: Do not use chart (Figure 7) in making repairs unless it is specifically referenced for a particular repair.

HONEYCOMB REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The honeycomb repairs described in this section are applicable for repair of the main gear outboard door and the passenger forward entrance stairway honeycomb. Additional repairs for honeycomb, preparation and application of resins, and complete bonding repair techniques are described in the repair bonding sections of Chapter 51.

2. Honeycomb Skin and Core Repair - Class A (See Figure 1.)

A. If damage is not located over supporting structure and is not over 4 inches in diameter, repair skin and core damage other than dings or dents in the following manner:

(1) Carefully inspect damage to determine extent of damage to both internal and external surfaces of honeycomb panel.

(2) Outline damaged area with a grease pencil.

(3) Hand-rout damaged area from panel. Make a circular-shaped cutout.

(4) Insert a wooden plug into the panel hole. The plug must be same size as hole diameter and thickness of removed section of honeycomb.

(5) Bolt a router template to each side of the plug. The template attached to external surface must allow for routing a path 1/2 inch beyond edge of panel hole. The template attached to the internal surface must allow for routing a path 1/2 inch beyond path of external routed surface.

(6) Rout out paths located by templates. Remove templates and wooden plug from panel.

(7) Peel damaged internal skin from honeycomb, thereby exposing the core. Do not apply leverage to the surrounding panel which could cause additional damage to adjacent honeycomb.

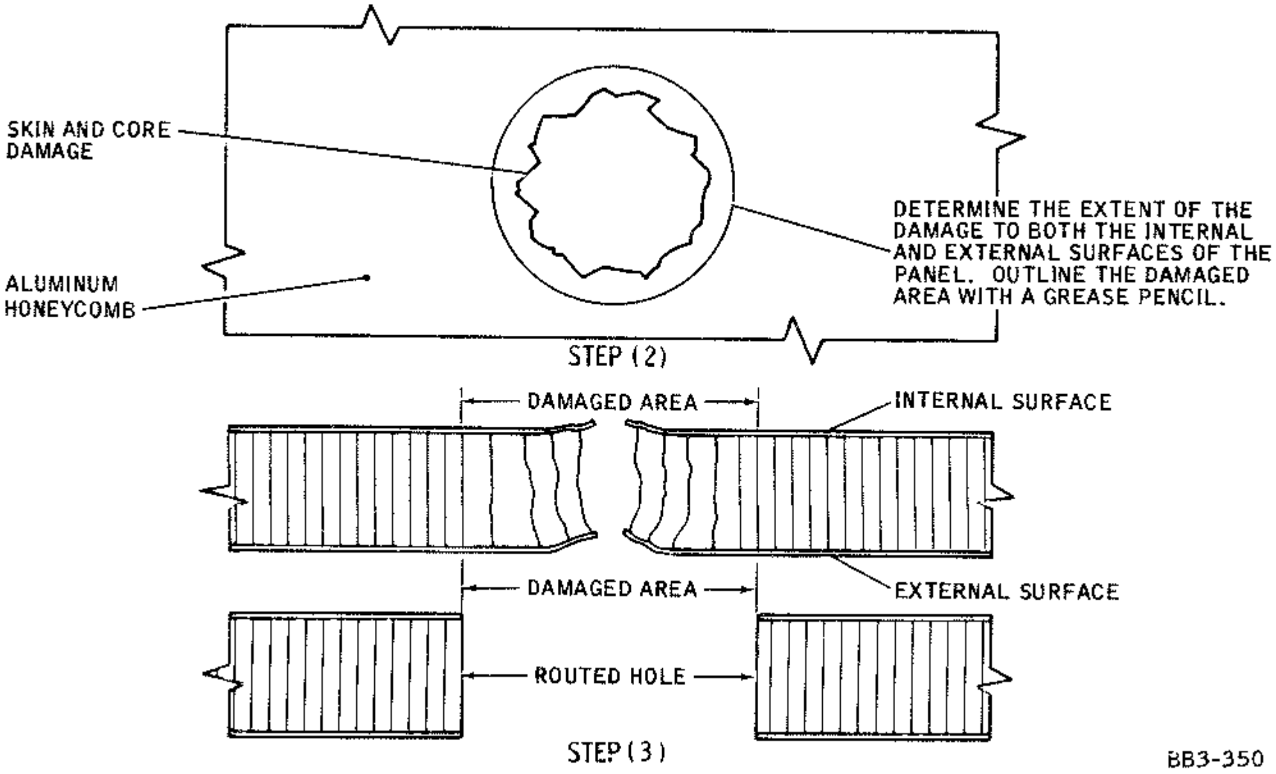
(8) Grind core down to bonding material at external skin surface. Surface should be smooth to touch. Some existing core material will still be embedded in the external bonded surface and will be visible.

(9) Deburr skin edges.

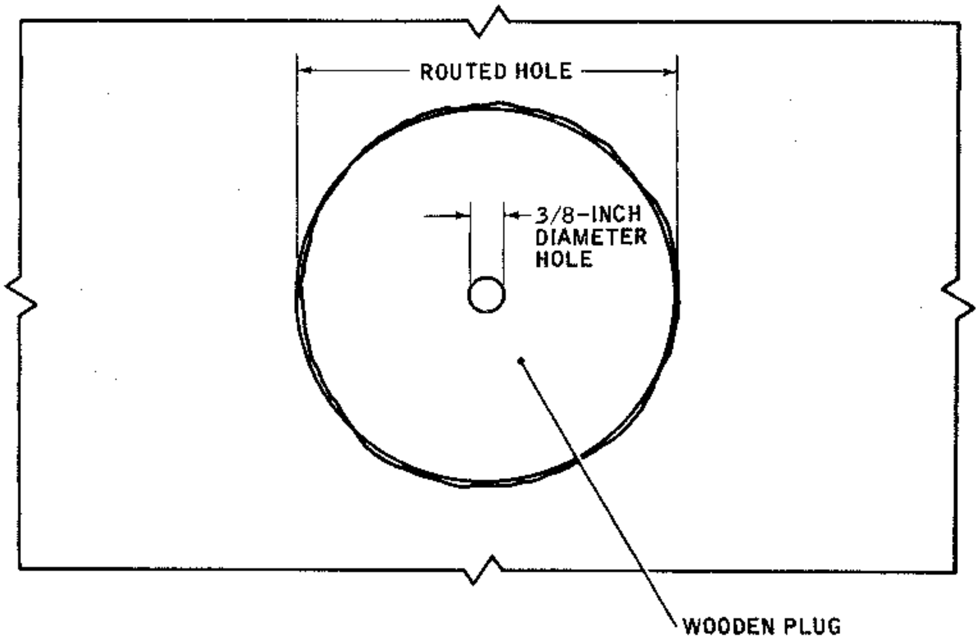
(10) Prepare repair plug from section of repair panel material. A bolt hole may be drilled at center of section of honeycomb and a bolt installed to hold section of honeycomb while it is being rotated about its axis during routing. The prepared honeycomb plug should be

fabricated to diameter of 1/16 inch less than hole in panel being repaired, except at the internal surface. At internal surface, an additional 2-inch diameter of bonded skin should be left to allow for 1-inch minimum overlap (main gear outboard door) as shown in Figure 1, sheet 3, step 10.

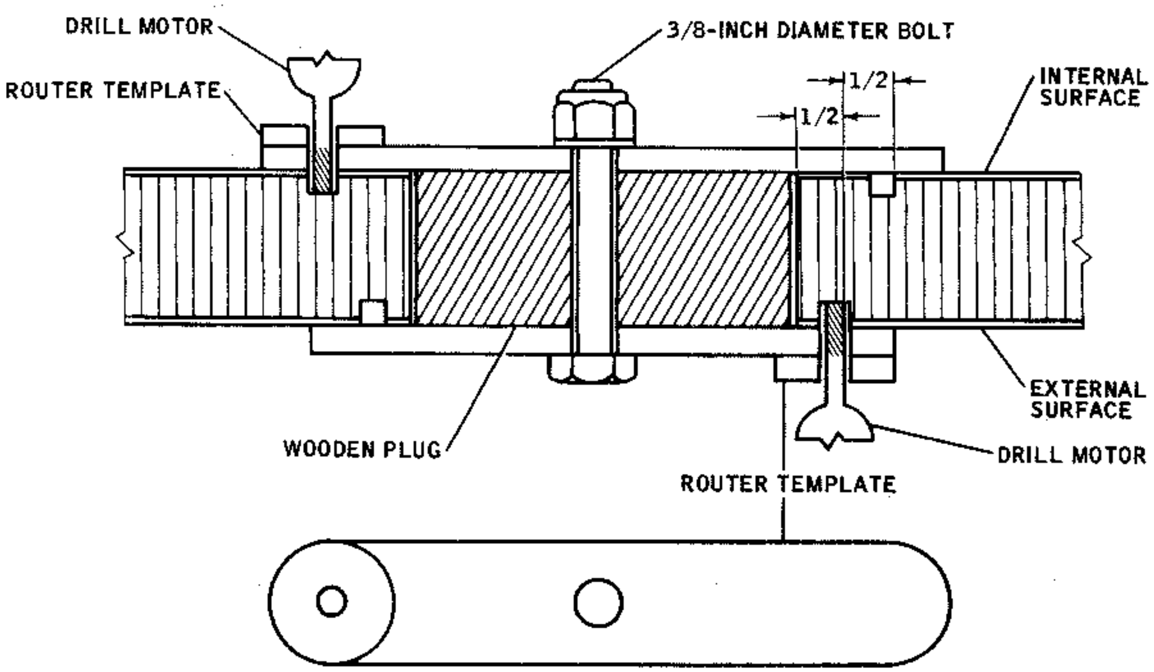
NOTES:
1. Bond fairing, repair plug, and doubler to panel as described in repair bonding section of Chapter 51.
2. Repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.
3. An alternate method of removing damaged surfaces with a hole saw is illustrated in Figure 2.
4. Do not make any repair closer than 3 inches to edge of another repair. Not more than 1/4 of the panel surface may contain repairs. Deviation from these requirements requires replacement of the panel, or specific engineering instructions.



Honeycomb Skin and Core Repair -- Class A
Figure 1 (Sheet 1)



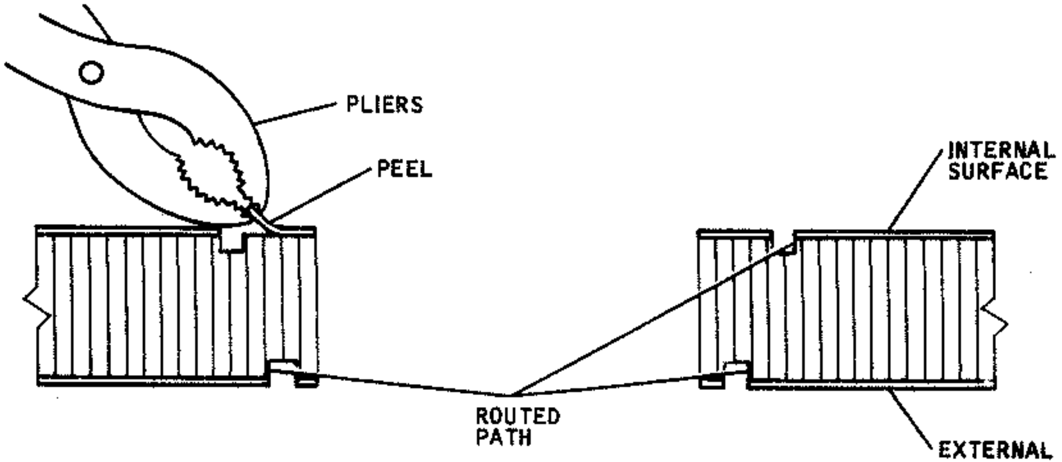
STEP (4)



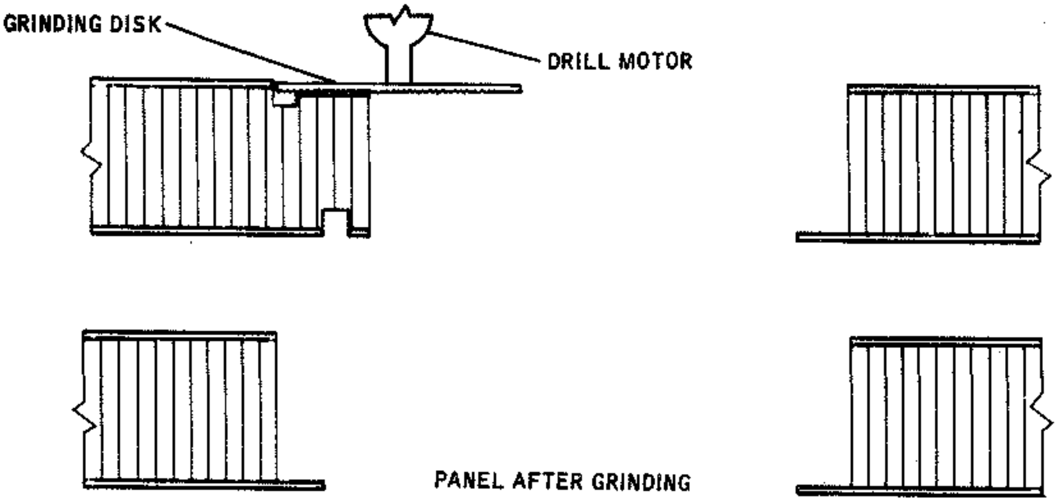
STEP (5)

BB3-351

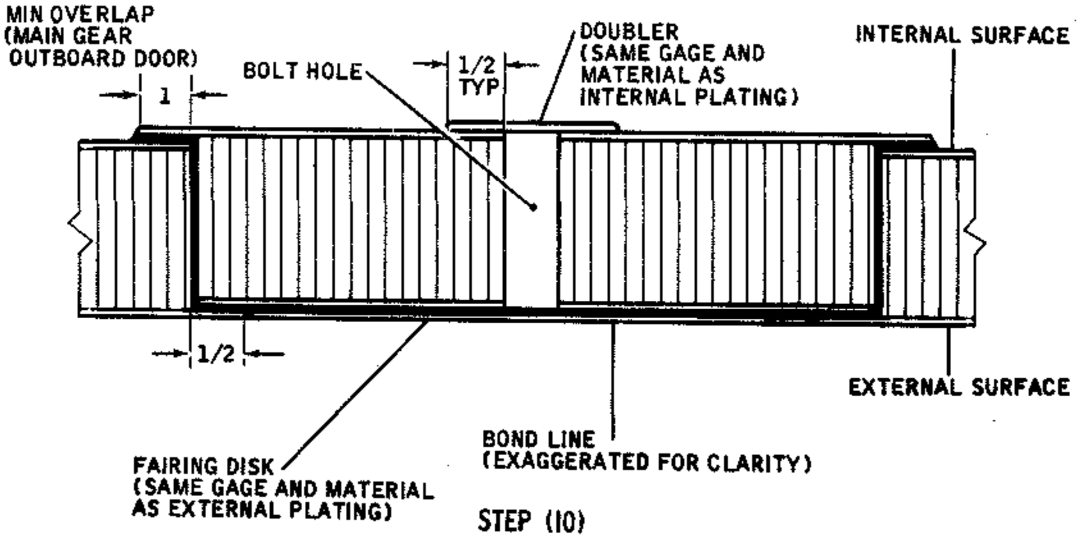
Honeybomb Skin and Core Repair -- Class A
Figure 1 (Sheet 2)



STEP (7)



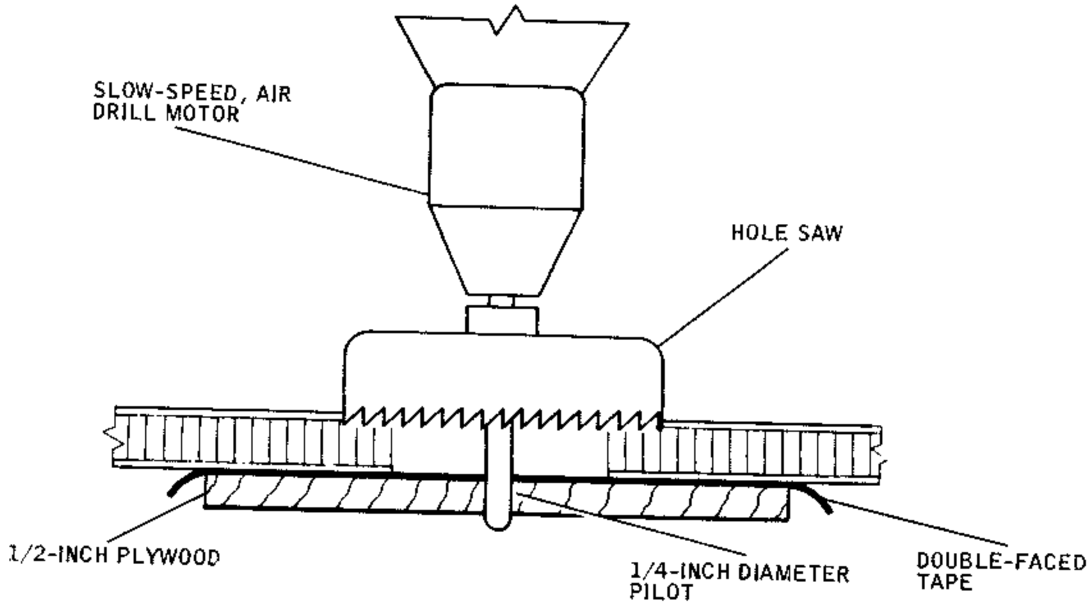
STEP (8)



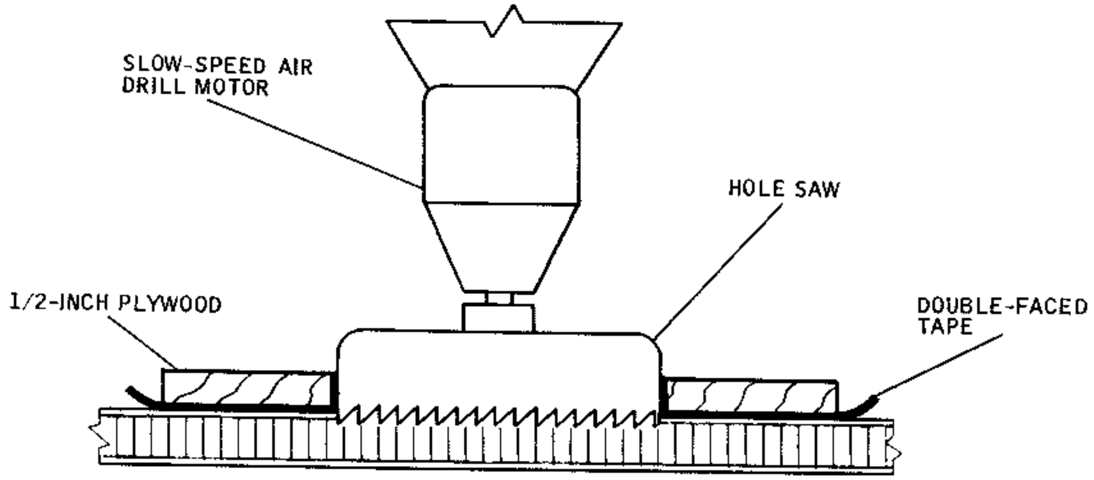
STEP (10)

BB3-352 A

Honeycomb Skin and Core Repair -- Class A
Figure 1 (Sheet 3)



BOTH SURFACES DAMAGED



ONE SURFACE DAMAGED

BB3-345

Alternate Method of Removing Damaged Honeycomb
Figure 2

3. Main Gear Outboard Door Honeycomb Skin Crack Repair - Class A (See Figure 3.)

A. Repair cracks not exceeding 4 inches in length in door honeycomb panel as follows:

(1) Drill 1/4-inch diameter stop holes at ends of crack.

(2) If crack is located in flat area of panel, bond a repair doubler over cracked portion of panel. Repair doubler may be made of the same gage and material as the cracked skin. If crack is located adjacent to a panel discontinuity, bond a doubler to the skin, a spacer to the doubler, and a repair doubler to the spacer and honeycomb discontinuity as illustrated in Figure 3.

NOTE: Refer to Chapter 51 repair bonding sections for complete bonding instructions.

4. Unbonded Honeycomb Repair - Class A (See Figure 4.)

A. Repair unbonded skins in the same manner as described in paragraph 2 and Figure 1.

NOTE: Unbonded repair areas must not exceed 4 inches in length, and the repair on any unbonded area must not be closer than 3 inches to another repair on the same panel. If more than four repairs of this type exist on a panel, replace the panel.

5. Honeycomb Dent Repairs - Class A and B (See Figure 5.)

A. Class A Repair: Accomplish Class A repair of honeycomb dent by filling dent area with mixture of glass fiber flakes and resin as described in the repair bonding sections of Chapter 51.

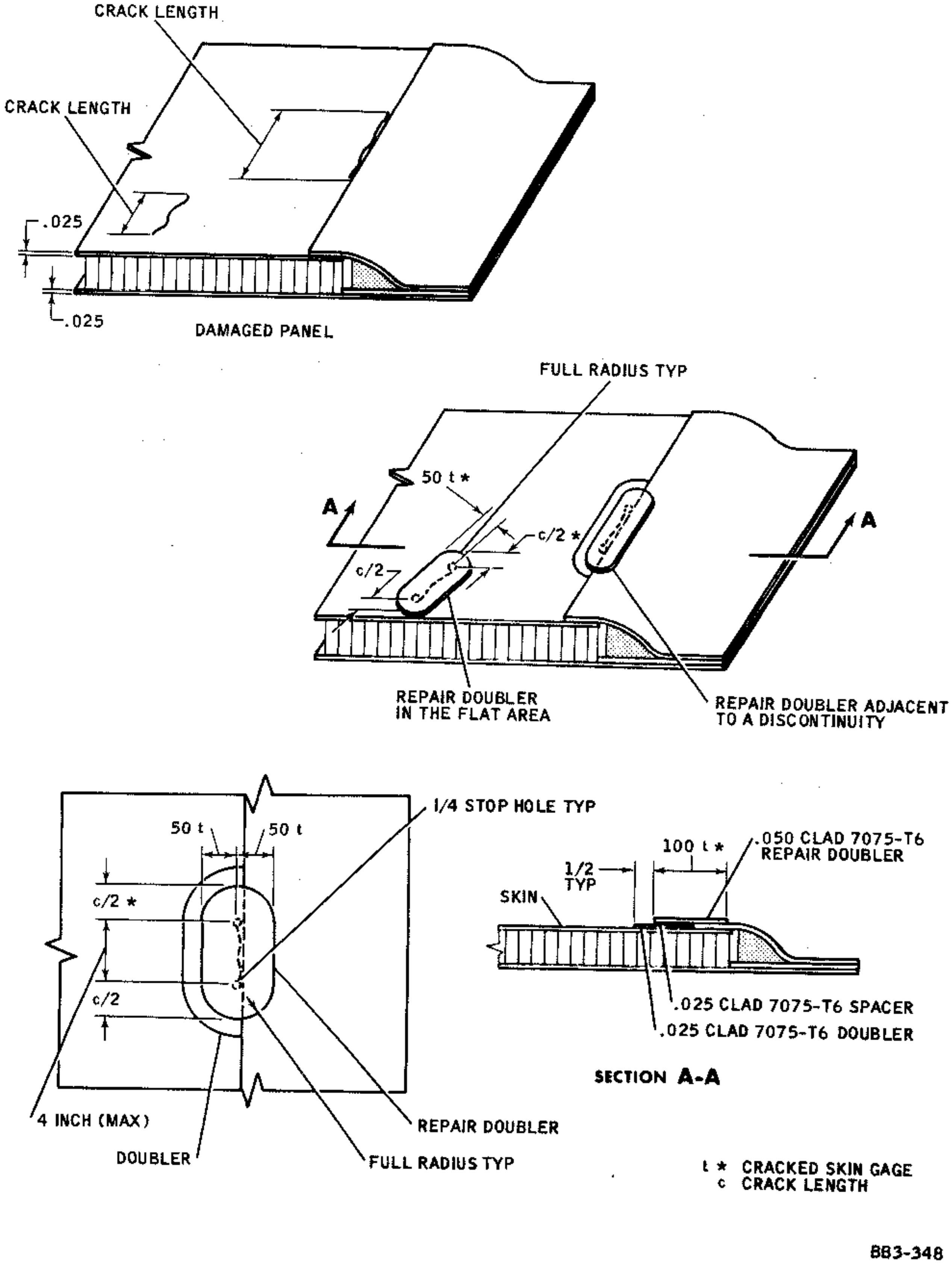
NOTES: (1) Dents to be repaired must be at least 1 inch in diameter, but not more than 3 inches.

(2) Dents must be less than 0.093 inch in depth.

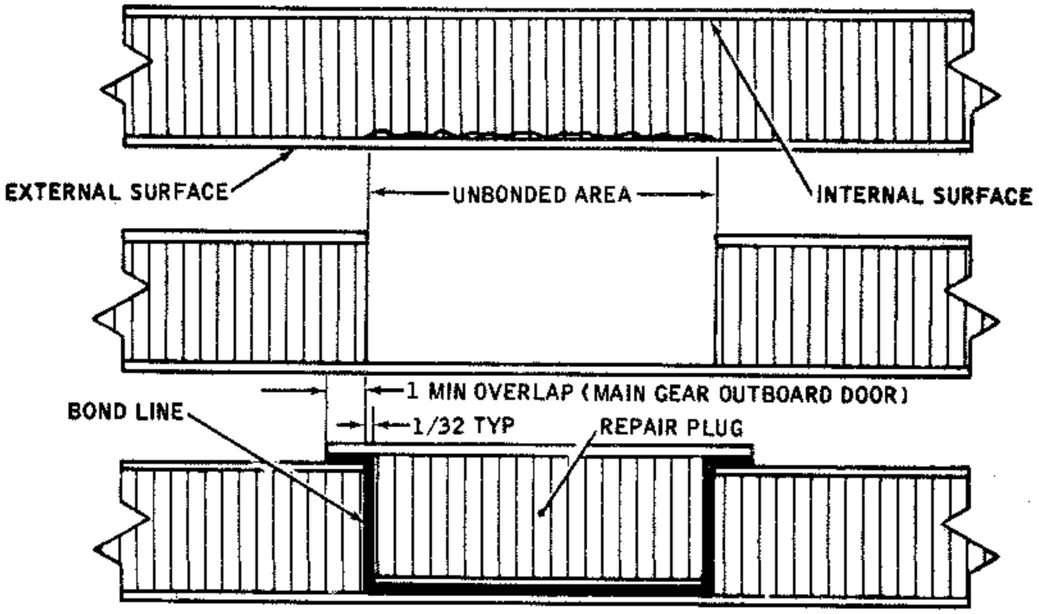
(3) Dents must be smooth (single radius), with no evidence of punctures, cracks, or scratches which cannot be polished out.

(4) Dents do not require repairing if they are less than 1 inch in diameter, less than 0.063 inch in depth, and are smooth, with no evidence of punctures, cracks, or scratches.

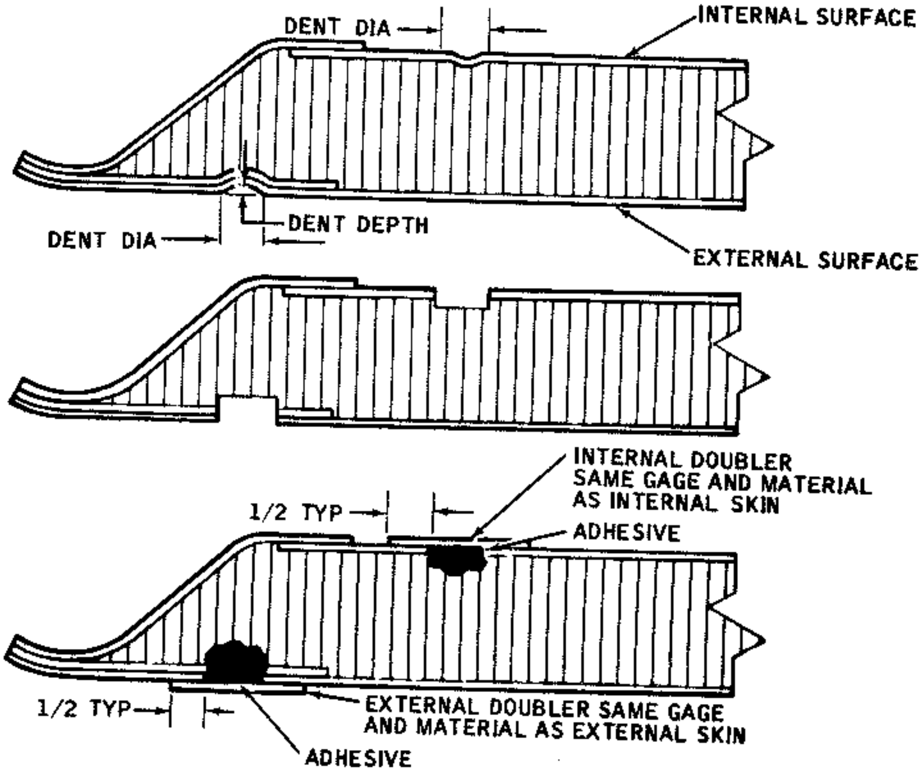
(5) Not more than 3 dents, or dents totalling one-tenth of the panel surface, whichever is smaller, may be repaired with glass flakes.



Main Gear Outboard Door Honeycomb Skin Crack Repair -- Class A
Figure 3



Unbonded Honeycomb Repair -- Class A
Figure 4



Honeycomb Dent Repair -- Class B
Figure 5

B. Class B Repair: If dents are between 3/8- and 1 1/4-inch diameter, and not more than six core cells are damaged, and the dent is not smooth, or if punctures, cracks, or deep scratches exist, repair as follows:

(1) Remove damaged skin with hole saw. Leave circular hole. Be certain that not more than one-sixteenth of core is removed. See Figure 2 for the method of removing skin and core with a hole saw.

(2) Bond a doubler to the panel dented area as described in repair bonding sections of Chapter 51. Apply just enough adhesive to core to make contact with doubler. Make certain doubler overlaps hole by 1/2 inch.

NOTES: (a) Not more than six dents or dents totaling one-tenth of the panel surface, whichever is smaller, may be repaired in this manner.

(b) The edge of any repair must not be closer than 2 inches to the edge of another repair.

6. Honeycomb Skin and Core Tear Damage Repair - Class A (See Figure 6.)

A. If the damage is not longer than 6 inches, or wider than 3 inches, repair single directional tear damage as follows:

(1) Carefully inspect damage to determine extent of damage to panel.

(2) Outline damaged area with a grease pencil.

(3) Hand rout damaged area from panel. Make ends semicircular-shaped and the same radius.

(4) Clamp a router template to each side of panel. External surface template must locate routing path 1/2 inch beyond edge of panel hole. The internal surface template must locate routing path 1/2 inch beyond path of external surface template.

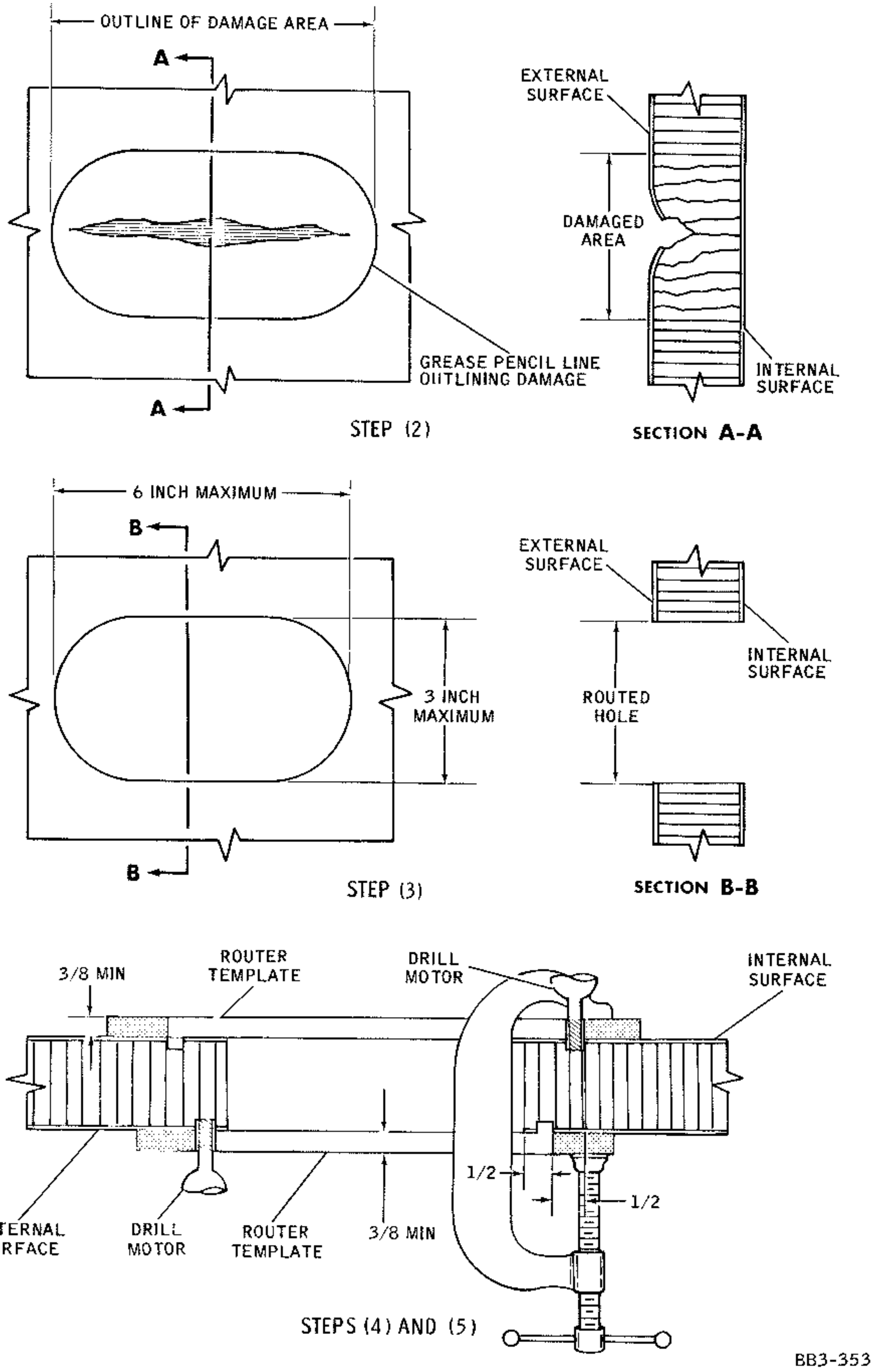
(5) Rout out paths located by templates. Remove templates from panel.

(6) Peel internal surface skin from panel. Do not apply leverage to surrounding panel which could cause damage to adjacent honeycomb.

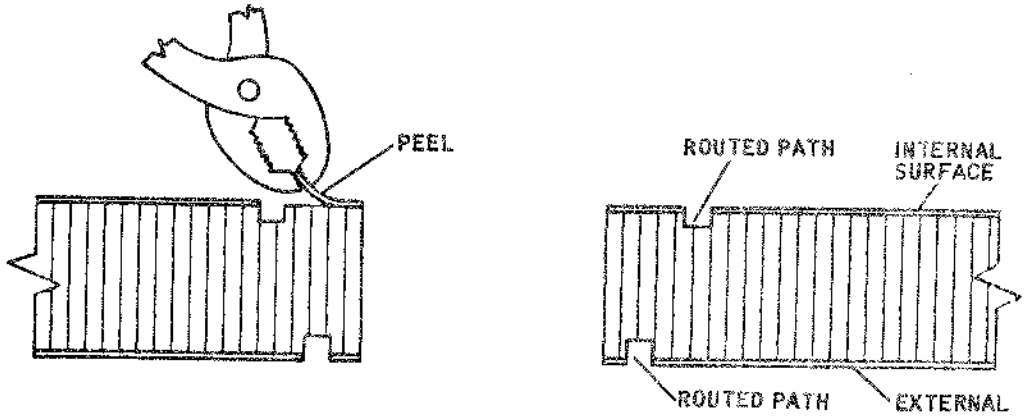
(7) Grind core down to bonding material at external skin surface. Surface will be smooth to touch. Some existing core material will still be embedded in external surface and will be visible.

(8) Deburr skin edges.

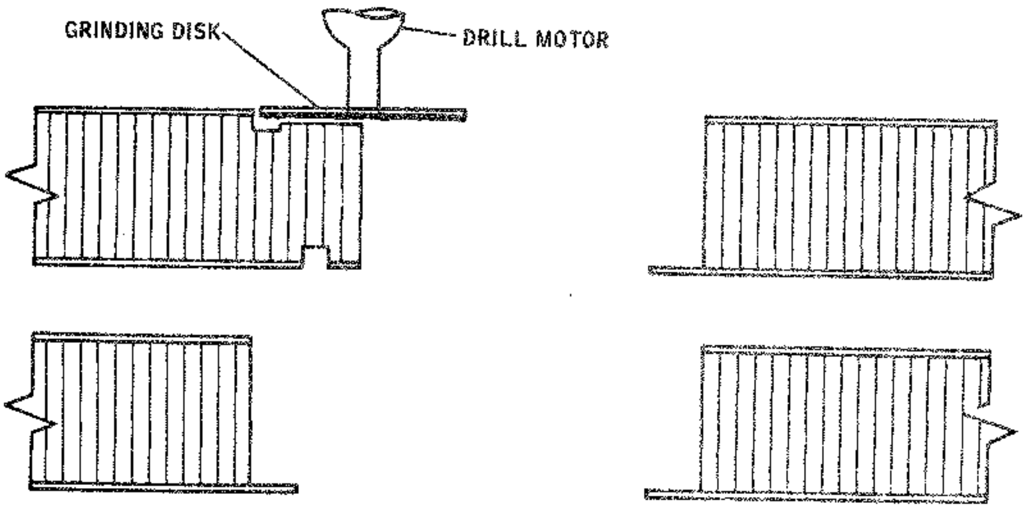
(9) Prepare fairing disk to fit external surface hole. Make fairing disk from same material and gage as external surface skin.



Honeycomb Skin and Core Tear Damage Repair -- Class A
Figure 6 (Sheet 1)

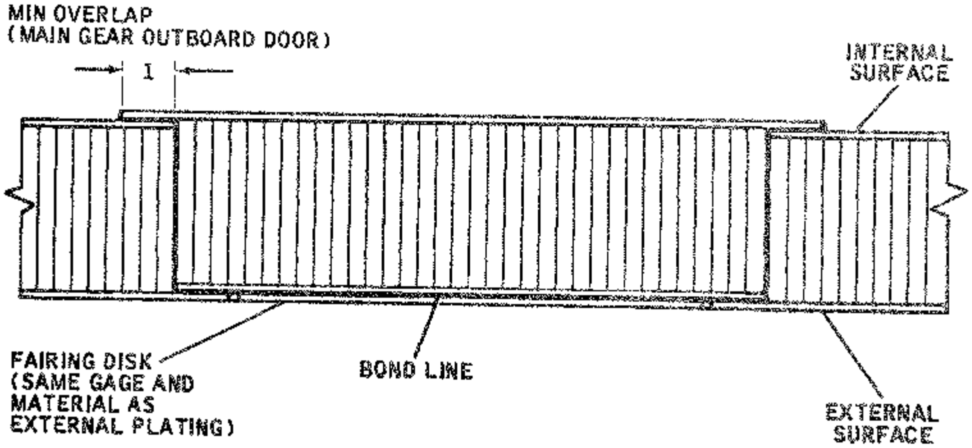


STEP (6)



PANEL AFTER GRINDING

STEP (7)



STEP (10)

883-354 A

Honeycomb Skin and Core Tear Damage Repair -- Class A
Figure 6 (Sheet 2)

(10) Prepare repair plug by routing a section of desired shape from repair panel. Repair plug should be fabricated to 1/16-diameter less than hole being repaired in panel, except at internal surface. At internal surface, an additional inch of bonded skin should be left to allow for an overlap as shown in Figure 6.

NOTES: 1. Bond the repair plug fairing disk to panel as described in repair bonding sections of Chapter 51.

2. Repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.

3. Do not make any repair closer than 3 inches to edge of another repair. Not more than one-fourth of the panel surface may contain repairs. Deviation from these requirements requires replacement of the panel, or specific engineering instructions.

7. Main Gear Outboard Door Panel Edge Repair - Class B (See Figure 7.)

A. Repair honeycomb door edge damage not exceeding 4 inches in diameter as follows:

(1) Carefully inspect honeycomb to determine extent of damage.

(2) Rout damaged skin from external surface of panel. Make a circular-shaped cutout.

(3) Hand rout core from panel.

(4) Prepare a repair plug on drill press from a repair panel section. Make certain external surface of plug has an additional 1-inch of skin remaining to allow bonding overlap as illustrated. Saw a corner from repair plug as required to fit plug into panel.

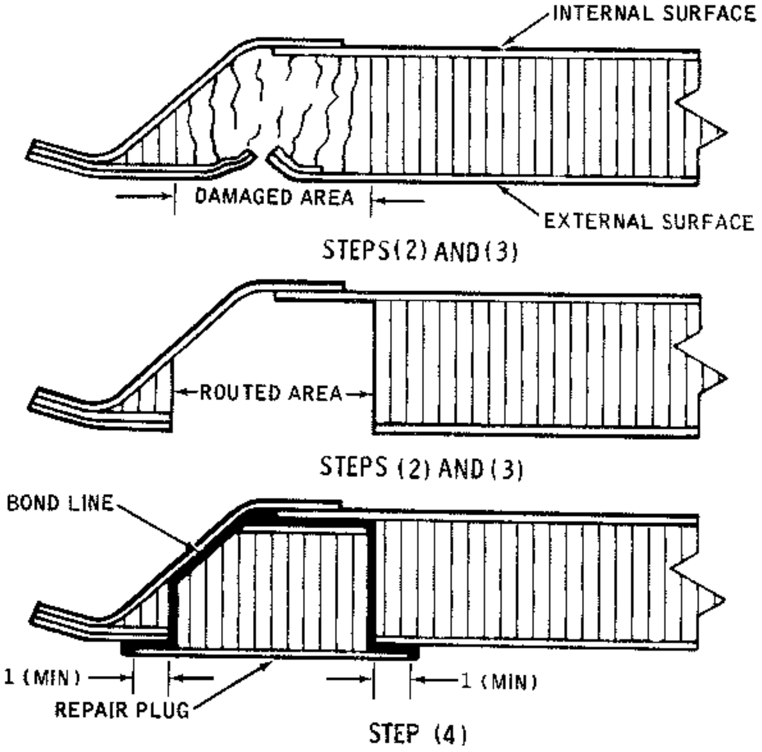
NOTES: 1. The damaged skin may be removed as shown in Figure 2.

2. The repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.

3. When hand-routing the core from the panel, rout only to internal bonded surface.

4. The edge of any repair must not be closer than 3 inches to the edge of another repair. Not more than four repairs of this type may be made on one panel.

Printed in U.S.A.



BB3-349A

Main Gear Outboard Door Panel Edge Repair -- Class B
Figure 7

DOOR EDGE FLANGE REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Door edge flanges may be repaired as follows:

(1) Deformed Edge Flanges: Dented or bent door edge flanges may be straightened, without additional repair under the following conditions:

(a) Straightening of material must not cause cracking or stretching.

(b) There must be no evidence of sheared attachments, elongated holes, or cracked material, either before or after straightening the flange.

(c) Straightening the flange must not be accomplished at point of contact with a door seal, while seal is installed, or if straightening will damage the seal. Straightening in the area of a seal is permissible if the seal is removed to accomplish the straightening, and then properly installed after straightening the flange.

(2) Cracked Flanges: Dented or bent door edge flanges which show cracks, sheared attachments, or elongated holes may be repaired as follows:

(a) Drill 1/4-inch stop holes at the ends of crack.

(b) Prepare repair doublers, and install as shown in Figures 1 through 6, as applicable.

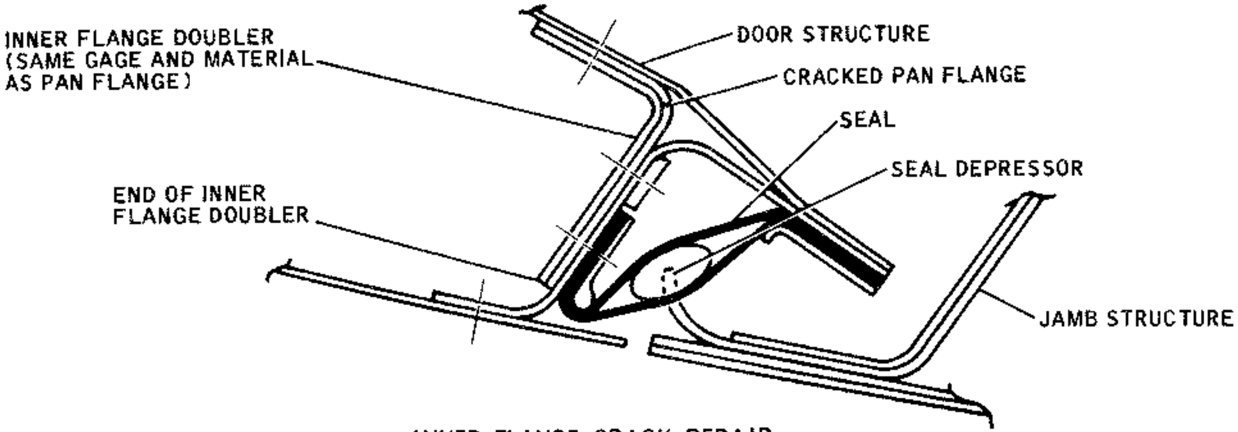
(3) Elongated Rivet Holes: If elongated rivet holes exist, repair as follows:

(a) If hole diameter in elongated direction is less than 0.010 inch larger than hole diameter 90 degrees to elongated direction, and there is no evidence of cracks, replace rivet to fill hole.

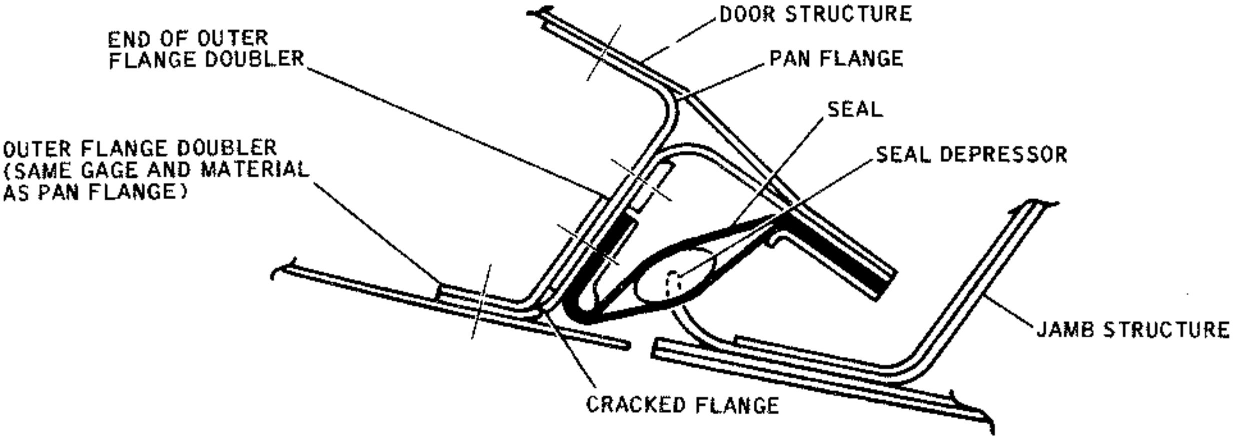
(b) If hole diameter in elongated direction is more than 0.010 inch larger than hole diameter 90 degrees to elongated direction, or there is evidence of cracks, increase diameter of elongated or cracked hole to clean up damage, providing the resulting edge distance and spacing requirements are in accordance with general requirements in Section 52-01. It is not necessary to increase the diameter of an associated countersink, if it is concentric to, and 1/16-inch diameter greater than, the enlarged hole. The head of the rivet may be shaved to fit the countersink.

(c) If a longitudinally cracked hole cannot be repaired by the procedure in step (b), drill a 1/4-inch diameter hole at ends of crack, or extend crack to adjacent rivet hole. Repair by adding repair doublers as illustrated in Figures 1 through 5.

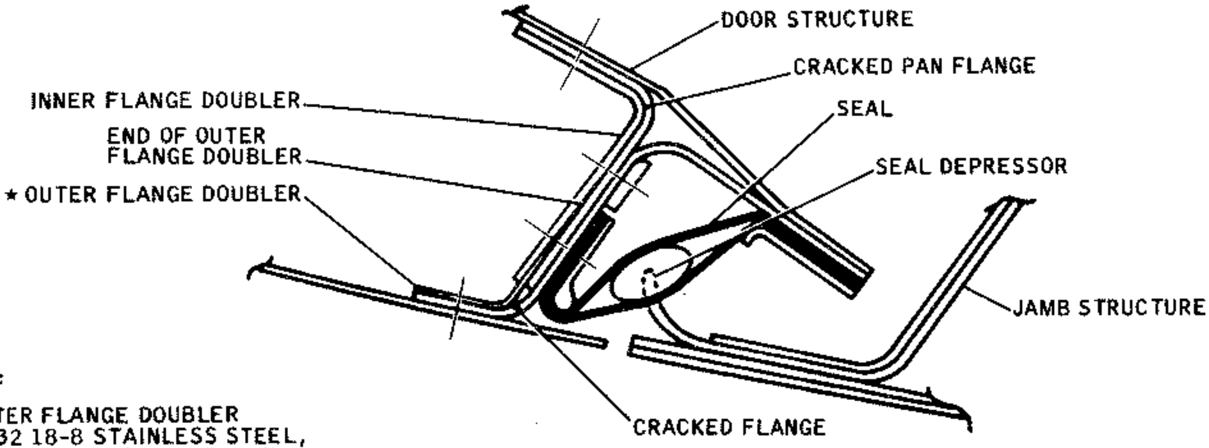
NOTE: Any repair affecting pressure sealing of the airplane should be repaired by installation of PR-1422 sealant, as described in the repair sealing section of Chapter 51. All requirements of Section 52-01 apply unless otherwise indicated.



INNER FLANGE CRACK REPAIR



OUTER FLANGE CRACK REPAIR



INNER AND OUTER FLANGE CRACK REPAIR

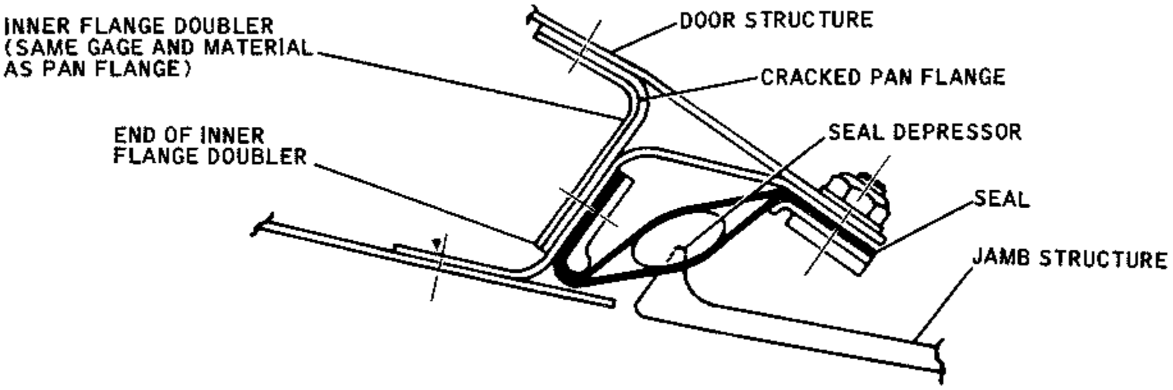
NOTES:

1. ★OUTER FLANGE DOUBLER (.032 18-8 STAINLESS STEEL, 1/4 H) IS PLACED BETWEEN PAN AND INNER FLANGE DOUBLER IF CRACKS ARE IN BOTH AREAS SHOWN.
2. STOP DRILL ENDS OF CRACK WITH 1/4-INCH DRILL. USE CARE NOT TO NICK ADJACENT STRUCTURE WHEN STOP DRILLING CRACKS.
3. PICK UP WITH DOUBLER, A MIN OF 3 ATTACHMENTS EITHER SIDE OF STOP HOLES IN ALL ROWS. USE SAME TYPE AND SIZE ATTACHMENTS AS EXISTING ATTACHMENTS.

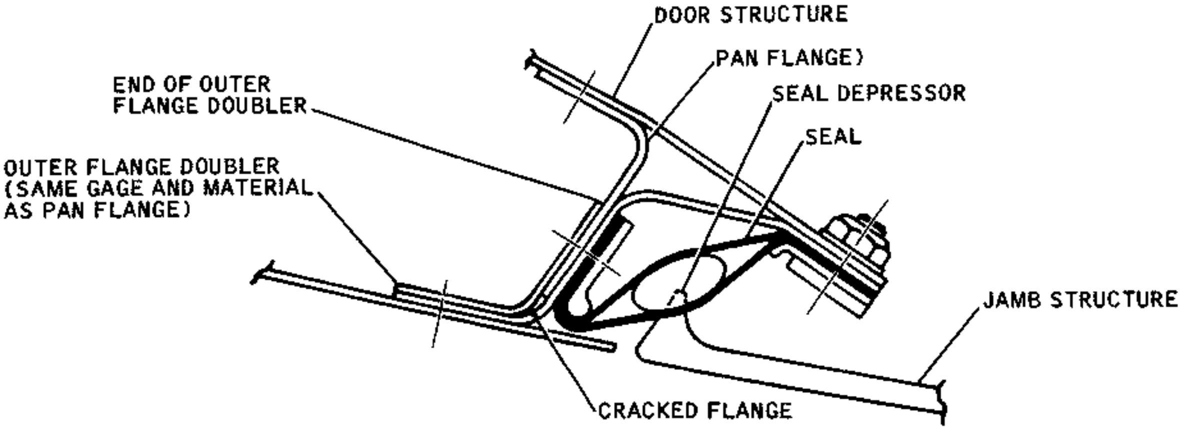
BB3-146

Forward Lower Cargo Compartment Door Edge Flange Repair -- Class A
Figure 1

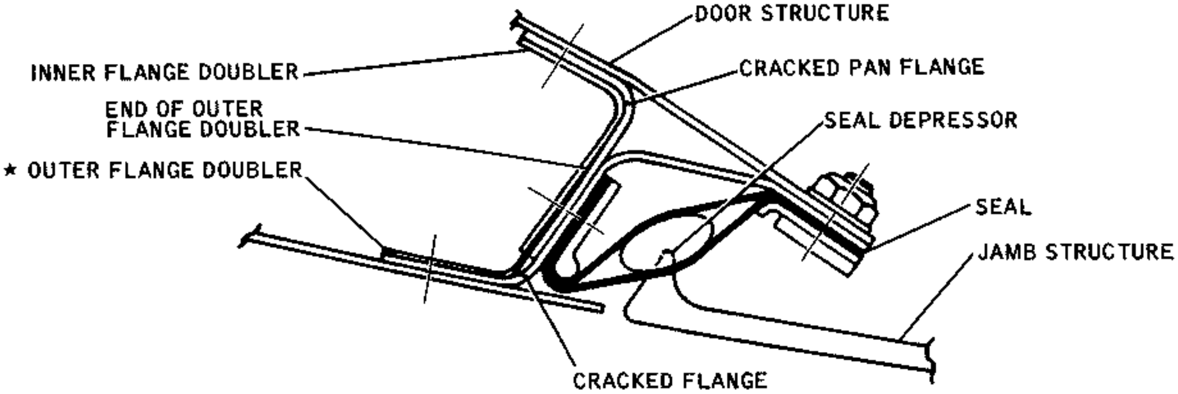
Printed in U.S.A.



INNER FLANGE CRACK REPAIR



OUTER FLANGE CRACK REPAIR



INNER AND OUTER FLANGE CRACK REPAIR

NOTES:

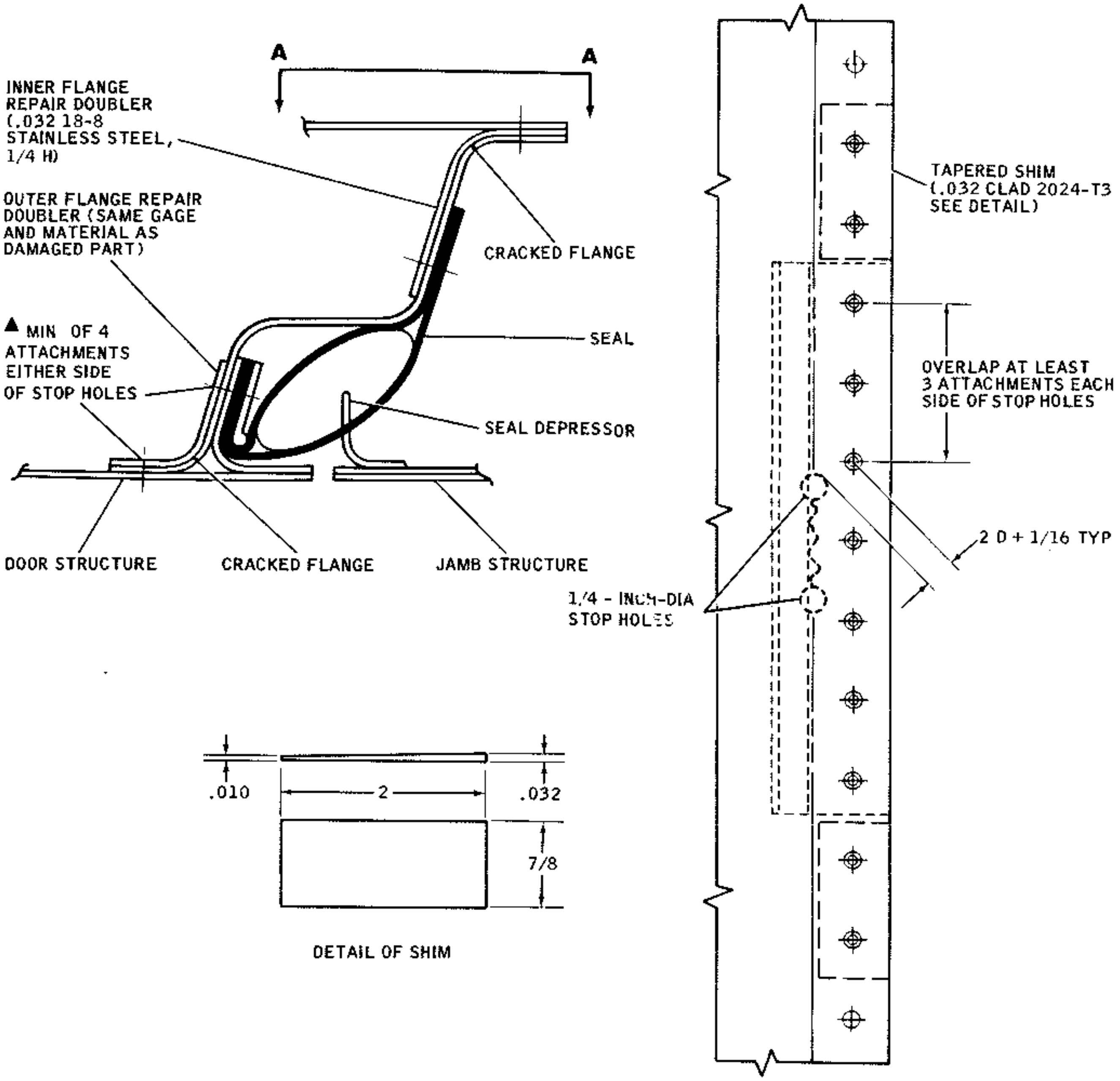
1. ★ OUTER FLANGE DOUBLER (.032 18-8 STAINLESS STEEL, 1/4 H) IS PLACED BETWEEN PAN AND INNER FLANGE DOUBLER IF CRACKS ARE IN BOTH AREAS SHOWN.

2. STOP DRILL ENDS OF CRACK WITH 1/4-INCH DRILL. USE CARE NOT TO NICK ADJACENT STRUCTURE WHEN STOP DRILLING CRACKS.

3 PICK UP WITH DOUBLER, A MIN OF 3 ATTACHMENTS EITHER SIDE OF STOP HOLES IN ALL ROWS. USE SAME TYPE AND SIZE ATTACHMENTS AS EXISTING ATTACHMENTS.

BB3-147

Aft Lower Cargo Compartment Door Edge Flange Repairs -- Class A
Figure 2



▲ EXISTING ATTACHMENTS
TYP BOTH REPAIR DOUBLERS

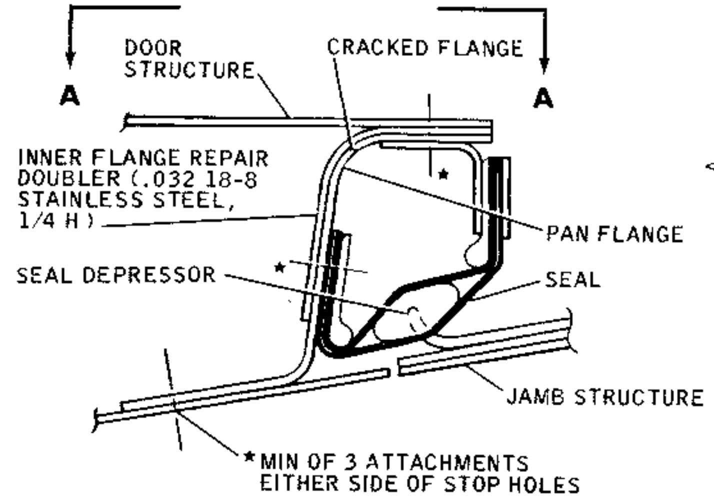
NOTE: WHEN STOP DRILLING ENDS OF CRACK, USE CARE NOT TO NICK ADJACENT STRUCTURE

RIVET CODE:

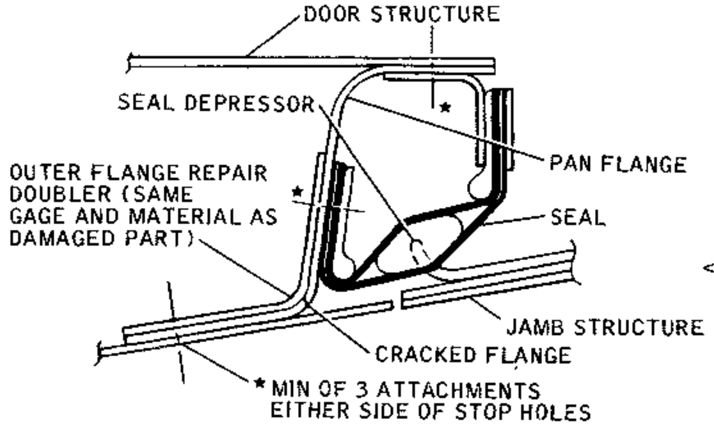
⌖ ORIGINAL ATTACHMENTS

⊕ ORIGINAL ATTACHMENTS USED IN REPAIR

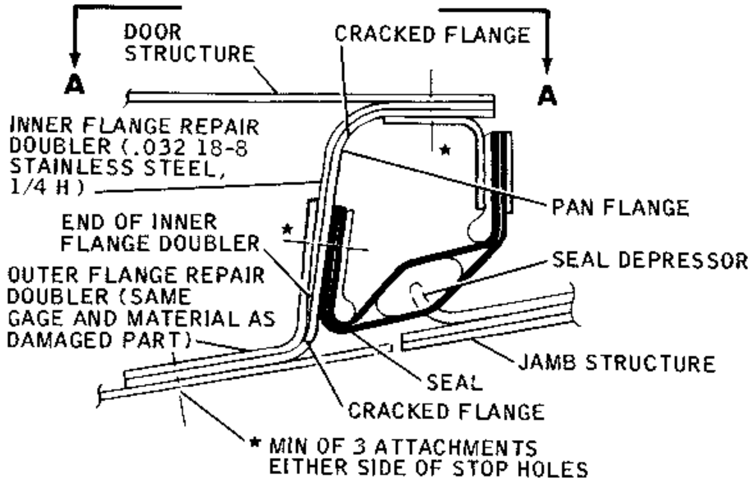
Forward Service Door Edge Flange Repair -- Class A
Figure 3



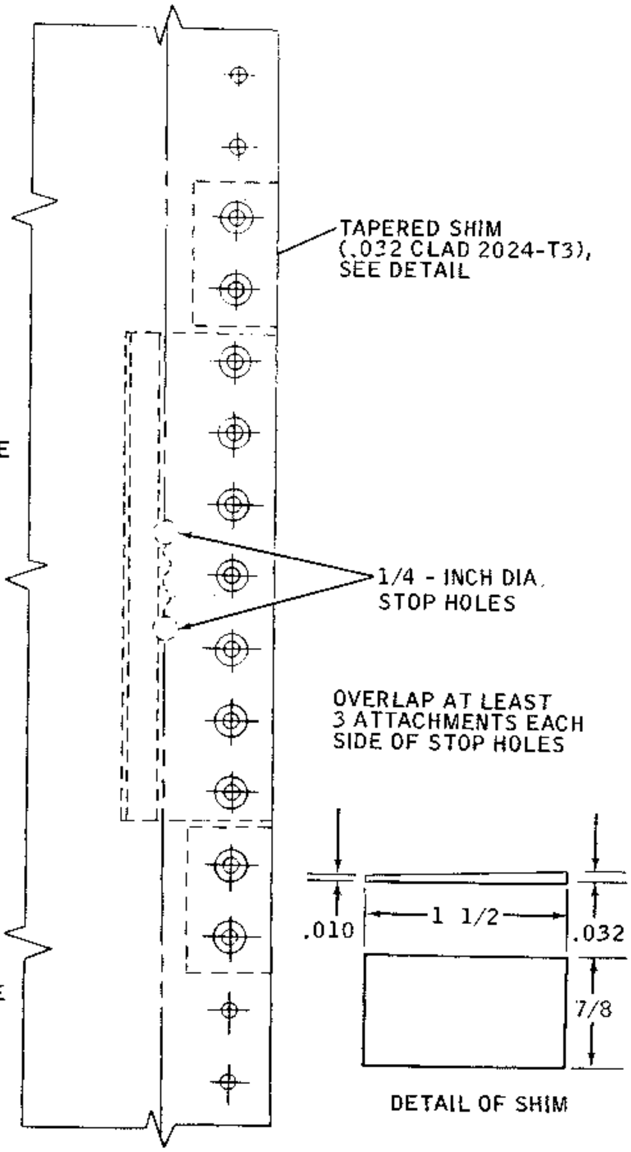
INNER FLANGE CRACK REPAIR



OUTER FLANGE CRACK REPAIR



INNER AND OUTER FLANGE CRACK REPAIR



VIEW A-A

DETAIL OF SHIM

ATTACHMENT CODE:

+ ORIGINAL ATTACHMENTS

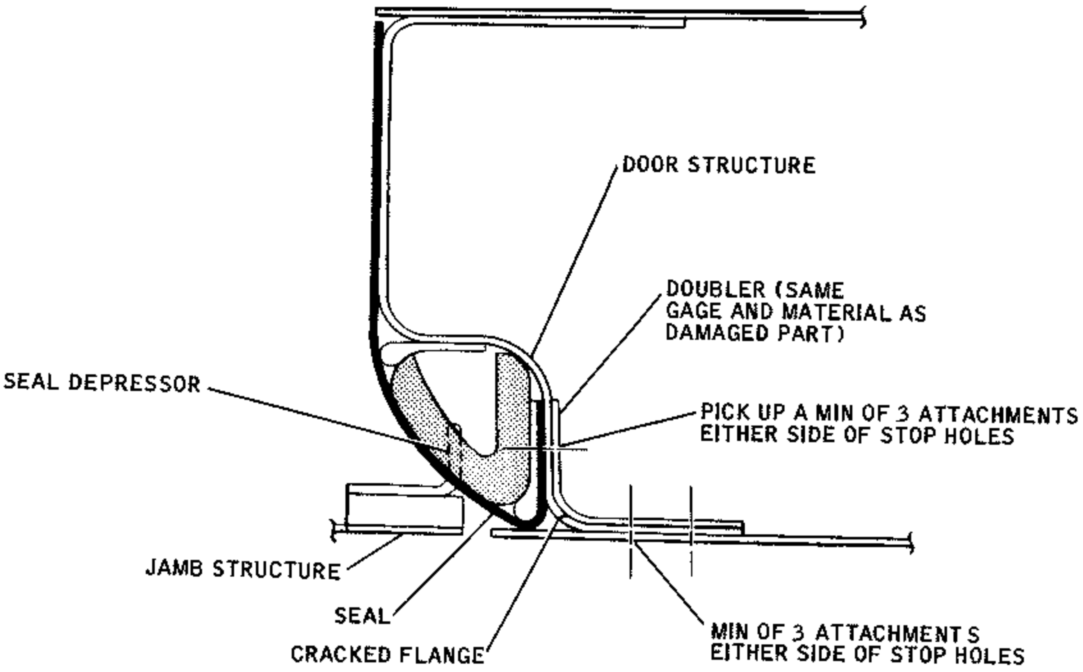
⊕ ORIGINAL ATTACHMENTS USED IN REPAIR

NOTE:

1. INNER FLANGE DOUBLER IS PLACED BETWEEN PAN AND OUTER FLANGE DOUBLER IF CRACKS ARE IN BOTH AREAS SHOWN.
2. WHEN STOP DRILLING ENDS OF CRACKS, USE CARE NOT TO NICK ADJACENT STRUCTURE.

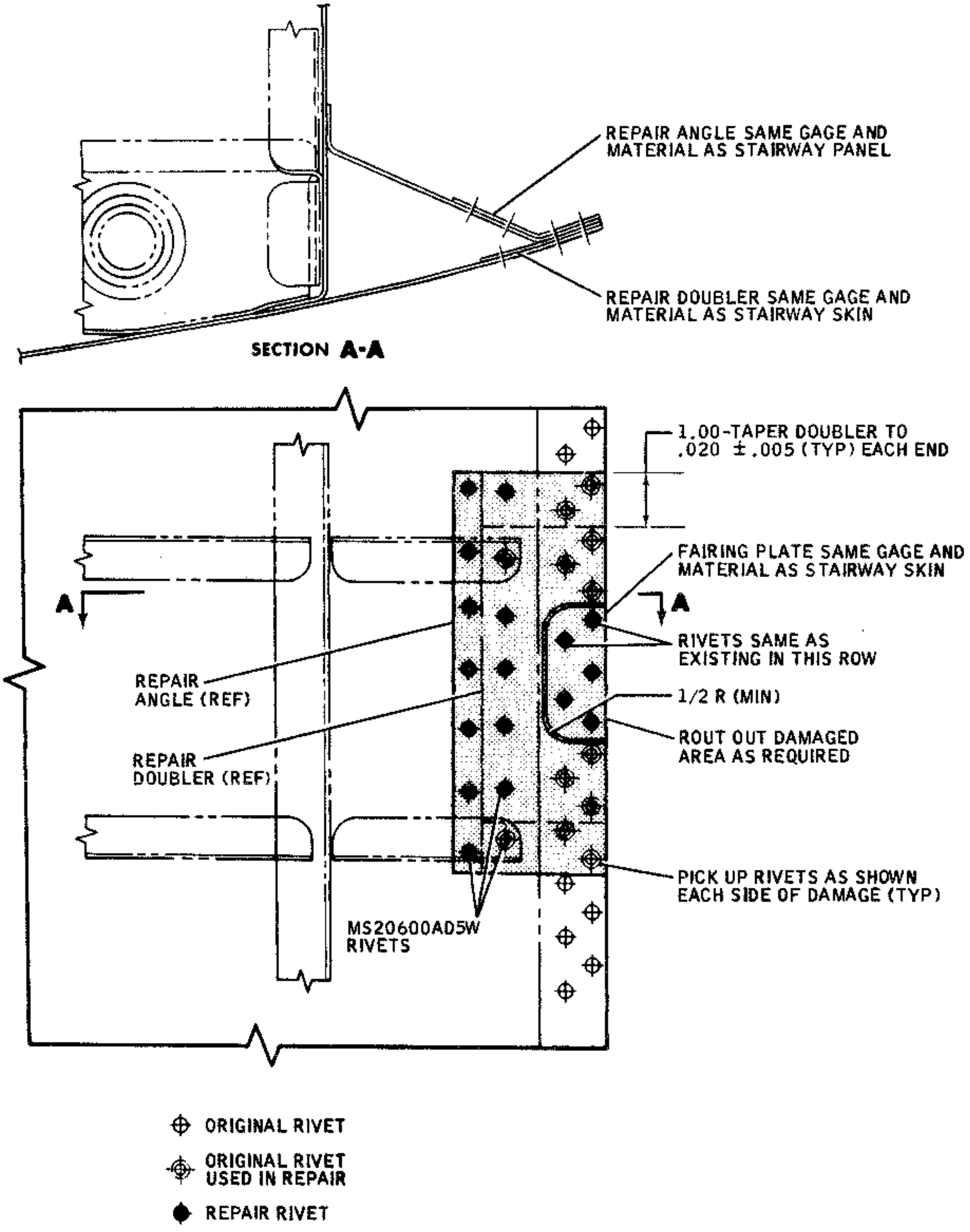
BB3-199

Electrical/Electronics Compartment Door Edge Flange Repair -- Class A
Figure 4



BB3-192

Passenger Forward Entrance Door Edge Flange Repair -- Class A
Figure 5



BB3-717

Passenger Aft Entrance Door Stairway Flange Repair - Class A
Figure 6

SEAL REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Minor damage to the airplane door seals may be repaired by patching as illustrated in Figure 1. Holes, elongated tears, and small ruptures are repaired as illustrated, subject to the following conditions:

(1) The addition of the patch must not cause existing seal to become stiff enough to affect proper elastic operation of the seal in opening and closing the doors.

(2) Tears, holes, or ruptures must not be within 1/2 inch of the clamping edges.

(3) The patch should be installed so that it will stretch the same direction as the seal material being repaired.

2. Preparation of Damaged Seal for Patching

A. A damaged seal is prepared for application of patch repair as follows:

(1) Roughen faying surface of seal 1-inch minimum radius from edge of damage, using medium grit carborundum. If a hole-filling fairing disk is needed for repair, also roughen faying surface of fairing disk.

(2) Using a clean, oil-free, dry, cotton cloth dampened with toluene or petroleum naphtha, clean roughened area. Do not dip cloth into cleaner. Pour cleaner on the cloth.

(3) Wipe area dry with a second, clean, dry, oil-free, cotton cloth.

(4) Repeat steps (1), (2), and (3) to ensure best possible adhesive conditions.

3. Door Seal Repair - Class A (See Figure 1.)

A. If repair of the seal meets conditions listed in paragraph 1, proceed as follows:

(1) Prepare patches (or patch) from Tricot-weave Dacron No. 4756 (Los Angeles Standard Rubber Co., 1500 E. Gage Ave., Los Angeles 1, Calif.) to overlap tear (or other damage) in the seal by 1/2 inch on each side of damage and

3/4 inch beyond ends of tear (or other damage). If a fairing disk is needed to fill a hole in a seal, prepare fairing disk to be installed to stretch the same direction as seal material being repaired.

NOTE: Round out hole in seal, and measure diameter of seal hole before preparing fairing disk. Fairing disk will be held in place by bonding material and patches when repair is assembled. When cutting elongated patches from patch material for repairs near corners, it is advisable to cut material on bias to avoid wrinkling. At butt splices and all other areas, patch material should be cut to stretch only in direction as the seal material stretches. Do not attempt to repair seals in corner areas by butt splicing.

(2) If easy access to inside surface of seal exists, remove sufficient number of seal-retaining fasteners to gain access to inside surface. In this instance, prepare a patch for both inside and outside surfaces of seal.

NOTE: An exterior patch only is acceptable if accessibility to inside surface is difficult, but the use of a patch on both sides of the damage will provide a longer service life for the repair. Butt-joint splice repairs require a patch on both sides of the joint.

(3) Using Silastic No. 140, or Q-3-0121 adhesive (Dow Corning Corp., 3033 W. Mission Road, Alhambra, Calif.), or equivalent, apply uniform coat 0.005- to 0.010-inch thick, to existing seal, seal patches, and fairing disk (if used). Moisten the tear or butt-joint edges of the area where fairing disk is to be installed with adhesive. Allow 5 to 10 minutes before assembling adhesive-coated parts.

NOTE: The adhesives specified are prepared for storage in squeeze-type tubes. Squeeze desired quantity of adhesive, directly on repair parts. Recap and return tube to storage. Adhesives should be stored in temperatures below 32°C (90°F) when not in use. Smooth adhesives with suitable spatula. Adhesives will cure under temperatures of 21°C (70°F) and humidity of 20 percent or more. Accelerated cure can be accomplished by adding 1/2 or 1 percent distilled water, or two drops of water to 10 grams of adhesive, and stirring the mixture together for 5 minutes before assembly. If this method is chosen, squeeze adhesive into a clean dish or pan to permit mixing with water.

(4) Assemble the parts together with sufficient pressure to maintain contact without causing excessive squeeze-out. Assembled parts may be handled after 3 hours. Maximum adhesion, however, is obtained in 24 hours.

(5) Overcoat the patches with additional adhesive, and fair edges of patches. Avoid excessive thickness of adhesive.

(6) Discard any excess water-mixed adhesive.

(7) Check patch application to observe proper overlap of damaged area.

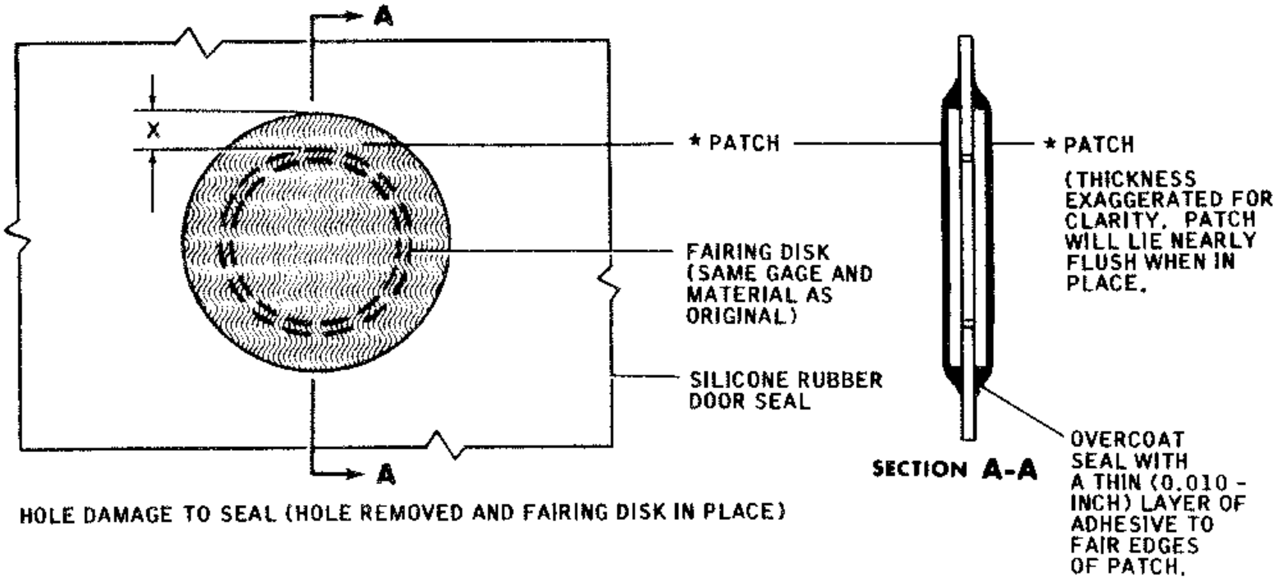
(8) Reinstall fasteners, if removed, to install a patch to interior surface of a seal.

4. Door Seal Butt-Splice Repair - Class A

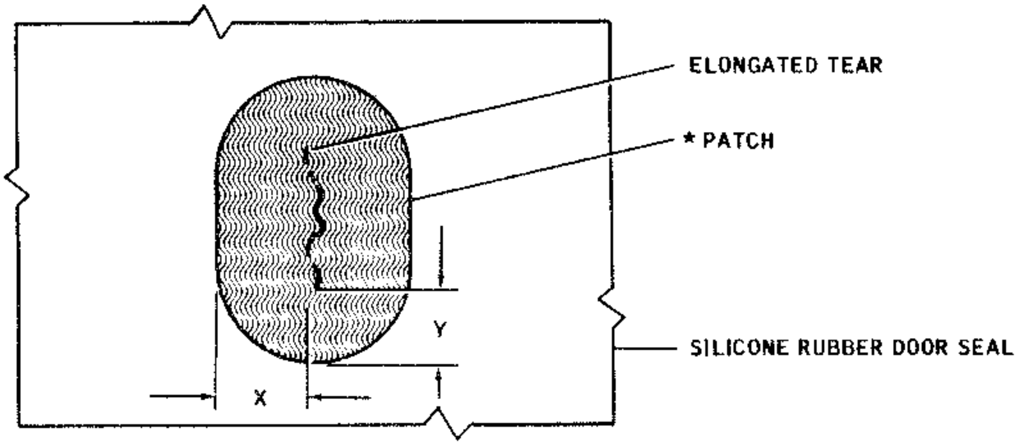
A. Door seal damage which comes within 1/2 inch of the clamping area as restricted by the instructions in paragraph 1, is also repairable. In this instance, the entire seal must be removed. A new section of seal of the same gage and material as the original may then be butt-spliced so that the splice will be more than 1/2 inch from the clamping area. Patches of the same type as described in Figure 1 must be applied to both sides of the damage at the splice joint and must overlap the seam at least 1 inch each side of the seam. The patch material should be cut to stretch the same direction as the seam material being repaired. All other instructions in paragraph 2 apply to this repair.

5. Door Seal Section Views

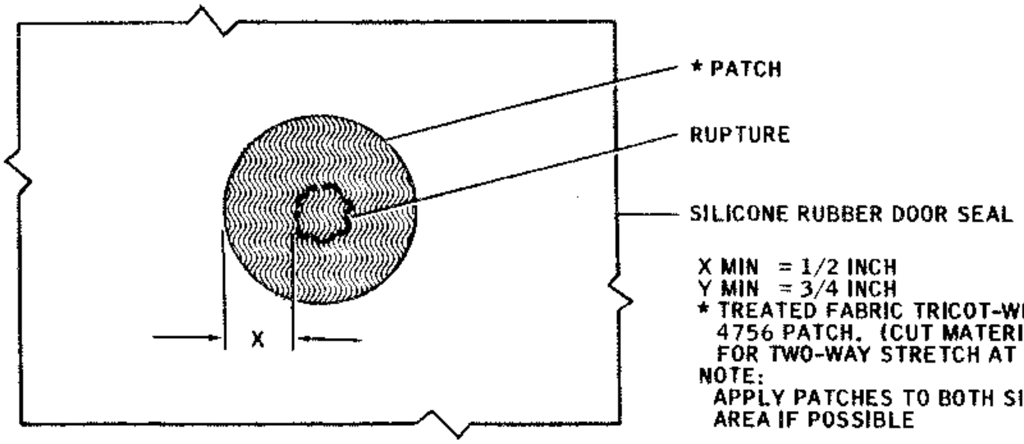
A. Door seal section views are provided in Figures 2 through 9 to indicate type of installation for specific doors. For further details of door seals, refer to material identification illustrations of individual door.



HOLE DAMAGE TO SEAL (HOLE REMOVED AND FAIRING DISK IN PLACE)



ELONGATED TEAR IN DOOR SEAL



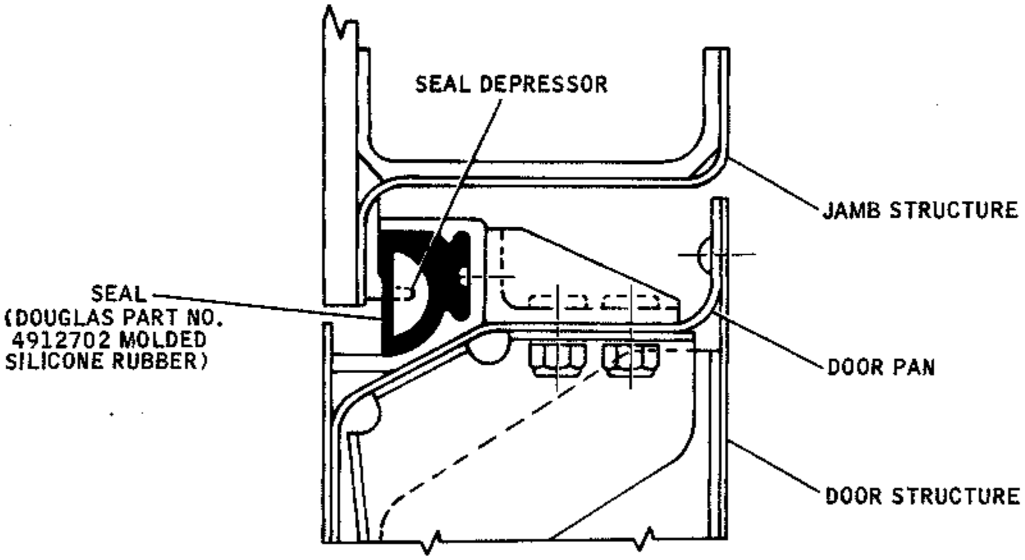
X MIN = 1/2 INCH
Y MIN = 3/4 INCH
* TREATED FABRIC TRICOT-WEAVE DACRON NO. 4756 PATCH. (CUT MATERIAL ON BIAS FOR TWO-WAY STRETCH AT CORNERS ONLY)

NOTE:
APPLY PATCHES TO BOTH SIDES OF DAMAGED AREA IF POSSIBLE

SMALL RUPTURE

BB3-104

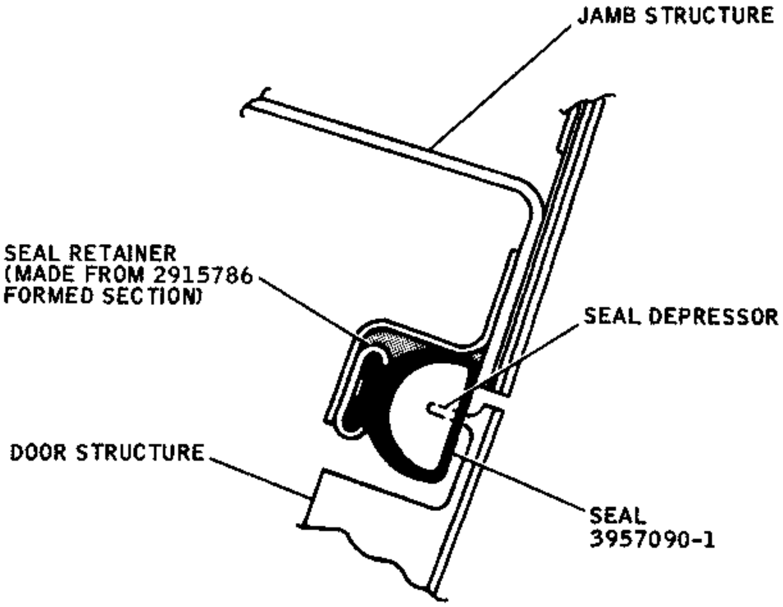
Door Seal Repair -- Class A
Figure 1



REFERENCE - DOUGLAS DRAWINGS 5910159 AND 4912702

BB3-164A

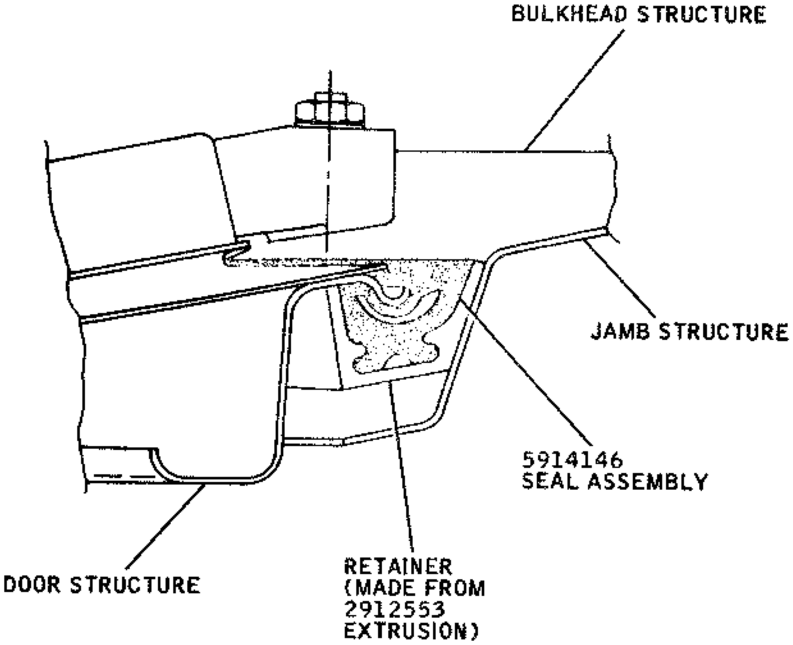
Overwing Emergency Exit Door Seal Section View
Figure 2



REFERENCE - DOUGLAS DRAWINGS 5910082 AND 3957090

BB3-142

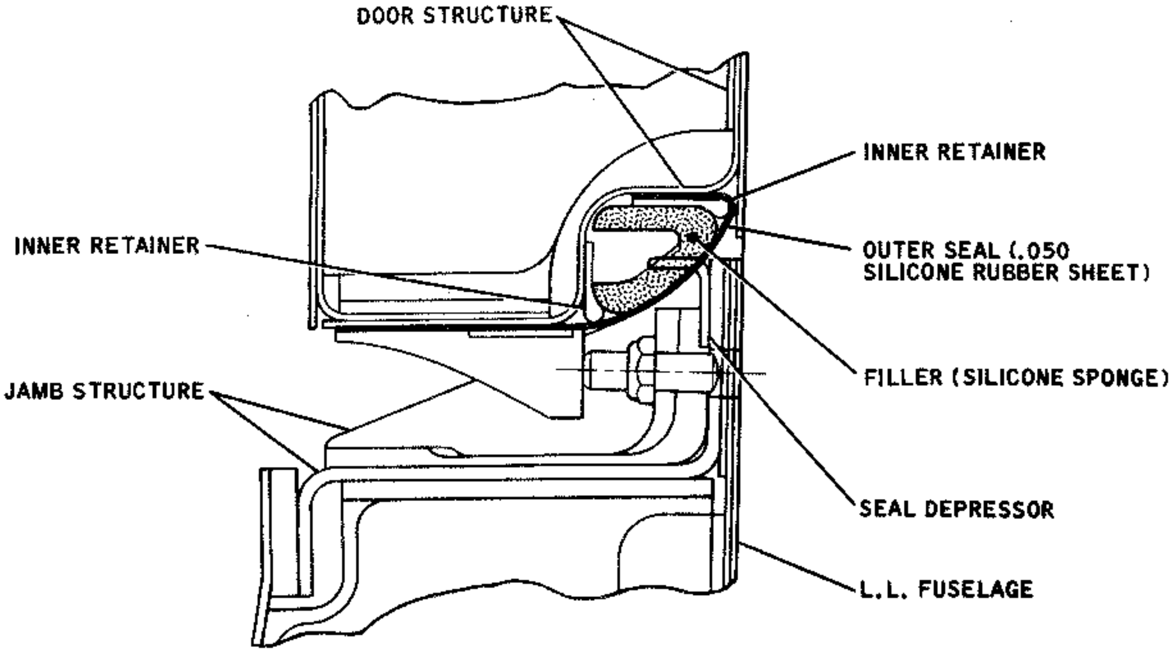
Forward Stairwell Door Seal Section View
Figure 3



REFERENCE - DOUGLAS DRAWINGS 5910163 AND 5914146

BB3-141

Pressure Bulkhead Emergency Exit Door Seal Section View
Figure 4

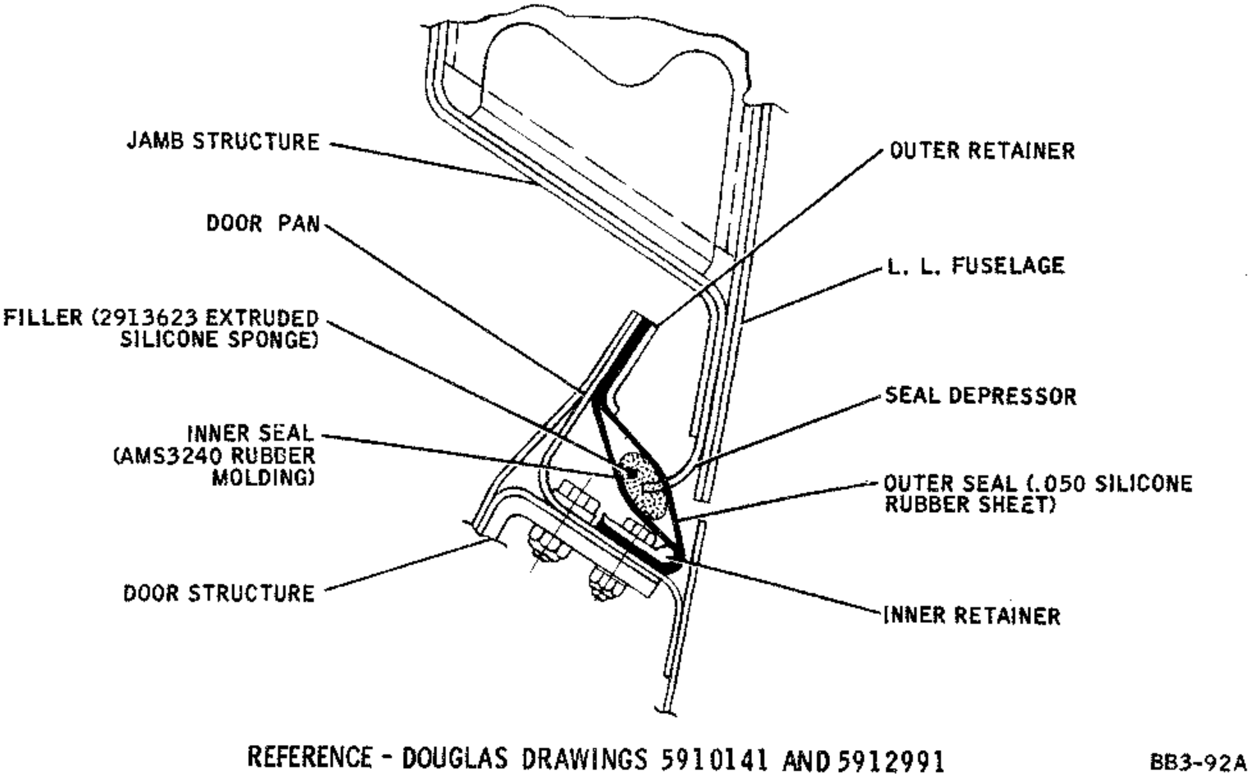


REFERENCE - DOUGLAS DRAWINGS 5910081 AND 5914665

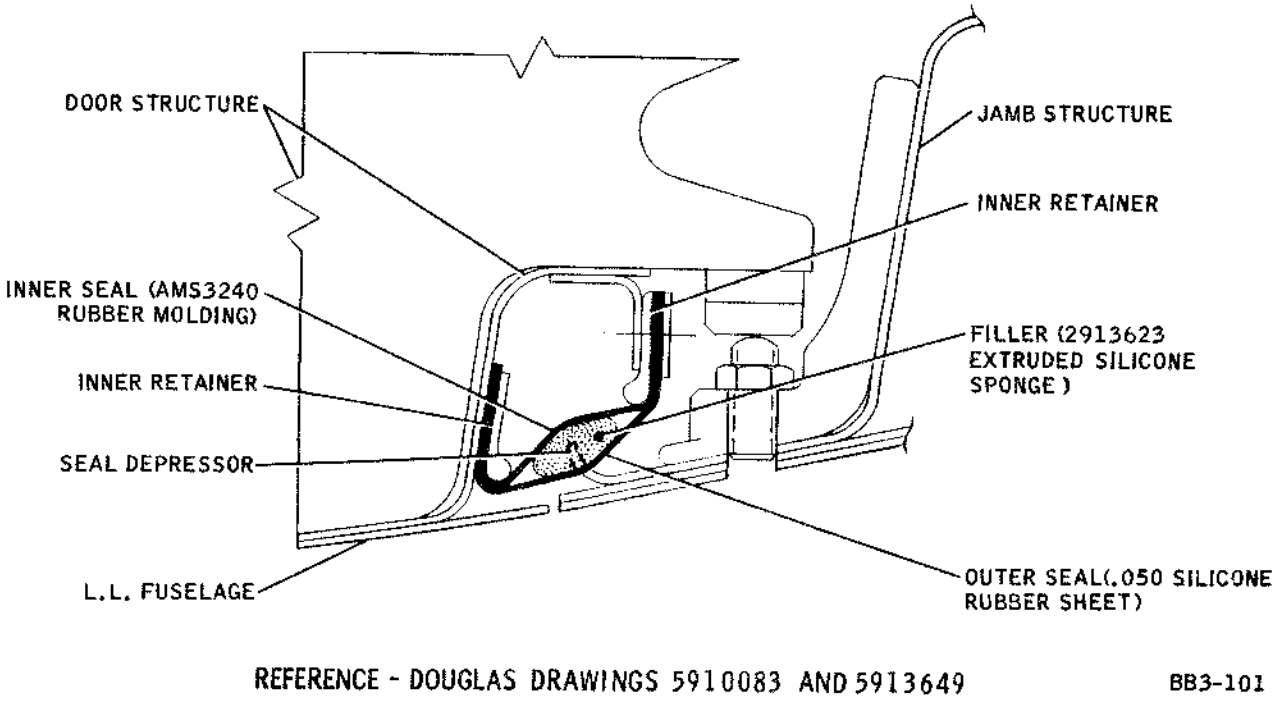
BB3-93

Passenger Forward Entrance Door Seal Section View
Figure 5

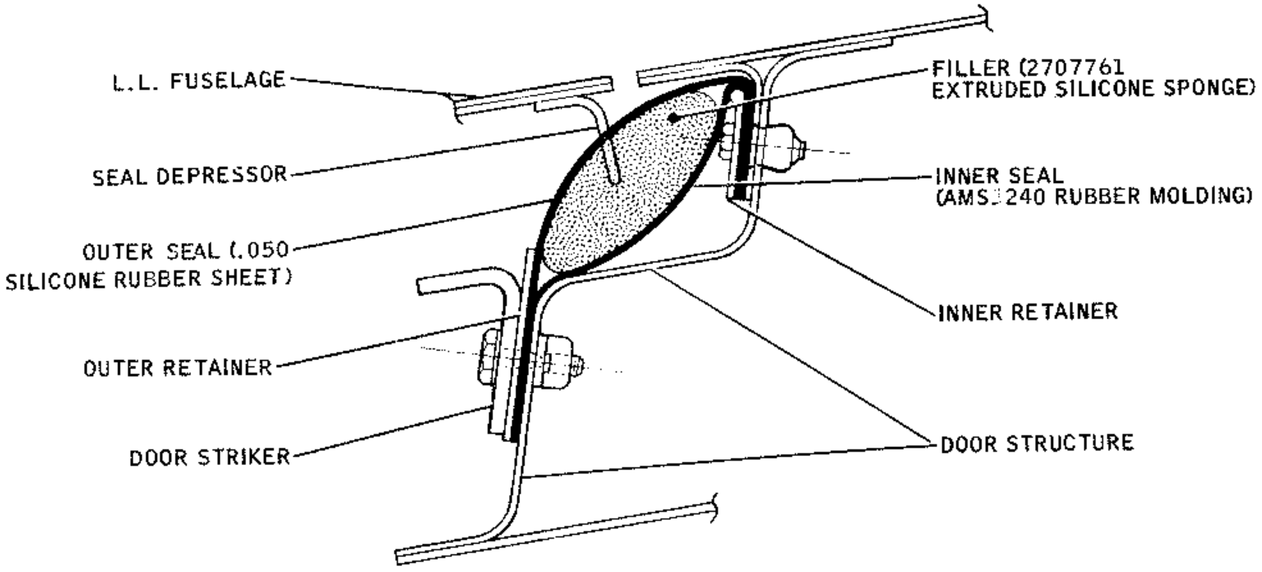
Printed in U.S.A.



Forward Service Door Seal Section View
Figure 6



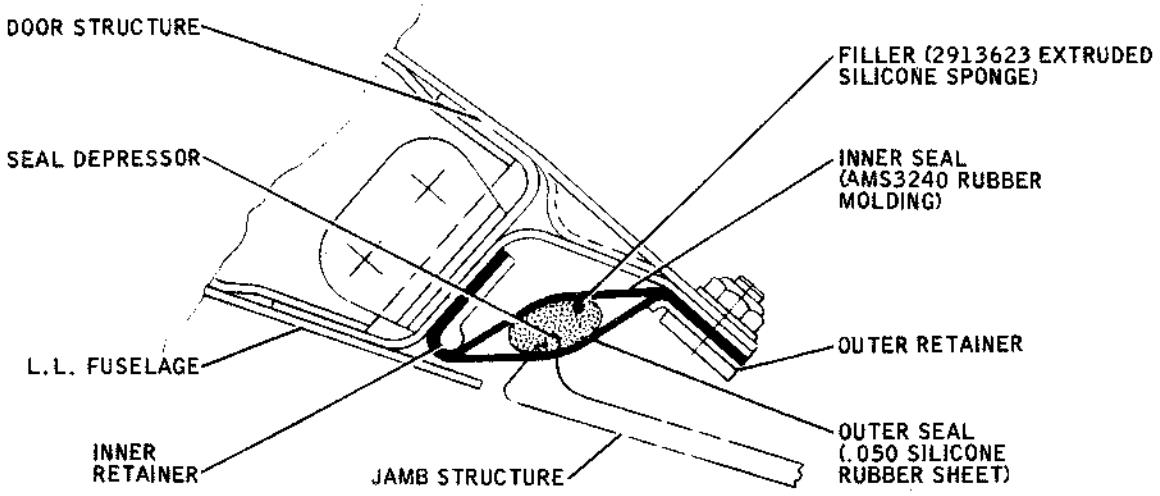
Electrical/Electronics Compartment Door Seal Section View
Figure 7



REFERENCE - DOUGLAS DRAWINGS 5910084 AND 3912558

BB3-94

Forward Service Door Seal Section View
Figure 8



REFERENCE - DOUGLAS DRAWINGS 5910157 AND 5912991

BB3-91A

Aft Lower Cargo Compartment Door Seal Section View
Figure 9

SKIN AND ATTACHING STRUCTURE REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

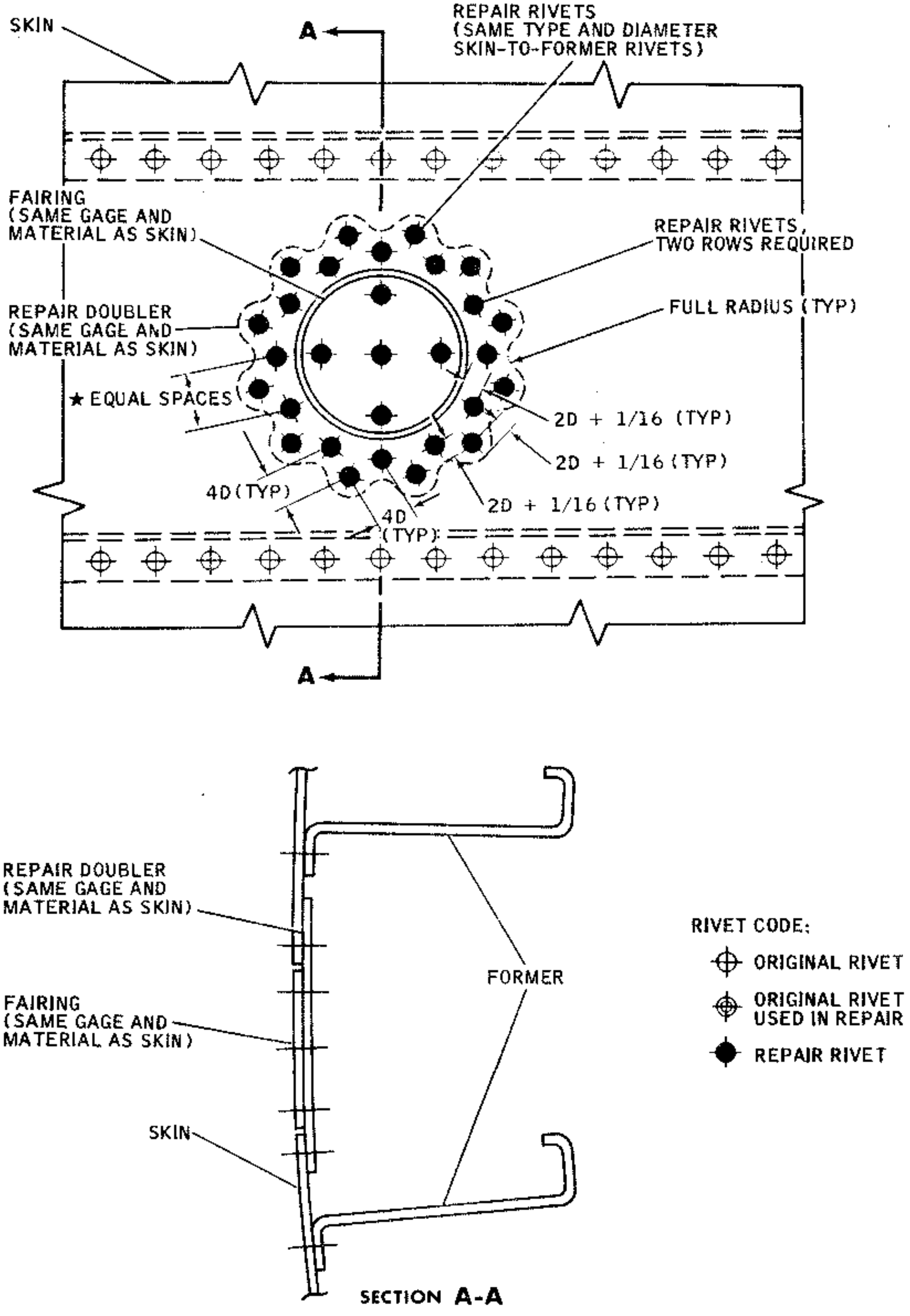
A. Repair of door skin damage, as well as skin and attaching structure damage, is illustrated in Figures 1 through 7 of this section, subject to the following:

   (1) Repairs must be in accordance with the general requirements listed in Section 52-01.

   (2) Cutouts of damage and the spacing of rivets must be in accordance with the attachment spacing chart, as applicable (see Figure 7, Section 52-01).

   (3) Smooth the metal edges of all cutouts to remove all sharp edges.

   (4) Use adequate protective practices in drilling holes and routing away damage, to prevent additional damage to other structure. Use drill stops and protective shims, as necessary.

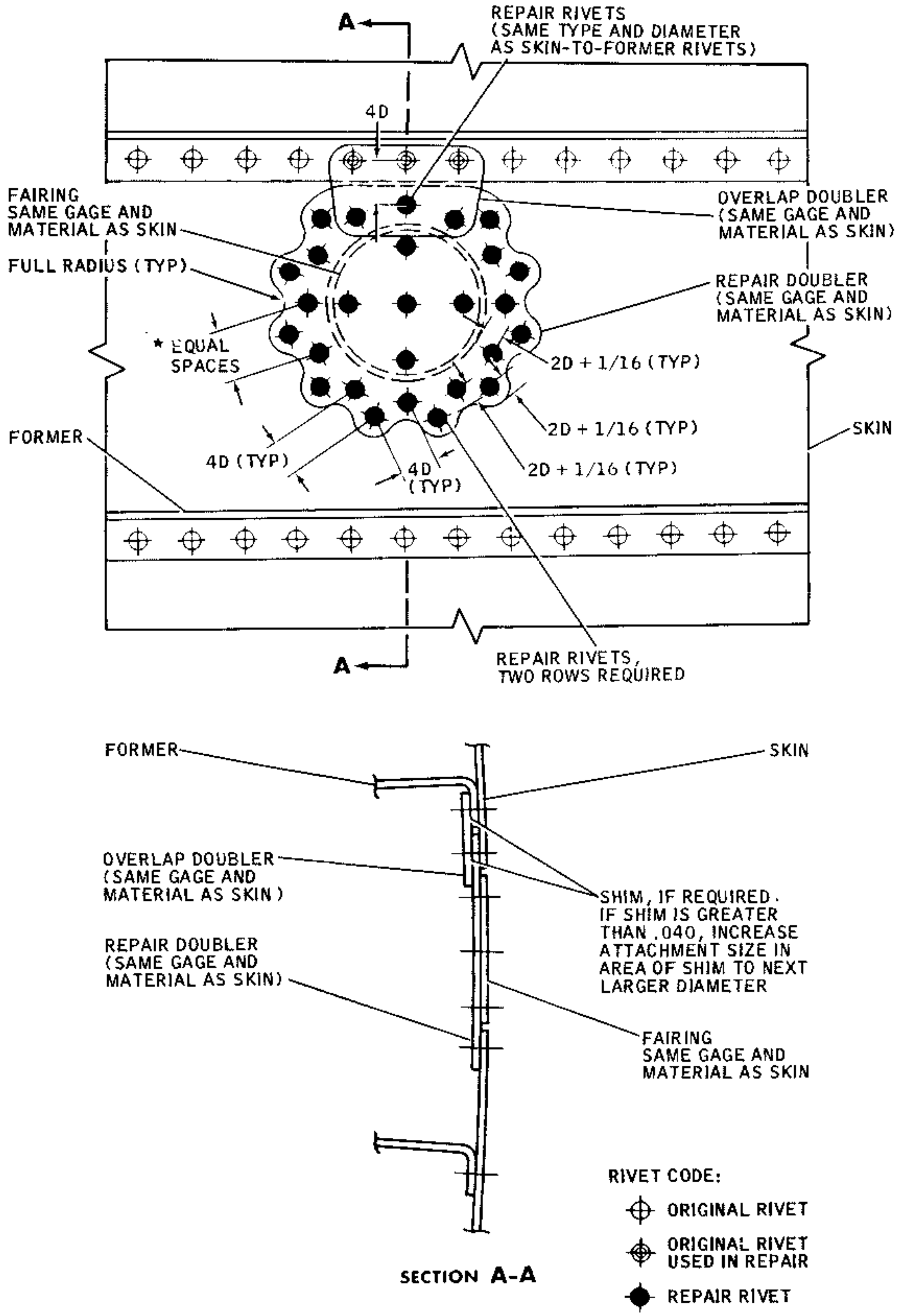


★ SEE THE ATTACHMENT SPACING CHART, SECTION 52-01, FOR NUMBER OF EQUAL SPACES

NOTE:
THIS REPAIR IS NOT APPLICABLE TO THE MAIN GEAR DOORS

BB3-294

Door Outer Skin Repair (Damage Between Formers) -- Class A
Figure 1

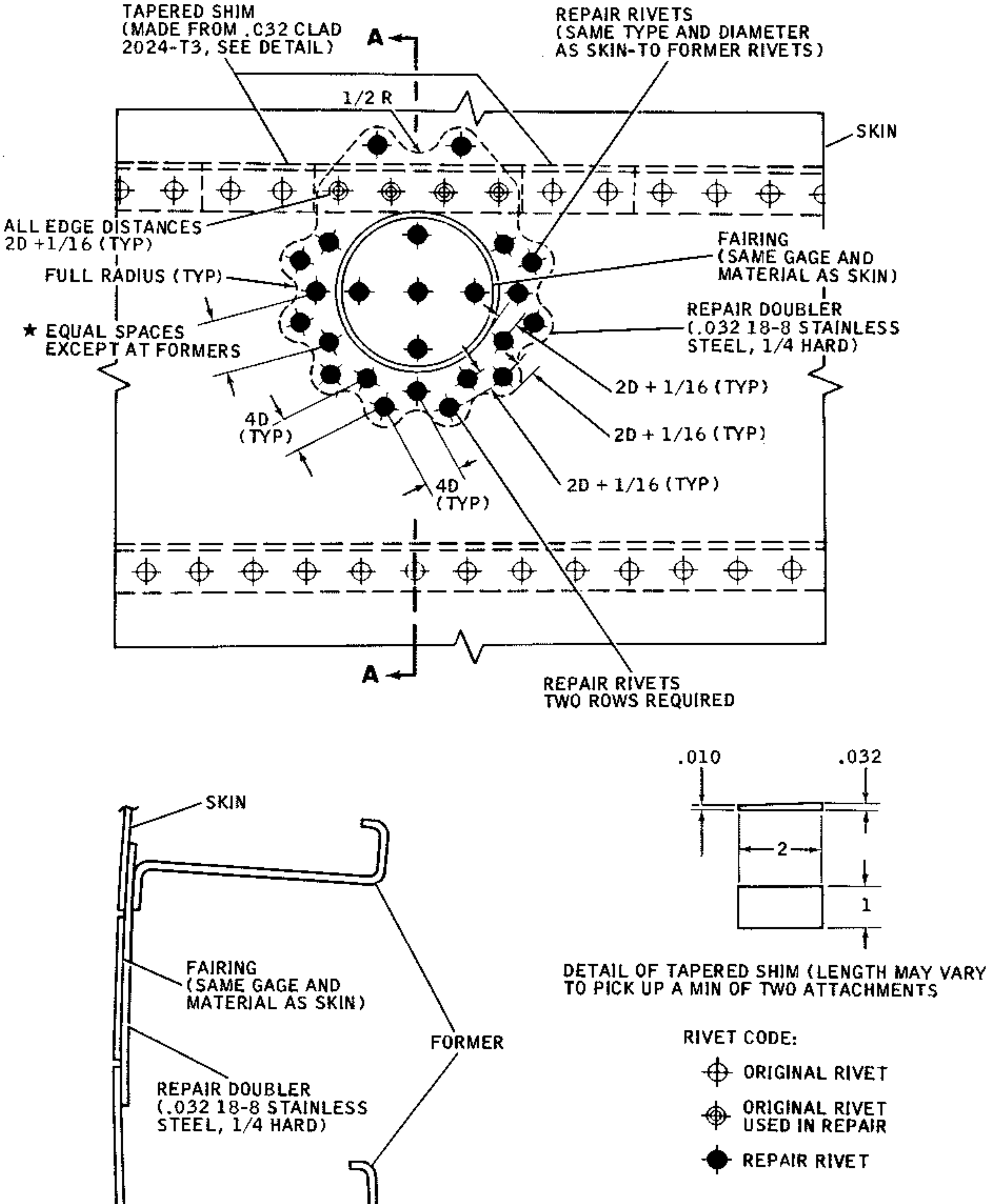


* SEE THE ATTACHMENT SPACING CHART, SECTION 52-01, FOR NUMBER OF EQUAL SPACES.

NOTE:
THIS REPAIR IS NOT APPLICABLE TO THE MAIN GEAR DOORS.

BB3-292

Door Outer Skin Repair (Damage Adjacent to Former) -- Class A
Figure 2

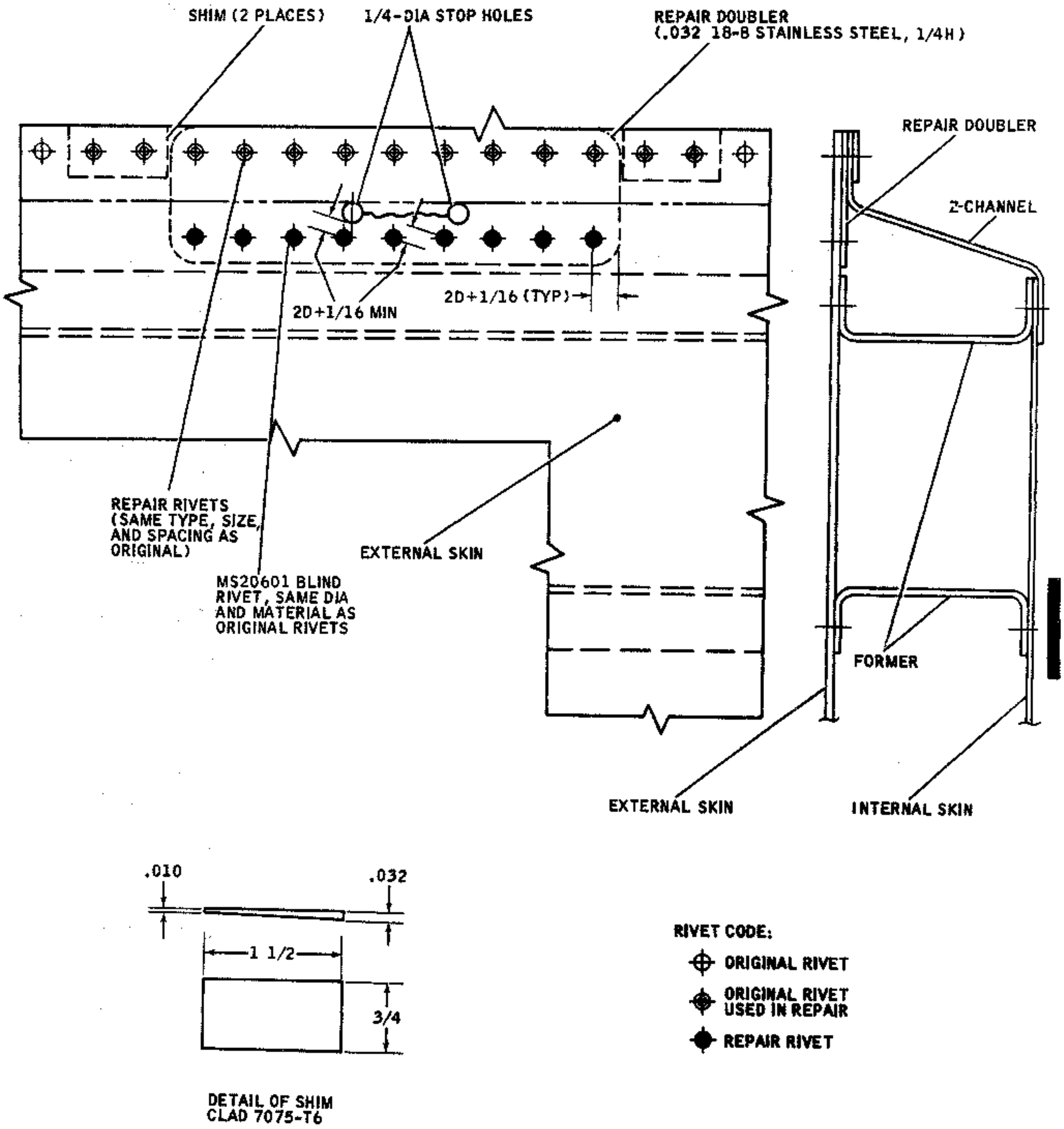


NOTES:

1. ★SEE THE ATTACHMENT SPACING CHART, SECTION 52-01, FOR NUMBER OF EQUAL SPACES.
2. THIS REPAIR IS NOT APPLICABLE FOR MAIN GEAR DOORS.

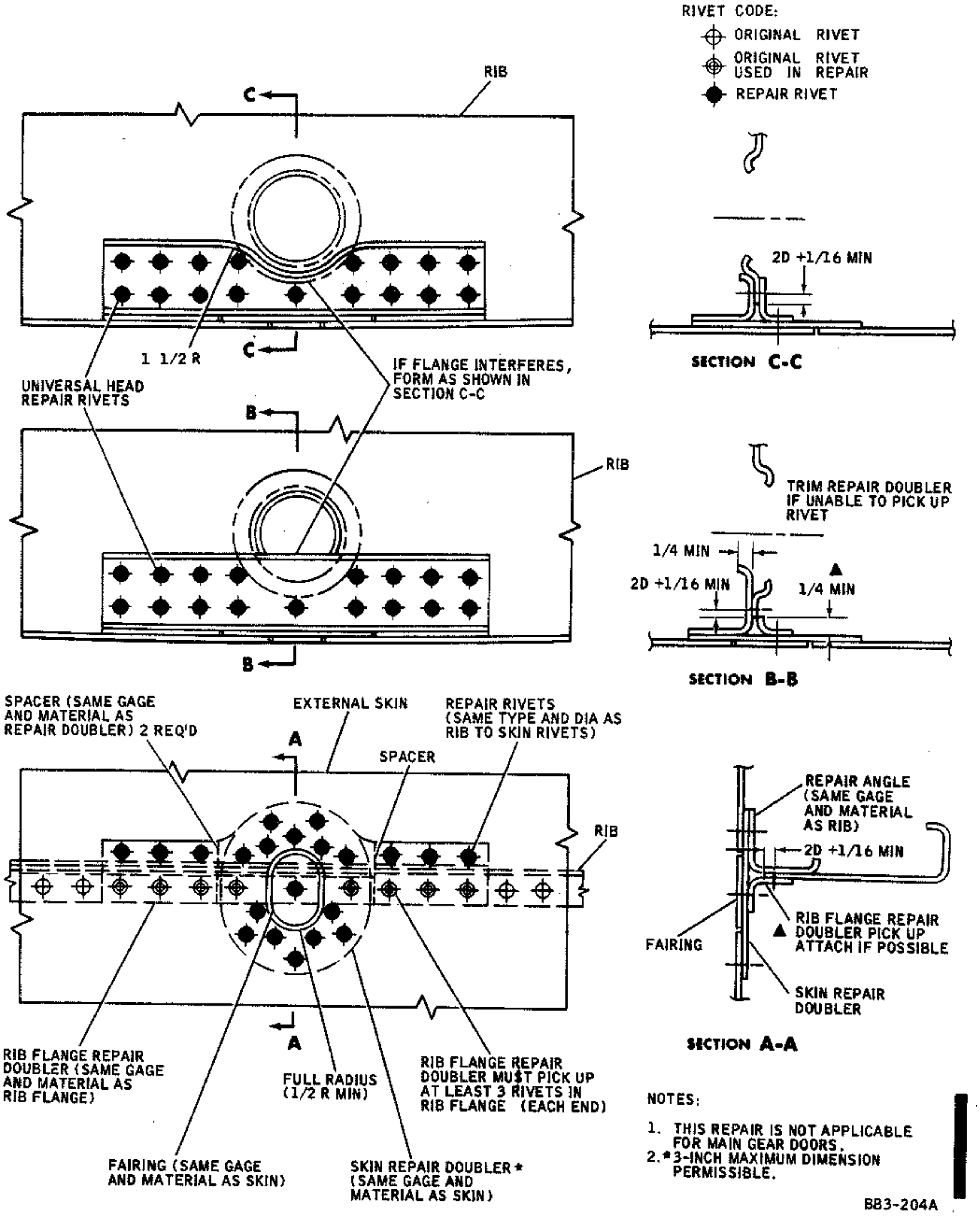
BB3-293

Door Outer Skin Alternate Repair (Damage Adjacent to Former) -- Class A
Figure 3



BB3-205A

Door Outer Skin Flange Crack Repair -- Class A
Figure 4

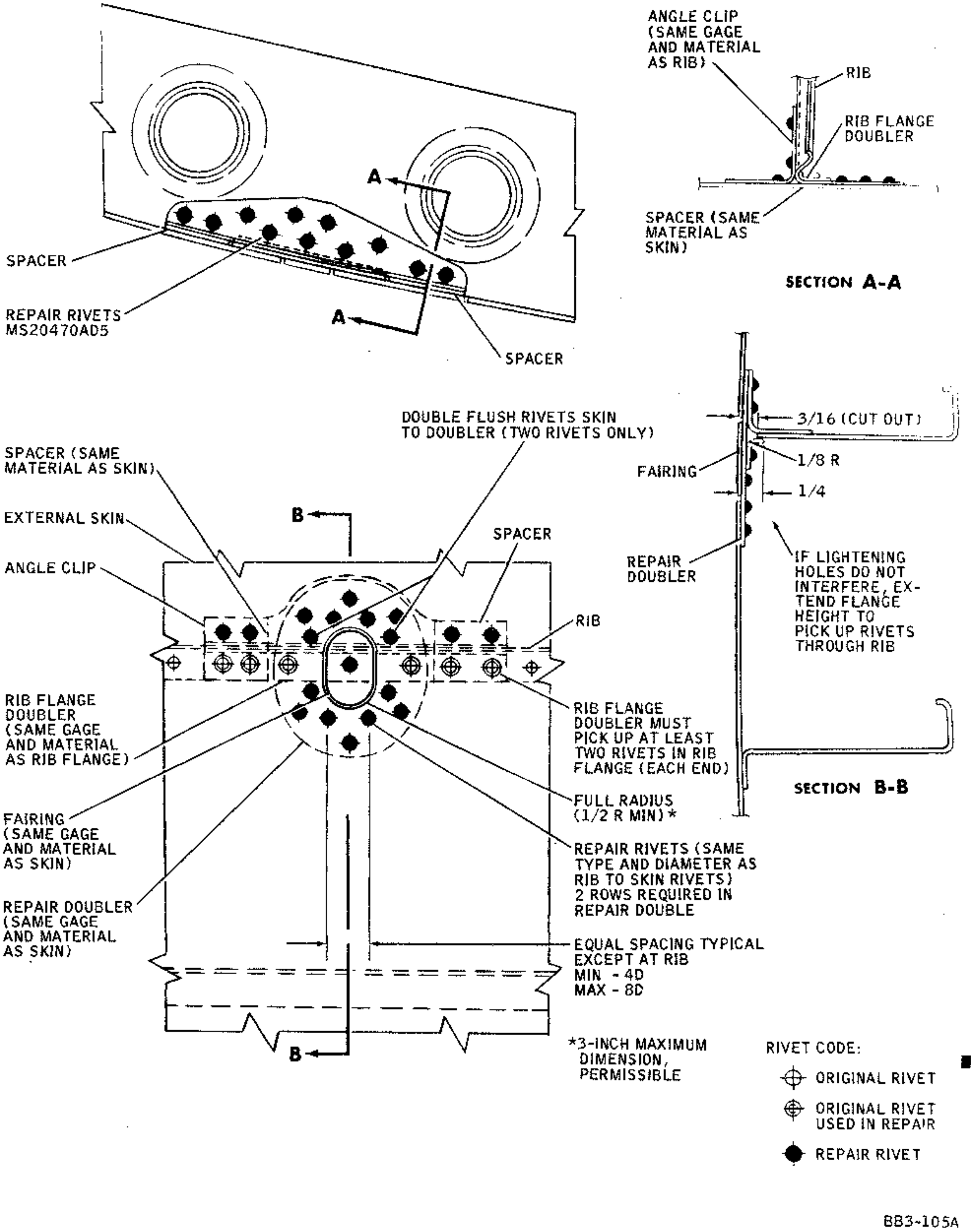


NOTES:

1. THIS REPAIR IS NOT APPLICABLE FOR MAIN GEAR DOORS.
2. * 3-INCH MAXIMUM DIMENSION PERMISSIBLE.

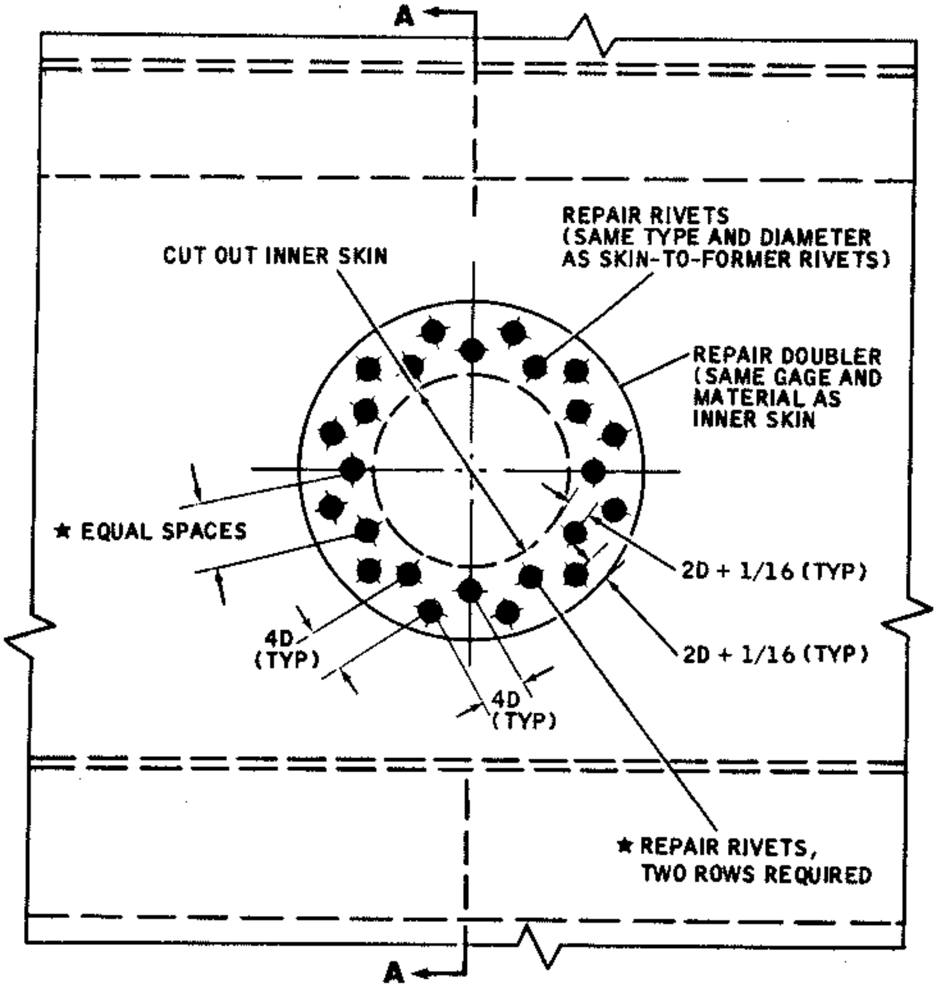
Door Outer Skin and Rib Flange Repair -- Class A
Figure 5

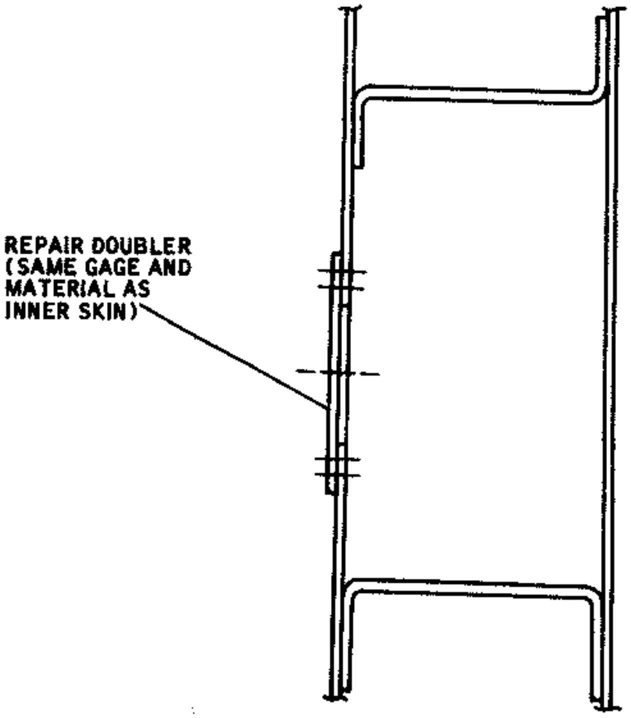
Printed in U.S.A.



Door Outer Skin and Rib Flange Repair
(Nose Gear Door Only) -- Class A
Figure 6

Printed in U.S.A.





SECTION A-A

NOTES:

1. ★ SEE THE ATTACHMENT SPACING CHART, SECTION 52-01, FOR NUMBER OF EQUAL SPACES AND ATTACHMENT SIZE.

2. THIS REPAIR IS APPLICABLE FOR ALL DOORS

BB3-291

Door Inner Skin Repair -- Class A
Figure 7

ACCESS DOOR LAND REPAIR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. Exterior doors, except the power plant doors, those pressurized, or those secured with bolts and/or screws, may be repaired by application of anti-chafe compound, Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.), on the door lands.

B. The repair is applicable for the following doors, and if desired, may be used on other doors within the limits defined above.

NOTE: Refer to Chapter 6, DC-9 Maintenance Manual, for access diagrams.

C. Wing Access Doors

(1) Right Wing Leading Edge Doors

Door No.	Name/Access to	Number
1210	Defueling Valve	3912482-1
1212	Fueling Valves and Control Panel	5912486-1
1214	Anti-Icing Duct Connector	5912485-1

(2) Left Wing Lower Trailing Edge Doors

Door No.	Name/Access to	Number
1504	Aileron Mechanism	9957499-1
1505	Aileron Mechanism	9957970-1
1506	Aileron Mechanism	9957969-1
1507	Aileron Hinge Bearing	9957968-1
1508	Aileron Mechanism	9957967-1
1509	Aileron Mechanism	9957966-1
1510	Aileron Hinge Bearing	9957965-1
1511	Aileron Mechanism	9957964-1
1512	Aileron Hinge Bearing	9957963-1

(3) Right Wing Lower Trailing Edge Doors

Door No.	Name/Access to	Number
1601	Inboard Flapwell	5912144-4
1602	Flapwell	5913622-2
1603	Outboard Flapwell	5912145-2
1604	Aileron Mechanism	9957499-2
1605	Aileron Mechanism	9957970-2
1606	Aileron Mechanism	9957969-2
1607	Aileron Mechanism	9957968-2
1608	Aileron Mechanism	9957967-2

Door No.	Name/Access to	Number
1609	Aileron Mechanism	9957966-2
1610	Aileron Mechanism	9957965-2
1611	Aileron Mechanism	9957964-2
1612	Aileron Mechanism	9957963-2

D. Fuselage Access Doors

(1) Forward Fuselage - Right Side

Door No.	Name/Access to	Number
4502	Forward Water Service	5914791-27

(2) Forward Fuselage - Left Side

Door No.	Name/Access to	Number
4301	External Ground Power	9955775-1

(3) Forward Fuselage - Lower

Door No.	Name/Access to	Number
4501	Electrical/Electronic Compartment	5910083-1
----	Forward Nose Gear Door	5914985-1, -2
----	Aft Nose Gear Door	5914984-1, -2
----	Main Landing Gear Door Installation	5910161-3, -4

(4) Fuselage Aft Right Side

Door No.	Name/Access to	Number
5702	Aft Fresh Water Service	5914791-25

(5) Fuselage Aft Left Side

Door No.	Name/Access to	Number
5701	Aft Toilet Service Panel	5914791-25
5901	Thrust Reverser Hydraulic Release Handle	5916424-10
5909	APU Ground Shutoff Switch	5916829-13

(6) Fuselage - Lower

Door No.	Name/Access to	Number
5903	APU Installation	5914694-3
5904	APU Installation	5915081-7
5905	Ground Pneumatic Power Connection	5913267-1
5906	Ground Air-Conditioning Connector and Check Valve	5913187-1

(7) Vertical Stabilizer

Door No.	Name/Access to	Number
6311	Latch for Door No. 6308	5956933-21

2. Prepare Surfaces

A. Unprimed Surfaces (Aluminum Alleys, Stainless Steel, and Titanium)

(1) Clean the area by wiping with clean, lint-free cotton cloths dampened, not dripping, with methyl ethyl ketone, TT-M-261, until all traces of contaminants are removed. Change the cleaning cloths often enough to ensure that the contaminants are being removed and not just redeposited.

(2) Before the solvent has an opportunity to dry, wipe dry with clean, lint-free cotton cloths.

(3) Clean the area again by wiping with clean, lint-free cloths dampened with No. 901 cleaner (Tec Chemical Co., 524 South Monterey Pass Road, Monterey Park, Calif.). Dry with clean, lint-free cotton cloths before the solvent has started to dry.

(4) Again clean the area with methyl ethyl ketone dampened cloths and dry with clean, lint-free cotton cloths.

(5) Apply Alodine No. 1200 solution (see Paragraph 3).

B. FR Primed Surfaces

(1) Clean the area with clean, lint-free cotton cloths dampened with methyl ethyl ketone until all traces of contaminants are removed.

(2) Scuff-sand the area with Scotchbrite Type A Aluminum Oxide Abrasive Nylon Wool Pads (Minnesota Mining and Manufacturing Co., 6023 Garfield Blvd., Los Angeles, Calif.), or equivalent.

(3) Repaint the area as required with FR primer, Koropon NO. 515-006 with catalyst, (DeSoto Chemical Co., Berkley, Calif.), by applying one wet cross coat.

3. Prepare and Apply Alodine No. 1200 Solution

A. Mix the following in a polyethylene bottle:

CAUTION: AVOID SKIN CONTACT WITH INGREDIENTS OR SOLUTION. WEAR RUBBER GLOVES AND PROTECTIVE FACE DEVICES WHEN MIXING OR APPLYING. IF INGREDIENTS OR SOLUTION CONTACT THE SKIN, FLUSH WITH WATER AND WASH THOROUGHLY WITH SOAP AND WATER.

Alodine No. 1200 powder (Amchem Products Inc., Box 390, St. Joseph, Mo.) ——— two ounces (by weight)

Nitric Acid (42° Baume), O-N-350 — six cubic centimeters (by volume)

Kloramine D-100 wetting agent (A. Ramsey & Sons, International Paint Co., Vancouver, Canada) ——— 0.34 ounce (by weight)

B. Add tap water to make one gallon and agitate the solution thoroughly to ensure that the Alodine 1200 powder is dissolved.

C. Date the bottle to note when mixed.

CAUTION: DO NOT USE ALODINE SOLUTION MORE THAN 72 HOURS OLD. WHEN NOT IN USE, KEEP THE SOLUTION IN CLOSED POLYETHYLENE CONTAINERS.

D. Apply Alodine 1200 solution using clean, lint-free cotton cloths. Keep the solution wet and agitate the area by constant swabbing for five minutes. Do not permit the solution to puddle and dry.

E. Wash with clean, lint-free cotton cloths and tap water and then wipe dry using clean, lint-free cotton cloths. Change the cloths and wash water frequently.

CAUTION: ALODINE RESIDUE MAY PREVENT ADHESION. ALL RESIDUE MUST BE REMOVED.

4. Prepare Laminar X-500 Teflon Coating

A. Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.) is a three-part material consisting of a resin/pigment (component A), a hardener (component B), and a thinner/converter (component C).

B. Mix the material as follows:

(1) Before weighing, thoroughly mix the resin/pigment (component A) until pigments are uniformly dispersed.

(2) Add components B and C and thoroughly mix the materials using the following proportions:

Resin/pigment (Component A)	57.5 parts (by weight)
Hardener (Component B)	18.5 parts (by weight)
Thinner/converter (Component C)	24.0 parts (by weight)

(3) Permit catalyzed material to stand at least five minutes before using.

NOTE: The pot life of catalyzed material is three hours at ambient temperature. After three hours, discard any unused material regardless of appearance.

5. Apply Laminar X-500 Teflon Coating

A. Spray Application

(1) Mask around areas to prevent overspray.

(2) Apply five to six successive cross coats using an MBC spray gun (DeVilbiss Co., Box 913, 300 Phillips Ave., Toledo, Ohio) with a No. E needle and a No. 30 air cap, or an equivalent spray gun, needle, and air cap combination.

<u>NOTE</u>: Five to six successive cross coats of Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch.

Immediately after use, thoroughly clean spray equipment using methyl ethyl ketone.

(3) Allow material to cure for 24 hours at 21.1°C (70°F).

B. Brush Application

(1) Mask around areas to prevent run-off onto adjacent parts.

(2) Using high quality bristle brushes, apply one uniform wet coat. Allow to air dry for two hours at ambient temperature.

(3) Apply a second uniform wet coat.

(4) Allow material to cure for 24 hours at 21.1°C (70°F).

<u>NOTE</u>: Two wet brush coats of the Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch.

PASSENGER/CREW - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

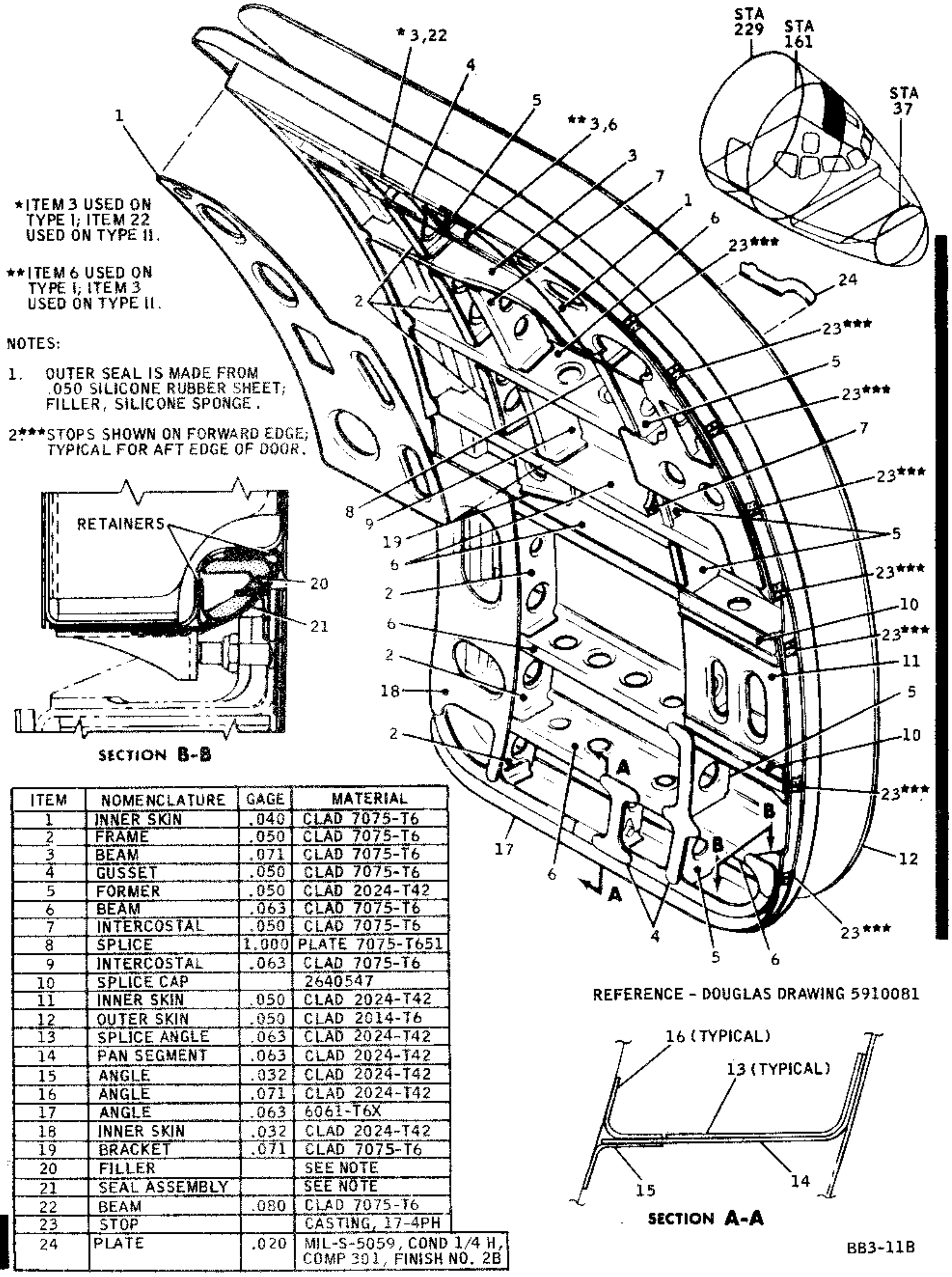
A. This section illustrates doors used for entrance to, and exit from, the airplane by the passengers and crew. Types and gages of material used in construction of the door assemblies are identified within the illustration.

2. Repair Index

A. A list of structural components and applicable repairs which are used to restore structural integrity and appearances is presented as follows:

Structural Component	Approved Repairs
Skins	Section 52-05, Figures 1 through 5, and 7
	Section 52-01, Figure 1, Sheets 2 and 3; Figure 2, Sheet 3; Figure 3, Sheet 3; Figure 4, Sheet 3
	Section 52-03, Figure 5
Seals	Section 52-04, as applicable
Internal structure (angles, frames, formers, etc.)	Section 52-01, Figure 1, Sheet 1; Figure 2, Sheet 4
	Section 52-05, Figures 1, 2, and 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.



*ITEM 3 USED ON TYPE I; ITEM 22 USED ON TYPE II.

**ITEM 6 USED ON TYPE I; ITEM 3 USED ON TYPE II.

NOTES:

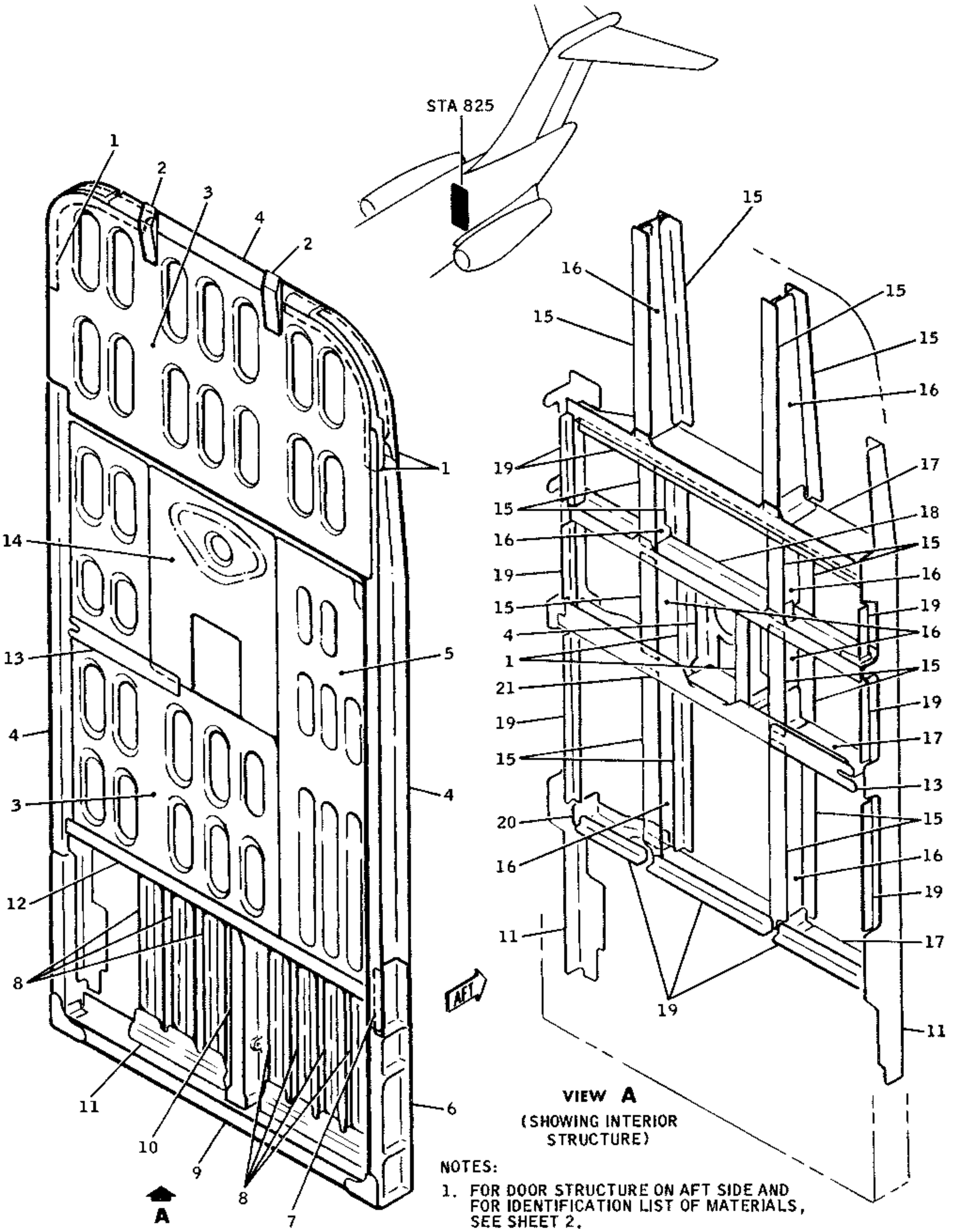
1. OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; FILLER, SILICONE SPONGE.
2. ***STOPS SHOWN ON FORWARD EDGE; TYPICAL FOR AFT EDGE OF DOOR.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SKIN	.040	CLAD 7075-T6
2	FRAME	.050	CLAD 7075-T6
3	BEAM	.071	CLAD 7075-T6
4	GUSSET	.050	CLAD 7075-T6
5	FORMER	.050	CLAD 2024-T42
6	BEAM	.063	CLAD 7075-T6
7	INTERCOSTAL	.050	CLAD 7075-T6
8	SPLICE	1.000	PLATE 7075-T651
9	INTERCOSTAL	.063	CLAD 7075-T6
10	SPLICE CAP		2640547
11	INNER SKIN	.050	CLAD 2024-T42
12	OUTER SKIN	.050	CLAD 2014-T6
13	SPLICE ANGLE	.063	CLAD 2024-T42
14	PAN SEGMENT	.063	CLAD 2024-T42
15	ANGLE	.032	CLAD 2024-T42
16	ANGLE	.071	CLAD 2024-T42
17	ANGLE	.063	6061-T6X
18	INNER SKIN	.032	CLAD 2024-T42
19	BRACKET	.071	CLAD 7075-T6
20	FILLER		SEE NOTE
21	SEAL ASSEMBLY		SEE NOTE
22	BEAM	.080	CLAD 7075-T6
23	STOP		CASTING, 17-4PH
24	PLATE	.020	MIL-S-5059, COND 1/4 H, COMP 301, FINISH NO. 2B

REFERENCE - DOUGLAS DRAWING 5910081

BB3-11B

Passenger Forward Entrance Door Structure -- Types I and II
Figure 1

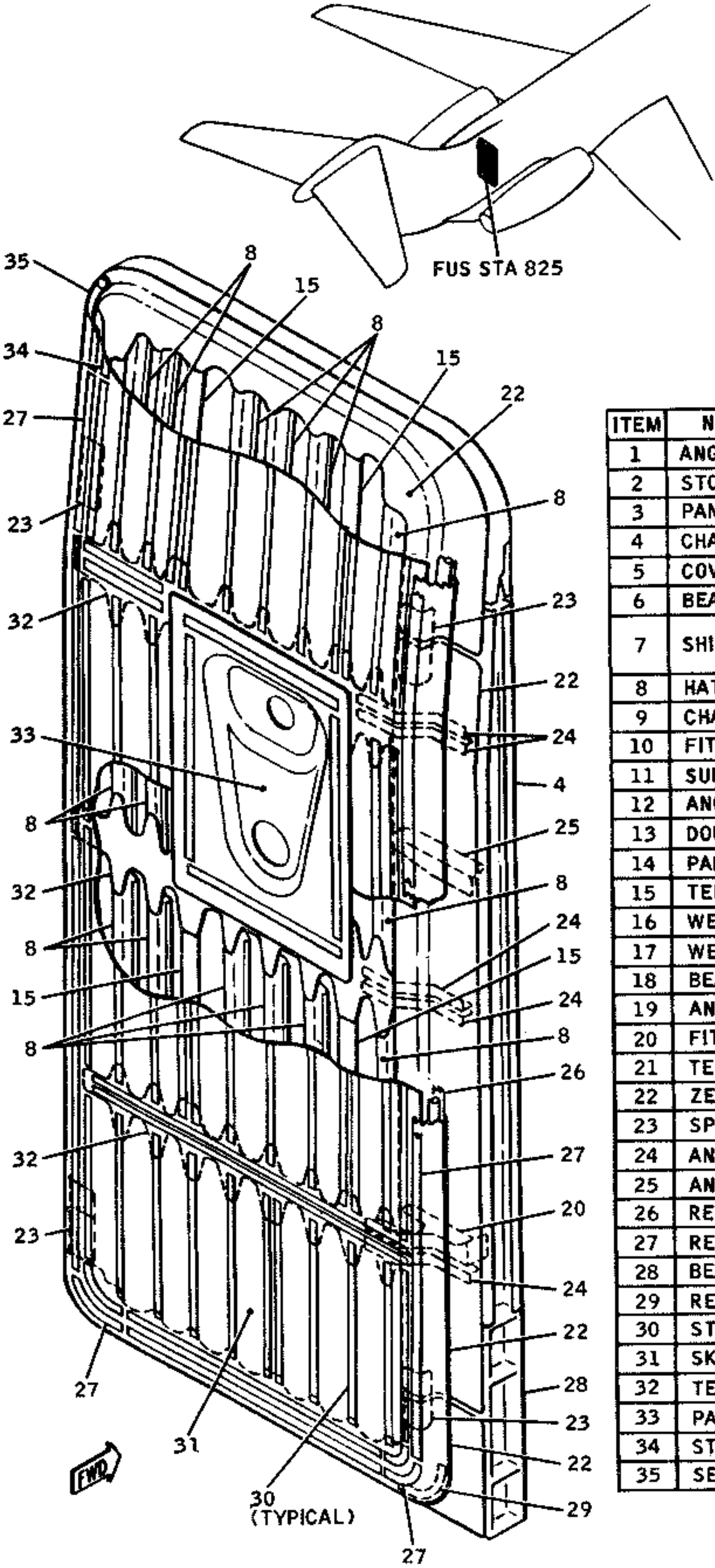


NOTES:

1. FOR DOOR STRUCTURE ON AFT SIDE AND FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 9915565.

BB3-561

Passenger Aft Entrance Stairwell Door (DC-9-10)
Figure 2 (Sheet 1)



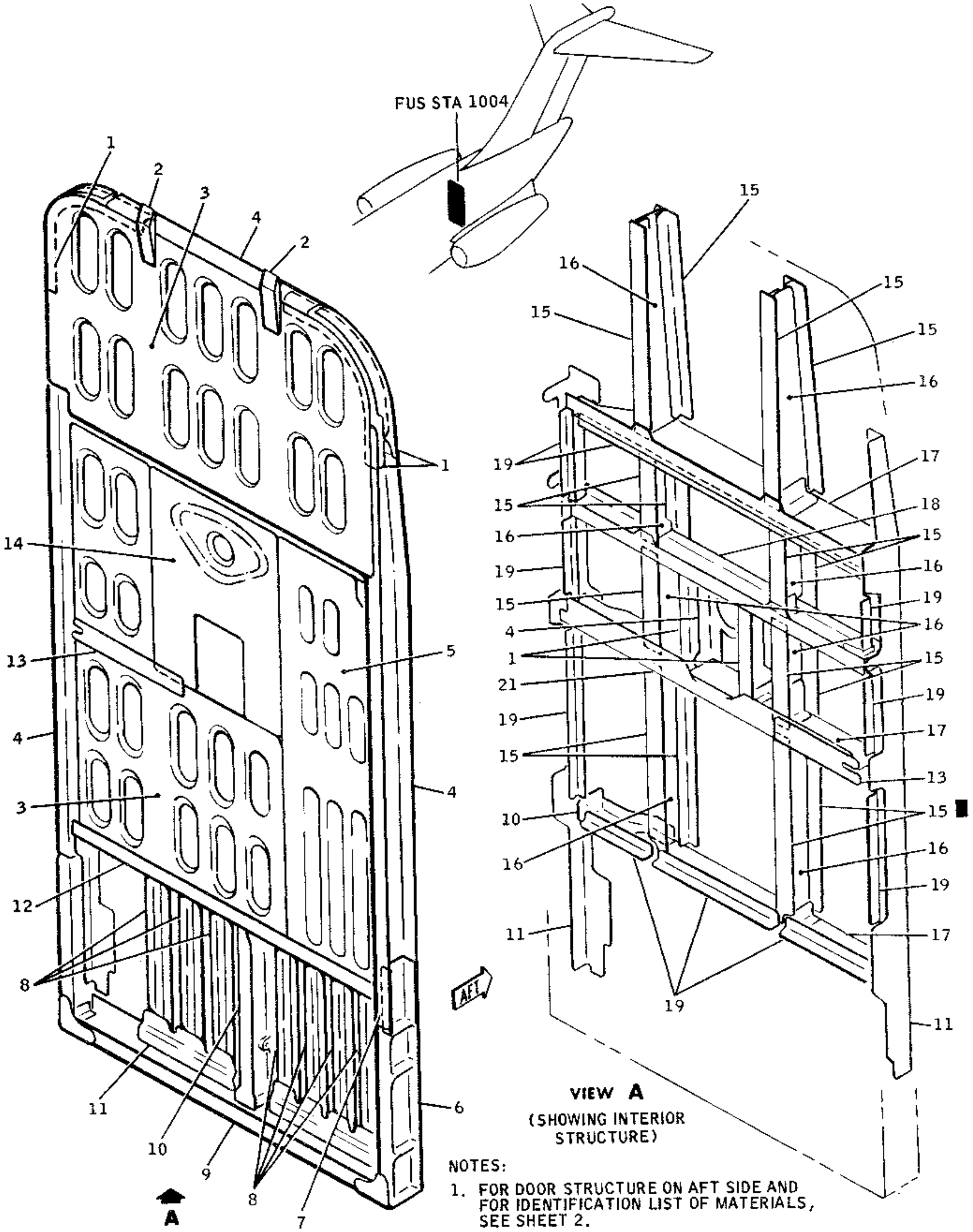
NOTES:

1. SEAL ASSY CONSISTS OF A SEAL (SILICONE RUBBER SHEET) AND A FILLER (SILICONE RUBBER SPONGE)
2. REFERENCE - DOUGLAS DRAWING 9915565

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.050	CLAD 7075-T6
2	STOP	.190	STEEL SHEET 4130
3	PANEL	.032	CLAD 2024-T42
4	CHANNEL	.050	CLAD 7075-T6
5	COVER	.032	CLAD 2024-T42
6	BEAM, 3917853-1	1.125	PLATE 7075-T651
7	SHIM	.062	.003 LAMINATED ALUMINUM
8	HAT		2777922-3
9	CHANNEL		1616373
10	FITTING, 3917864-1	2.000	PLATE 7075-T651
11	SUPPORT	.050	CLAD 7075-T6
12	ANGLE		1325737
13	DOUBLER	.050	CLAD 7075-T6
14	PAN	.050	CLAD 2024-T42
15	TEE CAP		1700632
16	WEB	.040	CLAD 7075-T6
17	WEB	.050	CLAD 7075-T6
18	BEAM		1331354
19	ANGLE		1464575
20	FITTING, 3917852-1	2.000	PLATE 7075-T651
21	TEE CAP		1666744
22	ZEE	.050	CLAD 7075-T6
23	SPLICE ANGLE	.063	CLAD 7075-T6
24	ANGLE	.063	CLAD 7075-T6
25	ANGLE		1418203
26	RETAINER		2505668
27	RETAINER	.050	CLAD 7075-T6
28	BEAM, 3917854-1	1.125	PLATE 7075-T651
29	RETAINER	.125	CLAD 2024-T3
30	STRIP		2917981
31	SKIN	.040	CLAD 2014-T6
32	TEE		2418534
33	PAN	.063	CLAD 2014-T4
34	STRIP	.040	CLAD 7075-T6
35	SEAL ASSY, 3918785-1		SEE NOTE 1

BB3-611

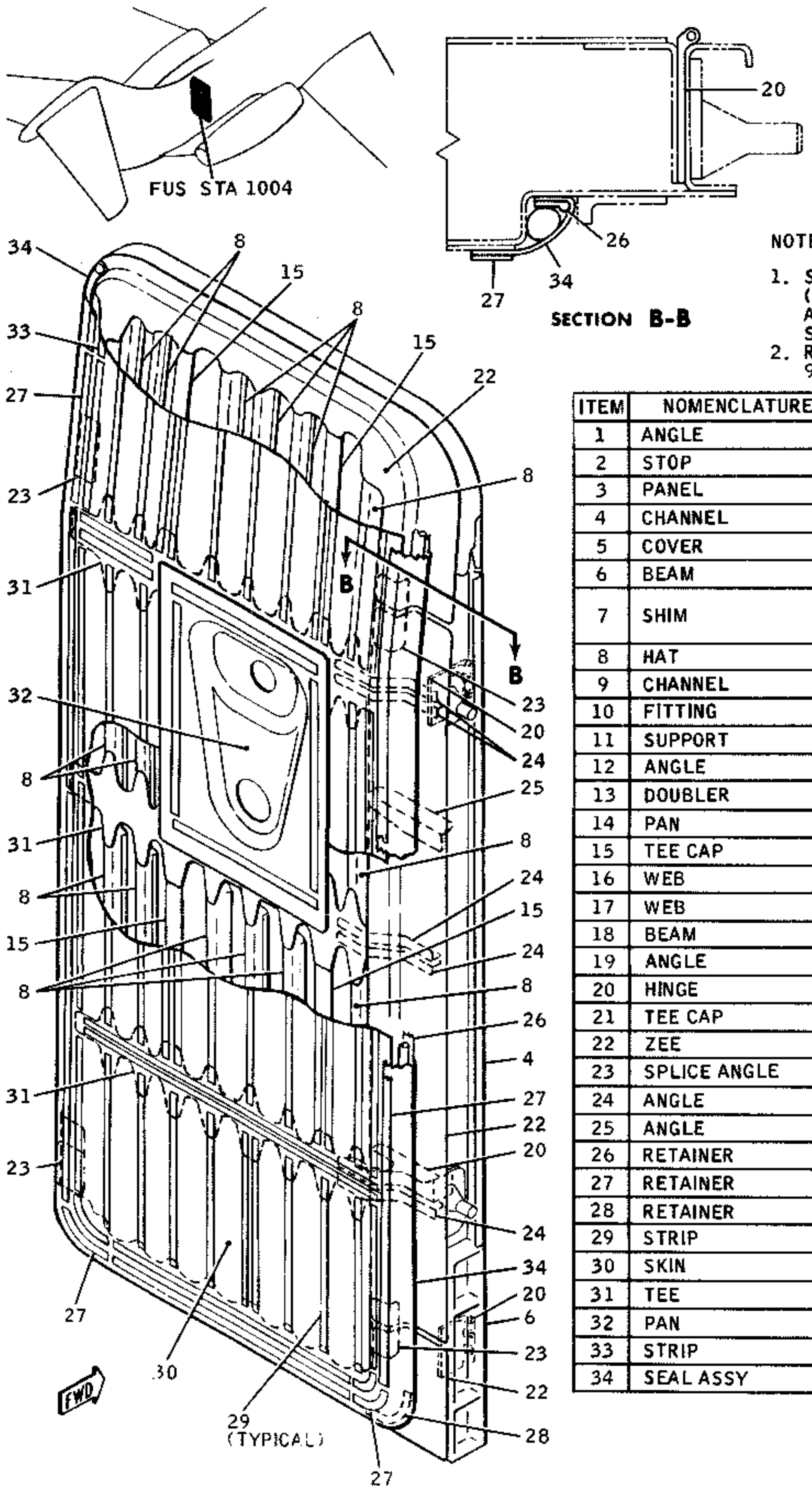
Passenger Aft Entrance Stairwell Door (DC-9-10)
Figure 2 (Sheet 2)



NOTES:

1. FOR DOOR STRUCTURE ON AFT SIDE AND FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 9915565.

Passenger Aft Entrance Stairwell Door (DC-9-30)
Figure 3 (Sheet 1)



NOTES:

1. SEAL ASSY CONSISTS OF A SEAL (SILICONE RUBBER SHEET) AND A FILLER (SILICONE RUBBER SPONGE)
2. REFERENCE - DOUGLAS DRAWING 9915565

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.050	CLAD 7075-T6
2	STOP	.190	STEEL SHEET 4130
3	PANEL	.032	CLAD 2024-T42
4	CHANNEL	.050	CLAD 7075-T6
5	COVER	.032	CLAD 2024-T42
6	BEAM	1.125	PLATE 7075-T651
7	SHIM	.062	.003 LAMINATED ALUMINUM
8	HAT		2777922-3
9	CHANNEL		1616373
10	FITTING	2.000	PLATE 7075-T651
11	SUPPORT	.050	CLAD 7075-T6
12	ANGLE		1325737
13	DOUBLER	.050	CLAD 7075-T6
14	PAN	.050	CLAD 2024-T42
15	TEE CAP		1700632
16	WEB	.040	CLAD 7075-T6
17	WEB	.050	CLAD 7075-T6
18	BEAM		1331354
19	ANGLE		1464575
20	HINGE	.375	PLATE 7075-T651
21	TEE CAP		1666744
22	ZEE	.050	CLAD 7075-T6
23	SPLICE ANGLE	.063	CLAD 7075-T6
24	ANGLE	.063	CLAD 7075-T6
25	ANGLE		1418203
26	RETAINER		2505668
27	RETAINER	.050	CLAD 7075-T6
28	RETAINER	.125	CLAD 2024-T3
29	STRIP		2917981
30	SKIN	.040	CLAD 2014-T6
31	TEE		2418534
32	PAN	.063	CLAD 2014-T4
33	STRIP	.040	CLAD 7075-T6
34	SEAL ASSY		SEE NOTE 1

Passenger Aft Entrance Stairwell Door (DC-9-30)
Figure 3 (Sheet 2)

EMERGENCY EXIT - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

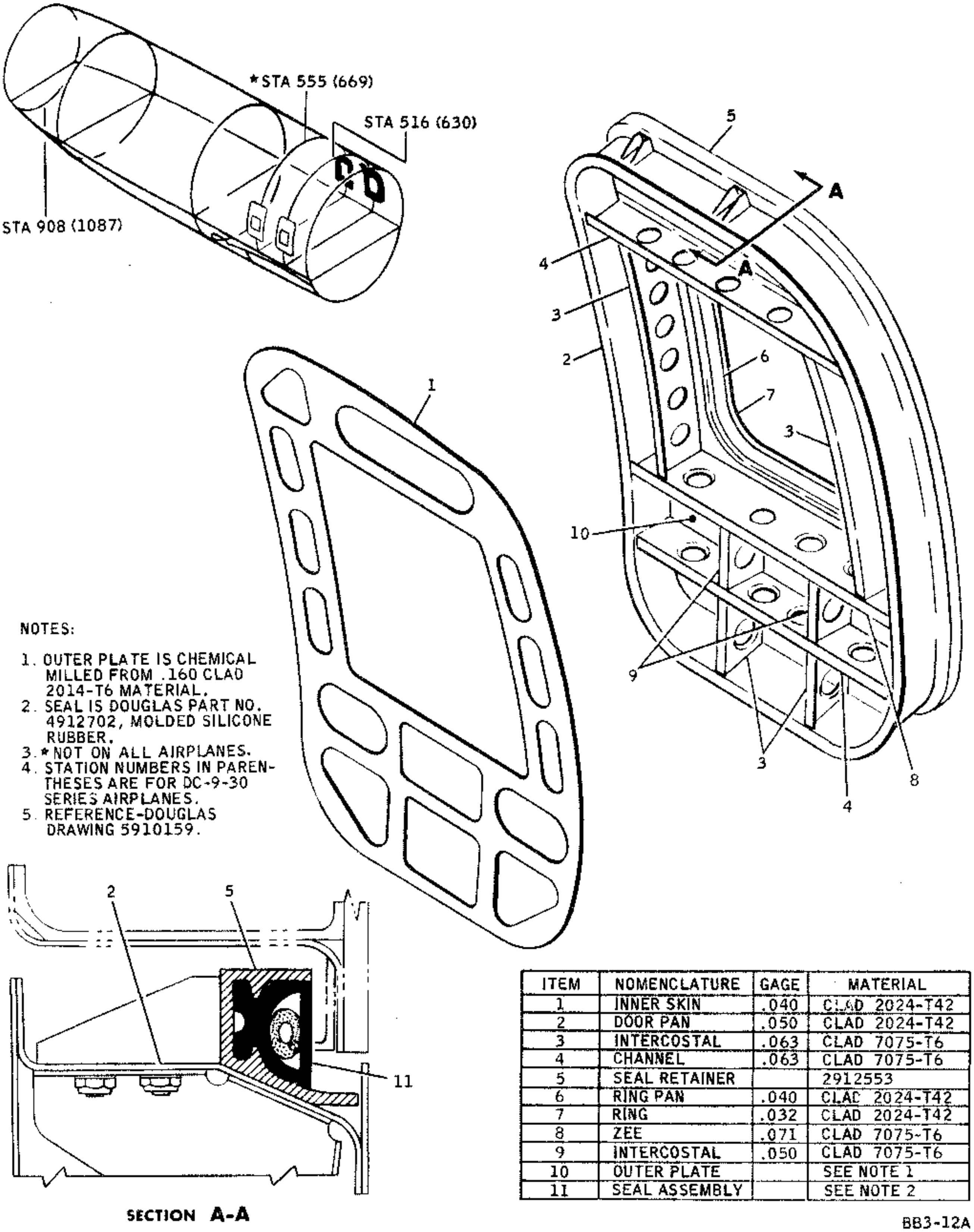
A. This section illustrates doors used for evacuation from the airplane which are not normally used for entrance and exit. Types and gages of material used in construction of the emergency exit door assemblies are identified within the illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which are used to restore structural integrity and appearance of structures is presented as follows:

Structural Component	Approved Repairs
Skins	Section 52-05, Figures 1 through 5, and 7
	Section 52-01, Figure 1, Sheets 2 and 3; Figure 2, Sheet 3; Figure 3, Sheet 3; Figure 4, Sheet 3
Seals	Section 52-04, as applicable
Internal structure (pans, zees, intercostals, etc.)	Section 52-01, Figure 1, Sheet 1; Figure 2, Sheet 4
	Section 52-05, Figures 1, 2, and 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

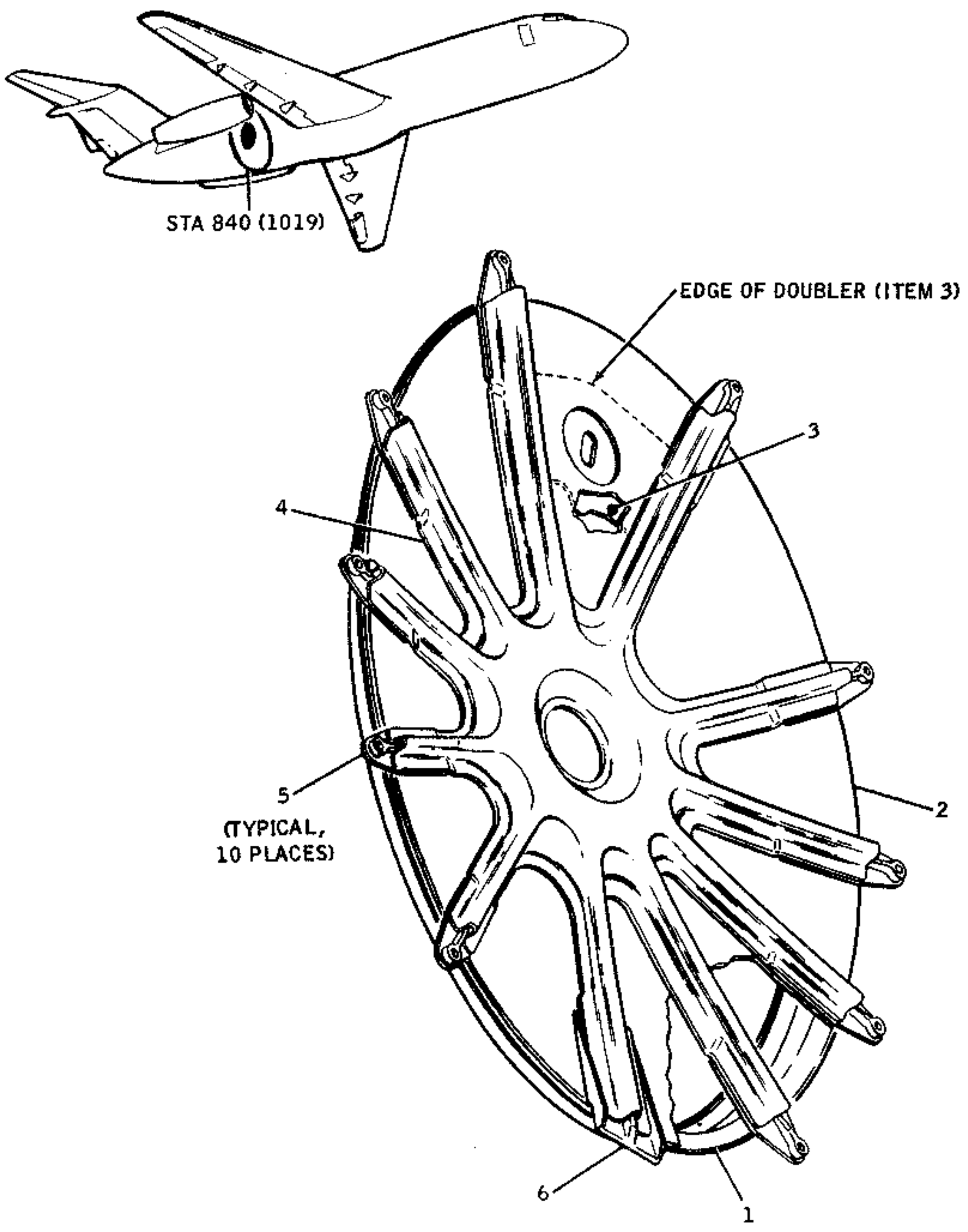


NOTES:

1. OUTER PLATE IS CHEMICAL MILLED FROM .160 CLAD 2014-T6 MATERIAL.
2. SEAL IS DOUGLAS PART NO. 4912702, MOLDED SILICONE RUBBER.
3. * NOT ON ALL AIRPLANES.
4. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
5. REFERENCE-DOUGLAS DRAWING 5910159.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SKIN	.040	CLAD 2024-T42
2	DOOR PAN	.050	CLAD 2024-T42
3	INTERCOSTAL	.063	CLAD 7075-T6
4	CHANNEL	.063	CLAD 7075-T6
5	SEAL RETAINER		2912553
6	RING PAN	.040	CLAD 2024-T42
7	RING	.032	CLAD 2024-T42
8	ZEE	.071	CLAD 7075-T6
9	INTERCOSTAL	.050	CLAD 7075-T6
10	OUTER PLATE		SEE NOTE 1
11	SEAL ASSEMBLY		SEE NOTE 2

Overwing Emergency Exit Door Structure
Figure 1



NOTES:

1. NOT INSTALLED ON AIRPLANES WITH PASSENGER AFT ENTRANCE STAIRWELL DOOR.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
3. REFERENCE-DOUGLAS DRAWING 5910367.

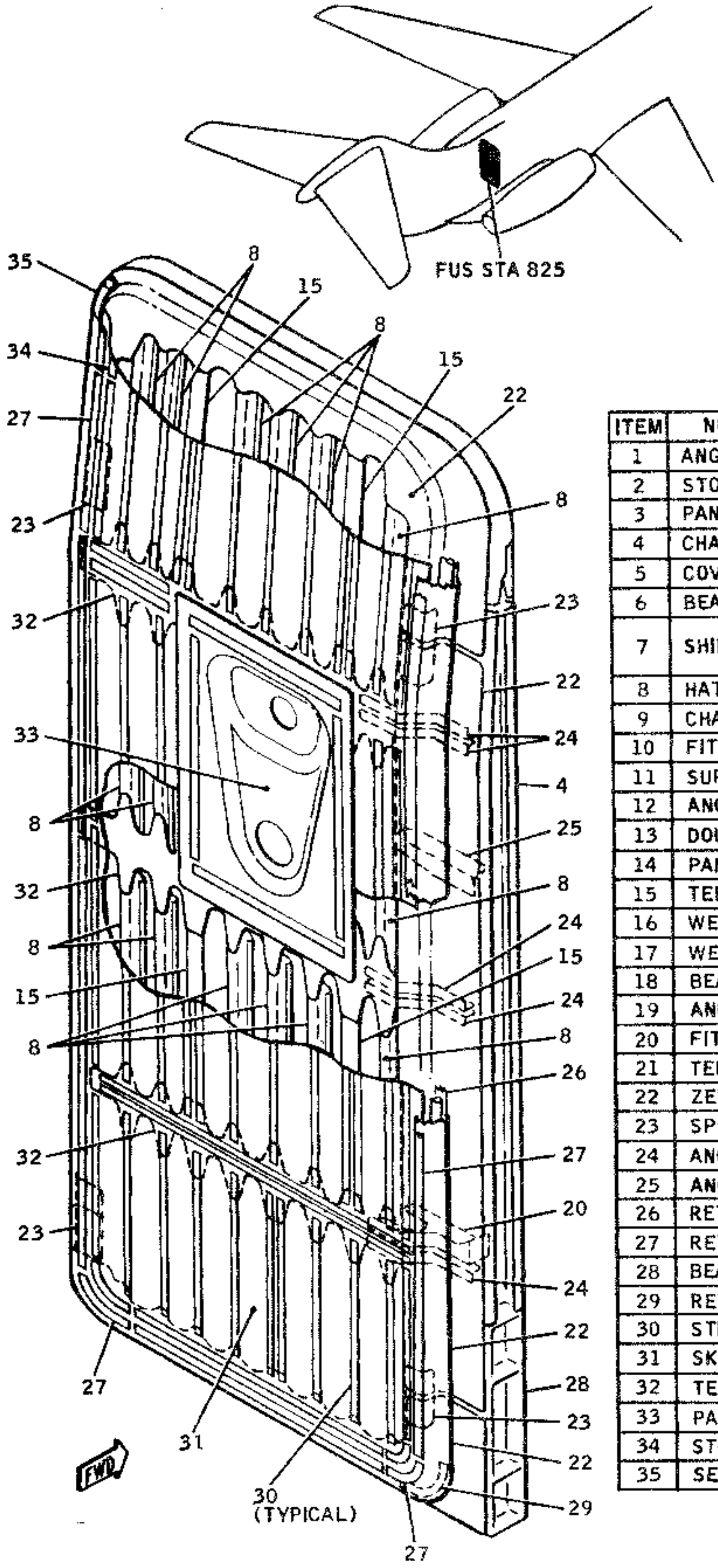
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.040	CLAD 2024-T42
2	WEB	.050	CLAD 2014-T6
3	DOUBLER	.040	CLAD 2024-T42
4	DOUBLER	.040	CLAD 2024-T42
5	FITTING	—	4140 STEEL FORGING
6	FITTING	—	7075-T6511 PLATE

BB3-498

Aft Pressure Bulkhead Emergency Exit Door Structure
Figure 2

NOTES:

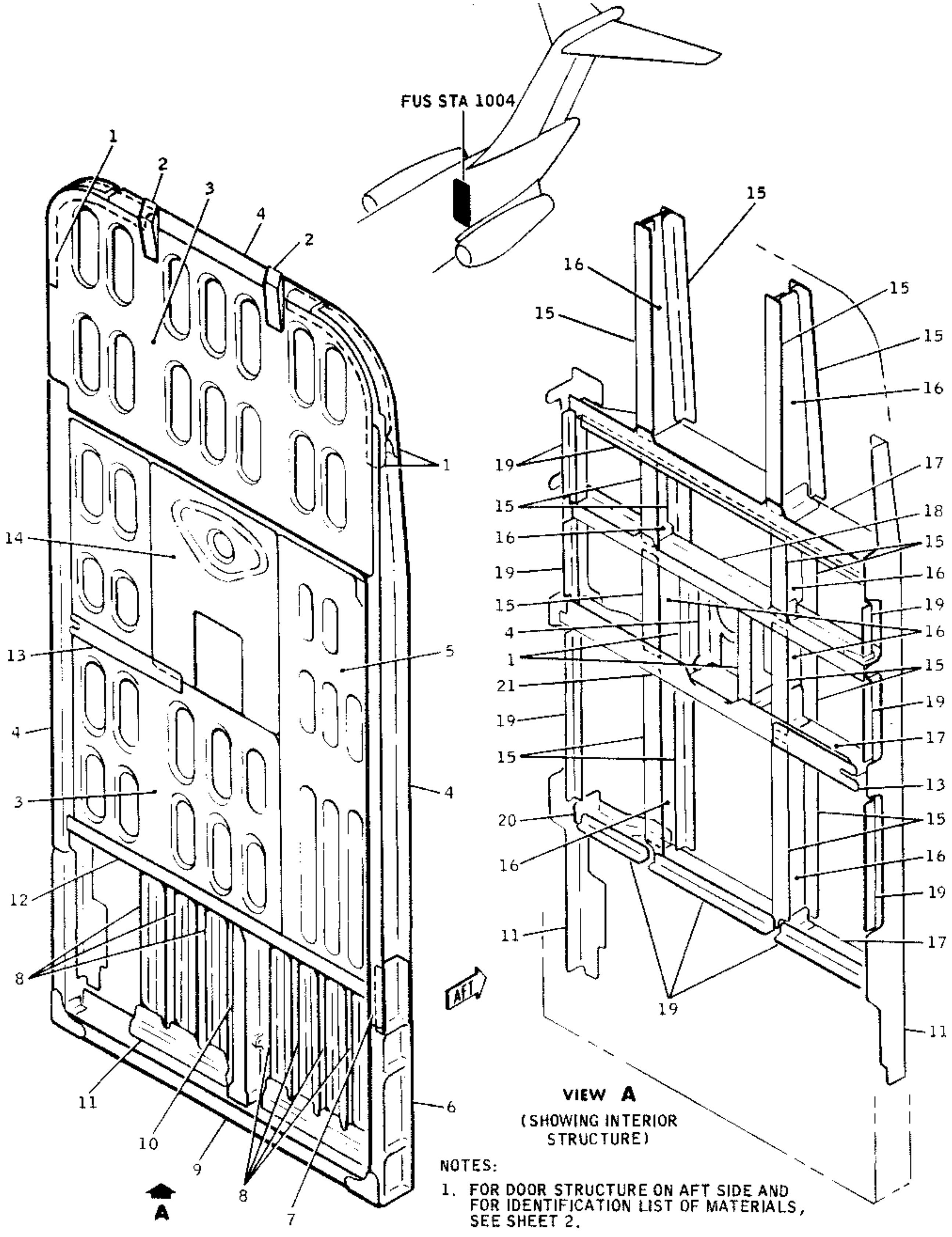
1. SEAL ASSY CONSISTS OF A SEAL (SILICONE RUBBER SHEET) AND A FILLER (SILICONE RUBBER SPONGE)
2. REFERENCE - DOUGLAS DRAWING 9915565



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.050	CLAD 7075-T6
2	STOP	.190	STEEL SHEET 4130
3	PANEL	.032	CLAD 2024-T42
4	CHANNEL	.050	CLAD 7075-T6
5	COVER	.032	CLAD 2024-T42
6	BEAM, 3917853-1	1.125	PLATE 7075-T651
7	SHIM	.062	.003 LAMINATED ALUMINUM
8	HAT		2777922-3
9	CHANNEL		1616373
10	FITTING, 3917864-1	2.000	PLATE 7075-T651
11	SUPPORT	.050	CLAD 7075-T6
12	ANGLE		1325737
13	DOUBLER	.050	CLAD 7075-T6
14	PAN	.050	CLAD 2024-T42
15	TEE CAP		1700632
16	WEB	.040	CLAD 7075-T6
17	WEB	.050	CLAD 7075-T6
18	BEAM		1331354
19	ANGLE		1464575
20	FITTING, 3917852-1	2.000	PLATE 7075-T651
21	TEE CAP		1666744
22	ZEE	.050	CLAD 7075-T6
23	SPLICE ANGLE	.063	CLAD 7075-T6
24	ANGLE	.063	CLAD 7075-T6
25	ANGLE		1418203
26	RETAINER		2505668
27	RETAINER	.050	CLAD 7075-T6
28	BEAM, 3917854-1	1.125	PLATE 7075-T651
29	RETAINER	.125	CLAD 2024-T3
30	STRIP		2917981
31	SKIN	.040	CLAD 2014-T6
32	TEE		2418534
33	PAN	.063	CLAD 2014-T4
34	STRIP	.040	CLAD 7075-T6
35	SEAL ASSY, 3918785-1		SEE NOTE 1

BB3-611

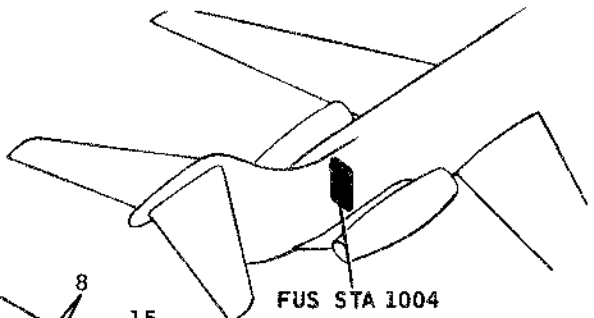
Passenger Aft Entrance Stairwell Door (DC-9-10)
Figure 3 (Sheet 2)



NOTES:

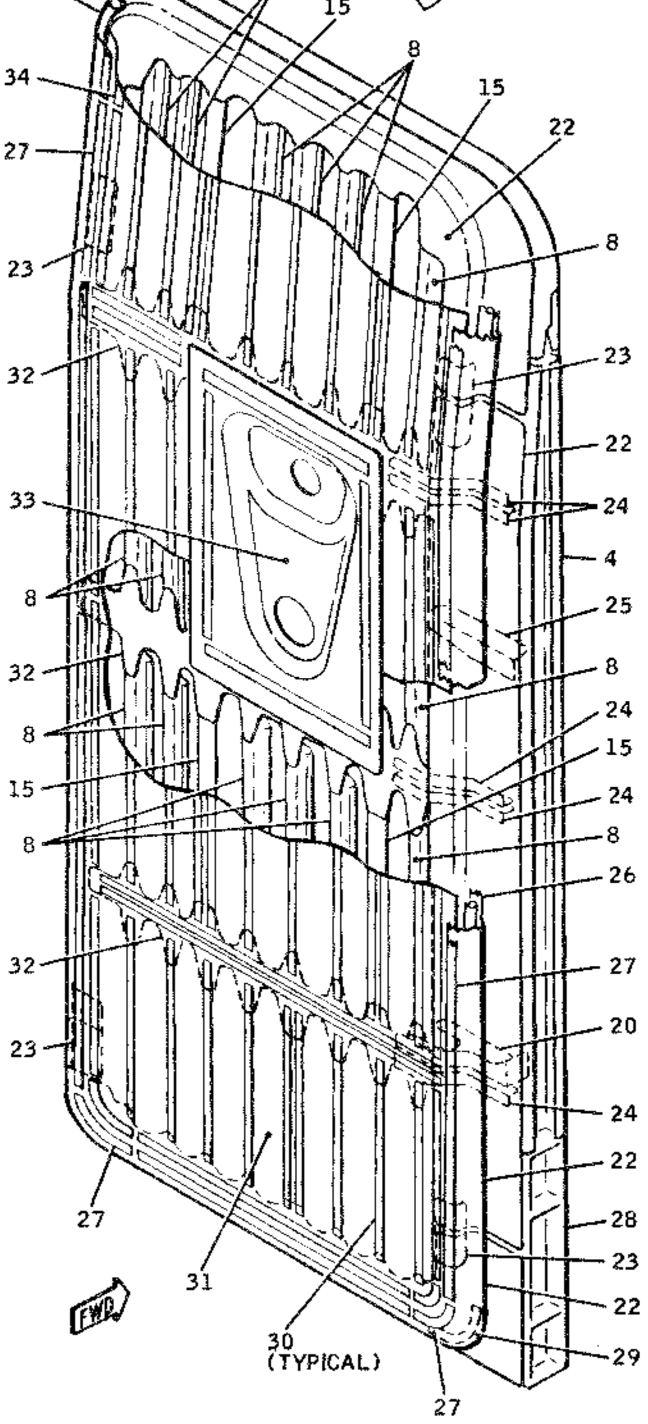
1. FOR DOOR STRUCTURE ON AFT SIDE AND FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 9915565.

Passenger Aft Entrance Stairwell Door (DC-9-30)
Figure 4 (Sheet 1)



NOTES:

1. SEAL ASSY CONSISTS OF A SEAL (SILICONE RUBBER SHEET) AND A FILLER (SILICONE RUBBER SPONGE)
2. REFERENCE - DOUGLAS DRAWING 9915565



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.050	CLAD 7075-T6
2	STOP	.190	STEEL SHEET 4130
3	PANEL	.032	CLAD 2024-T42
4	CHANNEL	.050	CLAD 7075-T6
5	COVER	.032	CLAD 2024-T42
6	BEAM, 3917853-1	1.125	PLATE 7075-T651
7	SHIM	.062	.003 LAMINATED ALUMINUM
8	HAT		2777922-3
9	CHANNEL		1616373
10	FITTING, 3917864-1	2.000	PLATE 7075-T651
11	SUPPORT	.050	CLAD 7075-T6
12	ANGLE		1325737
13	DOUBLER	.050	CLAD 7075-T6
14	PAN	.050	CLAD 2024-T42
15	TEE CAP		1700632
16	WEB	.040	CLAD 7075-T6
17	WEB	.050	CLAD 7075-T6
18	BEAM		1331354
19	ANGLE		1464575
20	FITTING, 3917852-1	2.000	PLATE 7075-T651
21	TEE CAP		1666744
22	ZEE	.050	CLAD 7075-T6
23	SPLICE ANGLE	.063	CLAD 7075-T6
24	ANGLE	.063	CLAD 7075-T6
25	ANGLE		1418203
26	RETAINER		2505668
27	RETAINER	.050	CLAD 7075-T6
28	BEAM, 3917854-1	1.125	PLATE 7075-T651
29	RETAINER	.125	CLAD 2024-T3
30	STRIP		2917981
31	SKIN	.040	CLAD 2014-T6
32	TEE		2418534
33	PAN	.063	CLAD 2014-T4
34	STRIP	.040	CLAD 7075-T6
35	SEAL ASSY, 3918785-1		SEE NOTE 1

BB3-961

Passenger Aft Entrance Stairwell Door (DC-9-30)
Figure 4 (Sheet 2)

CARGO - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates the doors used to gain access to cargo compartments of the airplane. Types and gages of material used in construction of the door assemblies are identified within the illustrations.

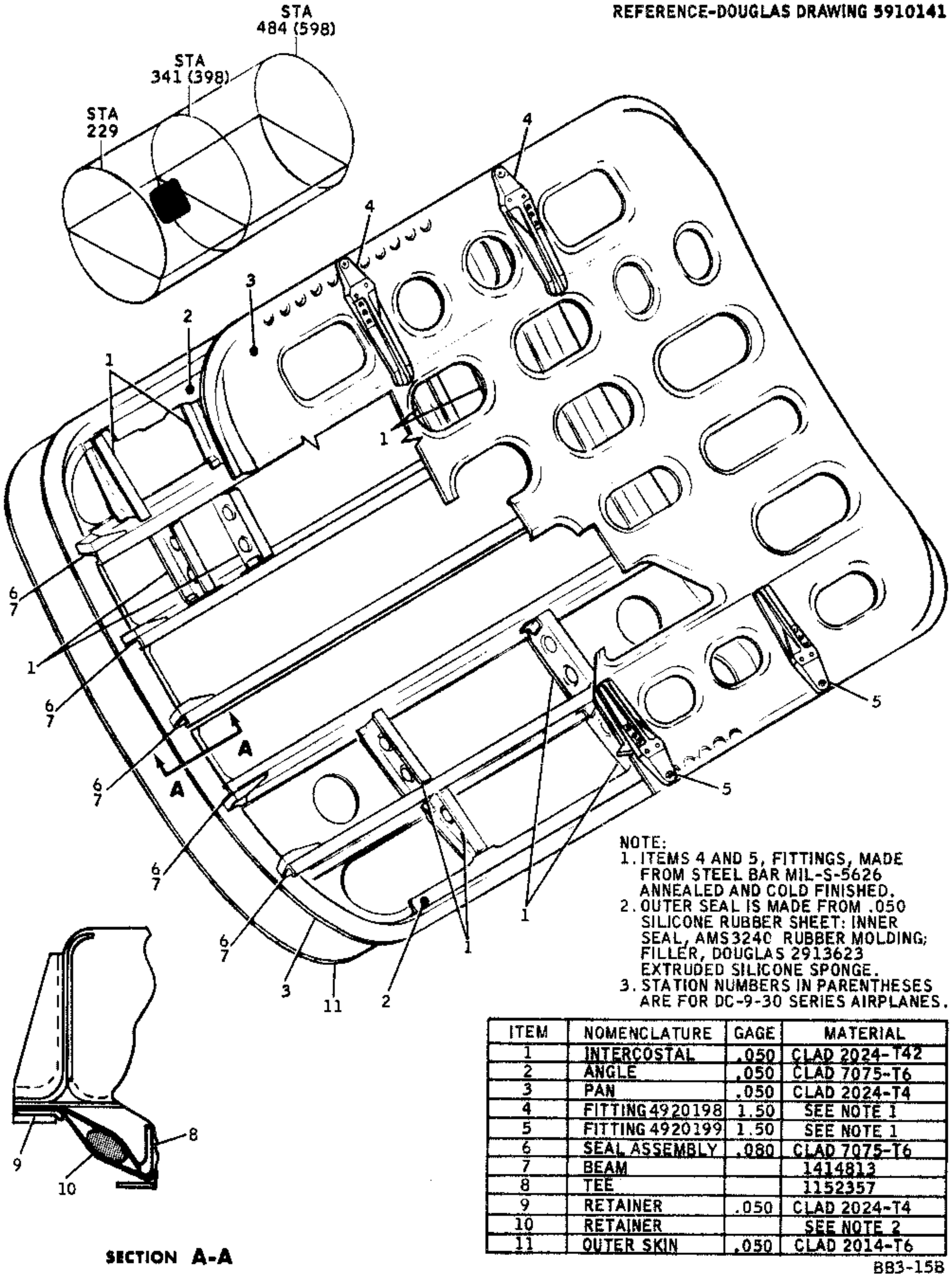
2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the structural integrity and appearance of the cargo doors is presented as follows:

Structural Component	Approved Repairs
Skins	Section 52-05, Figures 1 thru 5, and 7 Section 52-01, Figure 1, Sheets 2 and 3; Figure 2, Sheet 3; Figure 3, Sheet 3 Section 52-03, Figures 1 and 2
Seals	Section 52-04, as applicable
Internal structure (Intercostals, angles, etc.)	Section 52-05, Figures 1, 2, and 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

REFERENCE-DOUGLAS DRAWING 5910141

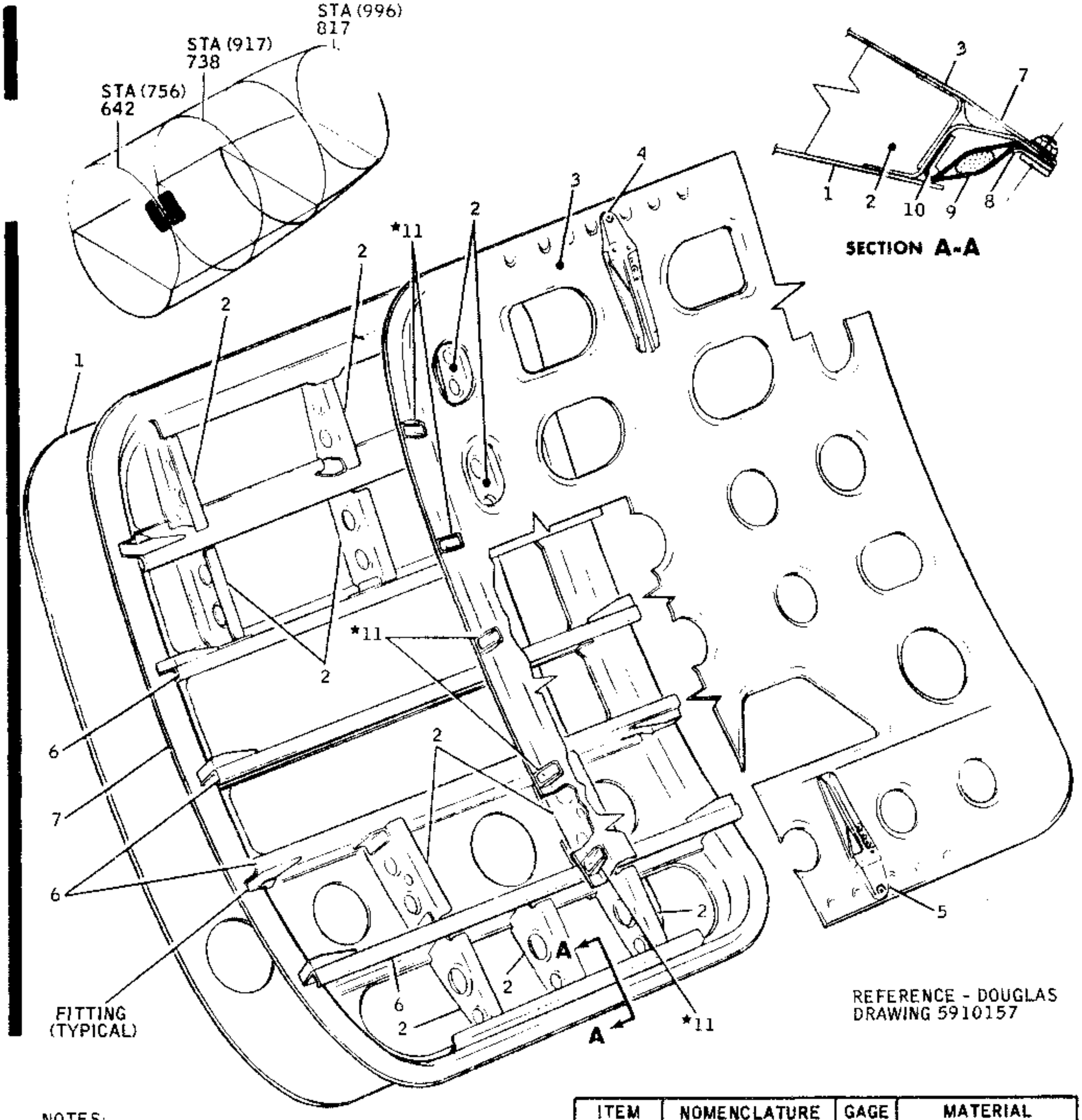


SECTION A-A

NOTE:
1. ITEMS 4 AND 5, FITTINGS, MADE FROM STEEL BAR MIL-S-5626 ANNEALED AND COLD FINISHED.
2. OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; INNER SEAL, AMS3240 RUBBER MOLDING; FILLER, DOUGLAS 2913623 EXTRUDED SILICONE SPONGE.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 2024-T42
2	ANGLE	.050	CLAD 7075-T6
3	PAN	.050	CLAD 2024-T4
4	FITTING 4920198	1.50	SEE NOTE 1
5	FITTING 4920199	1.50	SEE NOTE 1
6	SEAL ASSEMBLY	.080	CLAD 7075-T6
7	BEAM		1414813
8	TEE		1152357
9	RETAINER	.050	CLAD 2024-T4
10	RETAINER		SEE NOTE 2
11	OUTER SKIN	.050	CLAD 2014-T6

Forward Lower Cargo Compartment Door Structure
Figure 1



REFERENCE - DOUGLAS
DRAWING 5910157

NOTES:

1. OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; INNER SEAL, AMS 3240 RUBBER MOLDING; FILLER, 2913623 EXTRUDED.
2. FITTING IS MADE FROM BAR 4140 AFC, MIL-S-5626, ANNEALED AND COLD FINISHED.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
4. * STOPS SHOWN ON FORWARD EDGE; TYPICAL FOR AFT EDGE OF DOOR.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.050	CLAD 2014-T6
2	INTERCOSTAL	.050	CLAD 2024-T4
3	INNER PAN	.050	CLAD 2024-T4
4	FITTING,4920231	1.250	SEE NOTE 2
5	FITTING,4920232	1.250	SEE NOTE 2
6	BEAM	.063	CLAD 7075-T6
7	OUTER PAN	.050	CLAD 2024-T4
8	RETAINER	.050	CLAD 2024-T4
9	SEAL ASSEMBLY		SEE NOTE 1
10	RETAINER		1152357
11	STOP		166087-1

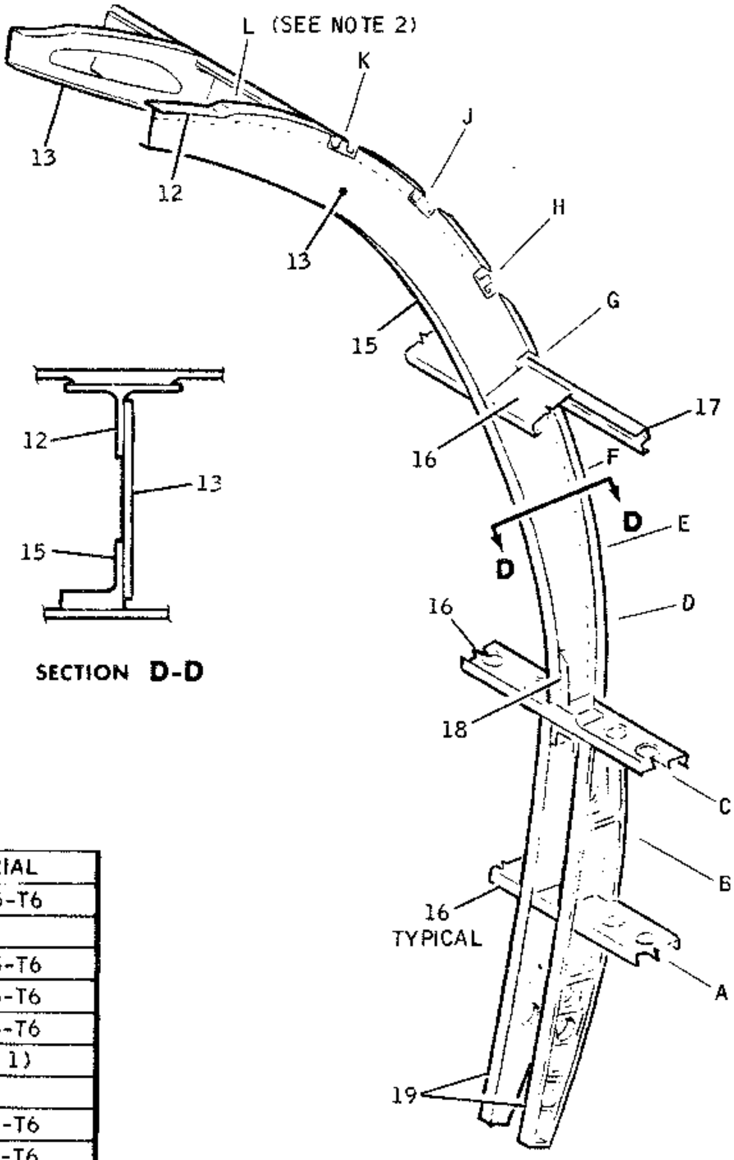
8B3-16B

Aft Lower Cargo Compartment Door Structure
Figure 2

THIS PAGE INTENTIONALLY LEFT BLANK

NOTES:

1. SEAL MADE FROM I - 15/32 I.D. .060 REINFORCED SILICONE RUBBER.
2. INTERCOSTALS, ITEM 16, ARE AT LOCATIONS A THROUGH L.
3. REFERENCE-DOUGLAS DRAWING 5921162



SECTION D-D

VIEW A
DETAIL AT STA 354

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	CLAD 7075-T6
2	GUSSET		2912555
3	FLANGE	.063	CLAD 7075-T6
4	DOUBLER	.063	CLAD 7075-T6
5	ANGLE	.063	CLAD 7075-T6
6	SEAL		(SEE NOTE 1)
7	RETAINER		1362734
8	CORNER	.071	CLAD 7075-T6
9	ANGLE	.071	CLAD 7075-T6
10	GUSSET	.063	CLAD 7075-T6
11	ZEE	.071	CLAD 7075-T6
12	TEE		2921901
13	FRAME	.063	CLAD 7075-T6
14	FORMER	.063	CLAD 7075-T6
15	ANGLE		2921902
16	INTERCOSTAL	.063	CLAD 7075-T6
17	HAT		2777923
18	ANGLE		1242937
19	FITTING	1.750	PLATE 7075-T651
20	DOUBLER	.312	PLATE 7075-T651
21	HINGE	3.000	BAR 4340 HRA
22	HINGE PIN	.312	BAR 4130
23	RING PAN	.040	CLAD 2024-T42
24	WINDOW RING	.032	CLAD 2024-T42

ITEM	NOMENCLATURE	GAGE	MATERIAL
25	FILLER	.071	CLAD 7075-T6
26	FITTING	6.000	FORGING 4340
27	PANEL	.160	CLAD 2014-T3
28	SKIN	.190	CLAD 2014-T3
29	FAIRING	.050	CLAD 2014-T3
30	GUSSET		4921917-1
31	DOUBLER	.025	CLAD 2014-T6
32	FIXTURE	.050	CLAD 6061-T6
33	CHANNEL	.063	CLAD 2014-T3

BB3-779A

Upper Cargo Door Structure
Figure 3 (Sheet 2)

Printed in U.S.A.

SERVICE - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

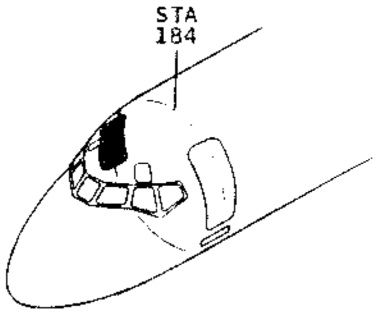
A. This section illustrates the doors used to gain access for servicing aircraft systems and equipment. Types and gages of material used in construction of these doors are identified within the illustrations.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the structural integrity and appearance of the doors is presented as follows:

Structural Component	Approved Repairs
Skins	Section 52-05, Figures 1 thru 5, and 7
	Section 52-01, Figure 1, Sheets 2 and 3; Figure 2, Sheet 3; Figure 3, Sheet 3; Figure 4, Sheet 3
	Section 52-03, Figures 3 and 4
Seals	Section 52-04, as applicable
Internal structure (Frames, stiffeners, etc.)	Section 52-01, Figure 1, Sheet 1; Figure 2, Sheet 4
	Section 52-05, Figures 1, 2, and 3

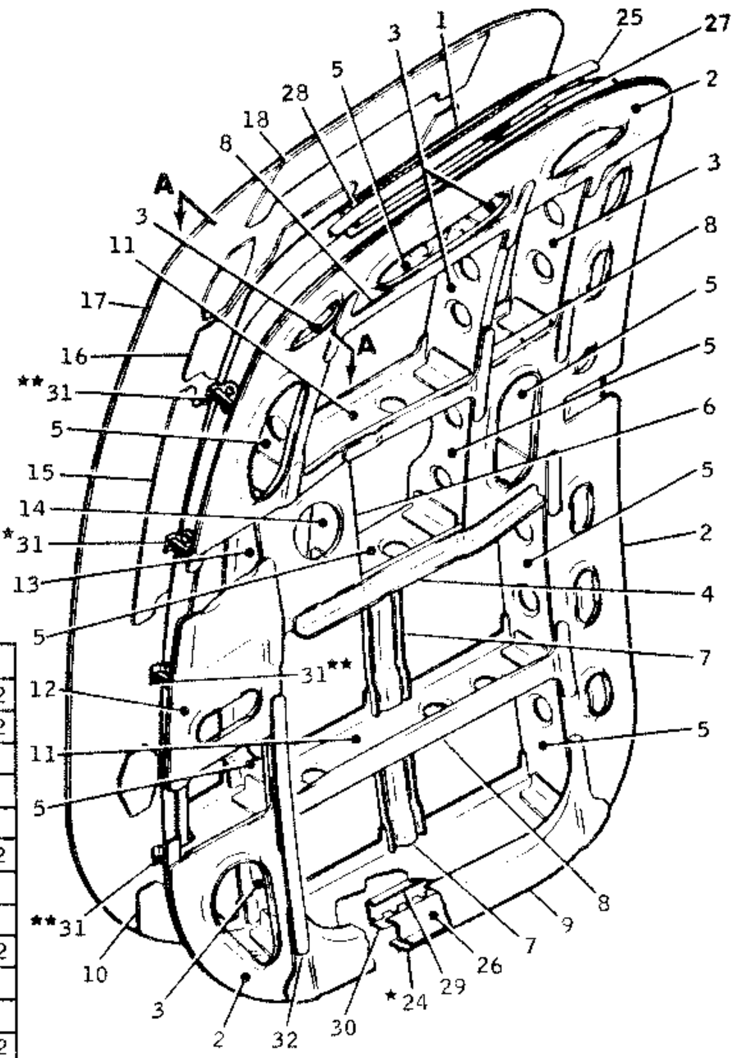
NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

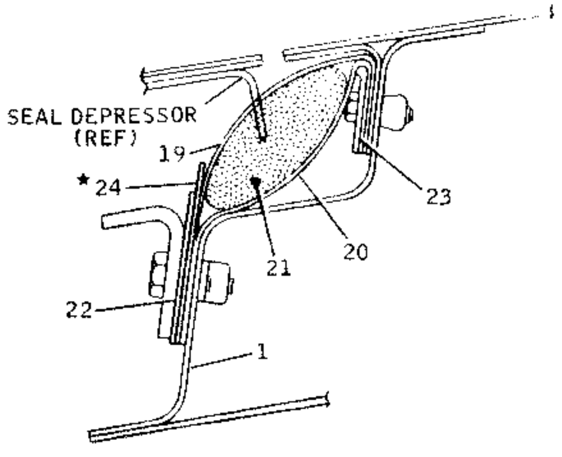


NOTES:

1. OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; INNER SEAL, AMS3240 RUBBER MOLDING.
2. ★ USED ON FUSELAGE 77 AND SUBSEQUENT.
3. FILLER IS MADE FROM 2707761 EXTRUDED SILICONE SPONGE.
4. ★★ STOPS SHOWN ON FORWARD EDGE; TYPICAL FOR AFT EDGE OF DOOR.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAN	.050	CLAD 2024-T42
2	SKIN	.040	CLAD 2024-T42
3	FRAME	.050	CLAD 7075-T6
4	DOUBLER	.063	CLAD 7075-T6
5	FRAME	.063	CLAD 7075-T6
6	SKIN	.071	CLAD 2024-T42
7	HAT SECTION		2777922-4
8	CAP PLATE	.063	CLAD 7075-T6
9	SKIN	.063	CLAD 2024-T42
10	SKIN DOUBLER	.025	CLAD 7075-T6
11	FRAME	.071	CLAD 7075-T6
12	SKIN	.050	CLAD 2024-T42
13	FRAME	.080	CLAD 7075-T6
14	FRAME	.080	CLAD 2024-T42
15	SKIN DOUBLER	.040	CLAD 7075-T6
16	WINDOW DOUBLER	.160	CLAD 2014-T6
17	SKIN	.050	CLAD 2014-T6
18	DOUBLER	.025	CLAD 7075-T6
19	OUTER SEAL		SEE NOTE 1
20	INNER SEAL		SEE NOTE 1
21	FILLER		SEE NOTE 3
22	RETAINER	.040	CLAD 7075-T6
23	RETAINER		1152357
24	EXTENDER	.063	CLAD 2024-T3
25	SUPPORT	.050	CLAD 2024-T42
26	SUPPORT	.063	CLAD 2024-T42
27	HINGE HALF		1243270
28	HINGE HALF		1653031
29	HINGE HALF		2505325
30	HINGE HALF		MS20001PYS
31	STOP		CASTING,17-4-PH
32	STRAP	.063	CLAD 7075-T6





SECTION A-A

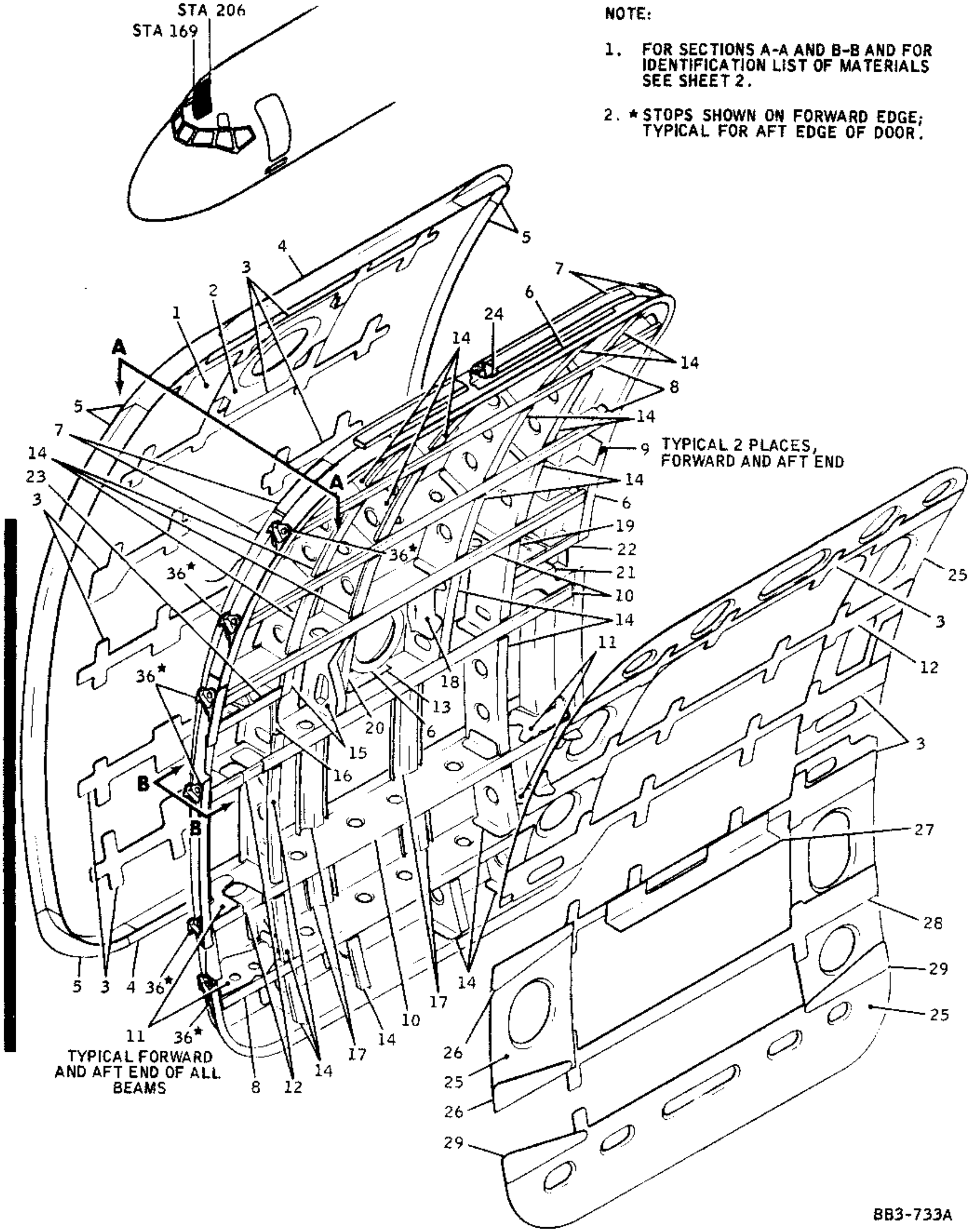
REFERENCE - DOUGLAS DRAWING 5910084

BB3-17B

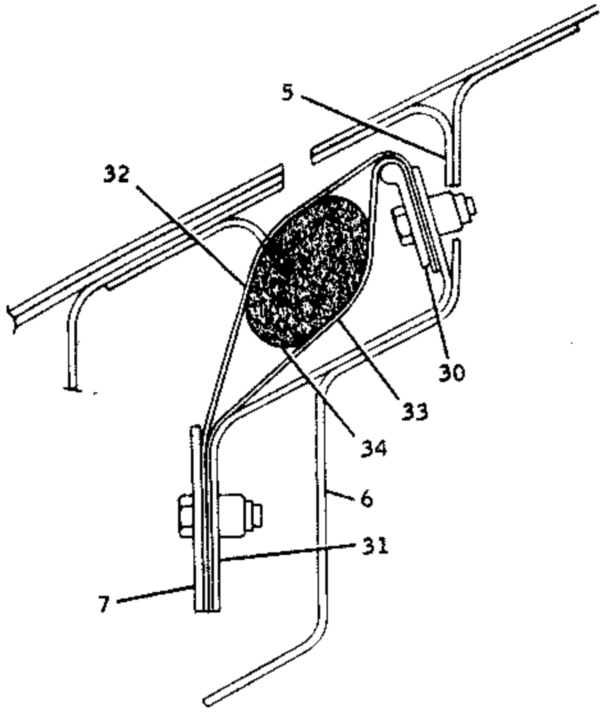
Forward Service Door Structure -- (DC-9-10)
Figure 1

NOTE:

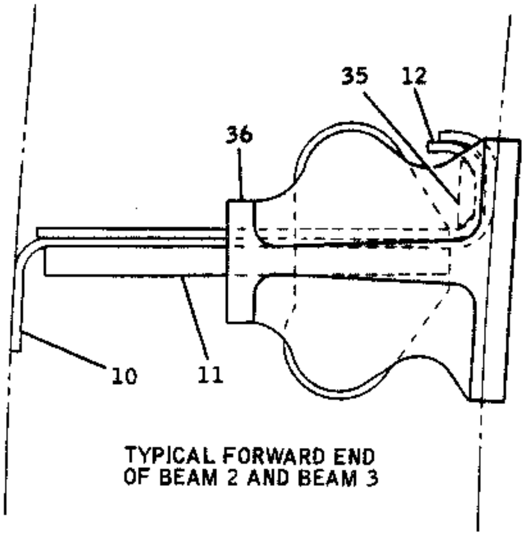
1. FOR SECTIONS A-A AND B-B AND FOR IDENTIFICATION LIST OF MATERIALS SEE SHEET 2.
2. * STOPS SHOWN ON FORWARD EDGE; TYPICAL FOR AFT EDGE OF DOOR.



Forward Service Door Structure -- Type A1
Figure 1A (Sheet 1)



SECTION A-A



TYPICAL FORWARD END
OF BEAM 2 AND BEAM 3

SECTION B-B

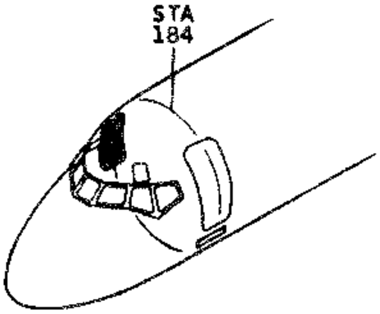
NOTES:

1. OUTER SEAL IS MADE FROM .040 SILICONE RUBBER SHEET; INNER SEAL, AMS3240 RUBBER MOLDING.
2. FILLER IS MADE FROM 2707761 EXTRUDED SILICONE SPONGE.
3. REFERENCE-DOUGLAS DRAWING 5910538.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.050	CLAD 2014-T3	19	FRAME	.071	CLAD 7075-T6
2	DOUBLER	.160	CLAD 2014-T6	20	CHANNEL	.100	CLAD 7075-T6
3	DOUBLER	.063	CLAD 7075-T6	21	INTERCOSTAL	2.250	BAR 7075-T651
4	SEAL FRAME	.050	CLAD 7075-T6	22	INTERCOSTAL	1.000	PLATE 7075-T651
5	SEAL FRAME	.040	CLAD 7075-T6	23	INTERCOSTAL	2.000	PLATE 7075-T651
6	PAN	.063	CLAD 2024-T42	24	CHANNEL	.040	CLAD 2024-T3
7	SUPPORT	.071	CLAD 7075-T6	25	SKIN	.050	CLAD 2024-T42
8	BEAM	.071	CLAD 7075-T6	26	DOUBLER	.050	CLAD 2024-T42
9	SPLICE	.063	CLAD 2024-T42	27	ANGLE	.063	CLAD 7075-T6
10	BEAM	.063	CLAD 7075-T6	28	DOUBLER	.050	CLAD 7075-T6
11	SUPPORT		4340 STEEL BAR	29	STRAP	.050	CLAD 7075-T6
12	DOUBLER	.080	CLAD 7075-T6	30	RETAINER		1152357
13	ANGLE	.050	CLAD 7075-T6	31	RETAINER	.040	CLAD 7075-T6
14	FRAME	.050	CLAD 7075-T6	32	OUTER SEAL		SEE NOTE 1
15	FRAME	.063	CLAD 7075-T6	33	INNER SEAL		SEE NOTE 1
16	ANGLE	.080	CLAD 7075-T6	34	FILLER		SEE NOTE 2
17	FRAME		2777922	35	WASHER	.080	CLAD 7075-T6
18	STIFFENER	.063	CLAD 7075-T6	36	STOP,	1.000	4340 STEEL BAR

BB3-808A

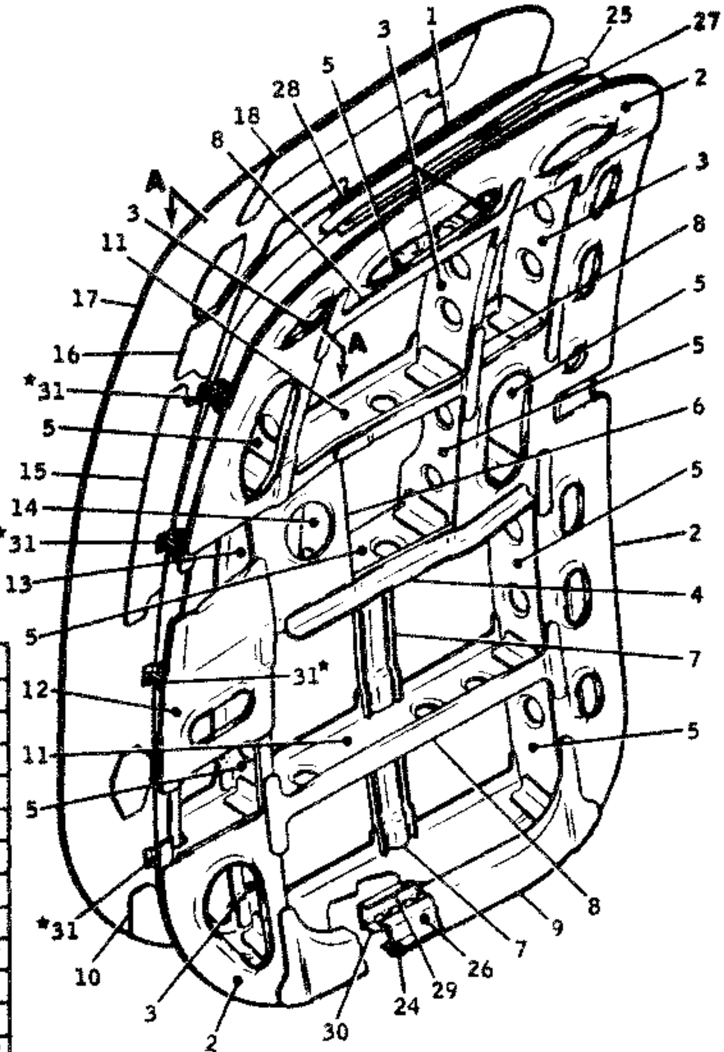
Forward Service Door Structure -- Type A
Figure 1A (Sheet 2)

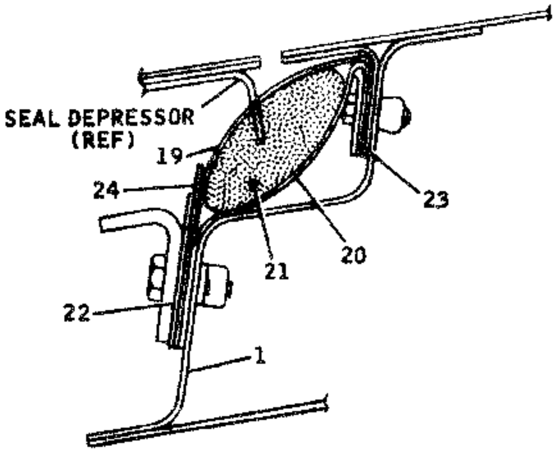


NOTES:

1. OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; INNER SEAL, AMS3240 RUBBER MOLDING.
2. FILLER IS MADE FROM 2707761 EXTRUDED SILICONE SPONGE.
3. ★ STOPS SHOWN ON FORWARD EDGE; TYPICAL FOR AFT EDGE OF DOOR.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAN	.050	CLAD 2024-T42
2	SKIN	.040	CLAD 2024-T42
3	FRAME	.050	CLAD 7075-T6
4	DOUBLER	.063	CLAD 7075-T6
5	FRAME	.063	CLAD 7075-T6
6	SKIN	.071	CLAD 2024-T42
7	HAT SECTION		2777922-4
8	CAP PLATE	.063	CLAD 7075-T6
9	SKIN	.063	CLAD 2024-T42
10	SKIN DOUBLER	.025	CLAD 7075-T6
11	FRAME	.071	CLAD 7075-T6
12	SKIN	.050	CLAD 2024-T42
13	FRAME	.080	CLAD 7075-T6
14	FRAME	.080	CLAD 2024-T42
15	SKIN DOUBLER	.040	CLAD 7075-T6
16	WINDOW DOUBLER	.160	CLAD 2014-T6
17	SKIN	.050	CLAD 2014-T6
18	DOUBLER	.025	CLAD 7075-T6
19	OUTER SEAL		SEE NOTE 1
20	INNER SEAL		SEE NOTE 1
21	FILLER		SEE NOTE 2
22	RETAINER	.040	CLAD 7075-T6
23	RETAINER		1152357
24	EXTENDER	.063	CLAD 2024-T3
25	SUPPORT	.050	CLAD 2024-T42
26	SUPPORT	.063	CLAD 2024-T42
27	HINGE HALF		1243270
28	HINGE HALF		1653031
29	HINGE HALF		2505325
30	HINGE HALF		MS20001PYS
31	STOP		CASTING,17-4-PH



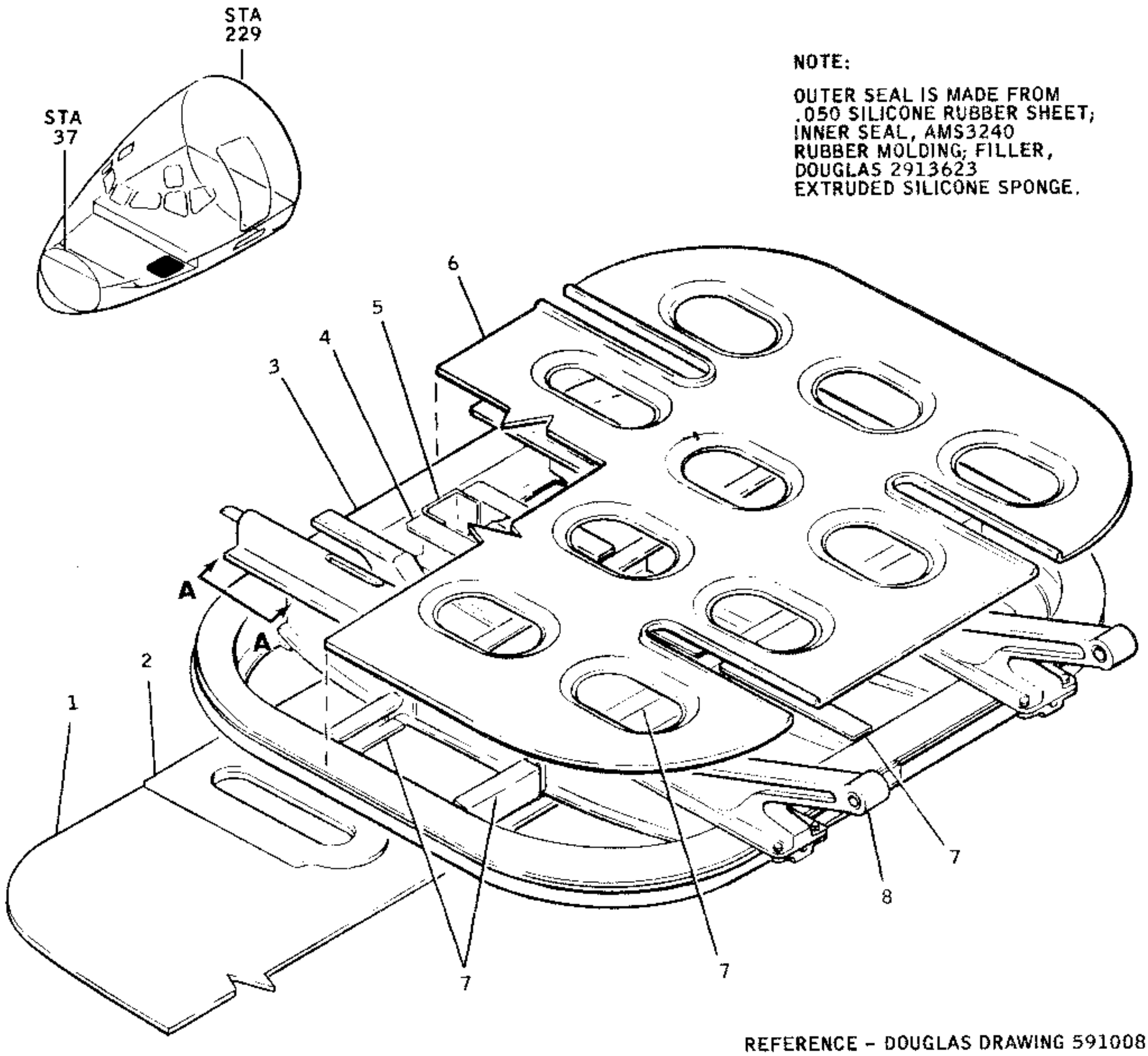


SECTION A-A

REFERENCE - DOUGLAS DRAWING 5910084

BB3-922

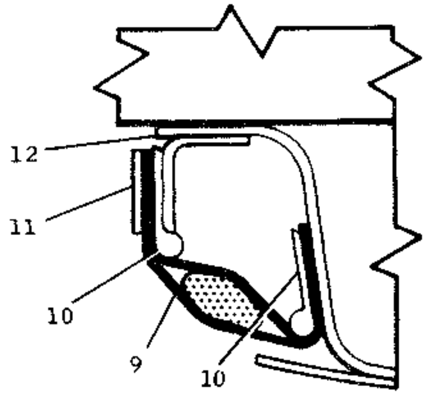
Forward Service Door Structure -- Type A2
Figure 1B



NOTE:

OUTER SEAL IS MADE FROM .050 SILICONE RUBBER SHEET; INNER SEAL, AMS3240 RUBBER MOLDING; FILLER, DOUGLAS 2913623 EXTRUDED SILICONE SPONGE.

REFERENCE - DOUGLAS DRAWING 5910083

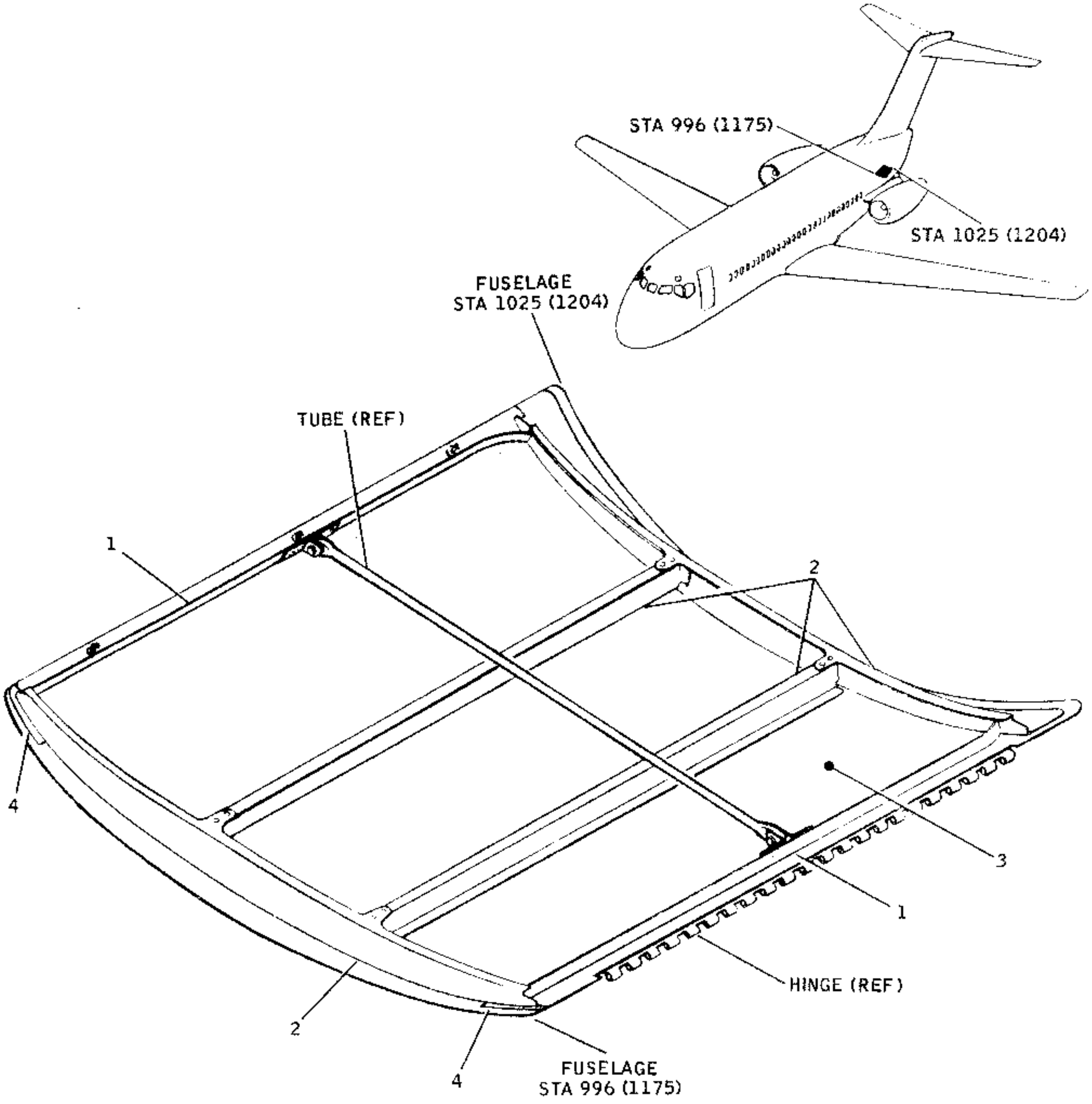


SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.050	CLAD 2014-T6
2	DOUBLER	.063	CLAD 2024-T6
3	PAN	.050	CLAD 2024-T42
4	FRAME	.063	CLAD 7075-T6
5	SHEAR CLIP	.063	CLAD 7075-T6
6	PANEL	.040	CLAD 2024-T42
7	FRAME	.050	CLAD 2024-T42
8	FITTING		5912036
9	SEAL ASSEMBLY		SEE NOTE
10	RETAINER		1152357
11	STRIP	.063	CLAD 2024-T3
12	SEAL SUPPORT	.050	CLAD 2024-T42

BB3-27

Electrical/Electronics Compartment Door Structure
Figure 2



NOTE:

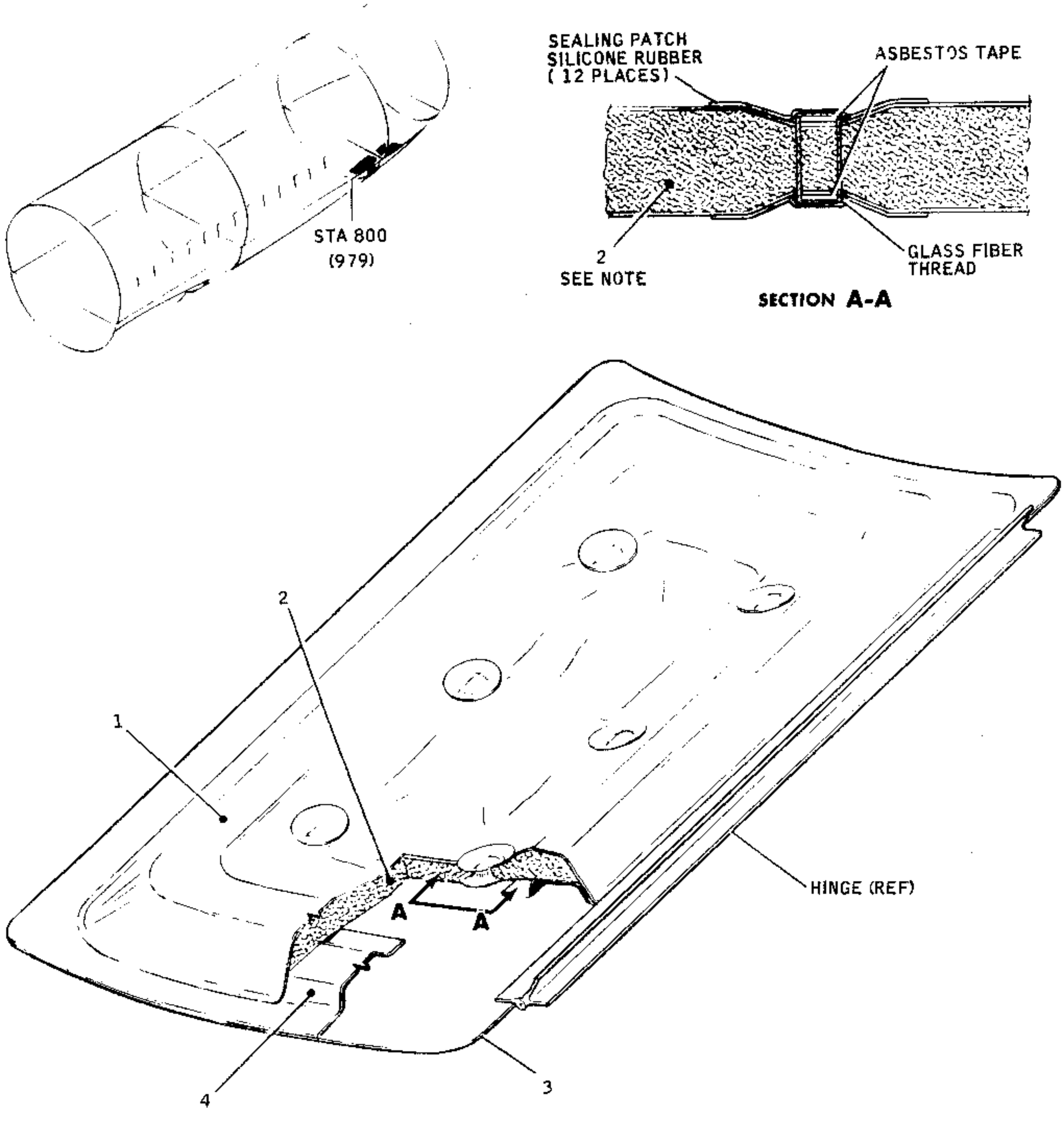
1. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER	.060	2024-T42
2	STIFFENER	.050	2024-T42
3	PANEL	.040	2024-T42
4	SHIM	.100	2024-T3

REFERENCE - DOUGLAS
DRAWING 5913367

BB3-714A

Tail Cone Access Door Structure
Figure 3



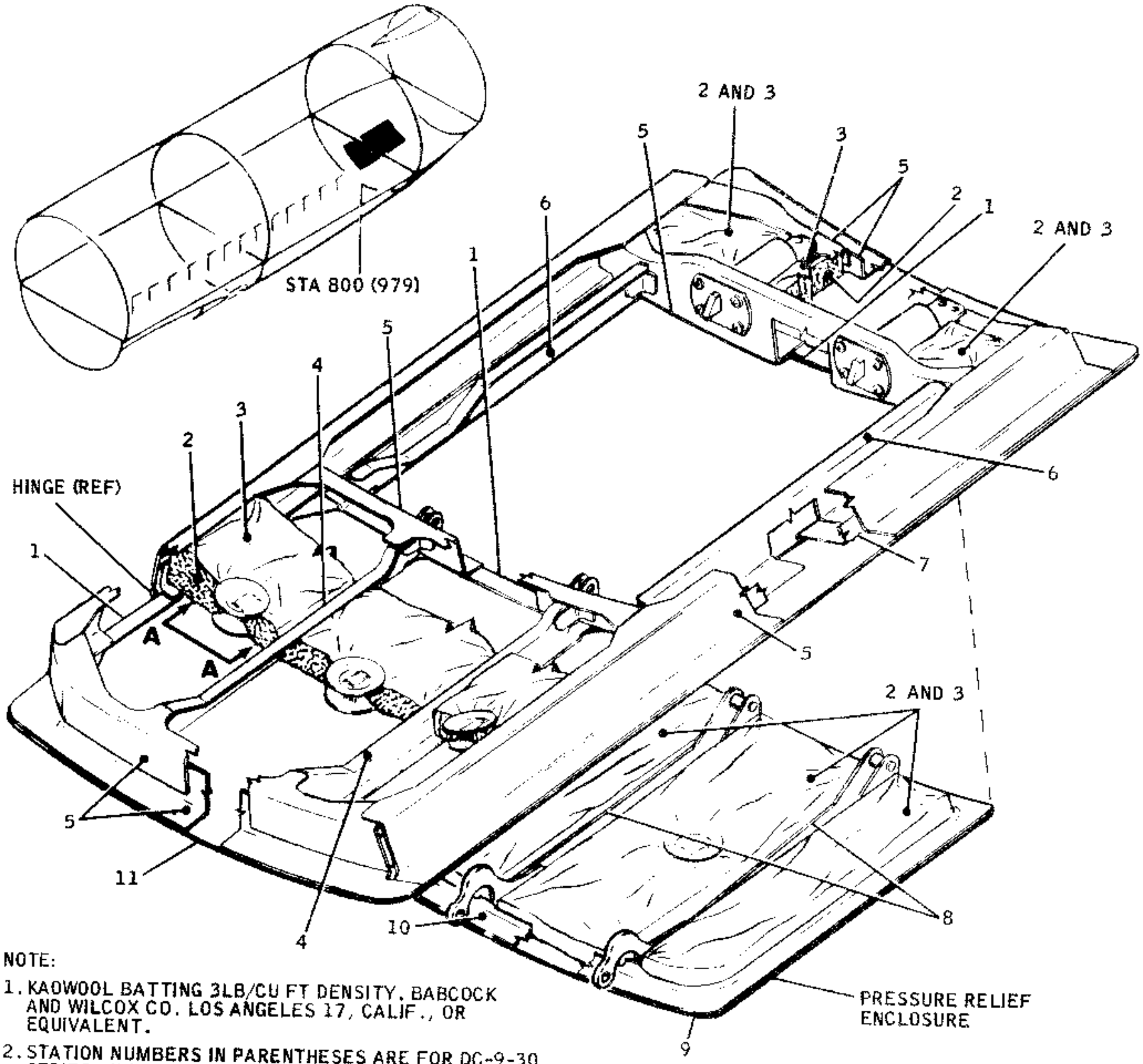
NOTES:

1. KAOWOOL BATTING, 3 LBS/CU FT DENSITY. BABCOCK AND WILCOX CO. LOS ANGLES 17, CLAIF., OR EQUIVALENT.
2. STATION NUMBER IN PARENTHESES IS FOR DC-9-30 SERIES AIRPLANES.
3. REFERENCE-DOUGLAS DRAWING 5915081.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	COVER		SILICONE RUBBER
2	BATTING		SEE NOTE
3	SKIN	.025	TITANIUM DMS1536
4	PILLOW	.032	TITANIUM DMS1536

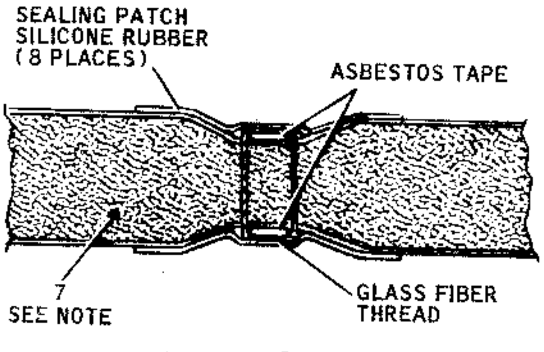
BB3-67A

APU Left Access Door Structure
Figure 4



NOTE:

1. KAOWOOL BATTING 3LB/CU FT DENSITY, BABCOCK AND WILCOX CO. LOS ANGELES 17, CALIF., OR EQUIVALENT.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES
3. REFERENCE-DOUGLAS DRAWINGS 5914694 AND 5915186.

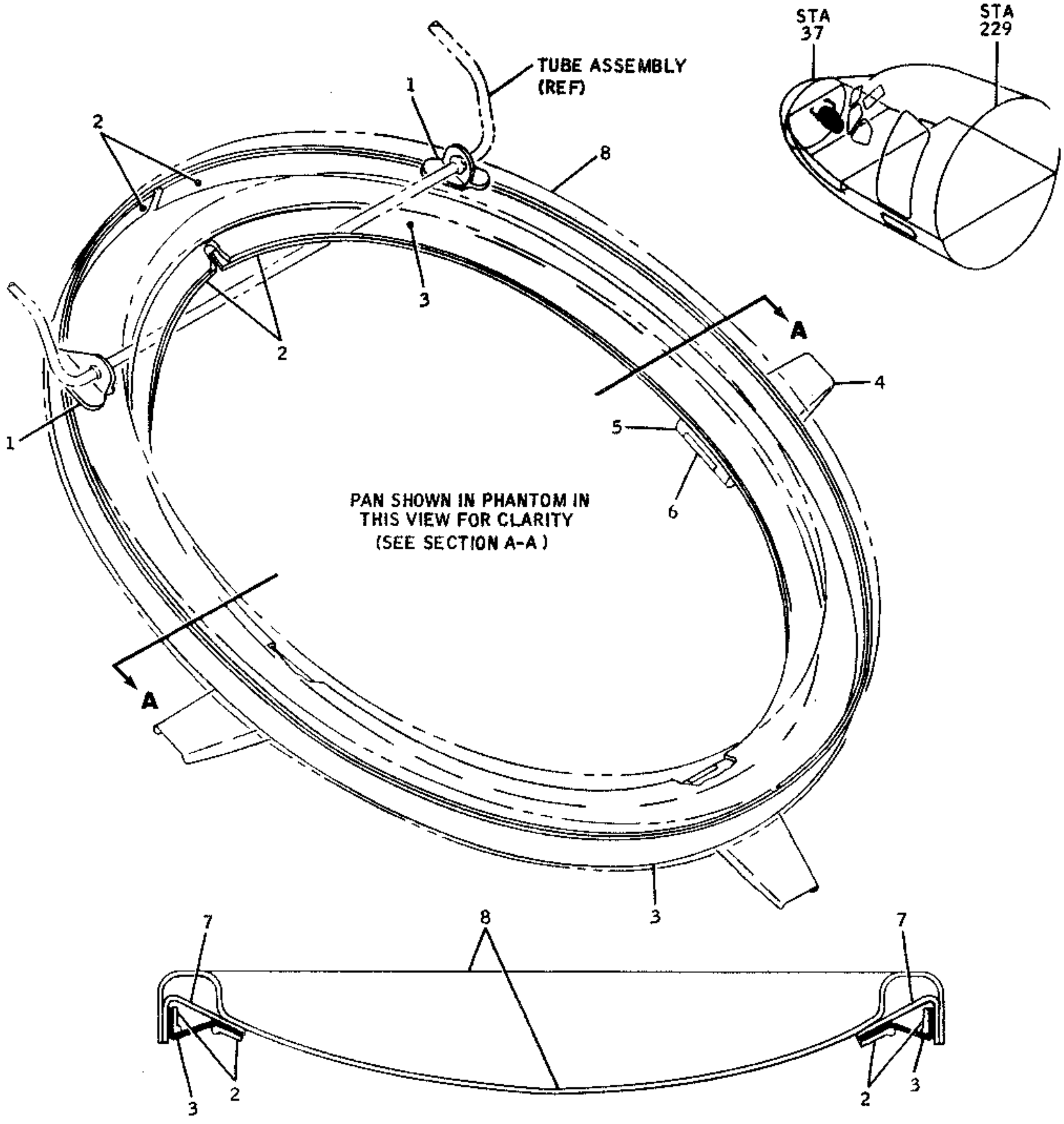


SECTION **A-A**

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.032	TITANIUM DMS1536
2	BATTING		SEE NOTE 1
3	COVER		SILICONE RUBBER
4	ZEE	.020	TITANIUM DMS1536
5	FORMER	.032	TITANIUM DMS1536
6	ZEE	.032	TITANIUM DMS1536
7	ANGLE	.032	TITANIUM DMS1536
8	CHANNEL	.025	TITANIUM DMS1536
9	OUTER PAN	.025	TITANIUM DMS1536
10	INNER STIFFENER	.032	CRES MIL-S-6721 TYPE 321, COMPT1 ANNEALED
11	SKIN	.025	TITANIUM DMS1536

BB3-69A

APU Right Access Door Structure
Figure 5



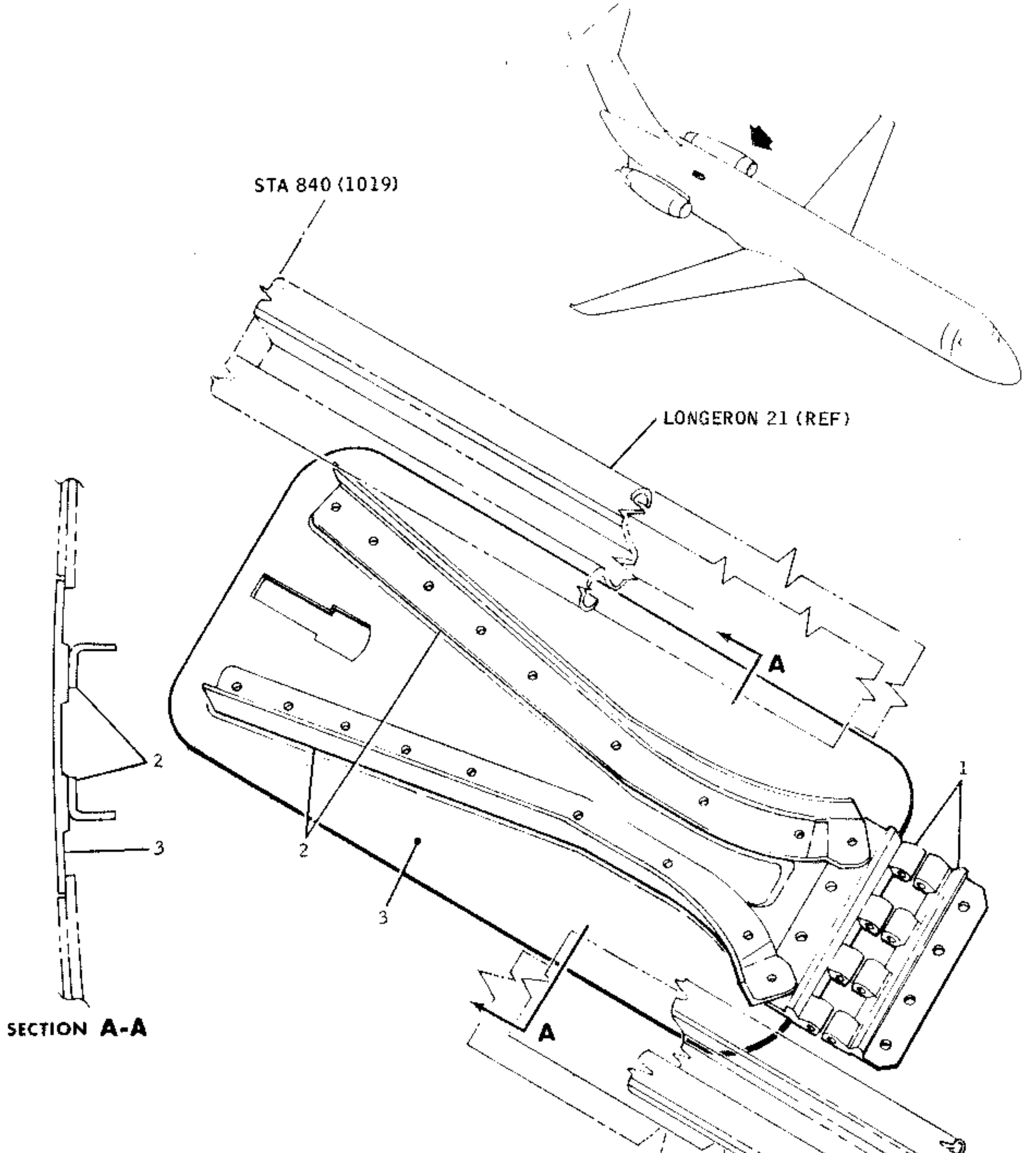
SECTION A-A

REFERENCE—DOUGLAS DRAWING 9911587

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		2613900	5	HINGE HALF		1418887
2	RETAINER		2505668	6	HINGE HALF		MS20001Y5
3	SEAL ASSEMBLY	.060	MOLDED SILICONE	7	RING	.063	CLAD 2024-T42
			RUBBER SHEET	8	PAN	.063	CLAD 2024-T42
4	LATCH CHANNEL	.050	CLAD 2024-T3				

BB3-576

Nosewheel Well to Directional and Vertical Gyros Door
Figure 6



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	HINGE HALF, 2546395		SEE NOTE 1
2	STIFFENER	.063	CLAD 2024-T3
3	DOOR	.090	CLAD 2024-T3

NOTES:

1. HINGE HALF IS MADE FROM 1666735 (2014-T6).
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
3. REFERENCE-DOUGLAS DRAWING 5916424.

BB3-597A

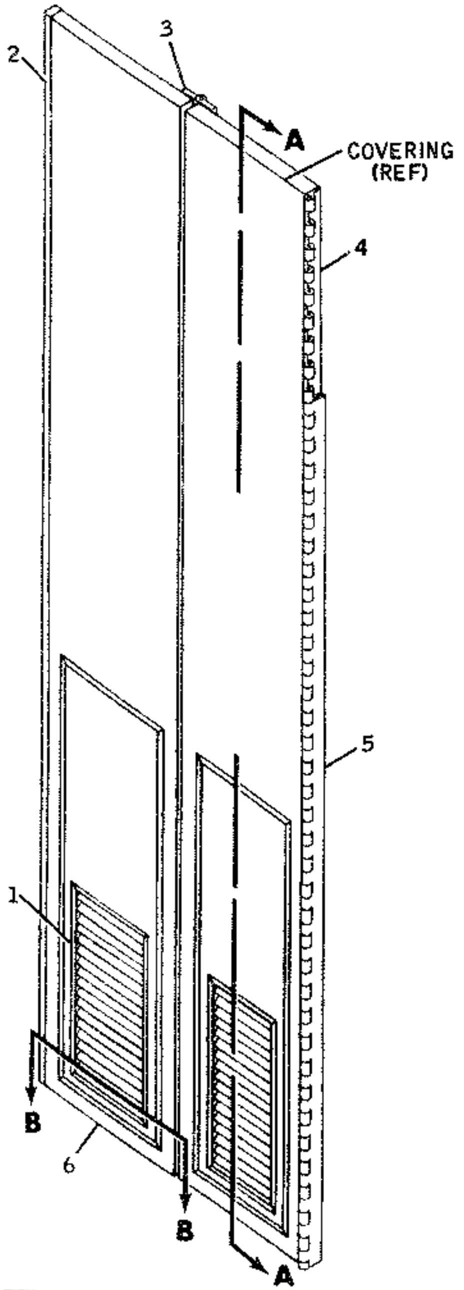
Thrust Reverser Hydraulic Release Door
Figure 7

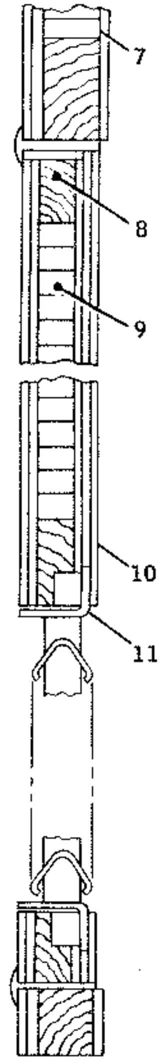
FIXED INTERIOR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

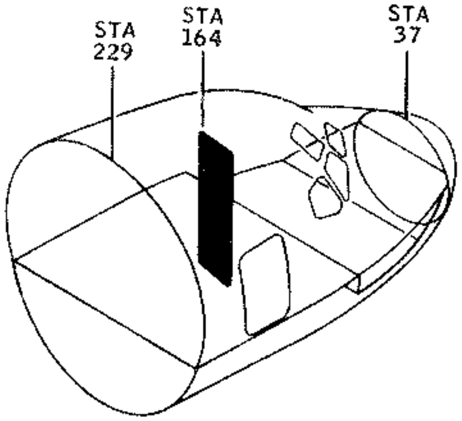
A. This section illustrates doors located within the airplane which are used to gain access to the flight compartment and to the aft lavatories. Types and gages of materials used in construction of the doors are identified within the illustrations.

Printed in U.S.A.



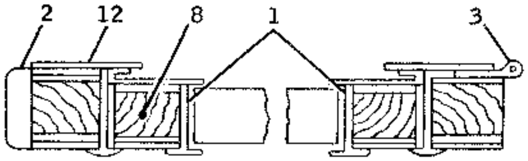


SECTION A-A



NOTES:

1. MAKE FROM HARDWOOD LUMBER MM-L-736 BASS FIRST GRADE KILN DRY ROUGH.
2. MAKE FROM 3 PLY MAHOGANY FACE PLYWOOD POPLAR CORE.
3. REFERENCE - DOUGLAS DRAWING 5956574.

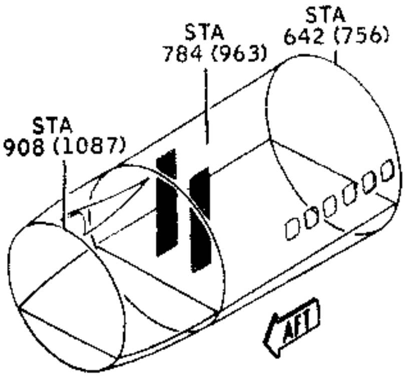


SECTION B-B

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	MOLDING		2655916
2	NOSING	.250	SLAB POLYAMIDE (NYLON)
3	HINGE HALF		NAS 40-4
4	PLATE	.040	6061-T6X
5	HINGE HALF		NAS 40-6
6	FACING	.060	(SEE NOTE 2)
7	CORE	.628	AIRCOMB STYLE 60-20, TYPE 40
8	BLOCKING	1.00	(SEE NOTE1)
9	CORE	.500	AIRCOMB STYLE 60-20, TYPE 40
10	COVER	.045	GLASS FIBER REINFORCED PLASTIC SHEET
11	SUPPORT	.032	CLAD 2024-T42
12	RETAINER	.040	ACRYLIC COLORLESS TRANSPARENT SHEET

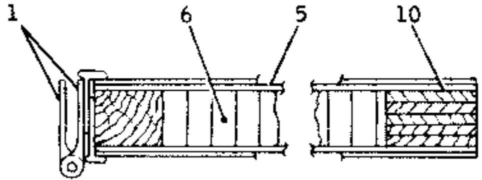
BB3-593

Flight Compartment Door Structure
Figure 1



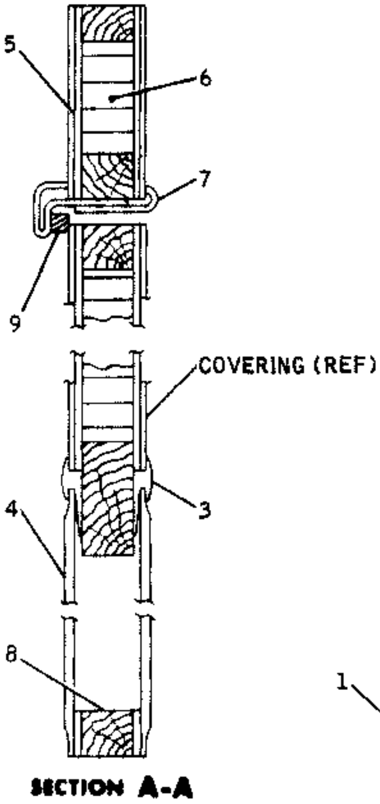
NOTES:

1. EXTRUDED ALUMINUM ALLOY (TRIM EDGE A601-T) MAY BE PURCHASED FROM THE WILLIAM L. BONNEL CO., NEWMAN, GA.
2. MADE FROM D2 EXPANDED METAL SHEET. MAY BE PURCHASED FROM DESIGNERS METAL CORP., HARVEY, ILLINOIS.
3. FACING MADE FROM 3 PLY MAHOGANY FACE PLYWOOD POPLAR CORE.
4. BLOCKING AND LAMINATE MADE FROM HARD WOOD LUMBER, MM-L-736 BASS FIRST GRADE KILN DRY ROUGH.
5. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
6. REFERENCE-DOUGLAS DRAWING 5956571.

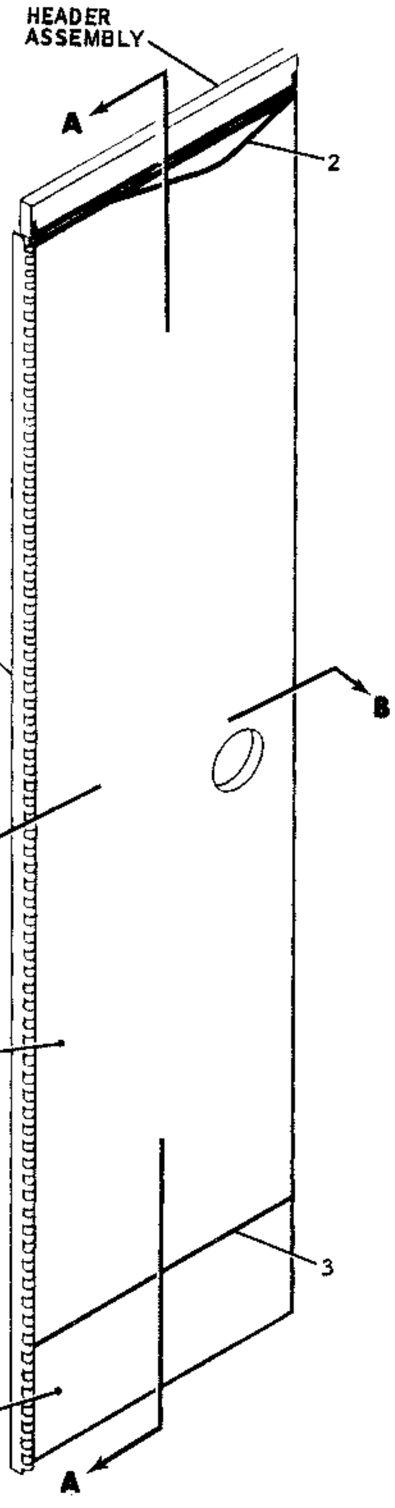


SECTION B-B

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	HINGE HALF		NAS40-5
2	STOP ASSEMBLY, 4775062 STRIP .375 SLAB POLYAMIDE NYLON MIL-P-1709 TYPE I BODY MOLDED POLYURETHANE		
3	MOLDING		(SEE NOTE 1)
4	GRILL		(SEE NOTE 2)
5	FACING	.060	(SEE NOTE 3)
6	CORE	.630	AIRCOMB STYLE 60-20, TYPE 40
7	CHANNEL	.032	6061-T6
8	BLOCKING	.750	(SEE NOTE 4)
9	BUMPER	.094	SYN RUBBER SHEET AMS3198
10	LAMINATE	.125	(SEE NOTE 4)



SECTION A-A



BB3-594A

Aft Lavatory Door Structure
Figure 2

ENTRANCE STAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates the entrance stairs used to gain access to the fuselage. Types and gages of material used in construction of the door assemblies are identified within the illustrations.

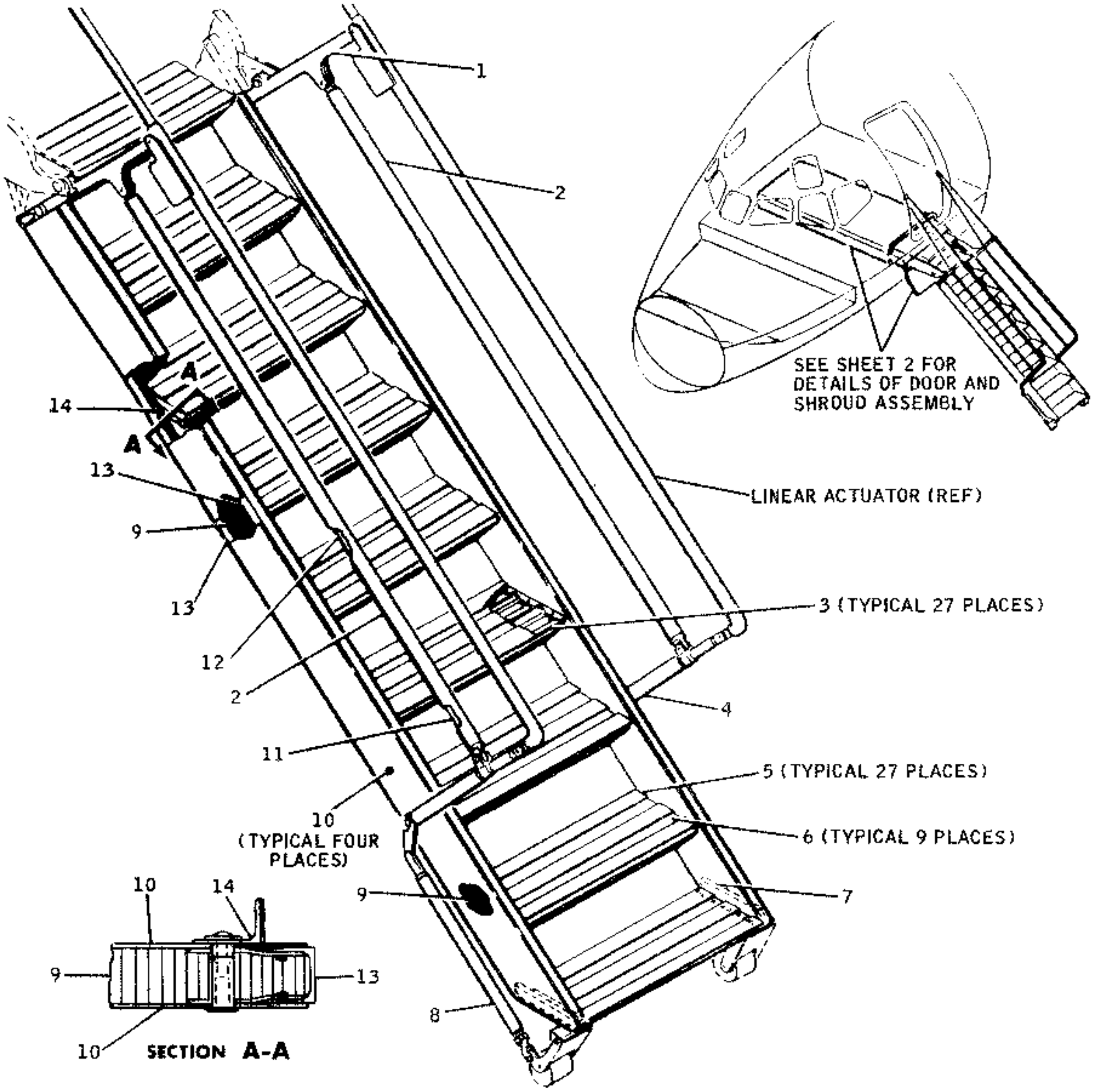
2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the structural integrity and appearance of these components is presented as follows:

Structural Component	Approved Repairs
Skins	Section 52-01, Figure 1, Sheets 2 and 3; Figure 2, Sheets 1 and 3; Figure 3, Sheet 1
	Section 52-05, Figures 1, 2, and 3
Honeycomb	Section 52-02, as applicable
	Section 52-01, Figure 2, Sheet 1; Figure 3, Sheet 1
	Chapter 51, Repair Bonding Sections, as applicable
Internal structure	Section 52-01, Figure 1, Sheet 1; Figure 2, Sheet 4
	Section 52-05, Figures 1, 2, 3, and 5, as applicable

NOTE: 1. Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

2. Repairs to stairwell door require specific engineering.



NOTES:

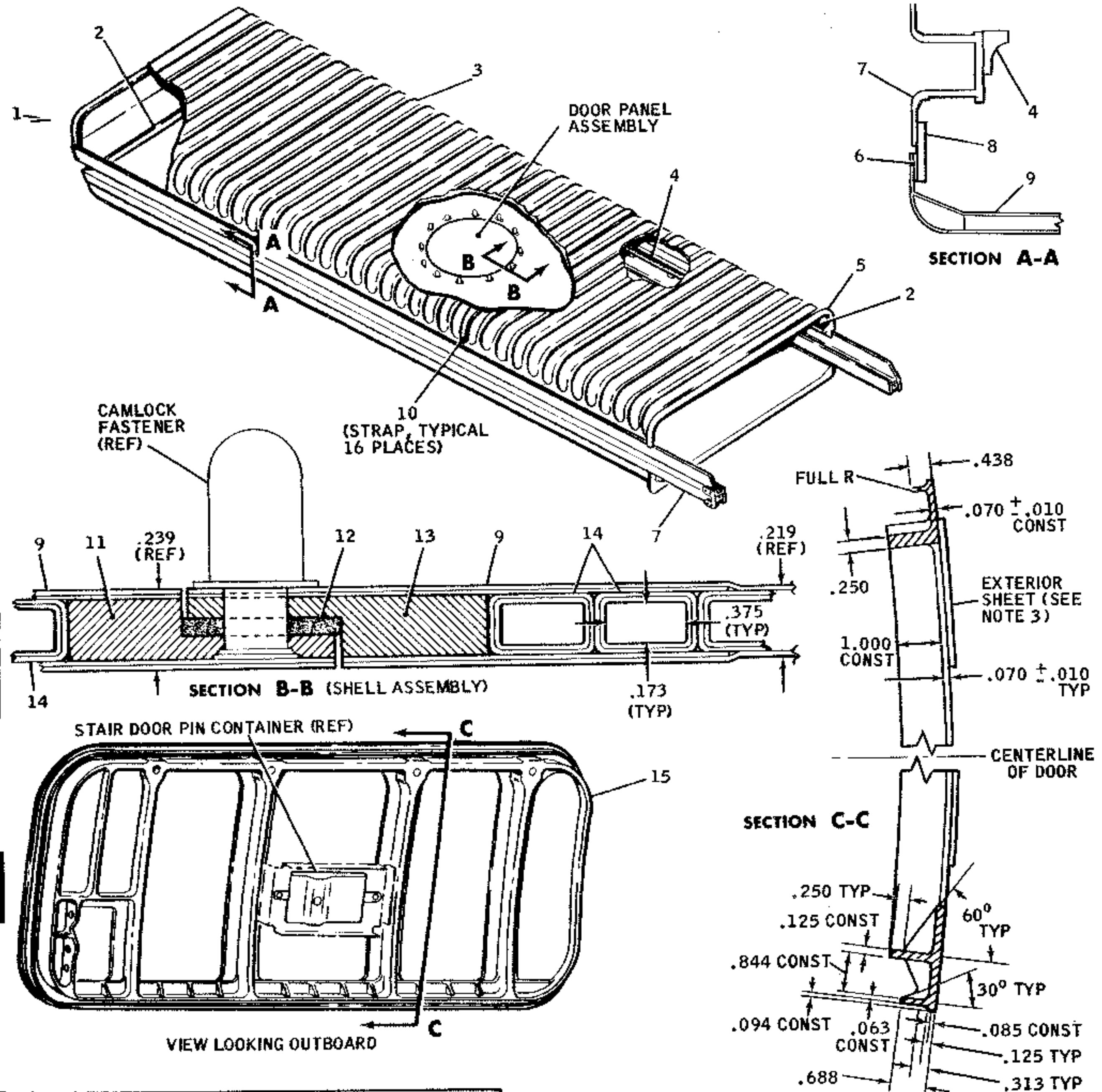
1. POST IS MACHINED FROM 7075-T651, 1.375 PLATE.
2. MADE FROM PRECOATED PRESSURE SENSITIVE, TYPE B, MEDIUM GRIT, BLACK.
3. CORE IS 1.000 X 3/16 HEX X .001 THICK ALUMINUM FOIL HONEYCOMB, NONPERFORATED.

REFERENCE - DOUGLAS DRAWING 5915901.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	UPPER POST		SEE NOTE 1
2	TUBE	.049 WALL	1.250 OD 2024-T3
3	STIFFENER	.032	CLAD 7075-T6
4	LOWER POST	.125 WALL	1.375 OD 2024-T3
5	SAFETYWALK		SEE NOTE 2
6	STEP COVER	.032	CLAD 7075-T6
7	BRACKET	.063	CLAD 7075-T6
8	TUBE	.049 WALL	0.750 OD 2024-T3
9	CORE		SEE NOTE 3
10	SKIN	.020	CLAD 7075-T6
11	INNER TUBE	.065 WALL	1.125 OD 2024-T3
12	TUBE LINER	.030 WALL	1.000 OD NYLON TUBING
13	CHANNEL		1419412
14	BRACKET		1332779

BB3-62A

Passenger Forward Entrance Stairway and
Forward Stairwell Door Structure
Figure 1 (Sheet 1)



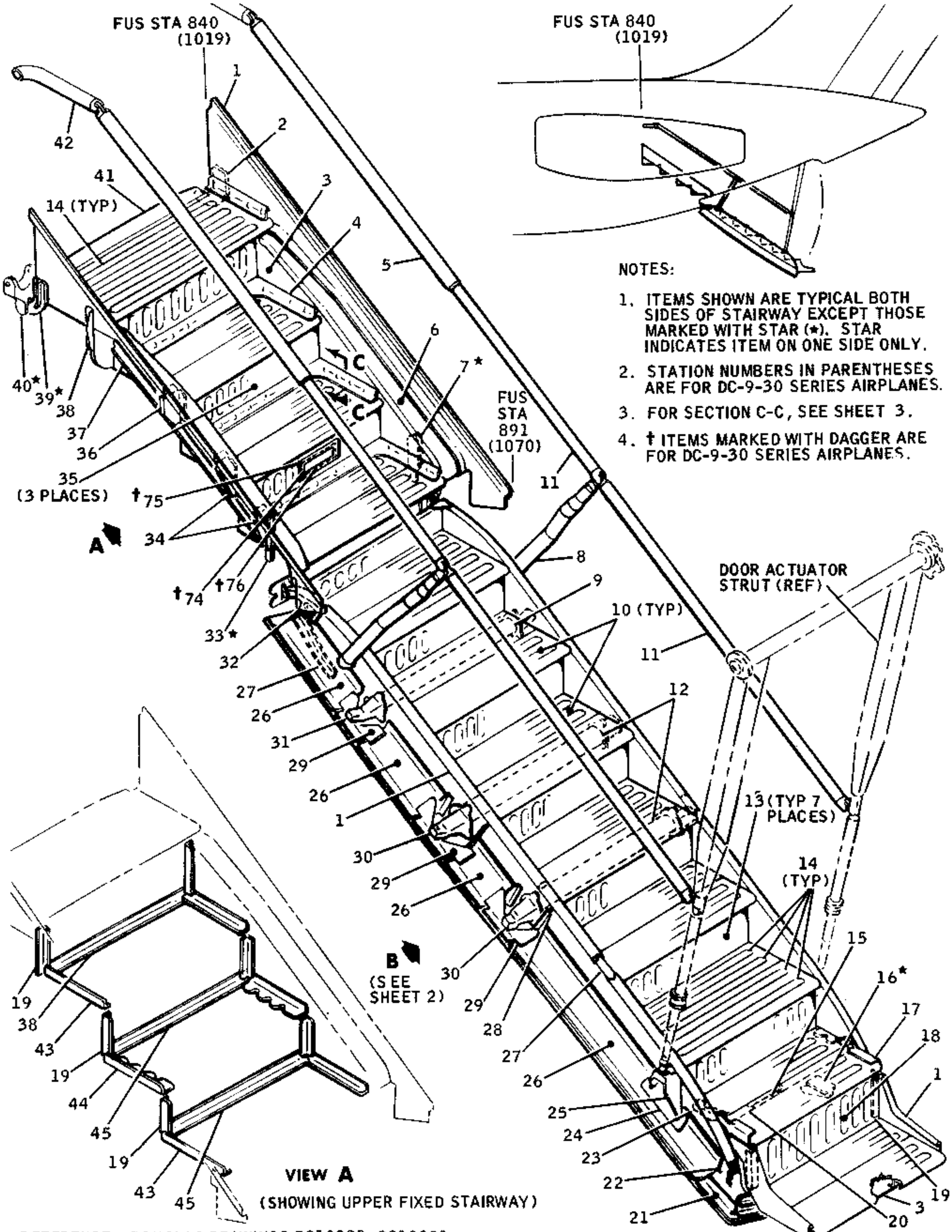
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	END	.020	6061-T4
2	BONDED DOUBLER	.020	6061-T6
3	SHROUD	.020	6061-T4
4	RACK	.375	MIL-S-7720, CRES BAR TYPE 303
5	LIP	.040	6061-T6
6	SHIM	.020	5052-0
7	TRACK		2915910
8	DOUBLER	.063	CLAD 7075-T6
9	SKIN		SEE NOTE 1
10	BONDED STRAP	.020	6061-T6
11	RIM	.190	CLAD 2024-T3
12	SEAL	.094	RUBBER SHEET
13	FRAME	.190	CLAD 2024-T3
14	FLUTE		SEE NOTE 2
15	DOOR		SEE NOTE 3

NOTES:

1. SKIN IS MADE FROM GLASS FIBER CLOTH, VOLAN FINISH, MIL-C-9084, TYPE 8.
2. FLUTE IS MADE FROM GLASS FIBER TAPE, VOLAN FINISH MIL-C-9084, TYPE 3 SLIT.
3. DOOR IS MILLED FROM 1.500 PLATE 7075-T73 AND HAS .063 CLAD 2014-T6 SHEET RIVETED TO EXTERIOR SURFACE.
4. REFERENCE - DOUGLAS DRAWINGS 5915064 AND 5915902.

BB3-63A

Passenger Forward Entrance Stairway and
Forward Stairwell Door Structure
Figure 1 (Sheet 2)

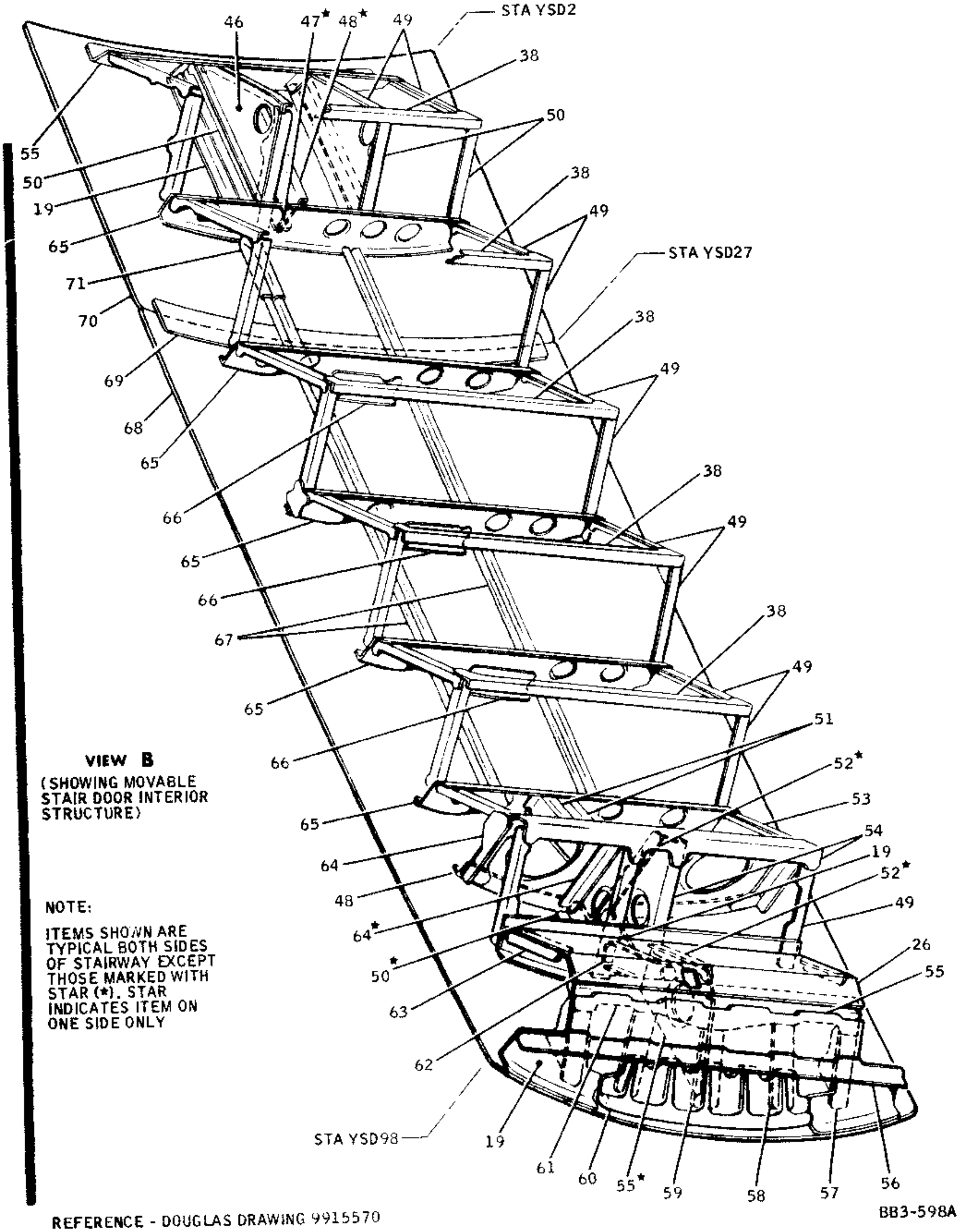


NOTES:

1. ITEMS SHOWN ARE TYPICAL BOTH SIDES OF STAIRWAY EXCEPT THOSE MARKED WITH STAR (*). STAR INDICATES ITEM ON ONE SIDE ONLY.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
3. FOR SECTION C-C, SEE SHEET 3.
4. † ITEMS MARKED WITH DAGGER ARE FOR DC-9-30 SERIES AIRPLANES.

REFERENCE - DOUGLAS DRAWINGS 5910382, 9910381

Passenger Aft Entrance Door Stairway
(DC-9-10 and DC-9-30 Ventral Stairway Installation)
Figure 2 (Sheet 1)



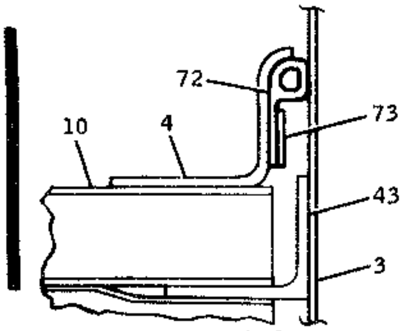
VIEW B
(SHOWING MOVABLE STAIR DOOR INTERIOR STRUCTURE)

NOTE:
ITEMS SHOWN ARE TYPICAL BOTH SIDES OF STAIRWAY EXCEPT THOSE MARKED WITH STAR (*). STAR INDICATES ITEM ON ONE SIDE ONLY

REFERENCE - DOUGLAS DRAWING 9915570

BB3-598A

Passenger Aft Entrance Door Stairway
(DC-9-10 and DC-9-30 Ventral Stairway Installation)
Figure 2 (Sheet 2)



SECTION C-C
(TAKEN FROM SHEET 1)

NOTES:

1. RETAINER IS MADE FROM ACRYLONITRILE BUTADIENE STYRENE COPOLYMER RIGID PLASTIC SHEET.
2. SEAL ASSEMBLY CONSISTS OF CORE (SILICONE RUBBER, M-700); FILLER (SILICONE SPONGE, M-732); AND COVER (SILICONE IMPREGNATED PLAIN WEAVE DACRON FABRIC, F-799, GAGE .016 MAXIMUM).
3. MADE FROM PRECOATED PRESSURE SENSITIVE, TYPE A, MEDIUM GRIT, BLACK.
4. MADE FROM CRES SHEET, MIL-S-5059 COMP 302 ANNEALED, FINISH NO. 2D.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RAIL	.063	CLAD 7075-T6
2	PLATE	.190	CLAD 7075-T6
3	PLATE	.062	CLAD 7075-T6
4	RETAINER	.062	SEE NOTE 1
5	TUBE	.065 WALL	1.750 OD 6061-T6
6	WEB	.032	CLAD 7075-T6
7	TEE		1761367
8	TUBE	.083 WALL	2.000 OD 2024-T4
9	BEAM	.049 WALL	1.500 OD 2024-T42
10	STEP		4917997
11	TUBE	.065 WALL	1.500 OD 6061-T6
12	BEAM	.049 WALL	2.500 OD 2024-T4
13	RISER	.040	CLAD 2024-T42
14	SAFETYWALK		SEE NOTE 3
15	BONDED BUMPER	.062	RUBBER SHEET
16	ARM	2.000	PLATE 7075-T651
17	FITTING	1.500	PLATE 7075-T651
18	RISER	.050	CLAD 7075-T6
19	ANGLE	.063	CLAD 7075-T6
20	SUPPORT		1499044
21	STIFFENER	.050	CLAD 2024-T42
22	FITTING, 3917698	FORGING 7079-T652	
23	FITTING	1.000	PLATE 7075-T651
24	DOUBLER	.032	CLAD 7075-T6
25	FITTING	3.500	PLATE 7075-T651
26	PANEL	.032	CLAD 7075-T6
27	STIFFENER	.063	CLAD 7075-T6
28	CLIP	.040	CLAD 2024-T42
29	GUSSET	.032	CLAD 2024-T42
30	FITTING	4.375	BAR 7075-T651
31	FITTING	3.750	BAR 7075-T651
32	FITTING	.625	PLATE 7075-T651
33	FITTING	1.250	PLATE 7075-T651
34	WEB	.063	CLAD 7075-T6
35	RISER	.032	CLAD 7075-T6
36	WEB	.050	CLAD 7075-T6
37	STRINGER	.063	CLAD 7075-T6
38	ANGLE		1125597
39	FITTING	.500	PLATE 7075-T651
40	YOKE		PLATE 7075-T651
41	PLATE	.012	SEE NOTE 4
42	TUBE	.083 WALL	1.750 OD 6061-T4
43	ANGLE		1418201
44	ANGLE		1287425
45	ANGLE	.050	CLAD 7075-T6
46	FORMER	.050	CLAD 7075-T6
47	ANGLE	.063	CLAD 2024-T42
48	INTERCOSTAL	.050	CLAD 7075-T6
49	ANGLE		1249243
50	ANGLE		1464575
51	INTERCOSTAL	.040	CLAD 2024-T42
52	ANGLE		1245399
53	ANGLE		1419056
54	FORMER	.063	CLAD 2024-T42
55	FORMER	.071	CLAD 2024-T42
56	SEAL DEPRESSOR	.032	CLAD 7075-T6
57	FITTING		2640547
58	FITTING	.500	PLATE 7075-T651
59	FITTING		1716225
60	TOE PLATE, 5918666		CASTING 356-T6
61	STIFFENER		1325739
62	INTERCOSTAL	.063	CLAD 2024-T42
63	ANGLE		1332779
64	TEE		1528377
65	FORMER	.032	CLAD 2024-T42
66	ANGLE	.040	CLAD 2024-T42
67	STRINGER		2777922
68	SKIN	.032	CLAD 2024-T42
69	DOUBLER	.040	CLAD 2024-T42
70	SKIN	.032	TITANIUM DMS1536
71	CLIP	.050	CLAD 7075-T6
72	SEAL, 4760834		SEE NOTE 2
73	STRIP	.032	CLAD 7075-T6
74	PLATE	.050	CLAD 7075-T6
75	DOUBLER	.050	CLAD 7075-T6
76	SHIM	.025	CLAD 7075-T6

REFERENCE - DOUGLAS DRAWINGS 5910382, 9910381

BB3-599A

Passenger Aft Entrance Door Stairway
(DC-9-10 and DC-9-30 Ventral Stairway Installation)
Figure 2 (Sheet 3)

DOOR WARNING - DESCRIPTION AND OPERATION (DC-9-ALL)

This section is not applicable to
the Structural Repair Manual.

Printed in U.S.A.

LANDING GEAR - DESCRIPTION AND OPERATION (DC-9-ALL)

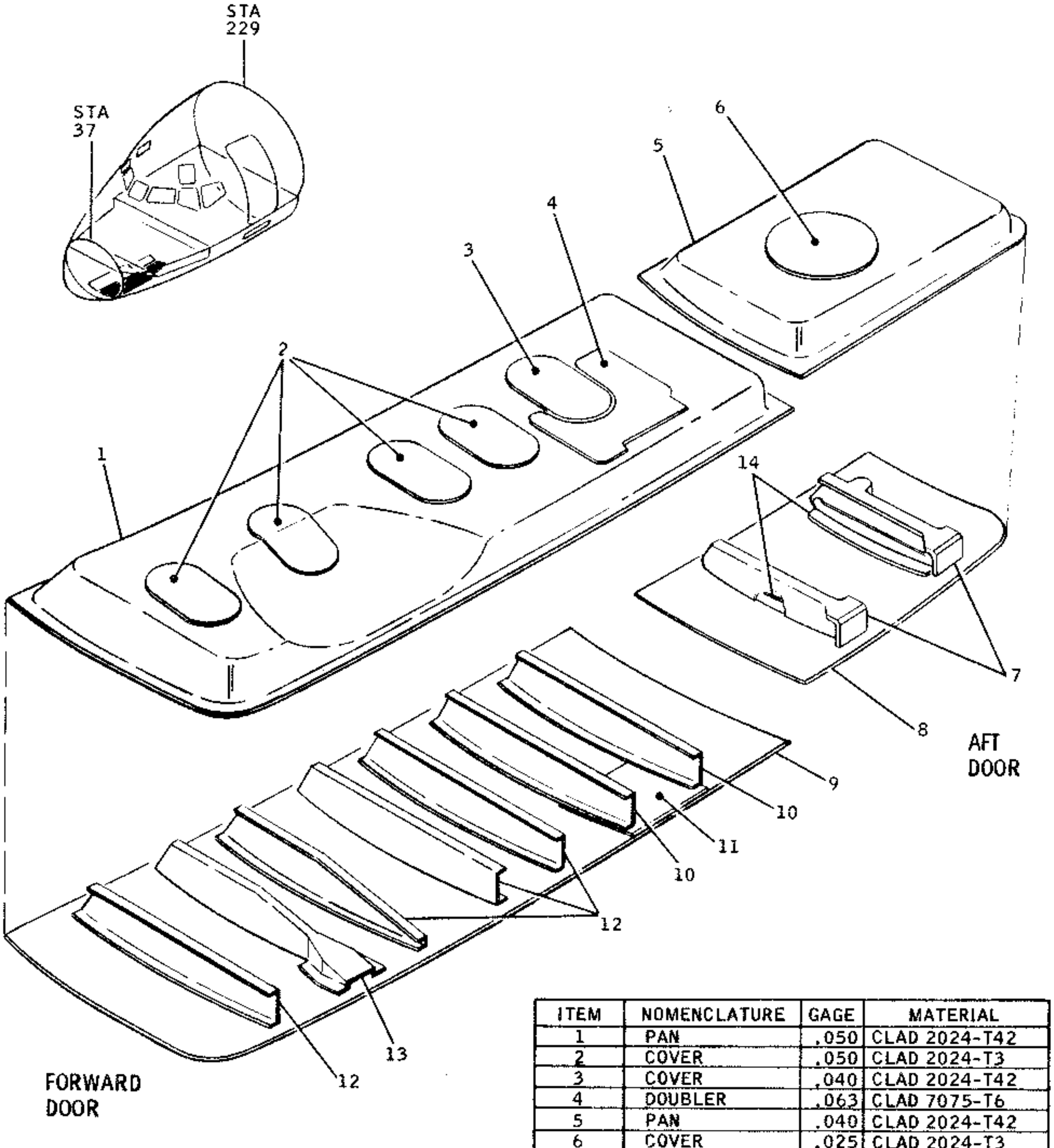
1. General

A. This section illustrates the doors used to enclose the landing gear components. Types and gages of material used in construction of the doors are identified within the illustrations.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the structural integrity and appearance is presented as follows:

Structural Component	Approved Repairs
Skin	Section 52-01, Figure 1, Sheets 2 and 3
	Section 52-05, as applicable
	Section 53-03, as applicable
Honeycomb	Section 52-02, as applicable
	Section 52-01, Figure 2, Sheet 1; Figure 3, Sheet 1
	Chapter 51, Repair Bonding Section, as applicable
Internal structure	Section 52-01, Figure 1, Sheet 1; Figure 2, Sheet 4
	Section 52-05, Figures 1, 2, 3, and 6 (nose gear door only)
	Section 52-05, Figure 5



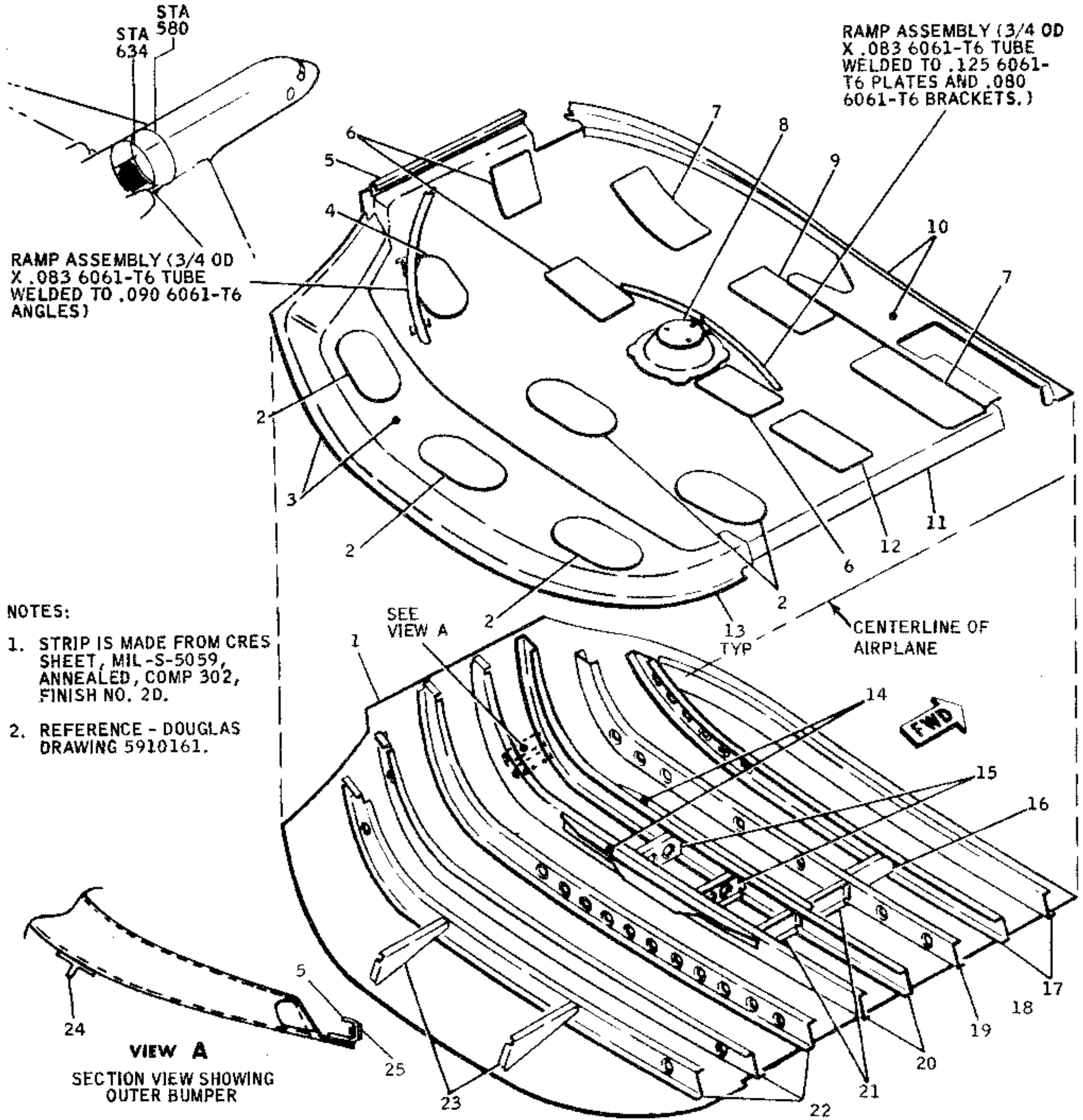
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAN	.050	CLAD 2024-T42
2	COVER	.050	CLAD 2024-T3
3	COVER	.040	CLAD 2024-T42
4	DOUBLER	.063	CLAD 7075-T6
5	PAN	.040	CLAD 2024-T42
6	COVER	.025	CLAD 2024-T3
7	RIB	1.750	PLATE 2024-T351
8	SKIN	.040	CLAD 2024-T3
9	SKIN	.040	CLAD 7075-T6
10	RIB	.063	CLAD 7075-T6
11	DOUBLER	.050	CLAD 7075-T6
12	RIB	.040	CLAD 2024-T42
13	RIB		7075-T651 BAR
14	ANGLE	.050	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWINGS
5914985 AND 5914984

BB3-51

Nose Gear Door Structure
Figure 1

Printed in U.S.A.



NOTES:

1. STRIP IS MADE FROM CRES SHEET, MIL-S-5059, ANNEALED, COMP 302, FINISH NO. 2D.
2. REFERENCE - DOUGLAS DRAWING 5910161.

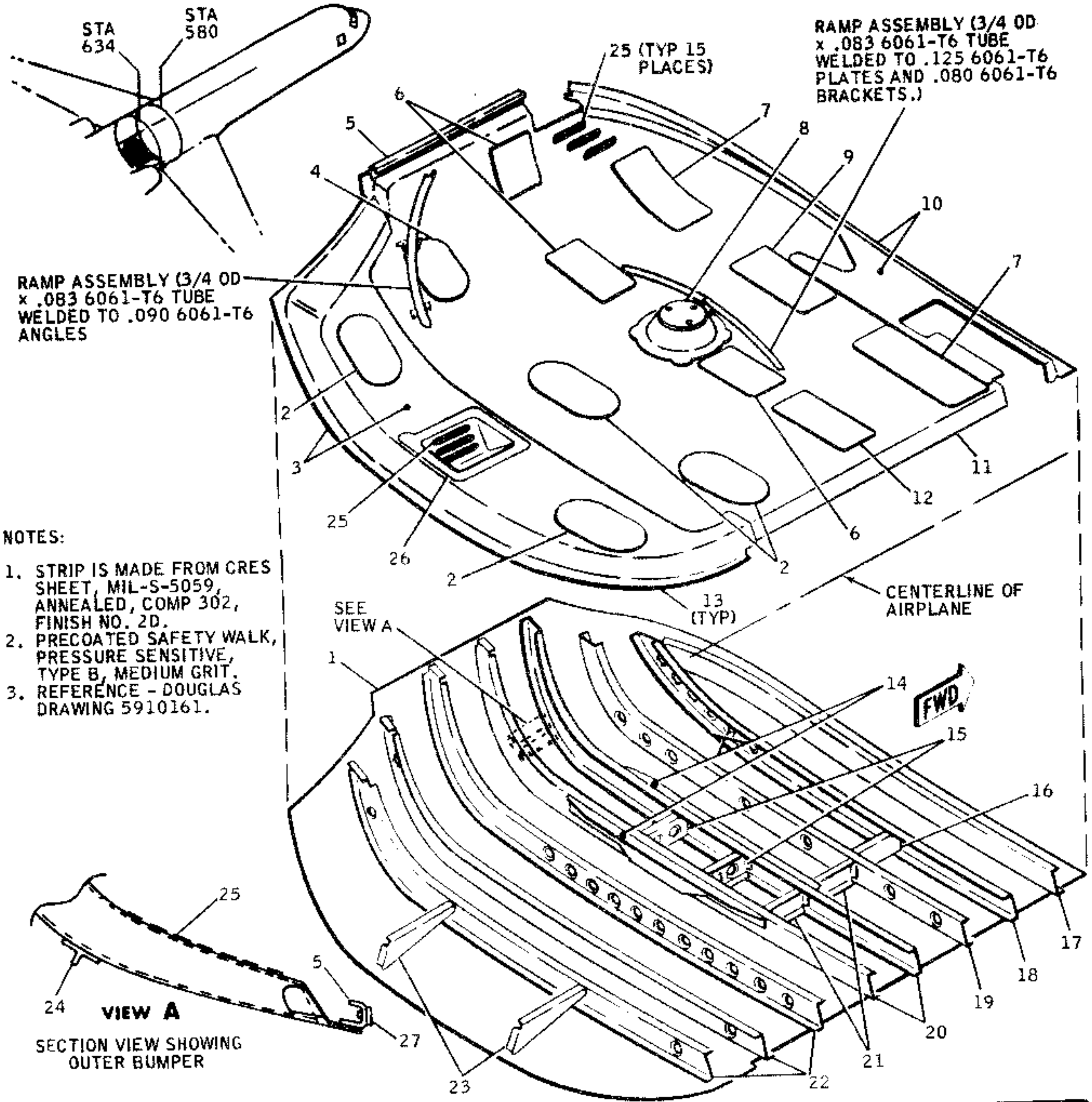
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.071	CLAD 7075-T6
2	COVER	.032	CLAD 2024-T3
3	CHANNEL	.040	CLAD 2024-T3
4	COVER	.032	CLAD 2024-T42
5	BUMPER	.063	CLAD 2014-T6
6	COVER	.040	CLAD 7075-T6
7	COVER	.071	CLAD 7075-T6
8	HUB SUPPORT	.080	CLAD 2024-T3
9	COVER	.050	CLAD 7075-T6
10	CHANNEL	.050	CLAD 7075-T6
11	INNER PANEL	.050	CLAD 7075-T6
12	COVER	.090	CLAD 7075-T6

ITEM	NOMENCLATURE	GAGE	MATERIAL
13	STRIP	.032	SEE NOTE
14	ANGLE	.090	CLAD 7075-T6
15	INTERCOSTAL	.090	CLAD 7075-T6
16	INTERCOSTAL	.071	CLAD 7075-T6
17	FORMER	.090	CLAD 7075-T6
18	STRAP	.125	CLAD 7075-T6
19	FORMER	.063	CLAD 7075-T6
20	FORMER	.080	CLAD 7075-T6
21	INTERCOSTAL	.063	CLAD 7075-T6
22	FORMER	.040	CLAD 7075-T6
23	INTERCOSTAL	.032	CLAD 7075-T6
24	OUTER BUMPER		1544604
25	STRIP	.063	CRES SHEET

BB3-52B

Main Gear Inboard Door Structure -- Type I
Figure 2

Printed in U.S.A.



NOTES:

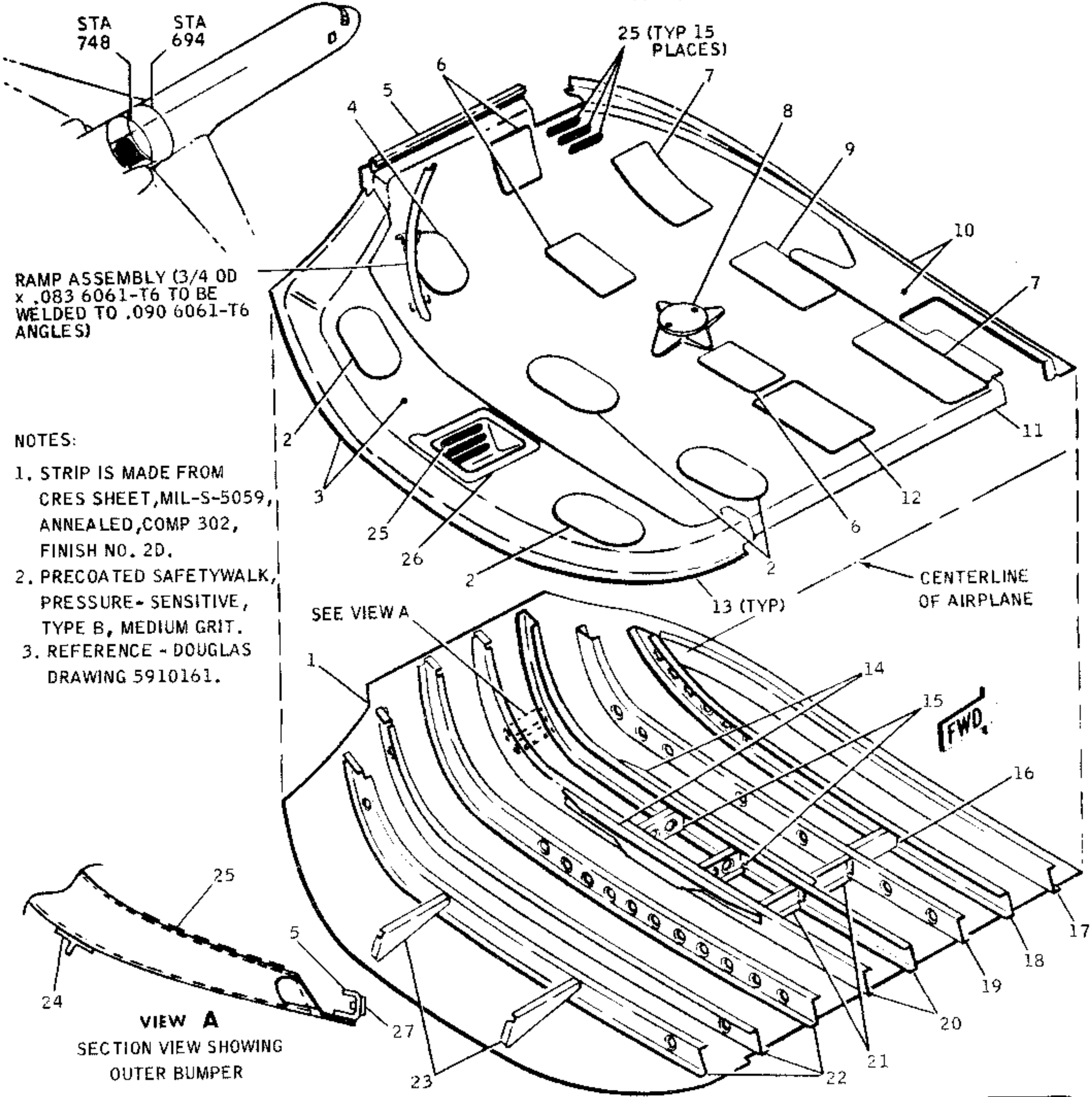
1. STRIP IS MADE FROM CRES SHEET, MIL-S-5059, ANNEALED, COMP 302, FINISH NO. 2D.
2. PRECOATED SAFETY WALK, PRESSURE SENSITIVE, TYPE B, MEDIUM GRIT.
3. REFERENCE - DOUGLAS DRAWING 5910161.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.071	CLAD 7075-T6
2	COVER	.032	CLAD 2024-T3
3	CHANNEL	.040	CLAD 2024-T3
4	COVER	.032	CLAD 2024-T42
5	BUMPER	.063	CLAD 2014-T6
6	COVER	.040	CLAD 7075-T6
7	COVER	.071	CLAD 7075-T6
8	PLATE	.080	CLAD 2024-T3
9	COVER	.050	CLAD 7075-T6
10	CHANNEL	.050	CLAD 7075-T6
11	INNER PANEL	.050	CLAD 7075-T6
12	COVER	.090	CLAD 7075-T6
13	STRIP	.032	SEE NOTE 1
14	ANGLE	.090	CLAD 7075-T6
15	INTERCOSTAL	.090	CLAD 7075-T6
16	INTERCOSTAL	.071	CLAD 7075-T6
17	FORMER	.090	CLAD 7075-T6
18	STRAP	.125	CLAD 7075-T6
19	FORMER	.063	CLAD 7075-T6
20	FORMER	.080	CLAD 7075-T6
21	INTERCOSTAL	.063	CLAD 7075-T6
22	FORMER	.040	CLAD 7075-T6
23	INTERCOSTAL	.032	CLAD 7075-T6
24	OUTER BUMPER		1544604
25	SAFETY WALK		SEE NOTE 2
26	STEP	.063	CLAD 2024-T42
27	STRIP	.063	CRES SHEET

BB3-774

Main Gear Inboard Door Structure -- Type II
Figure 2A

Printed in U.S.A.



NOTES:

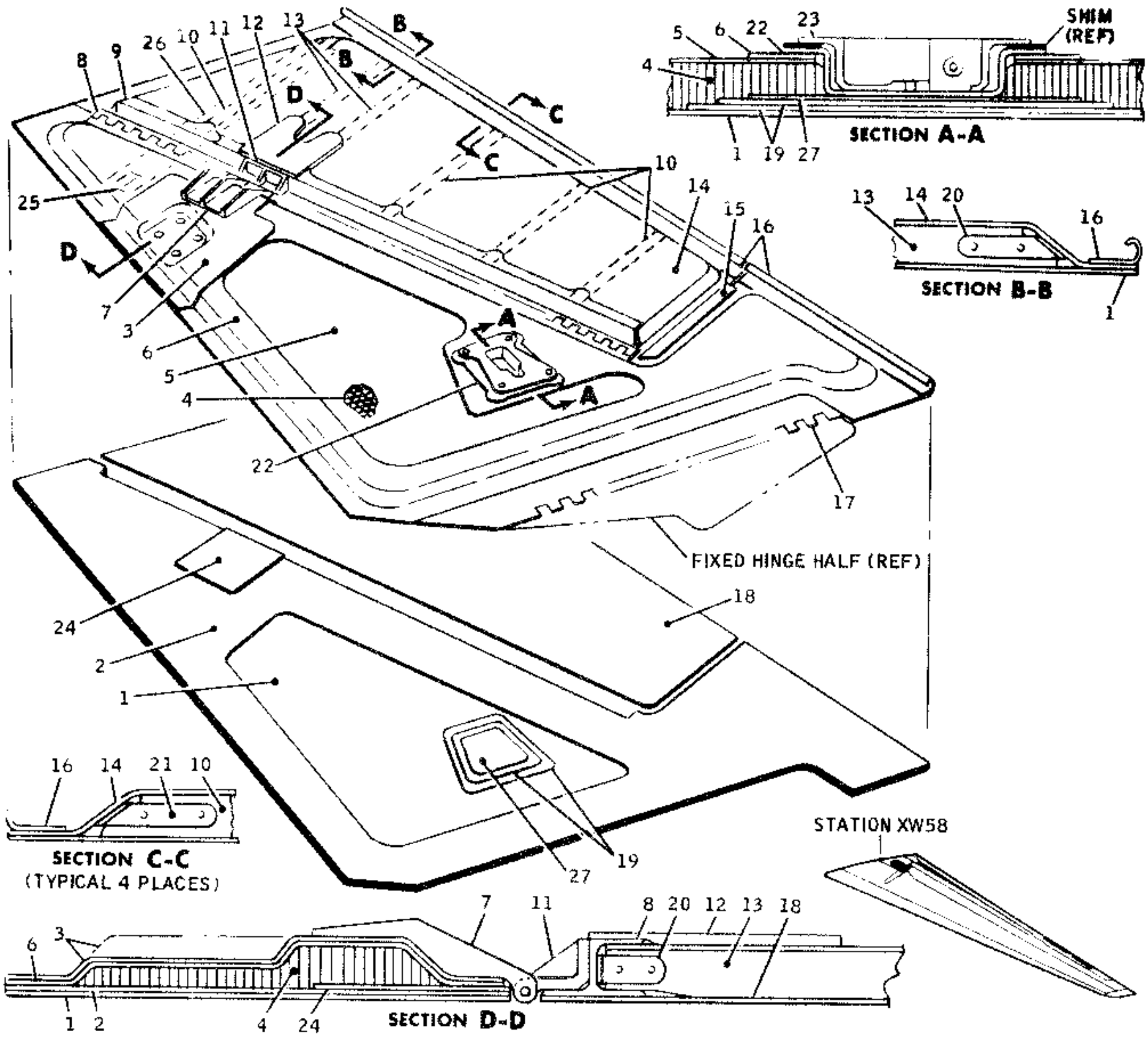
1. STRIP IS MADE FROM CRES SHEET, MIL-S-5059, ANNEALED, COMP 302, FINISH NO. 2D.
2. PRECOATED SAFETYWALK, PRESSURE-SENSITIVE, TYPE B, MEDIUM GRIT.
3. REFERENCE - DOUGLAS DRAWING 5910161.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.071	CLAD 7075-T6
2	COVER	.032	CLAD 2024-T3
3	CHANNEL	.040	CLAD 2024-T3
4	COVER	.032	CLAD 2024-T42
5	BUMPER	.063	CLAD 2014-T6
6	COVER	.040	CLAD 7075-T6
7	COVER	.071	CLAD 7075-T6
8	PLATE	.080	CLAD 2024-T3
9	COVER	.050	CLAD 7075-T6
10	CHANNEL	.050	CLAD 7075-T6
11	INNER PANEL	.050	CLAD 7075-T6
12	PLATE	.090	CLAD 7075-T6
13	STRIP	.032	SEE NOTE 1
14	ANGLE	.090	CLAD 7075-T6

ITEM	NOMENCLATURE	GAGE	MATERIAL
15	INTERCOSTAL	.090	CLAD 7075-T6
16	INTERCOSTAL	.071	CLAD 7075-T6
17	FORMER	.090	CLAD 7075-T6
18	STRAP	.125	CLAD 7075-T6
19	FORMER	.063	CLAD 7075-T6
20	FORMER	.080	CLAD 7075-T6
21	INTERCOSTAL	.063	CLAD 7075-T6
22	FORMER	.040	CLAD 7075-T6
23	INTERCOSTAL	.032	CLAD 7075-T6
24	OUTER BUMPER		1544604
25	SAFETY WALK		SEE NOTE 2
26	STEP	.063	CLAD 2024-T42
27	STRIP	.063	CRES SHEET

BB3-775

Main Gear Inboard Door Structure -- Type A
Figure 2B



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.050	CLAD 7075-T6
2	DOUBLER	.040	CLAD 7075-T6
3	DOUBLER	.050	CLAD 2024-T42
4	CORE	1.188	SEE NOTE 1
5	INNER SKIN	.050	CLAD 7075-T6
6	PAN	.050	CLAD 2014-T6
7	FITTING, 3923212	2.000	PLATE 7075-T651
8	HINGE HALF		2772677
9	BEAM		2923195
10	CHANNEL	.040	CLAD 2024-T42
11	FITTING, 3923211	1.250	PLATE 7075-T651
12	DOUBLER	.188	CLAD 7075-T6
13	CHANNEL	.063	CLAD 2024-T3
14	INNER SKIN	.040	CLAD 2024-T42
15	SUPPORT	.051	CLAD 2024-T3
16	SEAL	.012	CRES SHEET
17	HINGE HALF		2913434
18	OUTER SKIN	.040	CLAD 2024-T42
19	DOUBLER	.063	CLAD 7075-T6
20	CLIP	.063	CLAD 2024-T3
21	CLIP	.050	CLAD 2024-T3
22	PAN	.040	CLAD 7075-T6
23	FITTING, 5913437	1.50	PLATE 7075-T651
24	DOUBLER	.050	CLAD 2024-T3
25	WEIGHT		SEE NOTE 2
26	BEAM	.063	CLAD 7075-T6
27	DOUBLER	.050	CLAD 7075-T6

NOTES:

1. MADE FROM HONEYCOMB 1/8 X .002 NON-PERFORATED, RIBBON LENGTHWISE.
2. MADE FROM BAR HIGH DENSITY 2.
3. REFERENCE-DOUGLAS DRAWING 5910557.

BB3-658A

Main Gear Outboard Door Structure
Figure 3

CHAPTER 53

FUSELAGE

Chapter 53

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Title			53-02	1	Jun 1/66
*53-Eff.	1-5	Dec 1/66	53-02	2	Mar 1/66
53-Cont.	1	Jun 1/66	53-02	3	Dec 1/65
53-Cont.	2	Jun 1/66	53-02	4	Mar 1/66
53-Cont.	3	Jun 1/66	53-02	5	Sep 1/65
*53-T Var.	1	Dec 1/66	53-02	6	Dec 1/65
*53-T Var.	2	Dec 1/66	53-02	7	Dec 1/65
*53-T Var.	3	Dec 1/66	53-03	1	Jun 1/66
*53-T Var.	4	Dec 1/66	53-03	2	Sep 1/65
*53-T Var.	5	Dec 1/66	53-03	3	Sep 1/65
*53-T Var.	6	Dec 1/66	53-03	4	Sep 1/65
*53-T Var.	7	Dec 1/66	53-03	5	Mar 1/66
*53-T Var.	8	Dec 1/66	53-03	6	Sep 1/65
*53-T Var.	9	Dec 1/66	53-03	7	Sep 1/65
*53-T Var.	10	Dec 1/66	53-03	8	Sep 1/65
53-Sect. App.	1	Jun 1/66	53-04	1	Jun 1/66
53-Sect. App.	2	Jun 1/66	53-04	2	Mar 1/66
53-00	1	Jun 1/66	53-05	1	Jun 1/66
53-01	1	Jun 1/66	53-05	2	Sep 1/66
53-01	2	Sep 1/65	53-05	3	Mar 1/66
53-01	3	Mar 1/66	53-05	4	Mar 1/66
53-01	4	Sep 1/65	53-05	5	Mar 1/66
53-01	5	Sep 1/65	53-05	6	Mar 1/66
53-01	6	Mar 1/66	53-05	7	Mar 1/66
53-01	7	Mar 1/66	53-05	8	Sep 1/65
53-01	8	Mar 1/66	53-05	9	Sep 1/65
53-01	9	Mar 1/66	53-05	10	Sep 1/65
53-01	10	Mar 1/66	53-05	11	Sep 1/65
53-01	11	Mar 1/66	53-05	12	Mar 1/66
53-01	12	Mar 1/66	53-05	13	Sep 1/65
53-01	13	Mar 1/66	53-05	14	Sep 1/65
53-01	14	Mar 1/66	53-05	15	Mar 1/66
53-01	15	Mar 1/66	53-05	16	Mar 1/66
53-01	16	Mar 1/66	*53-05	17	Dec 1/66
53-01	17	Mar 1/66	*53-05	18	Dec 1/66
53-01	18	Mar 1/66	*53-05	19	Dec 1/66
53-01	19	Mar 1/66	*53-05	20	Dec 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
53-06	1	Jun 1/66	53-10-2	7	Jun 1/66
53-06	2	Mar 1/66	*53-10-2	8	Dec 1/66
53-06	3	Mar 1/66	*53-10-2	9	Dec 1/66
53-10-0	1	Jun 1/66	*53-10-2	10	Dec 1/66
53-10-1	1	Jun 1/66	*53-10-2	11	Dec 1/66
53-10-1	2	Sep 1/65	53-10-2	12	Sep 1/66
53-10-1	3	Jun 1/66	53-10-3	1	Jun 1/66
53-10-1	4	Sep 1/65	53-10-3	2	Sep 1/66
*53-10-1	5	Dec 1/66	53-10-3	3	Sep 1/65
*53-10-1	6	Dec 1/66	53-10-3	4	Sep 1/65
*53-10-1	7	Dec 1/66	53-10-3	5	Sep 1/65
53-10-1	8	Sep 1/65	*53-10-3	6	Dec 1/66
53-10-1	9	Sep 1/65	53-10-3	6A	Sep 1/66
53-10-1	10	Jun 1/66	53-10-3	7	Sep 1/65
53-10-1	10A	Jun 1/66	53-10-3	8	Sep 1/65
53-10-1	10B	Jun 1/66	53-10-3	9	Sep 1/65
53-10-1	11	Jun 1/66	53-10-3	10	Sep 1/65
53-10-1	12	Sep 1/65	53-10-3	11	Sep 1/65
53-10-1	13	Jun 1/66	53-10-3	12	Sep 1/65
53-10-1	14	Sep 1/65	53-10-3	13	Sep 1/65
53-10-1	15	Sep 1/65	*53-10-3	14	Dec 1/66
53-10-1	16	Dec 1/65	*53-10-3	14A	Dec 1/66
53-10-1	16A	Jun 1/66	*53-10-3	14B	Dec 1/66
53-10-1	16B	Jun 1/66	*53-10-3	14C	Dec 1/66
53-10-1	17	Jun 1/66	*53-10-3	15	Dec 1/66
53-10-1	18	Jun 1/66	53-10-3	16	Jun 1/66
53-10-1	19	Jun 1/66	53-10-3	17	Jun 1/66
53-10-1	20	Sep 1/65	53-10-3	18	Sep 1/66
53-10-1	21	Sep 1/65	53-10-3	18A	Sep 1/66
53-10-1	22	Jun 1/66	*53-10-3	19	Dec 1/66
53-10-1	23	Jun 1/66	53-10-3	20	Sep 1/66
53-10-1	24	Sep 1/66	53-10-3	20A	Sep 1/66
53-10-1	25	Sep 1/66	53-20-3	20B	Sep 1/66
53-10-2	1	Jun 1/66	53-20-3	20C	Sep 1/66
53-10-2	2	Jun 1/66	53-10-3	21	Sep 1/65
53-10-2	2A	Jun 1/66	53-10-3	22	Sep 1/65
53-10-2	2B	Jun 1/66	53-10-4	1	Jun 1/66
*53-10-2	2C	Dec 1/66	53-10-4	2	Dec 1/65
53-10-2	3	Sep 1/65	53-10-4	3	Dec 1/65
53-10-2	4	Sep 1/65	53-10-4	4	Dec 1/65
53-10-2	5	Jun 1/66	53-10-4	5	Dec 1/65
53-10-2	6	Jun 1/66	53-10-4	6	Dec 1/65
53-10-2	6A	Jun 1/66	53-10-4	7	Dec 1/65
53-10-2	6B	Jun 1/66	53-10-4	8	Dec 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
53-10-4	9	Dec 1/65	53-11-2	6	Jun 1/66
53-10-4	10	Dec 1/65	*53-11-2	7	Dec 1/66
53-10-4	11	Dec 1/65	53-11-2	9	Sep 1/66
53-10-4	12	Mar 1/66	53-11-3	1	Jun 1/66
53-10-4	13	Dec 1/65	*53-11-3	2	Dec 1/66
53-10-4	14	Dec 1/65	53-11-3	3	Jun 1/66
53-10-4	15	Dec 1/65	53-11-3	4	Jun 1/66
53-10-4	16	Dec 1/65	53-11-3	5	Jun 1/66
53-10-4	17	Dec 1/65	53-11-3	6	Jun 1/66
53-10-4	18	Mar 1/66	53-11-3	7	Jun 1/66
53-10-4	19	Dec 1/65	53-11-3	8	Jun 1/66
53-10-4	20	Dec 1/65	53-11-3	9	Jun 1/66
53-10-4	21	Dec 1/65	53-11-3	10	Jun 1/66
53-10-4	22	Dec 1/65	53-11-3	11	Jun 1/66
53-11-0	1	Jun 1/66	53-11-3	12	Jun 1/66
53-11-1	1	Jun 1/66	53-11-3	13	Jun 1/66
53-11-1	2	Jun 1/66	53-11-3	14	Jun 1/66
53-11-1	3	Jun 1/66	53-11-3	15	Jun 1/66
53-11-1	4	Jun 1/66	*53-11-3	16	Dec 1/66
53-11-1	5	Jun 1/66	*53-11-3	16A	Dec 1/66
53-11-1	6	Jun 1/66	*53-11-3	16B	Dec 1/66
53-11-1	7	Jun 1/66	*53-11-3	16C	Dec 1/66
53-11-1	8	Jun 1/66	*53-11-3	17	Dec 1/66
53-11-1	9	Jun 1/66	53-11-3	18	Jun 1/66
53-11-1	10	Jun 1/66	53-11-3	19	Sep 1/66
53-11-1	11	Jun 1/66	53-11-3	20	Sep 1/66
53-11-1	12	Jun 1/66	53-11-3	21	Sep 1/66
53-11-1	13	Jun 1/66	53-11-3	22	Sep 1/66
53-11-1	14	Jun 1/66	53-11-3	23	Sep 1/66
53-11-1	15	Jun 1/66	*53-11-3	24	Dec 1/66
53-11-1	16	Jun 1/66	53-11-4	1	Sep 1/66
53-11-1	17	Jun 1/66	53-11-4	2	Sep 1/66
53-11-1	18	Jun 1/66	53-11-4	3	Sep 1/66
53-11-1	19	Jun 1/66	53-11-4	4	Sep 1/66
53-11-1	20	Jun 1/66	53-11-4	5	Sep 1/66
53-11-1	21	Jun 1/66	53-11-4	6	Sep 1/66
53-11-1	22	Sep 1/66	53-11-4	7	Sep 1/66
53-11-1	23	Sep 1/66	53-11-4	8	Sep 1/66
53-11-2	1	Jun 1/66	53-11-4	9	Sep 1/66
53-11-2	2	Jun 1/66	53-11-4	10	Sep 1/66
53-11-2	3	Sep 1/66	53-11-4	11	Sep 1/66
53-11-2	4	Jun 1/66	53-11-4	12	Sep 1/66
53-11-2	5	Jun 1/66	53-11-4	13	Sep 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
53-11-4	14	Sep 1/66	53-30-0	6C	Jun 1/66
53-11-4	15	Sep 1/66	*53-30-0	6D	Dec 1/66
53-11-4	16	Sep 1/66	53-30-0	7	Jun 1/66
53-11-4	17	Sep 1/66	*53-30-0	8	Dec 1/66
53-11-4	18	Sep 1/66	53-30-0	9	Jun 1/66
53-11-4	19	Sep 1/66	*53-30-0	10	Dec 1/66
53-11-4	20	Sep 1/66	53-30-0	11	Dec 1/65
53-11-4	21	Sep 1/66	53-30-0	12	Dec 1/65
53-11-4	22	Sep 1/66	53-30-0	13	Mar 1/66
53-20-0	1	Jun 1/66	53-30-0	14	Dec 1/65
53-20-0	2	Sep 1/65	*53-30-0	15	Dec 1/66
53-20-0	3	Jun 1/66	*53-30-0	16	Dec 1/66
53-20-0	4	Jun 1/66	53-30-0	17	Mar 1/66
53-20-0	4A	Jun 1/66	53-31-0	1	Jun 1/66
53-20-0	4B	Jun 1/66	53-31-0	2	Jun 1/66
53-20-0	5	Jun 1/66	53-31-0	3	Jun 1/66
53-20-0	6	Sep 1/66	53-31-0	4	Jun 1/66
53-20-0	6A	Jun 1/66	53-31-0	5	Jun 1/66
53-20-0	6B	Sep 1/66	53-31-0	6	Jun 1/66
53-20-0	6C	Jun 1/66	*53-31-0	7	Dec 1/66
53-20-0	6D	Jun 1/66	*53-31-0	8	Dec 1/66
53-20-0	7	Jun 1/66	53-31-0	9	Jun 1/66
53-20-0	8	Jun 1/66	*53-31-0	10	Dec 1/66
53-20-0	9	Jun 1/66	53-31-0	11	Sep 1/66
53-20-0	10	Jun 1/66	53-31-0	12	Sep 1/66
53-21-0	1	Jun 1/66	53-31-0	12A	Sep 1/66
53-21-0	2	Sep 1/66	53-31-0	13	Sep 1/66
53-21-0	3	Sep 1/66	53-31-0	14	Sep 1/66
53-21-0	4	Sep 1/66	53-31-0	14A	Sep 1/66
53-21-0	5	Sep 1/66	53-31-0	14B	Sep 1/66
53-21-0	6	Sep 1/66	53-31-0	15	Sep 1/66
53-21-0	7	Sep 1/66	*53-50-0	1	Dec 1/66
*53-21-0	8	Dec 1/66	53-50-0	2	Sep 1/65
*53-21-0	8A	Dec 1/66	53-50-0	3	Sep 1/65
53-21-0	9	Jun 1/66	53-50-0	4	Sep 1/65
53-30-0	1	Jun 1/66	53-50-0	5	Sep 1/65
53-30-0	2	Jun 1/66	53-50-0	6	Sep 1/65
53-30-0	3	Jun 1/66	53-50-0	7	Sep 1/65
53-30-0	4	Jun 1/66	*53-50-0	8	Dec 1/66
53-30-0	5	Jun 1/66	*53-50-0	9	Dec 1/66
53-30-0	6	Jun 1/66	53-50-0	10	Sep 1/65
53-30-0	6A	Jun 1/66	*53-51-0	1	Dec 1/66
53-30-0	6B	Jun 1/66	53-51-0	2	Jun 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
53-51-0	3	Sep 1/66			
53-51-0	4	Sep 1/66			
53-51-0	5	Sep 1/66			
53-51-0	6	Sep 1/66			
53-51-0	7	Sep 1/66			
*53-51-0	8	Dec 1/66			
53-51-0	9	Sep 1/66			
53-51-0	10	Sep 1/66			

*The asterisk indicates pages revised or added by the current revision.

Chapter 53

TABLE OF CONTENTS

Chapter 53

TYPE VARIATIONS

The illustrations listed below, in numerical sequence by chapter, section and subject, reflect structural differences in the fuselage. These differences are indicated as type variations. The effectivity of each type is indicated by fuselage serial numbers.

Figure	Title	Effectivity
	53-10-1	
1	Frames and Intercostals, Nose Upper Section, Station 37 to 229	All DC-9-10 Airplanes except Type II listings.
1	Frames and Intercostals, Nose Upper Section, Station 37 to 229 -- Type II	DC-9-10 Airplanes 45826, 47010-47014.
4	Bulkhead, Station 37 and 41 -- Type I	All DC-9-10 Airplanes except Type II and Type III listings.
4	Bulkhead, Station 37 and 41 -- Type II	DC-9-10 Airplanes 45742-45749, 45770, 45771, 45825 45829-45832.
4	Bulkhead, Station 37 and 41 -- Type III	47049.
7	Bulkhead, Station 218 -- Type I	All DC-9-10 Airplanes except Type II listings.
7A	Bulkhead, Station 218 -- Type II	45695-45709.
11	Floor Support Structure, Station 120 to 218 -- Type I	All DC-9-10 Airplanes except Type II listings.
12	Floor Support Structure, Station 120 to 218 -- Type II	DC-9-10 Airplanes 45826, 47010-47014.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-10-2	
1	Frames and Intercostals, Station 229 to 474, Upper Section -- Type I	All DC-9-10 airplanes except Type II listings.
1A	Frames and Intercostals, Station 229 to 474, Upper Section -- Type II	DC-9-10 airplanes 45826, 47010-47014.
3	Longerons, Station 229 to 474 -- Type I	All DC-9-10 airplanes except Type II listings.
3A	Longerons, Station 229 to 474 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
4	Floor Support Structure, Station 218 to 484 -- Type I	All DC-9-10 airplanes except Type II listings.
5	Floor Support Structure, Station 218 to 484 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
	53-10-3	
1	Frames and Intercostals, Station 474 to 817, Upper Section -- Type I	All DC-9-10 airplanes except Type II listings.
1	Frames and Intercostals, Station 474 to 817, Upper Section -- Type II	DC-9-10 airplanes 45717, 45724, 45772, 45773, 45826, 45841, 47010-47014, 47033.
6	Pressure Bulkhead, Station 817 -- Type I	All DC-9-10 airplanes except Type II listings.
6A	Pressure Bulkhead, Station 817 -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-10-3 (Continued)	
10	Floor Support Structure, Station 484 to 642 -- Type I	All DC-9-10 airplanes except Type II listings.
10A	Floor Support Structure, Station 484 to 642 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
11	Floor Support Structure, Station 642 to 817 -- Type I	All DC-9-10 airplanes except Type II listings.
11A	Floor Support Structure, Station 642 to 817 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
	53-10-4	
1	Frames and Intercostals, Station 817 to 908 -- Type I	All DC-9-10 airplanes except Type II listings.
2	Frames and Intercostals, Station 817 to 908 -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.
4	Frames and Intercostals, Station 908 to Canted Station 989 -- Type I	All DC-9-10 airplanes except Type II listings.
5	Frames and Intercostals, Station 908 to Canted Station 989 -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-10-4 (Continued)	
7	Longerons, Station 908 to Canted Station 989 -- Type I	All DC-9-10 airplanes except Type II listings.
7	Longerons, Station 908 to Canted Station 989 -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785, 45786, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.
	53-11-3	
1	Frames and Intercostals, Station 588 to 996, Upper Section -- Types A1, A2, and A3	DC-9-30 airplanes A1 45710, 47025-47028, A2 47038, A3 All DC-9-30 airplanes except Type A1, and Type A2 listings.
6	Pressure Bulkhead, Station 996 -- Type A1	All DC-9-30 airplanes except Type A2 listings.
6A	Pressure Bulkhead, Station 996 -- Type A2	DC-9-30 airplanes 45710, 45845, 45846, 47003, 47006-47008, 47019, 47025, 47050.
	53-11-4	
1	Frames and Intercostals, Station 996 to 1087 -- Type A1	All DC-9-30 airplanes except Type A2 listings.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-11-4 (Continued)	
1	Frames and Intercostals, Station 996 to 1087 -- Type A2	DC-9-30 airplanes 45710, 45845, 45846, 47003, 47006-47008, 47019, 47025, 47050-47052.
2	Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A1	All DC-9-30 airplanes except Type A2 listings.
2	Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A2	DC-9-30 airplanes 45710, 45845, 45846, 47003, 47006-47008, 47019, 47025, 47050-47052.
	53-20-0	
2	Floor Panels, Station 120 to 200 -- Type I	All DC-9-10 airplanes except Type II listings.
2A	Floor Panels, Station 120 to 200 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
3	Floor Panels and Seat Tracks, Station 200 to 465 -- Type I	All DC-9-10 airplanes except Type II listings.
3A	Floor Panels and Seat Tracks, Station 200 to 465 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
4	Floor Panels and Seat Tracks, Station 465 to 786 -- Type I	All DC-9-10 airplanes except Type II listings.
4A	Floor Panels and Seat Tracks, Station 465 to 786 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
5	Floor Panels, Station 786 to 829 -- Type I	All DC-9-10 airplanes except Type II listings.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-20-0 (Continued)	
5A	Floor Panels, Station 786 to 829 -- Type II	DC-9-10 airplanes 45826, 47010-47014.
5B	Walkways, Aft Accessory Compartment -- Type I	All DC-9-10 airplanes except Type II listings.
5C	Walkways, Aft Accessory Compartment -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785, 45786, 45797-45799, 45826, 45841, 47000-47002, 47010-47014.
6	Forward Lower Cargo Compartment Floors and Lining -- Type I	DC-9-10 airplanes 45696-45709.
7	Forward Lower Cargo Compartment Floors and Lining -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45742-45749, 45770-45773, 45785-45787, 45797-45799, 45825, 45829-45832, 45841, 47000-47002, 47033.
7	Forward Lower Cargo Compartment Floors and Lining -- Type III	DC-9-10 airplanes 45695, 45711-45713, 45718-45723, 45725-45730, 45842-45844, 47043, 47048.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-20-0 (Continued)	
7	Forward Lower Cargo Compartment Floors and Lining -- Type IV	DC-9-10 airplanes 45714-45716, 45735-45741, 45775-45784, 45794-45796, 47049.
8	Aft Lower Cargo Compartment Floors and Lining -- Type I	DC-9-10 airplanes 45696-45709.
9	Aft Lower Cargo Compartment Floors and Lining -- Type II	DC-9-10 airplanes 45695, 45711-45713, 45718-45723, 45725-45730, 45742-45749, 45770, 45771, 45794-45796, 45825, 45826, 45829-45832, 45842-45844, 47010-47014, 47043, 47048, 47049.
9	Aft Lower Cargo Compartment Floors and Lining -- Type III	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45841, 47000-47002, 47033.
9	Aft Lower Cargo Compartment Floors and Lining -- Type IV	DC-9-10 airplanes 45714-45716, 45735-45741, 45775-45784.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-21-0	
7	Forward Lower Cargo Compartment Floors and Lining -- Type A1	DC-9-30 airplanes 45733, 45734, 45833-45840.
7A	Forward Lower Cargo Compartment Floors and Lining -- Type A2	DC-9-30 airplanes 47019, 47020, 47022, 47025-47028.
	53-30-0	
1	Plating, Station 37 to 229, Fuselage Nose -- Type I	All DC-9-10 airplanes except Type II and Type III listings.
1	Plating, Station 37 to 229, Fuselage Nose -- Type II	DC-9-10 airplanes 45695-45709, 45714-45724, 45728-45732, 45735-45749, 45770-45773, 45775-45787, 45794-45799, 45825, 45829-45832, 45841, 47000-47002, 47033, 47043, 47049.
2	Plating, Station 229 to 474 -- Type I	All DC-9-10 airplanes except Type II and Type III listings.
2	Plating, Station 229 to 474 -- Type II	DC-9-10 airplanes 45695-45709, 45714-45724, 45728-45732, 45735-45749, 45770-45773, 45775-45787, 45794-45799,

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-30-0 (Continued)	
2	Plating, Station 229 to 474 -- Type II (Continued)	45825, 45829-45832, 45841, 47000-47002, 47033, 47043, 47049.
2A	Plating, Station 229 to 474 -- Type III	DC-9-10 airplanes 45826, 47010-47014.
3	Plating, Station 474 to 817, -- Type I	All DC-9-10 airplanes except Type II listings.
3	Plating, Station 474 to 817, -- Type II	DC-9-10 airplanes 45717, 45724, 45826, 47010-47014.
4	Plating, Station 817 to 908, -- Type I	All DC-9-10 airplanes except Type II listings.
4	Plating, Station 817 to 908, -- Type II	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.
5	Plating, Station 908 to Canted Station 989 -- Type I	All DC-9-10 airplanes except Type II and Type III listings.
5	Plating, Station 908 to Canted Station 989 -- Type II	DC-9-10 airplanes 45711-45716, 45725-45730.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	53-30-0 (Continued)	
6	Plating, Station 908 to Canted Station 989 -- Type III	DC-9-10 airplanes 45717, 45724, 45731, 45732, 45772, 45773, 45785-45787, 45797-45799, 45826, 45841, 47000-47002, 47010-47014, 47033.
	53-31-0	
4	Plating, Station 996 to 1087 -- Type A1	DC-9-30 airplanes 45733, 45734, 45833-45840, 45863-45866, 47053, 47054, 47057, 47058, 47066, 47098.
4A	Plating, Station 996 to 1087 -- Type A2	DC-9-30 airplanes 45710, 45845, 45846, 47003, 47004, 47006-47008, 47019-47022, 47025-47028, 47050-47052.
5	Plating, Station 1087 to Canted Station 1168 -- Type A1	DC-9-30 airplanes 45733, 45734, 45833-45840, 45863-45866, 47053, 47054, 47057, 47058, 47066, 47098.
5A	Plating, Station 1087 to Canted Station 1168 -- Type A2	DC-9-30 airplanes 45710, 45845, 45846, 47003, 47004, 47006-47008, 47019-47022, 47025-47028, 47050-47052.

Chapter 53

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
53-00	YES	YES
53-01	YES	YES
53-02	YES	YES
53-02	YES	YES
53-03	YES	YES
53-04	YES	YES
53-05	YES	YES
53-06	YES	YES
53-10-0	YES	NO
53-10-1	YES	NO
53-10-2	YES	NO
53-10-3	YES	NO
53-10-4	YES	NO
53-11-0	NO	YES
53-11-1	NO	YES
53-11-2	NO	YES
53-11-3	NO	YES
53-11-4	NO	YES
53-20-0	YES	NO

SECTION APPLICABILITY INDEX (CONT)

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
53-21-0	NO	YES
53-30-0	YES	NO
53-31-0	NO	YES
53-50-0	YES	NO
53-51-0	NO	YES

Chapter 53

GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Repair instructions for components of the fuselage are presented in the following pages of this chapter. The repairs are for the most common types of damage. An explanation of the repairs and damage is given in 51-00. A repair index is provided in each section to direct the operator to repairs applicable to each component.

B. Material identification illustrations are provided to assist in the identification of materials and gages used in the fabrication of the fuselage components.

GENERAL REPAIR PROCEDURES AND PROCESSES -

DESCRIPTION AND OPERATION (DC-9-ALL)

1. General Requirements:

A. The following requirements are to be followed when making repairs to the fuselage and are in addition to the specific repair requirements indicated in the individual repairs.

(1) The recommended edge distance for all attachments in the repair areas is determined by multiplying the attachment diameter by two and adding 1/16 inch. The minimum edge distance is two diameters (2D), unless otherwise specified.

(2) All repair materials must be of the same material and heat treat condition as the part being repaired, unless otherwise specified. For approved substitutions, see Chapter 51.

(3) All metal repair parts must be cleaned and corrosion protected in accordance with Chapter 51, unless otherwise specified.

(4) All repair parts must be free from cracks, burrs, dings, and sharp edges. This requirement also applies to the parts to which the repair parts are being attached.

(5) All attachment holes must be prepared in accordance with drilling, countersinking, and dimpling methods (see Chapter 51).

(6) Attachments must be spaced so that a minimum of four times the attachment diameter (4D) exists between each attachment and any adjacent attachment.

(7) When applicable, all repairs must be sealed in accordance with instructions in the Repair Sealing section of Chapter 51.

(8) Where external doublers are to be tapered for aerodynamic reasons, a seal-type taper may be substituted. Refer to the Repair Sealing section of Chapter 51.

(9) All existing drain holes and fluid dams must be maintained. When making repairs, make certain that drain holes are drilled into parts used in repairs. Fluid dams must be replaced if they have been removed. See Maintenance Manual, Chapter 51, for further information.

(10) Mechanical attachments are required to further secure bonded repairs located in the areas defined in Figure 4, Section 51-70-2.

2. General Repairs

A. Repairs described in this paragraph are of a general nature and may be used separately or in conjunction with specific repairs that are provided in subsequent sections of the chapter. When applicable, the specific repairs are preferred. Repairs involving more than one illustration must comply with the requirements of each illustration. The following repairs are outlined in this section:

B. Determine the number of 181 bidirectional glass cloth plies required for making glass cloth repairs as follows:

Damaged Aluminum Gage	Total Number of Plies
.016	3
.020	4
.025	5
.032	6
.040	7
.050	9
.063	11
.071	12
.080	14
.090	15

NOTES:

1. When applying the glass-fiber cloth to both sides of the damaged aluminum alloy sheet, place half the total plies on each side. If the total number of plies is an odd number, add one more ply.
2. For members with extreme curvature, it may be desirable to use the thinner bidirectional cloth, Number 120. In this instance double the number of plies that is specified above.
3. Arrange the pattern of the glass cloth so that the threads are parallel to and 90 degrees from the direction of the crack.
4. This chart is for use only when specified in other repairs of this manual.

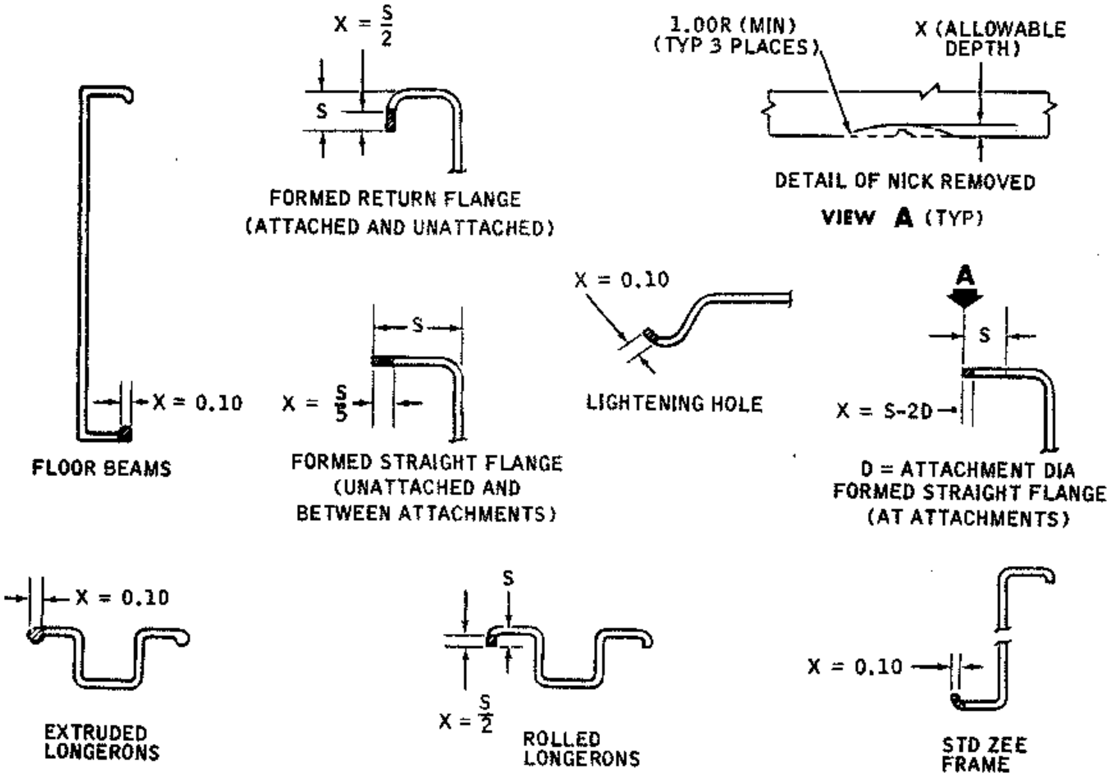
Printed in U.S.A.

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN FUSELAGE STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE

NICKS IN EXTRUSIONS, ROLLED, AND FORMED SECTIONS

1. NICKS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. NICKS UP TO THE DEPTH SHOWN IN THE SKETCHES BELOW SHOULD BE ROUNDED OUT TO 1.00 INCH RADIUS.
3. NICKS DEEPER THAN THE LIMIT SHOWN IN THE SKETCHES BELOW MUST BE SPLICED OR REINFORCED, AFTER THE NICK IS ROUNDED OUT. SEE THE CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.
4. NICKS IN A RADIUS AREA SHOULD BE REPAIRED AS A DING IN A RADIUS AREA AS DESCRIBED IN THE SKETCH ON SHEET 2.



FOR 1415997 EXTRUDED LONGERON, X = .032

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-161A

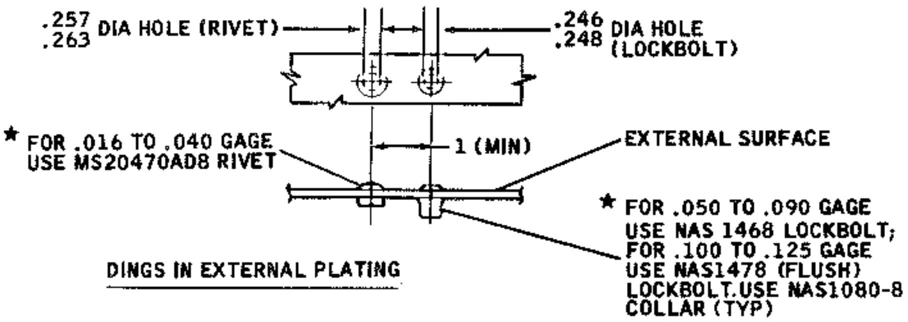
Cleanup of Scratches, Gouges, Nicks, and Dings in Fuselage Structure
Figure 1 (Sheet 1)

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN FUSELAGE STRUCTURE

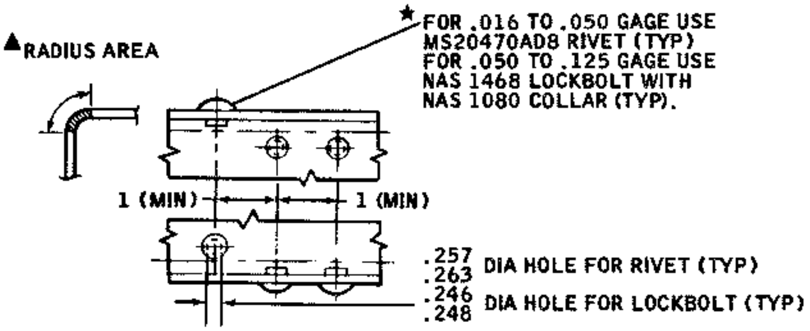
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
DINGS

1. DINGS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. DINGS THAT PENETRATE BEYOND THE CLAD AND ARE NOT LARGER THAN 0.250 INCH DIAMETER SHOULD BE REMOVED AND PLUGGED. SEE SKETCHES BELOW. SEE CHAPTER 51 FOR DING REPAIRS IN ALUMINUM HONEYCOMB PANELS.
3. DINGS LARGER THAN 0.250 INCH DIAMETER MUST BE REPAIRED. REPAIR IN SAME MANNER AS CRACKED MEMBERS, THIS SECTION.
4. THESE INSTRUCTIONS DO NOT APPLY TO THE VARIOUS SPAR FRAMES, BULKHEAD CAPS, KEEL CAPS, OR MACHINED FITTINGS IN THE AIRPLANE.



DINGS IN EXTERNAL PLATING



DINGS IN INTERNAL STRUCTURE

★ MS20470AD8 RIVET MAY BE USED IN PLACE OF LOCKBOLT IF MORE CONVENIENT.

▲ DINGS IN A RADIUS AREA REQUIRE THE SECTION TO BE REPAIRED AFTER THE DING IS DRILLED OUT. SEE THE ALUMINUM ALLOY TO ALUMINUM ALLOY (CRACKED MEMBER) REPAIRS, THIS SECTION, (ONLY 3 ATTACHMENTS REQUIRED WHERE 5 ARE CALLED OUT). DO NOT INSTALL A FASTENER IN THE DING CLEANOUT HOLE.

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-162

Cleanup of Scratches, Gouges, Nicks, and Dings in Fuselage Structure
Figure 1 (Sheet 2)

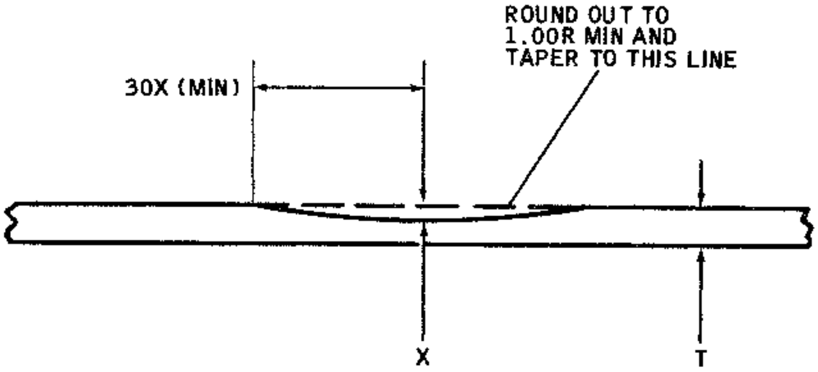
ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN FUSELAGE STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
SCRATCHES AND GOUGES

1. SCRATCHES OR GOUGES THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.

2. SCRATCHES OR GOUGES THAT PENETRATE BEYOND THE CLAD UP TO THE DEPTH SHOWN IN THE TABLE BELOW SHOULD BE ROUNDED OUT AND TAPERED. SEE SKETCH BELOW.

3. SCRATCHES OR GOUGES DEEPER THAN THE LIMIT SHOWN IN THE TABLE BELOW MUST BE REPAIRED. REPAIR IN THE SAME MANNER AS CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.



T = MATERIAL THICKNESS
X = ALLOWABLE DEPTH

MAX DEPTH OF X
NOT TO EXCEED 0.20T

NOTE: CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL).

BB3-249

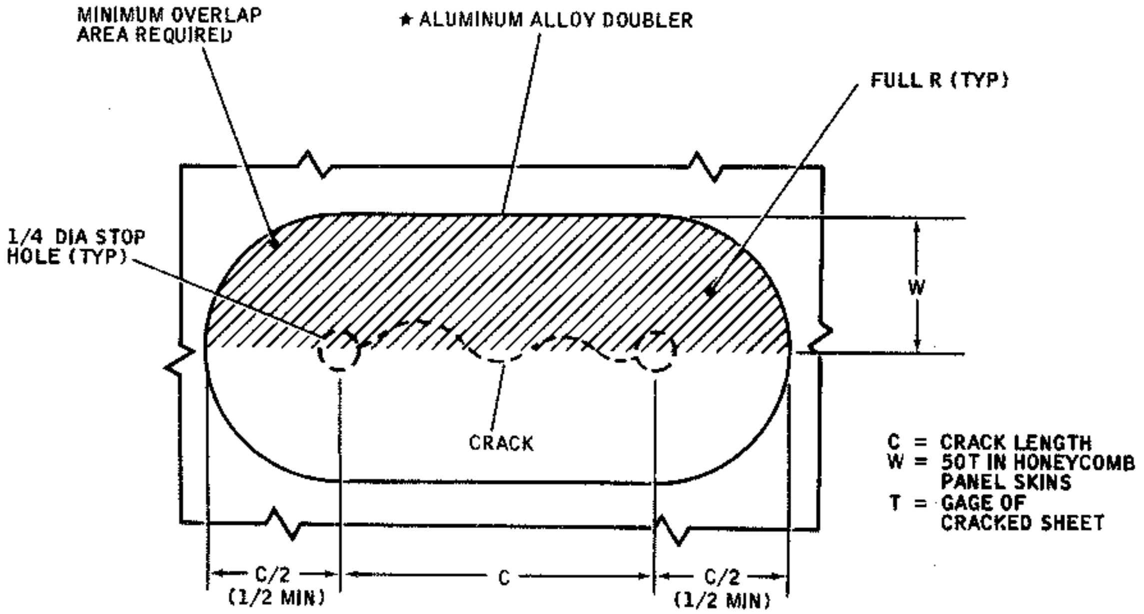
Cleanup of Scratches, Gouges, Nicks, and Dings in Fuselage Structure
Figure 1 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE A BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
4. IF CRACKS ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL IN THE SHORTEST DIRECTION, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL SURFACE, THEN THE PANEL SHOULD BE REPLACED.
5. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE A

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125°F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-122A

Aluminum Alloy to Aluminum Alloy Repairs
(Cracked Members)
Figure 2 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET

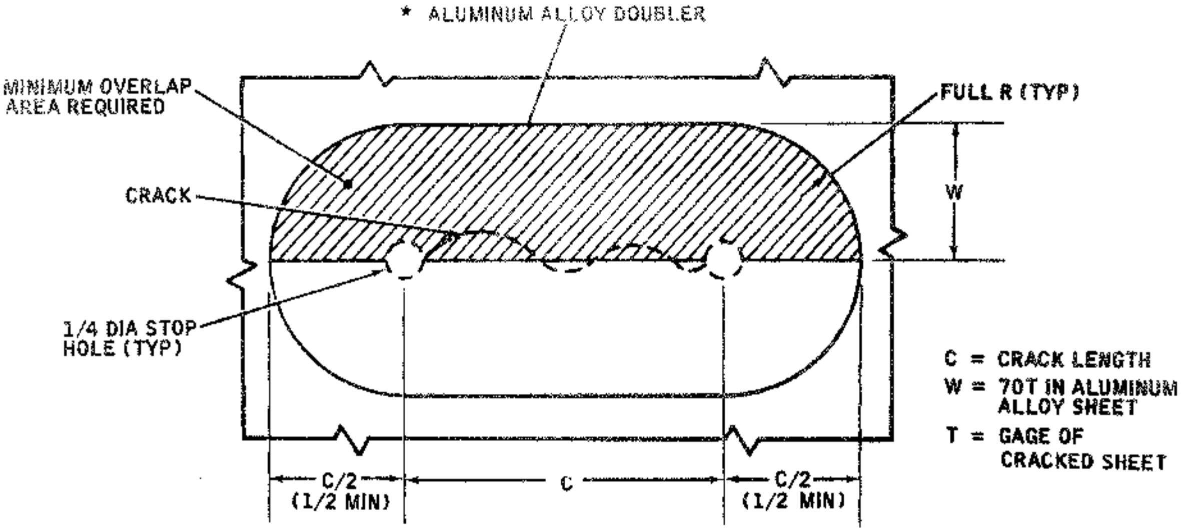
.010 TO .032 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE B BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 2, SHEET 3.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 35T AND THE DOUBLER GAGE SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI. USING FOLLOWING FORMULA, COMPUTE NUMBER OF RIVETS REQUIRED:

$$\frac{W \times C \times 500\ \text{PSI} \times 1.15}{R}$$

W = MIN OVERLAP
C = LENGTH OF CRACK
R = MIN RIVET ALLOWABLE
FROM 51-30-0

5. REPAIR TO FUSELAGE CUSP SHEETS SHOULD CONTAIN ONE ROW OF MS20470AD4 RIVETS AROUND THE EDGE OF THE DOUBLER SPACED 4D. MAKE CERTAIN RIVET HEADS CLEAR FLOOR HATS.
6. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE B

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

* DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIUAL REPAIR.

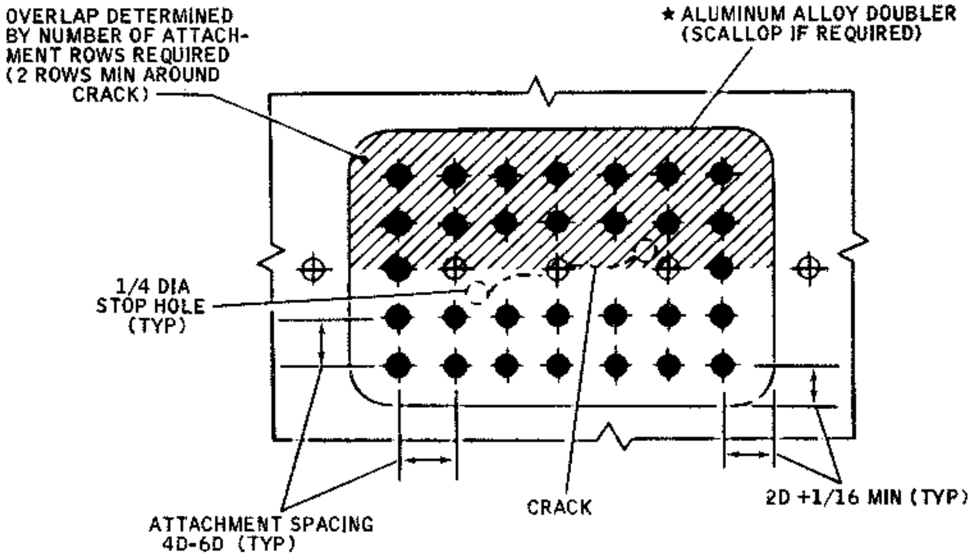
BB3-123A

Aluminum Alloy to Aluminum Alloy Repairs
(Cracked Members)
Figure 2 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.032 TO .090 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE C BELOW
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE IN THIS SECTION MAY ALSO BE USED. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE C

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F.).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-124A

Aluminum Alloy to Aluminum Alloy Repairs
(Cracked Members)
Figure 2 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

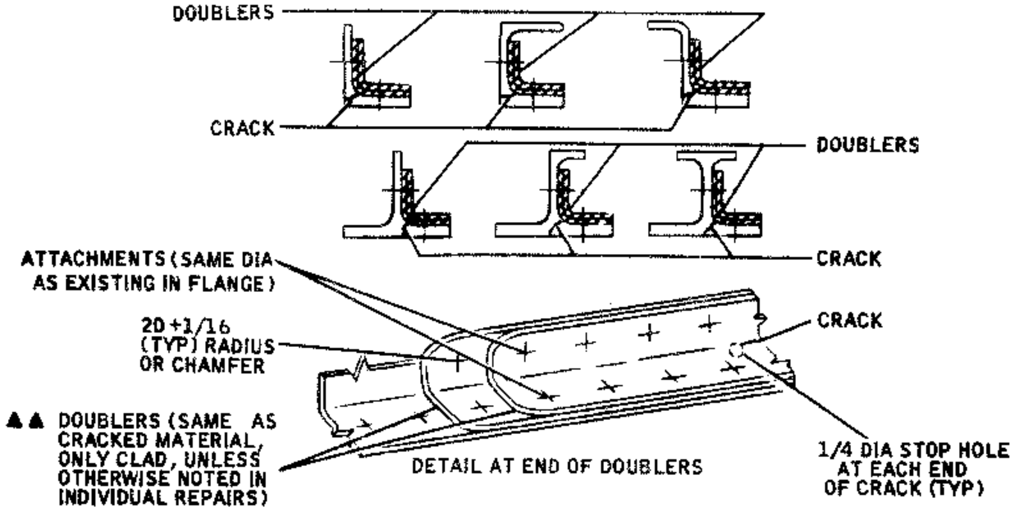
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY EXTRUDED, FORMED AND ROLLED SECTIONS

.016 TO .125 GAGE

1. REPAIR CRACKS PARALLEL TO THE ATTACHED FLANGE RADIUS OF EXTRUDED, FORMED, OR ROLLED SECTIONS, USING FORMED DOUBLERS. INSTALL WITH ATTACHMENTS AND BOND PER 51-70-2.
2. THE ADHESIVE WILL CAUSE THE DOUBLERS TO ACT AS A SINGLE DOUBLER, LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. PICK UP AT LEAST ONE ROW OF ATTACHMENTS EACH SIDE OF CRACK AND PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK IN EACH ROW AT EACH END AS SHOWN IN DETAIL BELOW.
4. THE DOUBLERS SHOULD BE EQUAL IN GAGE, IF POSSIBLE. THE THINNEST DOUBLER SHOULD BE INSTALLED NEXT TO CRACKED MEMBER.
5. IF THE CRACK IS PERPENDICULAR TO A FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED, OR ADDITIONAL DOUBLERS ADDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.
6. THESE INSTRUCTIONS ARE NOT APPLICABLE TO THE FUSELAGE LONGERONS, FRAMES, OR FLOOR BEAMS.
7. TWO THIN FORMED DOUBLERS ARE USED IN ORDER TO GET A SMALLER BEND RADIUS AND TO GET A TAPERED EFFECT IN LOAD PICKUP.



EXAMPLE D

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

▲▲ FOR FORMED AND ROLLED SECTIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE EQUAL TO OR GREATER THAN THE CRACKED MEMBER GAGE, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR. FOR EXTRUSIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE AT LEAST ONE GAGE HEAVIER THAN THE THICKEST LEG ADJACENT TO THE CRACK.

BB3-125A

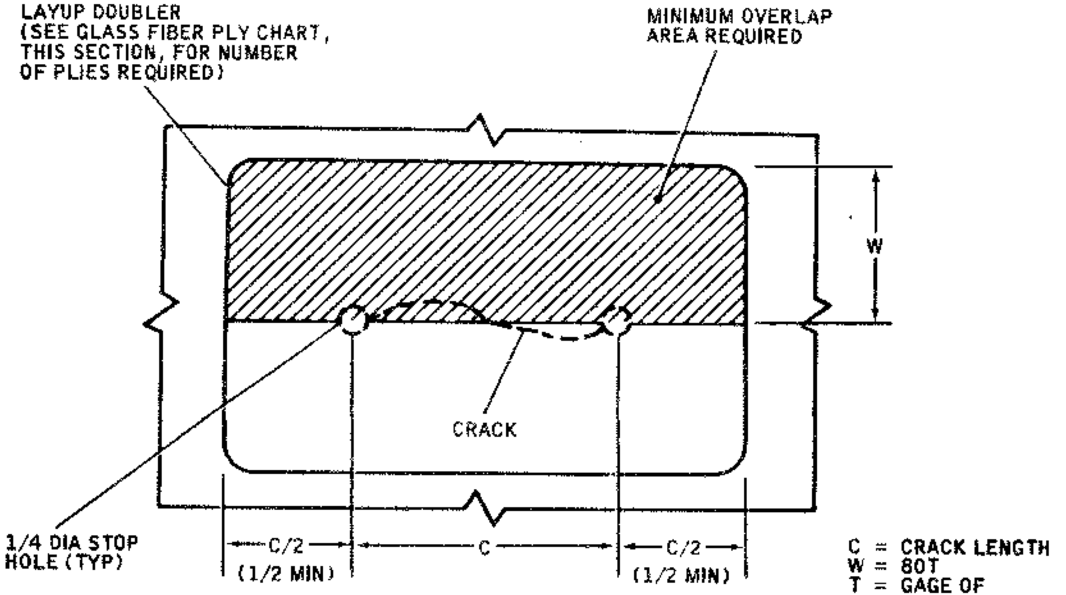
Aluminum Alloy to Aluminum Alloy Repairs
(Cracked Members)
Figure 2 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE A BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR ATTACHMENTS
5. IF CRACKS ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL SURFACE, THEN THE PANEL SHOULD BE REPLACED.



EXAMPLE A

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-127A

Glass-Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.010 TO .032 GAGE

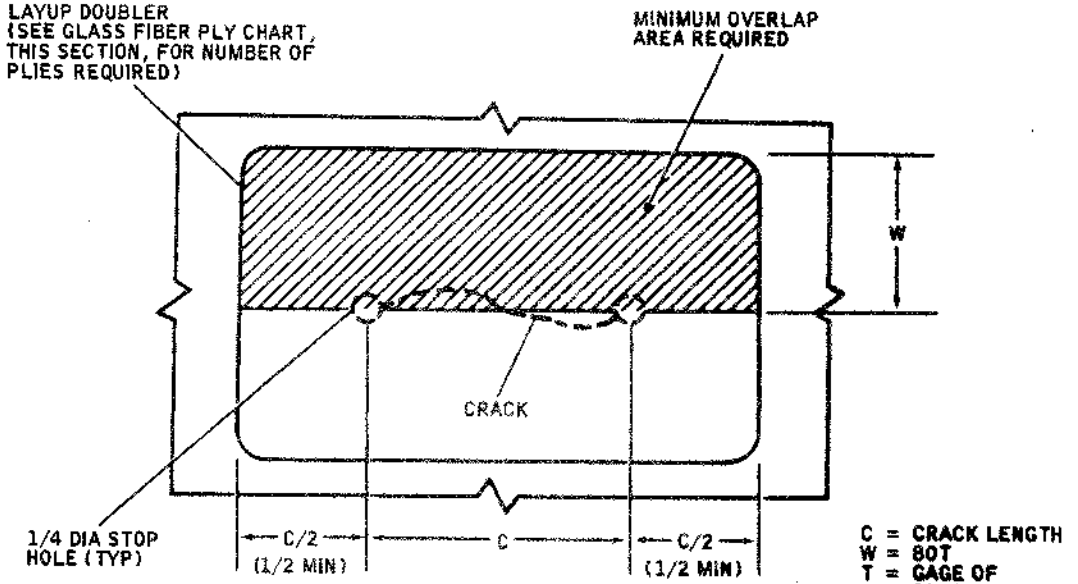
1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE B BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 3, SHEET 3.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 40T AND THE NUMBER OF PLIES SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI. USING FOLLOWING FORMULA, COMPUTE NUMBER OF RIVETS REQUIRED:

   $$\frac{W \times C \times 250 \text{ PSI} \times 1.15}{R}$$

   W=MIN OVERLAP

   C= LENGTH OF CRACK

   R= MIN RIVET ALLOWABLE FROM 51-30-0
5. DO NOT USE LAYUP DOUBLERS ON FUSELAGE CUSP SHEETS EXCEPT TO REPAIR LIGHTENING HOLE DAMAGE.
6. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE B

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125°F)

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-128A

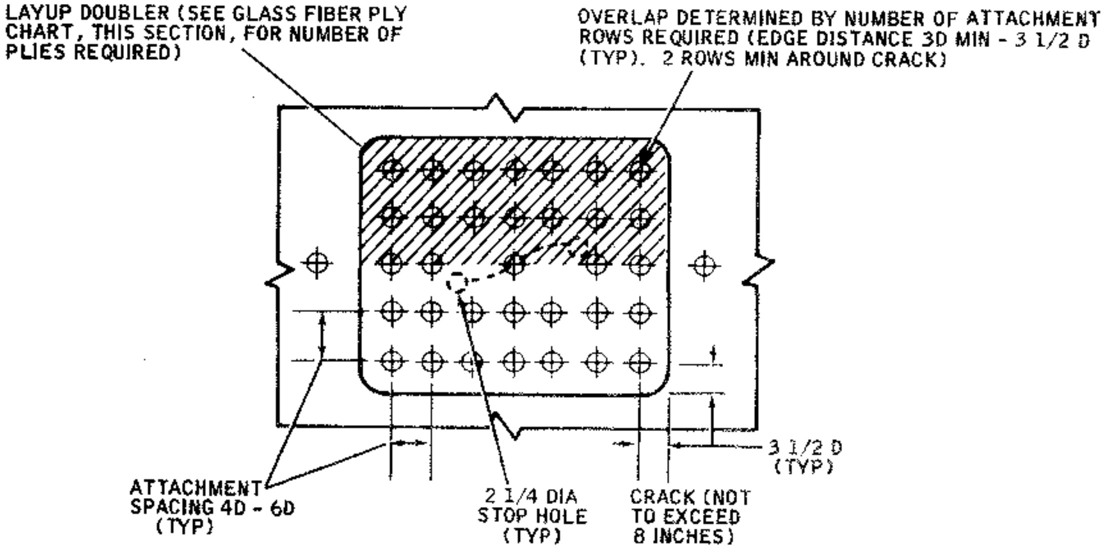
Glass-Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.032 TO .050 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-3. SEE EXAMPLE C BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. DO NOT USE LAYUP DOUBLERS ON THE FUSELAGE PRESSURIZED DOOR PLATING.
5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE C

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-129A

Glass-Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER

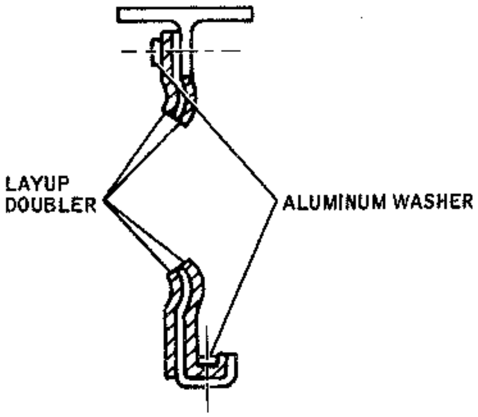
ALUMINUM ALLOY SHEET,
INTERCOSTALS, AND STIFFENERS

.016 TO .080 GAGE

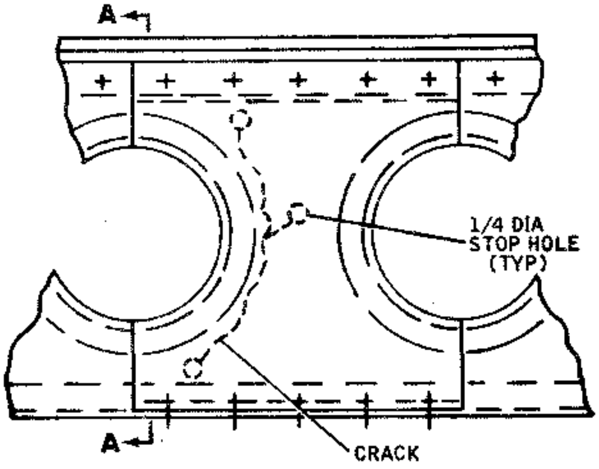
---

1. REPAIR LIGHTENING HOLE RADIUS CRACKS USING A LAYUP DOUBLER OVER BOTH SURFACES OF THE CRACKED MEMBER BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF THE MAIN CRACKS.
3. EXTEND THE DOUBLERS IN THE CRACK DIRECTION TO PICK UP ATTACHMENTS AS SHOWN. MAKE CERTAIN THAT ALUMINUM ALLOY WASHERS ARE INSTALLED ON THE GLASS FIBER SIDE OF THE REPAIR AT THE ATTACHMENTS.
4. EXTEND THE DOUBLERS ON BOTH SIDES OF THE CRACK TO THE APPROXIMATE CENTER OF THE LIGHTENING HOLE.

NOTE:
SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED IN DOUBLERS.



SECTION A-A



EXAMPLE D

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

883-130A

Glass-Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

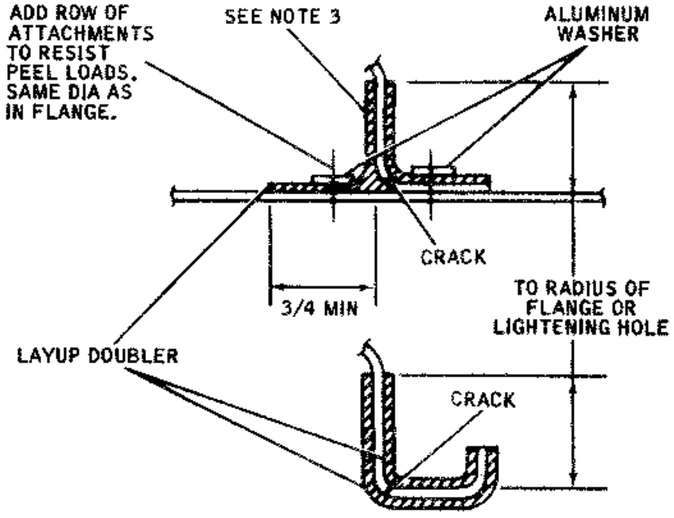
GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY FORMED AND ROLLED SECTIONS

.016 TO .080 GAGE

1. REPAIR CRACKS PARALLEL TO THE FLANGE RADIUS OF FORMED OR ROLLED SECTIONS USING LAYUP DOUBLERS BONDED PER 51-70-3. SEE EXAMPLE E BELOW.
2. IF THE CRACKED FLANGE IS ATTACHED, THEN PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK AT EACH END, AND ADD A ROW OF ATTACHMENTS AS SHOWN. MAKE BOTH DOUBLERS THE SAME LENGTH. INSTALL ATTACHMENTS AFTER CURING.
3. IF THE FLANGE IS NOT ATTACHED, THEN OVERLAP THE DOUBLERS BEYOND THE ENDS OF THE CRACK BY AT LEAST THREE INCHES.
4. THESE INSTRUCTIONS ARE NOT APPLICABLE TO THE FUSELAGE LONGERONS FRAMES AND FLOOR BEAMS.
5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
6. IF THE CRACK IS PERPENDICULAR TO THE FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.



EXAMPLE E

NOTES:

1. SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF CRACK.
3. IN .071 AND .080 GAGES, ADD ROW OF ATTACHMENTS SAME DIA AS THOSE IN FLANGE.

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-131A

Glass-Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 5)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

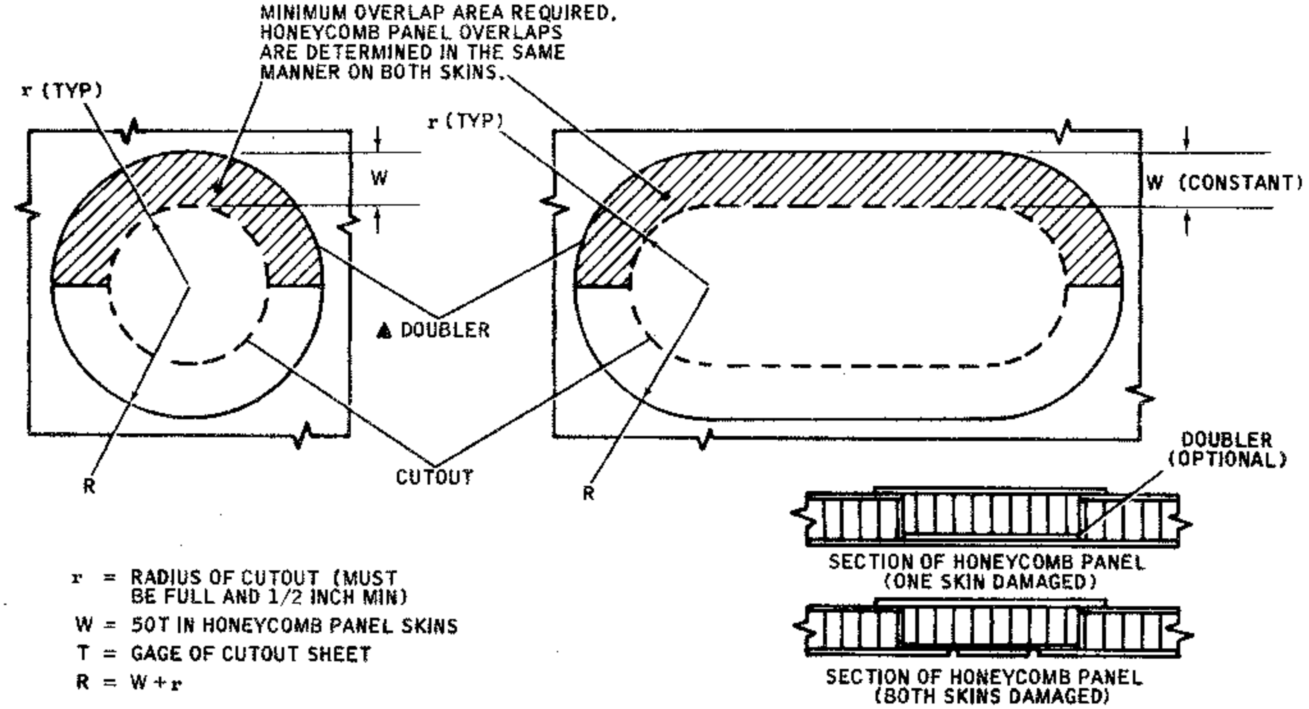
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE FROM A REPAIR PANEL OR ALUMINUM ALLOY DOUBLERS AND A REPAIR CORE BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
3. GLASS FIBER LAYUP SHOWN ON ANOTHER ILLUSTRATION, THIS SECTION, MAY BE USED AS A SUBSTITUTE FOR THE ALUMINUM ALLOY DOUBLERS. HOWEVER, ALUMINUM ALLOY DOUBLERS ARE PREFERRED.
4. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS), IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
5. IF DAMAGE IS LARGER THAN ONE-FOURTH THE DISTANCE ACROSS THE PANEL, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2 INCH MIN)
W = 50T IN HONEYCOMB PANEL SKINS
T = GAGE OF CUTOUT SHEET
R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

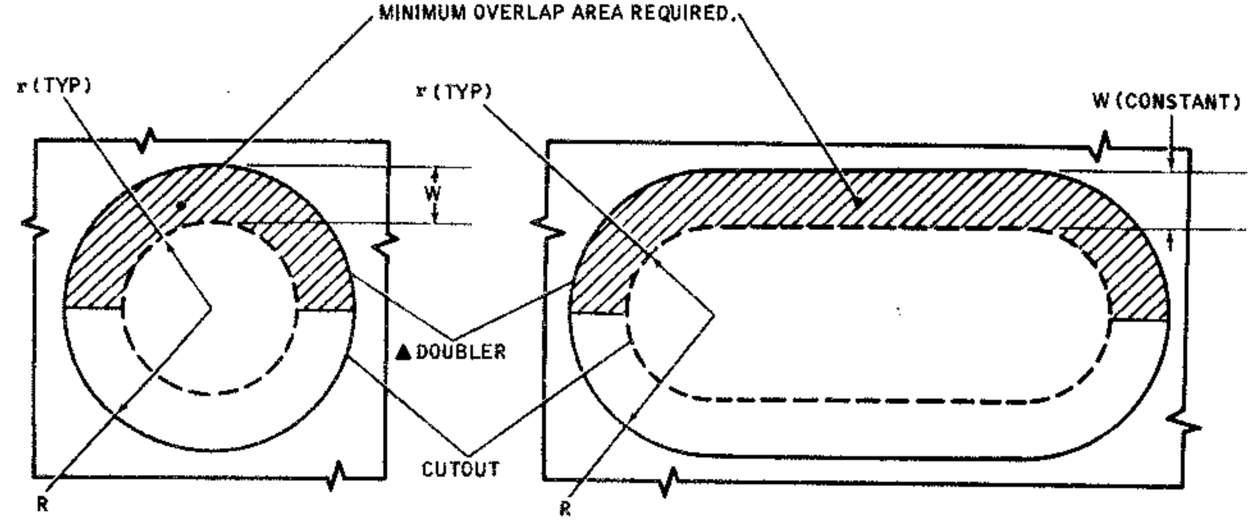
B83-133A

Aluminum Alloy to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 4 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR★

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR
TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.010 TO .016 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE DAMAGED MEMBER, THEN W = 50 T AND THE DOUBLER GAGE SHOULD BE HALVED. INSTALL AN ALUMINUM ALLOY SPACER IN THE CUTOUT.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2-INCH MIN)

W = 100T IN ALUMINUM ALLOY SHEET

T = GAGE OF CUTOUT SHEET

R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

B83-134A

Aluminum Alloy to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 4 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

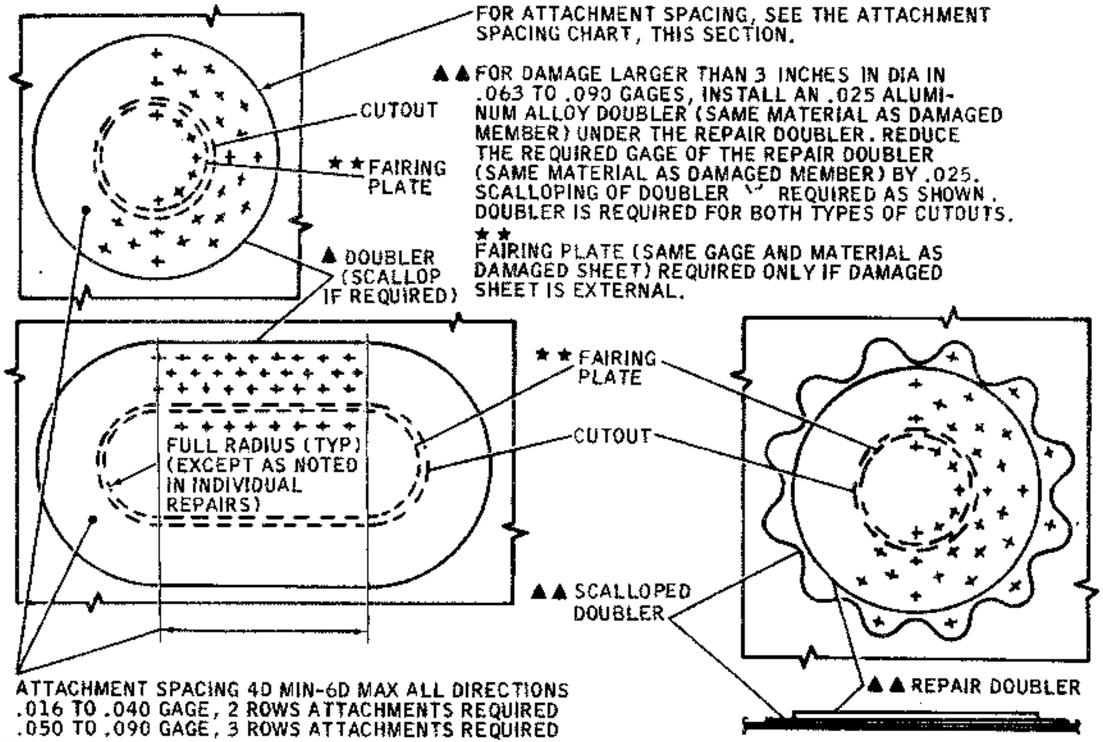
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM ALLOY SHEET

.016 TO .090 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED, AND CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAXIMUM CUTOUT DIAMETER ALLOWABLE IS SHOWN ON THE ATTACHMENT SPACING CHART, THIS SECTION. EXTENSIVE DAMAGE REQUIRES A PRODUCTION TYPE SPLICING OF THE SHEET OR REPLACEMENT OF THE SHEET TO THE NEAREST PRODUCTION SPLICE.
4. GLASS FIBER LAYUP DOUBLERS MAY ALSO BE USED IN CUTOUT REPAIRS UP TO .040 GAGE AS ILLUSTRATED ON ANOTHER ILLUSTRATION, THIS SECTION. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



FOR ATTACHMENT SPACING, SEE THE ATTACHMENT SPACING CHART, THIS SECTION.

▲▲ FOR DAMAGE LARGER THAN 3 INCHES IN DIA IN .063 TO .090 GAGES, INSTALL AN .025 ALUMINUM ALLOY DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) UNDER THE REPAIR DOUBLER. REDUCE THE REQUIRED GAGE OF THE REPAIR DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) BY .025. SCALLOPING OF DOUBLER "✓" REQUIRED AS SHOWN. DOUBLER IS REQUIRED FOR BOTH TYPES OF CUTOUTS.

★★ FAIRING PLATE (SAME GAGE AND MATERIAL AS DAMAGED SHEET) REQUIRED ONLY IF DAMAGED SHEET IS EXTERNAL.

ATTACHMENT SPACING 4D MIN-6D MAX ALL DIRECTIONS
.016 TO .040 GAGE, 2 ROWS ATTACHMENTS REQUIRED
.050 TO .090 GAGE, 3 ROWS ATTACHMENTS REQUIRED

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-135A

Aluminum Alloy to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 4 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

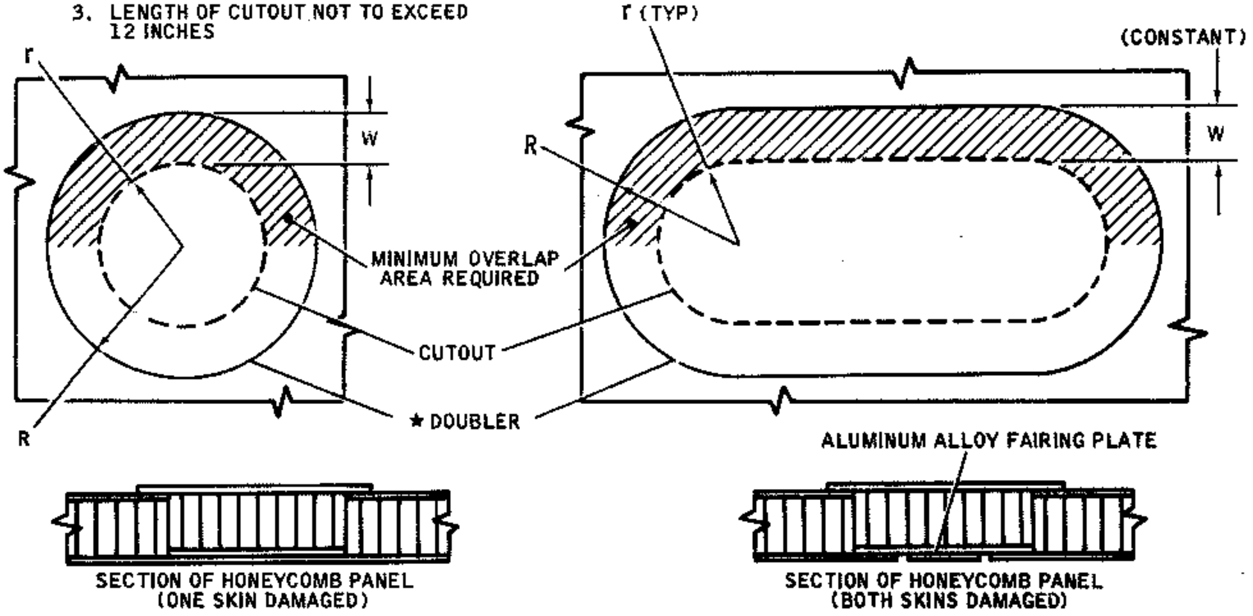
1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE WITH GLASS FIBER LAYUP DOUBLERS, AND REPAIR CORE BONDED PER 51-70-3. SEE SKETCHES BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE DAMAGE IS LARGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THE PANEL SHOULD BE REPLACED.

NOTES:

1. HONEYCOMB PANEL OVERLAPS ARE DETERMINED IN THE SAME MANNER ON BOTH SKINS
2. RADIUS r NOT TO EXCEED 4 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 12 INCHES

r = RADIUS OF CUTOUT
W = 80T
T = GAGE OF CUTOUT SKIN
R = W + r

r MUST BE FULL RADIUS AND NOT LESS THAN 1/2 INCH



DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER AND REPAIR CORE (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED FUSELAGE MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-136A

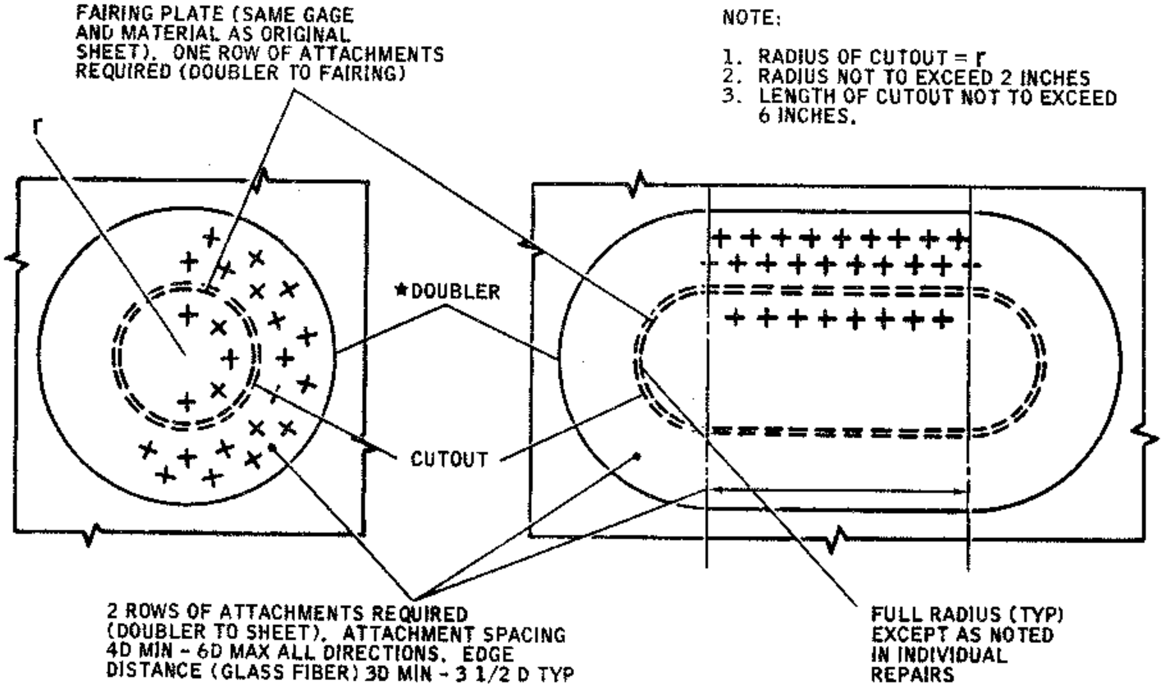
Glass-Fiber Layup to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 5 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY FUSELAGE MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .040 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER AND FAIRING PLATE WITH ATTACHMENTS AND BOND PER 51-70-3. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAKE CERTAIN THAT A FAIRING PLATE IS ATTACHED AND BONDED IN THE CUTOUT. THE FAIRING PLATE WILL STIFFEN THE GLASS FIBER AND WILL SERVE AS SURFACE FOR LAYUP. INSTALL ATTACHMENTS AFTER CURING.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



NOTE:

1. RADIUS OF CUTOUT = r
2. RADIUS NOT TO EXCEED 2 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 6 INCHES.

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED FUSELAGE MEMBERS LISTED IN THE CHART THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-137A

Glass Fiber Layup to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 5 (Sheet 2)

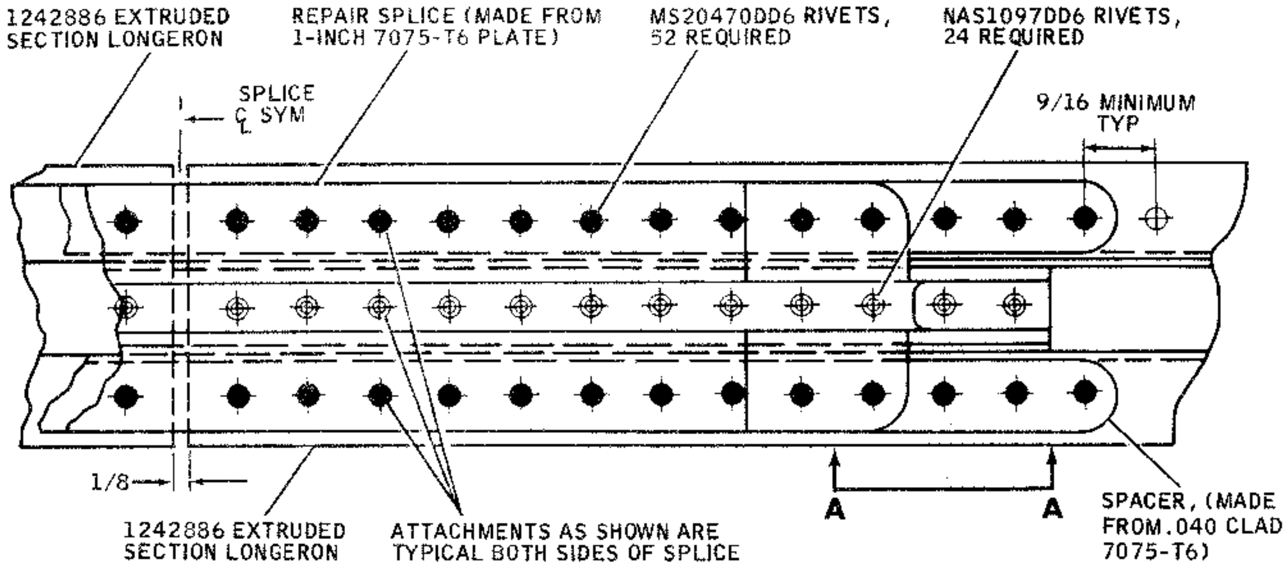
LONGERON REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

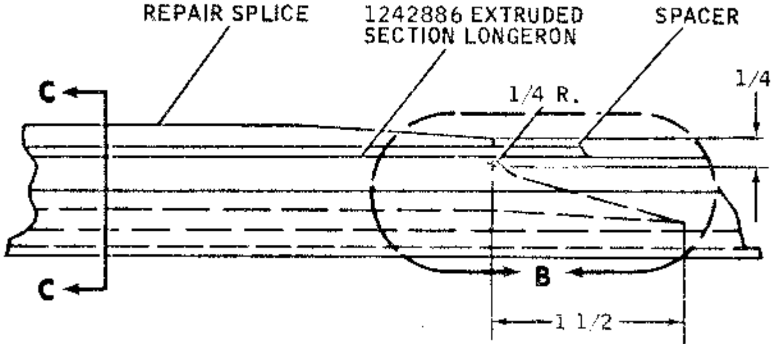
1. General

A. This section describes approved methods of repairing the fuselage longerons. To accomplish a repair, determine the extrusion, formed section, or machined part that the specific longeron is fabricated from by referring to the longeron illustrations for the applicable area where the repair is to be accomplished. Remove the section of longeron that is to be replaced. Install a new section of longeron and refer to the appropriate figure listed below, to accomplish the repair splice.

In cases where the damage requires the removal of only a short piece of longeron, the length of the repair splice may be extended to accommodate a short filler. Make the filler from the same gage and material as original longeron. The attachments that are specified for each end of the splice in the illustration must be used to attach the splice to each section of the existing longeron. The attachments in the filler area must extend through the plating and the splice, as well as the filler.

C. When making longeron repairs, the longeron will normally be cut between frames so that the splice will not conflict with adjacent structure. However, the splice may be located at a frame if space for the splice can be provided. The frame may be reworked to provide this space by appropriate repairs in the manual.





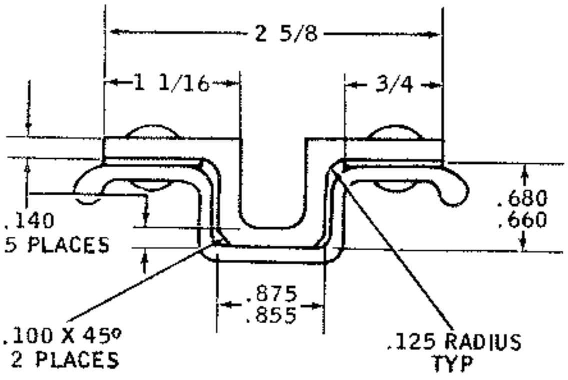
VIEW A-A

RIVET CODE:

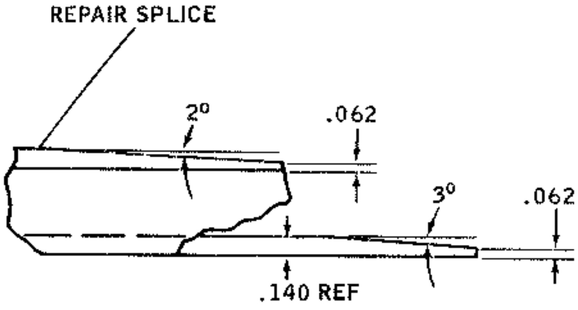
⊕ ORIGINAL RIVET

⊛ ORIGINAL RIVET USED IN REPAIR

● REPAIR RIVET



SECTION C-C

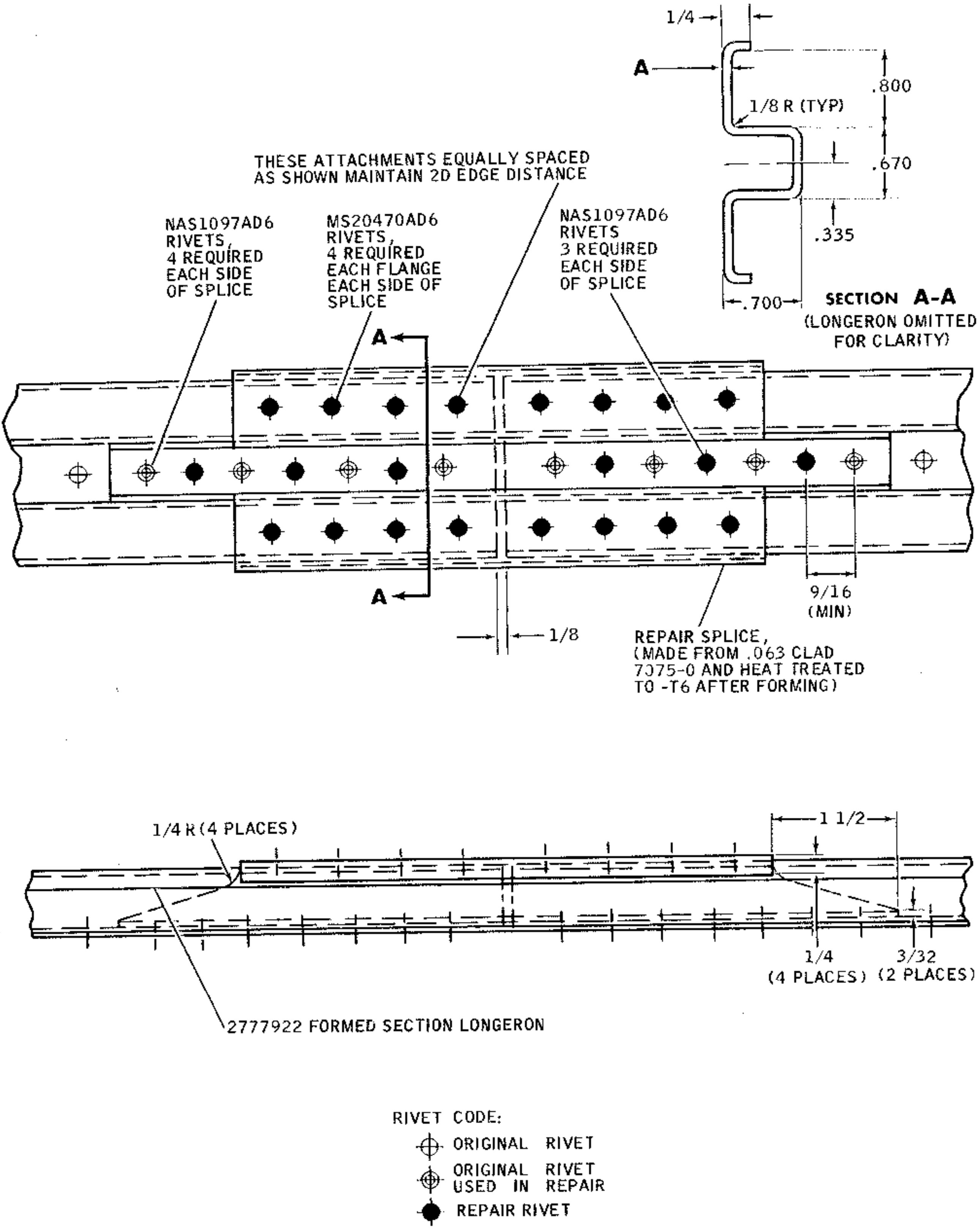


VIEW B

TAPER CUT BOTH ENDS OF REPAIR SPLICE (1242886 EXTRUDED SECTION LONGERON REMOVED FOR CLARITY)

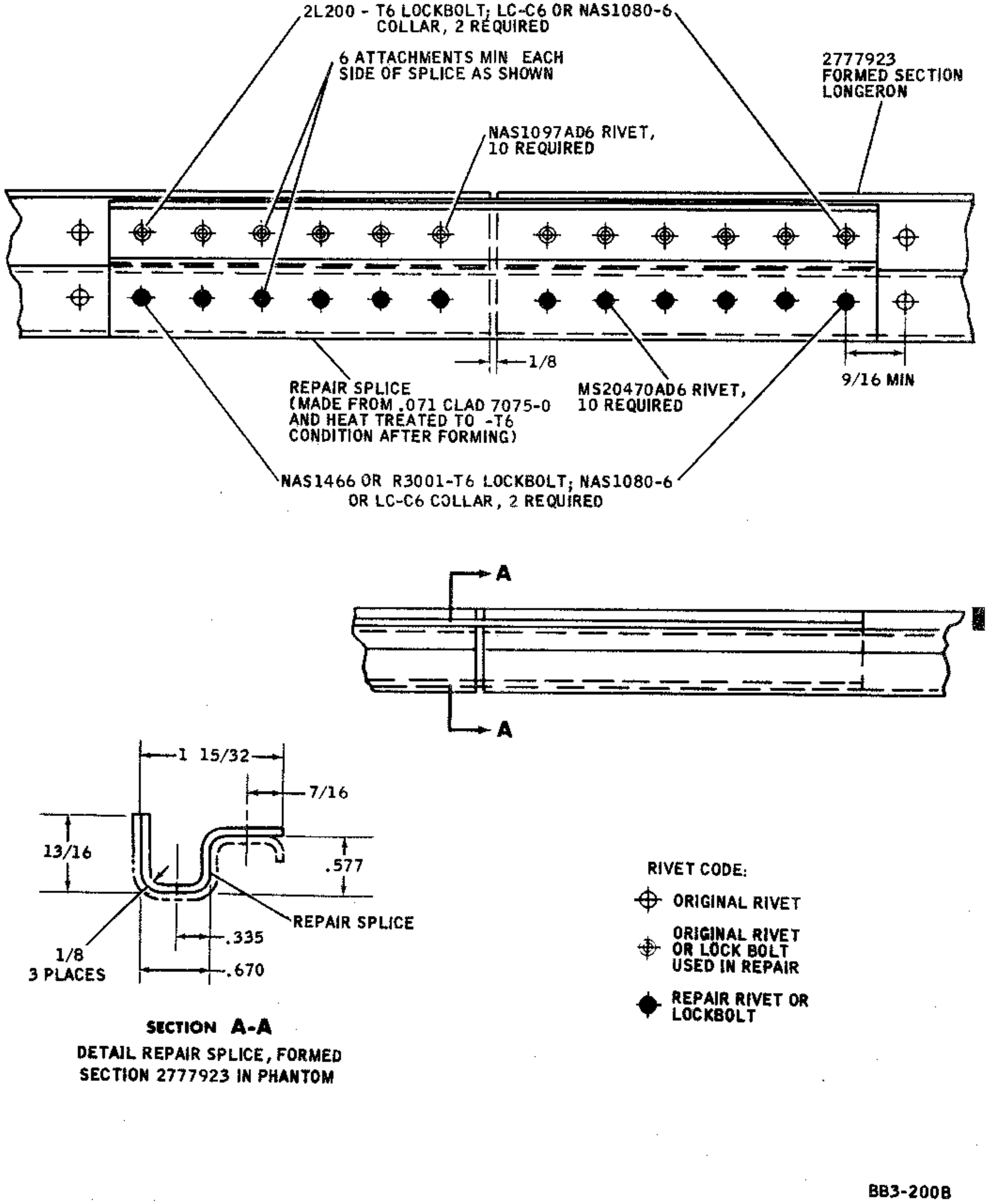
BB3-255B

Longeron (Extrusion No. 1242886) Repair Splice - Class A
Figure 1

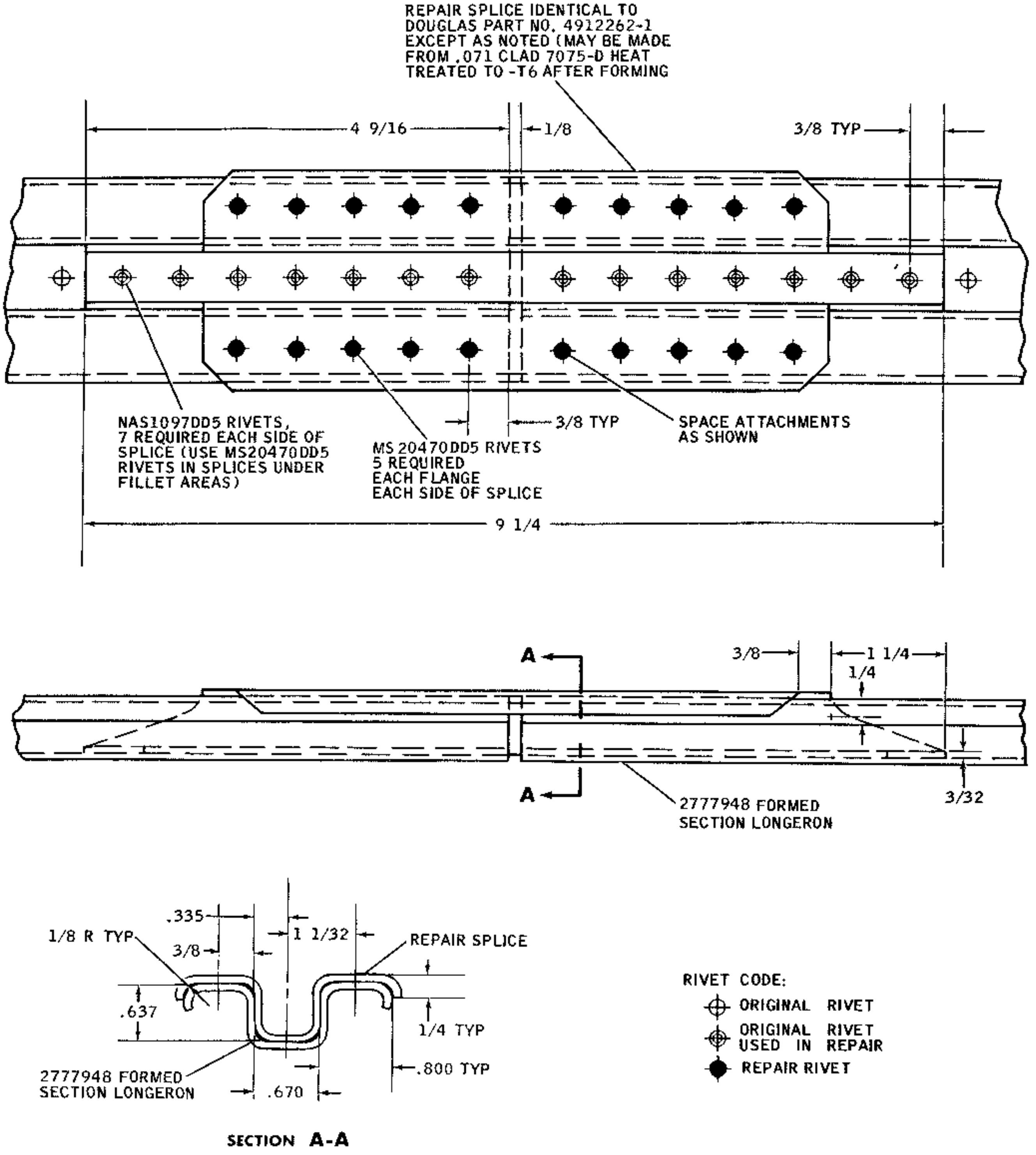


BB3-201A

Longeron (Formed Section 2777922) Repair Splice - Class A
Figure 2

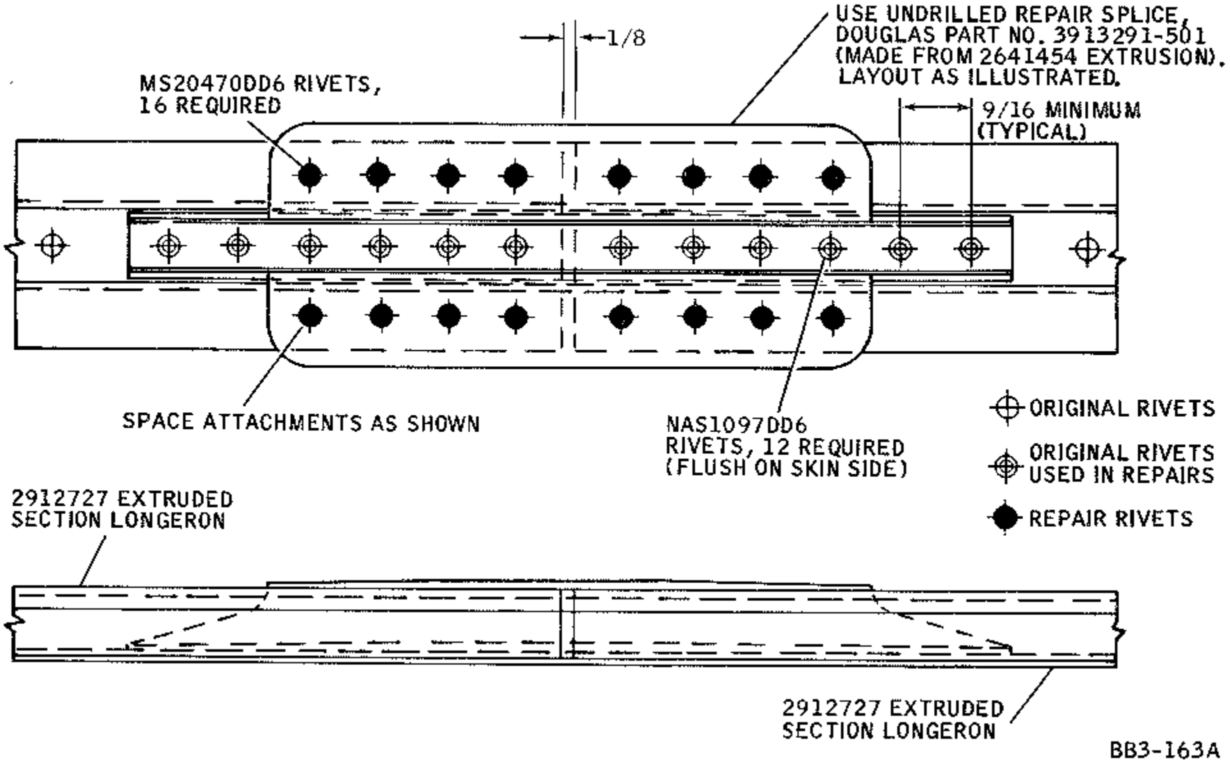


Longeron (Formed Section 2777923) Repair Splice - Class A
Figure 3

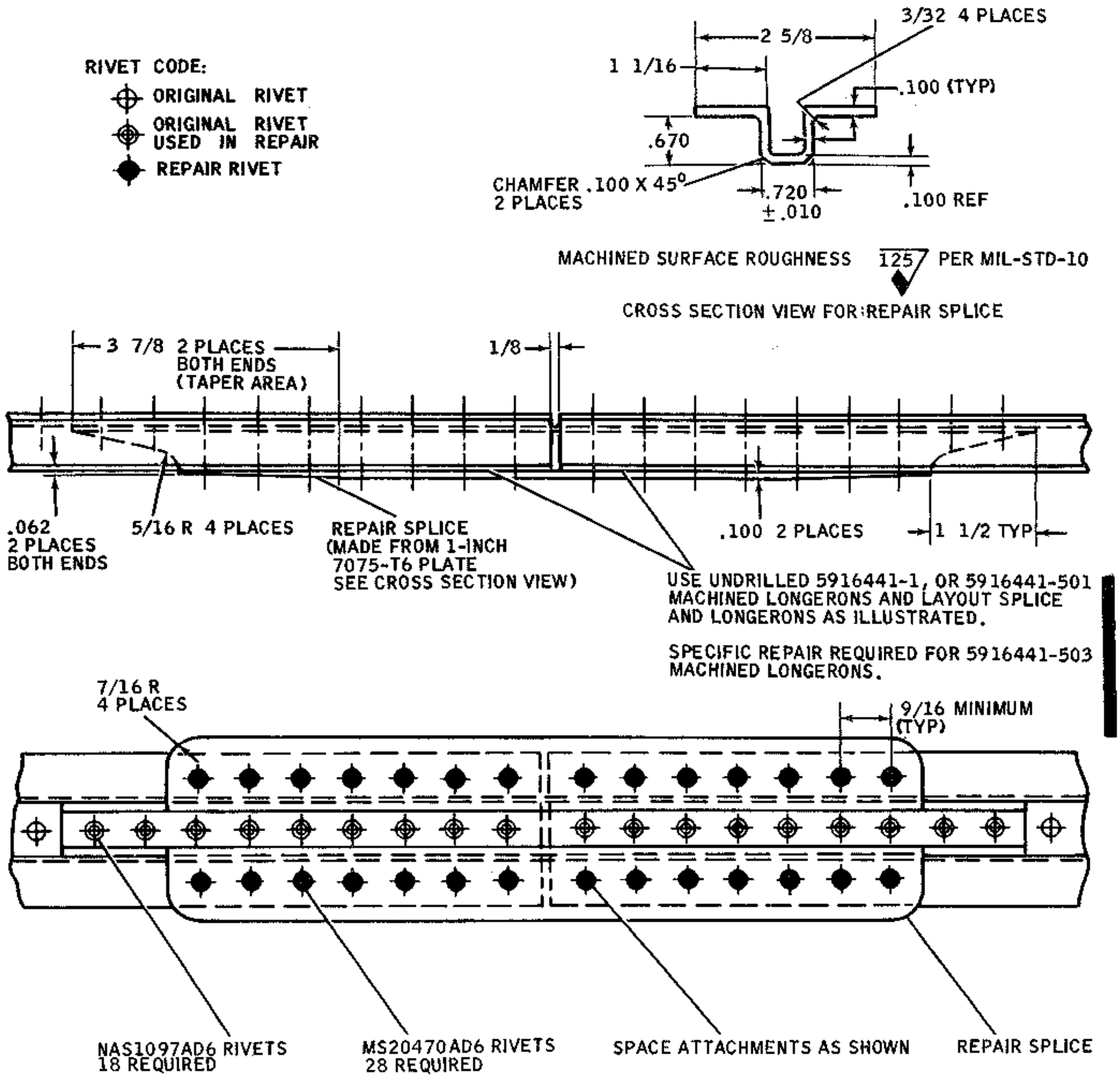


BB3-208

Longeron (Formed Section 2777948) Repair Splice - Class A
Figure 4



Longeron (Extrusion No. 2912727) Repair Splice - Class A
Figure 5



BB3-193A

Longeron (Machined Part Nos.
5916441-1, -2, and -501) Repair Splice - Class A
Figure 6

FRAME AND FORMER REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes approved methods of repairing the fuselage frames and formers. Two methods are generally illustrated and may be used as applicable.

(1) The repair splice method can be used when complete removal of a section of the part is most appropriate. This procedure provides information necessary to splice in a section of a part fabricated similar to the section removed. Refer to the appropriate figure listed below, to accomplish the repair splice.

Rolled Z-Frame Repair Splice (Except Lower Cargo Compartment Strut Area) - Class A.. Figure 1

Rolled Z-Frame Repair Splice (Lower Cargo Compartment Strut Area) - Class A.. Figure 2

Former Repair Splice - Class A.......................... Figure 3

(2) The repair method can be used when the damage is confined to the flange or attaching leg of the part. Refer to the appropriate figure listed below, to accomplish the repair.

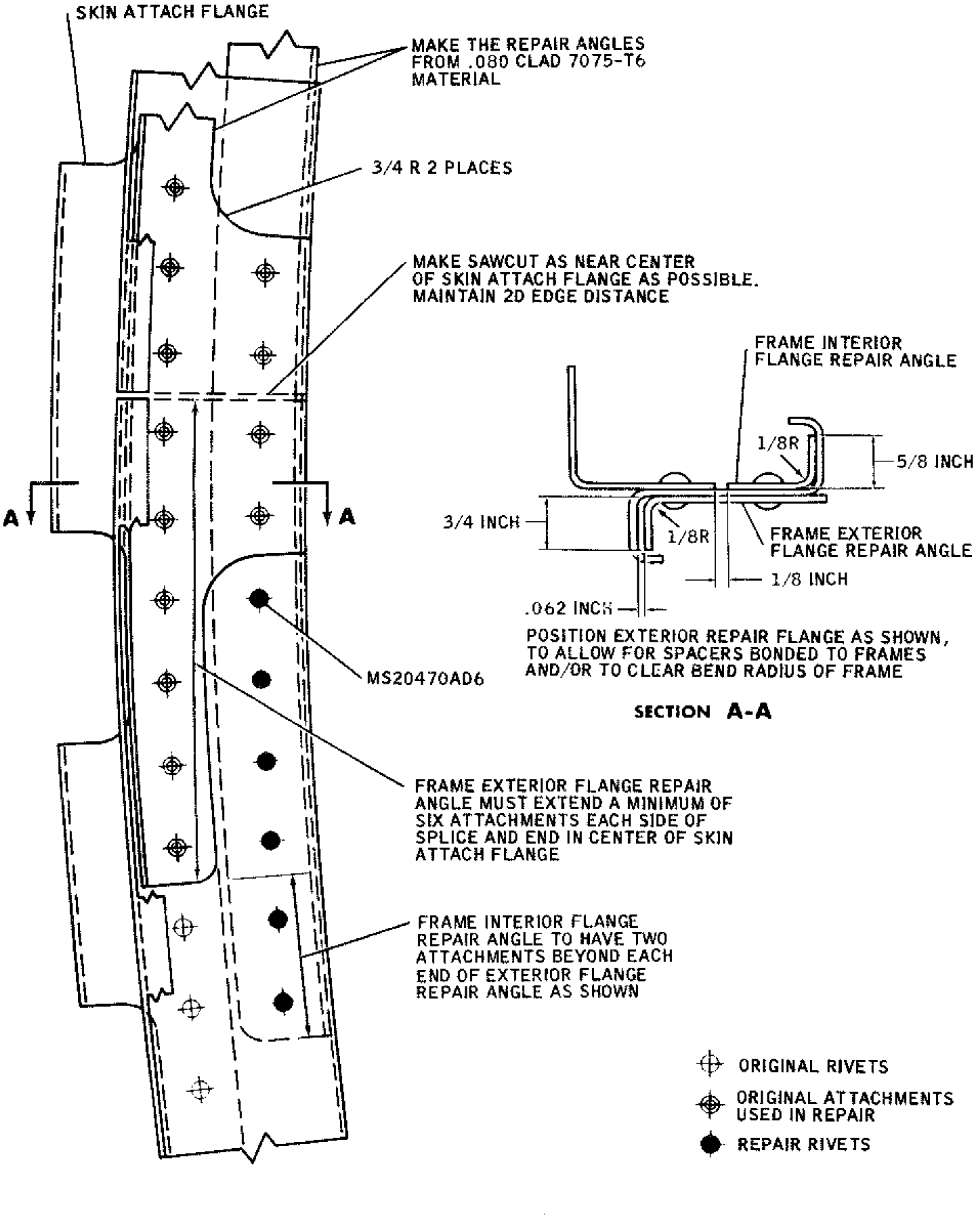
Rolled Z-Frame Flange Repair (Except Lower Cargo Compartment Areas) - Class A.. Figure 4

Rolled Z-Frame Flange Repair (Lower Cargo Compartment Areas) - Class A.. Figure 5

Former Repair (Except Lower Cargo Compartment Area) - Class A .... Figure 6

Former Repair (Lower Cargo Compartment Area) - Class A..... Figure 7

NOTE: Refer to the frame and former illustrations for the applicable frame requiring repair to determine the material that a specific part is made from.



MAKE THE REPAIR ANGLES FROM .080 CLAD 7075-T6 MATERIAL

MAKE SAWCUT AS NEAR CENTER OF SKIN ATTACH FLANGE AS POSSIBLE. MAINTAIN 2D EDGE DISTANCE

POSITION EXTERIOR REPAIR FLANGE AS SHOWN, TO ALLOW FOR SPACERS BONDED TO FRAMES AND/OR TO CLEAR BEND RADIUS OF FRAME

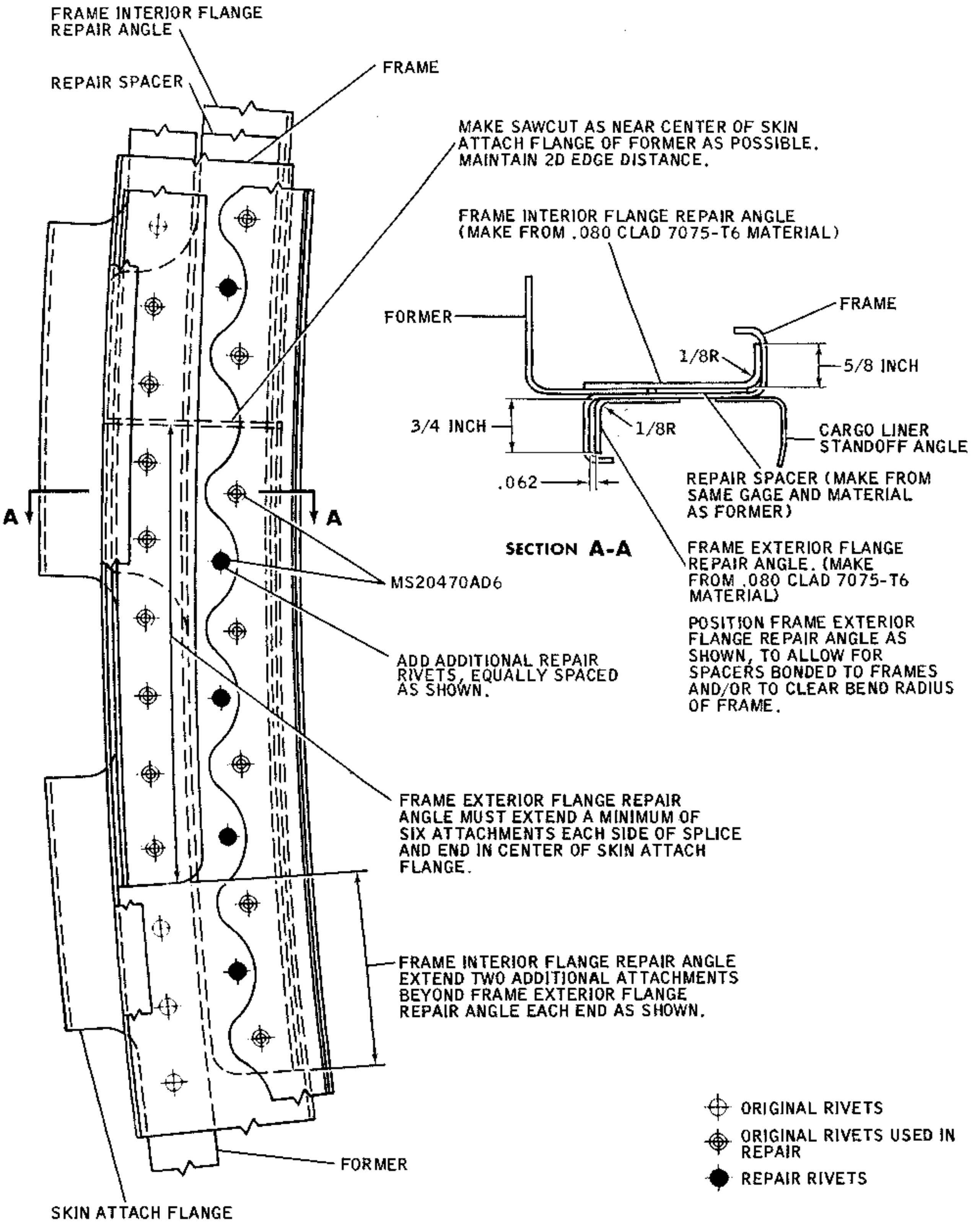
FRAME EXTERIOR FLANGE REPAIR ANGLE MUST EXTEND A MINIMUM OF SIX ATTACHMENTS EACH SIDE OF SPLICE AND END IN CENTER OF SKIN ATTACH FLANGE

FRAME INTERIOR FLANGE REPAIR ANGLE TO HAVE TWO ATTACHMENTS BEYOND EACH END OF EXTERIOR FLANGE REPAIR ANGLE AS SHOWN

Printed in U.S.A.

BB3-298

Rolled Z-Frame Repair Splice
(Except Lower Cargo Compartment Strut Area) - Class A
Figure 1



MAKE SAWCUT AS NEAR CENTER OF SKIN ATTACH FLANGE OF FORMER AS POSSIBLE. MAINTAIN 2D EDGE DISTANCE.

ADD ADDITIONAL REPAIR RIVETS, EQUALLY SPACED AS SHOWN.

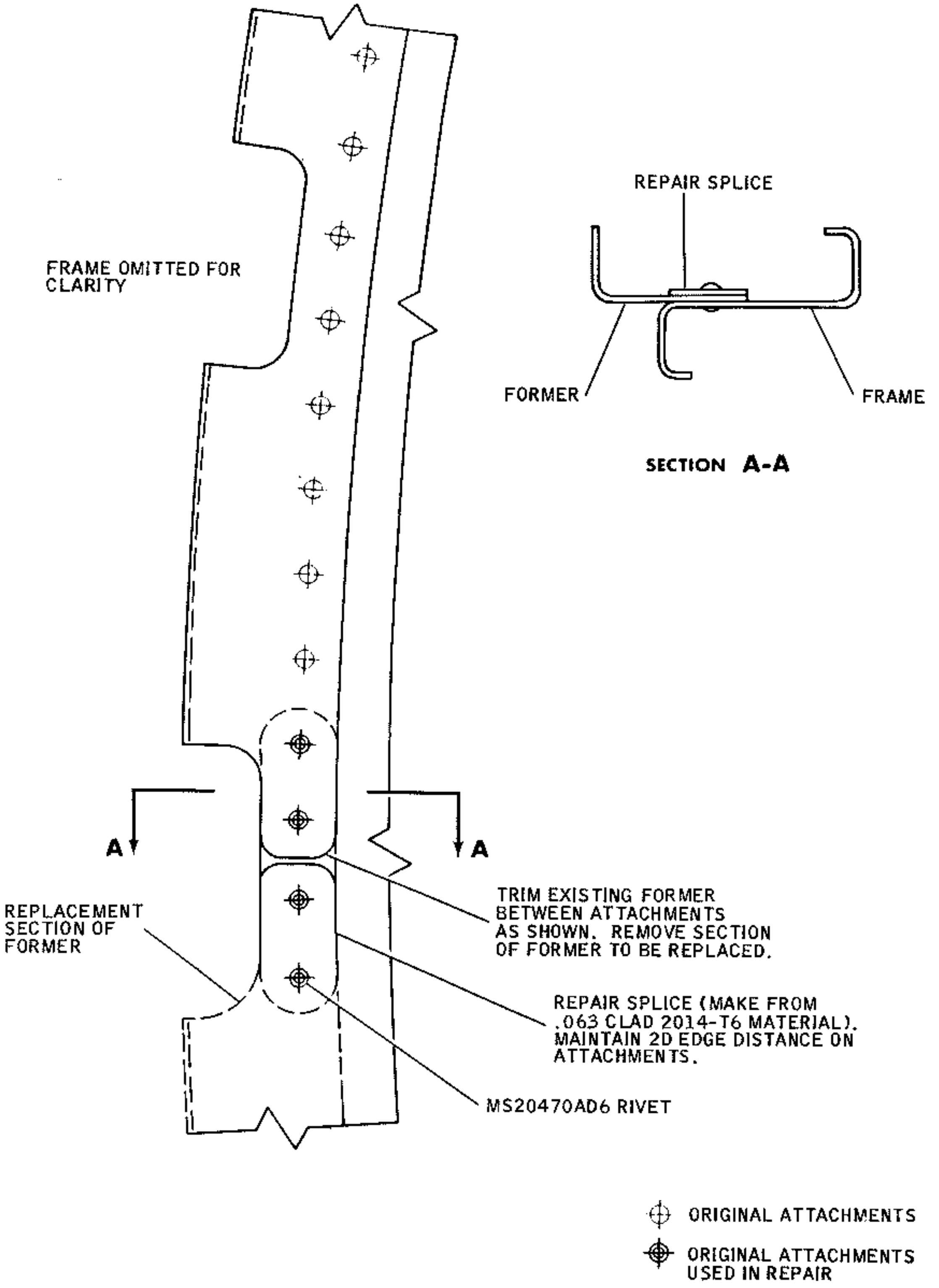
POSITION FRAME EXTERIOR FLANGE REPAIR ANGLE AS SHOWN, TO ALLOW FOR SPACERS BONDED TO FRAMES AND/OR TO CLEAR BEND RADIUS OF FRAME.

FRAME EXTERIOR FLANGE REPAIR ANGLE MUST EXTEND A MINIMUM OF SIX ATTACHMENTS EACH SIDE OF SPLICE AND END IN CENTER OF SKIN ATTACH FLANGE.

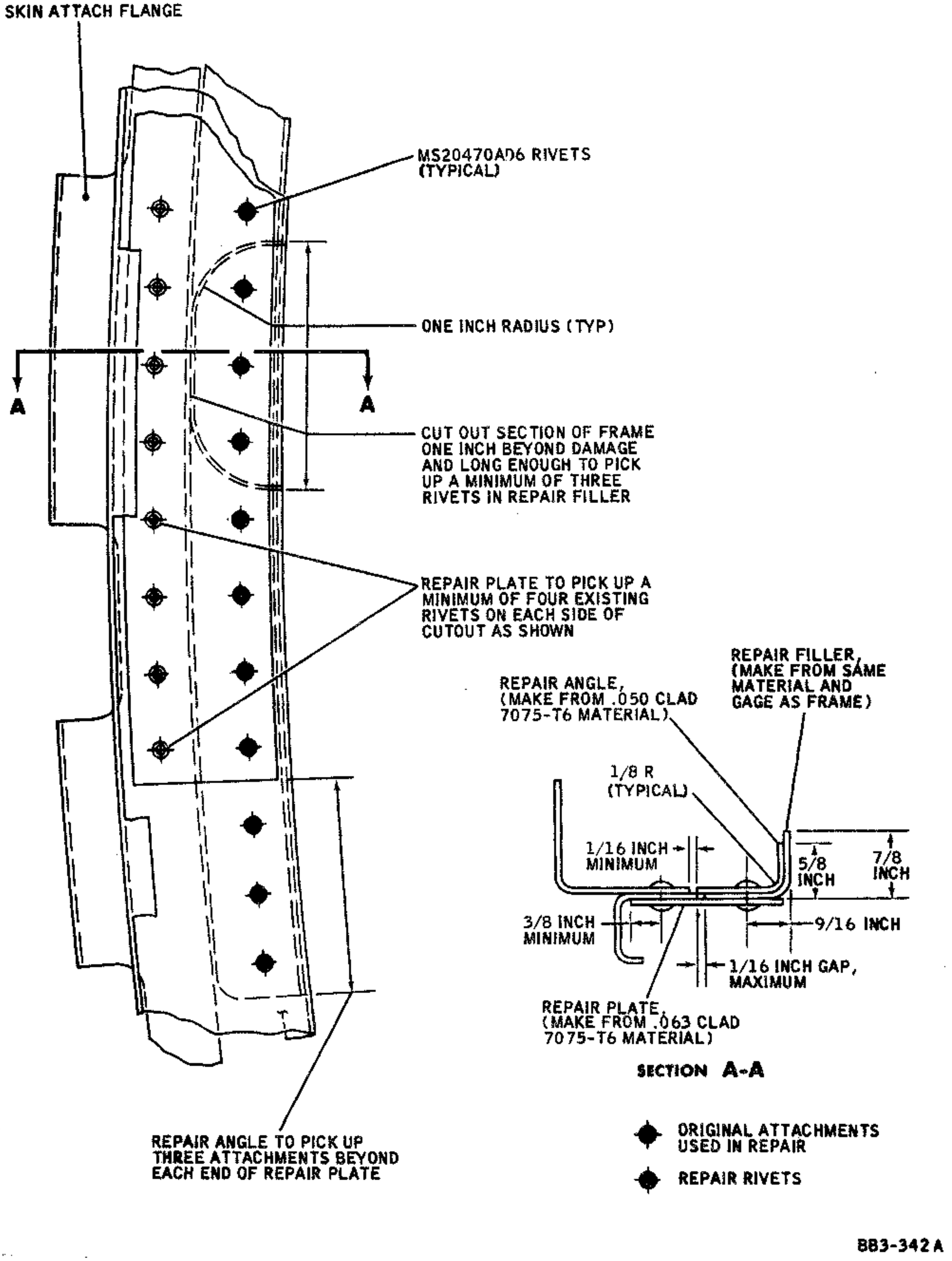
FRAME INTERIOR FLANGE REPAIR ANGLE EXTEND TWO ADDITIONAL ATTACHMENTS BEYOND FRAME EXTERIOR FLANGE REPAIR ANGLE EACH END AS SHOWN.

BB3-299

Rolled Z-Frame Repair Splice
(Lower Cargo Compartment Strut Area) - Class A
Figure 2

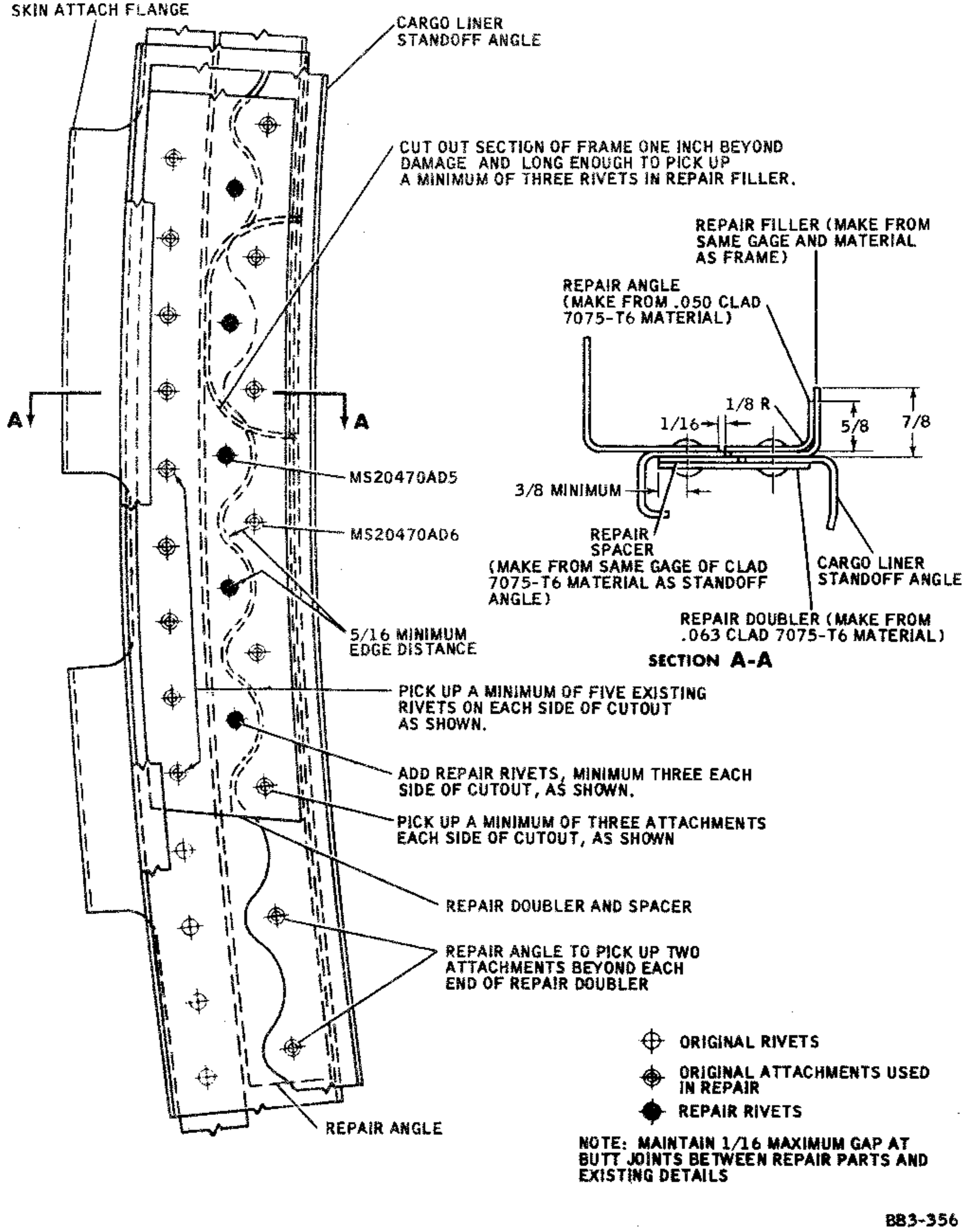


Former Repair Splice - Class A
Figure 3



Printed in U.S.A.

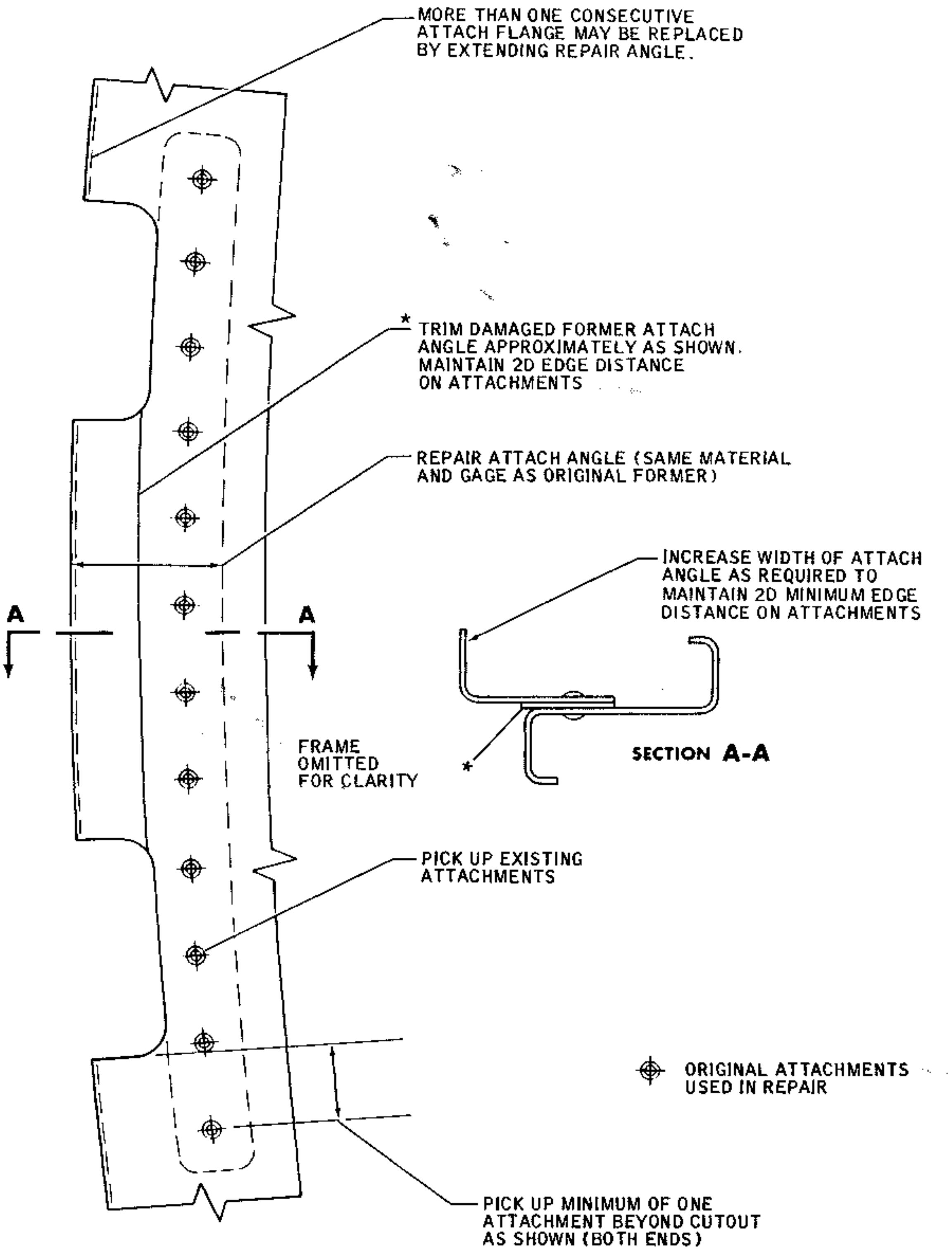
Rolled Z-Frame Flange Repair
(Except Lower Cargo Compartment Areas) - Class A
Figure 4



NOTE: MAINTAIN 1/16 MAXIMUM GAP AT BUTT JOINTS BETWEEN REPAIR PARTS AND EXISTING DETAILS

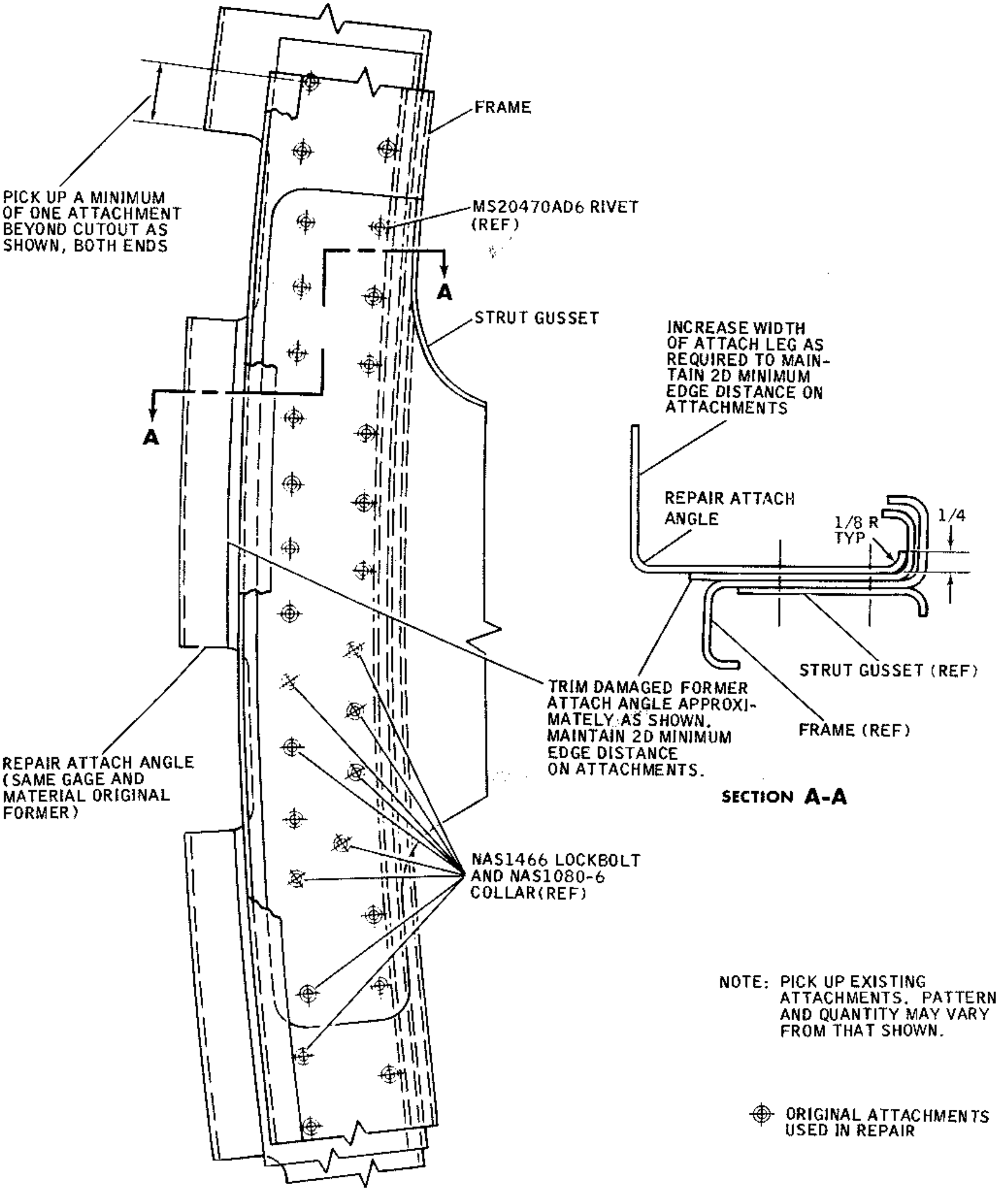
Printed in U.S.A.

Rolled Z-Frame Flange Repair
(Lower Cargo Compartment Areas) - Class A



BB3-296

Former Repair (Except Lower Cargo Compartment Strut Area) - Class A
Figure 6



Printed in U.S.A.

BB3-297

Former Repair (Lower Cargo Compartment Strut Attach Area) - Class A
Figure 7

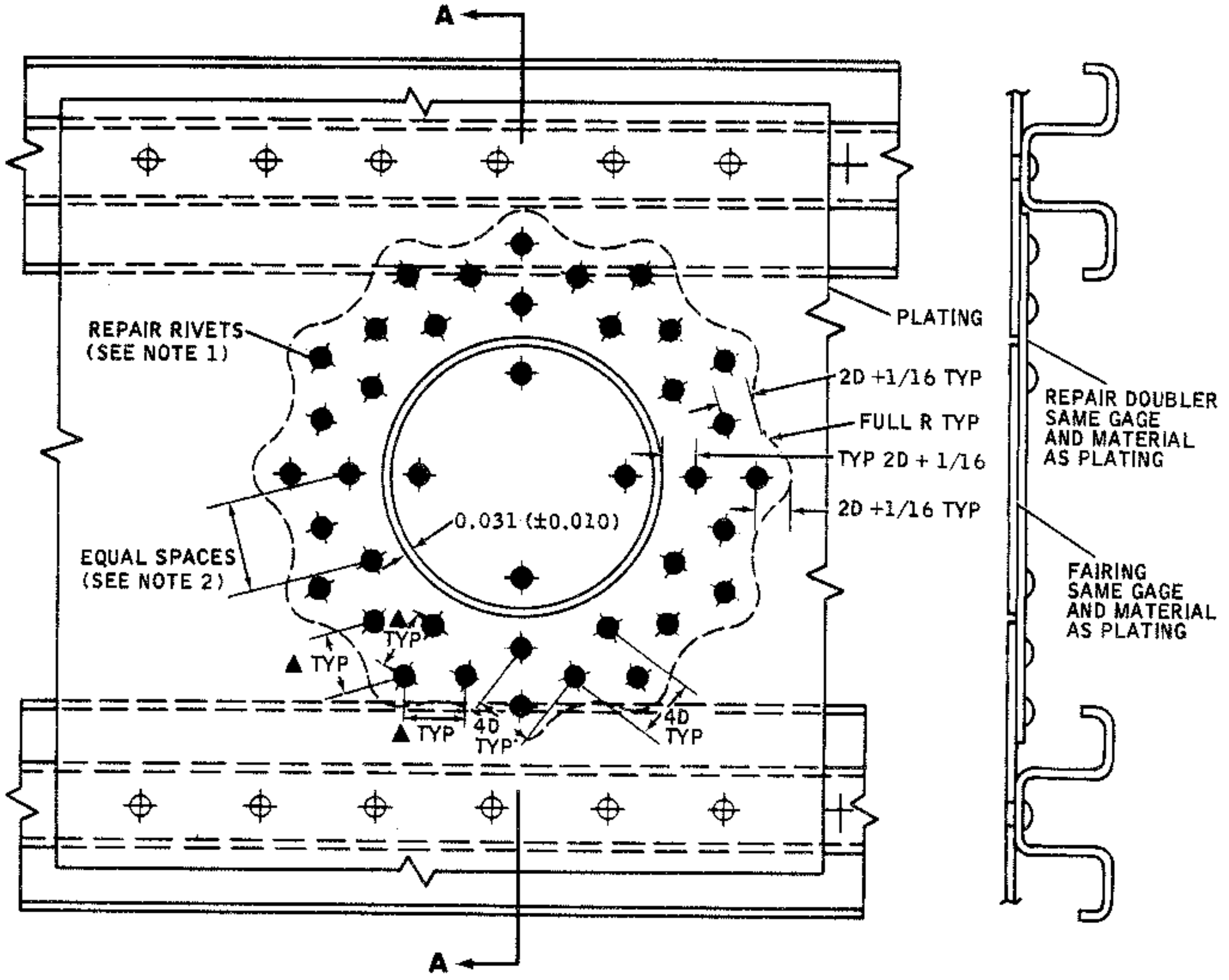
PLATING REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes a method for repairing the fuselage plating. To accomplish a repair, determine the material and gage of the plating being repaired, by referring to the plating illustration for the area requiring repair. Use the same gage and material as plating to make repair doubler and fairing. The repair is approved for .040 and .050 material, where the damaged area can be removed by making a hole and installing a repair doubler which will clear the longerons and adjacent structure (see Figure 2).

Plating Repair Cutout Diameter (Inches)						Attachment Diameter
1 to 1 1/4	1 1/4 to 2	2 to 3 1/4	3 1/4 to 5 1/4	5 1/4 to 7	7 to 11	1/8
1 to 1 3/4	1 3/4 to 3	3 to 4	4 to 6 1/2	6 1/2 to 9	9 to 13 3/4	5/32
8 Equal spaces	12 Equal spaces	16 Equal spaces	24 Equal spaces	36 Equal spaces	48 Equal spaces	

Attachment Spacing Chart
Figure 1



SECTION A-A
(CURVATURE OMITTED)

NOTES:

1. THREE ROWS REQUIRED. FOR .040 MATERIAL USE NAS1097AD4. FOR .050 MATERIAL USE NAS1097AD5.
2. SEE ATTACHMENT SPACING CHART, FIGURE 1, FOR NUMBER OF EQUAL SPACES.
3. ▲ WHEN LOCATING THE THIRD ROW OF ATTACHMENTS, SPACING MUST BE 4D OR GREATER IN ALL THREE DIRECTIONS; NEVER LESS THAN 4D.
4. 3-INCH MAXIMUM DIMENSION PERMISSIBLE.

RIVET CODE:

⊕ ORIGINAL RIVET

⊕ ORIGINAL RIVET USED IN REPAIR

● REPAIR RIVET

BB3-271A

Plating Repairs
Figure 2

MISCELLANEOUS REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes miscellaneous repairs for specific structural components, such as floor panels, seat tracks, and cargo compartment lining panels.

2. Floor Panel Repairs

A. The floor panel repairs listed below are provided for use, as applicable.

Fuselage Floor Panel Repair - Class A	Figure 1
Fuselage Floor Panel Repair (Floor Beam or Cusp Sheet Area)-Class A	Figure 2
Fuselage Floor Panel Repairs - Class B	Figure 3

(1) If the panel damage is greater than 8 inches in any direction, it is recommended that the panel be replaced. A 1-inch plywood panel may be used as a temporary installation.

(2) If three adjacent hats are damaged, they should be replaced. Bond the new hat sections to the floor panel in accordance with repair bonding and cementing instructions in Chapter 51.

(3) The repairs illustrated in Figures 1 and 2 may be accomplished according to the metal-to-metal bonding procedures in Chapter 51. In this repair, all rivets may be omitted, except those at the ends of the original and repair hat sections.

3. Seat Track Repairs

A. Seat tracks are repaired utilizing the repair splices illustrated in Figure 4. Sheet 1 of the illustration is to be used for repair splices in all areas except from Station 585 to 642. Sheet 2 of the illustration is to be used for repair splices between Stations 585 and 642.

B. To repair a seat track, determine the extrusion number from which the specific tract is fabricated by referring to the illustrations designating the appropriate seat track extrusion number. Remove the section of track that is to be replaced. Locate each splice so that it will not conflict with floor beams and other adjacent structure, or be closer than 20 inches from another splice (existing or repair).

4. Cargo Compartment Lining Repairs

A. Several cargo compartment lining repairs are provided for use, as described below.

(1) Damaged areas of less than 4 x 4 inches may be repaired using the quick-patch repair method illustrated in Figure 5.

(a) Make the quick patch from 0.028 Stratoglass pressure-sensitive liner (Air Logistics Co., Paraglas Div., 3600 E. Foothill Blvd., Pasadena, Calif.).

(b) The quick patch must be trimmed to extend at least 1 inch beyond the damage in all directions.

(2) Damaged areas less than 6 inches in diameter may be repaired by the glass-fiber layup method illustrated in Figure 6. Damaged glass fiber panels which have damaged areas larger than 6 inches should be replaced. Refer to Chapter 51 for glass fiber bonding procedures.

(3) The cargo lining can be repaired on an interim basis as illustrated in Figure 7.

NOTE: When locating and drilling the doubler attach holes, avoid conflict with adjacent frames and other structure.

5. Door Jamb Seal Depressor Repairs

A. The seal depressor repairs listed below are provided for use, as applicable.

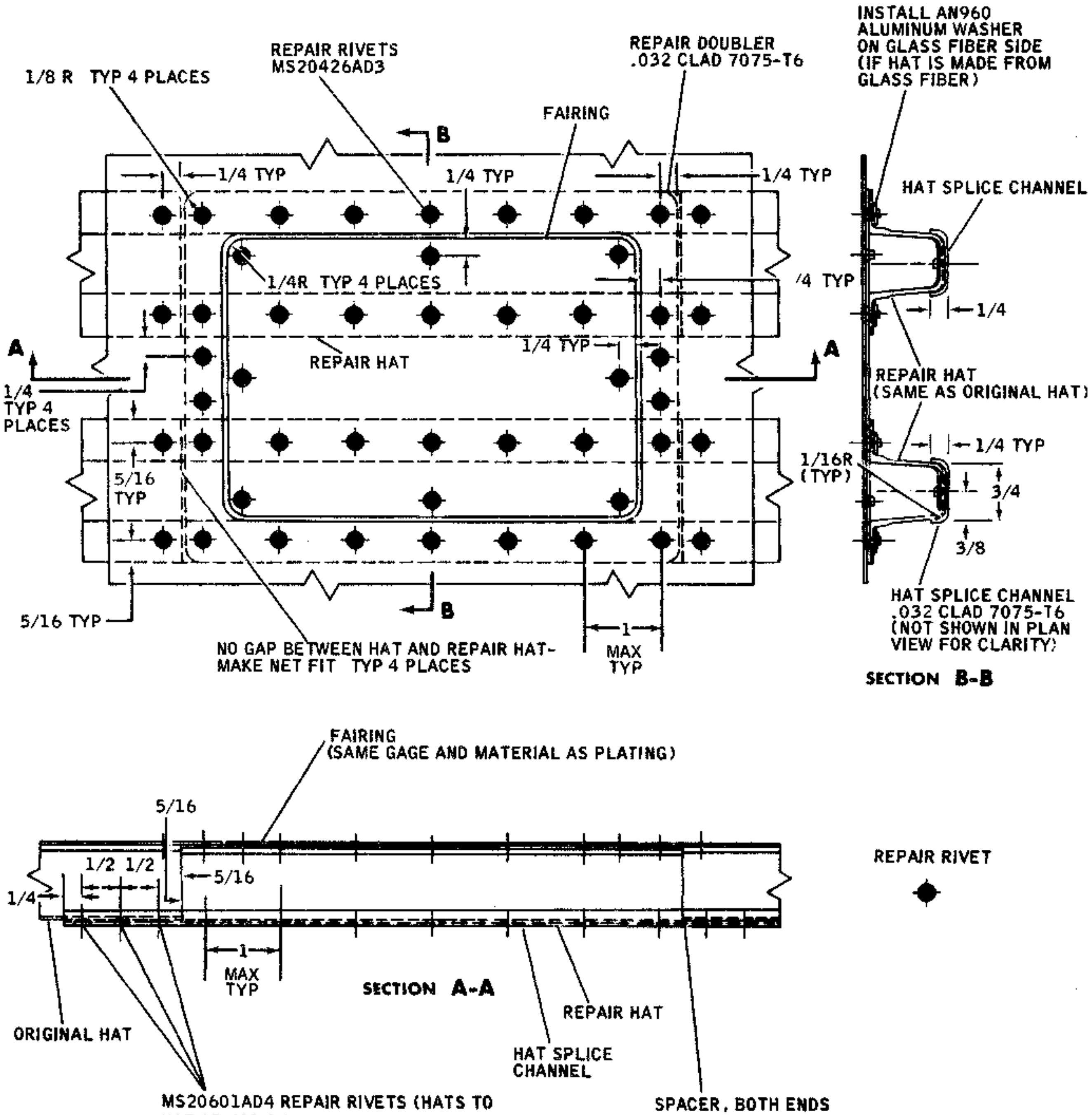
Door Jamb Seal Depressor Repair - Class A	Figure 8
Door Jamb Seal Depressor Repair - Class B	Figure 9

6. Node-Attached Molded Rubber Seal Repair

A. Sections of node-attached molded rubber seal may be removed and replaced as illustrated in Figure 10.

7. Door Area Plating Repair

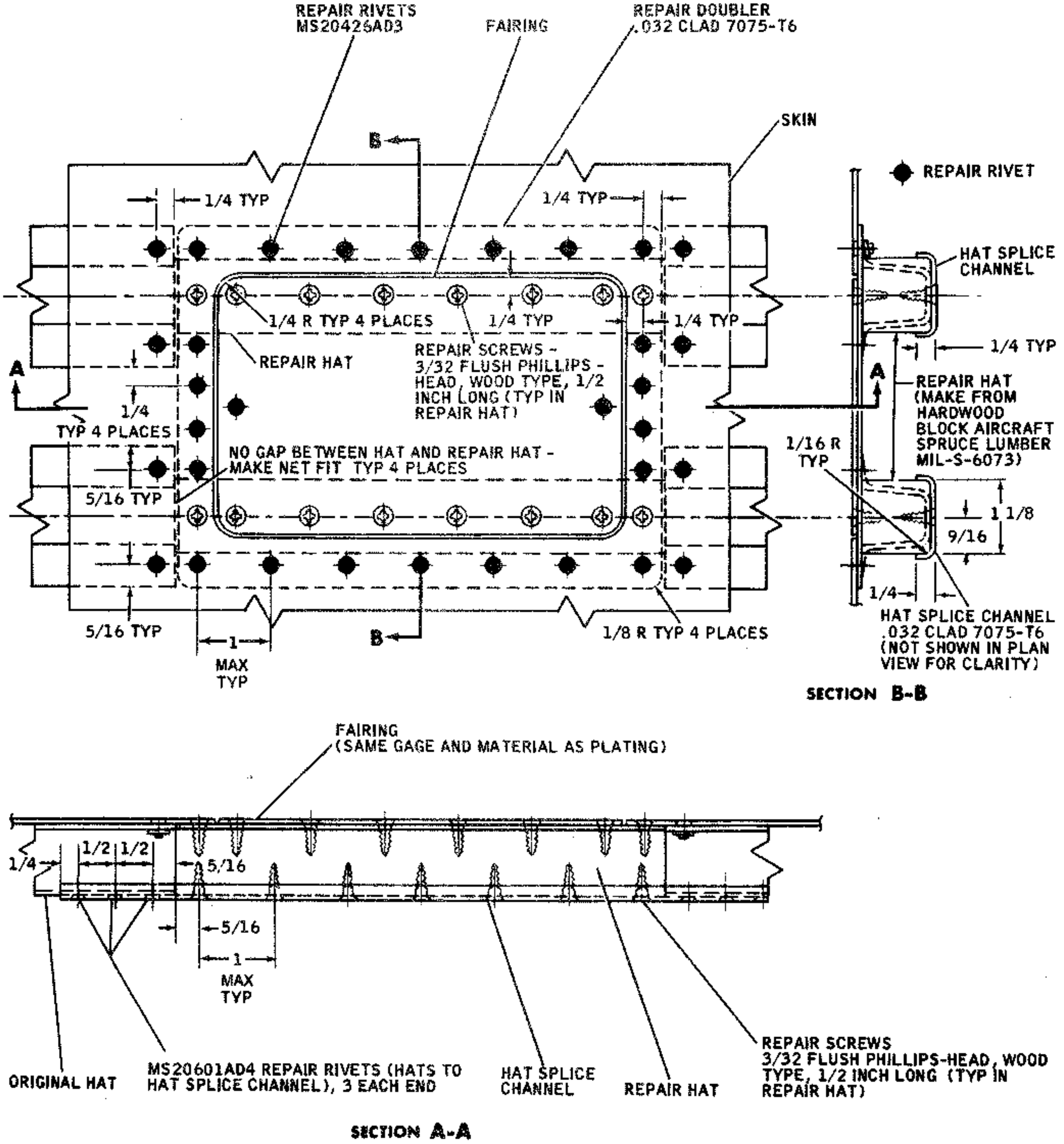
A. Repair of damaged sections of plating in door areas is illustrated in Figure 11.



BB3-148A

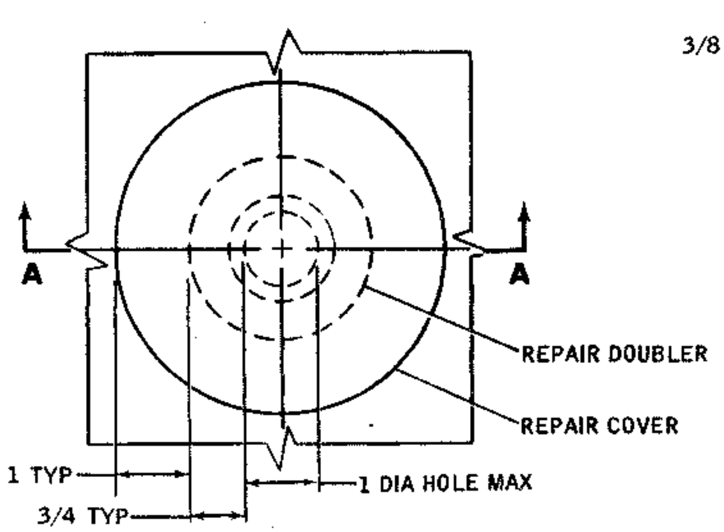
Fuselage Floor Panel Repair - Class A
Figure 1

Printed in U.S.A.

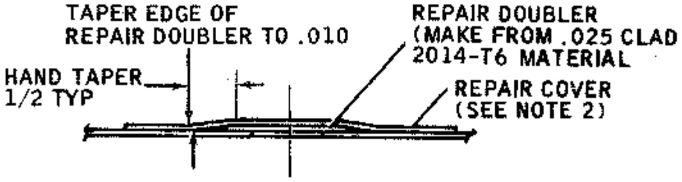


8B3-149A

Fuselage Floor Panel Repair
(Floor Beam or Cusp Sheet Area) - Class A
Figure 2

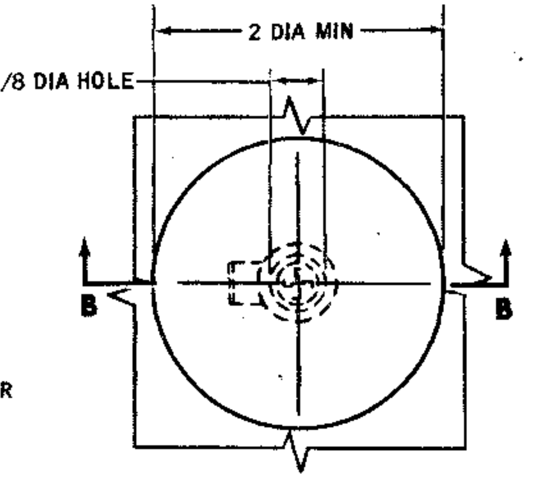


VIEW LOOKING DOWN

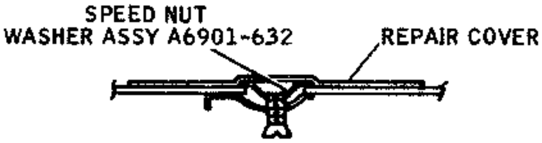


SECTION A-A

EXAMPLE B REPAIR



VIEW LOOKING DOWN



SECTION B-B

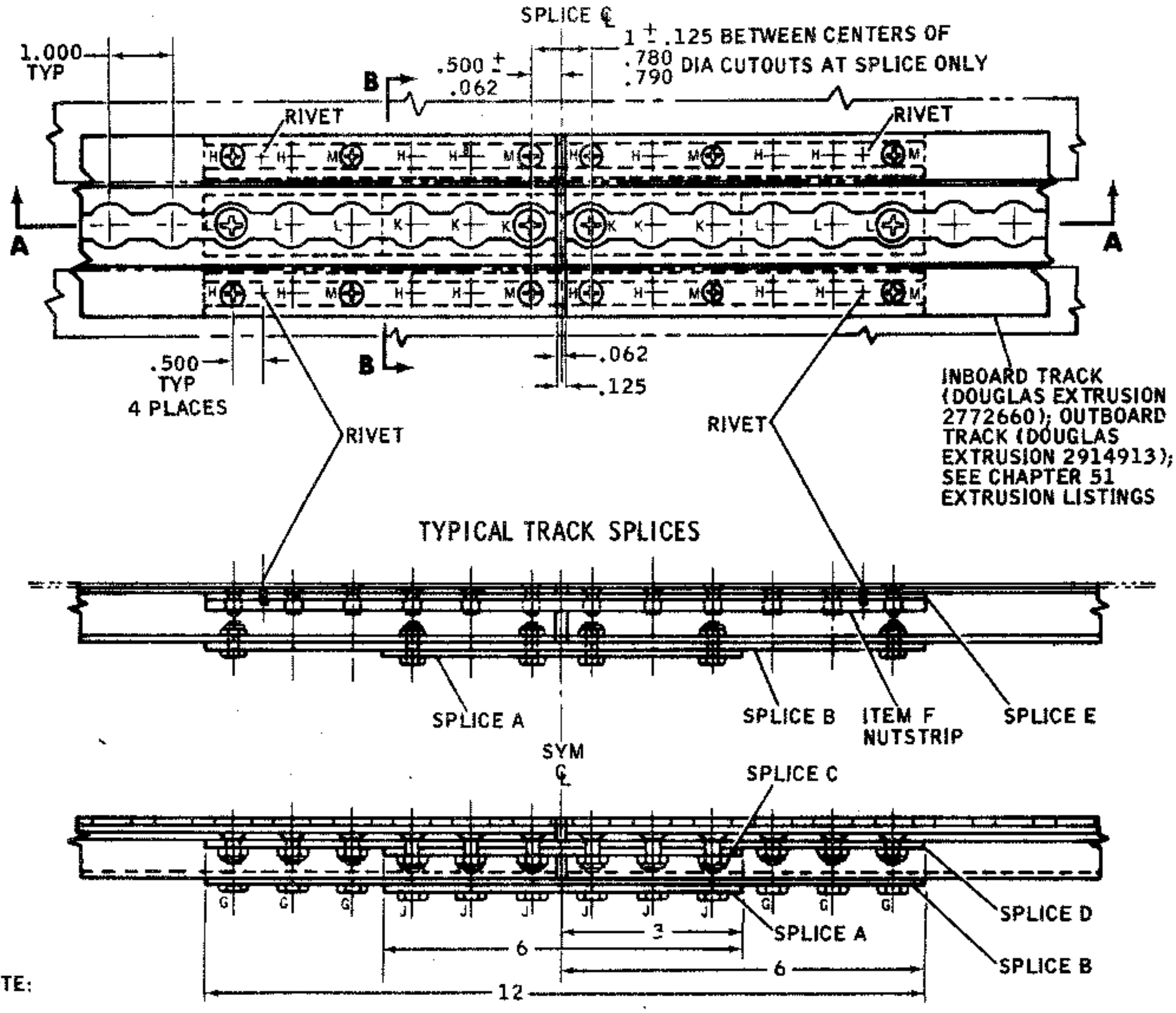
EXAMPLE A REPAIR

NOTES:

1. TINNERMAN SPEED NUT WASHER ASSEMBLY A6901-632 MAY BE PURCHASED FROM TINNERMAN PRODUCTS, INC., CLEVELAND, OHIO.
2. REPAIR COVERS SHOULD BE MADE FROM PERMACEL 68-W TAPE. THE TAPE MAY BE PURCHASED FROM THE PERMACEL TAPE CORP., NEW BRUNSWICK, NEW JERSEY. IF AVAILABLE TAPE IS NOT AS WIDE AS IS REQUIRED, THEN TWO OR MORE PIECES MAY BE BUTTED TOGETHER TO MAKE THE COVER. DO NOT OVERLAP THE PIECES.

BB3-1508

Fuselage Floor Panel Repairs - Class B
Figure 3



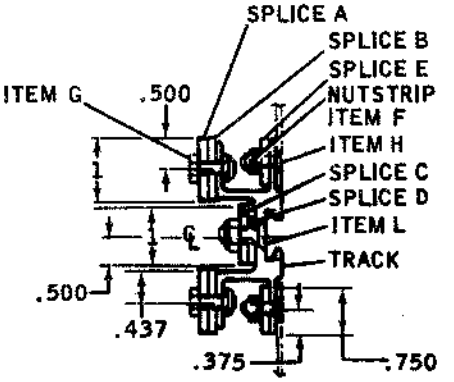
SECTION A-A

NOTE:

NAS 1103 BOLTS USE NAS679A3 NUTS AND NAS1252-10L WASHERS; NAS1204 BOLTS USE NAS679A4 NUTS AND NAS1252-416L WASHERS

ITEM	NOMENCLATURE	GAGE	MATERIAL
A	SPLICE	0.125	CLAD 7075-T6
B	SPLICE	0.125	CLAD 7075-T6
C	SPLICE	0.160	CLAD 7075-T6
D	SPLICE	0.160	CLAD 7075-T6
E	SPLICE	0.100	CLAD 7075-T6
* F	NUTSTRIP		G1000-3-8

ITEM	TYPE OF FASTENER
G	NAS 1103-4 BOLT
H	NAS 1203-4 BOLT
J	NAS 1103-6 BOLT
K	NAS 1204-6 BOLT
L	NAS 1204-4 BOLT
M	NAS 1203-5 BOLT



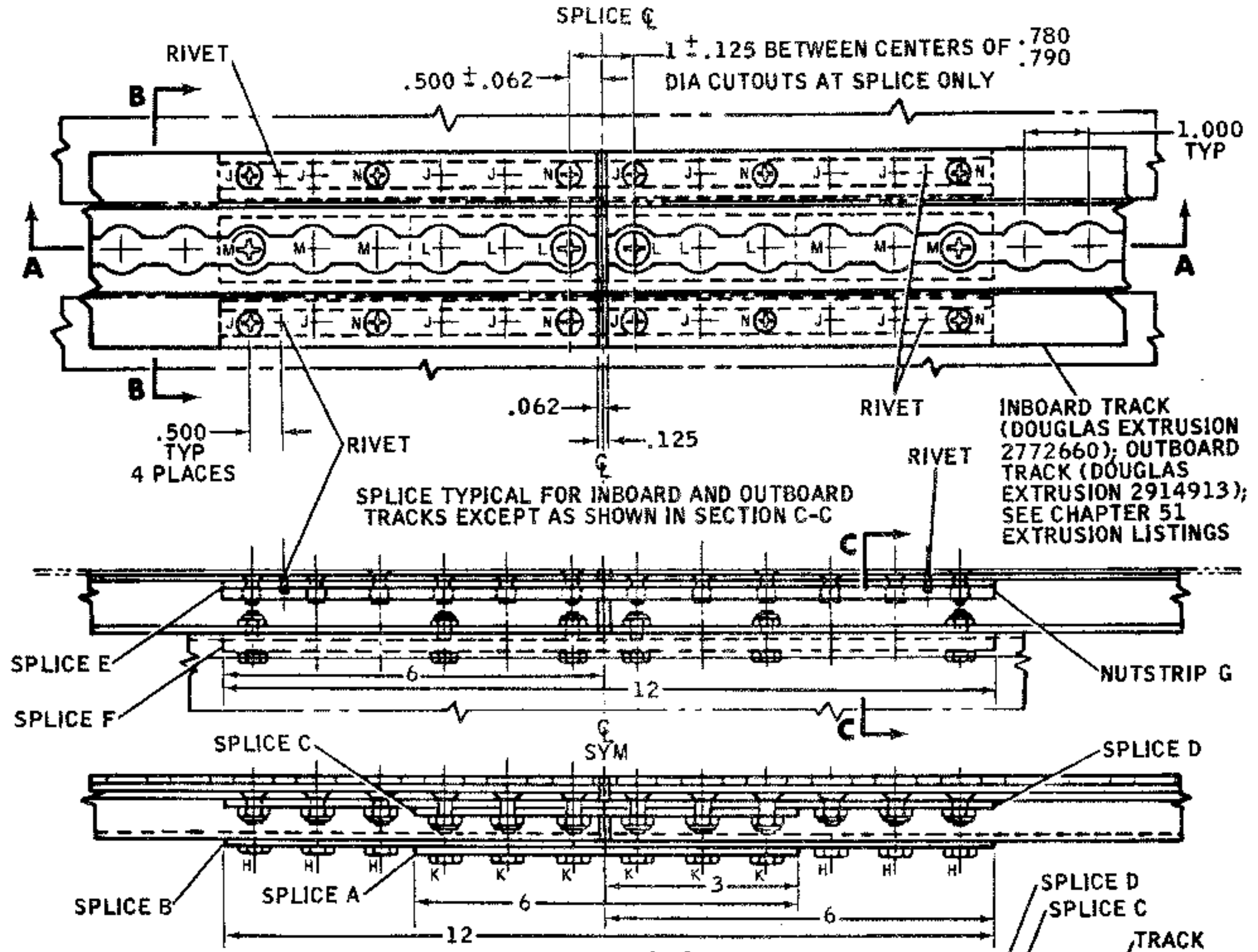
SECTION B-B
TYPICAL TRACK SPLICE
(NOT USED BETWEEN STA 585 AND 642 INBOARD AND OUTBOARD TRACK)

*NUTSTRIP (KAYNAR MFG CO, FULLERTON, CALIF), OR EQUIVALENT

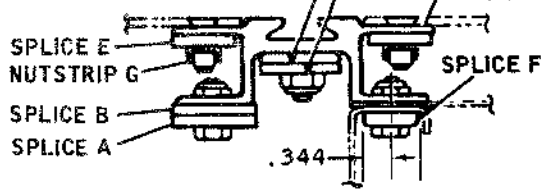
BB3-98A

Printed in U.S.A.

Seat Track Repair Splice
Figure 4 (Sheet 1)



SECTION A-A



SECTION C-C
TYPICAL FOR OUTBOARD TRACK ONLY
(STA 585 THRU 642)

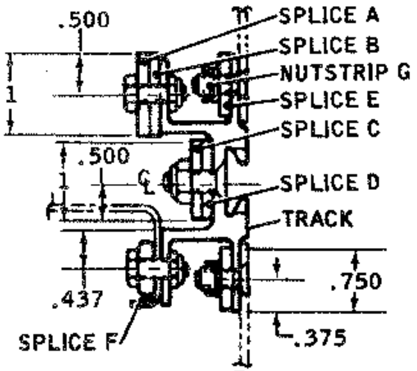
NOTE:

NAS1103 BOLTS USE NAS679A3 NUTS AND NAS1252-10L WASHERS
NAS1204 BOLTS USE NAS679A4 NUTS AND NAS1252-416L WASHERS

ITEM	NOMENCLATURE	GAGE	MATERIAL
A	SPLICE	0.125	CLAD 7075-T6
B	SPLICE	0.125	CLAD 7075-T6
C	SPLICE	0.160	CLAD 7075-T6
D	SPLICE	0.160	CLAD 7075-T6
E	SPLICE	0.100	CLAD 7075-T6
F	SPLICE	—	1651402
* G	NUTSTRIP	—	G1000-3-8

ITEM	TYPE OF FASTENER
H	NAS 1103-4 BOLT
J	NAS 1203-4 BOLT
K	NAS 1103-6 BOLT
L	NAS 1204-6 BOLT
M	NAS 1204-4 BOLT
N	NAS 1203-5 BOLT

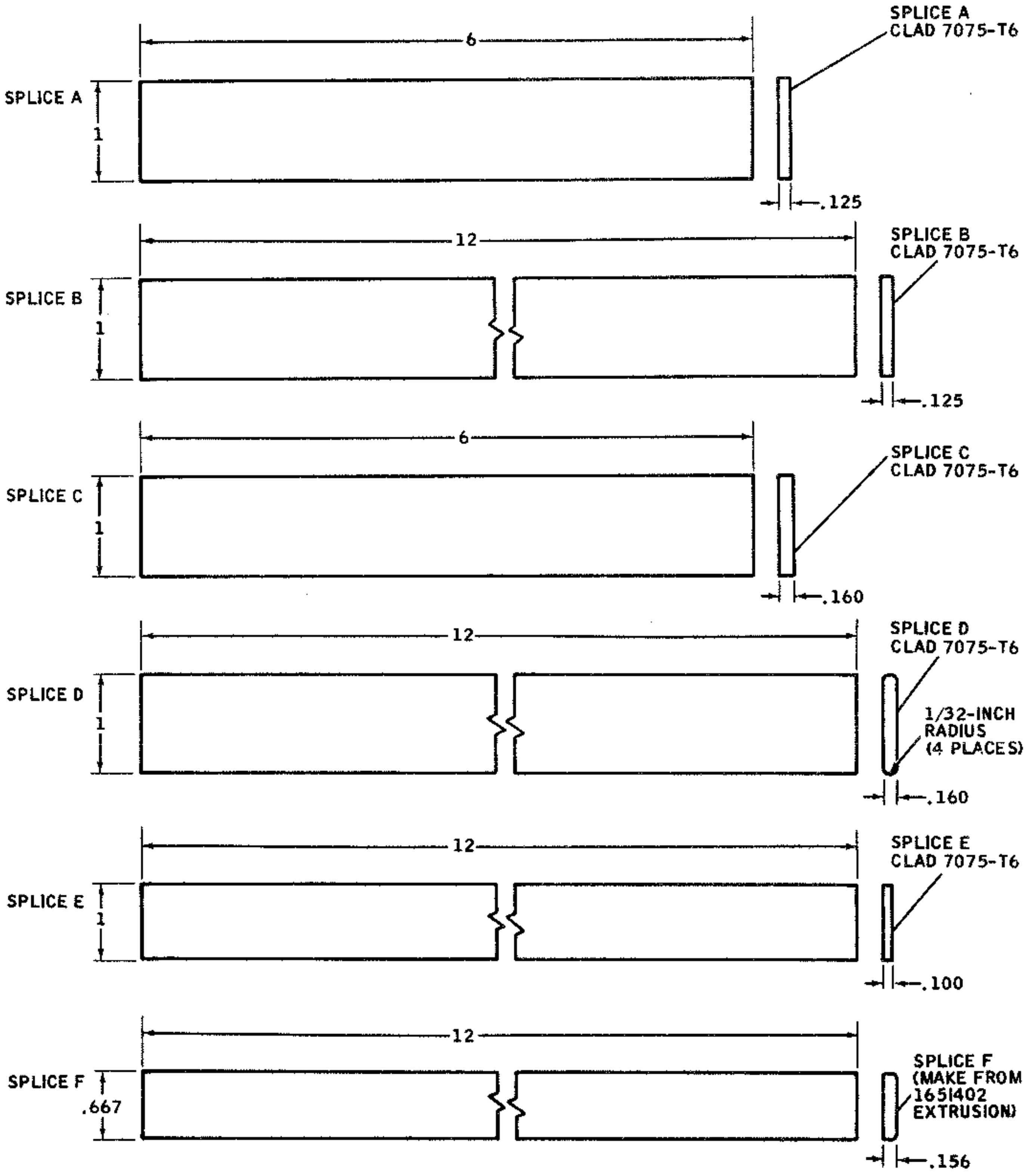
*NUTSTRIP (KAYNAR MFG CO, FULLERTON, CALIF), OR EQUIVALENT



SECTION B-B
TYPICAL TRACK SPLICE
(USED BETWEEN STA 585 THRU STA 642 EXCEPT AS SHOWN IN SECTION C-C)

BB3-99 A

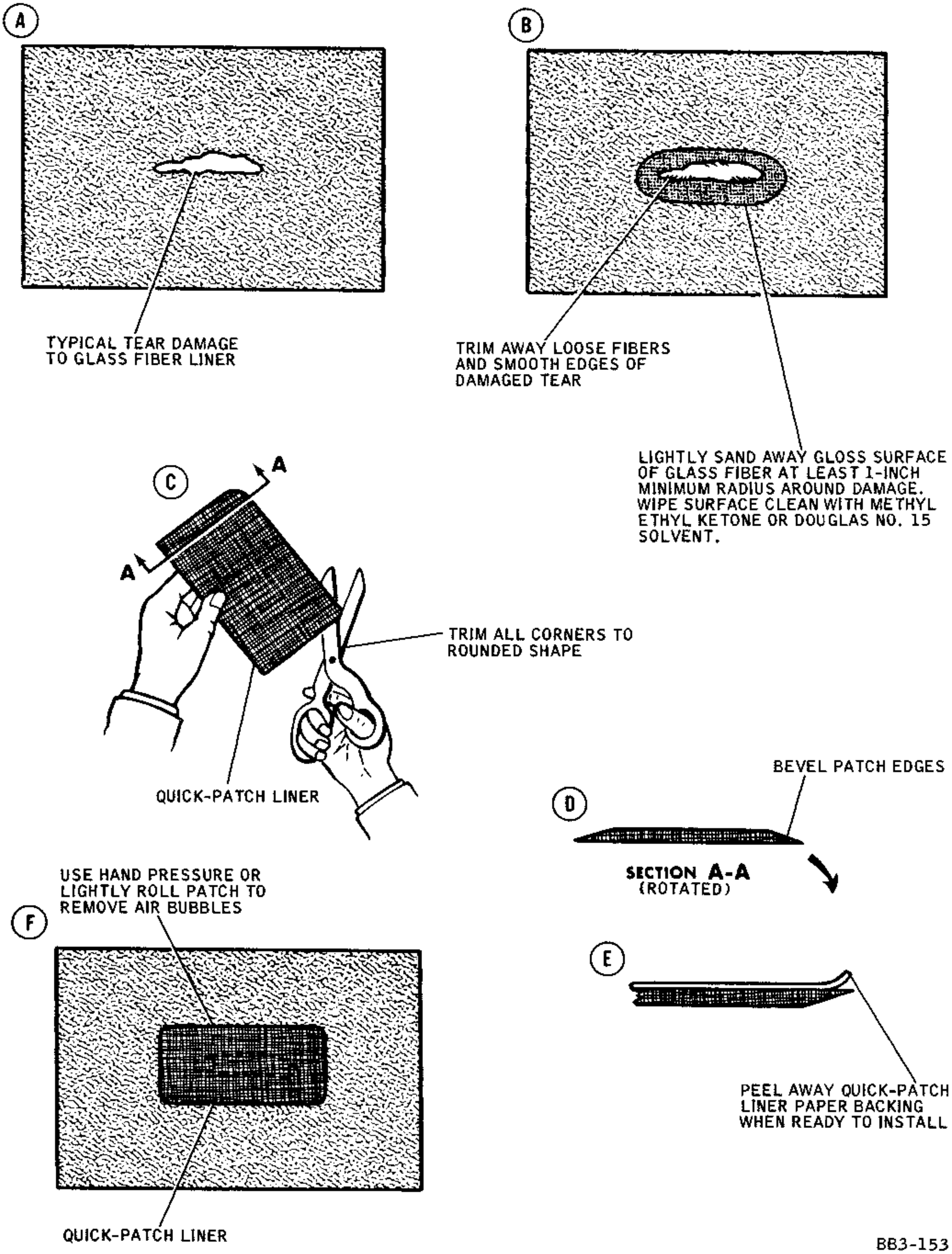
Seat Track Repair Splice
Figure 4 (Sheet 2)



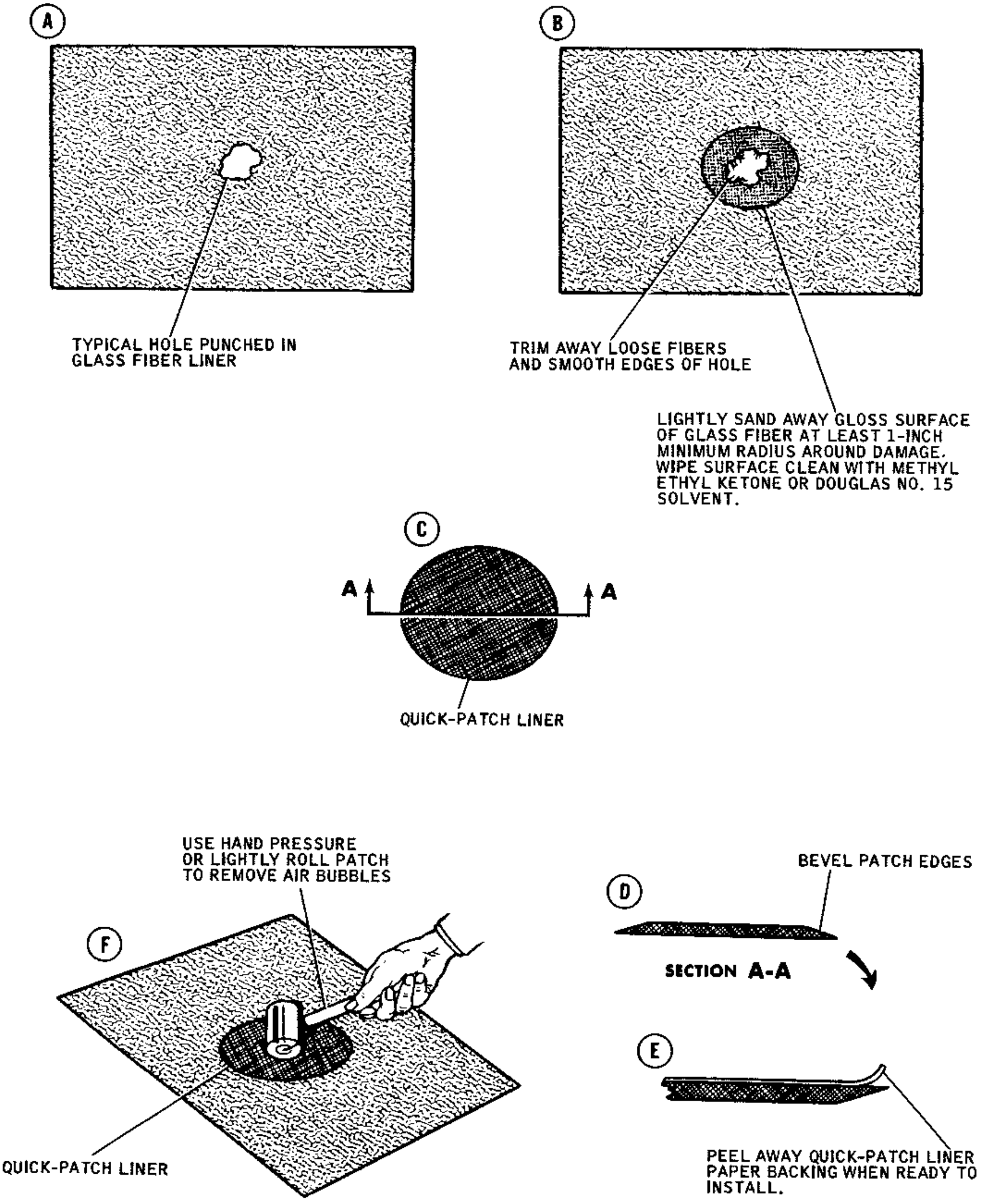
NOTE:

LENGTH OF SPLICES MAY BE EXTENDED WHEN NECESSARY TO PICK UP ATTACHMENTS.

Seat Track Repair Splice
Figure 4 (Sheet 3)



Cargo Compartment Lining Quick-Patch Repairs - Class A
Figure 5 (Sheet 1)



TYPICAL HOLE PUNCHED IN GLASS FIBER LINER

TRIM AWAY LOOSE FIBERS AND SMOOTH EDGES OF HOLE

LIGHTLY SAND AWAY GLOSS SURFACE OF GLASS FIBER AT LEAST 1-INCH MINIMUM RADIUS AROUND DAMAGE. WIPE SURFACE CLEAN WITH METHYL ETHYL KETONE OR DOUGLAS NO. 15 SOLVENT.

QUICK-PATCH LINER

USE HAND PRESSURE OR LIGHTLY ROLL PATCH TO REMOVE AIR BUBBLES

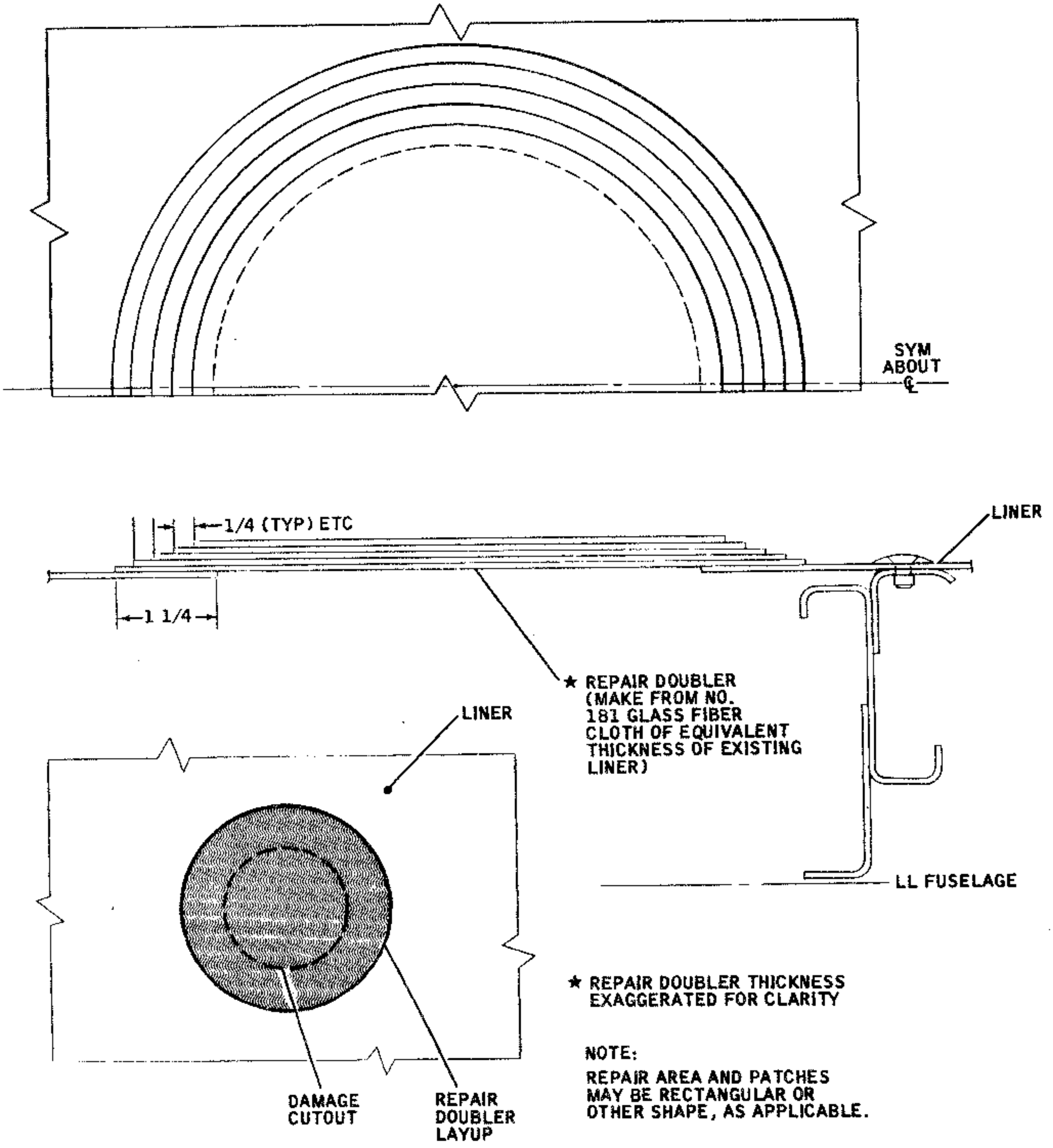
BEVEL PATCH EDGES

QUICK-PATCH LINER

PEEL AWAY QUICK-PATCH LINER PAPER BACKING WHEN READY TO INSTALL.

BB3-154

Cargo Compartment Lining Quick-Patch Repairs - Class A
Figure 5 (Sheet 2)

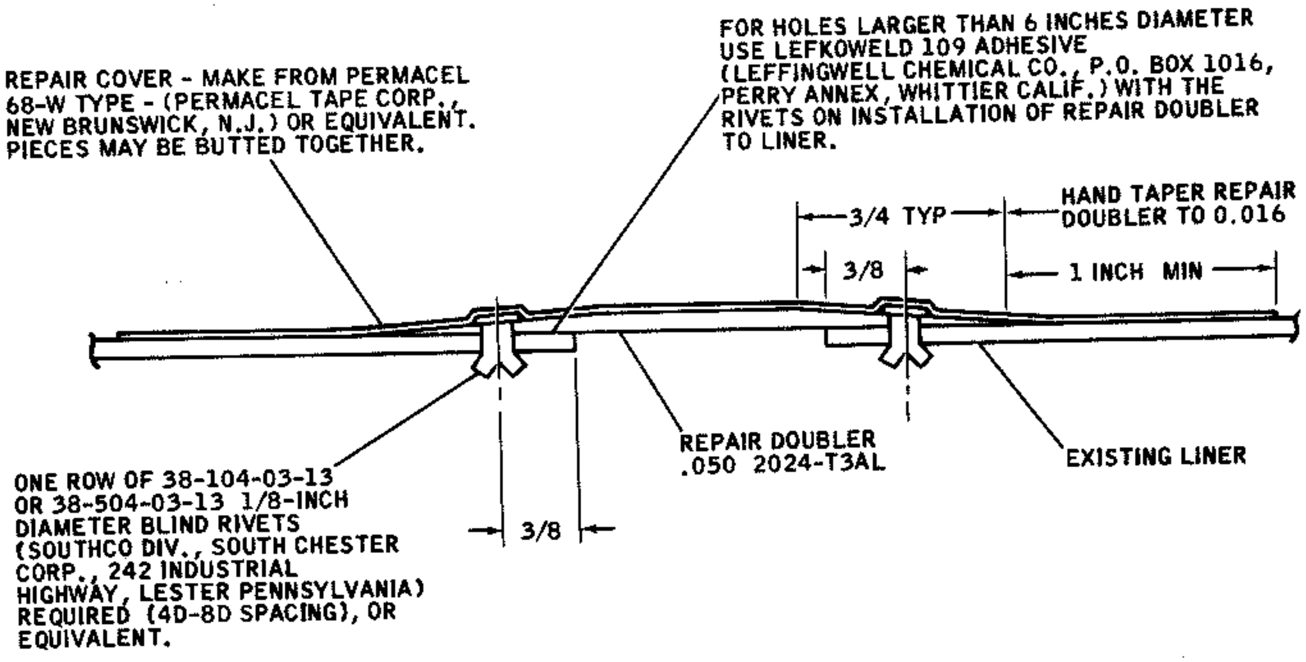


★ REPAIR DOUBLER THICKNESS EXAGGERATED FOR CLARITY

NOTE:
REPAIR AREA AND PATCHES MAY BE RECTANGULAR OR OTHER SHAPE, AS APPLICABLE.

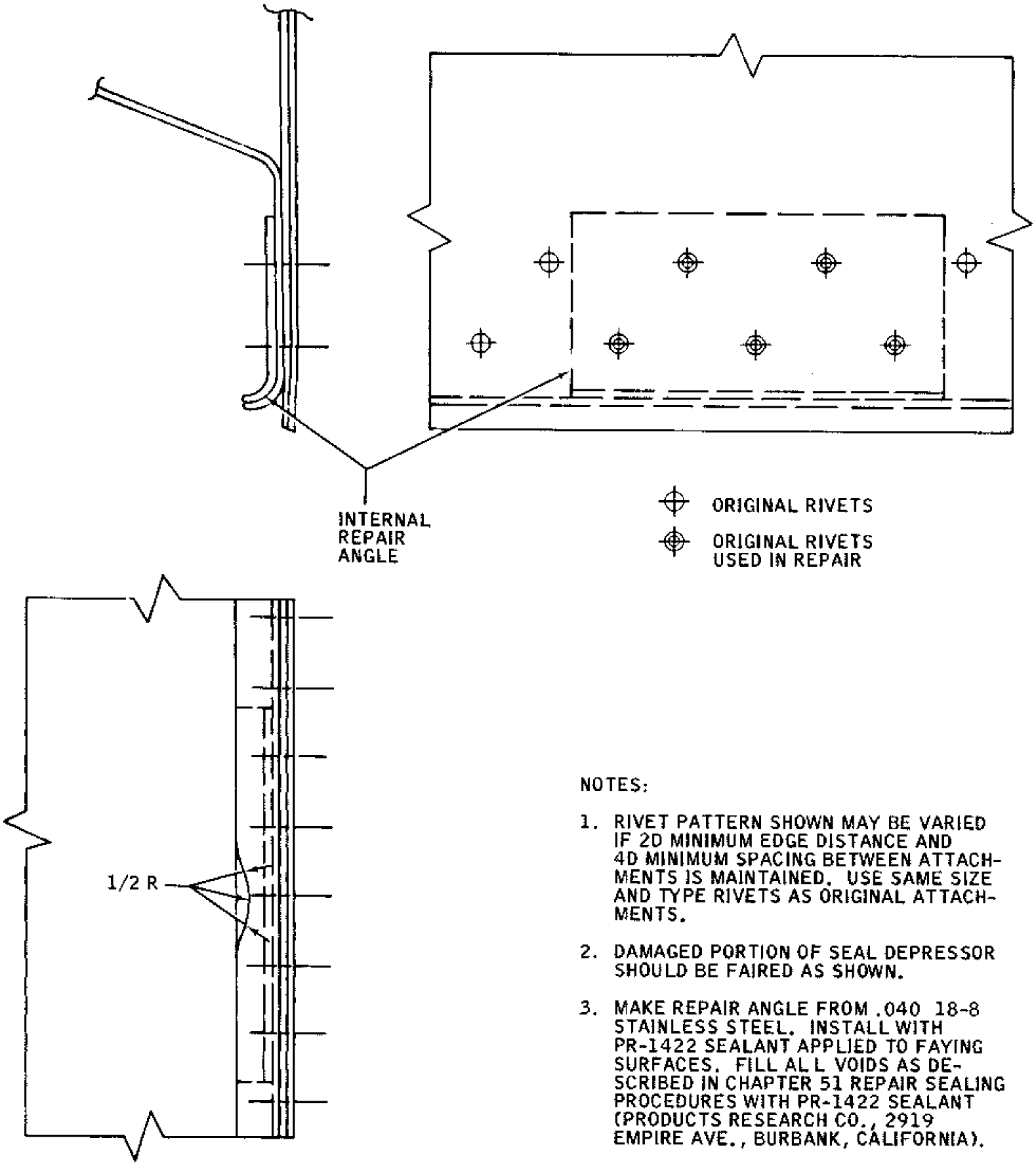
8B3-155

Cargo Compartment Lining Repair - Class A
Figure 6



BB3-156

Cargo Compartment Lining Repair - Class B
Figure 7



⊕ ORIGINAL RIVETS

⊕ ORIGINAL RIVETS USED IN REPAIR

NOTES:

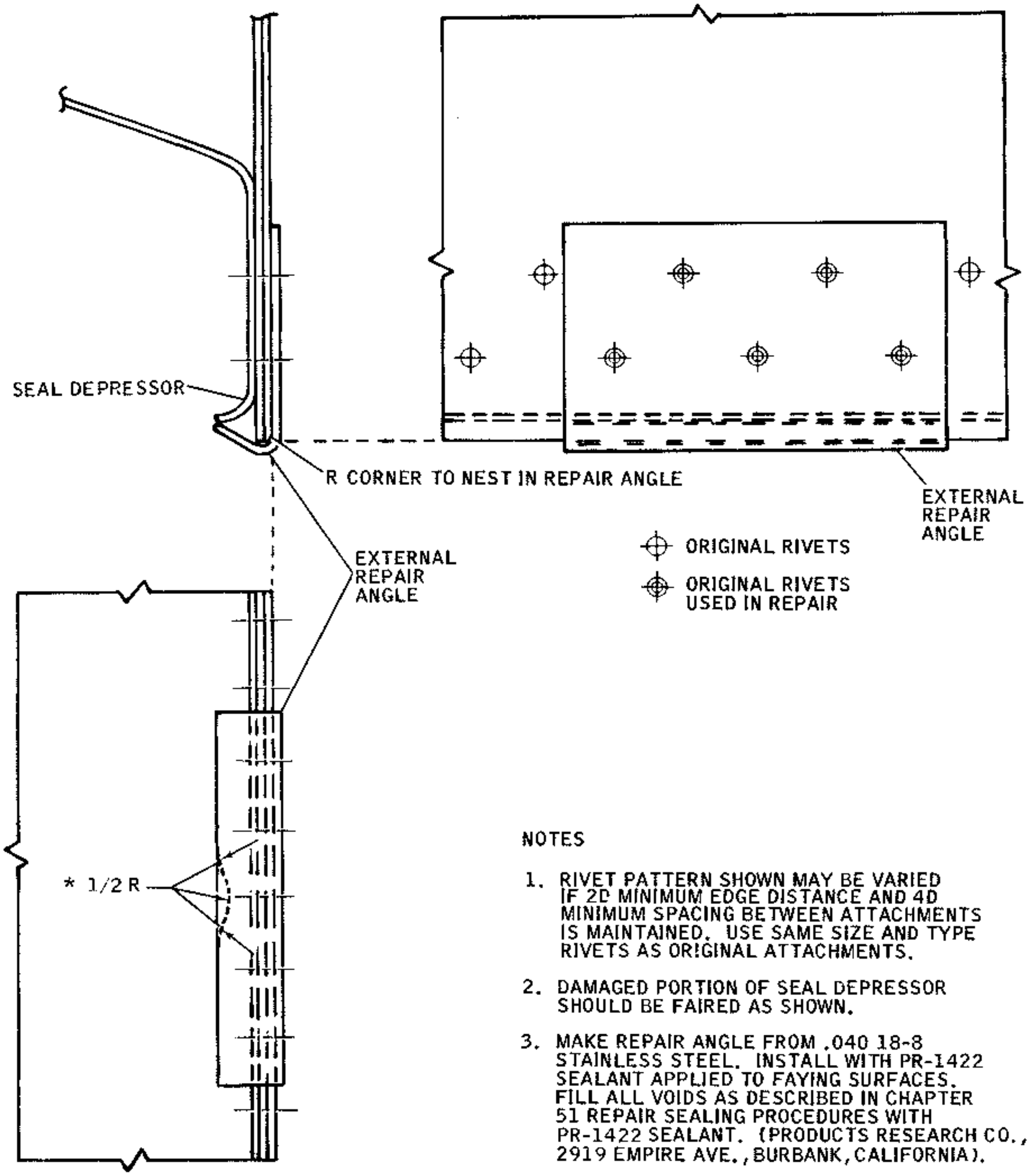
1. RIVET PATTERN SHOWN MAY BE VARIED IF 2D MINIMUM EDGE DISTANCE AND 4D MINIMUM SPACING BETWEEN ATTACHMENTS IS MAINTAINED. USE SAME SIZE AND TYPE RIVETS AS ORIGINAL ATTACHMENTS.

2. DAMAGED PORTION OF SEAL DEPRESSOR SHOULD BE FAIRED AS SHOWN.

3. MAKE REPAIR ANGLE FROM .040 18-8 STAINLESS STEEL. INSTALL WITH PR-1422 SEALANT APPLIED TO FAYING SURFACES. FILL ALL VOIDS AS DESCRIBED IN CHAPTER 51 REPAIR SEALING PROCEDURES WITH PR-1422 SEALANT (PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIFORNIA).

BB3-102

Door Jamb Seal Depressor Repair - Class A
Figure 8



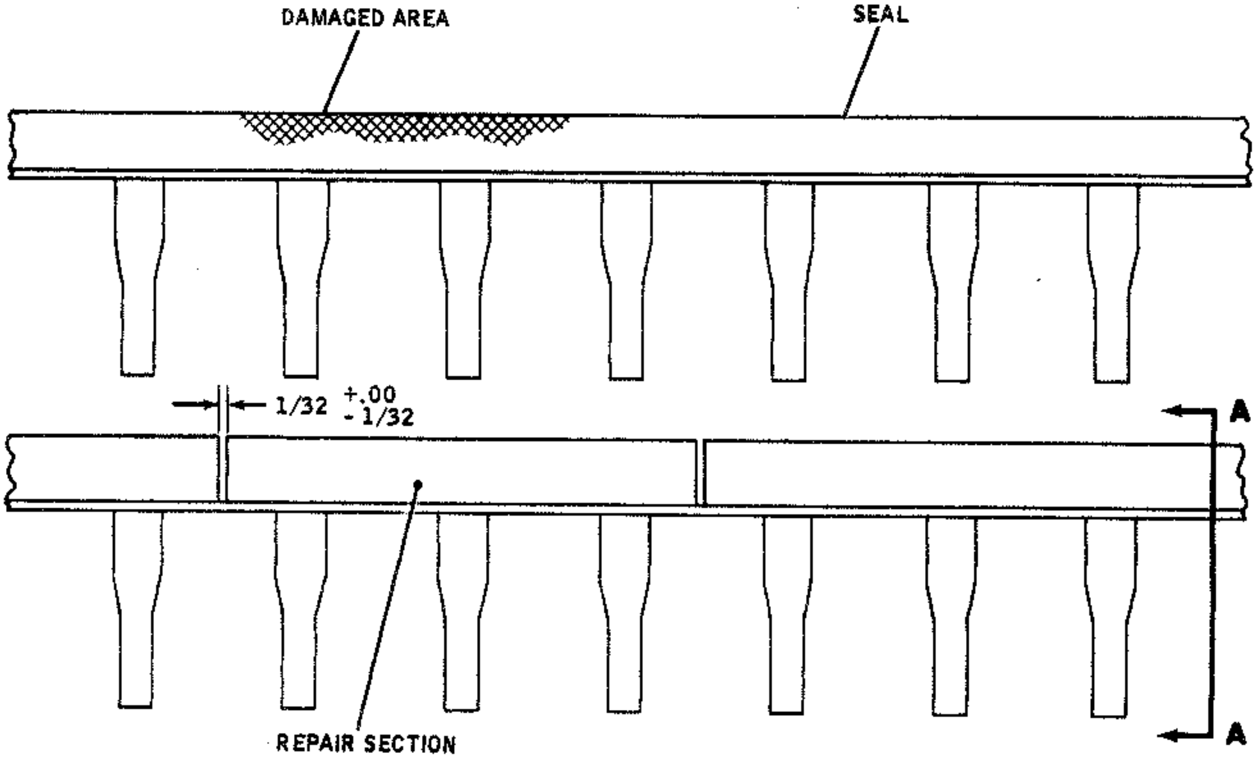
NOTES

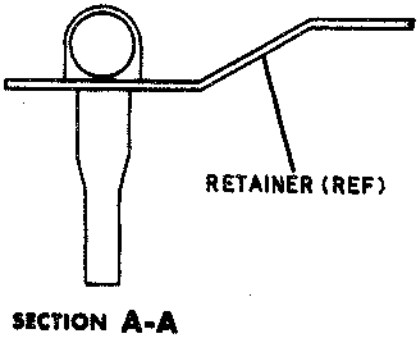
1. RIVET PATTERN SHOWN MAY BE VARIED IF 2D MINIMUM EDGE DISTANCE AND 4D MINIMUM SPACING BETWEEN ATTACHMENTS IS MAINTAINED. USE SAME SIZE AND TYPE RIVETS AS ORIGINAL ATTACHMENTS.
2. DAMAGED PORTION OF SEAL DEPRESSOR SHOULD BE FAIRED AS SHOWN.
3. MAKE REPAIR ANGLE FROM .040 18-8 STAINLESS STEEL. INSTALL WITH PR-1422 SEALANT APPLIED TO FAYING SURFACES. FILL ALL VOIDS AS DESCRIBED IN CHAPTER 51 REPAIR SEALING PROCEDURES WITH PR-1422 SEALANT. (PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIFORNIA).
4. TO IMPROVE AERODYNAMIC SMOOTHNESS EDGES OF REPAIR ANGLE MAY BE TAPERED TO 0.016 INCH IN AN AREA OF 0.200 INCH OF EDGE.

* RADII IN ORIGINAL SEAL DEPRESSOR THREE PLACES AS SHOWN TO REMOVE DAMAGE.

BB3-103

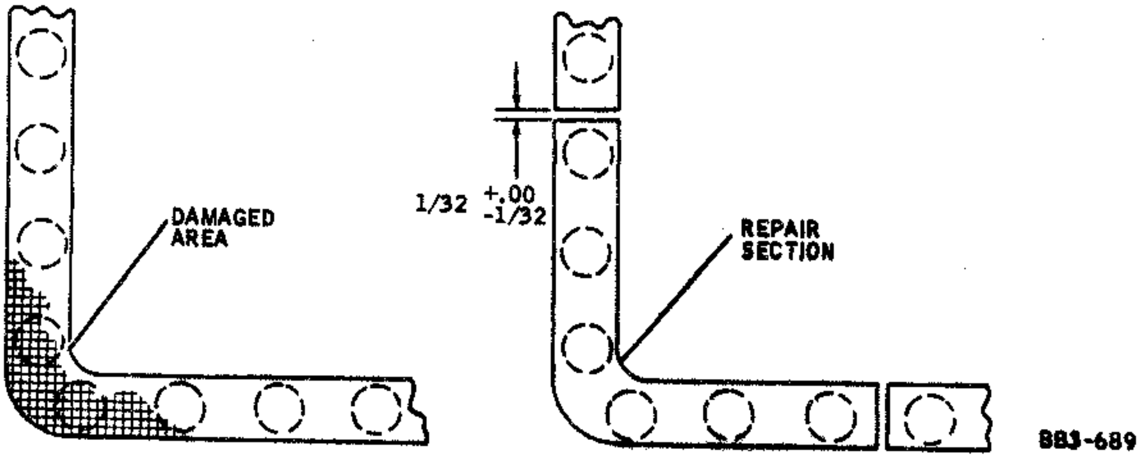
Door Jamb Seal Depressor Repair - Class B
Figure 9



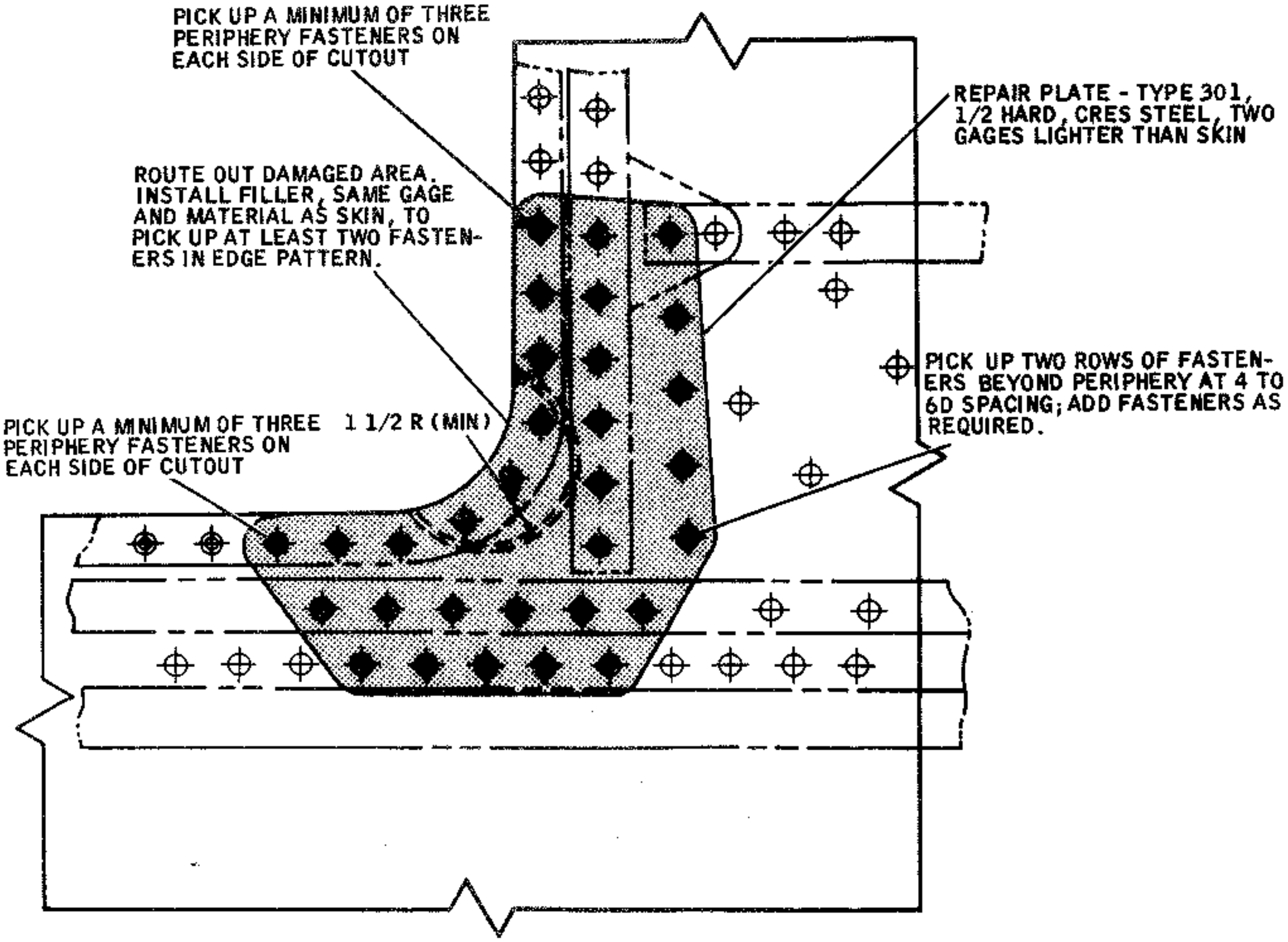


NOTES:

1. PARTIAL SECTIONS OF SEAL MAY BE REMOVED AND REPLACED, AS SHOWN ABOVE, PROVIDED THAT A MINIMUM OF THREE ATTACHING NODES ARE MAINTAINED IN ANY REMAINING AND/OR REPLACEMENT SECTION.
2. WHEN SEAL PASSES A SHARP CORNER ENTIRE CONTOURED SECTION PLUS TWO NODES BEYOND TANGENT ON EACH SIDE MUST BE REPLACED AS SHOWN BELOW.



Node-Attached Molded Rubber Seal Repair
Figure 10



PICK UP A MINIMUM OF THREE PERIPHERY FASTENERS ON EACH SIDE OF CUTOUT

ROUTE OUT DAMAGED AREA. INSTALL FILLER, SAME GAGE AND MATERIAL AS SKIN, TO PICK UP AT LEAST TWO FASTENERS IN EDGE PATTERN.

PICK UP A MINIMUM OF THREE PERIPHERY FASTENERS ON EACH SIDE OF CUTOUT

REPAIR PLATE - TYPE 301, 1/2 HARD, CRES STEEL, TWO GAGES LIGHTER THAN SKIN

PICK UP TWO ROWS OF FASTENERS BEYOND PERIPHERY AT 4 TO 6D SPACING; ADD FASTENERS AS REQUIRED.

NOTES:

1. APPLY PR-1422 SEALANT (PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIF.) TO ALL FAYING SURFACES.
2. SIZE, SHAPE, LOCATION OF DOUBLER OPTIONAL DEPENDING ON LOCATION OF DAMAGE.

⊕ ORIGINAL FASTENER

◈ ORIGINAL FASTENER USED IN REPAIR

◆ REPAIR FASTENER

BB3-711

Door Area Plating Repair
Figure 11

8. ADF Sense Antenna Bonded-On Metal Element Plate Repairs

NOTE: The following repair procedures are applicable to Airplanes 1-48 for the Forward ADF Antenna and Airplanes 1-20 for the Aft ADF Antenna, which were provided with a bonded-on metal ADF element plate. These procedures are not applicable to the later airplanes which incorporate an aluminum metal spray element.

A. Prior to making necessary repairs to ADF Sense Antenna panel elements, perform the required electrical disconnect procedures. Refer to DC-9 Maintenance Manual, 34-31-1.

B. Faying surfaces of parts to be repaired by bonding methods must be cleaned in accordance with the following:

(1) Wash rework area with acetone solvent, Specification FED-1-A (2) (or equivalent), to remove grease dirt, or other foreign materials.

(2) Remove surface gloss, paint, and old adhesive by scuff-sanding an area approximately three inches in width, centering on edge of the metal element (see Figure 12), with medium grit (No. 180 to 240) sandpaper. Scuff-sand area through paint down to the FR primer.

NOTE: Use care to prevent scuff or scratch damage to antenna metal element surfaces.

(3) Remove all dust particles, after sanding, with a clean cotton cloth dampened with acetone solvent.

C. Two different type repairs are described in the following paragraphs, both repairs utilize a liquid resin as a bonding adhesive. Prepare and mix the resin and its specified hardener as follows:

(1) Use clean, non-absorbent container to mix adhesive and hardener.

(2) To 100 parts (by weight) of Epon 828 epoxy resin (Shell Chemical Corp., 1008 W. 6th Street, Los Angeles, Calif.) (or Specification MIL-R-9300), add 8 parts (by weight) of Diethylene Trianine, DTA (HN-23 Hardener; Furane Plastics, 4516 Brazil Street, Los Angeles, Calif.) and mix thoroughly for approximately five minutes.

WARNING: WHEN USING EPOXY CATALYSTS OR HARDENERS, RUBBER GLOVES AND EYE PROTECTION MUST BE USED TO PREVENT SKIN CONTACT. IF CATALYST OR HARDENER DOES CONTACT SKIN, WASH THOROUGHLY WITH WHITE VINEGAR AND WATER.

(3) Usable pot life of mixed Epon 828 is 20-30 minutes.

D. In areas where edge of metal element has lifted from surface of panel, apply or inject a thin film of the mixed adhesive between faying edge of element and panel. A hypodermic needle may be used to inject the resin mixture into the delaminated area.

NOTE: If metal element edge does not show evidence of lifting, omit this step.

(1) Apply pressure and join the faying surfaces. Remove excessive adhesive by means of a plastic scraper.

E. To prevent delamination or edge lifting of the element, perform the following repair.

(1) Prepare repair doubler using a 2-inch wide (minimum) strip of Volan "A" Finish Glass fabric No. 1, Specification MIL-C-9084.

(2) Center repair doubler on edge of metal element and allow at least a minimum 1-inch overlap on both the element and glass fiber panel surface. Cut glass fabric to required size.

(3) Apply Epon 828 mixture to doubler. Stipple surface with a brush to completely impregnate the glass cloth with mixed adhesive and to expel any trapped air.

(4) Position repair doubler around periphery of metal element. Use fingers or a roller to smooth and expel trapped air.

NOTE: Ensure minimum overlap of 1-inch on both element and panel.

(5) Cover repair area with cellophane (or equivalent) and apply mechanical pressure (use wood or metal plates, weights or other applicable devices) to spread pressure evenly.

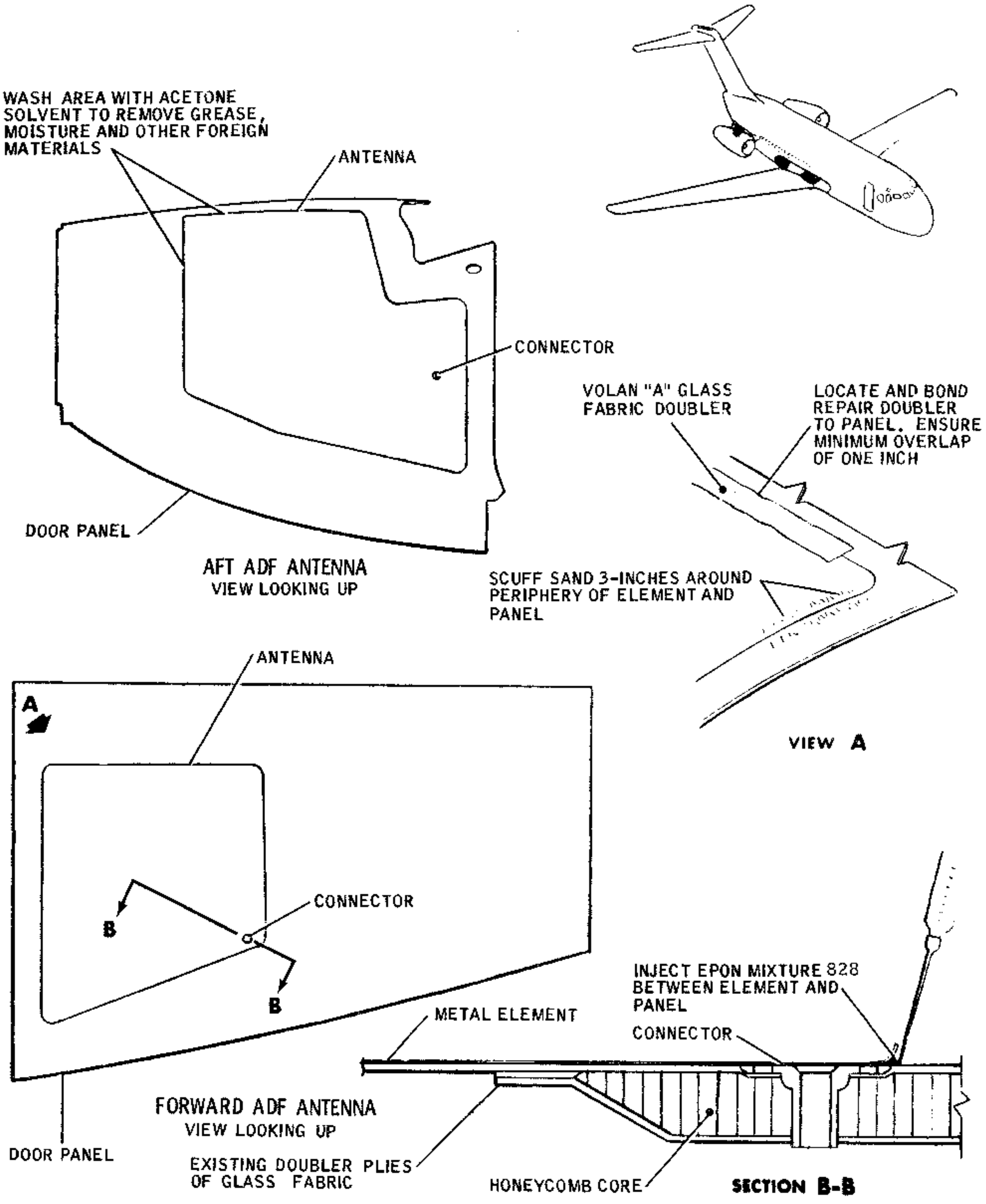
F. Cure repair, allowing 1 hour for resin to gel at ambient temperature. Follow by a 20-30 minute cure under a heatlamp at 93°C (200°F).

NOTE: Normal cure time at ambient temperature alone, is 16 hours.

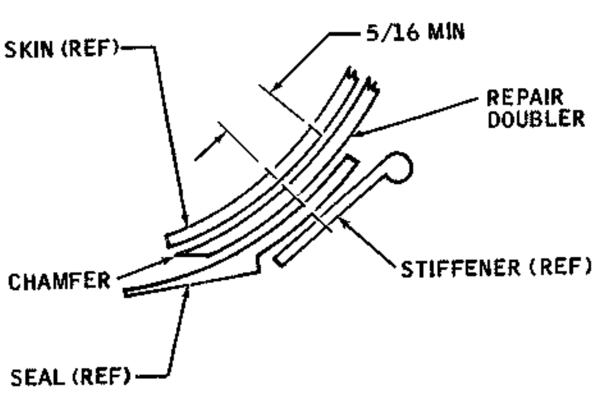
G. Sand repair to a smooth and faired finish surface. Use clean, dry cloth to remove dust particles. Apply finish paint coat, as required.

9. Wing-to-Fuselage Upper Fillet Crack Repair

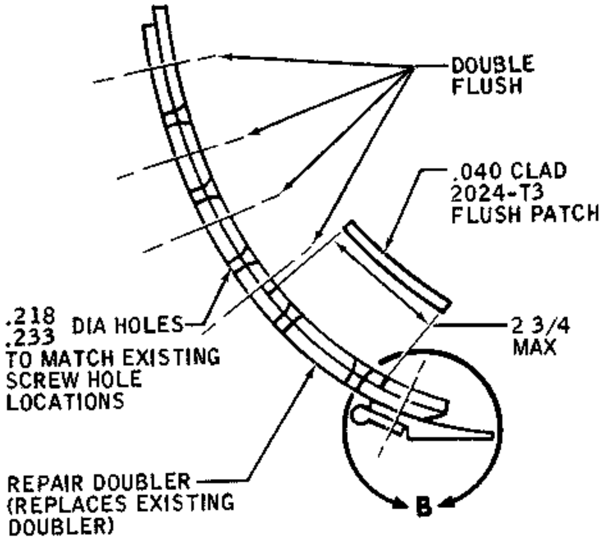
A. Repair of a damaged section of wing-to-fillet upper fillet is illustrated in Figure 13.



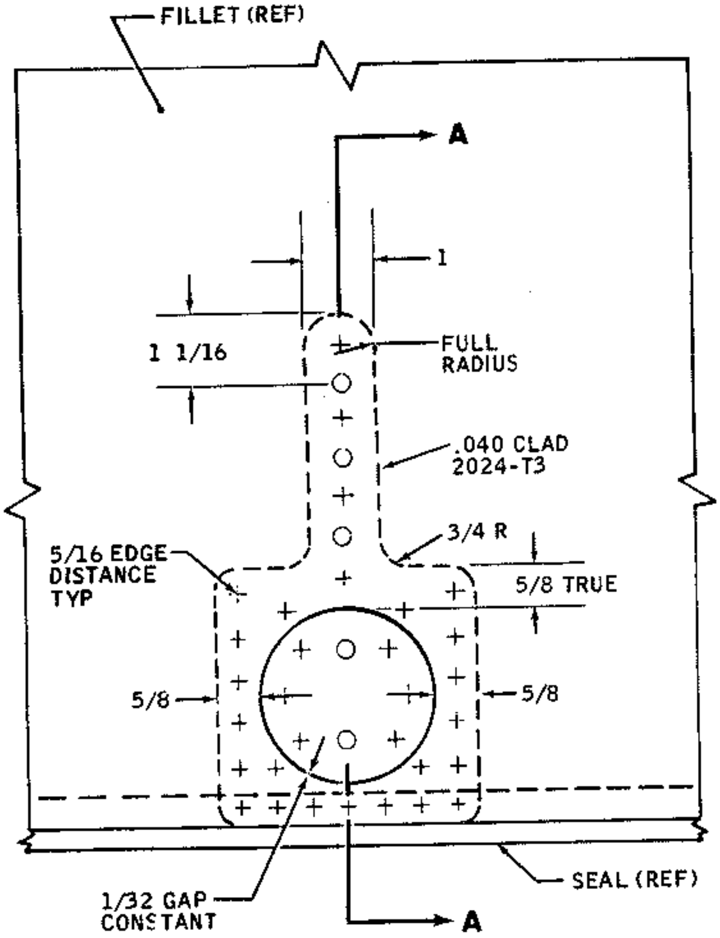
Forward and Aft ADF Sense Antenna Repair
Bonded-On Metal Element Only
Figure 12



VIEW B



SECTION A-A



NOTES:

1. MAKE FLUSH PATCH FROM .040 CLAD 2024-T3.
2. MAKE REPAIR DOUBLER FROM .040 CLAD 2024-T3.
3. BOND PER 51-70-2.
4. ATTACH WITH NAS1097AD4 RIVETS AS SHOWN.
5. IF NECESSARY, CHAFING OF STIFFENER ON WING MAY BE RELIEVED BY REMOVING MATERIAL FROM BULB.

BB3-982

Wing-to-Fuselage Upper Fillet
Crack Repair - Class A
Figure 13

COMBINATION REPAIR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes a combination repair involving plating, longerons, formers, and frames. Refer to Figure 1 to accomplish the repair.

THIS PAGE INTENTIONALLY LEFT BLANK

MAIN FRAME - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates the main frame of the fuselage, including such items as frames, longerons, bulkheads, intercostals, beams, and floor support structure. The subjects within this section are listed for convenience in locating a particular area of the fuselage.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore integrity and appearance is presented as follows:

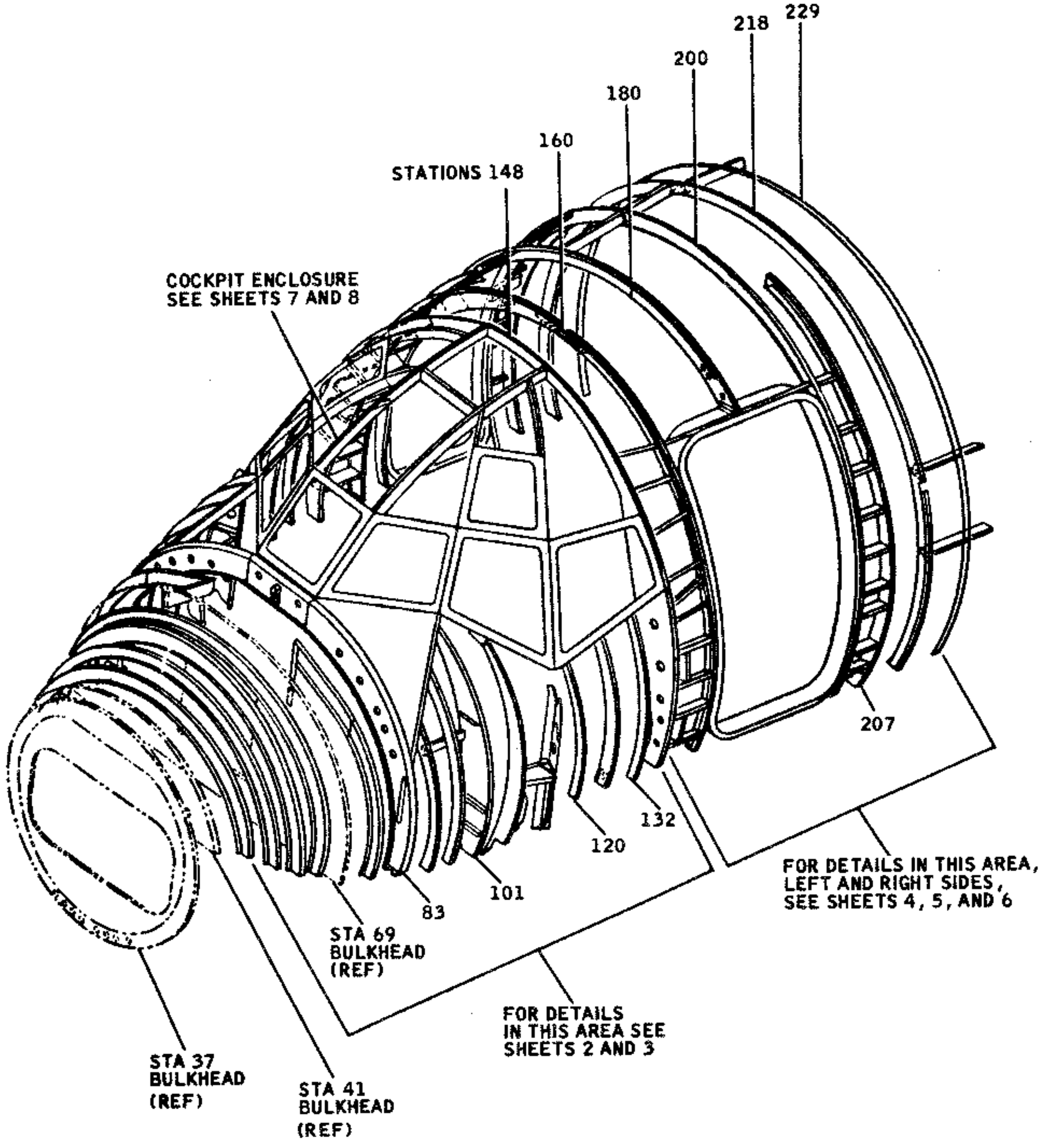
Structural Component	Approved Repairs
All	Section 53-01, Figure 1
Longerons	Section 53-02
Frames, formers, and bulkheads	Section 53-01, Figure 2 Sheet 4; Section 53-01, Figure 3, Sheets 4 and 5; Section 53-01, Figure 5, Sheet 2; Section 53-03
Door seal depressors	Section 53-05, Figures 8 and 9

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

FUSELAGE NOSE SECTION - DESCRIPTION AND OPERATION (DC-9-10)

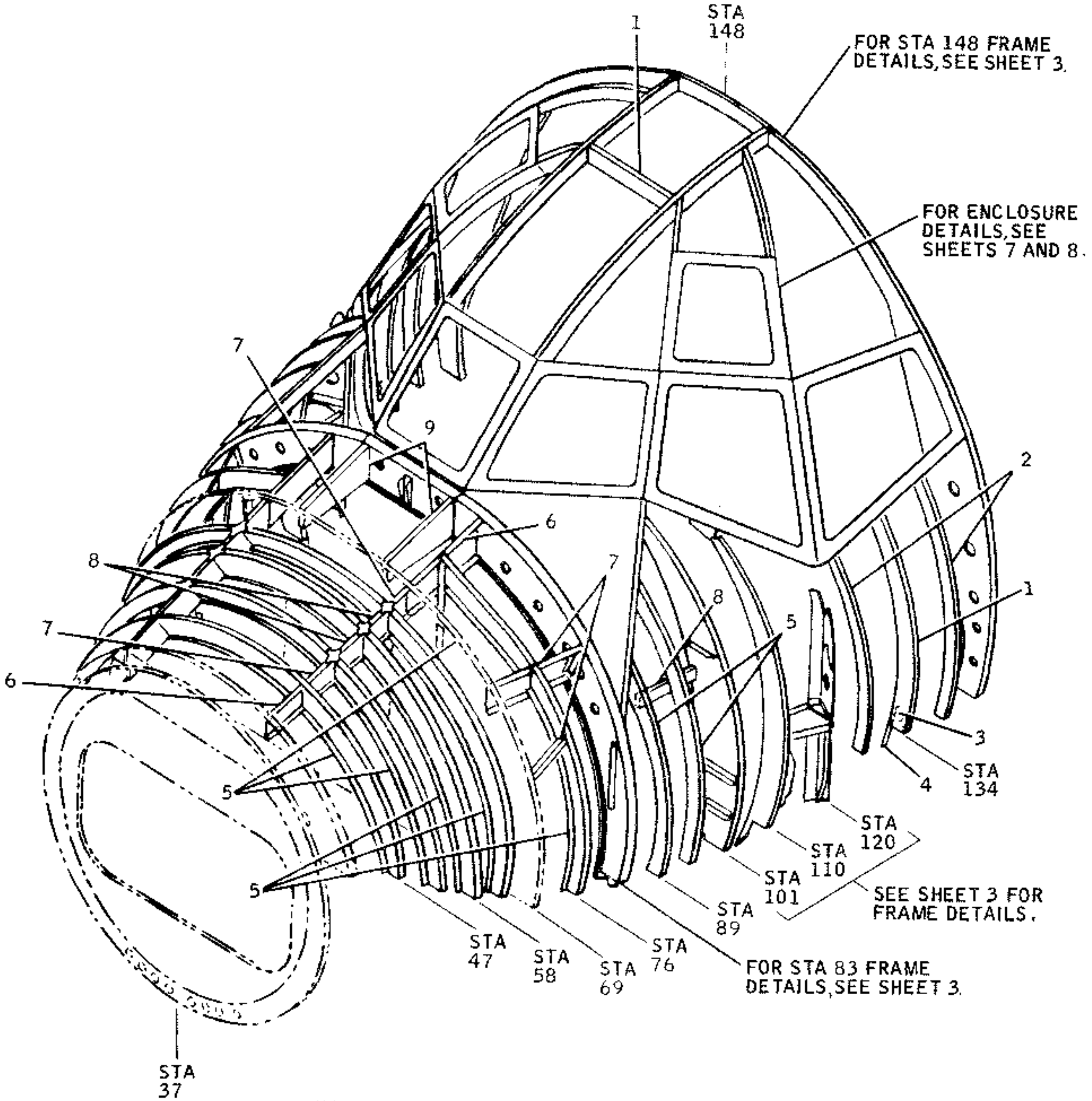
1. General

A. The following figures illustrate the structural components of the fuselage nose section. The materials used are identified by item number callouts.



BB3-114

Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 1)



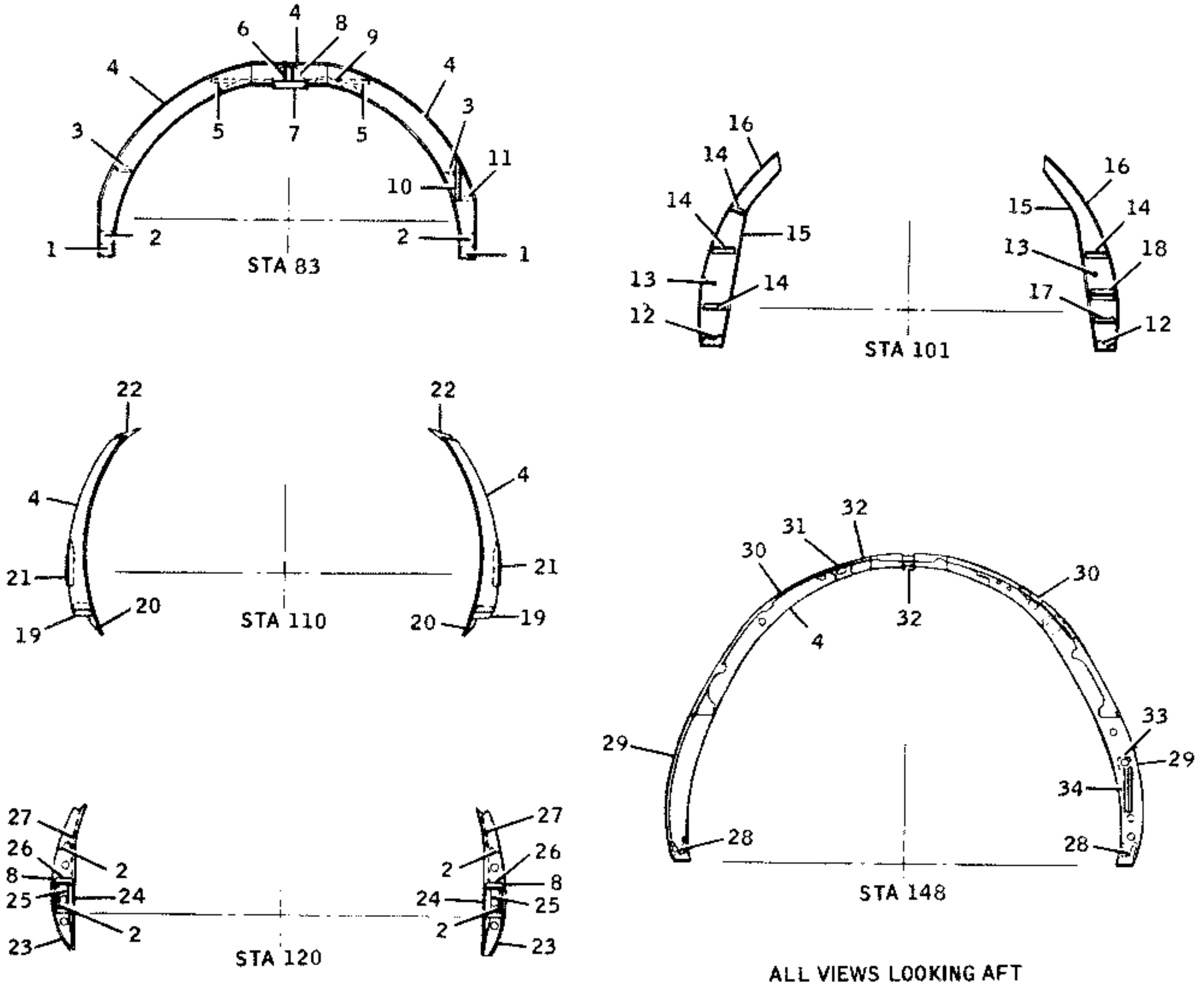
NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES UNLESS OTHERWISE NOTED.
2. MADE FROM 4130 STEEL SHEET, .080 GAGE TAPERED TO .045.
3. REFERENCE - DOUGLAS DRAWING 5910071.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.063	CLAD 7075-T6
2	FRAME	.050	CLAD 7075-T6
3	FITTING		2614618
4	STRAP		SEE NOTE 2
5	FRAME	.040	CLAD 7075-T6
6	INTERCOSTAL	.063	CLAD 7075-T6
7	INTERCOSTAL	.050	CLAD 7075-T6
8	INTERCOSTAL	.040	CLAD 7075-T6
9	BEAM	.090	CLAD 7075-T6

BB3-209A

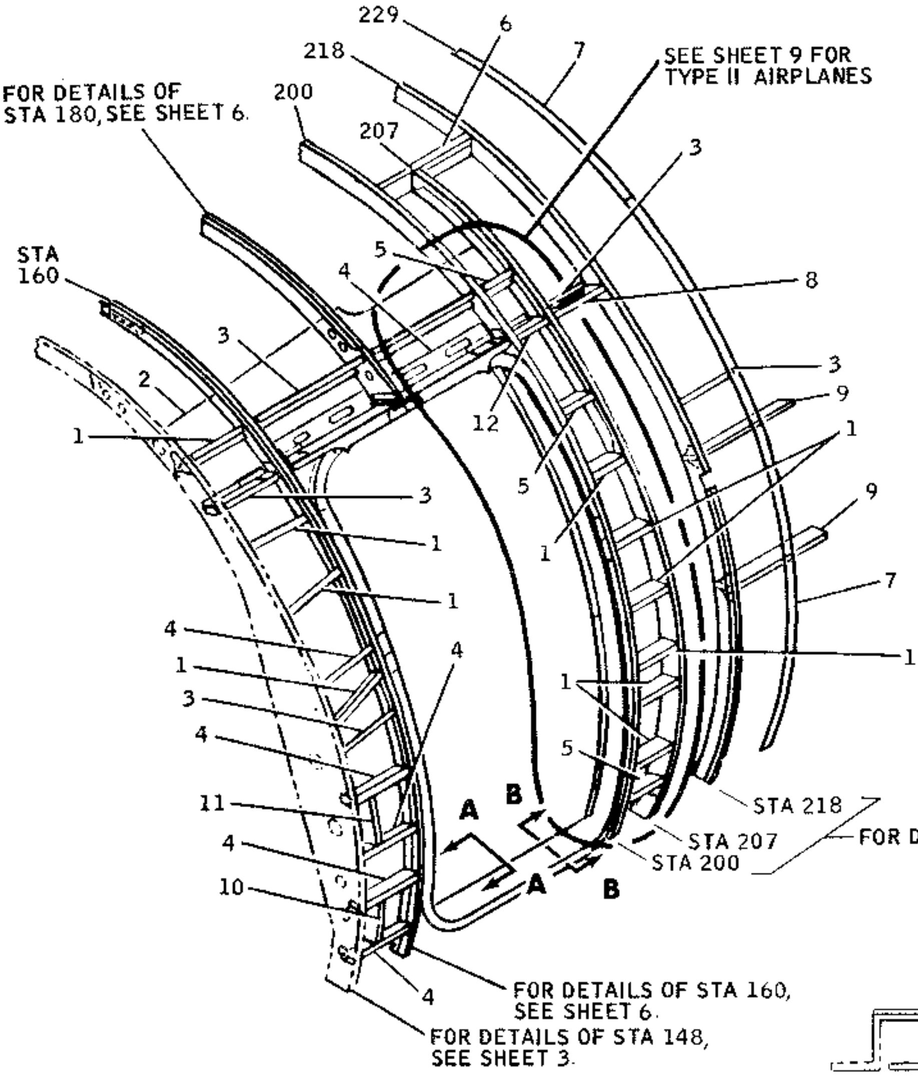
Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 2)



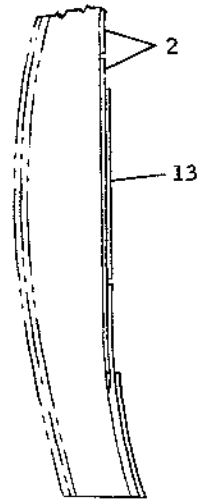
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING, 4912950-1, -2		2614618	18	TEE		1125558
2	DOUBLER	.050	CLAD 7075-T6	19	SPLICE TEE		1103715
3	SHEAR CLIP	.071	CLAD 7075-T6	20	CAP ANGLE		1419292
4	FRAME	.063	CLAD 7075-T6	21	SPLICE ANGLE	.063	CLAD 2024-T42
5	SHEAR CLIP	.080	CLAD 7075-T6	22	ANGLE	.071	CLAD 2024-T3
6	BRACE	.063	CLAD 7075-T6	23	STRAP	.071	CLAD 2024-T42
7	CHANNEL	.063	CLAD 7075-T6	24	WEB	.050	CLAD 7075-T6
8	FRAME	.071	CLAD 7075-T6	25	INTERCOSTAL	.050	CLAD 7075-T6
9	DOUBLER	.090	CLAD 7075-T6	26	GUSSET	.071	CLAD 7075-T6
10	ANGLE		1238984	27	ATTACH ANGLE		1242520
11	STIFFENER	.063	CLAD 7075-T6	28	FITTING, 4912953-1, -2		2614618
12	FITTING		2615551	29	SPLICE ANGLE	.090	CLAD 7075-T6
13	WEB	.063	CLAD 7075-T6	30	SPLICE ANGLE	.071	CLAD 7075-T6
14	STIFFENER		1249581	31	DOUBLER PLATING	.071	CLAD 7075-T6
15	CAP		1397514	32	SPLICE ANGLE	.063	CLAD 7075-T6
16	CAP		1418367	33	FITTING, 4914318-1		PLATE 7075-T651
17	ANGLE	.090	CLAD 7075-T6	34	HAT		2704877

BB3-210

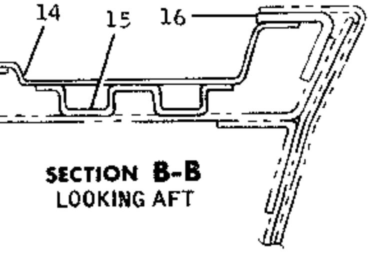
Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 3)



PASSENGER ENTRANCE DOOR AREA



VIEW A-A
LOOKING FORWARD



SECTION B-B
LOOKING AFT

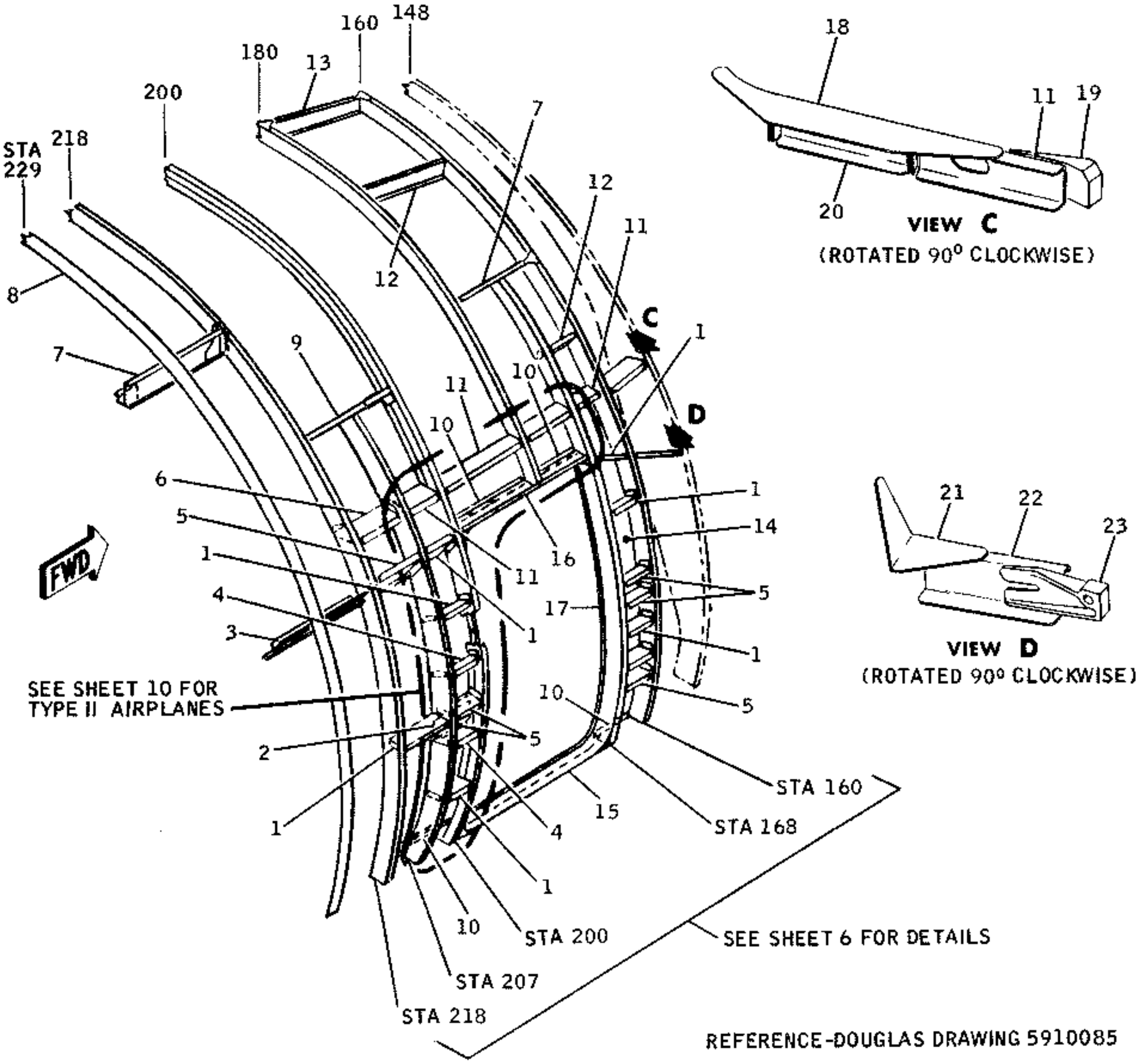
NOTES:

1. CRES SHEET, TYPE 321 T1, MIL-S-6721, COMP T1, ANLD.
2. REFERENCE-DOUGLAS DRAWING 5910082.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.071	CLAD 7075-T6	9	INTERCOSTAL		2912901
2	SKIN	.040	CLAD 7075-T6	10	WEB	.063	CLAD 7075-T6
3	INTERCOSTAL	.063	CLAD 7075-T6	11	WEB	.090	CLAD 7075-T6
4	INTERCOSTAL	.080	CLAD 7075-T6	12	INTERCOSTAL	3.000	BAR 7075-T651
5	INTERCOSTAL	.090	CLAD 7075-T6	13	FITTING, 3914332		PLATE 7075-T651
6	INTERCOSTAL	.040	CLAD 7075-T6	14	PAN	.025	SEE NOTE 1
7	STRAP	.071	CLAD 7075-T6	15	SUPPORT	NO. 181 GLASS FIBER	
8	INTERCOSTAL	2.000	PLATE 7075-T651	16	DEPRESSOR	.090	CLAD 2024-T42

BB3-212B

Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 4)



REFERENCE-DOUGLAS DRAWING 5910085

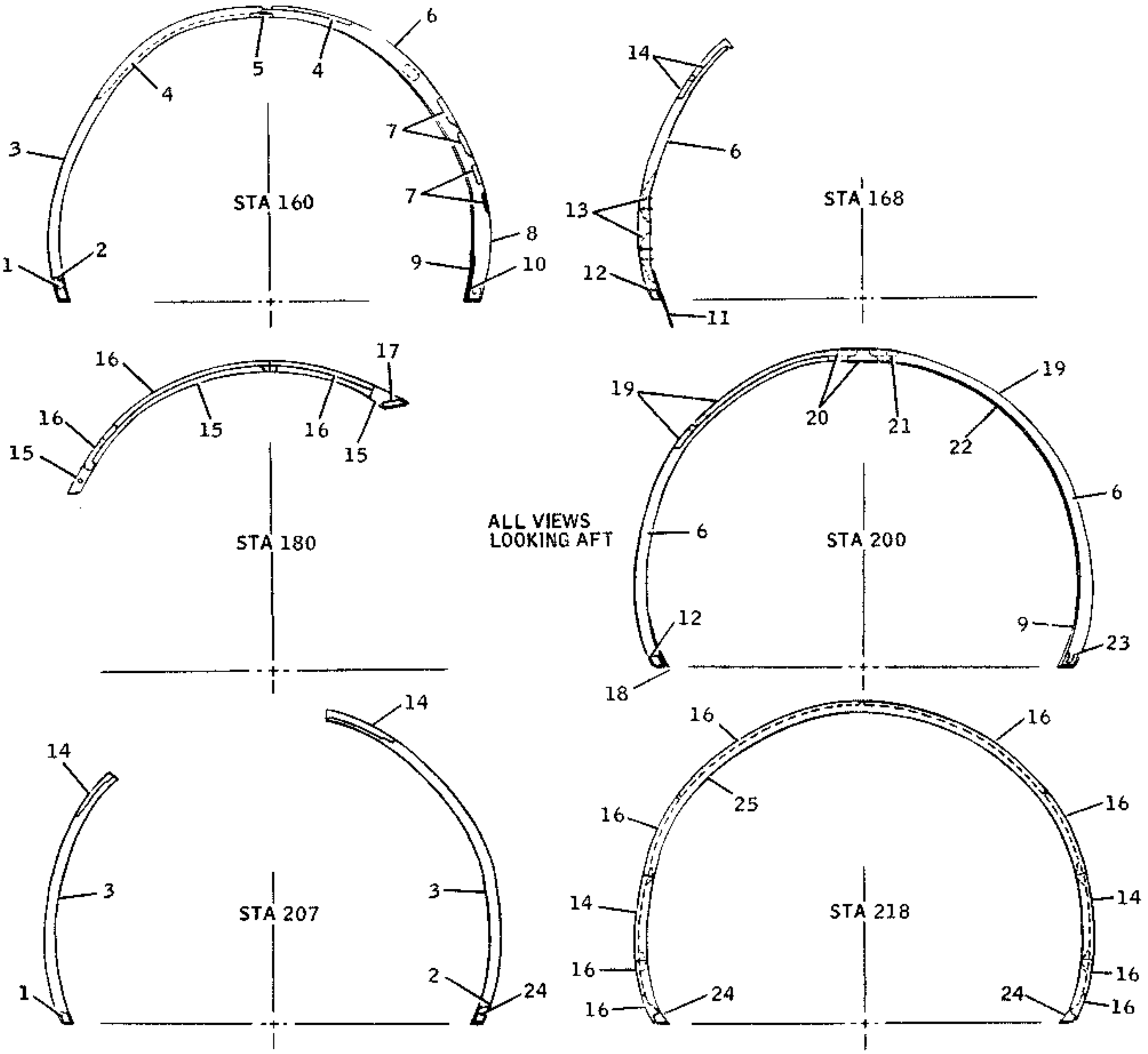
SERVICE ENTRANCE DOOR AREA

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.071	CLAD 7075-T6	13	INTERCOSTAL	.040	CLAD 2024-T42
2	PLATE	.063	CLAD 7075-T6	14	INNER SKIN	.050	CLAD 2024-T42
3	INTERCOSTAL		2912901	15	JAMB PAN	.050	CLAD 2024-T42
4	INTERCOSTAL	.050	CLAD 7075-T6	16	INTERCOSTAL	.071	CLAD 2024-T42
5	INTERCOSTAL	.071	CLAD 7075-T6	17	DEPRESSOR	.071	CLAD 2024-T42
6	INTERCOSTAL	.050	CLAD 2024-T42	18	DOUBLER	.071	CLAD 2014-T6
7	INTERCOSTAL	.040	CLAD 7075-T6	19	FITTING		3912353
8	STRAP	.071	CLAD 7075-T6	20	INTERCOSTAL	.071	CLAD 2014-T6
9	FRAME	.050	CLAD 7075-T6	21	GUSSET	.071	CLAD 2014-T6
10	ANGLE	.063	CLAD 2024-T42	22	INTERCOSTAL	.080	CLAD 7075-T6
11	INTERCOSTAL	.063	CLAD 2024-T42	23	FITTING, 3912352		PLATE 7075-T651
12	INTERCOSTAL	.032	CLAD 7075-T6				

BB3-214B

Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 5)

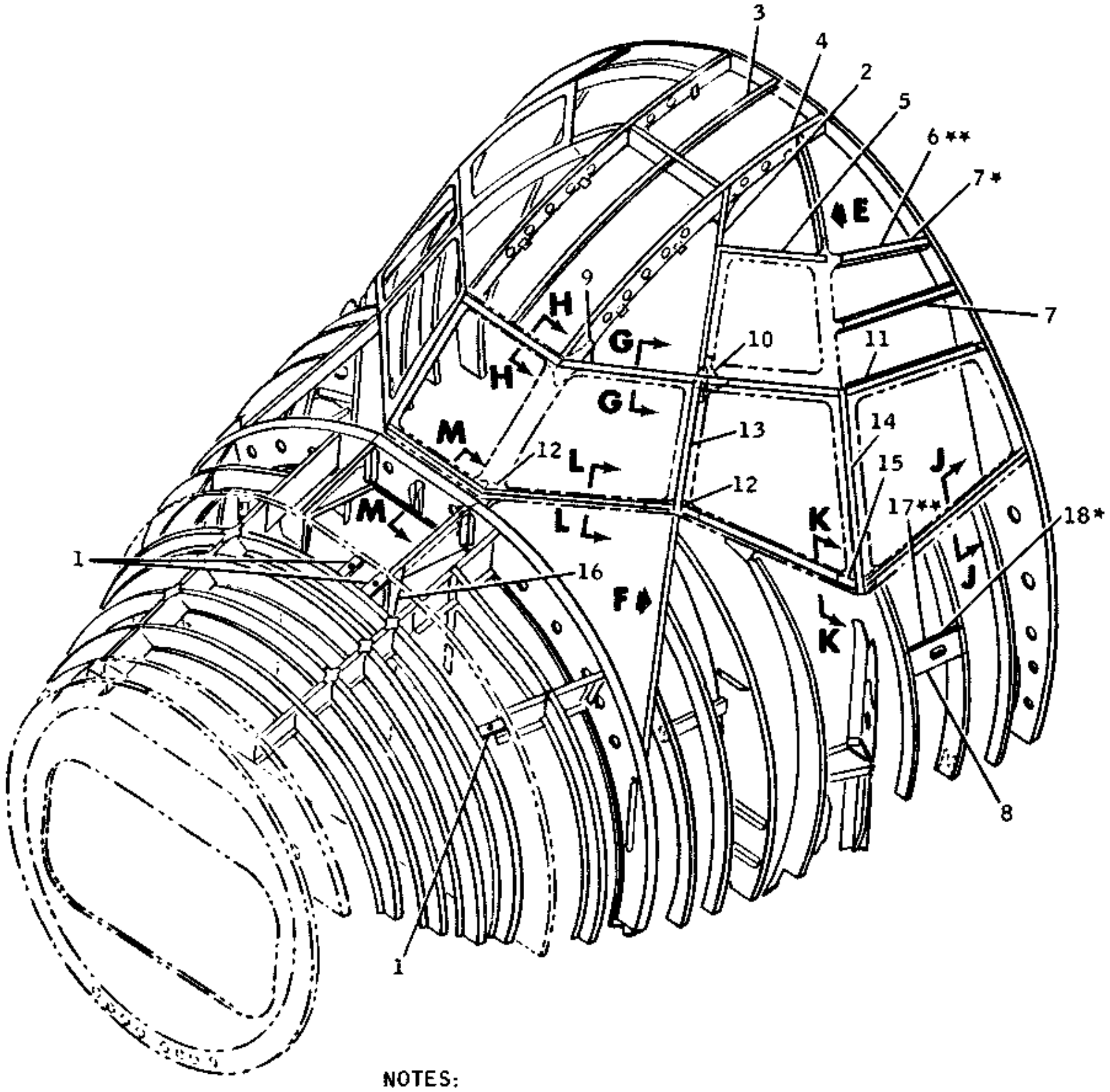
Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		4912499	14	SHEAR CLIP	.063	CLAD 2014-T6
2	DOUBLER	.063	CLAD 7075-T6	15	FRAME	.050	CLAD 7075-T6
3	FRAME	.071	CLAD 2024-T42	16	SHEAR CLIP	.050	CLAD 2014-T6
4	SHEAR CLIP	.071	CLAD 2014-T6	17	CLIP		1243327
5	SPLICE ANGLE	.090	CLAD 7075-T6	18	STRAP	.025	STEEL PLATE 4130
6	FRAME	.125	CLAD 2024-T42	19	SHEAR CLIP	.071	CLAD 7075-T6
7	ANGLE	.090	CLAD 7075-T6	20	SPLICE ANGLE	.125	CLAD 2024-T42
8	CAP	.250	PLATE 2024-T351	21	FILLER	.071	CLAD 2024-T3
9	CAP	.375	STEEL PLATE 4130	22	CAP	.190	CLAD 2024-T3
10	FITTING	2.250	STEEL PLATE 4130	23	FITTING	2.000	STEEL PLATE 4130
11	STRAP	.315	STEEL PLATE 4130	24	FITTING		4911383
12	FITTING		2614618	25	FRAME		2777930-5
13	SUPPORT		BAR 2014-T651				

BB3-213A

Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 6)



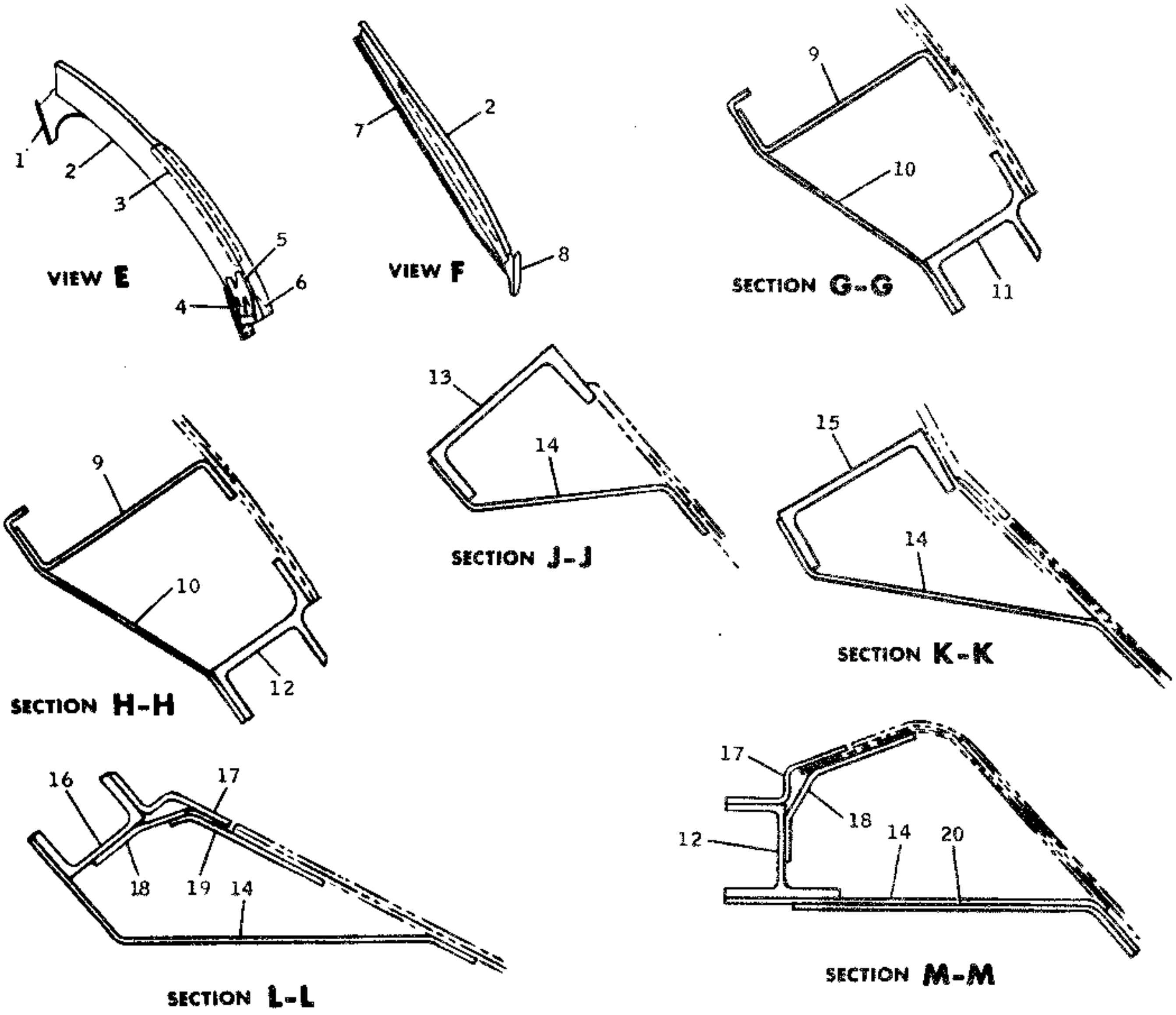
NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES EXCEPT AS NOTED
2. * RIGHT SIDE ONLY
3. ** LEFT SIDE ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6	10	DOUBLER	.090	STEEL SHEET 4130
2	FRAME	.090	CLAD 7075-T6	11	FITTING, 5641850-1, -2		STEEL BAR 4140
3	LONGERON		1243425	12	GUSSET	.090	STEEL SHEET 4130
4	BEAM	.071	CLAD 7075-T6	13	POST, 5912270-1, -2		STEEL BAR 4140
5	INTERCOSTAL	.090	CLAD 2024-T42	14	POST, 5643224		BAR 2014-T6
6	STRAP	.500	PLATE 2024-T351	15	GUSSET	.100	STEEL SHEET 4130
7	STIFFENER		2777922-4	16	BRACKET	.063	CLAD 7075-T6
8	PAN	.071	CLAD 6061-T6	17	DOUBLER	.500	PLATE 2024-T351
9	DOUBLER	.125	CLAD 7075-T6	18	DOUBLER	.312	PLATE 7075-T651

BB3-211

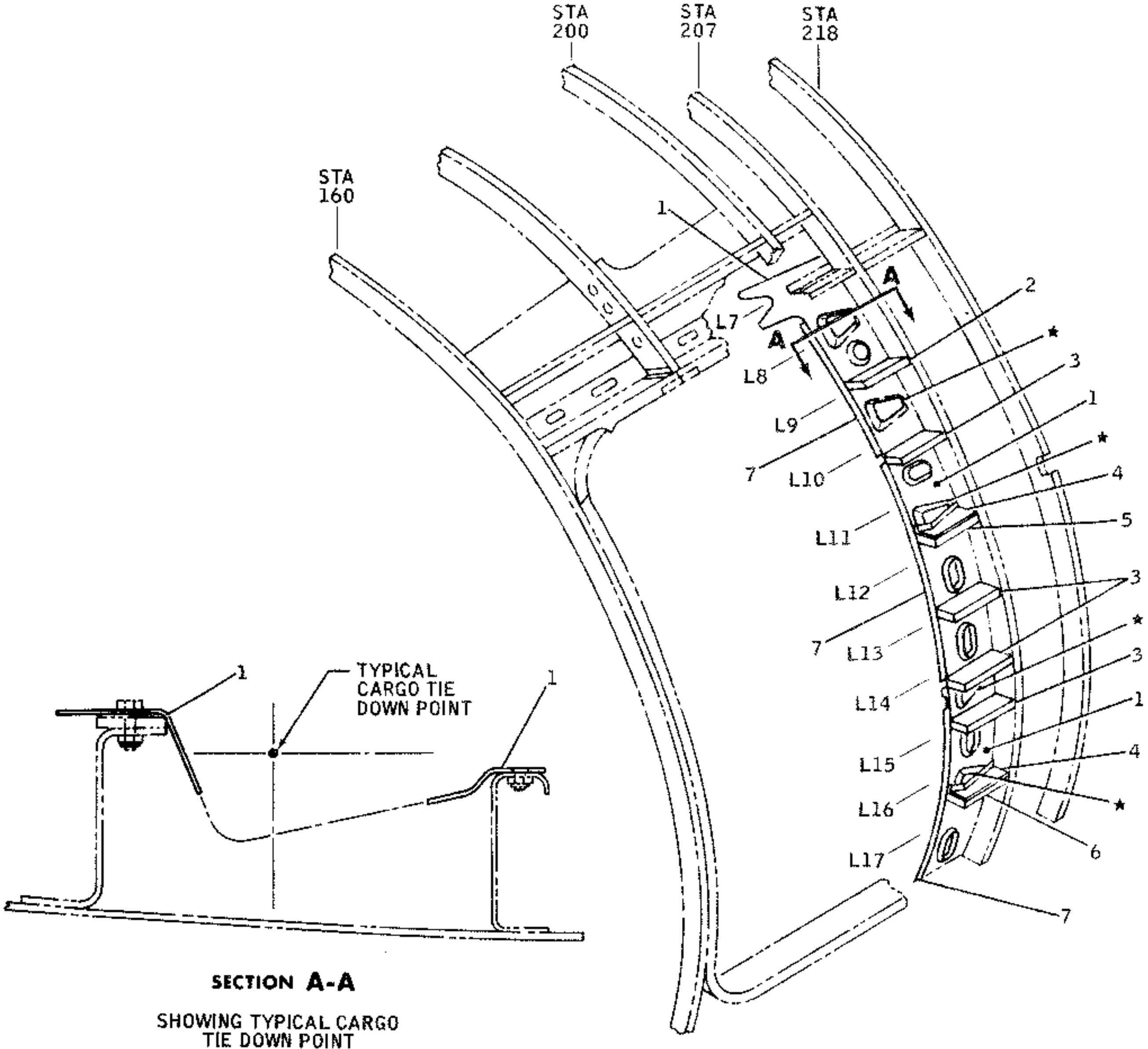
Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 7)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	GUSSET	.063	CLAD 7075-T6	11	FITTING, 5911373, -1, -2		BAR 2014-T651
2	FRAME	.125	CLAD 7075-T6	12	FITTING, 5911372-1		STEEL 4140
3	ANGLE		STEEL SHEET 4130	13	SILL, 5613731-1, -2		BAR 2014-T6
4	GUSSET	.090	CLAD 7075-T6	14	SKIN	.071	CLAD 7075-T6
5	FITTING, 3642944-1, -2		BAR 2014-T6	15	SILL, 5913730-1, -2		BAR 2014-T6
6	FITTING, 3642943-1, -2		BAR 2014-T6	16	FITTING, 5912067-1, -2		STEEL BAR 4140
7	ANGLE	.090	CLAD 7075-T6	17	ZEE	.090	CLAD 7075-T6
8	CLIP	.080	CLAD 7075-T6	18	DOUBLER	.090	CLAD 7075-T6
9	ZEE	.071	CLAD 7075-T6	19	DOUBLER, 3916850-1, -2	.090	STEEL SHEET 4130
10	WEB	.071	CLAD 7075-T6	20	DOUBLER	.071	CLAD 7075-T6

BB3-557

Frames and Intercostals, Nose Upper Section,
Station 37 to 229
Figure 1 (Sheet 8)



SECTION A-A

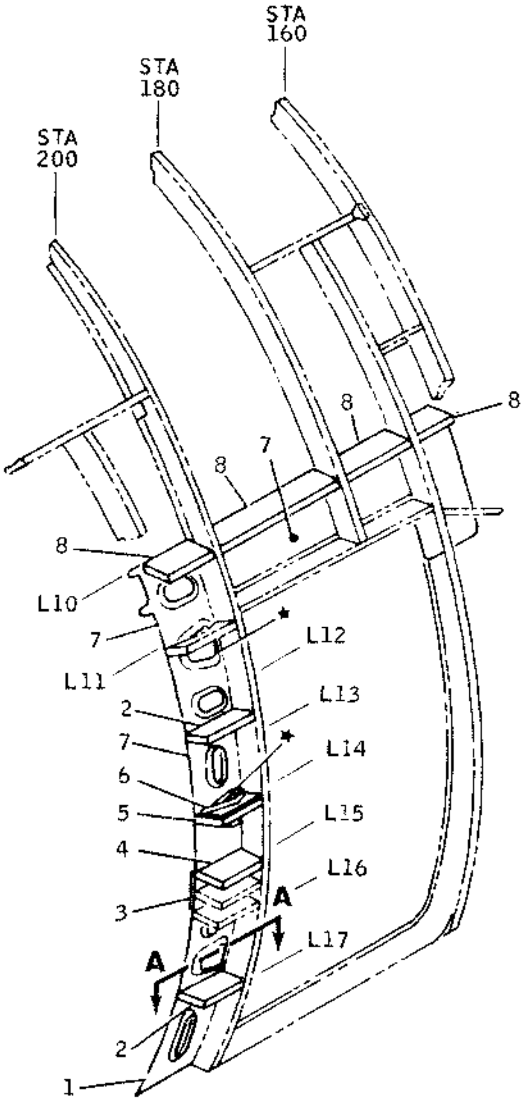
SHOWING TYPICAL CARGO TIE DOWN POINT
(★ STARS INDICATE ADDITIONAL CARGO TIE DOWN POINTS)

FORWARD PASSENGER DOOR AREA
TYPE II AIRPLANES ONLY

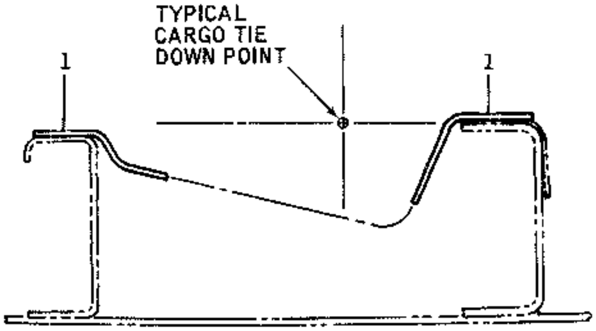
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SKIN	.050	CLAD 7075-T6
2	INTERCOSTAL	.090	CLAD 7075-T6
3	INTERCOSTAL	.071	CLAD 7075-T6
4	FITTING		3923861-1
5	INTERCOSTAL	.100	CLAD 7075-T6
6	INTERCOSTAL	.080	CLAD 7075-T6
7	SUPPORT	.032	CLAD 2024-T3

BB3-862

Frames and Intercostals, Nose Upper Section
Station 37 to 229
Figure 1 (Sheet 9)



SERVICE ENTRANCE DOOR AREA
TYPE II AIRPLANES ONLY



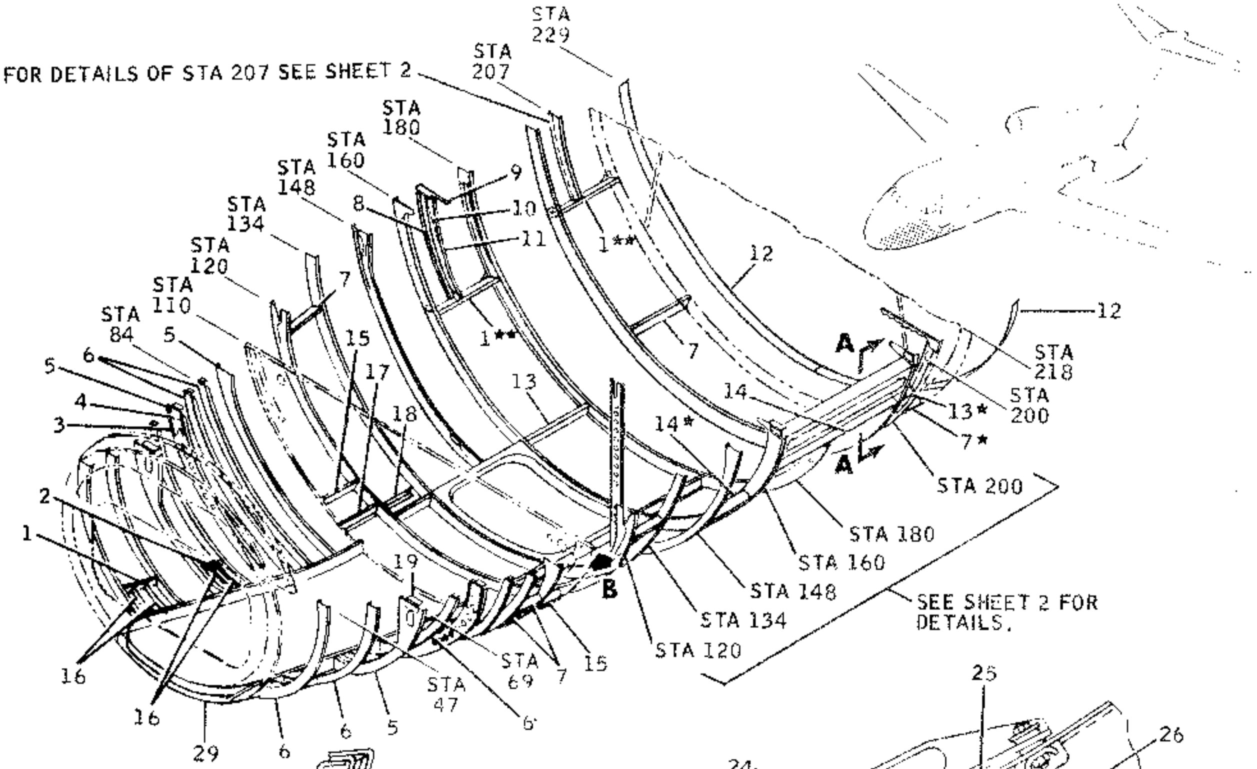
SECTION **A-A**

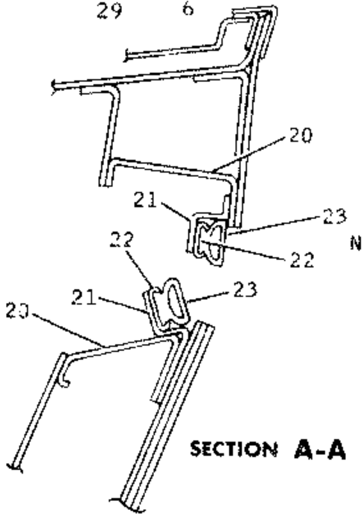
SHOWING TYPICAL CARGO
TIE DOWN POINT
(★STARS INDICATE ADDITIONAL
CARGO TIE DOWN POINTS)

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SKIN	.063	CLAD 2024-T42
2	INTERCOSTAL	.063	CLAD 7075-T6
3	PLATE	.063	CLAD 7075-T6
4	INTERCOSTAL	.063	CLAD 7075-T6
5	INTERCOSTAL	.071	CLAD 7075-T6
6	FITTING		3923836
7	INNER SKIN	.050	CLAD 2024-T42
8	INTERCOSTAL	.063	CLAD 2024-T42

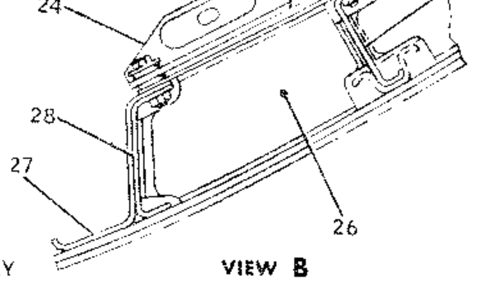
BB3-863

Frames and Intercostals, Nose Upper Section
Station 37 to 299
Figure 1 (Sheet 10)





SECTION **A-A**



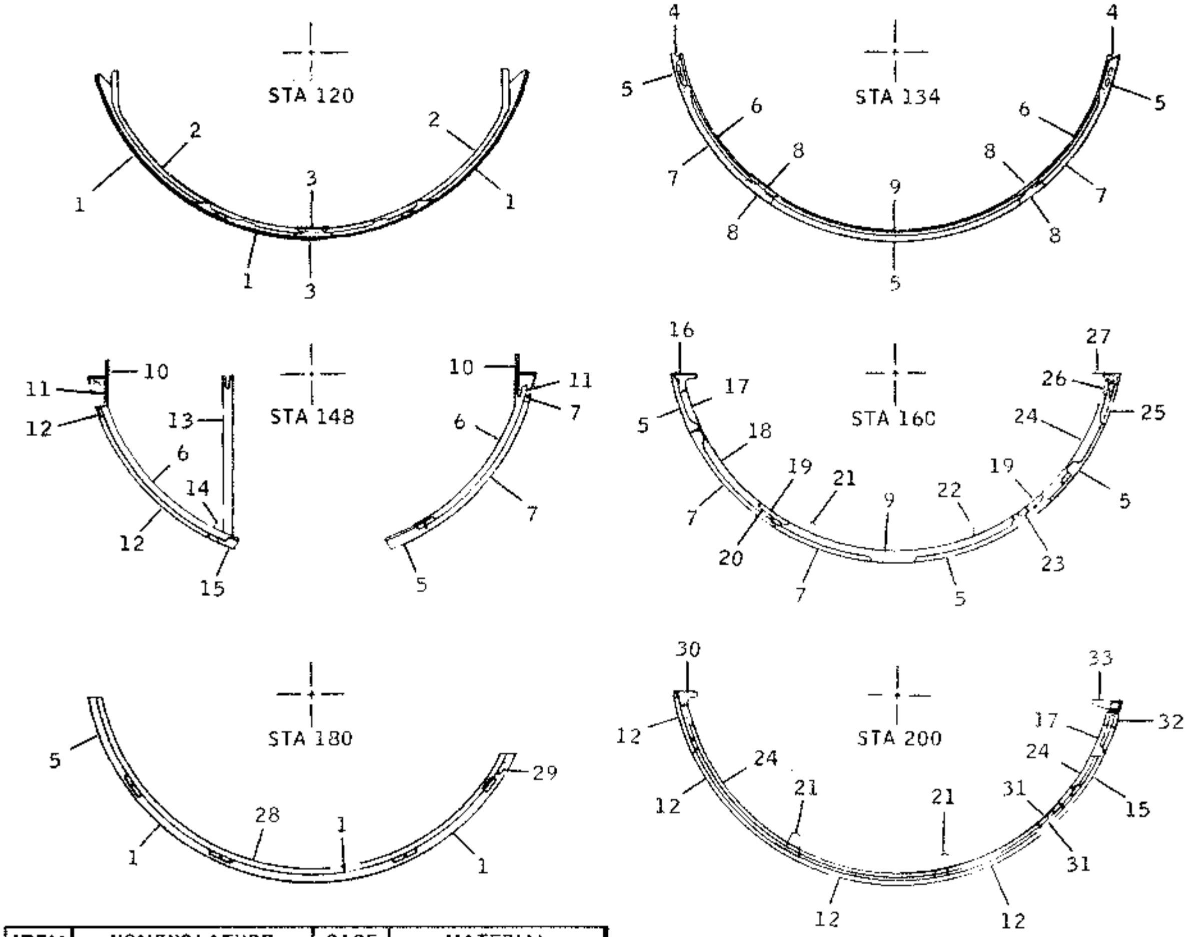
VIEW B

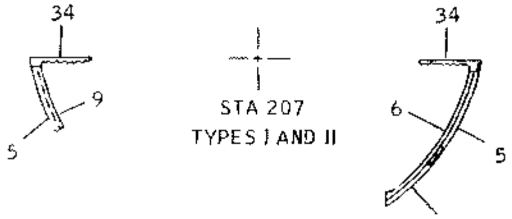
NOTES:
1. * LEFT SIDE ONLY
2. ** RIGHT SIDE ONLY
3. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES UNLESS OTHERWISE NOTED

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 2024-T42
2	INTERCOSTAL	.040	CLAD 2024-T3
3	DOUBLER	.040	CLAD 7075-T6
4	FITTING		4912951-1, -2
5	FRAME	.050	CLAD 7075-T6
6	FRAME	.040	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 7075-T6
8	SHEAR CLIP	.063	CLAD 2014-T6
9	FITTING		2614618
10	STIFFENER	.090	CLAD 2014-T6
11	FRAME	.090	CLAD 2024-T42
12	STRAP	.071	CLAD 7075-T6
13	INTERCOSTAL	.063	CLAD 7075-T6
14	INTERCOSTAL	.050	CLAD 7075-T6
15	INTERCOSTAL	.071	CLAD 7075-T6
16	INTERCOSTAL	.050	CLAD 2024-T3
17	FITTING		3912476-1,-2
18	TEE		2506869
19	ANGLE	.080	CLAD 7075-T6
20	INTERCOSTAL	.090	CLAD 7075-T6
21	SUPPORT	.063	CLAD 2024-T42
22	RETAINER		2915786
23	SEAL		SILICONE RUBBER
24	BRACKET		CRES 17-4PH
25	DOUBLER	.050	CLAD 2024-T42
26	FRAME	.050	CLAD 2024-T42
27	JAMB PAN	.063	CLAD 2024-T42
28	FRAME	.071	CLAD 2024-T42
29	JAMB	.050	CLAD 2024-T42

BB3-115A

Frames and Intercostals, Nose Lower Section,
Station 37 to 229
Figure 2 (Sheet 1)



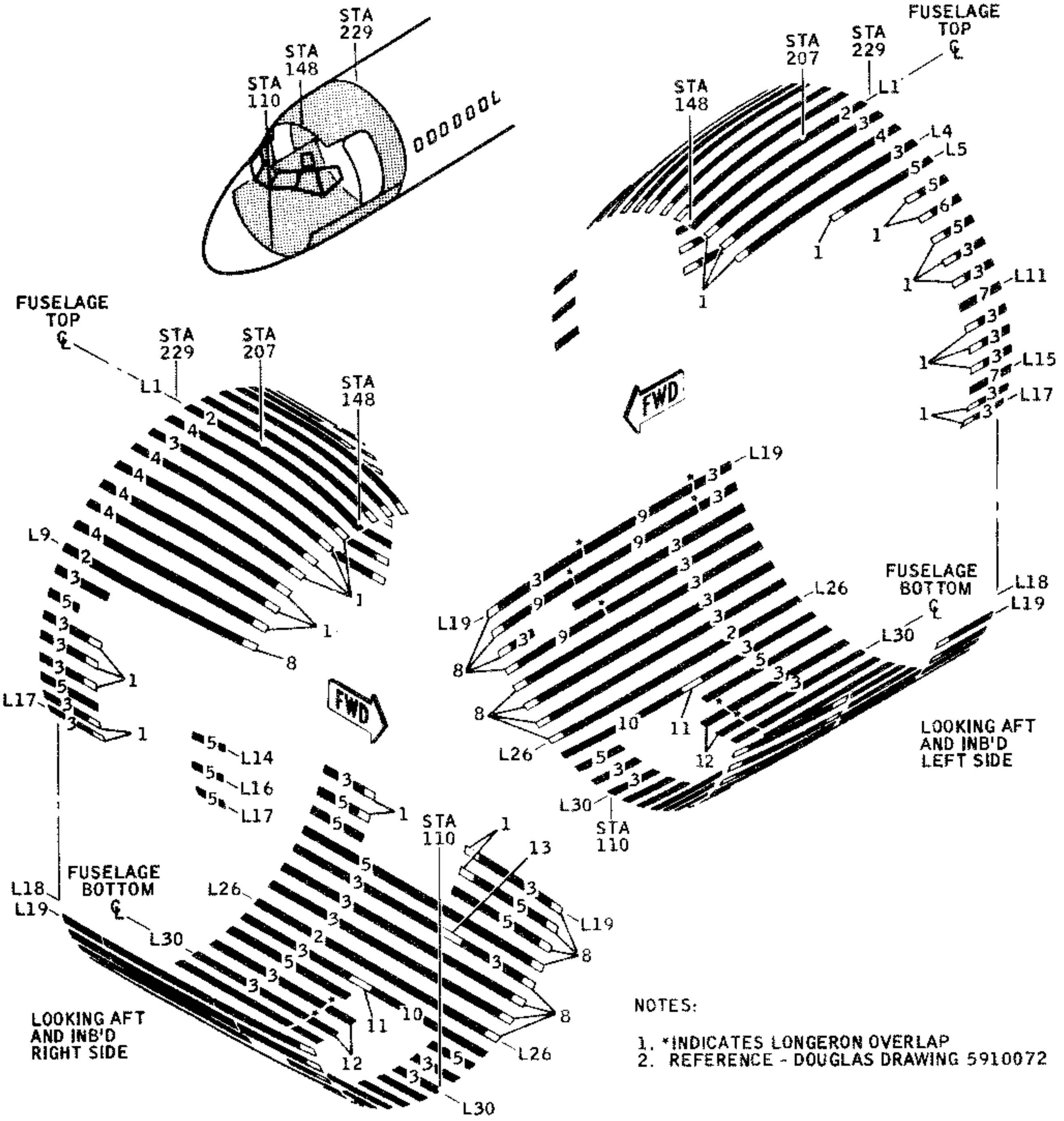


ALL VIEWS LOOKING AFT

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.050	CLAD 2014-T6
2	FRAME	.050	CLAD 7075-T6
3	SPLICE ANGLE	.050	CLAD 7075-T6
4	FITTING, 4915059-1, -2		1298097
5	FORMER	.071	CLAD 2014-T6
6	FRAME	.063	CLAD 7075-T6
7	FORMER	.063	CLAD 2014-T6
8	SPLICE ANGLE	.071	CLAD 7075-T6
9	FRAME	.071	CLAD 2024-T24
10	STRAP	.125	STEEL SHEET 4130
11	FITTING, 4912954-1, -2		2614618
12	FORMER	.063	CLAD 7075-T6
13	POST	.050	CLAD 7075-T6
14	GUSSET	.063	CLAD 7075-T6
15	FORMER	.071	CLAD 7075-T6
16	FITTING, 4912943-1		2614618
17	STIFFENER	.090	CLAD 7075-T6
18	FRAME		2777930-7
19	GUSSET	.080	CLAD 2024-T42
20	SPLICE ANGLE	.080	CLAD 2024-T42
21	CHANNEL	.080	CLAD 2024-T42
22	FITTING, 4917179-1		PLATE 7075-T651
23	SPLICE ANGLE	.063	CLAD 2024-T42
24	FRAME	.090	CLAD 2024-T42
25	ANGLE	.090	CLAD 7075-T6
26	FITTING, 3912858-1		STEEL PLATE 4130
27	FITTING, 3914462-1		STEEL BAR 4130
28	FRAME		2777930-5
29	CHANNEL	.050	CLAD 7075-T6
30	FITTING, 4912939-1		2911391
31	SPLICE ANGLE	.100	CLAD 2024-T42
32	FITTING, 4912938-1		STEEL PLATE 4130
33	FITTING, 3914461-1		STEEL BAR 4130
34	FITTING, 3912825-1, -2		2614618

BB3-327A

Frames and Intercostals, Nose Lower Section,
Station 37 to 229
Figure 2 (Sheet 2)



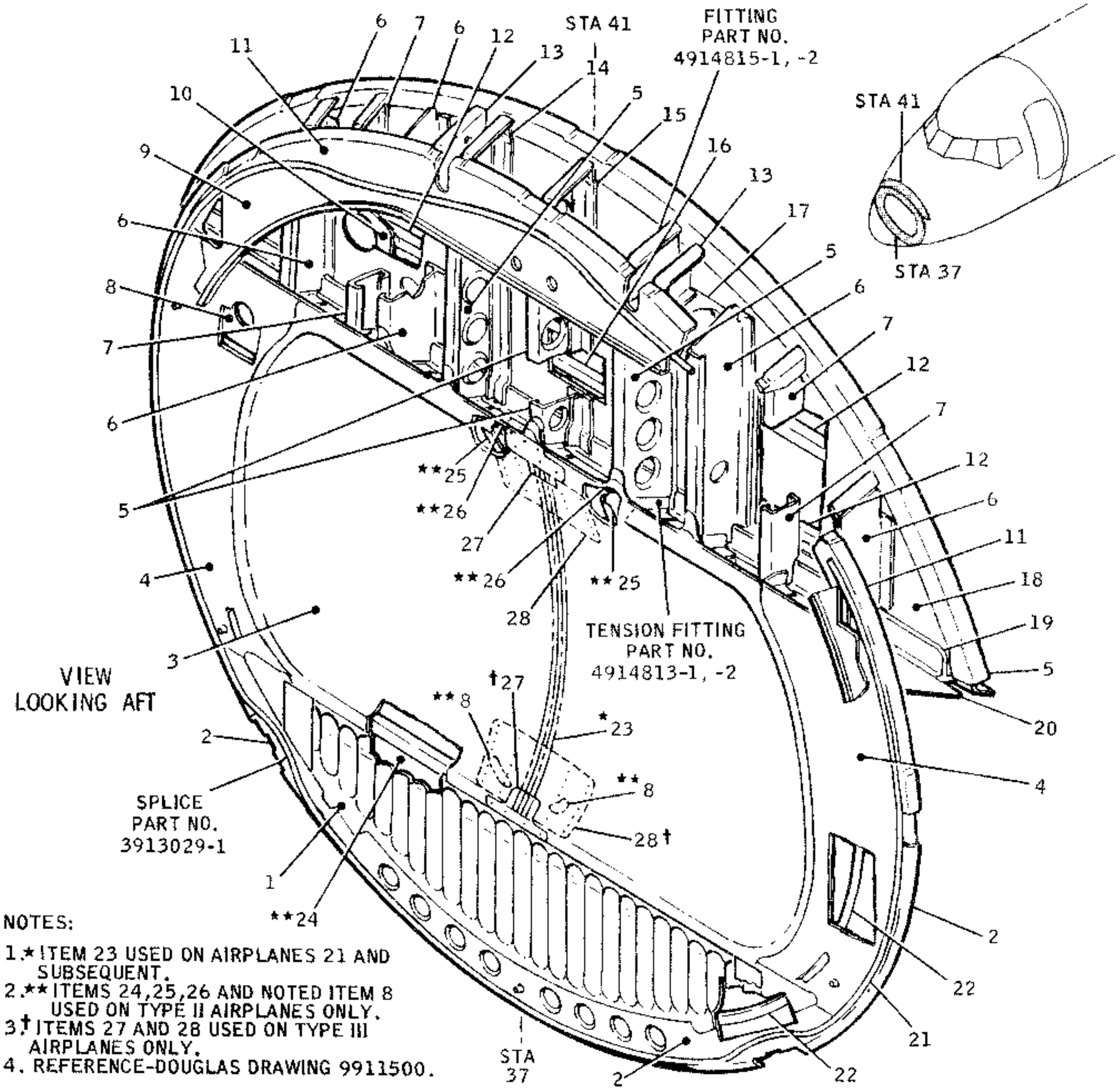
NOTES:

1. *INDICATES LONGERON OVERLAP
2. REFERENCE - DOUGLAS DRAWING 5910072

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLIP	.050	CLAD 7075-T6	8	CLIP	.063	CLAD 7075-T6
2	LONGERON		2777948-5	9	LONGERON	.063	CLAD 7075-T6
3	LONGERON		2777922-3	10	LONGERON		2777948
4	LONGERON		2777922-1	11	FITTING		2912099
5	LONGERON		2777922-4	12	LONGERON	.040	CLAD 7075-T6
6	LONGERON		2777922-5	13	FITTING	.875	CLAD 7075-T651
7	LONGERON		2777923				

BB3-72

Longerons, Station 37 to 229
Figure 3



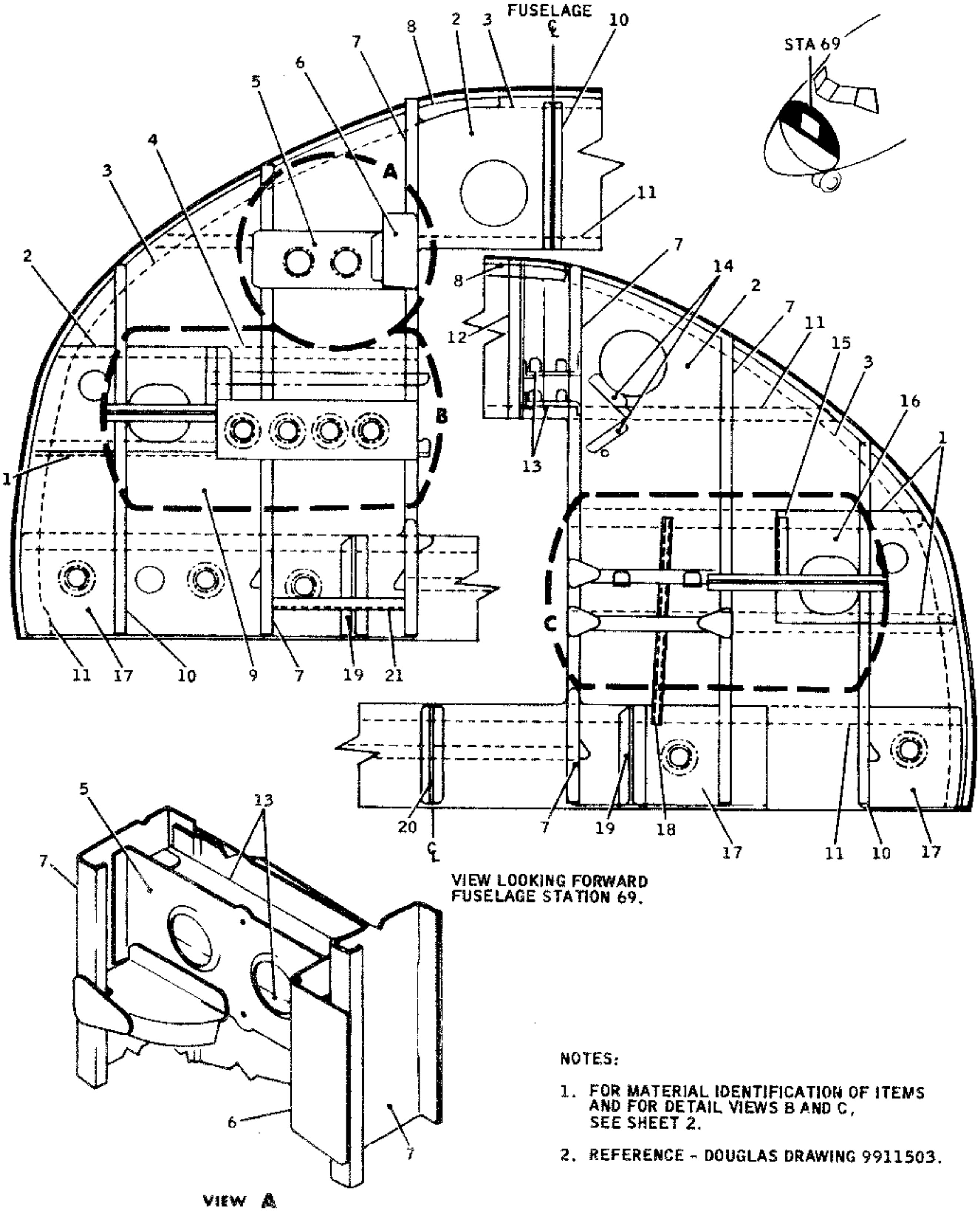
NOTES:

1.* ITEM 23 USED ON AIRPLANES 21 AND SUBSEQUENT.
2.** ITEMS 24,25,26 AND NOTED ITEM 8 USED ON TYPE II AIRPLANES ONLY.
3.† ITEMS 27 AND 28 USED ON TYPE III AIRPLANES ONLY.
4. REFERENCE-DOUGLAS DRAWING 9911500.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.020	CLAD 2024-T42	15	TEE		1482282
2	FORMER	.050	CLAD 7075-T6	16	SUPPORT		1417096
3	ANTENNA DISH	.025	CLAD 2024-T42	17	INTERCOSTAL	.032	CLAD 7075-T6
4	WEB	.020	CLAD 2024-T3	18	PANEL	.040	CLAD 2014-T6
5	FRAME	.080	CLAD 7075-T6	19	TEE		2914150
6	BEAM		4594694	20	SUPPORT	.063	CLAD 7075-T6
7	FRAME	.071	CLAD 7075-T6	21	SEAL		4913109-1
8	DOUBLER	.040	CLAD 2024-T3	22	ANGLE	.040	CLAD 7075-T6
9	FRAME	.040	CLAD 7075-T6	23	*STIFFENER		1093777
10	DOUBLER	.040	CLAD 2014-T6	24	**STIFFENER	.040	CLAD 7075-T6
11	ANGLE	.050	CLAD 7075-T6	25	**ANGLE	.040	CLAD 2024-T42
12	SUPPORT		1243092	26	**SUPPORT	.040	CLAD 2024-T42
13	INTERCOSTAL	.080	CLAD 7075-T6	27	† DOUBLER	.025	CLAD 2024-T3
14	ANGLE		1418201	28	† DOUBLER	.032	CLAD 2024-T3

BB3-808

Bulkhead, Station 37 and 41
Figure 4



VIEW LOOKING FORWARD
FUSELAGE STATION 69.

VIEW A

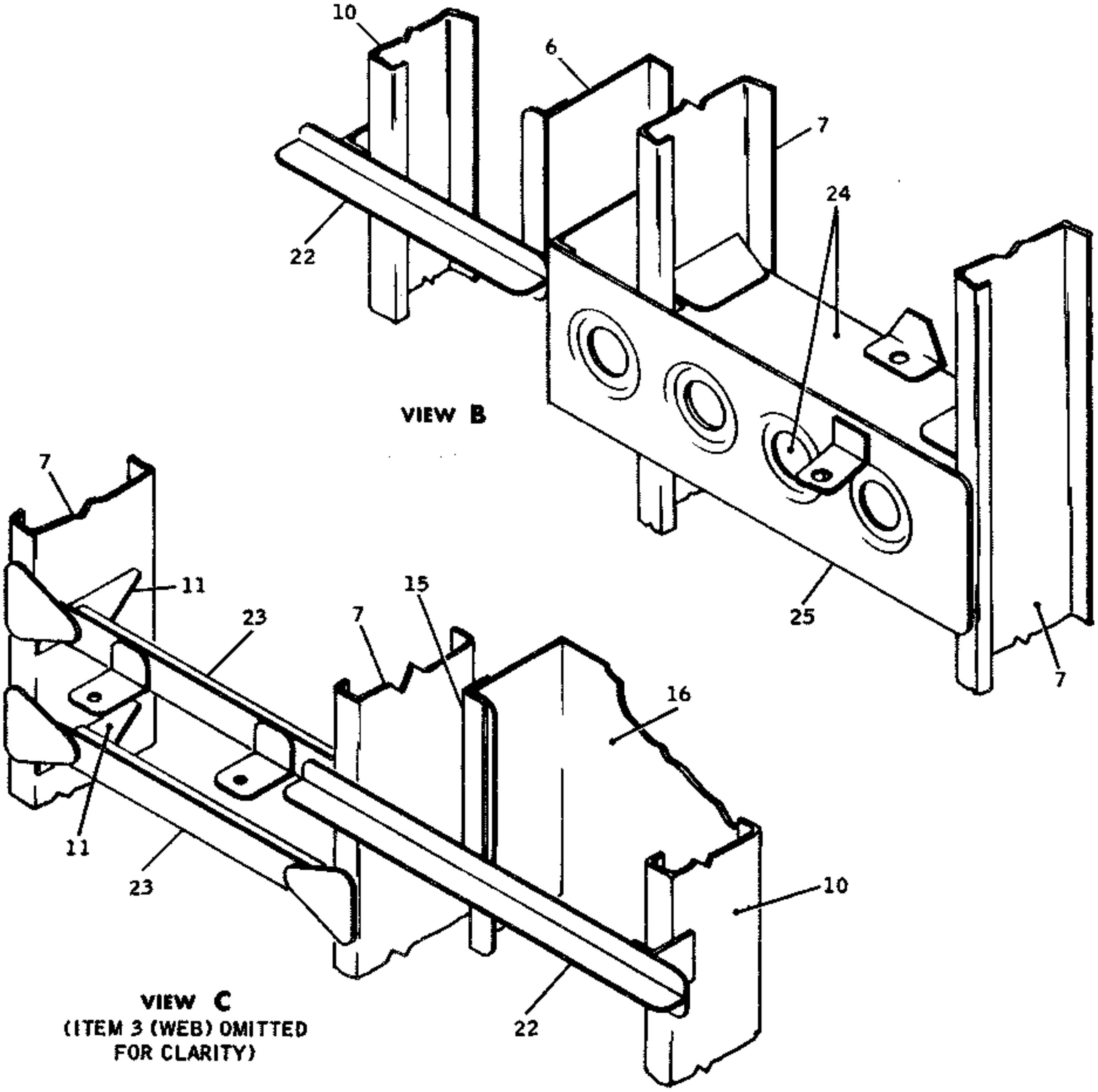
NOTES:

1. FOR MATERIAL IDENTIFICATION OF ITEMS AND FOR DETAIL VIEWS B AND C, SEE SHEET 2.

2. REFERENCE - DOUGLAS DRAWING 9911503.

BB3-81

Bulkhead, Station 69
Figure 5 (Sheet 1)



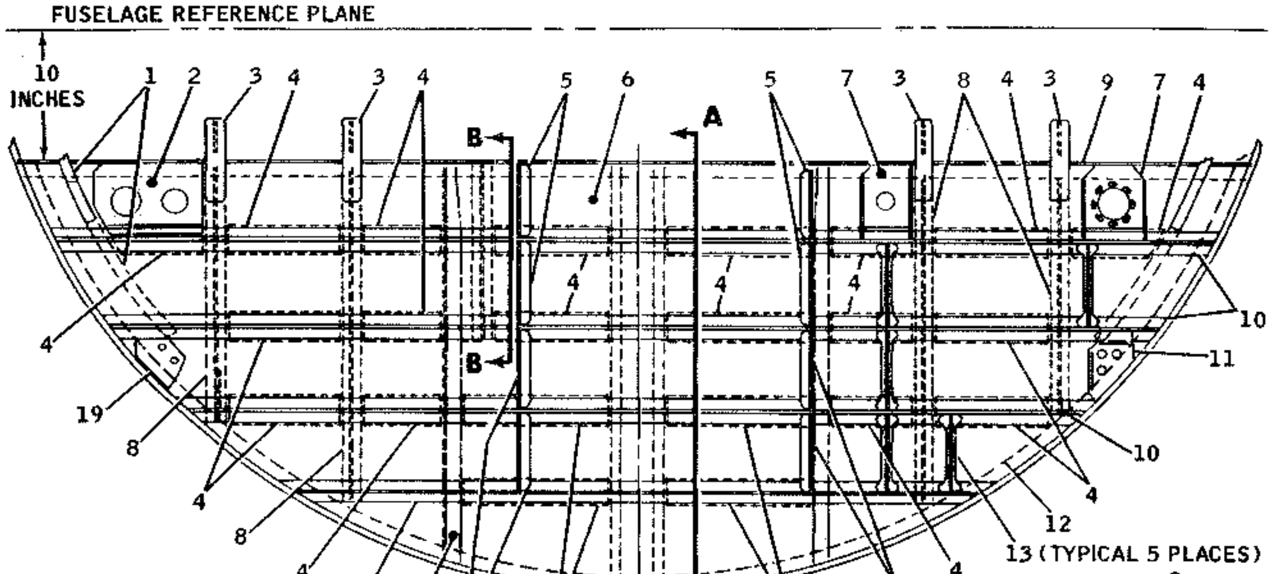
VIEW B

VIEW C
(ITEM 3 (WEB) OMITTED
FOR CLARITY)

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ZEE	.090	CLAD 7075-T6	14	SUPPORT	.050	CLAD 7075-T6
2	DOUBLER	.050	CLAD 2014-T6	15	ANGLE		1125597
3	FRAME	.100	CLAD 7075-T6	16	DOUBLER	.050	CLAD 2024-T3
4	ANGLE		1249581	17	DOUBLER	.050	CLAD 7075-T6
5	WEB	.071	CLAD 2024-T42	18	ZEE	.063	CLAD 7075-T6
6	SUPPORT	.063	CLAD 7075-T6	19	FITTING		3912376-1
7	CHANNEL	.071	CLAD 7075-T6	20	TEE		1329806
8	SPLICE ANGLE	.100	CLAD 7075-T6	21	ANGLE		1415741
9	WEB	.040	CLAD 7075-T6	22	TEE		137058
10	CHANNEL	.063	CLAD 7075-T6	23	CHANNEL		1417159
11	ANGLE		1287425	24	CHANNEL		1286684
12	STIFFENER	.063	CLAD 7075-T6	25	WEB	.032	CLAD 7075-T6
13	INTERCOSTAL	.050	CLAD 7075-T6				

BB3-97

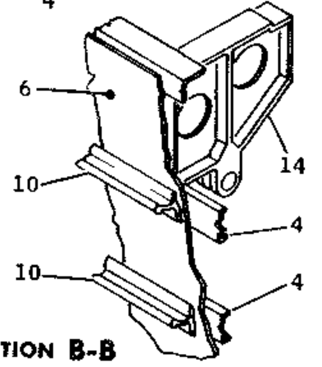
Bulkhead, Station 69
Figure 5 (Sheet 2)



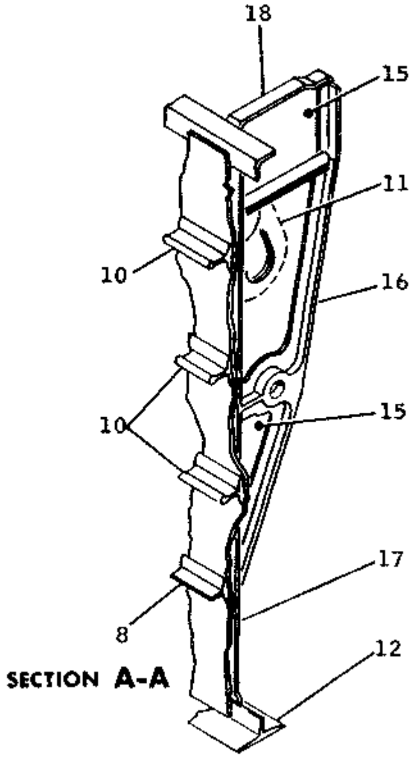
NOSE GEAR SUPPORT BEAM (REF), RIGHT AND LEFT SIDES

FUSELAGE ℄

VIEW LOOKING FORWARD
FUSELAGE STATION 110



SECTION B-B



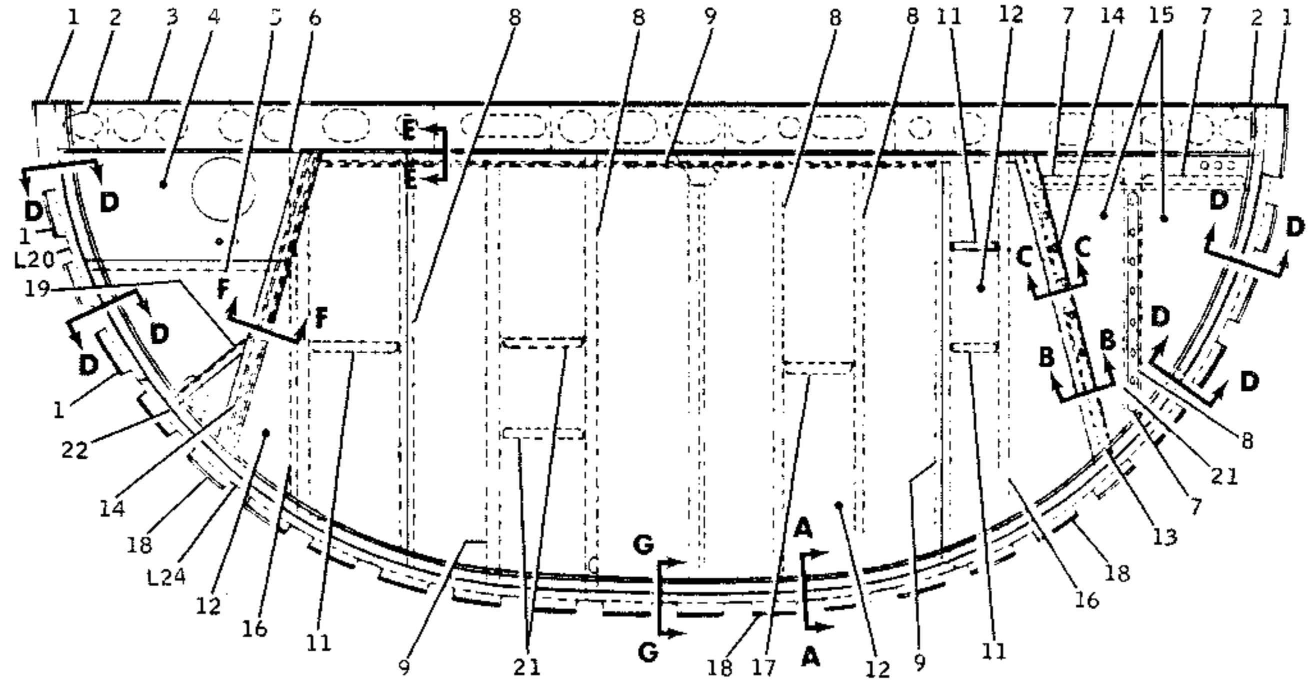
SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP ANGLE		1419292
*2	DOUBLER	.040	CLAD 7075-T6
3	STRAP	.125	CLAD 2024-T3
4	CHANNEL	.040	CLAD 2024-T3
5	ANGLE		1415595
6	WEB	.040	CLAD 2014-T6
7	DOUBLER	.040	CLAD 7075-T6
8	STIFFENER		4594694
9	ANGLE		2913108
10	STIFFENER		2777968
11	DOUBLER	.063	CLAD 7075-T6
12	CAP TEE		2912081
13	TEE FITTING		1414813
14	FITTING		5912386-1
15	WEB	.040	CLAD 7075-T6
16	FITTING		9911586-1, -2
17	CAP		1243327
18	CAP		167890
19	DOUBLER	.032	CLAD 7075-T6

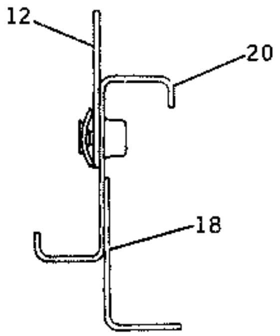
BB3-82A

NOTES:
1. *2014-T6 MATERIAL USED ON FUSELAGES 1 THOUGH 20.
2. REFERENCE - DOUGLAS DRAWING 9911509.

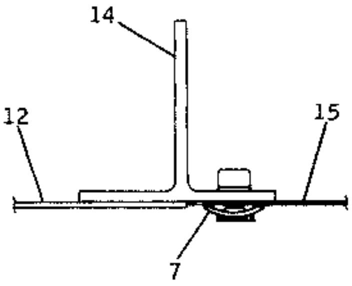
Bulkhead, Station 110
Figure 6



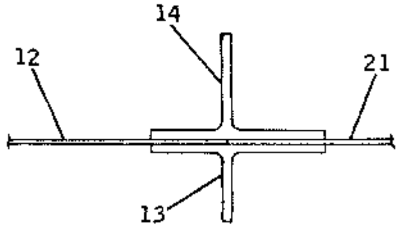
VIEW LOOKING FORWARD
FUSELAGE STATION 218



SECTION A-A



SECTION C-C



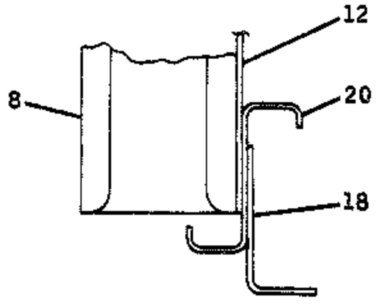
SECTION B-B

NOTES:

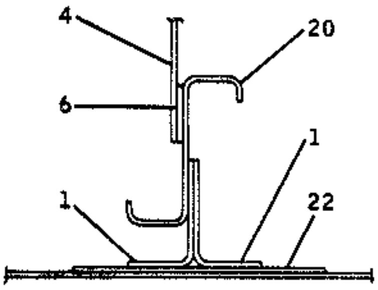
1. FOR MATERIAL IDENTIFICATION, SEE SHEET 2.
2. FOR SECTION VIEWS D-D, E-E, F-F AND G-G, SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 9911520.

BB3-752

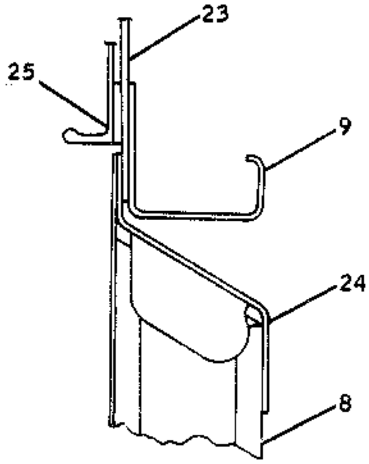
Bulkhead, Station 218 -- Type I
Figure 7 (Sheet 1)



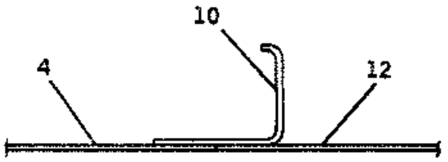
SECTION G-G



SECTION D-D



SECTION E-E

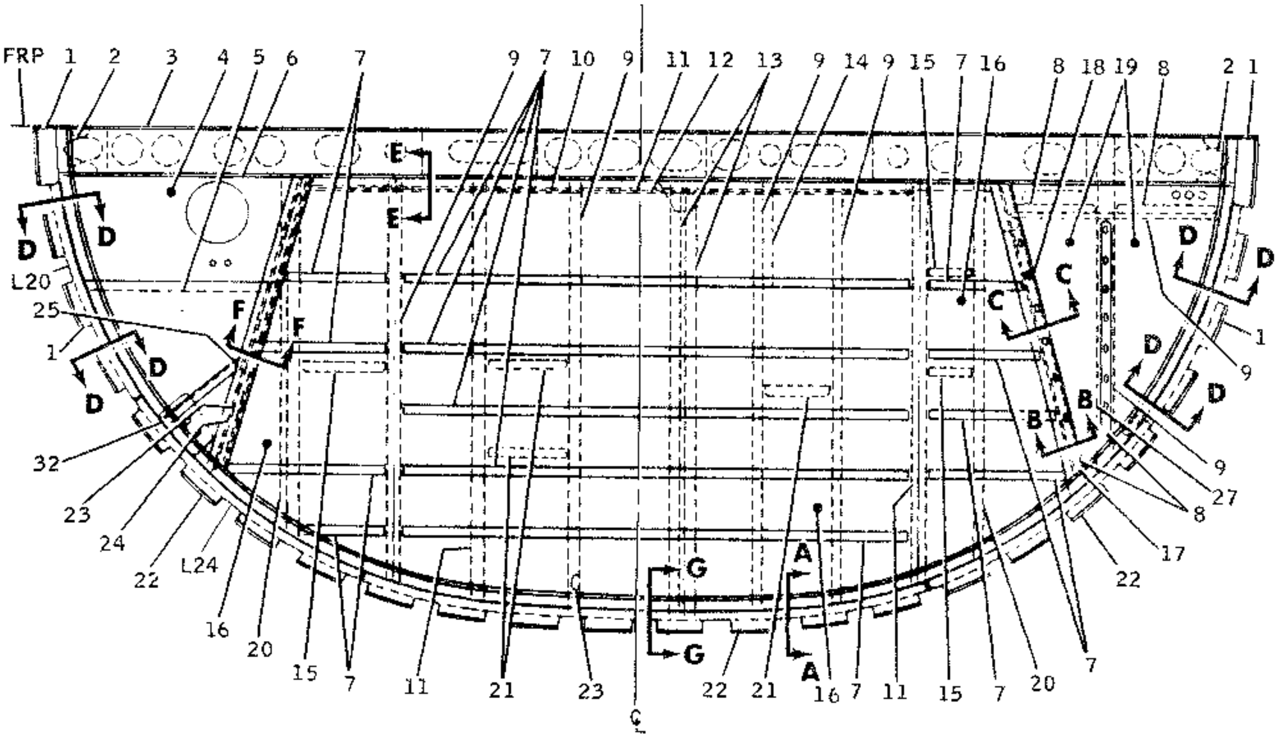


SECTION F-F

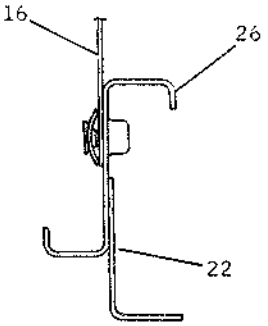
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 2014-T6	14	TEE		1329806
2	FITTING		2911391	15	BLOWOUT PANEL	.012	GLASS FIBER LAMINATE
3	BEAM		2777896				
4	WEB	.050	CLAD 7075-T6	16	CHANNEL	.050	CLAD 7075-T6
5	STIFFENER		1199981	17	ANGLE	.050	1418516
6	SPACER	.040	CLAD 7075-T6	18	FORMER	.050	CLAD 2014-T6
7	TRIM STRIP		2706706	19	STIFFENER	.063	CLAD 7075-T6
8	CHANNEL	.050	CLAD 7075-T6	20	FRAME	.063	2777930-5
9	CHANNEL	.071	CLAD 7075-T6	21	DOUBLER	.040	CLAD 7075-T6
10	SUPPORT	.063	CLAD 7075-T6	22	DOUBLER	.050	CLAD 7075-T6
11	INTERCOSTAL	.050	CLAD 2024-T3	23	SPACER	.125	CLAD 7075-T6
12	WEB	.032	CLAD 7075-T6	24	ZEE	.090	CLAD 7075-T6
13	TEE		1329806	25	BEAM		2777897

BB3-756

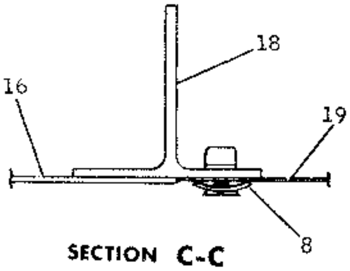
Bulkhead, Station 218 -- Type I
Figure 7 (Sheet 2)



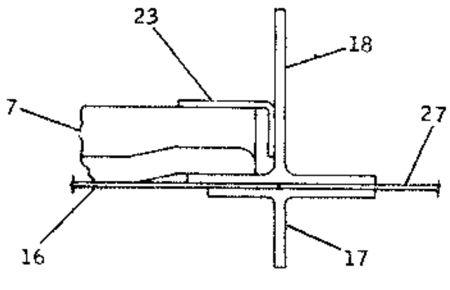
VIEW LOOKING FORWARD
FUSELAGE STATION 218



SECTION A-A
(TYPICAL)



SECTION C-C



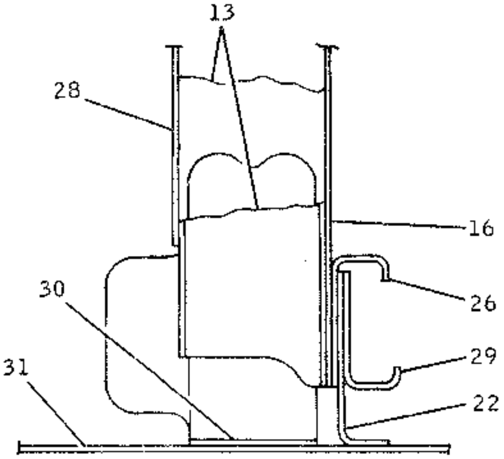
SECTION B-B

NOTES:

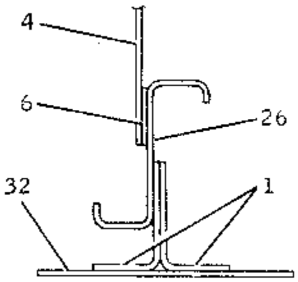
1. FOR MATERIAL IDENTIFICATION SEE SHEET 2.
2. FOR SECTION VIEWS D-D, E-E, F-F, AND G-G, SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 9911520.

BB3-83A

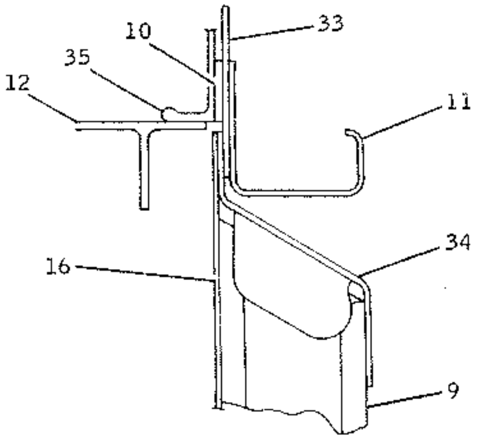
Bulkhead, Station 218 -- Type II
Figure 7A (Sheet 1)



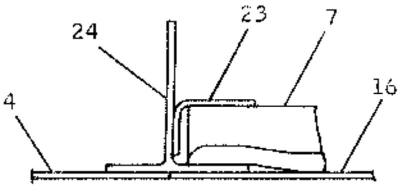
SECTION G-G



SECTION D-D



SECTION E-E

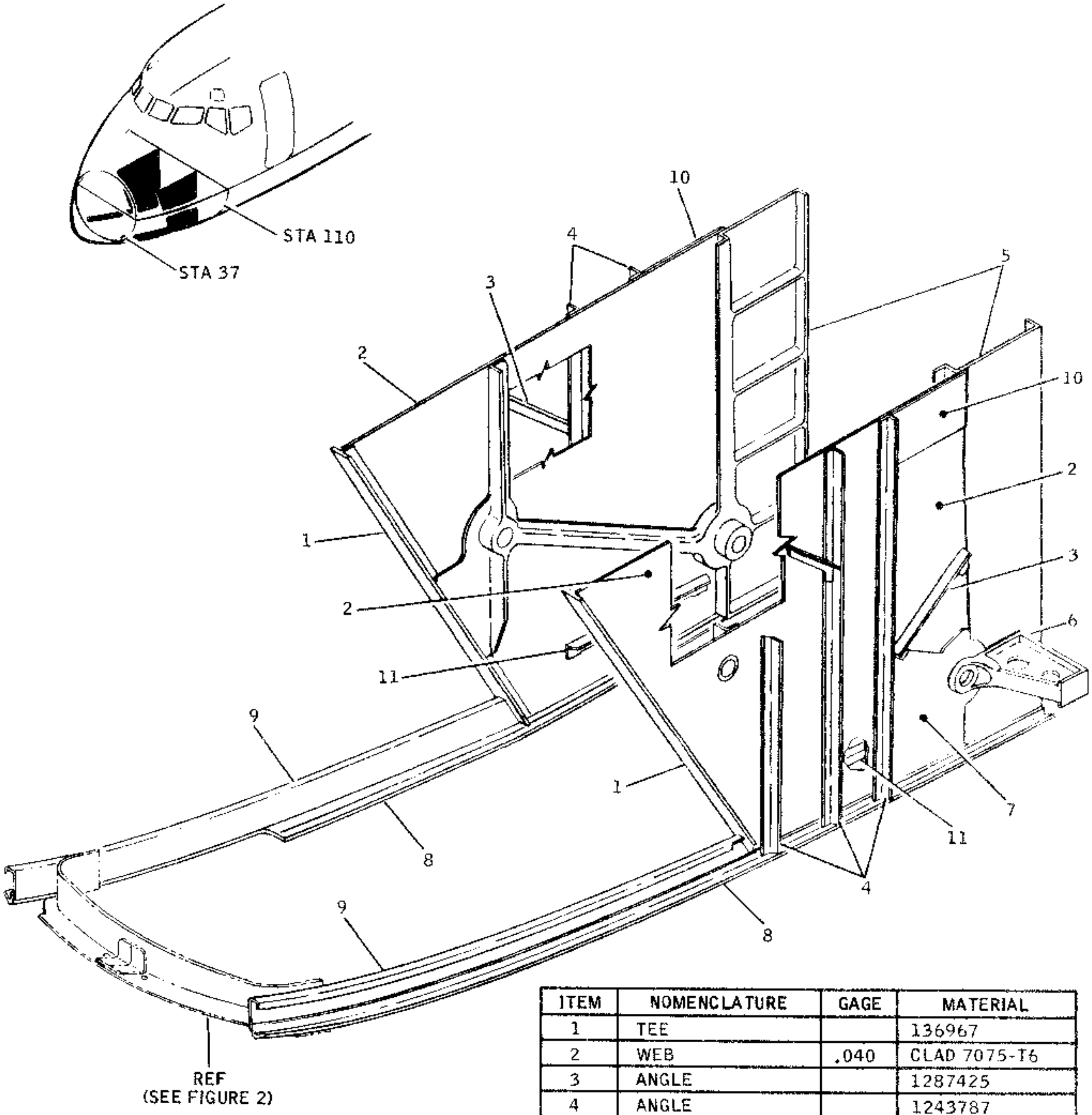


SECTION F-F

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 2014-T6
2	FITTING		2911391
3	BEAM		2777896
4	WEB	.050	CLAD 7075-T6
5	STIFFENER		1199981
6	SPACER	.040	CLAD 7075-T6
7	ZEE	.050	CLAD 7075-T6
8	TRIM STRIP		2706706
9	CHANNEL	.050	CLAD 7075-T6
10	SPACER	.050	CLAD 7075-T6
11	CHANNEL	.071	CLAD 7075-T6
12	TEE		1666744
13	CHANNEL	.080	CLAD 7075-T6
14	ZEE	.063	CLAD 7075-T6
15	INTERCOSTAL	.050	CLAD 2024-T3
16	WEB	.040	CLAD 7075-T6
17	TEE		1329806
18	TEE		1325214
19	BLOWOUT PANEL	.012	GLASS FIBER LAMINATE
20	CHANNEL	.063	CLAD 7075-T6
21	ANGLE	.050	1418516
22	FORMER	.050	CLAD 2014-T6
23	ANGLE	.063	CLAD 7075-T6
24	TEE		1642726
25	STIFFENER	.063	CLAD 7075-T6
26	FRAME		2777930-5
27	DOUBLER	.040	CLAD 7075-T6
28	DOUBLER	.080	CLAD 7075-T6
29	STIFFENER	.050	CLAD 7075-T6
30	JACK PAD ASSY		3914827-1
31	DOUBLER	.063	CLAD 7075-T6
32	DOUBLER	.050	CLAD 7075-T6
33	SPACER	.125	CLAD 7075-T6
34	ZEE	.090	CLAD 7075-T6
35	BEAM		2777897

BB3-126A

Bulkhead, Station 218 -- Type II
Figure 7A (Sheet 2)

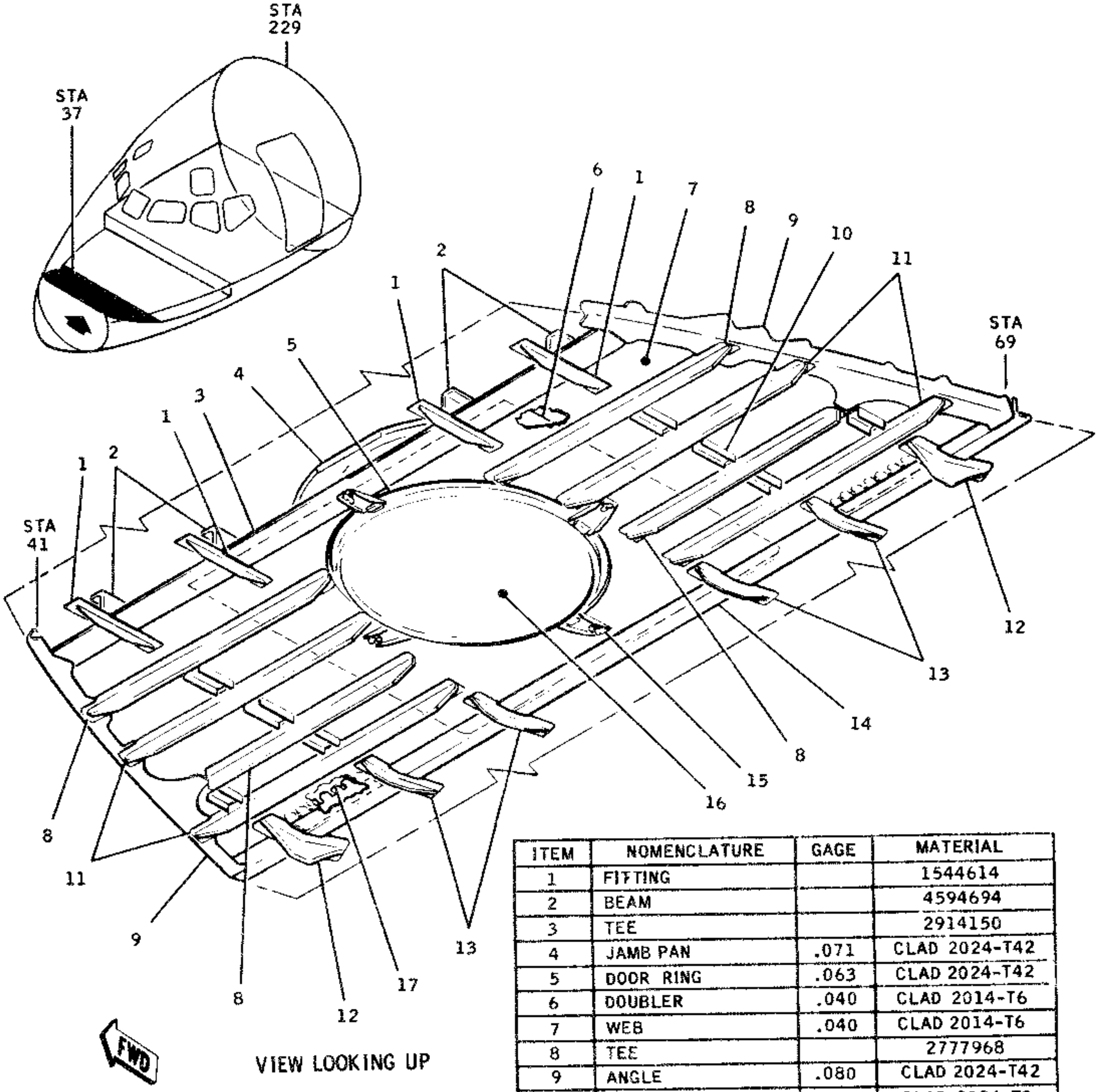


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		136967
2	WEB	.040	CLAD 7075-T6
3	ANGLE		1287425
4	ANGLE		1243787
5	FITTING	.500	PLATE 2014-T651
6	FITTING		FORGING 2014-T6
7	WEB	.032	CLAD 7075-T6
8	TEE		1642531
9	BEAM	.050	CLAD 2024-T42
10	DOUBLER	.032	CLAD 7075-T6
11	ANGLE		1418201

REFERENCE - DOUGLAS DRAWING 9910088

BB3-84A

Nose Gear Support Beam
Figure 8

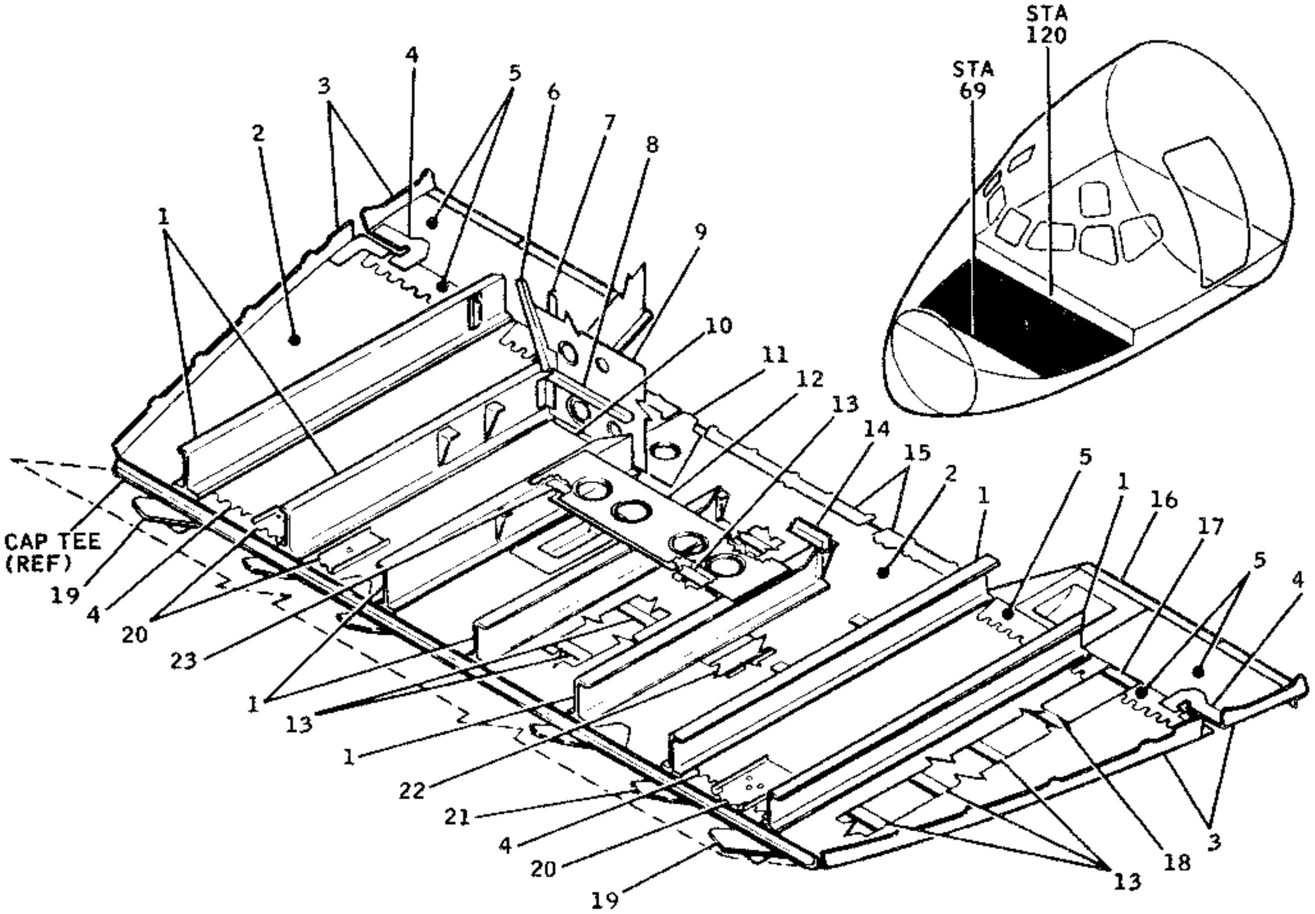


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		1544614
2	BEAM		4594694
3	TEE		2914150
4	JAMB PAN	.071	CLAD 2024-T42
5	DOOR RING	.063	CLAD 2024-T42
6	DOUBLER	.040	CLAD 2014-T6
7	WEB	.040	CLAD 2014-T6
8	TEE		2777968
9	ANGLE	.080	CLAD 2024-T42
10	CHANNEL (TYPICAL)	.040	CLAD 2024-T3
11	TEE		2613702
12	FITTING		4956878-1
13	FITTING		4956880-1
14	TEE		2914151
15	LATCH CHANNEL	.050	CLAD 2024-T3
16	DOOR PAN	.063	CLAD 2024-T42
17	DOUBLER	.032	CLAD 2024-T3

REFERENCE - DOUGLAS DRAWING 9910073

BB3-85

Pressure Panel, Station 41 to 69
Figure 9

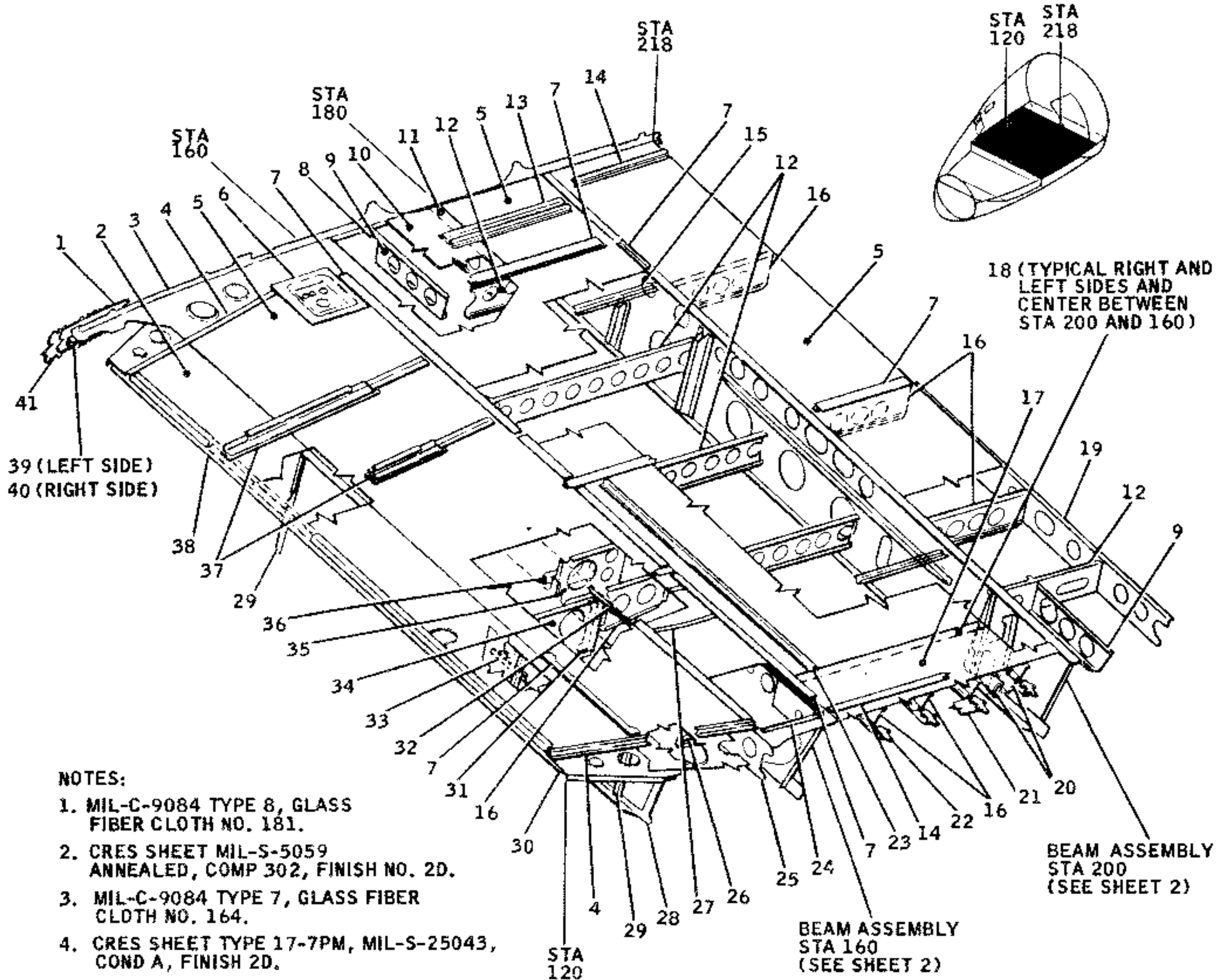


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BEAM		4594694
2	WEB	.040	CLAD 2014-T6
3	SUPPORT ANGLE	.080	CLAD 2024-T42
4	DOUBLER	.032	CLAD 2024-T3
5	WEB	.032	CLAD 2024-T3
6	ANGLE		1464575
7	ANGLE		1249243
8	ANGLE		1418516
9	WEB	.025	CLAD 2024-T42
10	TEE		1249240
11	DOUBLER	.050	CLAD 2024-T42
12	WEB	.032	CLAD 7075-T6
13	STIFFENER		2777968
14	TEE		1646170
15	STRIP	.032	CLAD 7075-T6
16	PAN	.032	SHEET 6061-T3
17	SUPPORT ANGLE		2913108
18	STIFFENER		2613702
19	FITTING		4956878-1
20	CHANNEL	.050	CLAD 2024-T42
21	FITTING (TYPICAL)		4956880-1
22	CAP TEE		1245835
23	CHANNEL	.063	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWING 9910073

BB3-86

Pressure Panel and Floor Support Structure,
Station 69 to 120
Figure 10



NOTES:

1. MIL-C-9084 TYPE 8, GLASS FIBER CLOTH NO. 181.
2. CRES SHEET MIL-S-5059 ANNEALED, COMP 302, FINISH NO. 2D.
3. MIL-C-9084 TYPE 7, GLASS FIBER CLOTH NO. 164.
4. CRES SHEET TYPE 17-7PM, MIL-S-25043, COND A, FINISH 2D.
5. RIGHT SIDE SHOWN; LEFT SIDE OPPOSITE.

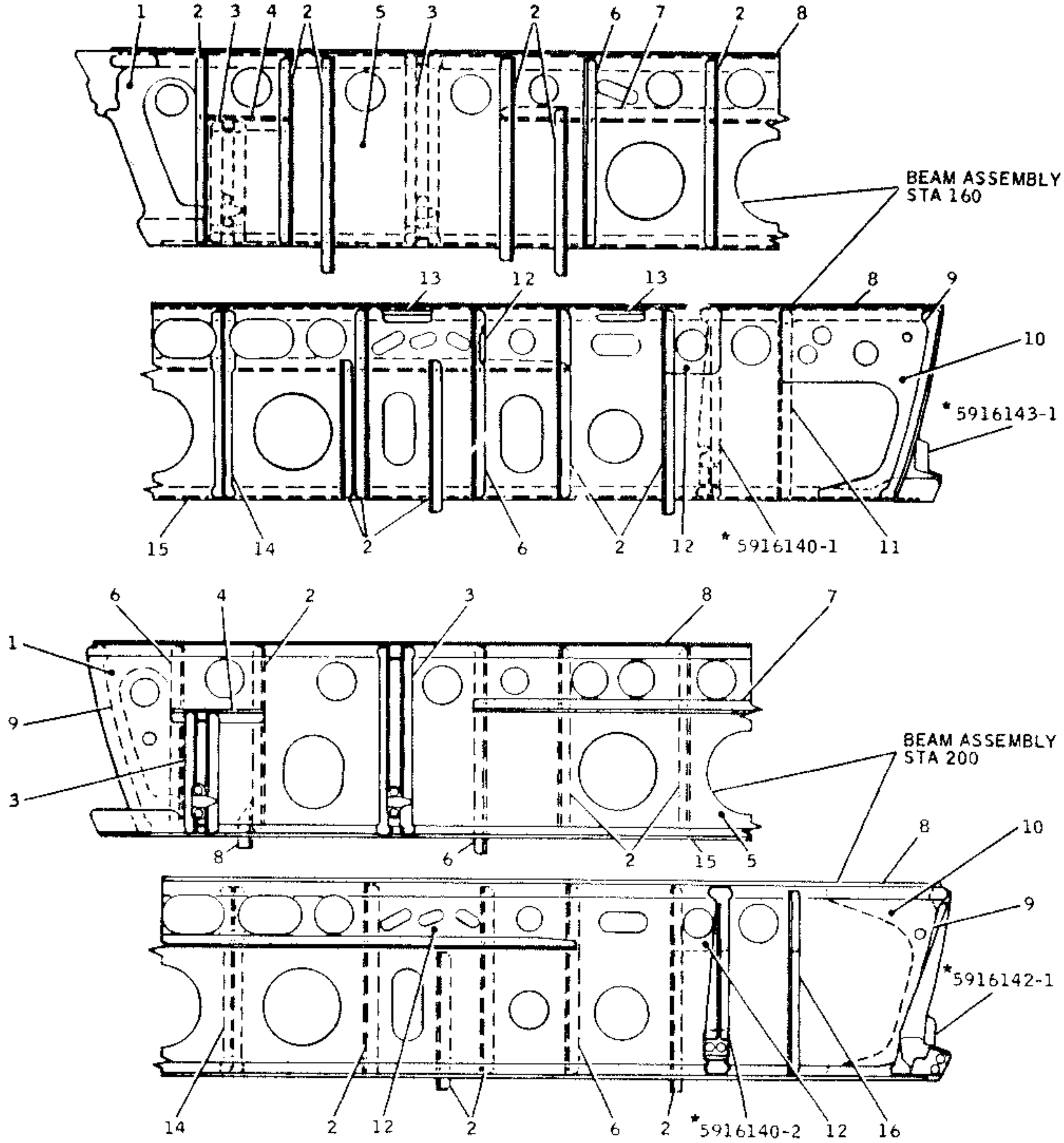
REFERENCE - DOUGLAS DRAWING 9910078

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.080	CLAD 7075-T6
2	DIAPHRAGM	.020	CLAD 2024-T4
3	UPPER CUSP ANGLE	.071	CLAD 7075-T6
4	SUPPORT		SEE NOTE 1
5	DIAPHRAGM	.020	CLAD 7075-T6
6	PAN	.025	SEE NOTE 2
7	SUPPORT		2652479
8	FITTING		2614618
9	BEAM	.071	CLAD 7075-T6
10	DOUBLER	.032	CLAD 7075-T6
11	FITTING		3912825-1
12	INTERCOSTAL	.063	CLAD 7075-T6
13	THERMAL BARRIER		SEE NOTE 3
14	SUPPORT		4616493
15	HAT		2777922-3
16	INTERCOSTAL	.050	CLAD 7075-T6
17	DIAPHRAGM	.040	CLAD 7075-T6
18	TEE		1414813
19	BEAM		2777896
20	INTERCOSTAL	.050	CLAD 2024-T3
21	CLIP	.090	CLAD 7075-T6
22	FITTING (TYPICAL)		3916393-1, -501, -503, AND -505

ITEM	NOMENCLATURE	GAGE	MATERIAL
23	HAT	.050	CLAD 2024-T4
24	ANGLE	.071	CLAD 2024-T4
25	BEAM		2614462
26	CHANNEL	.050	CLAD 2024-T4
27	STRAP	.040	CLAD 7075-T6
28	BEAM		4594047
29	STIFFENER (TYPICAL)		1294834
30	SUPPORT	.063	CLAD 7075-T6
31	ANGLE	.063	CLAD 7075-T6
32	ANGLE		1329780
33	STIFFENER		1415595
34	INTERCOSTAL	.040	CLAD 7075-T6
35	INTERCOSTAL	.040	CLAD 2024-T4
36	CHANNEL	.040	CLAD 2024-T4
37	SEAT TRACK		2912399 (SEE NOTE 5)
38	SUPPORT		1250426
39	LOWER CUSP ANGLE	.063	SEE NOTE 4
40	LOWER CUSP ANGLE	.090	CLAD 7075-T6
41	DOUBLER	.025	CLAD 2014-T6

BB3-87

Floor Support Structure, Station 120 to 218 -- Type I
Figure 11 (Sheet 1)



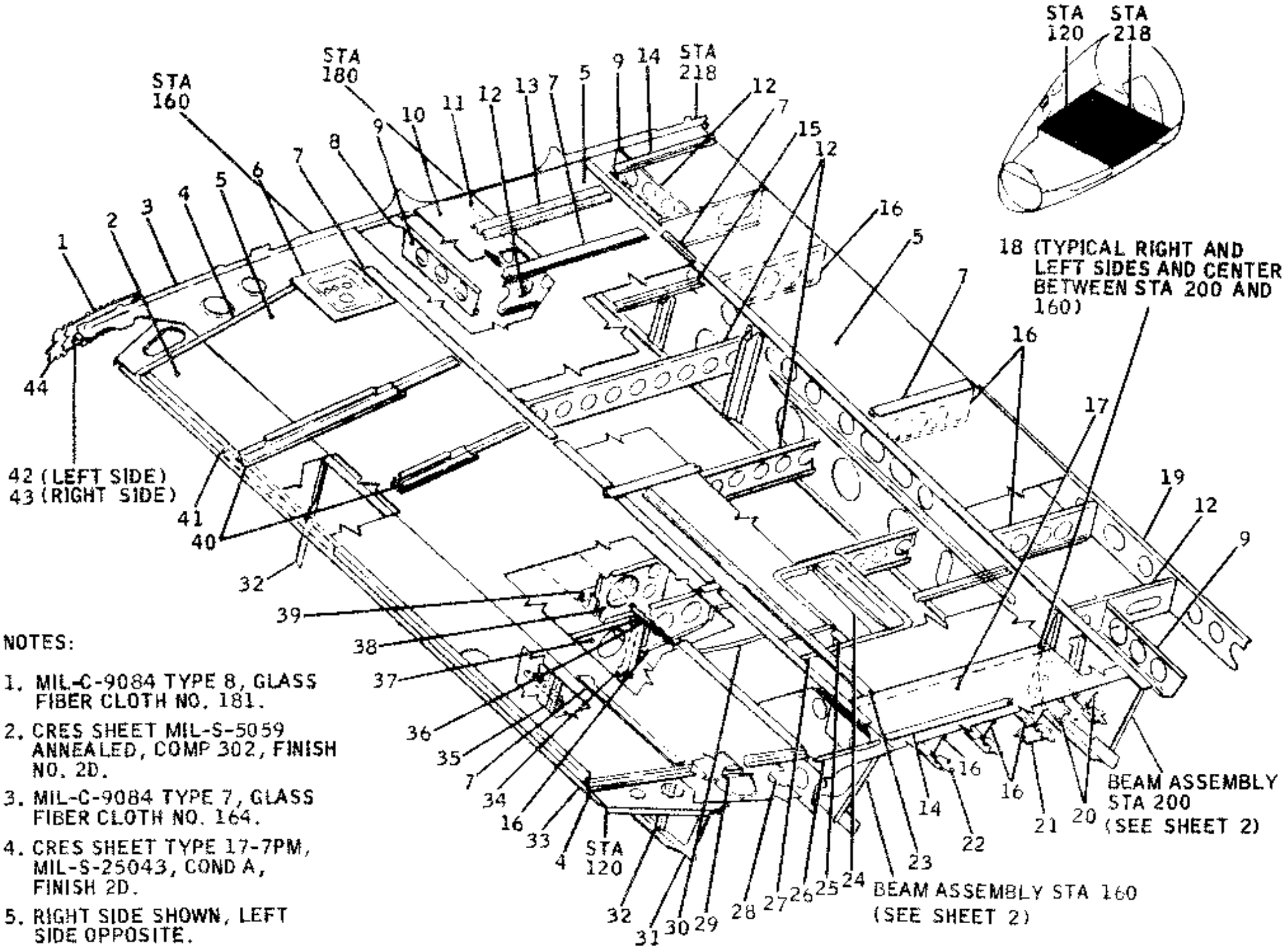
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.050	CLAD 2024-T42
2	STIFFENER		1415595
3	SUPPORT	.050	CLAD
4	ANGLE		119206
5	WEB	.032	CLAD 7075-T6
6	STIFFENER		1464575
7	STIFFENER		1242526
8	TEE		1414813

ITEM	NOMENCLATURE	GAGE	MATERIAL
9	ANGLE		161997C
10	DOUBLER	.063	CLAD 2024-T42
11	STIFFENER	.063	CLAD 7075-T6
12	DOUBLER	.040	CLAD 7075-T6
13	ANGLE		1286845
14	TEE		1430824
15	CAP		2777897
16	SUPPORT	.063	CLAD 7075-T6

* STAIRWAY SUPPORT

BB3-179

Floor Support Structure, Station 120 to 218 -- Type I
Figure 11 (Sheet 2)



NOTES:

1. MIL-C-9084 TYPE 8, GLASS FIBER CLOTH NO. 181.
2. CRES SHEET MIL-S-5059 ANNEALED, COMP 302, FINISH NO. 2D.
3. MIL-C-9084 TYPE 7, GLASS FIBER CLOTH NO. 164.
4. CRES SHEET TYPE 17-7PM, MIL-S-25043, COND A, FINISH 2D.
5. RIGHT SIDE SHOWN, LEFT SIDE OPPOSITE.

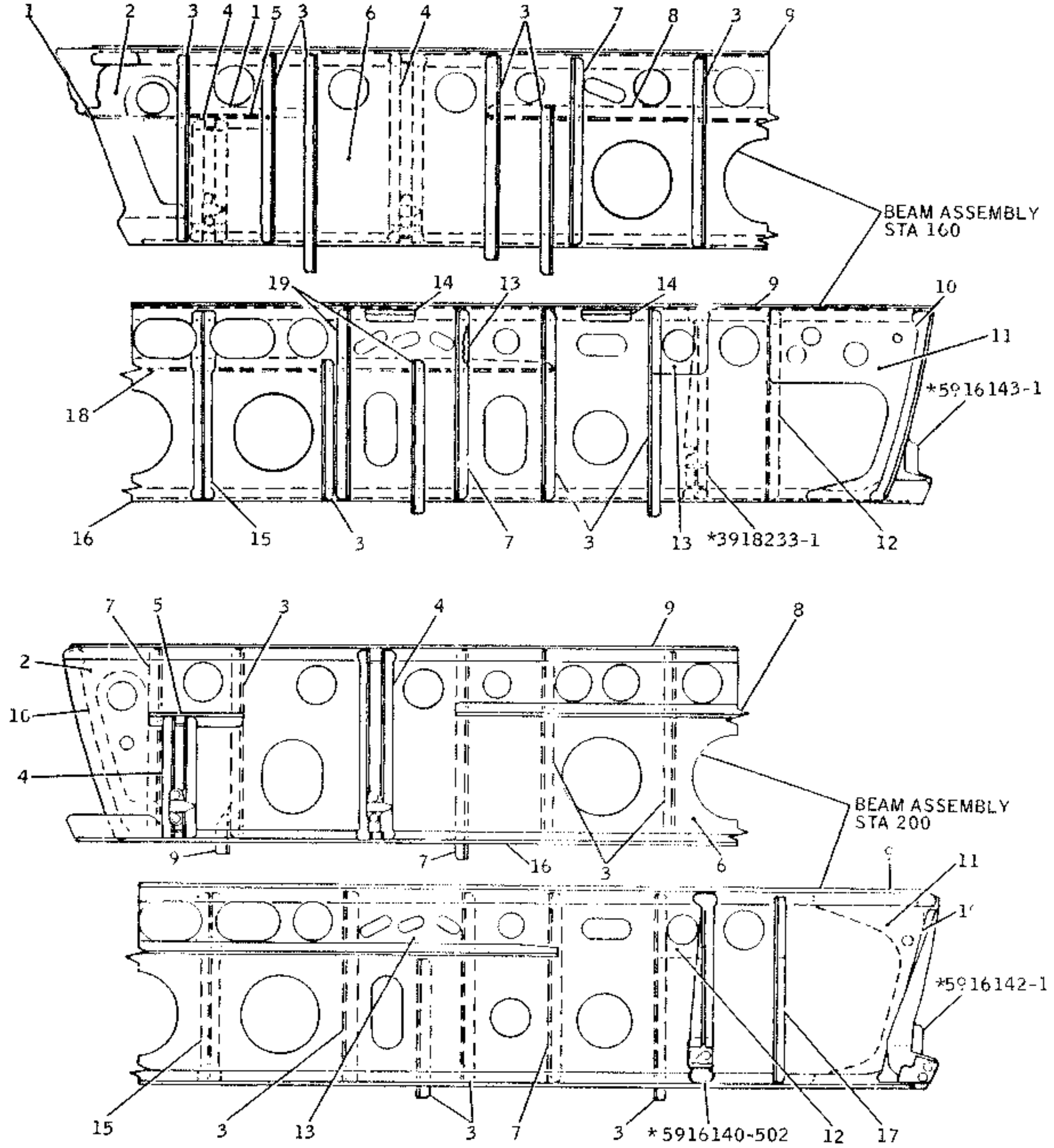
REFERENCE - DOUGLAS DRAWING 9910078

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.080	CLAD 7075-T6
2	DIAPHRAGM	.020	CLAD 2024-T4
3	UPPER CUSP ANGLE	.071	CLAD 7075-T6
4	SUPPORT		SEE NOTE 1
5	DIAPHRAGM	.020	CLAD 7075-T6
6	PAN	.025	SEE NOTE 2
7	SUPPORT		2652479
8	FITTING		2614618
9	BEAM	.071	CLAD 7075-T6
10	DIAPHRAGM	.020	CLAD 7075-T6
11	FITTING		3912825-1
12	INTERCOSTAL	.063	CLAD 7075-T6
13	THERMAL BARRIER		SEE NOTE 3
14	SUPPORT		4616493
15	HAT		2777922-3
16	INTERCOSTAL	.050	CLAD 7075-T6
17	DIAPHRAGM	.040	CLAD 7075-T6
18	TEE		1250495
19	BEAM		2777897
20	INTERCOSTAL	.050	CLAD 2024-T3
21	CLIP	.090	CLAD 7075-T6
22	FITTING (TYPICAL)		3916393-1, -501 -503 AND -505
23	HAT	.050	CLAD 2024-T4

ITEM	NOMENCLATURE	GAGE	MATERIAL
24	SUPPORT	.063	CLAD 2024-T42
25	BRACKET	.080	CLAD 2024-T42
26	ANGLE	.071	CLAD 2024-T4
27	PAN	.050	6061-T6
28	BEAM		2614462
29	CHANNEL	.050	CLAD 2024-T4
30	STRAP	.040	CLAD 7075-T6
31	BEAM		4594047
32	STIFFENER (TYPICAL)		1294834
33	SUPPORT	.063	CLAD 7075-T6
34	ANGLE	.063	CLAD 7075-T6
35	ANGLE		1329780
36	STIFFENER		1415595
37	INTERCOSTAL	.040	CLAD 7075-T6
38	INTERCOSTAL	.040	CLAD 2024-T4
39	CHANNEL	.040	CLAD 2024-T4
40	SEAT TRACK		2912399 (SEE NOTE 5)
41	SUPPORT		1250426
42	LOWER CUSP ANGLE	.063	SEE NOTE 4
43	LOWER CUSP ANGLE	.090	CLAD 7075-T6
44	DOUBLER	.025	CLAD 2014-T6

BB3-866

Floor Support Structure, Station 120 to 218 -- Type II
Figure 12 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SUPPORT	.032	CLAD 2024-T3
2	DOUBLER	.050	CLAD 2024-T42
3	STIFFENER		1415595
4	SUPPORT	.050	CLAD
5	ANGLE		119206
6	WEB	.032	CLAD 7075-T6
7	STIFFENER		1464575
8	STIFFENER		1242526
9	TEE		1414813
10	ANGLE		1619970
11	DOUBLER	.063	CLAD 2024-T42
12	STIFFENER	.063	CLAD 7075-T6
13	DOUBLER	.040	CLAD 7075-T6
14	ANGLE		1286845
15	TEE		1430824
16	CAP		2777897
17	SUPPORT	.063	CLAD 7075-T6
18	STIFFENER		1109080
19	STIFFENER		1093703

* STAIRWAY SUPPORT

BB3-867

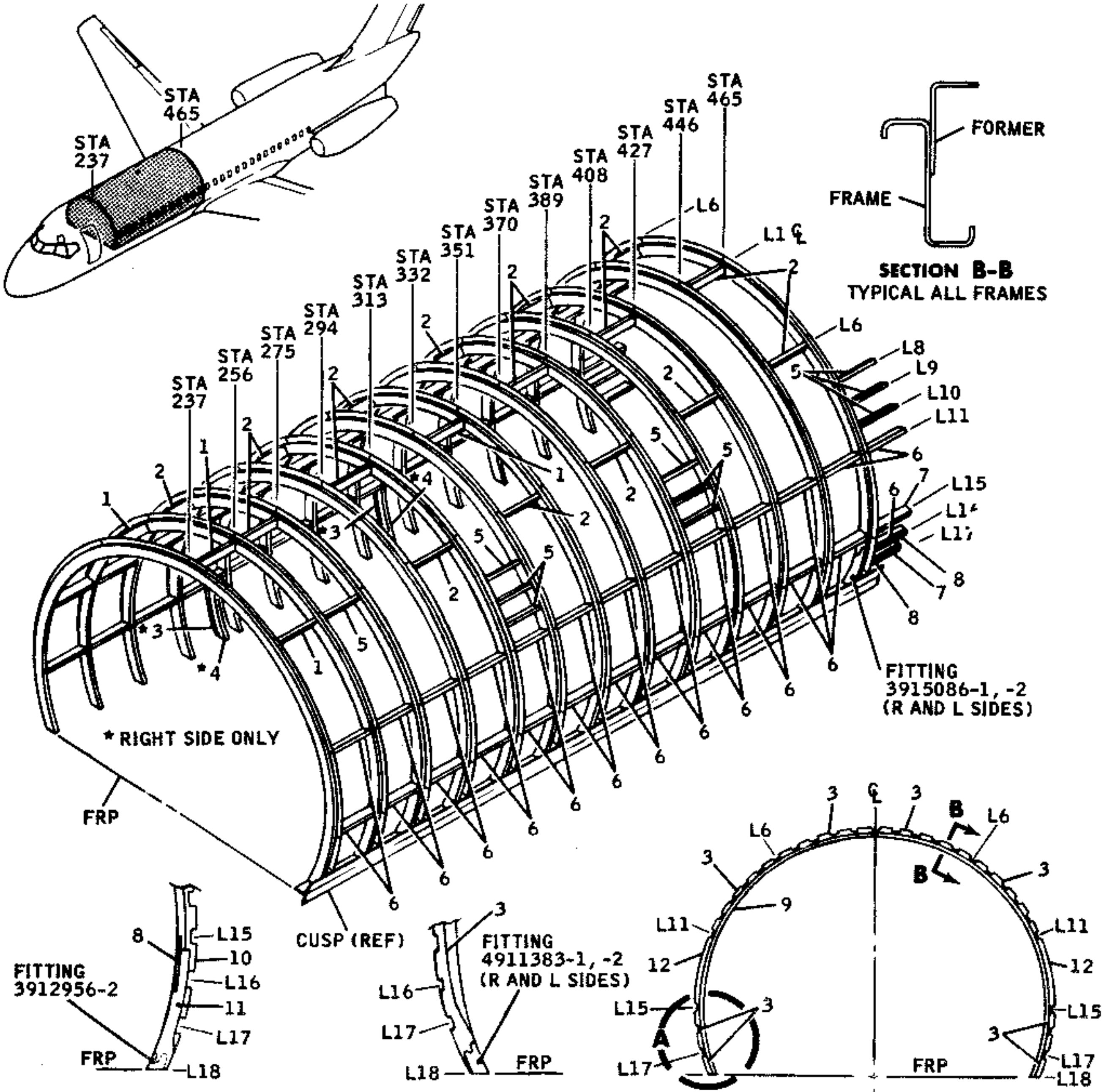
Floor Support Structure, Station 120 to 218 -- Type II
Figure 12 (Sheet 2)

FUSELAGE SECTION, STATION 229 TO 474 - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures illustrate the structural components of the fuselage section from station 229 to 474. The materials used are identified in the material lists by item number callouts.

Frames and Intercostals, Station 229 to 474, Upper Section	Figures 1 and 1A
Frames and Intercostals, Station 229 to 474, Lower Section	Figure 2
Longerons, Station 229 to 474	Figures 3 and 3A
Cargo Net Tie Down Details	Figure 3B
Floor Support Structure, Station 218 to 484	Figures 4 and 5



VIEW A
LOOKING FORWARD
DETAIL RIGHT SIDE AT
STA 313 AND 370 ONLY

VIEW
LOOKING FORWARD LEFT SIDE
TYPICAL ALL STATIONS (237-446)
EXCEPT AS SHOWN IN VIEW A

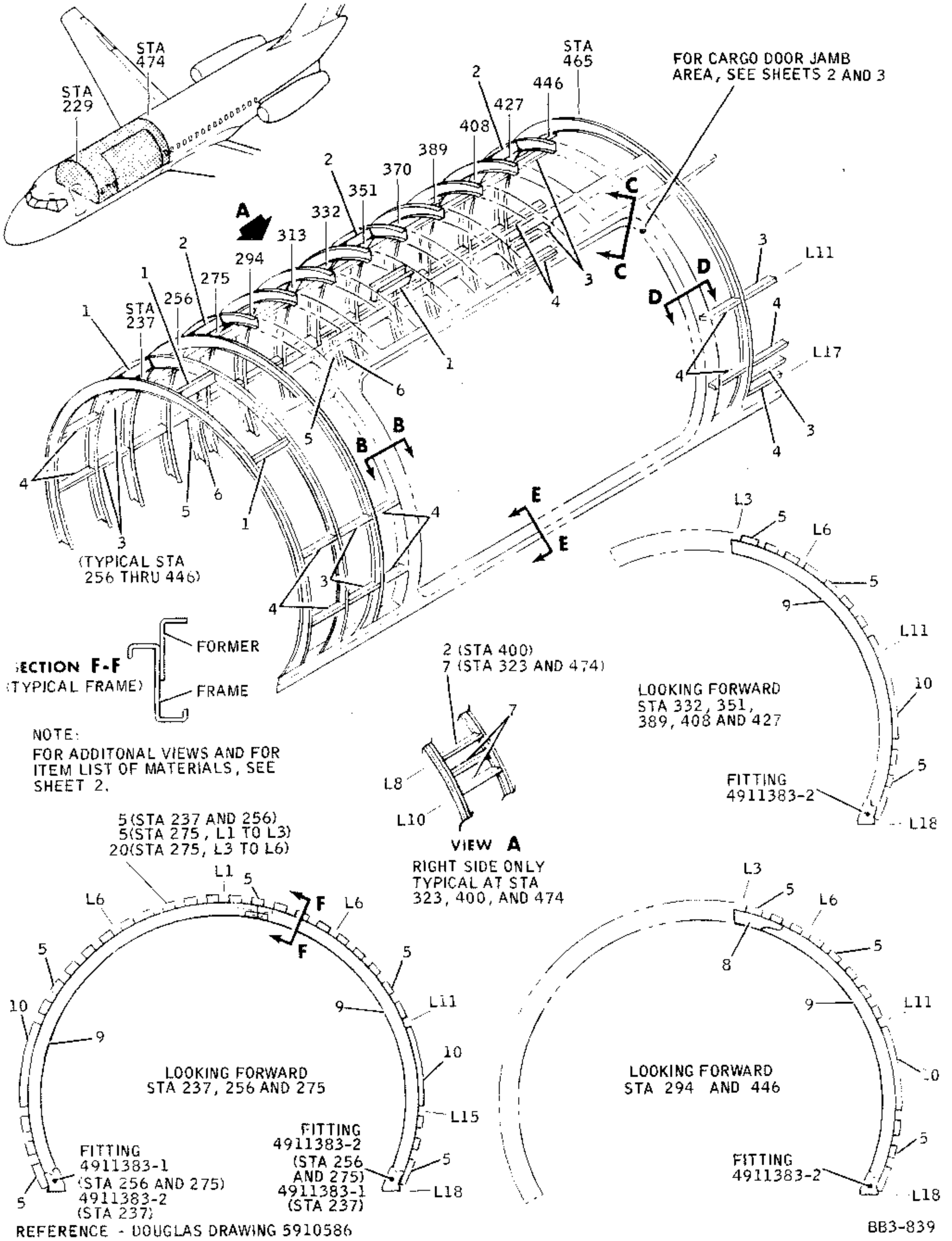
VIEW
LOOKING AFT AT STA 237
(TYPICAL FRAME MATERIALS FROM STA 237
THROUGH 465 EXCEPT AS SHOWN IN VIEW A)

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	7	INTERCOSTAL	.040	CLAD 7075-T6
2	INTERCOSTAL		2912412-2	8	SPLICE	.063	CLAD 2024-T42
3	FORMER	.050	CLAD 2014-T6	9	FRAME		2777930-5
4	FRAME	.063	CLAD 7075-T6	10	FORMER	.063	CLAD 2014-T6
5	INTERCOSTAL	.025	CLAD 7075-T6	11	FRAME	.080	CLAD 7075-T6
6	INTERCOSTAL		2912901-5	12	FORMER		2912538

REFERENCE - DOUGLAS DRAWING 5910132

BB3-106

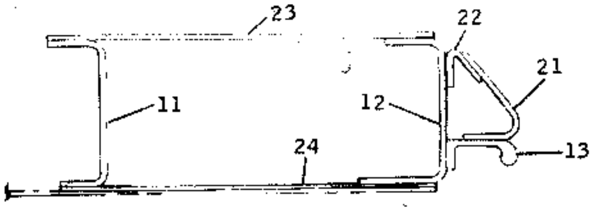
Frames and Intercostals, Station 229 to 474, Upper Section -- Type I
Figure 1



NOTE:
FOR ADDITONAL VIEWS AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.

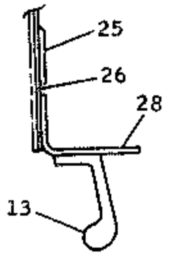
REFERENCE - DOUGLAS DRAWING 5910586

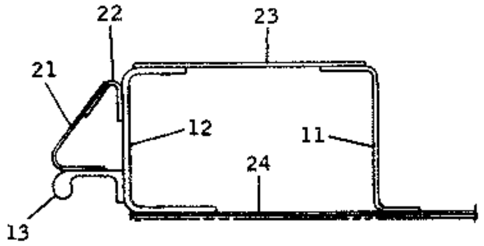
Frames and Intercostals, Station 229 to 474, Upper Section -- Type II
Figure 1A (Sheet 1)



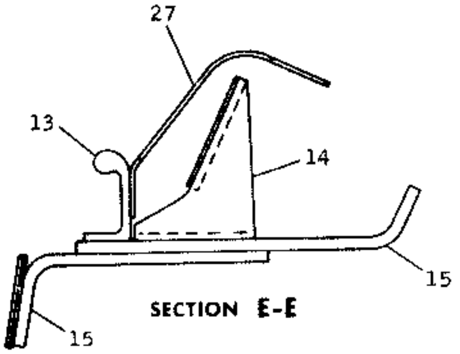
SECTION B-B

SECTION C-C



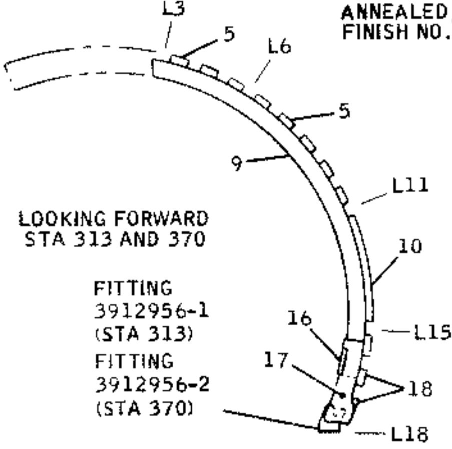


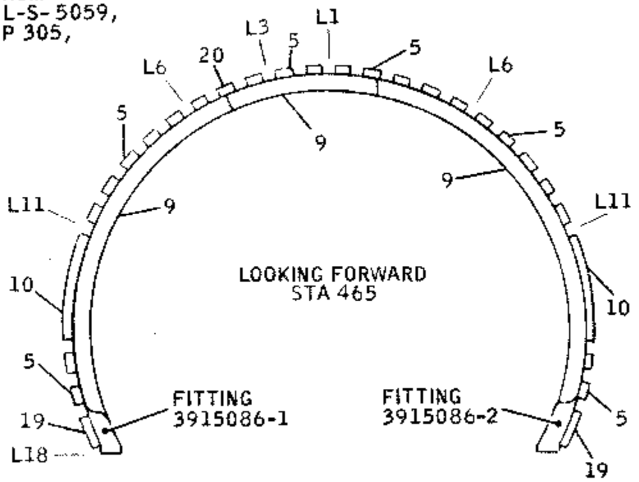
SECTION D-D



SECTION E-E

NOTE:
ITEM 27 MADE FROM
CRES SHEET, MIL-S-5059,
ANNEALED, COMP 305,
FINISH NO. 2D.

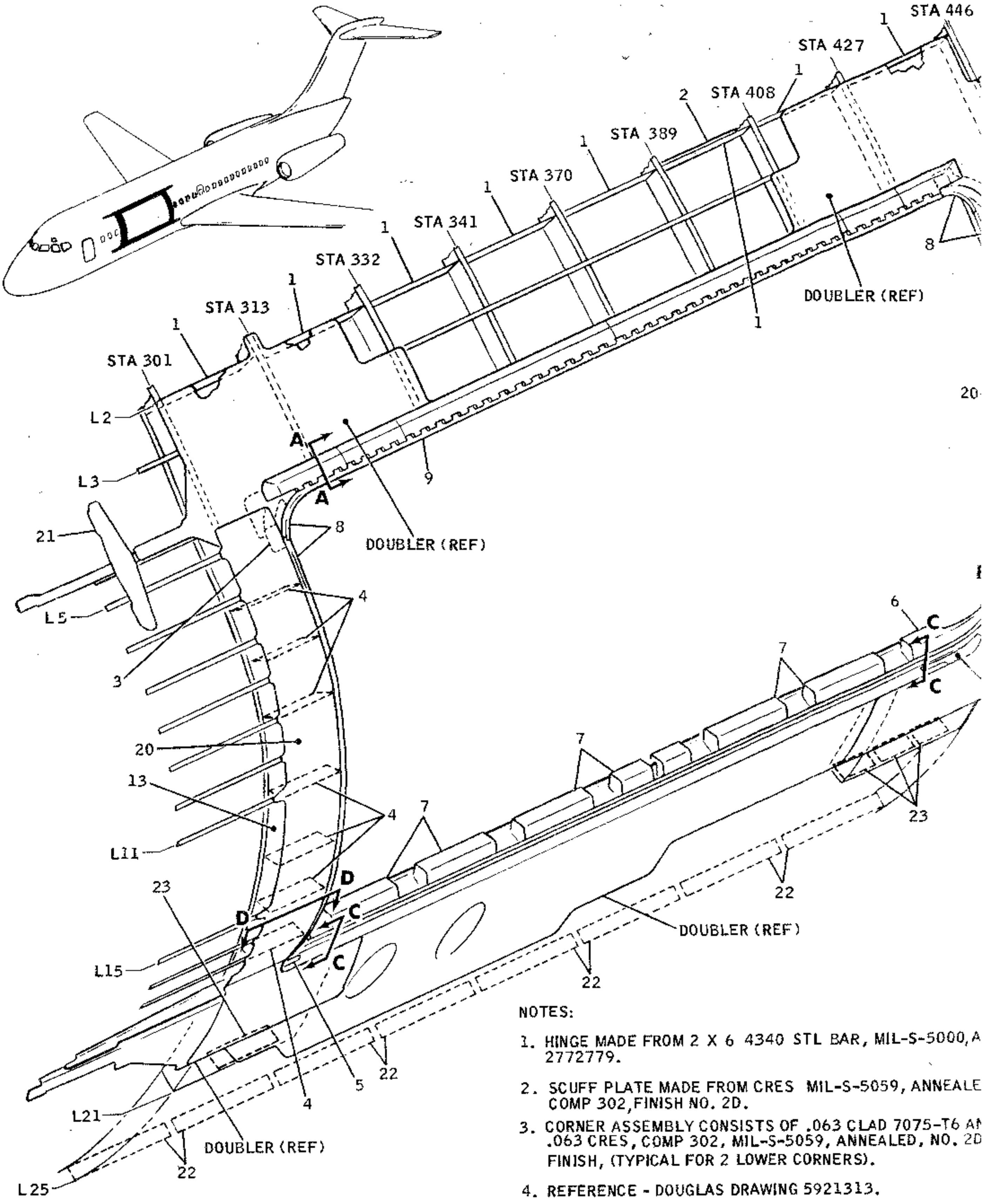




ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	15	ANGLE	.190	CLAD-7075-T6
2	INTERCOSTAL	.032	CLAD 7075-T6	16	SPLICE	.063	CLAD 7075-T6
3	INTERCOSTAL		2912901-5	17	FRAME	.080	CLAD 7075-T6
4	INTERCOSTAL	.040	CLAD 7075-T6	18	FORMER	.063	CLAD 2014-T6
5	FORMER	.050	CLAD 2014-T6	19	FORMER	.050	CLAD 7075-T6
6	FRAME	.063	CLAD 7075-T6	20	FORMER		2506195
7	INTERCOSTAL	.025	CLAD 7075-T6	21	SCUFF PLATE	.063	CLAD 2024-T42
8	ANGLE	.040	CLAD 7075-T6	22	ANGLE	.063	CLAD 7075-T6
9	FRAME		2777930-5	23	WEB	.071	CLAD 7075-T6
10	FORMER		2912538	24	DOUBLER	.040	CLAD 2014-T6
11	FRAME	.090	CLAD 7075-T6	25	DOUBLER	.070	CLAD 7075-T6
12	CHANNEL	.125	CLAD 7075-T6	26	DOUBLER	.032	TITANIUM DMS 1592
13	SEAL		1362726	27	SCUFF PLATE	.063	SEE NOTE
14	FITTING	2.250	7075-T651 BAR	28	ANGLE	.070	7075-T6AL

BB3-785

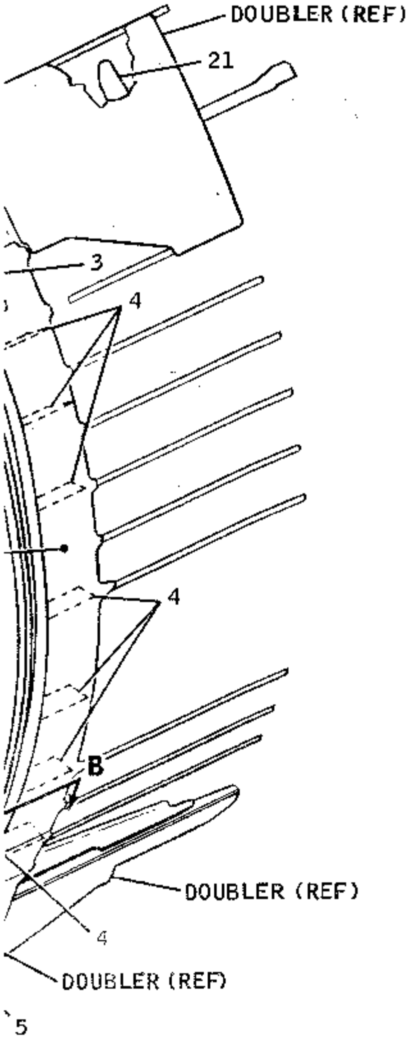
Frames and Intercostals, Station 229 to 474, Upper Section -- Type II
Figure 1A (Sheet 2)

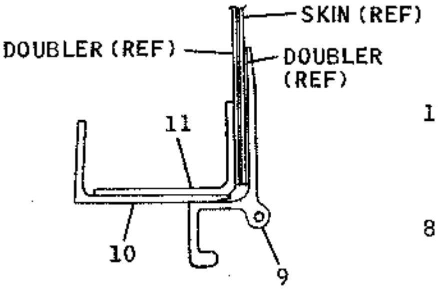


NOTES:

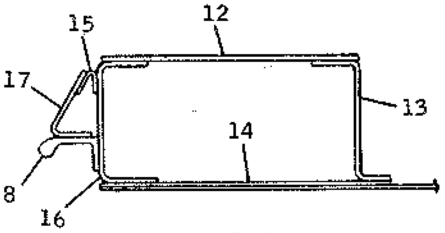
1. HINGE MADE FROM 2 X 6 4340 STL BAR, MIL-S-5000,A
   2772779.
2. SCUFF PLATE MADE FROM CRES MIL-S-5059, ANNEALE
   COMP 302,FINISH NO. 2D.
3. CORNER ASSEMBLY CONSISTS OF .063 CLAD 7075-T6 A
   .063 CRES, COMP 302, MIL-S-5059, ANNEALED, NO. 2D
   FINISH, (TYPICAL FOR 2 LOWER CORNERS).
4. REFERENCE - DOUGLAS DRAWING 5921313.

Frames and Intercostals, Station, 229 to 474, Upper Section -- Type II
Figure 1A (Sheet 3)

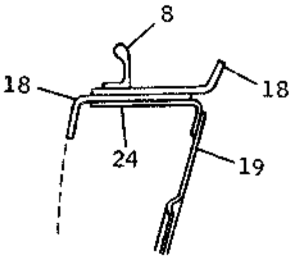




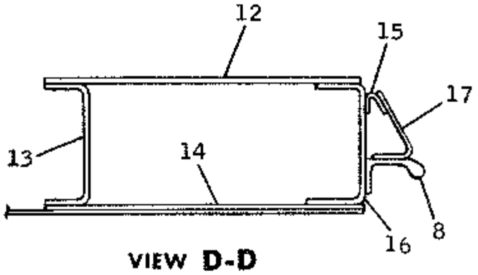
VIEW **A-A**



VIEW **B-B**



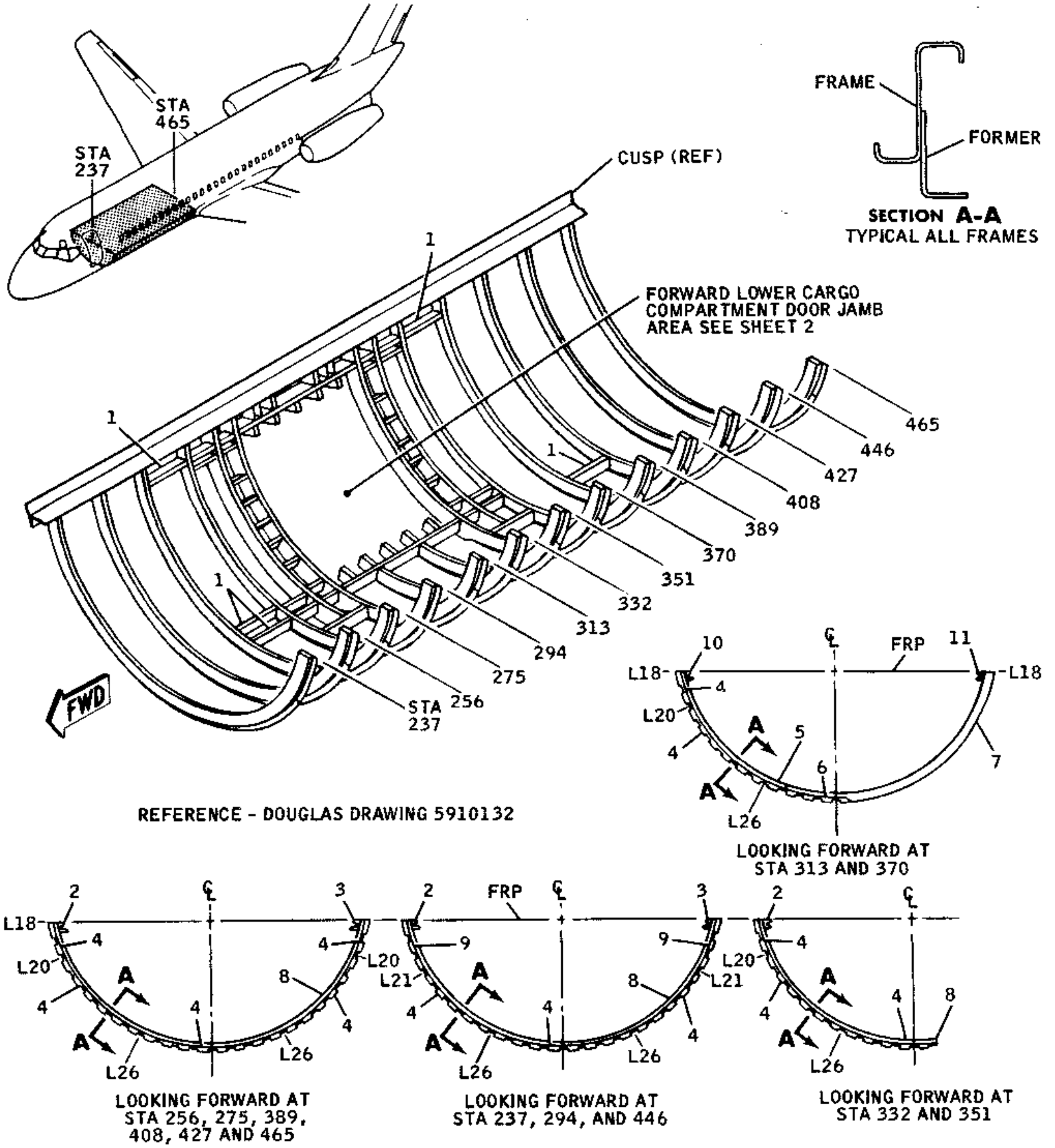
VIEW **C-C**



VIEW **D-D**

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.071	CLAD 7075-T6	13	FRAME	.090	CLAD 7075-T6
2	FILLER	.032	CLAD 7075-T6	14	DOUBLER	.040	CLAD 2014-T6
3	CORNER	.070	CLAD 7075-T6	15	ANGLE	.063	CLAD 7075-T6
4	INTERCOSTAL	.090	CLAD 7075-T6	16	CHANNEL	.125	CLAD 7075-T6
5	CORNER	.090	CLAD 7075-T6	17	SCUFF PLATE	.063	CLAD 2024-T42
6	CORNER		SEE NOTE 3	18	ANGLE	.190	CLAD 7075-T6
7	SCUFF PLATE	.063	SEE NOTE 2	19	INNER SKIN	.050	CLAD 7075-T6
8	SEAL DEPRESSOR		1362726	20	DOUBLER	.040	CLAD 7075-T6
9	HINGE		SEE NOTE 1	21	SPLICE STRAP	.071	CLAD 7075-T6
10	ANGLE		2921609	22	INTERCOSTAL	.050	CLAD 7075-T6
11	ANGLE		1249328	23	INTERCOSTAL	.063	CLAD 7075-T6
12	WEB	.071	CLAD 7075-T6	24	ANGLE	.100	CLAD 7075-T6

BB3-983



REFERENCE - DOUGLAS DRAWING 5910132

LOOKING FORWARD AT STA 313 AND 370

LOOKING FORWARD AT STA 256, 275, 389, 408, 427 AND 465

LOOKING FORWARD AT STA 237, 294, AND 446

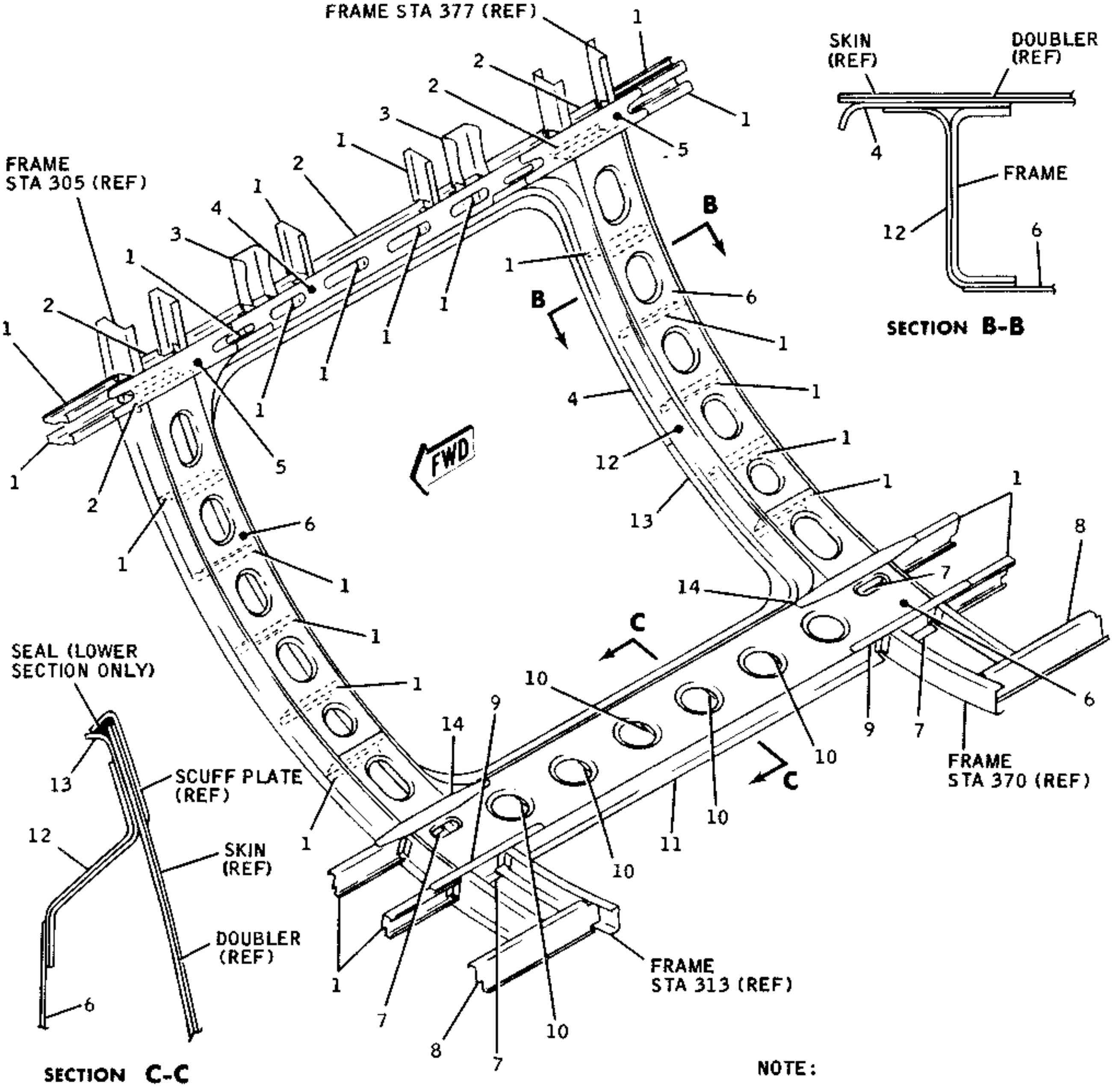
LOOKING FORWARD AT STA 332 AND 351

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6
2	★ FITTING		3912075-1
3	★ FITTING		3912075-2
4	FORMER	.050	CLAD 2014-T6
5	FRAME		2777930-7
6	SHEAR CLIP	.071	CLAD 7075-T6
7	FORMER	.125	CLAD 2024-T42
8	FRAME		2777930-5
9	FORMER	.063	CLAD 2014-T6
10	★ CLIP		3913647-1
11	★ CLIP		3913647-2

★ MAKE FROM EXTRUSION PART NO. 2911391

BB3-107

Frames and Intercostals, Station 229 to 474, Lower Section
Figure 2 (Sheet 1)



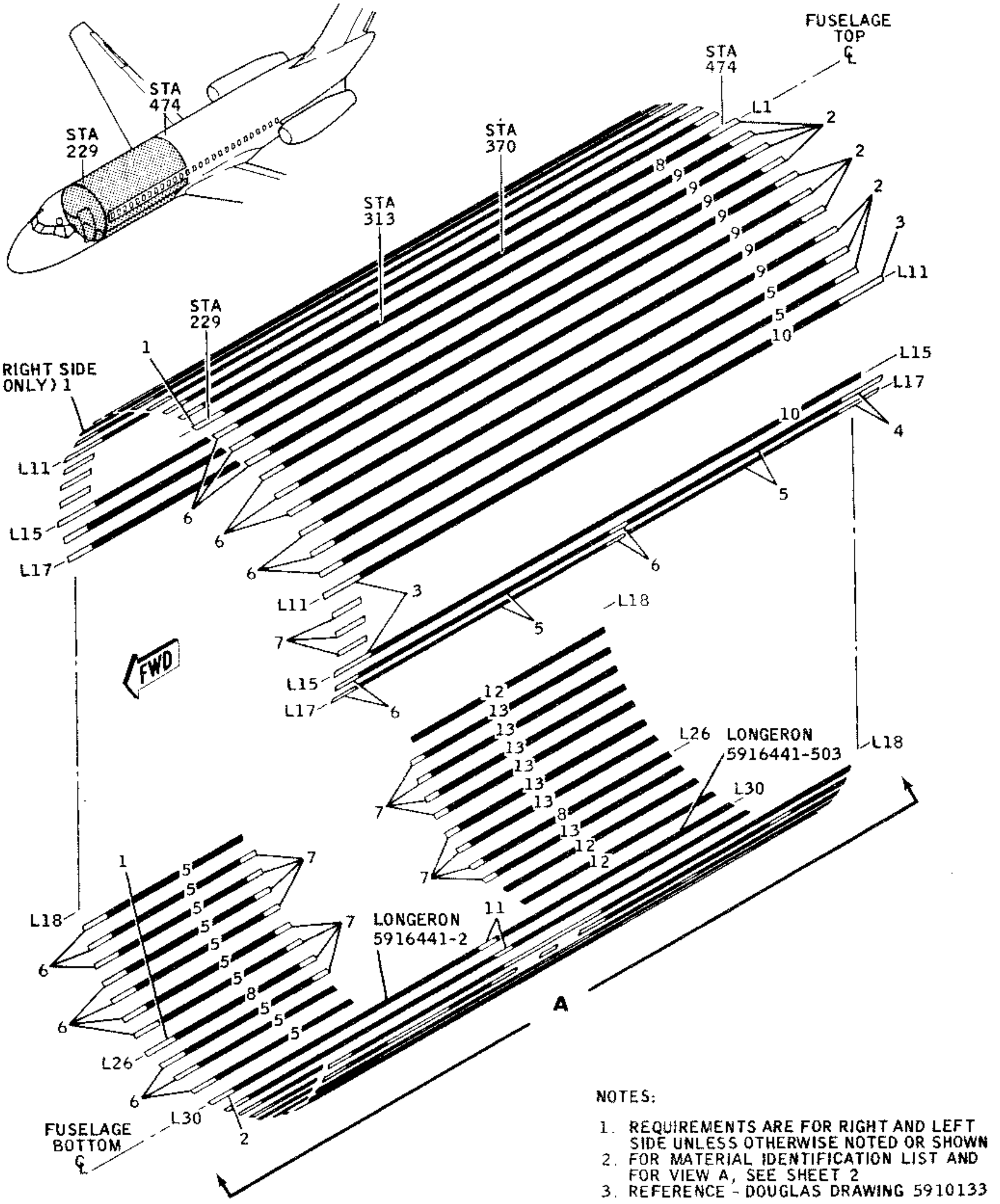
NOTE:

CRES SHEET TYPE 17-7PH,
MIL-S-25043,COND A,
FINISH 2D

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.063	CLAD 7075-T6	8	INTERCOSTAL	.040	CLAD 7075-T6
2	INTERCOSTAL	.071	CLAD 2024-T42	9	GUSSET	.125	STEEL BAR 4130
3	BRACKET	.090	CLAD 7075-T6	10	INTERCOSTAL	.050	CLAD 2024-T42
4	UPPER DEPRESSOR	.080	CLAD 2024-T42	11	INTERCOSTAL	.100	CLAD 2024-T42
5	GUSSET	.125	CLAD 2024-T3	12	PAN	.050	CLAD 2024-T42
6	WEB	.040	CLAD 2024-T42	13	LOWER DEPRESSOR	.080	SEE NOTE
7	INTERCOSTAL	.090	CLAD 2024-T42	14	GUSSET	.125	CLAD 2024-T42

BB3-202

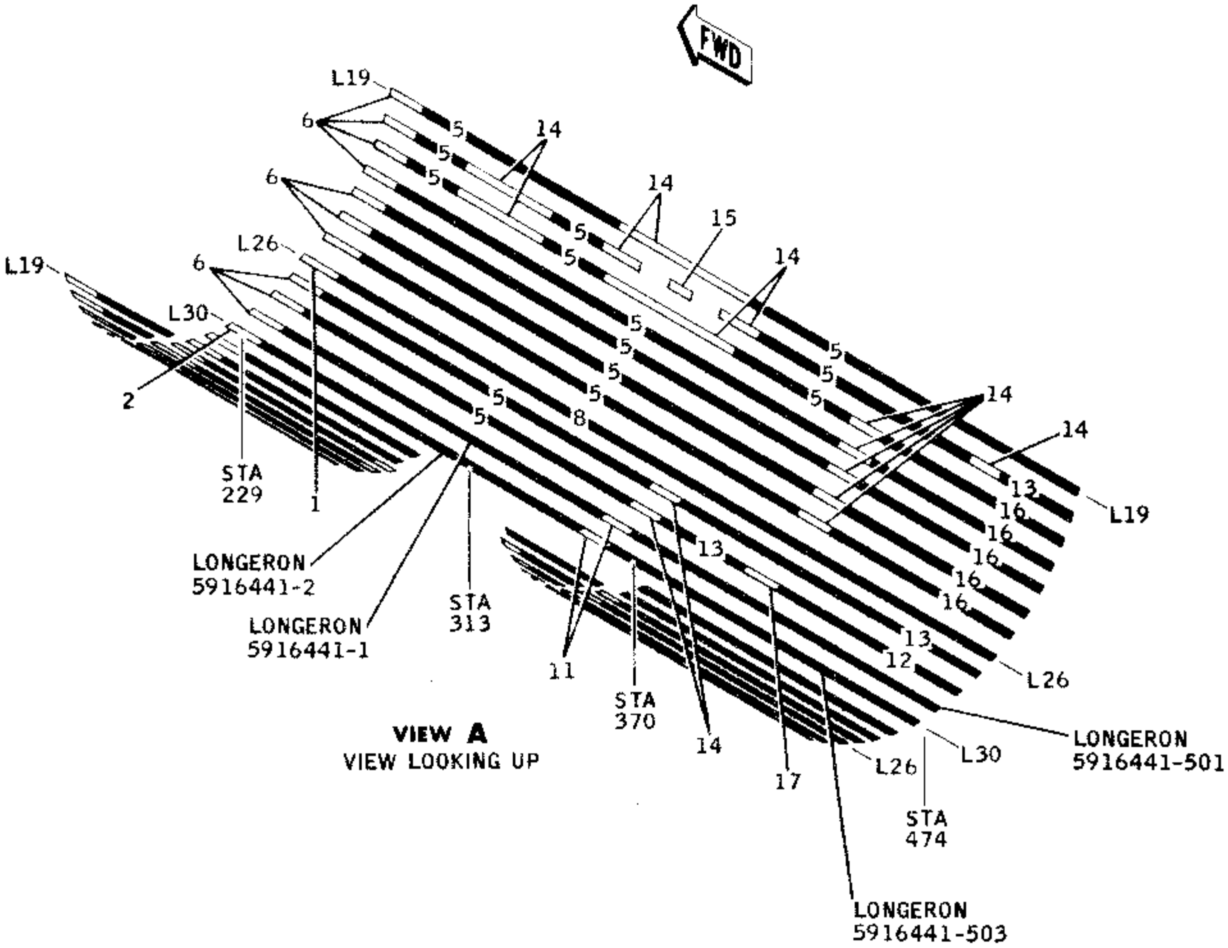
Frames and Intercostals, Station 229 to 474, Lower Section
Figure 2 (Sheet 2)



NOTES:

1. REQUIREMENTS ARE FOR RIGHT AND LEFT SIDE UNLESS OTHERWISE NOTED OR SHOWN
2. FOR MATERIAL IDENTIFICATION LIST AND FOR VIEW A, SEE SHEET 2
3. REFERENCE - DOUGLAS DRAWING 5910133

Longerons, Station 229 to 474 -- Type I
Figure 3 (Sheet 1)

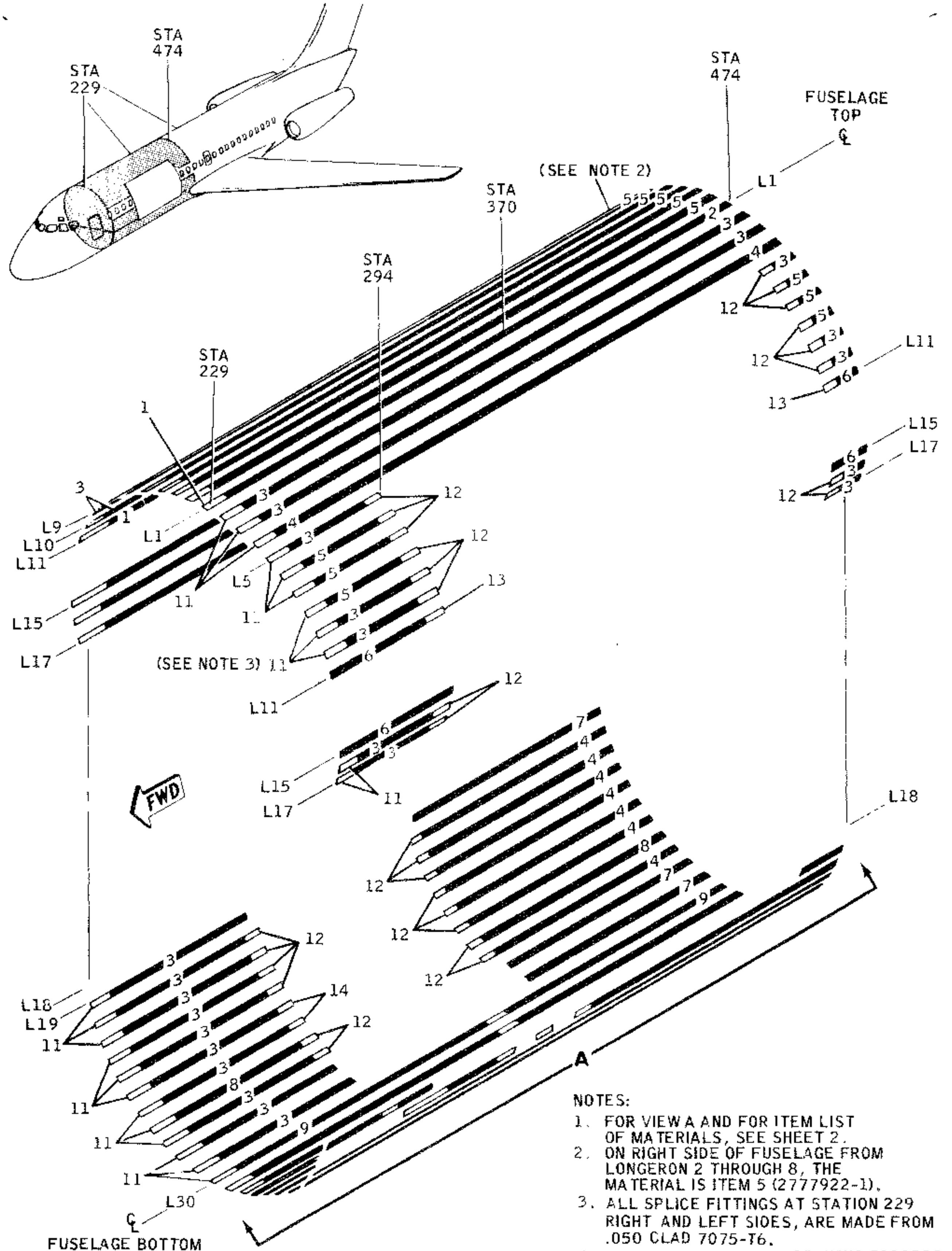


VIEW A
VIEW LOOKING UP

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	.071	CLAD 7075-T6	10	LONGERON		2777923-5
2	FITTING		2912099	11	FITTING		2641454
3	SPLICE	.071	CLAD 7075-T6	12	LONGERON		2912727
4	SPLICE	.063	CLAD 2024-T42	13	LONGERON		2777922-5
5	LONGERON		2777922-3	14	SPLICE	.050	CLAD 7075-T6
6	FITTING	.050	CLAD 7075-T6	15	CLIP	.050	2777948
7	CLIP	.050	CLAD 7075-T6	16	LONGERON		2777922-4
8	LONGERON		2777948-5	17	SPLICE	063	CLAD 7075-T6
9	LONGERON		2777922-1				

BB3-206

Longerons, Station 229 to 474 -- Type I
Figure 3 (Sheet 2)

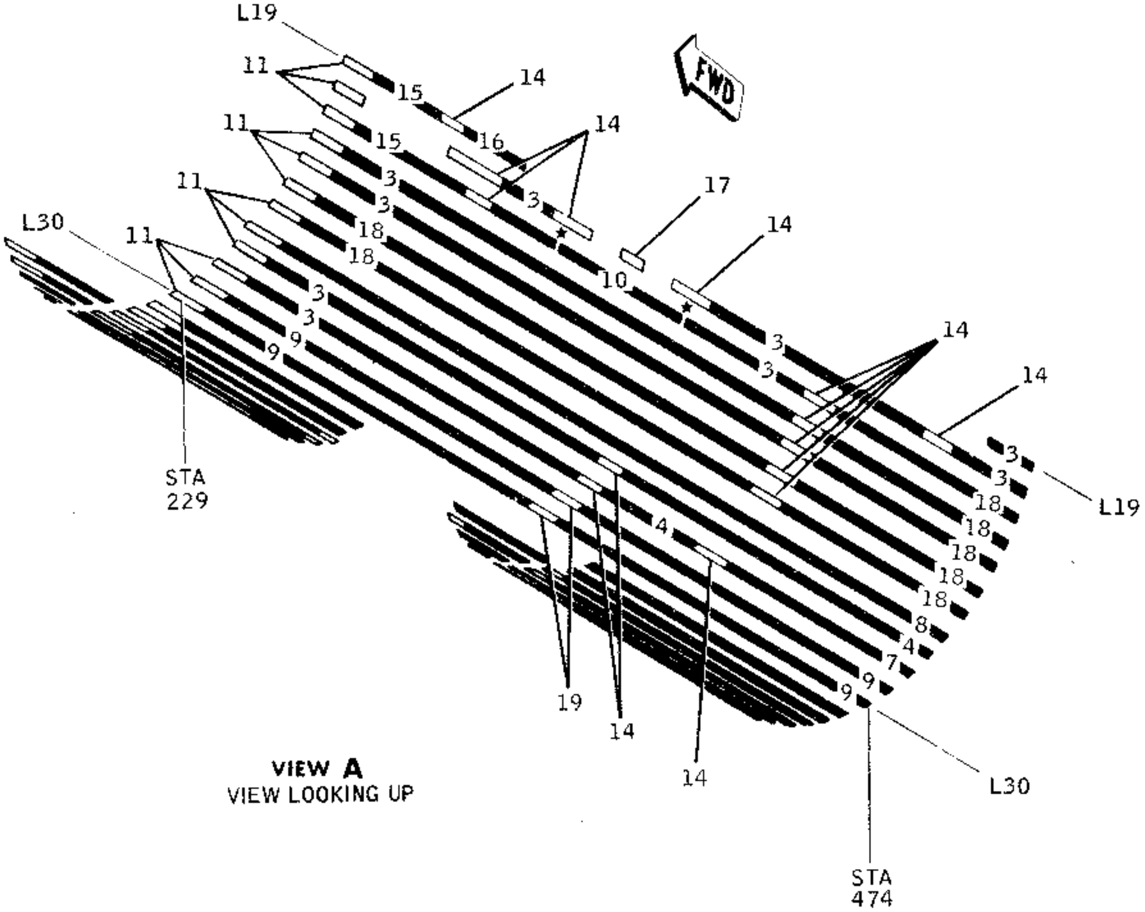


NOTES:

1. FOR VIEW A AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. ON RIGHT SIDE OF FUSELAGE FROM LONGERON 2 THROUGH 8, THE MATERIAL IS ITEM 5 (2777922-1).
3. ALL SPLICE FITTINGS AT STATION 229 RIGHT AND LEFT SIDES, ARE MADE FROM .050 CLAD 7075-T6.
4. REFERENCE- DOUGLAS DRAWING 5910593.

BB3-856

Longerons, Station 229 to 474 -- Type II
Figure 3A (Sheet 1)



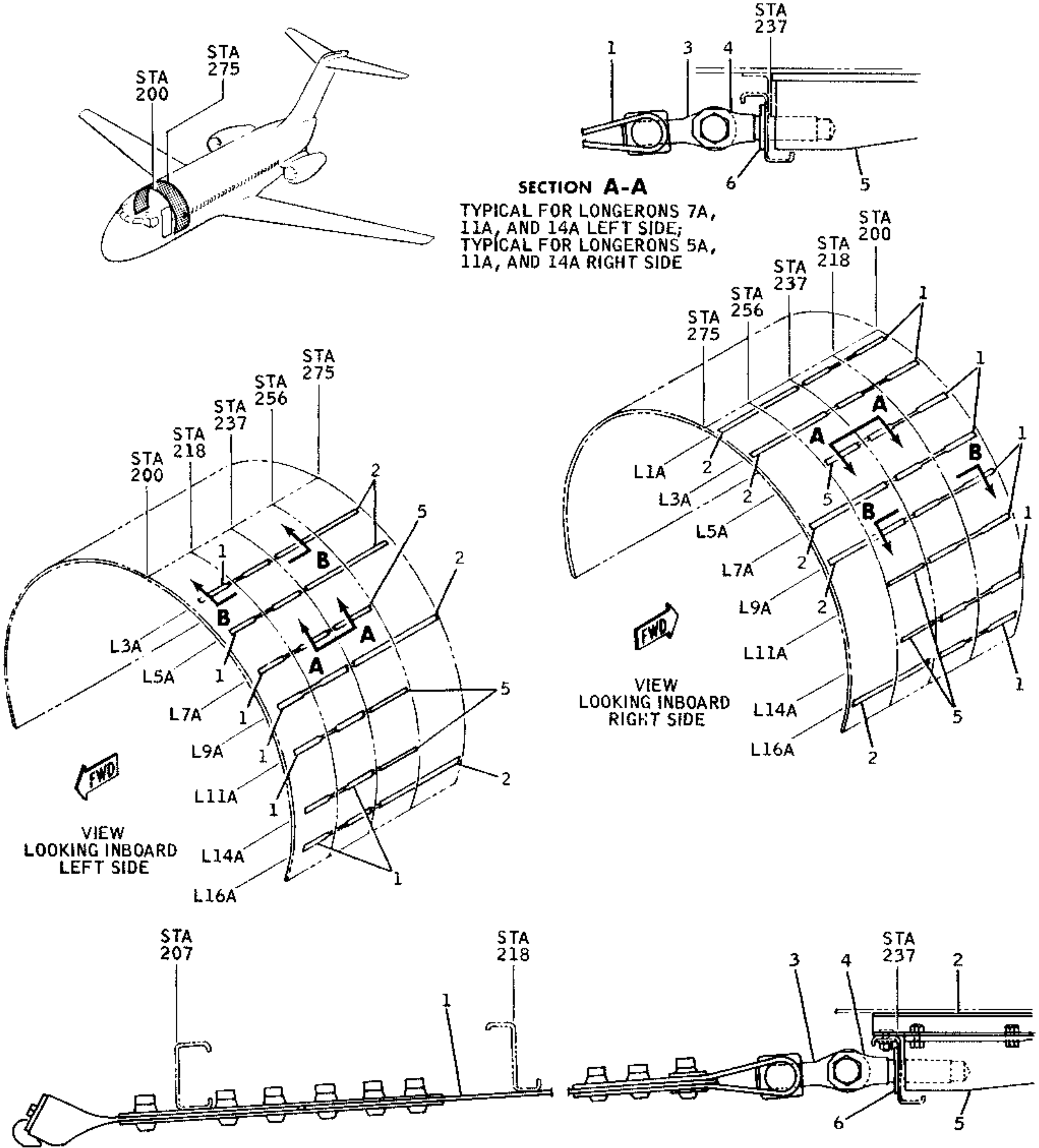
VIEW A
VIEW LOOKING UP

★ INDICATES LONGERON OVERLAP

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777923-5
2	LONGERON		2777948
3	LONGERON		2777922-3
4	LONGERON		2777922-5
5	LONGERON		2777922-1
6	LONGERON		2777923
7	LONGERON		2912727
8	LONGERON		2777948-5
9	LONGERON	.875	PLATE, 7075-T651
10	LONGERON	.050	CLAD 7075-T6
11	SPLICE FITTING	.050	CLAD 7075-T6
12	CLIP	.050	CLAD 7075-T6
13	SPLICE	.080	CLAD 7075-T6
14	SPLICE	.050	CLAD 7075-T6
15	LONGERON	.063	CLAD 7075-T6
16	LONGERON	.040	CLAD 7075-T6
17	CLIP		2777948
18	LONGERON		2777922-4
19	SPLICE		2641454

BB3-857

Longerons, Station 229 to 474 -- Type II
Figure 3A (Sheet 2)



SECTION B-B

TYPICAL FOR LONGERONS 3A, 5A, 9A, AND 16A LEFT SIDE; TYPICAL FOR LONGERONS 1A, 3A, 7A, 9A, AND 16A RIGHT SIDE

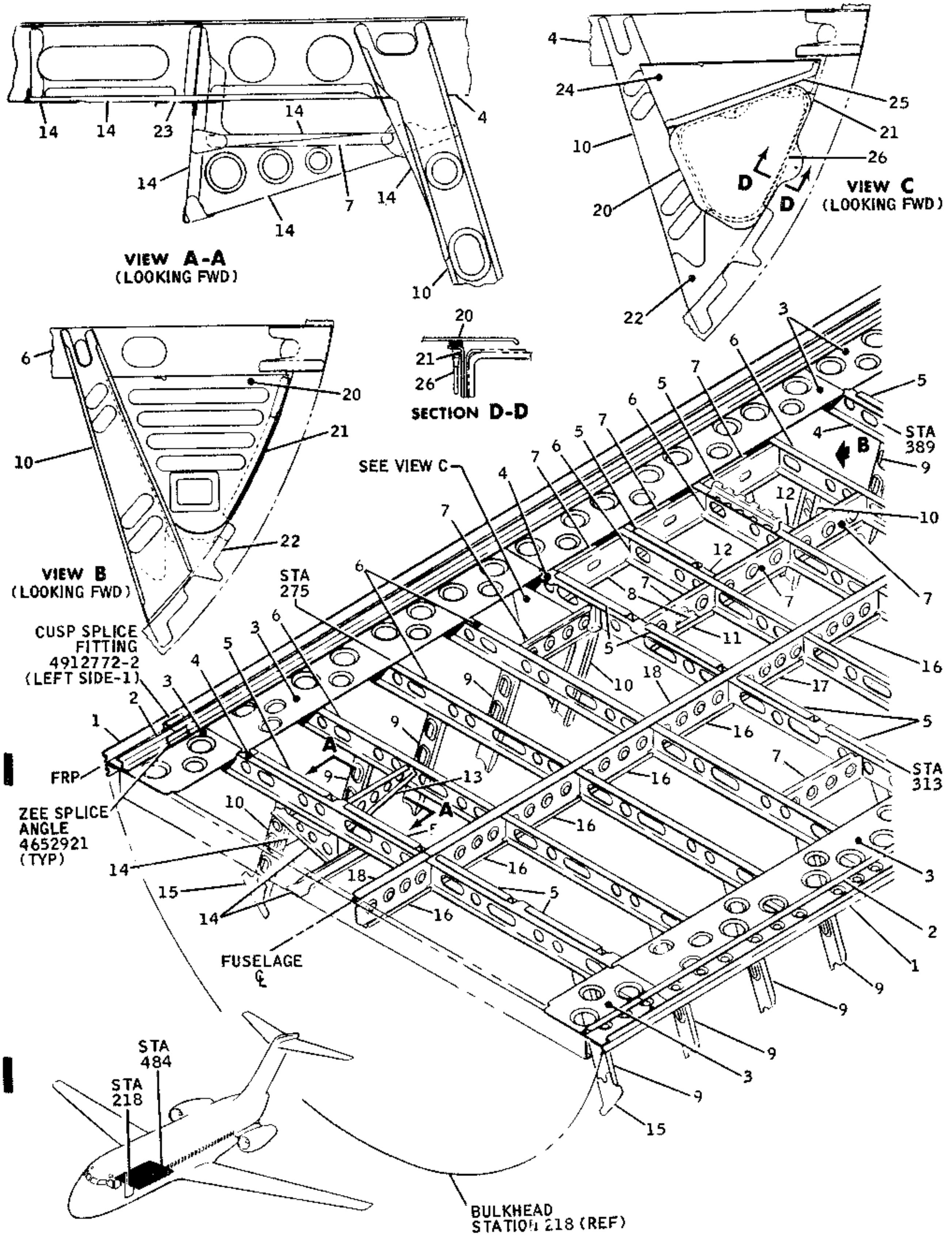
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRAP		SEE NOTE 1
2	LONGERON		2923727
3	FITTING		4774667
4	CLEVIS		4923766
5	FITTING		FORGING, 7075-T6
6	PLATE	.063	SEE NOTE 1

NOTES:
1. MADE FROM 4130 STEEL.
2. REFERENCE-DOUGLAS DRAWING 5923771.

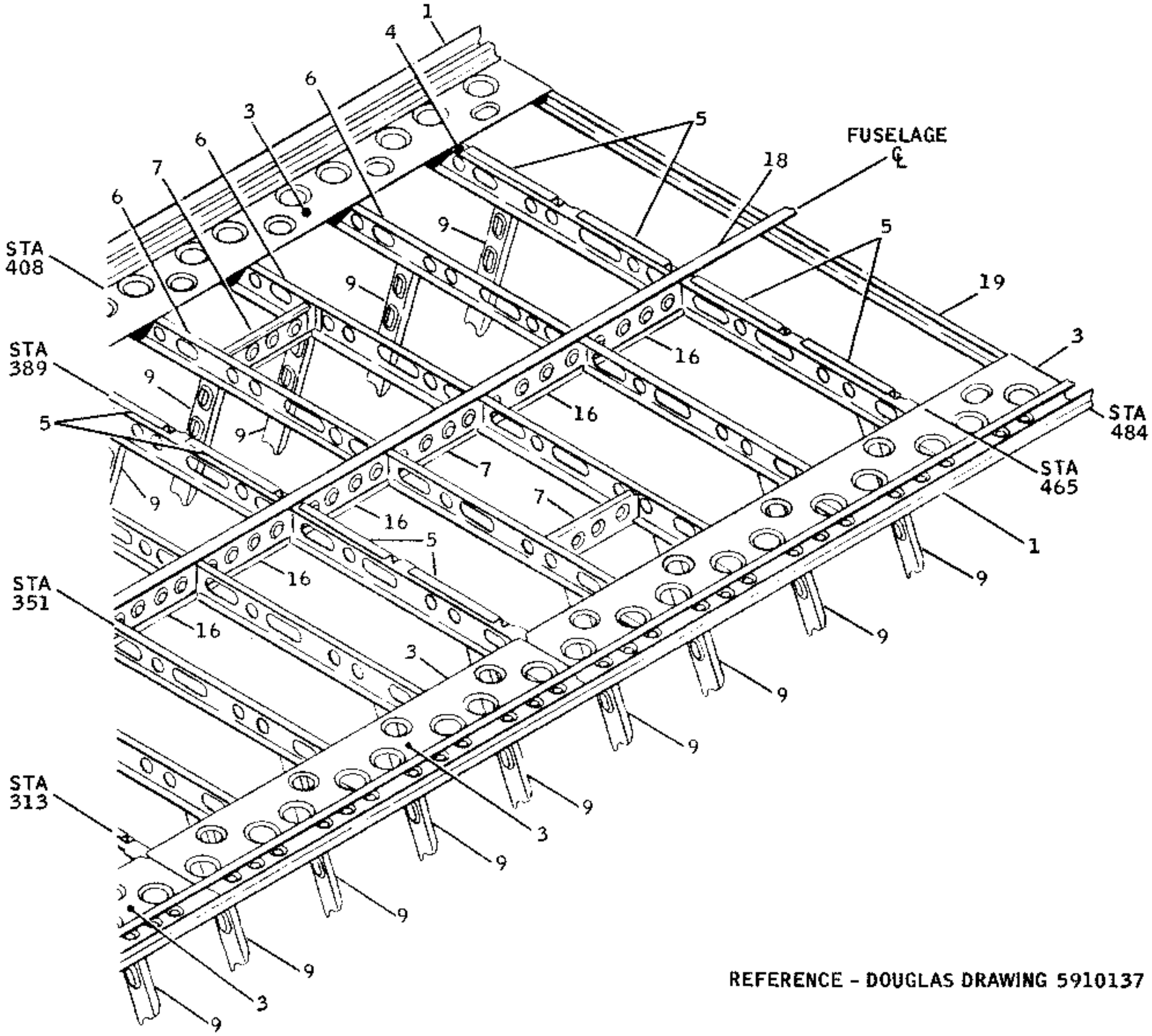
BB3-845

Cargo Net Tie Down Details
Figure 3B

Printed in U.S.A.



Floor Support Structure, Station 218 to 484 -- Type I
Figure 4 (Sheet 1)

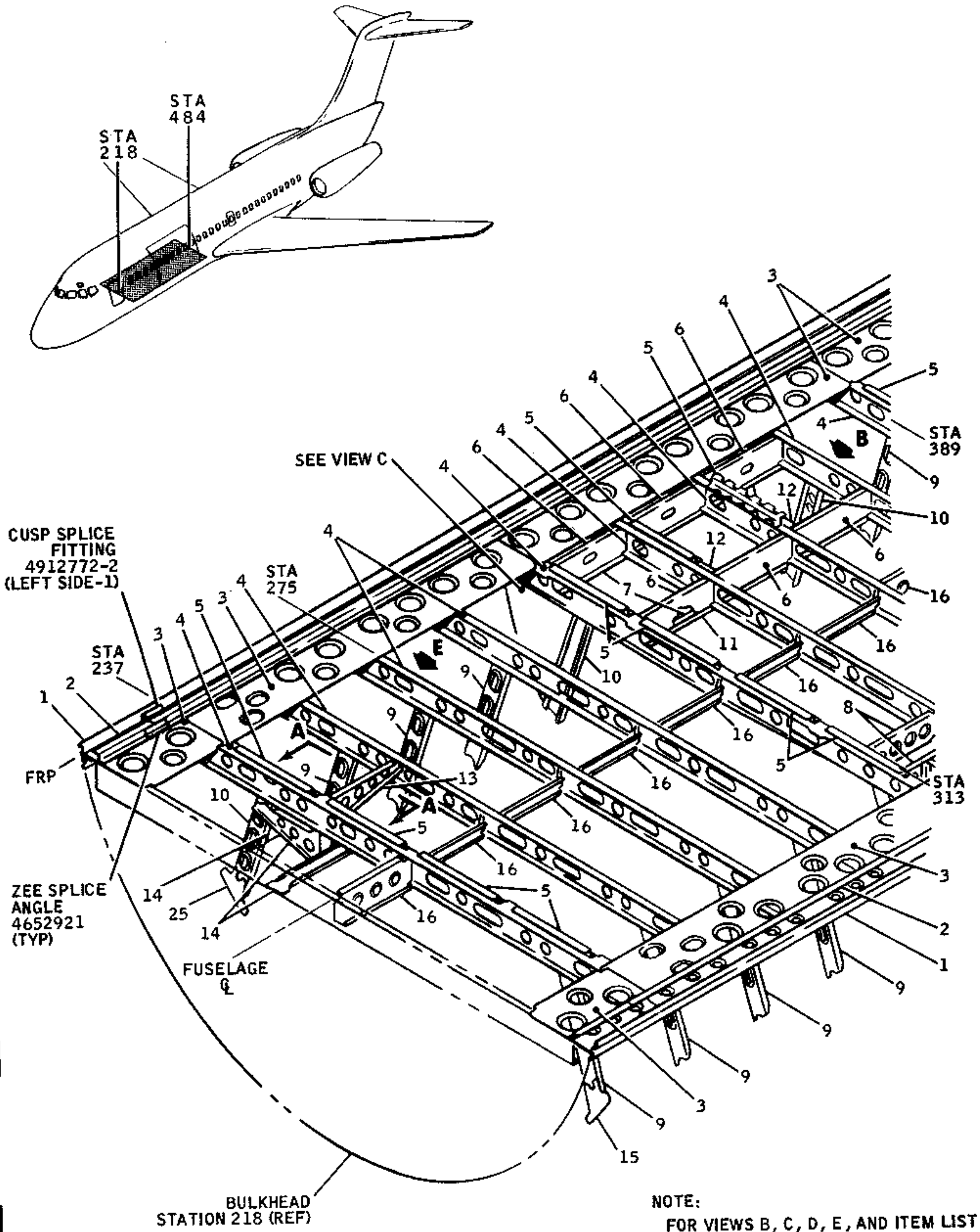


REFERENCE - DOUGLAS DRAWING 5910137

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP TEE		2777976	14	SUPPORT	.050	CLAD 2024-T42
2	ZEE		4616493	15	GUSSET	.050	CLAD 7075-T6
3	WEB	.020	CLAD 7075-T6	16	INTERCOSTAL	.025	CLAD 2024-T42
4	BEAM		2777897	17	INTERCOSTAL	.032	CLAD 2024-T42
5	ZEE	.050	CLAD 2024-T3	18	CAP		2652479
6	BEAM		2777896	19	BEAM	.125	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 7075-T6	20	WEB	.040	CLAD 2024-T42
8	ANGLE		1242520	21	ANGLE	.032	CLAD 2024-T42
9	STRUT	.050	CLAD 7075-T6	22	GUSSET	.080	CLAD 7075-T6
10	STRUT	.063	CLAD 7075-T6	23	CHANNEL	.063	CLAD 2024-T42
11	ANGLE		1329780	24	WEB	.032	CLAD 2024-T3
12	ANGLE		1276248	25	ATTACH PLATE	.050	CLAD 2024-T3
13	INTERCOSTAL	.040	CLAD 2024-T42	26	SEAL		SILICONE RUBBER

BB3-166A

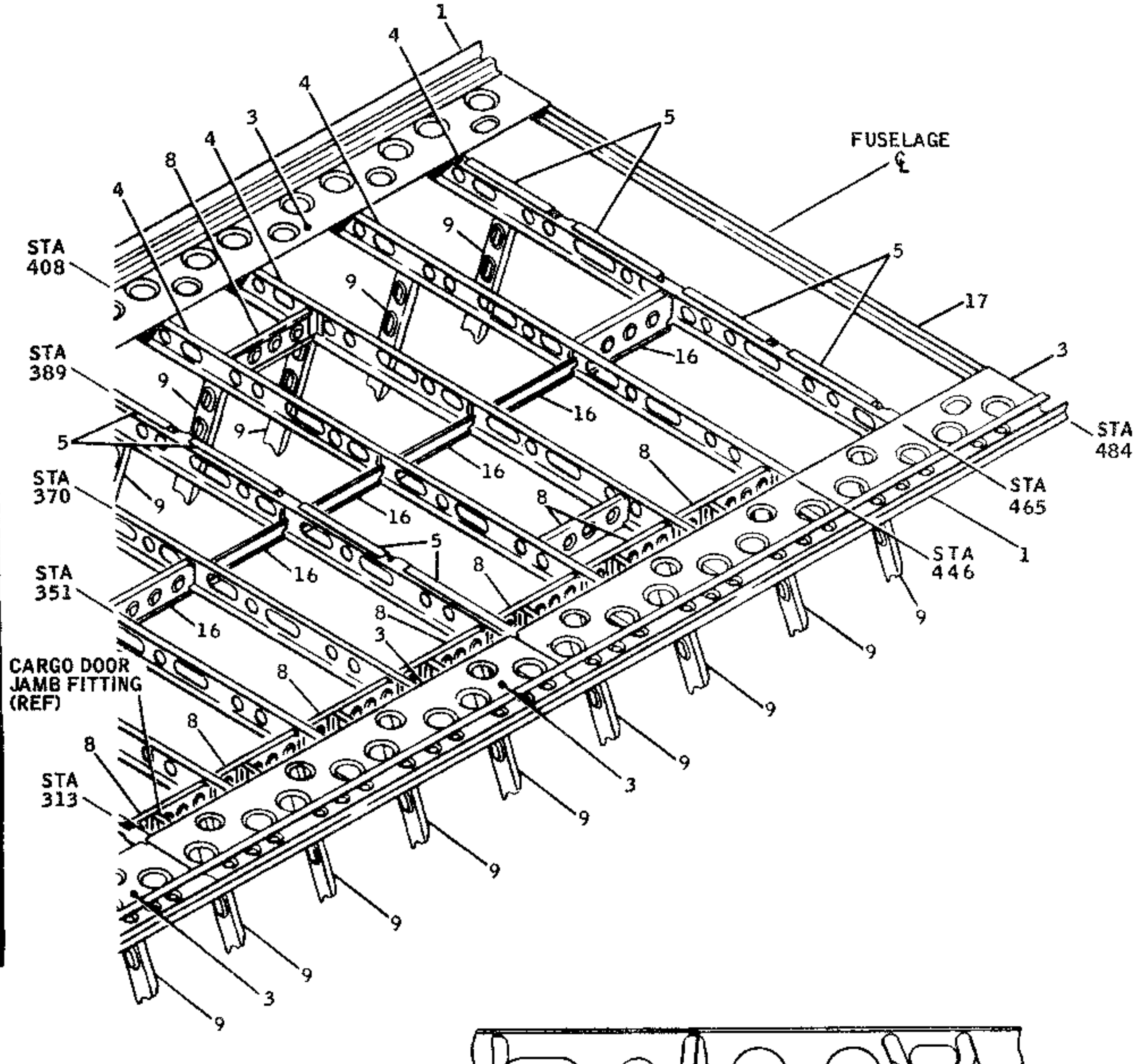
Floor Support Structure, Station 218 to 484 -- Type I
Figure 4 (Sheet 2)

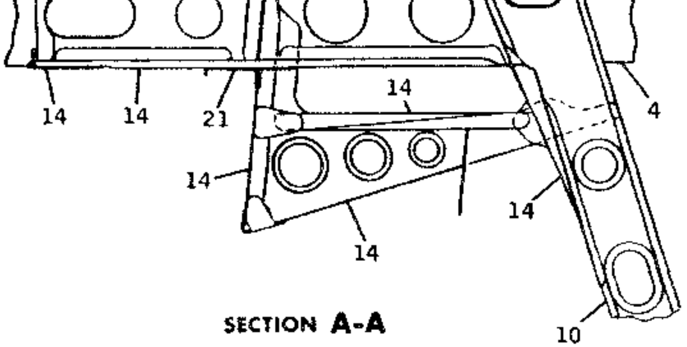


NOTE:
FOR VIEWS B, C, D, E, AND ITEM LIST OF MATERIALS, SEE SHEET 3

BB3-868A

Floor Support Structure, Station 218 to 484 -- Type II
Figure 5 (Sheet 1)

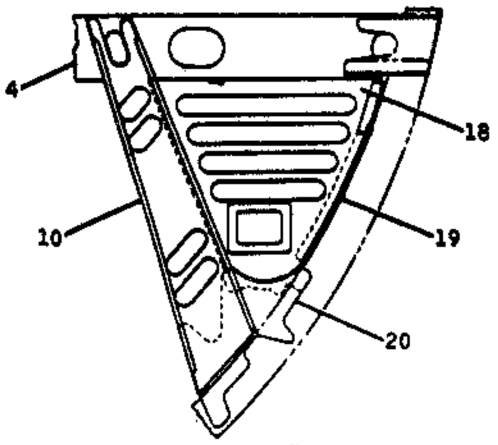




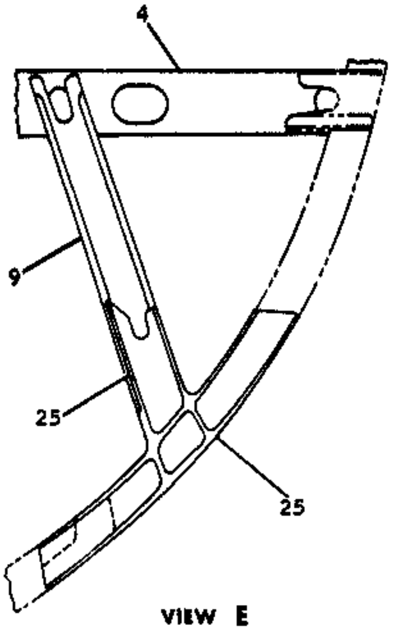
SECTION **A-A**
(LOOKING FORWARD)

BB3-869A

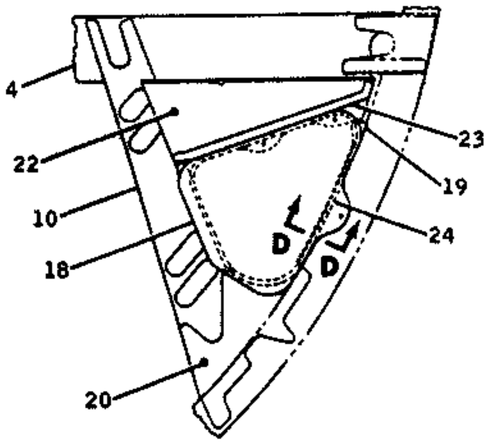
Floor Support Structure, Station 218 to 484 -- Type II
Figure 5 (Sheet 2)



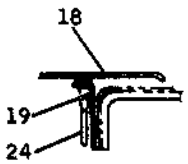
VIEW B
(LOOKING FORWARD)



VIEW E
(LOOKING FORWARD)
TYPE II AIRPLANES ONLY



VIEW C
(LOOKING FORWARD)



SECTION D-D

REFERENCE-DOUGLAS DRAWING 5910609

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP		2777976	14	SUPPORT	.050	CLAD 2024-T42
2	ZEE		4616493	15	GUSSET	.050	CLAD 7075-T6
3	WEB	.020	CLAD 7075-T6	16	INTERCOSTAL	.032	CLAD 7075-T6
4	BEAM		2921948	17	BEAM	.125	CLAD 7075-T6
5	ZEE	.050	CLAD 2024-T3	18	WEB	.040	CLAD 2024-T42
6	INTERCOSTAL	.050	CLAD 7075-T6	19	ANGLE	.032	CLAD 2024-T42
7	ANGLE		1242520	20	GUSSET	.080	CLAD 7075-T6
8	INTERCOSTAL	.040	CLAD 7075-T6	21	CHANNEL	.063	CLAD 2024-T42
9	STRUT	.050	CLAD 7075-T6	22	WEB	.032	CLAD 2024-T3
10	STRUT	.063	CLAD 7075-T6	23	ATTACH PLATE	.050	CLAD 2024-T3
11	ANGLE		1329780	24	SEAL		SILICONE RUBBER
12	ANGLE		1276248	25	SUPPORT	1.125	7075-T651
13	INTERCOSTAL	.040	CLAD 2024-T42				

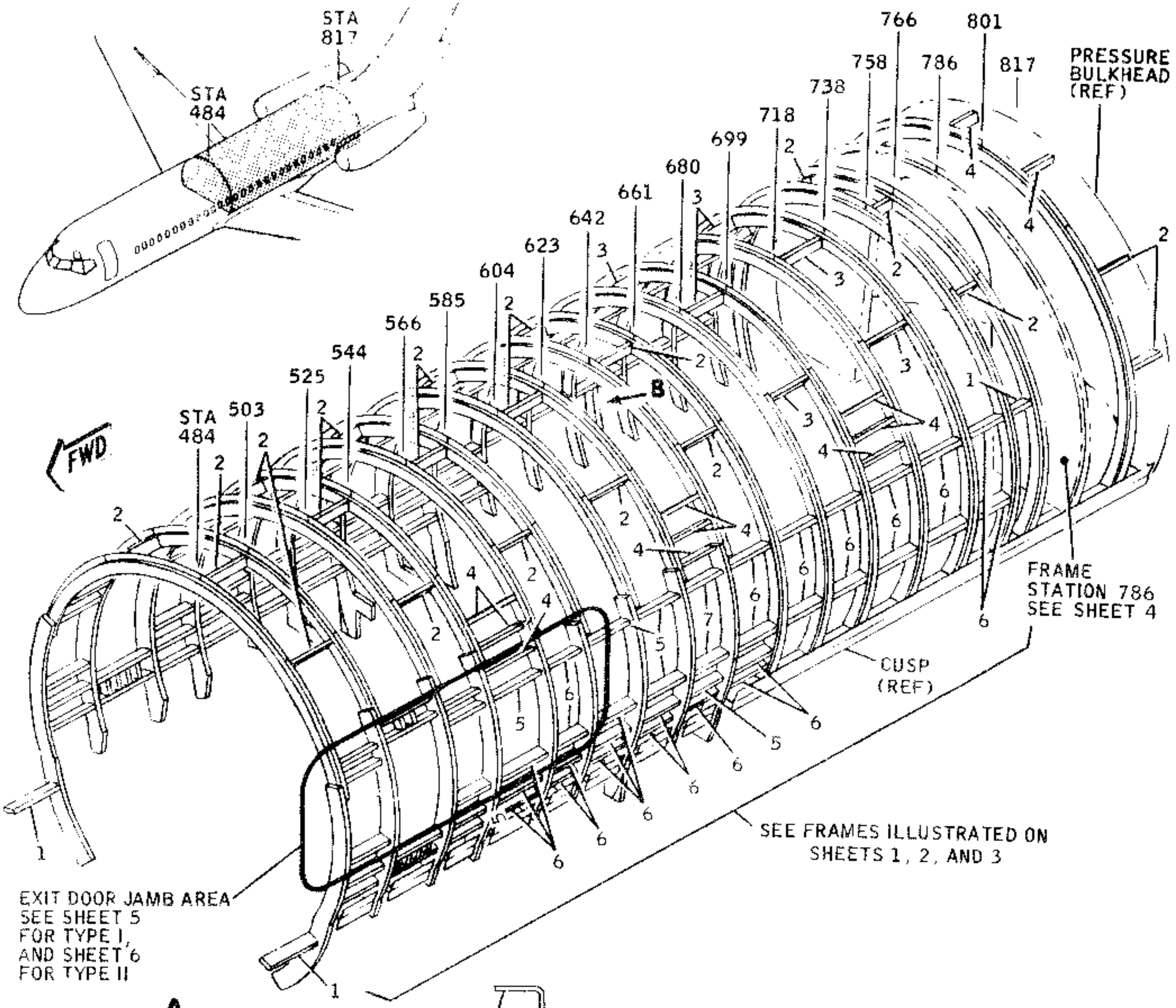
BB3-870

Floor Support Structure, Station 218 to 484 -- Type II
Figure 5 (Sheet 3)

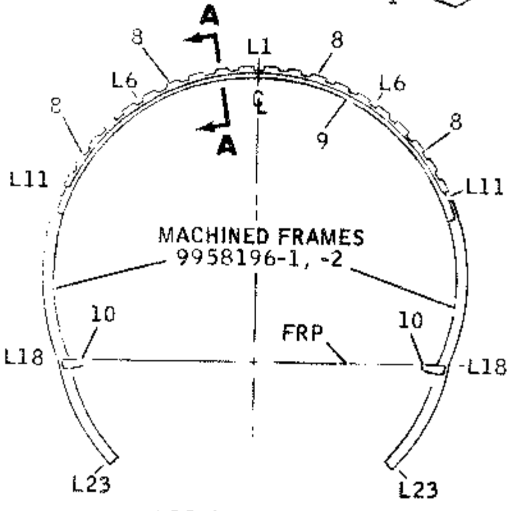
FUSELAGE SECTION, STATION 474 TO 817 - DESCRIPTION AND OPERATION (DC-9-10)

1. General

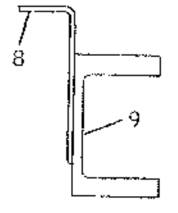
A. The following figures illustrate the structural components of the fuselage section from station 474 to 817. The materials used are identified in the material lists by item number callouts.



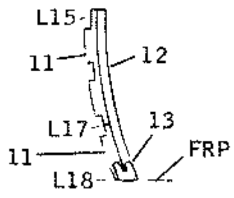
REFERENCE - DOUGLAS DRAWING 5910144



LOOKING FORWARD AT STA 484



SECTION A-A

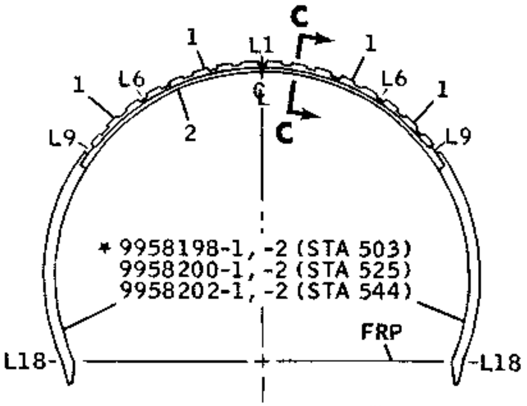


VIEW B
LOOKING AFT AT STA 710 RIGHT SIDE

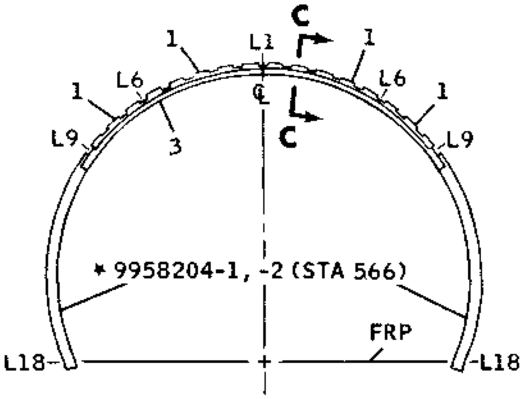
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6
2	INTERCOSTAL		2912412-3
3	INTERCOSTAL		2912412-4
4	INTERCOSTAL	.025	CLAD 7075-T6
5	INTERCOSTAL		2912901-6
6	INTERCOSTAL		2912901-5
7	INTERCOSTAL	.050	CLAD 7075-T6
8	FORMER	.050	CLAD 2014-T6
9	FRAME		1387619
10	FITTING		2642053-1
11	CLIP	.050	CLAD 2014-T6
12	FORMER	.063	CLAD 7075-T6
13	FITTING		2911391

BB3-108A

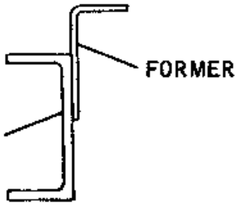
Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 1)



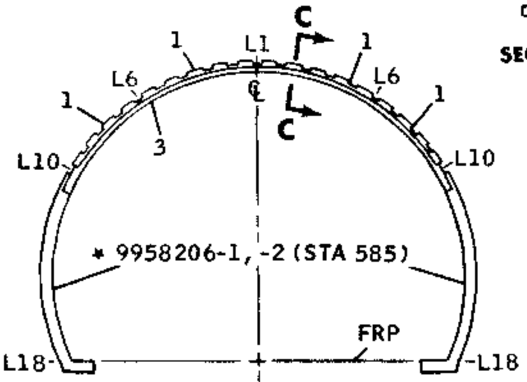
LOOKING FORWARD AT STA 503 AND 525 LOOKING AFT AT STA 544



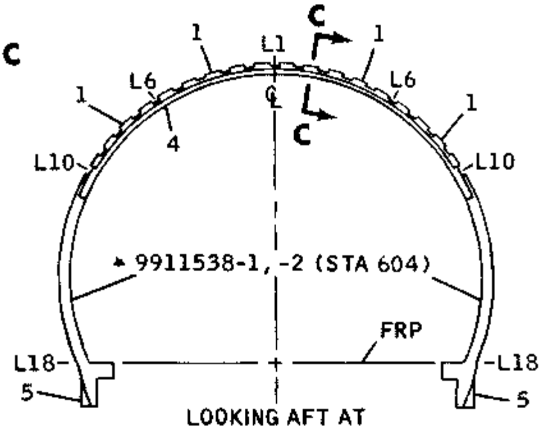
LOOKING FORWARD AT STA 566



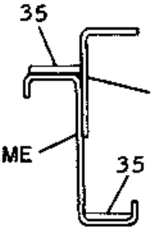
SECTION C-C



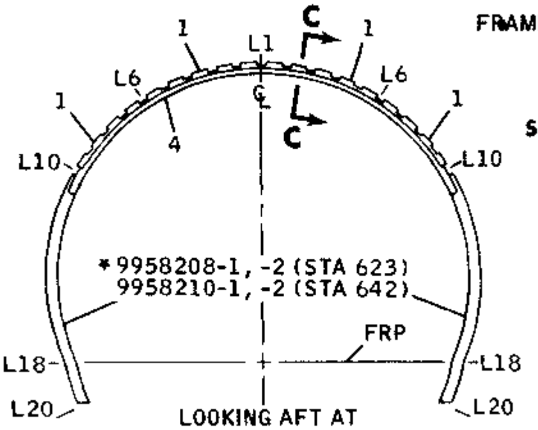
LOOKING AFT AT STA 585



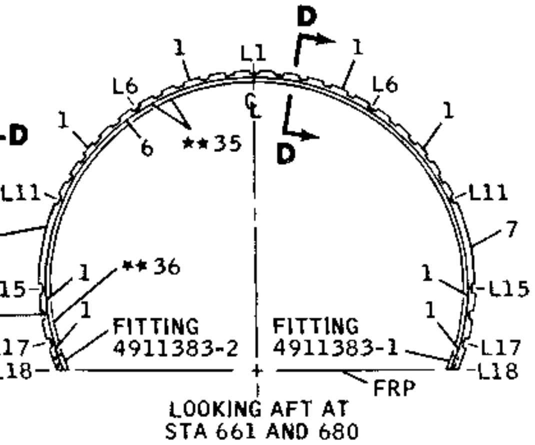
LOOKING AFT AT STA 604



SECTION D-D



LOOKING AFT AT STA 623 LOOKING FORWARD AT STA 642

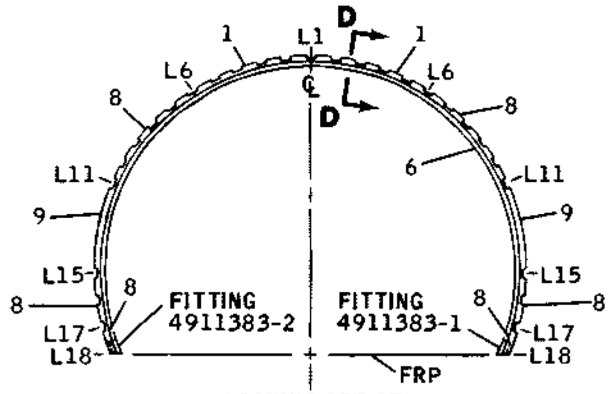


LOOKING AFT AT STA 661 AND 680

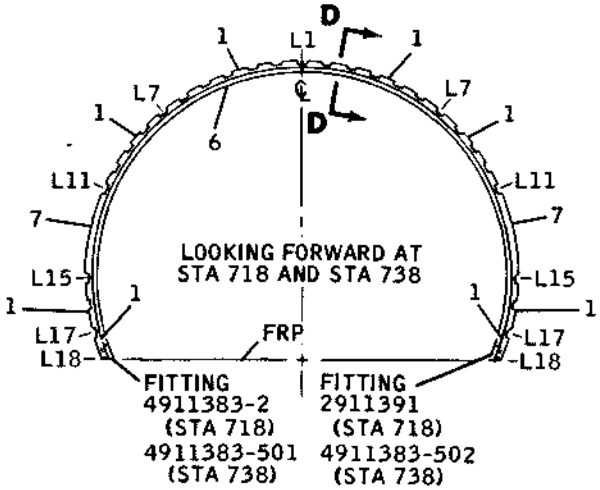
NOTES:
1. SEE SHEET 3 FOR ITEM LIST.
2.* PARTS ARE MACHINED FRAMES.
3.** ITEMS 35, 36, AND 37 ARE APPLICABLE TO STA 661 ONLY. BB3-195

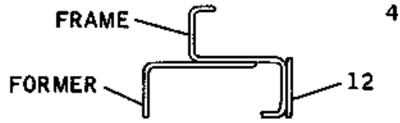
Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 2)

Printed in U.S.A.

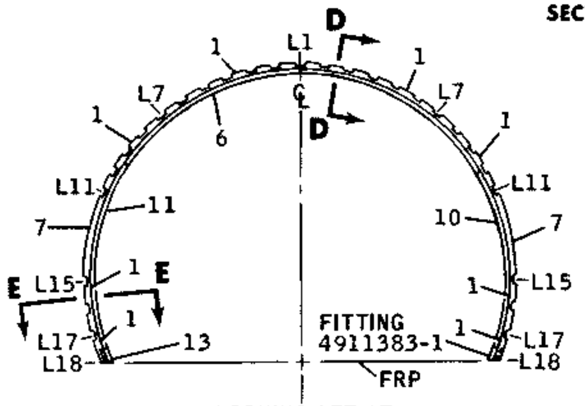


LOOKING AFT AT STA 699

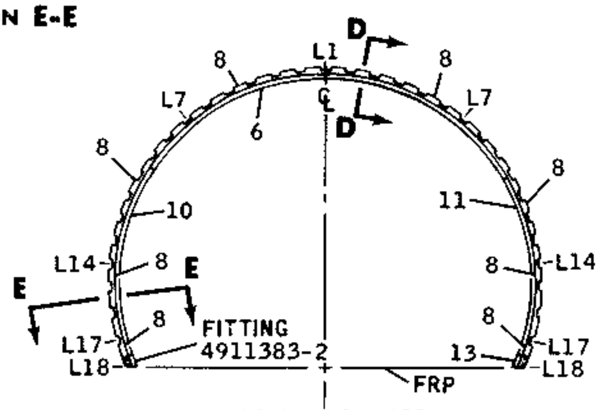




SECTION E-E



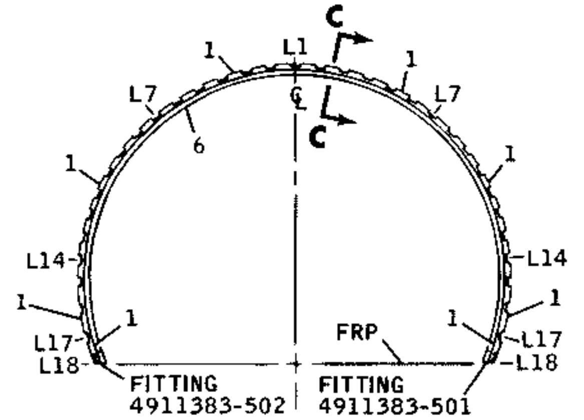
LOOKING AFT AT STA 758



LOOKING FORWARD AT STA 766

NOTE:

FOR SECTION VIEW D-D, SEE SHEET 2



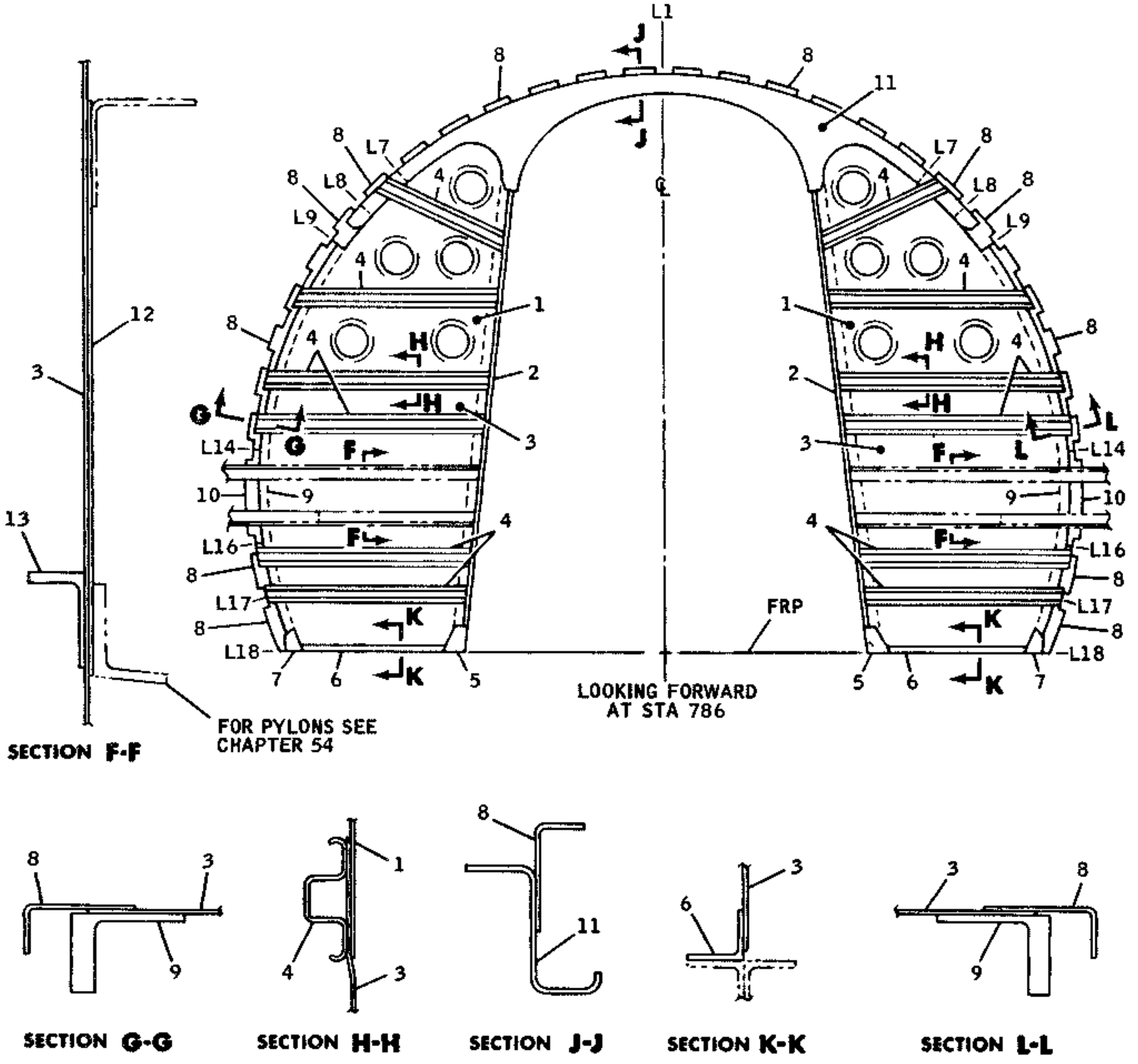
LOOKING FORWARD AT STA 801

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.050	CLAD 2014-T6
2	FRAME		2912094
3	FRAME		1387619
4	FRAME		2912096
5	FITTING		5911366-1
6	FRAME		2777930-5
7	FORMER TEE		2912538
8	SHEAR CLIP	.050	CLAD 2014-T6
9	SHEAR CLIP		1430824
10	FRAME	.063	CLAD 7075-T6
11	FRAME	.071	CLAD 7075-T6
12	STRAP	.040	TITANIUM DMS 1592
13	FITTING		2911391

BB3-196

Printed in U.S.A.

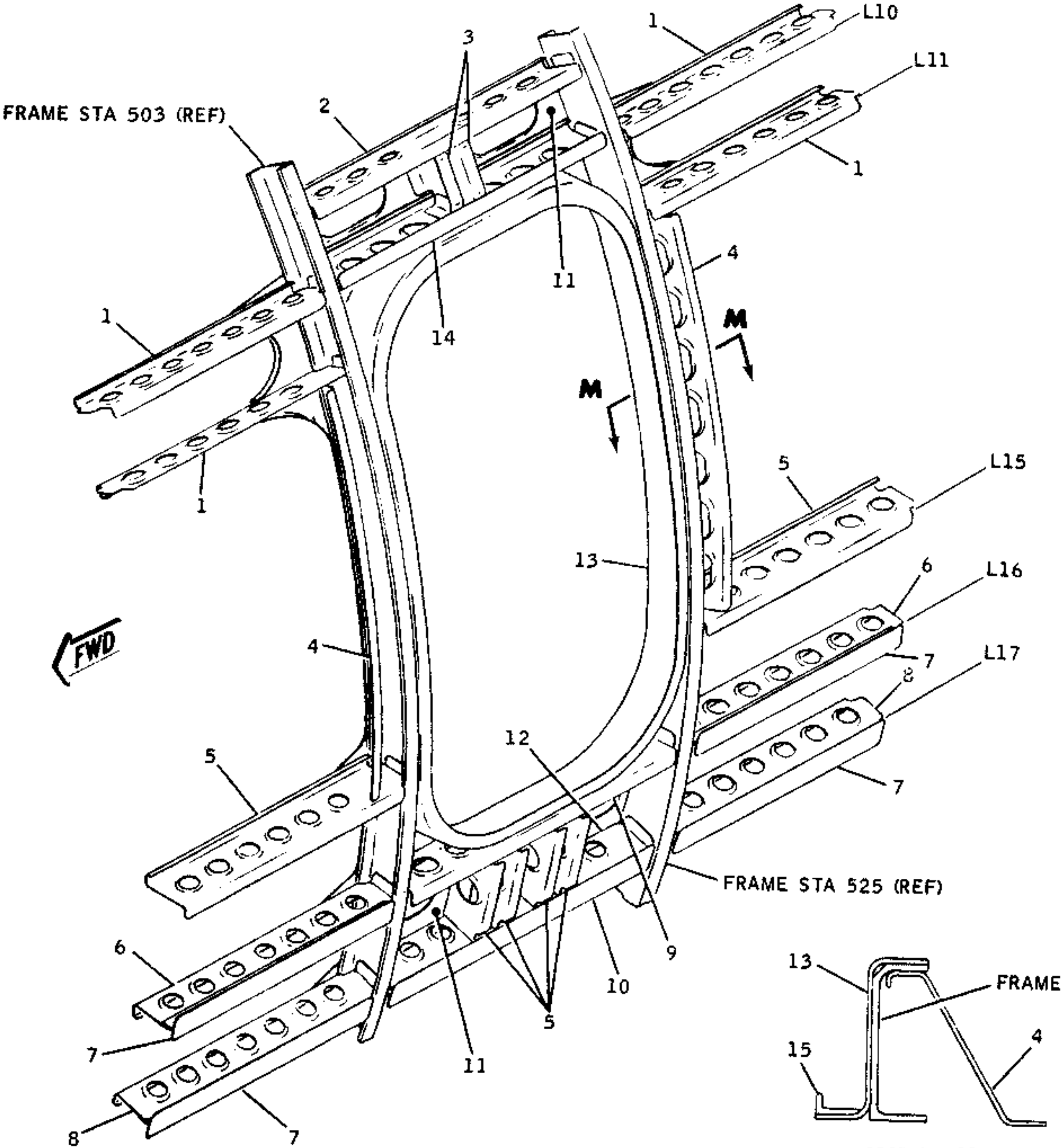
Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 3)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 2024-T3
2	TEE		3919064
3	WEB	.032	CLAD 7075-T6
4	HAT		2777922-4
5	FITTING		4912539-1, -2
6	ANGLE		1414967
7	FITTING		2911391
8	FORMER	.050	CLAD 2014-T6
9	ANGLE		2912397
10	FORMER	.071	CLAD 2014-T6
11	HEADER	.080	CLAD 7075-T6
12	DOUBLER	.080	CLAD 7075-T6
13	ANGLE		2912045

BB3-197

Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 4)



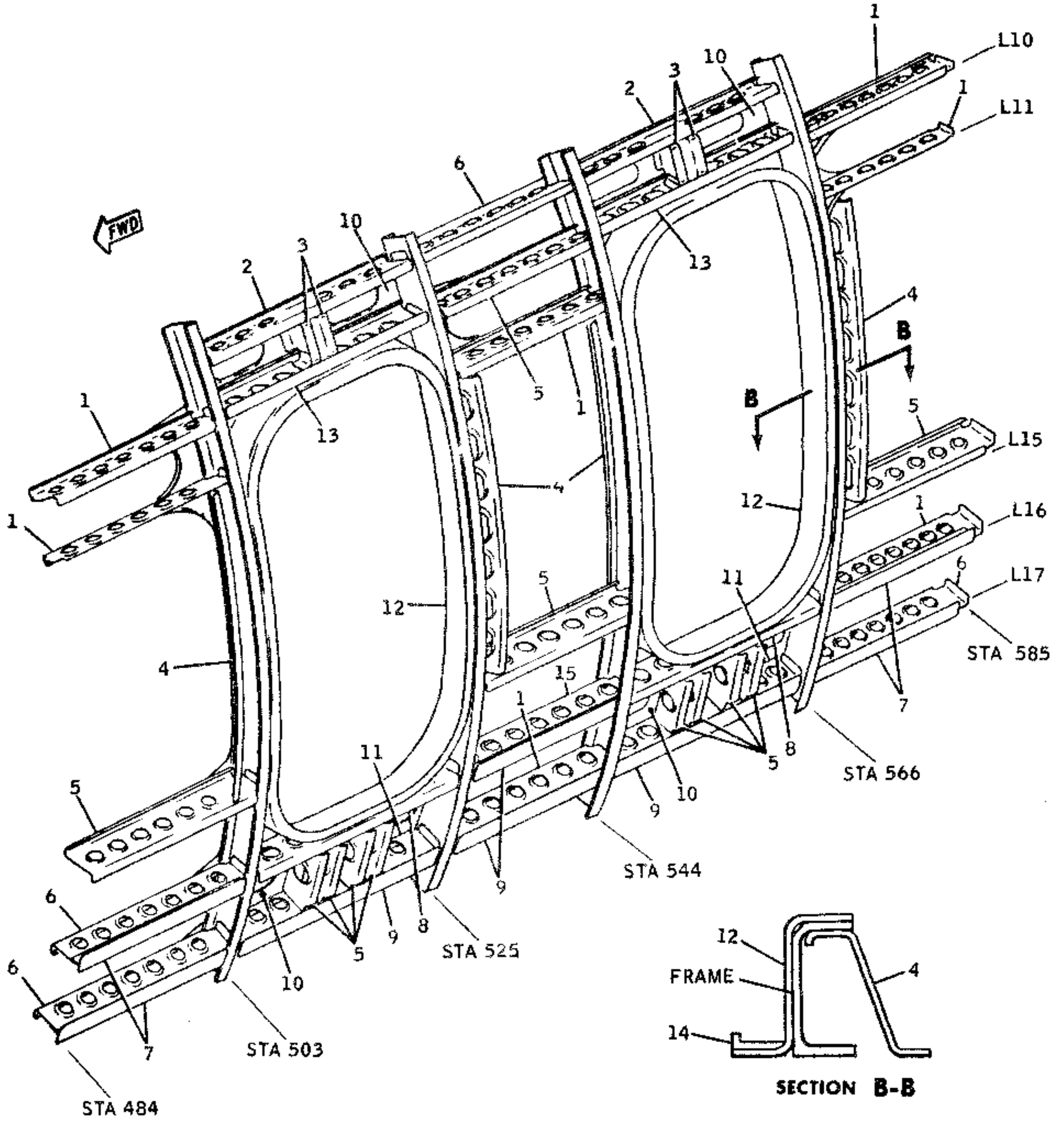
TYPE I AIRPLANES ONLY

REFERENCE- DOUGLAS DRAWING 5910160

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	9	INTERCOSTAL	.071	CLAD 2024-T6
2	INTERCOSTAL	.040	CLAD 2024-T3	10	TEE		1430824
3	INTERCOSTAL	.080	CLAD 7075-T6	11	INNER SKIN	.032	CLAD 2024-T42
4	WEB	.032	CLAD 2024-T42	12	INTERCOSTAL	.050	CLAD 2024-T3
5	INTERCOSTAL	.063	CLAD 7075-T6	13	PAN	.050	CLAD 2024-T42
6	INTERCOSTAL		2912901-6	14	INTERCOSTAL	.063	CLAD 2024-T3
7	TEE		1700632	15	SEAL DEPRESSOR		2912554
8	INTERCOSTAL		2912901-5				

BB3-198B

Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 5)



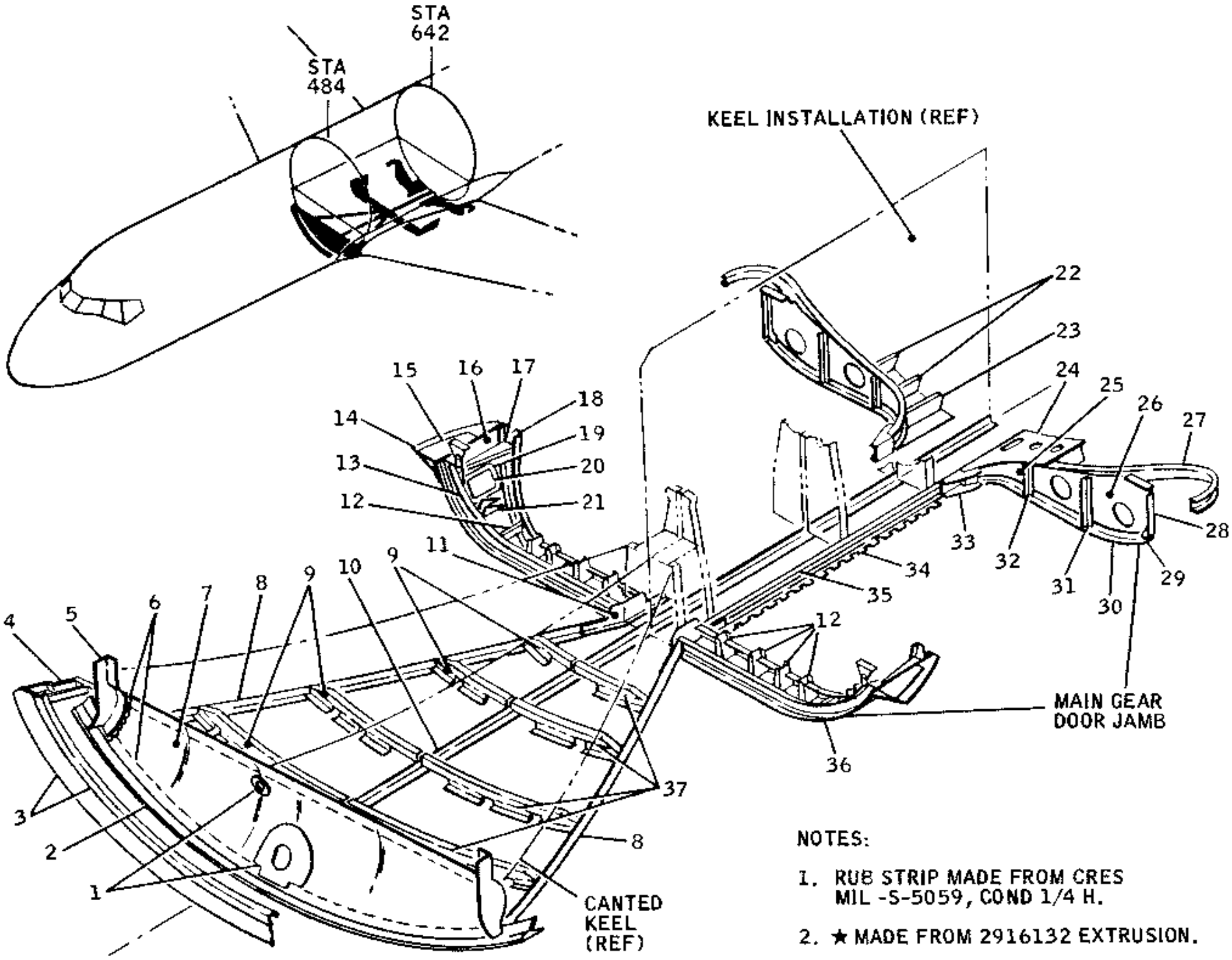
REFERENCE- DOUGLAS DRAWING 5910455

TYPE II AIRPLANES ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	9	TEE		1430824
2	INTERCOSTAL	.040	CLAD 2024-T42	10	INNER SKIN	.032	CLAD 2024-T42
3	INTERCOSTAL	.080	CLAD 7075-T6	11	INTERCOSTAL	.050	CLAD 2024-T3
4	WEB	.032	CLAD 2024-T42	12	PAN	.050	CLAD 2024-T42
5	INTERCOSTAL	.063	CLAD 7075-T6	13	INTERCOSTAL	.063	CLAD 2024-T3
6	INTERCOSTAL	.040	CLAD 7075-T6	14	SEAL DEPRESSOR		2912554
7	TEE		1700632	15	INTERCOSTAL	.071	CLAD 7075-T6
8	INTERCOSTAL	.071	CLAD 2024-T3				

BB3-924

Frames and Intercostals, Station 474 to 817, Upper Section
Figure 1 (Sheet 6)



NOTES:

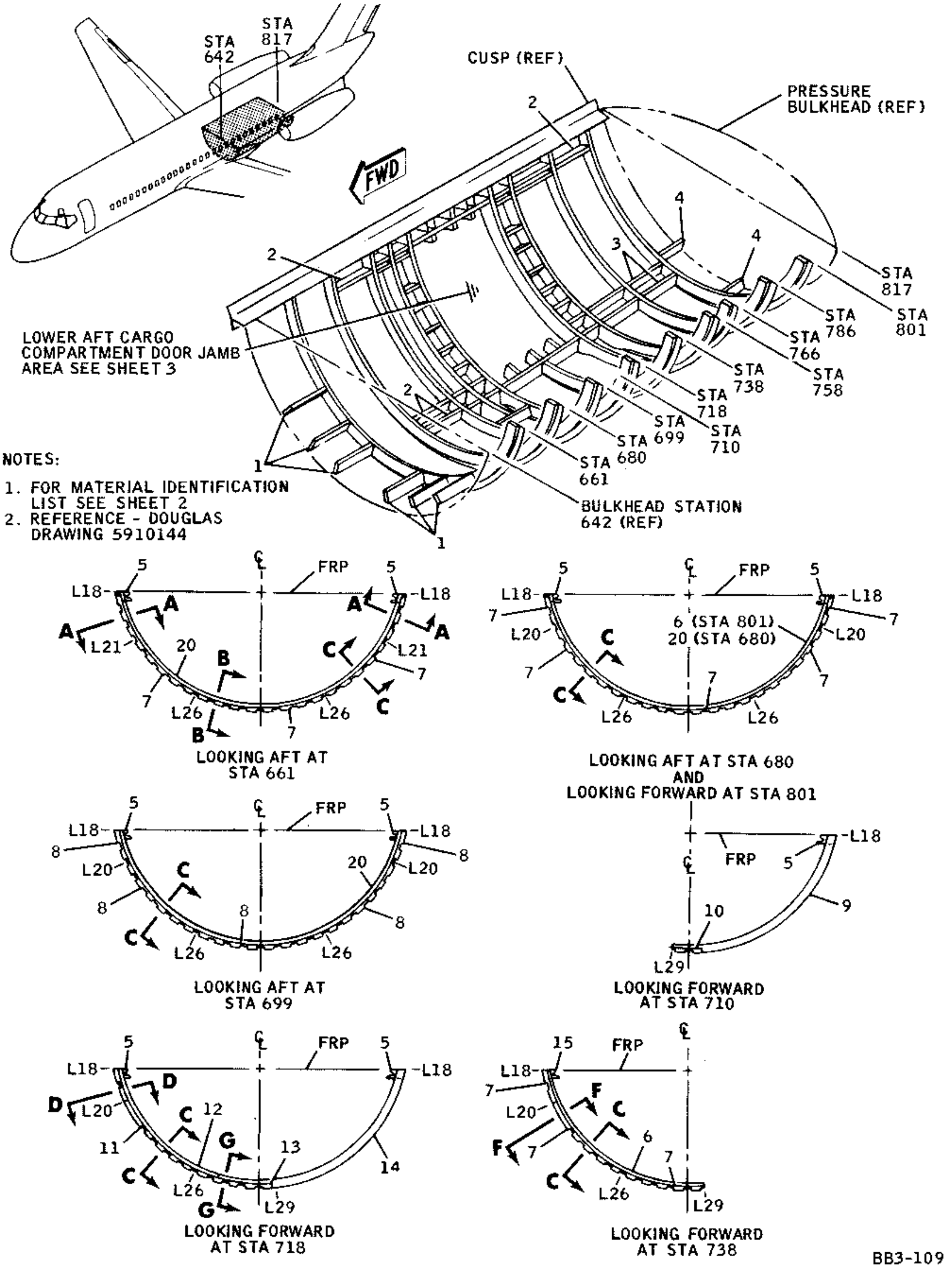
1. RUB STRIP MADE FROM CRES MIL -S-5059, COND 1/4 H.
2. ★ MADE FROM 2916132 EXTRUSION.
3. REFERENCE - DOUGLAS DRAWING 5910375.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 2024-T42
2	TEE		2613776
3	FRAME	.071	CLAD 7075-T6
4	FITTING		5912979 (-1, -2)
5	FITTING	.063	CLAD 2024-T42
6	DOUBLER	.025	CLAD 2014-T6
7	PANEL	.050	CLAD 2024-T42
8	CAP	.125	CLAD 7075-T6
9	FORMER	.063	CLAD 7075-T6
10	CAP		★ 9915525-1
11	SPLICE		9958195-1, -2
12	INTERCOSTAL	.063	CLAD 2024-T42
13	FORMER	.063	CLAD 2024-T42
14	FILLET	.070	CLAD 2024-T42
15	BRACKET	.040	CLAD 2024-T42
16	SKIN	.125	CLAD 2024-T42
17	STIFFENER	.040	CLAD 2024-T3
18	CHANNEL	.063	CLAD 2024-T42
19	DOUBLER	.063	CLAD 2024-T3

ITEM	NOMENCLATURE	GAGE	MATERIAL
20	DOOR	.125	CLAD 2024-T42
21	BRACKET	.071	CLAD 7075-T6
22	INTERCOSTAL	.080	CLAD 7075-T6
23	INTERCOSTAL	.090	CLAD 7075-T6
24	WEB	.040	CLAD 7075-T6
25	WEB	.063	CLAD 2024-T3
26	WEB	.063	CLAD 2024-T42
27	CHANNEL	.100	CLAD 7075-T6
28	ANGLE	.063	CLAD 7075-T6
29	RUB STRIP	.032	SEE NOTE 1
30	TEE		2914624
31	STIFFENER		1245835
32	SPLICE TEE		1440048
33	FITTING		3916184
34	HINGE		3956689-1, -2
35	ZEE	.100	CLAD 7075-T6
36	TEE		1243286
37	SHEAR CLIP		1242526

BB3-139

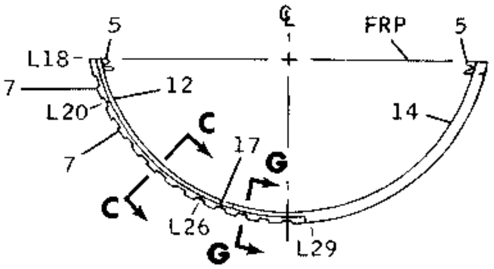
Frames and Intercostals, Station 474 to 642, Underwing
Figure 2



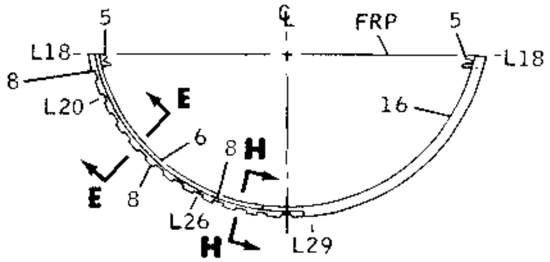
NOTES:

1. FOR MATERIAL IDENTIFICATION LIST SEE SHEET 2
2. REFERENCE - DOUGLAS DRAWING 5910144

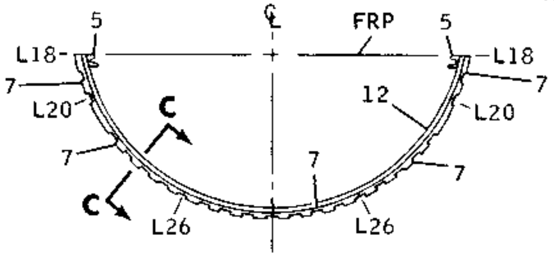
Frames and Intercostals, Station 642 to 817, Lower Section
Figure 3 (Sheet 1)



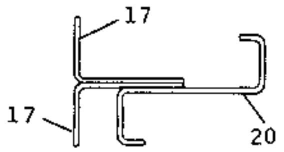
LOOKING AFT AT
STA 758



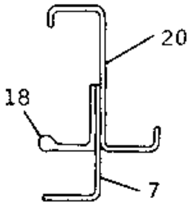
LOOKING FORWARD
AT STA 766



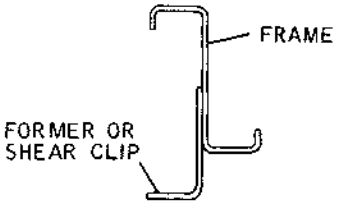
LOOKING AFT AT
STA 786



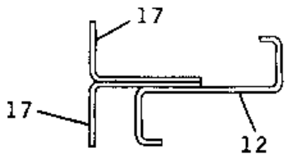
SECTION A-A



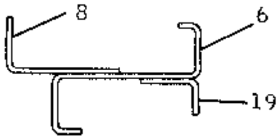
SECTION B-B



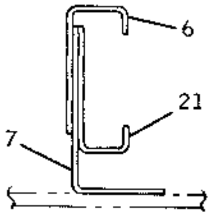
SECTION C-C



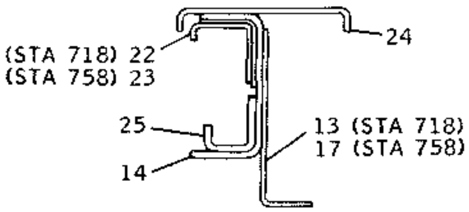
SECTION D-D



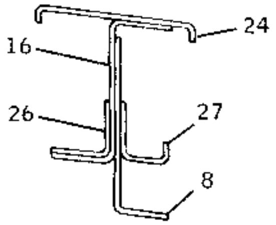
SECTION E-E



SECTION F-F



SECTION G-G

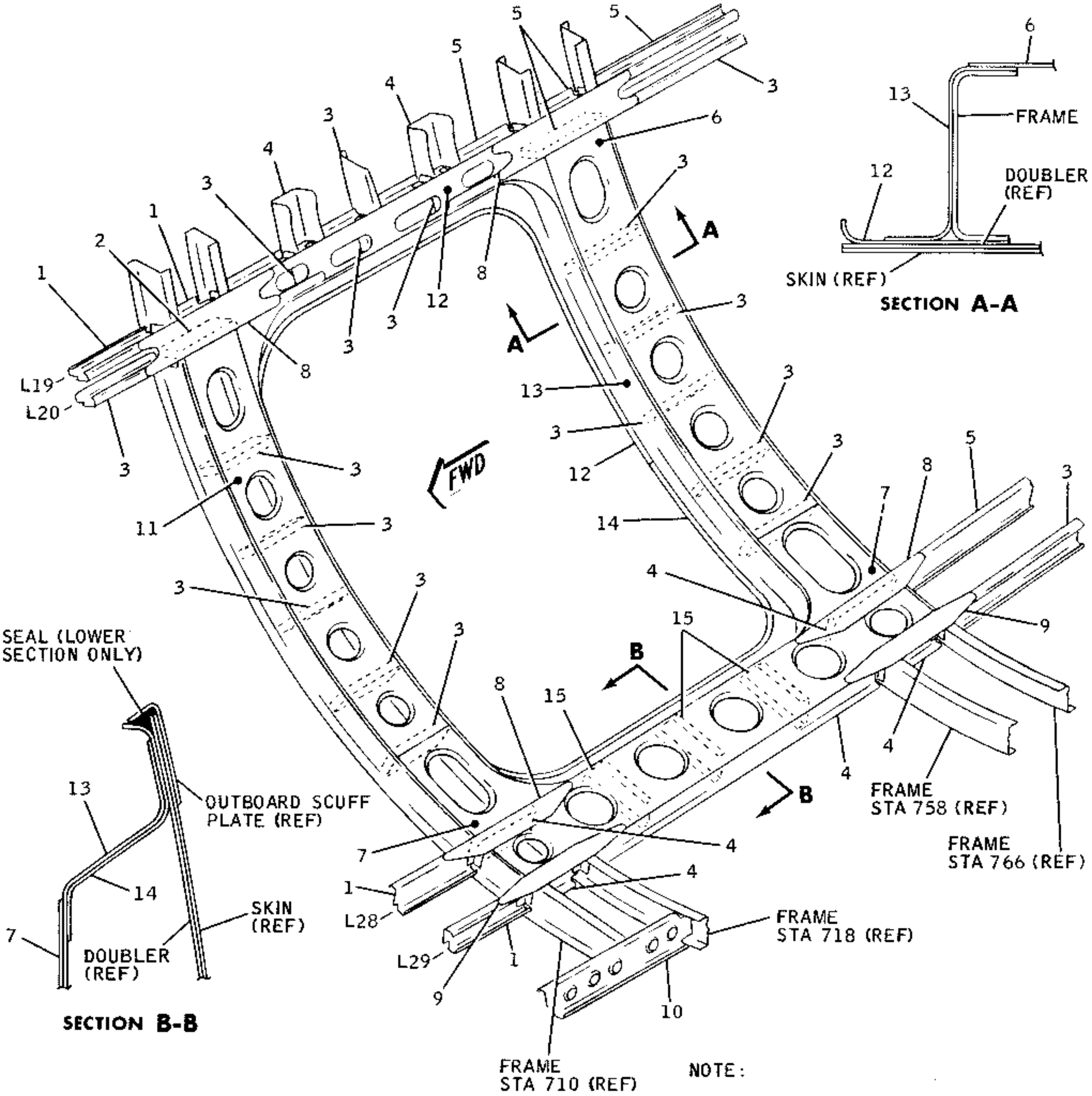


SECTION H-H

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.090	CLAD 7075-T6511	15	FITTING		3915009-1
2	INTERCOSTAL	.050	CLAD 7075-T6	16	FRAME	.063	CLAD 2024-T42
3	INTERCOSTAL	.071	CLAD 2024-T42	17	FORMER	.063	CLAD 2014-T6
4	INTERCOSTAL	.040	CLAD 7075-T6	18	ANGLE		2612329
5	FITTING		2911391	19	DOUBLER	.063	CLAD 7075-T6
6	FRAME		2777930-5	20	FRAME		2777930-7
7	FORMER	.050	CLAD 2014-T6	21	SPLICE FORMER	.063	CLAD 7075-T6
8	SHEAR CLIP	.050	CLAD 2014-T6	22	ANGLE SPLICE	.040	CLAD 7075-T6
9	FORMER	.063	CLAD 2024-T42	23	ANGLE SPLICE	.063	CLAD 7075-T6
10	CLIP	.050	CLAD 2014-T6	24	SPLICE CAP	.063	CLAD 7075-T6
11	FORMER	.071	CLAD 2014-T6	25	ANGLE SPLICE	.071	CLAD 7075-T6
12	FRAME		2777930-6	26	ANGLE DOUBLER	.050	CLAD 7075-T6
13	FORMER	.063	CLAD 7075-T6	27	ANGLE DOUBLER	.063	CLAD 7075-T6
14	FRAME	.090	CLAD 2024-T42				

BB3-203

Frames and Intercostals, Station 642 to 817, Lower Section
Figure 3 (Sheet 2)



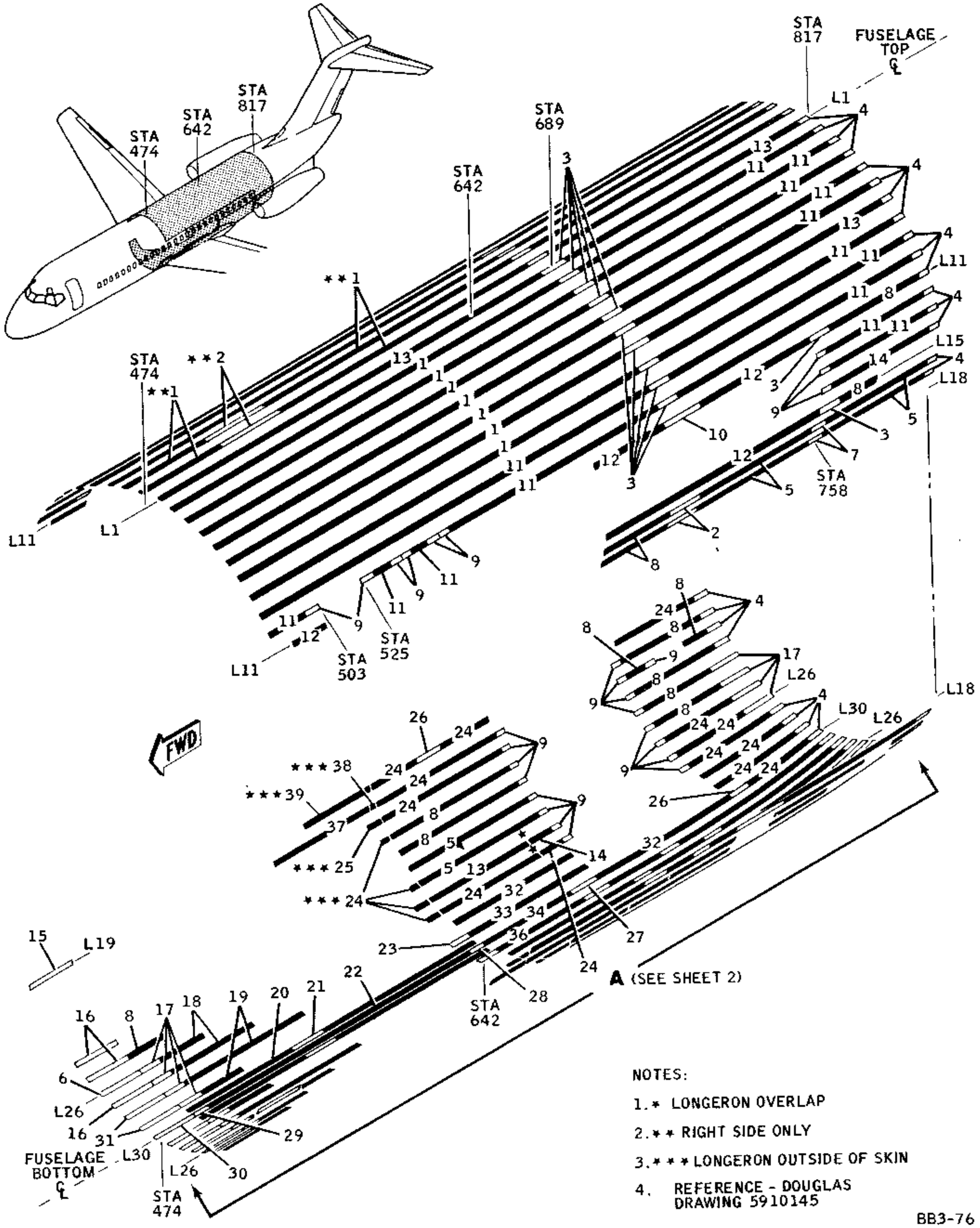
NOTE:

CRES SHEET TYPE 17-7PH, MIL-S-25043, COND A, FINISH 2D

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.080	CLAD 7075-T6
2	INTERCOSTAL	.071	CLAD 2024-T42
3	INTERCOSTAL	.063	CLAD 7075-T6
4	INTERCOSTAL	.090	CLAD 7075-T6
5	INTERCOSTAL	.071	CLAD 7075-T6
6	AFT WEB	.040	CLAD 7075-T6
7	LOWER WEB	.040	CLAD 2024-T4
8	GUSSET	.125	CLAD 7075-T6
9	GUSSET	.250	STEEL BAR 4130
10	INTERCOSTAL	.040	CLAD 7075-T6
11	FORWARD WEB	.040	CLAD 7075-T6
12	UPPER DEPRESSOR	.071	CLAD 2024-T4
13	PAN	.050	CLAD 2024-T42
14	LOWER DEPRESSOR	.063	SEE NOTE
15	INTERCOSTAL	.050	CLAD 7075-T6

BB3-215

Frames and Intercostals, Station 642 to 817, Lower Section
Figure 3 (Sheet 3)



NOTES:

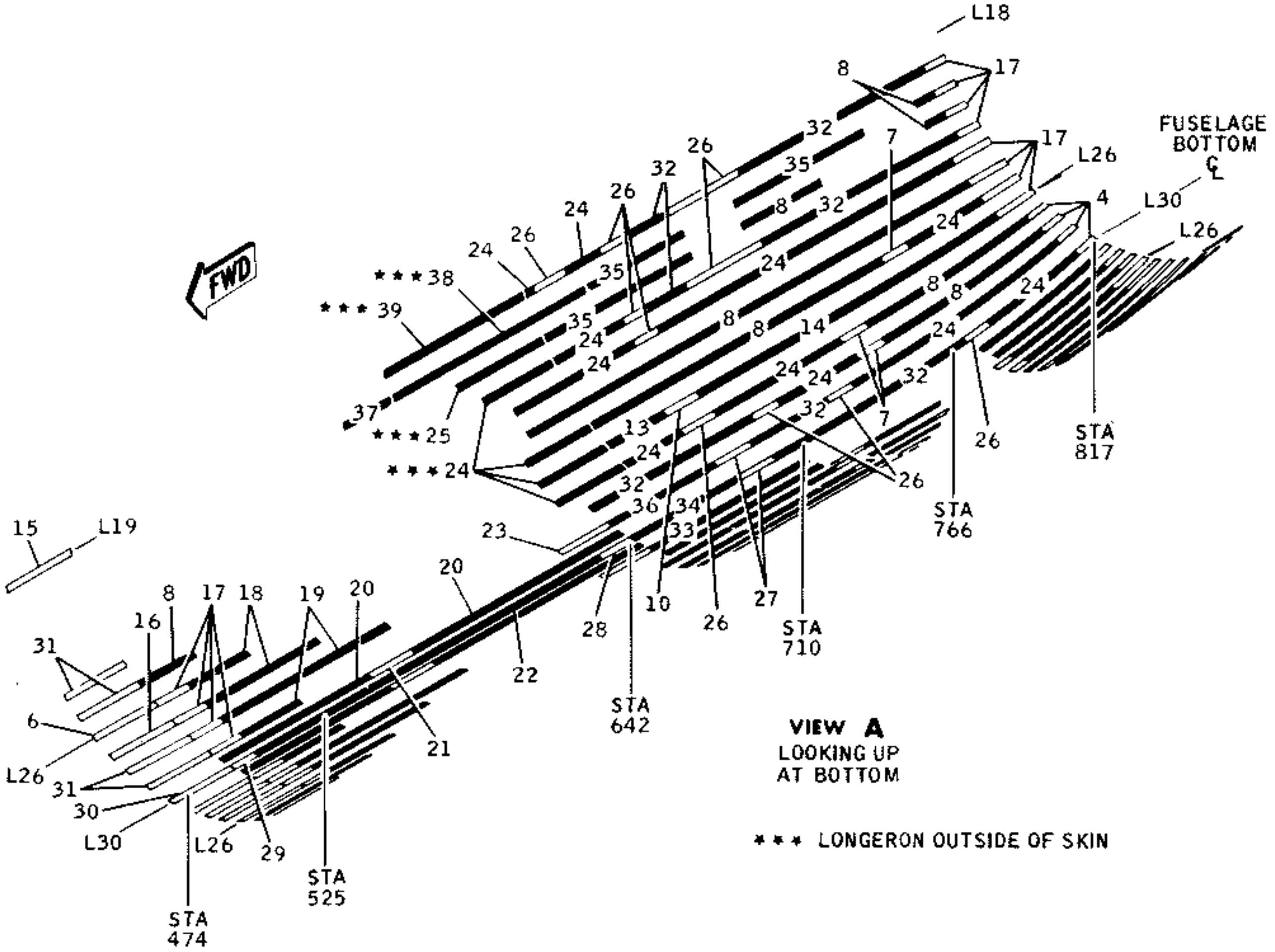
1.* LONGERON OVERLAP

2.** RIGHT SIDE ONLY

3.*** LONGERON OUTSIDE OF SKIN

4. REFERENCE - DOUGLAS DRAWING 5910145

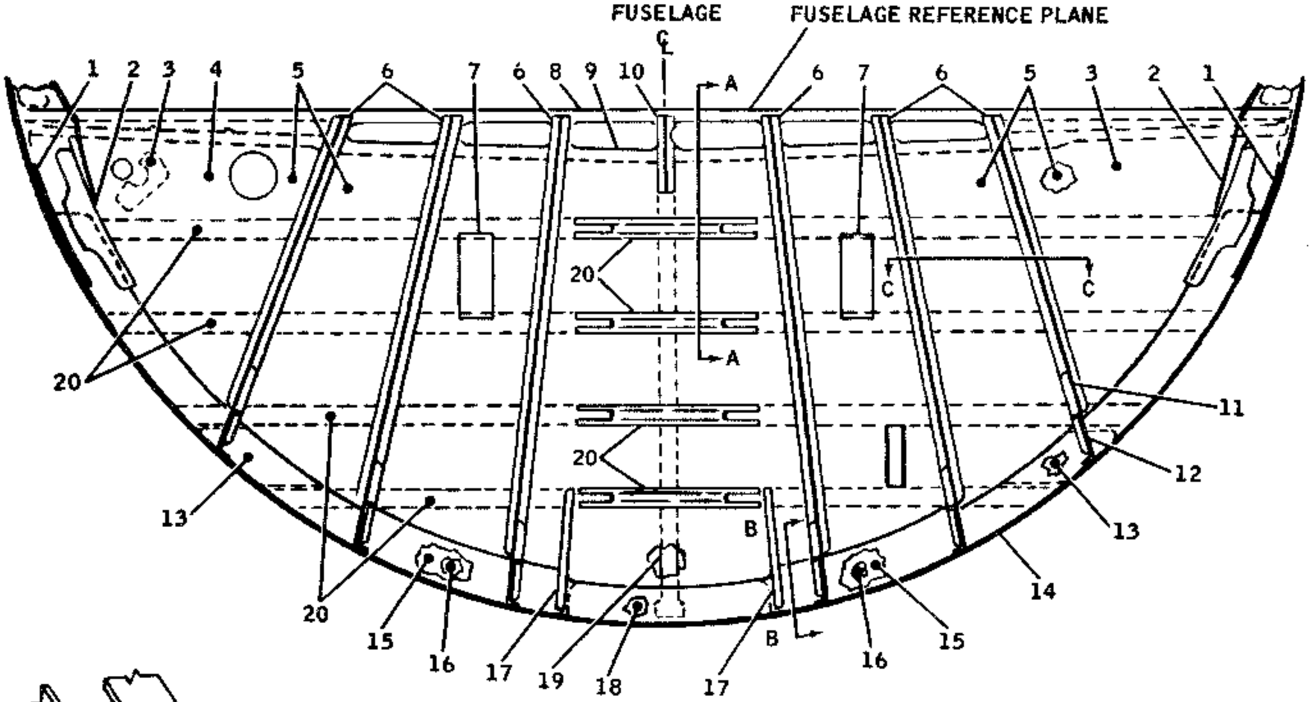
Longerons, Station 474 to 817
Figure 4 (Sheet 1)



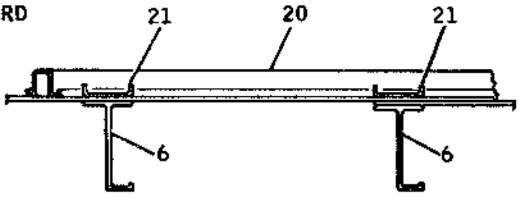
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777922-1	21	FITTING	.090	CLAD 7075-T6
2	FITTING	.050	CLAD 7075-T6	22	CAP		2916132
3	FITTING		2912099	23	FITTING		3915135-1, -2
4	CLIP	.063	CLAD 7075-T6	24	LONGERON		2912727
5	LONGERON		2777922-4	25	LONGERON		1375211
6	FITTING		3913209-501	26	FITTING		2641454
7	FITTING	.063	CLAD 7075-T6	27	SPLICE		3914677-1
8	LONGERON		2777922-5	28	FITTING		3915134-1, -501
9	CLIP	.050	CLAD 7075-T6	29	FITTING		3915130-1, -2
10	SPLICE	.071	CLAD 7075-T6	30	SPLICE		5916064-1
11	LONGERON		2777922-3	31	FITTING		3913209-1
12	LONGERON		2777923-5	32	LONGERON		1242886
13	LONGERON		2777948-5	33	LONGERON		5914563-503
14	LONGERON		2777948	34	LONGERON		5914562-1
15	FITTING		5912544-1	35	LONGERON		2912099
16	FITTING		3913209-503	36	LONGERON		5914563-1
17	FITTING		2647332	37	LONGERON		2914254
18	LONGERON		1415997	38	LONGERON		2914255
19	LONGERON		2610338	39	FITTING		5916516-1, -2
20	STRINGER	.080	CLAD 7075-T6				

BB3-437

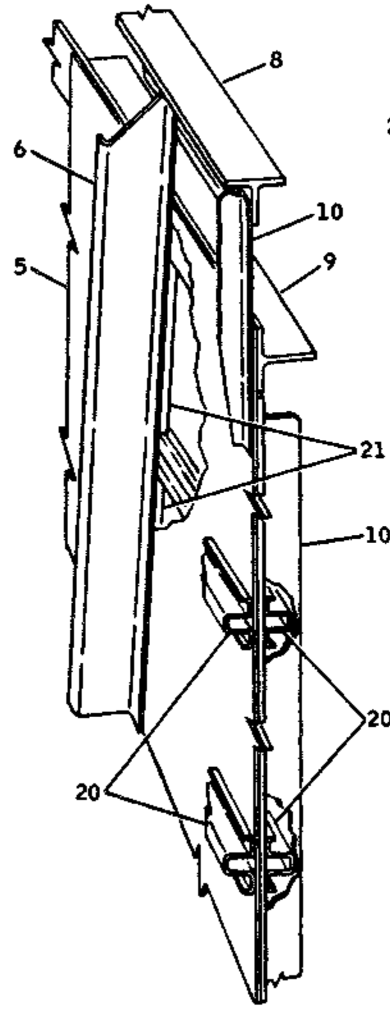
Longerons, Station 474 to 817
Figure 4 (Sheet 2)

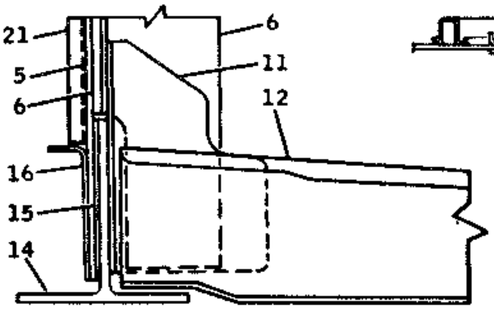


VIEW LOOKING FORWARD
FUSELAGE STA 642



SECTION C-C





SECTION B-B
(TYPICAL 6 PLACES)

REFERENCE - DOUGLAS
DRAWING - 9958212

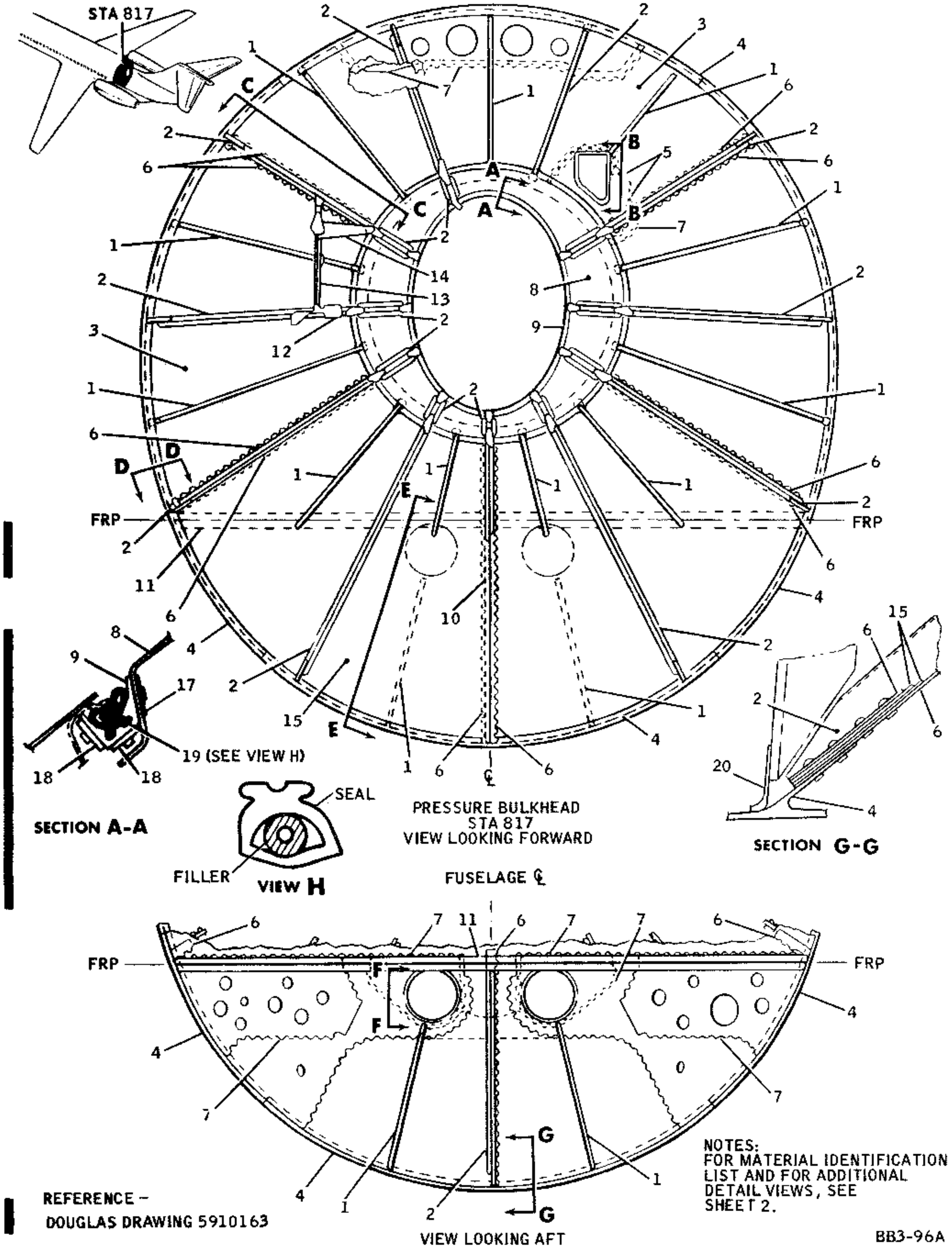
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE	.190	CLAD 7075-T6
2	ANGLE		1329812
3	SUPPORT	.090	6061-0
4	DOUBLER	.050	CLAD 2014-T6
5	WEB	.050	CLAD 2014-T6
6	STIFFENER		4594694
7	CHANNEL	.050	CLAD 2024-T3
8	TEE		1363992
9	TEE		1440004
10	TEE		2912538
11	DOUBLER	.090	CLAD 7075-T6
12	INTERCOSTAL	.090	CLAD 7075-T6
13	RETAINER	.050	CLAD 2024-T3
14	TEE		2914624
15	SPACER	.050	CLAD 2014-T6
16	RETAINER	.063	CLAD 2024-T3
17	SUPPORT		1332779
18	CHANNEL		2914646
19	TEE		1642726
20	HAT		2651332
21	CHANNEL		2914646

SECTION A-A

Printed in U.S.A.

BB3-120

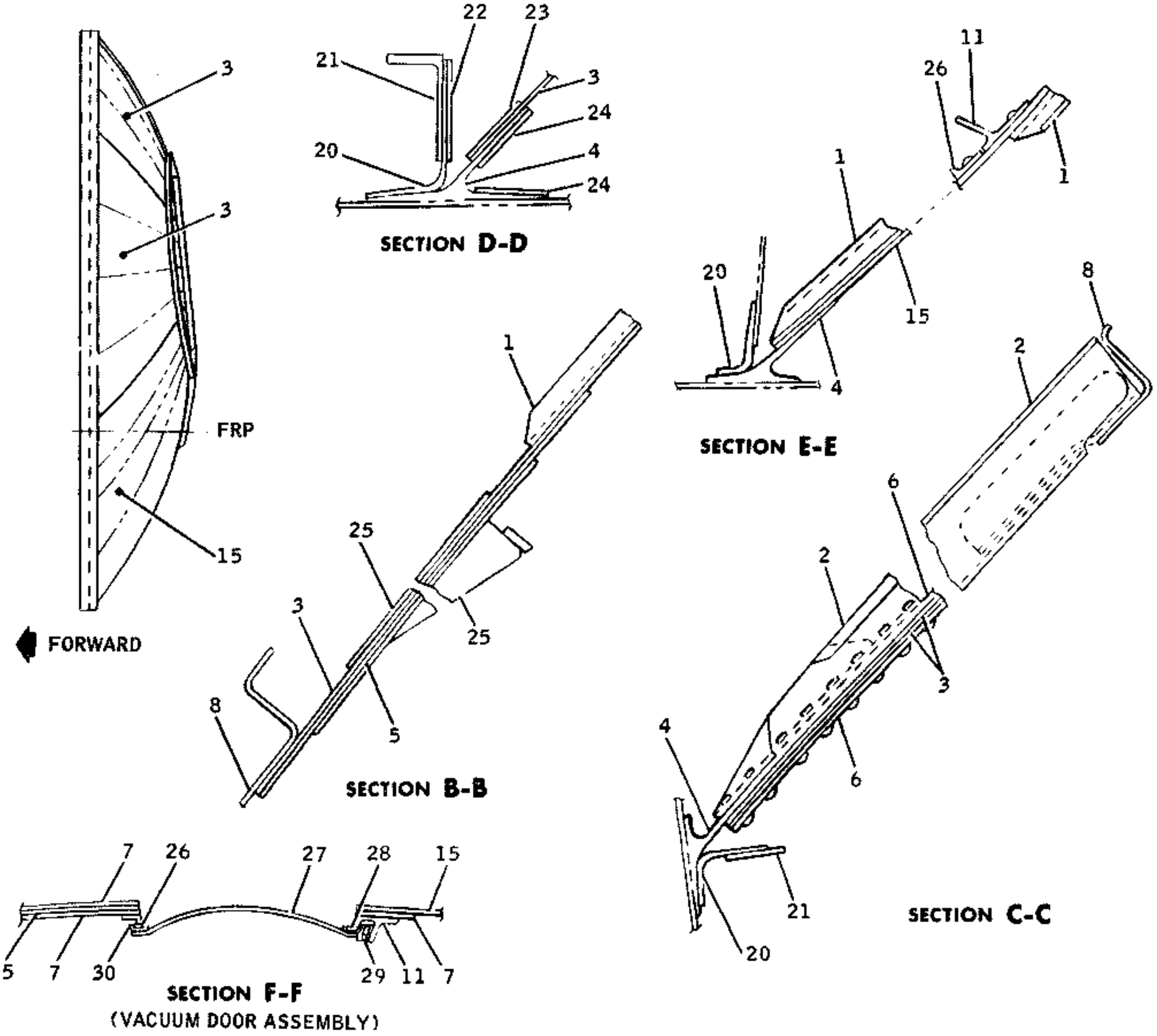
Bulkhead, Station 642
Figure 5



NOTES:
FOR MATERIAL IDENTIFICATION LIST AND FOR ADDITIONAL DETAIL VIEWS, SEE SHEET 2.

REFERENCE -
DOUGLAS DRAWING 5910163

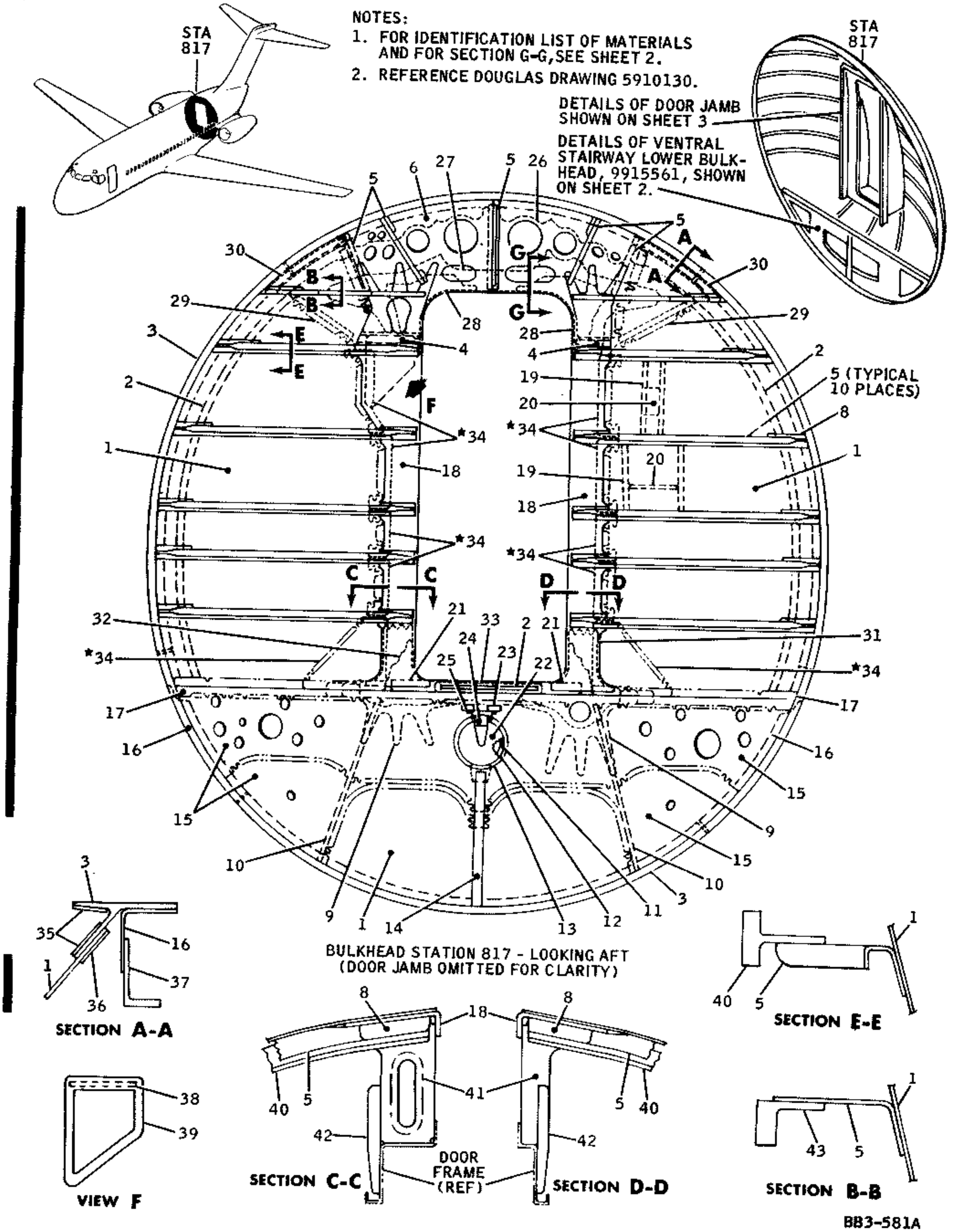
Pressure Bulkhead, Station 817 -- Type I
Figure 6 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		1109618	16	STRAP	.040	CLAD 2014-T6
2	STIFFENER	.032	CLAD 2014-T6	17	SPLICE	.040	CLAD 2014-T6
3	WEB	.039/.045	CLAD 2014-T6	18	SPLICE	.090	CLAD 2014-T6
4	TEE		2912046	19	SEAL ASSEMBLY		5914146-1
5	DOUBLER	.063	CLAD 2014-T6	20	ANGLE		2912293
6	DOUBLER	.025	CLAD 2014-T6	21	ANGLE		2912045
7	DOUBLER	.040	CLAD 2014-T6	22	SHIM	.032	CLAD 2014-T6
8	JAMB	.063	CLAD 2014-T6	23	SPLICE	.050	CLAD 2014-T6
9	RETAINER		2912553	24	SPLICE	.063	CLAD 2014-T6
10	STIFFENER	.050	CLAD 2014-T6	25	PAN	.080	CLAD 2024-T42
11	TEE		2649174	26	SEAL STRIKER	.250	2024-T351
12	SUPPORT		1646170	27	PLATE (DOOR)	.063	CLAD 2024-T42
13	INTERCOSTAL	.025	CLAD 2014-T6	28	SEAL		2916291
14	SUPPORT	.050	CLAD 2024-T42	29	HINGE		2272677
15	WEB	.042/.048	CLAD 2014-T6	30	CHANNEL	.050	CLAD 2024-T42

BB3-121B

Pressure Bulkhead, Station 817 -- Type I
Figure 6 (Sheet 2)



NOTES:
1. FOR IDENTIFICATION LIST OF MATERIALS AND FOR SECTION G-G, SEE SHEET 2.
2. REFERENCE DOUGLAS DRAWING 5910130.

DETAILS OF DOOR JAMB SHOWN ON SHEET 3

DETAILS OF VENTRAL STAIRWAY LOWER BULKHEAD, 9915561, SHOWN ON SHEET 2.

5 (TYPICAL 10 PLACES)

BULKHEAD STATION 817 - LOOKING AFT (DOOR JAMB OMITTED FOR CLARITY)

SECTION A-A

VIEW F

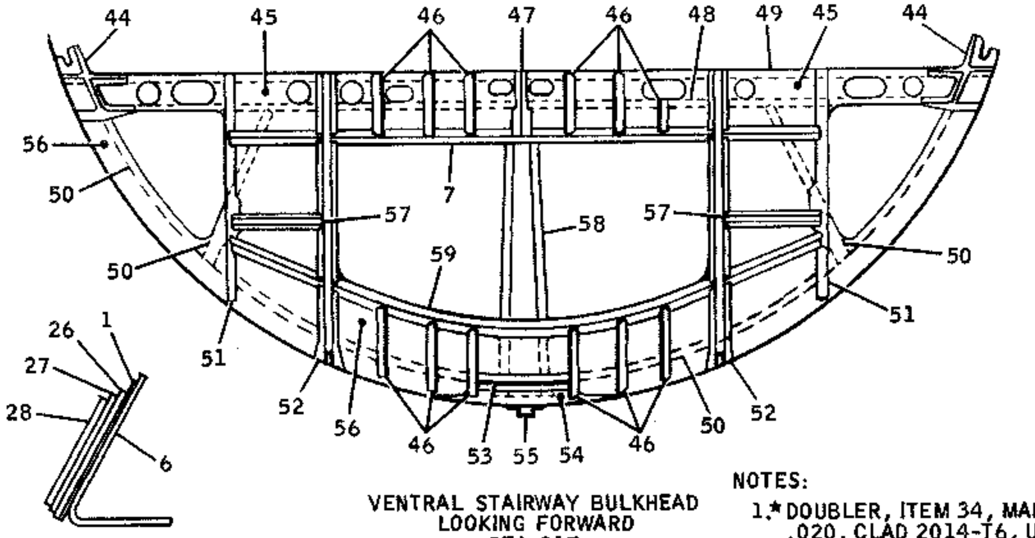
SECTION C-C

SECTION D-D

SECTION E-E

SECTION B-B

Pressure Bulkhead, Station 817 -- Type II
Figure 6A (Sheet 1)



VENTRAL STAIRWAY BULKHEAD
LOOKING FORWARD
STA 817

SECTION G-G
(FROM SHEET 1)

NOTES:

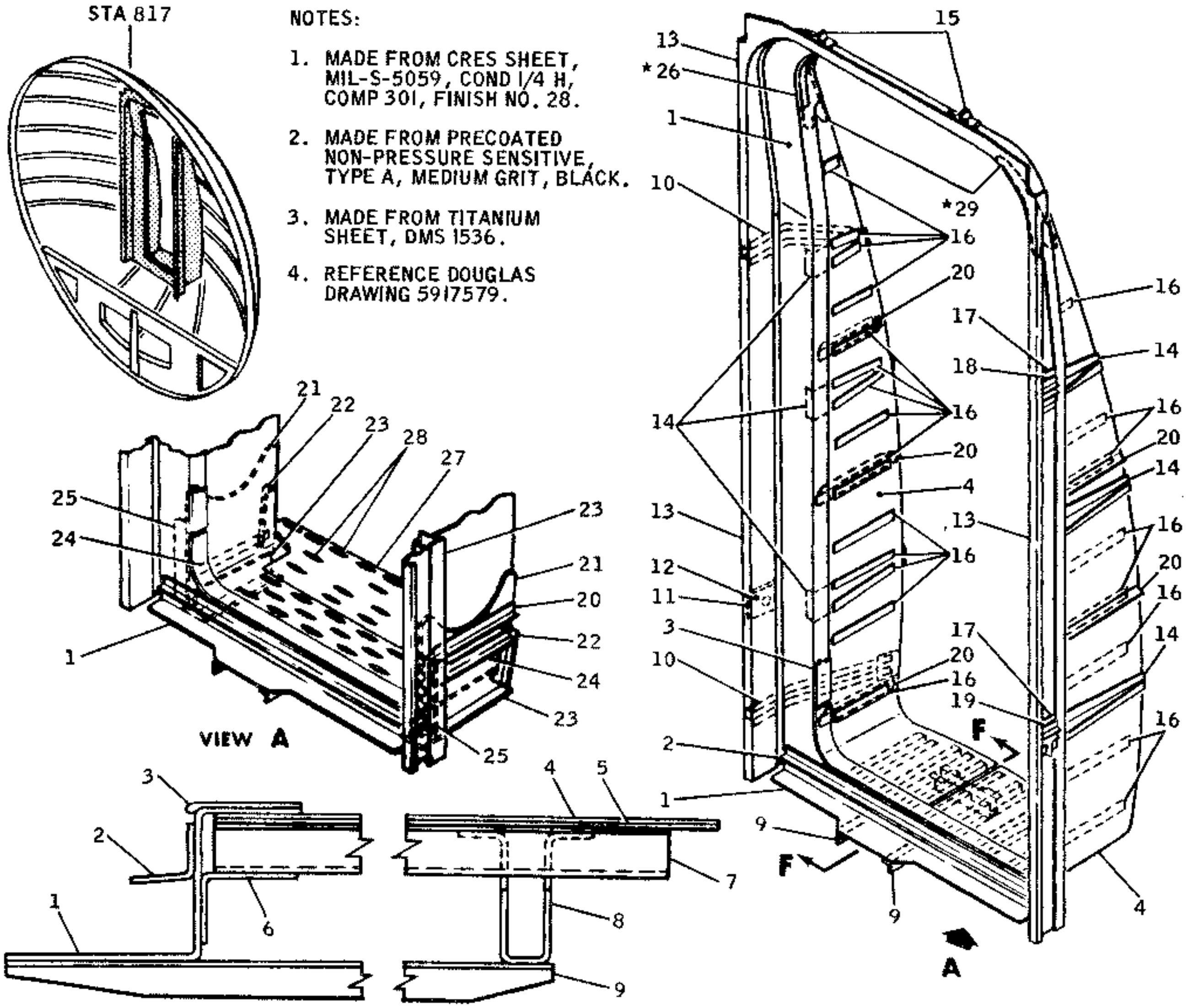
1.* DOUBLER, ITEM 34, MADE FROM .020, CLAD 2014-T6, USED ON AIRPLANES 87 AND SUBSEQUENT AIRPLANES.

2. REFERENCE - DOUGLAS DRAWING 9915561

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.039/.045	CLAD 2014-T6	31	GUSSET	.080	SHEET TITANIUM
2	ANGLE	.050	CLAD 2014-T6	32	DOUBLER	.080	SHEET TITANIUM
3	TEE		2912046	33	SPACER	.040	CLAD 2014-T6
4	SHIM	.080	CLAD 2024-T3	*34	DOUBLER		SEE NOTE 1
5	FORMER	.040	CLAD 2014-T6	35	SPLICE	.063	CLAD 2014-T6
6	DOUBLER	.080	CLAD 2014-T6	36	SPLICE	.050	CLAD 2014-T6
7	TEE		1666744	37	ANGLE		2912045
8	CLIP	.050	CLAD 2014-T6	38	PLATE	.375	PLATE 2024-T351
9	GUSSET	.080	SHEET TITANIUM	39	PAN	.080	CLAD 2024-T6
10	FORMER	.050	CLAD 2014-T6	40	TEE		1716225
11	SEAL		2916291	41	WEB	.050	CLAD 2014-T6
12	CHANNEL	.050	CLAD 2024-T42	42	CLIP		1465089
13	SEAL STRIKER	.250	PLATE 2024-T351	43	STIFFENER		2912813
14	TEE		1249240	44	FITTING	1.00	PLATE 7075-T651
15	DOUBLER	.040	CLAD 2014-T6	45	WEB	.032	CLAD 7075-T6
16	ANGLE		2912293	46	ANGLE		1242526
17	TEE		2917577	47	TEE		1642532
18	CHANNEL	.125	CLAD 2014-T6	48	ANGLE		1125597
19	ANGLE	.040	CLAD 2014-T6	49	ANGLE		2912758
20	SUPPORT	.040	CLAD 6061-T6	50	ANGLE	.063	CLAD 7075-T6
21	CHANNEL	.050	CLAD 2014-T6	51	ANGLE		1287425
22	PLATE	.063	CLAD 2024-T42	52	HAT	.063	CLAD 7075-T6
23	ANGLE	.063	CLAD 2024-T3	53	ANGLE		1249243
24	BUMPER		PLATE 6061-T6	54	DOUBLER	.100	CLAD 7075-T6
25	BRACKET	.100	PLATE 2024-T351	55	FITTING	2.750	PLATE 7075-T651
26	DOUBLER	.063	CLAD 2014-T6	56	WEB	.040	CLAD 7075-T6
27	DOUBLER	.063	SHEET TITANIUM	57	HAT	.040	CLAD 7075-T6
28	DOUBLER	.080	SHEET TITANIUM	58	HAT	.125	CLAD 7075-T6
29	DOUBLER	.020	CLAD 2014-T6	59	TEE		1325214
30	SPLICE	.040	CLAD 2014-T6				

BB3-582A

Pressure Bulkhead, Station 817 -- Type II
Figure 6A (Sheet 2)



NOTES:

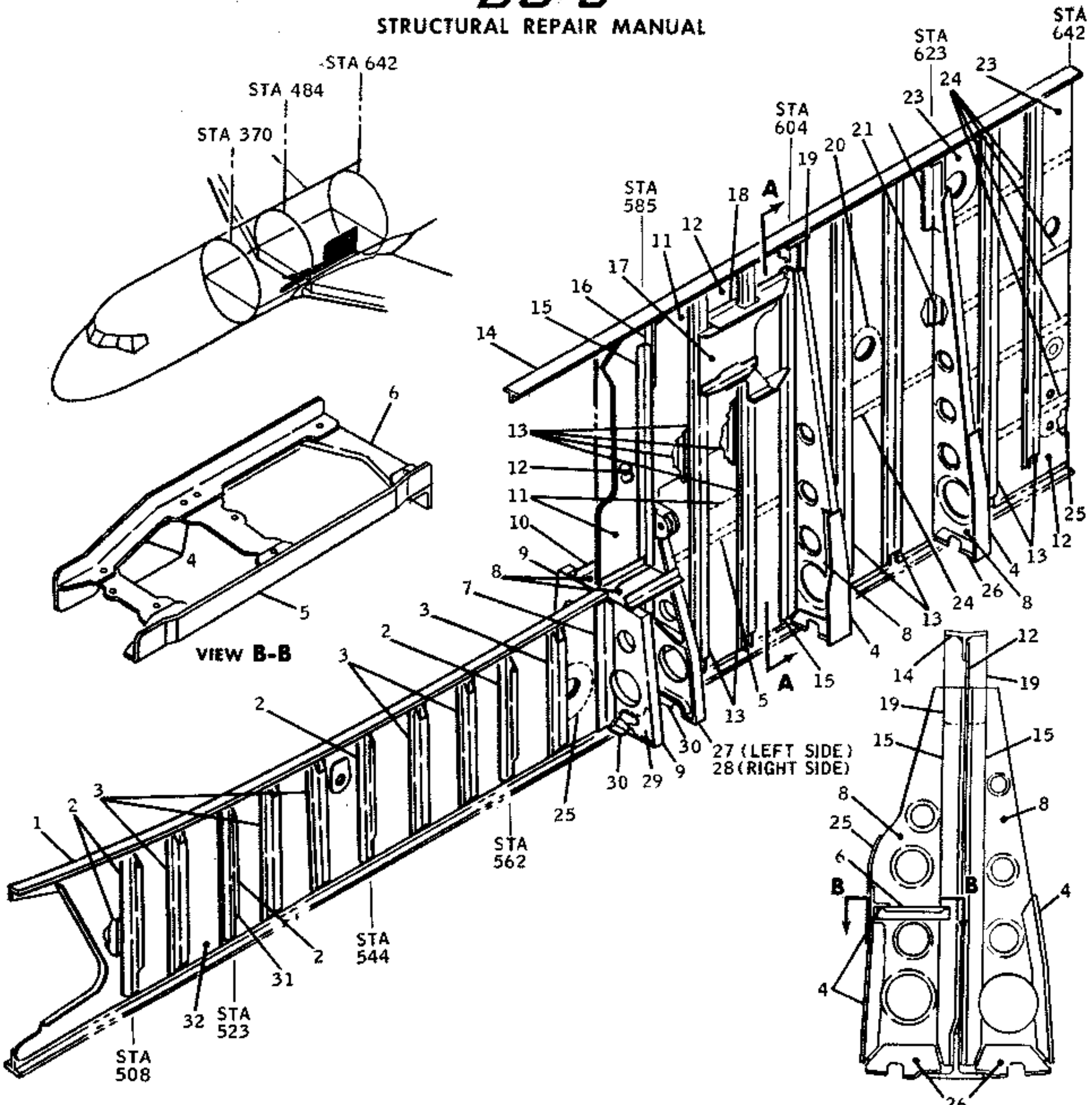
1. MADE FROM CRES SHEET, MIL-S-5059, COND 1/4 H, COMP 301, FINISH NO. 28.
2. MADE FROM PRECOATED NON-PRESSURE SENSITIVE, TYPE A, MEDIUM GRIT, BLACK.
3. MADE FROM TITANIUM SHEET, DMS 1536.
4. REFERENCE DOUGLAS DRAWING 5917579.

* EFFECTIVE ON FUSELAGE 87 AND SUBSEQUENT.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	JAMB	.040	CLAD 2014-T6	15	FITTING	2.000	PLATE 7075-T651
2	ANGLE	.020	SEE NOTE 1	16	STRAP		2917981
3	STRIKER		2505668	17	SERRATED PLATE	.125	CLAD 2024-T3
4	WEB	.040	CLAD 2014-T6	18	FITTING	.750	PLATE 2024-T351
5	SPLICE	.063	CLAD 2014-T6	19	FITTING	2.500	PLATE 2024-T351
6	ANGLE	.040	CLAD 2014-T6	20	ANGLE		1465089
7	HAT	.032	CLAD 2014-T6	21	SPLICE	.050	CLAD 2014-T6
8	SUPPORT	.063	CLAD 2014-T6	22	ANGLE	.063	CLAD 2014-T6
9	ANGLE		179364	23	TEE		2615551
10	SUPPORT		2777948	24	ANGLE		1243092
11	SERRATED PLATE	.190	STL SHEET 4130	25	ANGLE		1619970
12	FITTING	.500	STL PLATE 4130	*26	STRIKER		2505327
13	FRAME	.050	CLAD 2014-T6	27	SILL	.125	CLAD 7075-T6
14	FITTING	.750	PLATE 7075-T651	28	SAFETY WALK		SEE NOTE 2
				*29	SPLICE	.063	SEE NOTE 3

BB3-600A

Pressure Bulkhead, Station 817 -- Type II
Figure 6A (Sheet 3)



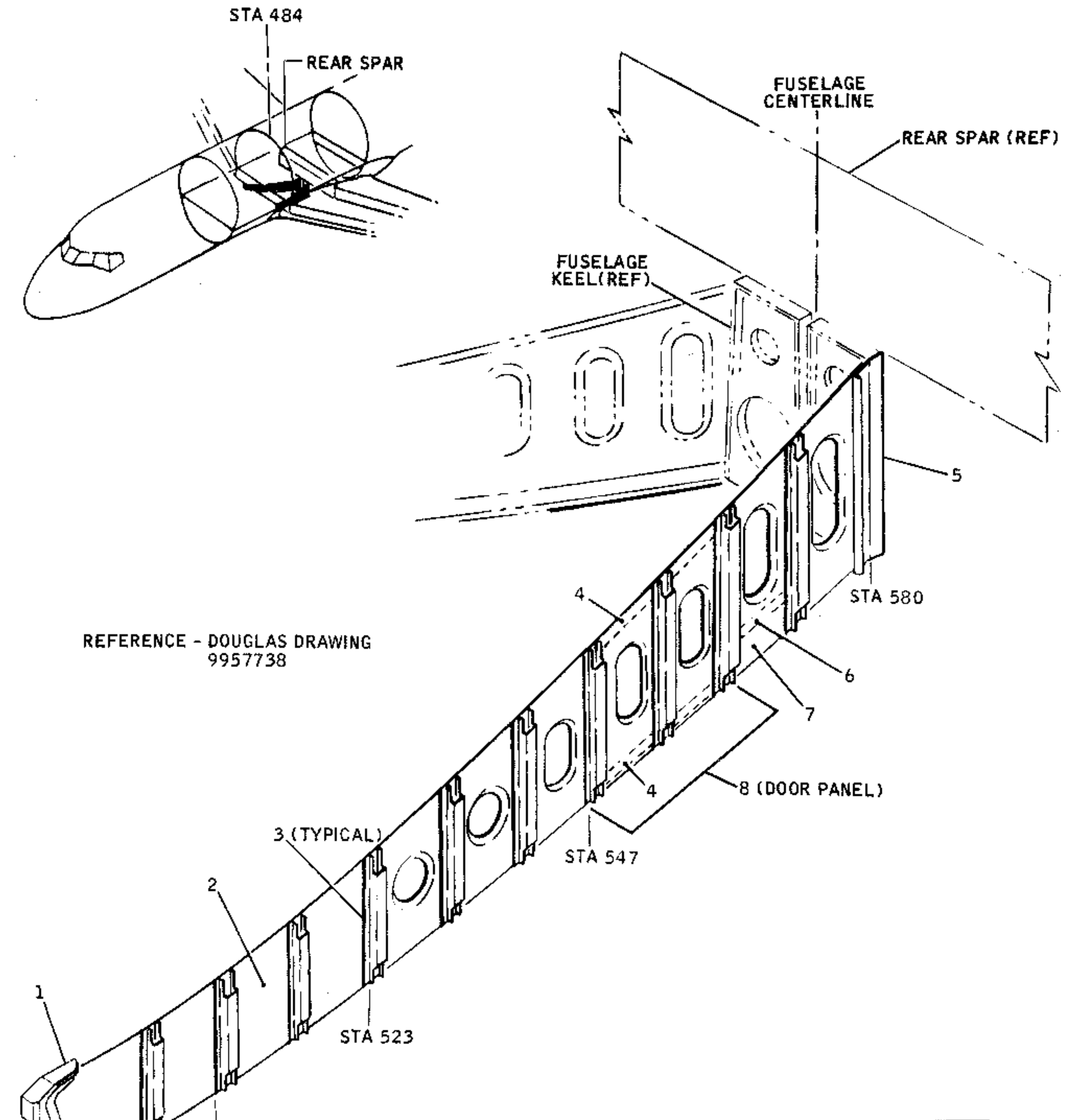
REFERENCE - DOUGLAS DRAWING 9910164

SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE		1419650	17	SUPPORT	.063	CLAD 7075-T6
2	ANGLE		1418516	18	ANGLE	.063	CLAD 7075-T6
3	HAT		2912727	19	FITTING		7075-T651
4	TEE		1249240	20	SUPPORT	.125	CLAD 2024-T3
5	ANGLE		1287425	21	ANGLE		1325738
6	GUSSET	.063	CLAD 7075-T6	22	FITTING		7075-T651
7	ANGLE		1419315	23	DOUBLER	.050	CLAD 7075-T6
8	WEB	.063	CLAD 7075-T6	24	ANGLE		1415595
9	FITTING		7075-T651	25	DOUBLER	.063	CLAD 7075-T6
10	ANGLE	.125	CLAD 7075-T6	26	CLIP		7075-T651
11	DOUBLER	.032	CLAD 7075-T6	27	FITTING		7075-T651
12	WEB	.050	CLAD 7075-T6	28	FITTING		7075-T651
13	HAT		2777922-5	29	FITTING		7075-T651
14	TEE		1325214	30	CLIP		1528377
15	ANGLE		1242937	31	WEB	.071	CLAD 7075-T6
16	FITTING		7075-T651	32	WEB	.040	CLAD 7075-T6

BB3-132A

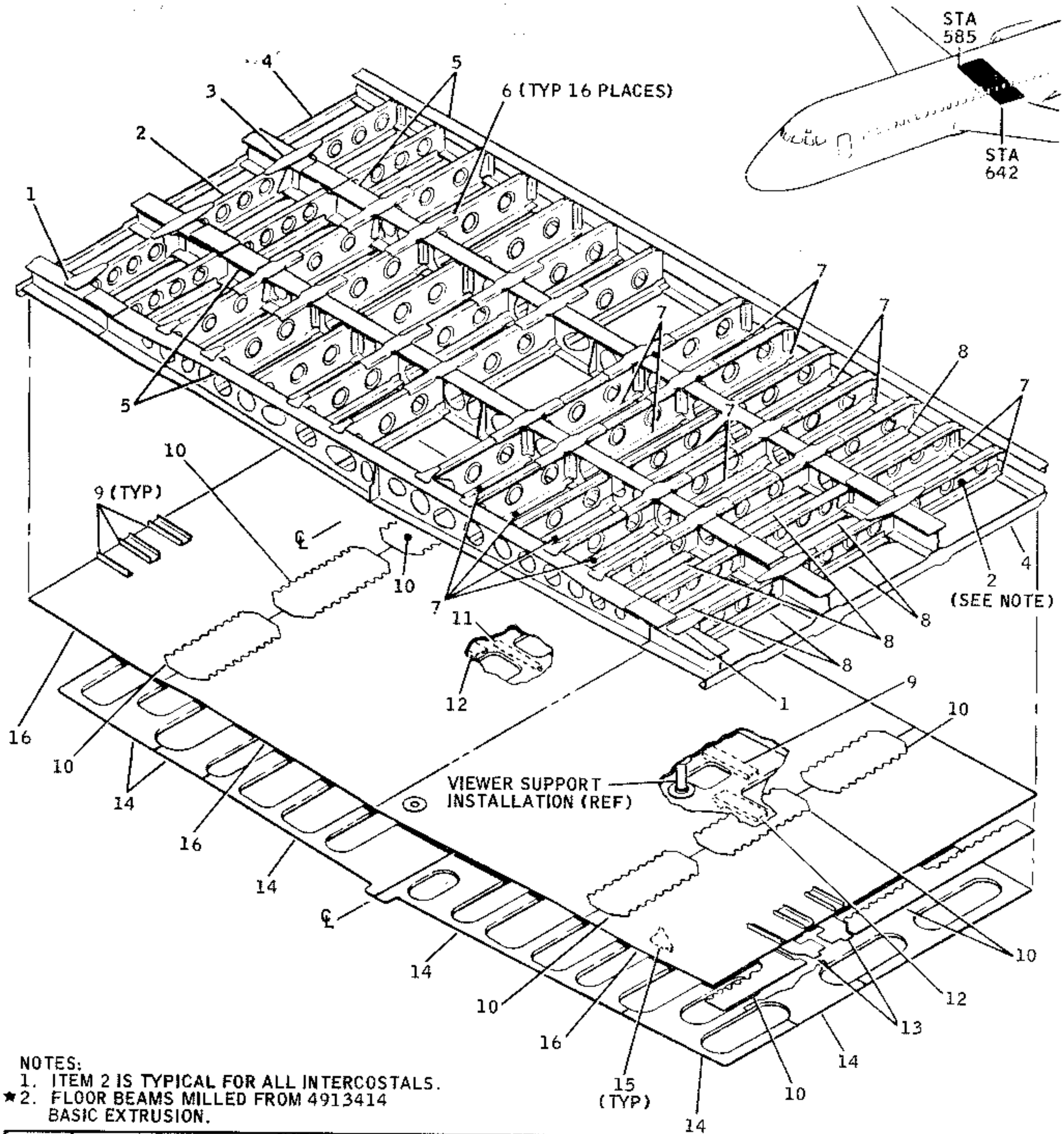
Keel, Station 490 to 642
Figure 7



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		5916175
2	PANEL	.050	CLAD 7075-T6
3	HAT		2777922-5
4	FILLER	.050	CLAD 7075-T6
5	CLIP	.063	CLAD 7075-T6
6	STIFFENER		1332779
7	PANEL	.040	CLAD 7075-T6
8	DOOR PANEL	.040	CLAD 7075-T6

BB3-138A

Canted Keel Panels
Figure 8



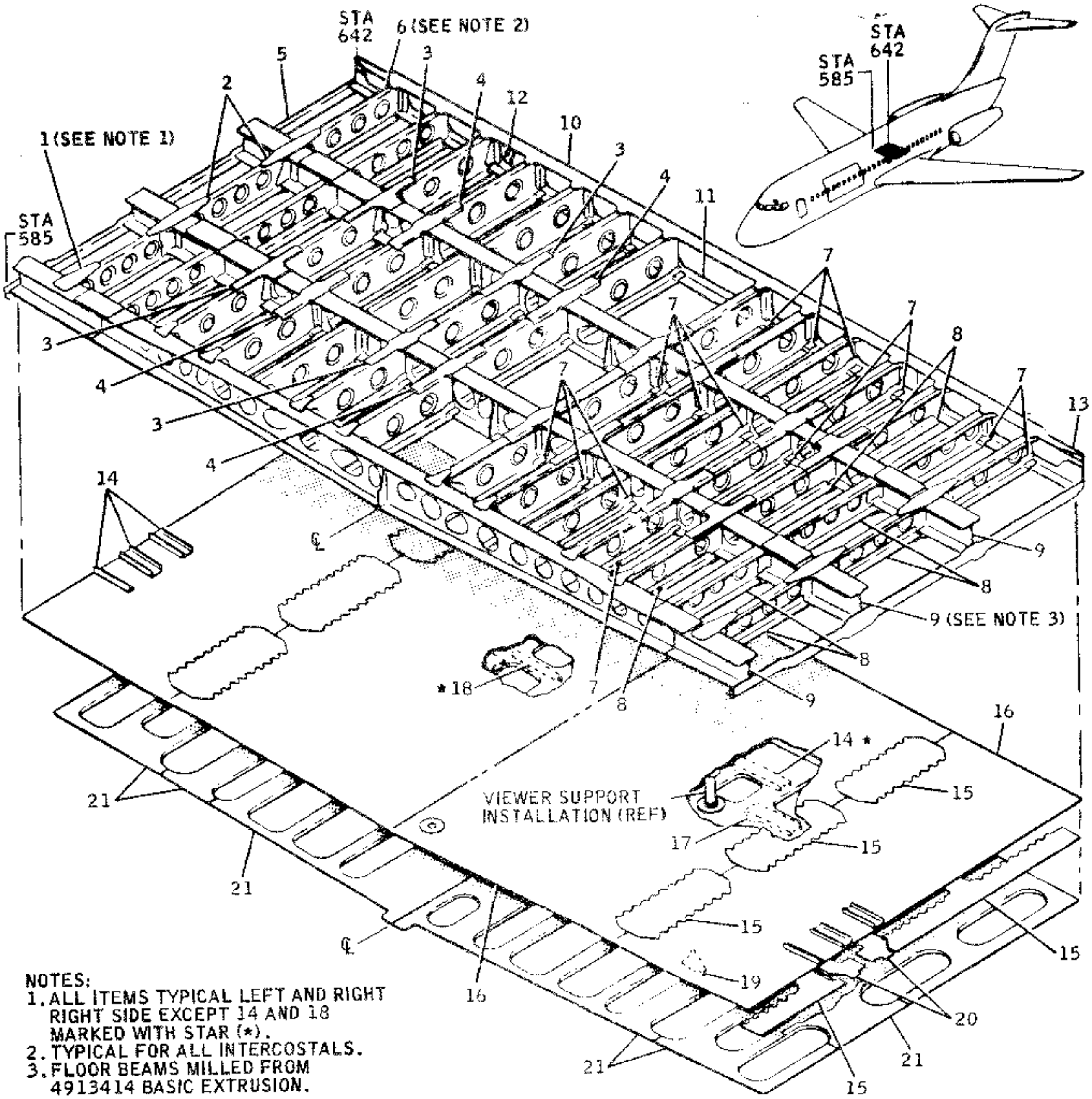
NOTES:
1. ITEM 2 IS TYPICAL FOR ALL INTERCOSTALS.
★2. FLOOR BEAMS MILLED FROM 4913414 BASIC EXTRUSION.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	GUSSET	.032	CLAD 2024-T3	9	CHANNEL	.050	CLAD 2024-T42
2	INTERCOSTAL	.050	CLAD 7075-T6	10	DOUBLER	.040	CLAD 2014-T6
3	SPLICE	.080	CLAD 2024-T3	11	ANGLE	.063	CLAD 2024-T42
4	TEE		4913966	12	CLIP	.063	CLAD 2024-T42
★5	FLOOR BEAM		4913414	13	DOUBLER	.050	CLAD 2024-T3
6	SPLICE	.040	CLAD 7075-T6	14	RETAINER PAN	.040	CLAD 2024-T42
7	TEE CAP		2914912	15	SUPPORT		1249328
8	TEE CAP		2914983	16	PANEL	.050	CLAD 2014-T6

REFERENCE - DOUGLAS DRAWING 9910155

BB3-119

Pressure Panel, Station 585 to 642 -- Type I
Figure 9



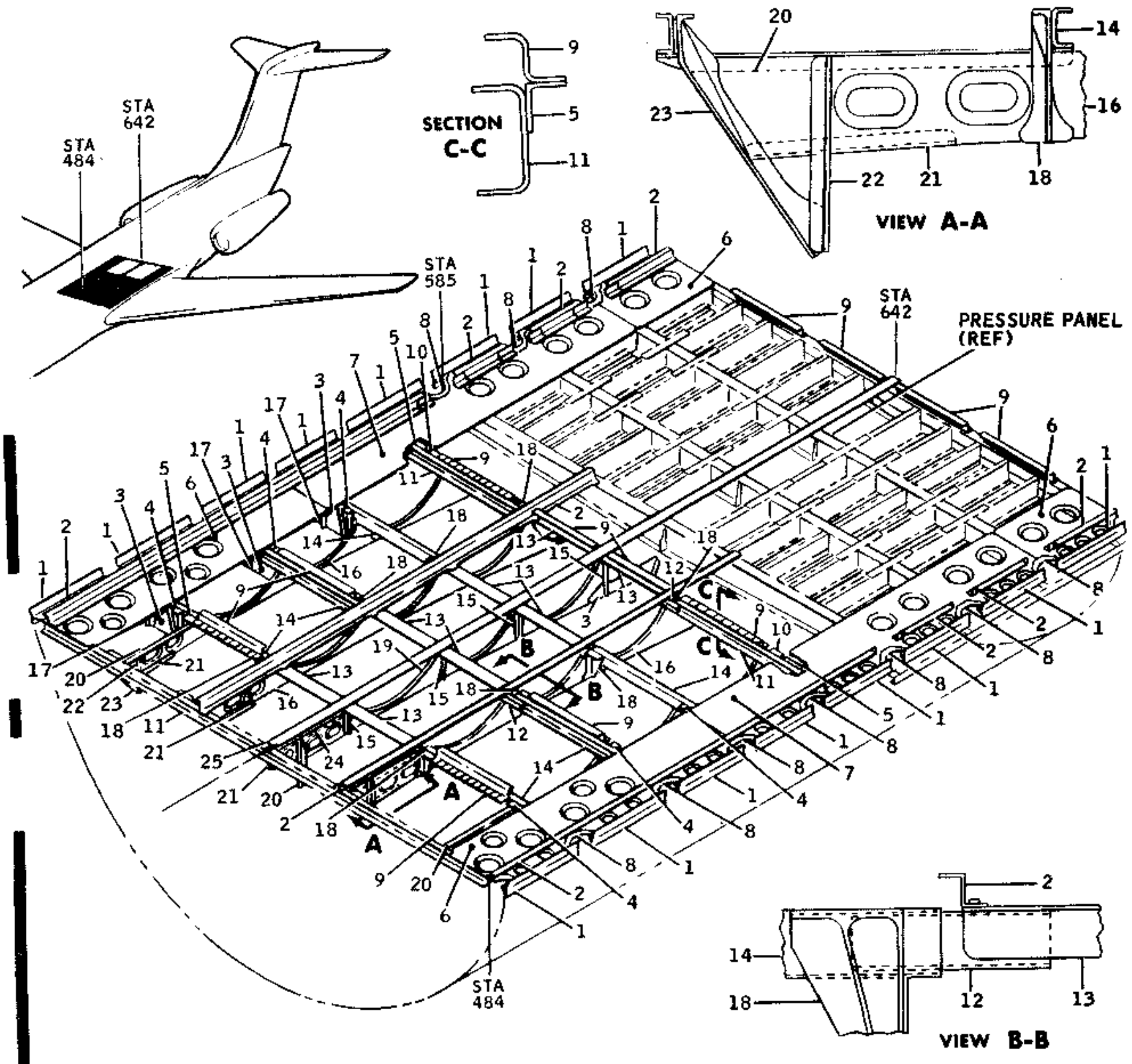
NOTES:
1. ALL ITEMS TYPICAL LEFT AND RIGHT RIGHT SIDE EXCEPT 14 AND 18 MARKED WITH STAR (*).
2. TYPICAL FOR ALL INTERCOSTALS.
3. FLOOR BEAMS MILLED FROM 4913414 BASIC EXTRUSION.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	GUSSET	.032	CLAD 2024-T3	12	WEB	.050	CLAD 2014-T6
2	SPLICE	.080	CLAD 2024-T3	13	DOUBLER	.050	CLAD 2014-T6
3	SPLICE	.080	CLAD 7075-T6	14	CHANNEL	.050	CLAD 2024-T42
4	SPLICE	.040	CLAD 7075-T6	15	DOUBLER	.040	CLAD 2014-T6
5	TEE		4913966	16	PANEL	.050	CLAD 2014-T6
6	INTERCOSTAL	.050	CLAD 7075-T6	17	CLIP	.063	CLAD 2024-T42
7	TEE CAP		2914912	18	ANGLE	.063	CLAD 2024-T42
8	TEE CAP		2914983	19	SUPPORT		1249328
9	FLOOR BEAM		4913414	20	DOUBLER	.050	CLAD 2024-T3
10	TEE		1325214	21	RETAINER PAN	.040	CLAD 2024-T42
11	TEE		1440004				

REFERENCE - DOUGLAS DRAWING 9910155

BB3-872

Pressure Panel, Station 585 to 642 -- Type II
Figure 9A



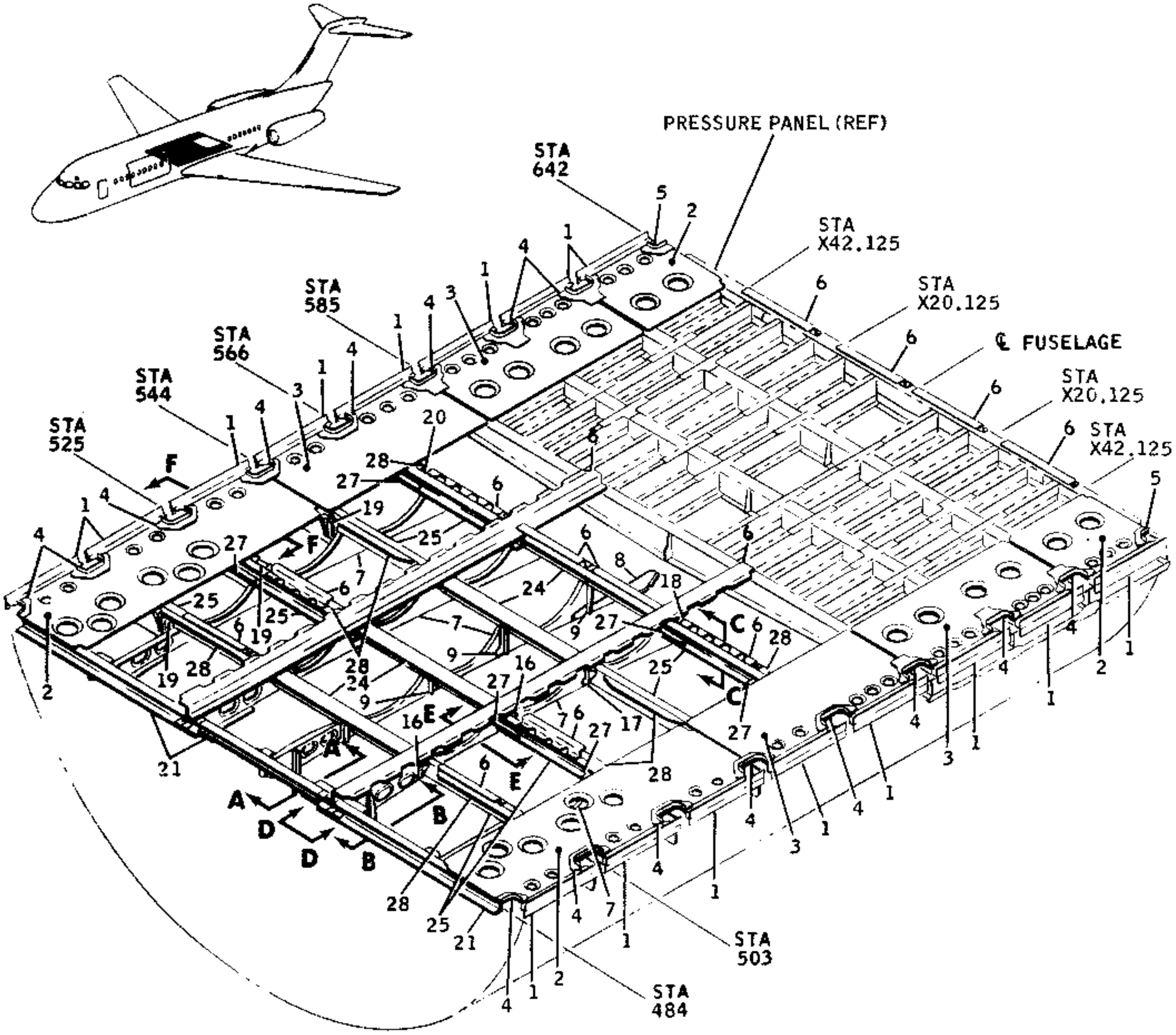
REFERENCE - DOUGLAS DRAWING 5910148

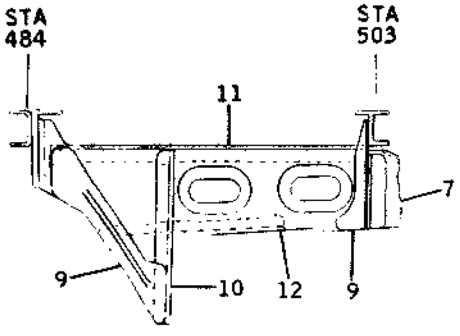
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP		2912047
2	ZEE		4616493
3	WEB	.063	CLAD 7075-T6
4	FITTING	1.000	PLATE 7075-T651
5	ANGLE		1276248
6	MEMBRANE	.020	CLAD 7075-T6
7	MEMBRANE	.040	CLAD 7075-T6
8	DOUBLER	.050	CLAD 2024-T42
9	ZEE	.050	CLAD 2024-T3
10	FITTING	3.000	PLATE 7075-T651
11	CHANNEL	.125	CLAD 7075-T6
12	SPLICE	.080	CLAD 7075-T6
13	BEAM		1419073

ITEM	NOMENCLATURE	GAGE	MATERIAL
14	CHANNEL	.080	CLAD 7075-T6
15	TEE		2912538
16	SUPPORT WEB	.050	CLAD 7075-T6
17	ANGLE		1418516
18	FITTING	3.000	PLATE 7075-T651
19	SUPPORT WEB	.040	CLAD 7075-T6
20	ANGLE		1332779
21	ANGLE		2616608
22	FITTING		1503998
23	FITTING	2.000	BAR 7075-T651
24	ANGLE		1415595
25	CAP		2652479

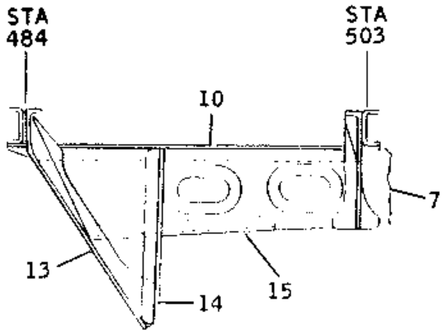
BB3-117A

Floor Support Structure, Station 484 to 642 -- Type I
Figure 10





VIEW **A-A**



VIEW **B-B**

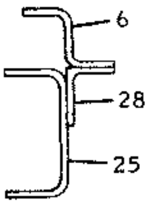
TYPICAL AT STATIONS X20.125
AND X42.125, LEFT AND RIGHT SIDES

NOTE:

FOR ADDITIONAL SECTION VIEWS AND FOR
ITEM LIST OF MATERIALS, SEE SHEET 2.

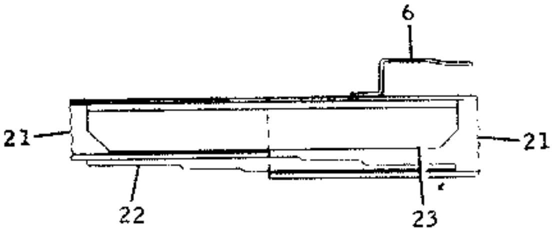
BB3-871

Floor Support Structure, Station 484 to 642 -- Type II
Figure 10A (Sheet 1)



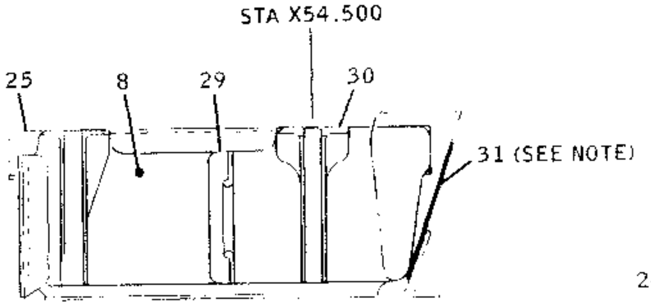
SECTION C-C

TYPICAL AT STATIONS
503, 525 AND 566
(LEFT AND RIGHT SIDES)



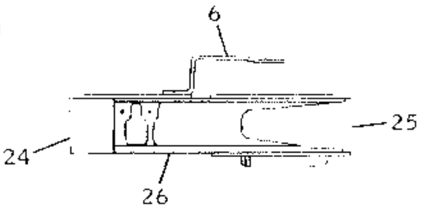
VIEW D-D

TYPICAL LEFT AND RIGHT SIDES



VIEW F-F

TYPICAL AT STATIONS
503, 525 AND 544
(LEFT AND RIGHT SIDES)



VIEW E-E

TYPICAL AT STATIONS 503 THROUGH 566
(LEFT AND RIGHT SIDES)

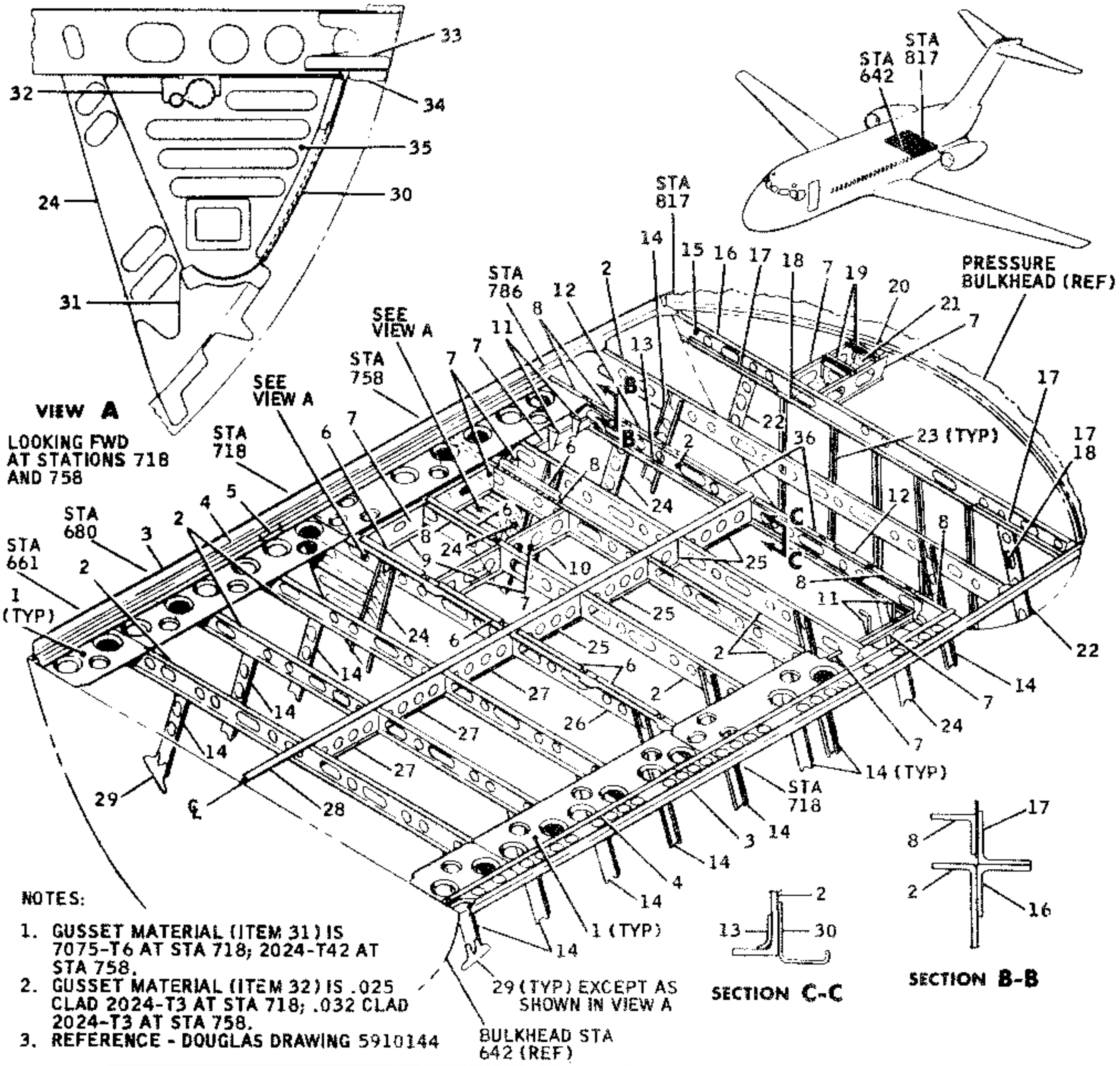
NOTE: SHEET TITANIUM 1592 AT STA 503 ONLY (LEFT AND RIGHT SIDES)

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP		2912047	17	FITTING		3921992
2	MEMBRANE	.020	CLAD 7075-T6	18	FITTING		3921989
3	MEMBRANE	.040	CLAD 7075-T6	19	FITTING		3916216
4	DOUBLER	.050	CLAD 2024-T42	20	FITTING		3921990
5	DOUBLER	.090	CLAD 2024-T42	21	CHANNEL	.125	STEEL SHEET 4130
6	ZEE	.050	CLAD 2024-T3	22	STRAP		4921998
7	SUPPORT WEB	.050	CLAD 7075-T6	23	ANGLE	.160	STEEL SHEET 4130
8	WEB	.063	CLAD 7075-T6	24	BEAM		1285527
9	TEE		1325214	25	CHANNEL	.125	CLAD 7075-T6
10	ANGLE		1332779	26	SPLICE		3921946
11	ANGLE		1418203	27	STRAP	.125	CLAD 7075-T6
12	ANGLE		1415595	28	ANGLE		1419315
13	FITTING		3916210	29	ANGLE		1418516
14	FITTING		3916211	30	FITTING		3921947
15	ANGLE		2616608	31	DOUBLER	.032	SEE NOTE
16	FITTING		3921991				

REFERENCE - DOUGLAS DRAWING 5921897

BB3-949

Floor Support Structure, Station 484 to 612 -- Type II
Figure 10A (Sheet 2)



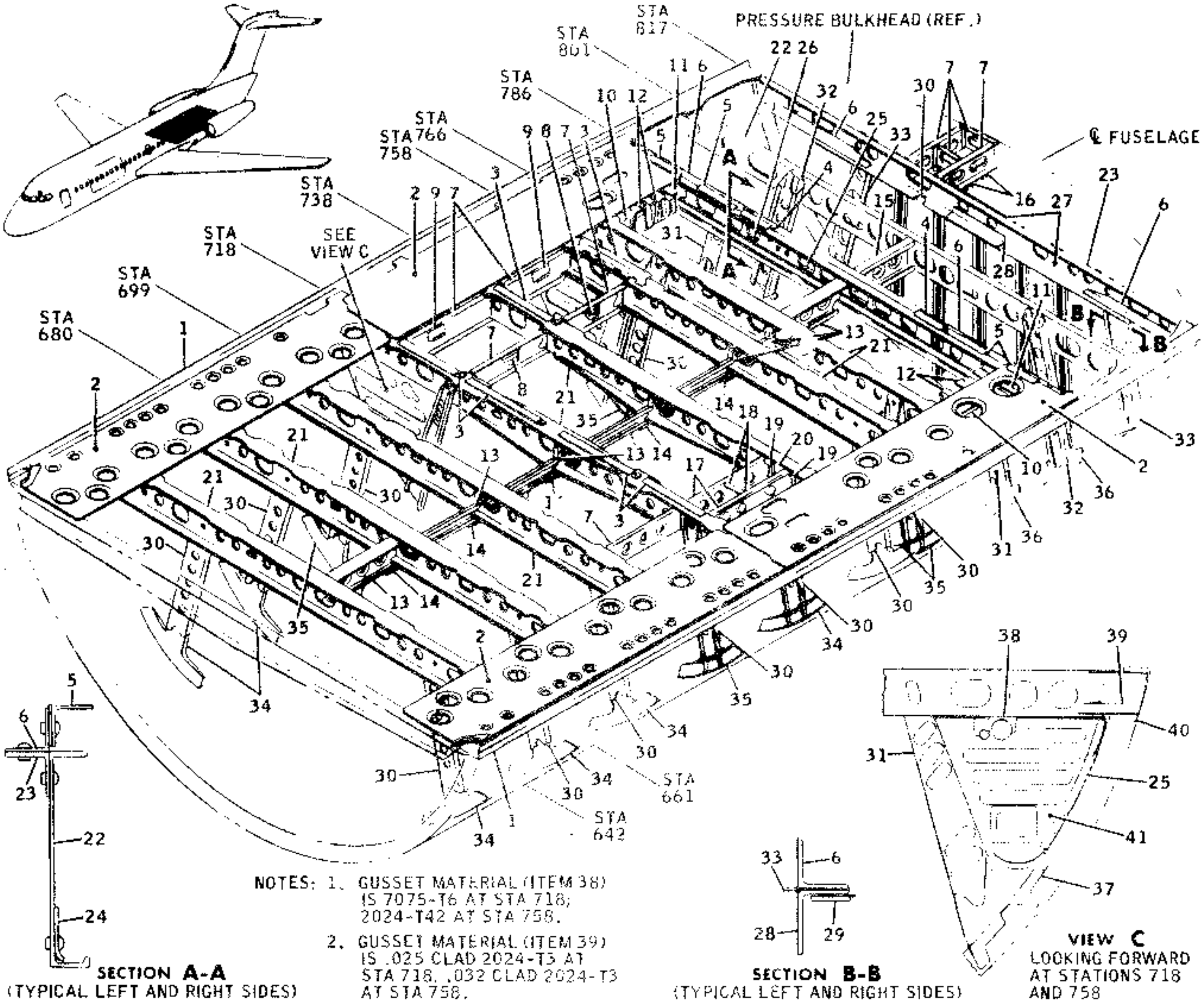
NOTES:

1. GUSSET MATERIAL (ITEM 31) IS 7075-T6 AT STA 718; 2024-T42 AT STA 758.
2. GUSSET MATERIAL (ITEM 32) IS .025 CLAD 2024-T3 AT STA 718; .032 CLAD 2024-T3 AT STA 758.
3. REFERENCE - DOUGLAS DRAWING 5910144

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	MEMBRANE	.020	CLAD 7075-T6	19	CHANNEL	.063	CLAD 2024-T42
2	BEAM		2777896	20	SPACER	.032	CLAD 7075-T6
3	CUSP		2777976	21	SUPPORT	.040	CLAD 2024-T42
4	ZEE		4616493	22	STRUT	.032	CLAD 2024-T42
5	SPLICE		1465089	23	HAT		1244347-3
6	ZEE	.050	CLAD 2024-T3	24	STRUT	.063	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 7075-T6	25	INTERCOSTAL	.032	CLAD 2024-T42
8	ANGLE		1276248	26	BEAM		2777897
9	ANGLE		1242520	27	INTERCOSTAL	.025	CLAD 2024-T6
10	ANGLE		1329780	28	CAP		2652479
11	CLIP	.040	CLAD 7075-T6	29	GUSSET	.050	CLAD 7075-T6
12	ZEE	.050	SHEET 6061-T6	30	ANGLE	.032	CLAD 2024-T3
13	ANGLE	.100	CLAD 7075-T6	31	GUSSET	.080	SEE NOTE 1
14	STRUT	.050	CLAD 7075-T6	32	GUSSET		SEE NOTE 2
15	WEB	.032	CLAD 7075-T6	33	ANGLE SPLICE		1093703
16	ANGLE		2912758	34	DOUBLER	.071	CLAD 2024-T3
17	ANGLE		1414967	35	WEB	.025	CLAD 2024-T42
18	ANGLE		1249243	36	ZEE	.050	CLAD 2024-T42

BB3-118

Floor Support Structure, Station 642 to 817 -- Type I
Figure 11



NOTES:
1. GUSSET MATERIAL (ITEM 38) IS 7075-T6 AT STA 718; 2024-T42 AT STA 758.
2. GUSSET MATERIAL (ITEM 39) IS .025 CLAD 2024-T3 AT STA 718, .032 CLAD 2024-T3 AT STA 758.

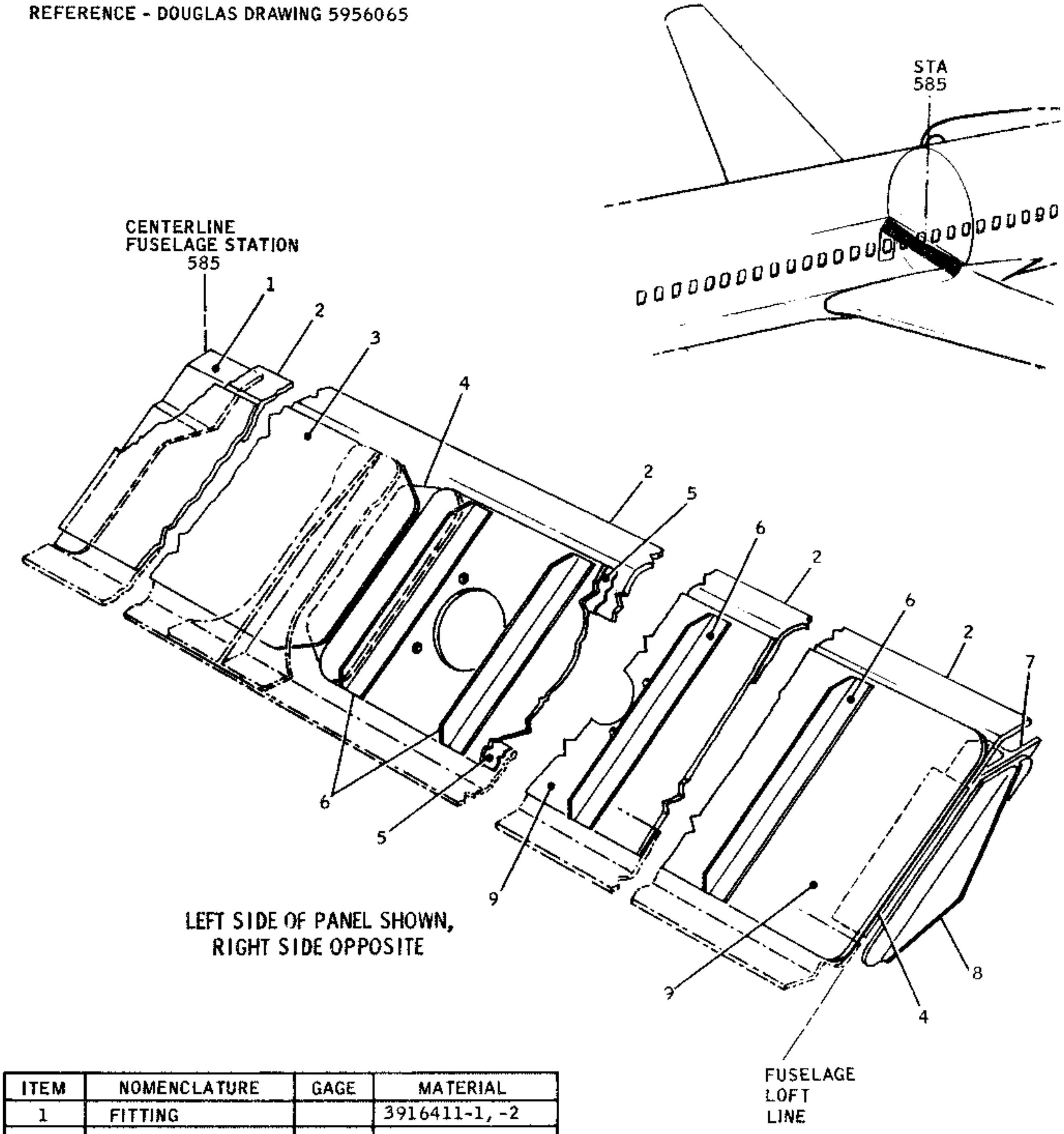
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP		2777976	22	BEAM		2777896
2	MEMBRANE	.020	CLAD 7075-T6	23	ANGLE		2912758
3	ZEE	.050	CLAD 2024-T3	24	ANGLE	.100	CLAD 7075-T6
4	ZEE	.050	AL SHT 6061-T6	25	ANGLE	.032	CLAD 2024-T3
5	ANGLE		1276248	26	ANGLE		1245399
6	ANGLE		1414967	27	WEB	.032	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 7075-T6	28	ANGLE		1249243
8	HAT		1419059	29	DOUBLER	.090	CLAD 2024-T3
9	DOUBLER	.050	CLAD 7075-T6	30	STRUT		2921877
10	INTERCOSTAL	.050	CLAD 7075-T6	31	STRUT	.063	CLAD 7075-T6
11	BEAM		1325214	32	STRUT	.050	CLAD 7075-T6
12	CLIP	.040	CLAD 7075-T6	33	STRUT	.032	CLAD 2024-T42
13	INTERCOSTAL	.032	CLAD 7075-T6	34	SUPPORT, 1.125, AL PLATE 7075-T651		
14	GUSSET	.063	CLAD 7075-T6	35	SUPPORT, 1.000, AL PLATE 7075-T651		
15	INTERCOSTAL	.032	CLAD 2024-T42	36	GUSSET	.050	CLAD 7075-T6
16	CHANNEL	.063	CLAD 2024-T42	37	GUSSET	.080	SEE NOTE 1
17	BEAM	.040	CLAD 7075-T6	38	GUSSET		SEE NOTE 2
18	STRUT		1464709	39	ANGLE SPLICE		1093703
19	TEE		1642726	40	DOUBLER	.071	CLAD 2024-T3
20	WEB	.040	CLAD 7075-T6	41	WEB	.025	CLAD 2024-T42
21	BEAM		2921948				

REFERENCE - DOUGLAS DRAWING 5921895

BB3-874

Floor Support Structure, Station 642 to 817 -- Type II
Figure 11A

REFERENCE - DOUGLAS DRAWING 5956065



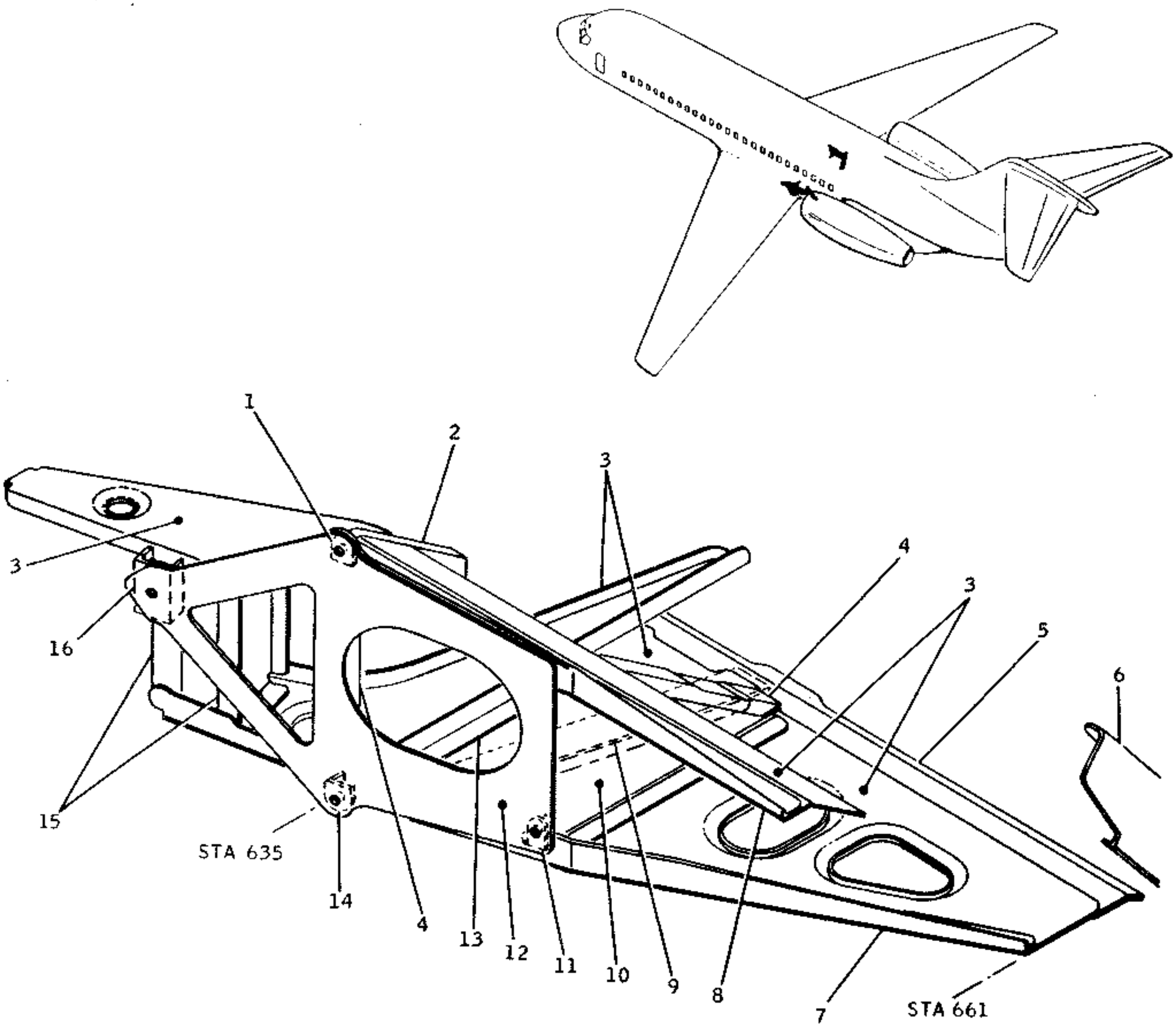
LEFT SIDE OF PANEL SHOWN,
RIGHT SIDE OPPOSITE

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		3916411-1, -2
2	ANGLE	.125	CLAD 2024-T42
3	PANEL	.125	CLAD 2024-T3
4	PLATE	.125	CLAD 2024-T3
5	GASKET ASSEMBLY		★ 3955892 -1, -2
6	STIFFENER		2500429
7	FITTING		1766648
8	FITTING		1430871
9	PANEL	.100	CLAD 2024-T3

★ GASKET ASSEMBLY IS .010 THICKNESS STRIP POLYTETRAFLUOROETHYLENE CEMENTED TO .020 SILICONE RUBBER SHEET.

BB3-152

Fuselage to Wing Slant Pressure Panel
Figure 12



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		4916402-501, 502
2	CHANNEL	.080	CLAD 7075-T6
3	WEB	.063	CLAD 7075-T6
4	ANGLE	.080	CLAD 7075-T6
5	ANGLE	.063	CLAD 7075-T6
6	INTERCOSTAL	.063	CLAD 2024-T42
7	TEE		2914624
8	ANGLE		1298097
9	FITTING		3916413-1, -2
10	WEB	.080	CLAD 7075-T6
11	FITTING		4616403-1, -2
12	PLATE	.160	CLAD 7075-T6
13	ANGLE	.063	CLAD 2024-T42
14	FITTING		4616402-1, -2
15	INTERCOSTAL	.071	CLAD 2024-T42
16	FITTING		4916404-1

REFERENCE - DOUGLAS DRAWING
9915521

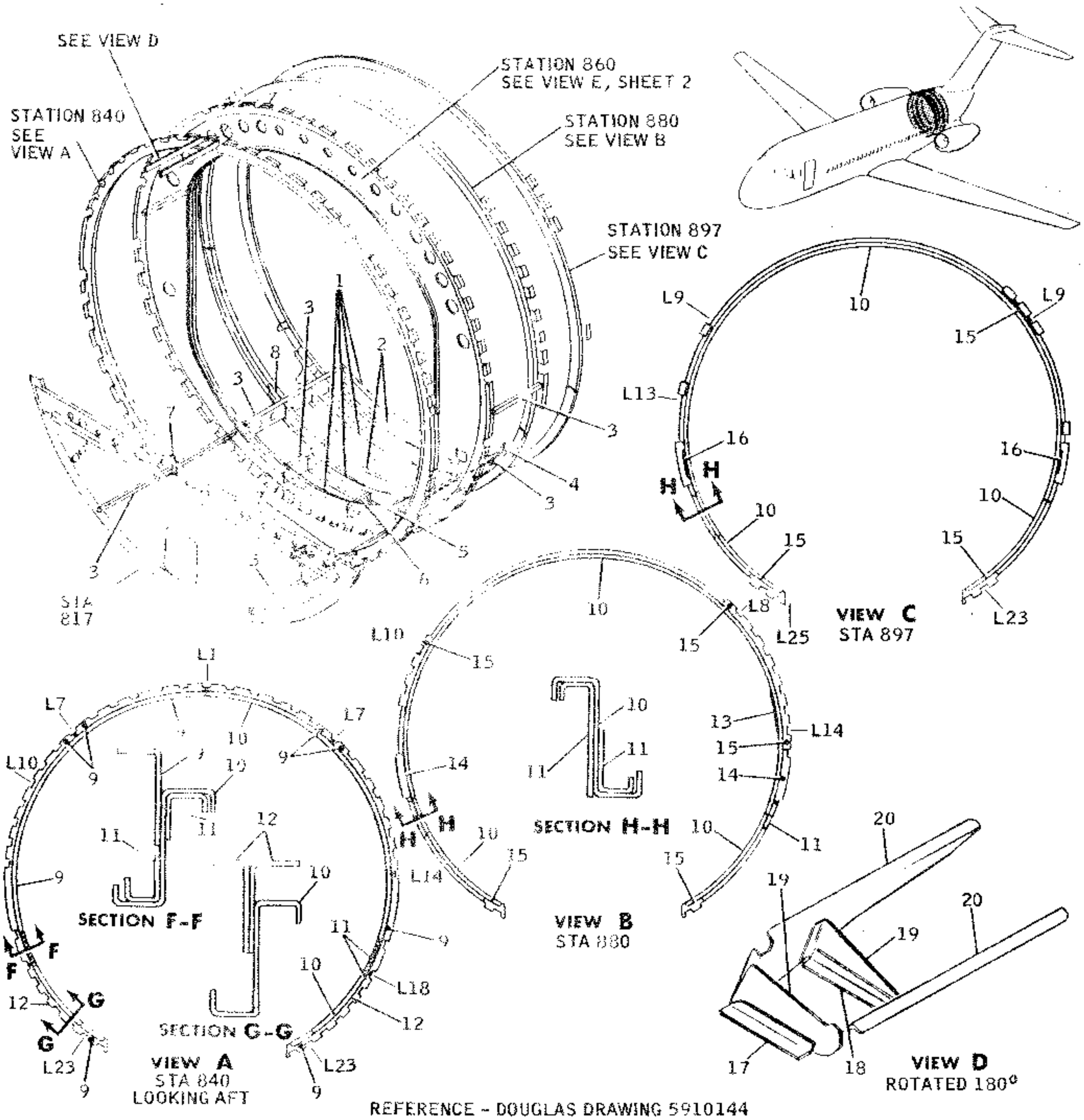
BB3-151

Wing Flap Track Carriage Support Structure
Figure 13

FUSELAGE SECTION, STATION 817 TO CANTED STATION 989 - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures illustrate the structural components of the fuselage section from station 817 to canted station 989. The materials are identified in the material lists by item number callouts

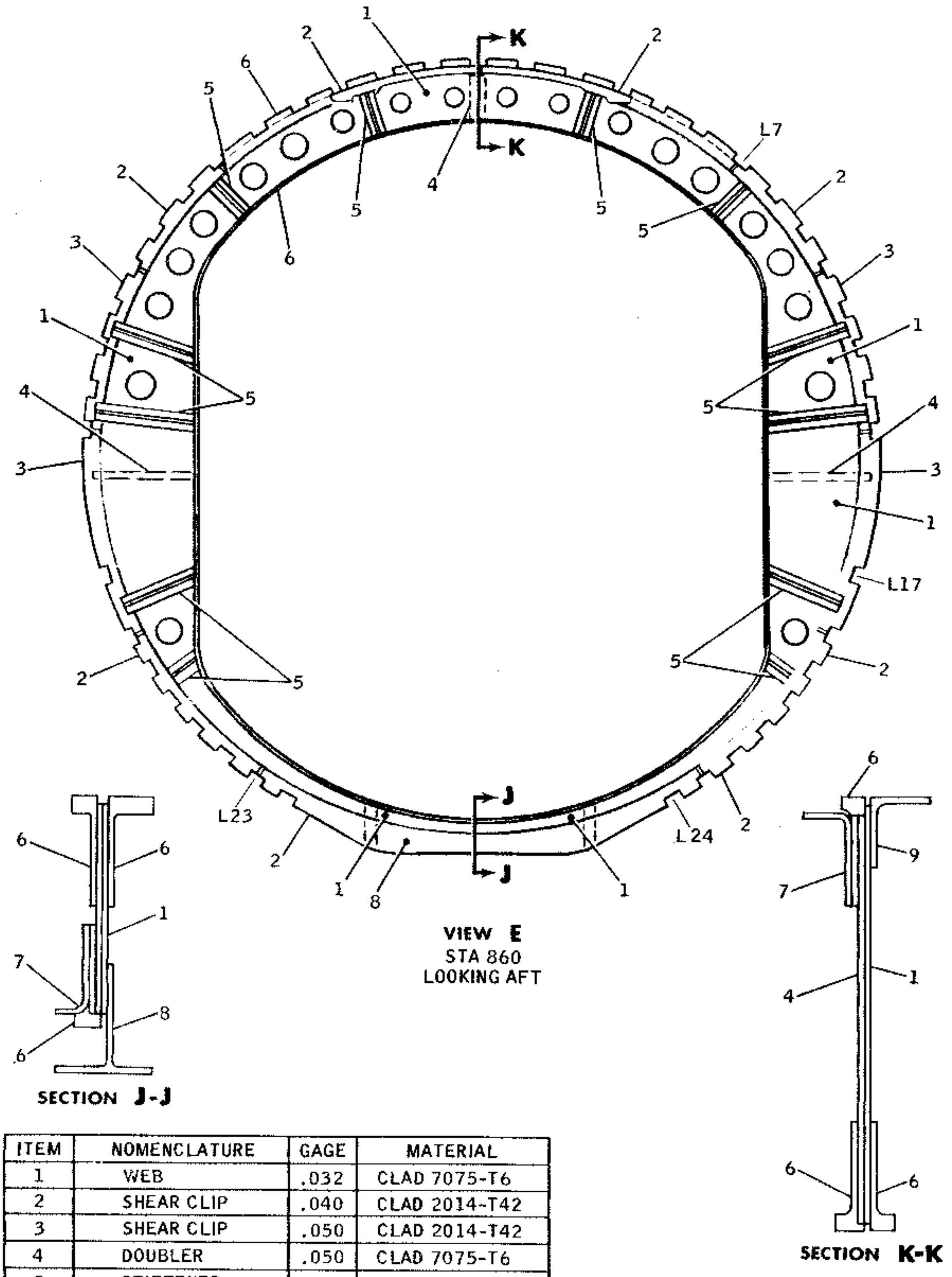


REFERENCE - DOUGLAS DRAWING 5910144

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.040	CLAD 7075-T6	11	SPLICE	.063	CLAD 7075-T6
2	FRAME	.050	CLAD 7075-T6	12	FORMER	.063	CLAD 2014-T6
3	INTERCOSTAL	.040	CLAD 7075-T6	13	TEE		1440048
4	CLIP	.063	CLAD 7075-T6	14	ANGLE	.050	CLAD 2014-T6
5	CLIP		1332779	15	SHEAR CLIP	.050	CLAD 7075-T6
6	INTERCOSTAL	.050	CLAD 7075-T6	16	SHEAR CLIP	.050	CLAD 2014-T6
7	BRACKET	.040	CLAD 7075-T6	17	TEE		1249240
8	SHEAR CLIP	.050	CLAD 7075-T6	18	ANGLE		1418201
9	FORMER	.050	CLAD 2014-T6	19	WEB	.040	CLAD 2024-T42
10	FRAME		2777930-5	20	INTERCOSTAL	.040	CLAD 2024-T42

BB3-112

Frames and Intercostals, Station 817 to 908 -- Type I
Figure 1 (Sheet 1)

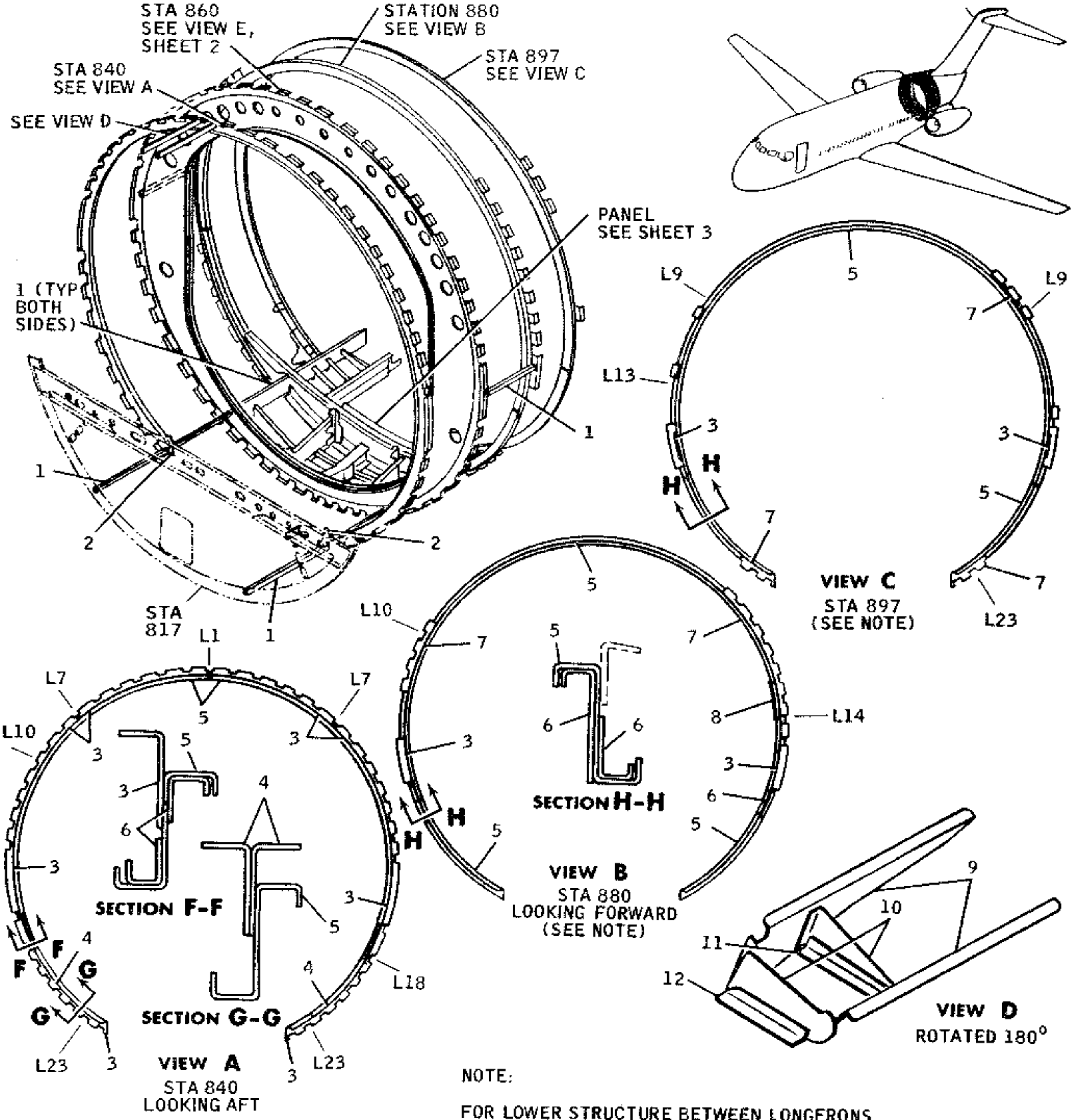


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6
2	SHEAR CLIP	.040	CLAD 2014-T42
3	SHEAR CLIP	.050	CLAD 2014-T42
4	DOUBLER	.050	CLAD 7075-T6
5	STIFFENER		2777922-3
6	CAP - ANGLE		2912813
7	SPLICE		CLAD 7075-T6
8	TEE		2919038*
9	ANGLE	.063	1416036

* 2914191 USED ON AIRPLANES 1 THRU 19

BB3-178

Frames and Intercostals, Station 817 to 908 -- Type I
Figure 1 (Sheet 2)



NOTE:

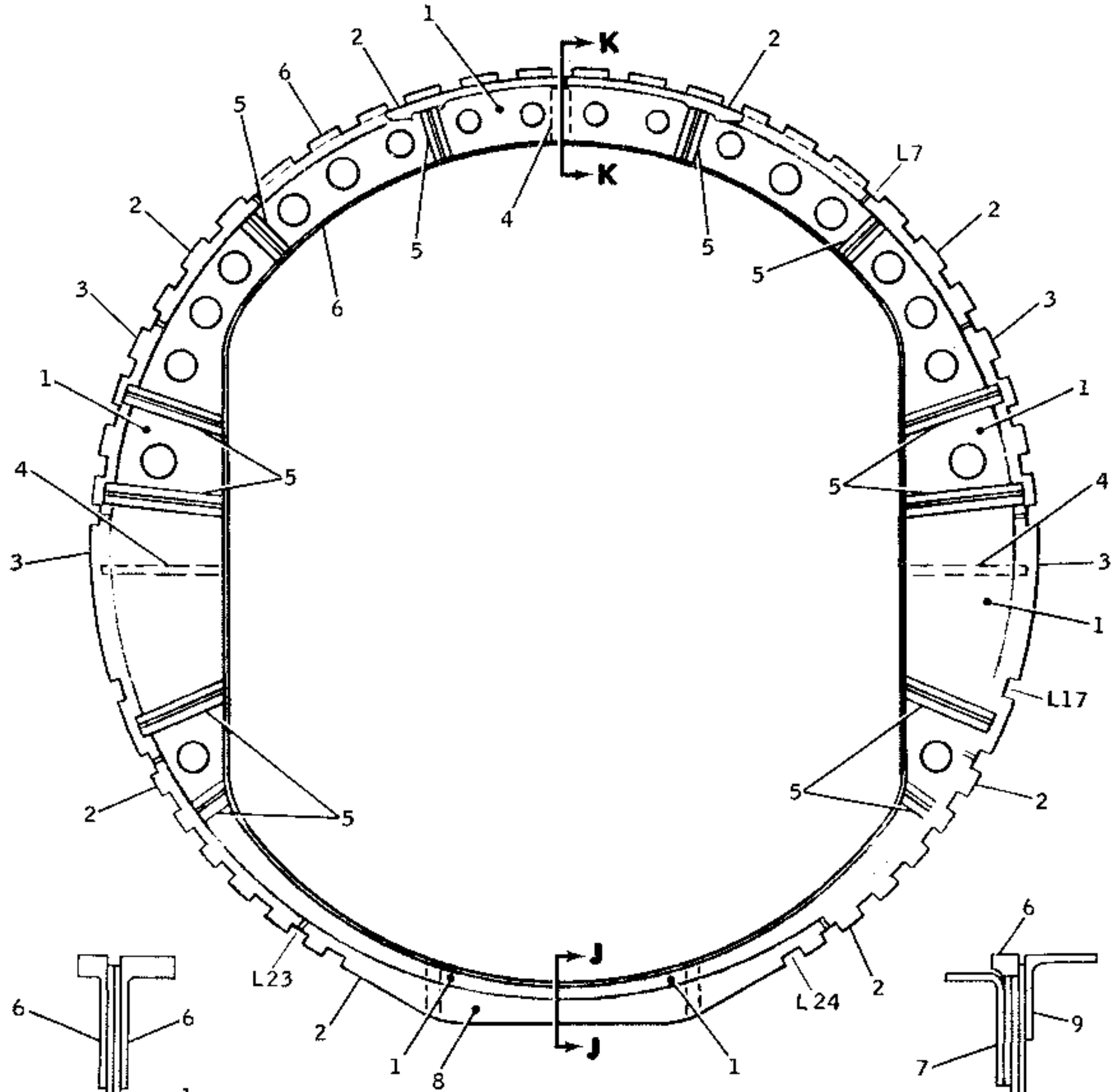
FOR LOWER STRUCTURE BETWEEN LONGERONS 25 (RIGHT AND LEFT SIDES) SEE SHEET 3

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6	7	FORMER	.050	CLAD 7075-T6
2	BRACKET	.040	CLAD 7075-T6	8	TEE		1440048
3	FORMER	.050	CLAD 2014-T6	9	INTERCOSTAL	.040	CLAD 2024-T42
4	FORMER	.063	CLAD 2014-T6	10	WEB	.040	CLAD 2024-T42
5	FRAME		2777930-5	11	ANGLE		1418201
6	SPLICE	.063	CLAD 7075-T6	12	TEE		1249240

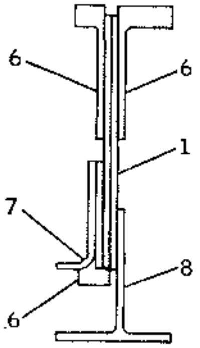
REFERENCE - DOUGLAS DRAWING 5910144

BB3-612

Frames and Intercostals, Station 817 to 908 -- Type II
Figure 2 (Sheet 1)



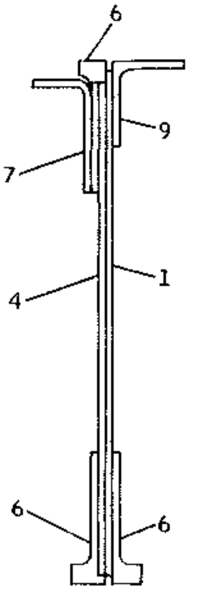
VIEW E
STA 860
LOOKING AFT



SECTION J-J

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6
2	SHEAR CLIP	.040	CLAD 2014-T42
3	SHEAR CLIP	.050	CLAD 2014-T42
4	DOUBLER	.050	CLAD 7075-T6
5	STIFFENER		2777922-3
6	CAP - ANGLE		2912813
7	SPLICE		CLAD 7075-T6
8	TEE		2919038 *
9	ANGLE	.063	1416036

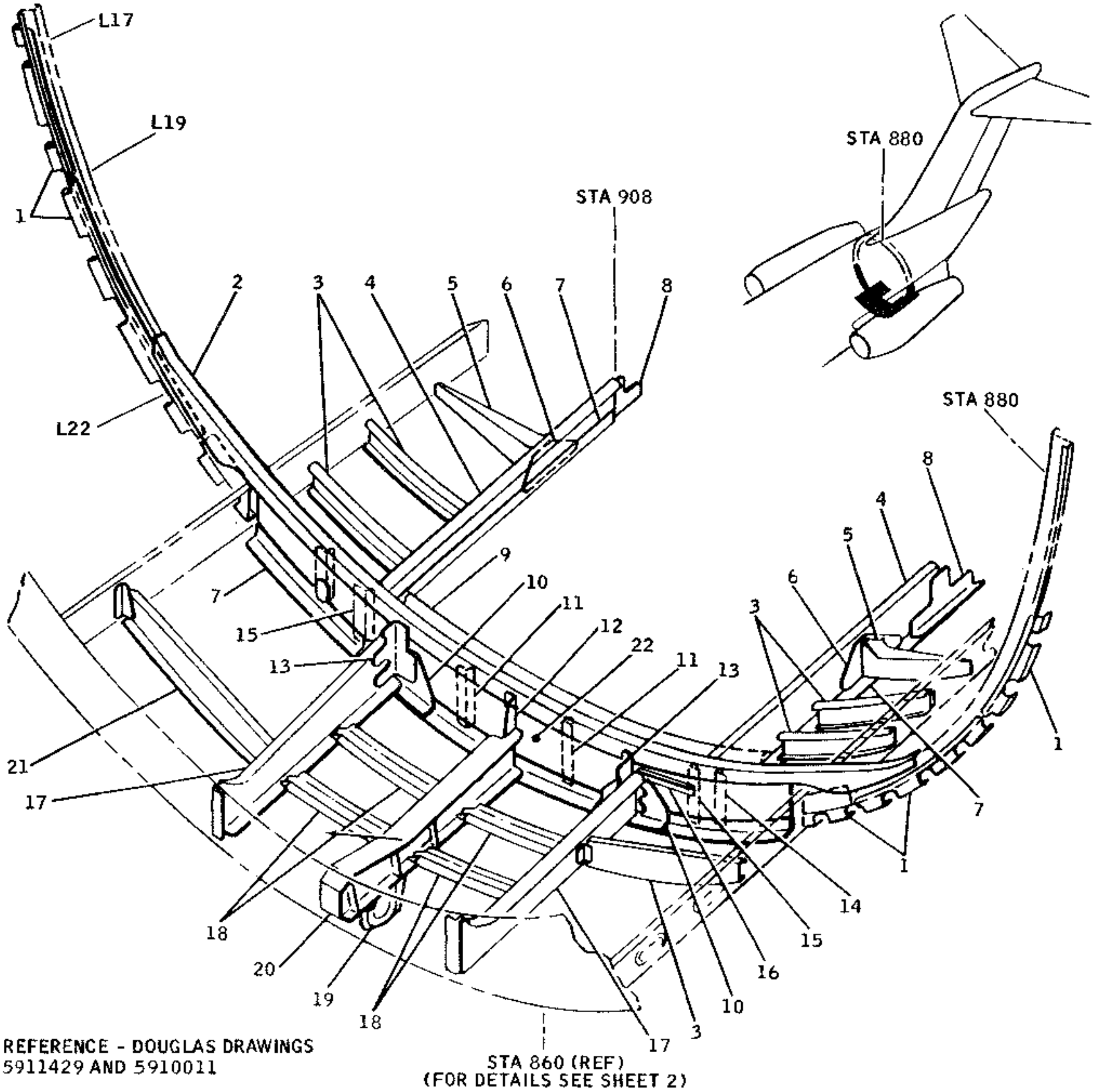
* 2914191 USED ON AIRPLANES 1 THRU 19



SECTION K-K

BB3-178

Frames and Intercostals, Station 817 to 908 -- Type II
Figure 2 (Sheet 2)

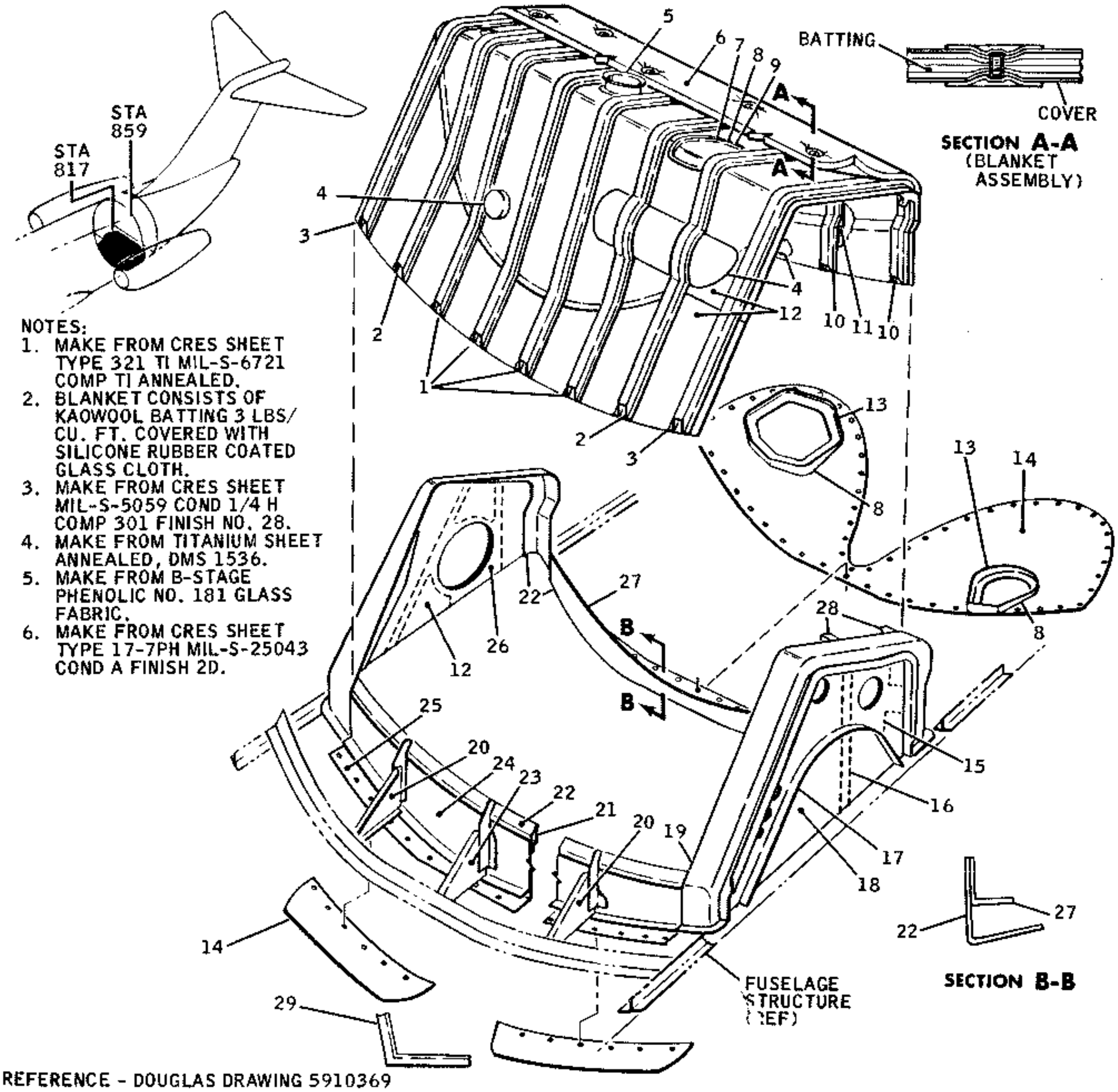


REFERENCE - DOUGLAS DRAWINGS
5911429 AND 5910011

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.050	CLAD 7075-T6
2	CAP ANGLE	.063	CLAD 7075-T6
3	FRAME	.040	CLAD 7075-T6
4	JAMB	.040	CLAD 7075-T6
5	FITTING,3957174-1,-2	2.250	PLATE 7075-T651
6	DOUBLER	.040	CLAD 7075-T6
7	CAP ANGLE	.050	CLAD 7075-T6
8	ANGLE	.071	CLAD 7075-T6
9	RETAINER	.050	CLAD 2024-T42
10	BRACKET	.100	CLAD 7075-T6
11	ANGLE		1244084
12	ANGLE		1416036
13	FITTING		2640547
14	ANGLE		1415595
15	CLIP		1419056
16	ANGLE	.063	CLAD 2024-T42
17	INTERCOSTAL	.050	CLAD 7075-T6
18	STIFFENER		2777922-3
19	FITTING,5912594-501		CRES 17-4PH
20	INTERCOSTAL 9915583-3	3.00	PLATE 7075-T651
21	FORMER	.040	CLAD 7075-T6
22	WEB	.032	CLAD 7075-T6

BB3-666

Frames and Intercostals, Station 817 to 908 -- Type II
Figure 2 (Sheet 3)



NOTES:
1. MAKE FROM CRES SHEET TYPE 321 TI MIL-S-6721 COMP TI ANNEALED.
2. BLANKET CONSISTS OF KAOWOOL BATTING 3 LBS/CU. FT. COVERED WITH SILICONE RUBBER COATED GLASS CLOTH.
3. MAKE FROM CRES SHEET MIL-S-5059 COND 1/4 H COMP 301 FINISH NO. 28.
4. MAKE FROM TITANIUM SHEET ANNEALED, DMS 1536.
5. MAKE FROM B-STAGE PHENOLIC NO. 181 GLASS FABRIC.
6. MAKE FROM CRES SHEET TYPE 17-7PH MIL-S-25043 COND A FINISH 2D.

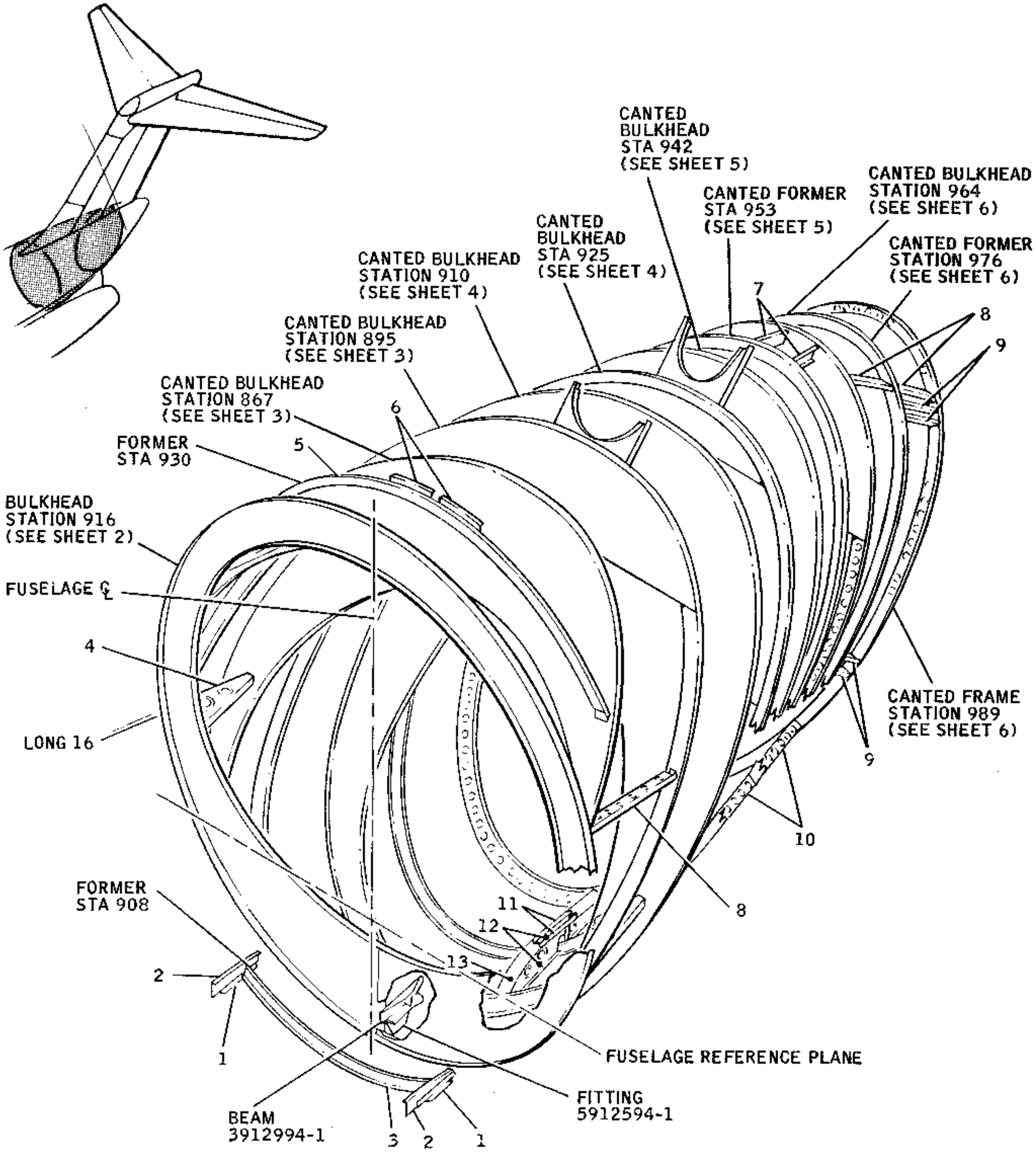
REFERENCE - DOUGLAS DRAWING 5910369

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		2777922-1
2	STIFFENER		2777922-3
3	STIFFENER	.040	CLAD 7075-T6
4	PAN	.025	SEE NOTE 1
5	FLANGE	.050	SEE NOTE 1
6	BLANKET		SEE NOTE 2
7	COVER	.025	SEE NOTE 3
8	SEAL	.125	SILICONE RUBBER
9	DOUBLER	.025	SEE NOTE 3
10	STIFFENER	.032	SEE NOTE 1
11	BEAM	.040	CLAD 7075-T6
12	SKIN	.020	SEE NOTE 4
13	PAN		SEE NOTE 5
14	FAIRING		SEE NOTE 5
15	BRACKET	.040	SEE NOTE 4

ITEM	NOMENCLATURE	GAGE	MATERIAL
16	STIFFENER	.032	SEE NOTE 4
17	DOUBLER	.020	SEE NOTE 6
18	PLATE	.020	SEE NOTE 4
19	ANGLE	.025	SEE NOTE 1
20	INTERCOSTAL	.063	CLAD 7075-T6
21	BEAM	.032	SEE NOTE 1
22	ANGLE	.032	SEE NOTE 1
23	INTERCOSTAL	.040	CLAD 7075-T6
24	FRAME	.025	SEE NOTE 4
25	ANGLE	.032	SEE NOTE 4
26	DOUBLER	.040	SEE NOTE 4
27	ANGLE	.032	CLAD 7075-T6
28	INTERCOSTAL	.032	SEE NOTE 1
29	FLUID DIVERTER	.063	CLAD 2024-T42

BB3-165

Auxiliary Power Unit Enclosure
Figure 3

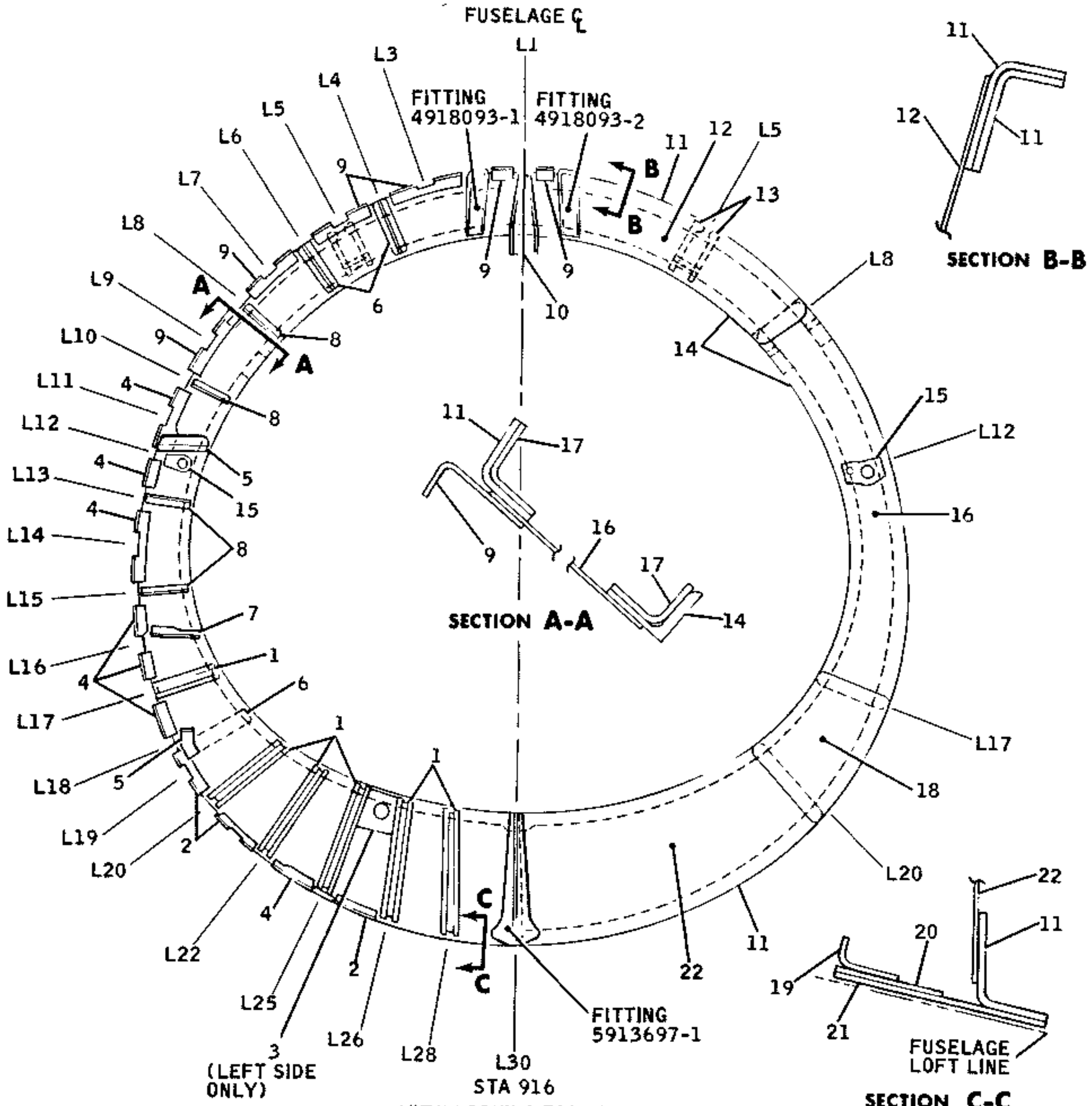


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE		2914057	8	INTERCOSTAL	.050	CLAD 7075-T6
2	INTERCOSTAL	.040	CLAD 7075-T6	9	INTERCOSTAL	.050	CLAD 2024-T42
3	FORMER	.040	CLAD 7075-T6	10	CHANNEL	.025	CLAD 2024-T3
4	INTERCOSTAL	.063	CLAD 7075-T6	11	ANGLE		1242526
5	FORMER		2912412-5	12	WEB	.032	CLAD 7075-T6
6	ANGLE	.050	CLAD 2024-T42	13	WEB	.020	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 2024-T42				

REFERENCE DOUGLAS DRAWING 5910227 AND 9911893

BB3-113

Frames and Intercostals, Station 908 to Canted Station 989 -- Type I
Figure 4 (Sheet 1)



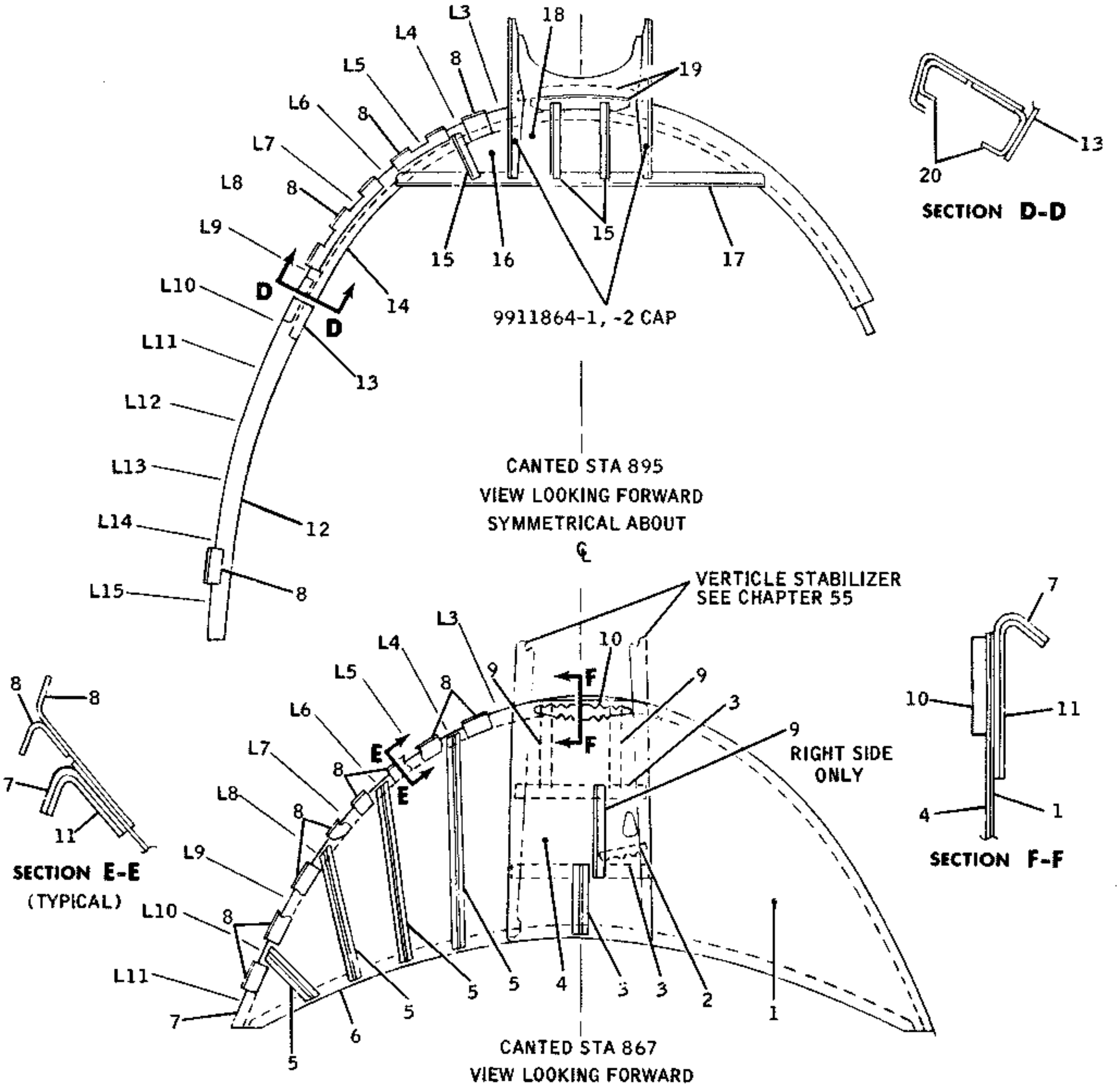
VIEW LOOKING FORWARD
SYMMETRICAL ABOUT ℄ EXCEPT AS NOTED

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		2777922-5	12	WEB	.080	CLAD 7075-T6
2	FORMER	.050	CLAD 7075-T6	13	BRACKET	.040	CLAD 2024-T42
3	DOUBLER	.063	CLAD 7075-T6	14	CAP		1419366
4	FORMER	.063	CLAD 7075-T6	15	DOUBLER	.040	CLAD 7075-T6
5	CLIP	.160	CLAD 7075-T6	16	WEB	.032	CLAD 7075-T6
6	STIFFENER		1414813	17	SPLICE	.125	CLAD 7075-T6
7	STIFFENER		1325737	18	WEB	.040	CLAD 7075-T6
8	STIFFENER		1415595	19	ANGLE	.090	CLAD 7075-T6
9	FORMER	.071	CLAD 7075-T6	20	DOUBLER	.071	CLAD 7075-T6
10	CHANNEL	.063	CLAD 7075-T6	21	DOUBLER	.080	CLAD 7075-T6
11	CAP ANGLE	.125	CLAD 7075-T6	22	WEB	.050	CLAD 7075-T6

REFERENCE-DOUGLAS DRAWING 9911840

BB3-364

Frames and Intercostals, Station 908 to Canted Station 989 -- Type I
Figure 4 (Sheet 2)



CANTED STA 895
VIEW LOOKING FORWARD
SYMMETRICAL ABOUT ℄

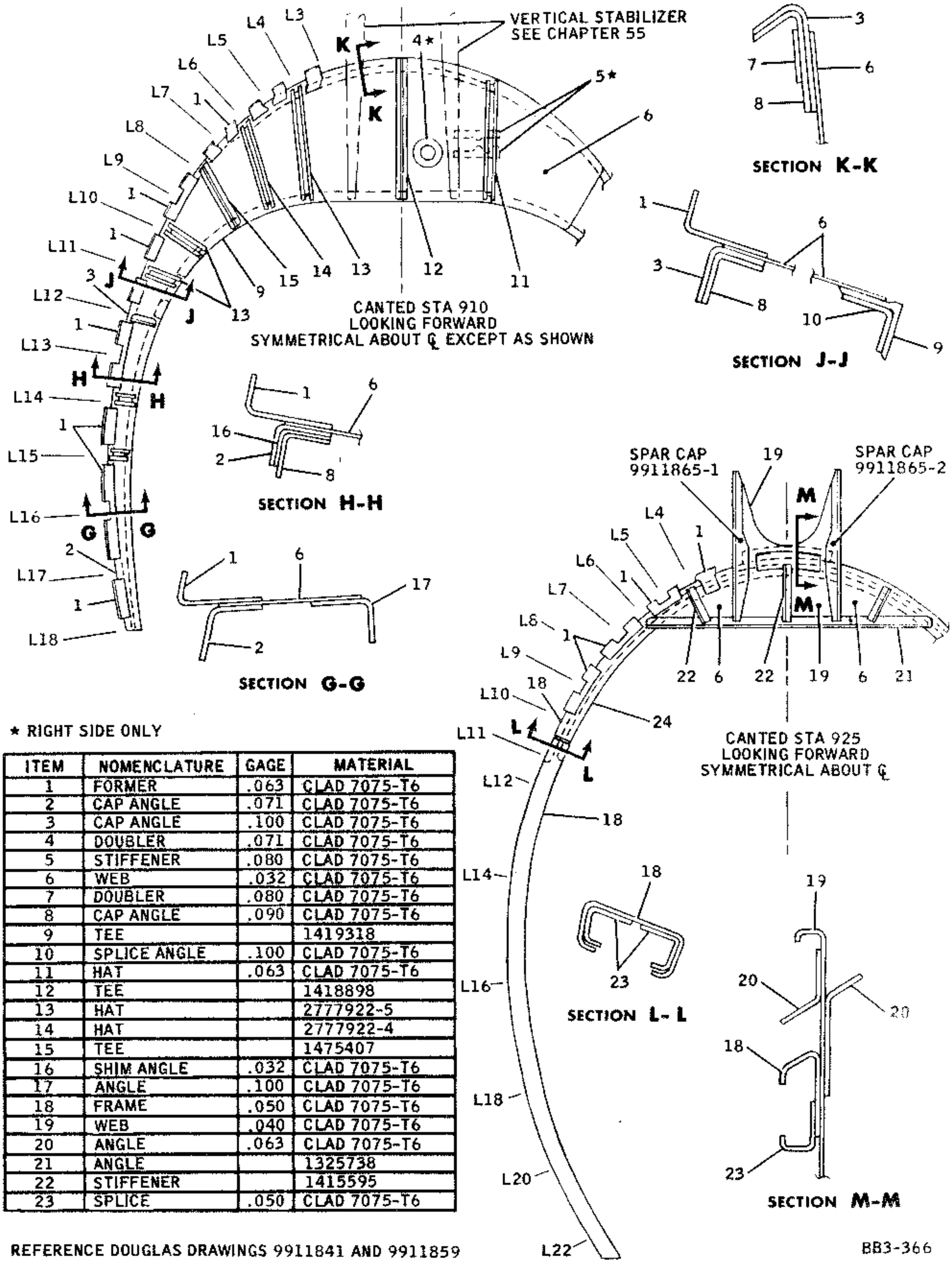
CANTED STA 867
VIEW LOOKING FORWARD
SYMMETRICAL ABOUT ℄ EXCEPT AS SHOWN

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.050	CLAD 7075-T6	11	CAP	.071	7075-T6
2	BRACKET	.125	6061-T6	12	FRAME		2777930
3	STIFFENER		1417984	13	SPLICE	.050	CLAD 7075-T6
4	DOUBLER	.040	CLAD 7075-T6	14	FRAME	.050	CLAD 7075-T6
5	STIFFENER		1332780	15	STIFFENER		1415595
6	CAP		2913786	16	WEB	.032	CLAD 7075-T6
7	CAP	.100	CLAD 7075-T6	17	ANGLE		1325738
8	FORMER	.063	CLAD 7075-T6	18	WEB	.040	CLAD 7075-T6
9	STIFFENER		1418201	19	ATTACH CLIP	.063	CLAD 7075-T6
10	FILLER	.250	7075-T651	20	CHANNEL	.050	CLAD 7075-T6

REFERENCE-DOUGLAS DRAWINGS 9911858 AND 9911838

BB3-365

Frames and Intercostals, Station 908 to Canted Station 989 -- Type I
Figure 4 (Sheet 3)

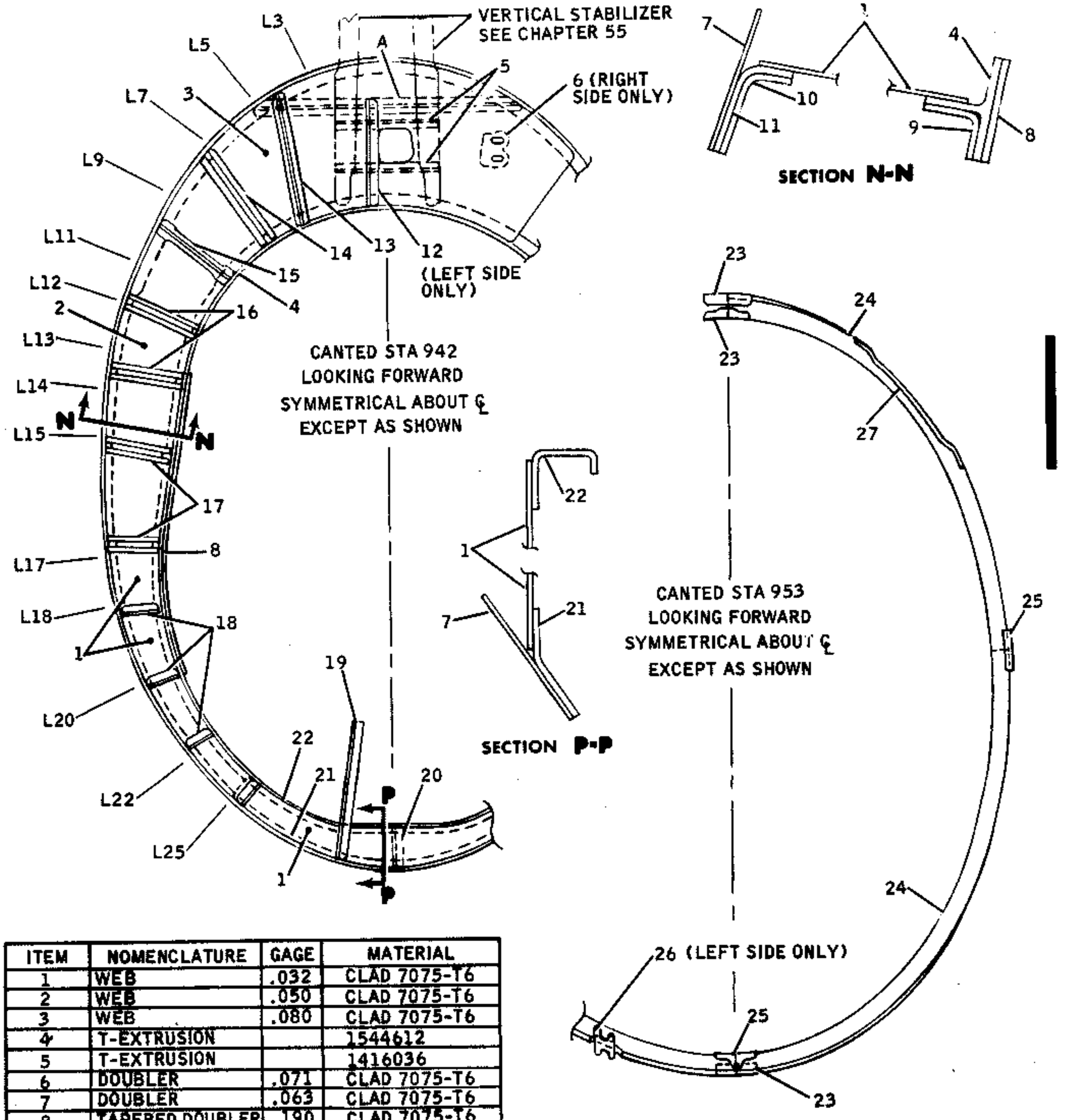


* RIGHT SIDE ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 7075-T6
2	CAP ANGLE	.071	CLAD 7075-T6
3	CAP ANGLE	.100	CLAD 7075-T6
4	DOUBLER	.071	CLAD 7075-T6
5	STIFFENER	.080	CLAD 7075-T6
6	WEB	.032	CLAD 7075-T6
7	DOUBLER	.080	CLAD 7075-T6
8	CAP ANGLE	.090	CLAD 7075-T6
9	TEE		1419318
10	SPLICE ANGLE	.100	CLAD 7075-T6
11	HAT	.063	CLAD 7075-T6
12	TEE		1418898
13	HAT		2777922-5
14	HAT		2777922-4
15	TEE		1475407
16	SHIM ANGLE	.032	CLAD 7075-T6
17	ANGLE	.100	CLAD 7075-T6
18	FRAME	.050	CLAD 7075-T6
19	WEB	.040	CLAD 7075-T6
20	ANGLE	.063	CLAD 7075-T6
21	ANGLE		1325738
22	STIFFENER		1415595
23	SPLICE	.050	CLAD 7075-T6

REFERENCE DOUGLAS DRAWINGS 9911841 AND 9911859

Frames and Intercostals, Station 908 to Canted Station 989 -- Type 1
Figure 4 (Sheet 4)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6
2	WEB	.050	CLAD 7075-T6
3	WEB	.080	CLAD 7075-T6
4	T-EXTRUSION		1544612
5	T-EXTRUSION		1416036
6	DOUBLER	.071	CLAD 7075-T6
7	DOUBLER	.063	CLAD 7075-T6
8	TAPERED DOUBLER	.190	CLAD 7075-T6
9	SPLICE	.090	CLAD 7075-T6
10	DOUBLER	.125	CLAD 7075-T6
11	CAP	.125	CLAD 7075-T6
12	STIFFENER		1415741
13	STIFFENER		1641009
14	STIFFENER	.100	CLAD 7075-T6
15	STIFFENER		1475407
16	STIFFENER		2777922-5
17	STIFFENER		2777922-4
18	STIFFENER		1242526

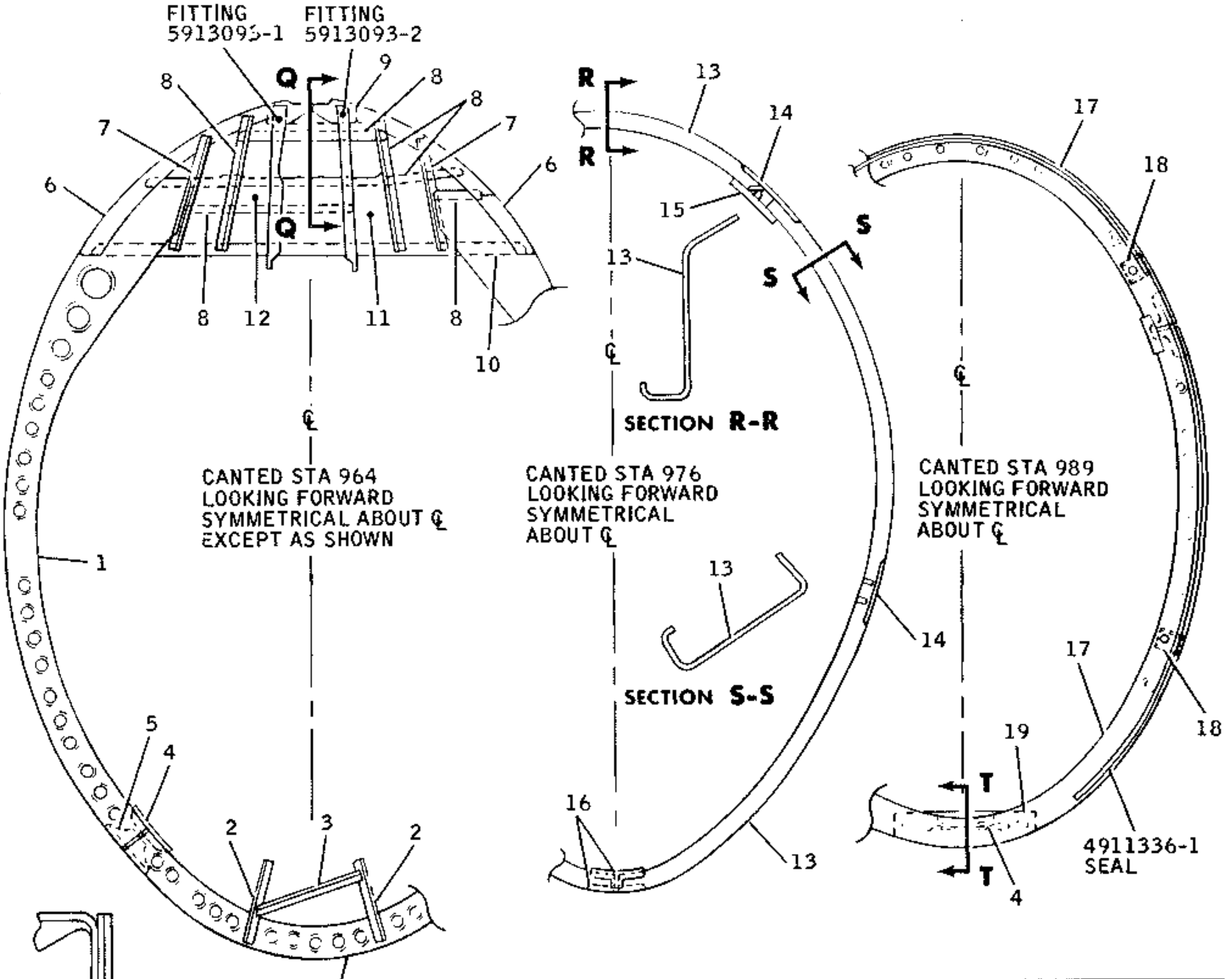
ITEM	NOMENCLATURE	GAGE	MATERIAL
19	ANGLE		1199981
20	FITTING		1416793
21	CAP	.071	CLAD 7075-T6
22	CAP	.090	CLAD 7075-T6
23	ANGLE	.040	CLAD 7075-T6
24	FRAME	.040	CLAD 7075-T6
25	ANGLE	.050	CLAD 7075-T6
26	DOUBLER	.040	CLAD 2014-T6
27	ANGLE	.063	CLAD 7075-T6

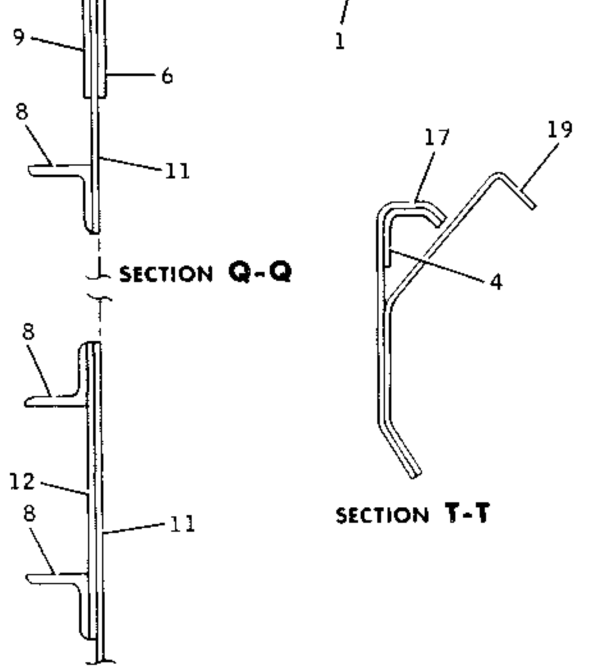
REFERENCE - DOUGLAS DRAWINGS 9911839 AND 9911877

BB3-367B

Frames and Intercostals, Station 908 to Canted Station 989 -- Type I
Figure 4 (Sheet 5)

Printed in U.S.A.



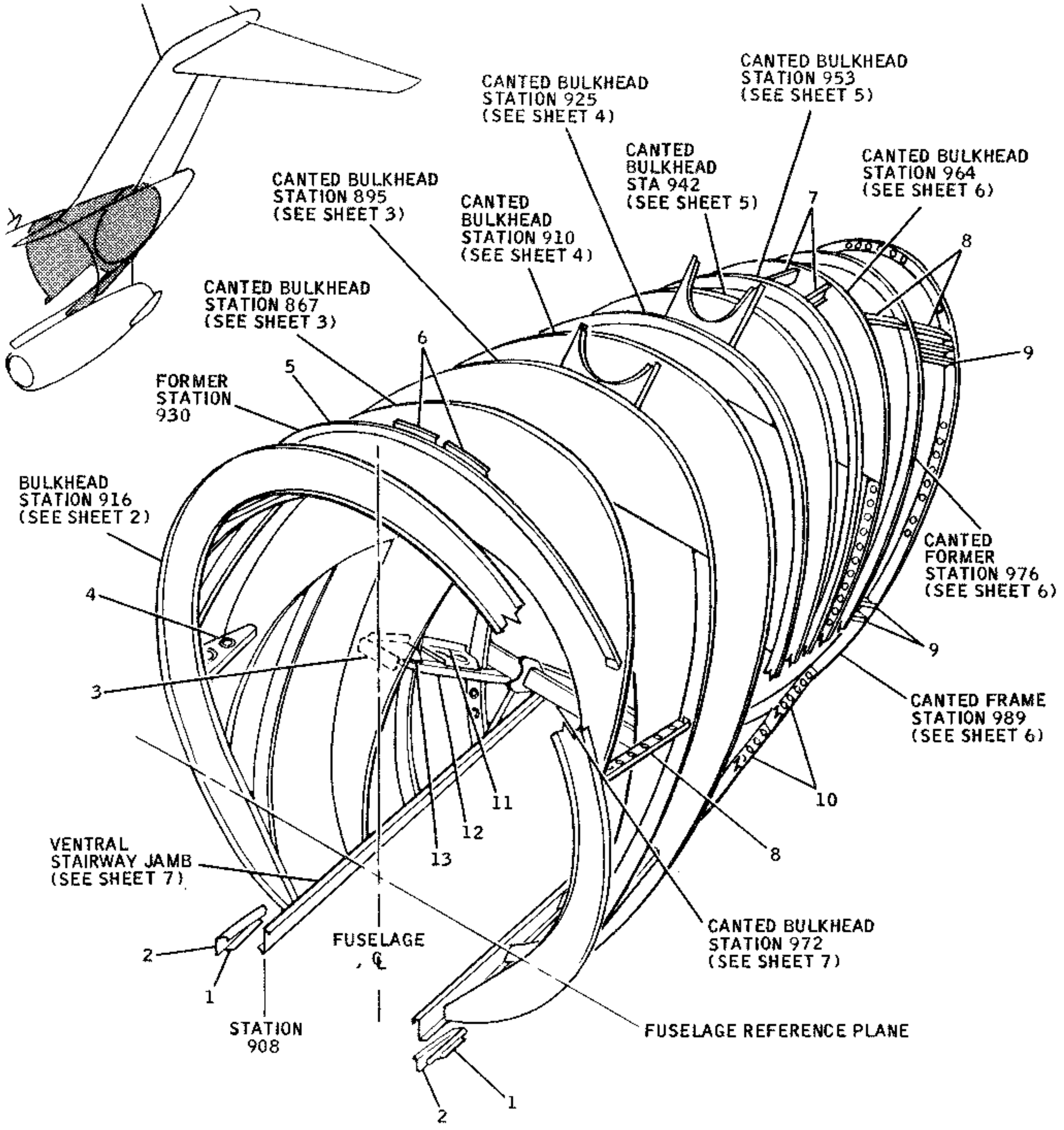


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.050	CLAD 7075-T6
2	ANGLE		1242526
3	STIFFENER		1245072
4	SPLICE ANGLE	.063	CLAD 7075-T6
5	SPLICE ANGLE	.050	CLAD 7075-T6
6	CAP ANGLE	.100	CLAD 7075-T6
7	STIFFENER		1249581
8	ANGLE		1249578
9	SPLICE ANGLE	.100	7075-T6
10	STIFFENER		1242937
11	WEB	.040	CLAD 7075-T6
12	DOUBLER	.050	CLAD 7075-T6
13	FRAME	.040	CLAD 7075-T6
14	GUSSET	.050	CLAD 2024-T42
15	CHANNEL	.063	CLAD 7075-T6
16	SPLICE ANGLE	.040	CLAD 7075-T6
17	FRAME	.063	CLAD 7075-T6
18	CHANNEL		1417718
19	SPLICE	.040	CLAD 7075-T6

REFERENCE DOUGLAS DRAWINGS 9911842, 9911878 AND 9911843

BB3-368

Frames and Intercostals, Station 908 to Canted Station 989 -- Type I
Figure 4 (Sheet 6)

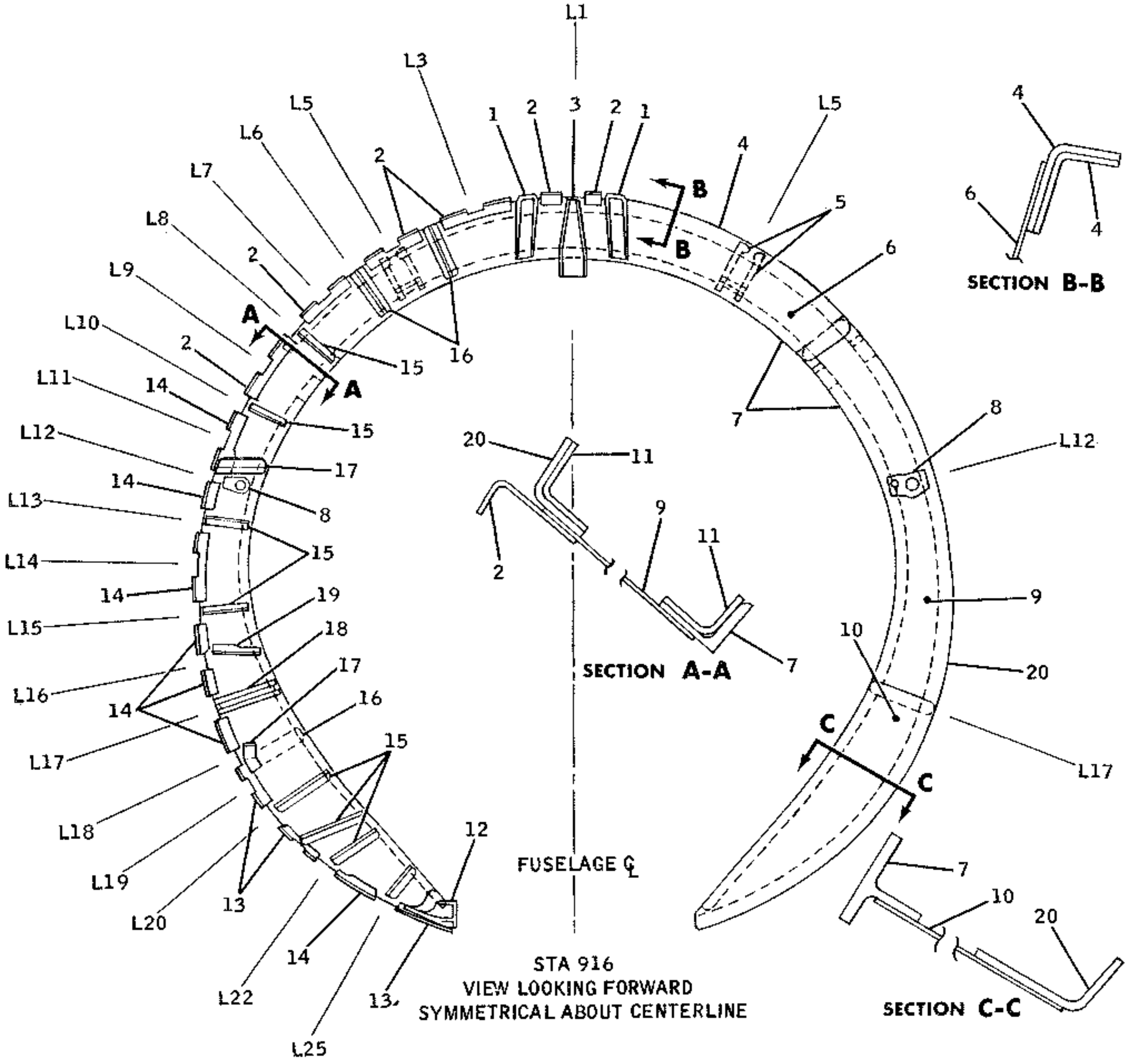


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE		2914057	8	INTERCOSTAL	.050	CLAD 7075-T6
2	INTERCOSTAL	.040	CLAD 7075-T6	9	INTERCOSTAL	.050	CLAD 2024-T42
3	CLIP		2777975	10	CHANNEL	.025	CLAD 2024-T3
4	INTERCOSTAL	.063	CLAD 7075-T6	11	WEB	.032	CLAD 7075-T6
5	FORMER		2912412-5	12	STIFFENER		1475407
6	ANGLE	.050	CLAD 2024-T42	13	WEB	.040	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 2024-T42				

REFERENCE - DOUGLAS DRAWINGS 5910227 AND 9911893

BB3-583

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 1)

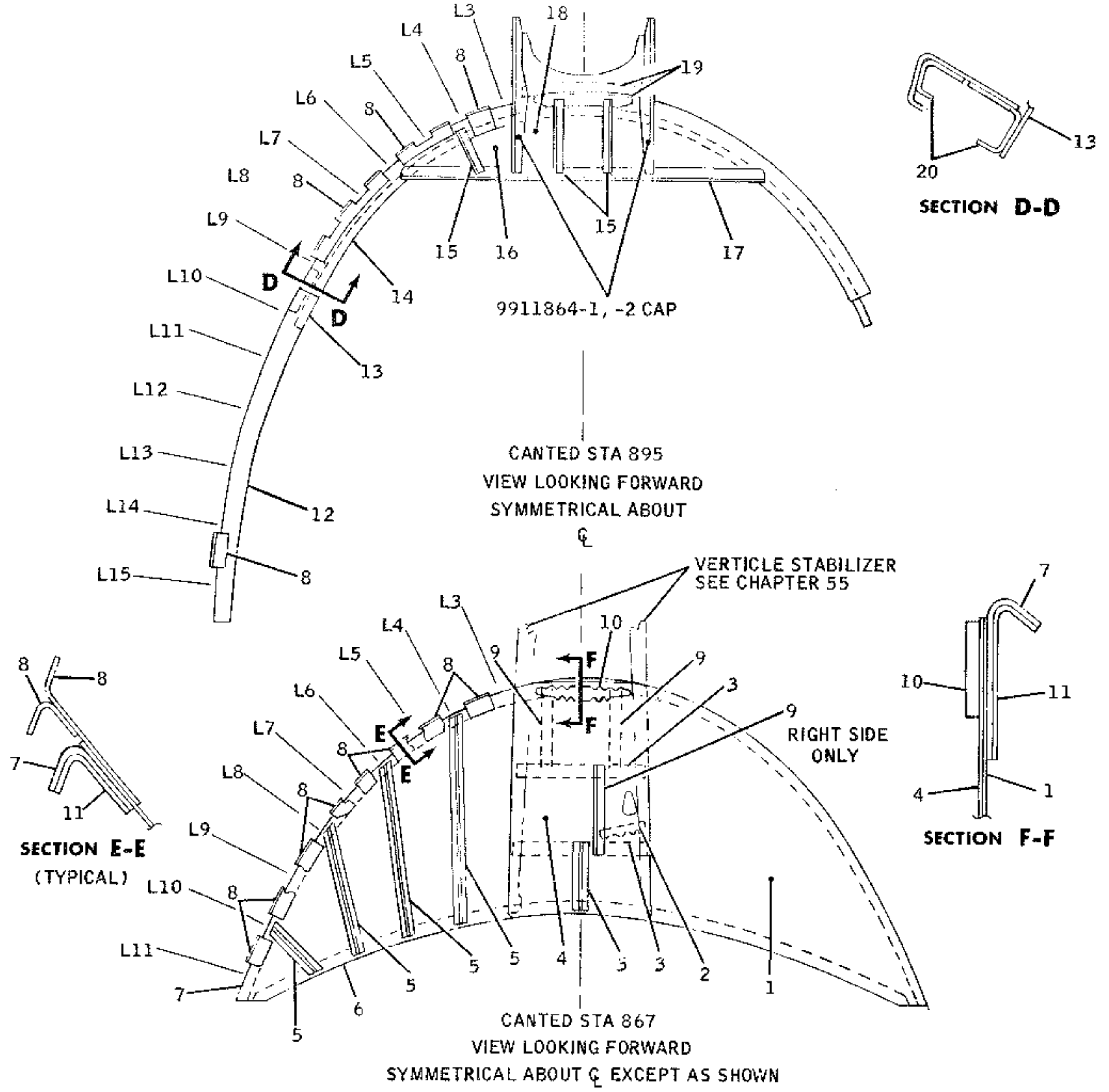


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING,4918093-1,-2	1.500	PLATE 7075-T651	11	SPLICE	.125	CLAD 7075-T6
2	FORMER	.071	CLAD 7075-T6	12	FITTING,9917700-1,-2	2.500	PLATE 7075-T651
3	CHANNEL	.063	CLAD 7075-T6	13	FORMER	.050	CLAD 7075-T6
4	CAP ANGLE	.125	CLAD 7075-T6	14	FORMER	.063	CLAD 7075-T6
5	BRACKET	.040	CLAD 2024-T42	15	STIFFENER		1415595
6	WEB	.080	CLAD 7075-T6	16	STIFFENER		1414813
7	CAP		1419366	17	CLIP	.160	CLAD 7075-T6
8	DOUBLER	.040	CLAD 7075-T6	18	STIFFENER		2777922-5
9	WEB	.032	CLAD 7075-T6	19	STIFFENER		1325737
10	WEB	.040	CLAD 7075-T6	20	CAP ANGLE	.100	7075-T6

REFERENCE - DOUGLAS DRAWING 9911840

BB3-584

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 2)

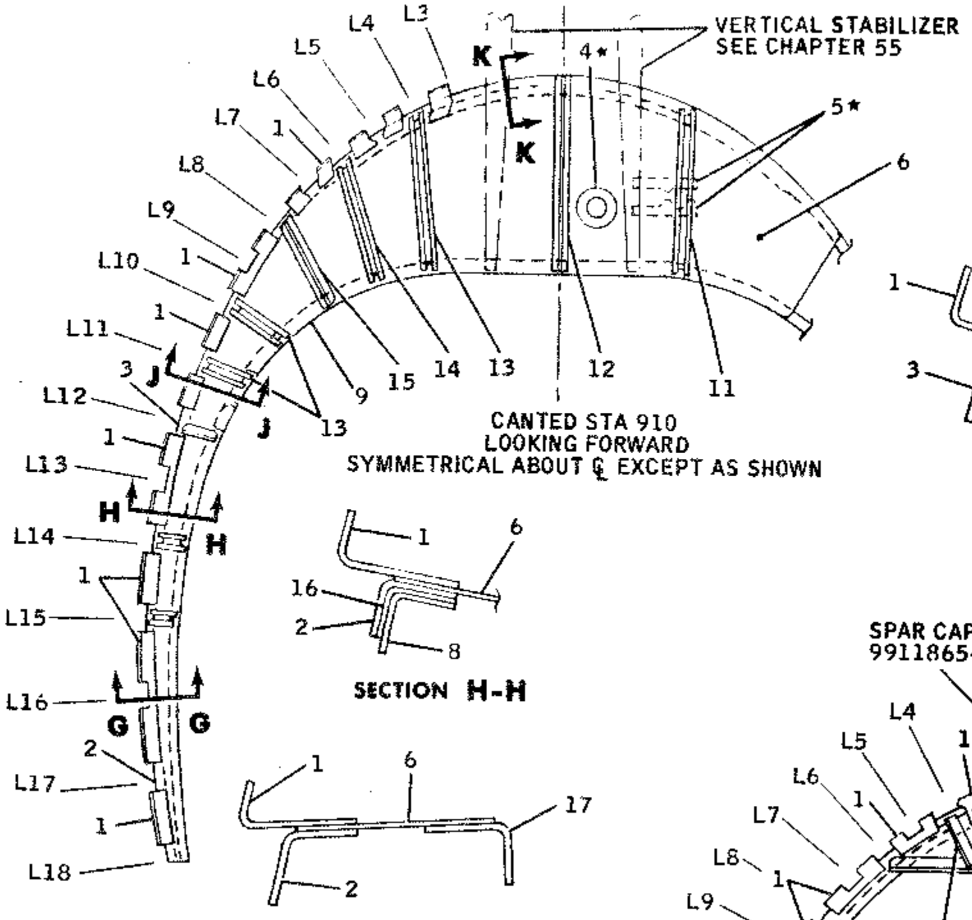


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.050	CLAD 7075-T6	11	CAP	.071	7075-T6
2	BRACKET	.125	6061-T6	12	FRAME		2777930
3	STIFFENER		1417984	13	SPLICE	.050	CLAD 7075-T6
4	DOUBLER	.040	CLAD 7075-T6	14	FRAME	.050	CLAD 7075-T6
5	STIFFENER		1332780	15	STIFFENER		1415595
6	CAP		2913786	16	WEB	.032	CLAD 7075-T6
7	CAP	.100	CLAD 7075-T6	17	ANGLE		1325738
8	FORMER	.063	CLAD 7075-T6	18	WEB	.040	CLAD 7075-T6
9	STIFFENER		1418201	19	ATTACH CLIP	.063	CLAD 7075-T6
10	FILLER	.250	7075-T651	20	CHANNEL	.050	CLAD 7075-T6

REFERENCE-DOUGLAS DRAWINGS 9911858 AND 9911838

BB3-365

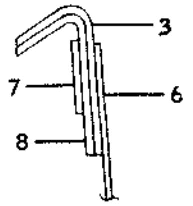
Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 3)



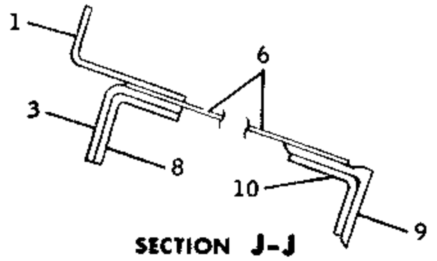
CANTED STA 910
LOOKING FORWARD
SYMMETRICAL ABOUT ℄ EXCEPT AS SHOWN

SECTION H-H

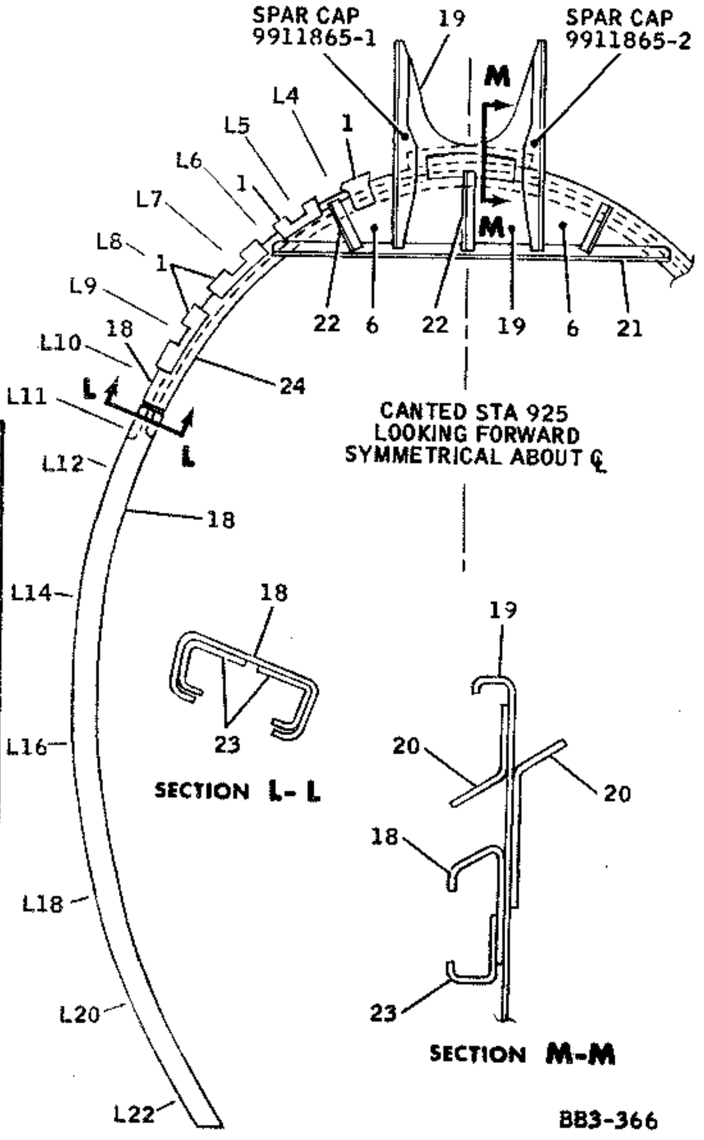
SECTION G-G



SECTION K-K



SECTION J-J



CANTED STA 925
LOOKING FORWARD
SYMMETRICAL ABOUT ℄

SECTION L-L

SECTION M-M

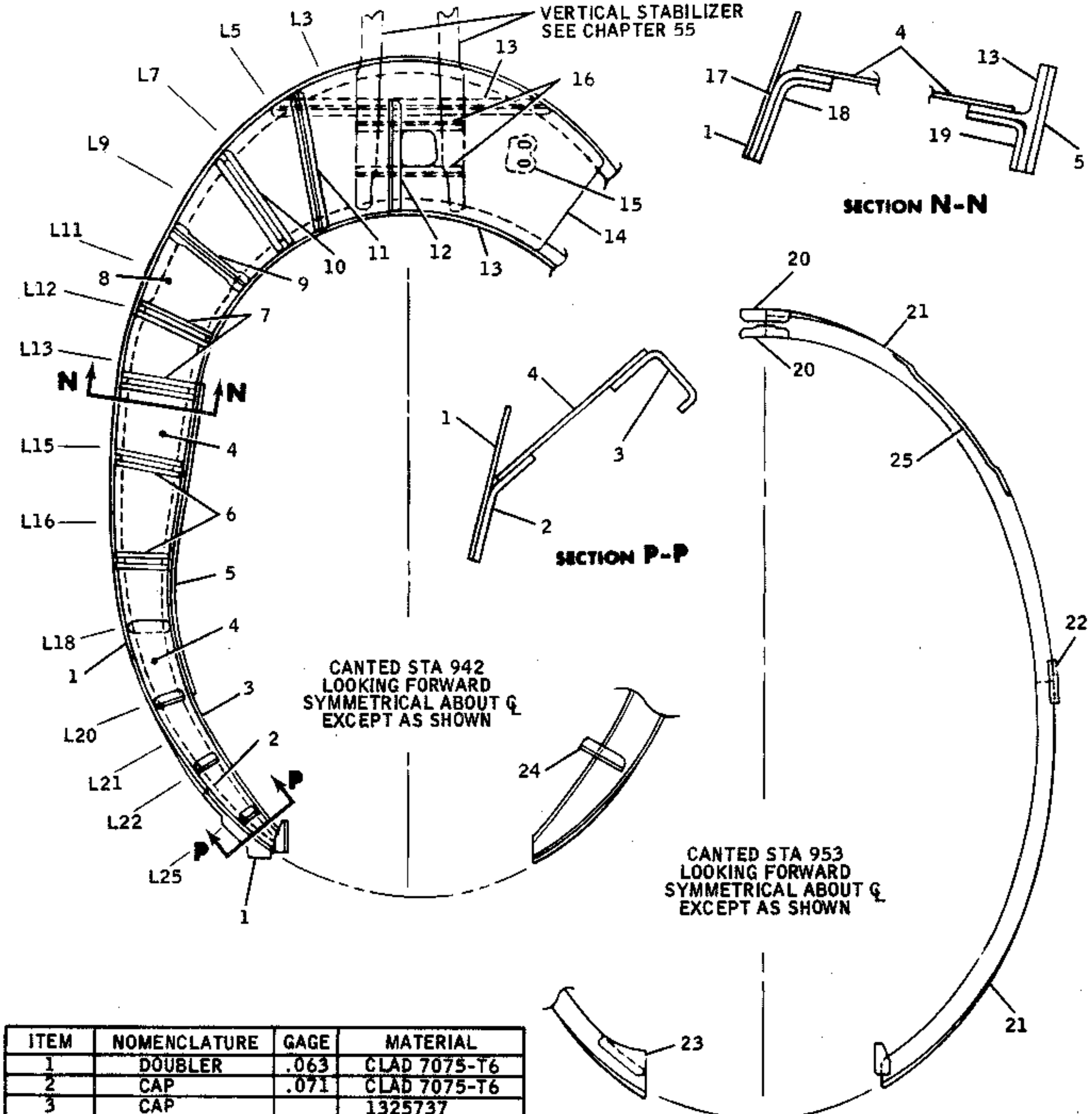
★ RIGHT SIDE ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 7075-T6
2	CAP ANGLE	.071	CLAD 7075-T6
3	CAP ANGLE	.100	CLAD 7075-T6
4	DOUBLER	.071	CLAD 7075-T6
5	STIFFENER	.080	CLAD 7075-T6
6	WEB	.032	CLAD 7075-T6
7	DOUBLER	.080	CLAD 7075-T6
8	CAP ANGLE	.090	CLAD 7075-T6
9	TEE		1419318
10	SPLICE ANGLE	.100	CLAD 7075-T6
11	HAT	.063	CLAD 7075-T6
12	TEE		1418898
13	HAT		2777922-5
14	HAT		2777922-4
15	TEE		1475407
16	SHIM ANGLE	.032	CLAD 7075-T6
17	ANGLE	.100	CLAD 7075-T6
18	FRAME	.050	CLAD 7075-T6
19	WEB	.040	CLAD 7075-T6
20	ANGLE	.063	CLAD 7075-T6
21	ANGLE		1325738
22	STIFFENER		1415595
23	SPLICE	.050	CLAD 7075-T6

REFERENCE DOUGLAS DRAWINGS 9911841 AND 9911859

BB3-366

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 4)



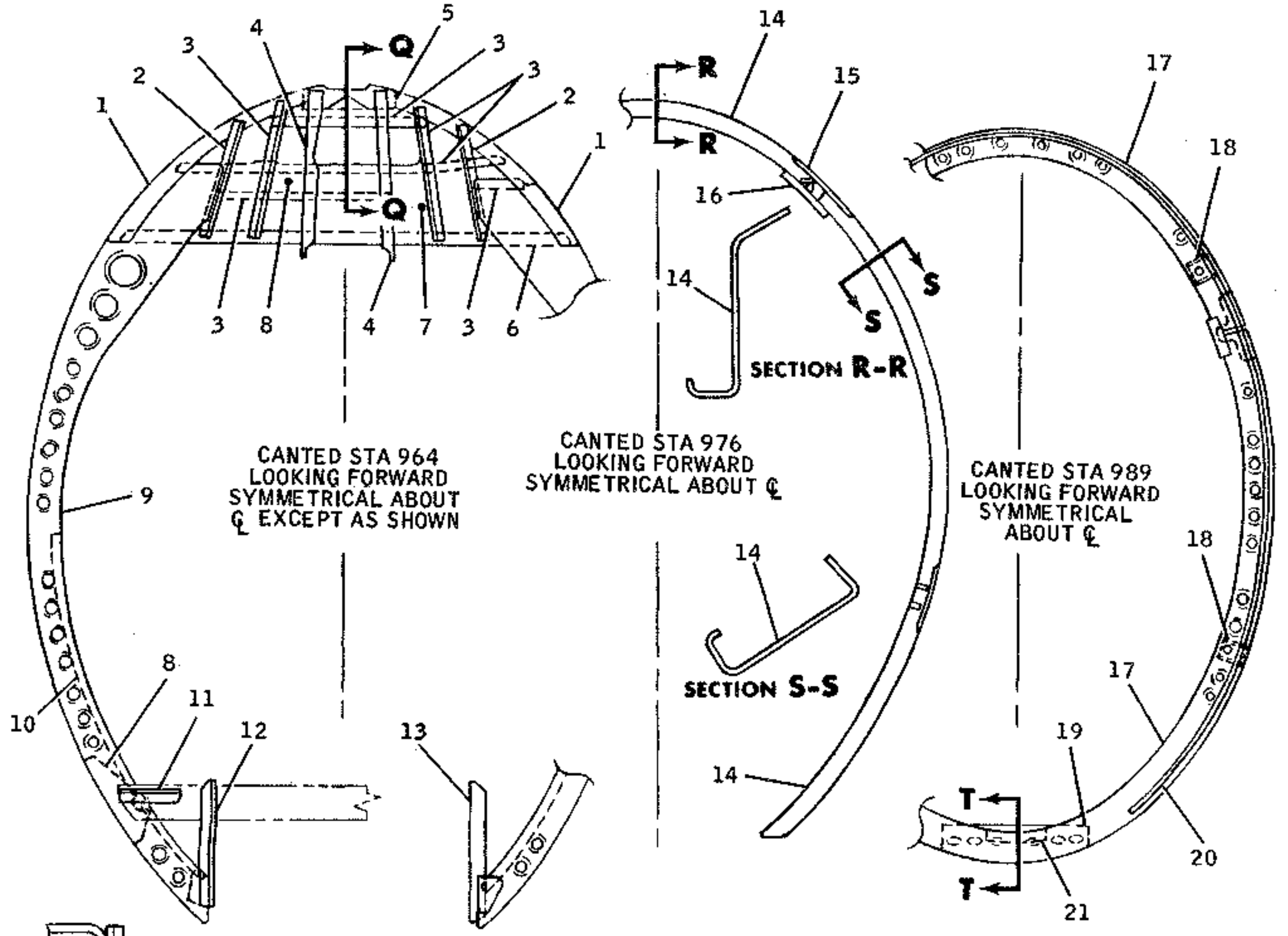
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 7075-T6
2	CAP	.071	CLAD 7075-T6
3	CAP		1325737
4	WEB	.032	CLAD 7075-T6
5	TAPERED DOUBLER	.190	CLAD 7075-T6
6	STIFFENER		2777922-4
7	STIFFENER		2777922-5
8	WEB	.050	CLAD 7075-T6
9	STIFFENER		1475407
10	STIFFENER	.100	CLAD 7075-T6
11	STIFFENER		1641009
12	STIFFENER		1415741
13	TEE EXTRUSION		1544612
14	WEB	.080	CLAD 7075-T6
15	DOUBLER	.071	CLAD 7075-T6
16	TEE EXTRUSION		1416036

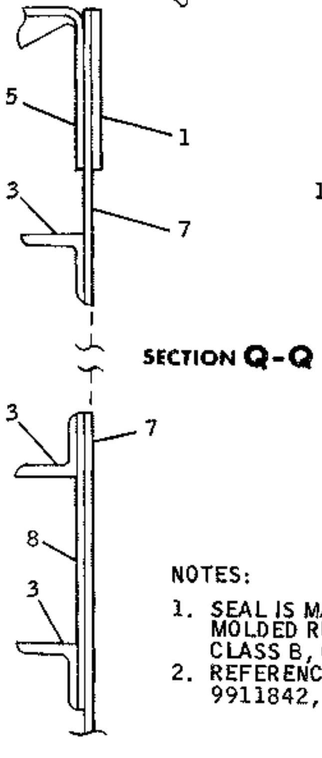
ITEM	NOMENCLATURE	GAGE	MATERIAL
17	CAP	.125	CLAD 7075-T6
18	DOUBLER	.125	CLAD 7075-T6
19	SPLICE	.090	CLAD 7075-T6
20	ANGLE	.040	CLAD 7075-T6
21	FRAME	.040	CLAD 7075-T6
22	ANGLE	.050	CLAD 7075-T6
23	GUSSET	.040	CLAD 7075-T6
24	STIFFENER		1242526
25	ANGLE	.063	CLAD 7075-T6

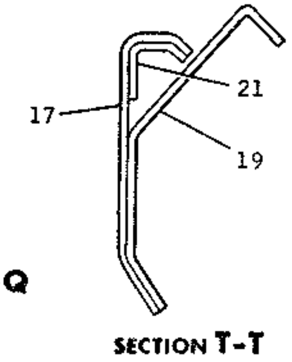
REFERENCE-DOUGLAS DRAWINGS 9911839 AND 9911877

BB3-585A

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 5)







ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP ANGLE	.100	CLAD 7075-T6
2	STIFFENER		1249581
3	ANGLE		1249578
4	FITTING,5913093-1,-2	1.250	PLATE 7075-T651
5	SPLICE ANGLE	.100	7075-T6
6	STIFFENER		1242937
7	WEB	.040	CLAD 7075-T6
8	DOUBLER	.050	CLAD 7075-T6
9	FRAME	.050	CLAD 7075-T6
10	CAP		1249578
11	ANGLE	.063	CLAD 7075-T6
12	BRACE		1223583
13	FITTING, 3917182-1	2.000	PLATE 7075-T651
14	FRAME	.040	CLAD 7075-T6
15	GUSSET	.050	CLAD 2024-T42
16	CHANNEL	.063	CLAD 7075-T6
17	FRAME	.063	CLAD 7075-T6
18	CHANNEL		1417718
19	SPLICE	.040	CLAD 7075-T6
20	SEAL, 4913366-1		SEE NOTE 1
21	SPLICE ANGLE	.063	CLAD 7075-T6

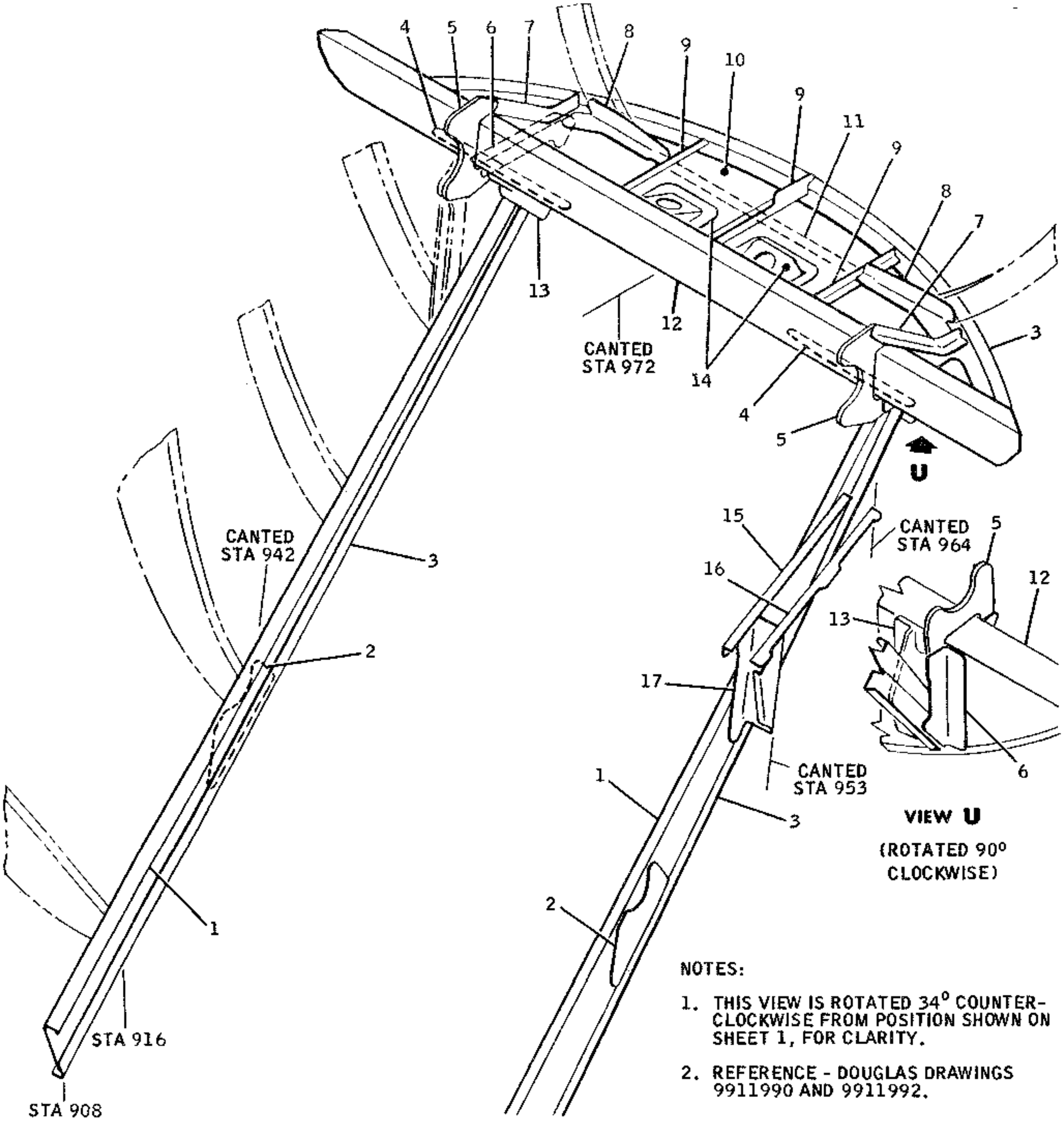
NOTES:

1. SEAL IS MADE FROM SILICONE MOLDED RUBBER, MIL-R-5847, CLASS B, GRADE 50
2. REFERENCE - DOUGLAS DRAWINGS 9911842, 9911878, AND 9911843

BB3-586

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 6)

Printed in U.S.A.



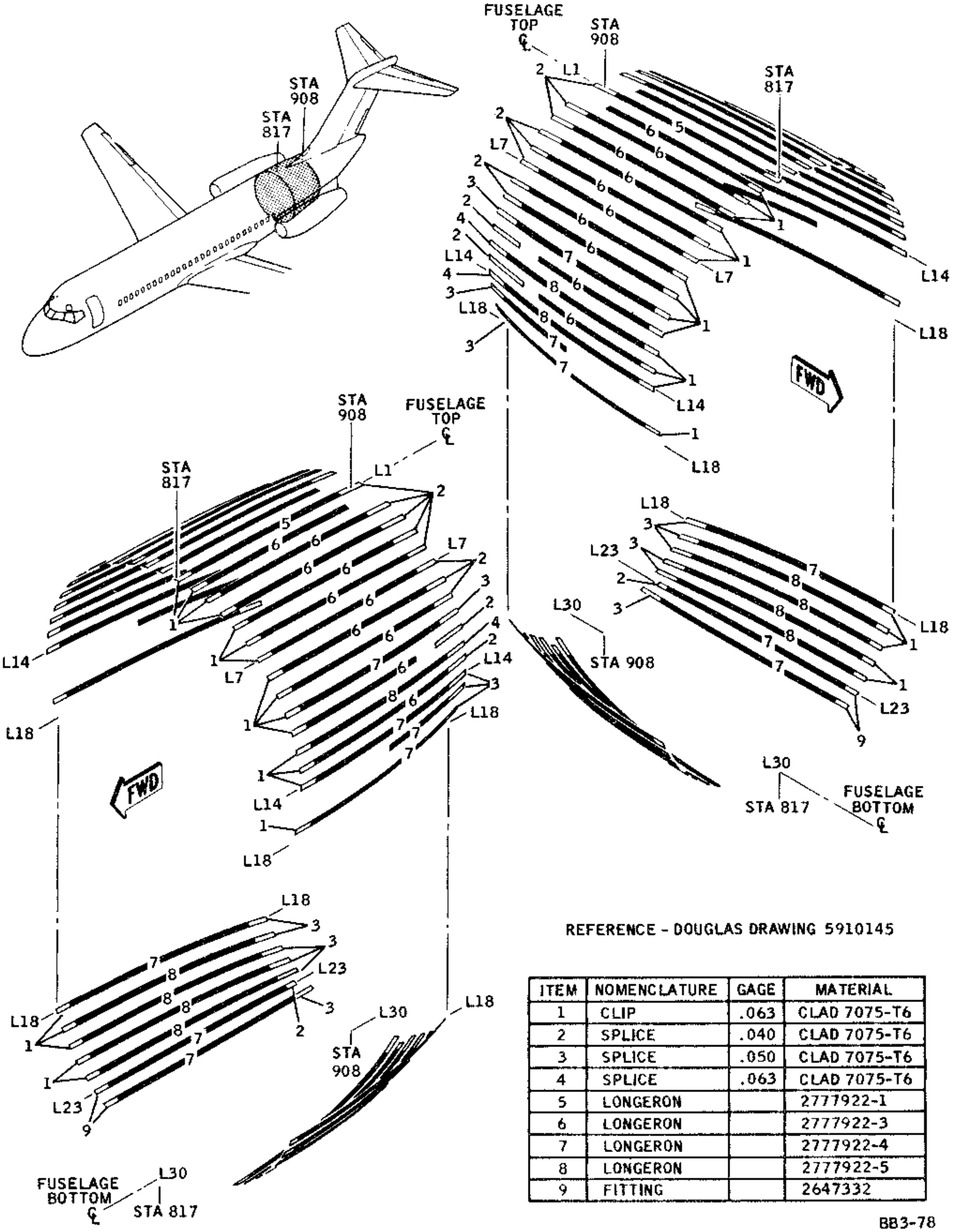
NOTES:

1. THIS VIEW IS ROTATED 34° COUNTER-CLOCKWISE FROM POSITION SHOWN ON SHEET 1, FOR CLARITY.
2. REFERENCE - DOUGLAS DRAWINGS 9911990 AND 9911992.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	JAMB	.040	CLAD 7075-T6
2	DOUBLER	.040	CLAD 7075-T6
3	CAP	.050	CLAD 7075-T6
4	DOUBLER	.100	CLAD 7075-T6
5	PLATE	.250	CLAD 7075-T651
6	STIFFENER		1464579
7	BRACE		1418201
8	CLIP	.063	CLAD 7075-T6
9	STIFFENER	.063	CLAD 7075-T6
10	WEB	.025	CLAD 2024-T3
11	ANGLE	.032	SHEET 6061-T6
12	INTERCOSTAL	.090	CLAD 7075-T6
13	FITTING,5917564-3,-4		CASTING 356-T6
14	HOUSING	.040	CLAD 2024-T42
15	SUPPORT		1109080
16	SUPPORT		1242526
17	BRACKET	.063	CLAD 7075-T6

BB3-587

Frames and Intercostals, Station 908 to Canted Station 989 -- Type II
Figure 5 (Sheet 7)

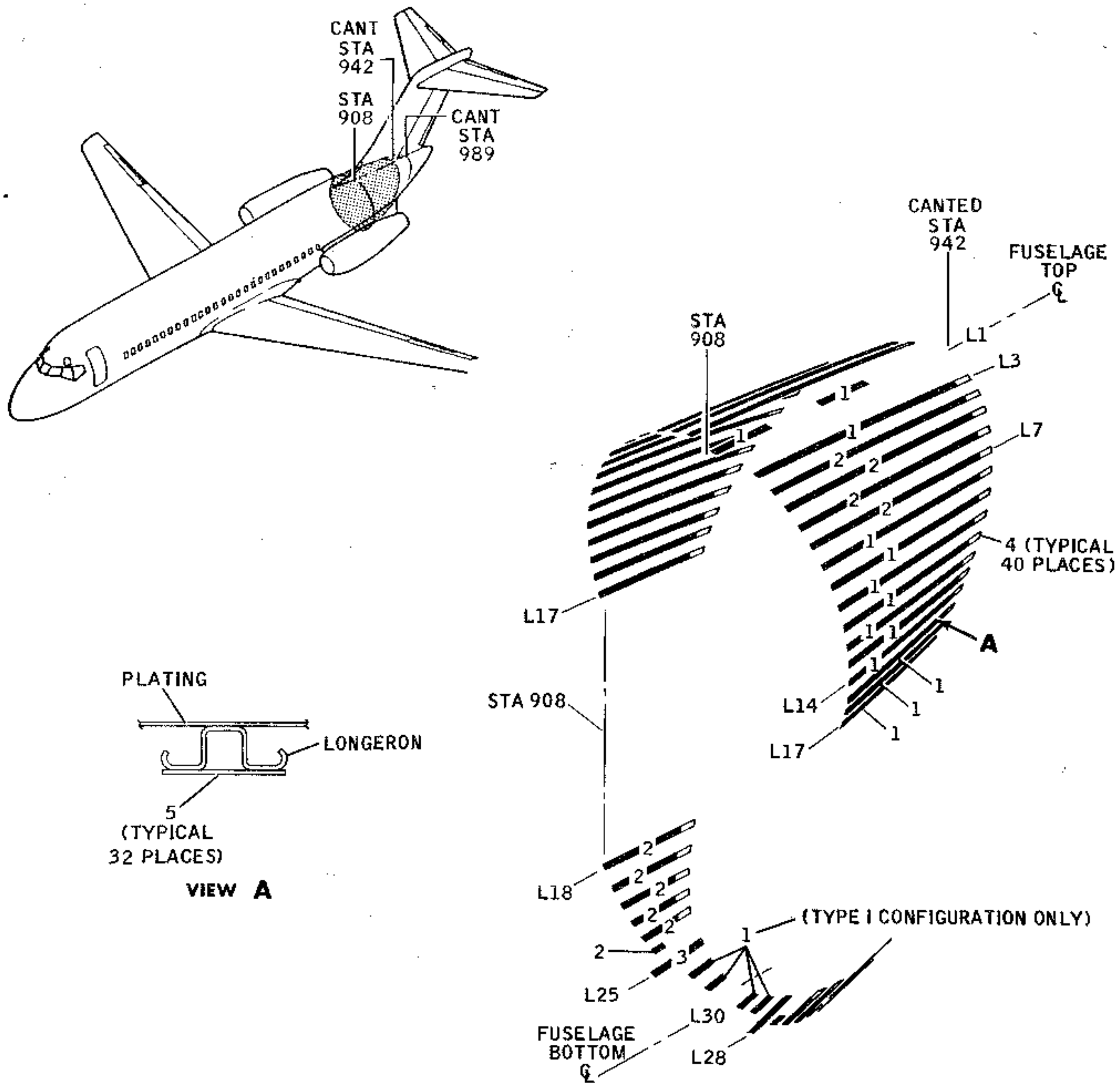


REFERENCE - DOUGLAS DRAWING 5910145

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLIP	.063	CLAD 7075-T6
2	SPLICE	.040	CLAD 7075-T6
3	SPLICE	.050	CLAD 7075-T6
4	SPLICE	.063	CLAD 7075-T6
5	LONGERON		2777922-1
6	LONGERON		2777922-3
7	LONGERON		2777922-4
8	LONGERON		2777922-5
9	FITTING		2647332

BB3-78

Longerons, Station 817 to 908
Figure 6



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777922-5
2	LONGERON		2777922-4
3	LONGERON		5914468-1, -2
4	CLIP		2912099
5	STRAP	.050	CLAD 7075-T6

NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES.
2. ITEM 3 IS MADE FROM 1.125 7075-T651 PLATE.
3. REFERENCE- DOUGLAS DRAWING 5910228.

BB3-111A

Longerons, Station 908 to Canted Station 989 -- Types I and II
Figure 7

MAIN FRAME - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates the main frame of the fuselage, including such items as frames, longerons, bulkheads, intercostals, beams, and floor support structure. The subjects within this section are listed for convenience in locating a particular area of the fuselage.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore integrity and appearance is presented as follows:

Structural Component	Approved Repairs
All	Section 53-01, Figure 1
Longerons	Section 53-02
Frames, Formers, and bulkheads	Section 53-01, Figure 2, Sheet 4; Section 53-01, Figure 3, Sheets 4 and 5; Section 53-01, Figure 5, Sheet 2; Section 53-03
Door seal depressors	Section 53-05, Figures 8 and 9

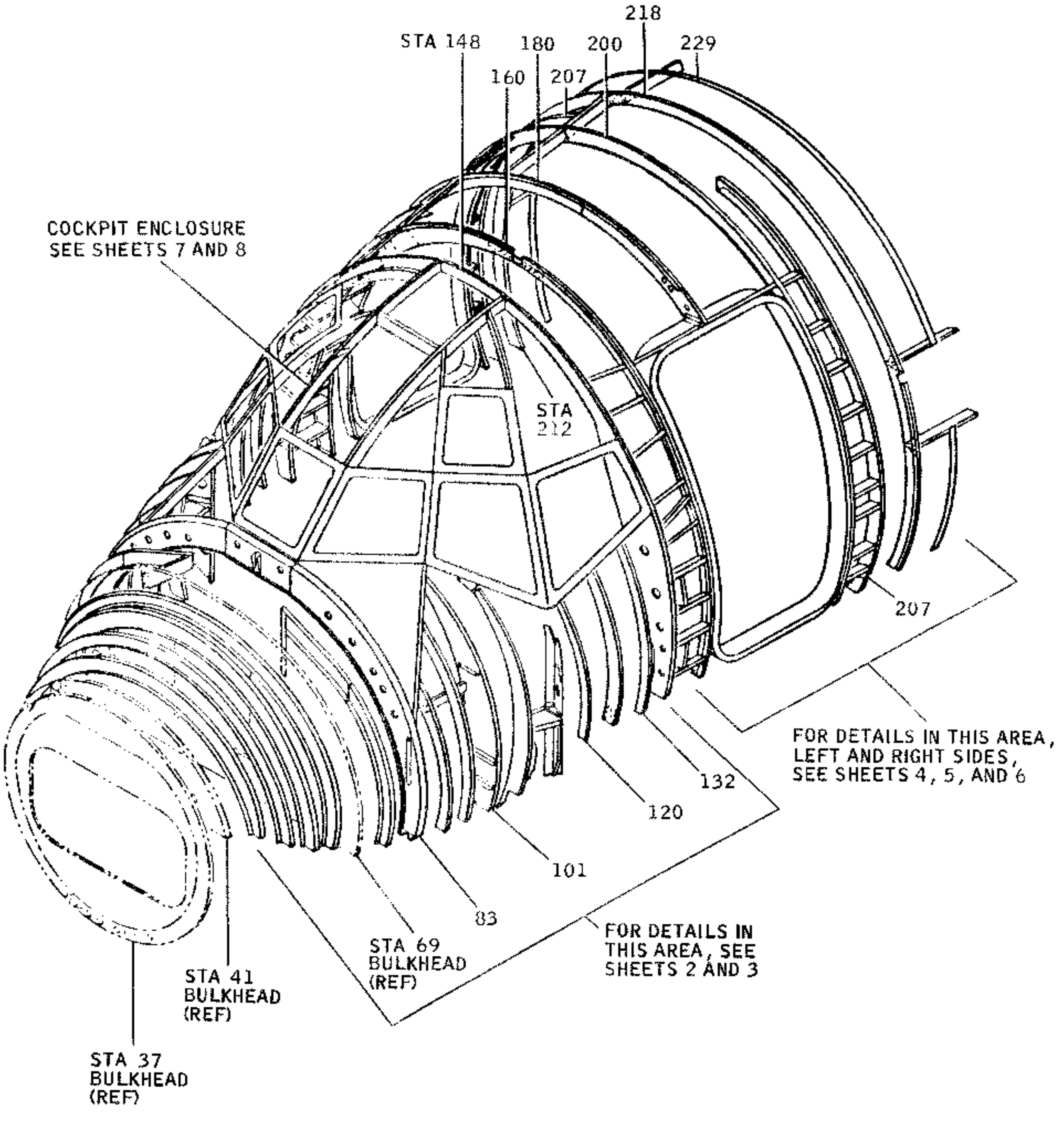
NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or boundary areas.

Printed in U.S.A.

FUSELAGE NOSE SECTION - DESCRIPTION AND OPERATION (DC-9-30)

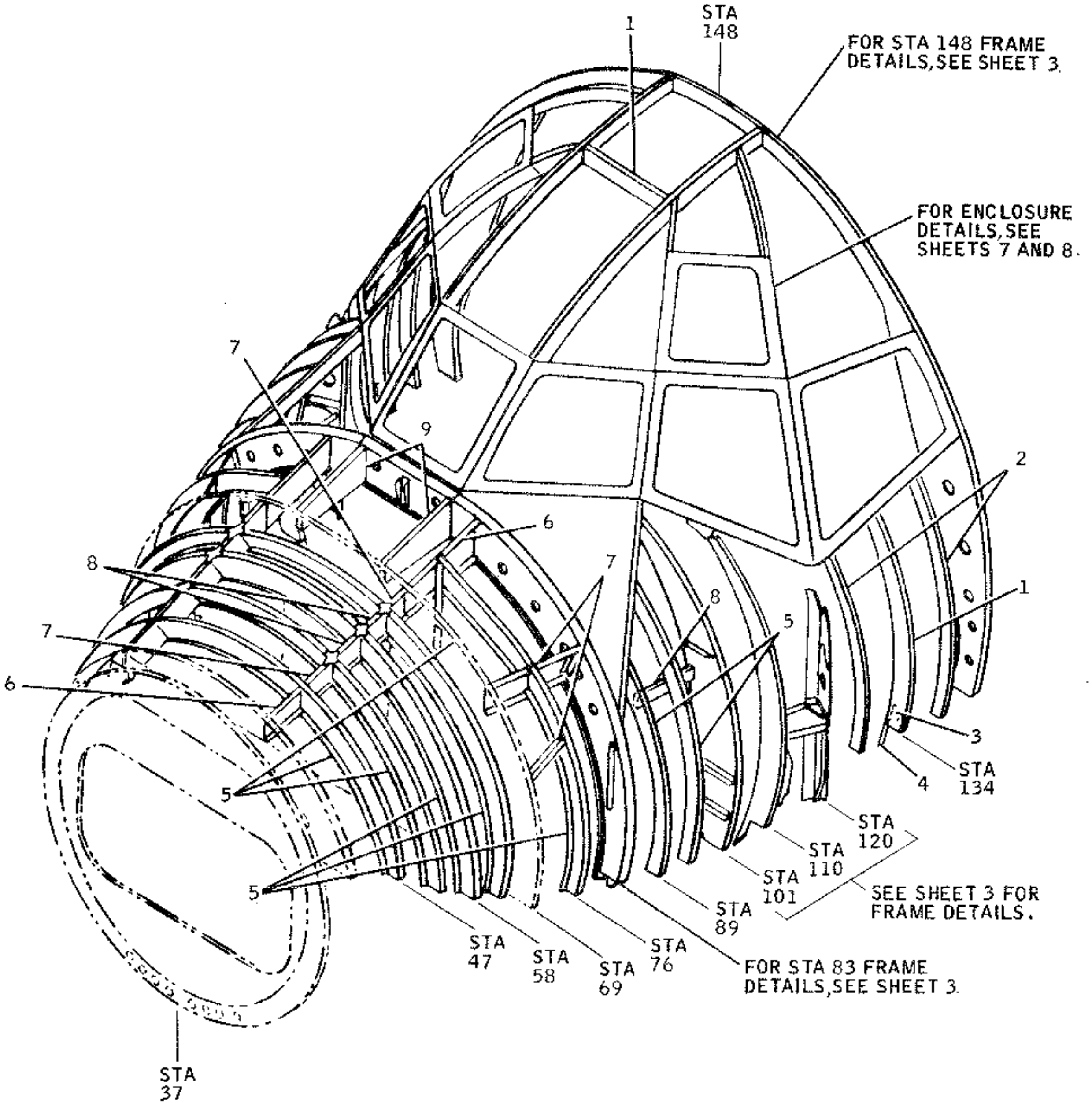
1. General

A. The following figures illustrate the structural components of the fuselage nose section. The materials used are identified by item number callouts.



BB3-830

Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 1)



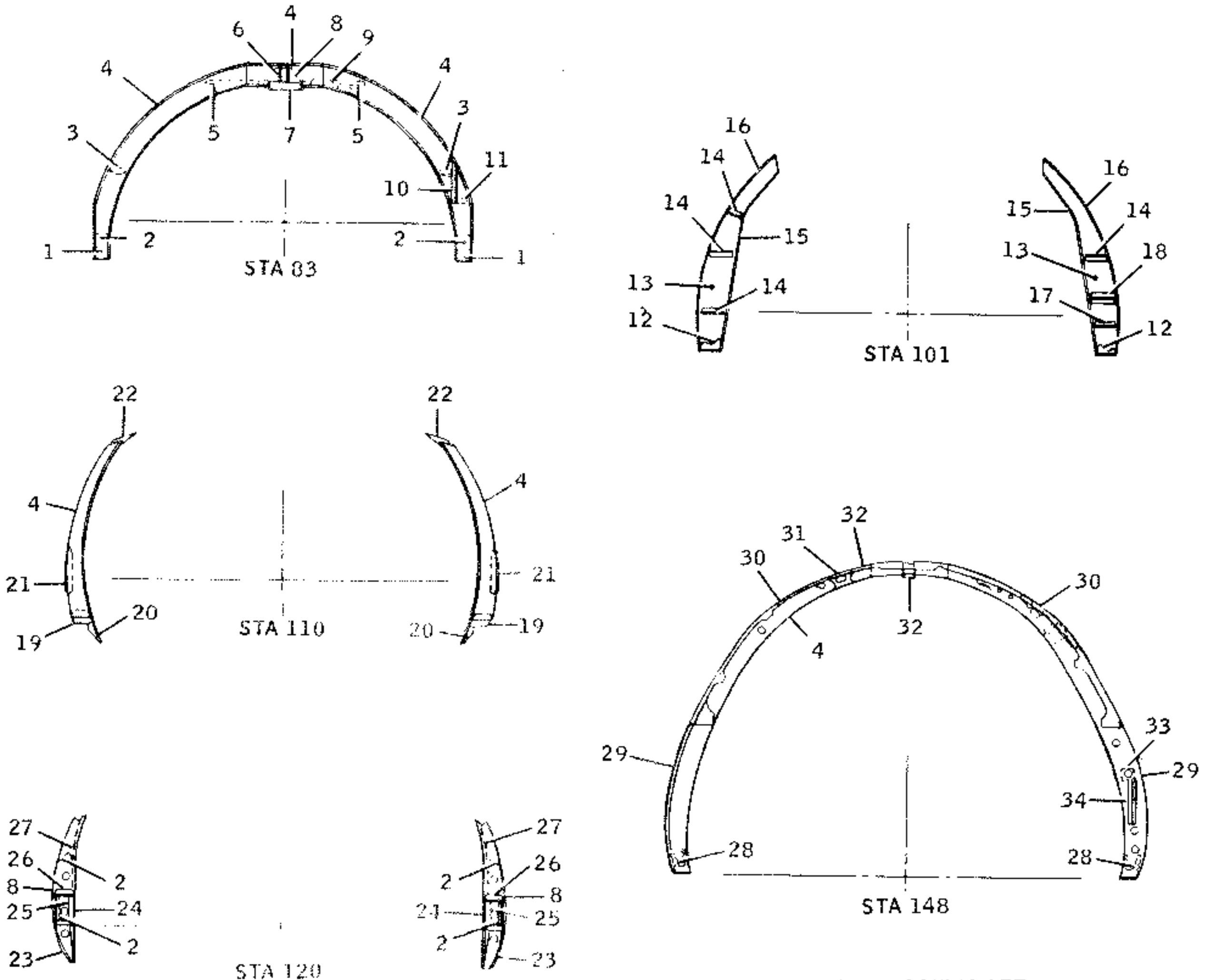
NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES UNLESS OTHERWISE NOTED.
2. MADE FROM 4130 STEEL SHEET, .080 GAGE TAPERED TO .045.
3. REFERENCE - DOUGLAS DRAWING 5910071.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.063	CLAD 7075-T6	6	INTERCOSTAL	.063	CLAD 7075-T6
2	FRAME	.050	CLAD 7075-T6	7	INTERCOSTAL	.050	CLAD 7075-T6
3	FITTING		2614618	8	INTERCOSTAL	.040	CLAD 7075-T6
4	STRAP		SEE NOTE 2	9	BEAM	.090	CLAD 7075-T6
5	FRAME	.040	CLAD 7075-T6				

BB3-209A

Frames and Intercostals, Nose Upper Section
Station 37 to 229 -- Type A
Figure 1 (Sheet 2)

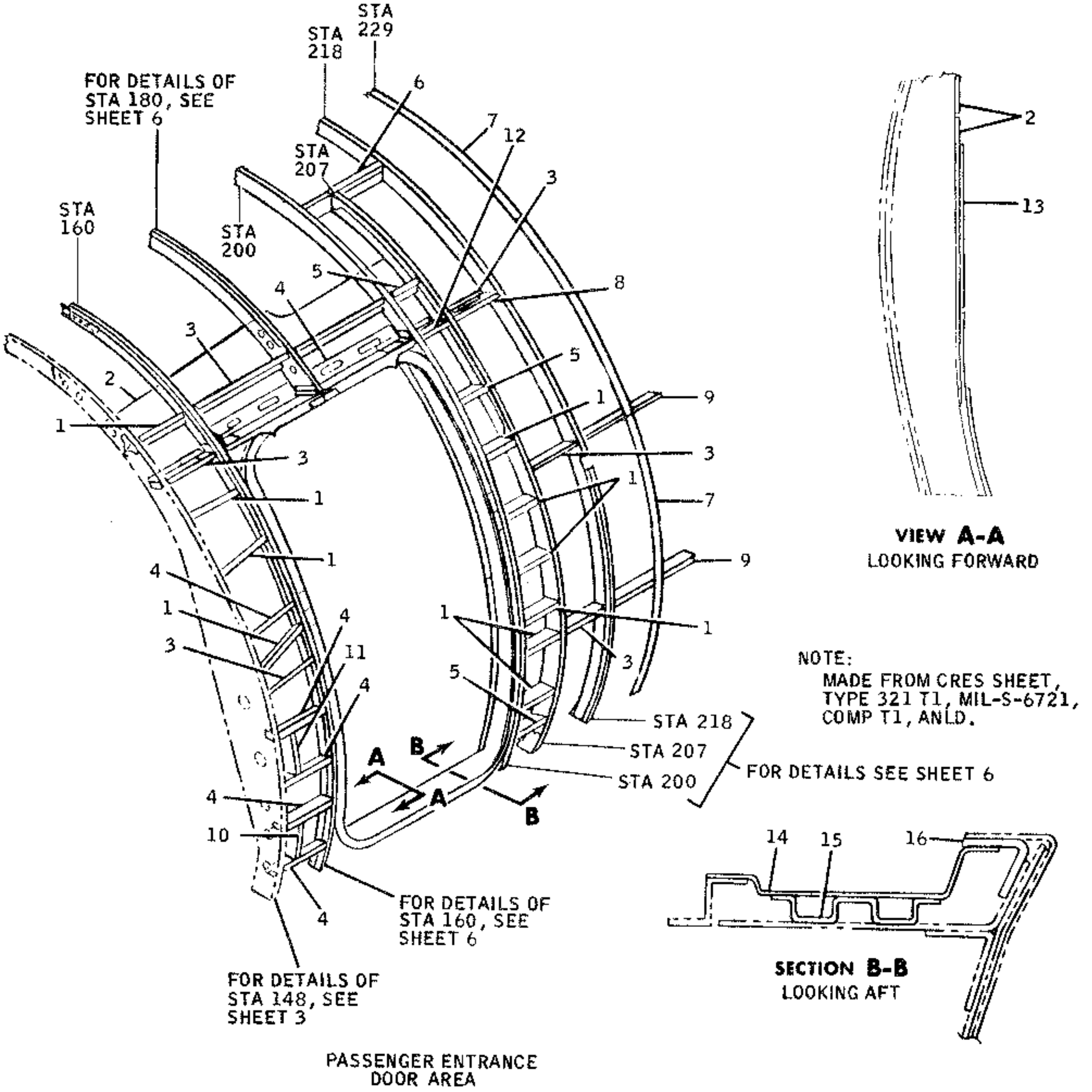


ALL VIEWS LOOKING AFT

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING, 4912950-1, -2		2614618	18	TEE		1125558
2	DOUBLER	.050	CLAD 7075-T6	19	SPLICE TEE		1103715
3	SHEAR CLIP	.071	CLAD 7075-T6	20	CAP ANGLE		1419292
4	FRAME	.063	CLAD 7075-T6	21	SPLICE ANGLE	.063	CLAD 2024-T42
5	SHEAR CLIP	.080	CLAD 7075-T6	22	ANGLE	.071	CLAD 2024-T3
6	BRACE	.063	CLAD 7075-T6	23	STRAP	.071	CLAD 2024-T42
7	CHANNEL	.063	CLAD 7075-T6	24	WEB	.050	CLAD 7075-T6
8	FRAME	.071	CLAD 7075-T6	25	INTERCOSTAL	.050	CLAD 7075-T6
9	DOUBLER	.090	CLAD 7075-T6	26	GUSSET	.071	CLAD 7075-T6
10	ANGLE		1238984	27	ATTACH ANGLE		1242520
11	STIFFENER	.063	CLAD 7075-T6	28	FITTING, 4912953-1, -2		2614618
12	FITTING		2615551	29	SPLICE ANGLE	.090	CLAD 7075-T6
13	WEB	.063	CLAD 7075-T6	30	SPLICE ANGLE	.071	CLAD 7075-T6
14	STIFFENER		1249581	31	DOUBLER PLATING	.071	CLAD 7075-T6
15	CAP		1397514	32	SPLICE ANGLE	.063	CLAD 7075-T6
16	CAP		1418367	33	FITTING, 4914318-1		PLATE 7075-T651
17	ANGLE	.090	CLAD 7075-T6	34	HAT		2704877

BB3-210

Frames and Intercostals, Nose Upper Section
Station 37 to 229 -- Type A
Figure 1 (Sheet 3)

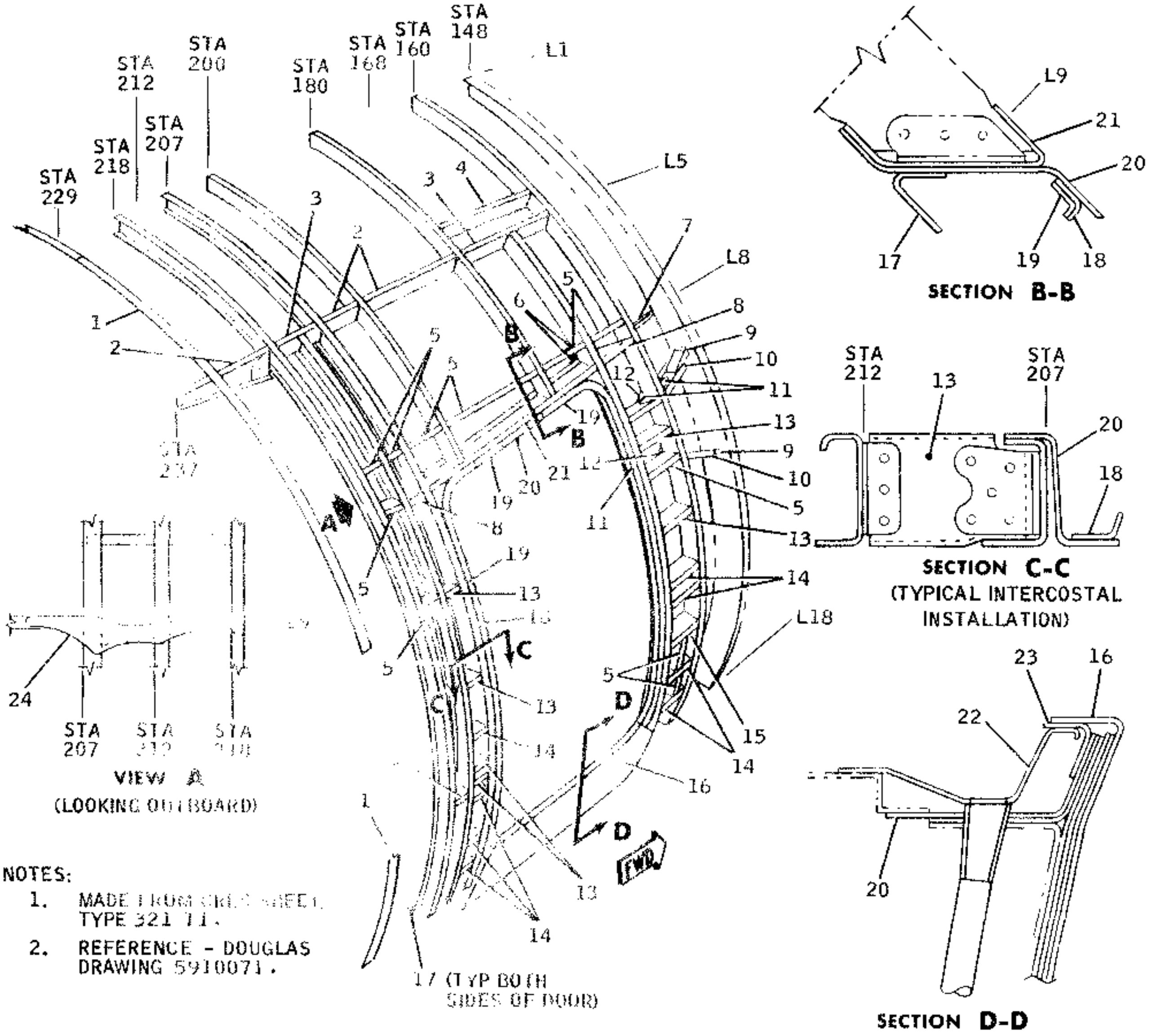


NOTE:
MADE FROM CRES SHEET, TYPE 321 T1, MIL-S-6721, COMP T1, ANLD.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.071	CLAD 7075-T6	9	INTERCOSTAL	.050	CLAD 7075-T6
2	SKIN	.040	CLAD 7075-T6	10	WEB	.063	CLAD 7075-T6
3	INTERCOSTAL	.063	CLAD 7075-T6	11	WEB	.090	CLAD 7075-T6
4	INTERCOSTAL	.080	CLAD 7075-T6	12	INTERCOSTAL		BAR 7075-T651
5	INTERCOSTAL	.090	CLAD 7075-T6	13	FITTING		PLATE 7075-T651
6	INTERCOSTAL	.040	CLAD 7075-T6	14	PAN	.025	SEE NOTE
7	STRAP	.071	CLAD 7075-T6	15	SUPPORT		GLASS FIBER NO.81
8	INTERCOSTAL		PLATE 7075-T651	16	DEPRESSOR	.090	CLAD 2024-T42

BB3-831

Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 4)



NOTES:

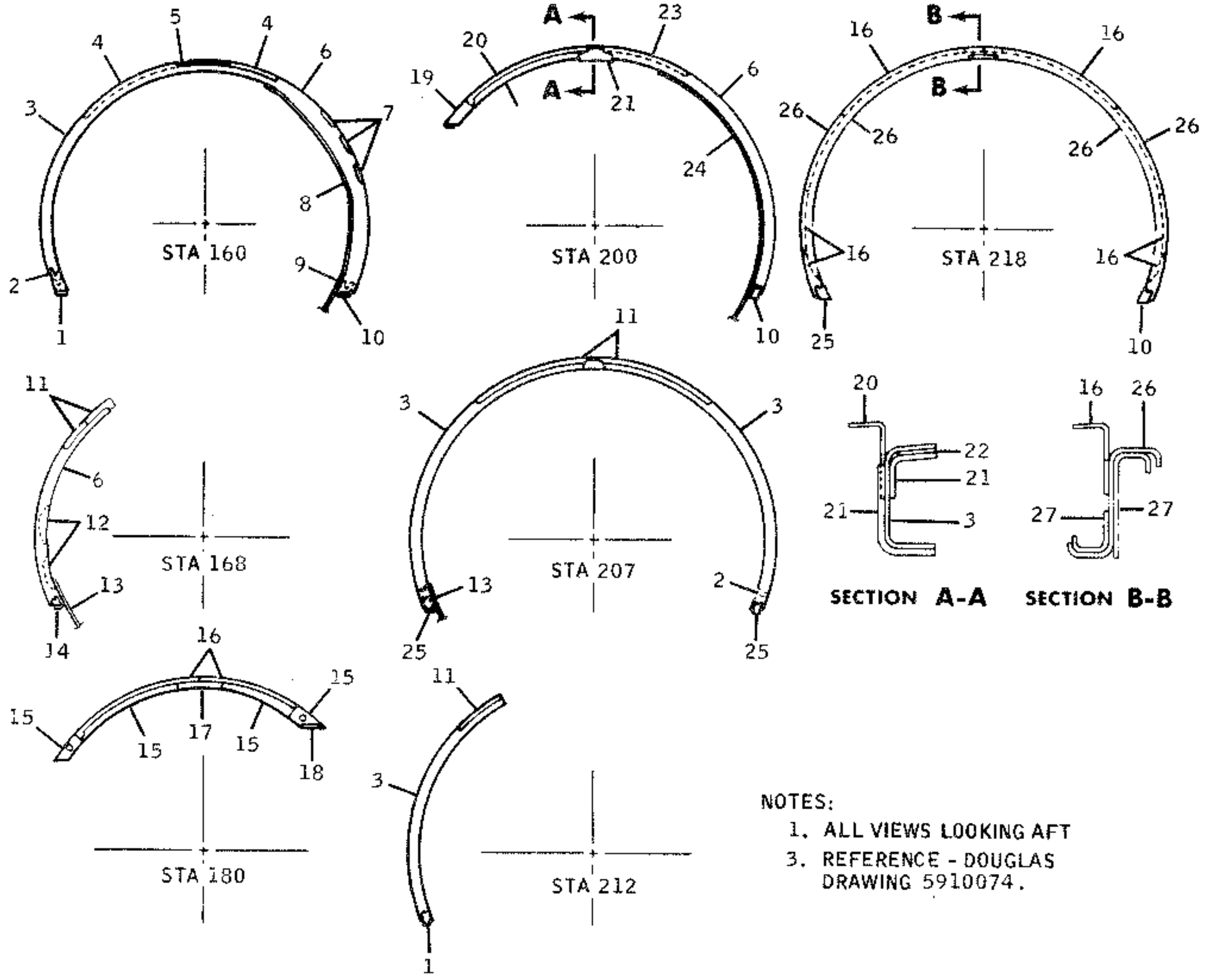
1. MADE FROM CRES SHEET, TYPE 321 TI.
2. REFERENCE - DOUGLAS DRAWING 5910071.

SERVICE ENTRANCE DOOR AREA

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRAP	.071	CLAD 7075-T6	13	INTERCOSTAL	.071	CLAD 7075-T6
2	INTERCOSTAL	.040	CLAD 7075-T6	14	INTERCOSTAL	.063	CLAD 7075-T6
3	INTERCOSTAL	.050	CLAD 7075-T6	15	INTERCOSTAL	.090	CLAD 7075-T6
4	INTERCOSTAL	.032	CLAD 7075-T6	16	SILL	.045	(SEE NOTE 1)
5	INTERCOSTAL	.063	CLAD 2024-T42	17	ANGLE	.063	CLAD 2024-T42
6	DOUBLER	.071	CLAD 2024-T3	18	SEAL ANGLE	.071	CLAD 2024-T42
7	BRACKET	.050	CLAD 7075-T6	19	SPLICE ANGLE	.050	CLAD 7075-T6
8	INTERCOSTAL	.071	CLAD 2024-T42	20	JAMB PAN	.050	CLAD 2024-T42
9	FITTING		PLATE 7075-T651	21	INTERCOSTAL	.080	CLAD 2024-T42
10	INTERCOSTAL	.100	CLAD 7075-T6	22	PAN	.045	(SEE NOTE 1)
11	GUSSET	.071	CLAD 2014-T6	23	ANGLE	.071	CLAD 2024-T42
12	DOUBLER	.063	CLAD 2014-T6	24	DOUBLER	.063	CLAD 2024-T3

BB3-806

Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 5)

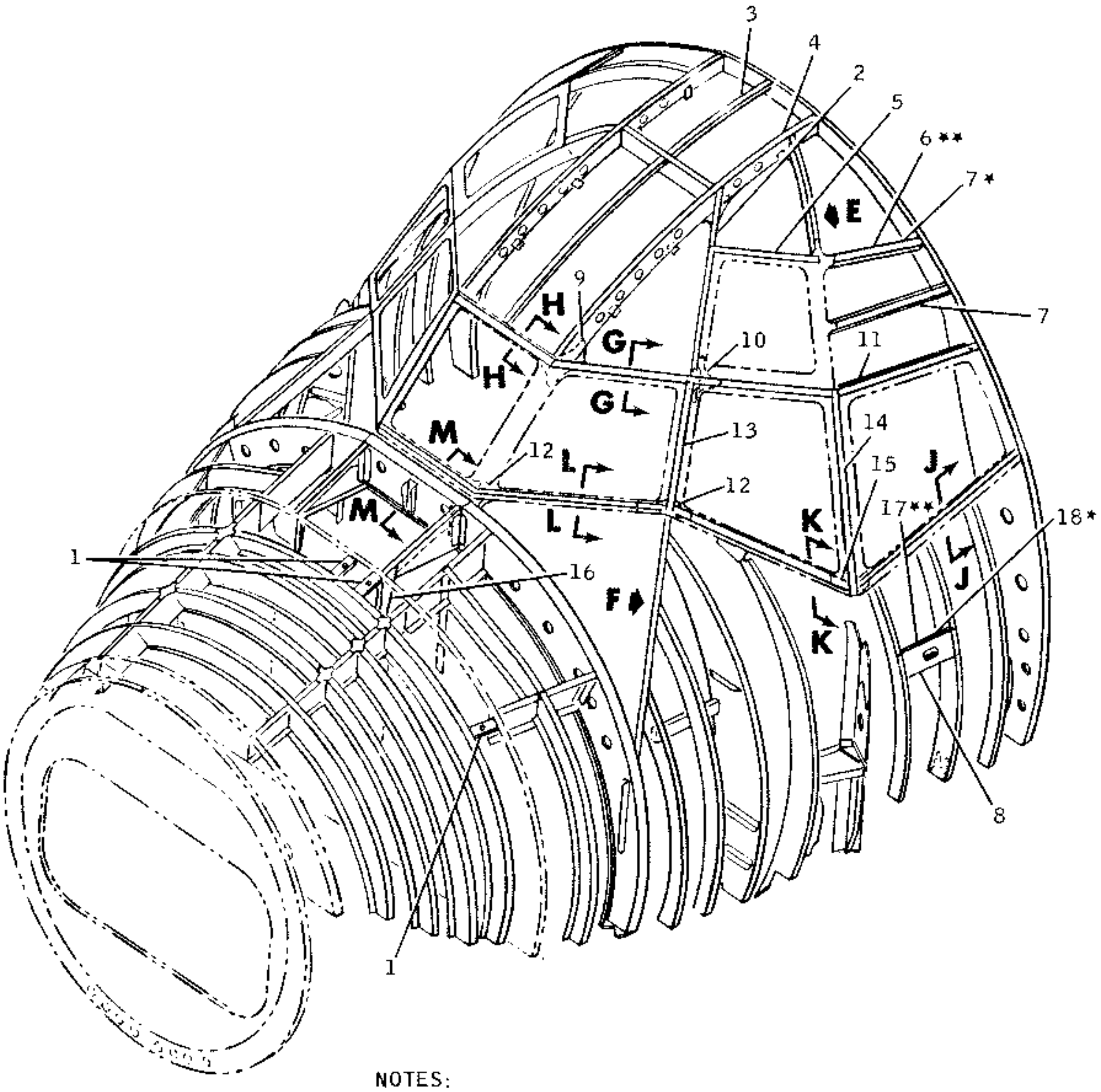


NOTES:
1. ALL VIEWS LOOKING AFT
3. REFERENCE - DOUGLAS DRAWING 5910074.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		BAR 7075-T651	16	SHEAR CLIP	.050	CLAD 2014-T6
2	DOUBLER	.063	CLAD 7075-T6	17	SPLICE ANGLE	.063	CLAD 7075-T6
3	FRAME	.071	CLAD 2024-T42	18	CLIP		1243327
4	SHEAR CLIP	.071	CLAD 2014-T6	19	CHANNEL	.071	CLAD 7075-T6
5	SPLICE ANGLE	.090	CLAD 7075-T6	20	SHEAR CLIP	.050	CLAD 7075-T6
6	FRAME	.125	CLAD 2024-T42	21	SPLICE ANGLE	.125	CLAD 2024-T42
7	ANGLE	.090	CLAD 7075-T6	22	FILLER	.050	CLAD 2024-T3
8	CAP	.250	PLATE 2024-T351	23	SHEAR CLIP	.071	CLAD 7075-T6
9	CAP	.375	STEEL PLATE 4130	24	CAP	.190	CLAD 2024-T42
10	FITTING		STEEL PLATE 4130	25	FITTING		BAR 7075-T651
11	SHEAR CLIP	.063	CLAD 2014-T6	26	FRAME		2777930 -5
12	SUPPORT		BAR 2014-T651	27	SPLICE ANGLE	.063	CLAD 2014-T3
13	STRAP		STEEL PLATE 4130				
14	FITTING		2614618				
15	FRAME	.050	CLAD 7075-T6				

BB3-807

Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 6)



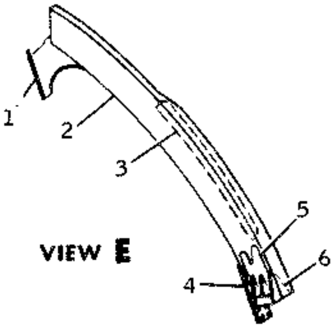
NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES EXCEPT AS NOTED
2. * RIGHT SIDE ONLY
3. ** LEFT SIDE ONLY

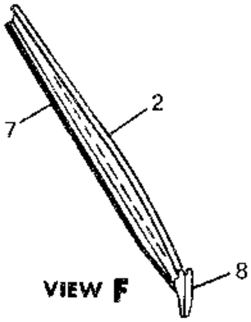
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6	10	DOUBLER	.090	STEEL SHEET 4130
2	FRAME	.090	CLAD 7075-T6	11	FITTING, 5641850-1, -2		STEEL BAR 4140
3	LONGERON		1243425	12	GUSSET	.090	STEEL SHEET 4130
4	BEAM	.071	CLAD 7075-T6	13	POST, 5912270-1, -2		STEEL BAR 4140
5	INTERCOSTAL	.090	CLAD 2024-T42	14	POST, 5643224		BAR 2014-T6
6	STRAP	.500	PLATE 2024-T351	15	GUSSET	.100	STEEL SHEET 4130
7	STIFFENER		2777922-4	16	BRACKET	.063	CLAD 7075-T6
8	PAN	.071	CLAD 6061-T6	17	DOUBLER	.500	PLATE 2024-T351
9	DOUBLER	.125	CLAD 7075-T6	18	DOUBLER	.312	PLATE 7075-T651

BB3-211

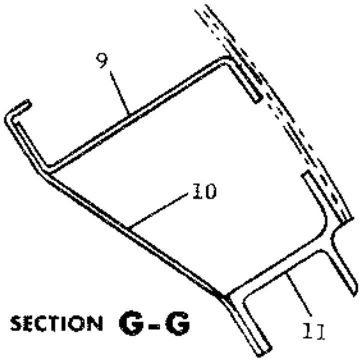
Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 7)



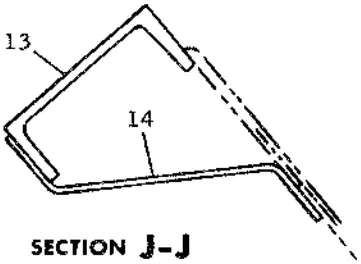
VIEW E



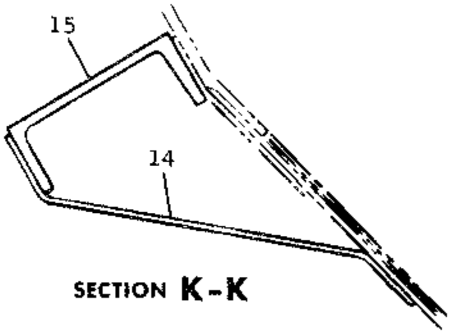
VIEW F



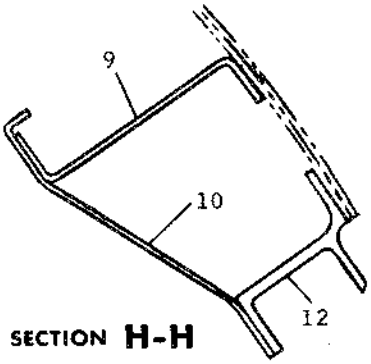
SECTION G-G



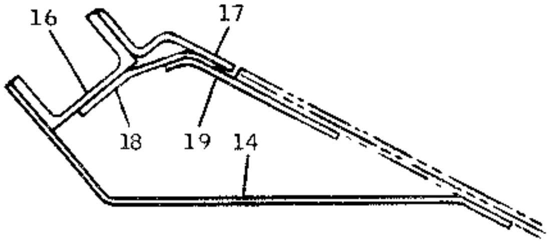
SECTION J-J



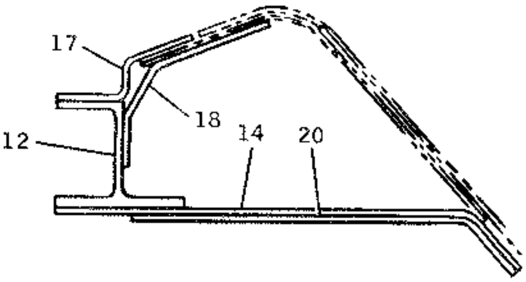
SECTION K-K



SECTION H-H



SECTION L-L

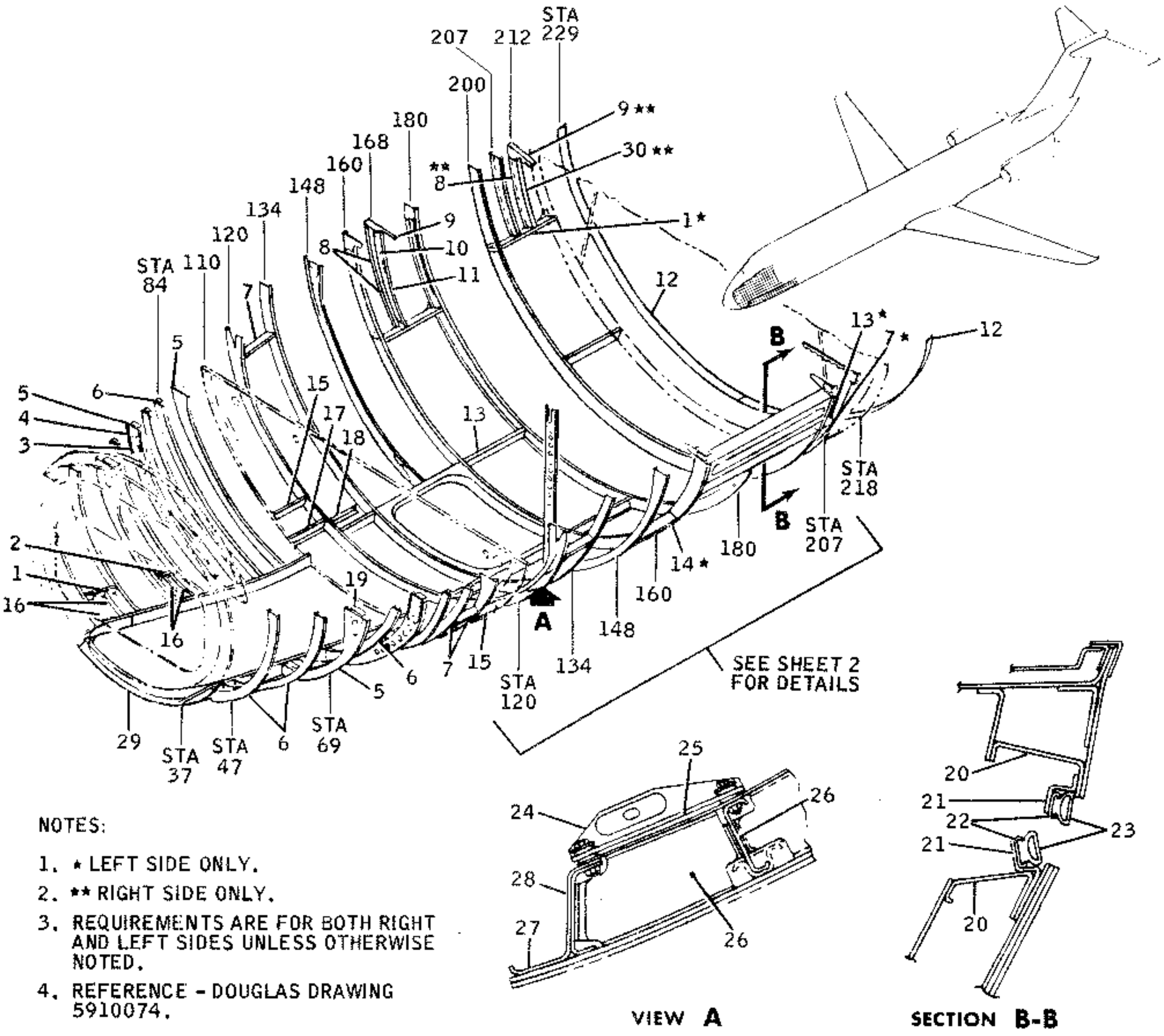


SECTION M-M

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	GUSSET	.063	CLAD 7075-T6	11	FITTING, 5911373, -1, -2		BAR 2014-T651
2	FRAME	.125	CLAD 7075-T6	12	FITTING, 5911372-1		STEEL 4140
3	ANGLE		STEEL SHEET 4130	13	SILL, 5613731-1, -2		BAR 2014-T6
4	GUSSET	.090	CLAD 7075-T6	14	SKIN	.071	CLAD 7075-T6
5	FITTING, 3642944-1, -2		BAR 2014-T6	15	SILL, 5913730-1, -2		BAR 2014-T6
6	FITTING, 3642943-1, -2		BAR 2014-T6	16	FITTING, 5912067-1, -2		STEEL BAR 4140
7	ANGLE	.090	CLAD 7075-T6	17	ZEE	.090	CLAD 7075-T6
8	CLIP	.080	CLAD 7075-T6	18	DOUBLER	.090	CLAD 7075-T6
9	ZEE	.071	CLAD 7075-T6	19	DOUBLER, 3916850-1, -2	.090	STEEL SHEET 4130
10	WEB	.071	CLAD 7075-T6	20	DOUBLER	.071	CLAD 7075-T6

BB3-557

Frames and Intercostals, Nose Upper Section,
Station 37 to 229 -- Type A
Figure 1 (Sheet 8)



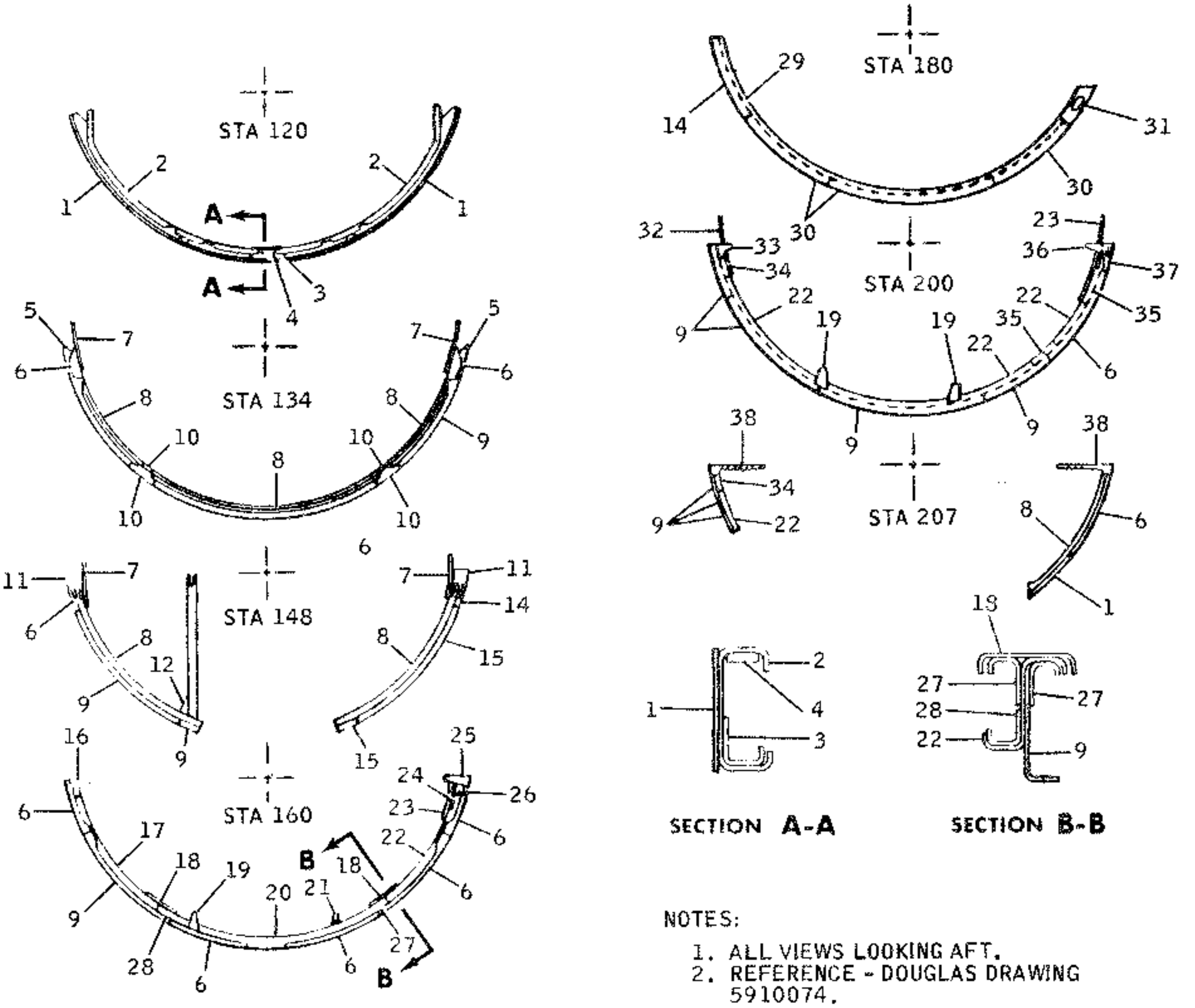
NOTES:

1. * LEFT SIDE ONLY.
2. ** RIGHT SIDE ONLY.
3. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES UNLESS OTHERWISE NOTED.
4. REFERENCE - DOUGLAS DRAWING 5910074.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 2024-T42	16	INTERCOSTAL	.050	CLAD 2024-T3
2	INTERCOSTAL	.040	CLAD 2024-T3	17	FITTING		3912476-1, -2
3	DOUBLER	.040	CLAD 7075-T6	18	TEE		2506869
4	FITTING		4912951-1, -2	19	ANGLE	.080	CLAD 7075-T6
5	FRAME	.050	CLAD 7075-T6	20	INTERCOSTAL	.090	CLAD 7075-T6
6	FRAME	.040	CLAD 7075-T6	21	SUPPORT	.063	CLAD 2024-T42
7	INTERCOSTAL	.040	CLAD 7075-T6	22	RETAINER		2915786
8	SHEAR CLIP	.063	CLAD 2014-T6	23	SEAL		SILICONE RUBBER
9	FITTING		2614618	24	BRACKET		CRES 17-4PH
10	STIFFENER	.090	CLAD 7075-T6	25	DOUBLER	.050	CLAD 2024-T42
11	FRAME	.090	CLAD 2024-T42	26	FRAME	.050	CLAD 2024-T42
12	STRAP	.071	CLAD 7075-T6	27	JAMB PAN	.063	CLAD 2024-T42
13	INTERCOSTAL	.063	CLAD 7075-T6	28	FRAME	.071	CLAD 2024-T42
14	INTERCOSTAL	.050	CLAD 7075-T6	29	JAMB	.050	CLAD 2024-T42
15	INTERCOSTAL	.071	CLAD 7075-T6	30	FRAME	.063	CLAD 7075-T6

BB3-828

Frames and Intercostals, Nose Lower Section,
Station 37 to 229 -- Type A
Figure 2 (Sheet 1)



NOTES:

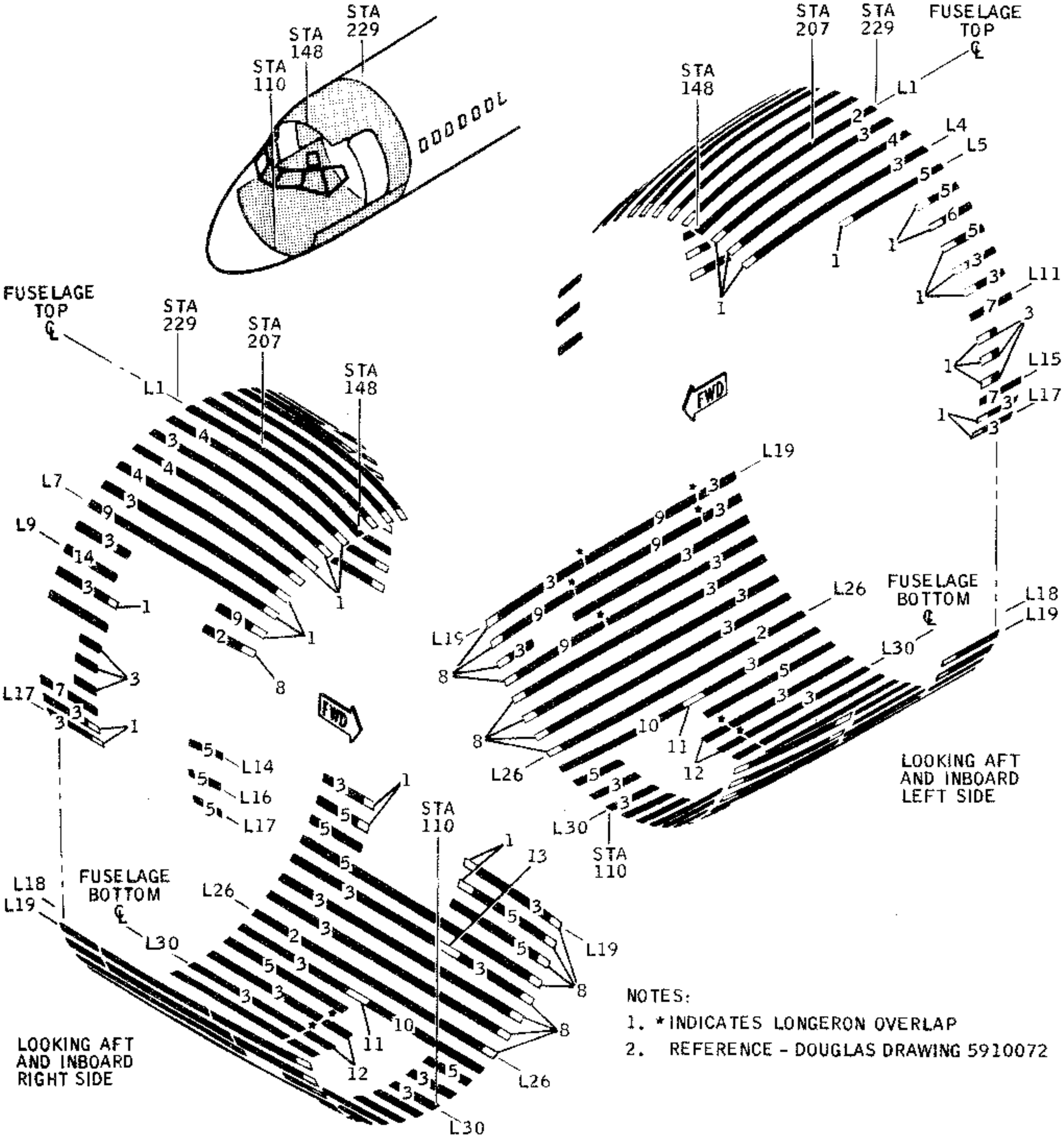
1. ALL VIEWS LOOKING AFT.
2. REFERENCE - DOUGLAS DRAWING 5910074.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SHEAR CLIP	.050	CLAD 2014-T6	20	FRAME	.071	CLAD 2024-T42
2	FRAME	.050	CLAD 7075-T6	21	FITTING		PLATE 7075-T651
3	SPLICE ANGLE	.050		22	FRAME	.090	CLAD 2024-T42
4	STRAP		1651402	23	CAP		STEEL PLATE 4130
5	FITTING		1298097	24	ANGLE	.090	CLAD 7075-T6
6	SHEAR CLIP	.071	CLAD 2014-T6	25	FITTING		STEEL BAR 4130
7	STRAP	.125	SHEET STEEL 4130	26	FITTING		STEEL PLATE 4130
8	FRAME	.063	CLAD 7075-T6	27	SPLICE ANGLE	.063	CLAD 2024-T42
9	SHEAR CLIP	.063	CLAD 2014-T6	28	SPLICE ANGLE	.080	CLAD 2024-T42
10	SPLICE ANGLE	.071	CLAD 7075-T6	29	FRAME		2777930
11	FITTING		2614618	30	CLIP	.050	CLAD 2014-T6
12	GUSSET	.063	CLAD 7075-T6	31	CHANNEL	.050	CLAD 7075-T6
13	POST	.050	CLAD 7075-T6	32	STRAP (4913568)	.250	STEEL PLATE 4130
14	CLIP	.071	CLAD 2014-T6	33	FITTING		2911391
15	CLIP	.063	CLAD 2014-T6	34	STIFFENER	.090	CLAD 7075-T6
16	FITTING		2614618	35	SPLICE ANGLE	.100	CLAD 2024-T42
17	FRAME		2777930-7	36	FITTING		STEEL BAR 4130
18	GUSSET	.080	CLAD 2024-T42	37	FITTING		STEEL PLATE 4130
19	CHANNEL	.080	CLAD 2024-T42	38	FITTING		2614618

BB3-844

Frames and Intercostals, Nose Lower Section,
Station 37 to 229 -- Type A
Figure 2 (Sheet 2)

Printed in U.S.A.



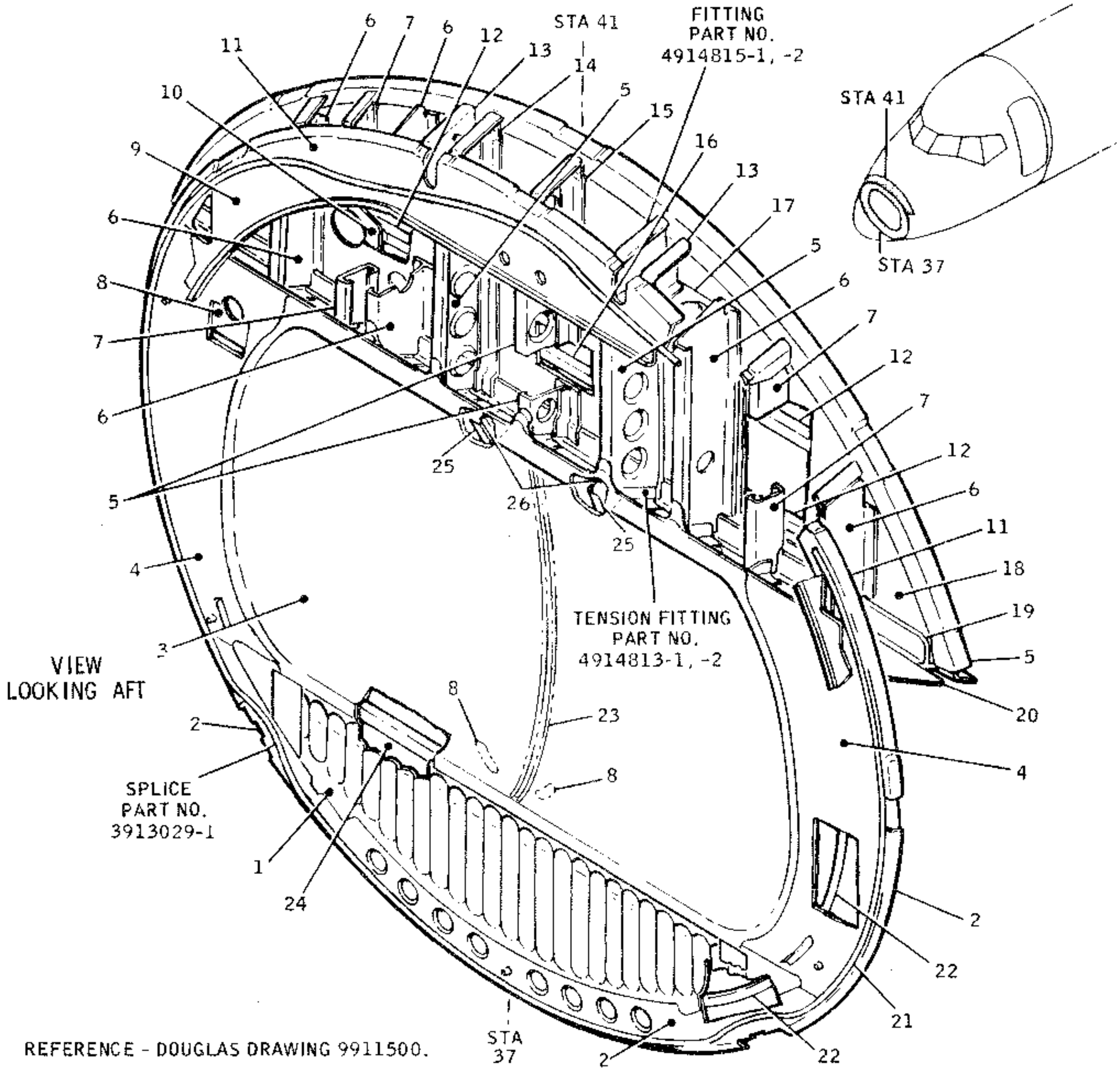
NOTES:

1. * INDICATES LONGERON OVERLAP
2. REFERENCE - DOUGLAS DRAWING 5910072

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLIP	.050	CLAD 7075-T6	8	CLIP	.063	CLAD 7075-T6
2	LONGERON		2777948-5	9	LONGERON	.063	CLAD 7075-T6
3	LONGERON		2777922-3	10	LONGERON		2777948
4	LONGERON		2777922-1	11	FITTING		2912099
5	LONGERON		2777922-4	12	LONGERON	.040	CLAD 7075-T6
6	LONGERON		2777922-5	13	FITTING	.875	CLAD 7075-T651
7	LONGERON		2777923	14	LONGERON	.050	CLAD 7075-T6

BB3-758

Longerons, Station 37 to 229 -- Type A
Figure 3

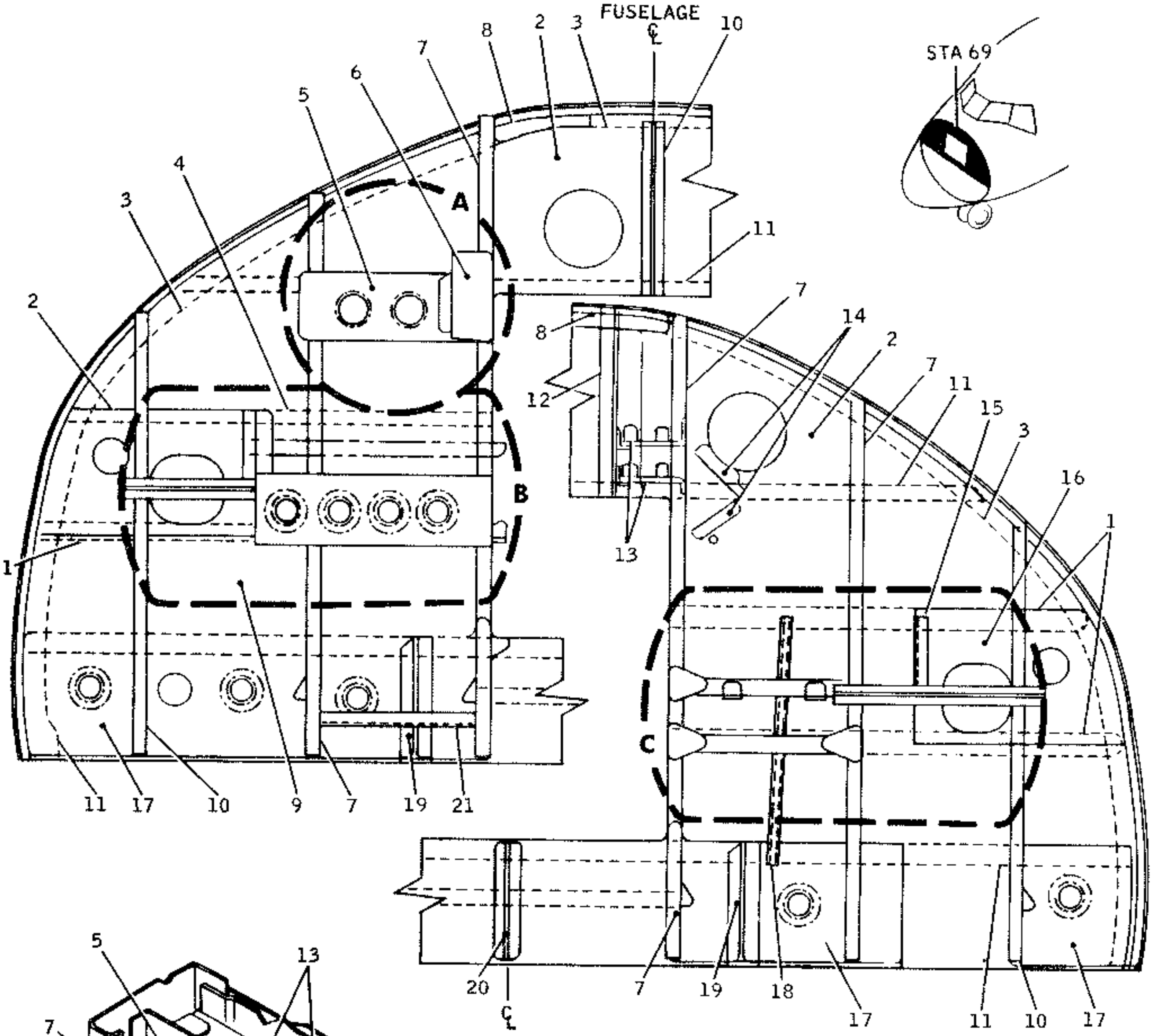


REFERENCE - DOUGLAS DRAWING 9911500.

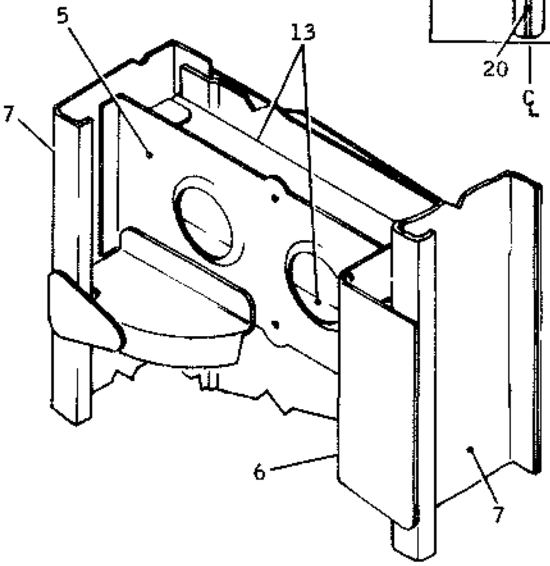
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.020	CLAD 2024-T42	14	ANGLE		1418201
2	FORMER	.050	CLAD 7075-T6	15	TEE		1482282
3	ANTENNA DISH	.025	CLAD 2024-T42	16	SUPPORT		1417096
4	WEB	.020	CLAD 2024-T3	17	INTERCOSTAL	.032	CLAD 7075-T6
5	FRAME	.080	CLAD 7075-T6	18	PANEL	.040	CLAD 2014-T6
6	BEAM		4594694	19	TEE		2914150
7	FRAME	.071	CLAD 7075-T6	20	SUPPORT	.063	CLAD 7075-T6
8	DOUBLER	.040	CLAD 2024-T3	21	SEAL		4913109-1
9	FRAME	.040	CLAD 7075-T6	22	ANGLE	.040	CLAD 7075-T6
10	DOUBLER	.040	CLAD 2014-T6	23	STIFFENER		1093777
11	ANGLE	.050	CLAD 7075-T6	24	STIFFENER	.040	CLAD 7075-T6
12	SUPPORT		1243092	25	ANGLE	.040	CLAD 2024-T42
13	INTERCOSTAL	.080	CLAD 7075-T6	26	SUPPORT	.040	CLAD 2024-T42

BB3-771

Bulkheads, Stations 37 and 41 -- Type A
Figure 4



VIEW LOOKING FORWARD
FUSELAGE STATION 69.



VIEW A

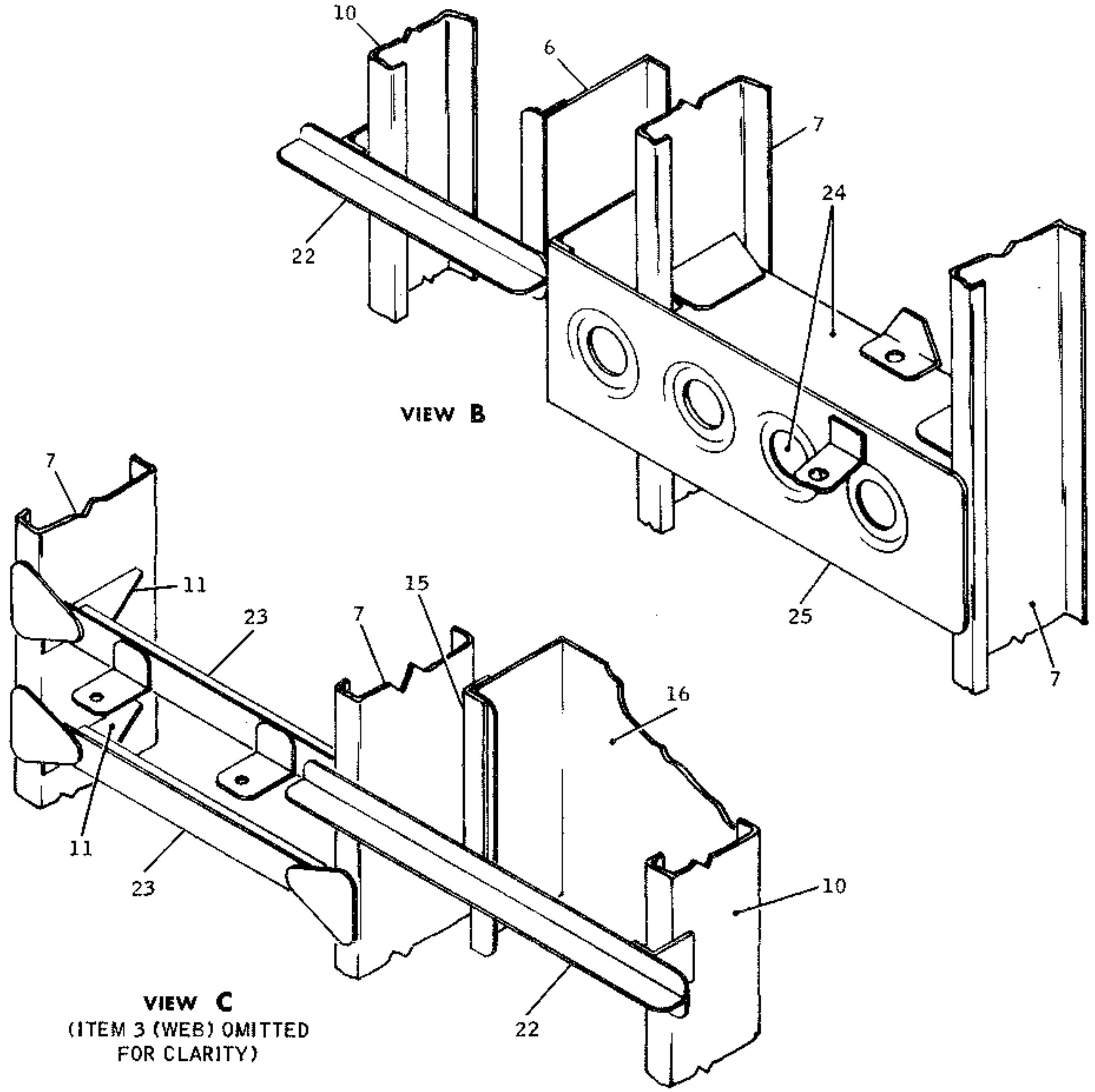
NOTES:

1. FOR MATERIAL IDENTIFICATION OF ITEMS AND FOR DETAIL VIEWS B AND C, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 9911503.

BB3-81

Printed in U.S.A.

Bulkhead, Station 69 -- Type A
Figure 5 (Sheet 1)



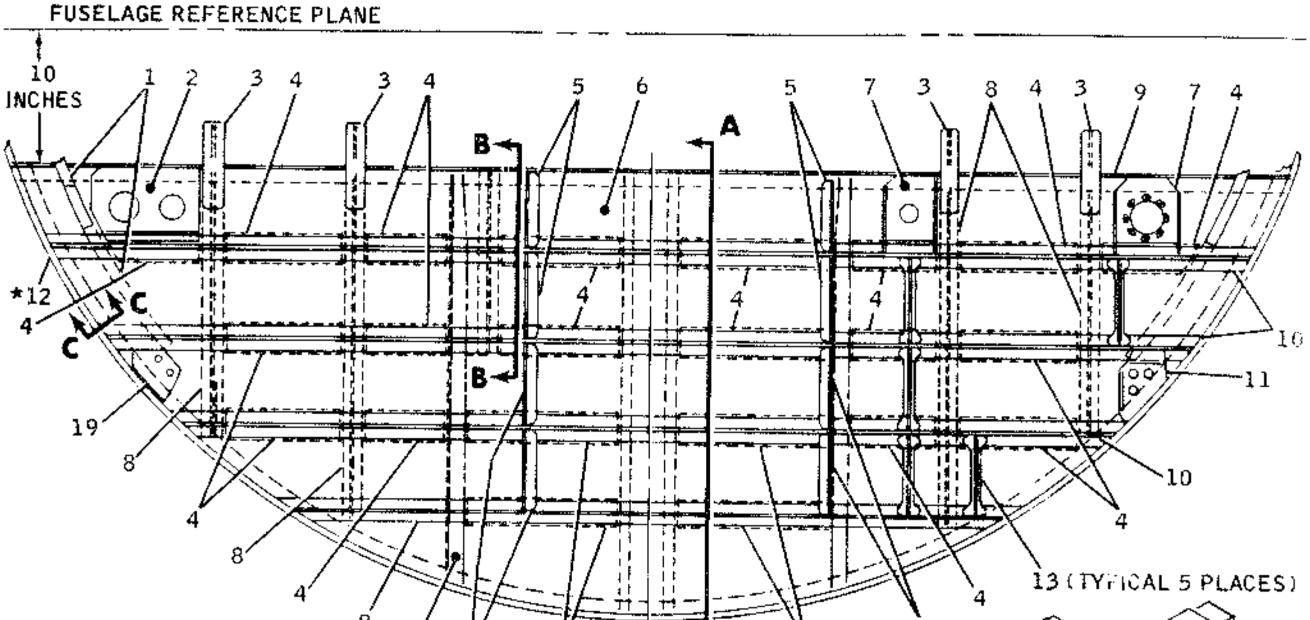
VIEW B

VIEW C
(ITEM 3 (WEB) OMITTED FOR CLARITY)

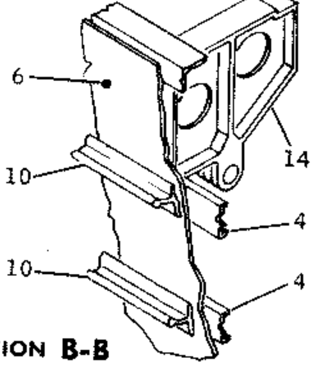
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ZEE	.090	CLAD 7075-T6
2	DOUBLER	.050	CLAD 2014-T6
3	FRAME	.100	CLAD 7075-T6
4	ANGLE		1249581
5	WEB	.071	CLAD 2024-T42
6	SUPPORT	.063	CLAD 7075-T6
7	CHANNEL	.071	CLAD 7075-T6
8	SPLICE ANGLE	.100	CLAD 7075-T6
9	WEB	.040	CLAD 7075-T6
10	CHANNEL	.063	CLAD 7075-T6
11	ANGLE		1287425
12	STIFFENER	.063	CLAD 7075-T6
13	INTERCOSTAL	.050	CLAD 7075-T6
14	SUPPORT	.050	CLAD 7075-T6
15	ANGLE		1125597
16	DOUBLER	.050	CLAD 2024-T3
17	DOUBLER	.050	CLAD 7075-T6
18	ZEE	.063	CLAD 7075-T6
19	FITTING		3912376-1
20	TEE		1329806
21	ANGLE		1415741
22	TEE		137058
23	CHANNEL		1417159
24	CHANNEL		1286684
25	WEB	.032	CLAD 7075-T6

BB3-97

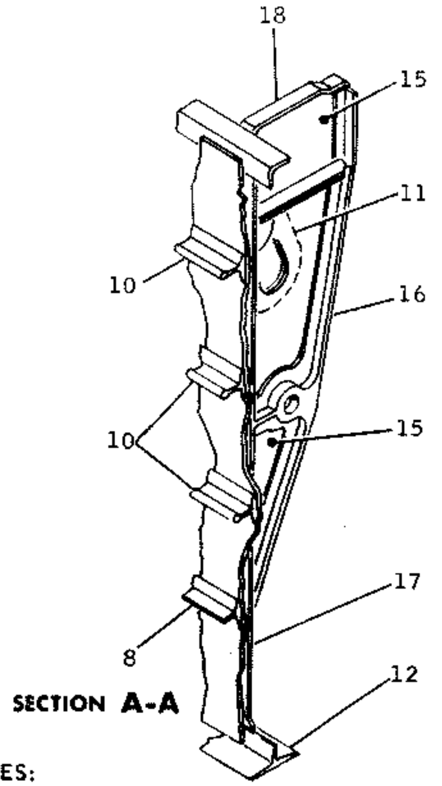
Bulkhead, Station 69 -- Type A
Figure 5 (Sheet 2)



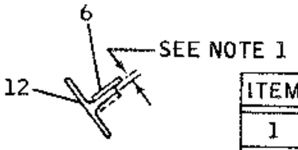
VIEW LOOKING FORWARD
FUSELAGE STATION 110



SECTION B-B



SECTION A-A



SECTION C-C

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP ANGLE		1419292
2	DOUBLER	.040	CLAD 7075-T6
3	STRAP	.125	CLAD 2024-T3
4	CHANNEL	.040	CLAD 2024-T3
5	ANGLE		1415595
6	WEB	.040	CLAD 2014-T6
7	DOUBLER	.040	CLAD 7075-T6
8	STIFFENER		4594694
9	ANGLE		2913108
10	STIFFENER		2777968
11	DOUBLER	.063	CLAD 7075-T6
*12	CAP TEE		2919896
13	TEE FITTING		1414813
14	FITTING		2014-T651
15	WEB	.040	CLAD 7075-T6
16	FITTING		2014-T651
17	CAP		1243327
18	CAP		167890
19	DOUBLER	.032	CLAD 7075-T6

NOTES:

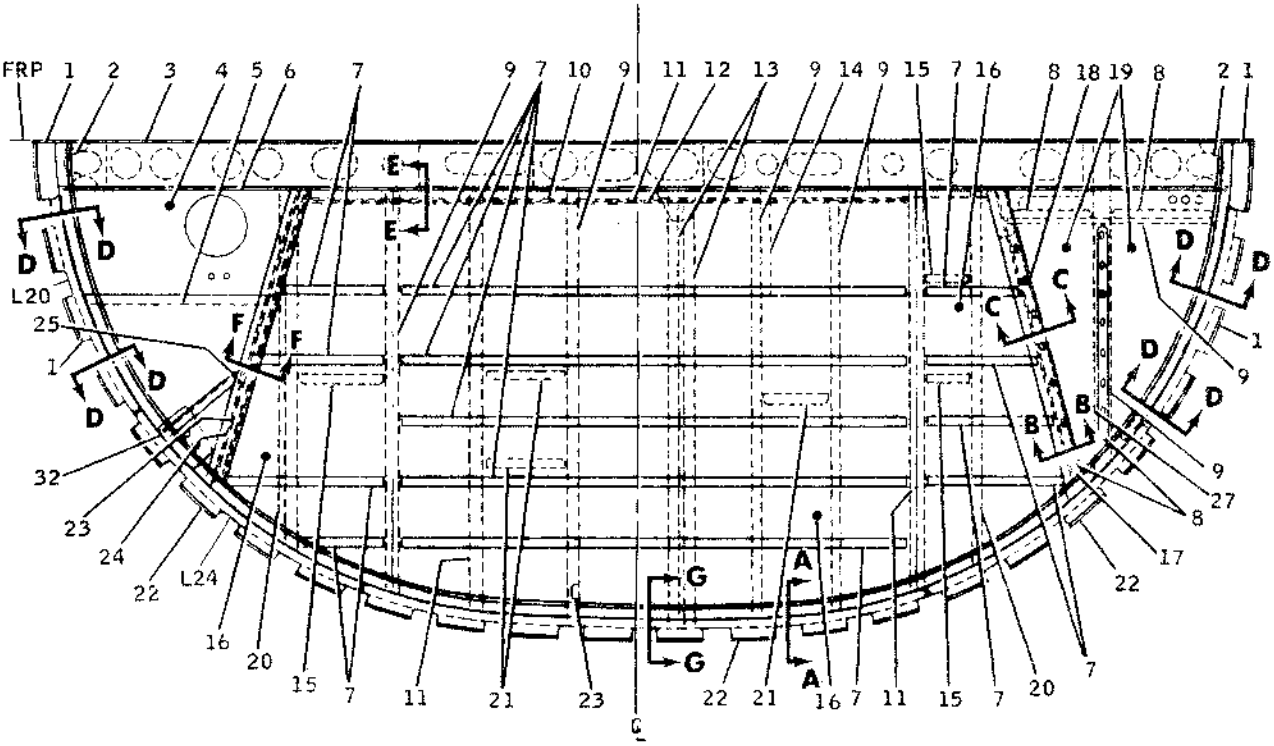
1.* TEE CHEM-MILLED TO .094 ± .008 FROM SECTION C-C. TO UPPER END

2. REFERENCE -DOUGLAS DRAWING 9911509.

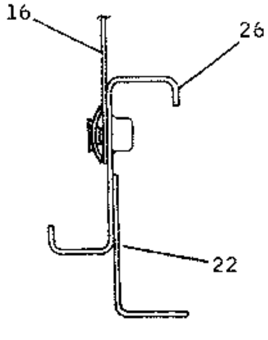
BB3-811

Bulkhead, Station 110 -- Type A
Figure 6

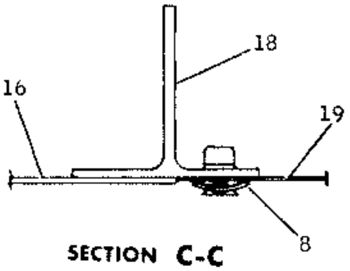
Printed in U.S.A.



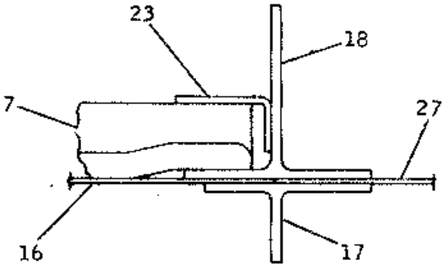
VIEW LOOKING FORWARD
FUSELAGE STATION 218



SECTION A-A
(TYPICAL)



SECTION C-C



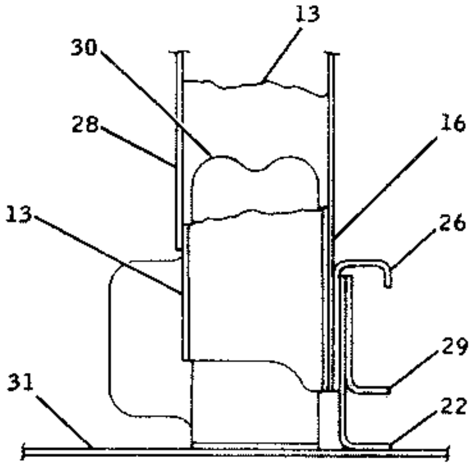
SECTION B-B

NOTES:

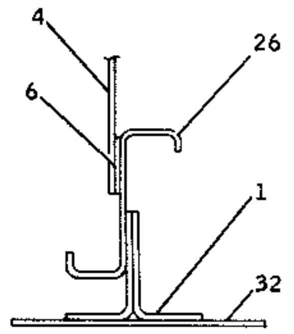
1. FOR MATERIAL IDENTIFICATION SEE SHEET 2.
2. FOR SECTION VIEWS D-D, E-E, F-F, AND G-G, SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 9911520.

BB3-83A

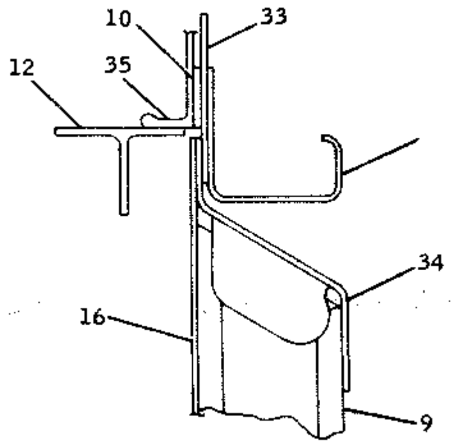
Bulkhead, Station 218 -- Type A
Figure 7 (Sheet 1)



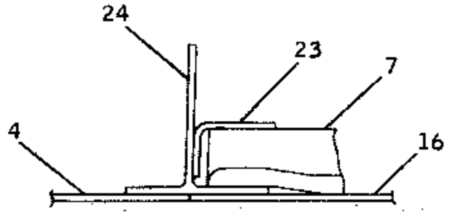
SECTION G-G



SECTION D-D



SECTION E-E

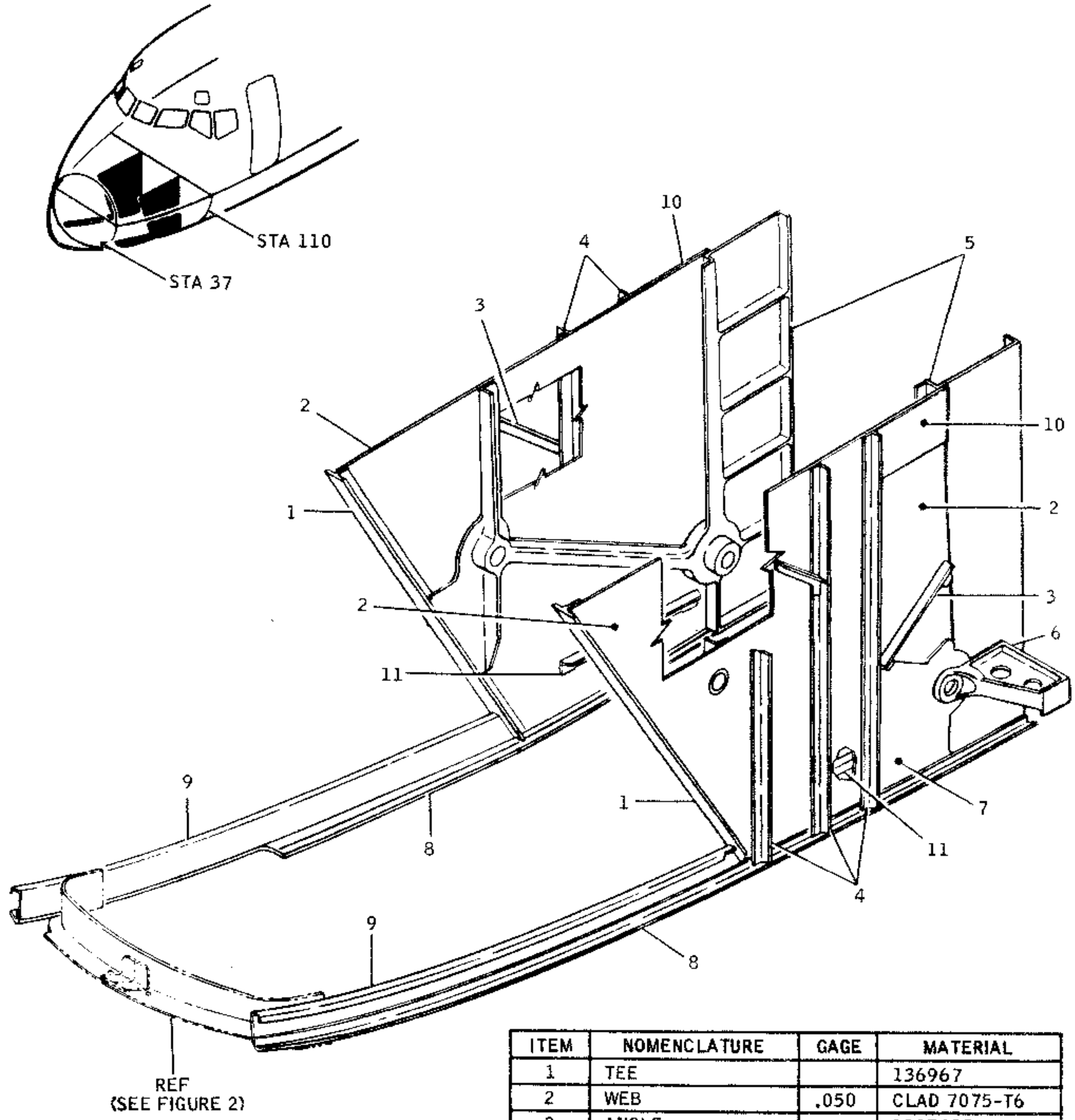


SECTION F-F

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 2014-T6	19	BLOWOUT PANEL	.012	GLASS FIBER LAMINATE
2	FITTING		2911391	20	CHANNEL	.063	CLAD 7075-T6
3	BEAM		2777896	21	ANGLE	.050	1418516
4	WEB	.050	CLAD 7075-T6	22	FORMER	.050	CLAD 2014-T6
5	STIFFENER		1199981	23	ANGLE	.063	CLAD 7075-T6
6	SPACER	.040	CLAD 7075-T6	24	TEE		1642726
7	ZEE	.050	CLAD 7075-T7	25	STIFFENER	.063	CLAD 7075-T6
8	TRIM STRIP		2706706	26	FRAME		2777930-5
9	CHANNEL	.050	CLAD 7075-T6	27	DOUBLER	.040	CLAD 7075-T6
10	SPACER	.050	CLAD 7075-T6	28	DOUBLER	.080	CLAD 7075-T6
11	CHANNEL	.071	CLAD 7075-T7	29	STIFFENER		1287425
12	TEE		1666744	30	JACK PAD ASSY		3914827-1
13	CHANNEL	.080	CLAD 7075-T6	31	DOUBLER	.063	CLAD 7075-T6
14	ZEE	.063	CLAD 7075-T6	32	DOUBLER	.050	CLAD 7075-T6
15	INTERCOSTAL	.050	CLAD 2024-T3	33	SPACER	.125	CLAD 7075-T6
16	WEB	.040	CLAD 7075-T6	34	ZEE	.090	CLAD 7075-T6
17	TEE		1329806	35	BEAM		2777897
18	TEE		1325214				

BB3-832

Bulkhead, Station 218 -- Type A
Figure 7 (Sheet 2)

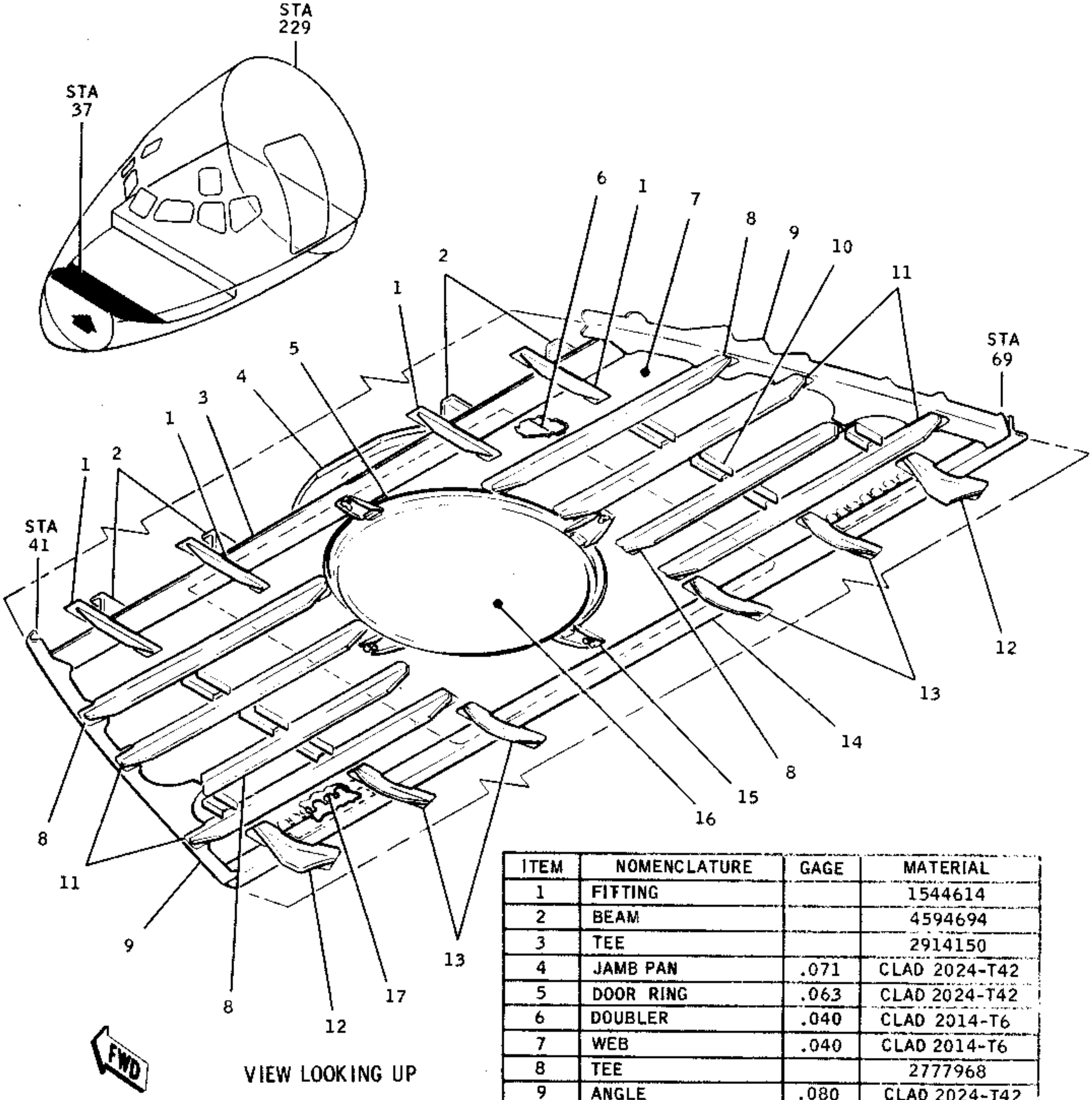


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		136967
2	WEB	.050	CLAD 7075-T6
3	ANGLE		1287425
4	ANGLE		1243787
5	FITTING	.500	PLATE 2014-T651
6	FITTING		FORGING 2014-T6
7	WEB	.040	TITANIUM DMS1592
8	TEE		1642531
9	BEAM	.050	CLAD 2024-T42
10	DOUBLER	.032	CLAD 7075-T6
11	ANGLE		1418201

REFERENCE- DOUGLAS DRAWING 9910088

BB3-829

Nose Gear Support Beam -- Type A
Figure 8



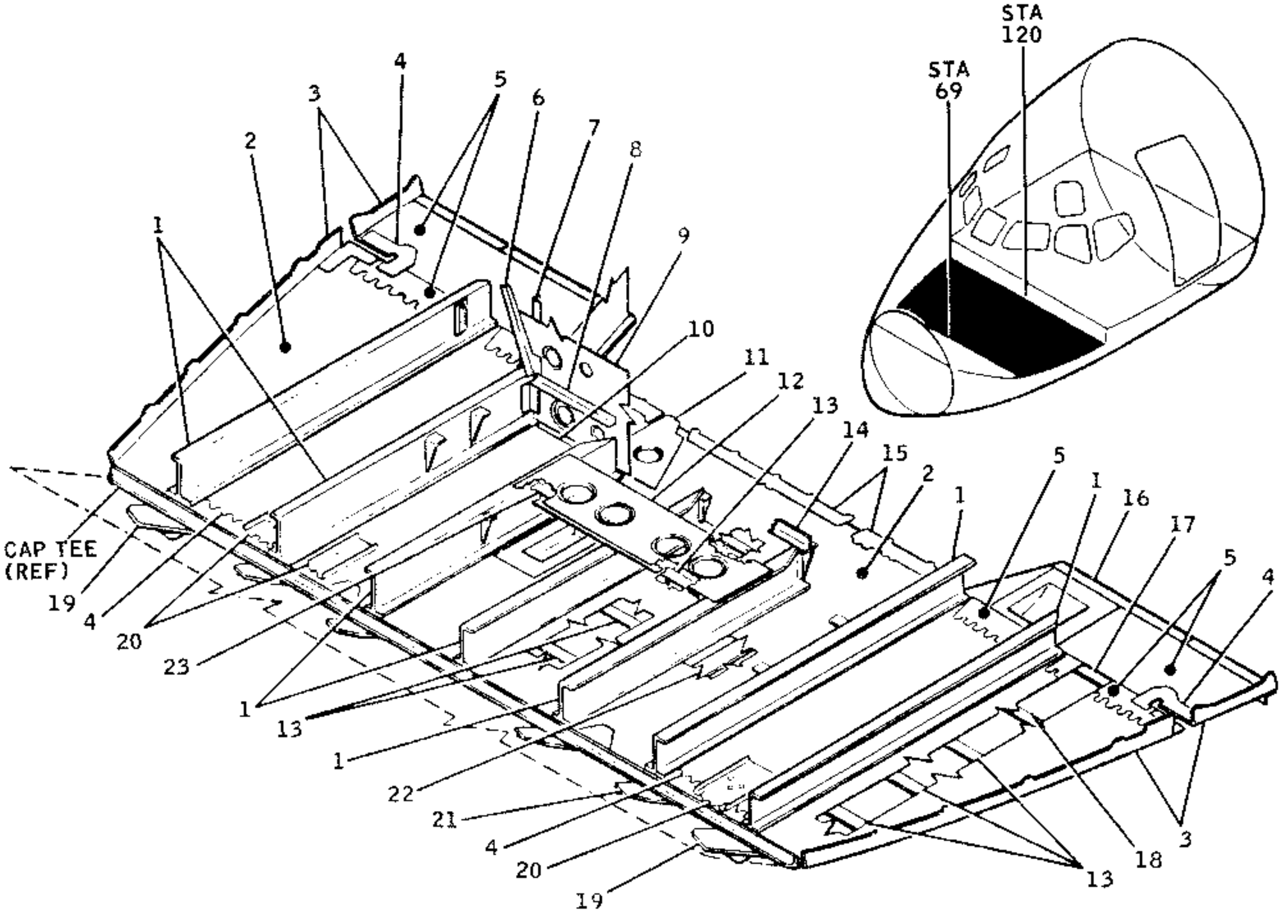
VIEW LOOKING UP

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		1544614
2	BEAM		4594694
3	TEE		2914150
4	JAMB PAN	.071	CLAD 2024-T42
5	DOOR RING	.063	CLAD 2024-T42
6	DOUBLER	.040	CLAD 2014-T6
7	WEB	.040	CLAD 2014-T6
8	TEE		2777968
9	ANGLE	.080	CLAD 2024-T42
10	CHANNEL (TYPICAL)	.040	CLAD 2024-T3
11	TEE		2613702
12	FITTING		4956878-1
13	FITTING		4956880-1
14	TEE		2914151
15	LATCH CHANNEL	.050	CLAD 2024-T3
16	DOOR PAN	.063	CLAD 2024-T42
17	DOUBLER	.032	CLAD 2024-T3

REFERENCE - DOUGLAS DRAWING 9910073

BB3-85

Pressure Panel, Station 41 to 69 -- Type A
Figure 9

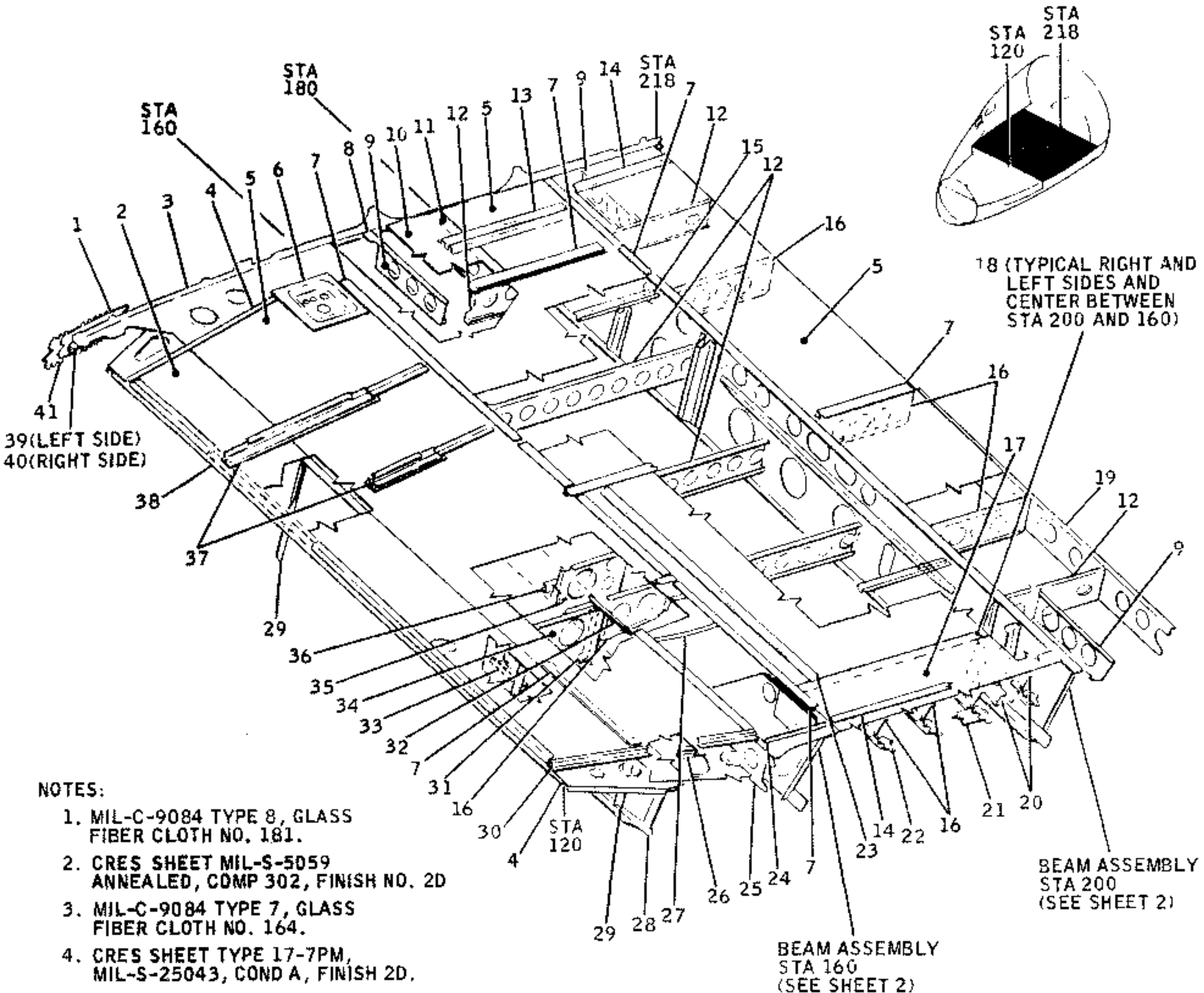


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BEAM		4594694
2	WEB	.040	CLAD 2014-T6
3	SUPPORT ANGLE	.080	CLAD 2024-T42
4	DOUBLER	.032	CLAD 2024-T3
5	WEB	.032	CLAD 2024-T3
6	ANGLE		1464575
7	ANGLE		1249243
8	ANGLE		1418516
9	WEB	.025	CLAD 2024-T42
10	TEE		1249240
11	DOUBLER	.050	CLAD 2024-T42
12	WEB	.032	CLAD 7075-T6
13	STIFFENER		2777968
14	TEE		1646170
15	STRIP	.032	CLAD 7075-T6
16	PAN	.032	SHEET 6061-T3
17	SUPPORT ANGLE		2913108
18	STIFFENER		2613702
19	FITTING		4956878-1
20	CHANNEL	.050	CLAD 2024-T42
21	FITTING (TYPICAL)		4956880-1
22	CAP TEE		1245835
23	CHANNEL	.063	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWING 9910073

BB3-86

Pressure Panel and Floor Support Structure,
Station 69 to 120 -- Type A
Figure 10



NOTES:

1. MIL-C-9084 TYPE 8, GLASS FIBER CLOTH NO. 181.
2. CRES SHEET MIL-S-5059 ANNEALED, COMP 302, FINISH NO. 2D
3. MIL-C-9084 TYPE 7, GLASS FIBER CLOTH NO. 164.
4. CRES SHEET TYPE 17-7PM, MIL-S-25043, COND A, FINISH 2D.
5. RIGHT SIDE SHOWN, LEFT SIDE OPPOSITE.

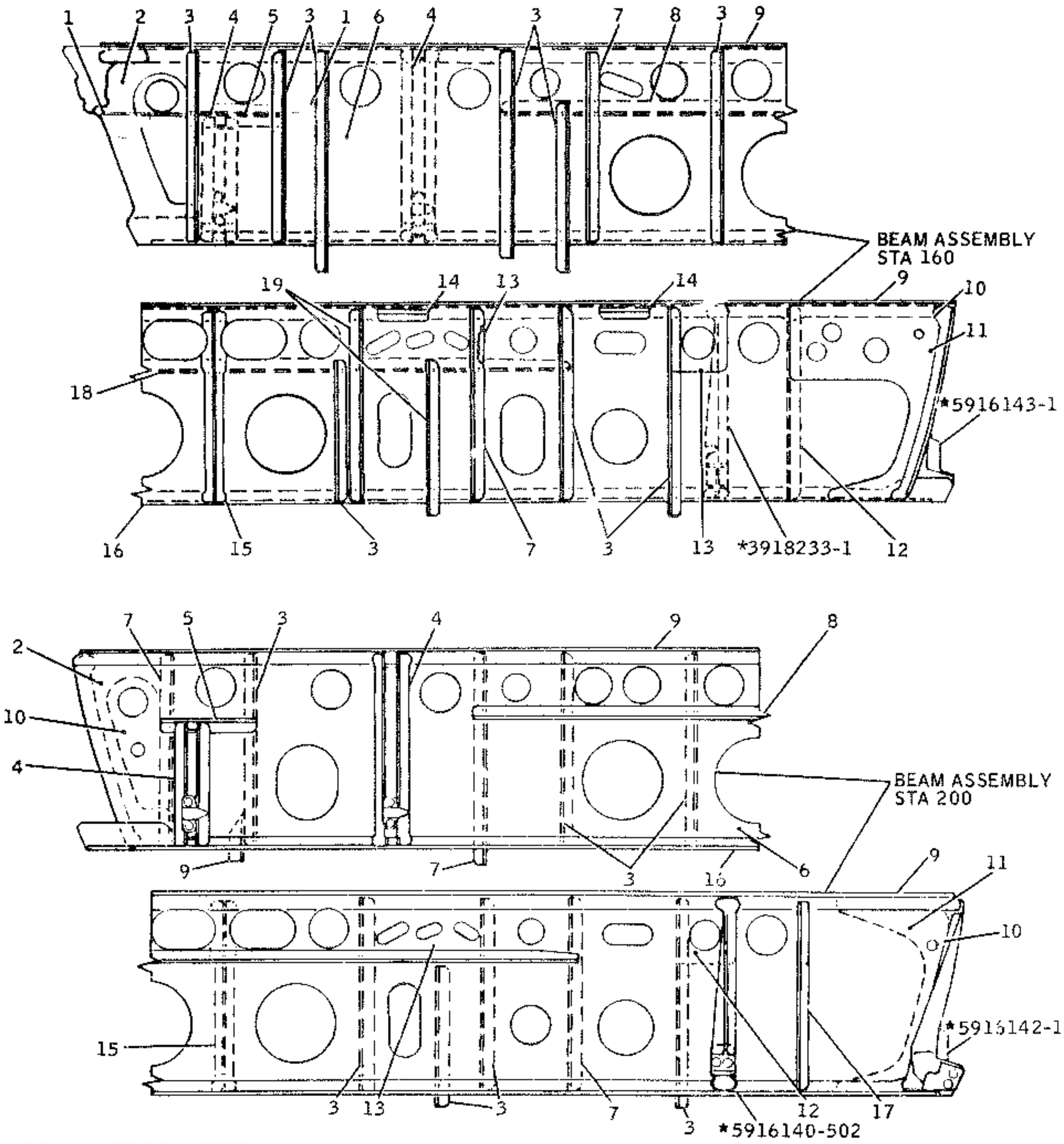
REFERENCE - DOUGLAS DRAWING 9910078

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.080	CLAD 7075-T6
2	DIAPHRAGM	.020	CLAD 2024-T4
3	UPPER CUSP ANGLE	.071	CLAD 7075-T6
4	SUPPORT		SEE NOTE 1
5	DIAPHRAGM	.020	CLAD 7075-T6
6	PAN	.025	SEE NOTE 2
7	SUPPORT		2652479
8	FITTING		2614618
9	BEAM	.071	CLAD 7075-T6
10	DOUBLER	.032	CLAD 7075-T6
11	FITTING		3912825-1
12	INTERCOSTAL	.063	CLAD 7075-T6
13	THERMAL BARRIER		SEE NOTE 3
14	SUPPORT		4616493
15	HAT		2777922-3
16	INTERCOSTAL	.050	CLAD 7075-T6
17	DIAPHRAGM	.040	CLAD 7075-T6
18	TEE		1414813
19	BEAM		2777896
20	INTERCOSTAL	.050	CLAD 2024-T3
21	CLIP	.090	CLAD 7075-T6
22	FITTING (TYPICAL)		3916393-1, -501, -503, AND -505

ITEM	NOMENCLATURE	GAGE	MATERIAL
23	HAT	.050	CLAD 2024-T4
24	ANGLE	.071	CLAD 2024-T4
25	BEAM		2614462
26	CHANNEL	.050	CLAD 2024-T4
27	STRAP	.040	CLAD 7075-T6
28	BEAM		4594047
29	STIFFENER (TYPICAL)		1294834
30	SUPPORT	.063	CLAD 7075-T6
31	ANGLE	.063	CLAD 7075-T6
32	ANGLE		1329780
33	STIFFENER		1415595
34	INTERCOSTAL	.040	CLAD 7075-T6
35	INTERCOSTAL	.040	CLAD 2024-T4
36	CHANNEL	.040	CLAD 2024-T4
37	SEAT TRACK		2912399 (SEE NOTE 5)
38	SUPPORT		1250426
39	LOWER CUSP ANGLE	.063	SEE NOTE 4
40	LOWER CUSP ANGLE	.090	CLAD 7075-T6
41	DOUBLER	.025	CLAD 2014-T6

BB3-864

Floor Support Structure, Station 120 to 218 -- Type A
Figure 11 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SUPPORT	.032	CLAD 2024-T3	10	ANGLE		1619970
2	DOUBLER	.050	CLAD 2024-T42	11	DOUBLER	.063	CLAD 2024-T42
3	STIFFENER		1415595	12	STIFFENER	.063	CLAD 7075-T6
4	SUPPORT	.050	CLAD	13	DOUBLER	.040	CLAD 7075-T6
5	ANGLE		119206	14	ANGLE		1286845
6	WEB	.032	CLAD 7075-T6	15	TEE		1430824
7	STIFFENER		1464575	16	CAP		2777897
8	STIFFENER		1242526	17	SUPPORT	.063	CLAD 7075-T6
9	TEE		1414813	18	STIFFENER		1109080
				19	STIFFENER		1093703

* STAIRWAY SUPPORT

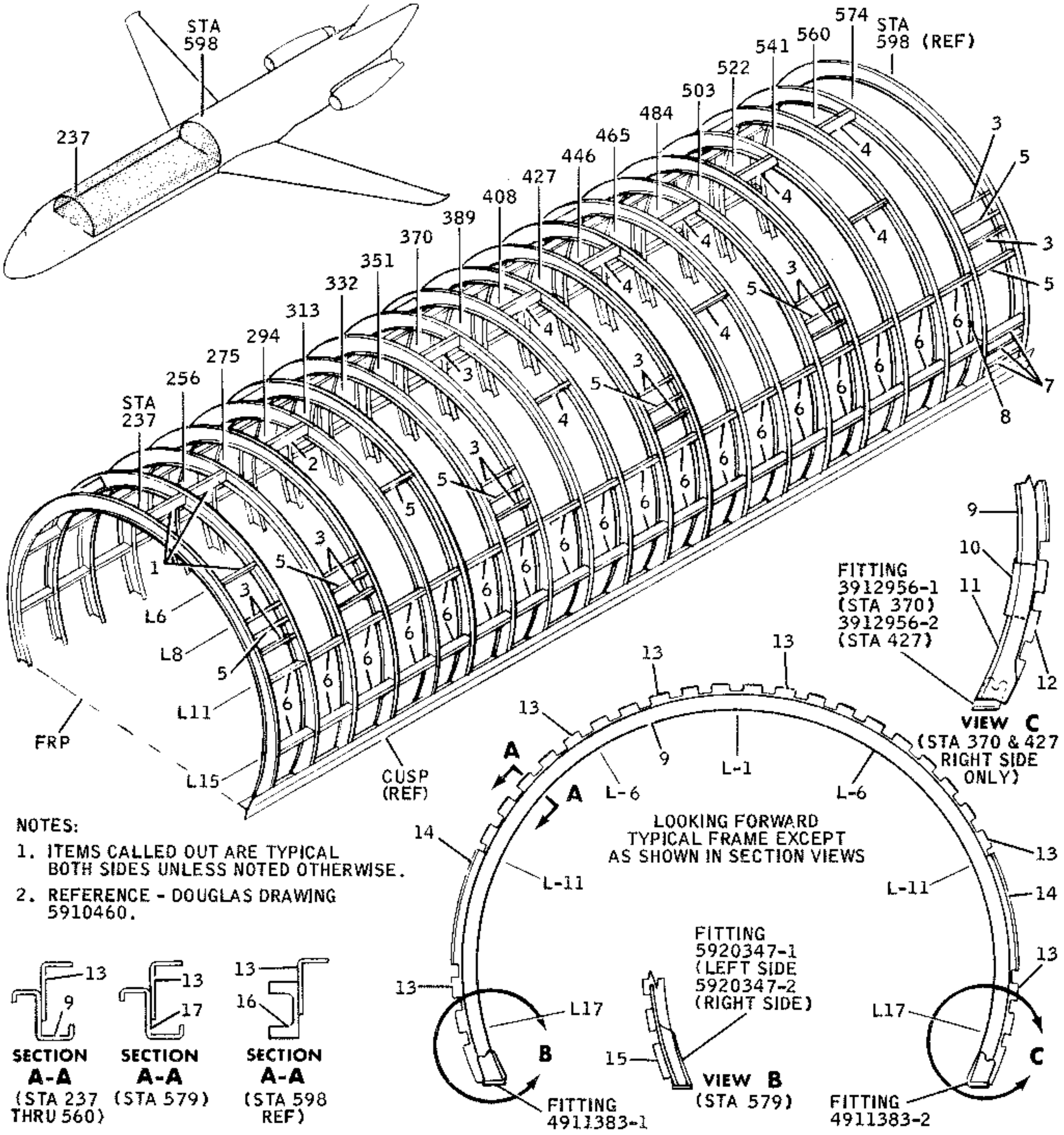
BB3-865

Floor Support Structure, Station 120 to 218 -- Type A
Figure 11 (Sheet 2)

FUSELAGE SECTION, STATION 229 to 588 - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures illustrate the structural components of the fuselage section from station 229 to 588. The materials used are identified in the material lists by item number callouts.



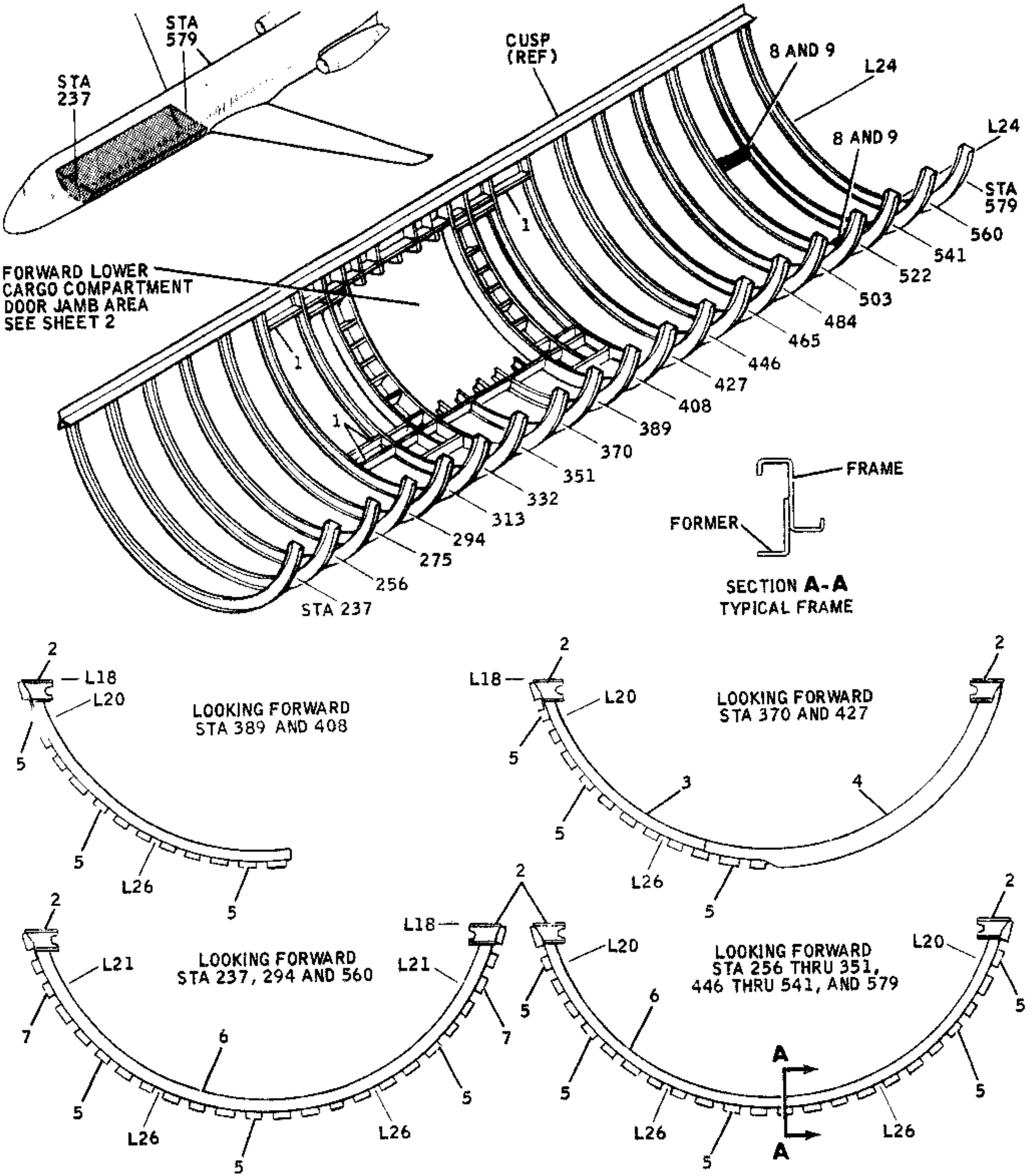
NOTES:

1. ITEMS CALLED OUT ARE TYPICAL BOTH SIDES UNLESS NOTED OTHERWISE.
2. REFERENCE - DOUGLAS DRAWING 5910460.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	10	SPLICE	.063	CLAD 7075-T6
2	INTERCOSTAL		2912412-2	11	FRAME	.080	CLAD 7075-T6
3	INTERCOSTAL	.032	CLAD 7075-T6	12	FORMER	.063	CLAD 2014-T6
4	INTERCOSTAL	.020	CLAD 7075-T6	13	FORMER	.050	CLAD 2014-T6
5	INTERCOSTAL	.025	CLAD 7075-T6	14	FORMER		2912538
6	INTERCOSTAL		2912901-5	15	FORMER	.071	CLAD 2014-T6
7	INTERCOSTAL	.040	CLAD 7075-T6	16	FRAME		1387619
8	STRAP		165402	17	FRAME		2777930-7
9	FRAME		2777930-5				

BB3-776

Frames and Intercostals, Station 229 to 588, Upper Section -- Type A
Figure 1

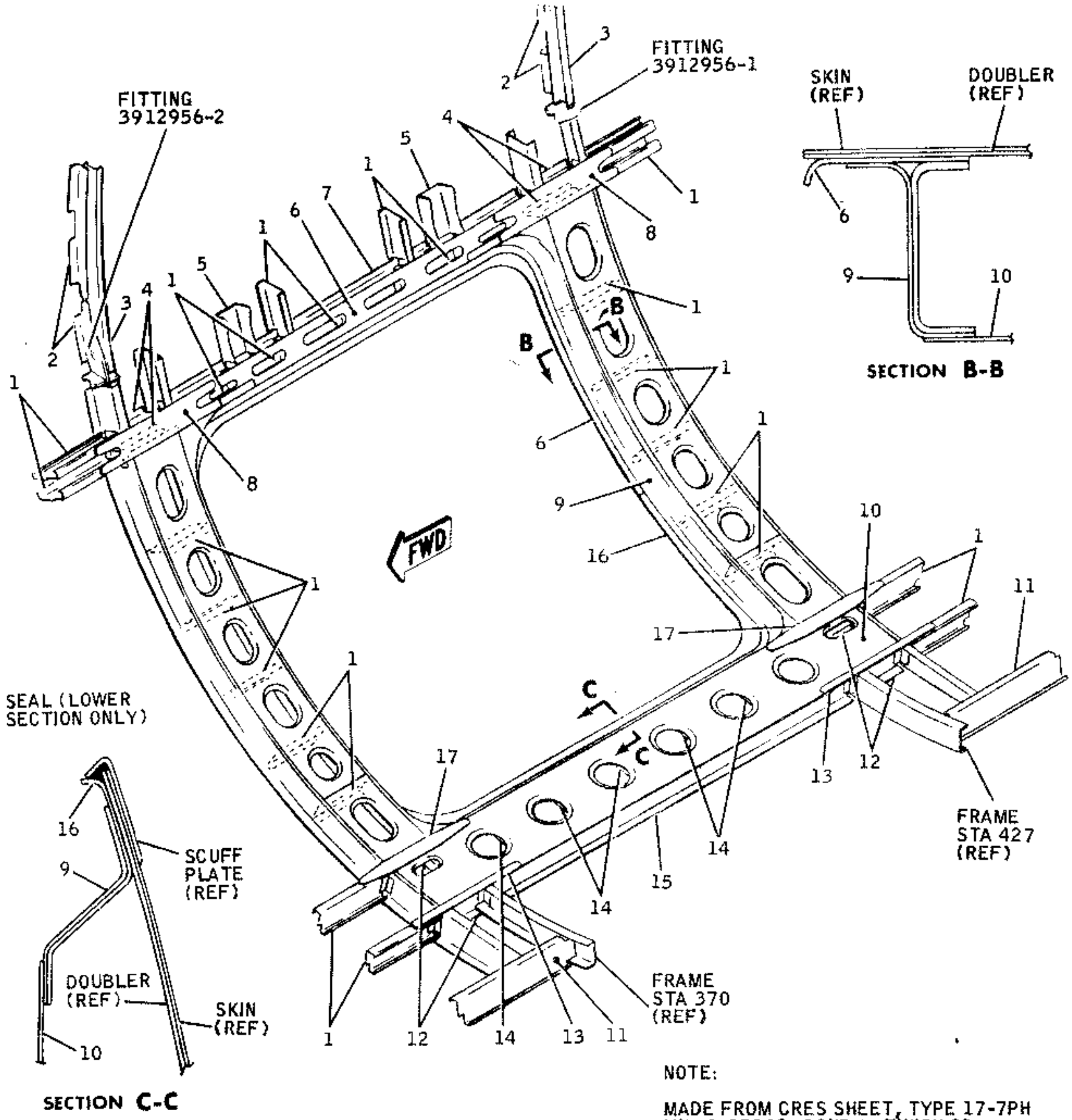


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	6	FRAME		2777930-5
2	FITTING		2911391	7	FORMER	.063	CLAD 2014-T6
3	FRAME		2777930-7	8	INTERCOSTAL	.063	CLAD 7075-T6
4	FORMER	.125	CLAD 2024-T42	9	SUPPORT	1.500	PLATE 7075-T651
5	FORMER	.050	CLAD 2014-T6				

REFERENCE - DOUGLAS DRAWINGS 5910460,5920323 AND 5920927.

BB3-777A

Frames and Intercostals, Station 229 to 588, Lower Section -- Type A
Figure 2 (Sheet 1)



NOTE:

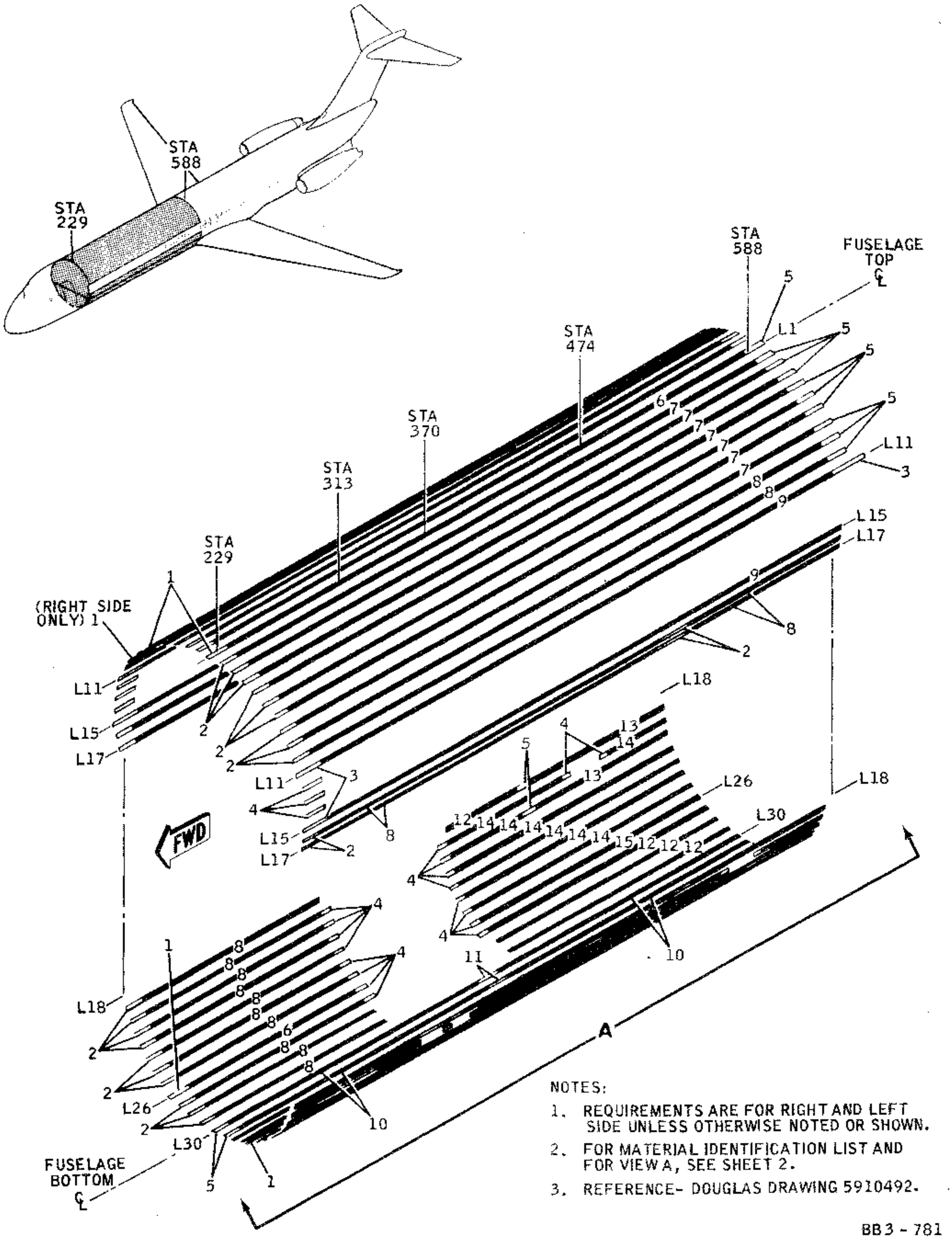
MADE FROM CRES SHEET, TYPE 17-7PH MIL-S-25043, COND A, FINISH 2D.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.063	CLAD 7075-T6	10	WEB	.040	CLAD 2024-T42
2	FORMER	.050	CLAD 2014-T6	11	INTERCOSTAL	.040	CLAD 7075-T6
3	FRAME	.063	CLAD 7075-T6	12	INTERCOSTAL	.090	CLAD 2024-T42
4	INTERCOSTAL	.071	CLAD 2024-T42	13	GUSSET	.125	STEEL BAR 4130
5	BRACKET	.090	CLAD 7075-T6	14	INTERCOSTAL	.050	CLAD 2024-T42
6	UPPER DEPRESSOR	.080	CLAD 2024-T42	15	INTERCOSTAL	.100	CLAD 7075-T6
7	INTERCOSTAL	.071	CLAD 7075-T6	16	LOWER DEPRESSOR	.080	SEE NOTE
8	GUSSET	.125	CLAD 2024-T3	17	GUSSET	.125	CLAD 2024-T42
9	PAN	.050	CLAD 2024-T42				

REFERENCE - DOUGLAS DRAWING 5910142

BB3-780

Frames and Intercostals, Station 229 to 588, Lower Section -- Type A
Figure 2 (Sheet 2)

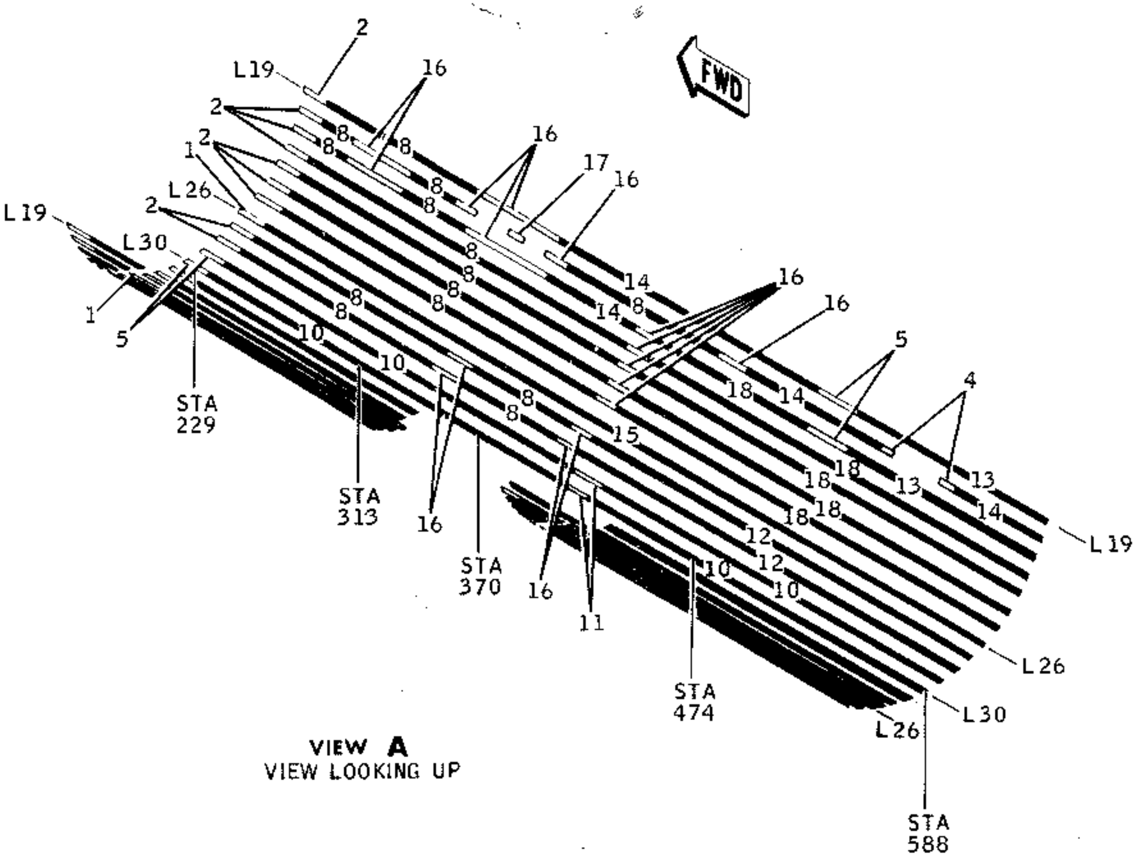


NOTES:

1. REQUIREMENTS ARE FOR RIGHT AND LEFT SIDE UNLESS OTHERWISE NOTED OR SHOWN.
2. FOR MATERIAL IDENTIFICATION LIST AND FOR VIEW A, SEE SHEET 2.
3. REFERENCE- DOUGLAS DRAWING 5910492.

BB3 - 781

Longerons, Station 229 to 588 -- Type A
Figure 3 (Sheet 1)

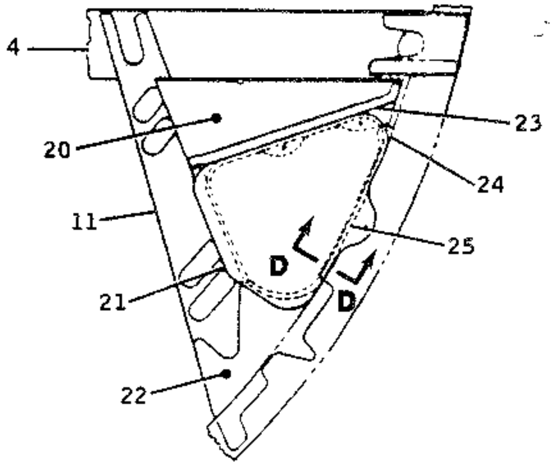


VIEW **A**
VIEW LOOKING UP

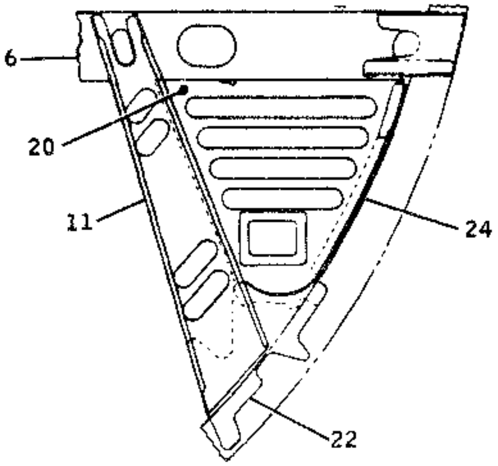
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	.071	CLAD 7075-T6	10	LONGERON	.875	PLATE 7075-T651
2	FITTING	.050	CLAD 7075-T6	11	SPLICE		2641454
3	SPLICE	.071	CLAD 7075-T6	12	LONGERON		2912727
4	CLIP	.050	CLAD 7075-T6	13	LONGERON		2923869
5	SPLICE		2912099	14	LONGERON		2777922-5
6	LONGERON		2777948-5	15	LONGERON		2777948
7	LONGERON		2777922-1	16	SPLICE	.050	CLAD 7075-T6
8	LONGERON		2777922-3	17	CLIP		2777948
9	LONGERON		2777923-5	18	LONGERON		2777922-4

BB3-782

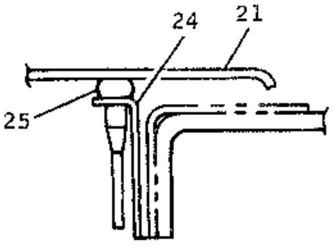
Longerons, Station 229 to 588 -- Type A
Figure 3 (Sheet 2)



VIEW B
(LOOKING FORWARD AT STATION 370)

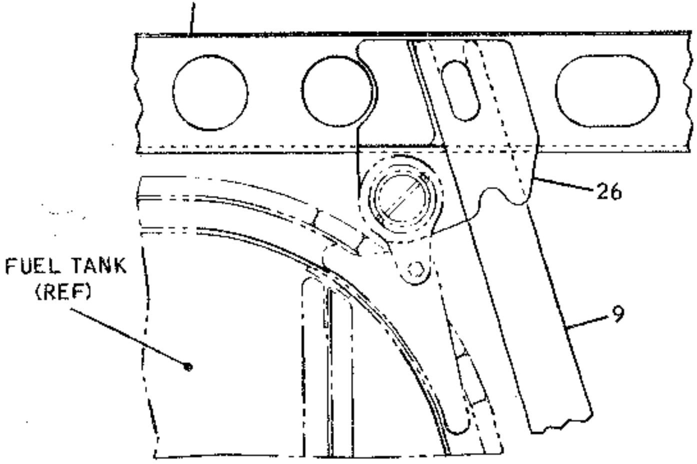


VIEW C
(LOOKING FORWARD AT STATION 427)



SECTION D-D

4 AT STATION 579;
6 AT STATIONS 560,
522 AND 503



SECTION E-E
(TYPICAL FOR STATIONS 503,
522, 560 AND 579)

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP TEE		2777976	14	SUPPORT	.050	CLAD 2024-T42
2	ZEE		4616493	15	GUSSET	.050	CLAD 7075-T6
3	WEB	.020	CLAD 7075-T6	16	INTERCOSTAL	.025	CLAD 2024-T42
4	BEAM		2777897	17	INTERCOSTAL	.032	CLAD 2024-T42
5	ZEE	.050	CLAD 2024-T3	18	CAP		2652479
6	BEAM		2777896	19	CHANNEL	.063	CLAD 2024-T42
7	INTERCOSTAL	.040	CLAD 7075-T6	20	WEB	.032	CLAD 2024-T3
8	ANGLE		1242520	21	DOOR	.040	CLAD 2024-T42
9	STRUT	.071	CLAD 7075-T6	22	GUSSET	.080	CLAD 7075-T6
10	ANGLE		1276248	23	ATTACH PLATE	.050	CLAD 2024-T3
11	STRUT	.063	CLAD 7075-T6	24	ANGLE	.032	CLAD 2024-T42
12	ANGLE		1329780	25	SEAL		SILICONE RUBBER
13	INTERCOSTAL	.040	CLAD 2024-T42	26	SUPPORT		3920928

REFERENCE - DOUGLAS DRAWING 5910137

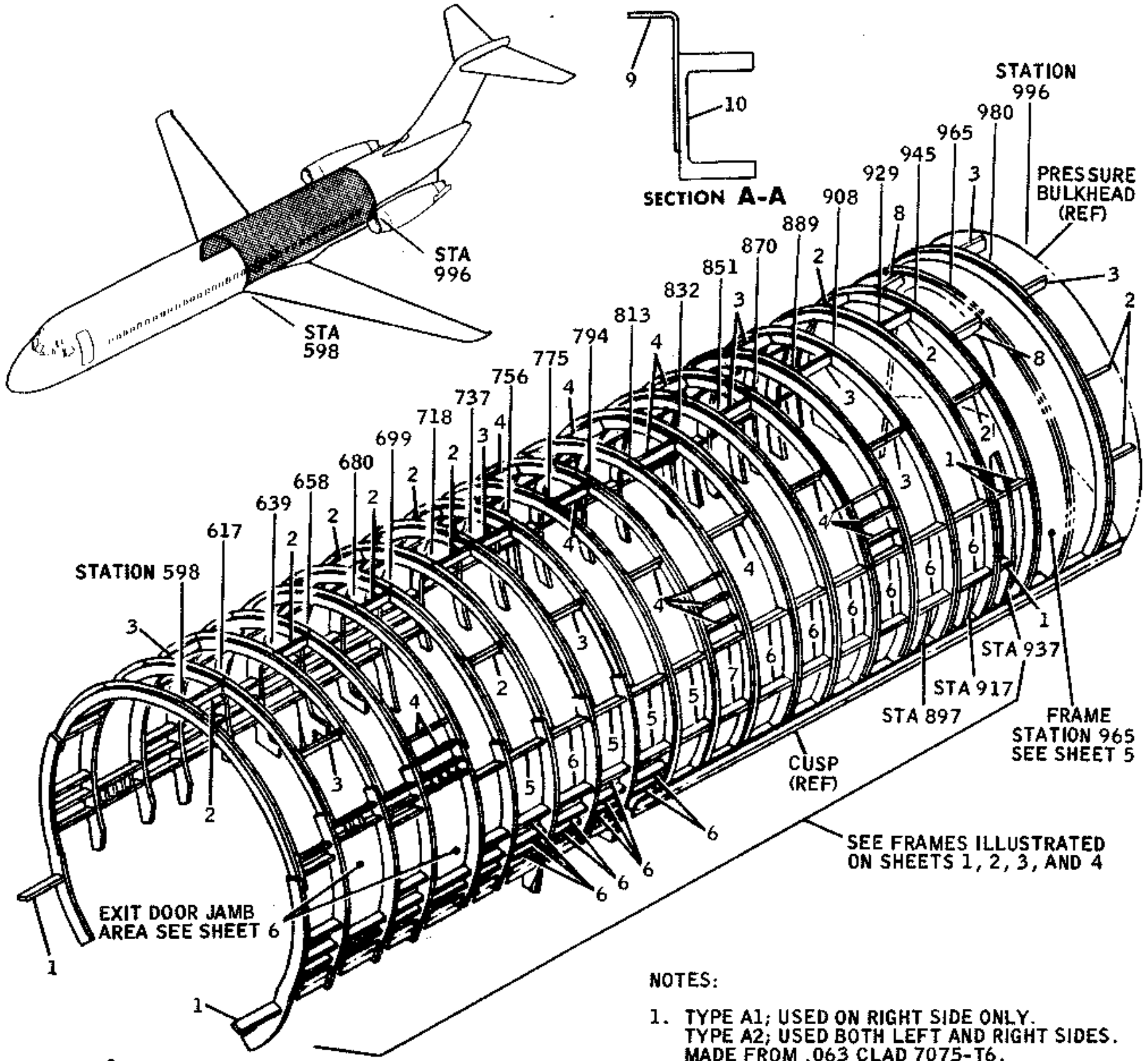
BB3-784A

Floor Support Structure, Station 218 to 588 -- Type A
Figure 4 (Sheet 2)

FUSELAGE SECTION, STATION 588 to 996 - DESCRIPTION AND OPERATION (DC-9-30)

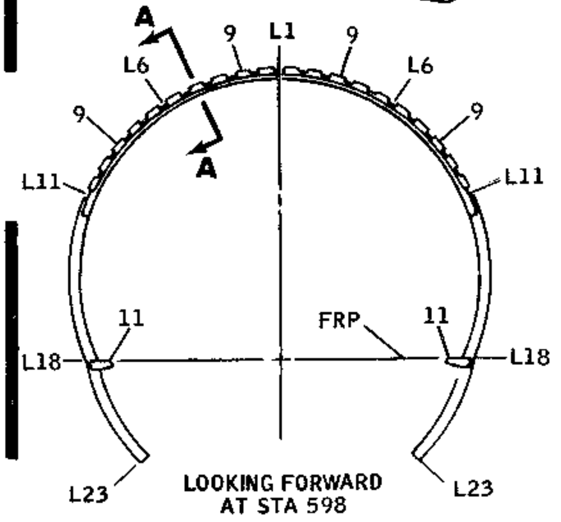
1. General

A. The following figures illustrate the structural components of the fuselage from station 588 to 996. The materials used are identified in the material lists by item number callouts.



NOTES:

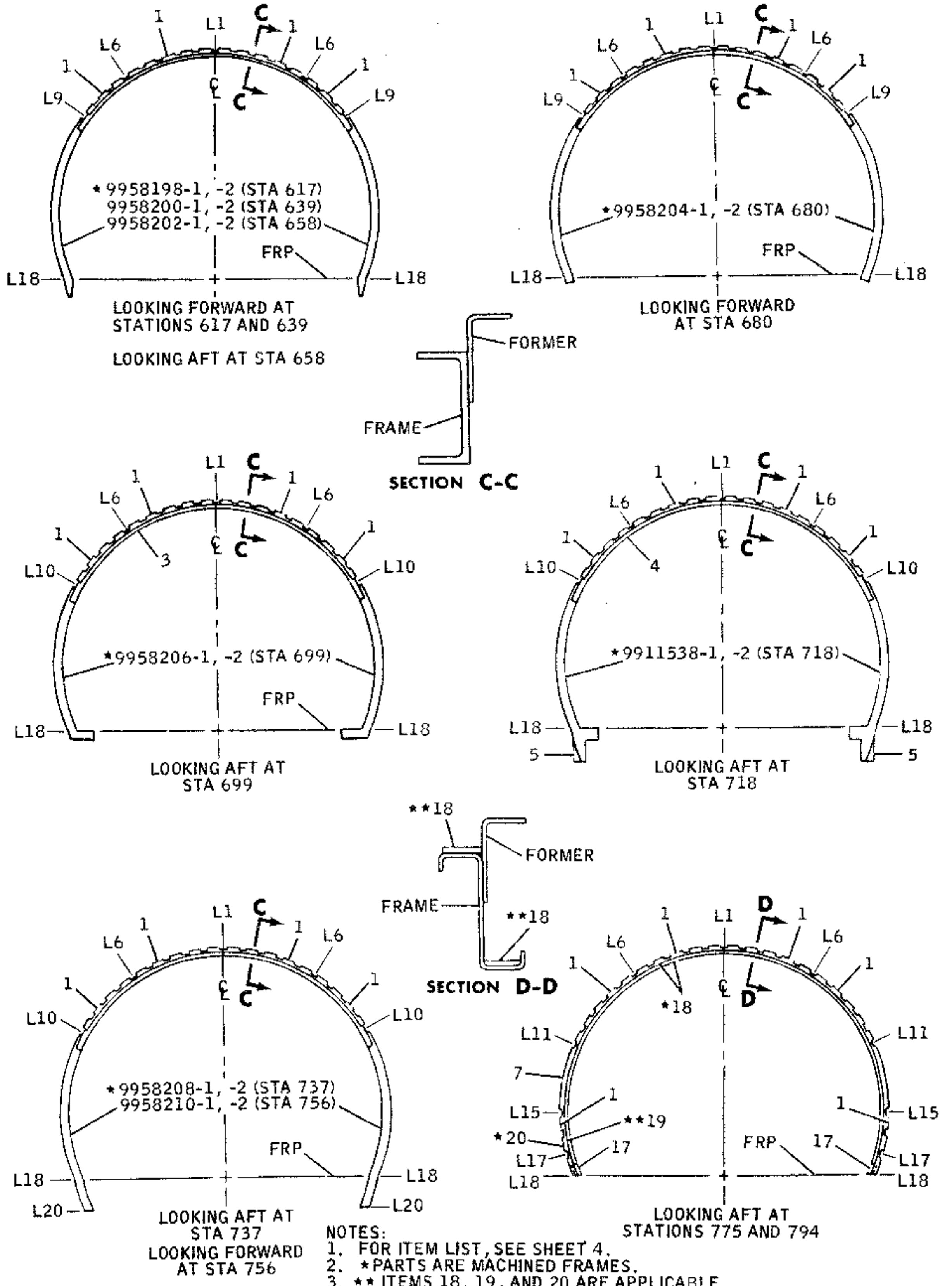
1. TYPE A1; USED ON RIGHT SIDE ONLY. TYPE A2; USED BOTH LEFT AND RIGHT SIDES. MADE FROM .063 CLAD 7075-T6.
2. REFERENCE - DOUGLAS DRAWINGS 5910493, 5910461 AND 5911422.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6
2	INTERCOSTAL	.020	CLAD 7075-T6
3	INTERCOSTAL	.025	CLAD 7075-T6
4	INTERCOSTAL	.032	CLAD 7075-T6
5	INTERCOSTAL		2912901-6
6	INTERCOSTAL		2912901-5
7	INTERCOSTAL	.050	CLAD 7075-T6
8	INTERCOSTAL		SEE NOTE 1
9	FORMER	.050	CLAD 2014-T6
10	FRAME		1387619
11	FITTING		2642053

BB3-786A

Frames and Intercostals, Station 588 to 996
Upper Section -- Type A
Figure 1 (Sheet 1)

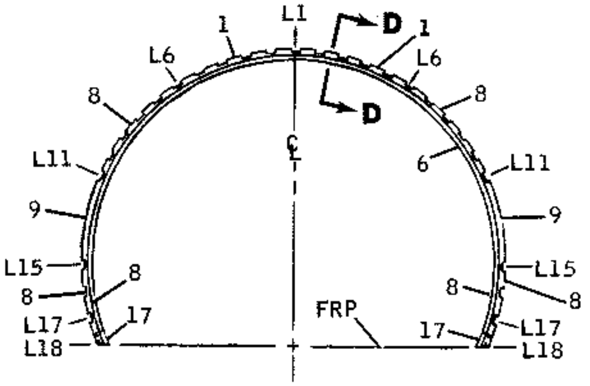


NOTES:
1. FOR ITEM LIST, SEE SHEET 4.
2. *PARTS ARE MACHINED FRAMES.
3. ** ITEMS 18, 19, AND 20 ARE APPLICABLE TO STATION 775 ONLY.

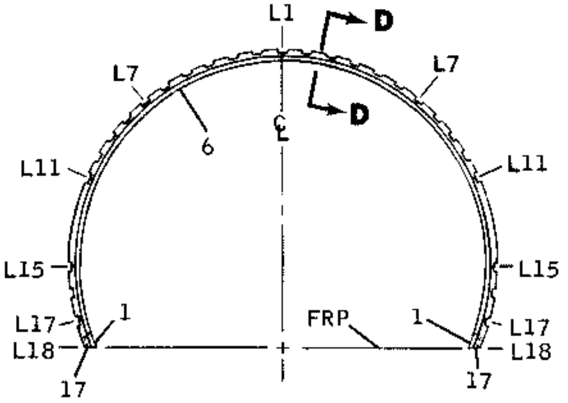
BB3-788

Frames and Intercostals, Station 588 to 996,
Upper Section -- Type A
Figure 1 (Sheet 2)

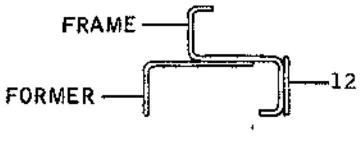
Printed in U.S.A.



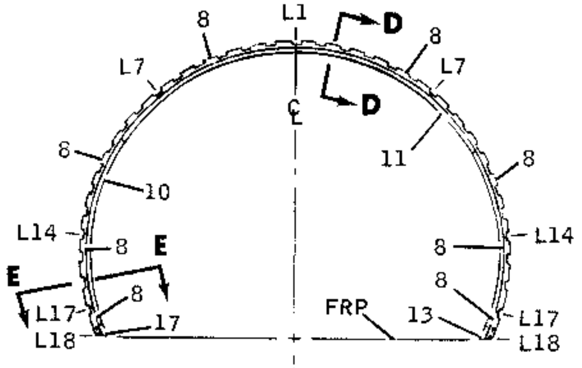
LOOKING AFT AT STA 870



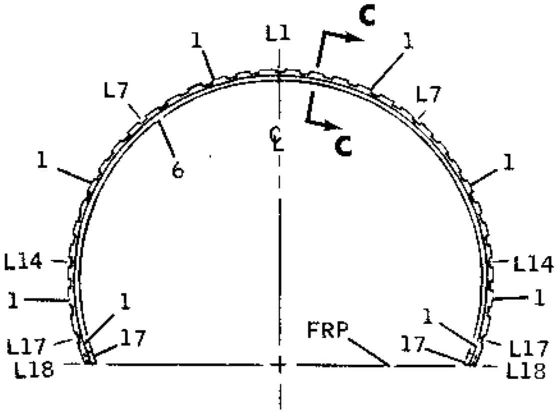
LOOKING FORWARD AT STATIONS 813, 832, AND 851



SECTION E-E



LOOKING FORWARD AT STA 945



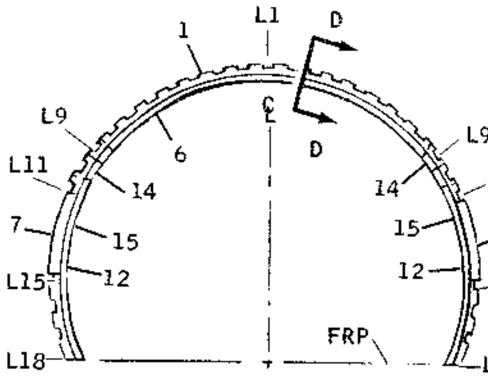
LOOKING FORWARD AT STA 980

NOTES:

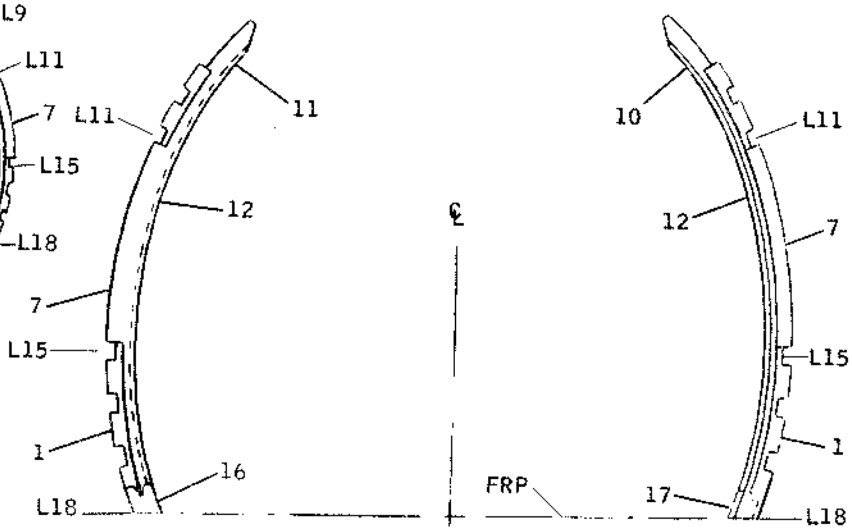
1. FOR SECTION VIEWS, SEE SHEET 2.
2. FOR ITEM LIST, SEE SHEET 4.

BB3-789

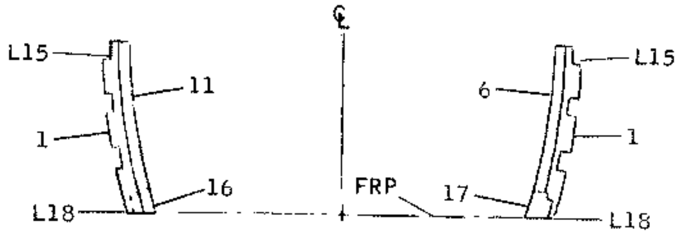
Frames and Intercostals, Station 588 to 996,
Upper Section -- Type A
Figure 1 (Sheet 3)



LOOKING AFT AT STATIONS
889, 908, AND 929



LOOKING AFT AT STATION 937



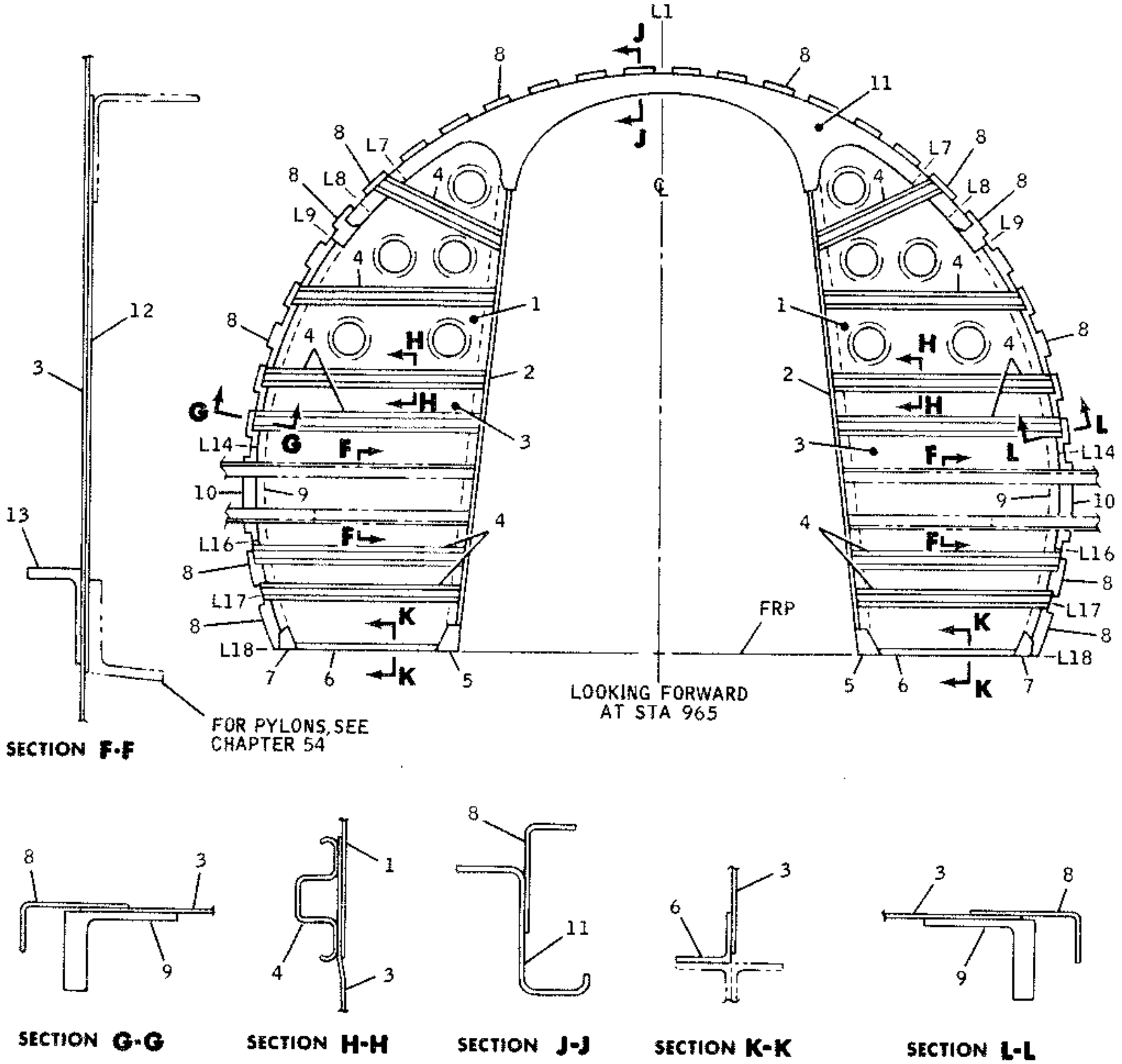
LOOKING AFT AT STATIONS 897 AND 916

NOTE:
FOR SECTION VIEW D-D, SEE SHEET 2.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.050	CLAD 2014-T6	11	FRAME	.071	CLAD 7075-T6
2	FRAME		2912094	12	STRAP		TITANIUM DMS 1592
3	FRAME		1387619	13	FITTING		2911391
4	FRAME		2912096	14	SPLICE PLATE	.063	CLAD 7075-T6
5	FITTING		5911366-1	15	FRAME	.050	CLAD 2014-T6
6	FRAME		2777930	16	FITTING		3912956
7	FORMER TEE		2912538	17	FITTING		4411383
8	SHEAR CLIP	.050	CLAD 2014-T6	18	STRAP	.125	CLAD 7075-T6
9	SHEAR CLIP		1430824	19	STRAP	.050	CLAD 7075-T6
10	FRAME	.063	CLAD 7075-T6	20	STRAP	.190	CLAD 7075-T6

BB3-787

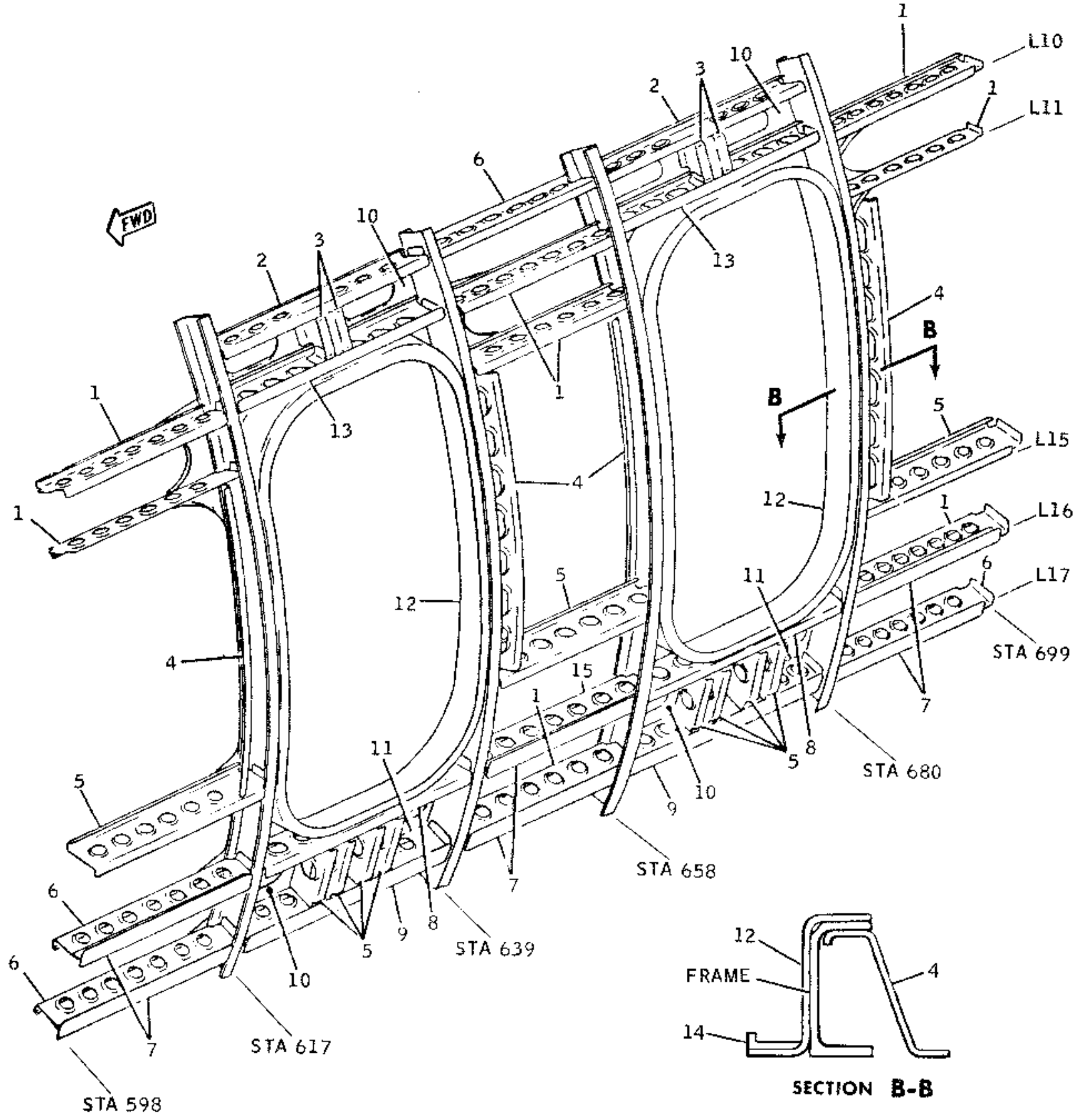
Frames and Intercostals, Station 588 to 996,
Upper Section -- Type A
Figure 1 (Sheet 4)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 2024-T3
2	TEE		3919064
3	WEB	.032	CLAD 7075-T6
4	HAT		2777922-4
5	FITTING		4912539-1, -2
6	ANGLE		1414967
7	FITTING		2911391
8	FORMER	.050	CLAD 2014-T6
9	ANGLE		2912397
10	FORMER	.071	CLAD 2014-T6
11	HEADER	.080	CLAD 7075-T6
12	DOUBLER	.080	CLAD 7075-T6
13	ANGLE		2912045

Frames and Intercostals, Station 588 to 996,
Upper Section -- Type A
Figure 1 (Sheet 5)

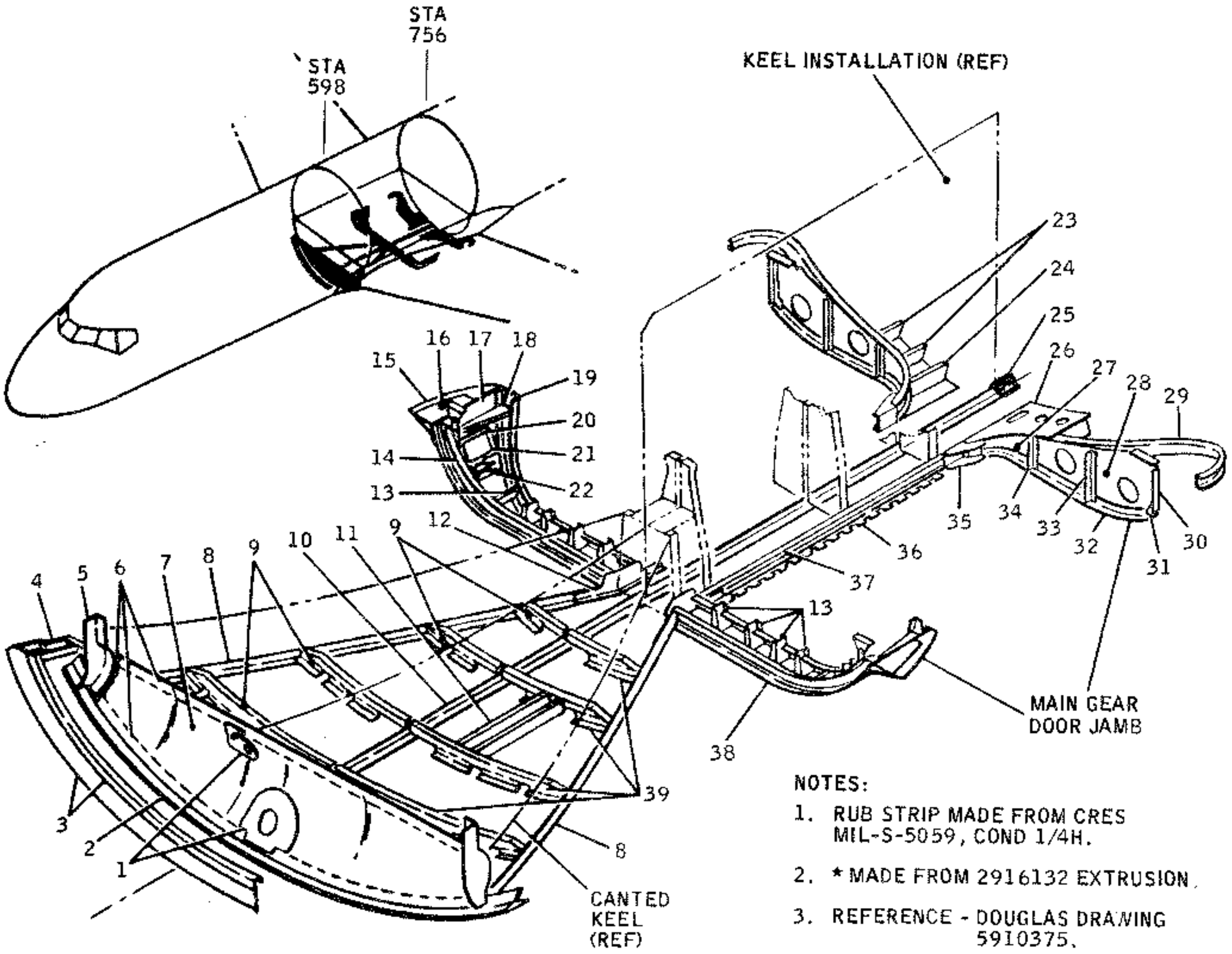
B83-793



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	9	TEE		1430824
2	INTERCOSTAL	.040	CLAD 2024-T42	10	INNER SKIN	.032	CLAD 2024-T42
3	INTERCOSTAL	.080	CLAD 7075-T6	11	INTERCOSTAL	.050	CLAD 2024-T3
4	WEB	.032	CLAD 2024-T42	12	PAN	.050	CLAD 2024-T42
5	INTERCOSTAL	.063	CLAD 7075-T6	13	INTERCOSTAL	.063	CLAD 2024-T42
6	INTERCOSTAL	.040	CLAD 7075-T6	14	SEAL DEPRESSOR		2912554
7	TEE		1700632	15	INTERCOSTAL	.071	CLAD 7075-T6
8	INTERCOSTAL	.071	CLAD 2024-T6				

BB3-794

Frames and Intercostals, Station 588 to 996,
Upper Section -- Type A
Figure 1 (Sheet 6)



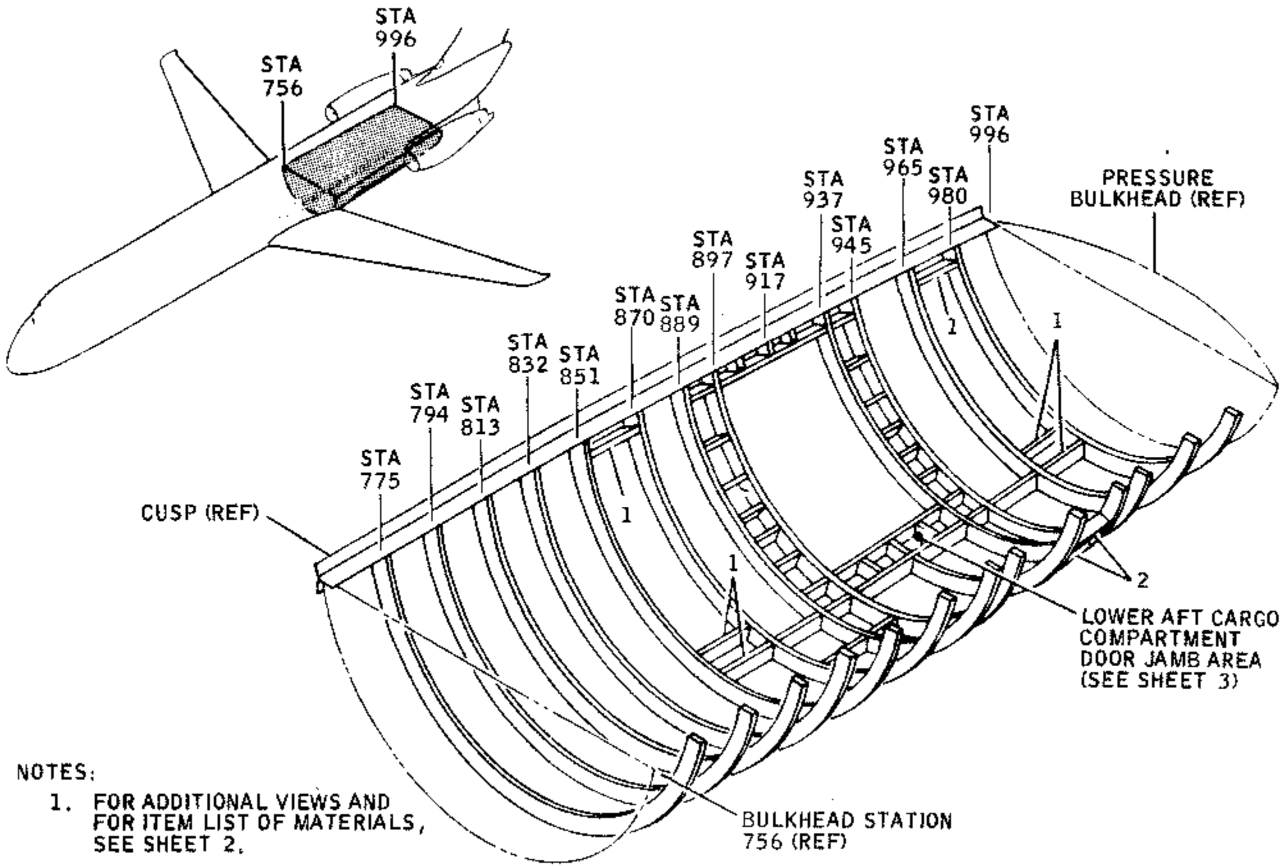
NOTES:

1. RUB STRIP MADE FROM CRES MIL-S-5059, COND 1/4H.
2. * MADE FROM 2916132 EXTRUSION.
3. REFERENCE - DOUGLAS DRAWING 5910375.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 2024-T42
2	TEE		2613776
3	FRAME	.071	CLAD 7075-T6
4	FITTING		5912979 (-1, -2)
5	FITTING	.063	CLAD 2024-T42
6	DOUBLER	.025	CLAD 2014-T6
7	PANEL	.050	CLAD 2024-T42
8	CAP	.125	CLAD 7075-T6
9	FORMER	.063	CLAD 7075-T6
10	INTERCOSTAL	.050	CLAD 7075-T6
11	CAP		*9915525-1
12	SPLICE		9958195-1, -2
13	INTERCOSTAL	.063	CLAD 2024-T42
14	FORMER	.063	CLAD 2024-T42
15	FILLET	.070	CLAD 2024-T42
16	BRACKET	.040	CLAD 2024-T42
17	SKIN	.125	CLAD 2024-T42
18	STIFFENER	.040	CLAD 2024-T3
19	CHANNEL	.063	CLAD 2024-T42
20	DOUBLER	.063	CLAD 2024-T3
21	DOOR	.125	CLAD 2024-T42
22	BRACKET	.071	CLAD 7075-T6
23	INTERCOSTAL	.080	CLAD 7075-T6
24	INTERCOSTAL	.090	CLAD 7075-T6
25	FITTING		3915134 -503,-505
26	WEB	.040	CLAD 7075-T6
27	WEB	.063	CLAD 2024-T3
28	WEB	.063	CLAD 2024-T42
29	CHANNEL	.100	CLAD 7075-T6
30	ANGLE	.063	CLAD 7075-T6
31	RUB STRIP	.032	SEE NOTE 1
32	TEE		2914624
33	STIFFENER		1245835
34	SPLICE TEE		1440048
35	FITTING		3916184
36	HINGE		3956689-1, -2
37	ZEE	.100	CLAD 7075-T6
38	TEE		1243286
39	SHEAR CLIP		1242526

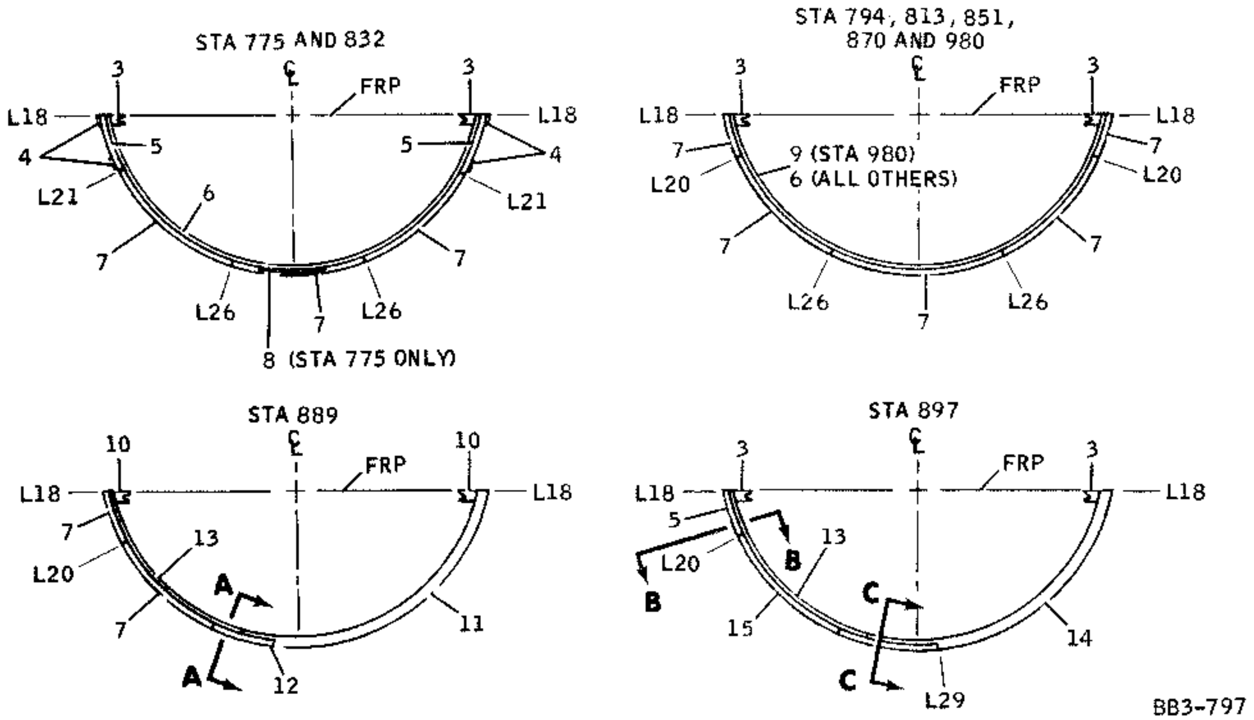
BB3-795

Frames and Intercostals, Station 598 to 756,
Underwing -- Type A
Figure 2



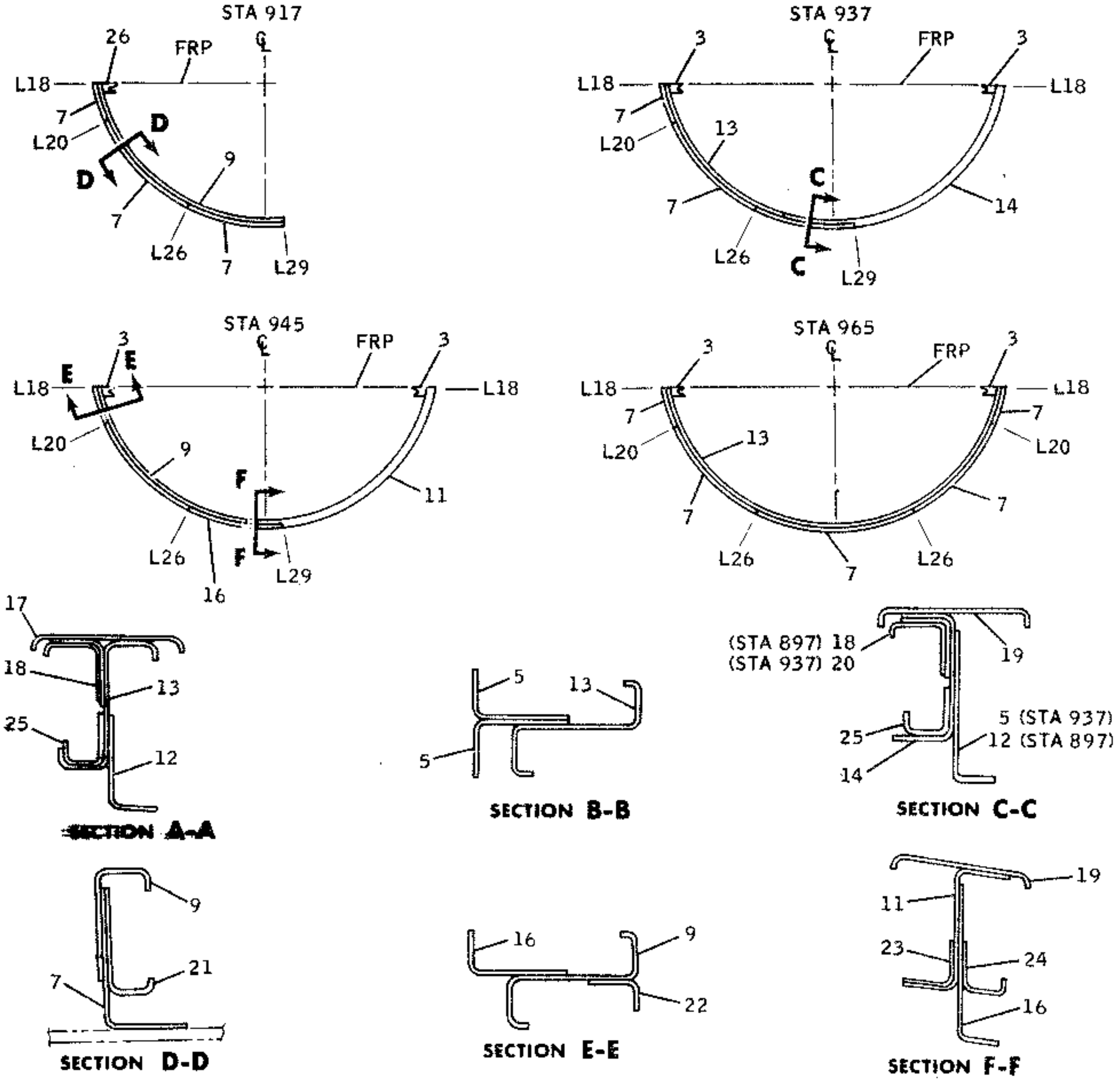
NOTES:

1. FOR ADDITIONAL VIEWS AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. ALL STATION VIEWS LOOKING FORWARD.
3. REFERENCE - DOUGLAS DRAWING 5910461.



BB3-797

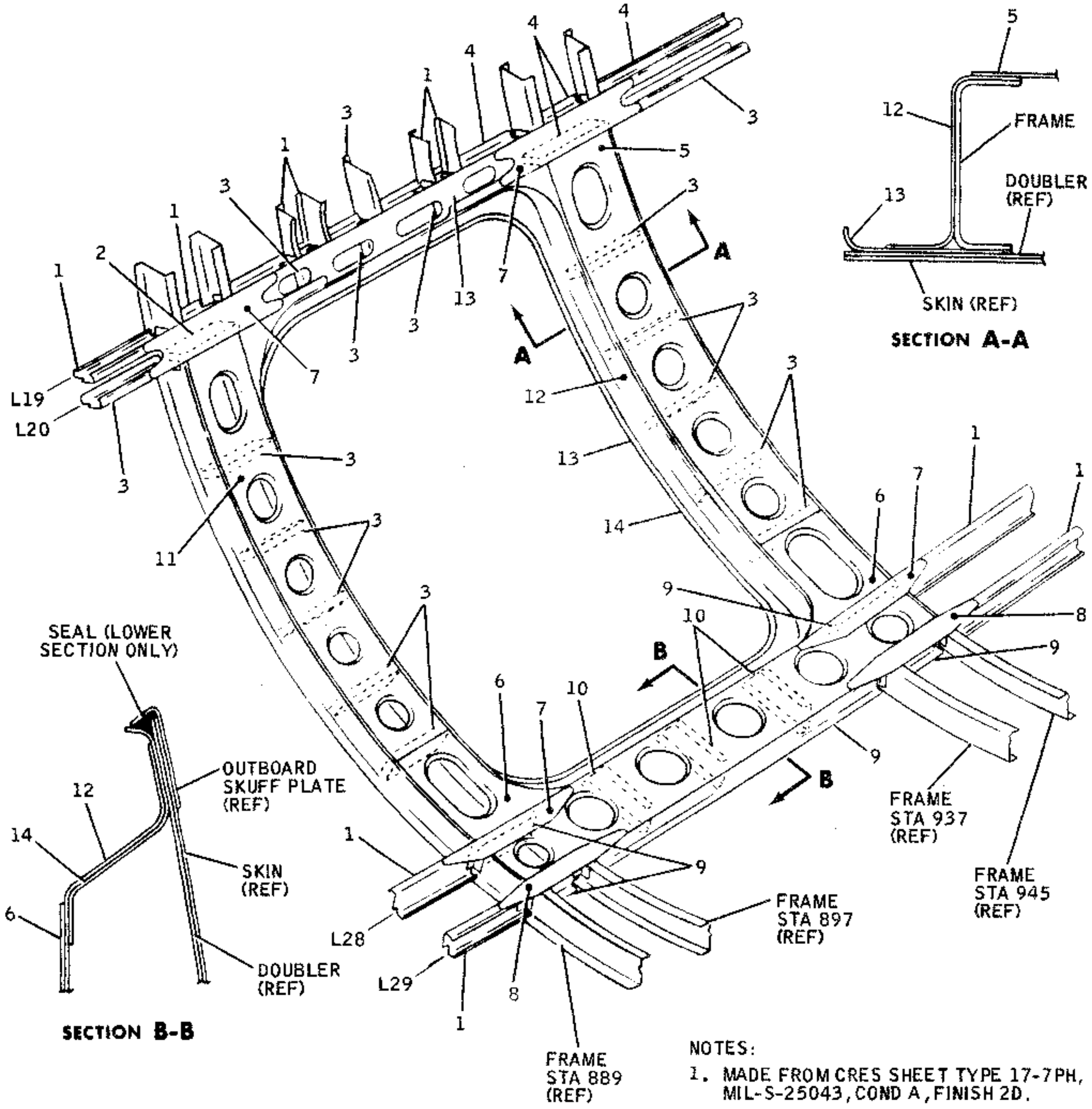
Frames and Intercostals, Station 756 to 996,
Lower Section -- Type A
Figure 3 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	14	FRAME	.090	CLAD 2024-T42
2	INTERCOSTAL	.063	CLAD 7075-T6	15	FORMER	.071	CLAD 2014-T6
3	FITTING		2911391	16	SHEAR CLIP	.050	CLAD 2014-T6
4	DOUBLER	.050	CLAD 2014-T6	17	SPLICE PLATE	.063	CLAD 7075-T6
5	FORMER	.063	CLAD 2014-T6	18	ANGLE SPLICE	.040	CLAD 7075-T6
6	FRAME		2777930-7	19	SPLICE CAP	.063	CLAD 7075-T6
7	FORMER	.050	CLAD 2014-T6	20	ANGLE SPLICE	.063	CLAD 7075-T6
8	ANGLE		2612329	21	SPLICE FORMER	.063	CLAD 7075-T6
9	FRAME		2777930-5	22	DOUBLER	.063	CLAD 7075-T6
10	FITTING	2.500	PLATE 7075-T651	23	ANGLE DOUBLER	.050	CLAD 7075-T6
11	FRAME	.063	CLAD 2024-T42	24	ANGLE DOUBLER	.063	CLAD 7075-T6
12	FORMER	.063	CLAD 7075-T6	25	ANGLE SPLICE	.071	CLAD 7075-T6
13	FRAME		2777930-6	26	FITTING	2.250	BAR 7075-T651

BB3-798

Frames and Intercostals, Station 756 to 996,
Lower Section -- Type A
Figure 3 (Sheet 2)



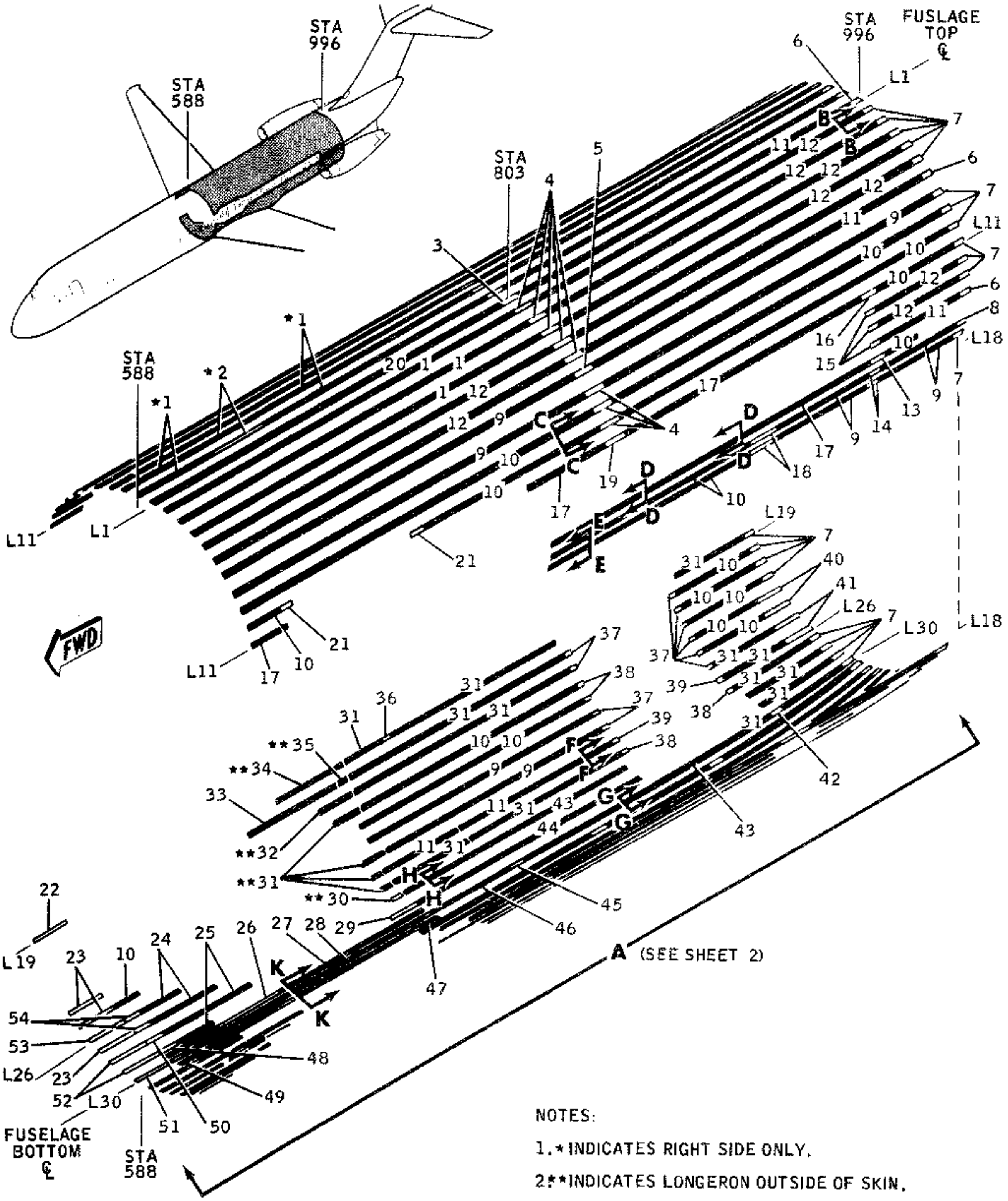
NOTES:

1. MADE FROM CRES SHEET TYPE 17-7PH, MIL-S-25043, COND A, FINISH 2D.
2. REFERENCE - DOUGLAS DRAWING 5910158.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.080	CLAD 7075-T6	9	INTERCOSTAL	.090	CLAD 7075-T6
2	INTERCOSTAL	.071	CLAD 2024-T42	10	INTERCOSTAL	.050	CLAD 7075-T6
3	INTERCOSTAL	.063	CLAD 7075-T6	11	FORWARD WEB	.040	CLAD 7075-T6
4	INTERCOSTAL	.071	CLAD 7075-T6	12	PAN	.050	CLAD 2024-T42
5	AFT WEB	.040	CLAD 7075-T6	13	UPPER DEPRESSOR	.071	CLAD 2024-T42
6	LOWER WEB	.040	CLAD 2024-T42	14	LOWER DEPRESSOR	.063	SEE NOTE 1
7	GUSSET	.125	CLAD 7075-T6				
8	GUSSET	.250	STEEL BAR 4130				

BB3-799

Frames and Intercostals, Station 756 to 996,
Lower Section -- Type A
Figure 3 (Sheet 3)



NOTES:

1.* INDICATES RIGHT SIDE ONLY.

2.** INDICATES LONGERON OUTSIDE OF SKIN.

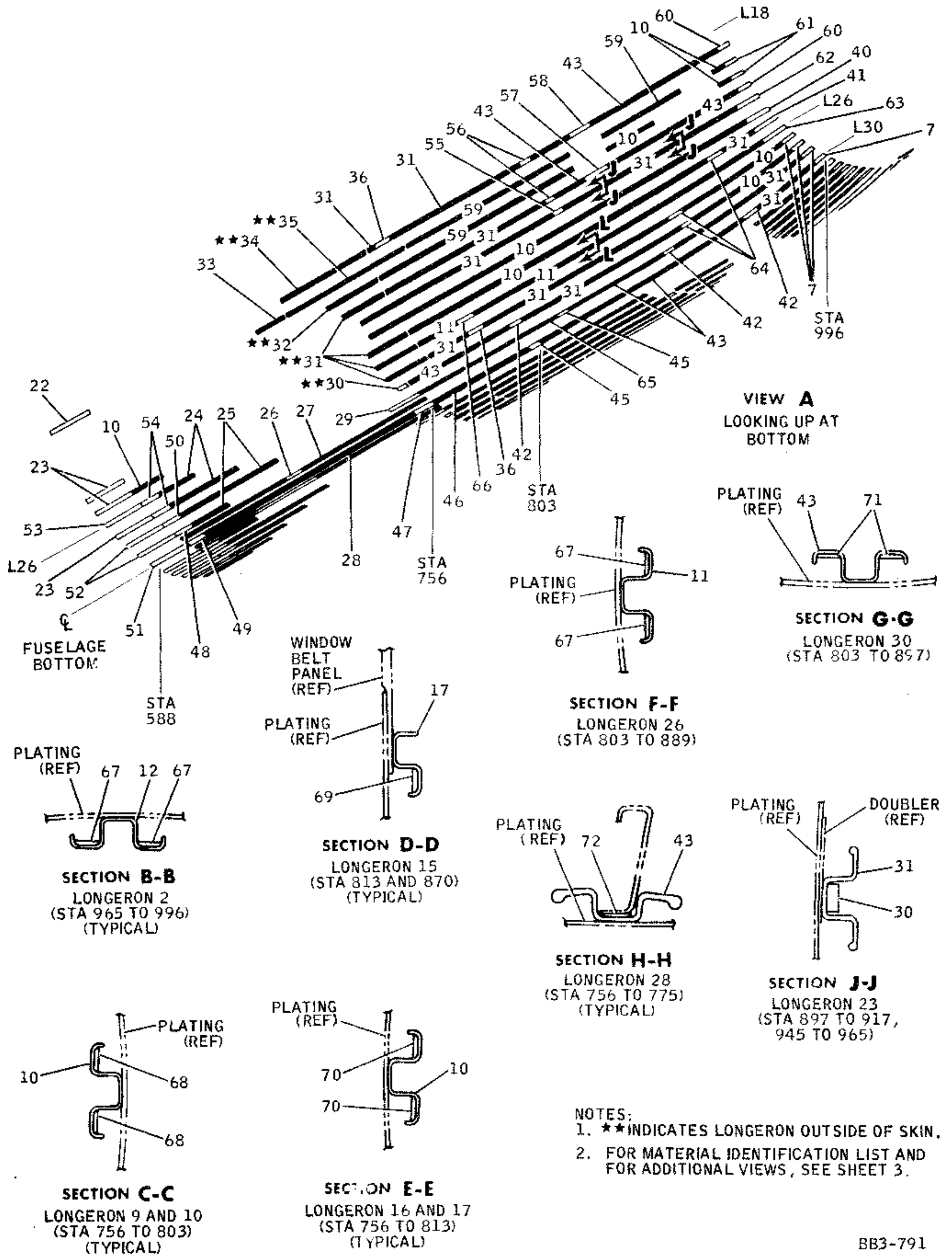
3. FOR ADDITIONAL VIEWS, SEE SHEETS 2 AND 3.

4. FOR ITEM LIST OF MATERIALS, SEE SHEET 3.

5. REFERENCE-DOUGLAS DRAWING 5910493.

BB3-790

Longerons, Station 588 to 996
Figure 4 (Sheet 1)



VIEW **A**
LOOKING UP AT BOTTOM

SECTION G-G
LONGERON 30
(STA 803 TO 897)

SECTION F-F
LONGERON 26
(STA 803 TO 889)

SECTION D-D
LONGERON 15
(STA 813 AND 870)
(TYPICAL)

SECTION B-B
LONGERON 2
(STA 965 TO 996)
(TYPICAL)

SECTION H-H
LONGERON 28
(STA 756 TO 775)
(TYPICAL)

SECTION J-J
LONGERON 23
(STA 897 TO 917,
945 TO 965)

SECTION C-C
LONGERON 9 AND 10
(STA 756 TO 803)
(TYPICAL)

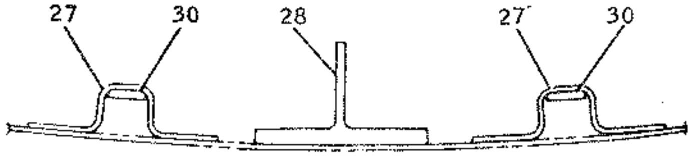
SECTION E-E
LONGERON 16 AND 17
(STA 756 TO 813)
(TYPICAL)

NOTES:
1. ★★INDICATES LONGERON OUTSIDE OF SKIN.
2. FOR MATERIAL IDENTIFICATION LIST AND FOR ADDITIONAL VIEWS, SEE SHEET 3.

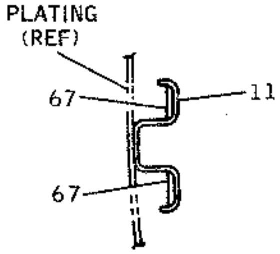
BB3-791

Longerons, Station 588 to 996 -- Type A
Figure 4 (Sheet 2)

Printed in U.S.A.



SECTION K-K
LONGERON 30
(STA 676 TO 718)

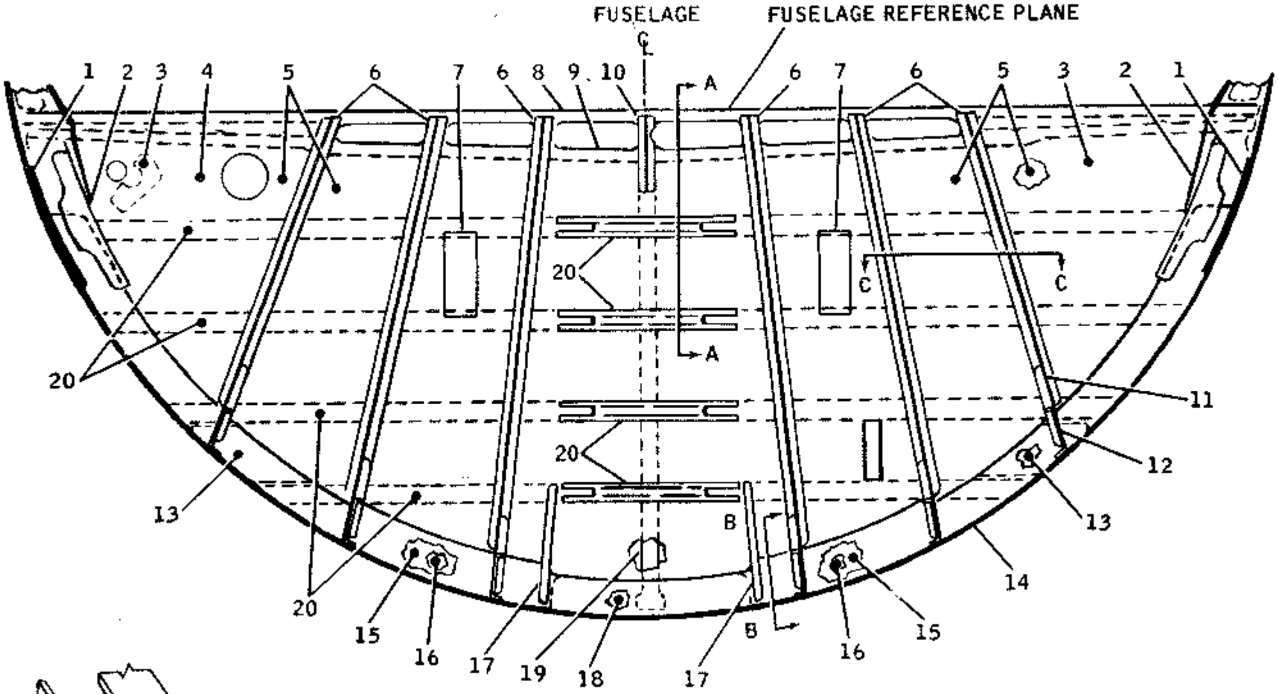


SECTION L-L
LONGERON 26
(STA 803 TO 945)

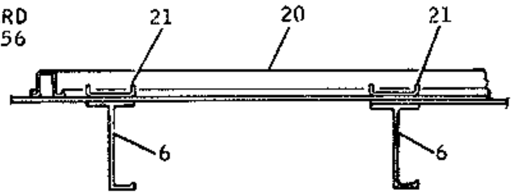
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777922-1	37	CLIP		4912798-501
2	FITTING	.050	CLAD 7075-T6	38	CLIP		4912798-503
3	FITTING		3920327-1	39	CLIP		4912798-507
4	FITTING		3920322-1	40	FITTING		3914590-1
5	FITTING		3920327-501	41	FITTING		3914867-1
6	CLIP		4913329-1	42	FITTING		3913291-1
7	CLIP		4912515-1	43	LONGERON		1242886
8	CLIP		4912515-501	44	LONGERON		5920302-501
9	LONGERON		2777922-4	45	SPLICE		3914677-1
10	LONGERON		2777922-5	46	LONGERON		5920303-1
11	LONGERON		2777948	47	FITTING		3915134-503,-505
12	LONGERON		2777922-3	48	FITTING		3916174-1
13	FITTING		3913214-1, -2	49	FITTING		3920324-1, -2
14	FITTING		4912261-501	50	FITTING		3920326
15	CLIP		4912098-1	51	SPLICE		5916064-1
16	FITTING		3913214-501	52	FITTING		3913209-1
17	LONGERON		2777923-5	53	FITTING		3913209-501
18	SPLICE		3913098-1	54	FITTING		3915129-1
19	FITTING		3920321-1	55	FITTING		4914956-1
20	LONGERON		2777948-5	56	FITTING		4914955-1
21	CLIP		4912098-501	57	SPLICE		3914675-1
22	FITTING		5912544-1	58	SPLICE		3914674-1
23	FITTING		3913209-503	59	LONGERON		2912099
24	LONGERON		1415977	60	FITTING		4914954-1
25	LONGERON		2610338	61	FITTING		4914957-1
26	FITTING	.100	CLAD 7075-T6	62	FITTING		3914654-1
27	STRINGER	.100	CLAD 7075-T6	63	FITTING		3914590-501
28	CAP		9915525-1	64	SPLICE		3913557-1
29	FITTING		3915135-501,-502	65	LONGERON		5920302-1
30	STRIP	.250	CLAD 7075-T651	66	FITTING		4912262-1
31	LONGERON		2912727	67	DOUBLER		4919255-5
32	LONGERON		1375211	68	DOUBLER		4919255-6
33	LONGERON		2914254	69	STRAP		4912920-1
34	LONGERON		5916516-1, -2	70	STRAP		2643899
35	LONGERON		2914255	71	DOUBLER		4919255-10
36	FITTING		3913208-1	72	SHIM	.032	CLAD 2014-T6

BB3-861

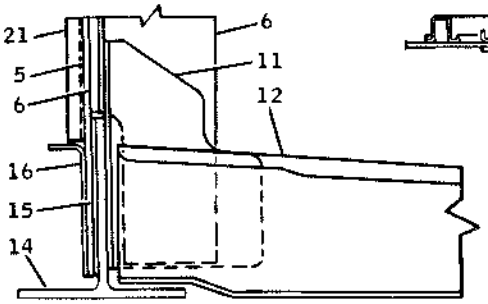
Longerons, Station 588 to 996 -- Type A
Figure 4 (Sheet 3)



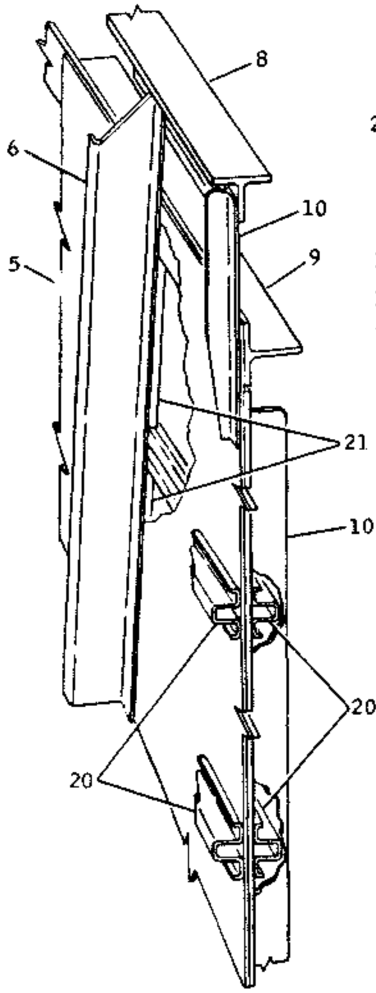
VIEW LOOKING FORWARD
FUSELAGE STATION 756



SECTION C-C



SECTION B-B
(TYPICAL 6 PLACES)



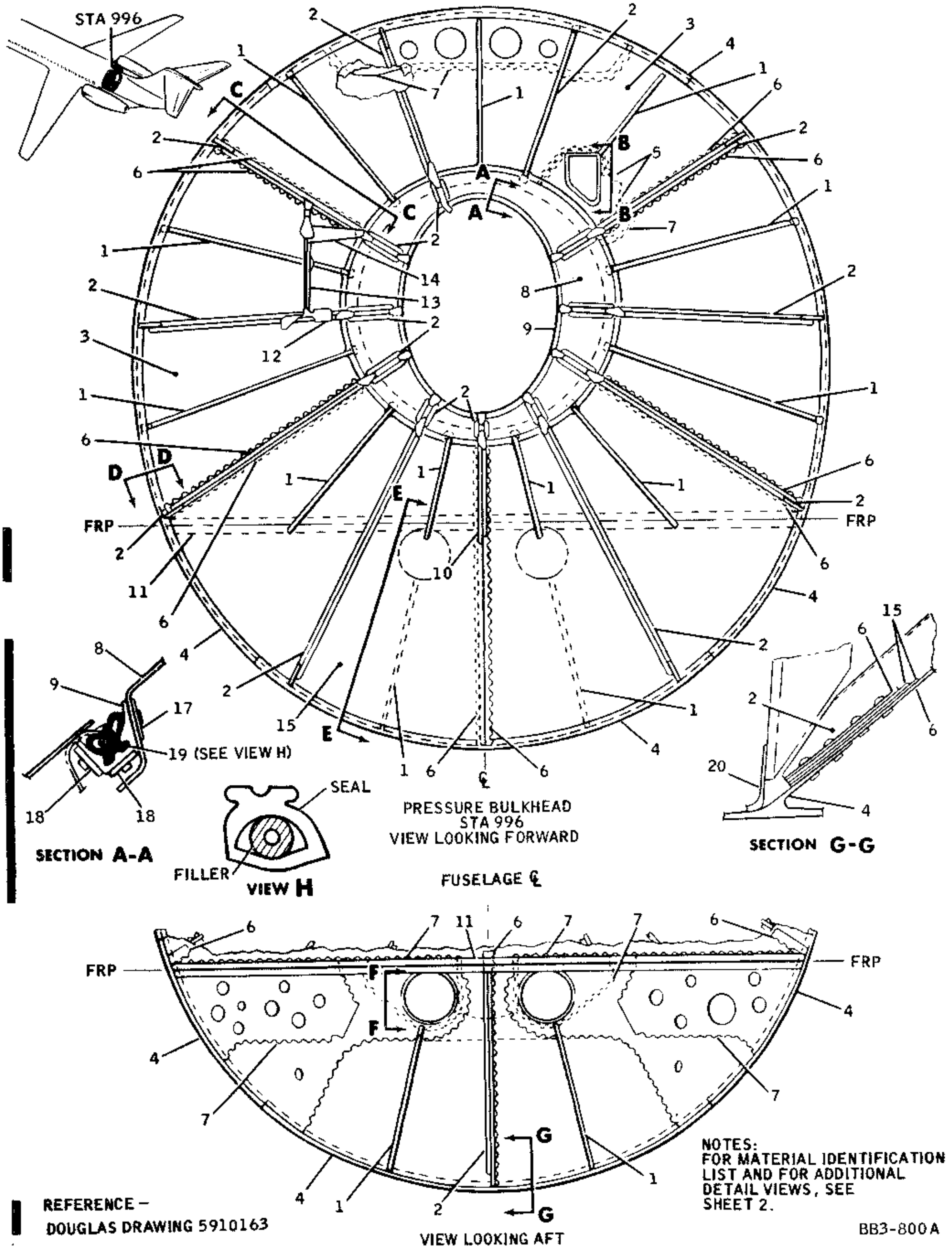
SECTION A-A

REFERENCE - DOUGLAS
DRAWING - 9958212

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE	.190	CLAD 7075-T6
2	ANGLE		1329812
3	SUPPORT	.090	6061-0
4	DOUBLER	.050	CLAD 2014-T6
5	WEB	.050	CLAD 2014-T6
6	STIFFENER		4594694
7	CHANNEL	.050	CLAD 2024-T3
8	TEE		1363992
9	TEE		1440004
10	TEE		2912538
11	DOUBLER	.090	CLAD 7075-T6
12	INTERCOSTAL	.090	CLAD 7075-T6
13	RETAINER	.050	CLAD 2024-T3
14	TEE		2914624
15	SPACER	.050	CLAD 2014-T6
16	RETAINER	.063	CLAD 2024-T3
17	SUPPORT		1332779
18	CHANNEL		2914646
19	TEE		1642726
20	HAT		2651332
21	CHANNEL		2914646

BB3-805

Bulkhead, Station 756 -- Type A
Figure 5



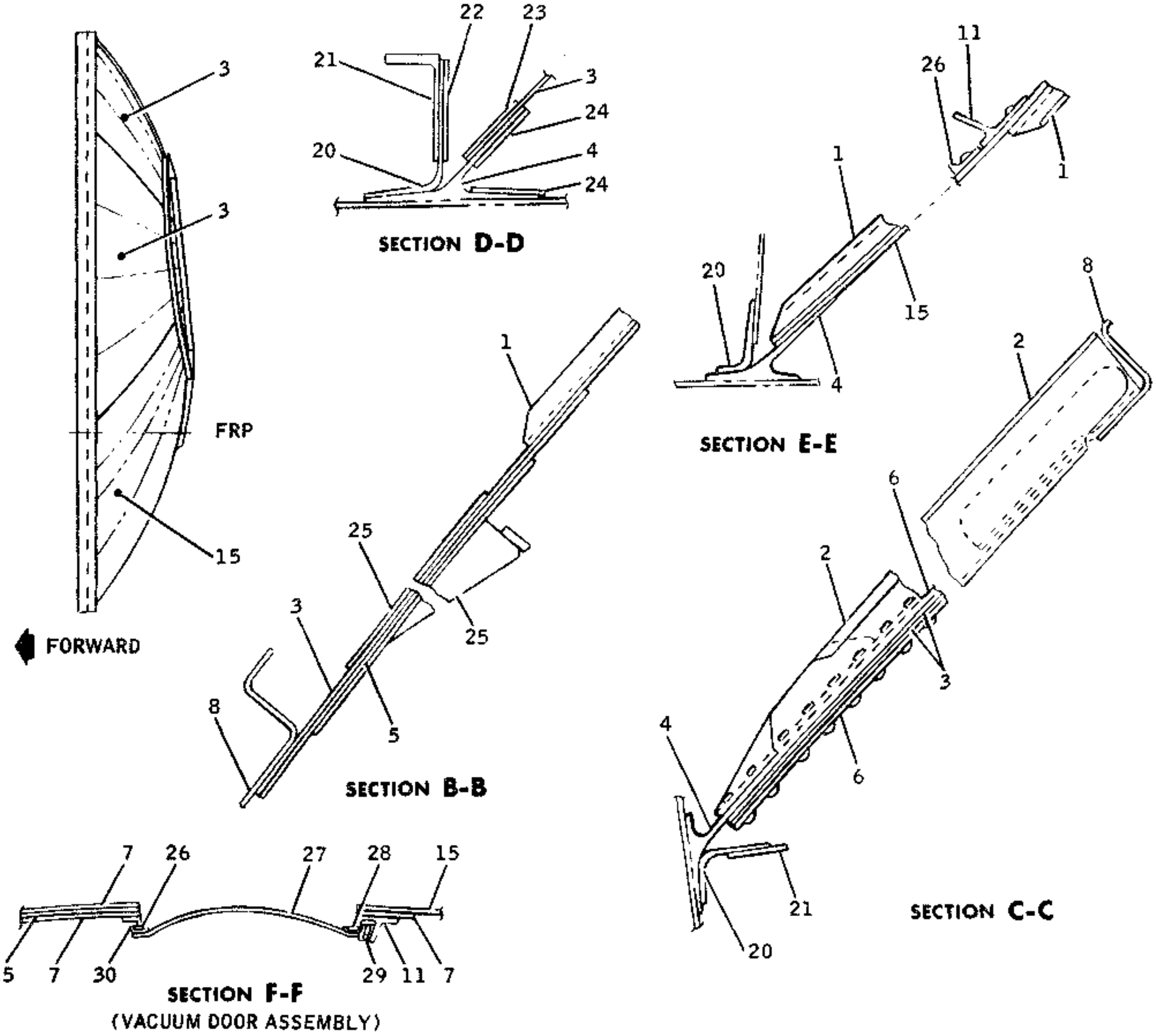
NOTES:
FOR MATERIAL IDENTIFICATION LIST AND FOR ADDITIONAL DETAIL VIEWS, SEE SHEET 2.

REFERENCE –
DOUGLAS DRAWING 5910163

BB3-800A

Pressure Bulkhead, Station 996 -- Type 1
Figure 6 (Sheet 1)

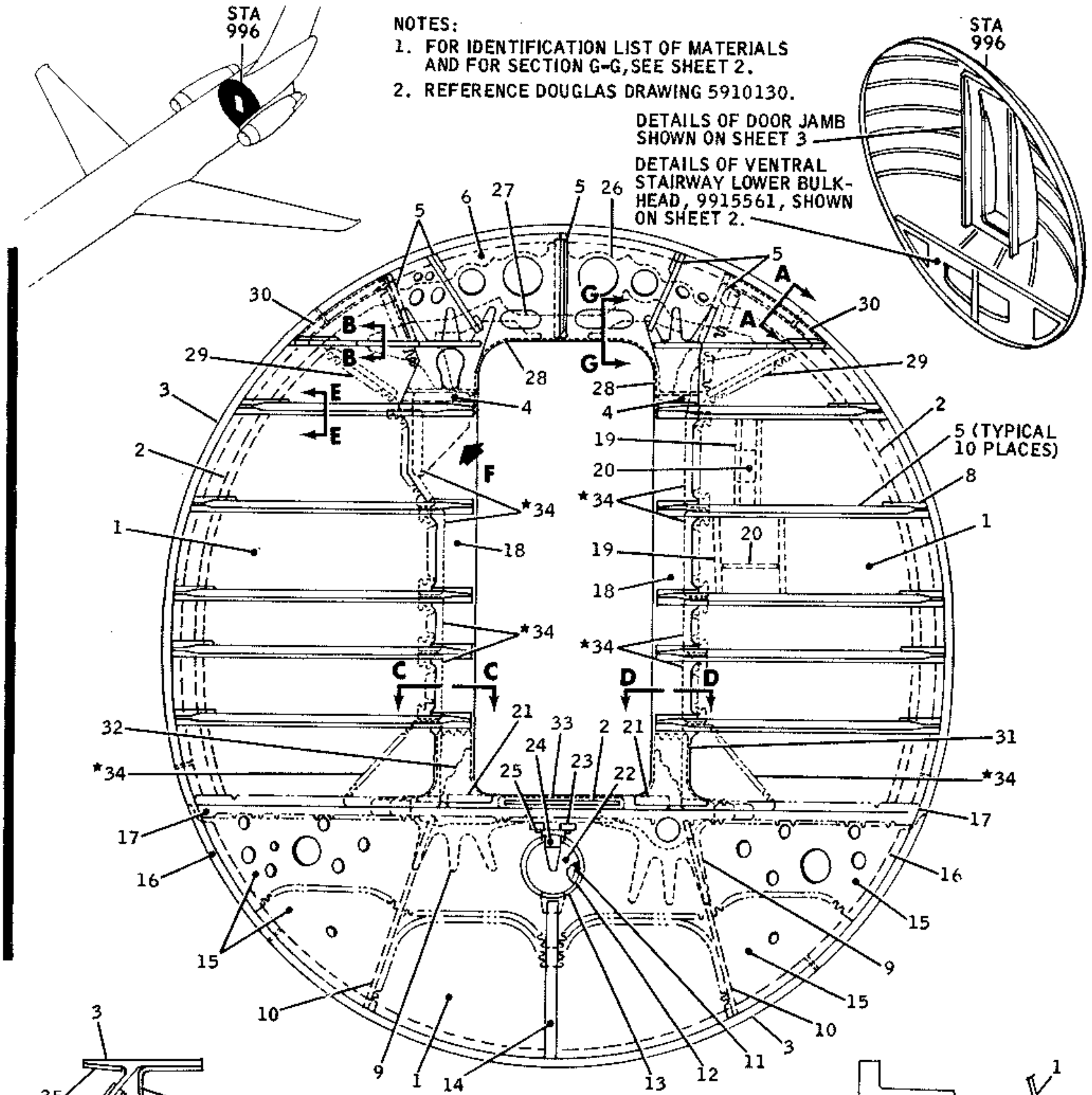
Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		1109618	16	STRAP	.040	CLAD 2014-T6
2	STIFFENER	.032	CLAD 2014-T6	17	SPLICE	.040	CLAD 2014-T6
3	WEB	.039/.045	CLAD 2014-T6	18	SPLICE	.090	CLAD 2014-T6
4	TEE		2912046	19	SEAL ASSEMBLY		5914146-1
5	DOUBLER	.063	CLAD 2014-T6	20	ANGLE		2912293
6	DOUBLER	.025	CLAD 2014-T6	21	ANGLE		2912045
7	DOUBLER	.040	CLAD 2014-T6	22	SHIM	.032	CLAD 2014-T6
8	JAMB	.063	CLAD 2014-T6	23	SPLICE	.050	CLAD 2014-T6
9	RETAINER		2912553	24	SPLICE	.063	CLAD 2014-T6
10	STIFFENER	.050	CLAD 2014-T6	25	PAN	.080	CLAD 2024-T42
11	TEE		2649174	26	SEAL STRIKER	.250	2024-T351
12	SUPPORT		1646170	27	PLATE (DOOR)	.063	CLAD 2024-T42
13	INTERCOSTAL	.025	CLAD 2014-T6	28	SEAL		2916291
14	SUPPORT	.050	CLAD 2024-T42	29	HINGE		2272677
15	WEB	.042/.048	CLAD 2014-T6	30	CHANNEL	.050	CLAD 2024-T42

BB3-121B

Pressure Bulkhead, Station 996 -- Type A1
Figure 6 (Sheet 2)

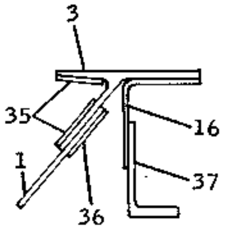


NOTES:
1. FOR IDENTIFICATION LIST OF MATERIALS AND FOR SECTION G-G, SEE SHEET 2.
2. REFERENCE DOUGLAS DRAWING 5910130.

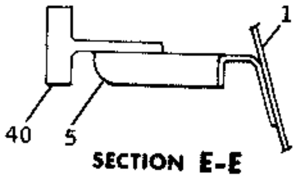
DETAILS OF DOOR JAMB SHOWN ON SHEET 3

DETAILS OF VENTRAL STAIRWAY LOWER BULKHEAD, 9915561, SHOWN ON SHEET 2.

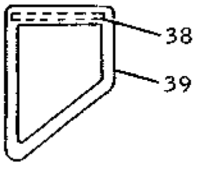
BULKHEAD STATION 996 - LOOKING AFT
(DOOR JAMB OMITTED FOR CLARITY)



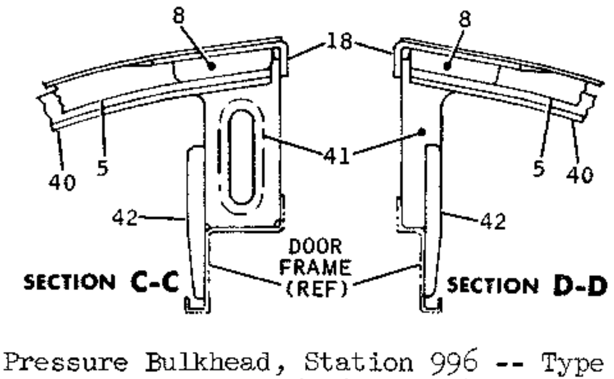
SECTION A-A



SECTION E-E

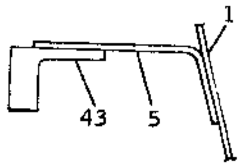


VIEW F



SECTION C-C

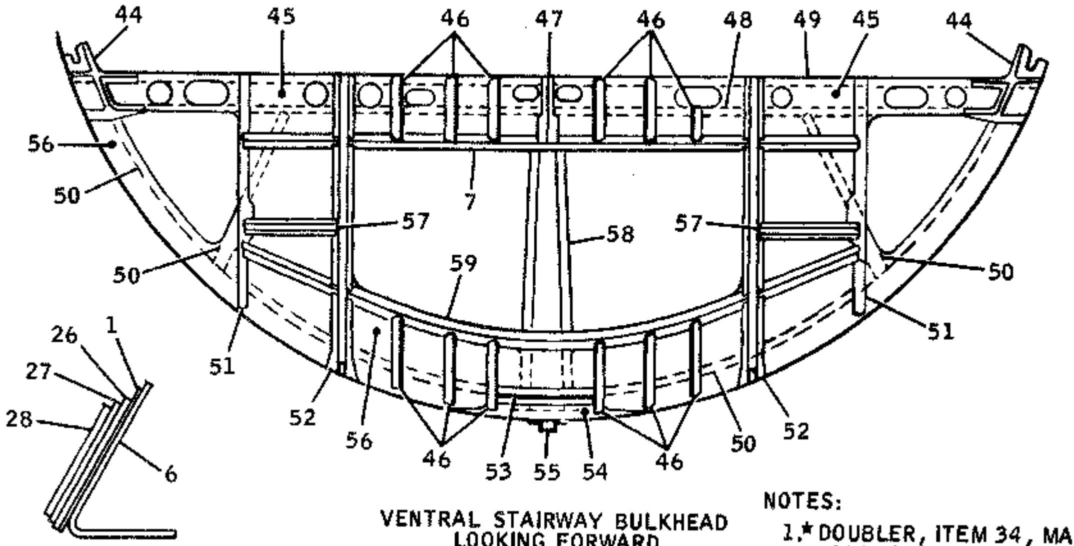
SECTION D-D



SECTION B-B

BB3-932A

Pressure Bulkhead, Station 996 -- Type A2
Figure 6A (Sheet 1)



SECTION G-G
(FROM SHEET 1)

VENTRAL STAIRWAY BULKHEAD
LOOKING FORWARD
STA 996

NOTES:

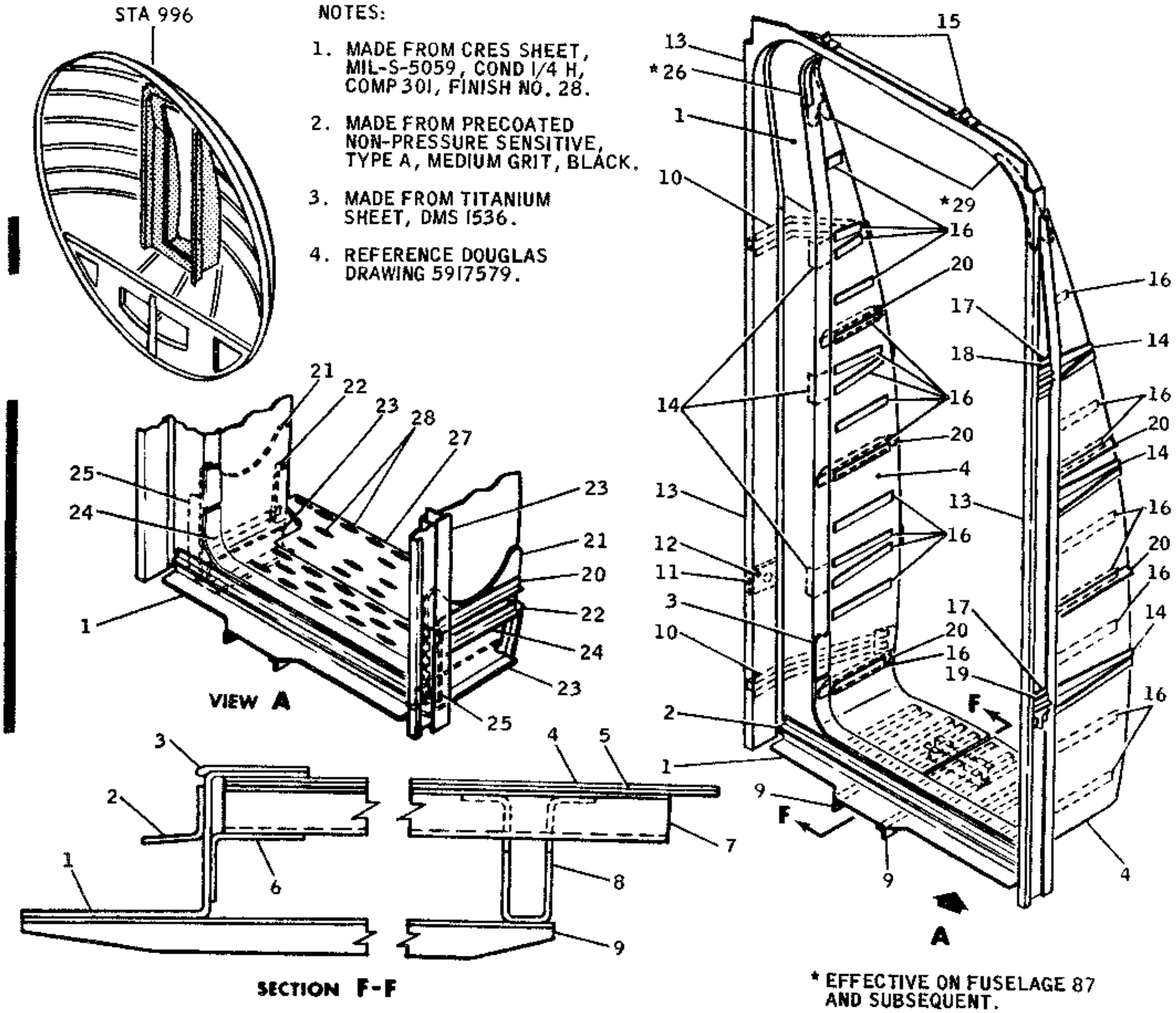
1.* DOUBLER, ITEM 34, MADE FROM .020, CLAD 2014-T6, USED ON AIRPLANES 87 AND SUBSEQUENT AIRPLANES.

2. REFERENCE - DOUGLAS DRAWING 9915561

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.039/.045	CLAD 2014-T6	31	GUSSET	.080	SHEET TITANIUM
2	ANGLE	.050	CLAD 2014-T6	32	DOUBLER	.080	SHEET TITANIUM
3	TEE		2912046	33	SPACER	.040	CLAD 2014-T6
4	SHIM	.080	CLAD 2024-T3	*34	DOUBLER		SEE NOTE 1
5	FORMER	.040	CLAD 2014-T6	35	SPLICE	.063	CLAD 2014-T6
6	DOUBLER	.080	CLAD 2014-T6	36	SPLICE	.050	CLAD 2014-T6
7	TEE		1666744	37	ANGLE		2912045
8	CLIP	.050	CLAD 2014-T6	38	PLATE	.375	PLATE 2024-T351
9	GUSSET	.080	SHEET TITANIUM	39	PAN	.080	CLAD 2024-T6
10	FORMER	.050	CLAD 2014-T6	40	TEE		1716225
11	SEAL		2916291	41	WEB	.050	CLAD 2014-T6
12	CHANNEL	.050	CLAD 2024-T42	42	CLIP		1465089
13	SEAL STRIKER	.250	PLATE 2024-T351	43	STIFFENER		2912813
14	TEE		1249240	44	FITTING	1.00	PLATE 7075-T651
15	DOUBLER	.040	CLAD 2014-T6	45	WEB	.032	CLAD 7075-T6
16	ANGLE		2912293	46	ANGLE		1242526
17	TEE		2917577	47	TEE		1642532
18	CHANNEL	.125	CLAD 2014-T6	48	ANGLE		1125597
19	ANGLE	.040	CLAD 2014-T6	49	ANGLE		2912758
20	SUPPORT	.040	CLAD 6061-T6	50	ANGLE	.063	CLAD 7075-T6
21	CHANNEL	.050	CLAD 2014-T6	51	ANGLE		1287425
22	PLATE	.063	CLAD 2024-T42	52	HAT	.063	CLAD 7075-T6
23	ANGLE	.063	CLAD 2024-T3	53	ANGLE		1249243
24	BUMPER		PLATE 6061-T6	54	DOUBLER	.100	CLAD 7075-T6
25	BRACKET	.100	PLATE 2024-T351	55	FITTING	2.750	PLATE 7075-T651
26	DOUBLER	.063	CLAD 2014-T6	56	WEB	.040	CLAD 7075-T6
27	DOUBLER	.063	SHEET TITANIUM	57	HAT	.040	CLAD 7075-T6
28	DOUBLER	.080	SHEET TITANIUM	58	HAT	.125	CLAD 7075-T6
29	DOUBLER	.020	CLAD 2014-T6	59	TEE		1325214
30	SPLICE	.040	CLAD 2014-T6				

BB3-933A

Pressure Bulkhead, Station 996 -- Type A2
Figure 6A (Sheet 2)



NOTES:

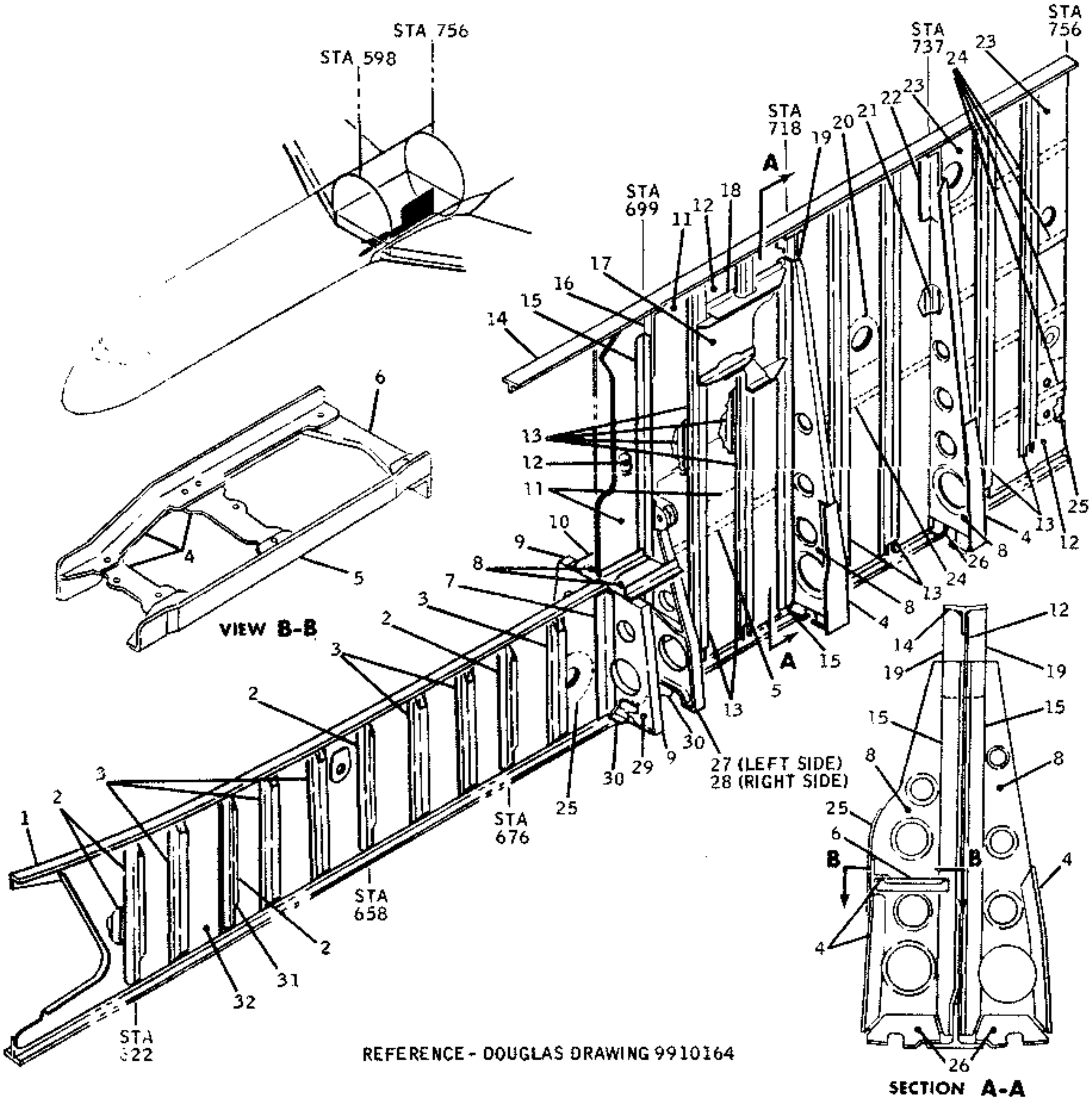
1. MADE FROM CRES SHEET, MIL-S-5059, COND 1/4 H, COMP 301, FINISH NO. 28.
2. MADE FROM PRECOATED NON-PRESSURE SENSITIVE, TYPE A, MEDIUM GRIT, BLACK.
3. MADE FROM TITANIUM SHEET, DMS 1536.
4. REFERENCE DOUGLAS DRAWING 5917579.

* EFFECTIVE ON FUSELAGE 87 AND SUBSEQUENT.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	JAMB	.040	CLAD 2014-T6
2	ANGLE	.020	SEE NOTE 1
3	STRIKER		2505668
4	WEB	.040	CLAD 2014-T6
5	SPLICE	.063	CLAD 2014-T6
6	ANGLE	.040	CLAD 2014-T6
7	HAT	.032	CLAD 2014-T6
8	SUPPORT	.063	CLAD 2014-T6
9	ANGLE		179364
10	SUPPORT		2777948 -5
11	SERRATED PLATE	.190	STL SHEET 4130
12	FITTING	.500	STL PLATE 4130
13	FRAME	.050	CLAD 2014-T6
14	FITTING	.750	PLATE 7075-T651
15	FITTING	2.000	PLATE 7075-T651
16	STRAP		2917981
17	SERRATED PLATE	.125	CLAD 2024-T3
18	FITTING	.750	PLATE 2024-T351
19	FITTING	2.500	PLATE 2024-T351
20	ANGLE		1465089
21	SPLICE	.050	CLAD 2014-T6
22	ANGLE	.063	CLAD 2014-T6
23	TEE		2615551
24	ANGLE		1243092
25	ANGLE		1619970
*26	STRIKER		2505327
27	SILL	.125	CLAD 7075-T6
28	SAFETY WALK		SEE NOTE 2
*29	SPLICE	.063	SEE NOTE 3

BB3-934A

Pressure Bulkhead, Station 996 -- Type A2
Figure 6A (Sheet 3)



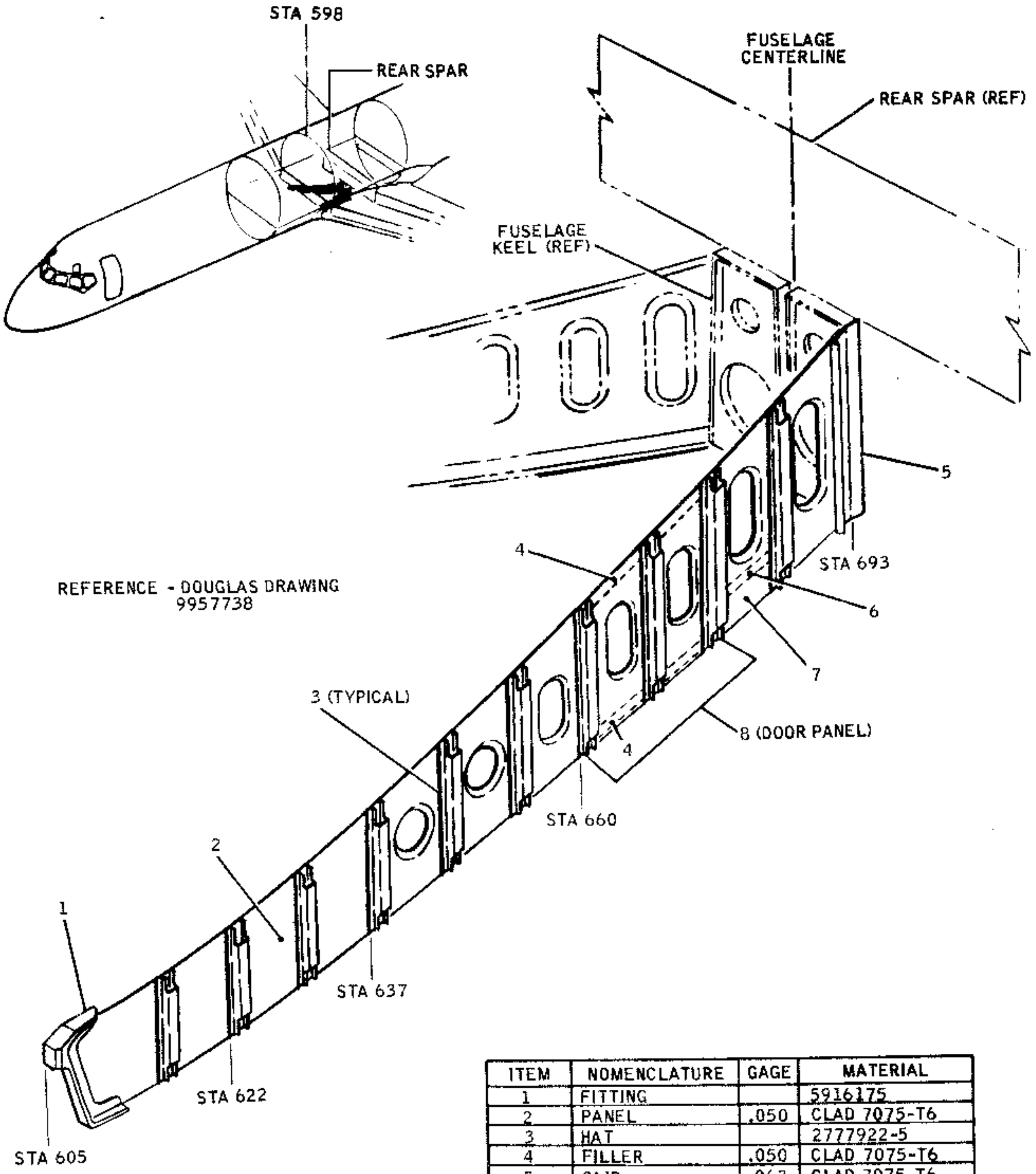
REFERENCE - DOUGLAS DRAWING 9910164

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE		1419650	17	SUPPORT	.063	CLAD 7075-T6
2	ANGLE		1418516	18	ANGLE	063	CLAD 7075-T6
3	HAT		2912727	19	FITTING		7075-T651
4	TEE		1249240	20	SUPPORT	.125	CLAD 2024-T3
5	ANGLE		1287425	21	ANGLE		1325738
6	GUSSET	.063	CLAD 7075-T6	22	FITTING		7075-T651
7	ANGLE		1419315	23	DOUBLER	.050	CLAD 7075-T6
8	WEB	.063	CLAD 7075-T6	24	ANGLE		1415595
9	FITTING		7075-T651	25	DOUBLER	.063	CLAD 7075-T6
10	ANGLE	.125	CLAD 7075-T6	26	CLIP		1528377
11	DOUBLER	.032	CLAD 7075-T6	27	FITTING		7075-T651
12	WEB	.050	CLAD 7075-T6	28	FITTING		7075-T651
13	HAT		2777922-5	29	FITTING		7075-T651
14	TEE		1325214	30	CLIP		1528377
15	ANGLE		1242937	31	WEB	.071	CLAD 7075-T6
16	FITTING		7075-T651	32	WEB	.040	CLAD 7075-T6

BB3-809

Keel, Station 598 to 756 -- Type A
Figure 7

Printed in U.S.A.

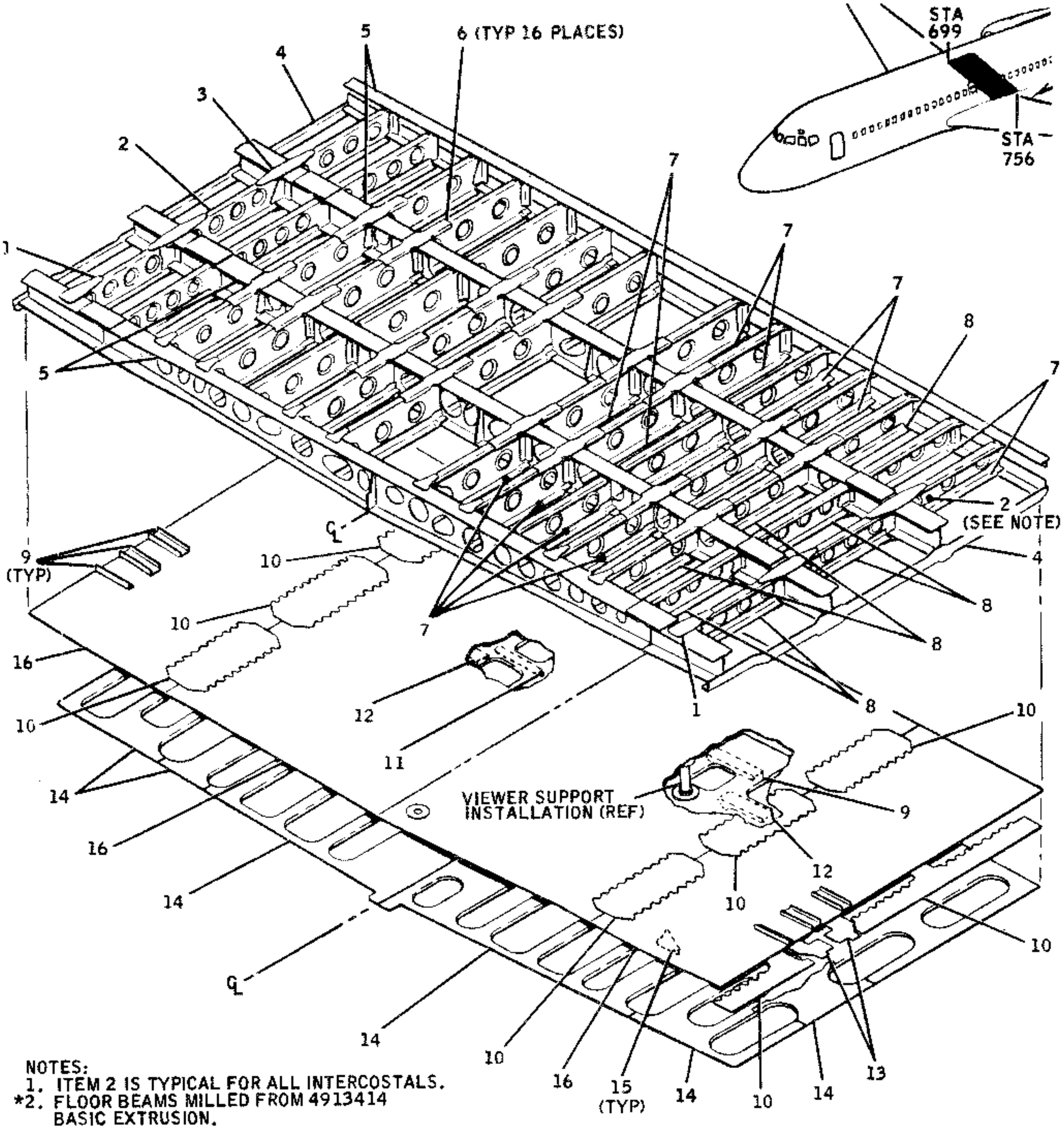


REFERENCE - DOUGLAS DRAWING
9957738

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		5916175
2	PANEL	.050	CLAD 7075-T6
3	HAT		2777922-5
4	FILLER	.050	CLAD 7075-T6
5	CLIP	.063	CLAD 7075-T6
6	STIFFENER		1332779
7	PANEL	.040	CLAD 7075-T6
8	DOOR PANEL	.040	CLAD 7075-T6

BB3-810

Canted Keel Panels -- Type A
Figure 8



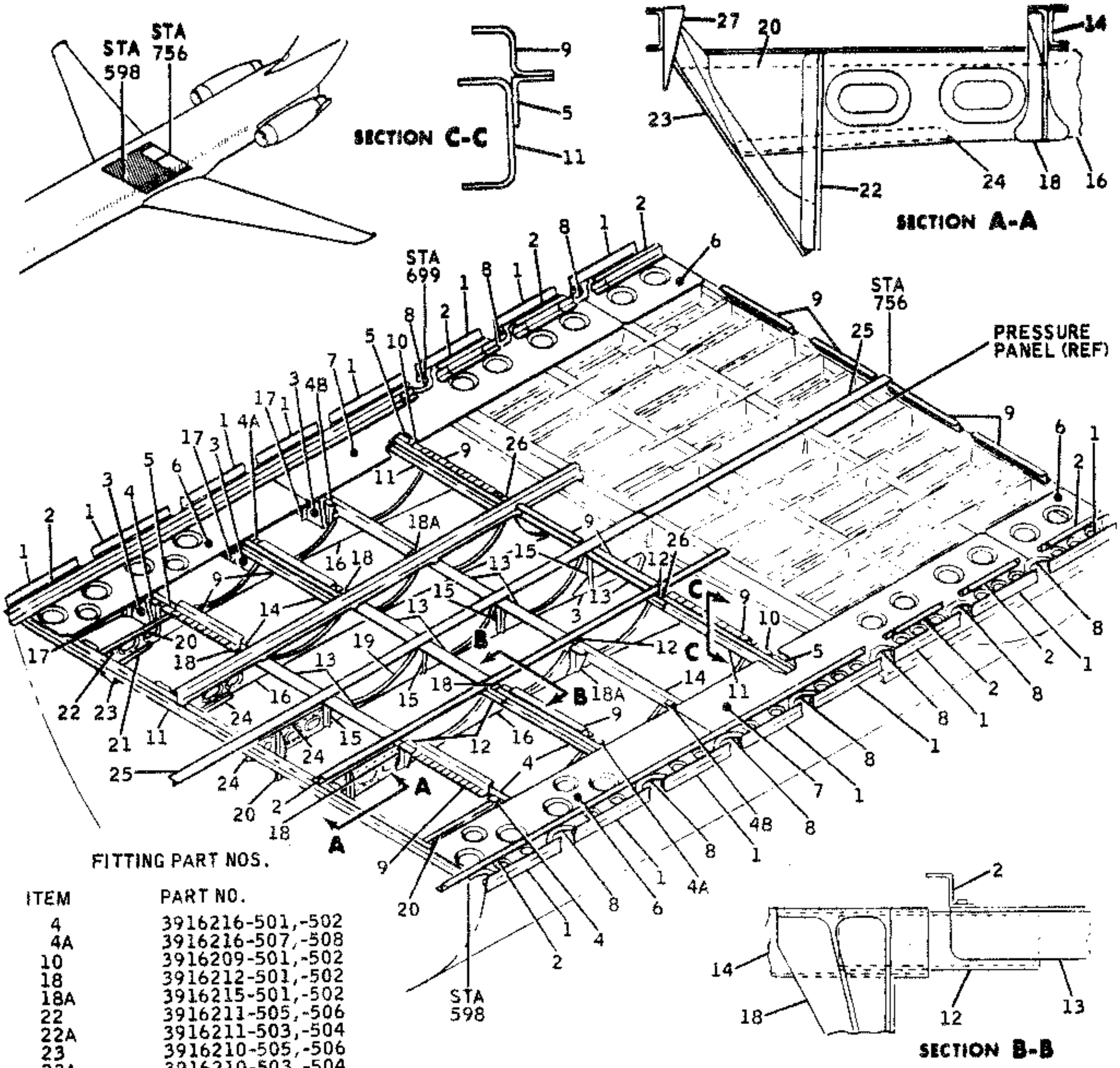
NOTES:
1. ITEM 2 IS TYPICAL FOR ALL INTERCOSTALS.
*2. FLOOR BEAMS MILLED FROM 4913414 BASIC EXTRUSION.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	GUSSET	.032	CLAD 2024-T3	9	CHANNEL	.050	CLAD 2024-T42
2	INTERCOSTAL	.050	CLAD 7075-T6	10	DOUBLER	.040	CLAD 2024-T6
3	SPLICE	.080	CLAD 2024-T3	11	ANGLE	.063	CLAD 2024-T42
4	TEE		4913966	12	CLIP	.063	CLAD 2024-T42
*5	FLOOR BEAM		4913414	13	DOUBLER	.050	CLAD 2024-T3
6	SPLICE	.040	CLAD 7075-T6	14	RETAINER PAN	.040	CLAD 2024-T42
7	TEE CAP		2914912	15	SUPPORT		1249328
8	TEE CAP		2914983	16	PANEL	.050	CLAD 2014-T6

REFERENCE - DOUGLAS DRAWING 9910155

BB3-916

Pressure Panel, Station 699 to 756
Figure 9



REFERENCE-DOUGLAS DRAWING 5910148
AND 5910347

FITTING PART NOS.

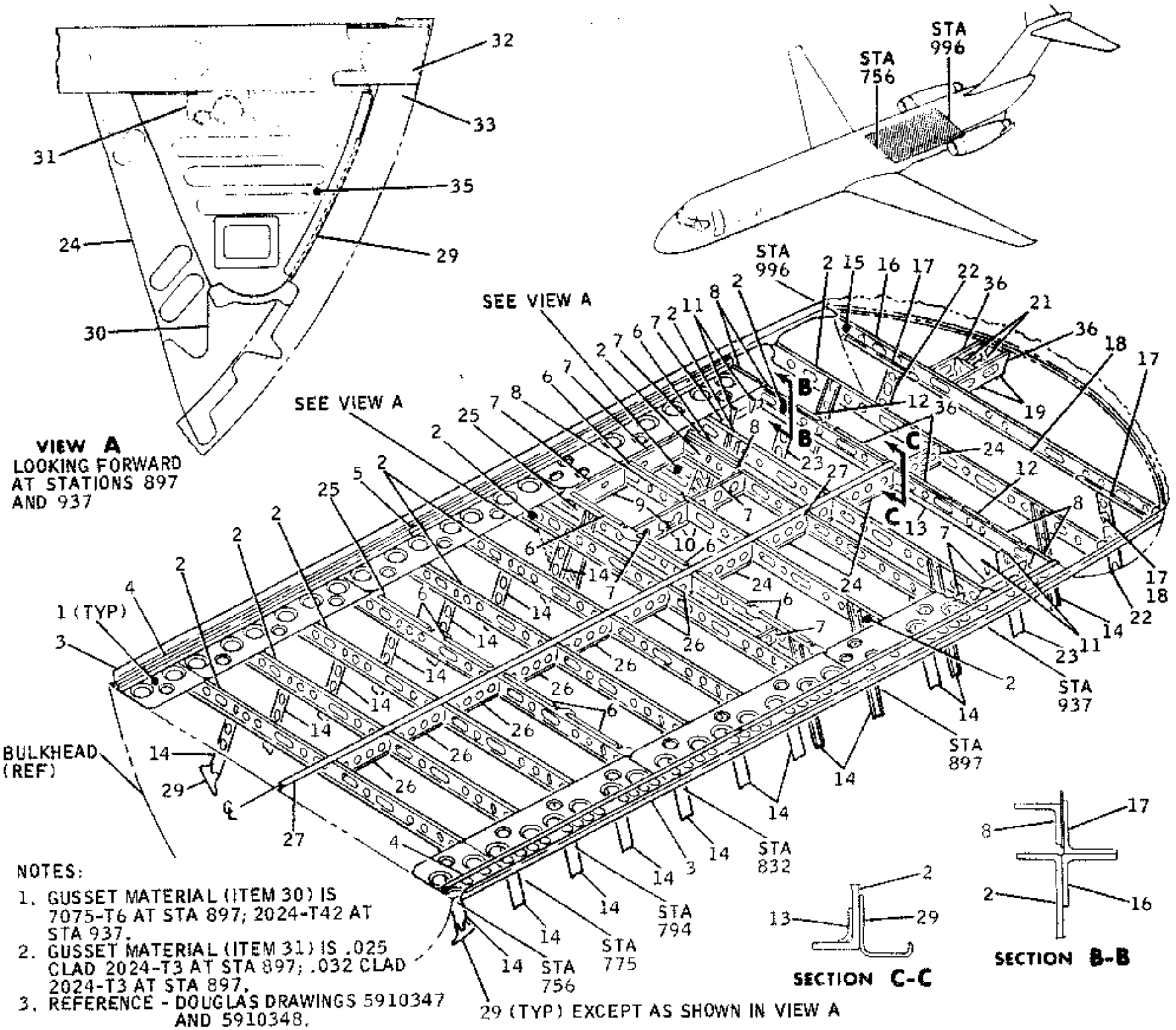
ITEM	PART NO.
4	3916216-501,-502
4A	3916216-507,-508
10	3916209-501,-502
18	3916212-501,-502
18A	3916215-501,-502
22	3916211-505,-506
22A	3916211-503,-504
23	3916210-505,-506
23A	3916210-503,-504
26	3916213-501,-502
27	4918783-1

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CUSP		2912047
2	ZEE		4616493
3	WEB	.063	CLAD 7075-T6
4	FITTING	SEE FITTING PART NOS.	
5	ANGLE		1276248
6	MEMBRANE	.020	CLAD 7075-T6
7	MEMBRANE	.040	CLAD 7075-T6
8	DOUBLER	.050	CLAD 2024-T42
9	ZEE	.050	CLAD 2024-T3
10	FITTING	SEE FITTING PART NOS.	
11	BEAM	.125	CLAD 7075-T6
12	SPLICE	.080	CLAD 7075-T6
13	BEAM		1419073
14	CHANNEL	.125	CLAD 7075-T6

ITEM	NOMENCLATURE	GAGE	MATERIAL
15	TEE		2912538
16	SUPPORT WEB	.050	CLAD 7075-T6
17	ANGLE		1418516
18	FITTING	SEE FITTING PART NOS.	
19	SUPPORT WEB	.040	CLAD 7075-T6
20	ANGLE		1332779
21	ANGLE		1242517
22	FITTING	SEE FITTING PART NOS.	
23	FITTING	SEE FITTING PART NOS.	
24	ANGLE		1415595
25	CAP		2652479
26	FITTING	SEE FITTING PART NOS.	
27	FITTING	SEE FITTING PART NOS.	

BB3-915

Floor Support Structure, Station 598 to 756
Figure 10



NOTES:

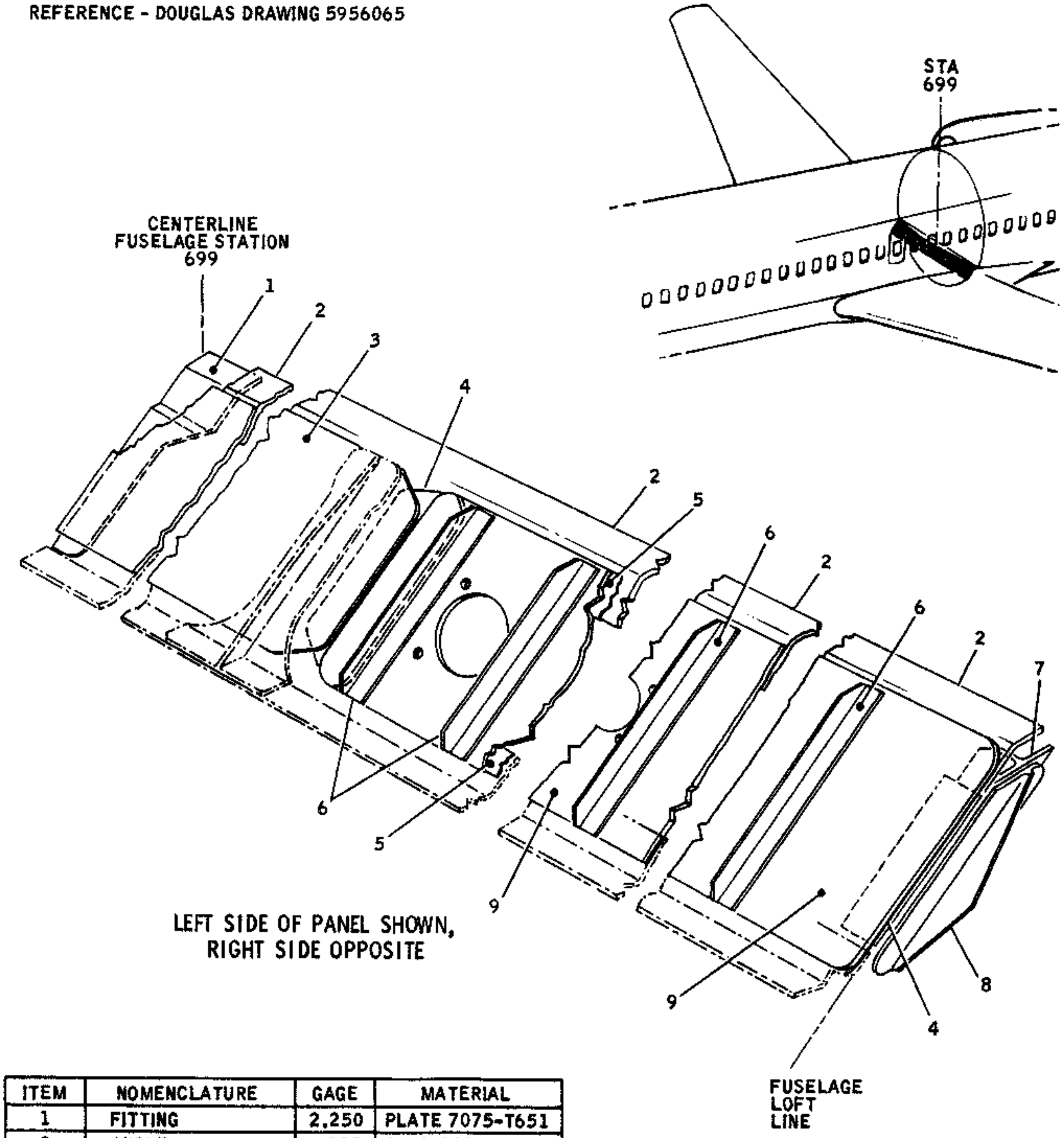
1. GUSSET MATERIAL (ITEM 30) IS 7075-T6 AT STA 897; 2024-T42 AT STA 937.
2. GUSSET MATERIAL (ITEM 31) IS .025 CLAD 2024-T3 AT STA 897; .032 CLAD 2024-T3 AT STA 897.
3. REFERENCE - DOUGLAS DRAWINGS 5910347 AND 5910348.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	MEMBRANE	.020	CLAD 7075-T6	19	CHANNEL	.063	CLAD 2024-T42
2	BEAM		2777896	20	SPACER	.032	CLAD 7075-T6
3	CUSP		2777976	21	SUPPORT	.040	CLAD 2024-T42
4	ZEE		4616493	22	STRUT	.032	CLAD 2024-T42
5	SPLICE		1465089	23	STRUT	.063	CLAD 7075-T6
6	ZEE	.050	CLAD 2024-T3	24	INTERCOSTAL	.032	CLAD 2024-T42
7	INTERCOSTAL	.040	CLAD 7075-T6	25	BEAM		2777897
8	ANGLE		1276248	26	INTERCOSTAL	.025	CLAD 2024-T42
9	ANGLE		1242520	27	CAP		2652479
10	ANGLE		1329780	28	GUSSET	.050	CLAD 7075-T6
11	CLIP	.040	CLAD 7075-T6	29	ANGLE	.032	CLAD 2024-T42
12	ZEE	.050	CLAD 6061-T6	30	GUSSET	.080	SEE NOTE 1
13	ANGLE	.100	CLAD 7075-T6	31	GUSSET		SEE NOTE 2
14	STRUT	.050	CLAD 7075-T6	32	ANGLE SPLICE		1093703
15	WEB	.032	CLAD 7075-T6	33	DOUBLER	.071	CLAD 2024-T3
16	ANGLE		2912758	34	WEB	.025	CLAD 2024-T42
17	ANGLE		1414967	35	SUPPORT	.025	CLAD 2024-T42
18	ANGLE		1249243	36	INTERCOSTAL	.040	CLAD 2024-T42

BB3-914

Floor Support Structure, Station 756 to 996 -- Type A
Figure 11

REFERENCE - DOUGLAS DRAWING 5956065



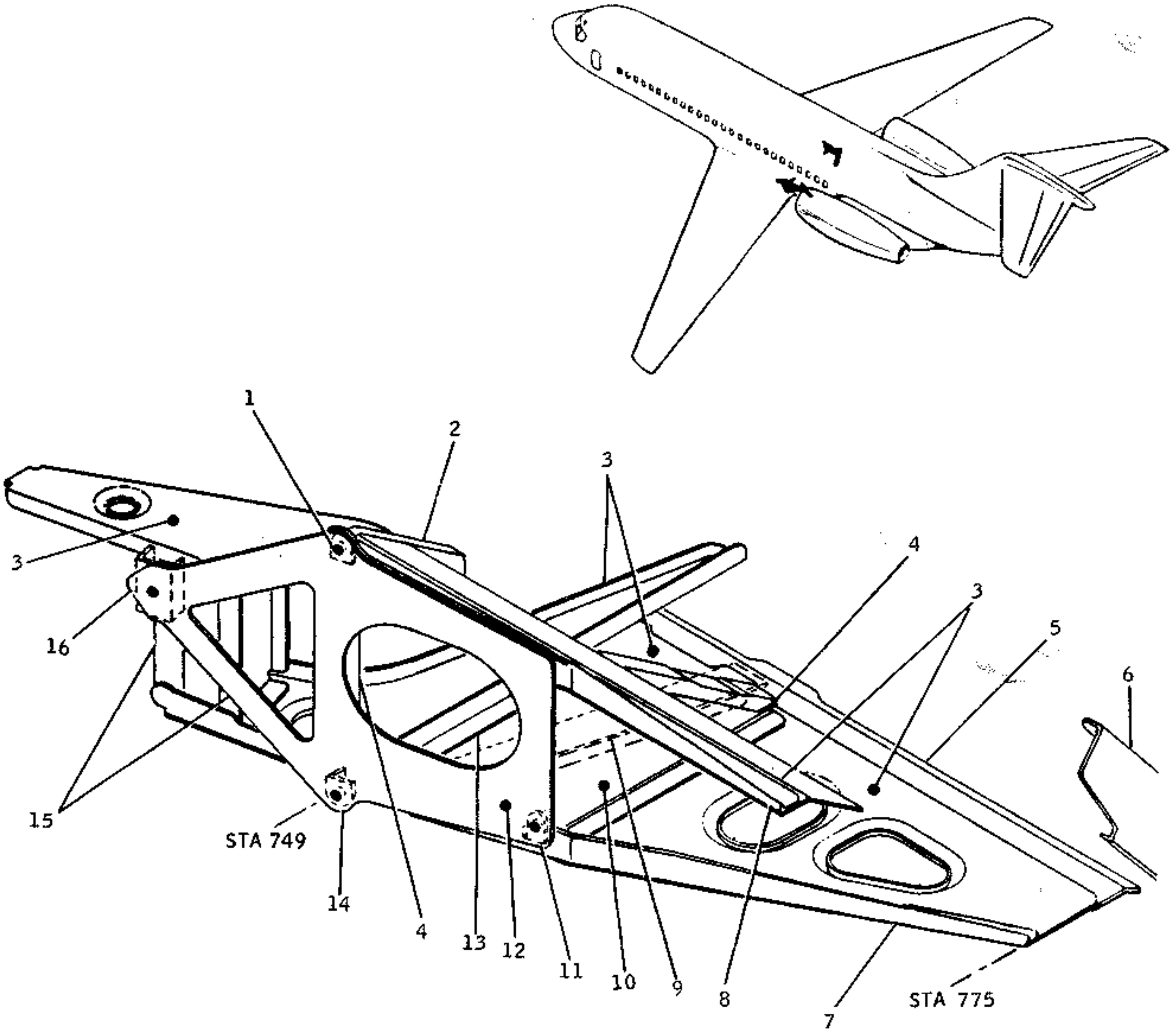
LEFT SIDE OF PANEL SHOWN,
RIGHT SIDE OPPOSITE

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	2.250	PLATE 7075-T651
2	ANGLE	.125	CLAD 2024-T42
3	PANEL	.125	CLAD 2024-T42
4	PLATE	.125	CLAD 2024-T42
5	GASKET ASSEMBLY		* 3955892-1, -2
6	STIFFENER		2500429
7	FITTING		1766648
8	FITTING		1430871
9	PANEL	.100	CLAD 2024-T42

* GASKET ASSEMBLY IS .010 THICKNESS STRIP POLYTETRAFLUOROETHYLENE CEMENTED TO .020 SILICONE RUBBER SHEET.

BB3-880

Fuselage-to-Wing Slant Pressure Panel
Figure 12



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	1.500	CLAD 7075-T651
2	CHANNEL	.080	CLAD 7075-T6
3	WEB	.063	CLAD 7075-T6
4	ANGLE	.080	CLAD 7075-T6
5	ANGLE	.063	CLAD 7075-T6
6	INTERCOSTAL	.063	CLAD 2024-T42
7	TEE		2914624
8	ANGLE		1298097
9	FITTING		3916413
10	WEB	.080	CLAD 7075-T6
11	FITTING	.071	CLAD 7075-T6
12	PLATE	.160	CLAD 7075-T6
13	ANGLE	.063	CLAD 2024-T42
14	FITTING	.071	CLAD 7075-T6
15	INTERCOSTAL	.071	CLAD 7075-T6
16	FITTING	.071	CLAD 7075-T6

REFERENCE - DOUGLAS DRAWING
9915521

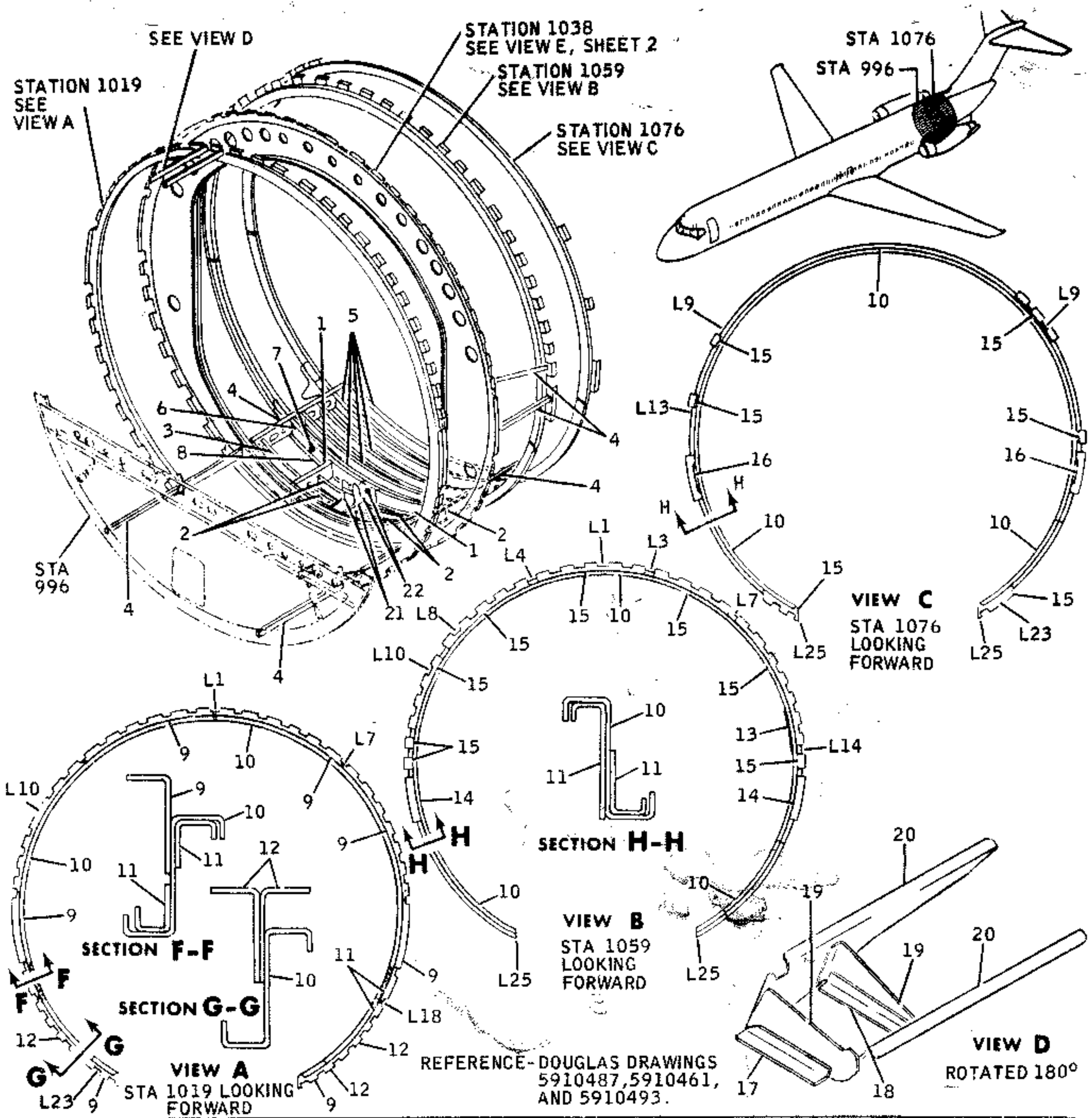
BB3-984

Wing Flap Track Carriage Support
Sturcture -- Type A
Figure 13

FUSELAGE SECTION, STATION 996 TO CANTED STATION 1168 - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures illustrate the structural components of the fuselage section from station 996 to canted station 1168. The materials are identified in the material lists by item number callouts.

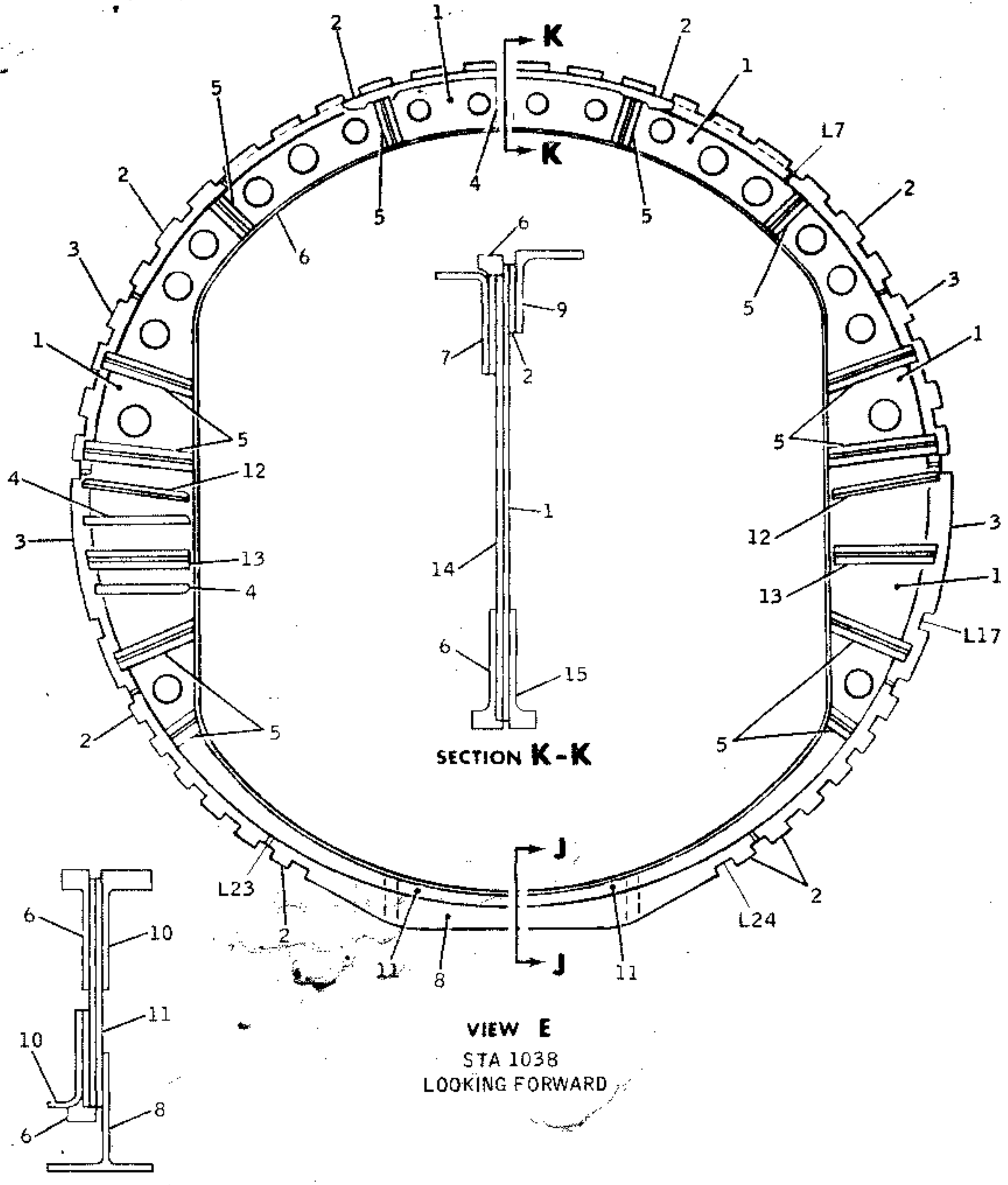


REFERENCE-DOUGLAS DRAWINGS 5910487,5910461, AND 5910493.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.050	CLAD 7075-T6	12	FORMER	.063	CLAD 2014-T6
2	FRAME	.040	CLAD 7075-T6	13	TEE		144004B
3	FORMER	.040	CLAD 7075-T6	14	ANGLE	.050	CLAD 2014-T6
4	INTERCOSTAL	.040	CLAD 7075-T6	15	SHEAR CLIP	.050	CLAD 7075-T6
5	FRAME	.050	CLAD 7075-T6	16	SHEAR CLIP	.050	CLAD 2014-T6
6	CAP		1249328	17	TEE		1249240
7	WEB	.063	CLAD 7075-T6	18	ANGLE		1418201
8	CAP		2506869	19	WEB	.040	CLAD 2024-T42
9	FORMER	.050	CLAD 2014-T6	20	INTERCOSTAL	.040	CLAD 2024-T42
10	FRAME		2777930-5	21	BEAM	2.500	CLAD 7075-T651
11	SPLICE	.063	CLAD 7075-T6	22	WEB	.040	CLAD 7075-T6

BB3-906

Frames and Intercostals, Station 996 to 1087 -- Type A1
Figure 1 (Sheet 1)



SECTION K-K

VIEW E
STA 1038
LOOKING FORWARD

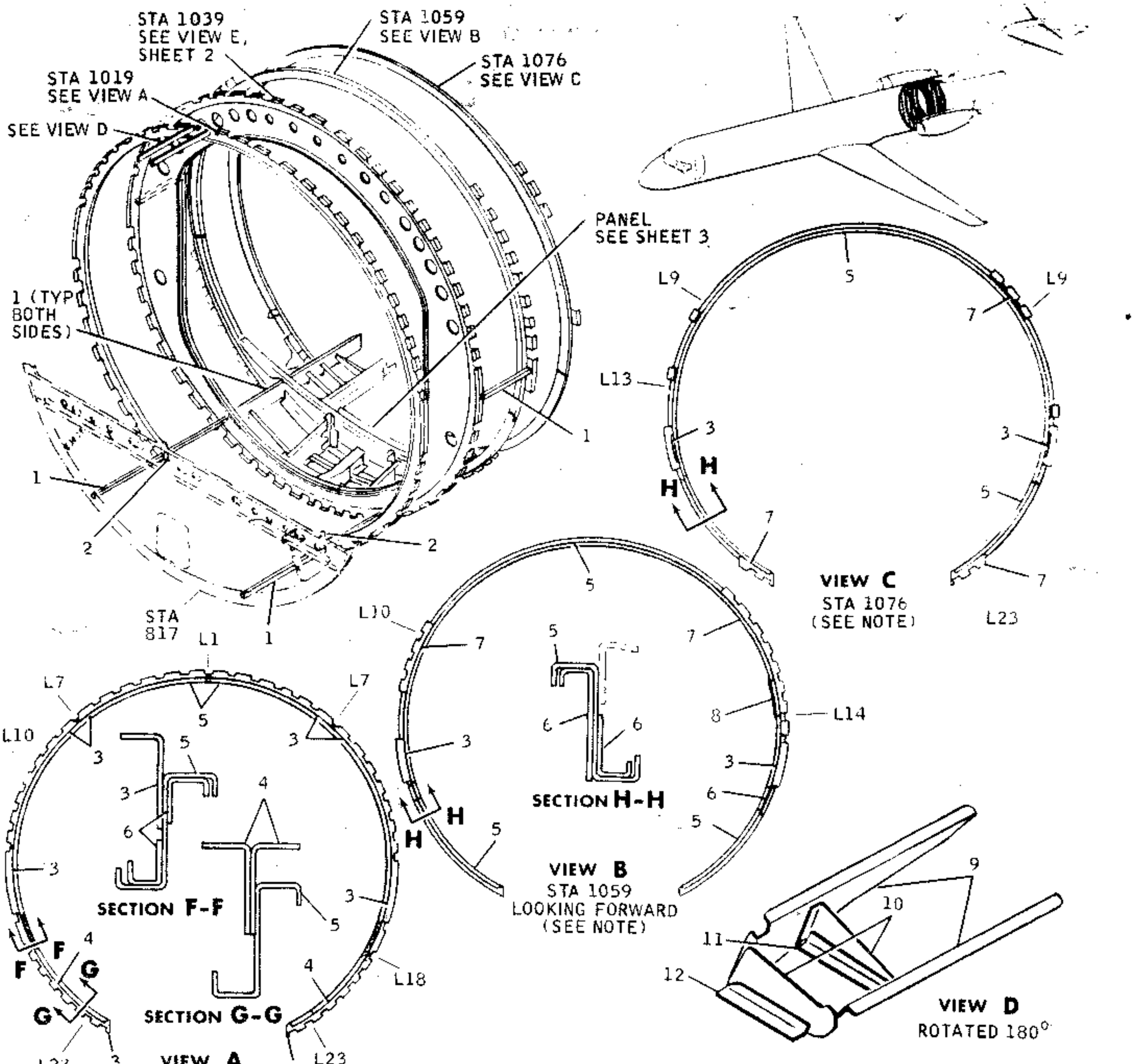
SECTION J-J

REFERENCE-DOUGLAS DRAWING 9912246

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6	9	ANGLE		1416036
2	SHEAR CLIP	.040	CLAD 2014-T42	10	SPLICE		1298097
3	SHEAR CLIP	.050	CLAD 2014-T42	11	WEB	.050	CLAD 7075-T6
4	DOUBLER	.063	CLAD 7075-T6	12	ANGLE		1250445
5	STIFFENER		27[illegible]	13	TEE		1414813
6	CAP-ANGLE		2912813	14	DOUBLER	.050	CLAD 7075-T6
7	SPLICE	.063	CLAD 7075-T6	15	SPLICE		2912813
8	TEE		4923323				

BB3-907

Frames and Intercostals, Station 996 to 1087 -- Type A1
Figure 1 (Sheet 2)



NOTE:

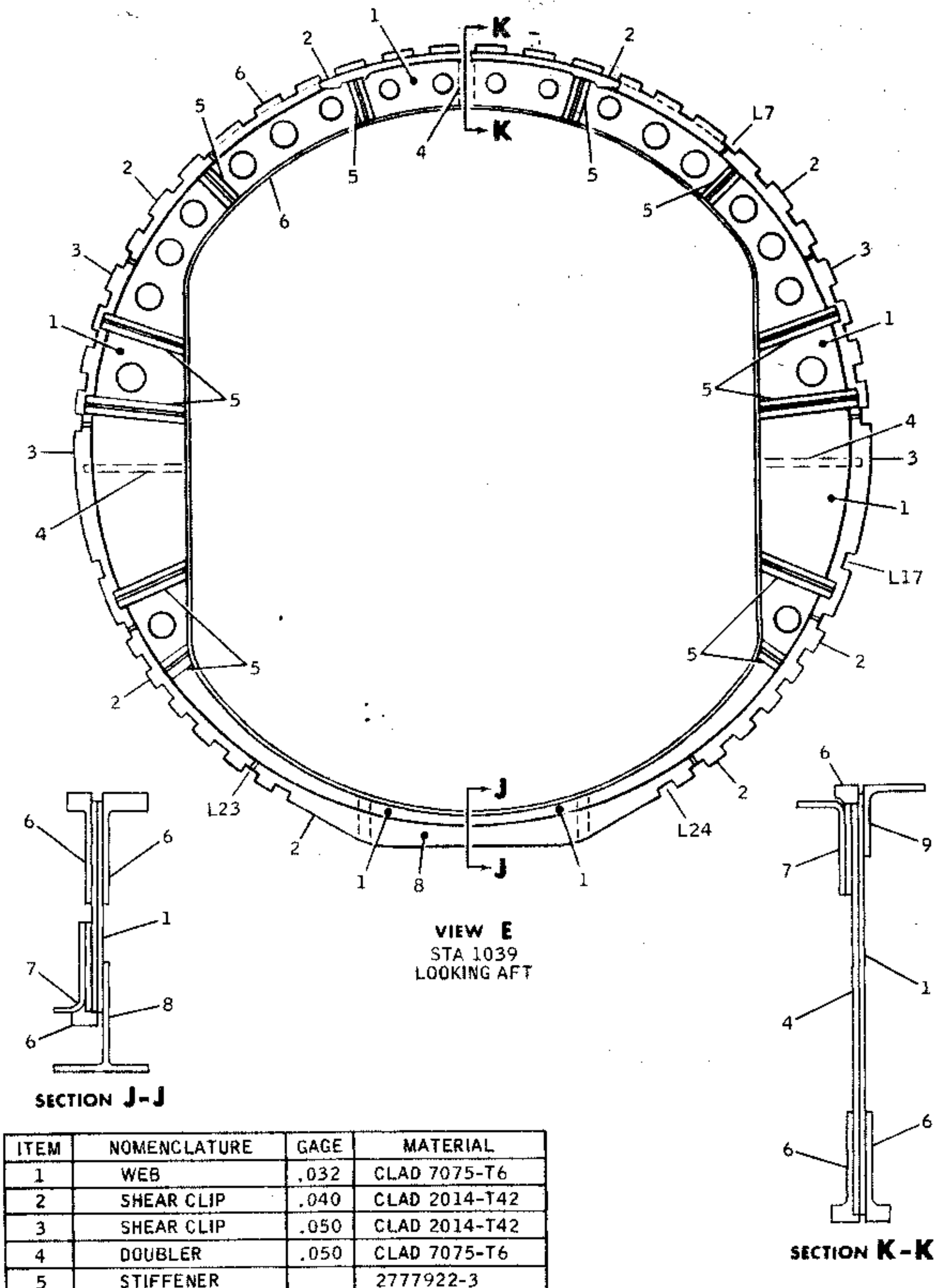
FOR LOWER STRUCTURE BETWEEN LONGERONS 25 (RIGHT AND LEFT SIDES) SEE SHEET 3

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 7075-T6	7	FORMER	.050	CLAD 7075-T6
2	BRACKET	.040	CLAD 7075-T6	8	TEE		1440048
3	FORMER	.050	CLAD 2014-T6	9	INTERCOSTAL	.040	CLAD 2024-T42
4	FORMER	.063	CLAD 2014-T6	10	WEB	.040	CLAD 2024-T42
5	FRAME		2777930-5	11	ANGLE		1418201
6	SPLICE	.063	CLAD 7075-T6	12	TEE		1249240

REFERENCE - DOUGLAS DRAWING 5910144

BB3-935

Frames and Intercostals, Station 996 to 1087 -- Type A2
Figure 2 (Sheet 1)



VIEW E
STA 1039
LOOKING AFT

SECTION J-J

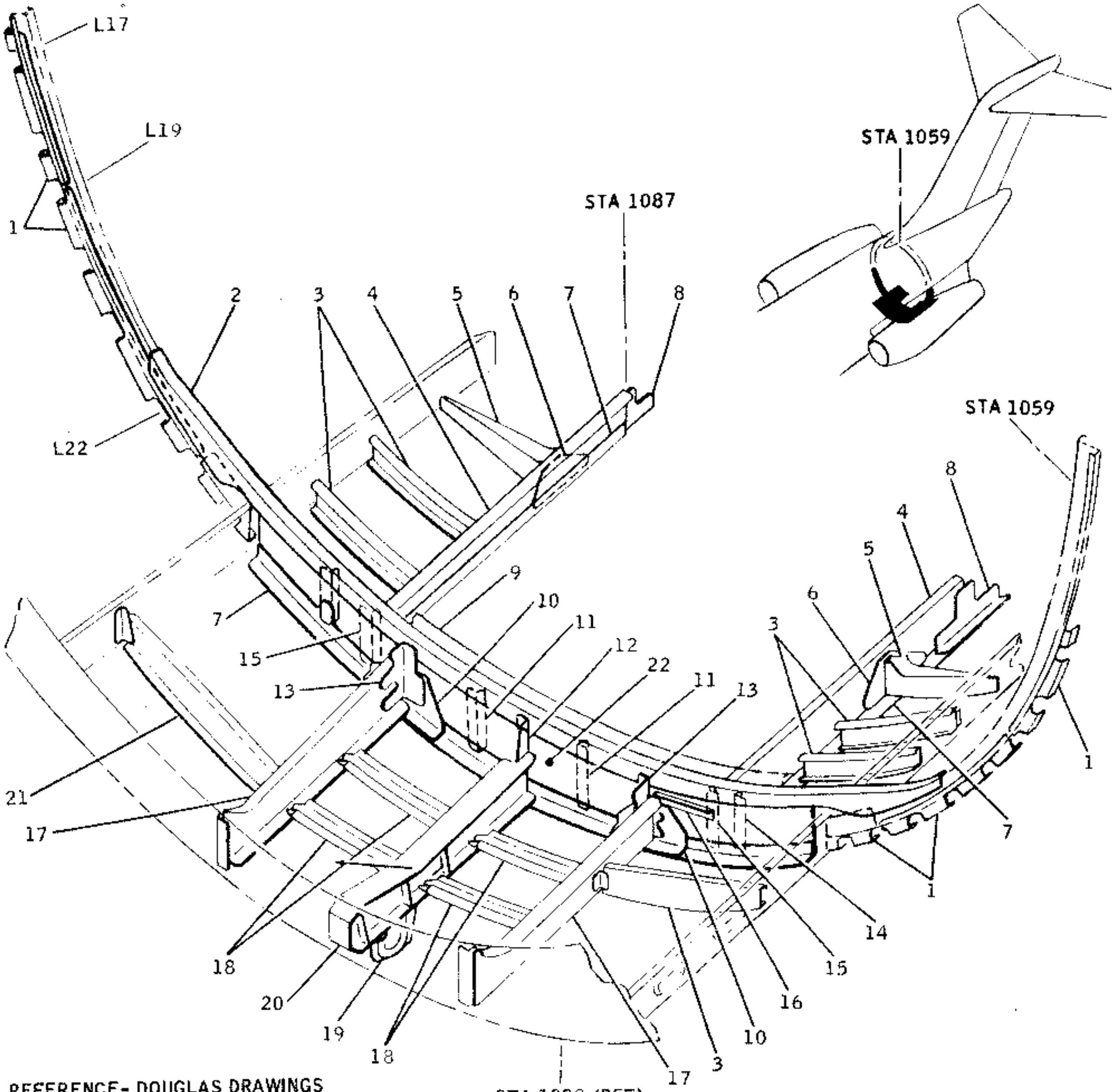
SECTION K-K

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6
2	SHEAR CLIP	.040	CLAD 2014-T42
3	SHEAR CLIP	.050	CLAD 2014-T42
4	DOUBLER	.050	CLAD 7075-T6
5	STIFFENER		2777922-3
6	CAP - ANGLE		2912813
7	SPLICE		CLAD 7075-T6
8	TEE		2919038 *
9	ANGLE	.063	1416036

* 2914191 USED ON AIRPLANES 1 THRU 19

BB3-936

Frames and Intercostals, Station 996 to 1087 -- Type A2
Figure 2 (Sheet 2)



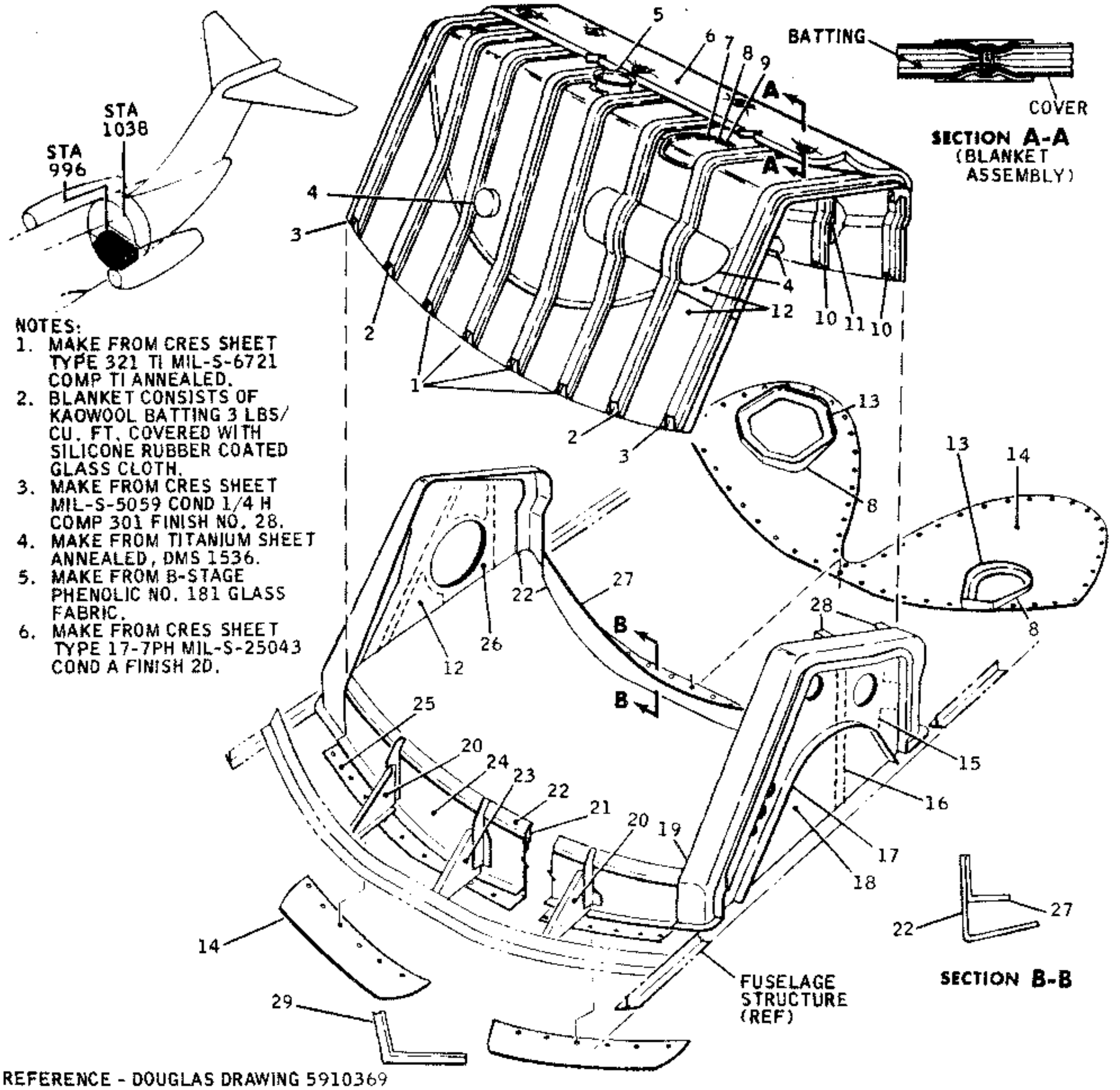
REFERENCE- DOUGLAS DRAWINGS
5911429 AND 5910011

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.050	CLAD 7075-T6
2	CAP ANGLE	.063	CLAD 7075-T6
3	FRAME	.040	CLAD 7075-T6
4	JAMB	.040	CLAD 7075-T6
5	FITTING,3957174-1,-2	2.250	PLATE 7075-T651
6	DOUBLER	.040	CLAD 7075-T6
7	CAP ANGLE	.050	CLAD 7075-T6
8	ANGLE	.071	CLAD 7075-T6
9	RETAINER	.050	CLAD 2024-T42
10	BRACKET	.100	CLAD 7075-T6
11	ANGLE		1244084

ITEM	NOMENCLATURE	GAGE	MATERIAL
12	ANGLE		1416036
13	FITTING		2640547
14	ANGLE		1415595
15	CLIP		1419056
16	ANGLE	.063	CLAD 2024-T42
17	INTERCOSTAL	.050	CLAD 7075-T6
18	STIFFENER		2777922-3
19	FITTING,5912594-501		CRES 17-4PH
20	INTERCOSTAL 9915583-3	3.00	PLATE 7075-T651
21	FORMER	.040	CLAD 7075-T6
22	WEB	.032	CLAD 7075-T6

BB3-937

Frames and Intercostals, Station 996 to 1087 -- Type A2
Figure 2 (Sheet 3)



NOTES:
1. MAKE FROM CRES SHEET TYPE 321 TI MIL-S-6721 COMP TI ANNEALED.
2. BLANKET CONSISTS OF KAOWOOL BATTING 3 LBS/ CU. FT. COVERED WITH SILICONE RUBBER COATED GLASS CLOTH.
3. MAKE FROM CRES SHEET MIL-S-5059 COND 1/4 H COMP 301 FINISH NO. 28.
4. MAKE FROM TITANIUM SHEET ANNEALED, DMS 1536.
5. MAKE FROM B-STAGE PHENOLIC NO. 181 GLASS FABRIC.
6. MAKE FROM CRES SHEET TYPE 17-7PH MIL-S-25043 COND A FINISH 2D.

REFERENCE - DOUGLAS DRAWING 5910369

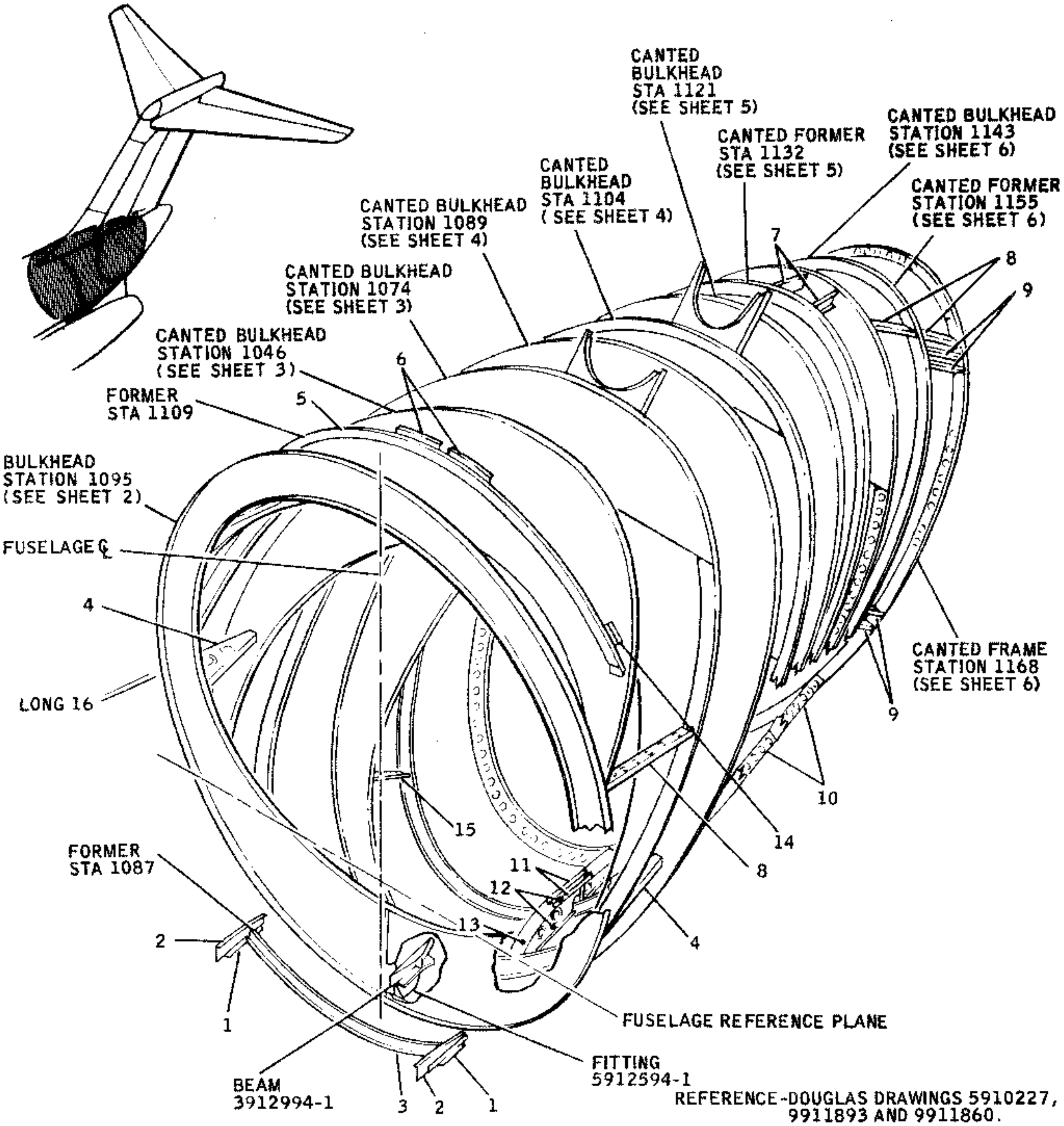
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		2777922-1
2	STIFFENER		2777922-3
3	STIFFENER	.040	CLAD 7075-T6
4	PAN	.025	SEE NOTE 1
5	FLANGE	.050	SEE NOTE 1
6	BLANKET		SEE NOTE 2
7	COVER	.025	SEE NOTE 3
8	SEAL	.125	SILICONE RUBBER
9	DOUBLER	.025	SEE NOTE 3
10	STIFFENER	.032	SEE NOTE 1
11	BEAM	.040	CLAD 7075-T6
12	SKIN	.020	SEE NOTE 4
13	PAN		SEE NOTE 5
14	FAIRING		SEE NOTE 5
15	BRACKET	.040	SEE NOTE 4

ITEM	NOMENCLATURE	GAGE	MATERIAL
16	STIFFENER	.032	SEE NOTE 4
17	DOUBLER	.020	SEE NOTE 6
18	PLATE	.020	SEE NOTE 4
19	ANGLE	.025	SEE NOTE 1
20	INTERCOSTAL	.063	CLAD 7075-T6
21	BEAM	.032	SEE NOTE 1
22	ANGLE	.032	SEE NOTE 1
23	INTERCOSTAL	.040	CLAD 7075-T6
24	FRAME	.025	SEE NOTE 4
25	ANGLE	.032	SEE NOTE 4
26	DOUBLER	.040	SEE NOTE 4
27	ANGLE	.032	CLAD 7075-T6
28	INTERCOSTAL	.032	SEE NOTE 1
29	FLUID DIVERTER	.063	CLAD 2024-T42

BB3-894

Auxiliary Power Unit Enclosure -- Type A
Figure 3

Printed in U.S.A.

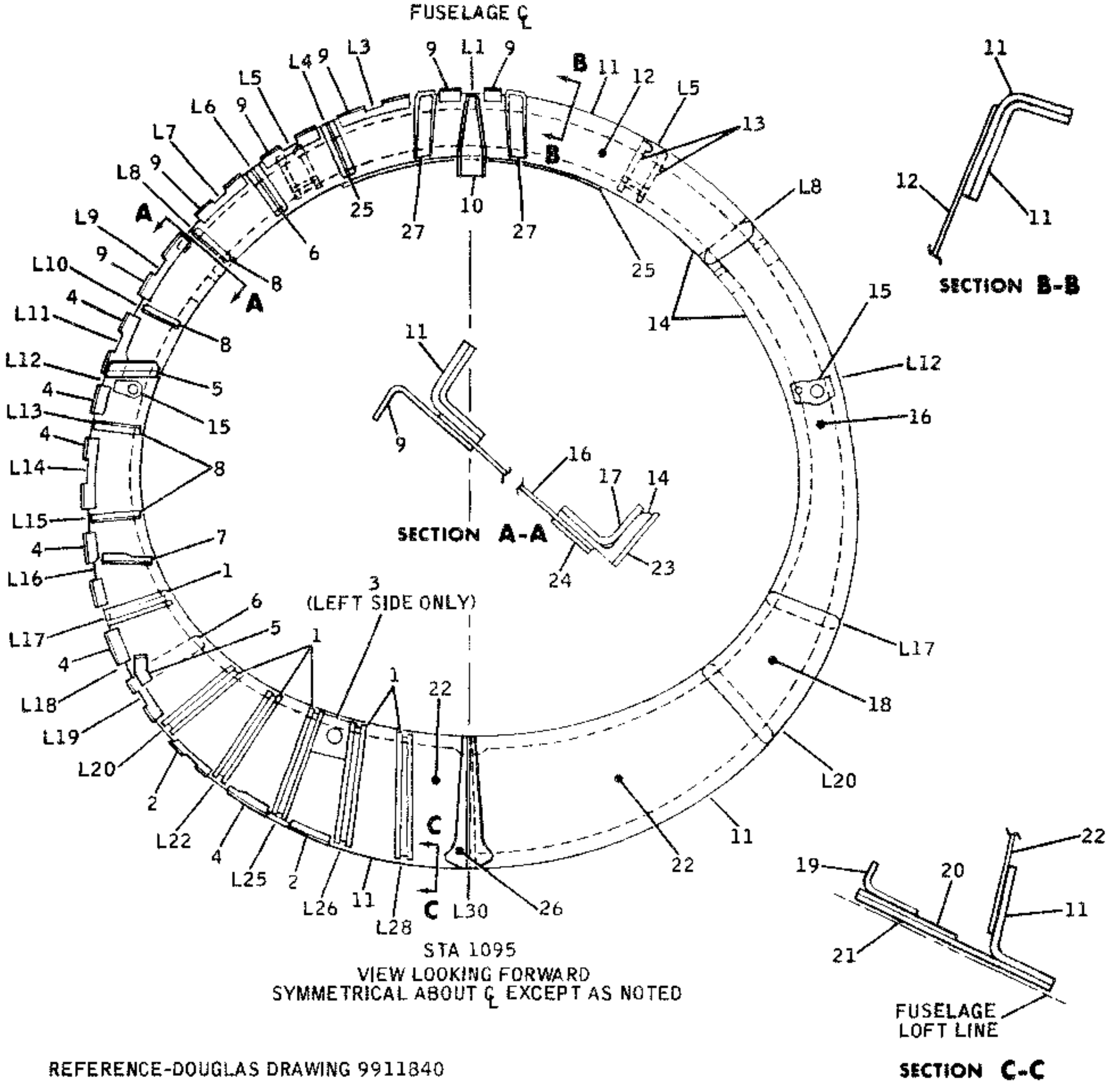


REFERENCE-DOUGLAS DRAWINGS 5910227, 9911893 AND 9911860.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE		2914057	9	INTERCOSTAL	.050	CLAD 2024-T42
2	INTERCOSTAL	.040	CLAD 7075-T6	10	CHANNEL	.025	CLAD 2024-T3
3	FORMER	.040	CLAD 7075-T6	11	ANGLE		1242526
4	INTERCOSTAL	.063	CLAD 7075-T6	12	WEB	.032	CLAD 7075-T6
5	ZEE		2912412	13	WEB	.020	CLAD 7075-T6
6	ANGLE	.050	CLAD 2024-T42	14	CLIP	.050	CLAD 2024-T42
7	INTERCOSTAL	.040	CLAD 2024-T42	15	WEB	.032	CLAD 2024-T42
8	INTERCOSTAL	.050	CLAD 7075-T6				

BB3-896

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A1
Figure 4 (Sheet 1)



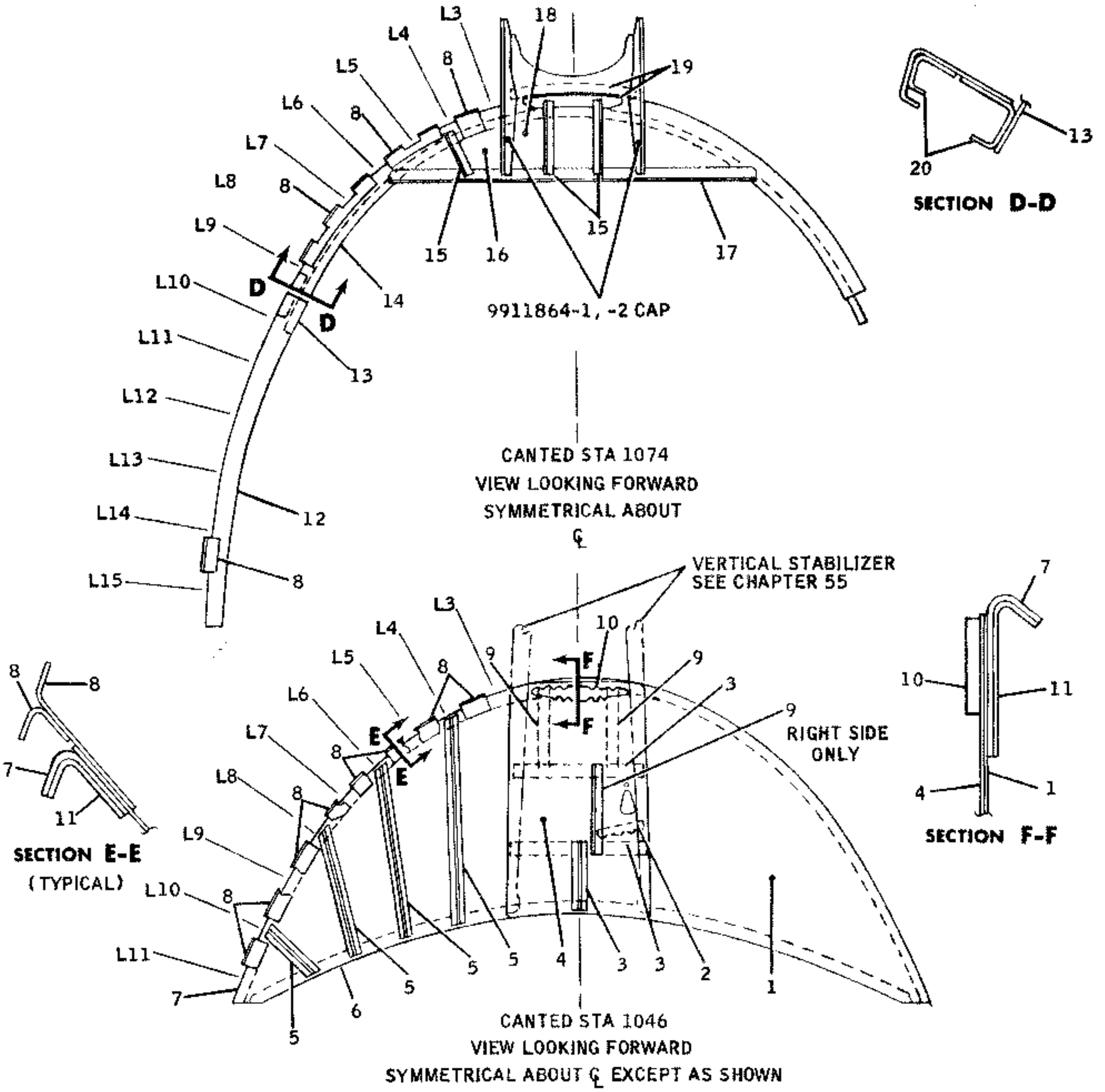
STA 1095
VIEW LOOKING FORWARD
SYMMETRICAL ABOUT ℄ EXCEPT AS NOTED

REFERENCE-DOUGLAS DRAWING 9911840

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER		2777922-5
2	CLIP	.050	CLAD 7075-T6
3	DOUBLER	.063	CLAD 7075-T6
4	CLIP	.063	CLAD 7075-T6
5	CLIP	.160	CLAD 7075-T6
6	STIFFENER		1414813
7	STIFFENER		1325737
8	STIFFENER		1415595
9	CLIP	.071	CLAD 7075-T6
10	CHANNEL	.063	CLAD 7075-T6
11	CAP ANGLE	.125	CLAD 7075-T6
12	WEB	.080	CLAD 7075-T6
13	BRACKET	.040	CLAD 2024-T42
14	CAP		1419366
15	DOUBLER	.040	CLAD 7075-T6
16	WEB	.032	CLAD 7075-T6
17	SPLICE	.125	CLAD 7075-T6
18	WEB	.040	CLAD 7075-T6
19	ANGLE	.090	CLAD 7075-T6
20	DOUBLER	.071	CLAD 7075-T6
21	DOUBLER	.080	CLAD 7075-T6
22	WEB	.050	CLAD 7075-T6
23	STRAP	.125	CLAD 7075-T6
24	STRAP	.063	CLAD 7075-T6
25	STIFFENER		1418683
26	FITTING		FORGING 7075-T6
27	FITTING	1.750	PLATE 7075-T651

883-897

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A1
Figure 4 (Sheet 2)



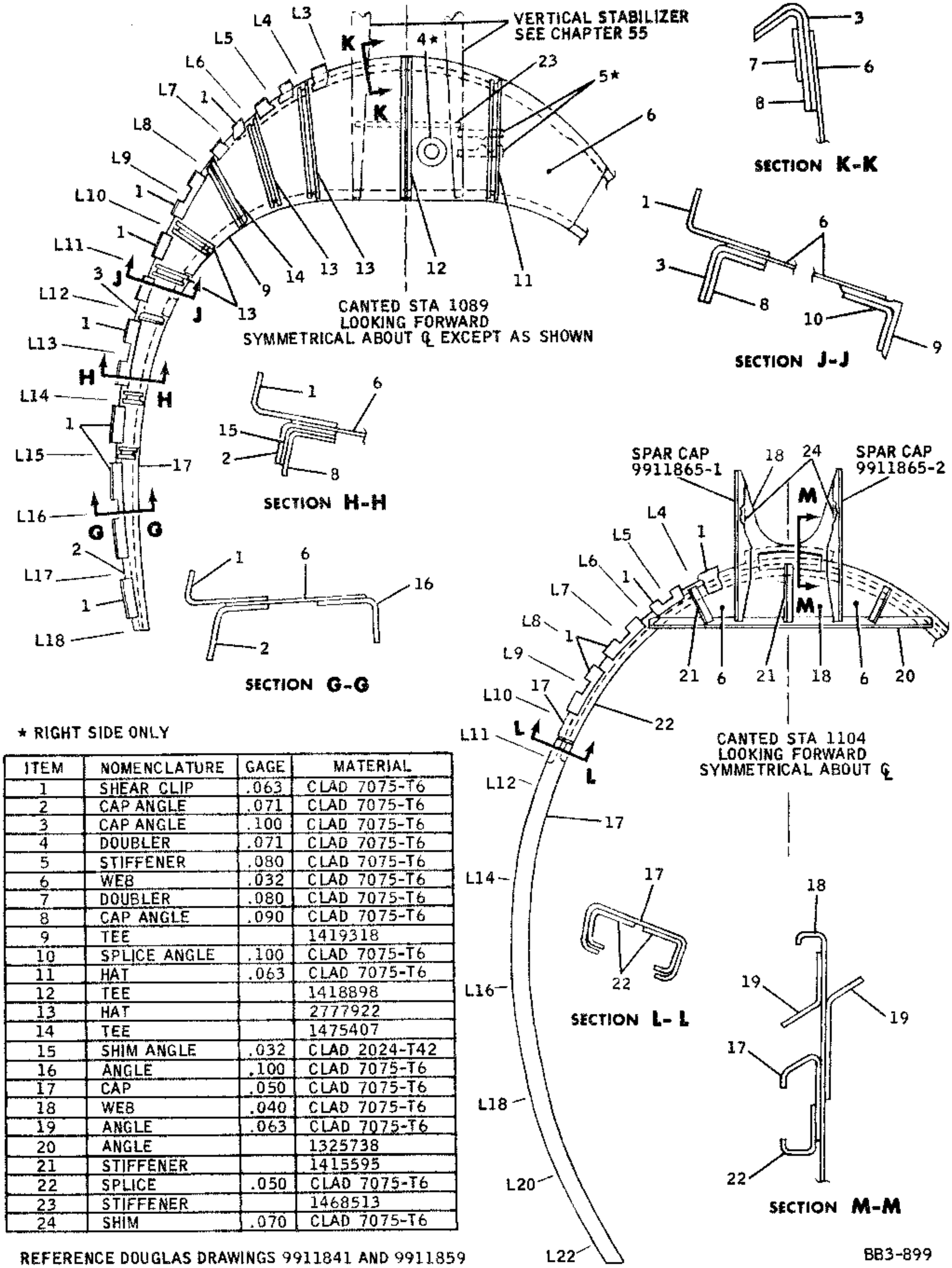
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.050	CLAD 7075-T6	11	CAP	.071	7075-T6
2	BRACKET	.125	6061-T6	12	FRAME		2777930
3	STIFFENER		1417984	13	SPLICE	.050	CLAD 7075-T6
4	DOUBLER	.040	CLAD 7075-T6	14	FRAME	.050	CLAD 7075-T6
5	STIFFENER		1332780	15	STIFFENER		1415595
6	CAP		2913786	16	WEB	.032	CLAD 7075-T6
7	CAP	.100	CLAD 7075-T6	17	ANGLE		1325738
8	CLIP	.063	CLAD 7075-T6	18	WEB	.040	CLAD 7075-T6
9	STIFFENER		1418201	19	ATTACH CLIP	.063	CLAD 7075-T6
10	FILLER	.250	7075-T651	20	CHANNEL	.050	CLAD 7075-T6

REFERENCE-DOUGLAS DRAWINGS 9911858 AND 9911838

BB3-898

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A1
Figure 4 (Sheet 3)

Printed in U.S.A.



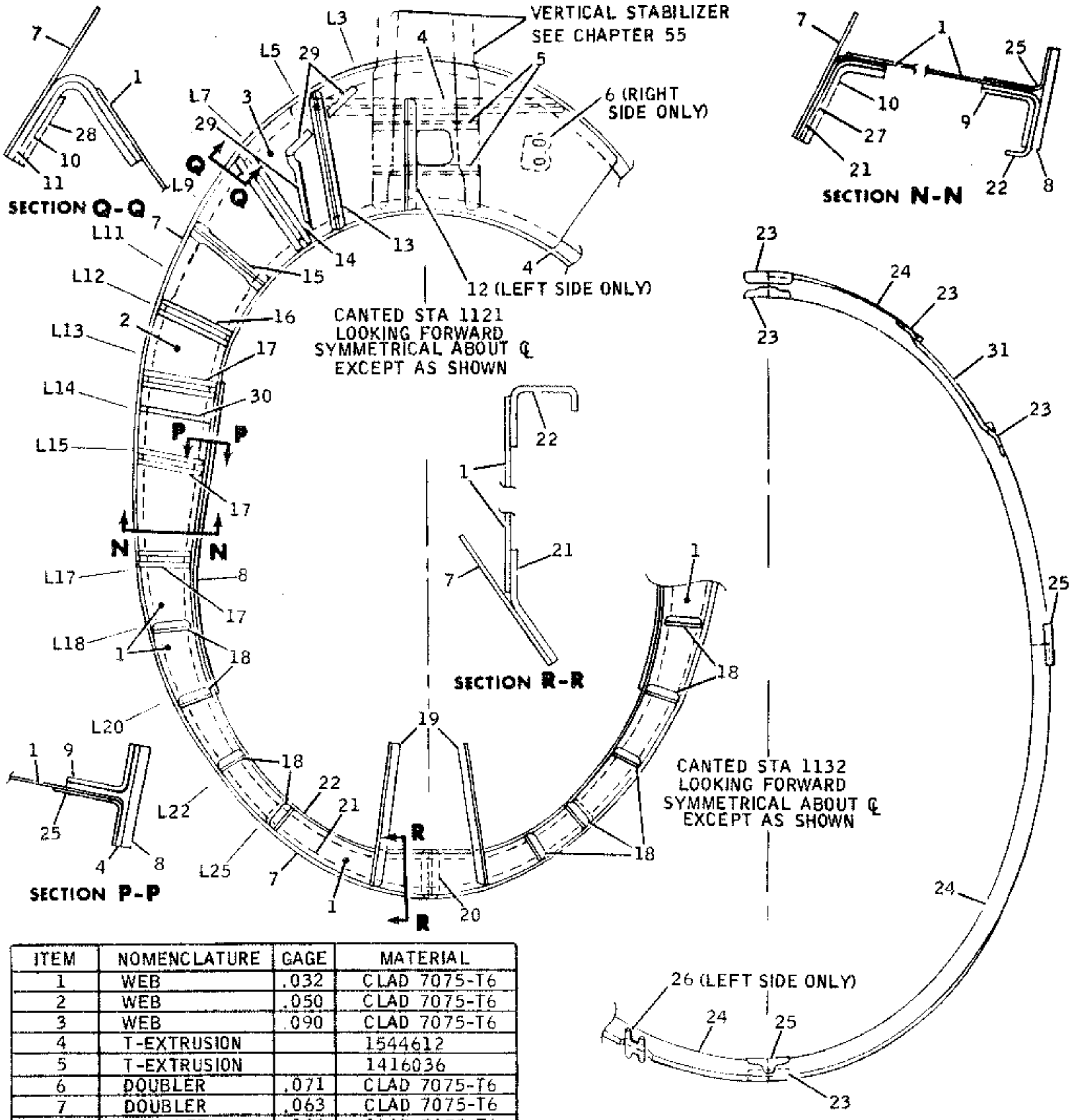
★ RIGHT SIDE ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SHEAR CLIP	.063	CLAD 7075-T6
2	CAP ANGLE	.071	CLAD 7075-T6
3	CAP ANGLE	.100	CLAD 7075-T6
4	DOUBLER	.071	CLAD 7075-T6
5	STIFFENER	.080	CLAD 7075-T6
6	WEB	.032	CLAD 7075-T6
7	DOUBLER	.080	CLAD 7075-T6
8	CAP ANGLE	.090	CLAD 7075-T6
9	TEE		1419318
10	SPLICE ANGLE	.100	CLAD 7075-T6
11	HAT	.063	CLAD 7075-T6
12	TEE		1418898
13	HAT		2777922
14	TEE		1475407
15	SHIM ANGLE	.032	CLAD 2024-T42
16	ANGLE	.100	CLAD 7075-T6
17	CAP	.050	CLAD 7075-T6
18	WEB	.040	CLAD 7075-T6
19	ANGLE	.063	CLAD 7075-T6
20	ANGLE		1325738
21	STIFFENER		1415595
22	SPLICE	.050	CLAD 7075-T6
23	STIFFENER		1468513
24	SHIM	.070	CLAD 7075-T6

REFERENCE DOUGLAS DRAWINGS 9911841 AND 9911859

BB3-899

Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A1
Figure 4 (Sheet 4)

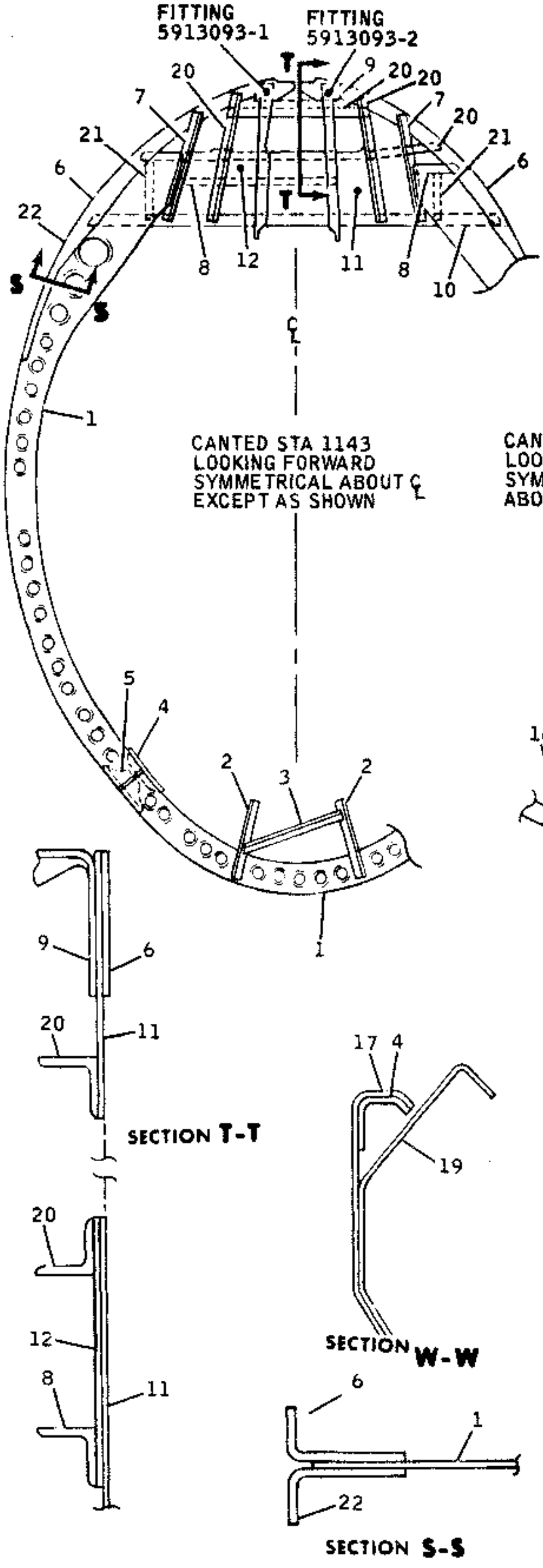


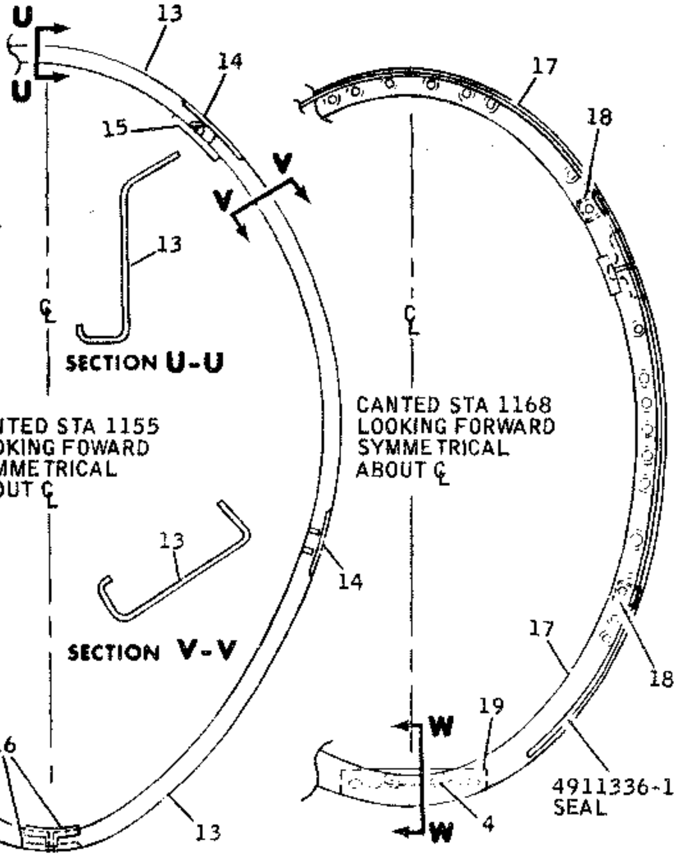
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 7075-T6
2	WEB	.050	CLAD 7075-T6
3	WEB	.090	CLAD 7075-T6
4	T-EXTRUSION		1544612
5	T-EXTRUSION		1416036
6	DOUBLER	.071	CLAD 7075-T6
7	DOUBLER	.063	CLAD 7075-T6
8	DOUBLER	.190	CLAD 7075-T6
9	SPLICE	.090	CLAD 7075-T6
10	DOUBLER	.125	CLAD 7075-T6
11	CAP	.125	CLAD 7075-T6
12	STIFFENER		1415741
13	STIFFENER		1641009
14	STIFFENER	.100	CLAD 7075-T6
15	STIFFENER		1475407
16	STIFFENER		2777922-5
17	STIFFENER		2777922-4
18	STIFFENER		1242526
19	ANGLE		1199981
20	FITTING		1416793

ITEM	NOMENCLATURE	GAGE	MATERIAL
21	CAP	.071	CLAD 7075-T6
22	CAP	.090	CLAD 7075-T6
23	ANGLE	.040	CLAD 7075-T6
24	FRAME	.040	CLAD 7075-T6
25	ANGLE	.050	CLAD 7075-T6
26	DOUBLER	.040	CLAD 2024-T3
27	DOUBLER	.050	CLAD 7075-T6
28	DOUBLER	.080	CLAD 7075-T6
29	ANGLE	.032	CLAD 2024-T42
30	ANGLE	.040	CLAD 2024-T42
31	ANGLE	.063	CLAD 7075-T6

BB3-900

Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A1
Figure 4 (Sheet 5)



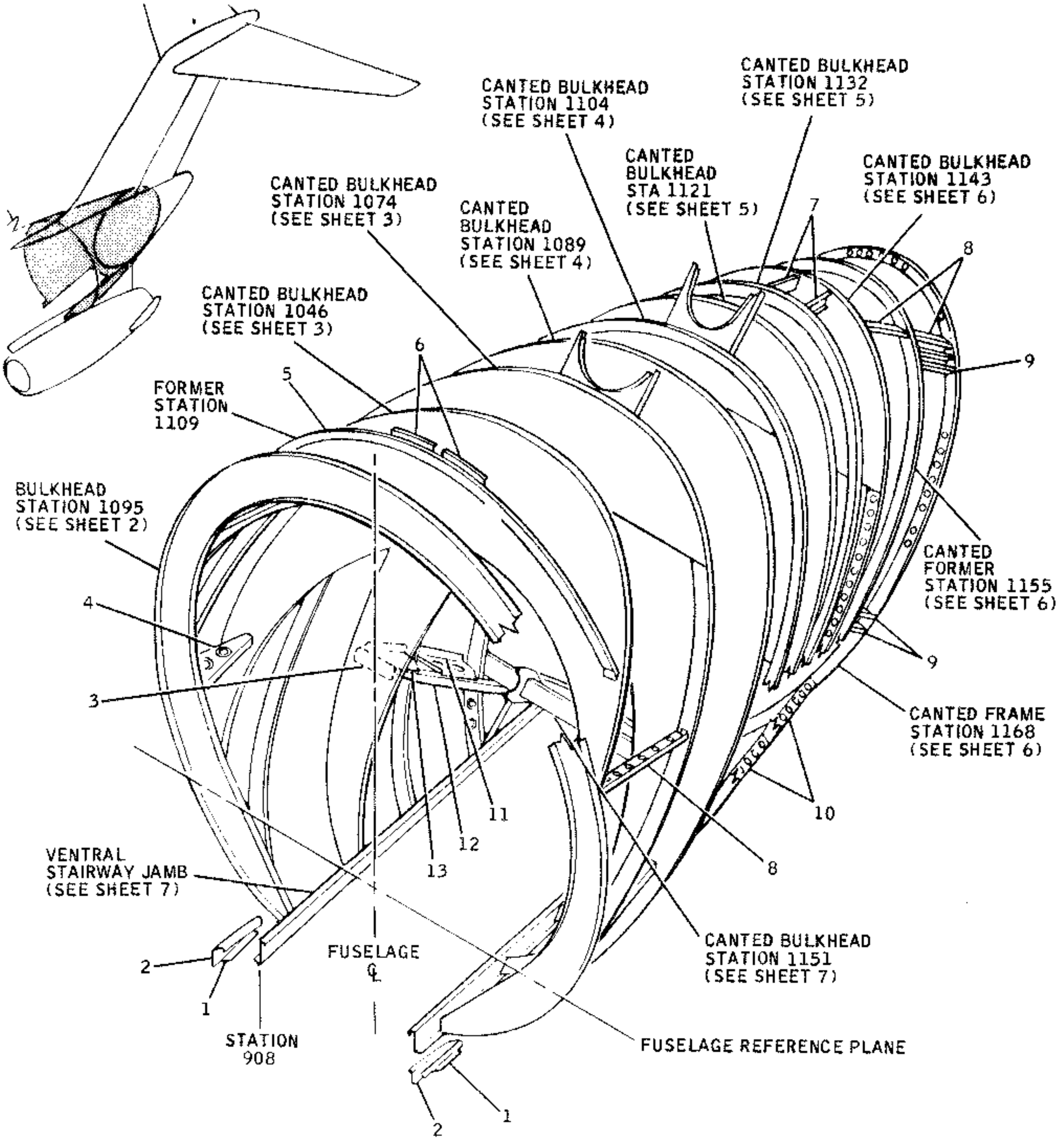


REFERENCE DOUGLAS DRAWINGS
9911842, 9911878, AND 9911843

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.050	CLAD 7075-T6
2	ANGLE		1242526
3	STIFFENER		1245072
4	SPLICE PLATE	.063	CLAD 7075-T6
5	SPLICE ANGLE	.050	CLAD 7075-T6
6	CAP	.100	CLAD 7075-T6
7	STIFFENER		1249581
8	ANGLE		1249578
9	SPLICE ANGLE	.100	7075-T6
10	STIFFENER		1242937
11	WEB	.040	CLAD 7075-T6
12	DOUBLER	.050	CLAD 7075-T6
13	FRAME	.040	CLAD 7075-T6
14	GUSSET	.050	CLAD 2024-T42
15	CHANNEL	.063	CLAD 7075-T6
16	SPLICE ANGLE	.040	CLAD 7075-T6
17	FRAME	.063	CLAD 7075-T6
18	CHANNEL		1417718
19	SPLICE	.040	CLAD 7075-T6
20	STIFFENER		1249578
21	ANGLE	.040	CLAD 2024-T42
22	CAP	.050	CLAD 7075-T6

BB3-901

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A1
Figure 4 (Sheet 6)

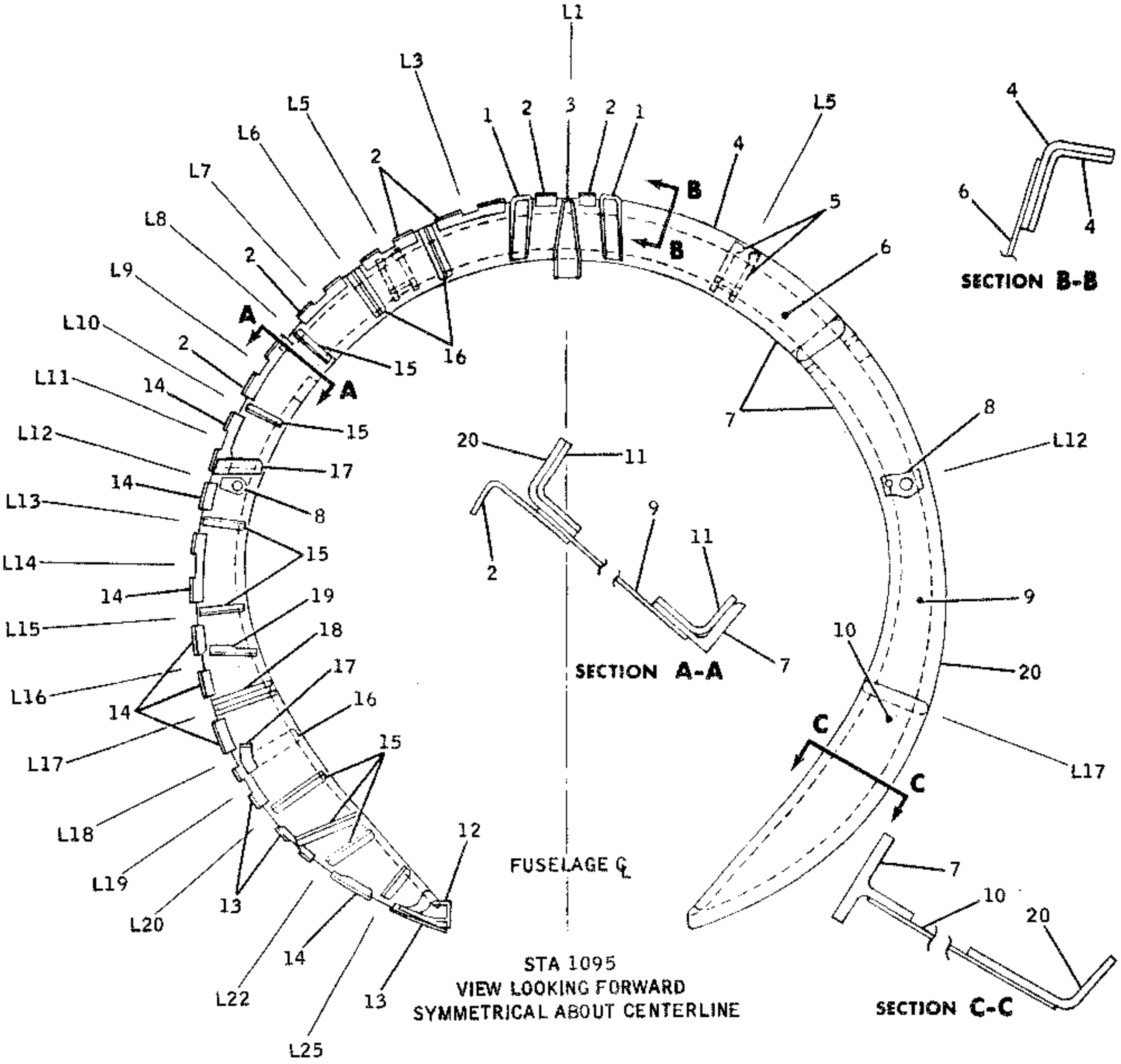


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE		2914057	8	INTERCOSTAL	.050	CLAD 7075-T6
2	INTERCOSTAL	.040	CLAD 7075-T6	9	INTERCOSTAL	.050	CLAD 2024-T42
3	CLIP		2777975	10	CHANNEL	.025	CLAD 2024-T3
4	INTERCOSTAL	.063	CLAD 7075-T6	11	WEB	.032	CLAD 7075-T6
5	FORMER		2912412-5	12	STIFFENER		1475407
6	ANGLE	.050	CLAD 2024-T42	13	WEB	.040	CLAD 7075-T6
7	INTERCOSTAL	.040	CLAD 2024-T42				

REFERENCE - DOUGLAS DRAWINGS 5910227 AND 9911893

BB3-939

Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A2
Figure 5 (Sheet 1)

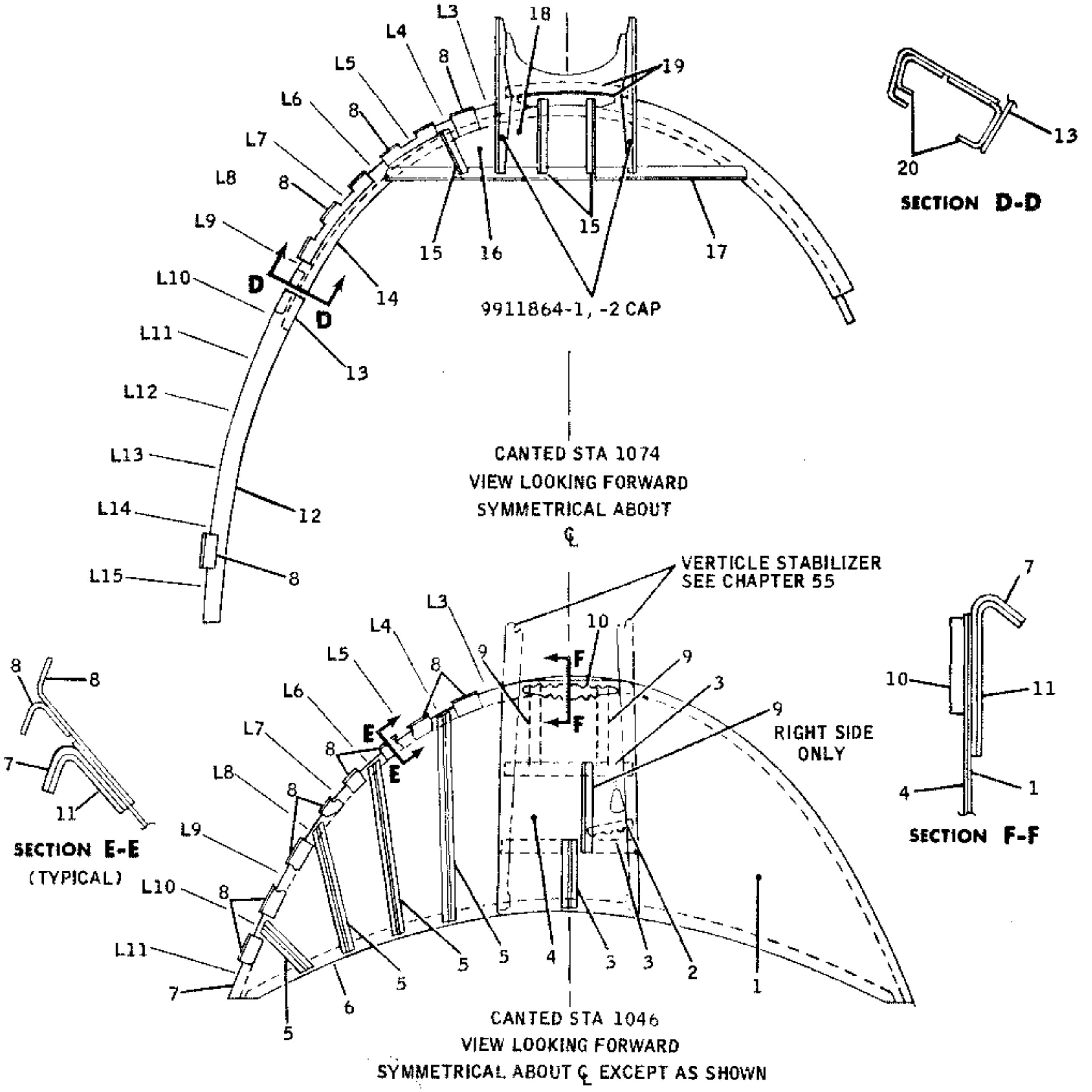


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING,4918093-1,-2	1.500	PLATE 7075-T651	11	SPLICE	.125	CLAD 7075-T6
2	FORMER	.071	CLAD 7075-T6	12	FITTING,9917700-1,-2	2.500	PLATE 7075-T651
3	CHANNEL	.063	CLAD 7075-T6	13	FORMER	.050	CLAD 7075-T6
4	CAP ANGLE	.125	CLAD 7075-T6	14	FORMER	.063	CLAD 7075-T6
5	BRACKET	.040	CLAD 2024-T42	15	STIFFENER		1415595
6	WEB	.080	CLAD 7075-T6	16	STIFFENER		1414813
7	CAP		1419366	17	CLIP	.160	CLAD 7075-T6
8	DOUBLER	.040	CLAD 7075-T6	18	STIFFENER		2777922-5
9	WEB	.032	CLAD 7075-T6	19	STIFFENER		1325737
10	WEB	.040	CLAD 7075-T6	20	CAP ANGLE	.100	7075-T6

REFERENCE - DOUGLAS DRAWING 9911840

BB3-938

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A2
Figure 5 (Sheet 2)



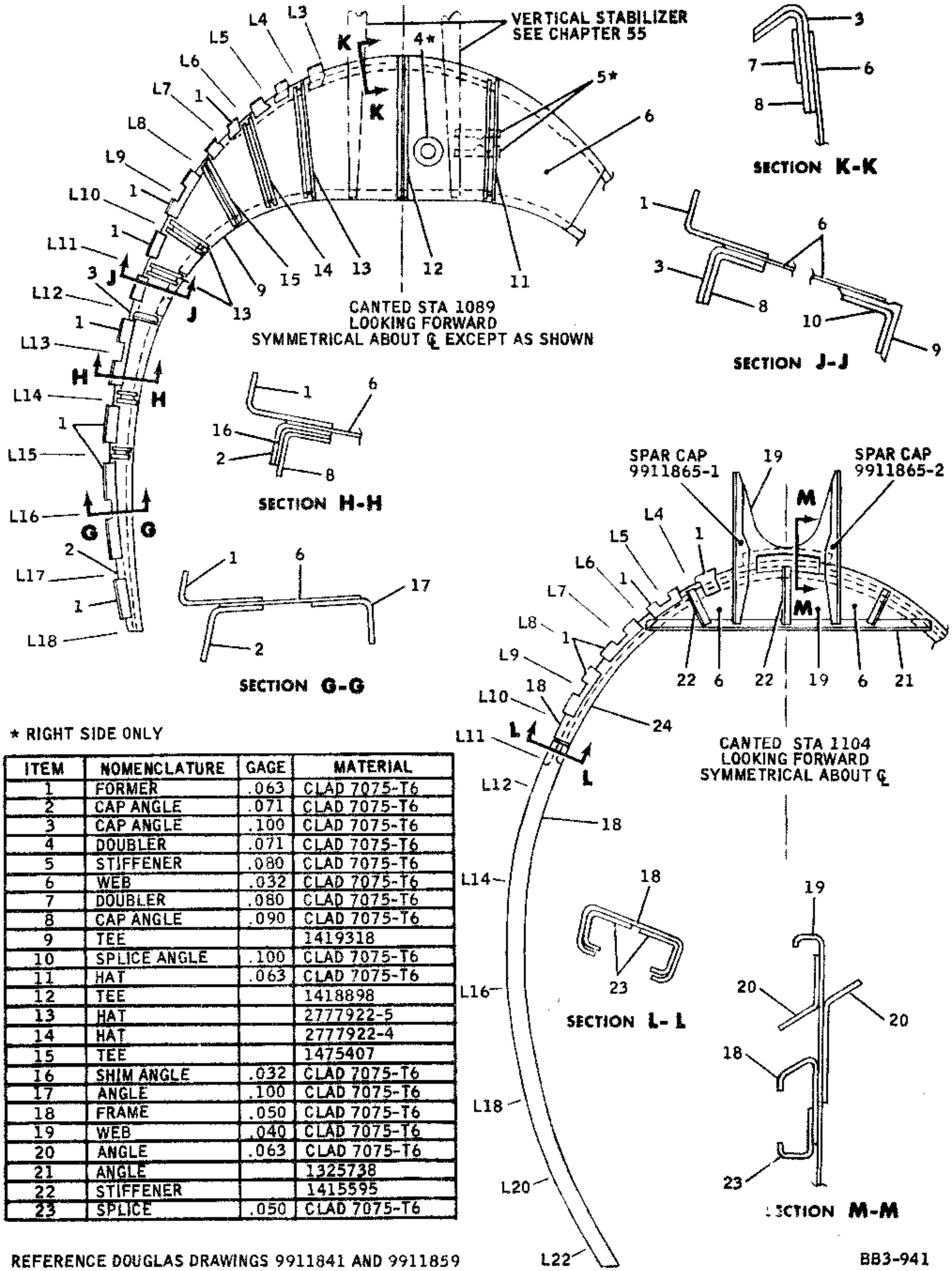
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.050	CLAD 7075-T6
2	BRACKET	.125	6061-T6
3	STIFFENER		1417984
4	DOUBLER	.040	CLAD 7075-T6
5	STIFFENER		1332780
6	CAP		2913786
7	CAP	.100	CLAD 7075-T6
8	FORMER	.063	CLAD 7075-T6
9	STIFFENER		1418201
10	FILLER	.250	7075-T651
11	CAP	.071	7075-T6
12	FRAME		2777930
13	SPLICE	.050	CLAD 7075-T6
14	FRAME	.050	CLAD 7075-T6
15	STIFFENER		1415595
16	WEB	.032	CLAD 7075-T6
17	ANGLE		1325738
18	WEB	.040	CLAD 7075-T6
19	ATTACH CLIP	.063	CLAD 7075-T6
20	CHANNEL	.050	CLAD 7075-T6

REFERENCE-DOUGLAS DRAWINGS 9911858 AND 9911838

BB3-940

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A2
Figure 5 (Sheet 3)

Printed in U.S.A.



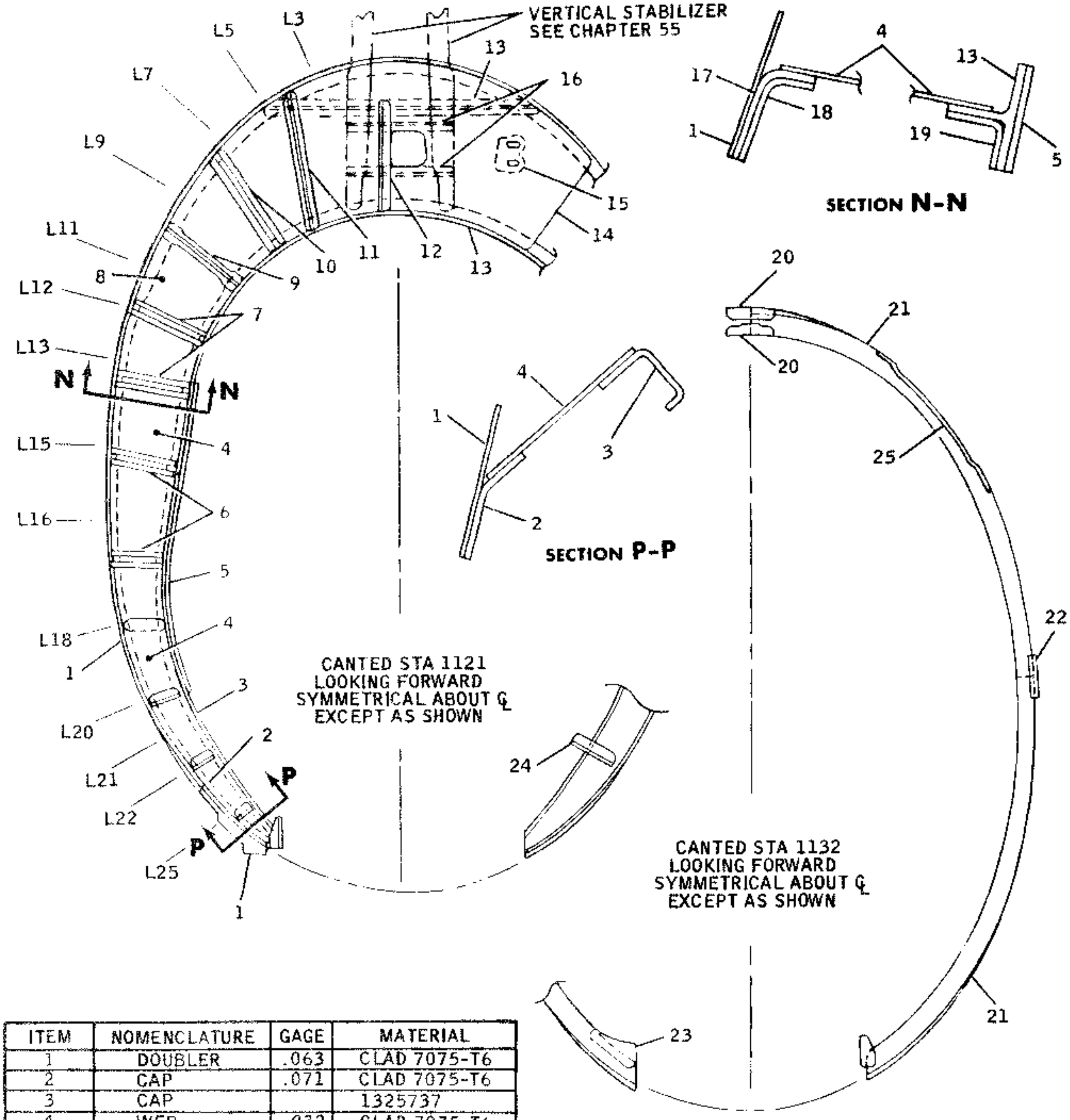
* RIGHT SIDE ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.063	CLAD 7075-T6
2	CAP ANGLE	.071	CLAD 7075-T6
3	CAP ANGLE	.100	CLAD 7075-T6
4	DOUBLER	.071	CLAD 7075-T6
5	STIFFENER	.080	CLAD 7075-T6
6	WEB	.032	CLAD 7075-T6
7	DOUBLER	.080	CLAD 7075-T6
8	CAP ANGLE	.090	CLAD 7075-T6
9	TEE		1419318
10	SPLICE ANGLE	.100	CLAD 7075-T6
11	HAT	.063	CLAD 7075-T6
12	TEE		1418898
13	HAT		2777922-5
14	HAT		2777922-4
15	TEE		1475407
16	SHIM ANGLE	.032	CLAD 7075-T6
17	ANGLE	.100	CLAD 7075-T6
18	FRAME	.050	CLAD 7075-T6
19	WEB	.040	CLAD 7075-T6
20	ANGLE	.063	CLAD 7075-T6
21	ANGLE		1325738
22	STIFFENER		1415595
23	SPLICE	.050	CLAD 7075-T6

REFERENCE DOUGLAS DRAWINGS 9911841 AND 9911859

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A2
Figure 5 (Sheet 4)

Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 7075-T6
2	CAP	.071	CLAD 7075-T6
3	CAP		1325737
4	WEB	.032	CLAD 7075-T6
5	TAPERED DOUBLER	.190	CLAD 7075-T6
6	STIFFENER		2777922-4
7	STIFFENER		2777922-5
8	WEB	.050	CLAD 7075-T6
9	STIFFENER		1475407
10	STIFFENER	.100	CLAD 7075-T6
11	STIFFENER		1641009
12	STIFFENER		1415741
13	TEE EXTRUSION		1544612
14	WEB	.080	CLAD 7075-T6
15	DOUBLER	.071	CLAD 7075-T6
16	TEE EXTRUSION		1416036

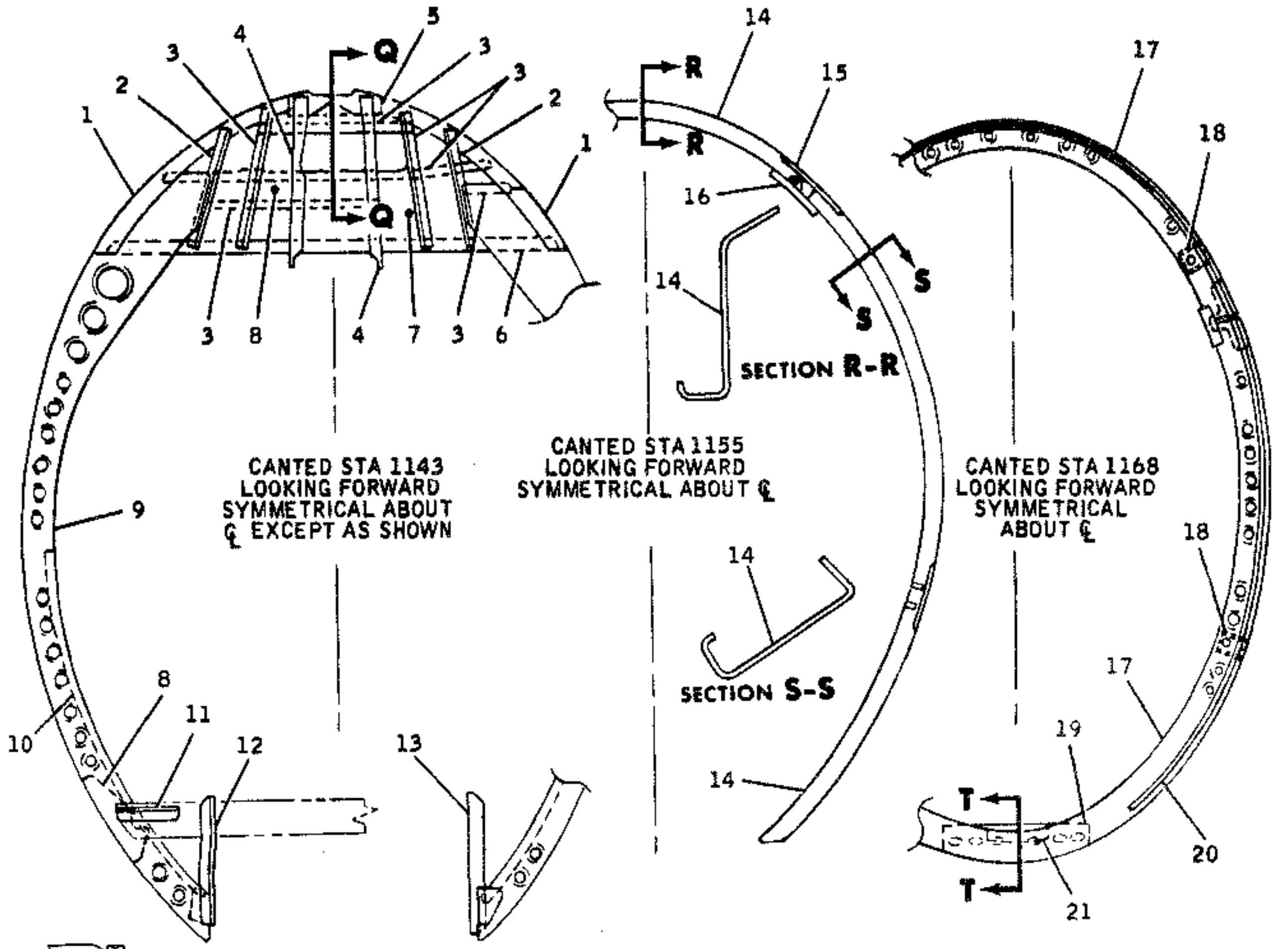
ITEM	NOMENCLATURE	GAGE	MATERIAL
17	CAP	.125	CLAD 7075-T6
18	DOUBLER	.125	CLAD 7075-T6
19	SPLICE	.090	CLAD 7075-T6
20	ANGLE	.040	CLAD 7075-T6
21	FRAME	.040	CLAD 7075-T6
22	ANGLE	.050	CLAD 7075-T6
23	GUSSET	.040	CLAD 7075-T6
24	STIFFENER		1242526
25	ANGLE	.063	CLAD 7075-T6

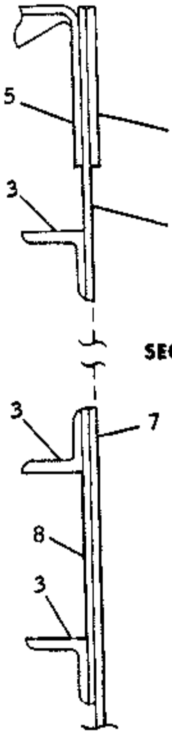
REFERENCE-DOUGLAS DRAWINGS 9911839 AND 9911877

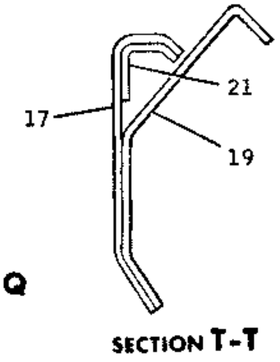
BB3-942

Frames and Intercostals, Station 1087 to Canted Station 1168 -- Type A2
Figure 5 (Sheet 5)

Printed in U.S.A.







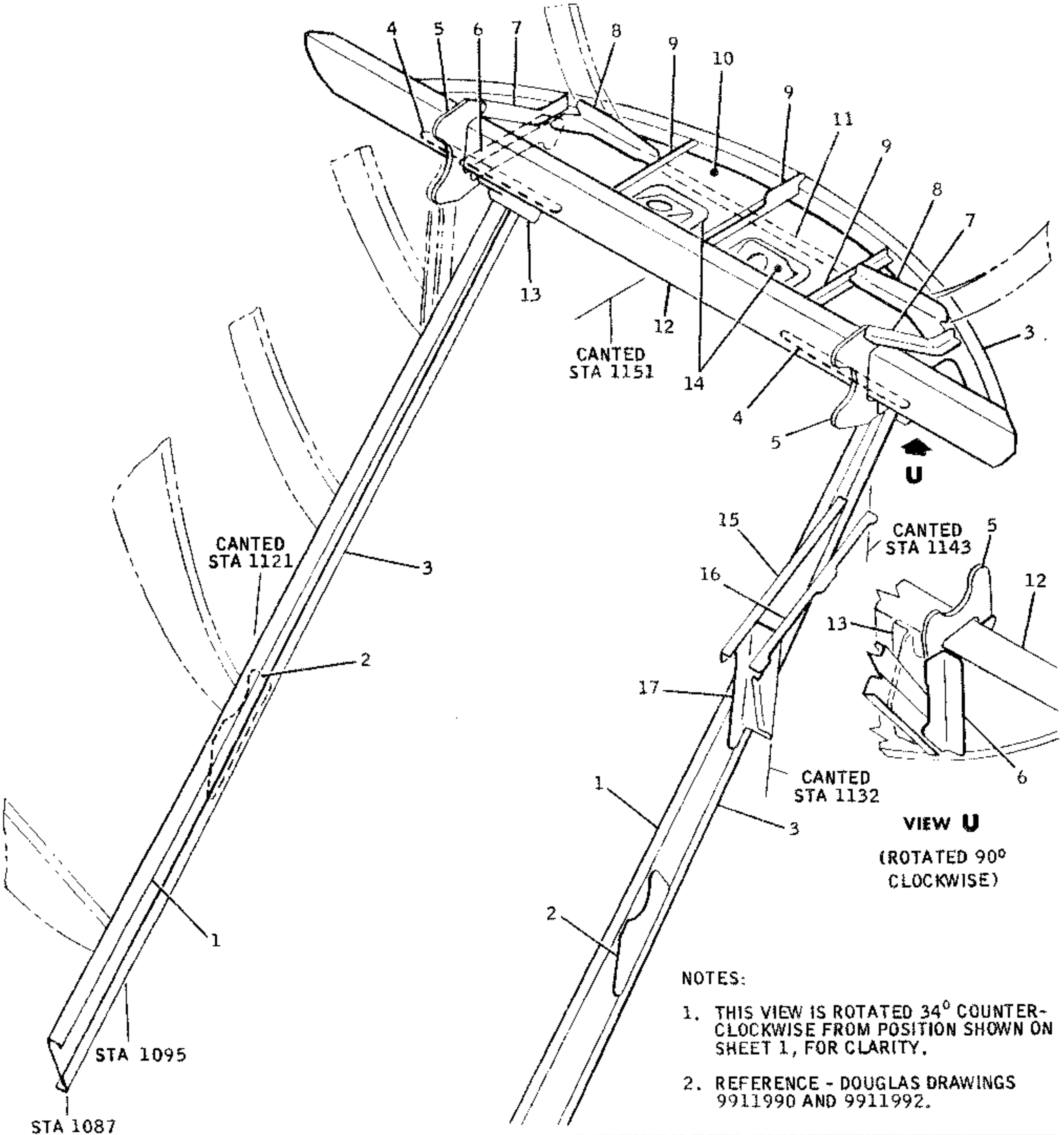
NOTES:

1. SEAL IS MADE FROM SILICONE MOLDED RUBBER, MIL-R-5847, CLASS B, GRADE 50
2. REFERENCE - DOUGLAS DRAWINGS 9911842, 9911878, AND 9911843

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP ANGLE	.100	CLAD 7075-T6
2	STIFFENER		1249581
3	ANGLE		1249578
4	FITTING,5913093-1,-2	1.250	PLATE 7075-T651
5	SPLICE ANGLE	.100	7075-T6
6	STIFFENER		1242937
7	WEB	.040	CLAD 7075-T6
8	DOUBLER	.050	CLAD 7075-T6
9	FRAME	.050	CLAD 7075-T6
10	CAP		1249578
11	ANGLE	.063	CLAD 7075-T6
12	BRACE		1223583
13	FITTING, 3917182-1	2.000	PLATE 7075-T651
14	FRAME	.040	CLAD 7075-T6
15	GUSSET	.050	CLAD 2024-T42
16	CHANNEL	.063	CLAD 7075-T6
17	FRAME	.063	CLAD 7075-T6
18	CHANNEL		1417718
19	SPLICE	.040	CLAD 7075-T6
20	SEAL, 4913366-1		SEE NOTE 1
21	SPLICE ANGLE	.063	CLAD 7075-T6

8B3-943

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A2
Figure 5 (Sheet 6)



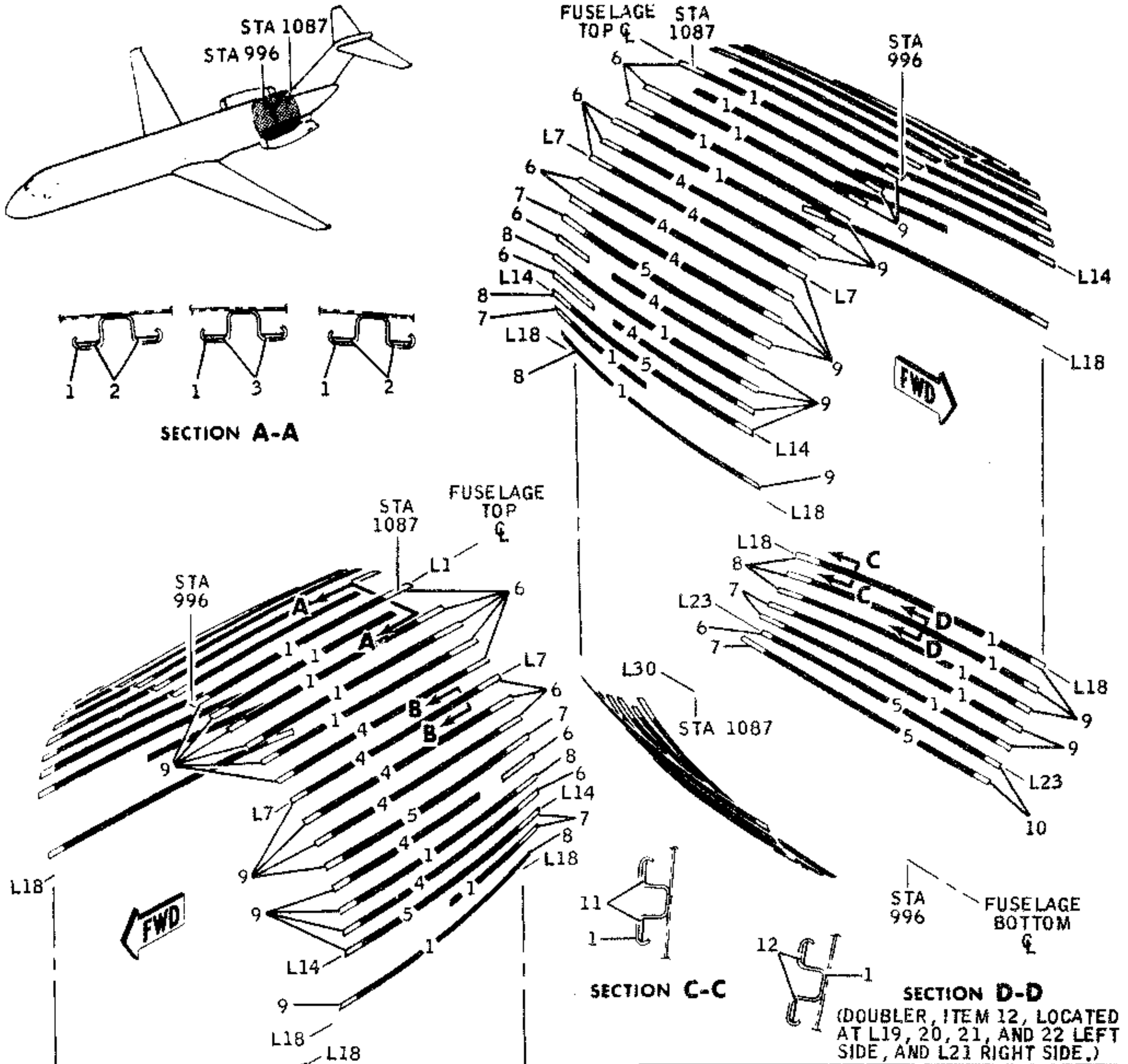
NOTES:

1. THIS VIEW IS ROTATED 34° COUNTER-CLOCKWISE FROM POSITION SHOWN ON SHEET 1, FOR CLARITY.
2. REFERENCE - DOUGLAS DRAWINGS 9911990 AND 9911992.

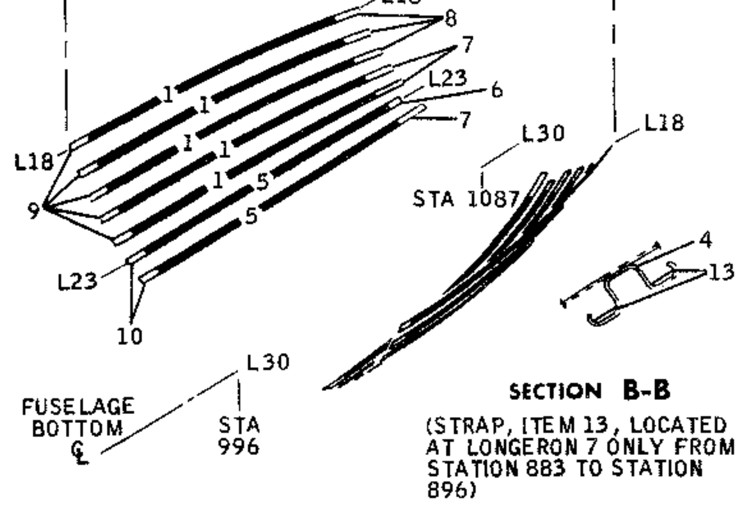
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	JAMB	.040	CLAD 7075-T6	10	WEB	.025	CLAD 2024-T3
2	DOUBLER	.040	CLAD 7075-T6	11	ANGLE	.032	SHEET 6061-T6
3	CAP	.050	CLAD 7075-T6	12	INTERCOSTAL	.090	CLAD 7075-T6
4	DOUBLER	.100	CLAD 7075-T6	13	FITTING,5917564-3,-4		CASTING 356-T6
5	PLATE	.250	CLAD 7075-T651	14	HOUSING	.040	CLAD 2024-T42
6	STIFFENER		1464579	15	SUPPORT		1109080
7	BRACE		1418201	16	SUPPORT		1242526
8	CLIP	.063	CLAD 7075-T6	17	BRACKET	.063	CLAD 7075-T6
9	STIFFENER	.063	CLAD 7075-T6				

BB3-944

Frames and Intercostals, Station 1087 to Canted
Station 1168 -- Type A2
Figure 5 (Sheet 7)



SECTION D-D
(DOUBLER, ITEM 12, LOCATED AT L19, 20, 21, AND 22 LEFT SIDE, AND L21 RIGHT SIDE.)



SECTION B-B
(STRAP, ITEM 13, LOCATED AT LONGERON 7 ONLY FROM STATION 883 TO STATION 896)

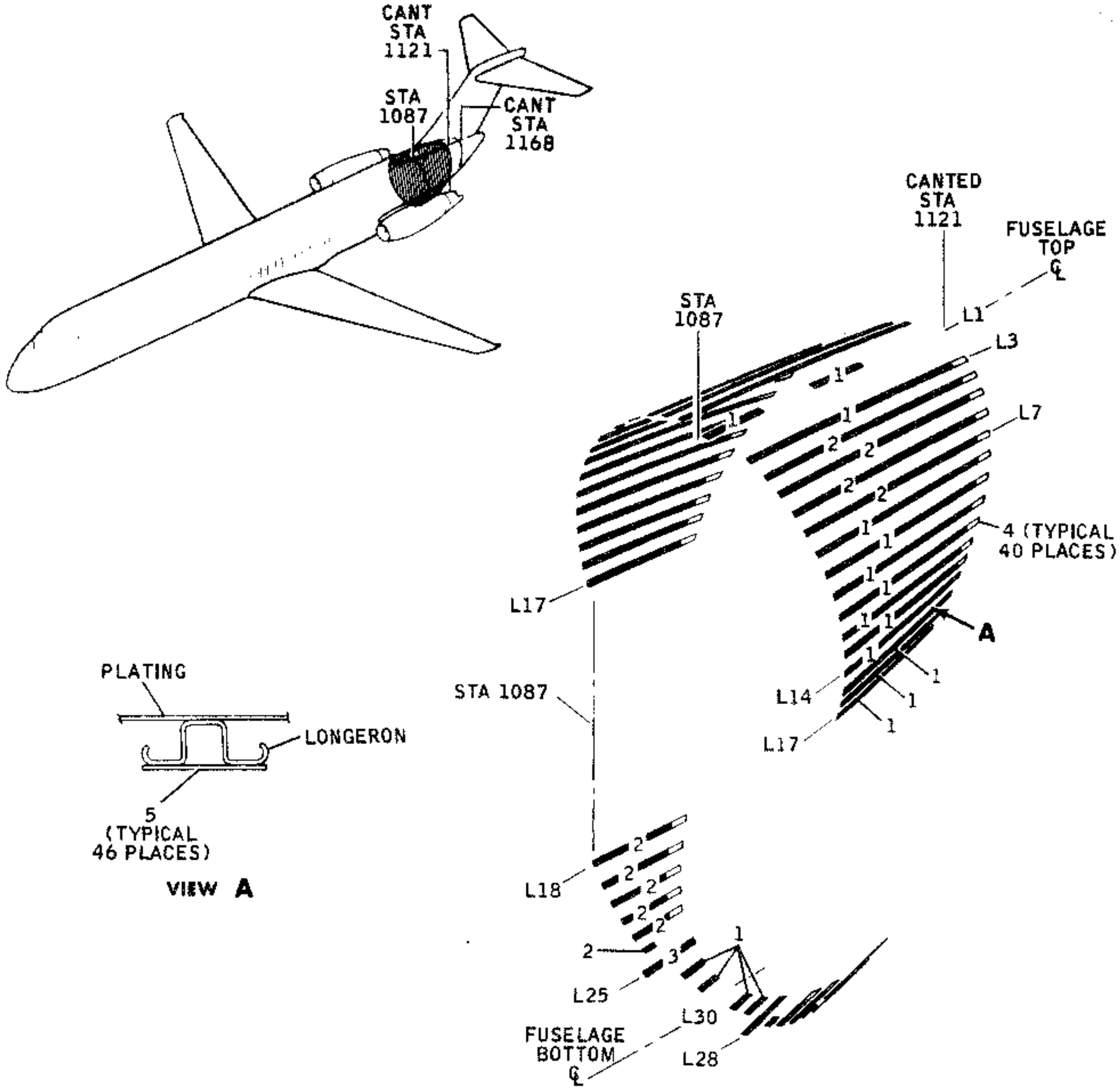
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777922-5
2	STRAP		4919255-6
3	STRAP		4919255-3
4	LONGERON		2777922-3
5	LONGERON		2777922-4
6	SPLICE	.040	CLAD 7075-T6
7	SPLICE	.050	CLAD 7075-T6
8	SPLICE	.063	CLAD 7075-T6
9	CLIP	.040	CLAD 7075-T6
10	FITTING		2647332
11	DOUBLER		4919255-5
12	DOUBLER		4919255-10
13	STRAP	.250	PLATE 7075-T651

REFERENCE - DOUGLAS DRAWING 5910493

BB3-813

Longerons, Station 996 to 1087 -- Type A
Figure 6

Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LONGERON		2777922-5
2	LONGERON		2777922-4
3	LONGERON		SEE NOTE 2
4	CLIP		2912099
5	STRAP	.050	CLAD 7075-T6

NOTES:

1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES.
2. ITEM 3 IS MADE FROM 1.125 7075-T651 PLATE.
3. REFERENCE- DOUGLAS DRAWING 5910228.

BB3-812

Longerons, Station 1087 to Canted Station 1168 -- Type A
Figure 7

AUXILIARY STRUCTURE - DESCRIPTION AND OPERATION (DC-9-10)

1. General

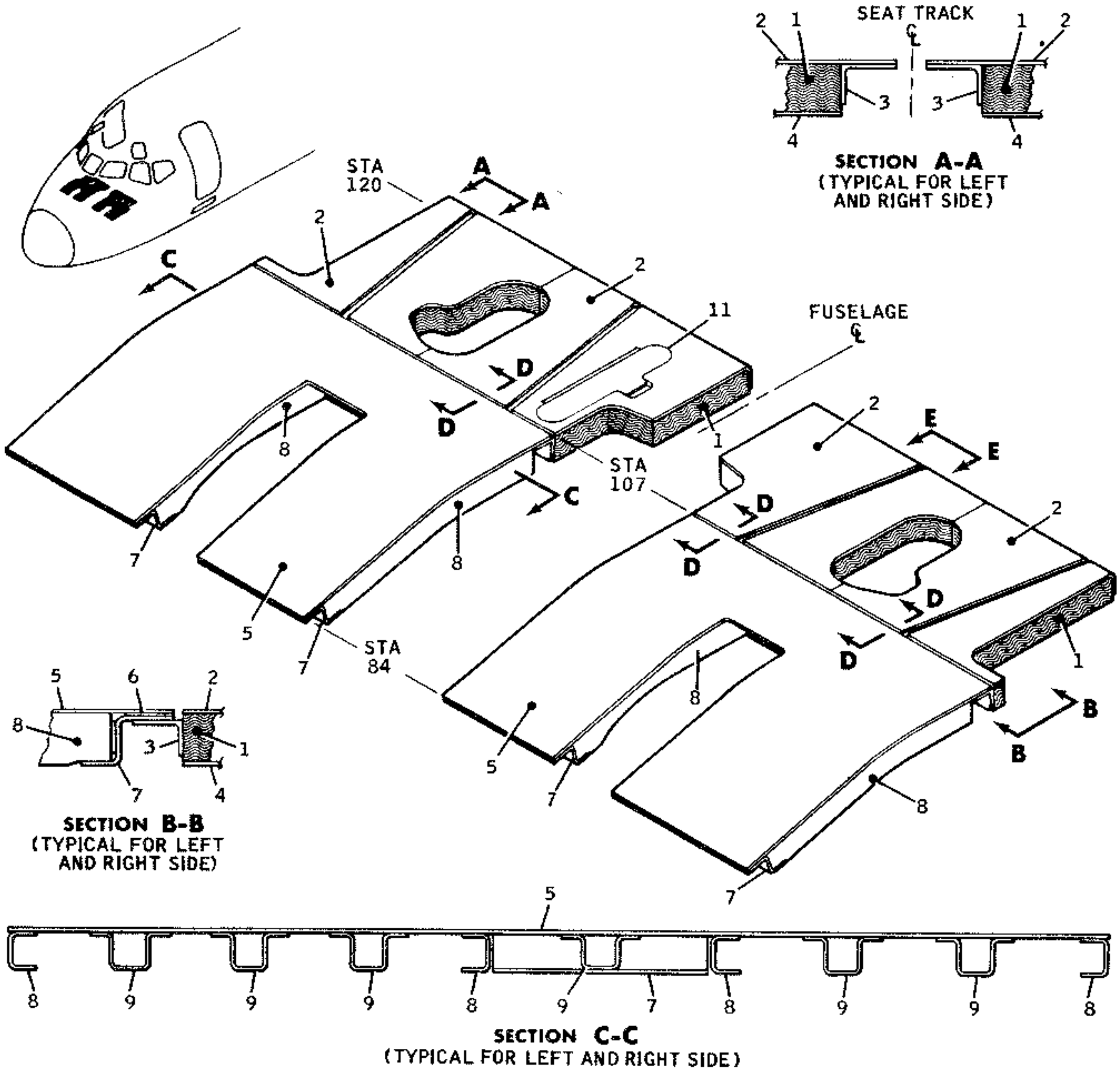
A. The following figures illustrate the auxiliary structure of the fuselage, including such items as the floors and cargo compartment lining. The materials used are identified in the material lists by item number callouts.

Floor Panels, Forward of Station 120	Figures 1 and 1A
Floor Panels, Station 120 to 200	Figures 2 and 2A
Floor Panels and Seat Tracks, Station 200 to 465	Figures 3 and 3A
Floor Panels and Seat Tracks, Station 465 to 786	Figures 4 and 4A
Floor Panels, Station 786 to 829	Figures 5 and 5A
Walkways, Aft Accessory Compartment	Figures 5B and 5C
Forward Lower Cargo Compartment Floors and Lining	Figures 6 and 7
Aft Lower Cargo Compartment Floors and Lining	Figures 8 and 9

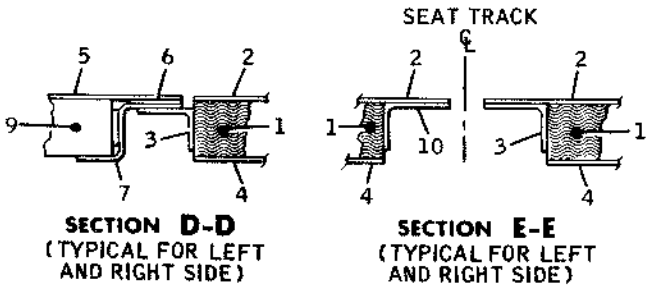
2. Repair Index

A. A list of components covered in this section and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Component	Approved Repair
All	Section 53-01
Floor panels	Section 53-05, Figures 1, 2, and 3
Seat tracks	Section 53-05, Figure 4
Cargo compartment floors and lining	Section 53-05, Figures 5, 6, and 7



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BLOCKING		SEE NOTE
2	WEB	.050	CLAD 2024-T3
3	ANGLE		1464708
4	WEB	.020	CLAD 7075-T6
5	WEB	.032	CLAD 7075-T6
6	SPACER	.063	CLAD 2024-T3
7	FRAME	.040	6061-T6
8	CAP	.040	6061-T6
9	STIFFENER		2916423-2
10	ANGLE		1464709
11	DOOR	.050	CLAD 7075-T6

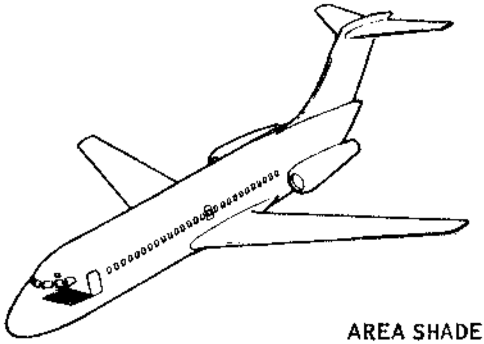


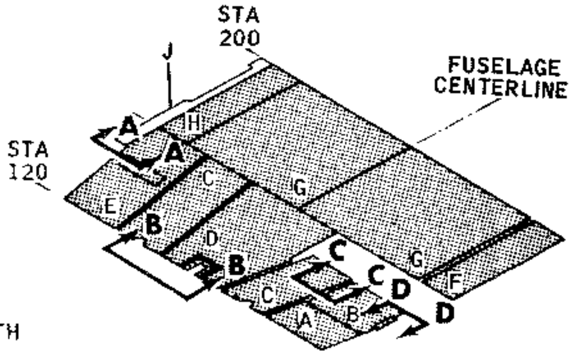
NOTES:

1. LUMBER TO BE WCLA GRADE B OR BETTER SPRUCE SPECIES.
2. REFERENCE - DOUGLAS DRAWING 5910080

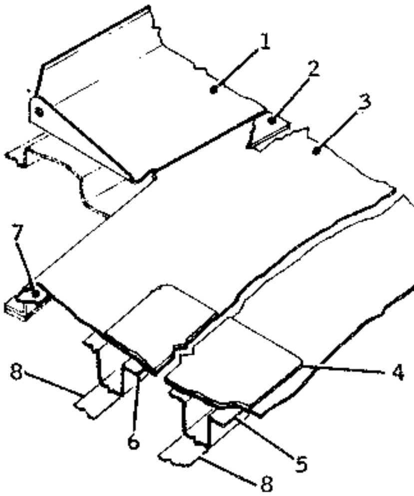
BB3-88

Floor Panels, Forward of Fuselage Station 120 (Flight Compartment)
Figure 1

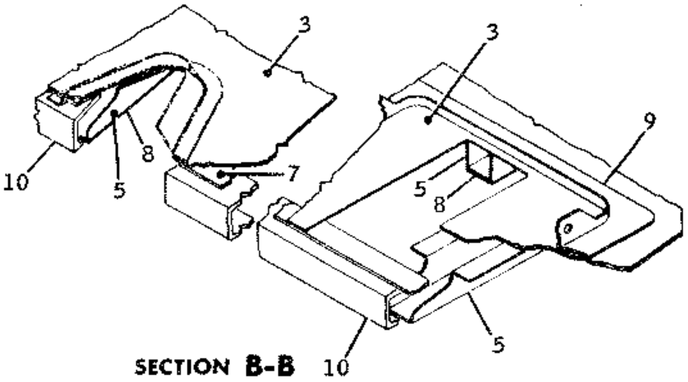




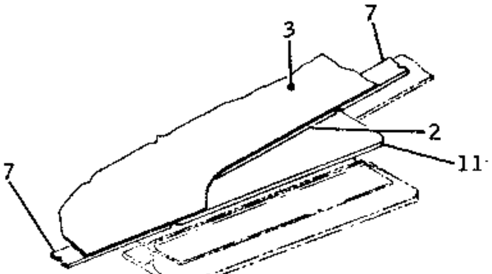
AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.



SECTION **A-A**

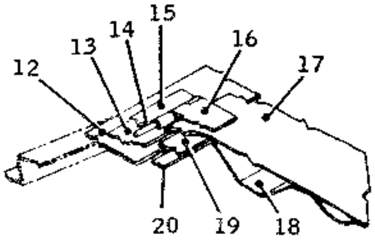


SECTION **B-B**



SECTION **D-D**

ITEM	PANEL TYPE A	B	C	D	E	F	G	H	J	NOMENCLATURE	GAGE	MATERIAL
1									•	WEB	.025	CLAD 2024-T42
2				•	•	•		•		STRIP	.050	SEE NOTE 1
3	•		•	•	•	•	•	•		WEB	.025	CLAD 7075-T6
4					•		•			DOUBLER	.125	CLAD 7075-T6
5	•				•	•		•		HAT		4616492
6	•		•	•	•	•	•			HAT		2912282
7	•		•	•	•	•	•	•		STRIP	.070	SEE NOTE 1
8	•		•	•	•		•			TAPE		SEE NOTE 1
9				•						ANGLE	.040	CLAD 2024-T4
10			•	•						CHANNEL		1250426
11				•						PLATE	.025	CLAD 7075-T6
12		•								RETAINER	.094	SEE NOTE 1
13		•								DOOR JAMB	.020	SEE NOTE 3
14		•								PIN		MS20253P2-737
15		•								HINGE		MS20001PY10
16		•								HINGE		MS20001PY4
17		•								DOOR	.032	6061-T6
18		•								DOUBLER	.032	6061-T6
19		•								SEAL		1555214
20		•								RETAINER	.040	CLAD 2024-T3



SECTION **C-C**

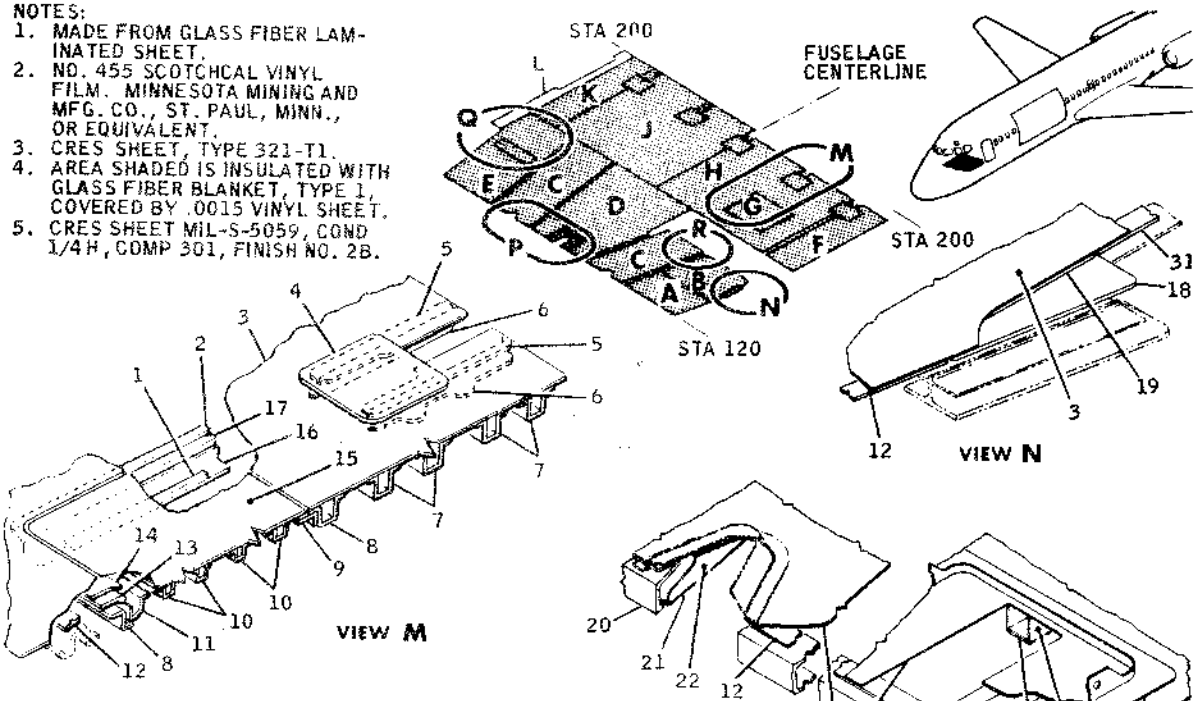
NOTES:

1. MADE FROM GLASS FIBER LAMINATED SHEET (POLYESTER).
2. NO. 455 SCOTCHCAL VINYL FILM. MINNESOTA MINING AND MFG. CO., ST. PAUL, MINN., OR EQUIVALENT.
3. CREW SHEET, TYPE 321-T1.
4. REFERENCE - DOUGLAS DRAWING 5910079.

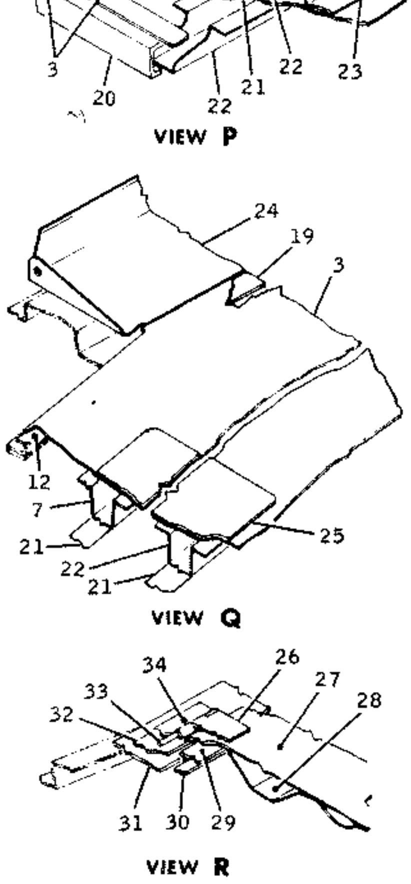
BB3-89

Floor Panels, Station 120 to 200 -- Type I
Figure 2

NOTES:
1. MADE FROM GLASS FIBER LAMINATED SHEET.
2. NO. 455 SCOTCHCAL VINYL FILM. MINNESOTA MINING AND MFG. CO., ST. PAUL, MINN., OR EQUIVALENT.
3. CRES SHEET, TYPE 321-T1.
4. AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.
5. CRES SHEET MIL-S-5059, COND 1/4 H, COMP 301, FINISH NO. 2B.

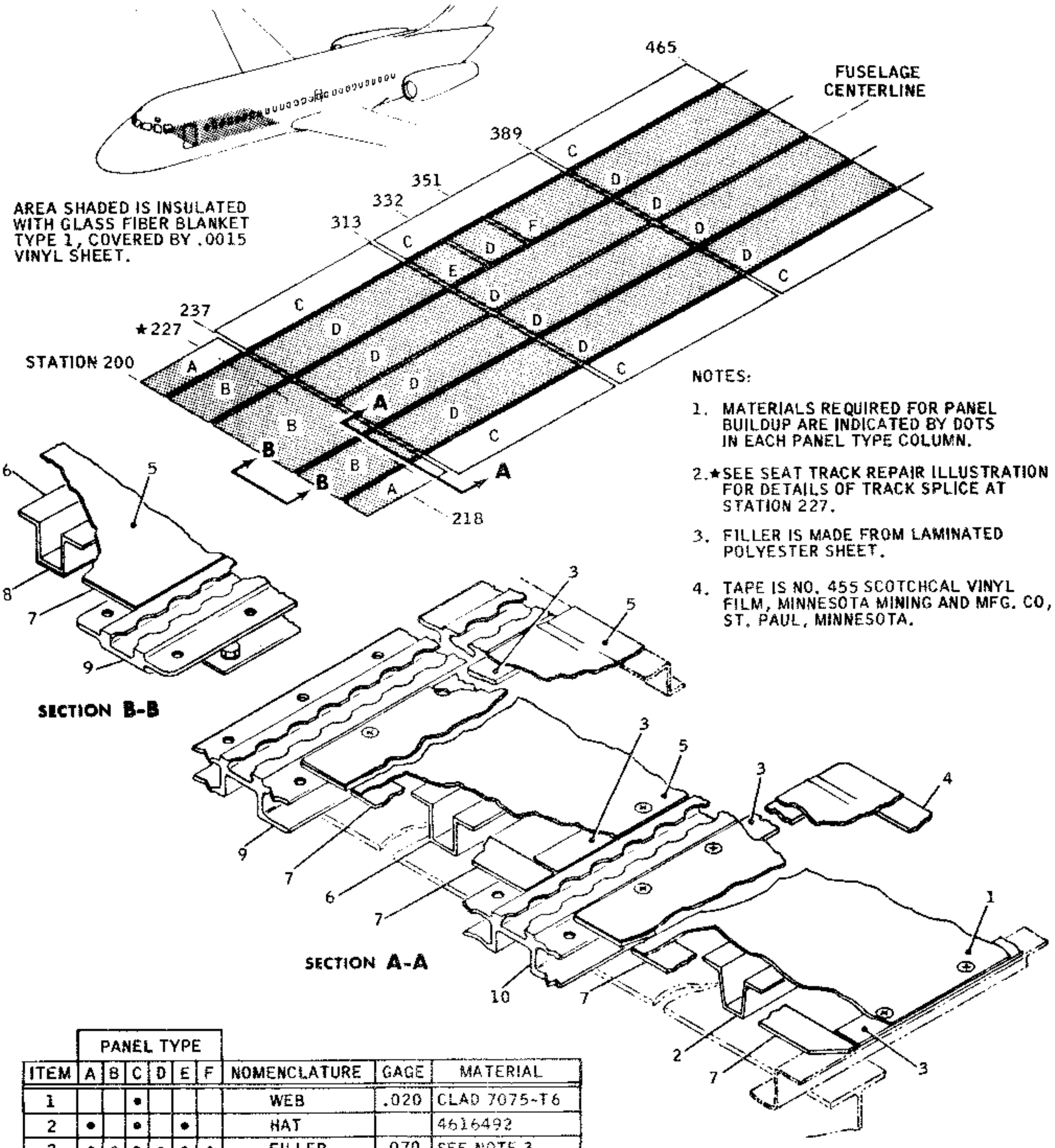


ITEM	PANEL TYPE A	B	C	D	E	F	G	H	J	K	L	NOMENCLATURE	GAGE	MATERIAL
												REFERENCE-DOUGLAS DRAWING 5910079		
1								•				SUPPORT		SHEET PHENOLIC
2								•				FILLER	.032	CLAD 2024-T3
3	•		•	•	•	•		•	•	•		WEB	.025	CLAD 7075-T6
4						•		•	•	•		COVER	.063	CLAD 2024-T3
5								•	•			ANGLE	.040	CLAD 7075-T6
6								•	•			ZEE	.050	CLAD 7075-T6
7	•		•	•	•	•		•	•			HAT		2912282
8								•				HAT	.050	CLAD 7075-T6
9								•				ANGLE	.063	CLAD 7075-T6
10							•					HAT	.063	CLAD 7075-T6
11							•					HINGE		2915533
12	•		•	•	•	•		•	•	•		STRIP	.070	SEE NOTE 1
13								•				HINGE		MS20001PY6
14								•				LANDING	.063	CLAD 7075-T6
15							•					DOOR	.071	CLAD 7075-T6
16								•				ANGLE		1199973
17								•				ANGLE		1276248
18				•								PLATE	.025	CLAD 7075-T6
19				•	•	•				•		STRIP	.050	SEE NOTE 1
20			•	•								CHANNEL		1250426
21	•		•	•	•			•				TAPE		SEE NOTE 2
22	•				•	•				•		HAT		4616492
23				•								ANGLE	.040	CLAD 2024-T4
24											•	WEB	.025	CLAD 2024-T42
25					•			•				DOUBLER	.125	CLAD 7075-T6
26		•										HINGE		MS20001PY4
27		•										DOOR	.032	6061-T6
28		•										DOUBLER	.032	6061-T6
29		•										SEAL		1555214
30		•										RETAINER	.040	CLAD 2024-T3
31		•										RETAINER	.094	SEE NOTE 1
32		•										DOOR JAMB	.020	SEE NOTE 3
33		•										PIN		MS20253P2-737
34		•										HINGE		MS20001PY10
35						•						ANGLE	.040	SEE NOTE 5



Printed in U.S.A.

Floor Panels, Station 120 to 200 -- Type II
Figure 2A



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET TYPE 1, COVERED BY .0015 VINYL SHEET.

NOTES:

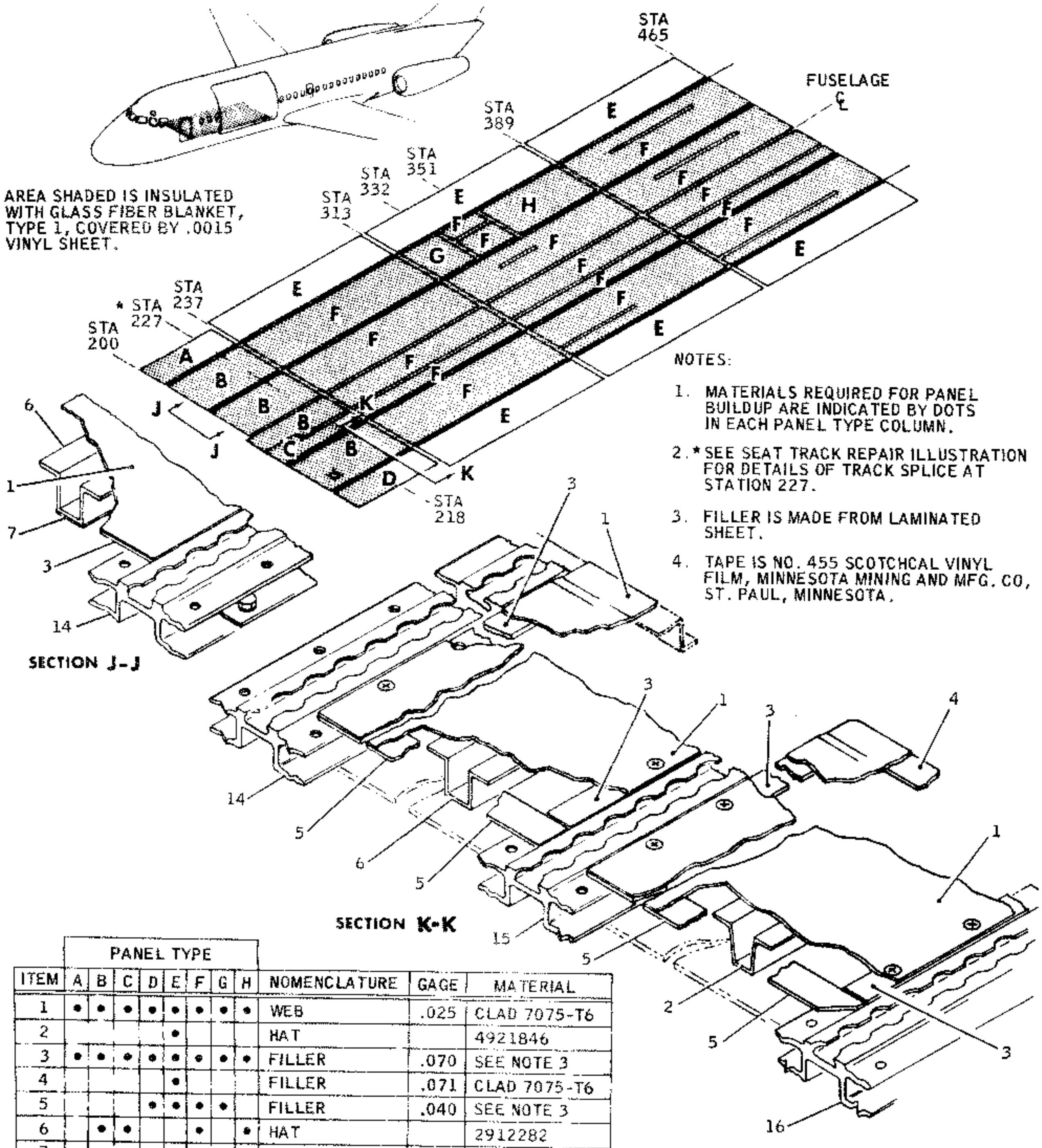
1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. ★SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATION 227.
3. FILLER IS MADE FROM LAMINATED POLYESTER SHEET.
4. TAPE IS NO. 455 SCOTCHCAL VINYL FILM, MINNESOTA MINING AND MFG. CO, ST. PAUL, MINNESOTA.

	PANEL TYPE								
ITEM	A	B	C	D	E	F	NOMENCLATURE	GAGE	MATERIAL
1			●				WEB	.020	CLAD 7075-T6
2	●		●		●		HAT		4616492
3	●	●	●	●	●	●	FILLER	.070	SEE NOTE 3
4	●		●				STRIP	.071	CLAD 7075-T6
5	●	●		●	●	●	WEB	.025	CLAD 7075-T6
6		●		●		●	HAT		2912282
7			●	●	●		FILLER	.040	SEE NOTE 3
8		●					TAPE		SEE NOTE 4
9							TRACK		2772660
10							TRACK		2914913

REFERENCE - DOUGLAS DRAWING 5910138

BB3-145

Floor Panels and Seat Tracks, Station 200 to 465 -- Type I
Figure 3



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

NOTES:

1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. * SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATION 227.
3. FILLER IS MADE FROM LAMINATED SHEET.
4. TAPE IS NO. 455 SCOTCHCAL VINYL FILM, MINNESOTA MINING AND MFG. CO, ST. PAUL, MINNESOTA.

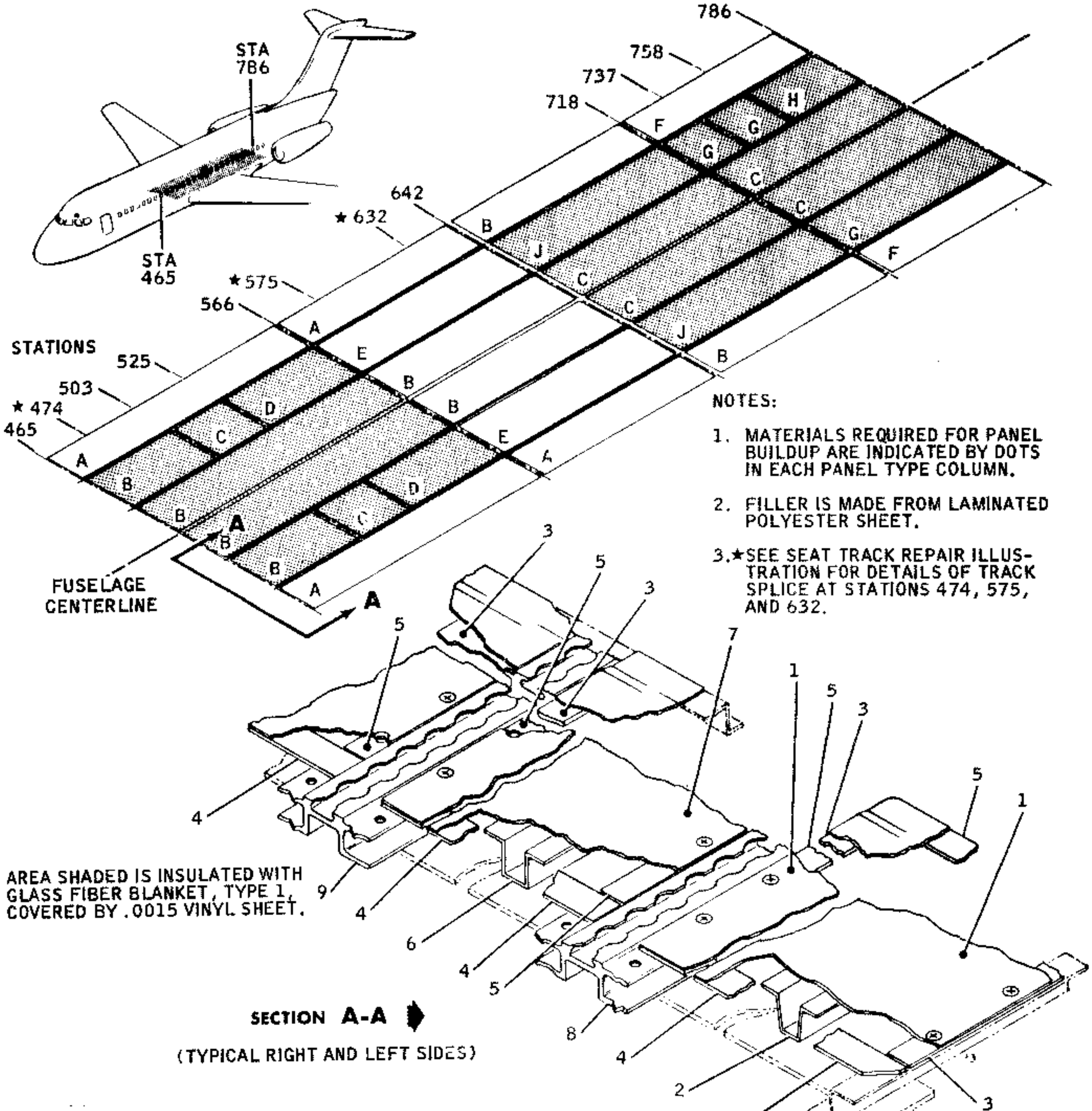
ITEM	PANEL TYPE A	B	C	D	E	F	G	H	NOMENCLATURE	GAGE	MATERIAL
1	●	●	●	●	●	●	●	●	WEB	.025	CLAD 7075-T6
2					●				HAT		4921846
3	●	●	●	●	●	●	●	●	FILLER	.070	SEE NOTE 3
4					●				FILLER	.071	CLAD 7075-T6
5				●	●	●	●		FILLER	.040	SEE NOTE 3
6		●	●			●		●	HAT		2912282
7		●	●						TAPE		SEE NOTE 4
8	●			●					STRAP	.070	CLAD 7075-T6
9				●					DOUBLER	.032	CLAD 7075-T6
10				●					FILLER	.032	SEE NOTE 3
11	●			●			●		HAT		4616492
12			●						HAT	.040	CLAD 7075-T6
13				●			●		FILLER	.050	SEE NOTE 3
14									TRACK		2772660
15									TRACK		2914913
16									TRACK		2921967

REFERENCE- DOUGLAS DRAWING 5910079 AND 5910614

BB3-859

Printed in U.S.A.

Floor Panels and Seat Tracks, Station 200 to 465 -- Type II
Figure 3A



NOTES:

1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. FILLER IS MADE FROM LAMINATED POLYESTER SHEET.
3. ★SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATIONS 474, 575, AND 632.

AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

SECTION A-A

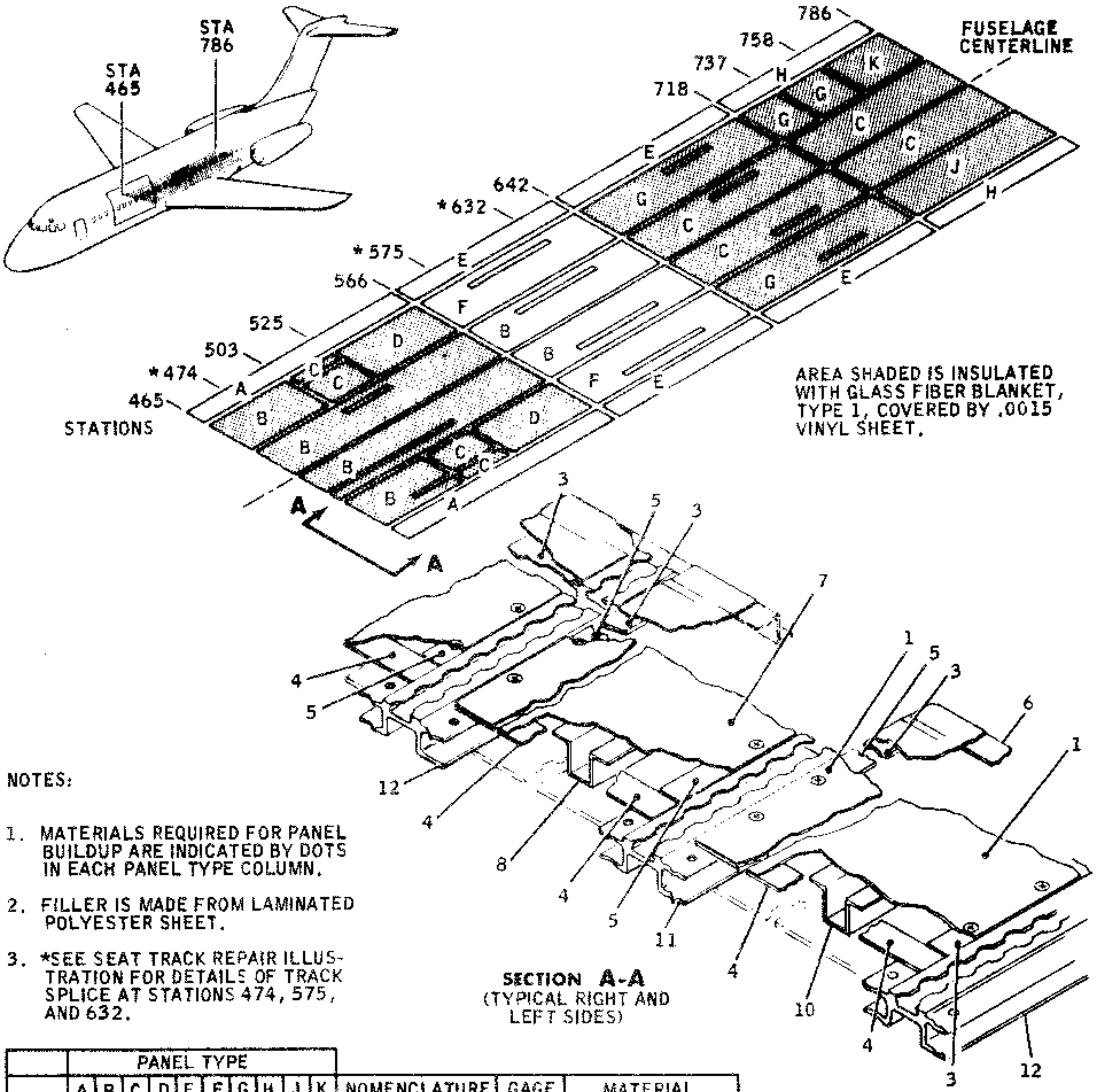
(TYPICAL RIGHT AND LEFT SIDES)

	PANEL TYPE											
ITEM	A	B	C	D	E	F	G	H	J	NOMENCLATURE	GAGE	MATERIAL
1	●					●				WEB	.020	CLAD 7075-T6
2	●					●	●	●	●	HAT		4616492
3	●	●	●	●	●	●	●	●	●	FILLER	.070	SEE NOTE 2
4	●	●	●			●	●		●	FILLER	.040	
5	●	●			●				●	STRIP	.071	CLAD 7075-T6
6		●	●	●	●					HAT		2912282
7		●	●	●	●		●	●	●	WEB	.025	CLAD 7075-T6
8										TRACK		2914913
9										TRACK		2772660

REFERENCE - DOUGLAS DRAWING 5910144

BB3-90

Floor Panels and Seat Tracks, Station 465 to 786 -- Type I
Figure 4



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

SECTION A-A
(TYPICAL RIGHT AND LEFT SIDES)

NOTES:

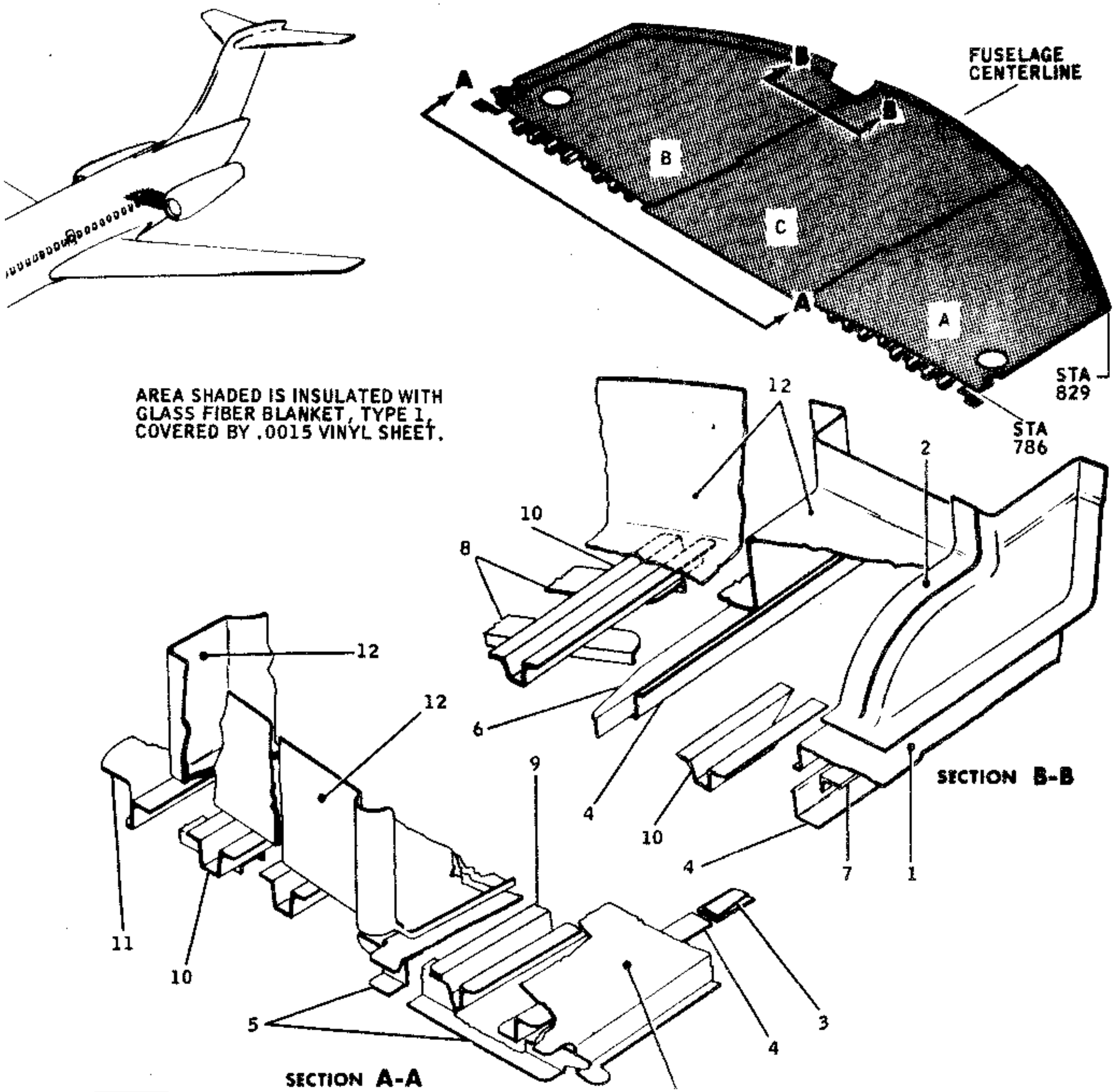
1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. FILLER IS MADE FROM LAMINATED POLYESTER SHEET.
3. *SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATIONS 474, 575, AND 632.

	PANEL TYPE												
	A	B	C	D	E	F	G	H	J	K	NOMENCLATURE	GAGE	MATERIAL
1	•							•			WEB	.020	CLAD 7075-T6
2							•		•	•	HAT		4616492
3	•	•	•	•	•	•	•	•	•	•	FILLER	.070	SEE NOTE 2
4	•	•	•		•	•	•	•	•		FILLER	.040	SEE NOTE 2
5	•	•			•	•					FILLER	.071	CLAD 7075-T6
6	•										STRAP	.071	CLAD 7075-T6
7		•	•	•	•	•	•		•	•	WEB	.025	CLAD 7075-T6
8		•	•	•		•					HAT		2912282
9									•	•	RETAINER	.025	CLAD 2024-T3
10	•	•			•			•			HAT		4921846
11											TRACK		2914913
12											TRACK		2772660

REFERENCE - DOUGLAS DRAWING 5921857, 5921858, 5921872 AND 5921873.

BB3-875

Floor Panels and Seat Tracks, Station 465 to 786 -- Type II
Figure 4A



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

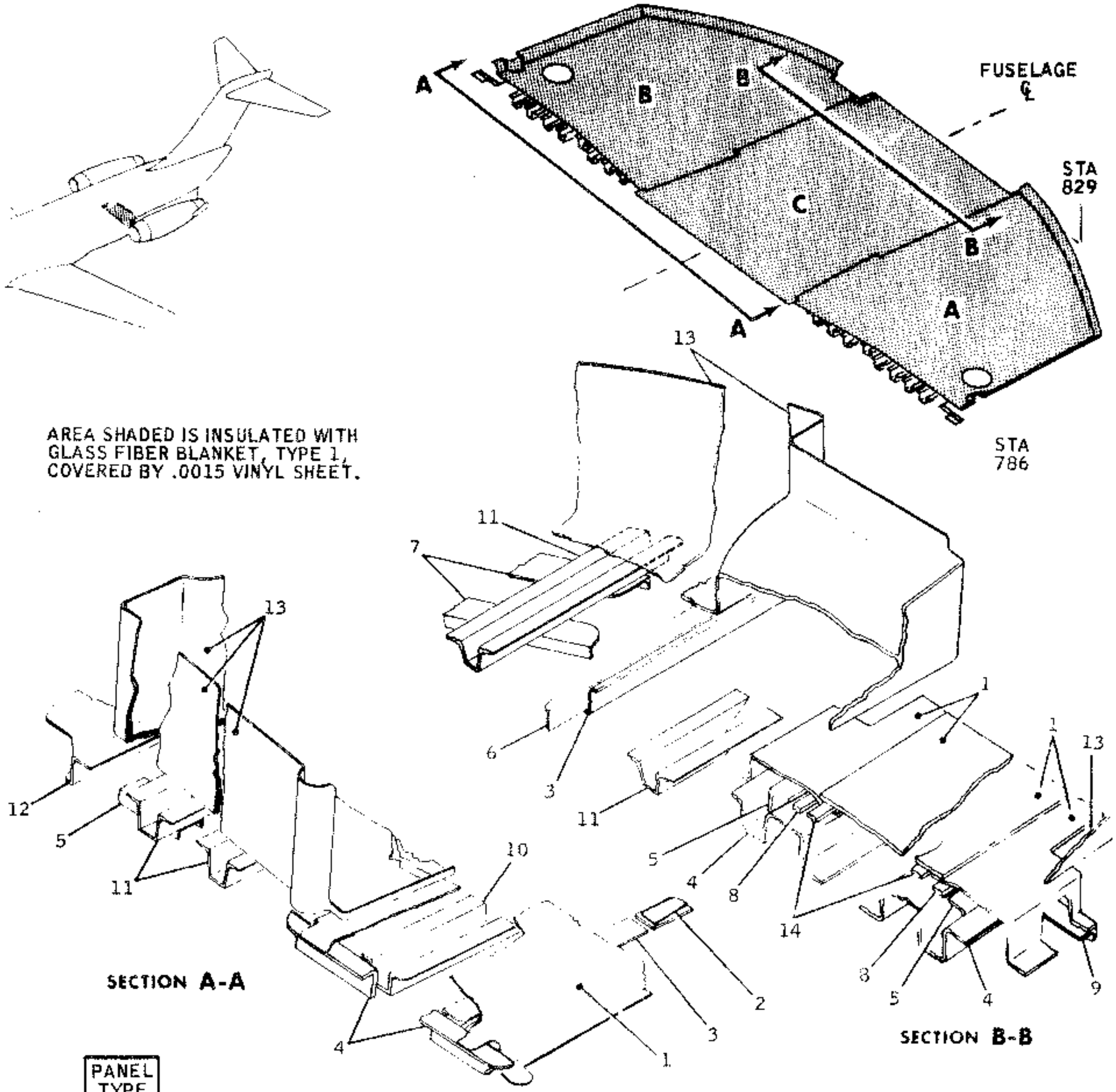
	PANEL TYPE					
ITEM	A	B	C	NOMENCLATURE	GAGE	MATERIAL
1			●	WEB	.025	6061-T6
2			●	FAIRING	.040	6061-T6
3		●	●	FILLER	.050	CLAD 2024-T3
4	●	●	●	ZEE	.050	CLAD 2024-T42
5			●	SUPPORT	.050	CLAD 2024-T42
6		●		ANGLE		1244084
7			●	ANGLE		1276248
8	●	●		ANGLE		1416036
9			●	HAT		2912282
10	●	●		HAT		4616492
11	●	●		ZEE		(SEE NOTE 1)
12	●	●		PAN		(SEE NOTE 2)

NOTE

1. B-STAGE POLYESTER GLASS FABRIC, DMS1618 TYPE 8
2. NO. 1534 GLASS FIBER CLOTH VOLAN FINISH
3. REFERENCE - DOUGLAS DRAWING 5910348

BB3-140

Floor Panels, Station 786 to 829 -- Type I
Figure 5



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

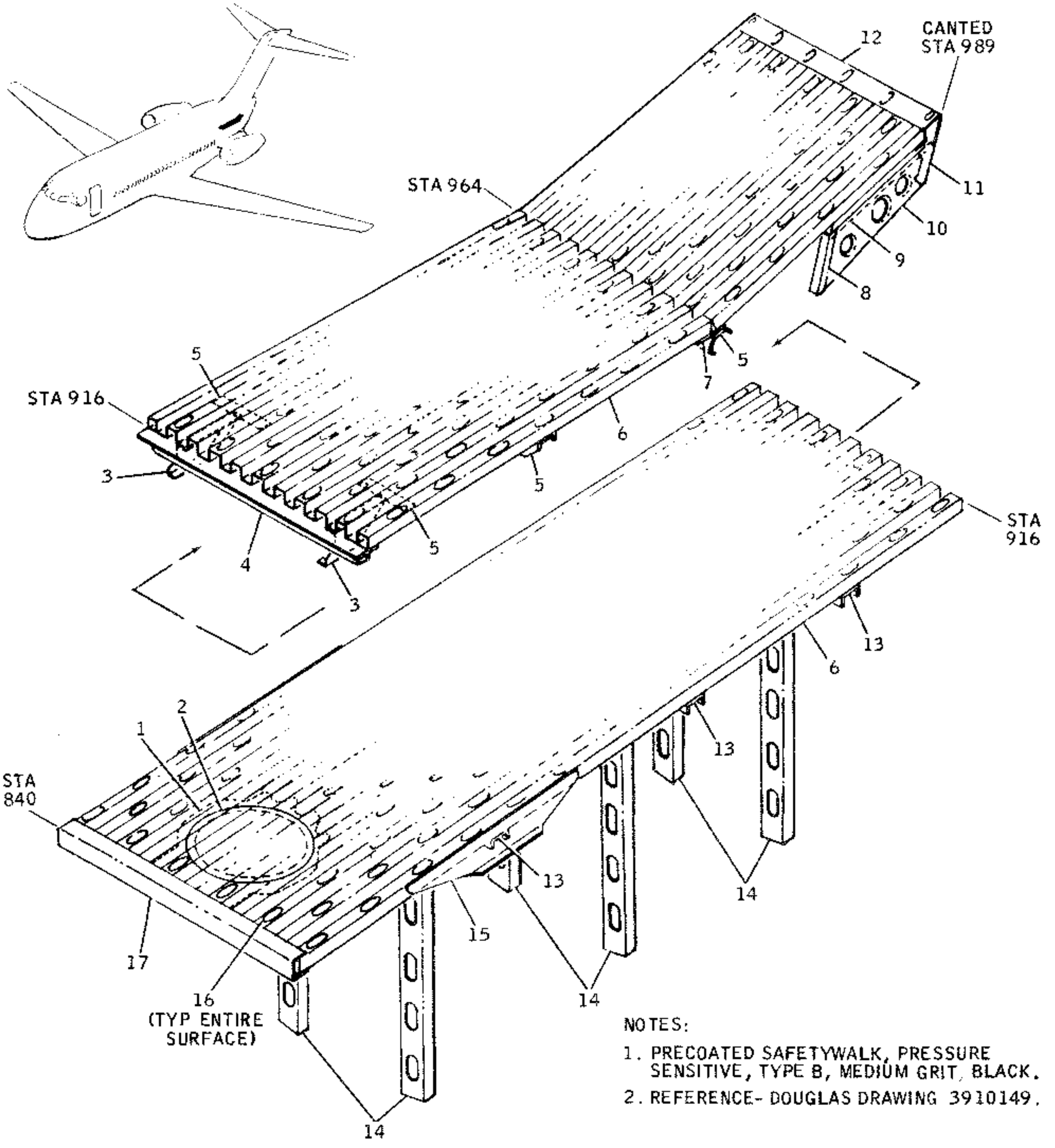
ITEM	PANEL TYPE A	PANEL TYPE B	PANEL TYPE C	NOMENCLATURE	GAGE	MATERIAL
1			●	PANEL	.025	6061-T6X
2			●	FILLER	.050	CLAD 2024-T3
3		●		ZEE	.050	CLAD 2024-T42
4			●	SUPPORT	.050	CLAD 2024-T42
5	●		●	CHANNEL	.050	CLAD 2024-T42
6		●		ANGLE		1244084
7	●	●		ANGLE		1416036
8			●	SPACER	.090	SEE NOTE 1
9			●	ANGLE	.040	CLAD 2024-T42
10			●	HAT		2912282
11	●	●		HAT		4616492
12	●	●		ZEE		SEE NOTE 2
13	●	●		PAN		SEE NOTE 3
14			●	SPACER	.050	SEE NOTE 1

NOTES:

1. SHEET GLASS LAMINATE, DMS-3.
2. B-STAGE GLASS FABRIC, DMS 1618, TYPE 8.
3. NO. 1534 GLASS FIBER CLOTH, VOLAN FINISH.
4. REFERENCE - DOUGLAS DRAWING 5910348

BB3-902

Floor Panels, Station 786 to 829 -- Type II
Figure 5A

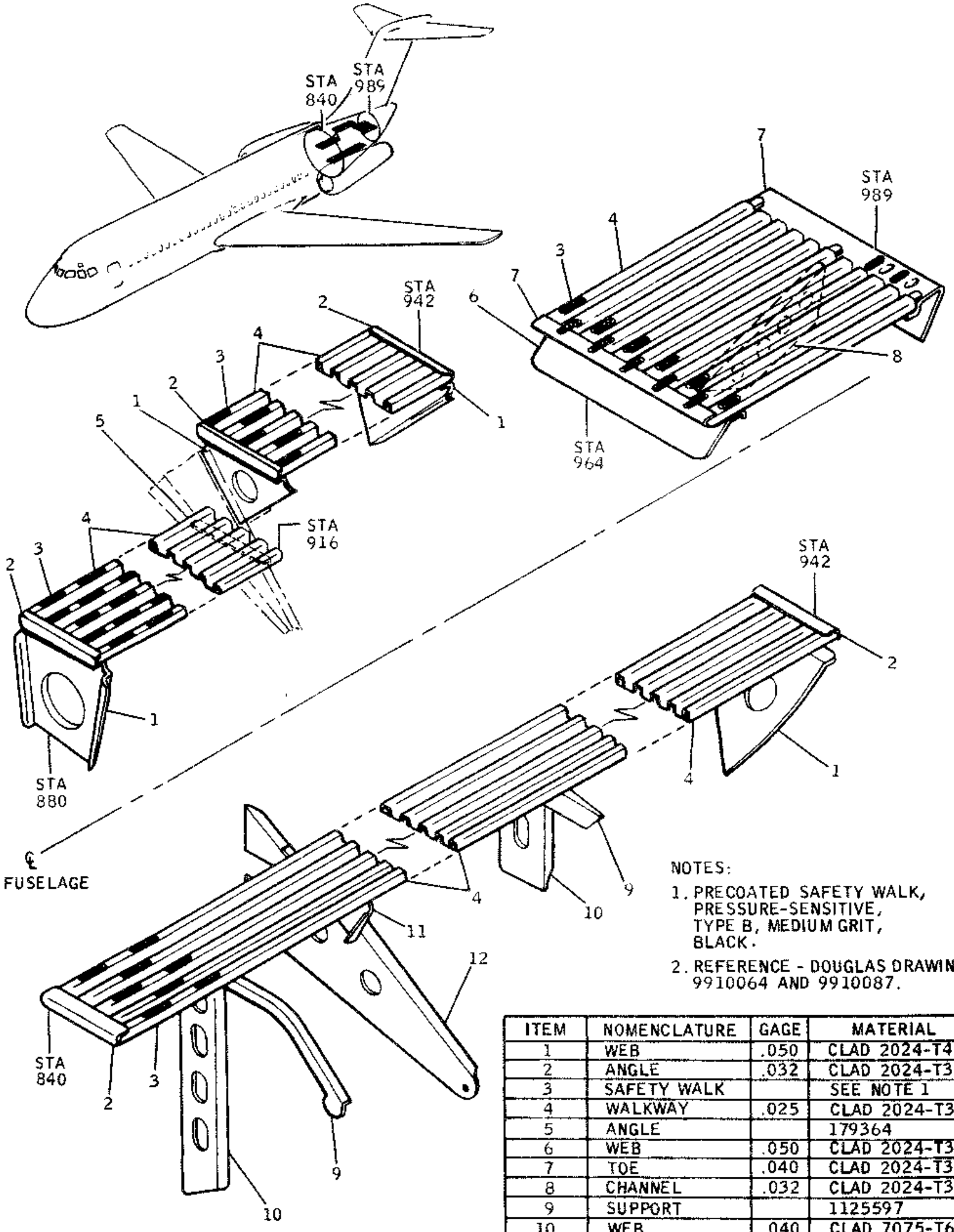


NOTES:
1. PRECOATED SAFETYWALK, PRESSURE SENSITIVE, TYPE B, MEDIUM GRIT, BLACK.
2. REFERENCE- DOUGLAS DRAWING 3910149.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAN	.032	CLAD 2024-T42	10	WEB	.040	CLAD 2024-T42
2	COVER	.050	CLAD 2024-T3	11	CLIP	.050	CLAD 2024-T42
3	CLIP	.063	CLAD 2024-T42	12	TOE	.040	CLAD 2024-T42
4	STIFFENER		1414813	13	STIFFENER		4143179
5	STIFFENER	.063	CLAD 2024-T3	14	STRUT	.040	CLAD 7075-T6
6	WALKWAY	.025	CLAD 2024-T3	15	SUPPORT		1464575
7	CLIP	.063	CLAD 2024-T3	16	SAFETYWALK		SEE NOTE 1
8	STIFFENER		1415595	17	SHIELD	.032	CLAD 2024-T3
9	STIFFENER		1278964				

BB3-716

Walkways, Aft Accessory Compartment -- Type I
Figure 5B



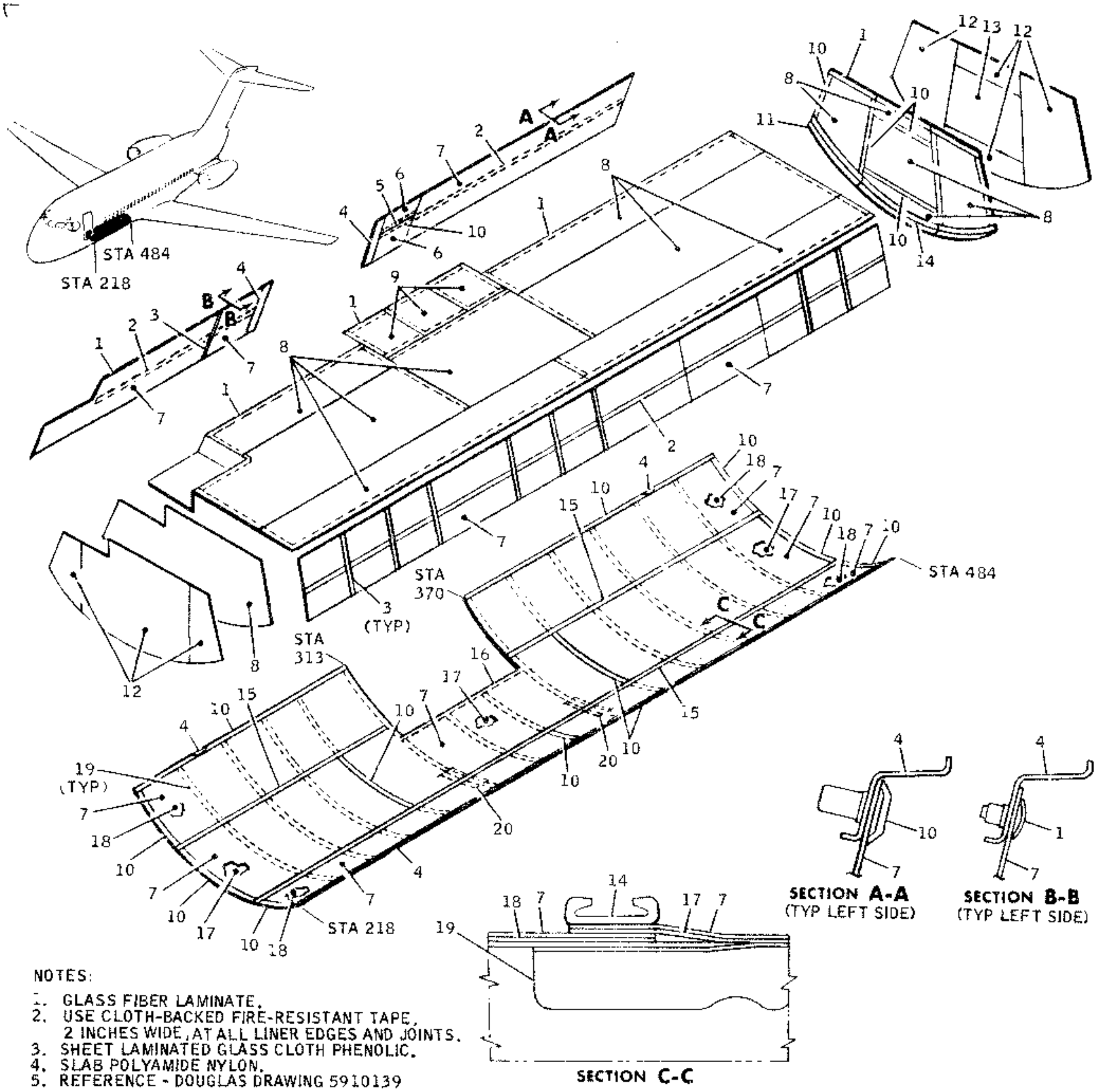
NOTES:

1. PRECOATED SAFETY WALK, PRESSURE-SENSITIVE, TYPE B, MEDIUM GRIT, BLACK.
2. REFERENCE - DOUGLAS DRAWINGS 9910064 AND 9910087.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.050	CLAD 2024-T42
2	ANGLE	.032	CLAD 2024-T3
3	SAFETY WALK		SEE NOTE 1
4	WALKWAY	.025	CLAD 2024-T3
5	ANGLE		179364
6	WEB	.050	CLAD 2024-T3
7	TOE	.040	CLAD 2024-T3
8	CHANNEL	.032	CLAD 2024-T3
9	SUPPORT		1125597
10	WEB	.040	CLAD 7075-T6
11	WEB	.040	CLAD 2024-T3
12	WEB	.050	CLAD 7075-T6

BB3-770

Walkways, Aft Accessory Compartment -- Type II
Figure 5C



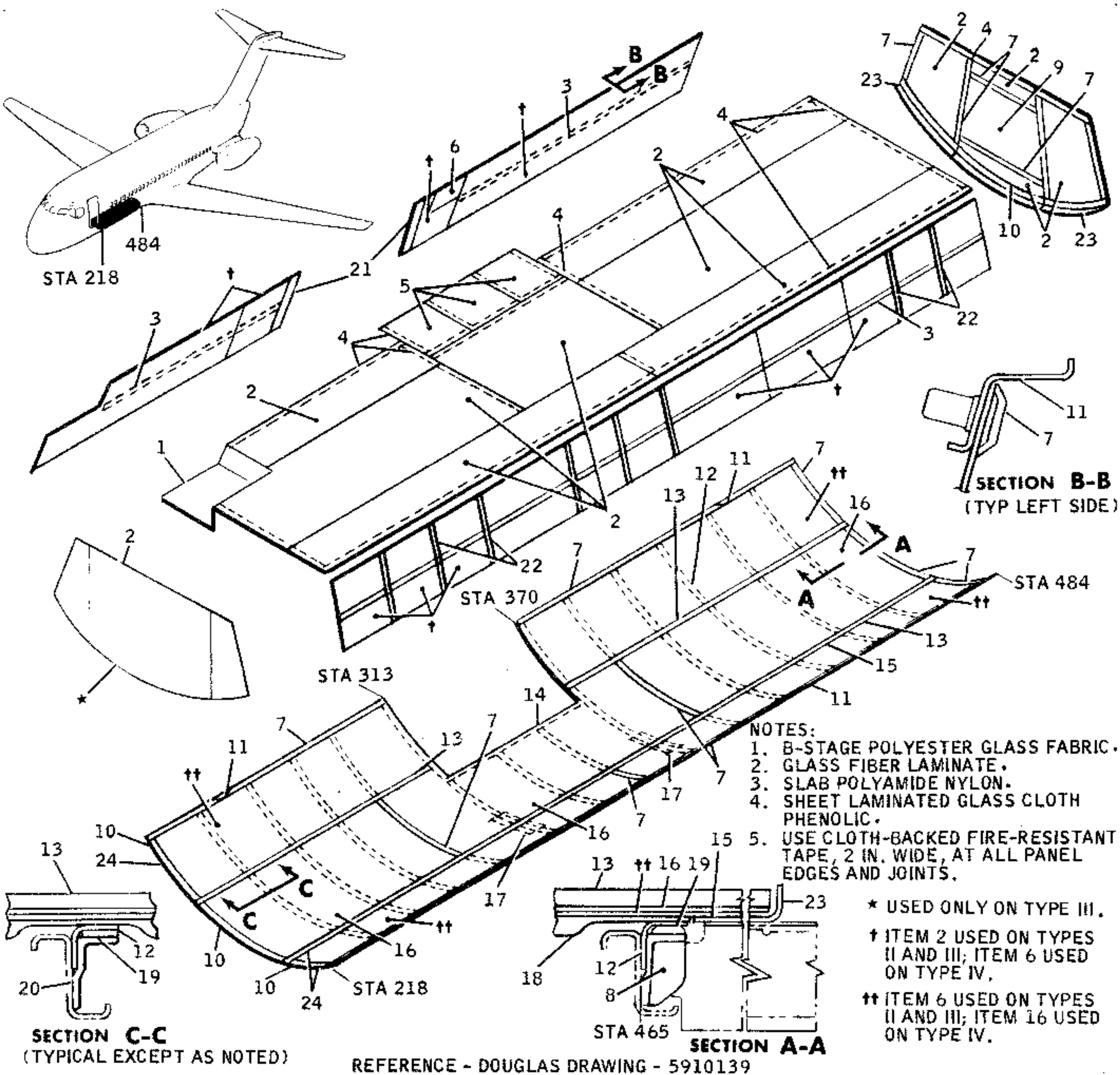
NOTES:

1. GLASS FIBER LAMINATE.
2. USE CLOTH-BACKED FIRE-RESISTANT TAPE, 2 INCHES WIDE, AT ALL LINER EDGES AND JOINTS.
3. SHEET LAMINATED GLASS CLOTH PHENOLIC.
4. SLAB POLYAMIDE NYLON.
5. REFERENCE - DOUGLAS DRAWING 5910139

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TRIM STRIP		2606706	11	ANGLE	.050	CLAD 7075-T6
2	STIFFENER	.032	CLAD 2024-T3	12	SHEET	.025	CLAD 7075-T6
3	CHANNEL	.050	CLAD 2024-T3	13	DOOR	.032	AL SHEET 6061-T6
4	SUPPORT	.040	CLAD 2024-T3	14	TRIM STRIP	.090	AL SHEET 6061-T6
5	SUPPORT	.032	CLAD 2024-T3	15	TRACK		2955978
6	PANEL	.045	SEE NOTE 1	16	SPACER	.187	SEE NOTE 4
7	PANEL	.030	SEE NOTE 1	17	PANEL	.040	CLAD 7075-T6
8	PANEL	.023	SEE NOTE 1	18	PANEL	.032	CLAD 7075-T6
9	PANEL	.012	SEE NOTE 1	19	ANGLE	.040	TITANIUM DMS1536
10	TRIM STRIP		2706708	20	STRIP	.187	SEE NOTE 3

BB3-709A

Forward Lower Cargo Compartment Floors and Lining -- Type I
Figure 6



NOTES:
1. B-STAGE POLYESTER GLASS FABRIC.
2. GLASS FIBER LAMINATE.
3. SLAB POLYAMIDE NYLON.
4. SHEET LAMINATED GLASS CLOTH PHENOLIC.
5. USE CLOTH-BACKED FIRE-RESISTANT TAPE, 2 IN. WIDE, AT ALL PANEL EDGES AND JOINTS.

* USED ONLY ON TYPE III.

† ITEM 2 USED ON TYPES II AND III; ITEM 6 USED ON TYPE IV.

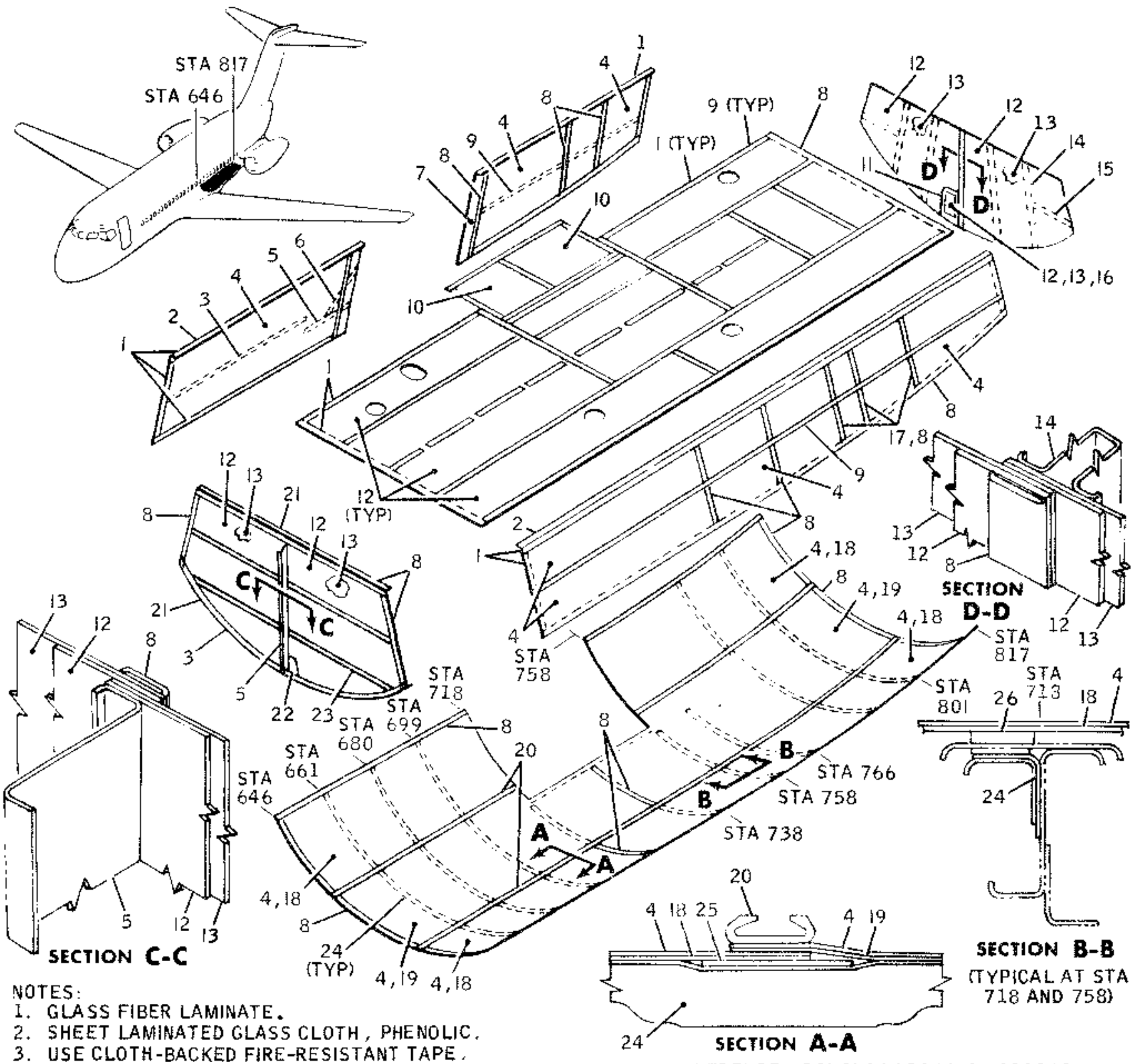
†† ITEM 6 USED ON TYPES II AND III; ITEM 16 USED ON TYPE IV.

REFERENCE - DOUGLAS DRAWING - 5910139

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	COVER		SEE NOTE 1	13	TRACK		2955978
2	PANEL	.023	SEE NOTE 2	14	SPACER	.187	SEE NOTE 3
3	STIFFENER	.032	CLAD 2024-T3	15	STRIP	.060	SEE NOTE 2
4	TRIM STRIP		2706706	16	PANEL	.060	SEE NOTE 2
5	PANEL	.012	SEE NOTE 2	17	STRIP	.187	SEE NOTE 4
6	PANEL	.045	SEE NOTE 2	18	CHANNEL	.063	CLAD 7075-T6
7	TRIM STRIP		2706708	19	SPACER	.146	SEE NOTE 4
8	SUPPORT FITTING		PLATE 7075-T651	20	SUPPORT		2956031
9	DOOR	.032	AL SHEET 6061-T6	21	SUPPORT	.063	CLAD 2024-T3
10	TRIM STRIP	.090	AL SHEET 6061-T6	22	CHANNEL	.050	CLAD 2024-T3
11	SUPPORT	.040	CLAD 2024-T3	23	ANGLE	.050	CLAD 7075-T6
12	ANGLE	.040	TITANIUM SHEET	24	SPACER		1714303

Forward Lower Cargo Compartment Floors and Lining --
Types II, III, and IV
Figure 7

BB3-144B



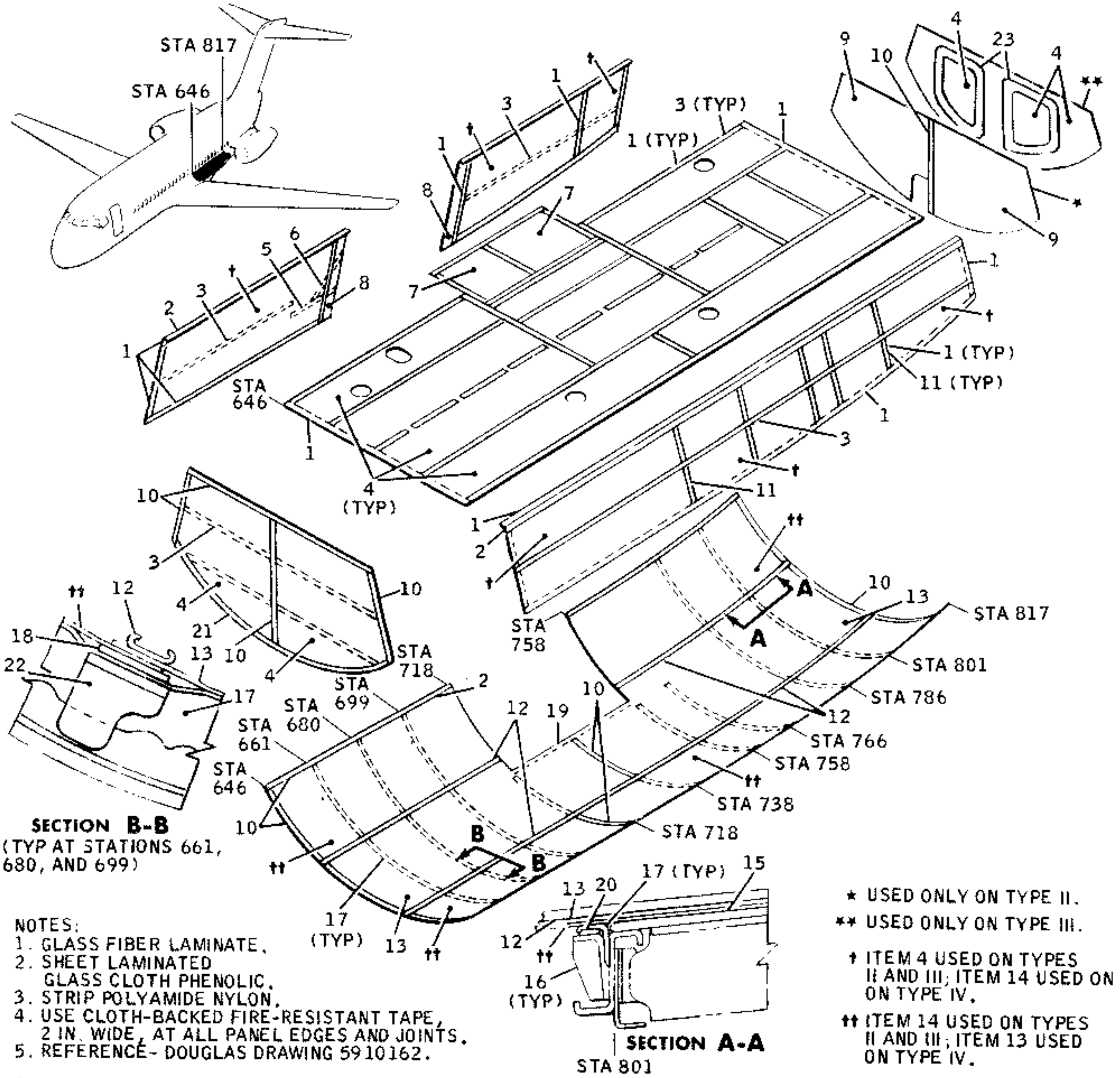
NOTES:
1. GLASS FIBER LAMINATE.
2. SHEET LAMINATED GLASS CLOTH, PHENOLIC.
3. USE CLOTH-BACKED FIRE-RESISTANT TAPE, 2 IN. WIDE FOR ALL PANEL EDGES AND JOINTS.

REFERENCE - DOUGLAS DRAWING 5910162

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TRIM STRIP		2706706	14	HAT		1244347
2	ANGLE	.040	CLAD 2024-T3	15	BRACKET	.040	CLAD 2024-T42
3	TRIM STRIP	.090	SHEET 6061-T6	16	DOUBLER	.090	CLAD 2024-T3
4	PANEL	.030	SEE NOTE 1	17	SUPPORT	.050	CLAD 2024-T3
5	INTERCOSTAL	.050	CLAD 7075-T6	18	PANEL	.032	CLAD 7075-T6
6	BRACE	.050	CLAD 7075-T6	19	PANEL	.040	CLAD 7075-T6
7	WEB	.040	CLAD 7075-T6	20	TRACK		2955978
8	TRIM STRIP		2706708	21	ANGLE	.050	CLAD 2024-T42
9	SUPPORT	.032	CLAD 2024-T3	22	GUSSET	.040	CLAD 2024-T42
10	PANEL	.012	SEE NOTE 1	23	INTERCOSTAL	.032	CLAD 2024-T3
11	DOUBLER	.032	CLAD 2024-T42	24	ANGLE	.040	TITANIUM SHEET
12	PANEL	.023	SEE NOTE 1	25	CHANNEL	.063	CLAD 7075-T6
13	SHEET	.025	CLAD 7075-T6	26	SPACER	.191	SEE NOTE 2

BB3-710A

Aft Lower Cargo Compartment Floors and Lining -- Type I
Figure 8



NOTES:
1. GLASS FIBER LAMINATE.
2. SHEET LAMINATED GLASS CLOTH PHENOLIC.
3. STRIP POLYAMIDE NYLON.
4. USE CLOTH-BACKED FIRE-RESISTANT TAPE, 2 IN. WIDE, AT ALL PANEL EDGES AND JOINTS.
5. REFERENCE- DOUGLAS DRAWING 5910162.

* USED ONLY ON TYPE II.
** USED ONLY ON TYPE III.
† ITEM 4 USED ON TYPES II AND III; ITEM 14 USED ON ON TYPE IV.
†† ITEM 14 USED ON TYPES II AND III; ITEM 13 USED ON TYPE IV.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TRIM STRIP		2706706	12	TRACK		2955978
2	ANGLE	.040	CLAD 2024-T3	13	PANEL	.060	SEE NOTE 1
3	SUPPORT	.032	CLAD 2024-T3	14	PANEL	.045	SEE NOTE 1
4	PANEL	.023	SEE NOTE 1	15	SPACER	.191	SEE NOTE 2
5	INTERCOSTAL	.050	CLAD 7075-T6	16	SUPPORT FITTING		PLATE 7075-T651
6	BRACE	.050	CLAD 7075-T6	17	ANGLE	.040	TITANIUM SHEET
7	PANEL	.012	SEE NOTE 1	18	CHANNEL	.063	CLAD 7075-T6
8	WEB	.040	CLAD 7075-T6	19	SPACER	.125	SEE NOTE 3
9	LINER	.030	SEE NOTE 1	20	SPACER	.128	SEE NOTE 2
10	TRIM STRIP		2706708	21	TRIM STRIP	.090	SHEET 6061-T6
11	SUPPORT	.050	CLAD 2024-T3	22	SUPPORT FITTING		2956031
				23	DOOR	.063	CLAD 7075-T6

BB3-143B

Aft Lower Cargo Compartment Floors and Lining -- Types II, III, and IV
Figure 9

Printed in U.S.A.

AUXILIARY STRUCTURE -- DESCRIPTION AND OPERATION (DC-9-30)

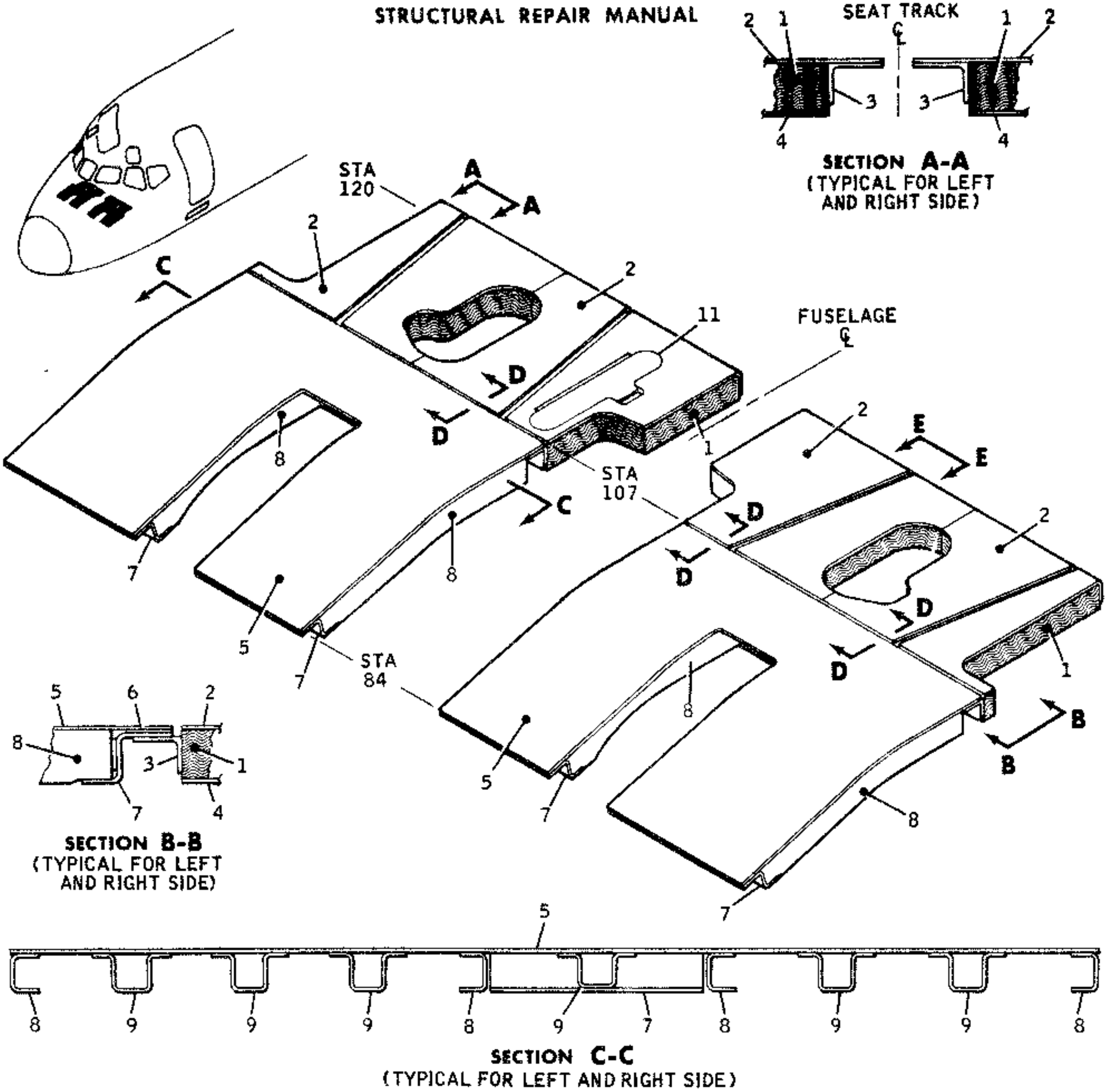
1. General

A. The following figures illustrate the auxiliary structure of the fuselage, including such items as the floors and cargo compartment lining. The materials used are identified in the material lists by item number callouts.

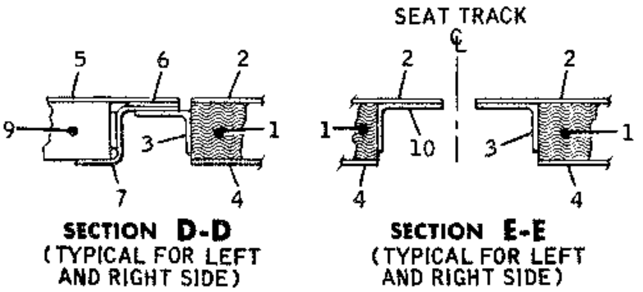
2. Repair Index

A. A list of components covered in this section and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Component	Approved Repair
All	Section 53-01
Floor Panels	Section 53-05, Figures 1, 2, and 3
Seat Tracks	Section 53-05, Figure 4
Cargo compartment floors and lining	Section 53-05, Figures 5, 6, and 7



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BLOCKING		SEE NOTE
2	WEB	.050	CLAD 2024-T3
3	ANGLE		1464708
4	WEB	.020	CLAD 7075-T6
5	WEB	.032	CLAD 7075-T6
6	SPACER	.063	CLAD 2024-T3
7	FRAME	.040	6061-T6
8	CAP	.040	6061-T6
9	STIFFENER		2916423-2
10	ANGLE		1464709
11	DOOR	.050	CLAD 7075-T6

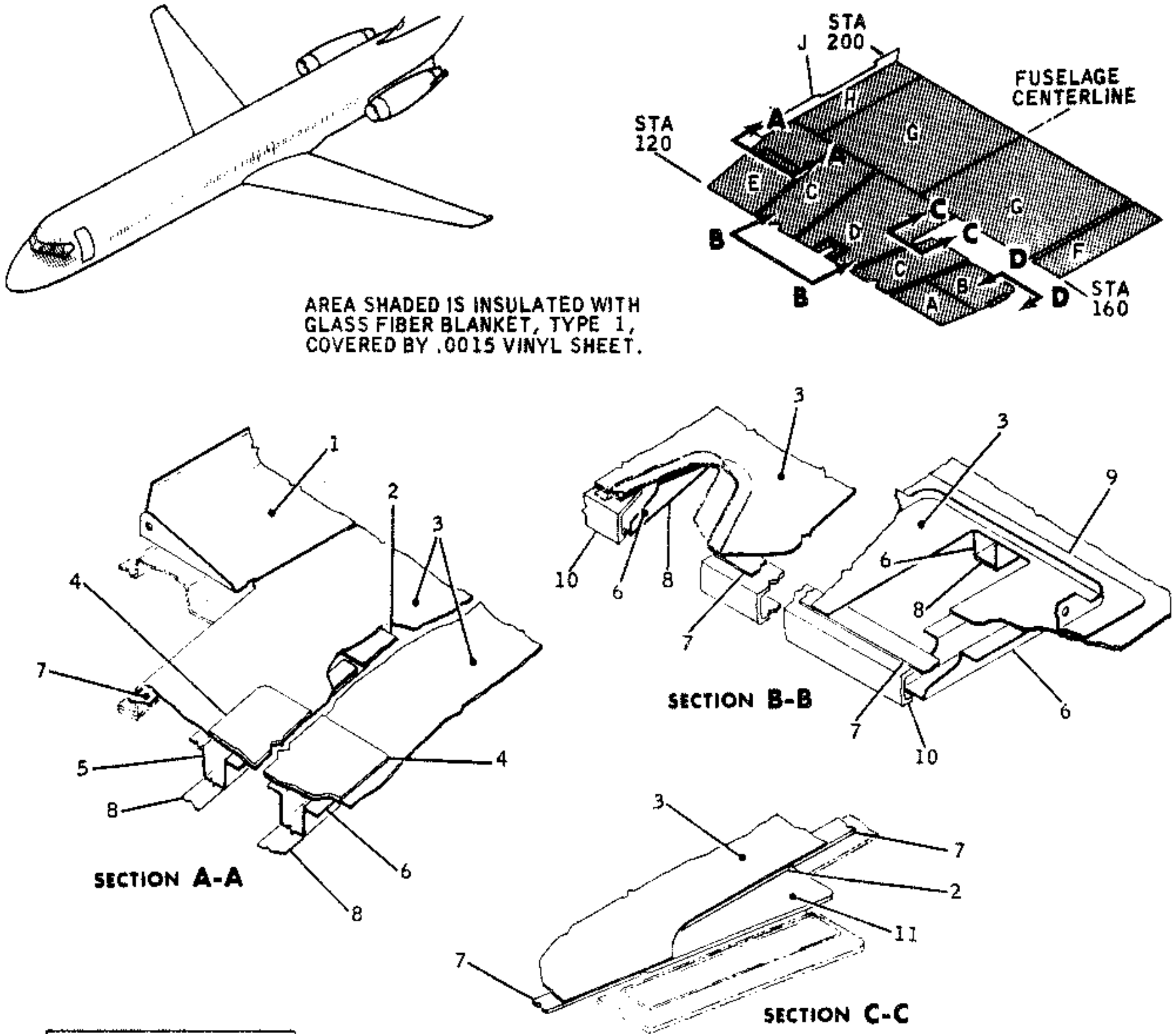


NOTES:

1. LUMBER TO BE WCLA GRADE B OR BETTER SPRUCE SPECIES.
2. REFERENCE - DOUGLAS DRAWING 5910080

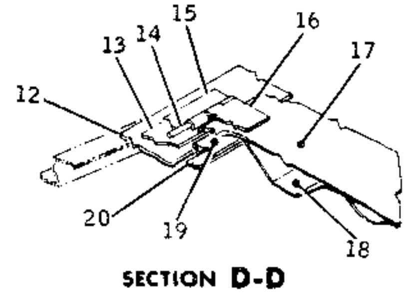
BB3-904

Floor Panels, Forward of Fuselage Station 120
(Flight Compartment) -- Type A
Figure 1



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET.

	PANEL TYPE											
ITEM	A	B	C	D	E	F	G	H	J	NOMENCLATURE	GAGE	MATERIAL
1									•	WEB	.025	CLAD 2024-T42
2				•	•	•		•		STRIP	.050	SEE NOTE 1
3	•		•	•	•	•	•	•		WEB	.025	CLAD 7075-T6
4					•					DOUBLER	.032	CLAD 7075-T6
5	•				•	•		•		HAT		4616492
6	•		•	•	•		•			HAT		2912282
7	•		•	•	•	•	•	•		STRIP	.070	SEE NOTE 1
8	•		•	•	•		•			TAPE		SEE NOTE 2
9				•						ANGLE	.040	CLAD 2024-T42
10			•	•						CHANNEL		1250426
11				•						PLATE	.025	CLAD 7075-T6
12		•								RETAINER	.090	SEE NOTE 1
13		•								DOOR JAMB	.020	SEE NOTE 3
14		•								PIN		MS20253P2-737
15		•								HINGE		MS20001PY10
16		•								HINGE		MS20001PY4
17		•								DOOR	.032	6061-T6
18		•								DOUBLER	.032	6061-T6
19		•								SEAL		1555214
20		•								RETAINER	.040	CLAD 2024-T3

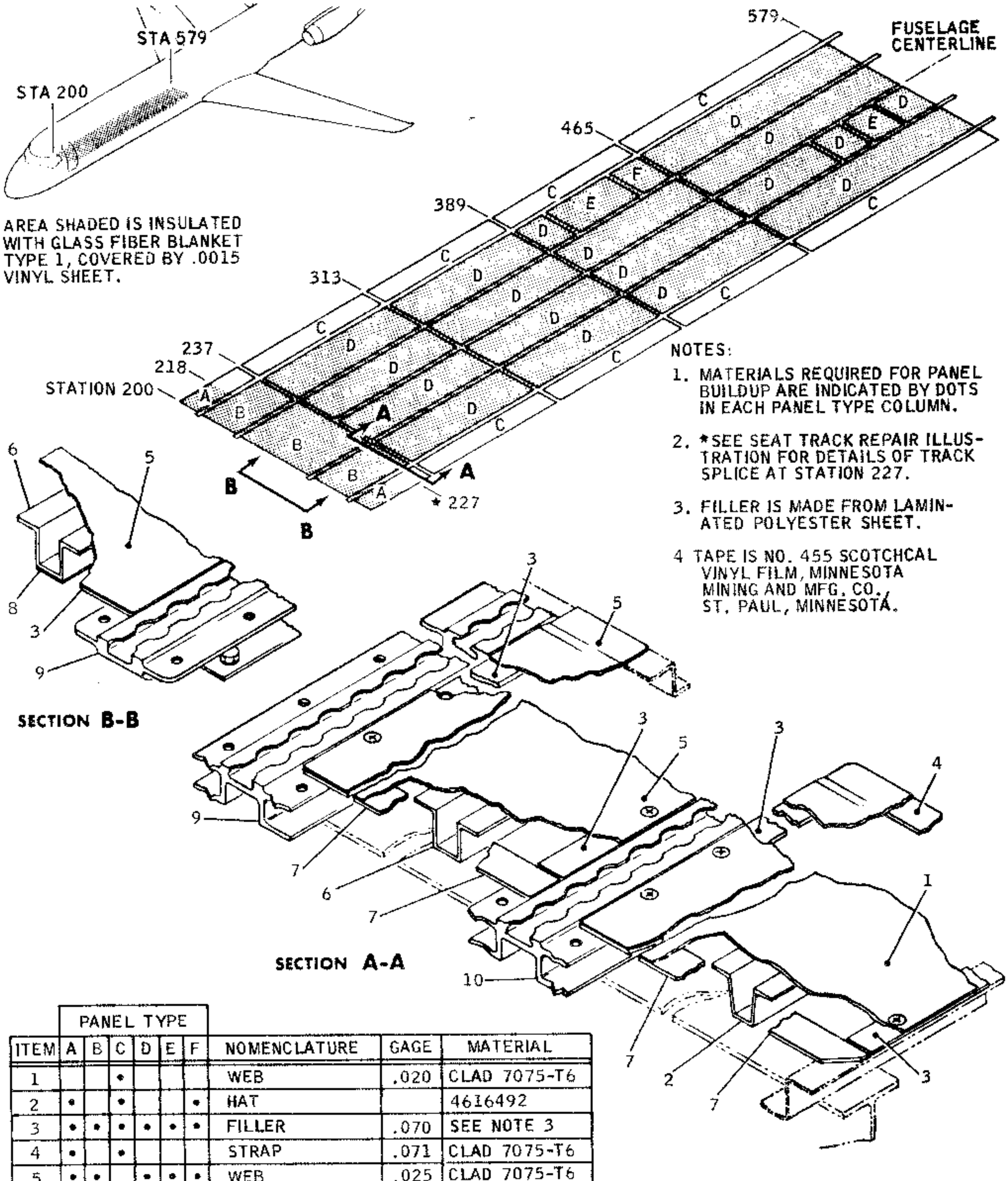


NOTES:

1. MADE FROM GLASS FIBER LAMINATED SHEET (POLYESTER).
2. NO.455 SCOTCHCAL VINYL FILM, MINNESOTA MINING AND MFG. CO. ST. PAUL, MINN. OR EQUIVALENT.
3. CREW SHEET, TYPE 321-T1.
4. REFERENCE- DOUGLAS DRAWING 5910079.

BB3-931

Floor Panels, Station 120 to 200 -- Type A
Figure 2



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET TYPE 1, COVERED BY .0015 VINYL SHEET.

NOTES:

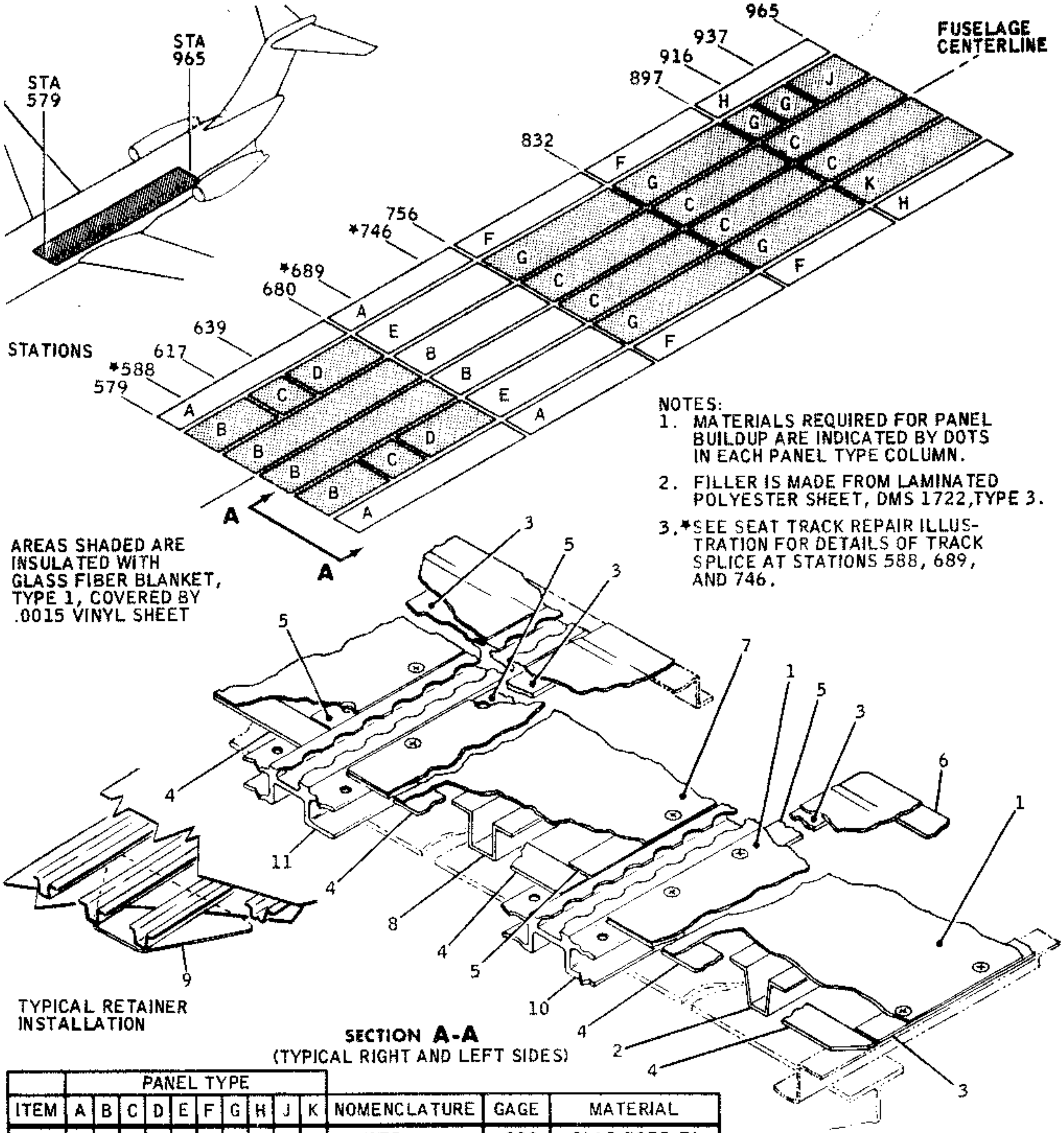
1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. *SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATION 227.
3. FILLER IS MADE FROM LAMINATED POLYESTER SHEET.
4. TAPE IS NO. 455 SCOTCHCAL VINYL FILM, MINNESOTA MINING AND MFG. CO., ST. PAUL, MINNESOTA.

	PANEL TYPE								
ITEM	A	B	C	D	E	F	NOMENCLATURE	GAGE	MATERIAL
1			•				WEB	.020	CLAD 7075-T6
2	•		•			•	HAT		4616492
3	•	•	•	•	•	•	FILLER	.070	SEE NOTE 3
4	•		•				STRAP	.071	CLAD 7075-T6
5	•	•		•	•	•	WEB	.025	CLAD 7075-T6
6		•		•	•		HAT		2912282
7			•	•		•	FILLER	.040	SEE NOTE 3
8		•					TAPE		SEE NOTE 4
9							TRACK		2772660
10							TRACK		2914913

REFERENCE-DOUGLAS DRAWINGS 5910079 AND 5910482

BB3-877

Floor Panels and Seat Tracks, Station 200 to 589 -- Type A
Figure 3



AREAS SHADED ARE INSULATED WITH GLASS FIBER BLANKET, TYPE 1, COVERED BY .0015 VINYL SHEET

NOTES:
1. MATERIALS REQUIRED FOR PANEL BUILDUP ARE INDICATED BY DOTS IN EACH PANEL TYPE COLUMN.
2. FILLER IS MADE FROM LAMINATED POLYESTER SHEET, DMS 1722, TYPE 3.
3. *SEE SEAT TRACK REPAIR ILLUSTRATION FOR DETAILS OF TRACK SPLICE AT STATIONS 588, 689, AND 746.

TYPICAL RETAINER INSTALLATION

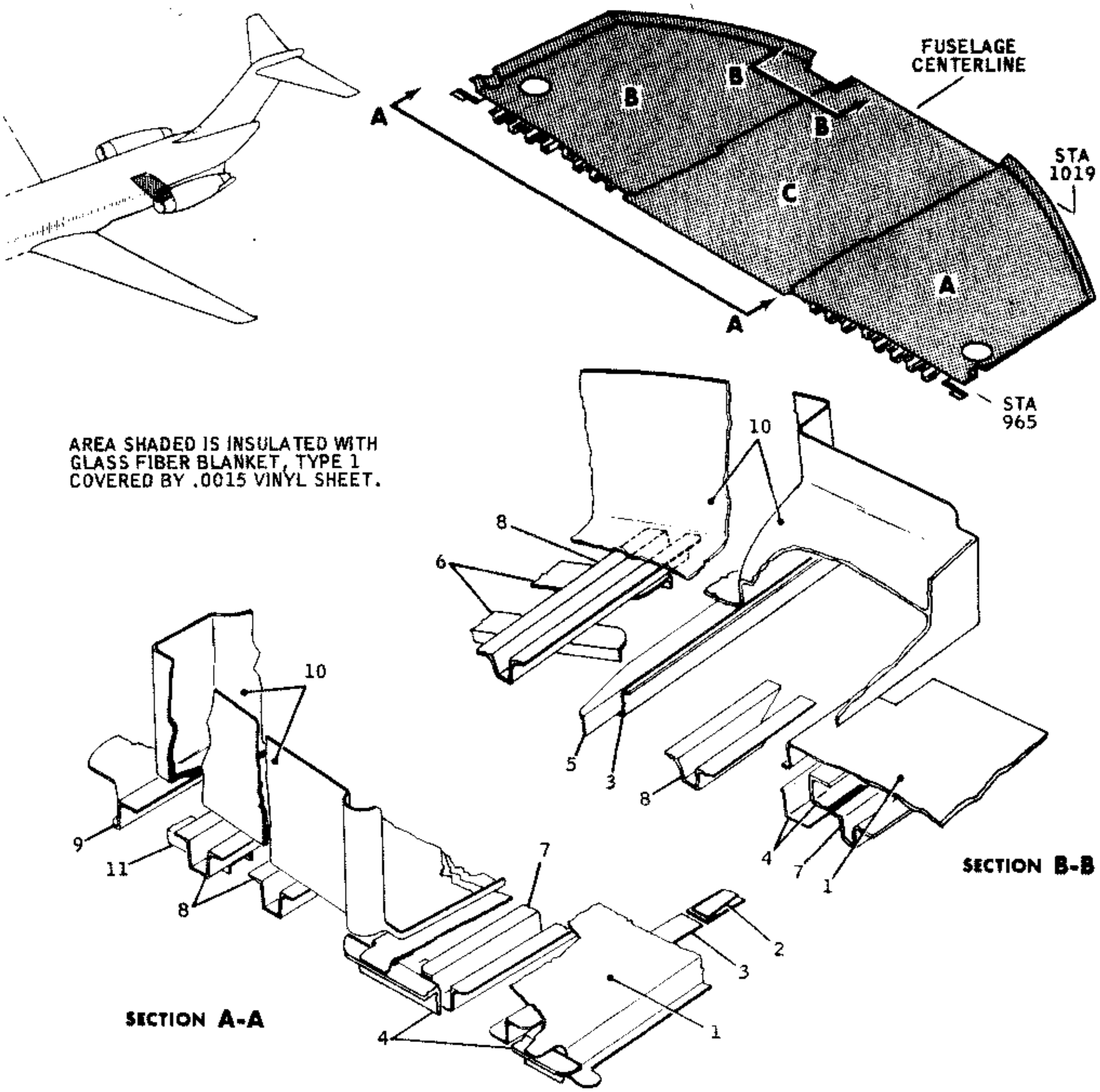
SECTION A-A
(TYPICAL RIGHT AND LEFT SIDES)

	PANEL TYPE												
ITEM	A	B	C	D	E	F	G	H	J	K	NOMENCLATURE	GAGE	MATERIAL
1	●					●		●			WEB	.020	CLAD 7075-T6
2	●					●	●	●	●	●	HAT		4616492
3	●	●	●	●		●	●	●	●	●	FILLER	.070	SEE NOTE 2
4	●	●	●		●	●	●	●		●	FILLER	.040	SEE NOTE 2
5	●	●			●						FILLER	.071	CLAD 7075-T6
6	●					●					STRAP	.071	CLAD 7075-T6
7		●	●	●	●		●		●	●	WEB	.025	CLAD 7075-T6
8		●	●	●	●						HAT		2912282
9									●	●	RETAINER	.025	CLAD 2024-T3
10											TRACK		2914913
11											TRACK		2772660

REFERENCE- DOUGLAS DRAWING 5910363 AND 5910483

BB3-878

Floor Panels and Seat Tracks, Station 589 to 965 -- Type A
Figure 4



AREA SHADED IS INSULATED WITH GLASS FIBER BLANKET, TYPE 1 COVERED BY .0015 VINYL SHEET.

ITEM	PANEL TYPE			NOMENCLATURE	GAGE	MATERIAL
	A	B	C			
1			●	PANEL	.025	6061-T6X
2			●	FILLER	.050	CLAD 2024-T3
3		●		ZEE	.050	CLAD 2024-T42
4			●	SUPPORT	.050	CLAD 2024-T42
5		●		ANGLE		1244084
6	●	●		ANGLE		1416036
7			●	HAT		2912282
8	●	●		HAT		4616492
9	●	●		ZEE		SEE NOTE 1
10	●	●		PAN		SEE NOTE 2
11	●			CHANNEL	.050	CLAD 2024-T42

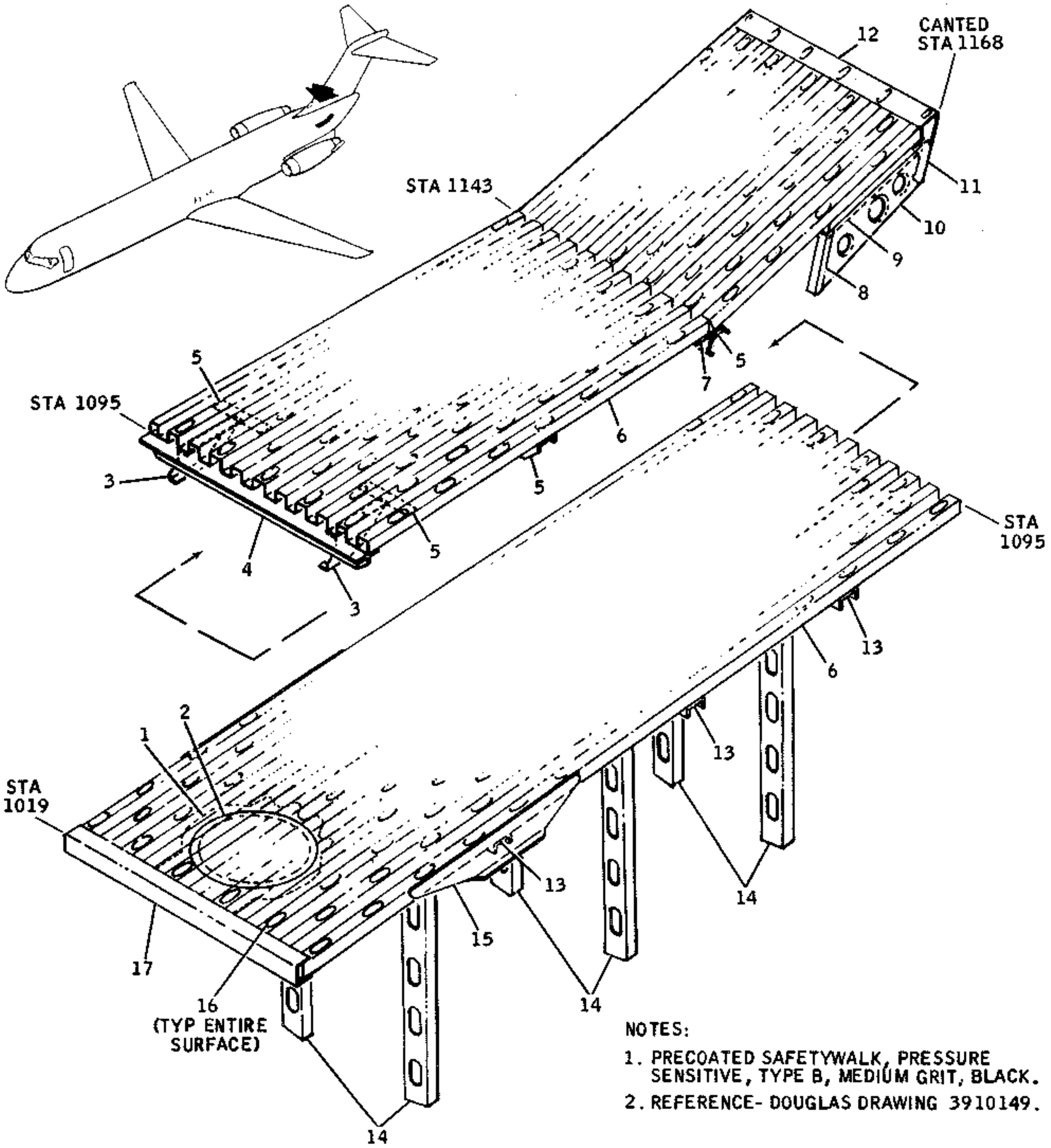
NOTES:

1. B-STAGE GLASS FABRIC, DMS 1618, TYPE 8.
2. NO. 1534 GLASS FIBER CLOTH, VOLAN FINISH.
3. REFERENCE - DOUGLAS DRAWING 5910348.

BB3-905

Floor Panels, Station 965 to 1008 -- Type A
Figure 5

Printed in U.S.A.



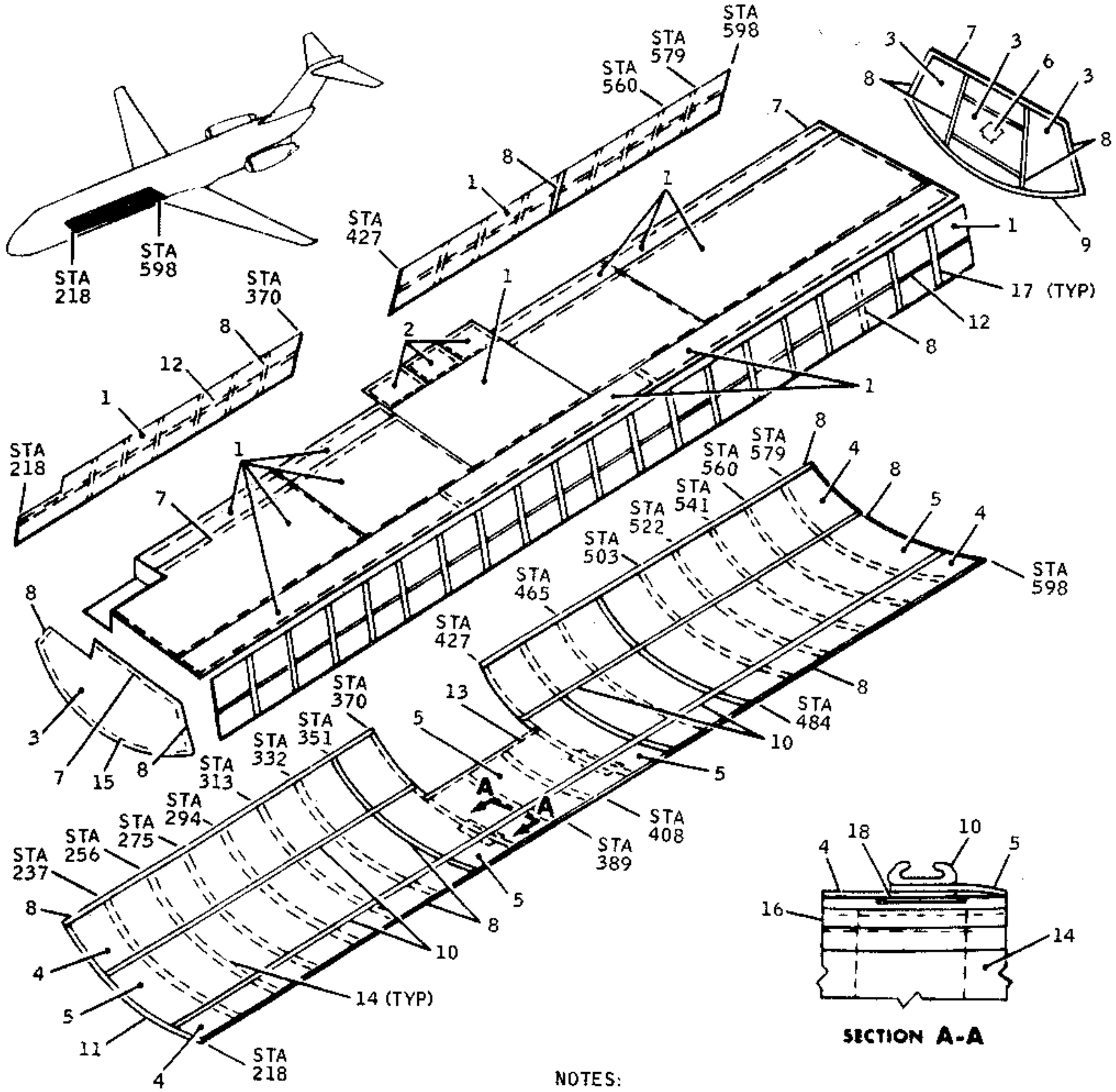
NOTES:

1. PRECOATED SAFETYWALK, PRESSURE SENSITIVE, TYPE B, MEDIUM GRIT, BLACK.
2. REFERENCE- DOUGLAS DRAWING 3910149.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAN	.032	CLAD 2024-T42	10	WEB	.040	CLAD 2024-T42
2	COVER	.050	CLAD 2024-T3	11	CLIP	.050	CLAD 2024-T42
3	CLIP	.063	CLAD 2024-T42	12	TOE	.040	CLAD 2024-T42
4	STIFFENER		1414813	13	STIFFENER		4143179
5	STIFFENER	.063	CLAD 2024-T3	14	STRUT	.040	CLAD 7075-T6
6	WALKWAY	.025	CLAD 2024-T3	15	SUPPORT		1464575
7	CLIP	.063	CLAD 2024-T3	16	SAFETYWALK		SEE NOTE 1
8	STIFFENER		1415595	17	SHIELD	.032	CLAD 2024-T3
9	STIFFENER		1278964				

BB3-908

Walkways, Aft Accessory Compartment -- Type A
Figure 6



NOTES:

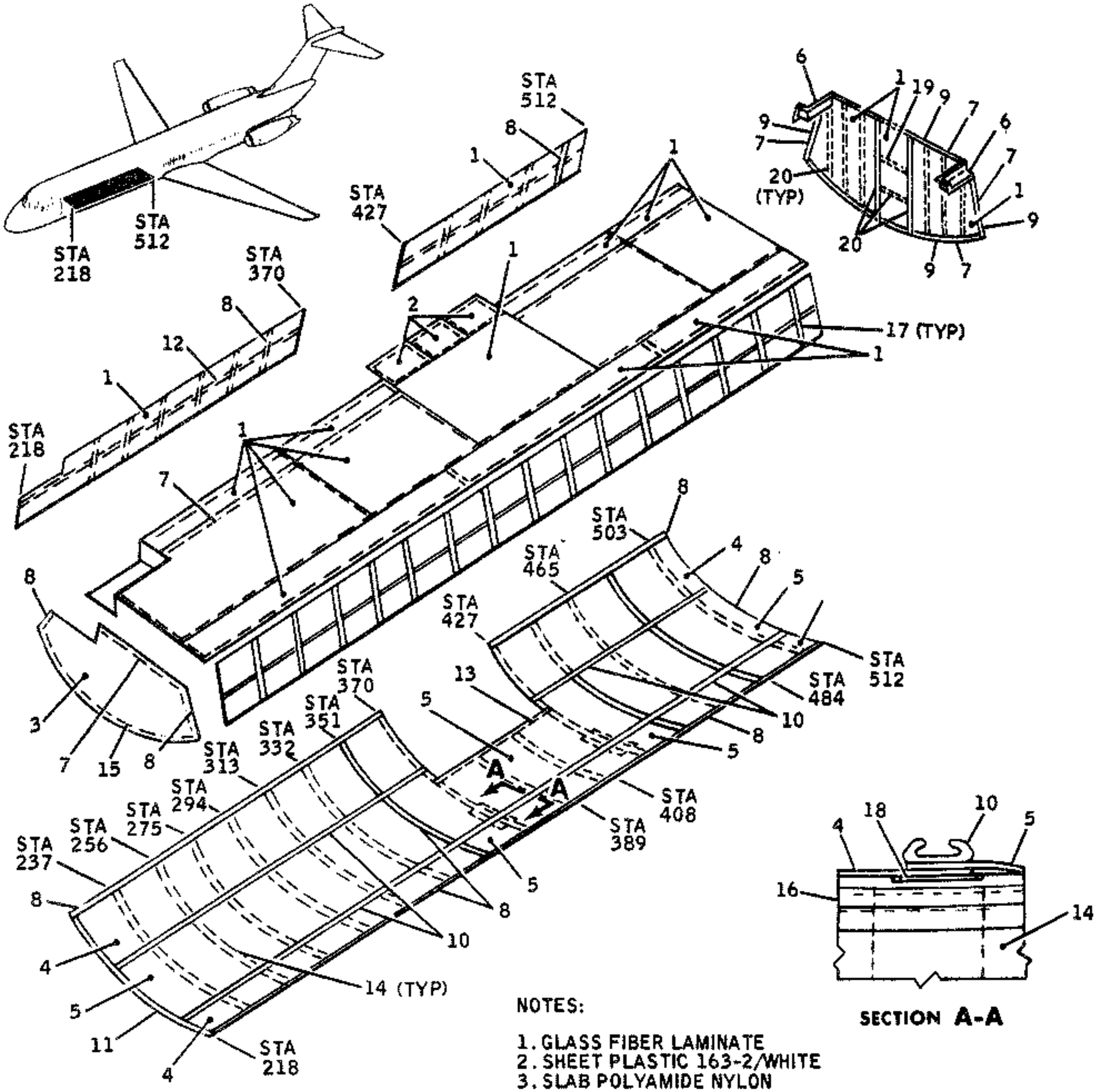
1. GLASS FIBER LAMINATE
2. SLAB POLYAMIDE NYLON
3. SHEET LAMINATED GLASS CLOTH PHENOLIC

REFERENCE - DOUGLAS DRAWING 5910507

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL	.030	SEE NOTE 1	10	TRACK		2955978
2	PANEL	.012	SEE NOTE 1	11	TRIM STRIP	.090	AL SHEET 6061-T6
3	PANEL	.040	SEE NOTE 1	12	STIFFENER	.032	CLAD 2024-T3
4	PANEL	.040	CLAD 7075-T6	13	SPACER	.125	SEE NOTE 2
5	PANEL	.050	CLAD 7075-T6	14	ANGLE	.040	TITANIUM SHEET
6	DOOR	.032	AL SHEET 6061-T6	15	PLATE	.090	AL SHEET 6061-T6
7	TRIM STRIP		2706706	16	STRIP	.187	SEE NOTE 3
8	TRIM STRIP		2706708	17	CHANNEL	.050	CLAD 2024-T3
9	ANGLE	.050	CLAD 7075-T6	18	CHANNEL	.063	CLAD 7075-T6

BB3-980

Forward Lower Cargo Compartment Floors and Lining -- Type A1
Figure 7



NOTES:

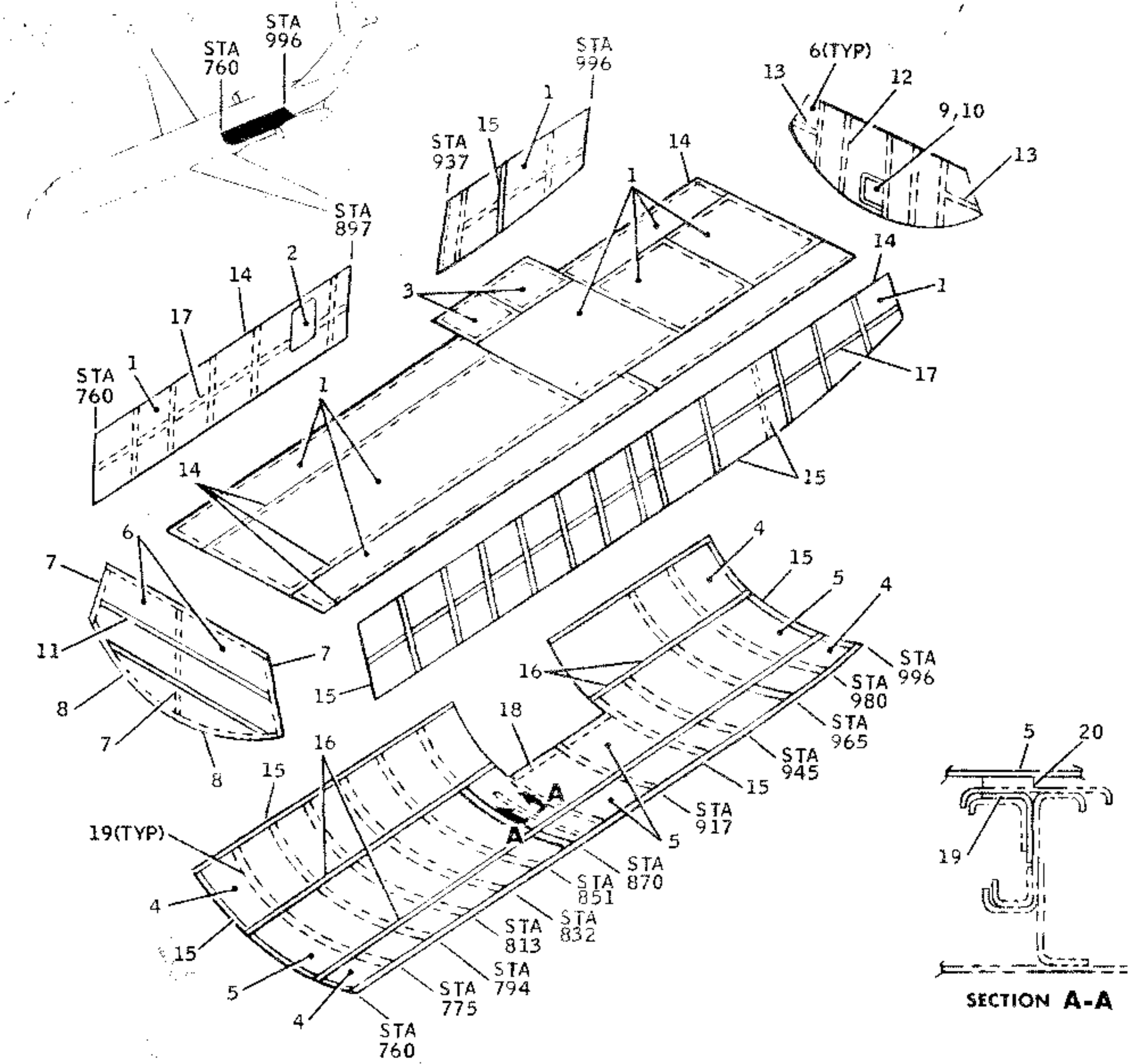
1. GLASS FIBER LAMINATE
2. SHEET PLASTIC 163-2/WHITE
3. SLAB POLYAMIDE NYLON
4. SHEET LAMINATED GLASS CLOTH PHENOLIC

REFERENCE - DOUGLAS DRAWING 5910507

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL	.030	SEE NOTE 1	11	TRIM STRIP	.090	AL SHEET 6061-T6
2	PANEL	.012	SEE NOTE 1	12	STIFFENER	.032	CLAD 2024-T3
3	PANEL	.040	SEE NOTE 1	13	SPACER	.125	SEE NOTE 3
4	PANEL	.040	CLAD 7075-T6	14	ANGLE	.040	TITANIUM SHEET
5	PANEL	.050	CLAD 7075-T6	15	PLATE	.090	AL SHEET 6061-T6
6	PAN	.062	SEE NOTE 2	16	STRIP	.187	SEE NOTE 4
7	TRIM STRIP		2706706	17	CHANNEL	.050	CLAD 2024-T3
8	TRIM STRIP		2706708	18	CHANNEL	.063	CLAD 7075-T6
9	ANGLE	.050	CLAD 7075-T6	19	CHANNEL	.050	CLAD 7075-T6
10	TRACK		2955978	20	SUPPORT	.050	CLAD 7075-T6

BB3-850B

Forward Lower Cargo Compartment Floors and Lining -- Type A2
Figure 7A



NOTES:
1. GLASS FIBER LAMINATE
2. SLAB POLYAMIDE NYLON
3. SHEET LAMINATED GLASS CLOTH PHENOLIC

REFERENCE-DOUGLAS DRAWING 5910508

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL	.030	SEE NOTE 1	11	INTERCOSTAL	.032	CLAD 2024-T3
2	PANEL	.050	SEE NOTE 1	12	HAT		1244347
3	PANEL	.012	SEE NOTE 1	13	BRACKET	.040	CLAD 2024-T42
4	PANEL	.040	CLAD 7075-T6	14	TRIM STRIP		2706706
5	PANEL	.050	CLAD 7075-T6	15	TRIM STRIP		2706708
6	PANEL	.040	SEE NOTE 1	16	TRACK		5956039
7	TRIM STRIP		2706708	17	SUPPORT	.032	CLAD 2024-T3
8	TRIM STRIP		AL SHEET 6061-T6	18	SPACER	.187	SEE NOTE 2
9	COVER	.032	CLAD 7075-T6	19	ANGLE	.040	TITANIUM SHEET
10	DOUBLER	.090	CLAD 7075-T6	20	SPACER	.191	SEE NOTE 3

883-851

Aft Lower Cargo Compartment Floors and Lining -- Type A
Figure 8

PLATES/SKIN - DESCRIPTION AND OPERATION (DC-9-10)

1. General

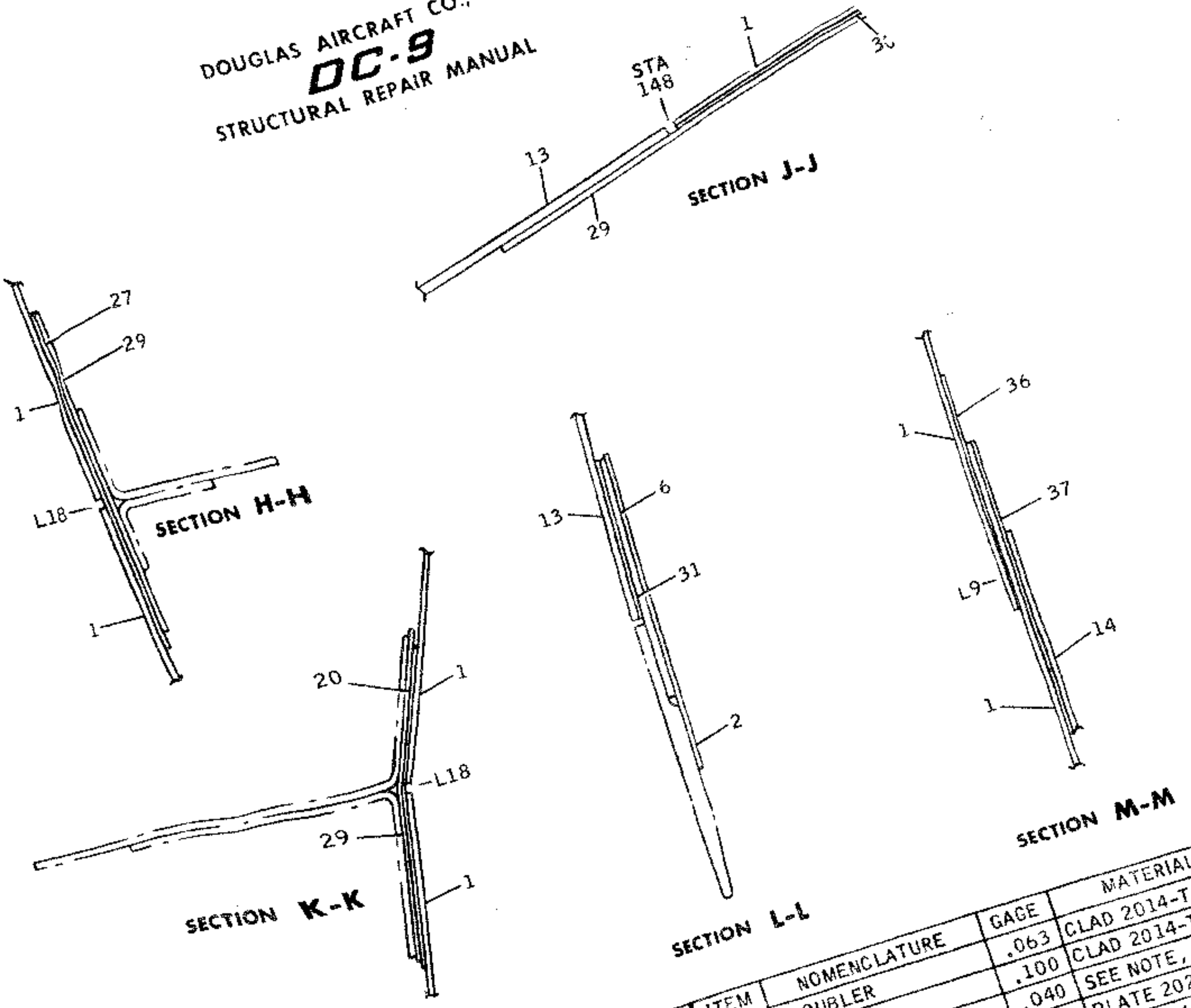
A. The following figures illustrate the plates and doublers in the fuselage. The materials used are identified by the item number callouts.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Components	Applicable Repairs
Plates, skins, and doublers	Section 53-01, Figure 1; Section 53-04, Figure 4, Sheet 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.050	CLAD 2014-T6
2	DOUBLER	.071	CLAD 2024-T42
3	SPACER	.100	CLAD 7075-T6
4	DOUBLER	.050	CLAD 7075-T6
5	DOUBLER	.025	TITANIUM DMS 1592
6	DOUBLER	.090	CLAD 2024-T42
7	BEADED INNER SKIN	.040	CLAD 2014-T6
8	DOUBLER	.050	CLAD 2014-T6
9	SPLICE CHANNEL	.071	CLAD 7075-T6
10	DOUBLER	.312	PLATE 7075-T651
11	DOUBLER	.090	CLAD 7075-T6
12	SKIN	.080	CLAD 2014-T6
13	SKIN	.071	CLAD 2014-T6
14	DOUBLER	.063	CLAD 2024-T42
15	SKIN	.040	CLAD 2024-T3
16	STRIP	.040	CLAD 2014-T6
17	DOUBLER	.050	CLAD 2024-T42
18	DOUBLER	.071	CLAD 7075-T6
	SKIN	.040	CLAD 2014-T6
		.025	CLAD 2014-T6

ITEM	NOMENCLATURE	GAGE	MATERIAL
21	DOUBLER	.063	CLAD 2014-T6
22	SPLICE	.100	CLAD 2014-T6
23	DOUBLER	.040	SEE NOTE, SHEET 2
24	DOUBLER	.500	PLATE 2024-T351
25	DOUBLER	.032	TITANIUM DMS 1592
26	DOUBLER	.063	CLAD 2024-T6
27	DOUBLER	.025	CLAD 2024-T6
28	FILLER	.063	CLAD 2024-T6
29	SPLICE DOUBLER	.080	CLAD 7075-T6
30	DOUBLER	.020	CLAD 2024-T6
31	SPACER	.032	CLAD 7075-T6
32	FILLET	.040	CLAD 2014-T6
33	CHANNEL	.040	CLAD 2014-T6
34	SPACER	.050	CLAD 2014-T6
35	GUSSET	.040	CLAD 2014-T6
36	DOUBLER		2912900-2
37	DOUBLER		2912900-9
38	DOUBLER	.050	2014-T6
39	SPACER	.050	2014-T6

BB3-4

Printed in U.S.A.

on 37 to 229, Fuselage Nose -- Types I and II
Figure 1 (Sheet 3)

PLATES/SKIN - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures illustrate the plates and doublers in the fuselage. The materials used are identified by the item number callouts.

Plating, Station 37 to 229, Fuselage Nose........................Figure 1

Plating, Station 229 to 474.............................Figures 2 and 2A

Plating, Station 474 to 817......................................Figure 3

Plating, Station 817 to 908 -- Types I and II.....................Figure 4

Plating, Station 908 to Canted Station 989................Figures 5 and 6

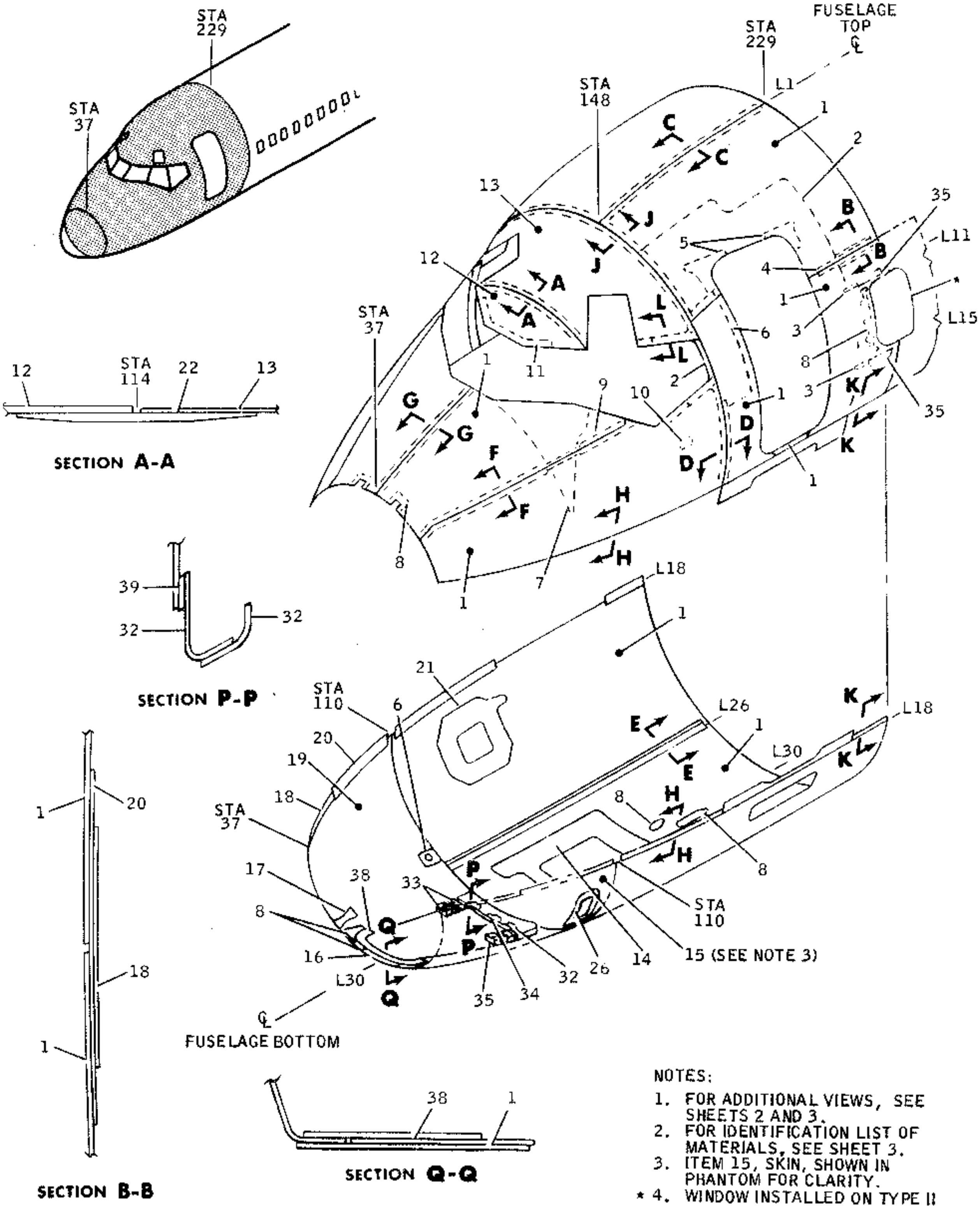
Aft Accessory Compartment Ventilation Louver......................Figure 7

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Components	Applicable Repairs
Plates, skins, and doublers	Section 53-01, Figure 1; Section 53-04, Figure 4, Sheet 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

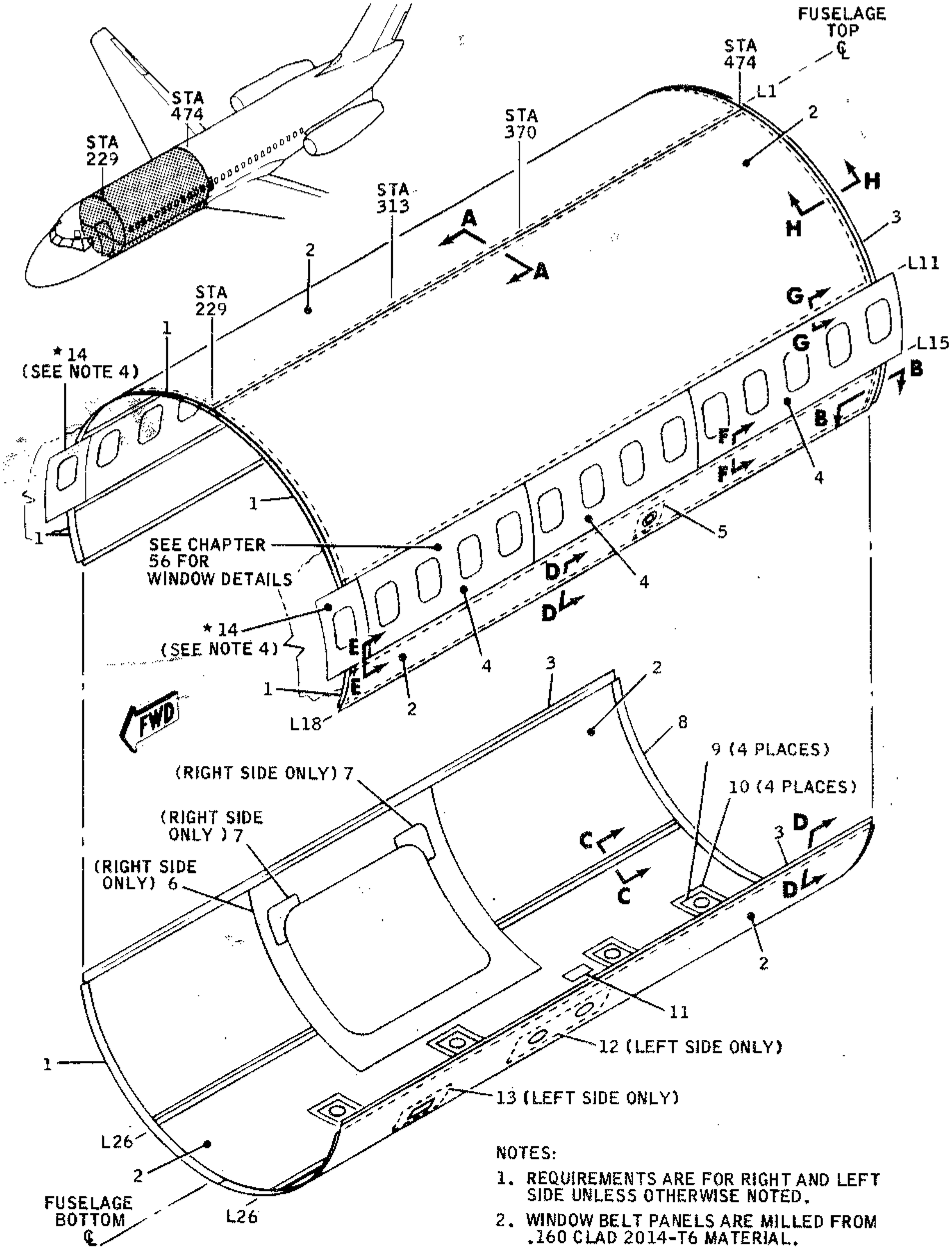


NOTES:

1. FOR ADDITIONAL VIEWS, SEE SHEETS 2 AND 3.
2. FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 3.
3. ITEM 15, SKIN, SHOWN IN PHANTOM FOR CLARITY.
* 4. WINDOW INSTALLED ON TYPE II AIRPLANES ONLY.
5. REFERENCE - DOUGLAS DRAWING 5910072.

BB3-71A

Plating, Station 37 to 229, Fuselage Nose -- Types I and II
Figure 1 (Sheet 1)

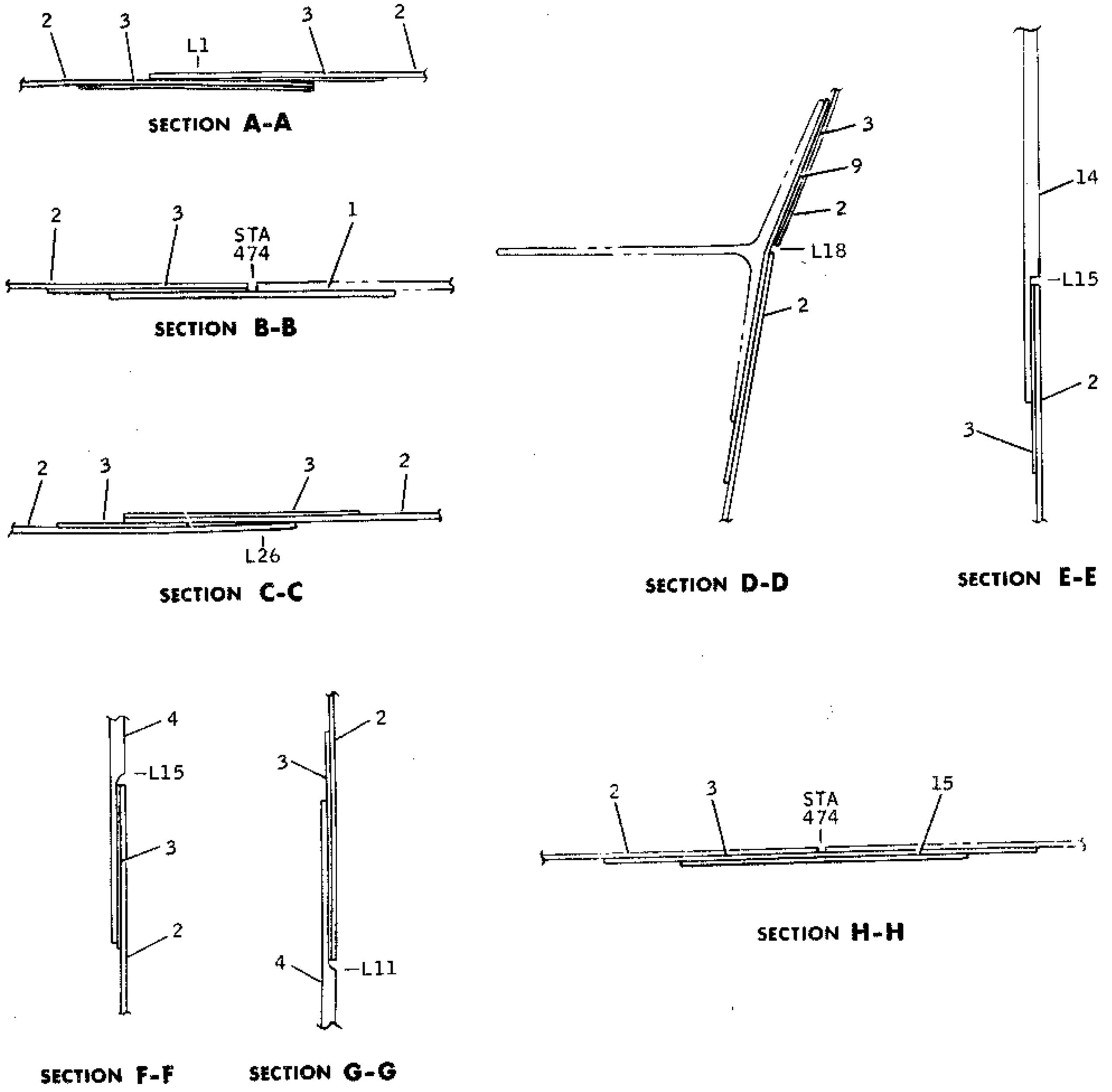


NOTES:

1. REQUIREMENTS ARE FOR RIGHT AND LEFT SIDE UNLESS OTHERWISE NOTED.
2. WINDOW BELT PANELS ARE MILLED FROM .160 CLAD 2014-T6 MATERIAL.
3. FOR MATERIAL IDENTIFICATION LIST AND FOR SECTION VIEWS, SEE SHEET 2.
4.* TYPE II AIRPLANES ONLY.
5. REFERENCE - DOUGLAS DRAWING 5910133.

BB3-73A

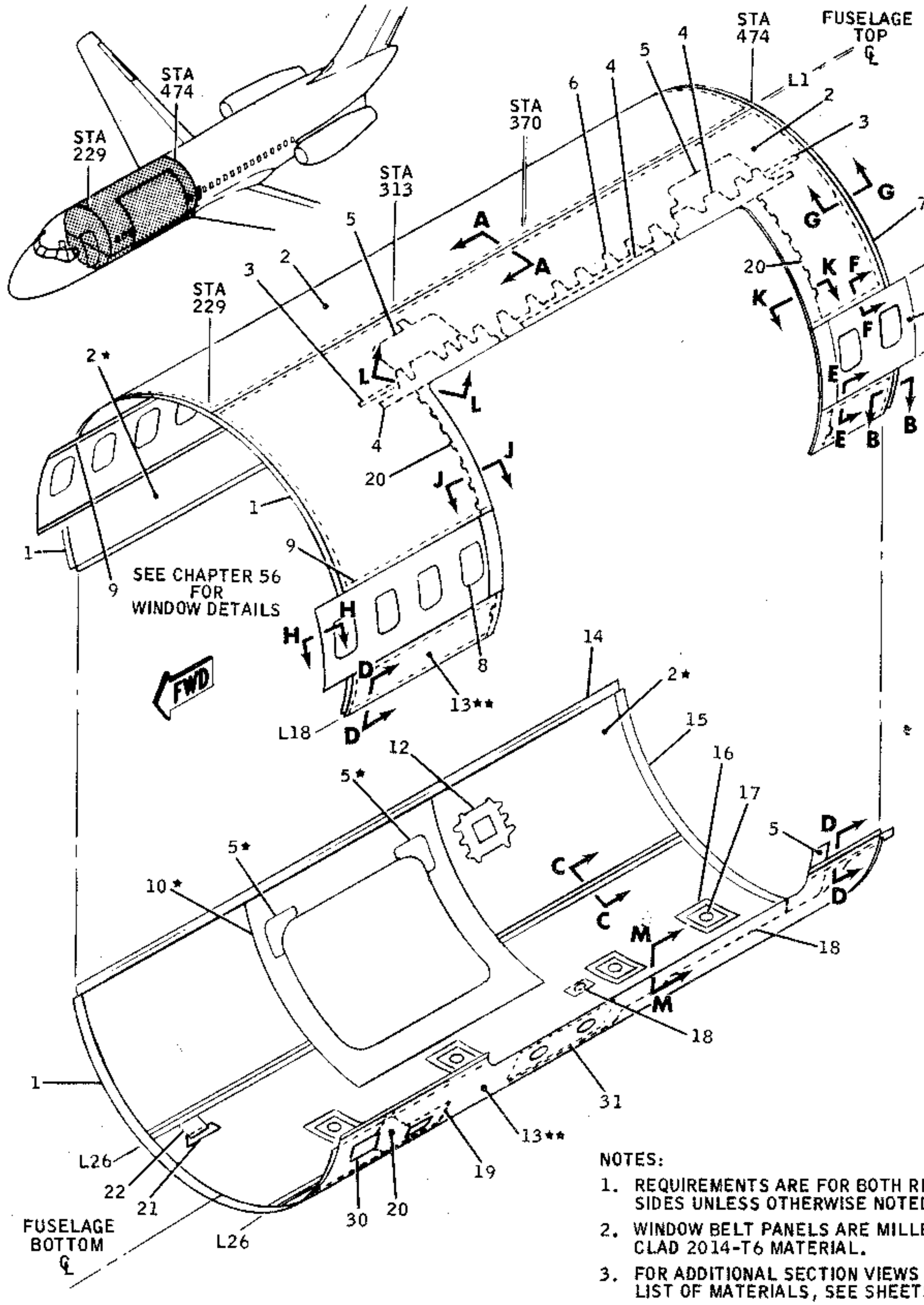
Plating, Station 229 to 474 -- Types I and II
Figure 2 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE	.080	CLAD 7075-T6
2	PLATING	.050	CLAD 2014-T6
3	DOUBLER	.025	CLAD 2014-T6
4	WINDOW BELT		SEE NOTE 2
5	DOUBLER	.063	CLAD 2014-T6
6	DOUBLER	.090	CLAD 2014-T6
7	DOUBLER	.032	TITANIUM DMS 1595
8	SPLICE	.071	CLAD 2014-T6
9	DOUBLER	.040	CLAD 2014-T6
10	DOUBLER	.160	CLAD 2014-T6
11	DOUBLER	.050	CLAD 2014-T6
12	DOUBLER	.125	CLAD 7075-T6
13	DOUBLER	.071	CLAD 7075-T6
14	WINDOW PANEL	.160	CLAD 2014-T6
15	SPLICE	.080	CLAD 2014-T6

8B3-207A

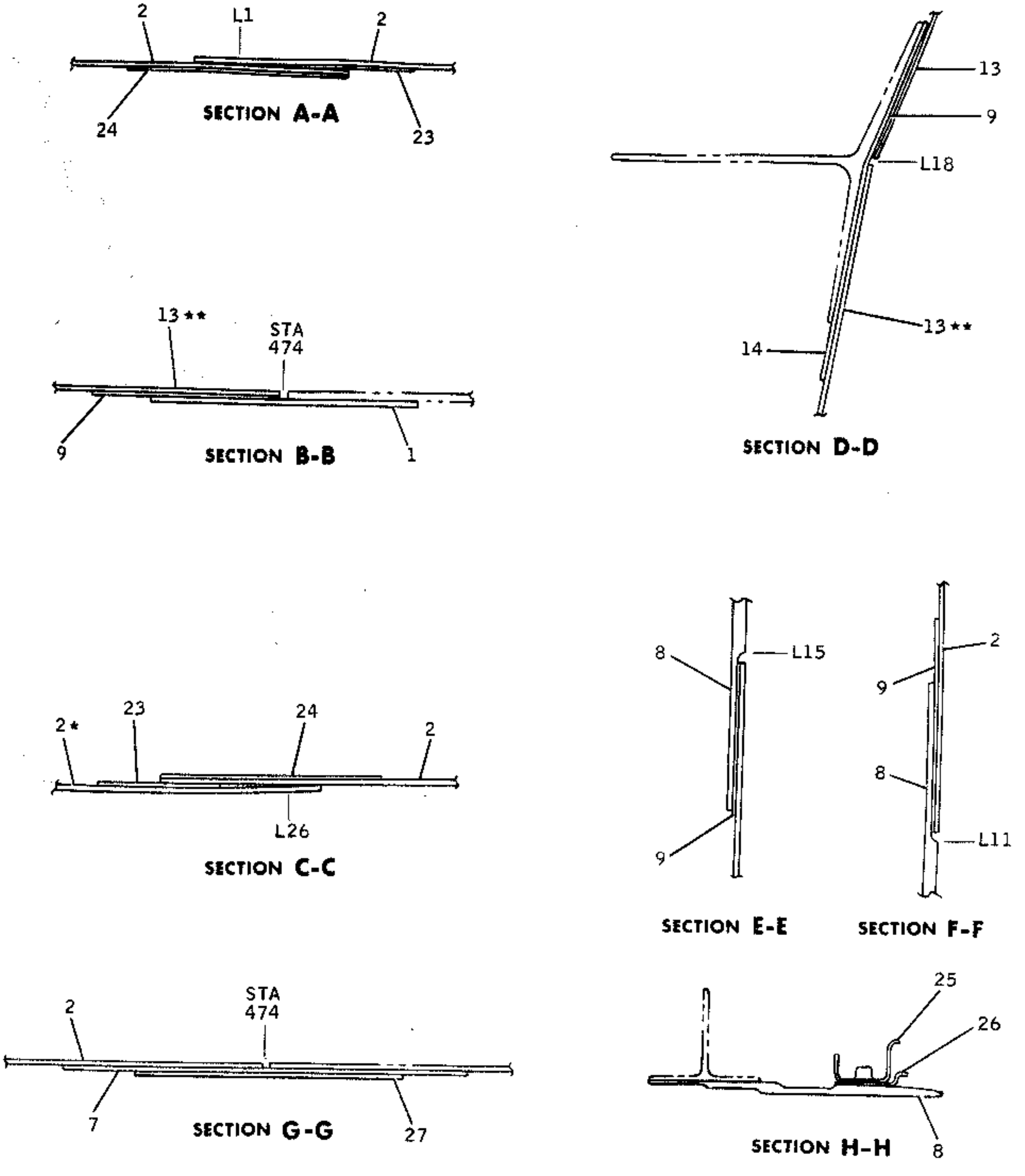
Plating, Station 229 to 474 -- Types I and II
Figure 2 (Sheet 2)



NOTES:
1. REQUIREMENTS ARE FOR BOTH RIGHT AND LEFT SIDES UNLESS OTHERWISE NOTED.
2. WINDOW BELT PANELS ARE MILLED FROM .160 CLAD 2014-T6 MATERIAL.
3. FOR ADDITIONAL SECTION VIEWS AND FOR ITEM LIST OF MATERIALS, SEE SHEETS 2 AND 3.
4. * INDICATES RIGHT SIDE ONLY.
5. ** INDICATES LEFT SIDE ONLY.
6. REFERENCE - DOUGLAS DRAWING 5910593.

BB3-837

Plating, Station 229 to 474 -- Type III
Figure 2A (Sheet 1)



SECTION A-A

SECTION B-B

SECTION C-C

SECTION G-G

SECTION D-D

SECTION E-E

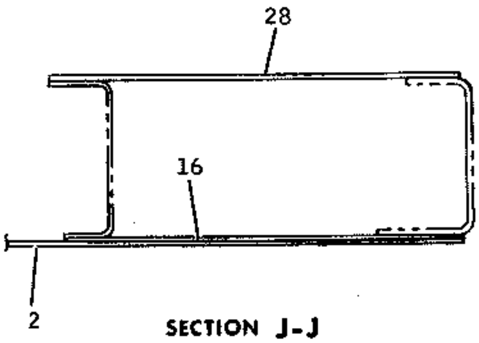
SECTION F-F

SECTION H-H

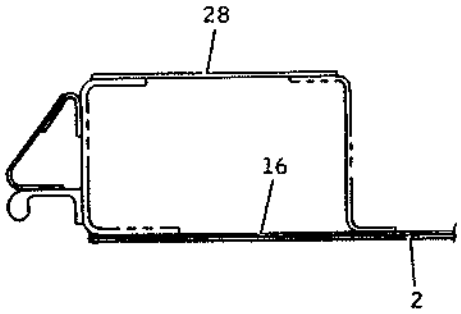
Printed in U.S.A.

BB3-838

Plating, Station 229 to 474 -- Type III
Figure 2A (Sheet 2)

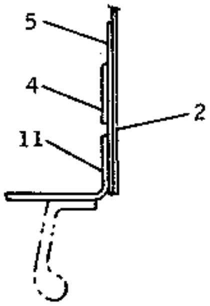


SECTION J-J

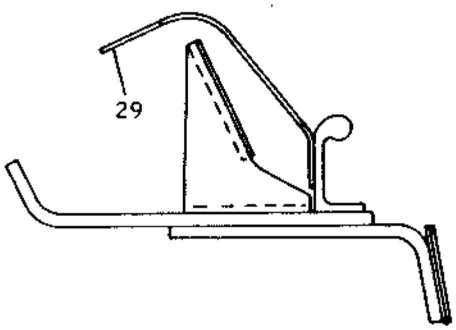


SECTION K-K

NOTE:
† ITEMS 9, 23, 14, AND 24 ARE MADE FROM DOUGLAS STANDARD SCALLOPED SHEET 2912900-4, 2912900-2, 2912900-3, AND 2912900-5 RESPECTIVELY. EDGE OF ITEM 23 IS TAPERED TO .012 ± .005.



SECTION L-L

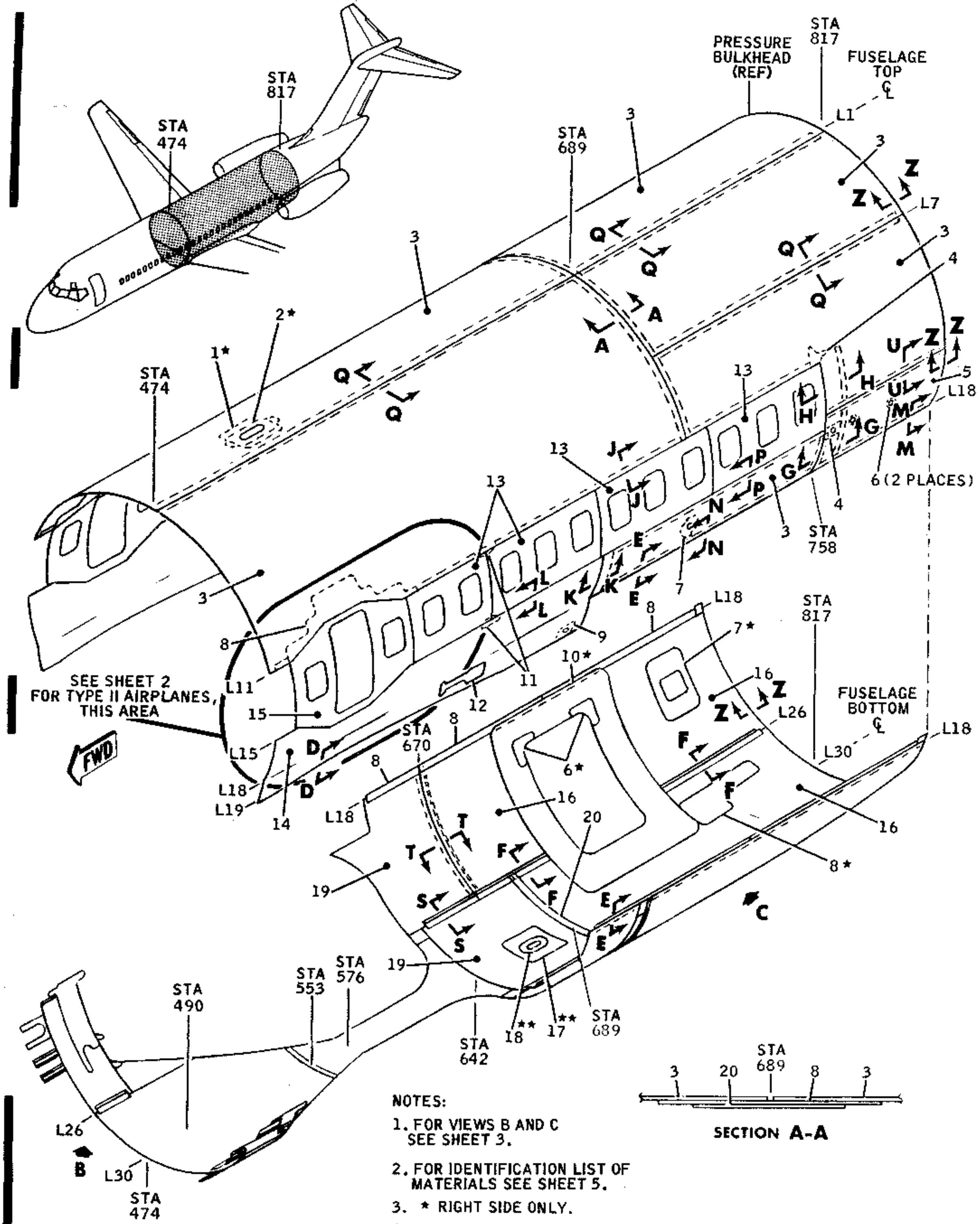


SECTION M-M

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE	.080	CLAD 7075-T6
2	SKIN	.050	CLAD 2014-T6
3	FILLER	.071	CLAD 7075-T6
4	DOUBLER	.070	CLAD 7075-T6
5	DOUBLER	.032	TITANIUM DMS 1592
6	DOUBLER	.032	CLAD 7075-T6
7	SCALLOPED DOUBLER	.025	2014-T6
8	WINDOW BELT		SEE NOTE 2
† 9	SCALLOPED DOUBLER	.025	CLAD 2014-T6
10	DOUBLER	.090	CLAD 2014-T6
11	ANGLE	.070	CLAD 7075-T6
12	DOUBLER	.063	CLAD 2014-T6
13	SKIN	.063	CLAD 2014-T6
†14	SCALLOPED DOUBLER	.025	CLAD 2014-T6
15	SPLICE	.071	CLAD 2014-T6
16	DOUBLER	.040	CLAD 2014-T6
17	DOUBLER	.160	CLAD 2014-T6
18	DOUBLER	.050	CLAD 2014-T6
19	DOUBLER	.071	CLAD 7075-T6
20	DOUBLER	.025	TITANIUM DMS 1592
21	DOUBLER	.025	CLAD 2014-T6
22	DOUBLER	.250	CLAD 2014-T651
†23	SCALLOPED DOUBLER	.025	CLAD 2014-T6
†24	SCALLOPED DOUBLER	.025	CLAD 2014-T6
25	RING PAN	.040	CLAD 2024-T42
26	RING	.032	CLAD 2024-T42
27	SPLICE	.080	CLAD 2014-T6
28	WEB	.071	CLAD 7075-T6
29	SCUFF PLATE	.063	CRES SHEET ANLD.
30	DOOR	.190	CLAD 7075-T6
31	DOUBLER	.125	CLAD 7075-T6

BB3-860

Plating, Station 229 to 474 -- Type III
Figure 2A (Sheet 3)



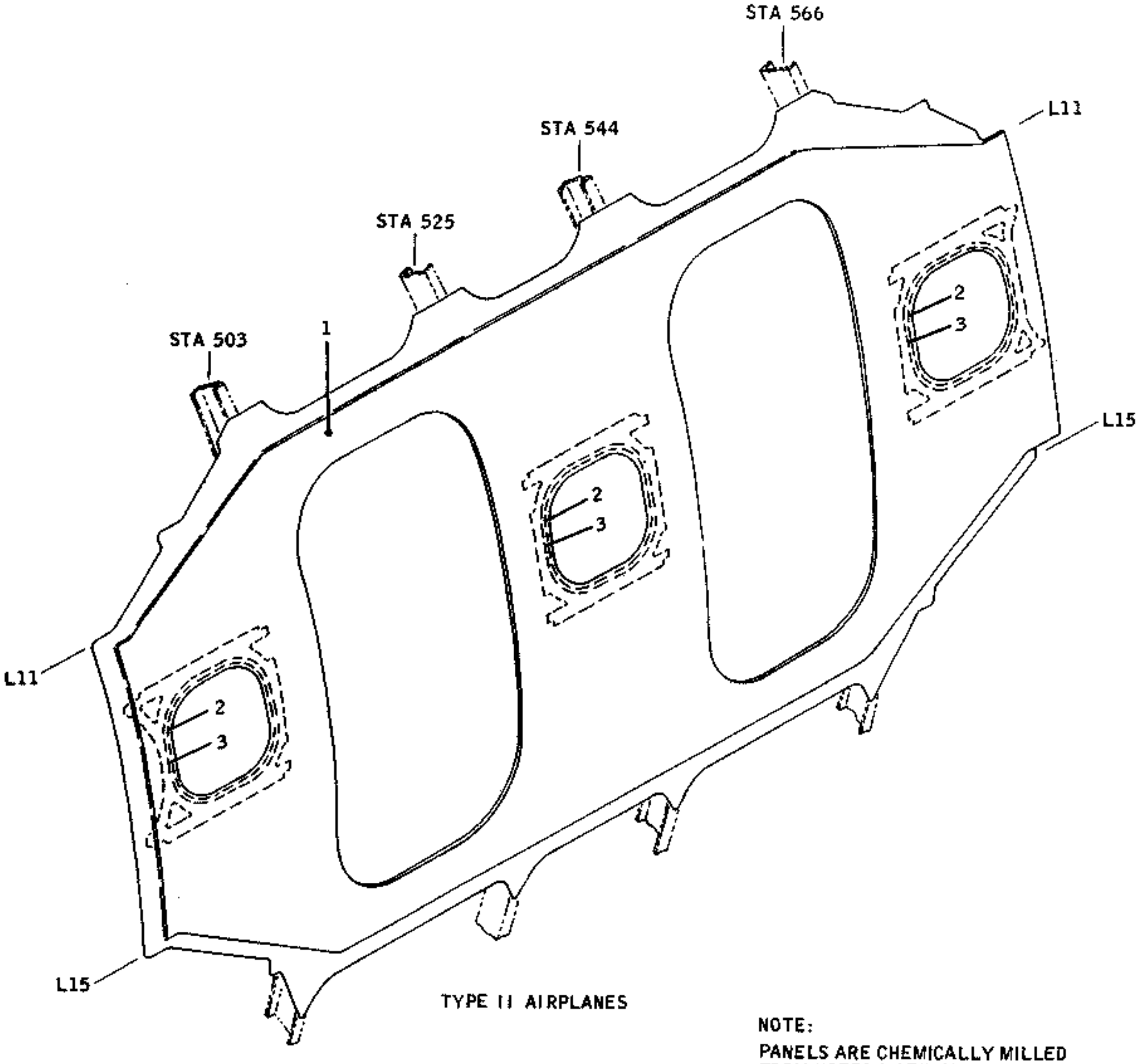
NOTES:

1. FOR VIEWS B AND C SEE SHEET 3.
2. FOR IDENTIFICATION LIST OF MATERIALS SEE SHEET 5.
3. * RIGHT SIDE ONLY.
4. ** LEFT SIDE ONLY.

BB3-75 B

Plating, Station 474 to 817 -- Types I and II
Figure 3 (Sheet 1)

Printed in U.S.A.



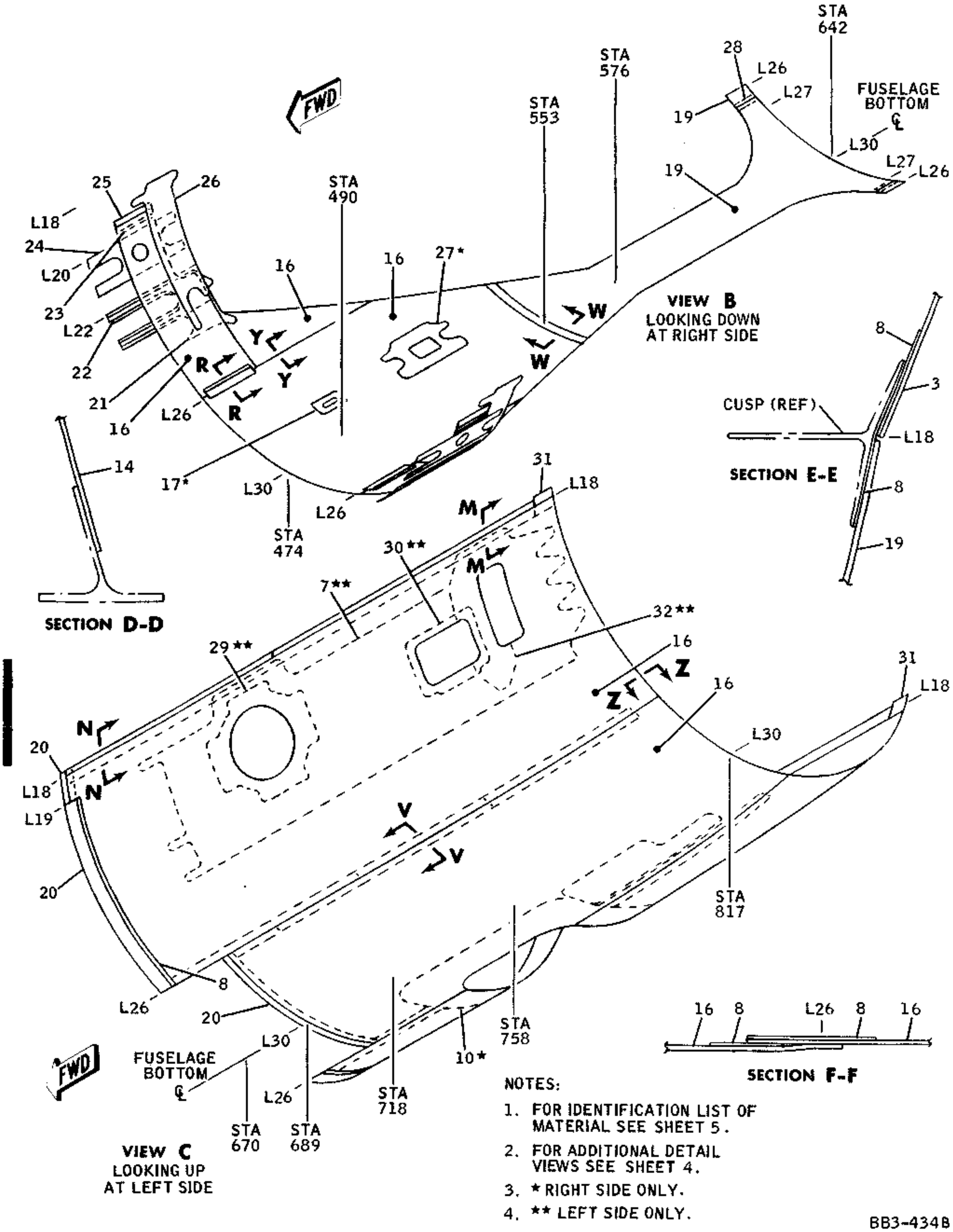
NOTE:
PANELS ARE CHEMICALLY MILLED FROM NOTED MATERIAL.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WINDOW BELT PANEL	.250	CLAD 2014-T651 (SEE NOTE)
2	WINDOW RING	.032	CLAD 2024-T42
3	WINDOW RING PAN	.040	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWING 5918374

8B3-852

Plating, Station 474 to 817 -- Types I and II
Figure 3 (Sheet 2)

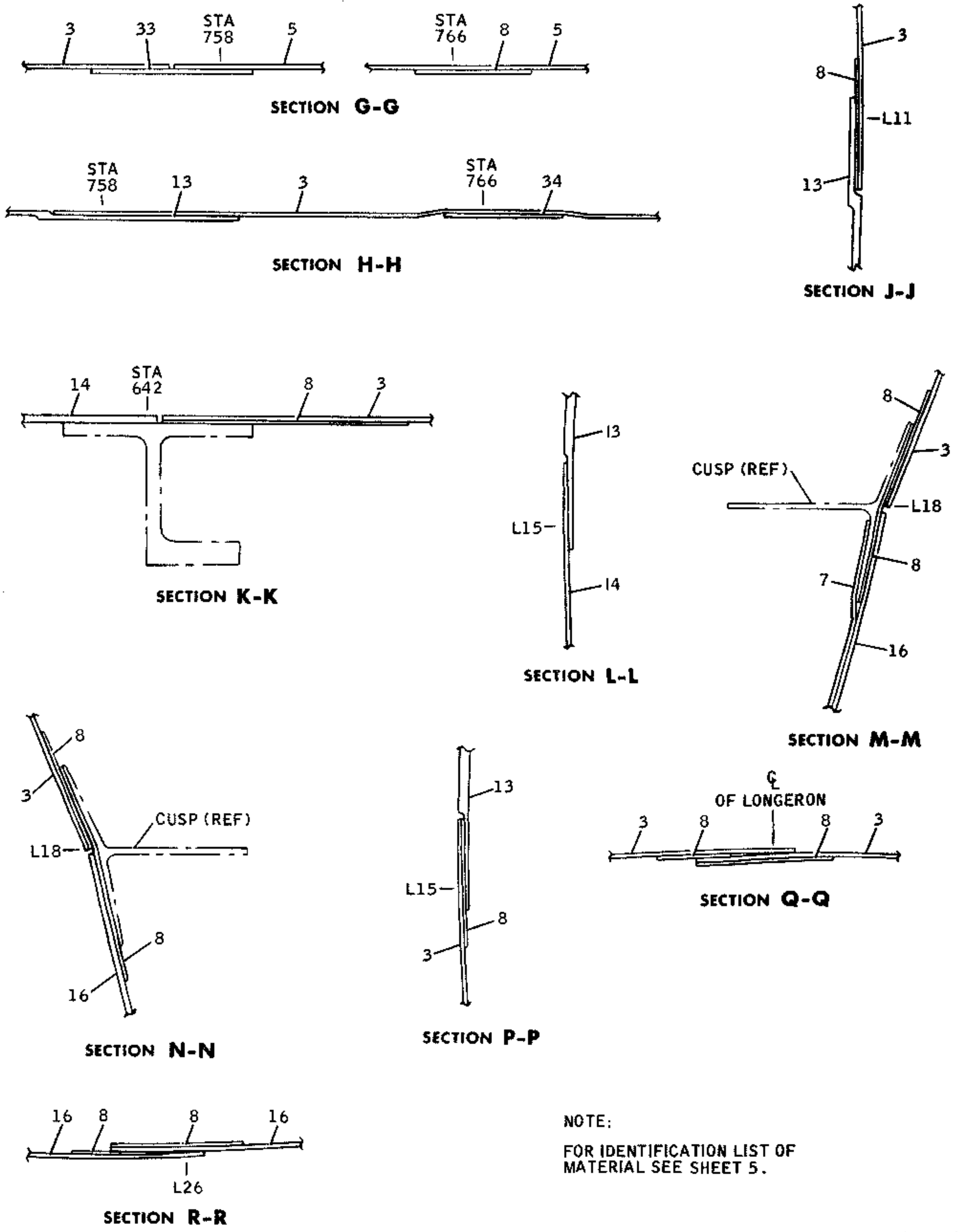


NOTES:

1. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 5.
2. FOR ADDITIONAL DETAIL VIEWS SEE SHEET 4.
3. * RIGHT SIDE ONLY.
4. ** LEFT SIDE ONLY.

Plating, Station 474 to 817 -- Types I and II
Figure 3 (Sheet 3)

Printed in U.S.A.

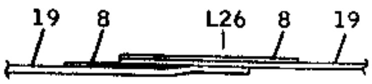


NOTE:

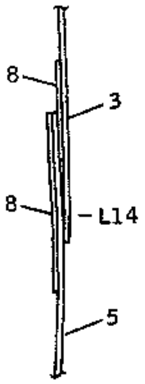
FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 5.

BB3-435A

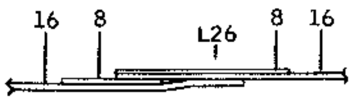
Plating, Station 474 to 817 -- Types I and II
Figure 3 (Sheet 4)



SECTION S-S

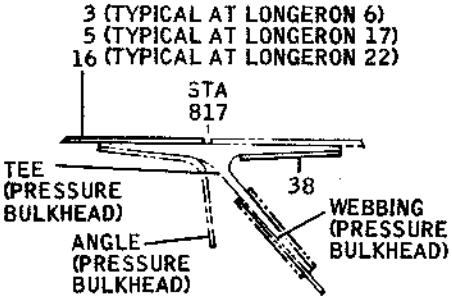


SECTION U-U



SECTION V-V

SECTION T-T



SECTION Z-Z

SECTION W-W

SECTION Y-Y

NOTES:

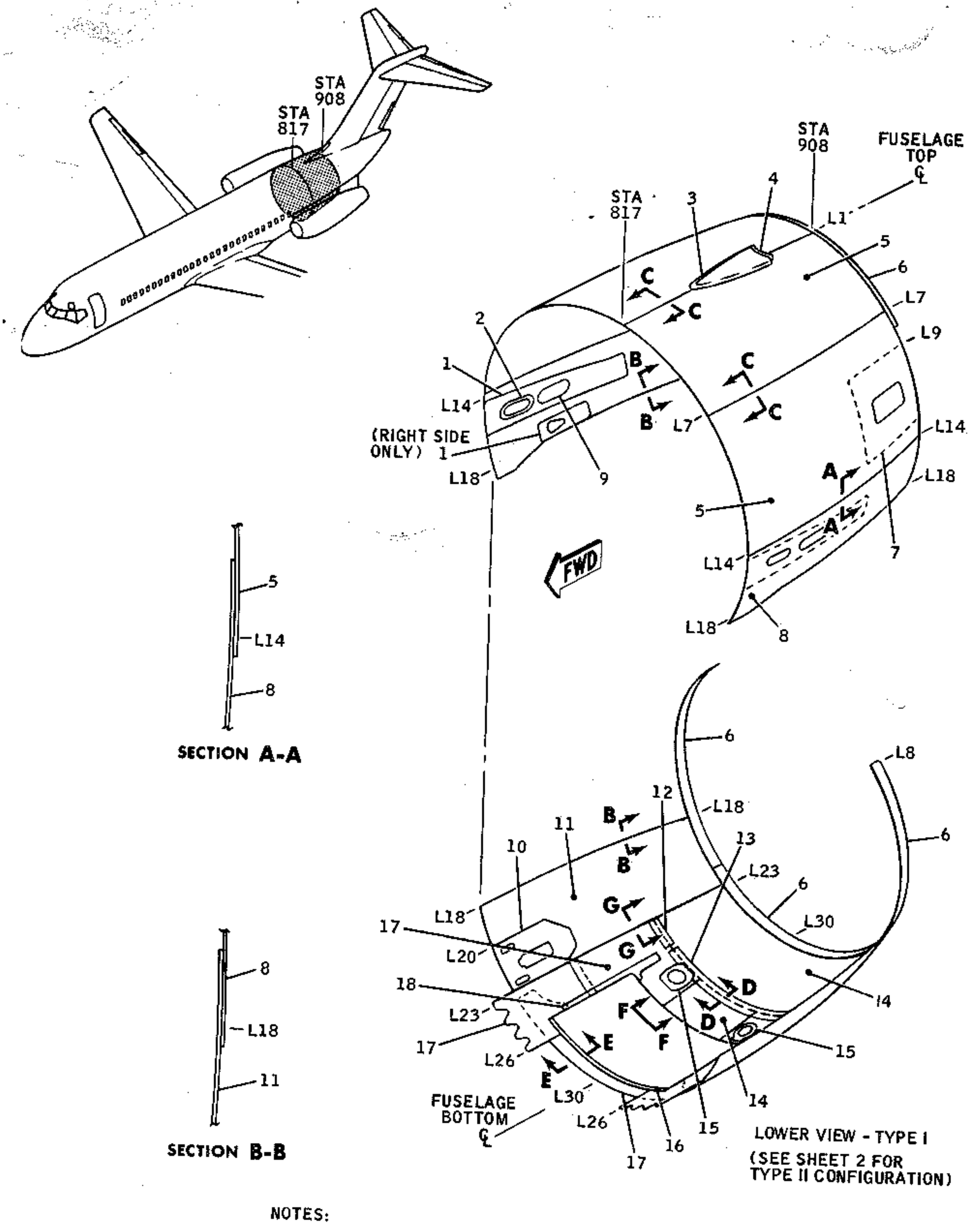
1. CRES SHEET MIL-S-5059 COND 1/4 H COMP 301 FINISH NO. 28.
2. STEEL SHEET 4130 MIL-S-18729 COND N.
3. * PANELS ARE CHEMICALLY MILLED FROM NOTED MATERIAL.
4. CRES SHEET TYPE 17-7PH MIL-S-25043 COND A FINISH 2D.
5. REQUIREMENTS ARE FOR RIGHT AND LEFT SIDE UNLESS OTHERWISE NOTED.
6. REFERENCE - DOUGLAS DRAWING 5910145 AND 5911418.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.040	CLAD 2014-T6	20	SPLICE	.080	CLAD 2014-T6
2	DOUBLER	.071	CLAD 2014-T6	21	DOUBLER	.100	CLAD 7075-T6
3	PLATING	.050	CLAD 2014-T6	22	PAN	.050	CLAD 7075-T6
4	DOUBLER	.025	SEE NOTE 1	23	DOUBLER	.016	CLAD 2014-T6
5	PLATING	.032	TITANIUM DMS 1592	24	PAN	.071	CLAD 7075-T6
6	DOUBLER	.032	TITANIUM DMS 1592	25	SPLICE	.071	CLAD 7075-T6
7	DOUBLER	.063	CLAD 2014-T6	26	DOUBLER	.125	CLAD 7075-T6
8	DOUBLER	.025	CLAD 2014-T6	27	DOUBLER	.090	CLAD 7075-T6
9	DOUBLER	.080	CLAD 7075-T6	28	SPLICE	.080	CLAD 7075-T6
10	DOUBLER	.063	CLAD 2024-T4	29	DOUBLER	.375	PLATE 2014-T651
11	DOUBLER	.040	TITANIUM DMS 1592	30	PLATE	.250	CLAD 2014-T651
12	DOUBLER	.050	SEE NOTE 2	31	DOUBLER	.025	SEE NOTE 4
13	WINDOW BELT PANEL	.160	CLAD 2014-T6 *	32	DOUBLER	.025	TITANIUM DMS 1592
14	PANEL	.090	CLAD 7075-T6 *	33	STRAP	.071	CLAD 2014-T6
15	WINDOW BELT PANEL	.250	CLAD 2014-T651*	34	STRAP	.025	SEE NOTE 1
16	PLATING	.063	CLAD 2014-T6	35	STRAP	.125	CLAD 7075-T6
17	DOUBLER	.050	CLAD 2014-T6	36	STRAP	.050	4130 STEEL
18	DOUBLER	.125	CLAD 2014-T6	37	STRAP	.190	CLAD 7075-T6
19	PLATING	.080	CLAD 7075-T6	38	SPLICE	.050	CLAD 2014-T6

8B3-436B

Plating Station 474 to 817 -- Types I and II
Figure 3 (Sheet 5)

Printed in U.S.A.

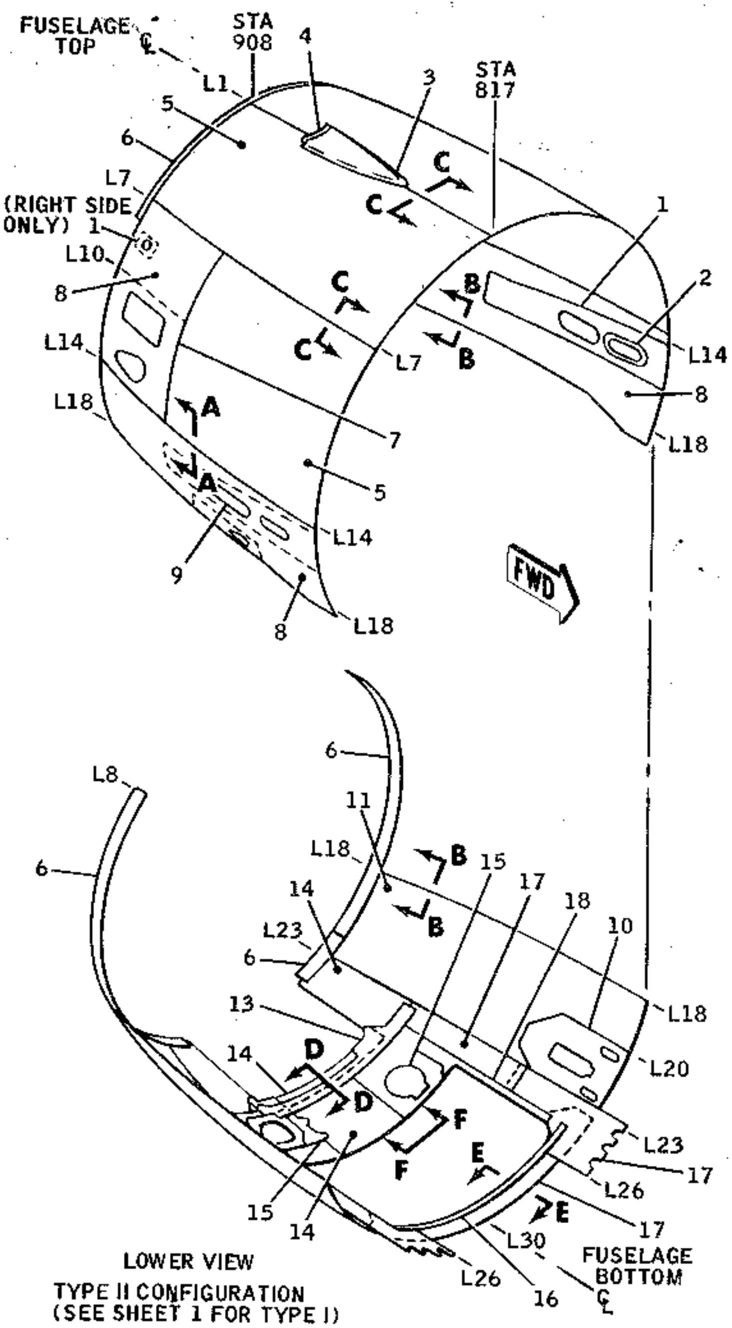


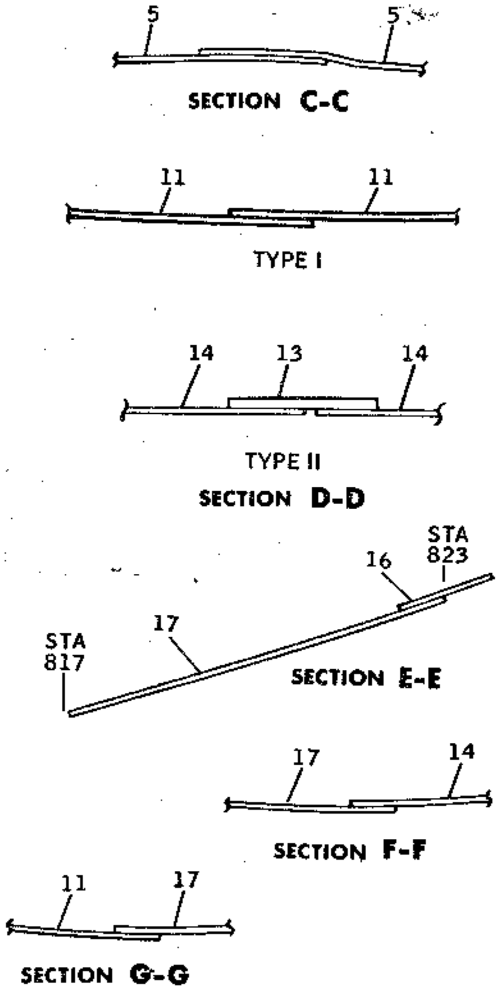
NOTES:

1. FOR ADDITIONAL VIEWS SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 5910145.

BB3-77A

Plating, Station 817 to 908 -- Types I and II
Figure 4 (Sheet 1)





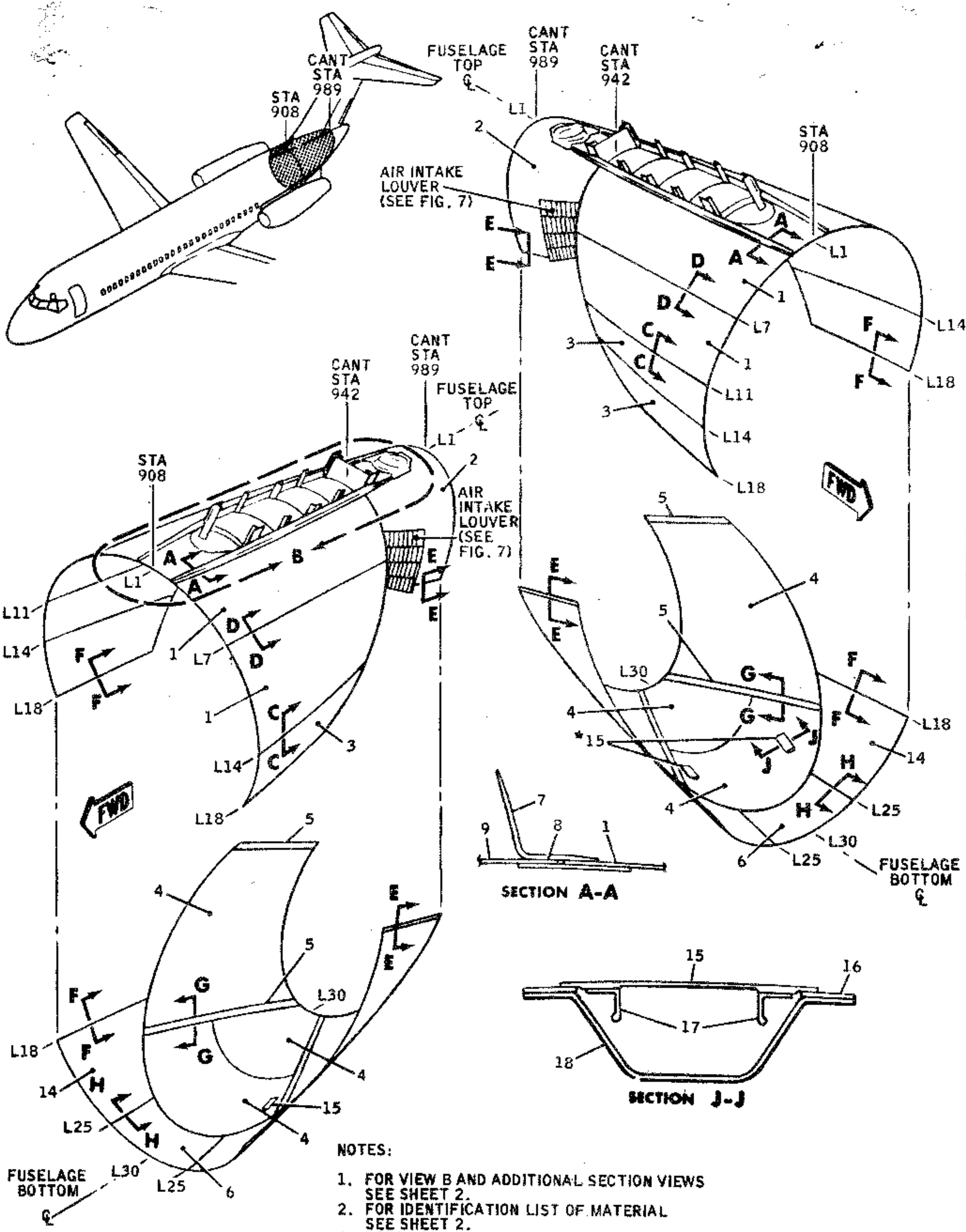
NOTES:

1. CRES SHEET MIL-S-5059 ANNEALED, COMP 302, FINISH NO. 2D.
2. CRES SHEET MIL-S-6721 ANNEALED, COMP TI.
3.* ITEM 11 IS MILLED FROM NOTED MATERIAL.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.032	TITANIUM DMS1592
2	PAN	.025	SEE NOTE 1
3	FIN	.040	CLAD 2014-T6
4	SPLICE	.050	CLAD 2014-T6
5	PLATING	.040	CLAD 2014-T6
6	SPLICE	.050	CLAD 7075-T6
7	DOUBLER	.025	TITANIUM DMS1592
8	PLATING	.032	TITANIUM DMS1592
9	PAN	.032	SEE NOTE 2
10	DOUBLER	.040	CLAD 2014-T6
*11	PLATING	.063	CLAD 2014-T6
12	SPLICE	.025	TITANIUM DMS1592
13	SPLICE	.040	CLAD 2014-T6
14	PLATING	.025	TITANIUM DMS1592
15	DOUBLER	.050	CLAD 2014-T6
16	DOUBLER	.050	TITANIUM DMS1592
17	PLATING	.050	TITANIUM DMS1592
18	FILLER	.125	CLAD 2014-T6

BB3-475A

Plating, Station 817 to 908 -- Types I and II
Figure 4 (Sheet 2)



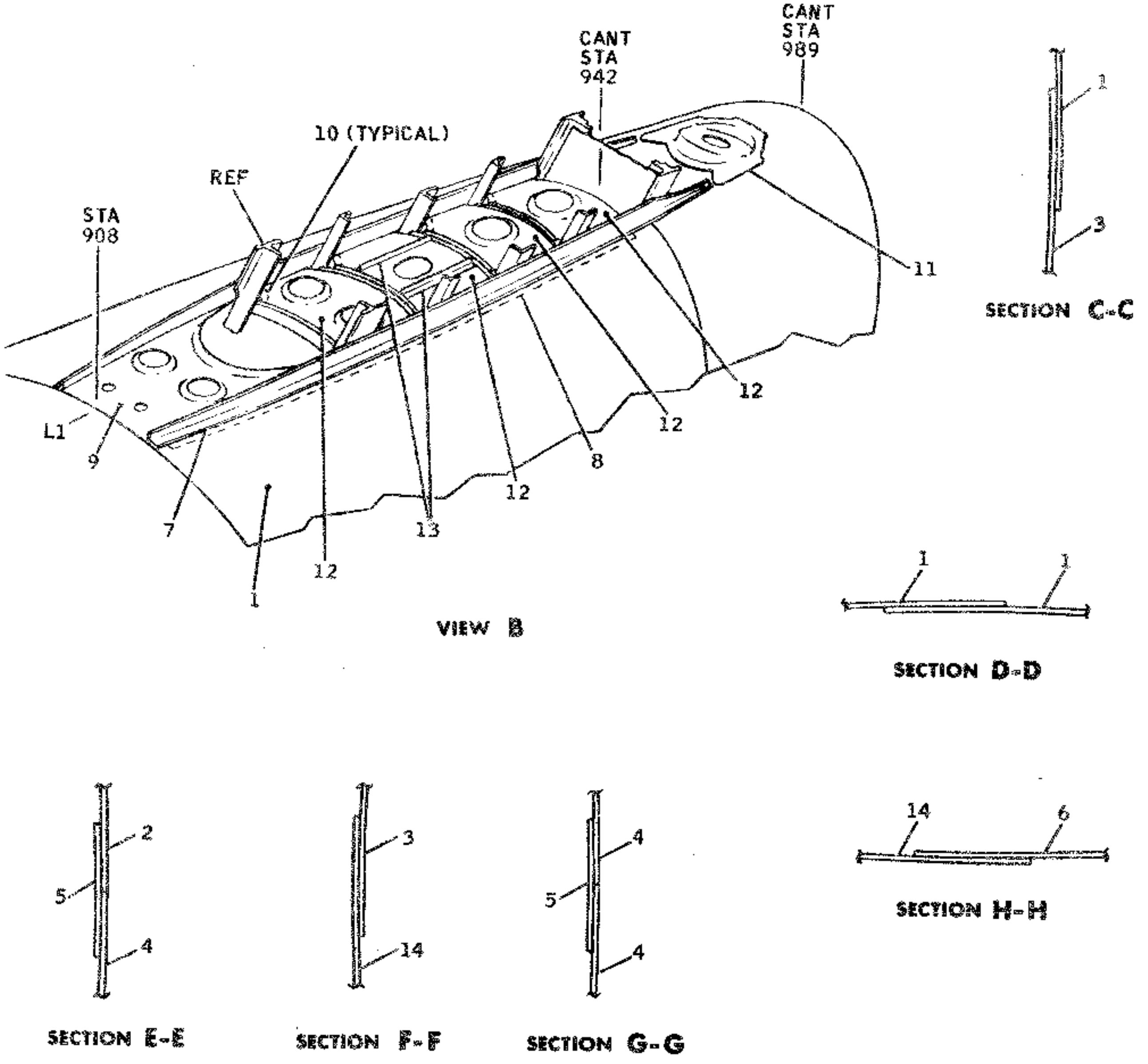
NOTES:

1. FOR VIEW B AND ADDITIONAL SECTION VIEWS SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 2.
3. *LEFT DOOR ON TYPE II AIRPLANES ONLY.
4. REFERENCE - DOUGLAS DRAWING 5910228.

BB3-110B

Plating, Station 908 to Canted Station 989 -- Types I and II
Figure 5 (Sheet 1)

Printed in U.S.A.



VIEW B

SECTION C-C

SECTION D-D

SECTION E-E

SECTION F-F

SECTION G-G

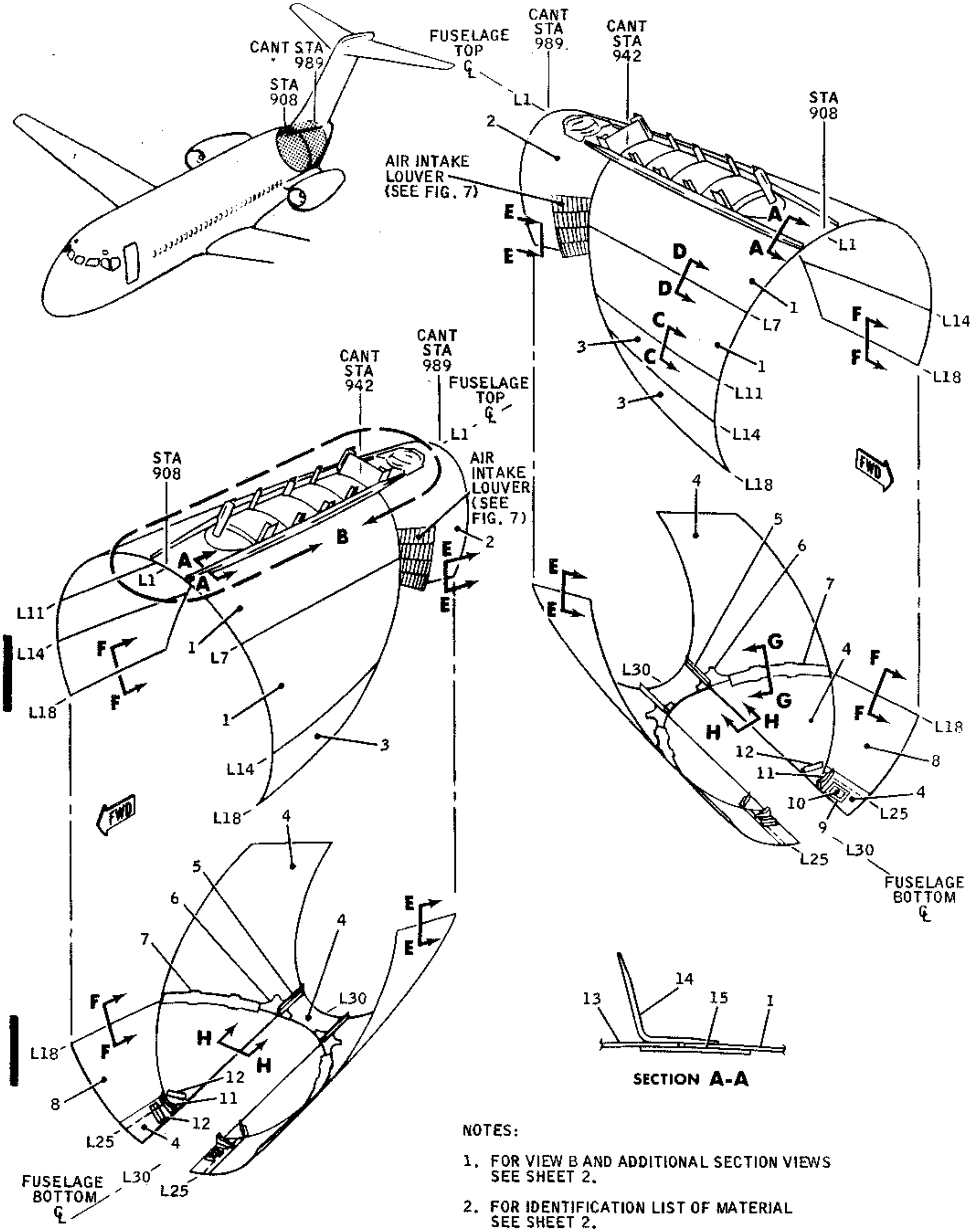
SECTION H-H

*TYPE II ONLY

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.063	CLAD 2014-T6	10	ANGLE	.063	CLAD 2024-T42
2	PLATING	.063	CLAD 2024-T4	11	PAN	.090	CLAD 2014-T6
3	PLATING	.040	TITANIUM DMS1592	12	PANEL	.050	CLAD 2014-T6
4	PLATING	.032	CLAD 2024-T4	13	ANGLE		1332462
5	SPLICE	.032	CLAD 2024-T4	14	PLATING	.050	CLAD 2014-T6
6	PLATING	.040	CLAD 2014-T6	*15	DOOR	.063	CLAD 2014-T6
7	ANGLE	.125	CLAD 7075-T6	16	DOUBLER	.032	CLAD 2014-T6
8	DOUBLER	.050	CLAD 2024-T3	17	STIFFENER		1361525
9	PANEL	.063	CLAD 2014-T6	18	PAN	.080	CLAD 6061-T6

BB3-501A

Plating, Station 908 to Canted Station 989 -- Types I and II
Figure 5 (Sheet 2)



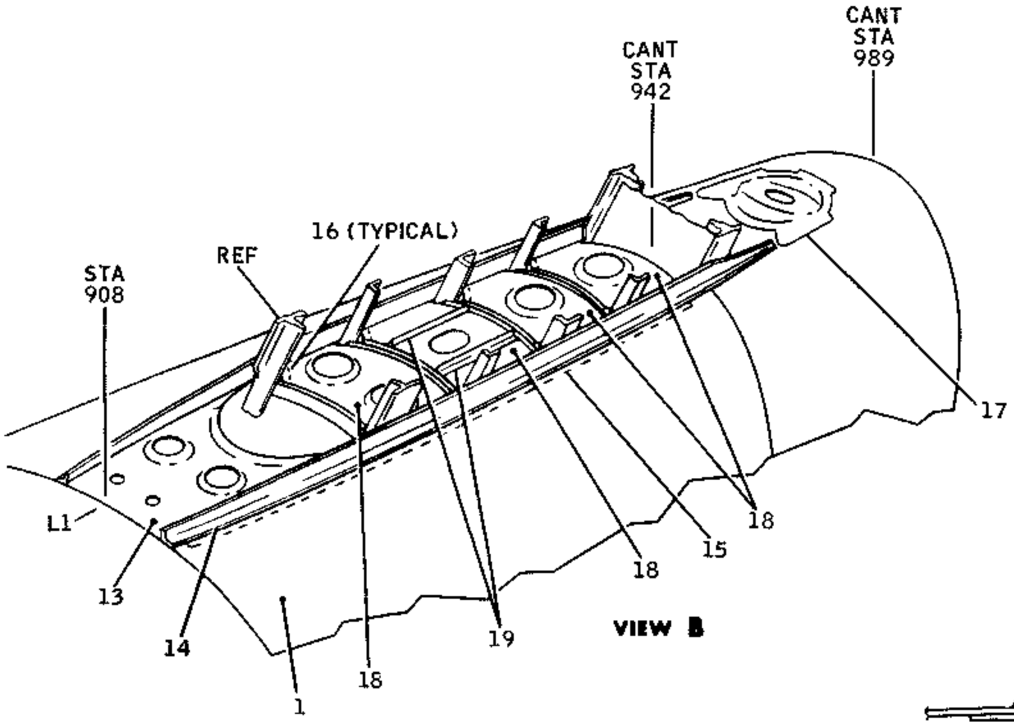
NOTES:

1. FOR VIEW B AND ADDITIONAL SECTION VIEWS SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 5910228

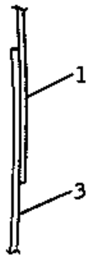
BB3-595B

Plating, Station 908 to Canted Station 989 -- Type III
Figure 6 (Sheet 1)

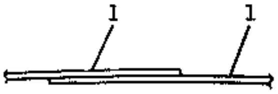
Printed in U.S.A.



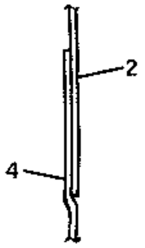
VIEW B



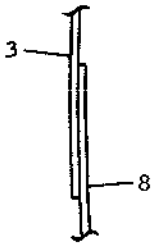
SECTION C-C



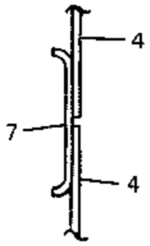
SECTION D-D



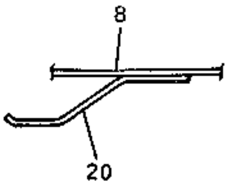
SECTION E-E



SECTION F-F



SECTION G-G

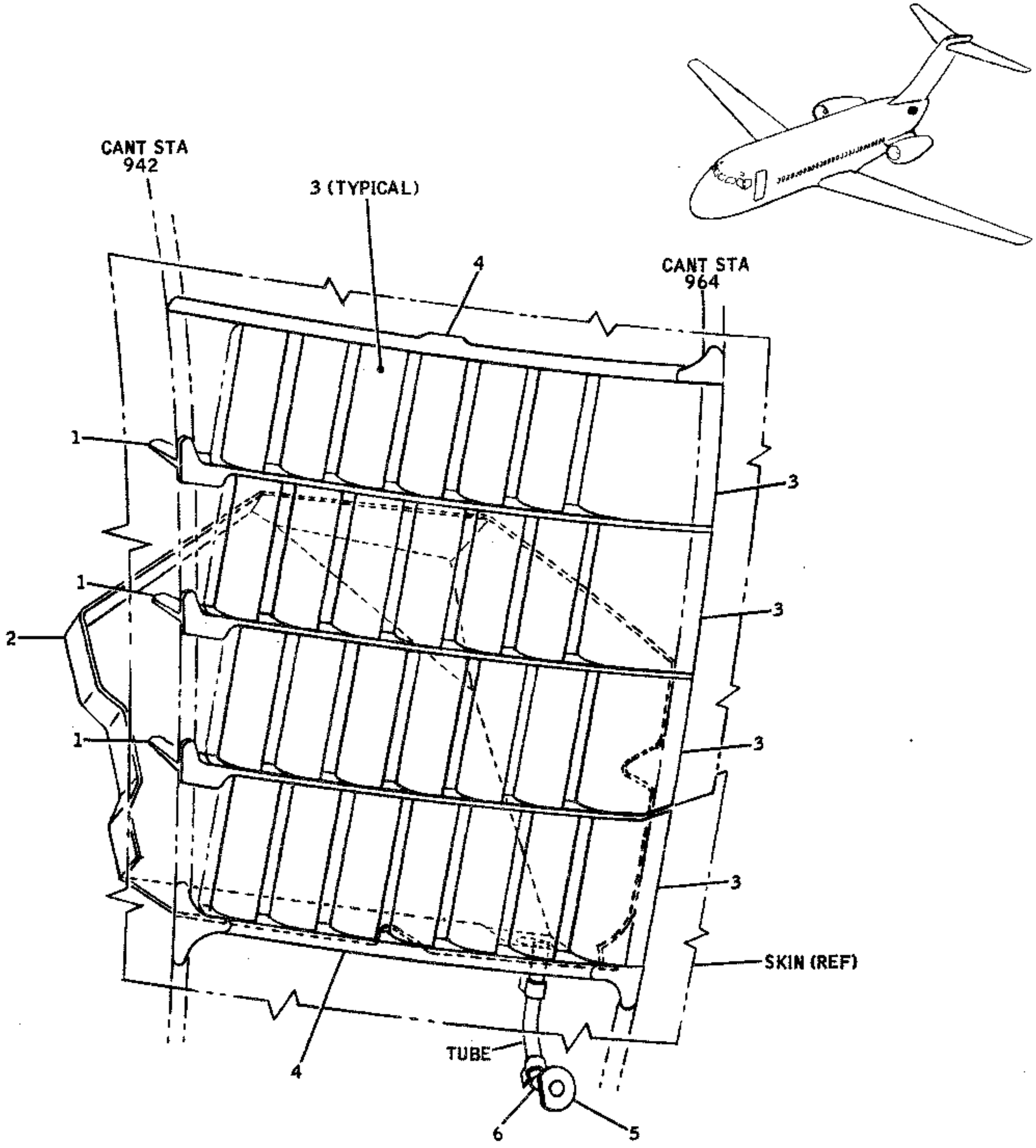


SECTION H-H

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.063	CLAD 2014-T6	11	FITTING,3957175-1,-2	2.250	PLATE 7075-T651
2	PLATING	.063	CLAD 2024-T4	12	ANGLE	.050	CLAD 2024-T4
3	PLATING	.040	TITANIUM DMS 1592	13	PANEL	.063	CLAD 2014-T6
4	PLATING	.032	CLAD 2024-T4	14	ANGLE	.125	CLAD 7075-T6
5	ANGLE	.063	CLAD 2024-T4	15	DOUBLER	.050	CLAD 2024-T3
6	SPLICE	.040	CLAD 2024-T3	16	ANGLE	.063	CLAD 2024-T42
7	SPLICE	.040	CLAD 2024-T4	17	PAN	.090	CLAD 2014-T6
8	PLATING	.050	CLAD 2014-T6	18	PANEL	.050	CLAD 2014-T6
9	DOUBLER	.032	CLAD 2014-T6	19	ANGLE		1332462
10	DOOR	.063	CLAD 2014-T6	20	GUTTER	.050	AL SHEET 6061-T6

BB3-596A

Plating, Station 908 to Canted Station 989 -- Type III
Figure 6 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		2920847
2	PAN	.060	SEE NOTE 1
3	LOUVER	.050	CLAD 2014-T6
4	ANGLE	.071	CLAD 2024-T42
5	PLATE	.032	AL SHEET 6061-T6
6	TUBE	.035	AL TUBE 5052-0

NOTES:

1. PLASTIC SHEET, ACRYLO-NITRILE BUTADIENE STYRENE COPOLYMER, RIGID
2. REFERENCE - DOUGLAS DRAWING 5920838

BB3-695

Printed in U.S.A.

Aft Accessory Compartment Ventilation Louver
Figure 7

PLATES/SKIN - DESCRIPTION AND OPERATION (DC-9-30)

1. General

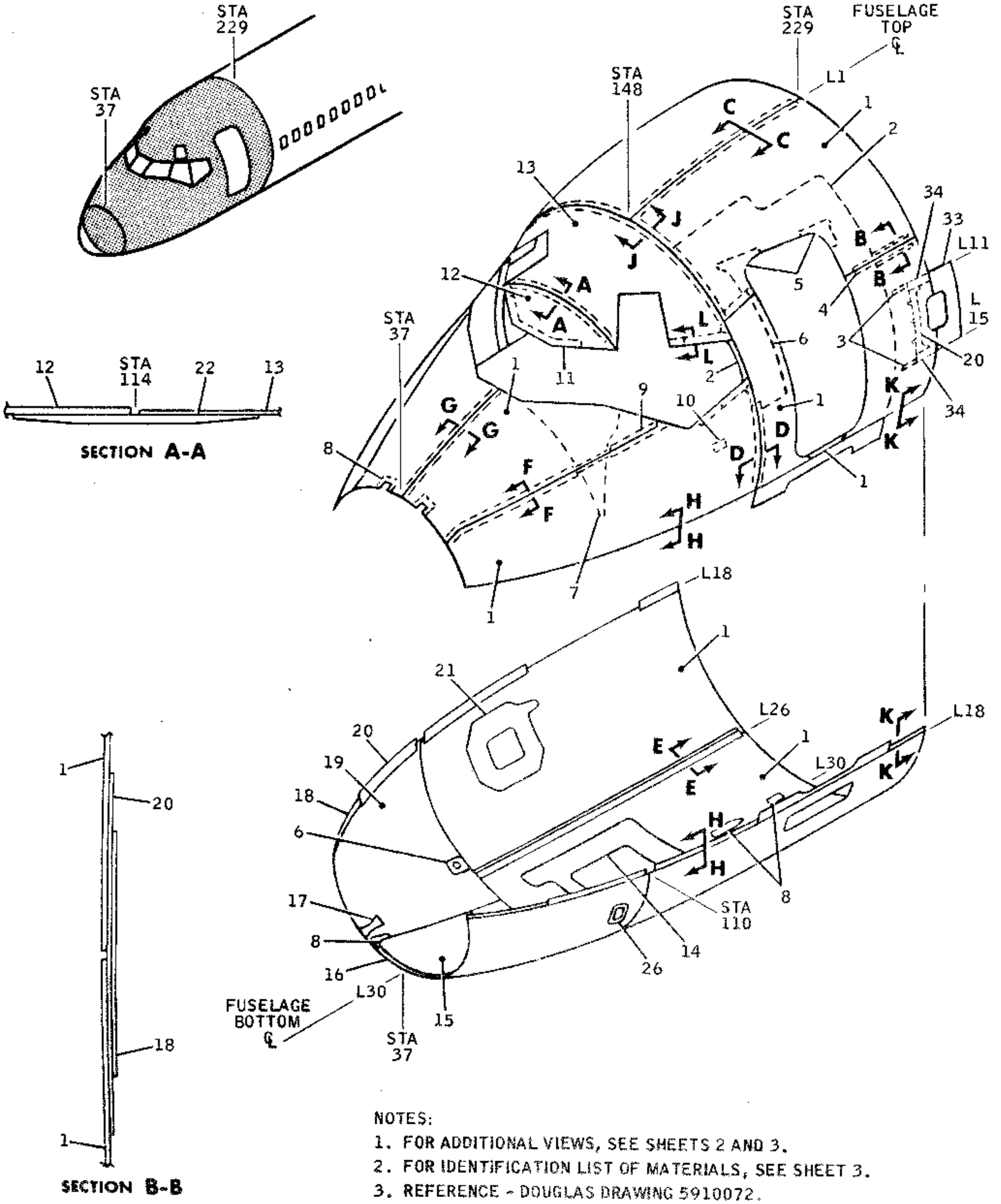
A. The following figures illustrate the plates and doublers in the fuselage. The materials used are identified by the item number callouts.

2. Repair Index

A. A list of structural components and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Components	Applicable Repairs
Plates, skins, and doublers	Section 53-01, Figure 1; Section 53-04, Figure 4, Sheet 3

NOTE: Glass fiber repairs, or bonded repairs (without attachments), are not permissible in pressure or pressure boundary areas.

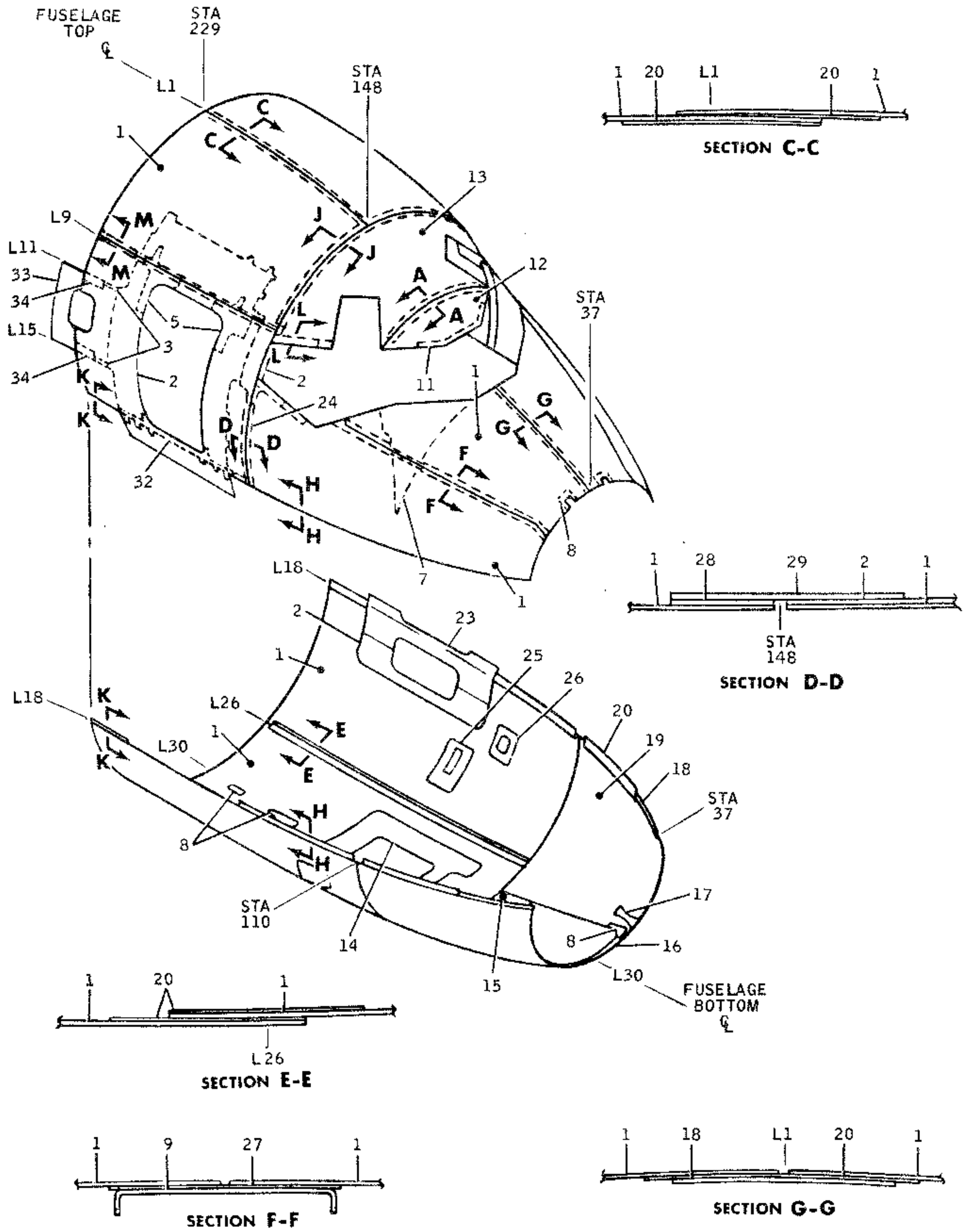


NOTES:

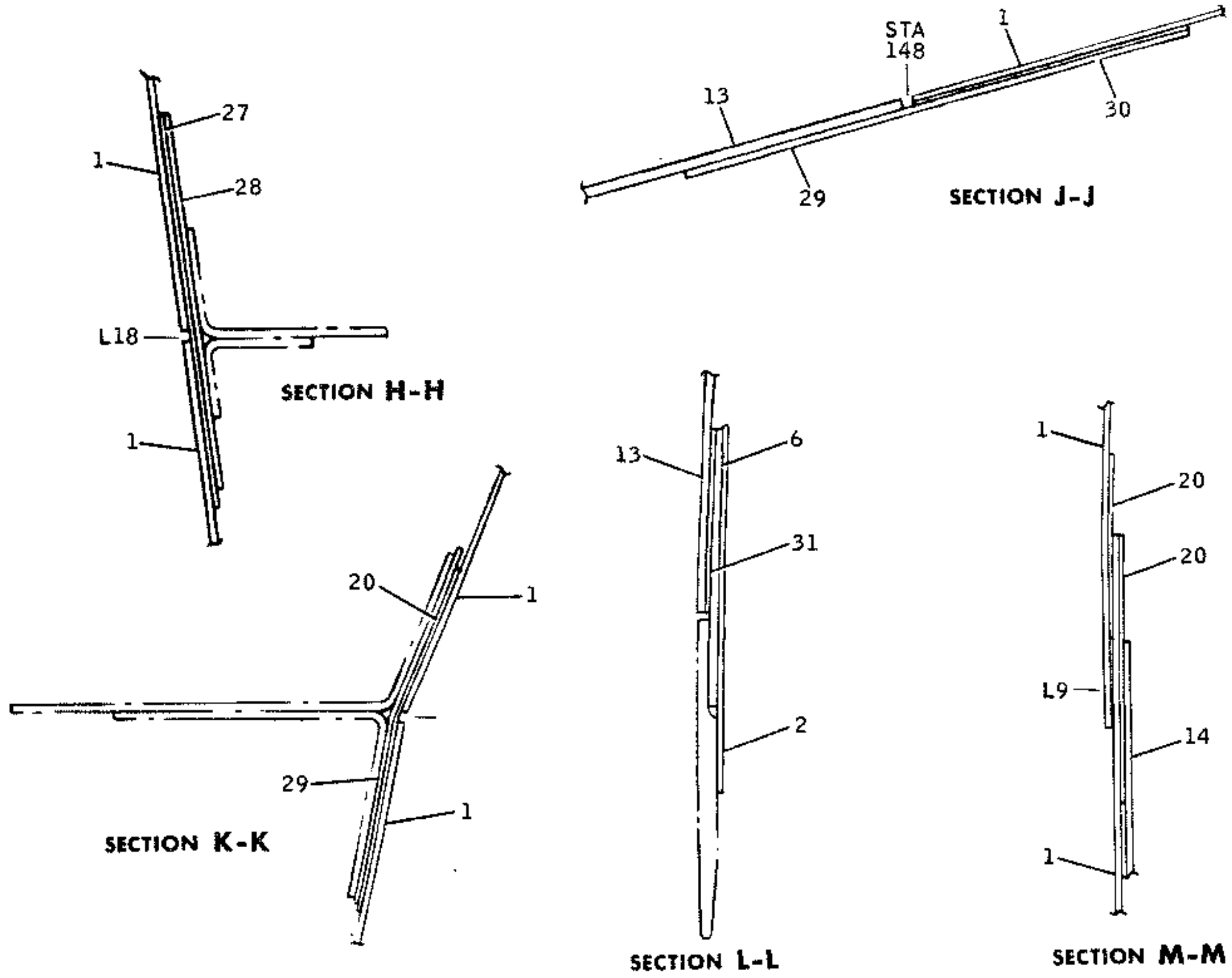
1. FOR ADDITIONAL VIEWS, SEE SHEETS 2 AND 3.
2. FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 3.
3. REFERENCE - DOUGLAS DRAWING 5910072.

BB3-833

Plating, Station 37 to 229, Fuselage Nose -- Type A
Figure 1 (Sheet 1)



Plating, Station 37 to 229, Fuselage Nose -- Type A
Figure 1 (Sheet 2)

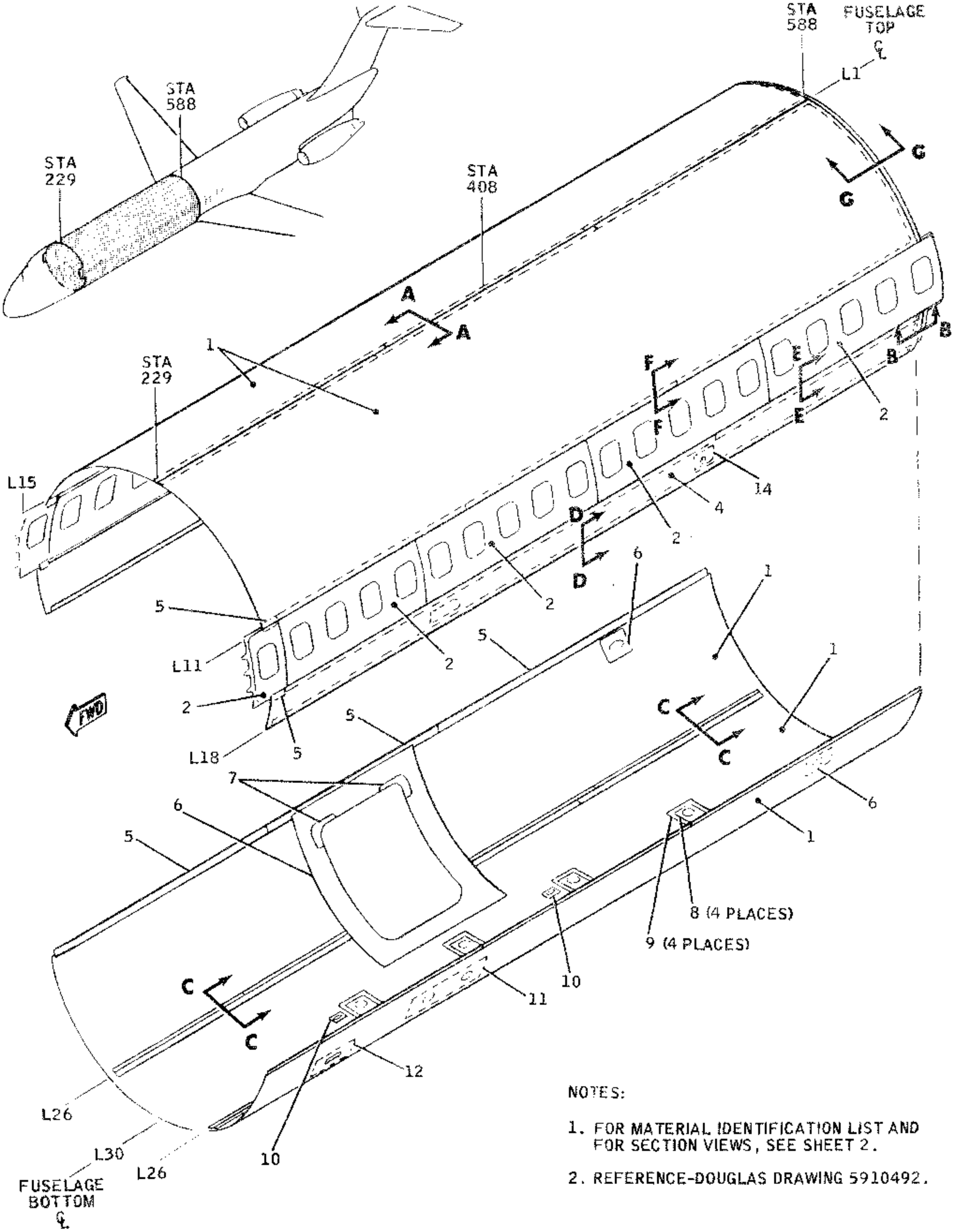


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.050	CLAD 2014-T6	18	DOUBLER	.071	CLAD 7075-T6
2	DOUBLER	.071	CLAD 2024-T42	19	PLATING	.040	CLAD 2014-T6
3	SPACER	.100	CLAD 7075-T6	20	DOUBLER	.025	CLAD 2014-T6
4	DOUBLER	.050	CLAD 7075-T6	21	DOUBLER	.063	CLAD 2014-T6
5	DOUBLER	.025	TITANIUM DMS 1592	22	SPLICE	.100	CLAD 2014-T6
6	DOUBLER	.090	CLAD 2024-T42	23	DOUBLER	.040	SEE NOTE, SHEET 2
7	BEADED INNER SKIN	.040	CLAD 2014-T6	24	DOUBLER	.500	PLATE 2024-T351
8	DOUBLER	.050	CLAD 2014-T6	25	DOUBLER	.032	TITANIUM DMS 1592
9	SPLICE CHANNEL	.071	CLAD 7075-T6	26	DOUBLER	.063	CLAD 2024-T3
10	DOUBLER	.312	PLATE 7075-T651	27	DOUBLER	.025	CLAD 2014-T6
11	DOUBLER	.090	CLAD 7075-T6	28	FILLER	.063	CLAD 2024-T3
12	PLATING	.080	CLAD 2014-T6	29	SPLICE DOUBLER	.071	CLAD 7075-T6
13	PLATING	.071	CLAD 2014-T6	30	DOUBLER	.020	CLAD 2024-T3
14	DOUBLER	.063	CLAD 2024-T42	31	SPACER	.032	CLAD 7075-T6
15	PLATING	.040	CLAD 2024-T3	32	DOUBLER	.071	TITANIUM DMS 1592
16	STRIP	.040	CLAD 2014-T6	33	PANEL	.160	CLAD 2014-T6
17	DOUBLER	.050	CLAD 2024-T42	34	DOUBLER		2912900

BB3-835

Printed in U.S.A.

Plating, Station 37 to 339, Fuselage Nose -- Type A
Figure 1 (Sheet 3)



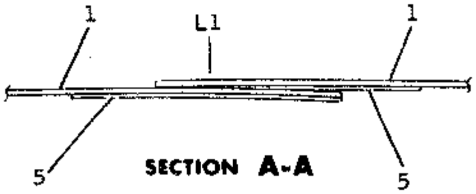
NOTES:

1. FOR MATERIAL IDENTIFICATION LIST AND FOR SECTION VIEWS, SEE SHEET 2.
2. REFERENCE-DOUGLAS DRAWING 5910492.

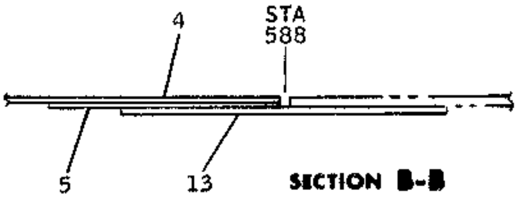
BB3-814

Plating, Station 229 to 588 -- Type A
Figure 2 (Sheet 1)

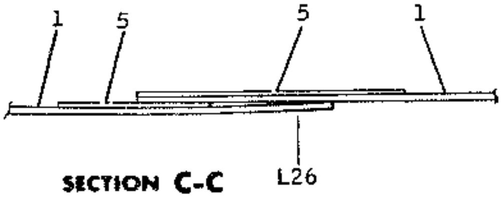
Printed in U.S.A.



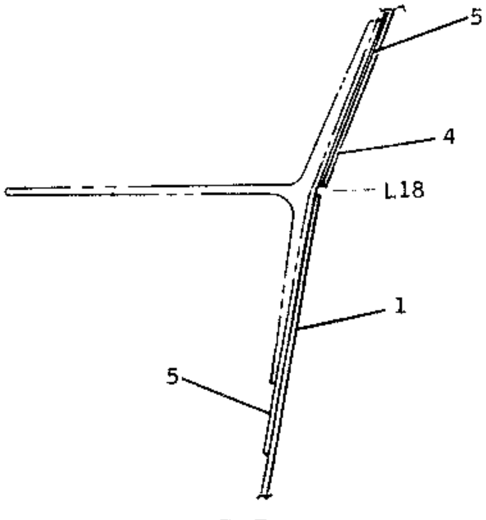
SECTION A-A



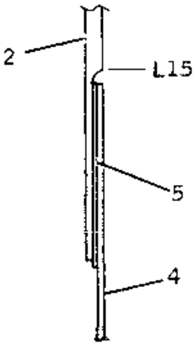
SECTION B-B



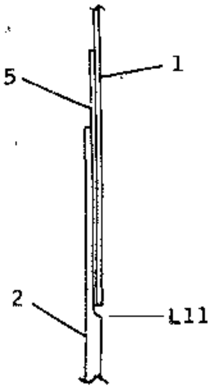
SECTION C-C



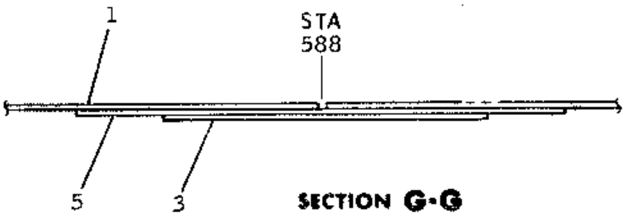
SECTION D-D



SECTION E-E



SECTION F-F



SECTION G-G

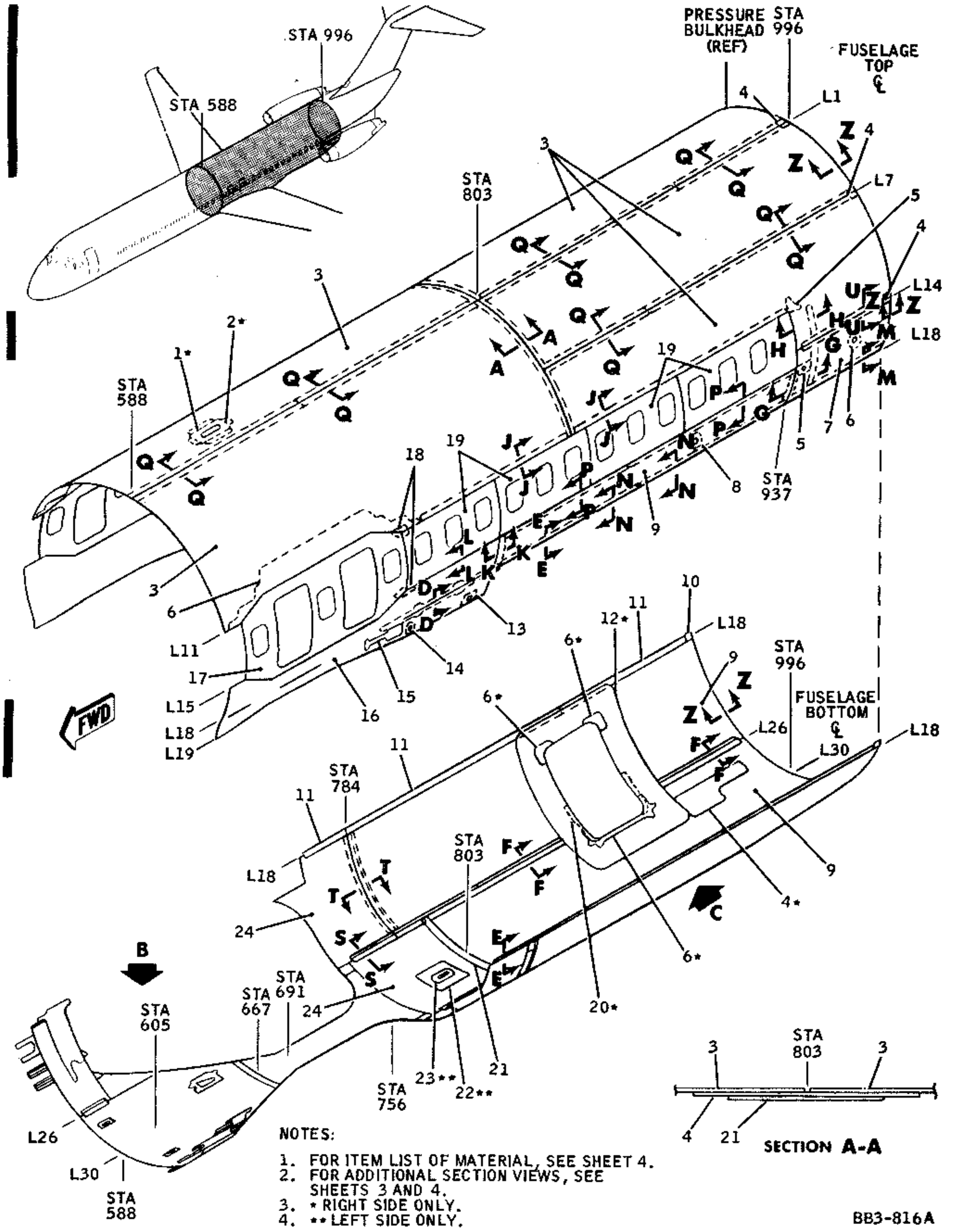
NOTES:

1. WINDOW BELT PANELS ARE CHEMICALLY MILLED FROM .160 CLAD 2014-T6 MATERIAL.
2. SEE CHAPTER 56 FOR WINDOW DETAILS.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.050	CLAD 2014-T6	8	DOUBLER	.160	CLAD 2014-T6
2	WINDOW BELT PANEL		SEE NOTES 1 AND 2	9	DOUBLER	.040	CLAD 2014-T6
3	SPLICE	.080	CLAD 2014-T6	10	DOUBLER	.050	CLAD 2014-T6
4	PLATING	.063	CLAD 2014-T6	11	DOUBLER	.125	CLAD 7075-T6
5	DOUBLER	.025	CLAD 2014-T6	12	DOUBLER	.071	CLAD 7075-T6
6	DOUBLER	.090	CLAD 2014-T6	13	SPLICE	.071	CLAD 7075-T6
7	DOUBLER	.032	TITANIUM DMS 1592	14	DOUBLER	.063	CLAD 2014-T6

BB3-815

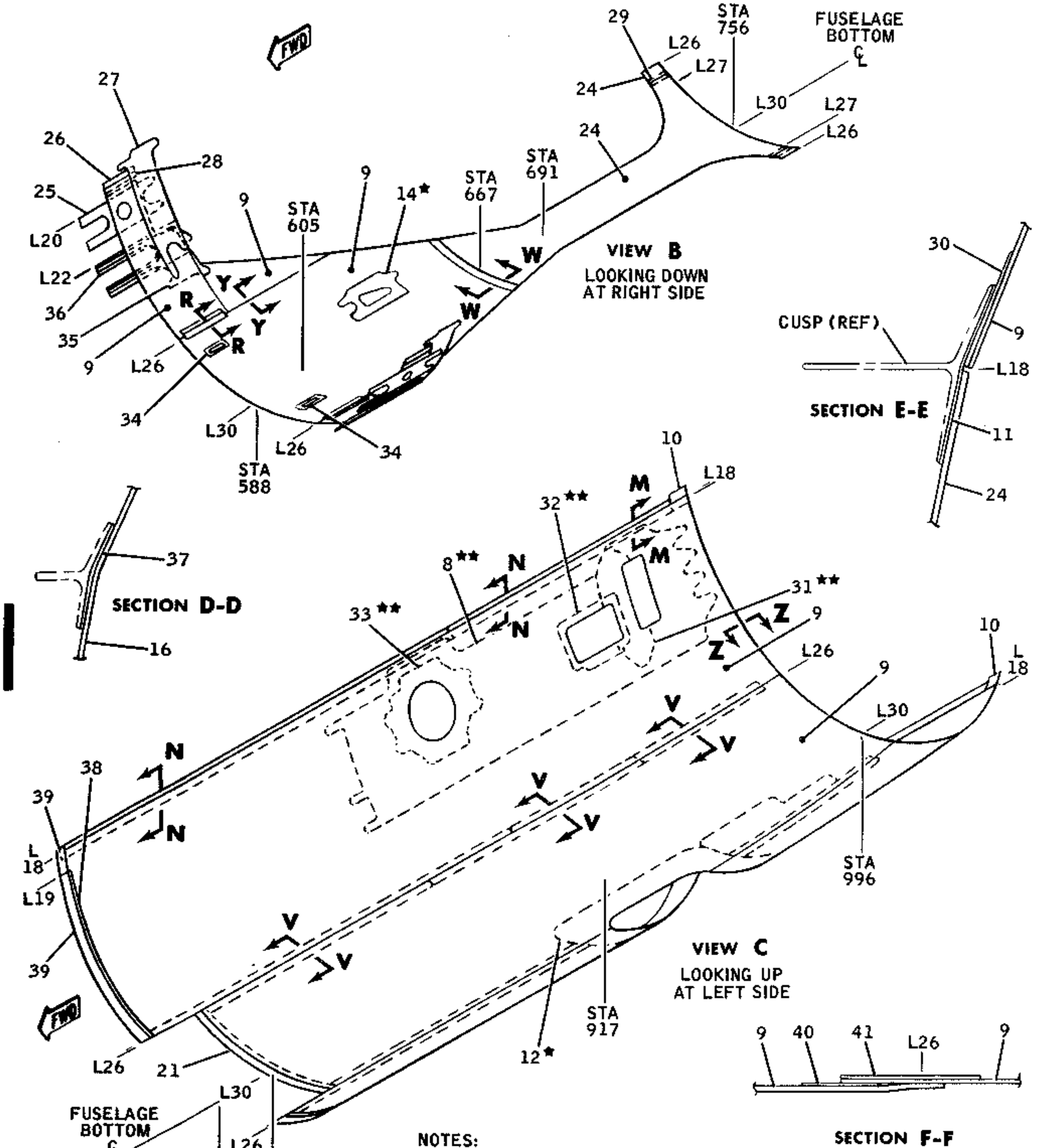
Plating, Station 229 to 588 -- Type A
Figure 2 (Sheet 2)



NOTES:

1. FOR ITEM LIST OF MATERIAL, SEE SHEET 4.
2. FOR ADDITIONAL SECTION VIEWS, SEE SHEETS 3 AND 4.
3. * RIGHT SIDE ONLY.
4. ** LEFT SIDE ONLY.

Plating, Station 588 to 996 -- Type A
Figure 3 (Sheet 1)



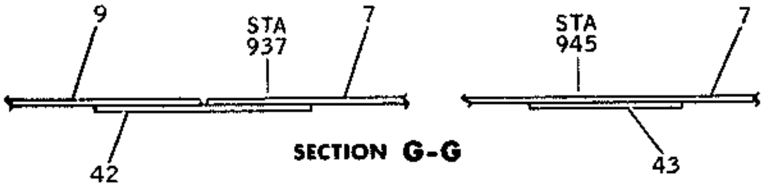
NOTES:

1. FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 4.
2. FOR ADDITIONAL DETAIL VIEWS, SEE SHEET 3.
3. *RIGHT SIDE ONLY.
4. **LEFT SIDE ONLY.

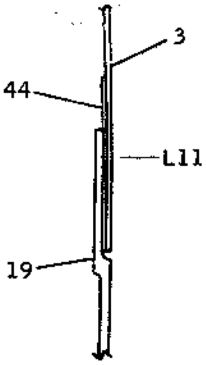
BB3-817A

Plating, Station 558 to 996 -- Type A
Figure 3 (Sheet 2)

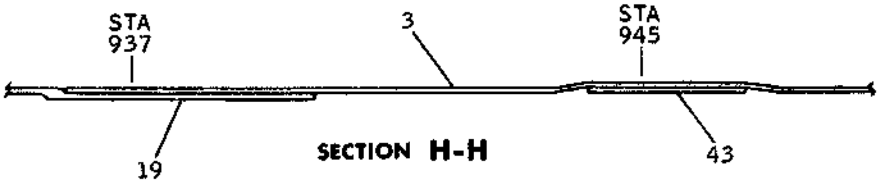
Printed in U.S.A.



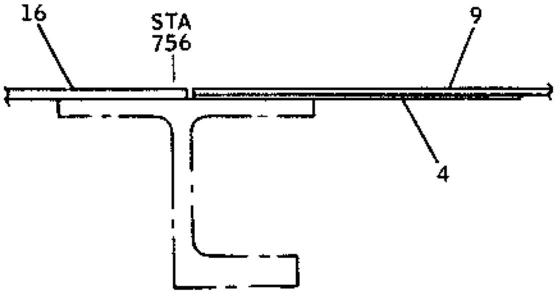
SECTION G-G



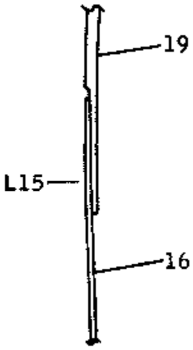
SECTION J-J



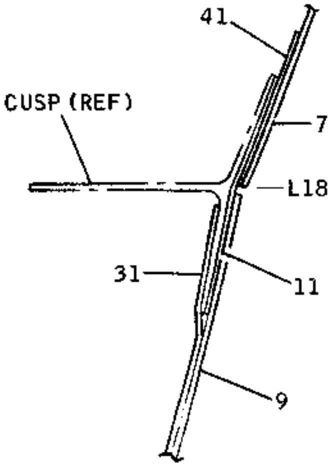
SECTION H-H



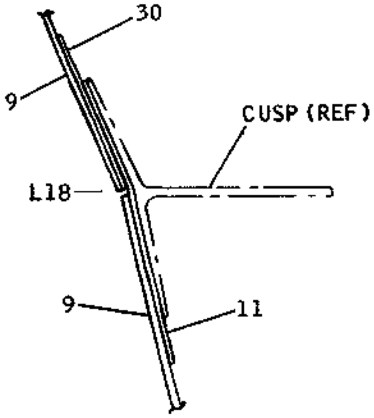
SECTION K-K



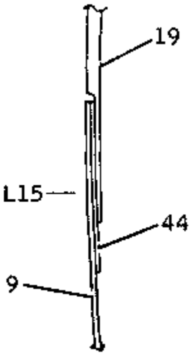
SECTION L-L



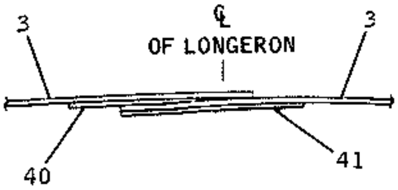
SECTION M-M



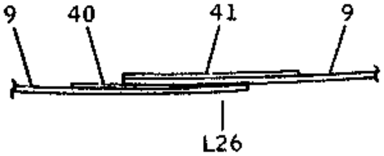
SECTION N-N



SECTION P-P



SECTION Q-Q

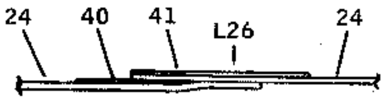


SECTION R-R

NOTE:
FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 4.

6B3-818

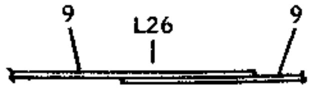
Plating, Station 558 to 996 -- Type A
Figure 3 (Sheet 3)



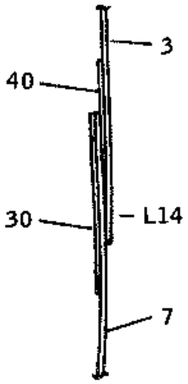
SECTION S-S

SECTION T-T

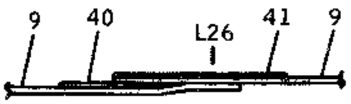
SECTION W-W



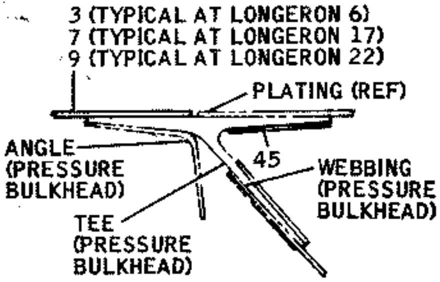
SECTION Y-Y



SECTION U-U



SECTION V-V



SECTION Z-Z

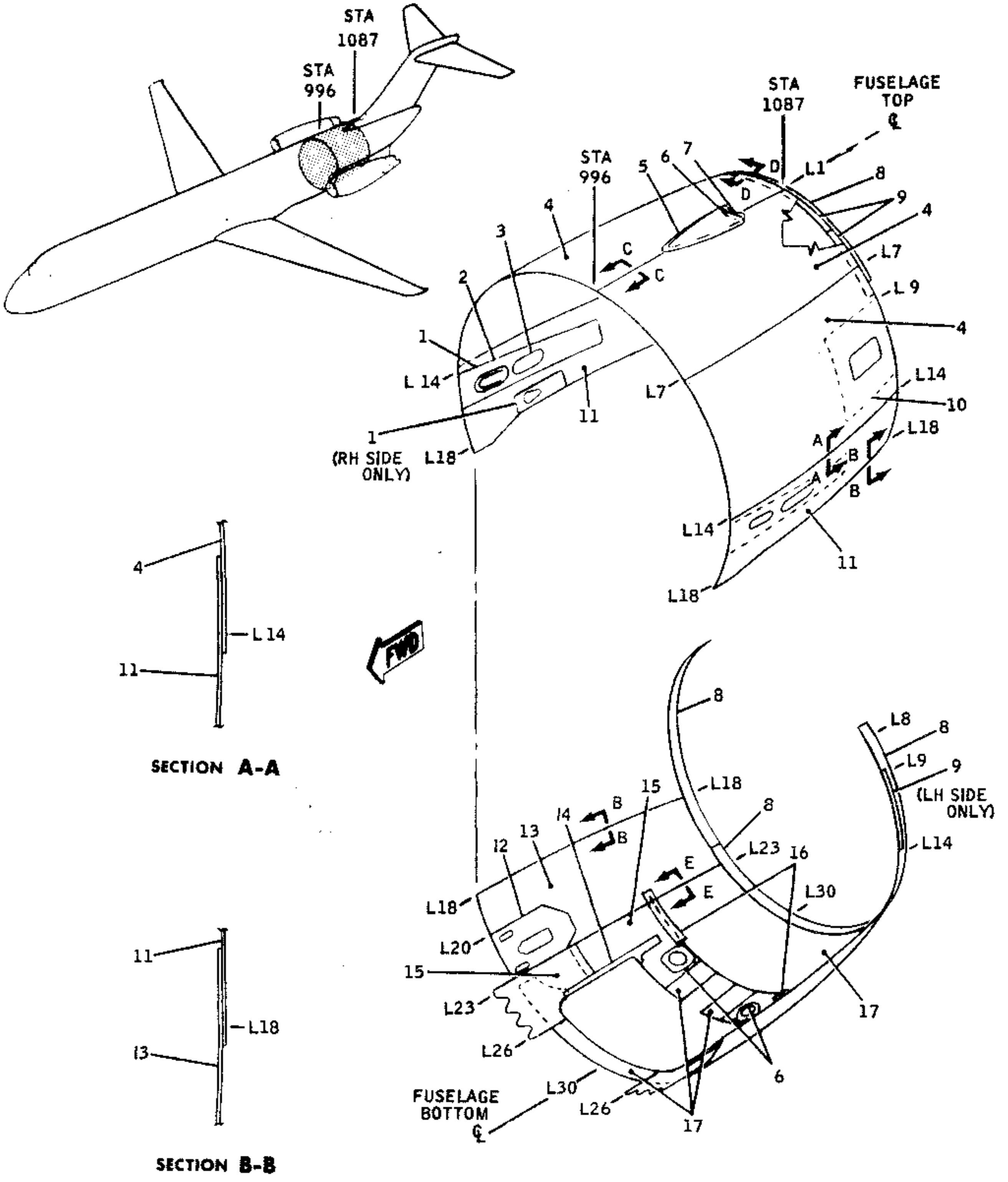
NOTES:

1. MADE FROM CRES SHEET MIL-S-5059, COND 1/4 H, COMP 301, FINISH NO. 2B.
2. MADE FROM STEEL SHEET 4130 MIL-S-18729, COND N.
3. ★PANELS ARE CHEMICALLY MILLED FROM NOTED MATERIAL.
4. MADE FROM CRES SHEET TYPE 17-7PH, MIL-S-25043, COND A, FINISH 2D.
5. REQUIREMENTS ARE FOR RIGHT AND LEFT SIDE UNLESS OTHERWISE NOTED.
6. REFERENCE - DOUGLAS DRAWING 5910493.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.040	CLAD 2014-T6	23	DOUBLER	.125	CLAD 2014-T6
2	DOUBLER	.071	CLAD 2014-T6	24	SKIN	.080	CLAD 7075-T6
3	SKIN	.050	CLAD 2014-T6	25	PAN	.071	CLAD 7075-T6
4	DOUBLER	.025	CLAD 2014-T6	26	SPLICE	.071	CLAD 7075-T6
5	DOUBLER	.025	SEE NOTE 1	27	DOUBLER	.125	CLAD 7075-T6
6	DOUBLER	.032	TITANIUM SHEET	28	DOUBLER	.016	CLAD 2014-T6
7	SKIN	.032	TITANIUM SHEET	29	SPLICE	.080	CLAD 7075-T6
8	DOUBLER	.063	CLAD 2014-T6	30	DOUBLER		2912900-6
9	SKIN	.063	CLAD 2014-T6	31	DOUBLER	.025	TITANIUM SHEET
10	DOUBLER	.025	SEE NOTE 4	32	PLATE	.250	CLAD 2014-T651
11	DOUBLER		2912900-5	33	DOUBLER	.375	CLAD 2014-T651
12	DOUBLER	.063	CLAD 2024-T4	34	DOUBLER	.071	CLAD 7075-T6
13	DOUBLER	.080	CLAD 7075-T6	35	DOUBLER	.100	CLAD 7075-T6
14	DOUBLER	.090	CLAD 7075-T6	36	PAN	.050	CLAD 7075-T6
15	DOUBLER	.050	SEE NOTE 2	37	DOUBLER	.063	TITANIUM SHEET
16	SKIN	.125	CLAD 7075-T6★	38	DOUBLER	.080	CLAD 2014-T6
17	WINDOW BELT PANEL	.250	CLAD 2014-T651★	39	STRAP	.080	CLAD 2014-T6
18	DOUBLER	.040	TITANIUM SHEET	40	DOUBLER		2912900-2
19	WINDOW BELT PANEL	.160	CLAD 2014-T6★	41	DOUBLER		2912900-3
20	DOUBLER	.032	CLAD 2024-T3	42	STRAP	.071	CLAD 2014-T6
21	SPLICE	.080	CLAD 2014-T6	43	STRAP	.025	SEE NOTE 1
22	DOUBLER	.050	CLAD 2014-T6	44	DOUBLER		2912900-4
				45	SPLICE	.063	CLAD 2014-T6

BB3-819A

Plating, Station 558 to 996 -- Type A
Figure 3 (Sheet 4)

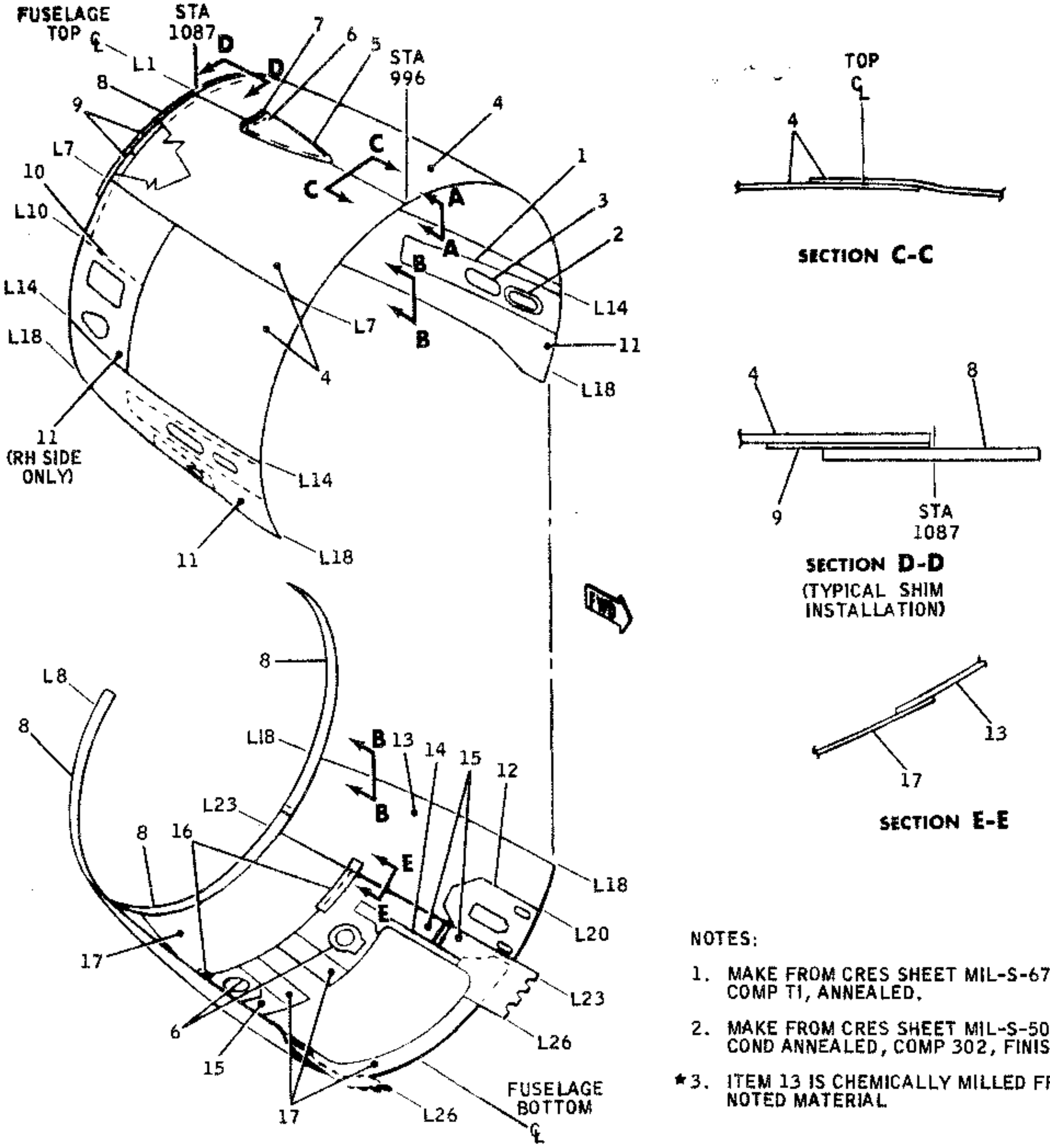


NOTES:

1. FOR ADDITIONAL VIEWS, SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 2.
3. REFERENCE-DOUGLAS DRAWING 5910493.

BB3 759

Plating, Station 996 to 1087 -- Type A1
Figure 4 (Sheet 1)



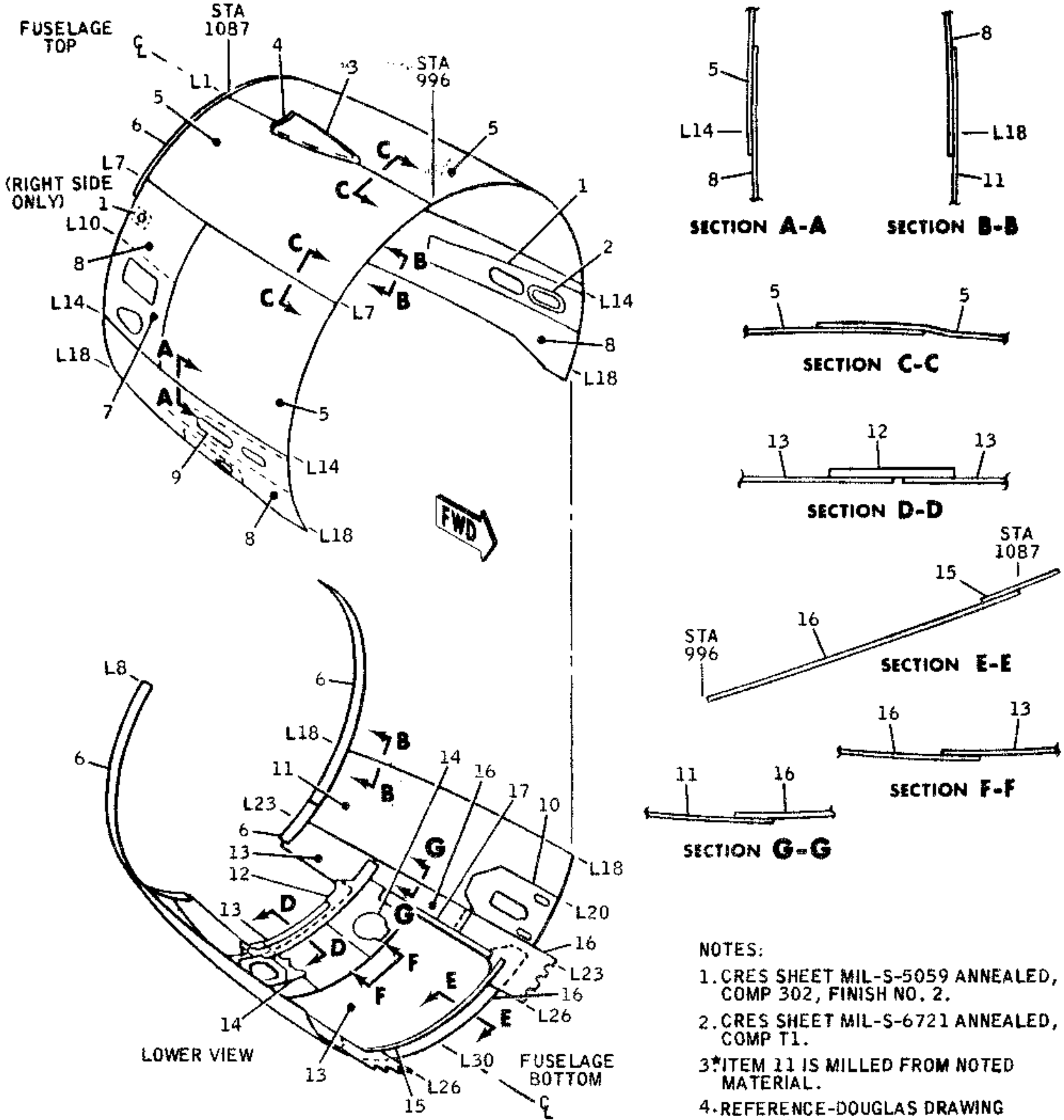
NOTES:

1. MAKE FROM CRES SHEET MIL-S-6721, COMP T1, ANNEALED.
2. MAKE FROM CRES SHEET MIL-S-5059, COND ANNEALED, COMP 302, FINISH 2D.
★3. ITEM 13 IS CHEMICALLY MILLED FROM NOTED MATERIAL.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.032	TITANIUM DMS 1592
2	PAN	.025	SEE NOTE 2
3	PAN	.032	SEE NOTE 1
4	SKIN	.040	CLAD 2014-T6
5	FIN	.040	CLAD 2014-T6
6	DOUBLER	.050	CLAD 2014-T6
7	SPLICE	.050	CLAD 2014-T6
8	SPLICE	.050	CLAD 7075-T6
9	SHIM	.020	CLAD 7075-T6
10	DOUBLER	.025	TITANIUM DMS 1592
11	SKIN	.032	TITANIUM DMS 1592
12	DOUBLER	.040	CLAD 2014-T6
★13	SKIN	.063	CLAD 2014-T6
14	FILLER	.125	CLAD 2014-T6
15	SKIN	.050	TITANIUM DMS 1592
16	SPLICE	.032	TITANIUM DMS 1592
17	SKIN	.025	TITANIUM DMS 1592

BB3-836

Plating, Station 996 to 1087 -- Type A1
Figure 4 (Sheet 2)



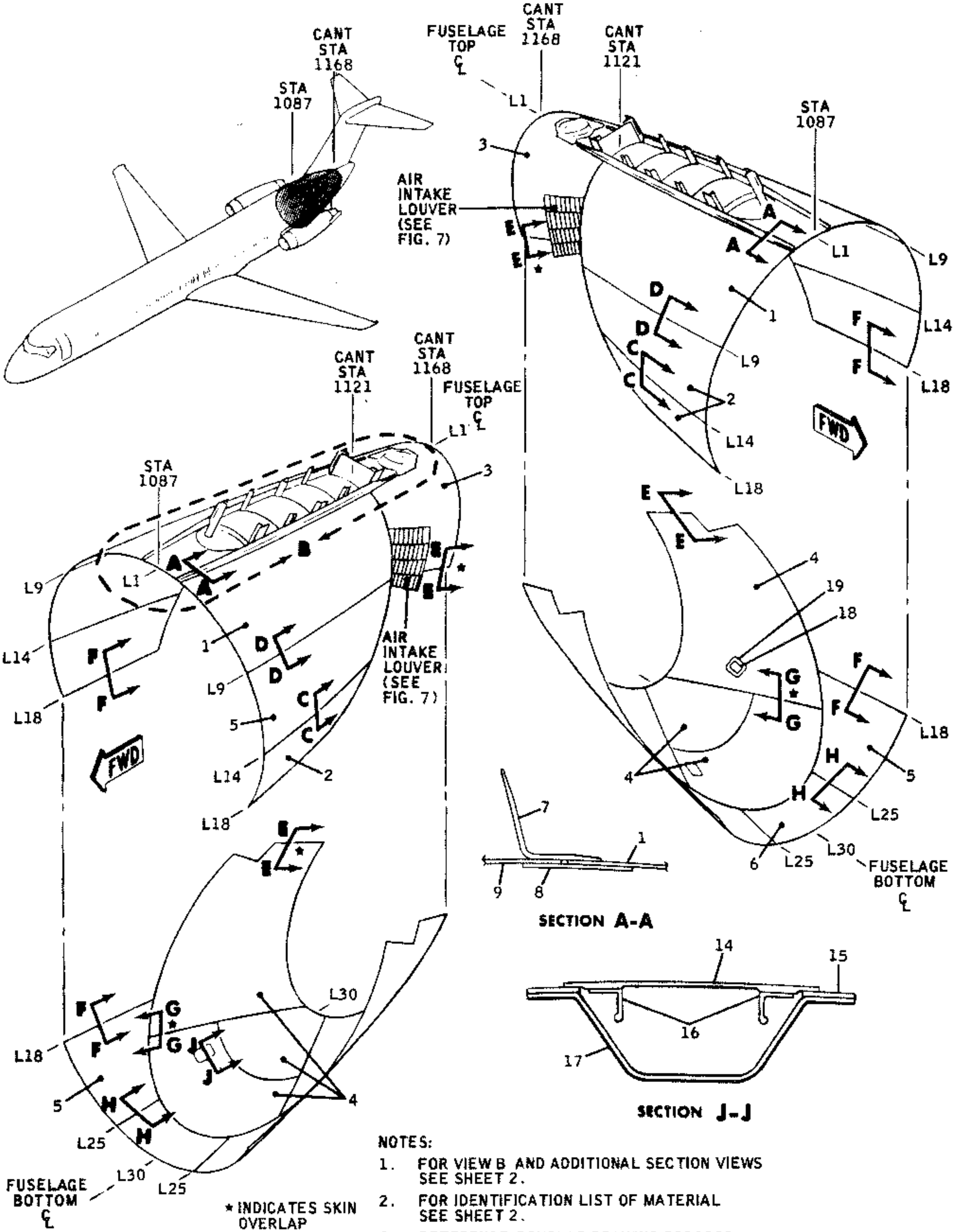
NOTES:

1. CRES SHEET MIL-S-5059 ANNEALED, COMP 302, FINISH NO. 2.
2. CRES SHEET MIL-S-6721 ANNEALED, COMP T1.
3. *ITEM 11 IS MILLED FROM NOTED MATERIAL.
4. REFERENCE-DOUGLAS DRAWING 5910493.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.032	TITANIUM DMS1592	10	DOUBLER	.040	CLAD 2014-T6
2	PAN	.025	SEE NOTE 1	11	*PLATING	.063	CLAD 2014-T6
3	FIN	.040	CLAD 2014-T6	12	SPLICE	.040	CLAD 2014-T6
4	SPLICE	.050	CLAD 2014-T6	13	PLATING	.025	TITANIUM DMS1592
5	PLATING	.040	CLAD 2014-T6	14	DOUBLER	.050	CLAD 2014-T6
6	SPLICE	.050	CLAD 7075-T6	15	DOUBLER	.050	TITANIUM DMS1592
7	DOUBLER	.025	TITANIUM DMS1592	16	PLATING	.050	TITANIUM DMS1592
8	PLATING	.032	TITANIUM DMS1592	17	FILLER	.125	CLAD 2014-T6
9	PAN	.032	SEE NOTE 2				

BB3-952

Plating, Station 996 to 1087 -- Type A2
Figure 4A



* INDICATES SKIN OVERLAP

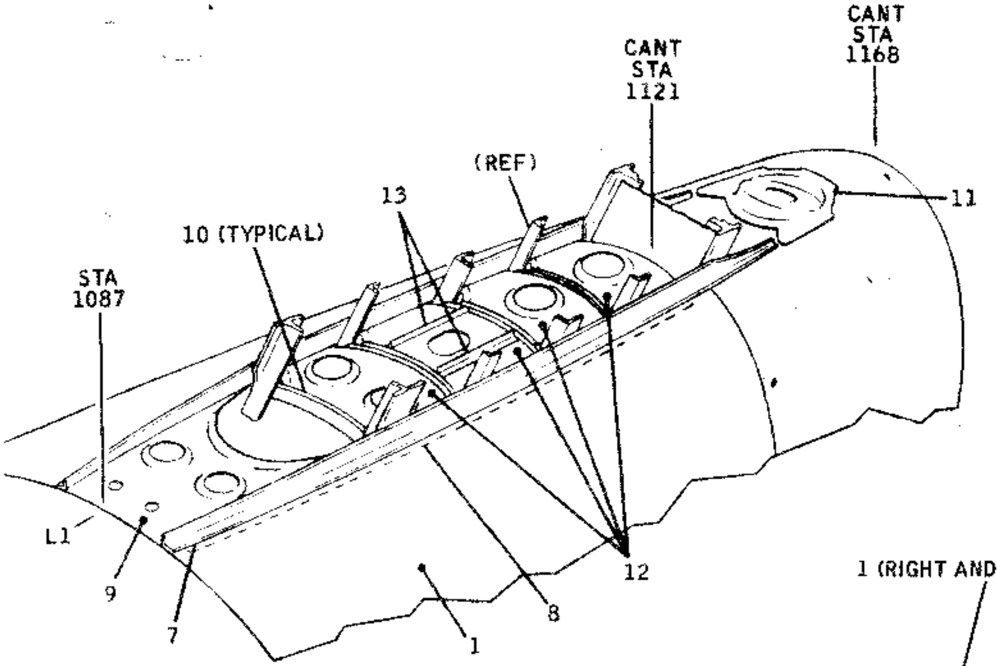
NOTES:

1. FOR VIEW B AND ADDITIONAL SECTION VIEWS SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 2.
3. REFERENCE-DOUGLAS DRAWING 5910228 AND 5912141.

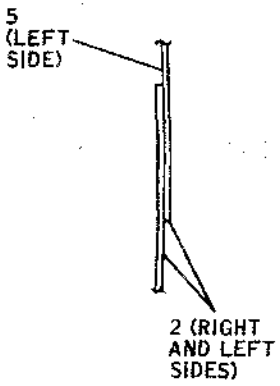
BB3-684

Plating, Station 1087 to Canted Station 1168 -- Type A1
Figure 5 (Sheet 1)

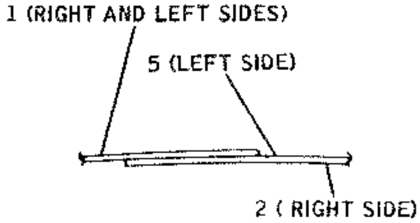
Printed in U.S.A.



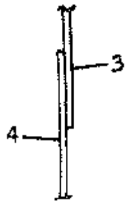
VIEW B



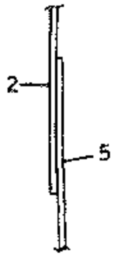
SECTION C-C



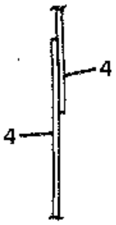
SECTION D-D



SECTION E-E



SECTION F-F



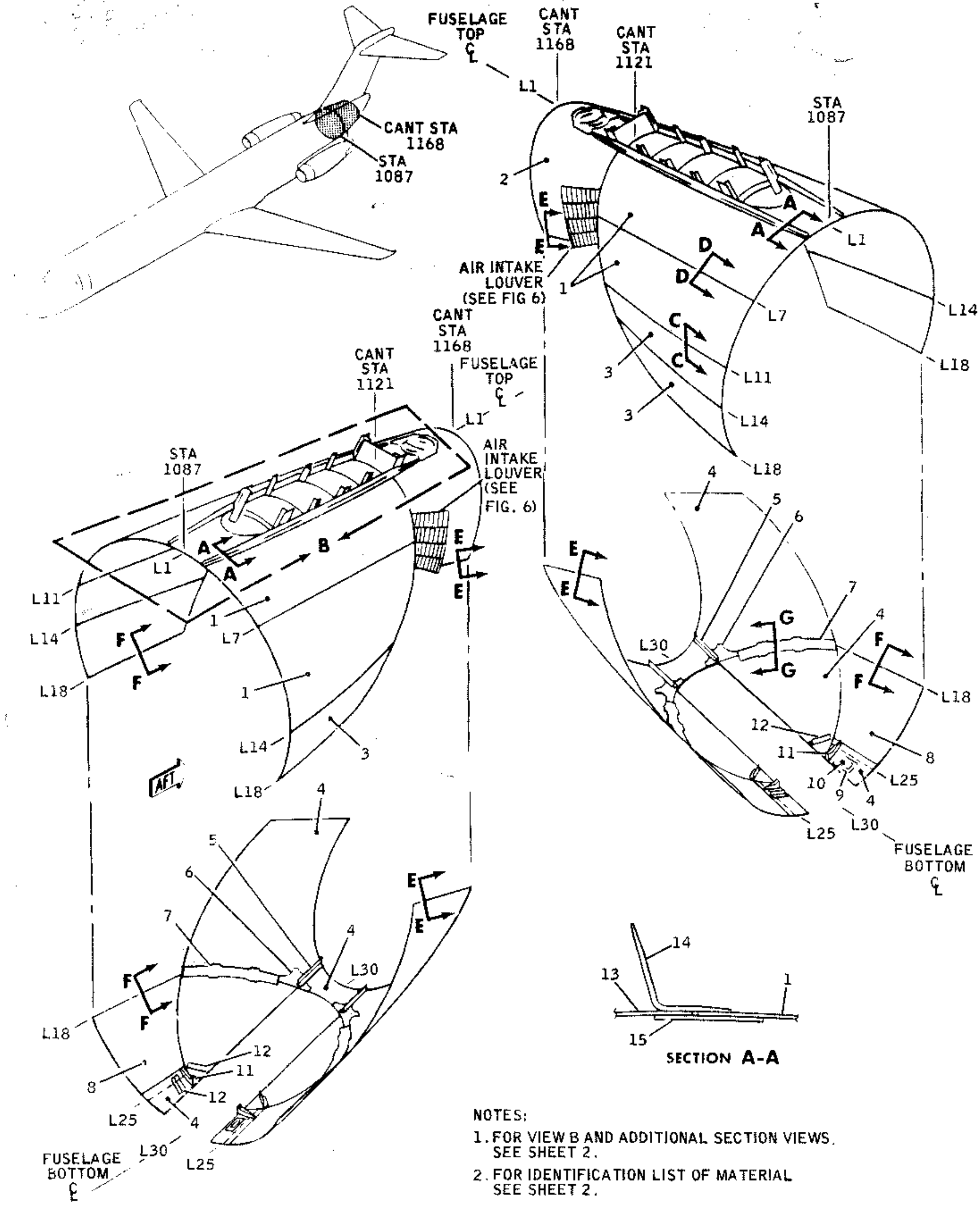
SECTION G-G

SECTION H-H

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.063	CLAD 2014-T6	11	PAN	.090	CLAD 2014-T6
2	PLATING	.050	TITANIUM DMS 1592	12	PANEL	.050	CLAD 2014-T6
3	PLATING	.063	CLAD 2024-T4	13	ANGLE		1332462
4	PLATING	.032	CLAD 2024-T3	14	DOOR	.063	CLAD 2014-T6
5	PLATING	.050	CLAD 2014-T6	15	DOUBLER	.032	CLAD 2014-T6
6	PLATING	.040	CLAD 2014-T6	16	STIFFENER		1361525
7	ANGLE	.125	CLAD 7075-T6	17	PAN	.080	CLAD 6061-T6
8	DOUBLER	.050	CLAD 2024-T3	18	DOOR	.032	CLAD 2024-T3
9	PANEL	.063	2014-T6	19	PAN	.063	CLAD 6061-T6
10	ANGLE	.063	CLAD 2024-T42				

BB3-885

Plating, Station 1087 to Canted Station 1168 -- Type A1
Figure 5 (Sheet 2)

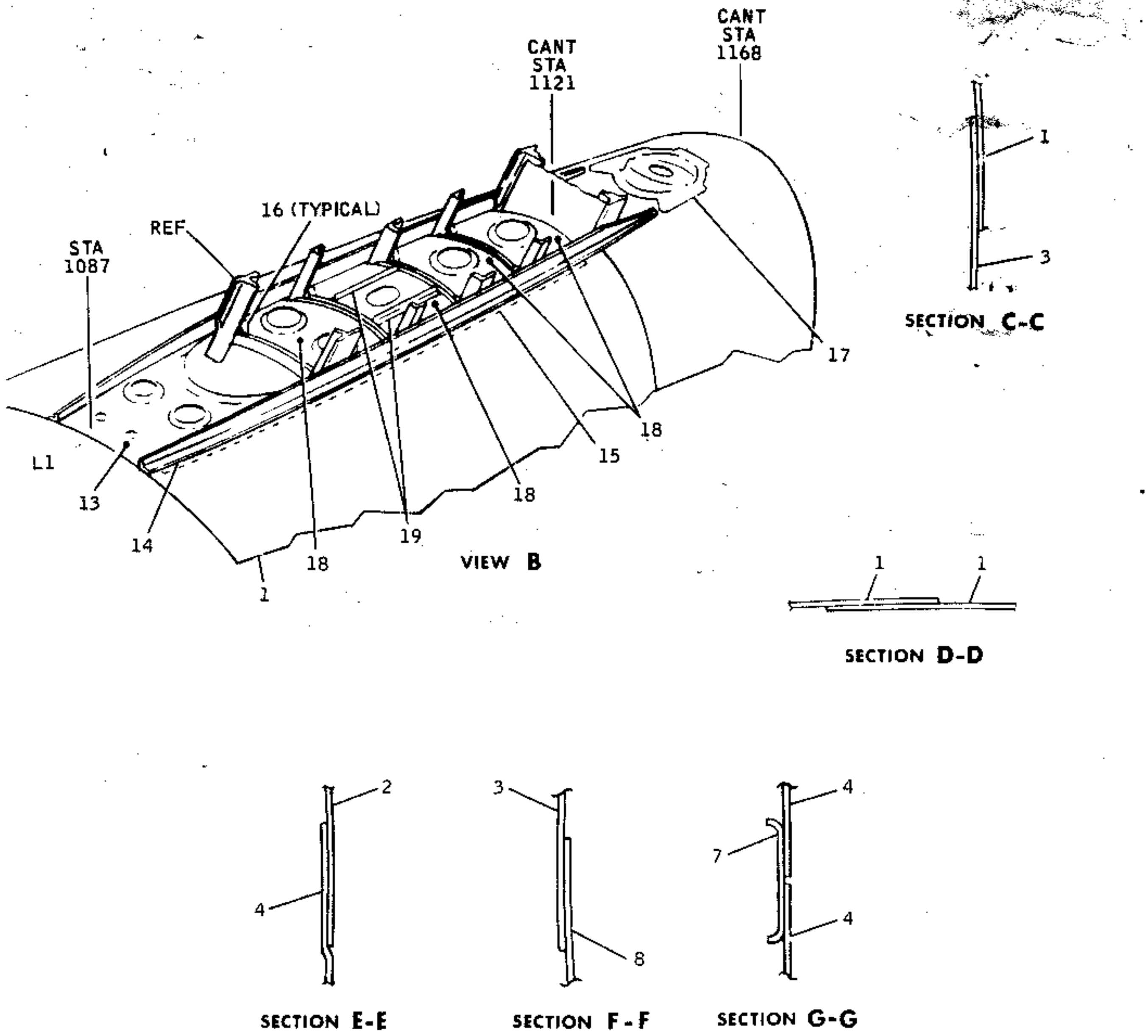


NOTES:

1. FOR VIEW B AND ADDITIONAL SECTION VIEWS, SEE SHEET 2.
2. FOR IDENTIFICATION LIST OF MATERIAL SEE SHEET 2.
3. REFERENCE-DOUGLAS DRAWING 5910228

BB3-953

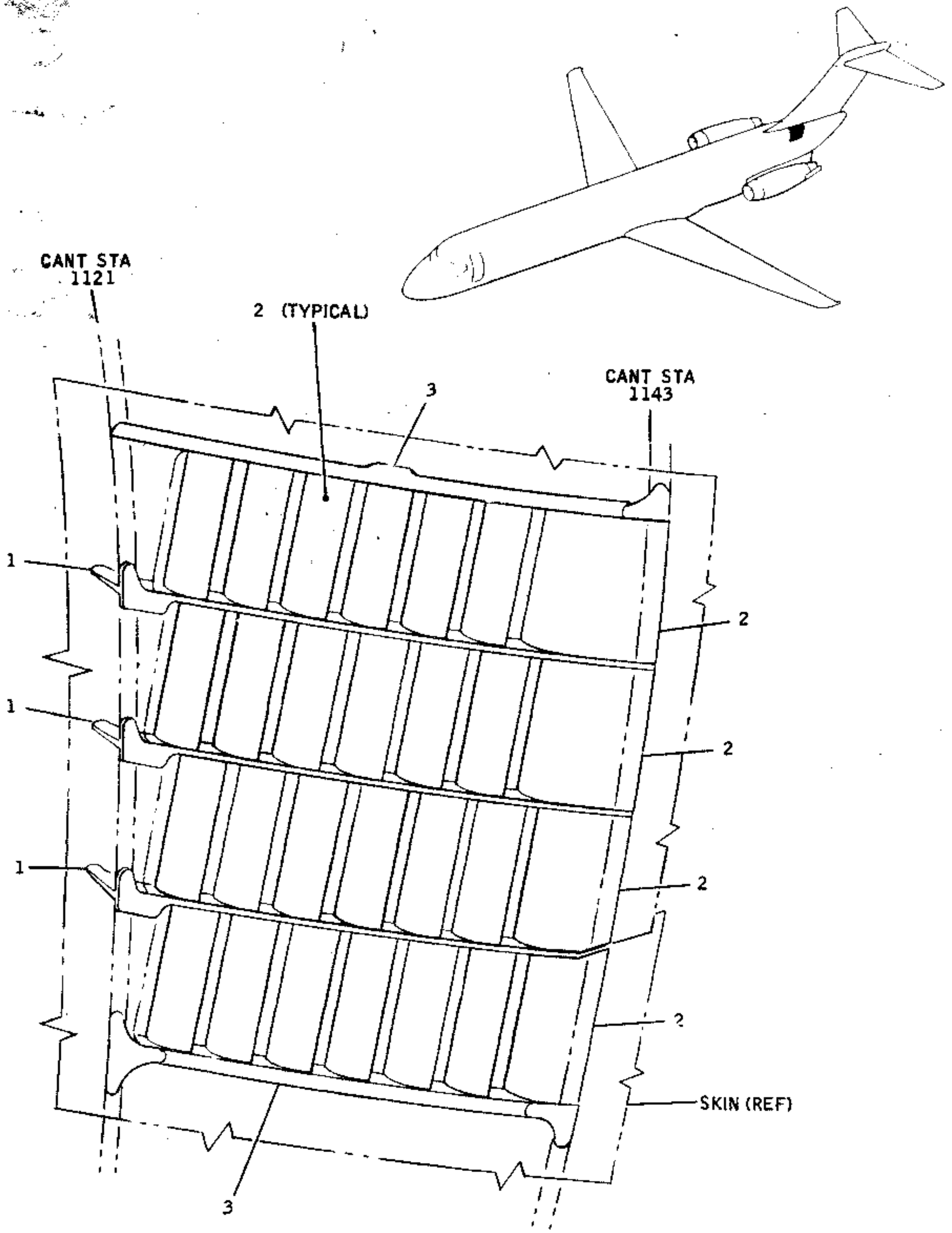
Plating, Station 1087 to Canted Station 1168 -- Type A2
Figure 5A (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATING	.063	CLAD 2014-T6	11	FITTING,3957175-1,-2	2.250	PLATE 7075-T651
2	PLATING	.063	CLAD 2024-T4	12	ANGLE	.050	CLAD 2024-T4
3	PLATING	.040	TITANIUM DMS 1592	13	PANEL	.063	CLAD 2014-T6
4	PLATING	.032	CLAD 2024-T4	14	ANGLE	.125	CLAD 7075-T6
5	ANGLE	.063	CLAD 2024-T4	15	DOUBLER	.050	CLAD 2024-T3
6	SPLICE	.040	CLAD 2024-T3	16	ANGLE	.063	CLAD 2024-T42
7	SPLICE	.040	CLAD 2024-T4	17	PAN	.090	CLAD 2014-T6
8	PLATING	.050	CLAD 2014-T6	18	PANEL	.050	CLAD 2014-T6
9	DOUBLER	.032	CLAD 2014-T6	19	ANGLE		1332462
10	DOOR	.063	CLAD 2014-T6				

BB3-954

Plating, Station 1087 to Canted Station 1168 -- Type A2
Figure 5A (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		2920847
2	LOUVER	.050	CLAD 2014-T6
3	ANGLE	.071	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWING 5920838

BB3-887

Aft Accessory Compartment Ventilation Louver -- Type A
Figure 6

CONES, FILLETS, AND FAIRINGS - DESCRIPTION AND OPERATION (DC-9-10)

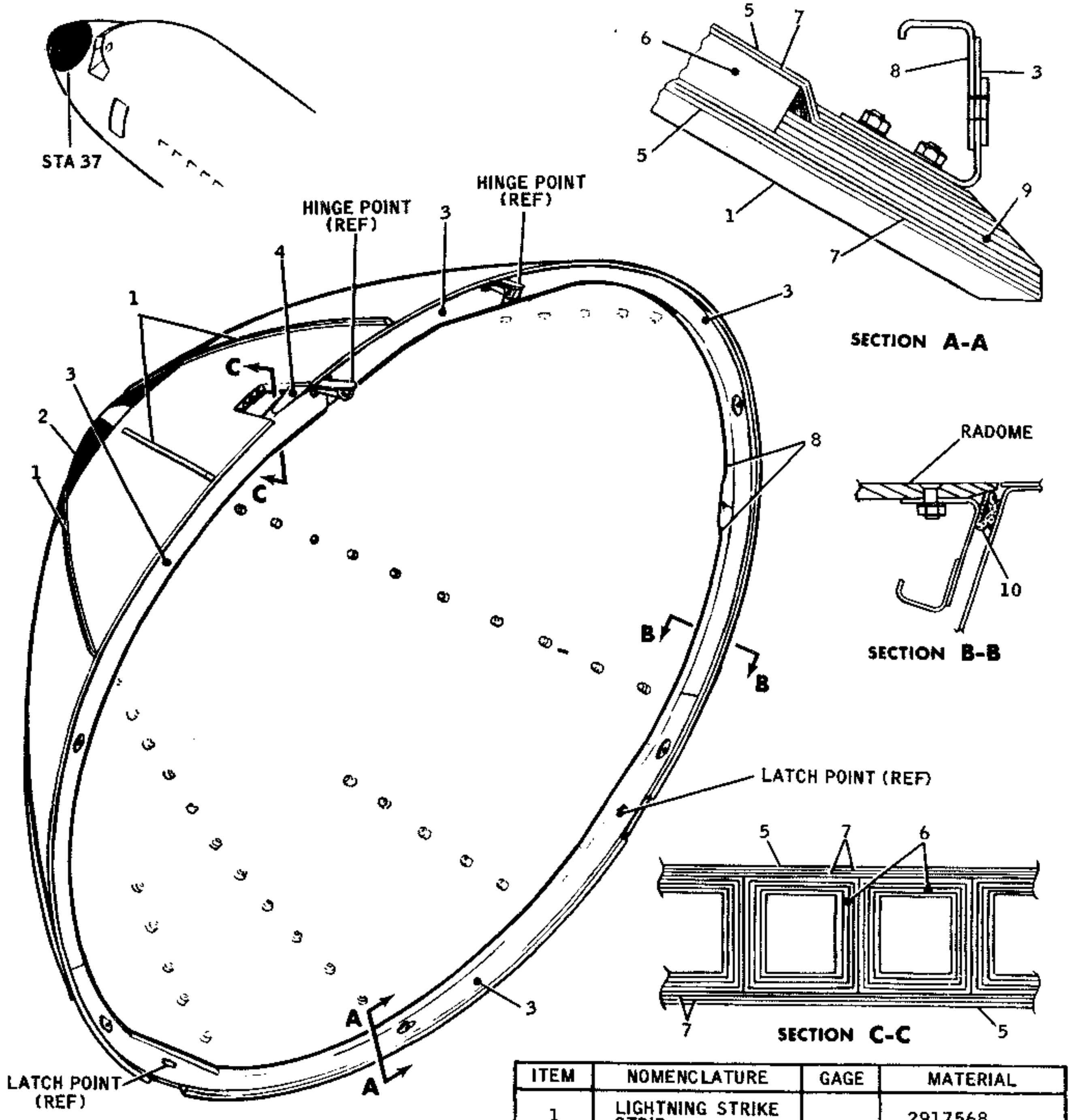
1. General

A. The following figures illustrate the construction of the radome, tail cone, wing-to-fuselage fillets and fairings. The materials used are identified by the item number callouts.

2. Repair Index

A. A list of components and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Components	Applicable Repairs
Radome, Tail Cone, and ADF Antenna Panels in Fillets	Section 51-70-1
Wing-to-Fuselage Fillets	Section 53-01
ADF Antenna (Metal Element only) Section 53-10 Figure 12	



NOTES:

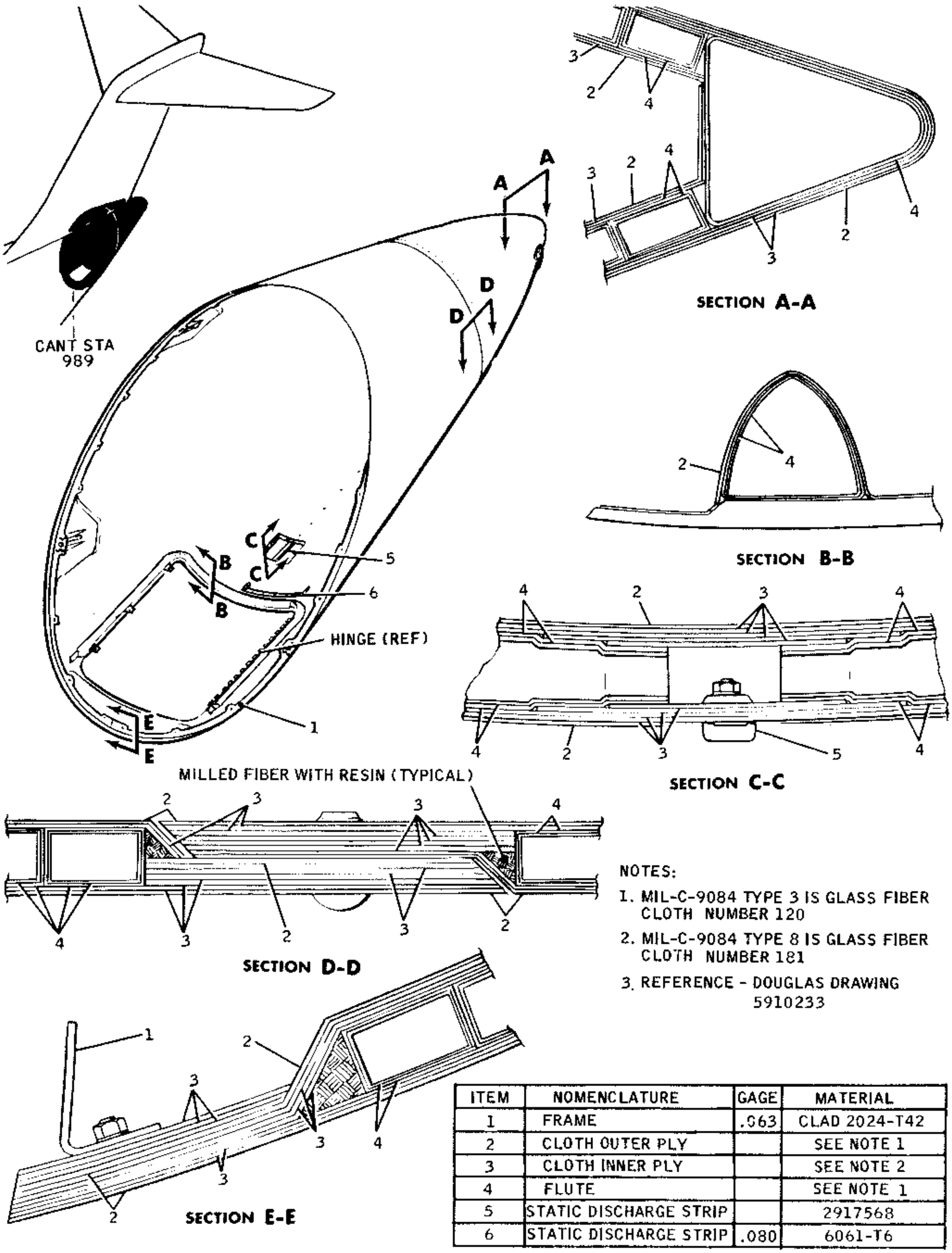
1. MIL-C-9084 TYPE 3 IS GLASS FIBER CLOTH NUMBER 120
2. MIL-C-9084 TYPE 8 IS GLASS FIBER CLOTH NUMBER 181
3. MIL-C-9084 TYPE 11 IS GLASS FIBER CLOTH NUMBER 184
4. SEE MAINTENANCE MANUAL FOR LIGHTNING STRIKE STRIP AND EROSION BOOT INSTALLATION PROCEDURES.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LIGHTNING STRIKE STRIP		2917568
2	EROSION BOOT		7915076-1
3	CHANNEL	.050	CLAD 7075-T6
4	PLATE	.090	CLAD 7075-T6
5	CLOTH OUTER PLY		SEE NOTE 2
6	FLUTE		SEE NOTE 1
7	CLOTH INNER PLY		SEE NOTE 1
8	ANGLE	.071	CLAD 7075-T6
9	CLOTH		SEE NOTE 3
10	RADOME SEAL		4913109-1

REFERENCE - DOUGLAS DRAWING 5910091

BB3-95

Fuselage Nose Radome, Laminated Glass Fiber
Figure 1

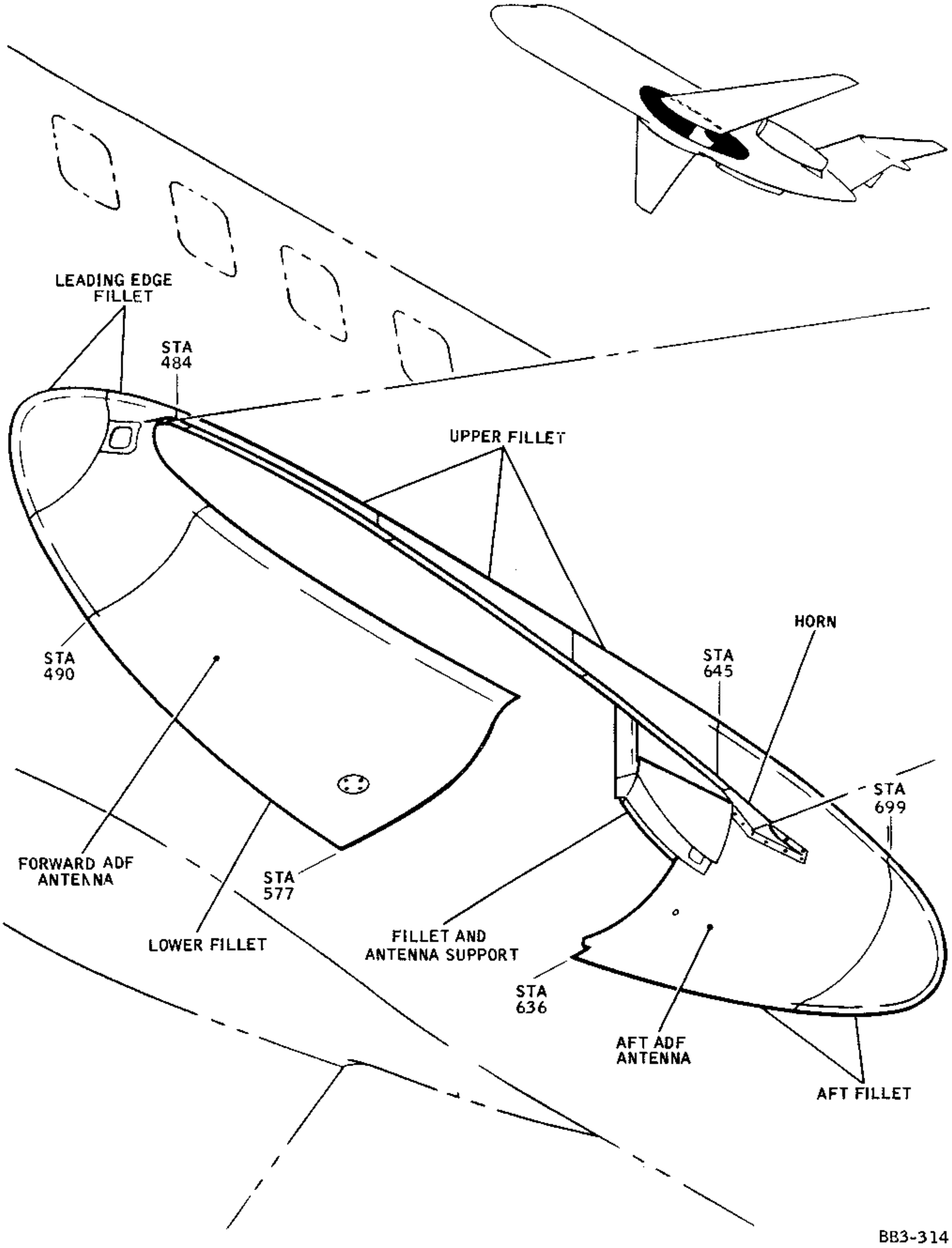


NOTES:

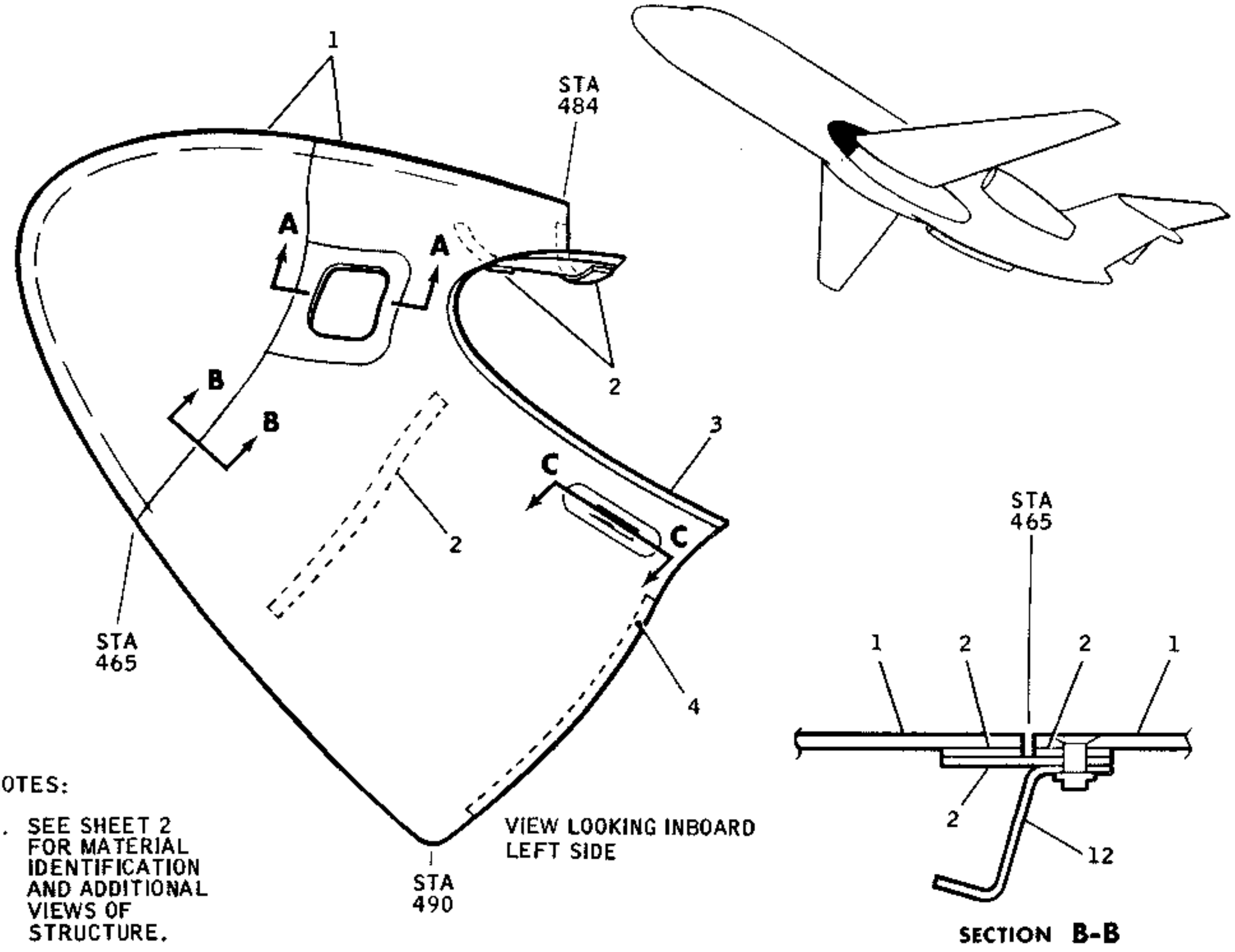
1. MIL-C-9084 TYPE 3 IS GLASS FIBER CLOTH NUMBER 120
2. MIL-C-9084 TYPE 8 IS GLASS FIBER CLOTH NUMBER 181
3. REFERENCE - DOUGLAS DRAWING 5910233

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.063	CLAD 2024-T42
2	CLOTH OUTER PLY		SEE NOTE 1
3	CLOTH INNER PLY		SEE NOTE 2
4	FLUTE		SEE NOTE 1
5	STATIC DISCHARGE STRIP		2917568
6	STATIC DISCHARGE STRIP	.080	6061-T6

Fuselage Tail Cone, Laminated Glass Fiber
Figure 2



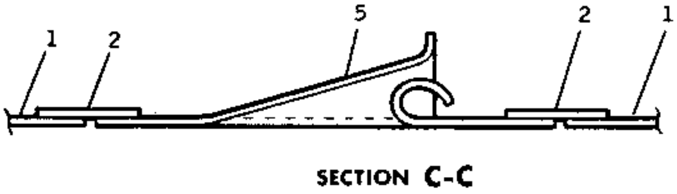
Wing-to-Fuselage Fillet, Key Illustration
Figure 3



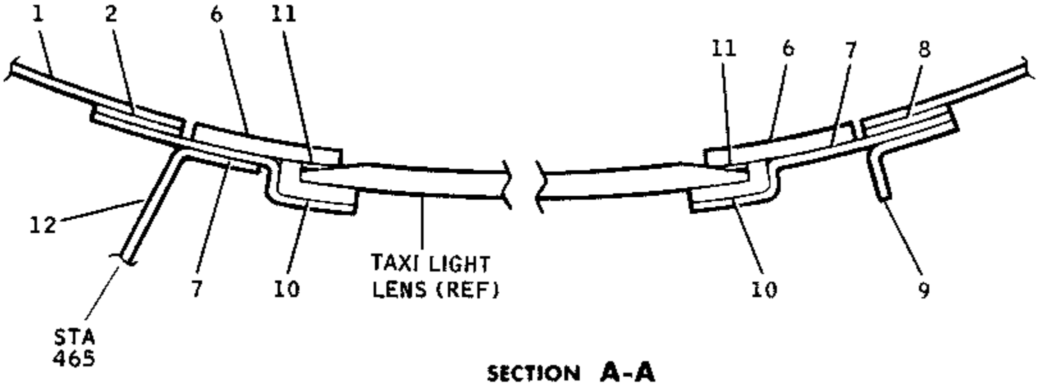
SECTION B-B

NOTES:

1. SEE SHEET 2 FOR MATERIAL IDENTIFICATION AND ADDITIONAL VIEWS OF STRUCTURE.
2. REFERENCE - DOUGLAS DRAWING 5955912.



SECTION C-C

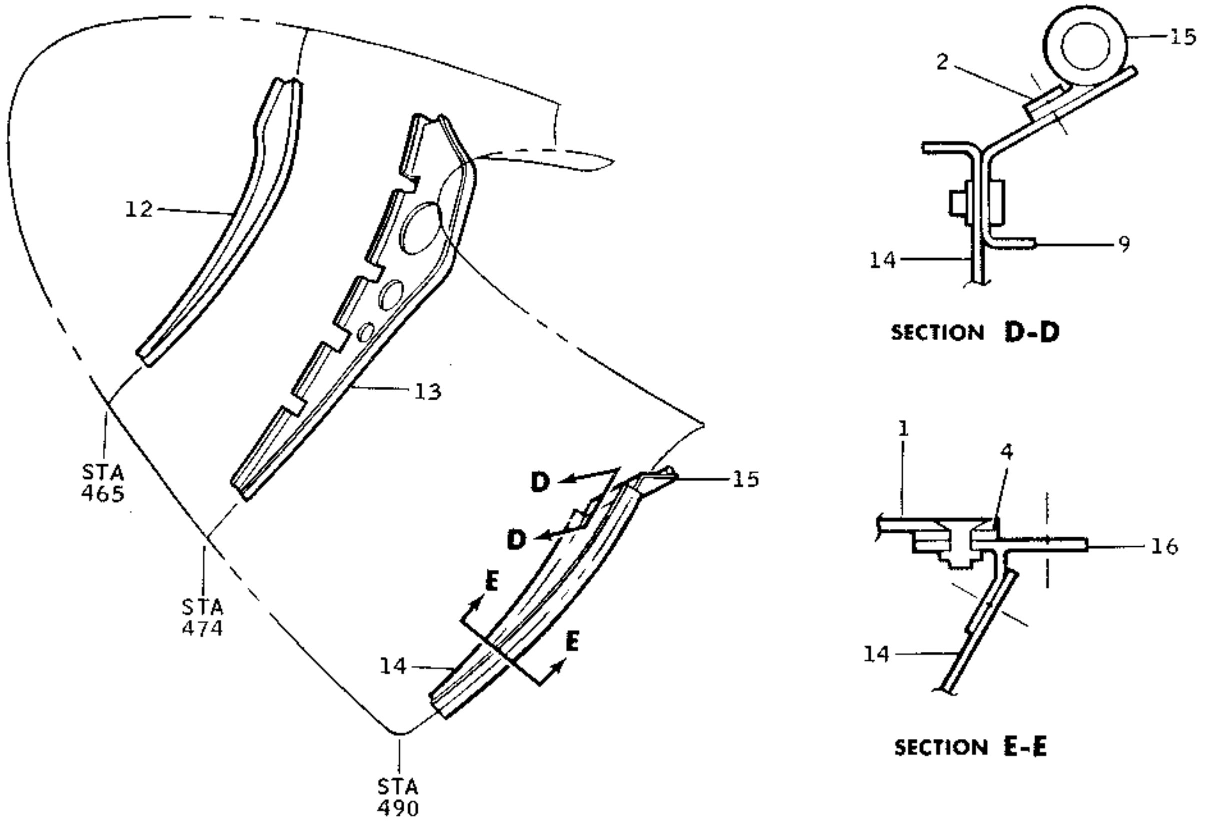


SECTION A-A

BB3-315

Printed in U.S.A.

Leading Edge Fillet
Figure 4 (Sheet 1)



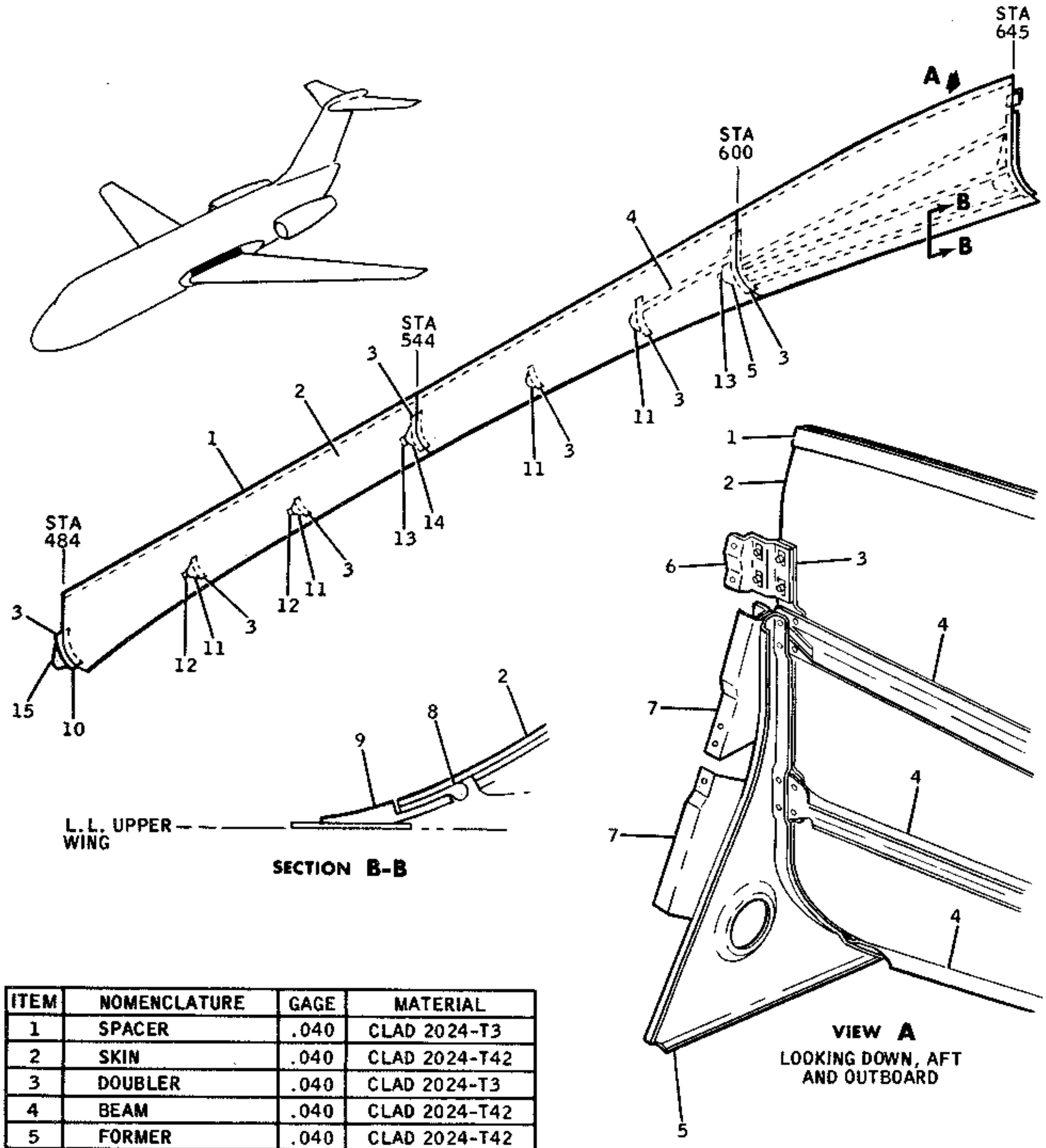
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.040	CLAD 2024-T42
2	DOUBLER	.040	CLAD 2024-T3
3	SEAL 2766959A		(SEE NOTE 2)
4	DOUBLER	.080	CLAD 2024-T3
5	SCOOP ASSEMBLY	.040	6061-T6
6	RETAINER, OUTSIDE	.080	CLAD 2024-T42
7	RETAINER, INSIDE	.050	CLAD 2024-T42
8	DOUBLER	.040	CLAD 2024-T42
9	ANGLE	.050	CLAD 2024-T42
10	SEAL 2917162		(SEE NOTE 3)
11	GASKET 4956847		(SEE NOTE 4)
12	FORMER	.050	CLAD 2024-T42
13	FORMER	.032	CLAD 2024-T42
14	FILLET	.063	CLAD 2024-T42
15	SEAL 4914344		(SEE NOTE 1)
16	TEE		1243286

NOTES:

1. SEAL IS MADE FROM SILICONE RUBBER WITH FABRIC COVERING D-400, OR EQUIVALENT. FABRIC MAY BE PURCHASED FROM MOHAWK FABRIC, AMSTERDAM, N. Y.
2. SEAL IS FLUORO-SILICONE RUBBER CORE WITH TRICOT-WEAVE, SILICONE IMPREGNATED DACRON COVER.
3. SEAL IS MADE FROM SILICONE RUBBER SPONGE SUITABLE FOR CEMENTING.
4. GASKET IS MADE FROM .031 SILICONE RUBBER SHEET SUITABLE FOR CEMENTING.

BB3-474

Leading Edge Fillet
Figure 4 (Sheet 2)

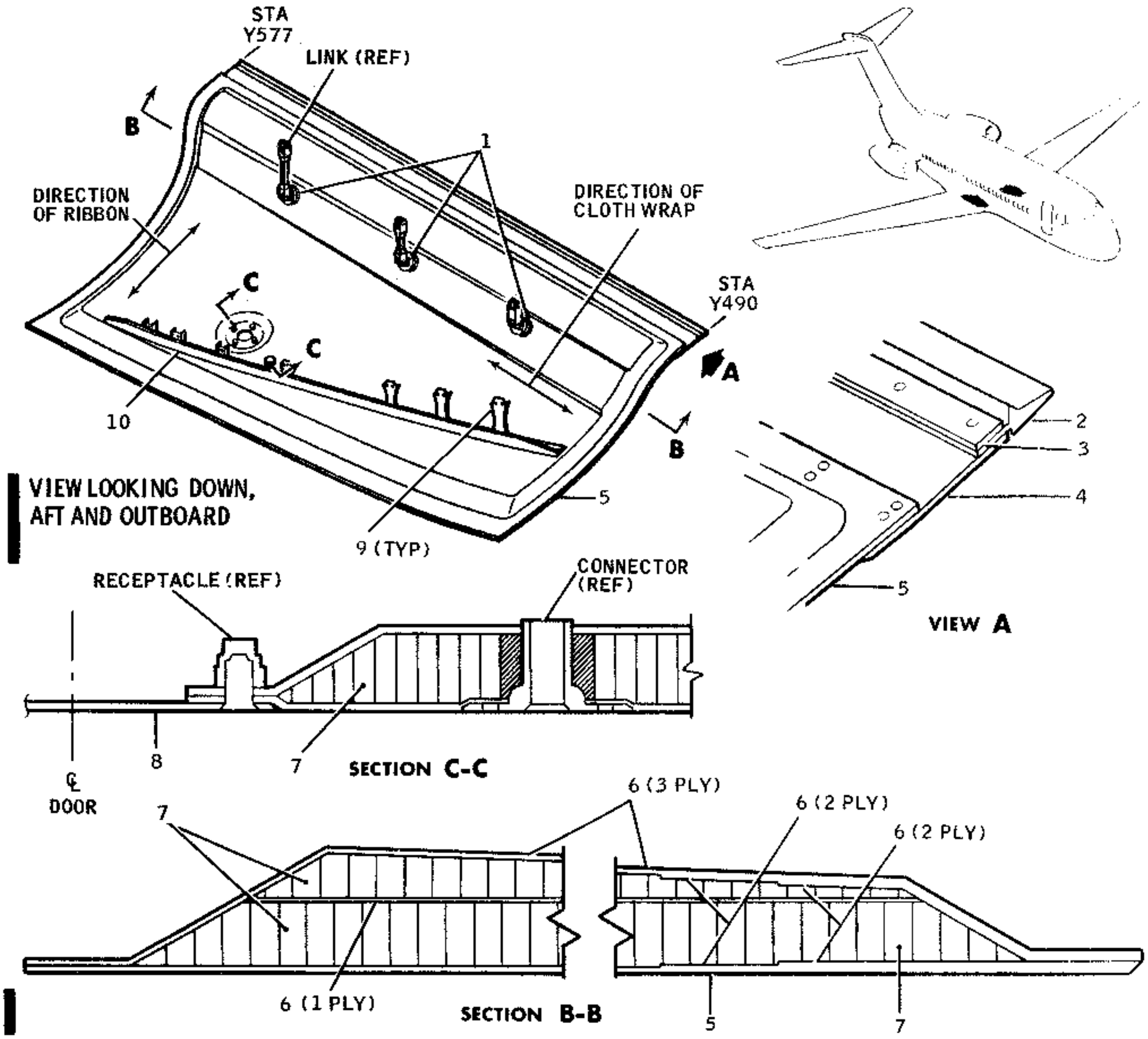


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPACER	.040	CLAD 2024-T3
2	SKIN	.040	CLAD 2024-T42
3	DOUBLER	.040	CLAD 2024-T3
4	BEAM	.040	CLAD 2024-T42
5	FORMER	.040	CLAD 2024-T42
6	Z-SECTION	.040	CLAD 2024-T42
7	SUPPORT ANGLE		CLAD 2024-T42
8	STIFFENER		1250422
9	RUB STRIP		2766959
10	T-CAP		1700632
11	FORMER	.050	CLAD 2024-T42
12	T-SECTION		1245835
13	CLIP		1245835
14	T-FORMER		2506195
15	FORMER	.063	2024-T42

REFERENCE - DOUGLAS DRAWING 5955913.

BB3-316

Upper Fillet
Figure 5



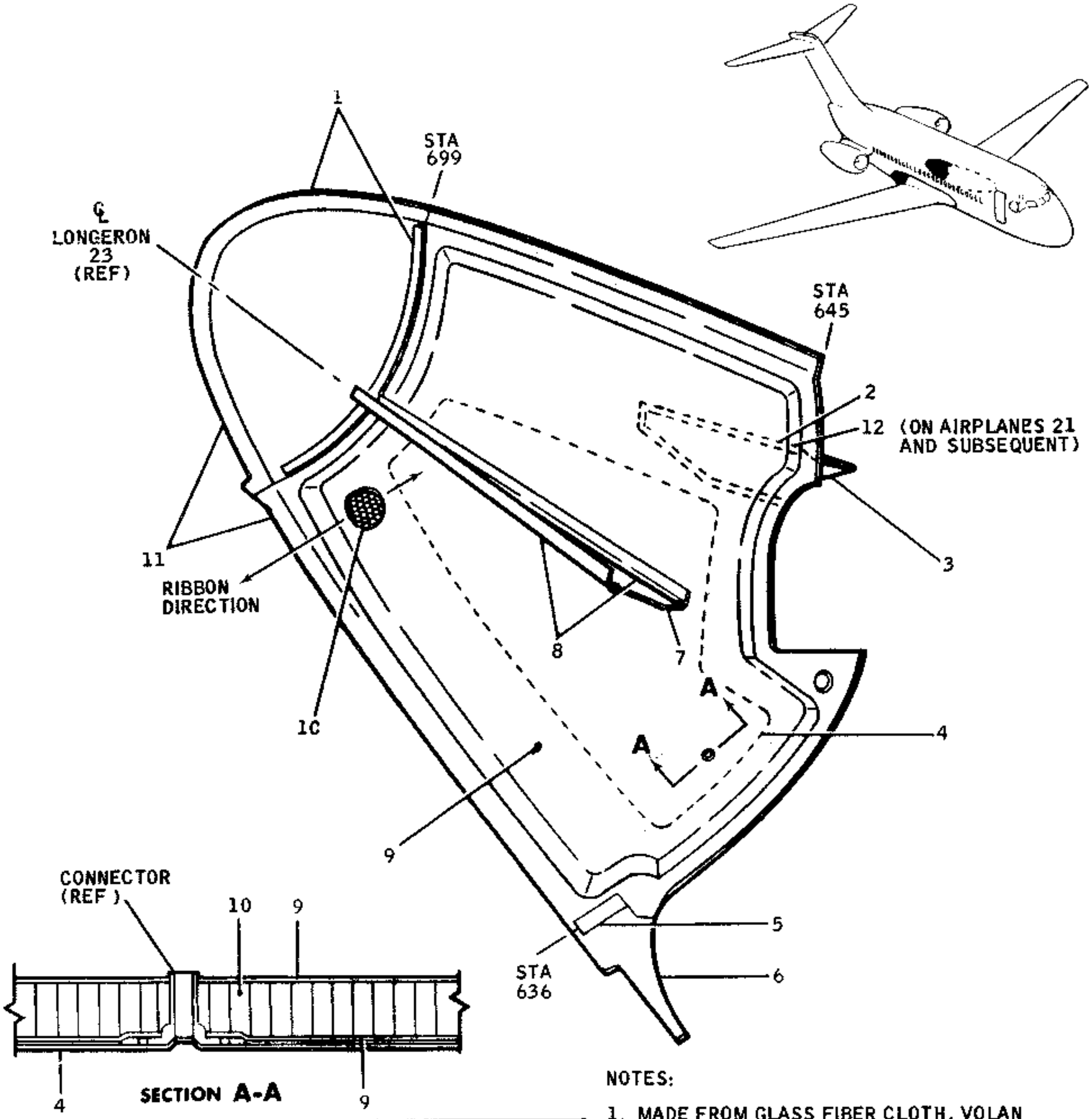
NOTES:

1. MADE FROM LAMINATED FIBER GLASS EPOXY, MIL-P-18177, TYPE GEE.
2. CLOTH IS MADE FROM GLASS FIBER VOLAN FINISH, MIL-C-9084, TYPE 8.
3. MADE FROM .812 AND .416 INCH NYLON PHENOLIC FABRIC, MIL-C-8073, CLASS 2, TYPE 2B, CLOTH COVERED (SEE NOTE 1).
4. MADE FROM .032 GAGE, 6061-T6 SHEET FOR AIRPLANES 1 THROUGH 48. MADE FROM SPRAYED ALUMINUM .008 TO .012 THICK FOR AIRPLANES 49 TO 80, AND IS .012 TO .016 THICK FOR AIRPLANES 81 AND SUBSEQUENT.
5. MADE FROM 6061-T6 SHEET FOR AIRPLANES 1-48. MADE FROM CLAD 2024-T3 FOR AIRPLANES 49 AND SUBSEQUENT.
6. REFERENCE - DOUGLAS DRAWINGS 5955914 AND 5914221.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAD	.125	(SEE NOTE 1)
2	STRIP		4923882
3	STRIP	.025	CLAD 6061-T6
4	STRIP	.063	CLAD 2014-T3
5	ANTENNA ELEMENT		(SEE NOTE 4)
6	CLOTH		(SEE NOTE 2)
7	HONEYCOMB		(SEE NOTE 3)
8	DOOR	.090	(SEE NOTE 5)
9	SUPPORT	.050	CLAD 2024-T42
10	ANGLE	.050	CLAD 2024-T42

BB3-3178

Lower Fillet and Forward ADF Antenna
Figure 6



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RUB STRIP	.040	CLAD 2024-T3
2	RUB STRIP		2766959
3	HORN		(SEE NOTE 1)
4	ANTENNA		(SEE NOTE 4)
5	SPLICE	.040	CLAD 2024-T3
6	RETAINER		(SEE NOTE 3)
7	INTERCOSTAL		(SEE NOTE 1)
8	ANGLE		(SEE NOTE 1)
9	CLOTH		(SEE NOTE 1)
10	HONEYCOMB		(SEE NOTE 2)
11	SKIN	.040	CLAD 2024-T42
12	STRIP	.062	PHENOLIC SHEET

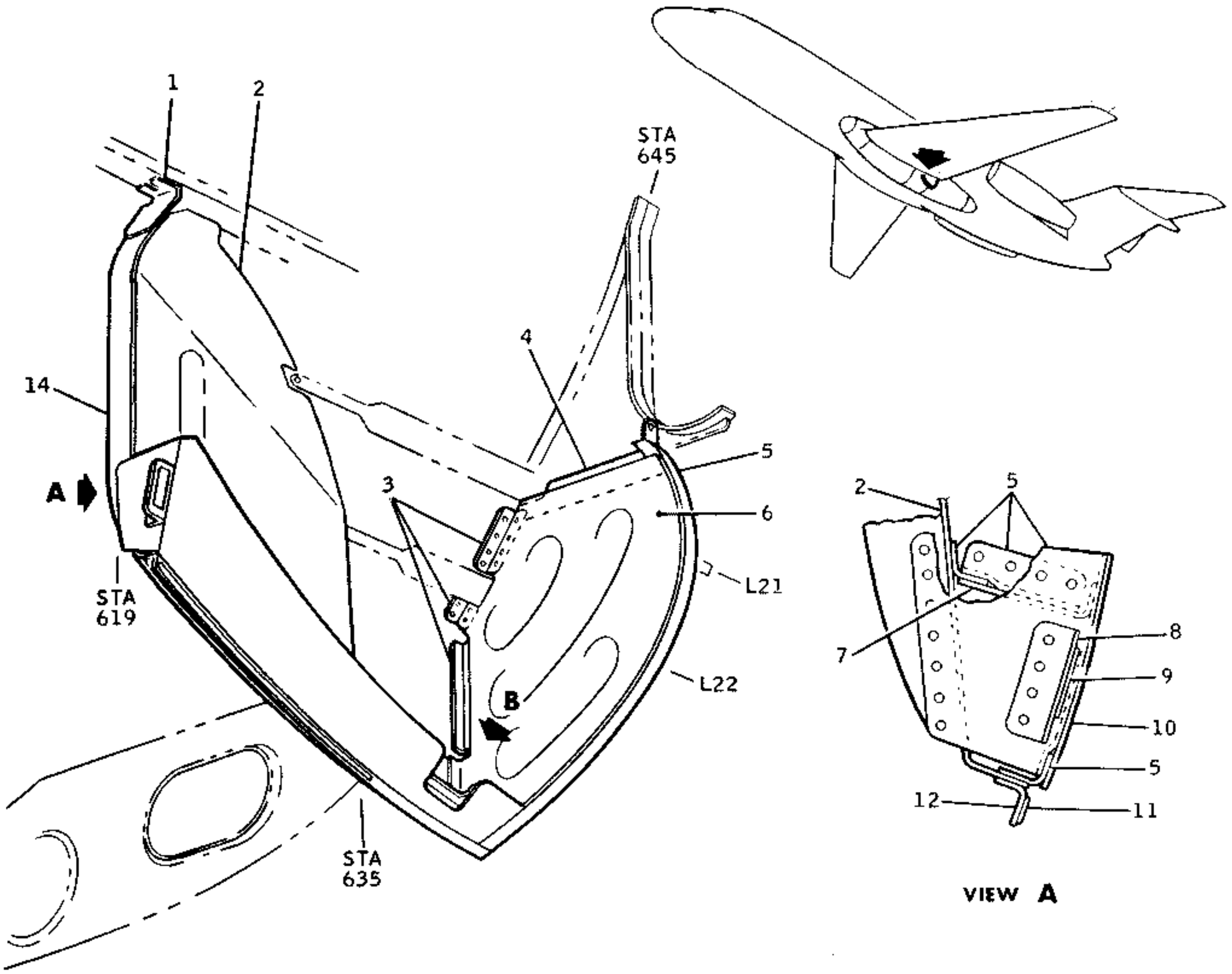
NOTES:

1. MADE FROM GLASS FIBER CLOTH, VOLAN FINISH, MIL-C-9084, TYPE 8.
2. MADE FROM .500-INCH NYLON PHENOLIC FABRIC HONEYCOMB, MIL-C-8073, CLASS 2, TYPE 28, CLOTH COVERED (SEE NOTE 1)
3. MADE FROM LAMINATED FIBERITE FM-3510, OR EQUIVALENT. (FIBERITE CORP., WINONA, MINN.)
4. MADE FROM .025 GAGE, 6061-T6 SHEET FOR AIRPLANES 1 THROUGH 20. MADE FROM SPRAYED ALUMINUM .008 TO .012 THICK FOR AIRPLANES 21 THROUGH 55, AND IS .012 TO .016 THICK FOR AIRPLANES 56 AND SUBSEQUENT.
5. REFERENCE - DOUGLAS DRAWINGS 5955915, 5955854, AND 5914222.

BB3-318A

Aft Fillet, Aft ADF Antenna, and Horn
Figure 7

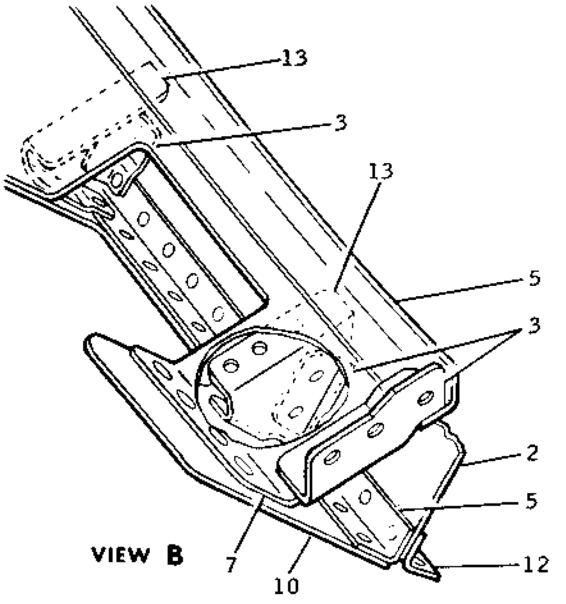
Printed in U.S.A.



NOTES:

1. MADE FROM CRES SHEET, MIL-S-5059, COND A, COMP 302, NO. 2D FINISH.
2. REFERENCE - DOUGLAS DRAWING 5955911.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLIP	.090	CLAD 2024-T42
2	WEB	.040	CLAD 2024-T42
3	CLIP	.050	CLAD 2024-T42
4	ANGLE	.040	CLAD 2024-T42
5	ANGLE	.050	CLAD 2024-T42
6	CLOSING PANEL	.050	CLAD 2024-T42
7	INTERCOSTAL	.050	CLAD 2024-T42
8	ANGLE	.063	CLAD 2024-T42
9	STRIP	.032	(SEE NOTE 1)
10	SKIN	.050	CLAD 2024-T42
11	RUB STRIP	.032	(SEE NOTE 1)
12	DOOR JAMB	.090	CLAD 7075-T6
13	BULKHEAD	.050	CLAD 2024-T42
14	FORMER	.050	CLAD 2024-T42



Fillet and Antenna Support
Figure 8

CONES, FILLETS, AND FAIRINGS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

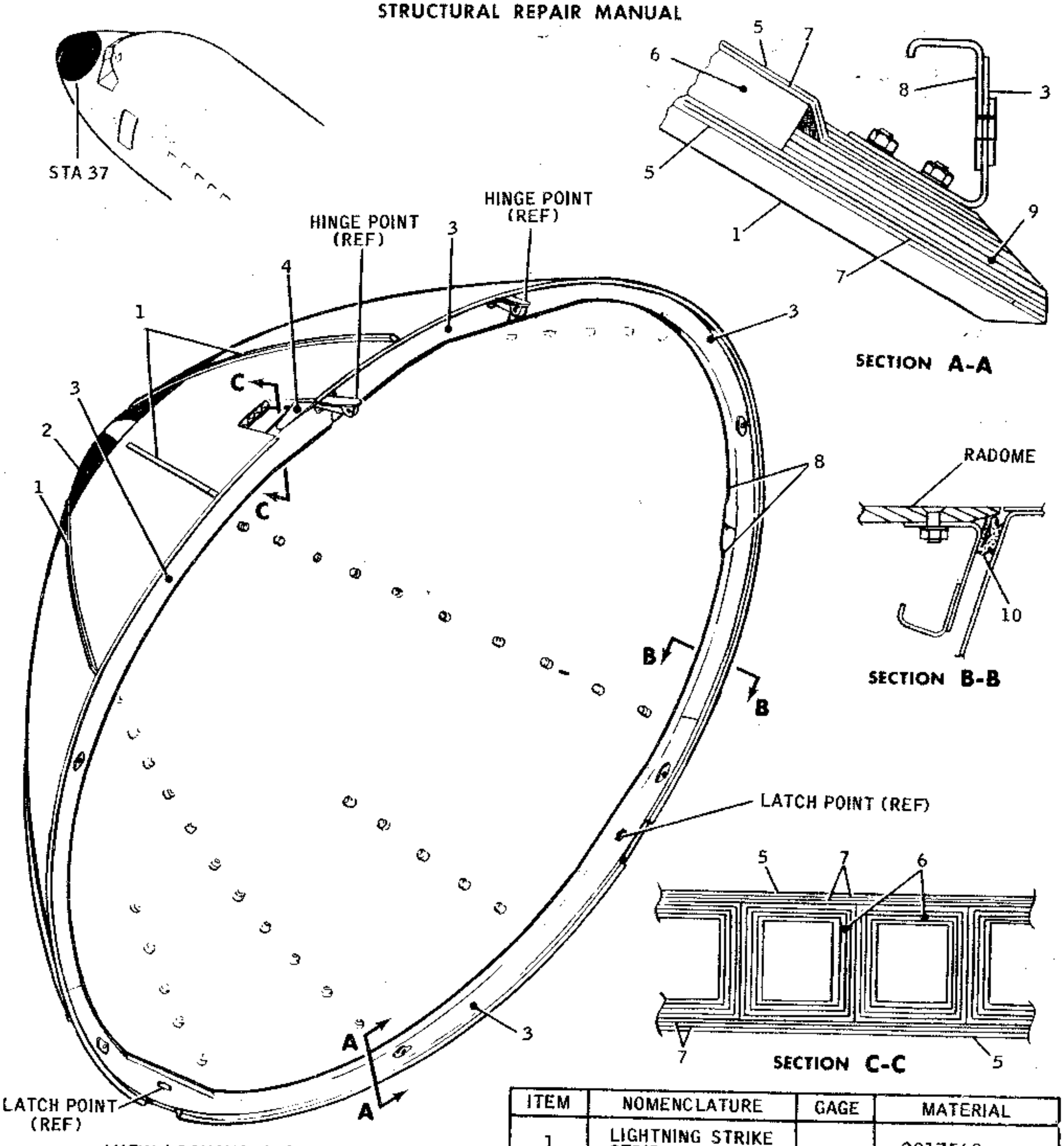
A. The following figures illustrate the construction of the radome, tail cone, wing-to-fuselage fillets and fairings. The materials used are identified by the item number callouts.

2. Repair Index

A. A list of components and the applicable repairs which may be used to restore the integrity and appearance is presented as follows:

Components	Applicable Repairs
Radome, Tail Cone, and ADF Antenna Panels in Fillets	Section 51-70-1
Wing-to-Fuselage Fillets	Section 53-01

ADF Antenna (Metal Element only) Section 53-50 Figure 12



NOTES:

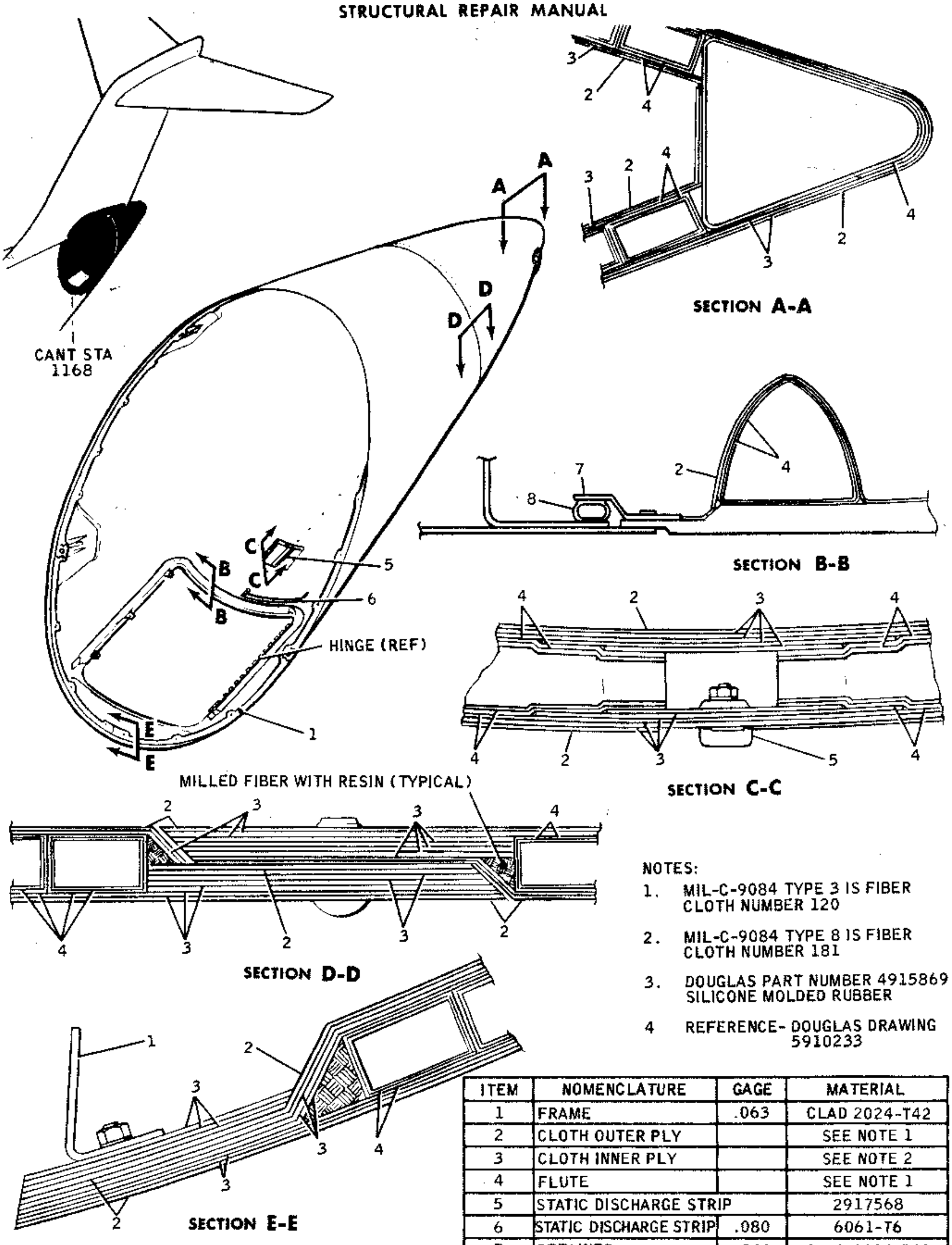
1. MIL-C-9084 TYPE 3 IS GLASS FIBER CLOTH NUMBER 120
2. MIL-C-9084 TYPE 8 IS GLASS FIBER CLOTH NUMBER 181
3. MIL-C-9084 TYPE 11 IS GLASS FIBER CLOTH NUMBER 184
4. SEE MAINTENANCE MANUAL FOR LIGHTNING STRIKE STRIP AND EROSION BOOT INSTALLATION PROCEDURES.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LIGHTNING STRIKE STRIP		2917568
2	EROSION BOOT		7915076-1
3	CHANNEL	.050	CLAD 7075-T6
4	PLATE	.090	CLAD 7075-T6
5	CLOTH OUTER PLY		SEE NOTE 2
6	FLUTE		SEE NOTE 1
7	CLOTH INNER PLY		SEE NOTE 1
8	ANGLE	.071	CLAD 7075-T6
9	CLOTH		SEE NOTE 3
10	RADOME SEAL		4913109-1

REFERENCE - DOUGLAS DRAWING 5910091

BB3-95

Fuselage Nose Radome, Laminated Glass Fiber -- Type A
Figure 1



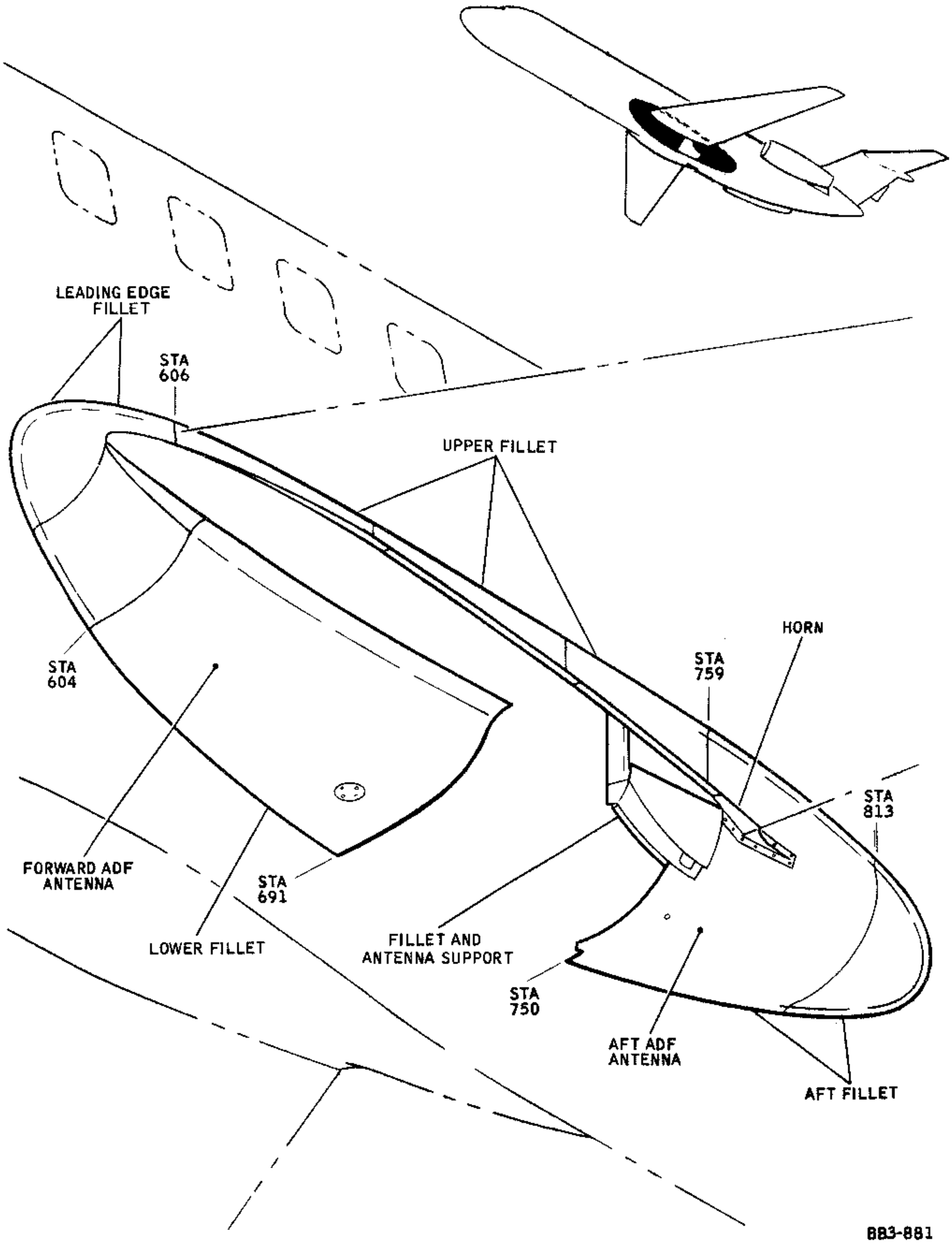
NOTES:

1. MIL-C-9084 TYPE 3 IS FIBER CLOTH NUMBER 120
2. MIL-C-9084 TYPE 8 IS FIBER CLOTH NUMBER 181
3. DOUGLAS PART NUMBER 4915869 SILICONE MOLDED RUBBER
4. REFERENCE- DOUGLAS DRAWING 5910233

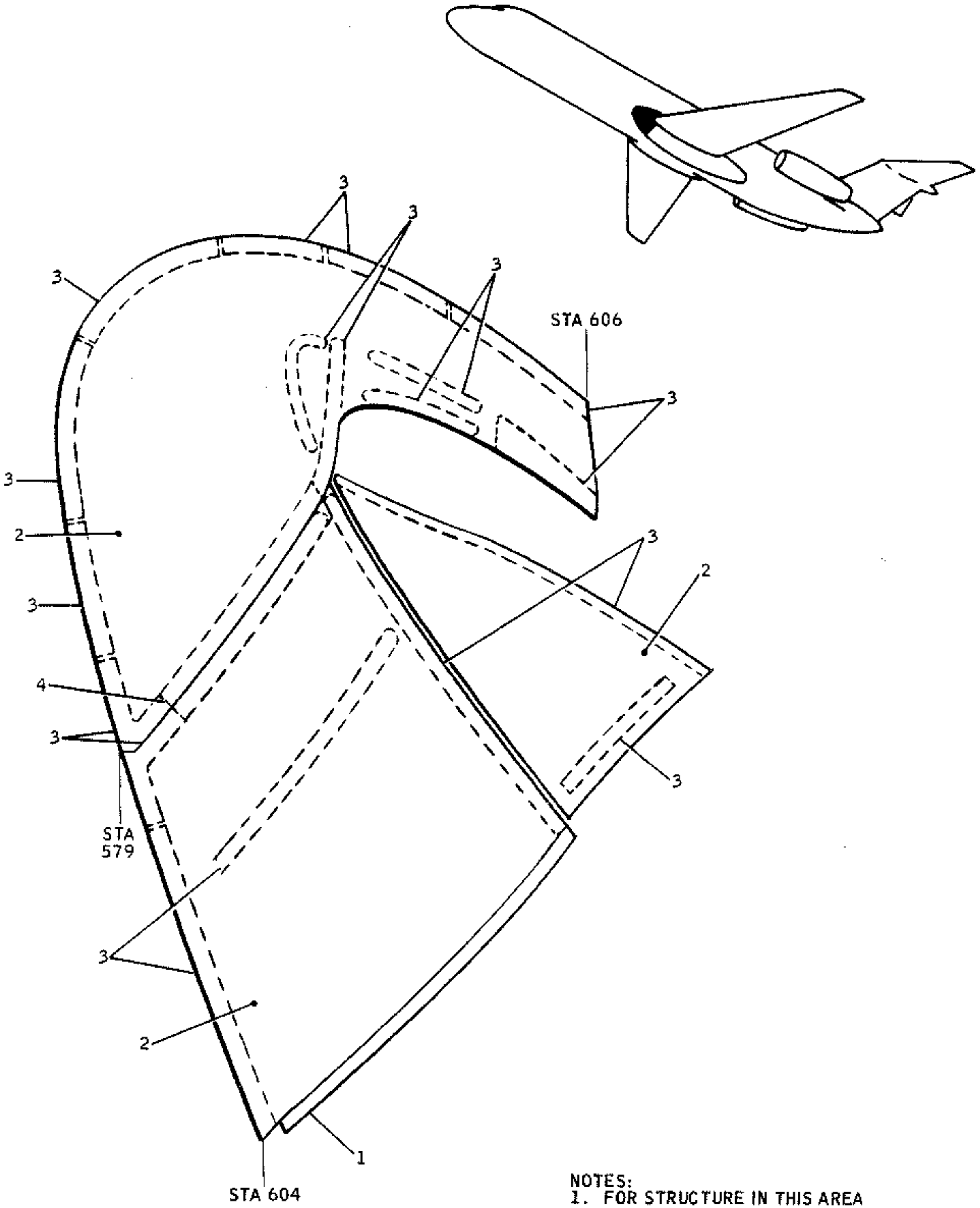
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FRAME	.063	CLAD 2024-T42
2	CLOTH OUTER PLY		SEE NOTE 1
3	CLOTH INNER PLY		SEE NOTE 2
4	FLUTE		SEE NOTE 1
5	STATIC DISCHARGE STRIP		2917568
6	STATIC DISCHARGE STRIP	.080	6061-T6
7	RETAINER	.040	CLAD 2024-T42
8	SEAL		SEE NOTE 3

BB3-888

Fuselage Tail Cone, Laminated Glass Fiber -- Type A
Figure 2



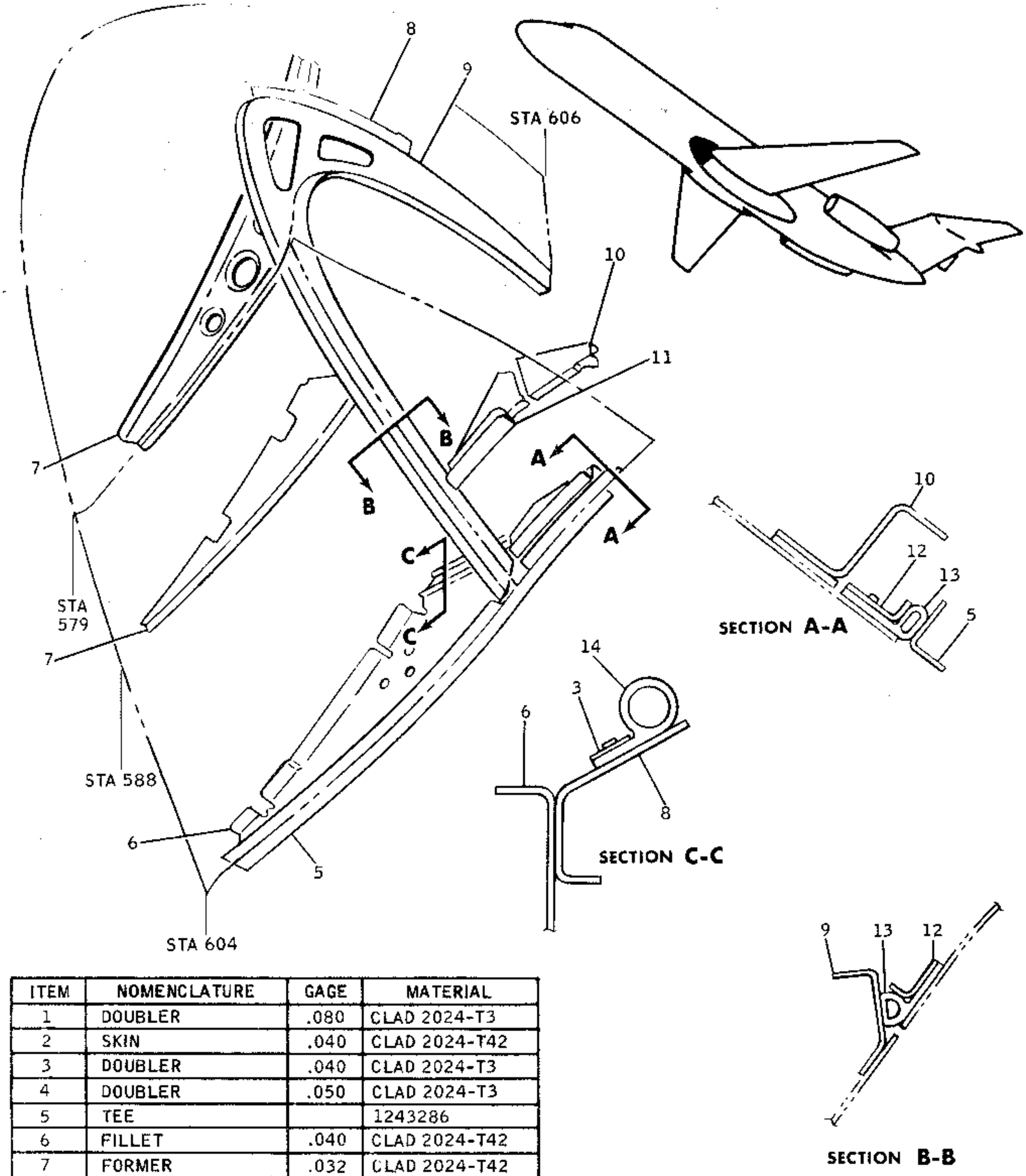
Wing-to-Fuselage Fillet, Key Illustration -- Type A
Figure 3



NOTES:
1. FOR STRUCTURE IN THIS AREA AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE-DOUGLAS DRAWING 5910066

BB3-882

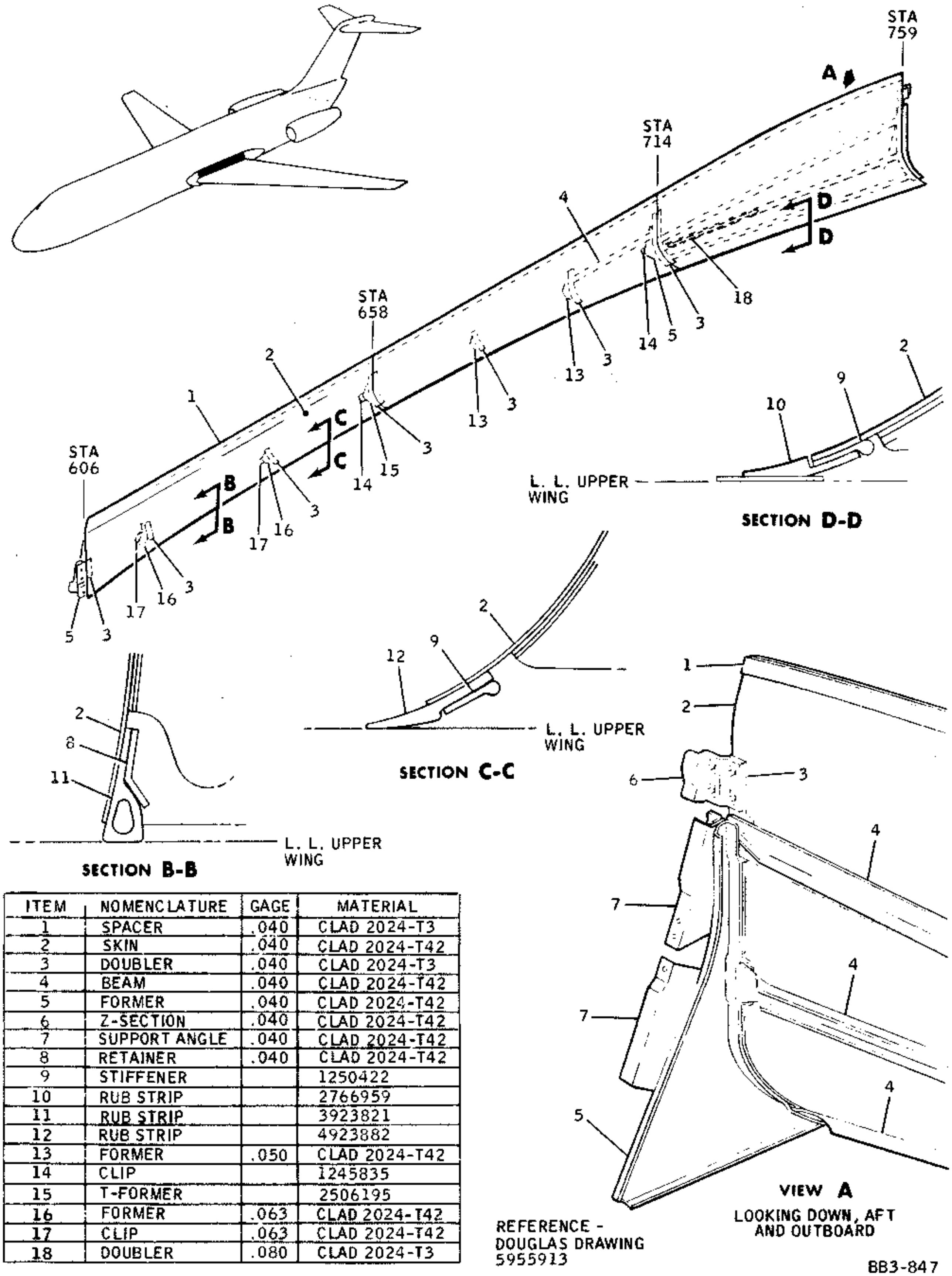
Leading Edge Fillet -- Type A
Figure 4 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.080	CLAD 2024-T3
2	SKIN	.040	CLAD 2024-T42
3	DOUBLER	.040	CLAD 2024-T3
4	DOUBLER	.050	CLAD 2024-T3
5	TEE		1243286
6	FILLET	.040	CLAD 2024-T42
7	FORMER	.032	CLAD 2024-T42
8	ANGLE	.050	CLAD 2024-T42
9	FORMER	.050	CLAD 2024-T42
10	FORMER	.063	CLAD 2024-T42
11	FORMER	.063	CLAD 2024-T42
12	RETAINER	.040	CLAD 2024-T42
13	RUB STRIP		1410055
14	RUB STRIP		4914344

BB3-883

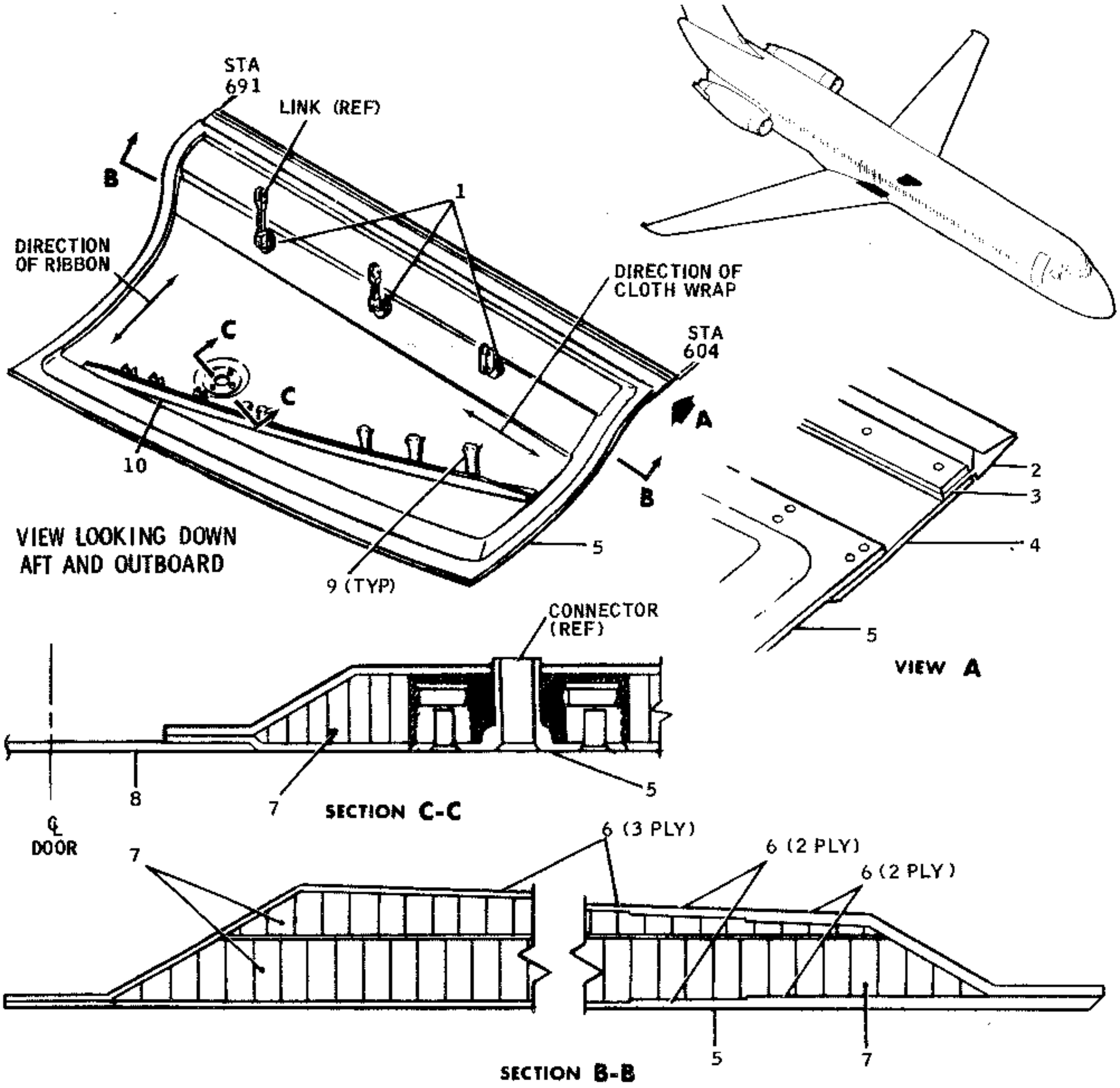
Leading Edge Fillet -- Type A
Figure 4 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPACER	.040	CLAD 2024-T3
2	SKIN	.040	CLAD 2024-T42
3	DOUBLER	.040	CLAD 2024-T3
4	BEAM	.040	CLAD 2024-T42
5	FORMER	.040	CLAD 2024-T42
6	Z-SECTION	.040	CLAD 2024-T42
7	SUPPORT ANGLE	.040	CLAD 2024-T42
8	RETAINER	.040	CLAD 2024-T42
9	STIFFENER		1250422
10	RUB STRIP		2766959
11	RUB STRIP		3923821
12	RUB STRIP		4923882
13	FORMER	.050	CLAD 2024-T42
14	CLIP		1245835
15	T-FORMER		2506195
16	FORMER	.063	CLAD 2024-T42
17	CLIP	.063	CLAD 2024-T42
18	DOUBLER	.080	CLAD 2024-T3

Upper Fillet -- Type A
Figure 5

Printed in U.S.A.



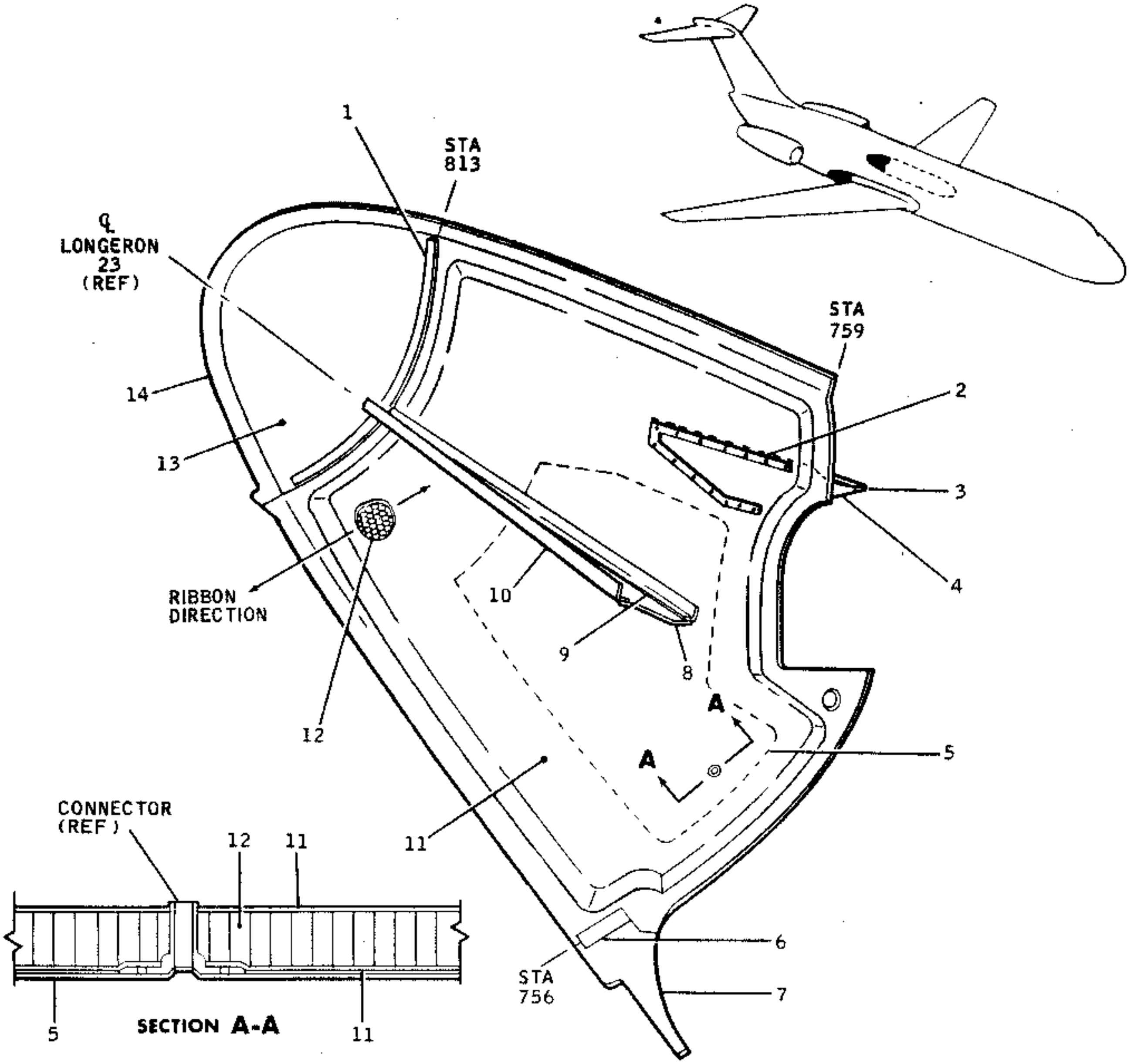
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAD	.125	SEE NOTE 1
2	RUB STRIP		4923882
3	STRIP	.025	CLAD 6061-T6
4	STRIP	.063	CLAD 2014-T6
5	ANTENNA ELEMENT		SEE NOTE 4
6	CLOTH		(SEE NOTE 2)
7	HONEYCOMB		(SEE NOTE 3)
8	DOOR	.090	6061-T6
9	SUPPORT	.050	CLAD 2024-T42
10	ANGLE	.050	CLAD 2024-T42

NOTES:

1. MADE FROM LAMINATED FIBER GLASS EPOXY, MIL-P-18177, TYPE GEE.
2. CLOTH IS MADE FROM GLASS FIBER VOLAN FINISH, MIL-C-9084, TYPE 8.
3. MADE FROM .812 AND .416 INCH NYLON PHENOLIC FABRIC, MIL-C-8073, CLASS 2, TYPE 2B.
4. METAL SPRAYED ALUMINUM ELEMENT .012 TO .016 THICK.
5. REFERENCE DOUGLAS DRAWINGS 5955914 AND 5914221.

BB3-981

Lower Fillet and Forward ADF Antenna -- Type A
Figure 6



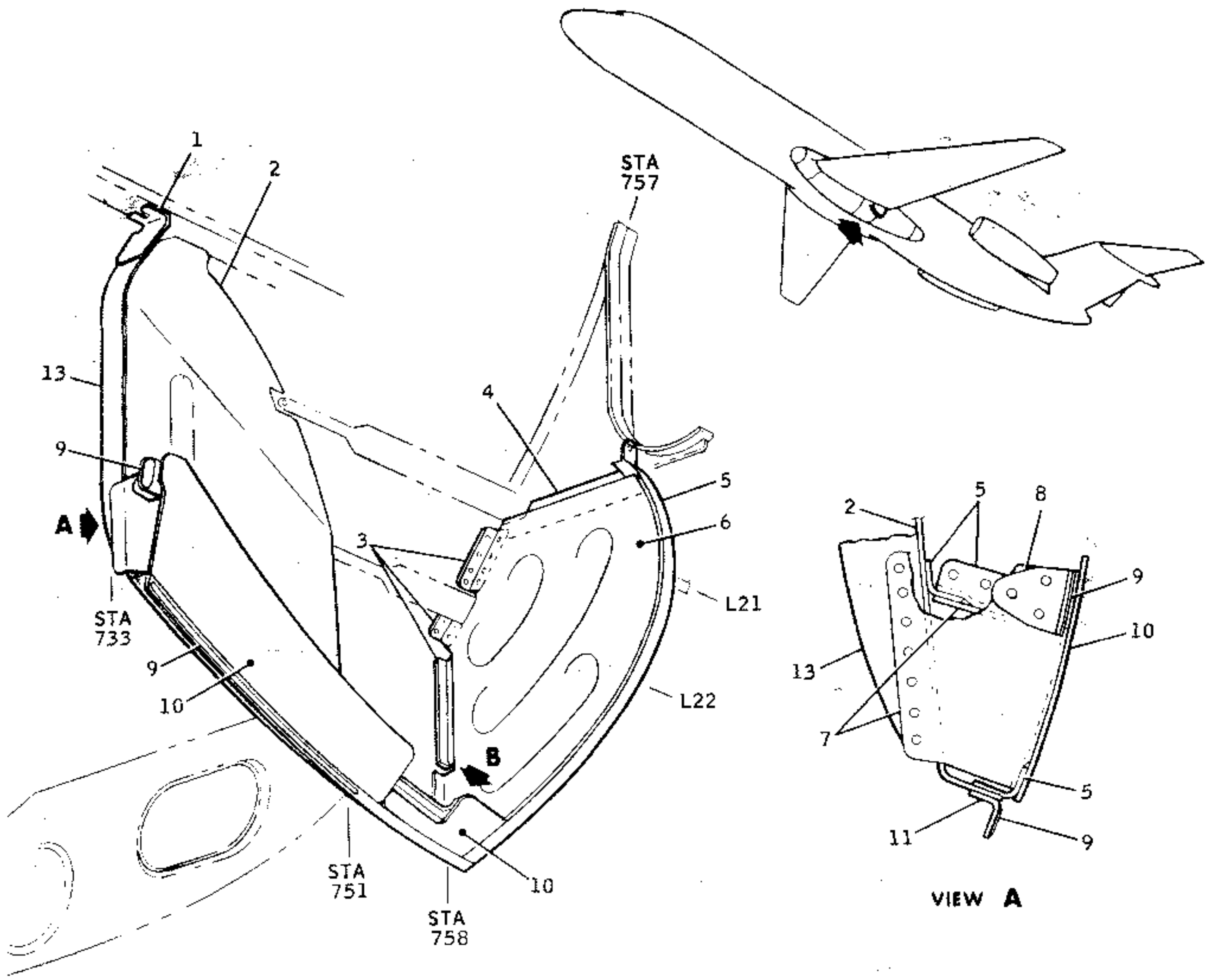
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.040	CLAD 2024-T3
2	STRIP, .050 SHEET PHENOLIC, PF AMS1		
3	RUB STRIP		2766959
4	HORN		(SEE NOTE 1)
5	ANTENNA, .008 TO .062 METAL SPRAY ALUMINUM		
6	SPLICE	.040	CLAD 2024-T3
7	RETAINER		(SEE NOTE 3)
8	INTERCOSTAL		(SEE NOTE 1)
9	ANGLE		(SEE NOTE 1)
10	ANGLE	.050	CLAD 2024-T3
11	CLOTH		(SEE NOTE 1)
12	HONEYCOMB	.500	(SEE NOTE 2)
13	SKIN	.040	CLAD 2024-T42
14	DOUBLER	.040	CLAD 2024-T42

NOTES:

1. MADE FROM GLASS FIBER CLOTH VOLAN FINISH, MIL-C-9084, TYPE 8.
2. MADE FROM .500-INCH NYLON PHENOLIC FABRIC HONEYCOMB, MIL-C-8073, CLASS 2,TYPE 2B, CLOTH COVERED (SEE NOTE 1).
3. MADE FROM LAMINATED FIBERITE FM-3510, OR EQUIVALENT. (FIBERITE CORP., WINONA, MINN.)
4. REFERENCE- DOUGLAS DRAWINGS 5955915, 5955854, AND 5914222.

BB3-886

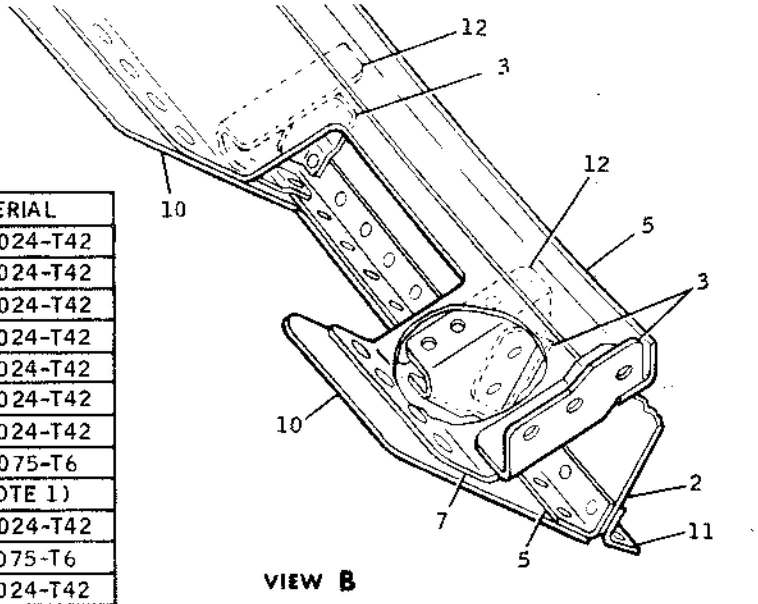
Aft Fillet, Aft ADF Antenna, and Horn -- Type A
Figure 7



NOTES:

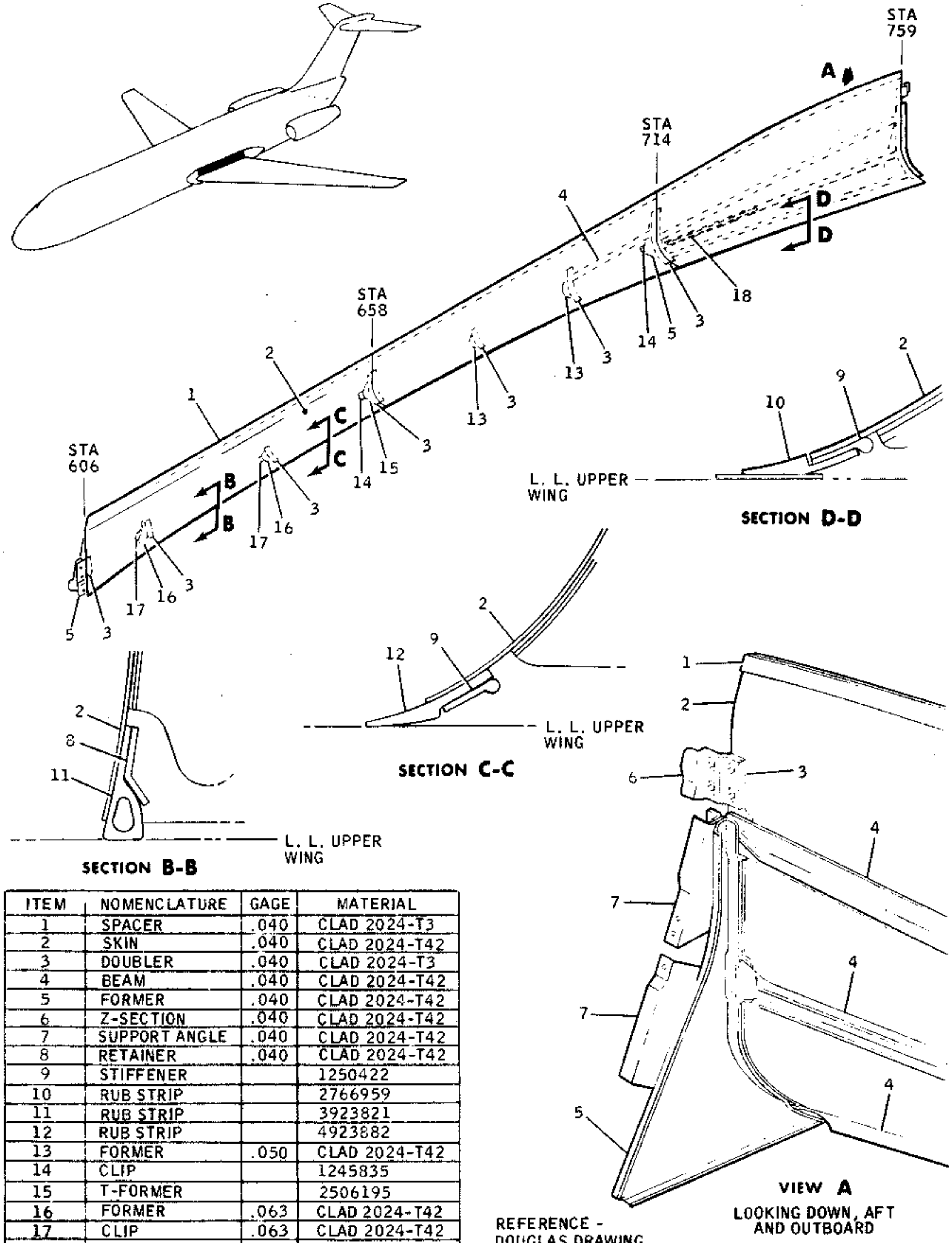
1. MADE FROM CRES SHEET, MIL-S-5059, COND A, COMP 302, NO. 2D FINISH.
2. REFERENCE - DOUGLAS DRAWING 5955911.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLIP	.090	CLAD 2024-T42
2	WEB	.040	CLAD 2024-T42
3	CLIP	.050	CLAD 2024-T42
4	ANGLE	.040	CLAD 2024-T42
5	ANGLE	.050	CLAD 2024-T42
6	CLOSING PANEL	.050	CLAD 2024-T42
7	INTERCOSTAL	.050	CLAD 2024-T42
8	ANGLE	.090	CLAD 7075-T6
9	RUB STRIP	.032	(SEE NOTE 1)
10	SKIN	.050	CLAD 2024-T42
11	DOOR JAMB	.090	CLAD 7075-T6
12	BULKHEAD	.050	CLAD 2024-T42
13	FORMER	.063	CLAD 2024-T42



BB3-879

Fillet and Antenna Support -- Type A
Figure 8

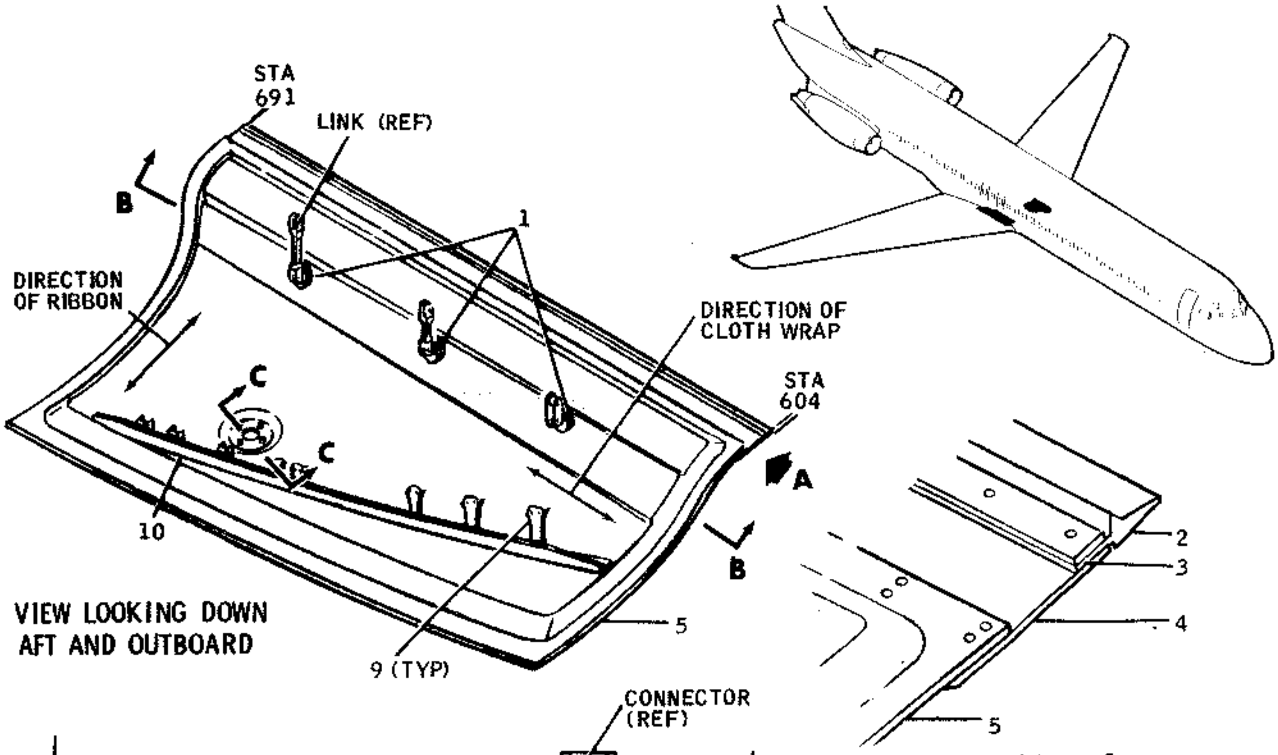


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPACER	.040	CLAD 2024-T3
2	SKIN	.040	CLAD 2024-T42
3	DOUBLER	.040	CLAD 2024-T3
4	BEAM	.040	CLAD 2024-T42
5	FORMER	.040	CLAD 2024-T42
6	Z-SECTION	.040	CLAD 2024-T42
7	SUPPORT ANGLE	.040	CLAD 2024-T42
8	RETAINER	.040	CLAD 2024-T42
9	STIFFENER		1250422
10	RUB STRIP		2766959
11	RUB STRIP		3923821
12	RUB STRIP		4923882
13	FORMER	.050	CLAD 2024-T42
14	CLIP		1245835
15	T-FORMER		2506195
16	FORMER	.063	CLAD 2024-T42
17	CLIP	.063	CLAD 2024-T42
18	DOUBLER	.080	CLAD 2024-T3

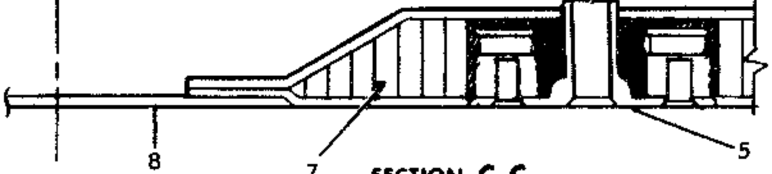
REFERENCE -
DOUGLAS DRAWING
5955913

BB3-847

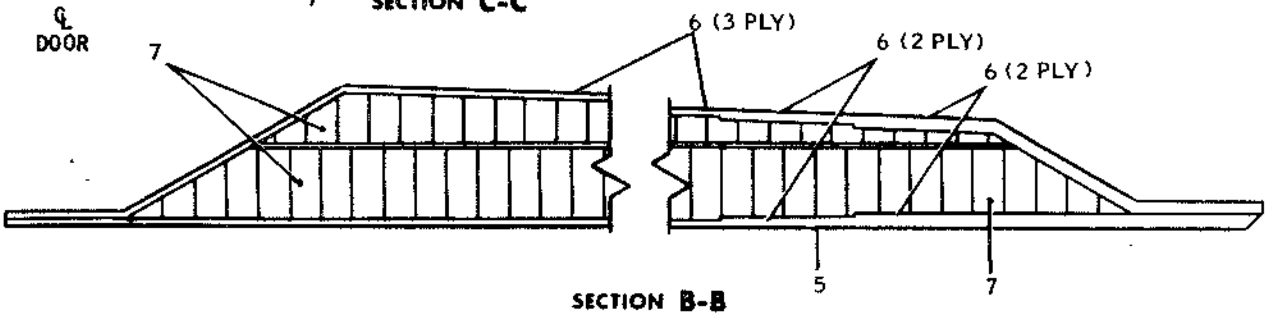
Upper Fillet -- Type A
Figure 5



VIEW A



SECTION C-C



SECTION B-B

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PAD	.125	SEE NOTE 1
2	RUB STRIP		4923882
3	STRIP	.025	CLAD 6061-T6
4	STRIP	.063	CLAD 2014-T6
5	ANTENNA ELEMENT		SEE NOTE 4
6	CLOTH		(SEE NOTE 2)
7	HONEYCOMB		(SEE NOTE 3)
8	DOOR	.090	6061-T6
9	SUPPORT	.050	CLAD 2024-T42
10	ANGLE	.050	CLAD 2024-T42

NOTES:

1. MADE FROM LAMINATED FIBER GLASS EPOXY, MIL-P-18177, TYPE GEE.
2. CLOTH IS MADE FROM GLASS FIBER VOLAN FINISH, MIL-C-9084, TYPE 8.
3. MADE FROM .812 AND .416 INCH NYLON PHENOLIC FABRIC, MIL-C-8073, CLASS 2, TYPE 2B.
4. METAL SPRAYED ALUMINUM ELEMENT .012 TO .016 THICK.
5. REFERENCE DOUGLAS DRAWINGS 5955914 AND 5914221.

8B3-981

Lower Fillet and Forward ADF Antenna -- Type A
Figure 6

TABLE OF CONTENTS

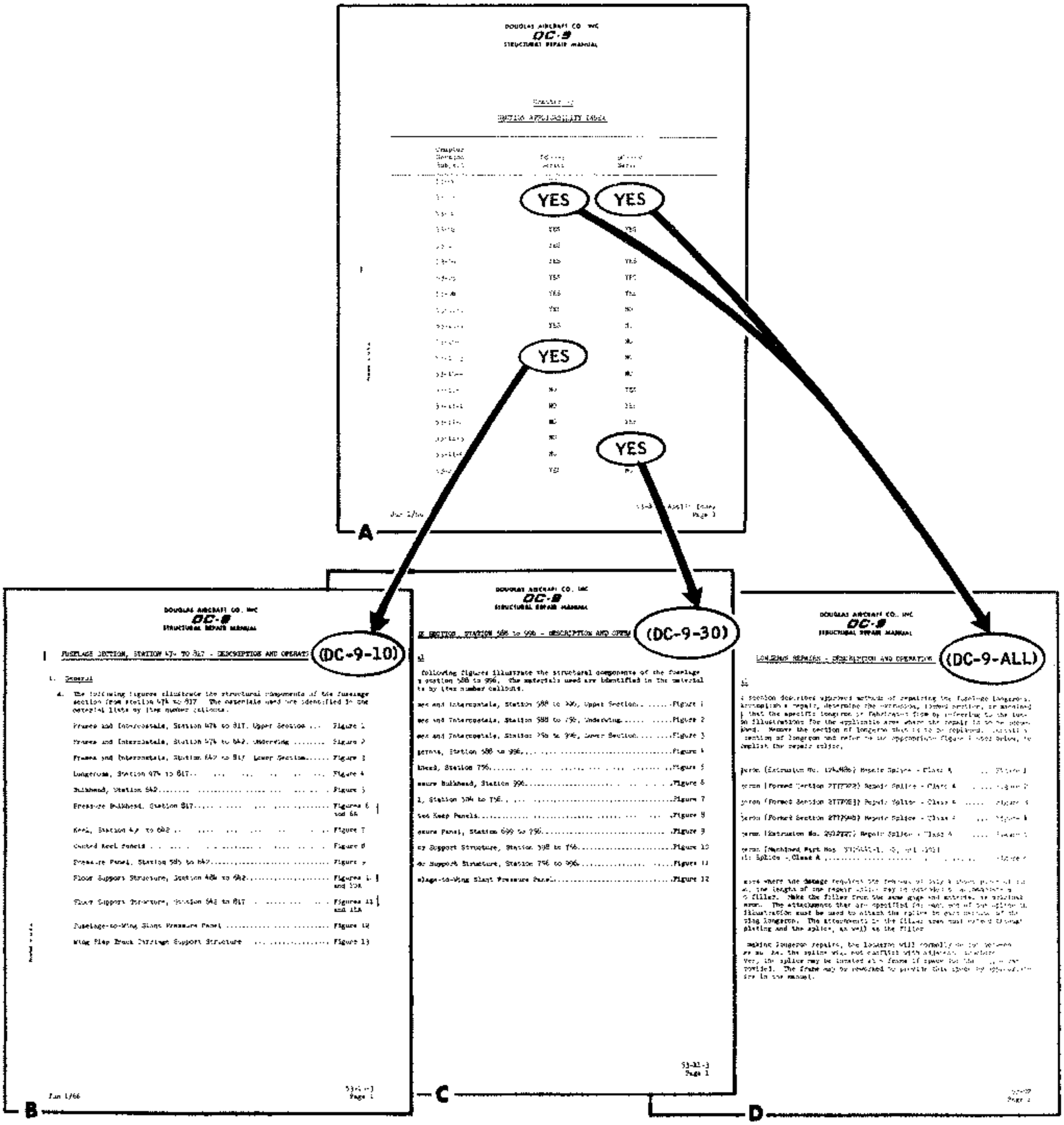
Printed in U.S.A.

ALPHABETICAL INDEX

TEMPORARY REVISION INTRO-1

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following Introduction page iv. Retain this Temporary Revision until the Dec 1/66 revision to the Structural Repair Manual incorporates this information.
DESCRIPTION AND REASON:	Provides a set of How to Use the Manual pages to explain the use of the section applicability index, type designations, airplane identification list, and alphabetical index.
EFFECTIVITY:	All

HOW TO USE THE MANUAL - -
APPLICABILITY OF SECTIONS TO AIRPLANE SERIES



A THE SECTION APPLICABILITY INDEX AT THE BEGINNING OF EACH CHAPTER LISTS EVERY SECTION WITHIN THE CHAPTER. "YES" OR "NO" AFTER EACH SECTION LISTING INDICATES WHETHER THE SECTION APPLIES TO DC-9-10 SERIES AIRPLANES, TO DC-9-30 SERIES AIRPLANES, OR TO BOTH.

B SECTIONS THAT PERTAIN TO ONLY DC-9-10 SERIES AIRPLANES HAVE (DC-9-10) IN THEIR SECTION TITLES.

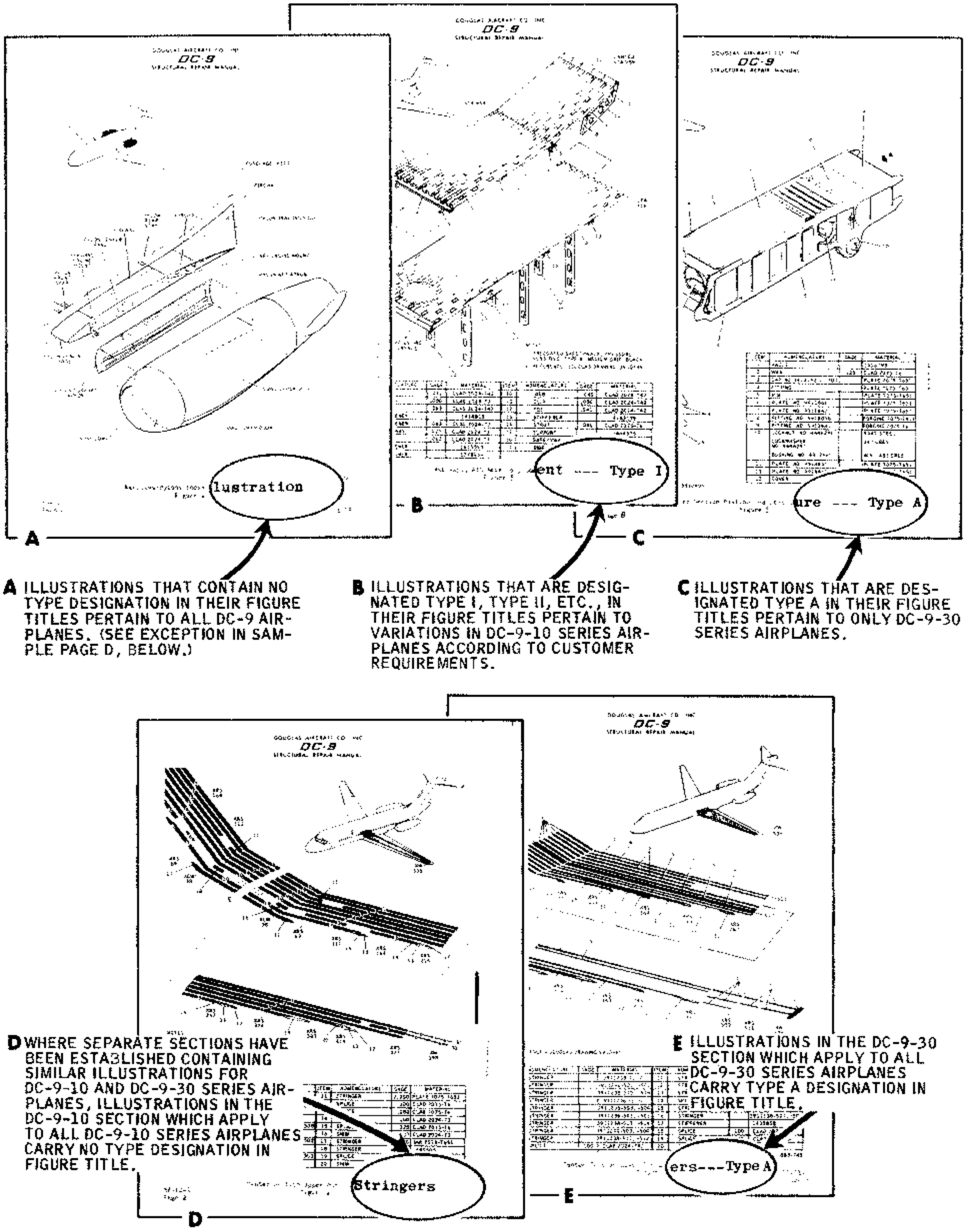
C SECTIONS THAT PERTAIN TO ONLY DC-9-30 SERIES AIRPLANES HAVE (DC-9-30) IN THEIR SECTION TITLES.

D SECTIONS THAT PERTAIN TO ALL DC-9 AIRPLANES (ANY SERIES) HAVE (DC-9-ALL) IN THEIR SECTION TITLES.

BB3-964

How to Use the Manual
Figure 1 (Sheet 1)

HOW TO USE THE MANUAL-- AIRPLANE SERIES AND TYPE DESIGNATIONS IN ILLUSTRATIONS



A ILLUSTRATIONS THAT CONTAIN NO TYPE DESIGNATION IN THEIR FIGURE TITLES PERTAIN TO ALL DC-9 AIRPLANES. (SEE EXCEPTION IN SAMPLE PAGE D, BELOW.)

B ILLUSTRATIONS THAT ARE DESIGNATED TYPE I, TYPE II, ETC., IN THEIR FIGURE TITLES PERTAIN TO VARIATIONS IN DC-9-10 SERIES AIRPLANES ACCORDING TO CUSTOMER REQUIREMENTS.

C ILLUSTRATIONS THAT ARE DESIGNATED TYPE A IN THEIR FIGURE TITLES PERTAIN TO ONLY DC-9-30 SERIES AIRPLANES.

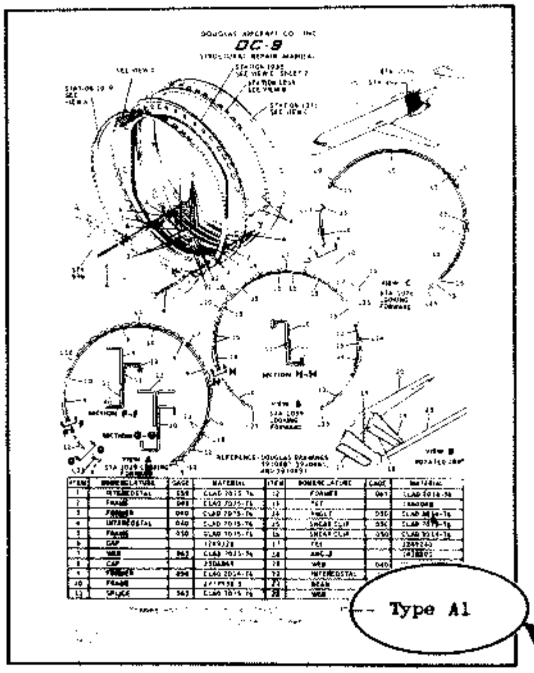
D WHERE SEPARATE SECTIONS HAVE BEEN ESTABLISHED CONTAINING SIMILAR ILLUSTRATIONS FOR DC-9-10 AND DC-9-30 SERIES AIRPLANES, ILLUSTRATIONS IN THE DC-9-10 SECTION WHICH APPLY TO ALL DC-9-10 SERIES AIRPLANES CARRY NO TYPE DESIGNATION IN FIGURE TITLE.

E ILLUSTRATIONS IN THE DC-9-30 SECTION WHICH APPLY TO ALL DC-9-30 SERIES AIRPLANES CARRY TYPE A DESIGNATION IN FIGURE TITLE.

BB3-967

How to Use the Manual
Figure 1 (Sheet 2)

HOW TO USE THE MANUAL--
AIRPLANE SERIES AND TYPE DESIGNATIONS IN ILLUSTRATIONS (CONT.)



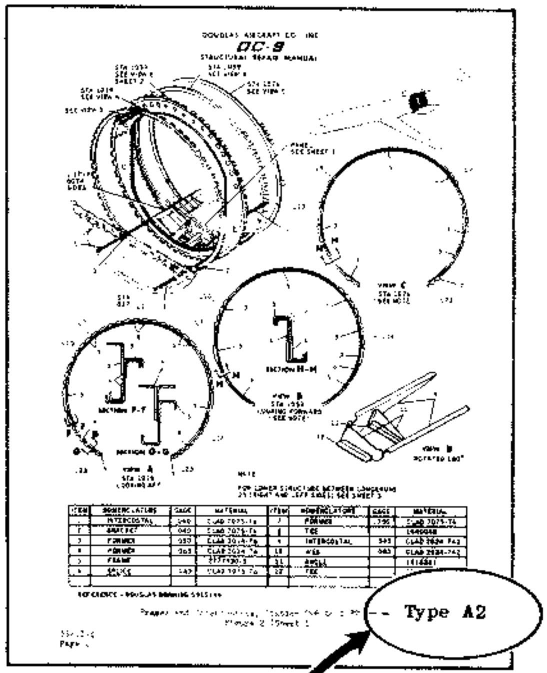
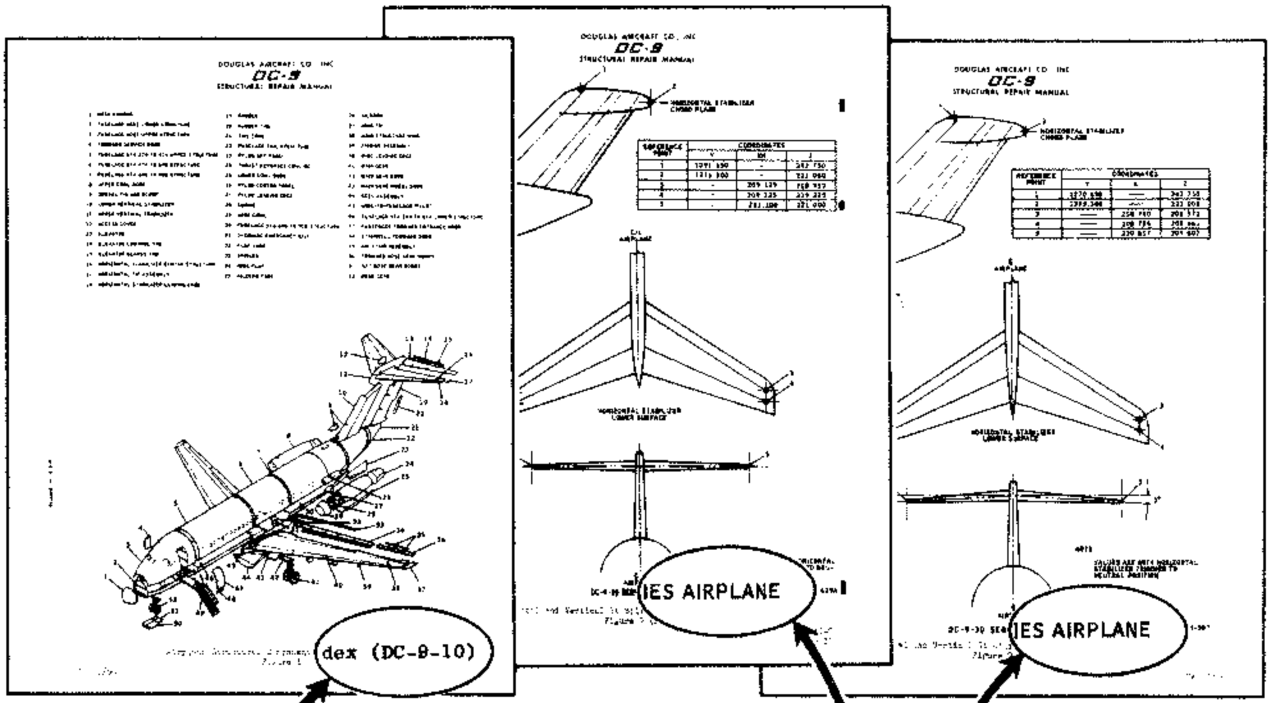


FIGURE TITLES CONTAINING TYPE A1, TYPE A2, ETC., DESIGNATIONS INDICATE VARIATIONS IN DC-9-30 SERIES AIRPLANES ACCORDING TO CUSTOMER REQUIREMENTS.



EXAMPLE OF AIRPLANE SERIES INDICATED IN FIGURE TITLE.

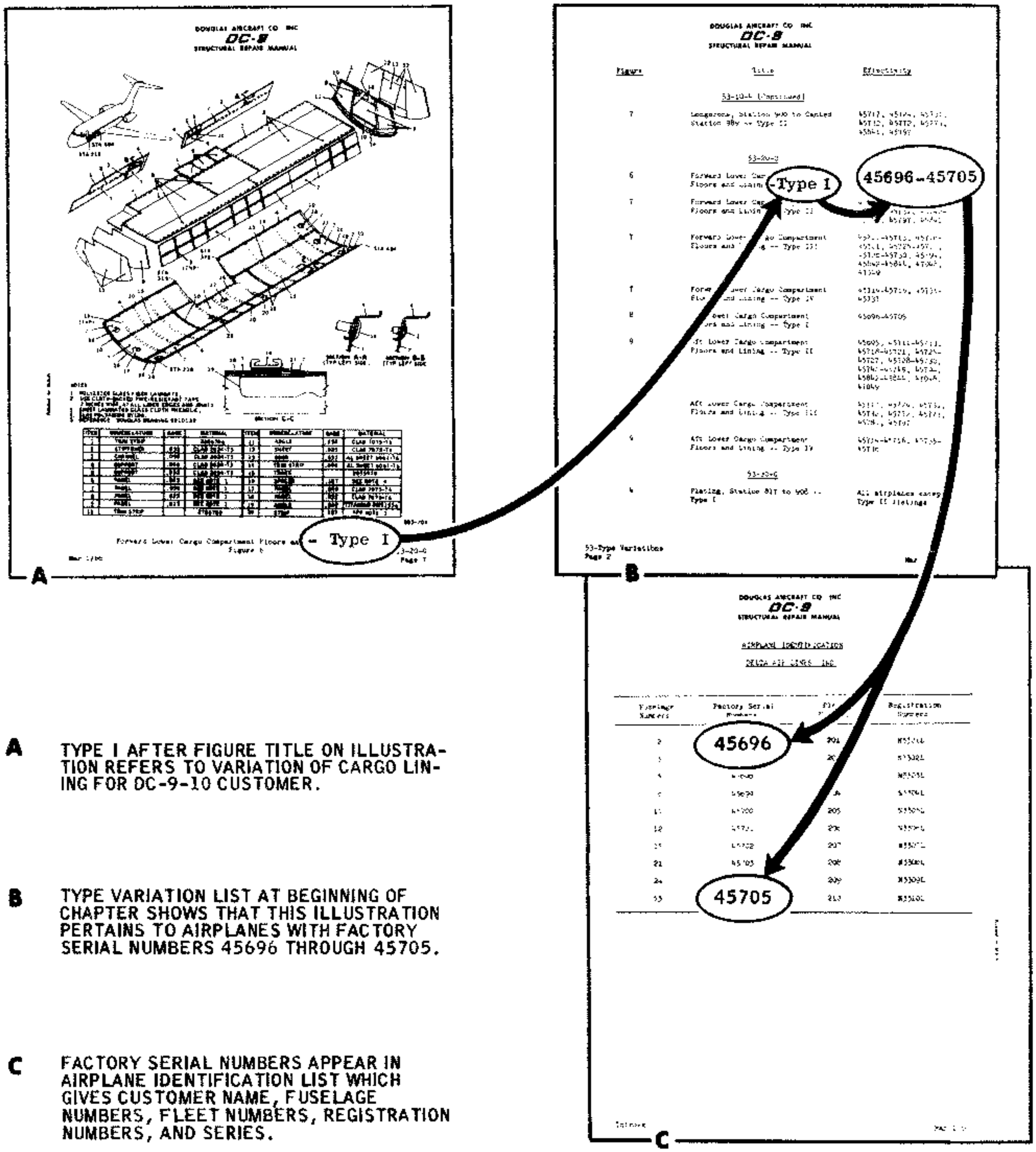
EXAMPLES OF AIRPLANE SERIES INDICATED IN BOLDFACE TYPE IN BODY OF ILLUSTRATION

SB3-968

How to Use the Manual
Figure 1 (Sheet 3)

HOW TO USE THE MANUAL - -

TYPE DESIGNATION TO EFFECTIVITY TO AIRPLANE IDENTIFICATION



A TYPE I AFTER FIGURE TITLE ON ILLUSTRATION REFERS TO VARIATION OF CARGO LINING FOR DC-9-10 CUSTOMER.

B TYPE VARIATION LIST AT BEGINNING OF CHAPTER SHOWS THAT THIS ILLUSTRATION PERTAINS TO AIRPLANES WITH FACTORY SERIAL NUMBERS 45696 THROUGH 45705.

C FACTORY SERIAL NUMBERS APPEAR IN AIRPLANE IDENTIFICATION LIST WHICH GIVES CUSTOMER NAME, FUSELAGE NUMBERS, FLEET NUMBERS, REGISTRATION NUMBERS, AND SERIES.

BB3-969

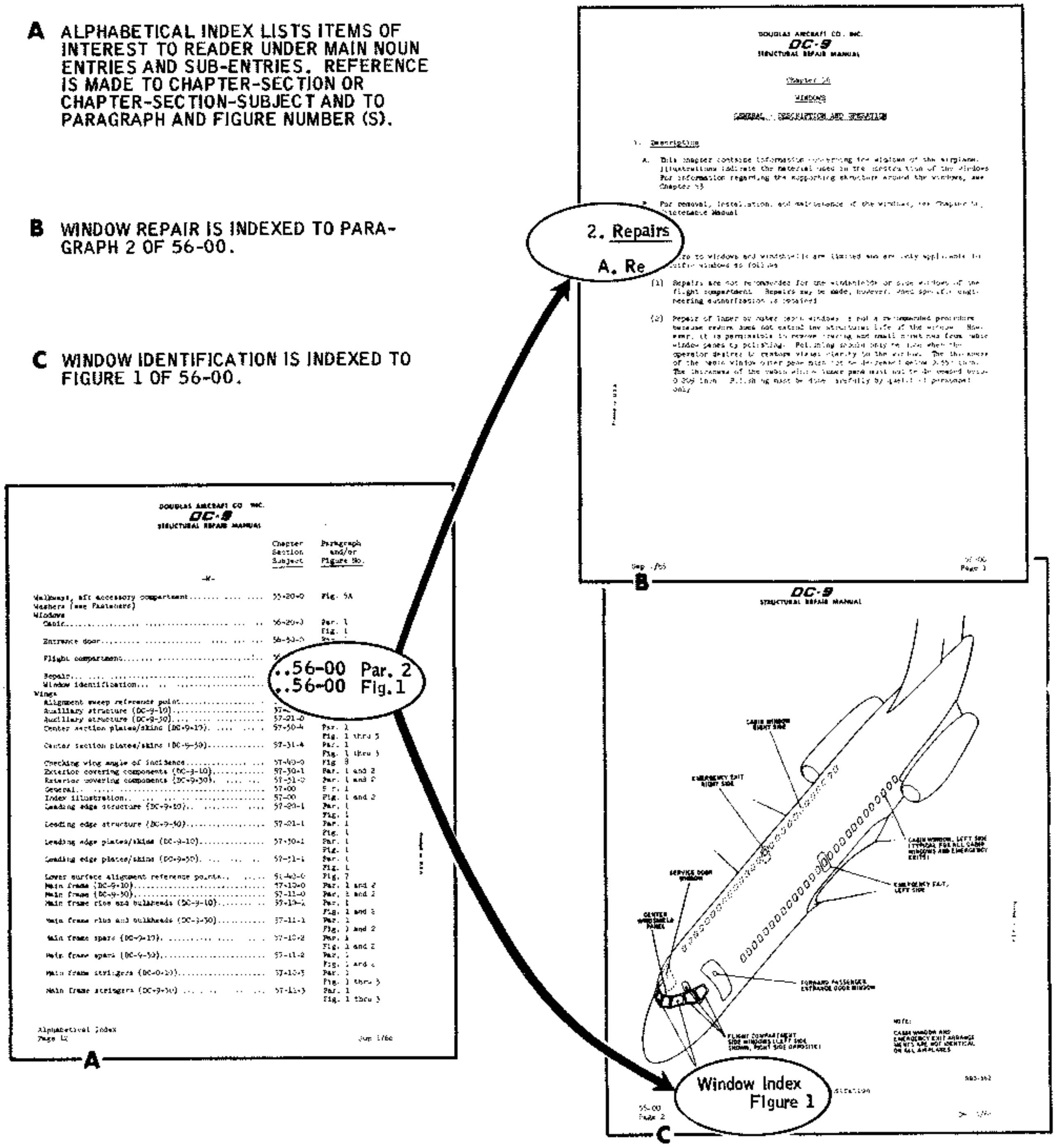
How to Use the Manual
Figure 1 (Sheet 4)

HOW TO USE THE MANUAL - -
ALPHABETICAL INDEX

A ALPHABETICAL INDEX LISTS ITEMS OF INTEREST TO READER UNDER MAIN NOUN ENTRIES AND SUB-ENTRIES. REFERENCE IS MADE TO CHAPTER-SECTION OR CHAPTER-SECTION-SUBJECT AND TO PARAGRAPH AND FIGURE NUMBER (S).

B WINDOW REPAIR IS INDEXED TO PARAGRAPH 2 OF 56-00.

C WINDOW IDENTIFICATION IS INDEXED TO FIGURE 1 OF 56-00.



BB3-970

How to Use the Manual
Figure 1 (Sheet 5)

Printed in U.S.A.

CHAPTER 1

GENERAL INFORMATION

Printed in U.S.A.

DOUGLAS AIRCRAFT CO., INC.
DC-9
NONDESTRUCTIVE TESTING MANUAL

TO: ALL HOLDERS OF DC-9 NONDESTRUCTIVE TESTING MANUAL

CONCERNING: REVISION 1, CHAPTER ALL, DATED DEC 1/66

SUMMARY:

Intro		Added material to aid in use of the manual.
Chapter 1	1-0	Added DC-9-30 Series Airplane Information.
	1-1	Corrected errata.
	1-2	Added new penetrant materials.
	1-3	Added new example of longitudinal magnetization application.
	1-4	Changed title and corrected errata.
	1-4A	Provides new section on separate field/detector eddy current equipment.
	1-5	Added new example of surface wave mode application.
Chapter 3	3-0	Added DC-9-30 Series Airplane Information.
Chapter 4	4-0	Added DC-9-30 Series Airplane Information.
Chapter 5	5-0	Added DC-9-30 Series Airplane Information.
Chapter 7	7-0	Added DC-9-30 Series Airplane Information.
Chapter 8	8-0	Added illustration showing eddy current testing of main and nose gear boss areas.

Remove		Insert	
Subject	Page	Subject	Page
None		Record of Revision	
Effective Pages	All	Effective Pages	All
Intro	i thru x	Table of Contents	1
None		Intro	i thru v
None		Alpha Index	1 thru 8
1-0	1 thru 11	1-0	1 thru 4B 5 thru 6A, 7 thru 9
1-1	1 thru 4	1-1	1 thru 4
1-2	1 thru 12	1-2	1 thru 12
None		1-3	4A
1-3	5 and 6	1-3	5 and 6
1-4	1, 2 and 7	1-4	1, 2 and 7
None		1-4A	1 and 2
1-5	3 and 4	1-5	3, 4 and 4A
2-0	1	2-0	1
3-0	1 and 2	3-0	1 and 2
3-0	11 thru 36	3-0	11 thru 42
4-0	1 thru 10	4-0	1 thru 10
5-0	1 and 2	5-0	1 and 2
5-0	13 thru 16	5-0	13 thru 16
5-0	19 thru 22	5-0	19 thru 22
5-0	25 and 26	5-0	25 and 26
7-0	1 and 2	7-0	1 and 2
7-0	21	7-0	21 thru 25
8-0	1 and 2	8-0	1, 2 and 5

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Title Page			*1-2	2	Dec 1/66
*Record of Revisions			*1-2	3	Dec 1/66
*Effective Pages	1-3	Dec 1/66	*1-2	4	Dec 1/66
*Table of Contents	1	Dec 1/66	*1-2	5	Dec 1/66
*Introduction	i	Dec 1/66	*1-2	6	Dec 1/66
*Introduction	ii	Dec 1/66	*1-2	7	Dec 1/66
*Introduction	iii	Dec 1/66	1-2	8	May 1/66
*Introduction	iv	Dec 1/66	*1-2	9	Dec 1/66
*Introduction	v	Dec 1/66	1-2	10	May 1/66
*Alpha Index	1	Dec 1/66	*1-2	11	Dec 1/66
*Alpha Index	2	Dec 1/66	1-2	12	May 1/66
*Alpha Index	3	Dec 1/66	1-2	13	May 1/66
*Alpha Index	4	Dec 1/66	1-3	1	May 1/66
*Alpha Index	5	Dec 1/66	1-3	2	May 1/66
*Alpha Index	6	Dec 1/66	1-3	3	May 1/66
*Alpha Index	7	Dec 1/66	1-3	4	May 1/66
*Alpha Index	8	Dec 1/66	*1-3	4A	Dec 1/66
Chapter 1-Title			1-3	5	May 1/66
*1-0	1	Dec 1/66	*1-3	6	Dec 1/66
1-0	2	May 1/66	1-3	7	May 1/66
1-0	3	May 1/66	1-3	8	May 1/66
*1-0	4	Dec 1/66	1-3	9	May 1/66
*1-0	4A	Dec 1/66	*1-4	1	Dec 1/66
*1-0	4B	Dec 1/66	*1-4	2	Dec 1/66
*1-0	5	Dec 1/66	1-4	3	May 1/66
*1-0	6	Dec 1/66	1-4	4	May 1/66
*1-0	6A	Dec 1/66	1-4	5	May 1/66
*1-0	7	Dec 1/66	1-4	6	May 1/66
*1-0	8	Dec 1/66	*1-4	7	Dec 1/66
*1-0	8A	Dec 1/66	*1-4A	1	Dec 1/66
*1-0	9	Dec 1/66	*1-4A	2	Dec 1/66
*1-1	1	Dec 1/66	1-5	1	May 1/66
*1-1	2	Dec 1/66	1-5	2	May 1/66
*1-1	3	Dec 1/66	*1-5	3	Dec 1/66
*1-1	4	Dec 1/66	1-5	4	May 1/66
1-1	5	May 1/66	*1-5	4A	Dec 1/66
1-1	6	May 1/66	1-5	5	May 1/66
*1-2	1	Dec 1/66	1-5	6	May 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
1-5	7	May 1/66
1-5	8	May 1/66
Chapter 2-Title		
*2-0	1	Dec 1/66
Chapter 3-Title		
*3-0	1	Dec 1/66
3-0	2	May 1/66
3-0	3	May 1/66
3-0	4	May 1/66
3-0	5	May 1/66
3-0	6	May 1/66
3-0	7	May 1/66
3-0	8	May 1/66
3-0	9	May 1/66
3-0	10	May 1/66
*3-0	11	Dec 1/66
3-0	12	May 1/66
*3-0	13	Dec 1/66
*3-0	14	Dec 1/66
*3-0	15	Dec 1/66
*3-0	16	Dec 1/66
*3-0	17	Dec 1/66
*3-0	18	Dec 1/66
*3-0	19	Dec 1/66
*3-0	20	Dec 1/66
*3-0	21	Dec 1/66
*3-0	22	Dec 1/66
*3-0	23	Dec 1/66
*3-0	24	Dec 1/66
*3-0	25	Dec 1/66
*3-0	26	Dec 1/66
*3-0	27	Dec 1/66
*3-0	28	Dec 1/66
*3-0	29	Dec 1/66
*3-0	30	Dec 1/66
*3-0	31	Dec 1/66
*3-0	32	Dec 1/66
*3-0	33	Dec 1/66
*3-0	34	Dec 1/66
*3-0	35	Dec 1/66
*3-0	36	Dec 1/66
*3-0	37	Dec 1/66
*3-0	38	Dec 1/66
*3-0	39	Dec 1/66
*3-0	40	Dec 1/66
*3-0	41	Dec 1/66
*3-0	42	Dec 1/66
Chapter 4-Title		
*4-0	1	Dec 1/66
*4-0	2	Dec 1/66
*4-0	3	Dec 1/66
*4-0	4	Dec 1/66
4-0	5	May 1/66
*4-0	6	Dec 1/66
4-0	7	May 1/66
*4-0	8	Dec 1/66
*4-0	9	Dec 1/66
*4-0	10	Dec 1/66
Chapter 5-Title		
*5-0	1	Dec 1/66
5-0	2	May 1/66
5-0	3	May 1/66
5-0	4	May 1/66
5-0	5	May 1/66
5-0	6	May 1/66
5-0	7	May 1/66
5-0	8	May 1/66
5-0	9	May 1/66
5-0	10	May 1/66
5-0	11	May 1/66
5-0	12	May 1/66
5-0	13	May 1/66
*5-0	14	Dec 1/66
*5-0	15	Dec 1/66
*5-0	16	Dec 1/66
5-0	17	May 1/66
5-0	18	May 1/66
*5-0	19	Dec 1/66
*5-0	20	Dec 1/66
*5-0	21	Dec 1/66
5-0	22	May 1/66
5-0	23	May 1/66
5-0	24	May 1/66
*5-0	25	Dec 1/66
5-0	26	May 1/66
5-0	27	May 1/66
5-0	28	May 1/66
5-0	29	May 1/66
5-0	30	May 1/66
5-0	31	May 1/66
5-0	32	May 1/66
5-0	33	May 1/66
5-0	34	May 1/66
5-0	35	May 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
5-0	36	May 1/66			
Chapter 6-Title					
6-0	1	May 1/66			
Chapter 7-Title					
*7-0	1	Dec 28/66			
*7-0	2	Dec 1/66			
7-0	3	Dec 28/66			
7-0	4	May 1/66			
7-0	5	May 1/66			
7-0	6	May 1/66			
7-0	7	May 1/66			
7-0	8	May 1/66			
7-0	9	May 1/66			
7-0	10	May 1/66			
7-0	11	May 1/66			
7-0	12	May 1/66			
7-0	13	May 1/66			
7-0	14	May 1/66			
7-0	15	May 1/66			
7-0	16	May 1/66			
7-0	17	May 1/66			
7-0	18	May 1/66			
7-0	19	May 1/66			
7-0	20	May 1/66			
*7-0	21	Dec 1/66			
*7-0	22	Dec 1/66			
*7-0	23	Dec 1/66			
*7-0	24	Dec 1/66			
*7-0	25	Dec 1/66			
Chapter 8-Title					
*8-0	1	Dec 1/66			
8-0	2	May 1/66			
8-0	3	May 1/66			
8-0	4	May 1/66			
*8-0	5	Dec 1/66			

*The asterisk indicates pages revised or added by the current revision.

TABLE OF CONTENTS

INTRODUCTION

The material included in this manual has been prepared to assist qualified personnel in the performance of nondestructive inspection of the DC-9 airplane. Use of the techniques herein should result in the detection of structural damage not readily accessible to visual inspection. The discovery of minor structural damage before it progresses to a critical condition will ensure the structural integrity of the airplane.

A continuous pictorial history of areas most frequently subjected to damage (or areas where disassembly is undesirable because of time and expense required) will prove valuable.

Use of the techniques contained within this manual should be in conformity with all national, state, and local requirements of the government agencies involved to ensure the safety of both the technician and surrounding personnel within regulated specified ranges of the area involved.

The techniques provided are intended as a guide in the performance of nondestructive testing procedures. Their frequency of use depends upon the individual inspection and maintenance requirements of the user. These techniques constitute a system which may be adopted by the user or serve as an alternative to other techniques specified by the airline operator.

NOTE: The Douglas Aircraft Co. is interested in any nondestructive testing techniques developed by operators of DC-9 airplanes and suggests that copies of any techniques used be forwarded for consideration and possible inclusion into this manual. Techniques forwarded may be in any convenient form that identifies the part or area being inspected and technique used. A simple sketch accompanying the technique will be helpful. A sample radiograph reporting form is shown in Figure 1. This form may be reproduced for internal reporting and recording of radiograph operations and is suggested for use in transmitting radiographic techniques. Techniques should be transmitted to:

Douglas Aircraft Co., Inc.
3855 Lakewood Blvd.,
Long Beach, Calif.

Attention: Customer Service Dept.

The DC-9 Nondestructive Testing Manual has been arranged in a similar manner to the other DC-9 manuals to aid the user in determining the locations of the material. Structural chapters contained within this manual carry the same titles as those within the DC-9 Maintenance Manual, DC-9 Parts Catalog, and the DC-9 Structural Repair Manual. For example, chapter titles are arranged in sequence as General Information, Doors, Fuselage, Nacelles/Pylons, Stabilizers, and Miscellaneous Airplane Components within this manual.

RADIOGRAPH REPORT FORM

OPERATOR________________ AIRPLANE IDENTIFICATION NO.________

AREA OF AIRPLANE________________

SUBJECT OF RADIOGRAPH________________

INSPECTING FOR________________

TOTAL TIME ON PART____________ TIME SINCE LAST INSPECTION________

DC-9 NONDESTRUCTIVE TESTING MANUAL TECHNIQUE NUMBER________ DATE________

NOTE: When reporting a radiographic technique, which is not included or exactly as indicated in the manual, record any pertinent information below. Provide locating dimensions for source and film on separate sketch.

EXP NO.	SUBJECT	KV	MAS	SFD	FILM	SIZE	*DENSITY

* Indicate density of developed radiograph in area of interest.

REMARKS________________

Sample Radiograph Report Form
Figure

In addition, the illustration format of the DC-9 Structural Repair Manual has utilized orthographic projections wherever feasible to supply the technician, who desires to examine the structural materials, with a natural view of the structure. For an understanding of how the illustrations presented in the DC-9 Nondestructive Testing Manual are related to the illustrations in the DC-9 Structural Repair Manual and how the illustrations within the Structural Repair Manual may be selected to determine the structural arrangement of areas being inspected, refer to Figure 2, Aids in Use of the Manual.

Supplementary structural inspection suggestions are also described in Section 51-10-5 of the Structural Repair Manual, and airplane extruded and formed section shapes have been illustrated in cross-sectional format in Section 51-10-1 of that manual. The use of the orthographic projections and the cross-sectional illustrations within the Structural Repair Manual has made it possible to eliminate the duplication of material identification illustrations within the Nondestructive Testing Manual.

Illustrations within the Nondestructive Testing Manual are common to both the DC-9-10 and DC-9-30 Series Airplanes unless the figure title contains a specific series identification.

Example 1: (Illustration common to both DC-9-10 and DC-9-30 Series Airplanes)

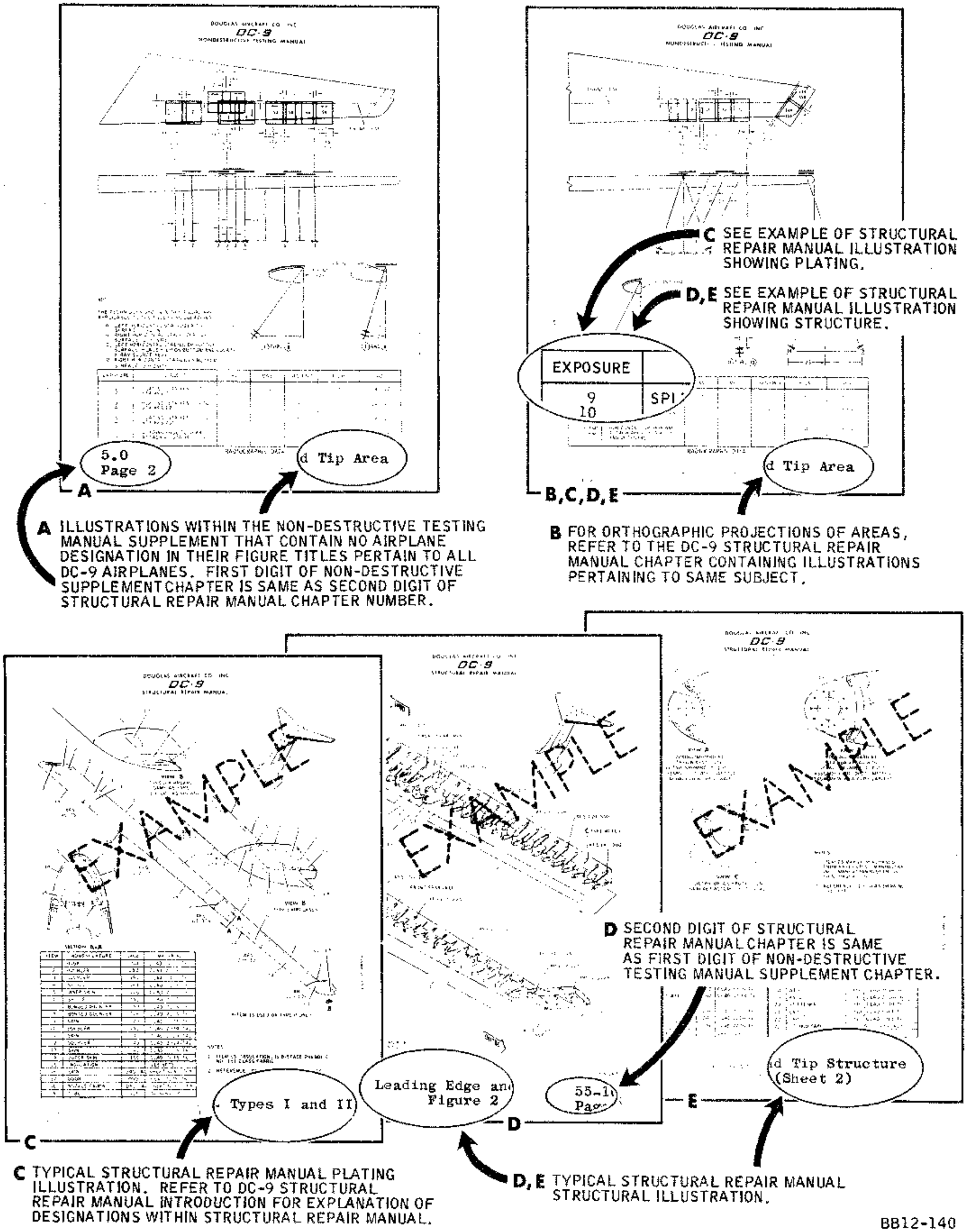
Pilots Enclosure Area
Figure xx

Example 2: (Illustrations peculiar to a specific Series Airplane)

DC-9-30 Wing Slats
Figure xxx

The user of this manual will also find Chapter 5, Section 5-51-0 thru 5-51-3 of the DC-9 Maintenance Manual a helpful aid in determining useful criteria in his understanding of the use of nondestructive testing applications to examine the components of the DC-9.

An illustrated example of the symbols and abbreviations used in the radiographic techniques is presented in Figure 3.



C SEE EXAMPLE OF STRUCTURAL REPAIR MANUAL ILLUSTRATION SHOWING PLATING.

D,E SEE EXAMPLE OF STRUCTURAL REPAIR MANUAL ILLUSTRATION SHOWING STRUCTURE.

A ILLUSTRATIONS WITHIN THE NON-DESTRUCTIVE TESTING MANUAL SUPPLEMENT THAT CONTAIN NO AIRPLANE DESIGNATION IN THEIR FIGURE TITLES PERTAIN TO ALL DC-9 AIRPLANES. FIRST DIGIT OF NON-DESTRUCTIVE SUPPLEMENT CHAPTER IS SAME AS SECOND DIGIT OF STRUCTURAL REPAIR MANUAL CHAPTER NUMBER.

B FOR ORTHOGRAPHIC PROJECTIONS OF AREAS, REFER TO THE DC-9 STRUCTURAL REPAIR MANUAL CHAPTER CONTAINING ILLUSTRATIONS PERTAINING TO SAME SUBJECT.

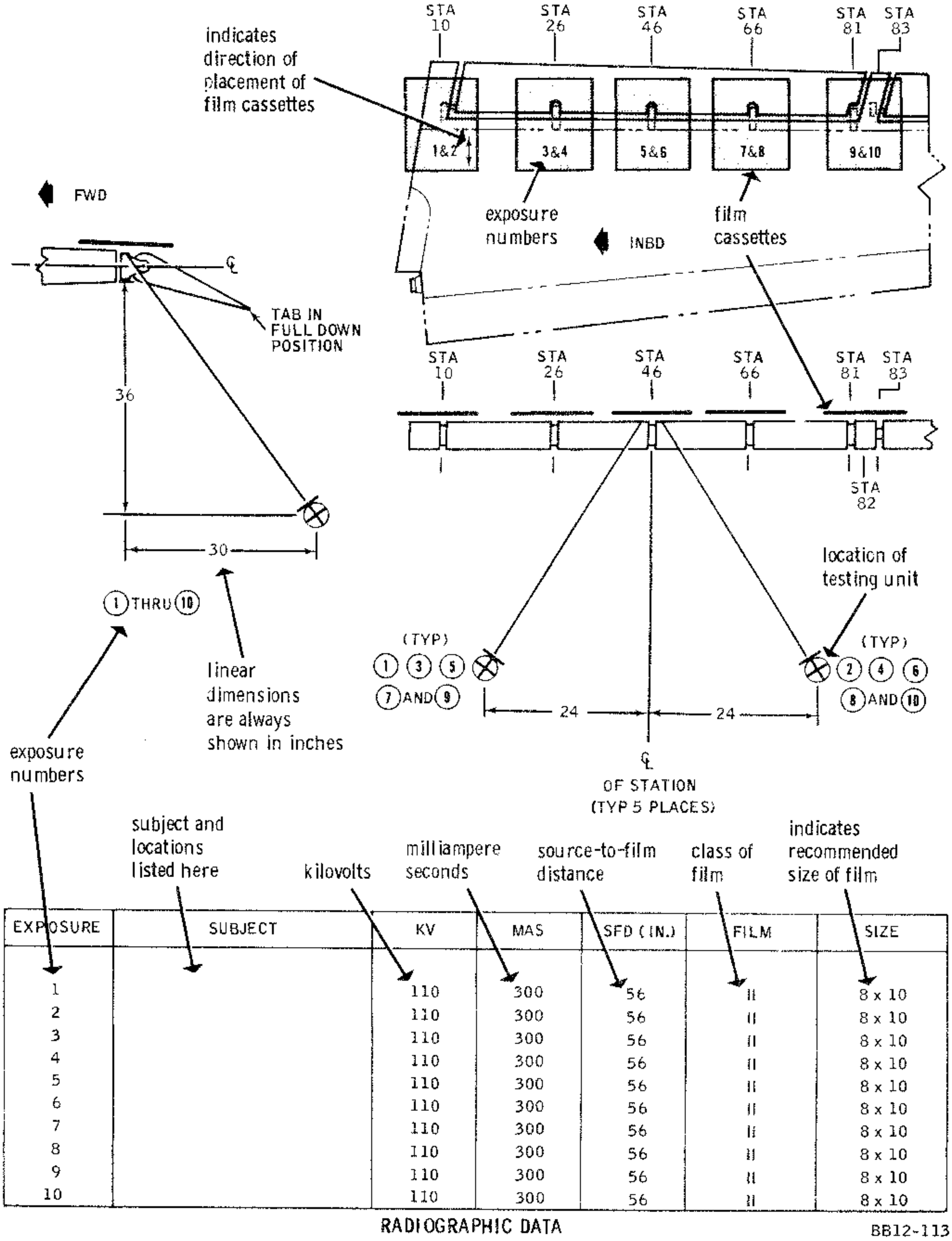
D SECOND DIGIT OF STRUCTURAL REPAIR MANUAL CHAPTER IS SAME AS FIRST DIGIT OF NON-DESTRUCTIVE TESTING MANUAL SUPPLEMENT CHAPTER.

C TYPICAL STRUCTURAL REPAIR MANUAL PLATING ILLUSTRATION. REFER TO DC-9 STRUCTURAL REPAIR MANUAL INTRODUCTION FOR EXPLANATION OF DESIGNATIONS WITHIN STRUCTURAL REPAIR MANUAL.

D,E TYPICAL STRUCTURAL REPAIR MANUAL STRUCTURAL ILLUSTRATION.

BB12-140

Aids in Use of the Manual
Figure 2



EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1		110	300	56	II	8 x 10
2		110	300	56	II	8 x 10
3		110	300	56	II	8 x 10
4		110	300	56	II	8 x 10
5		110	300	56	II	8 x 10
6		110	300	56	II	8 x 10
7		110	300	56	II	8 x 10
8		110	300	56	II	8 x 10
9		110	300	56	II	8 x 10
10		110	300	56	II	8 x 10

RADIOGRAPHIC DATA

Radiographic Symbols and Abbreviations
Figure 3

ALPHABETICAL INDEX

Chapter 1

GENERAL INFORMATION

GENERAL

1. Description

A. The information in this chapter has been prepared to assist personnel in nondestructive testing techniques applicable to the DC-9 airplane. The most commonly used methods currently employed in evaluating structural conditions are described in the subsequent sections of this chapter as follows:

Method of Inspection	Chapter 1 Section
Radiography	1-1
Liquid Penetrants	1-2
Magnetic Particle	1-3
Eddy Current	1-4
Ultrasonics	1-5

Figure 1 of this section outlines the recommendations for usage of these methods with pertinent information concerning limitations of the method employed.

B. THE PROCEDURES ARE NOT MANDATORY REQUIREMENTS; HOWEVER, THEY SHOULD BE USEFUL IN ACCOMPLISHING NONDESTRUCTIVE TESTING.

C. The following structural component index and station identification illustrations are provided to assist users of the manual in orientation of the individual illustrations within the manual with the major airplane structural sections:

Airplane Structural Component Index....................	Figure 2 and 2A
Fuselage Station Numbers and Longeron Arrangement.......	Figure 3 and 3A
Wing Station Numbers and Stringer Arrangement...........	Figure 4 and 4A
Nacelles/Pylons Station Identification.................	Figure 5
Vertical Stabilizer Station Identification.............	Figure 6
Horizontal Stabilizer Station Identification...........	Figure 7 and 7A

Type Of Method Employed	Application	Advantages	Application Factors
Radiography	Detection of internal flaws and defects such as cracks, holes, porosity, inclusions, unbonded areas, and thickness variations in forgings, castings, tubing, plating, and assemblies.	Eliminates many disassembly requirements. Has high sensitivity, and provides a permanent record on film.	Initial cost is moderate. Requires power source, conformance with radiation regulations to avoid hazards. Trained technicians needed.
Liquid Penetrants	Detection of surface cracks, porosity, laps, cold shuts, lack of weld bond in all metals, castings, forgings, machined parts, glass, and ceramics.	Is simple to use. Accurate, fast, easy to interpret. No elaborate setups required.	Cost is low. Use is limited to surface defect detection. Surface cleanliness is required. Metal smearing such as that caused by sanding prohibits penetration and may make method ineffective.
Magnetic Particle	Detection of surface or near surface defects in ferromagnetic materials of any shape or heat treat condition.	Is simple in principle, easy, portable, fast method is positive.	Cost is low. Parts to be checked must be ferro-magnetic. Power source is required. Parts to be checked must be cleaned and demagnetized.
Eddy Current	Detection of defects in metallic surfaces, cracks, pits, porosity, intergranular corrosion, and heat treat condition.	Is useful for checking attachment holes and surfaces where other methods are impractical.	Experience in interpretations necessary to preclude false indications. Requires careful check procedures to analyze results.

Commonly Used Types of Nondestructive Testing
Figure 1 (Sheet 1)

Printed in U.S.A.

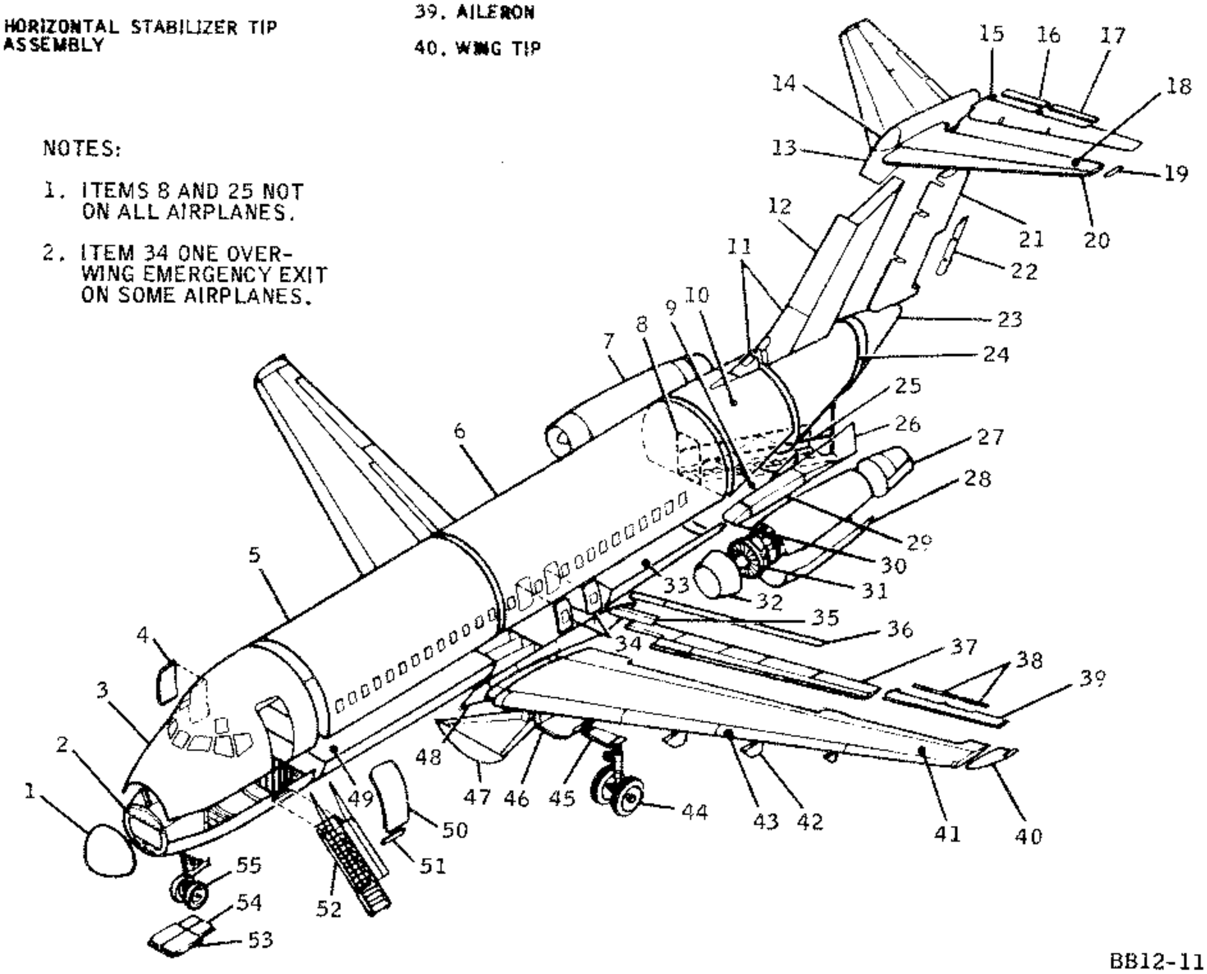
Type Of Method Employed	Application	Advantages	Application Factors
Ultrasonic	Detection of surface and sub-surface defects, cracks, lack of bond, segregations, porosity, laminar flaws, and thickness gaging in all materials by pulso-echo or through transmission.	Fast, dependable, is easy to operate. Results are immediately known, highly accurate, high sensitivity, and portable.	Requires contact or immersion scanning. Will furnish information on section of material in direct contact only. Requires interpretation by trained personnel.

Commonly Used Types of Nondestructive Testing
Figure 1 (Sheet 2)

1. RADOME
2. FUSELAGE NOSE LOWER STRUCTURE
3. FUSELAGE NOSE UPPER STRUCTURE
4. FORWARD SERVICE DOOR
5. FUSELAGE STA 229 TO 474 UPPER STRUCTURE
6. FUSELAGE STA 474 TO 817 UPPER STRUCTURE
7. UPPER COWL DOOR
8. PASSENGER AFT ENTRANCE STAIRWELL DOOR
9. FUSELAGE STA 817 TO 908 LOWER STRUCTURE
10. FUSELAGE STA 817 TO 908 UPPER STRUCTURE
11. DORSAL FIN
12. VERTICAL STABILIZER
13. VERTICAL STABILIZER TIP
14. REMOVABLE TIP FAIRING
15. ELEVATOR
16. ELEVATOR CONTROL TAB
17. ELEVATOR GEARED TAB
18. HORIZONTAL STABILIZER AFT SECTION
19. HORIZONTAL STABILIZER TIP ASSEMBLY
20. HORIZONTAL STABILIZER LEADING EDGE
21. RUDDER
22. RUDDER TAB
23. TAIL CONE
24. FUSELAGE TAIL STRUCTURE
25. PASSENGER AFT ENTRANCE DOOR STAIRWAY
26. PYLON AFT PANEL
27. THRUST REVERSER COWLING
28. LOWER COWL DOOR
29. PYLON CENTER PANEL
30. PYLON LEADING EDGE
31. ENGINE
32. NOSE COWL
33. FUSELAGE STA 642 TO 817 LOWER STRUCTURE
34. OVERWING EMERGENCY EXIT
35. FLAP VANE
36. SPOILER
37. WING FLAP
38. AILERON TABS
39. AILERON
40. WING TIP
41. WING MAIN STRUCTURE
42. FLAP HINGE FAIRINGS
43. WING LEADING EDGE
44. MAIN GEAR
45. MAIN GEAR OUTBOARD DOOR
46. MAIN GEAR INBOARD DOOR
47. KEEL
48. WING-TO-FUSELAGE FILLET
49. FUSELAGE STA 229 TO 474 LOWER STRUCTURE
50. PASSENGER FORWARD ENTRANCE DOOR
51. FORWARD STAIRWELL DOOR
52. PASSENGER FORWARD ENTRANCE STAIRWAY
53. FORWARD NOSE GEAR DOORS
54. AFT NOSE GEAR DOORS
55. NOSE GEAR

NOTES:

1. ITEMS 8 AND 25 NOT ON ALL AIRPLANES.
2. ITEM 34 ONE OVER-WING EMERGENCY EXIT ON SOME AIRPLANES.

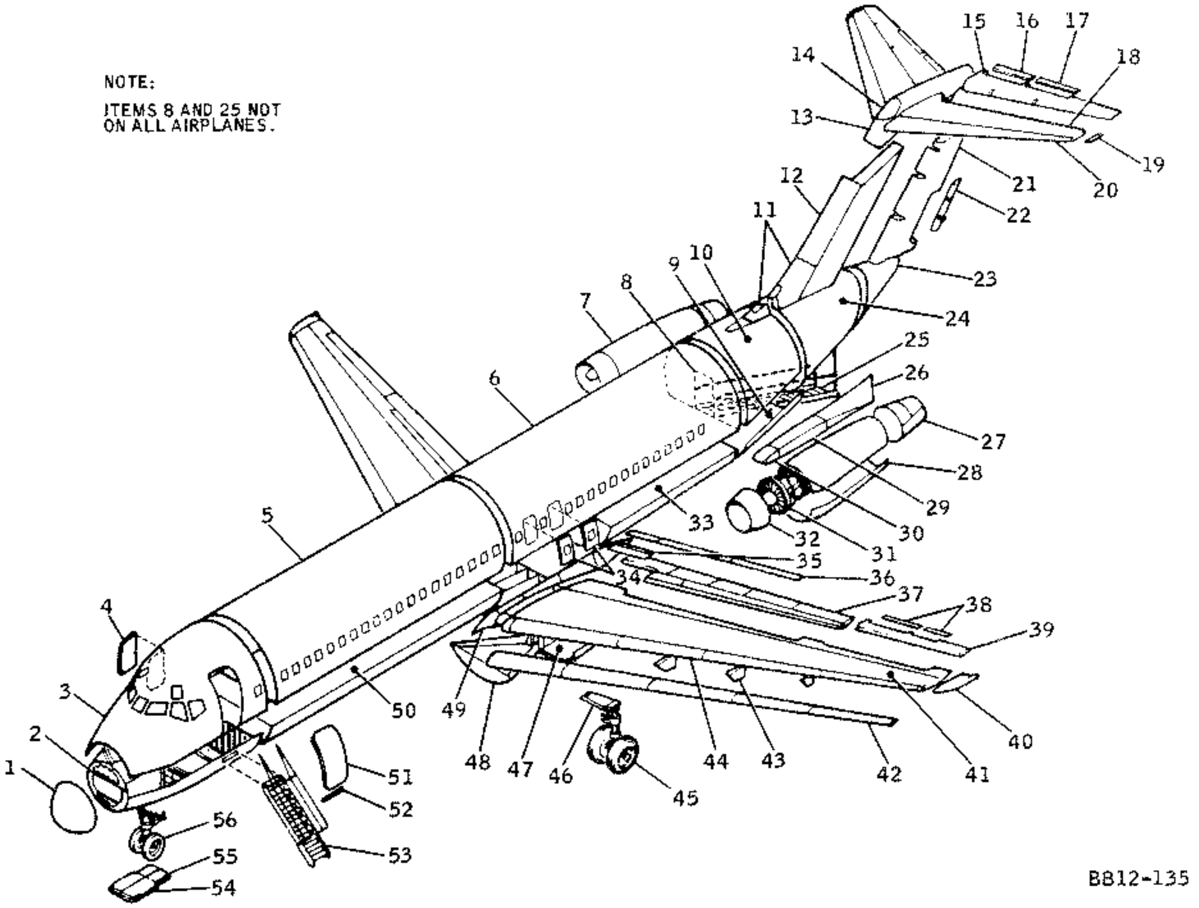


BB12-11A

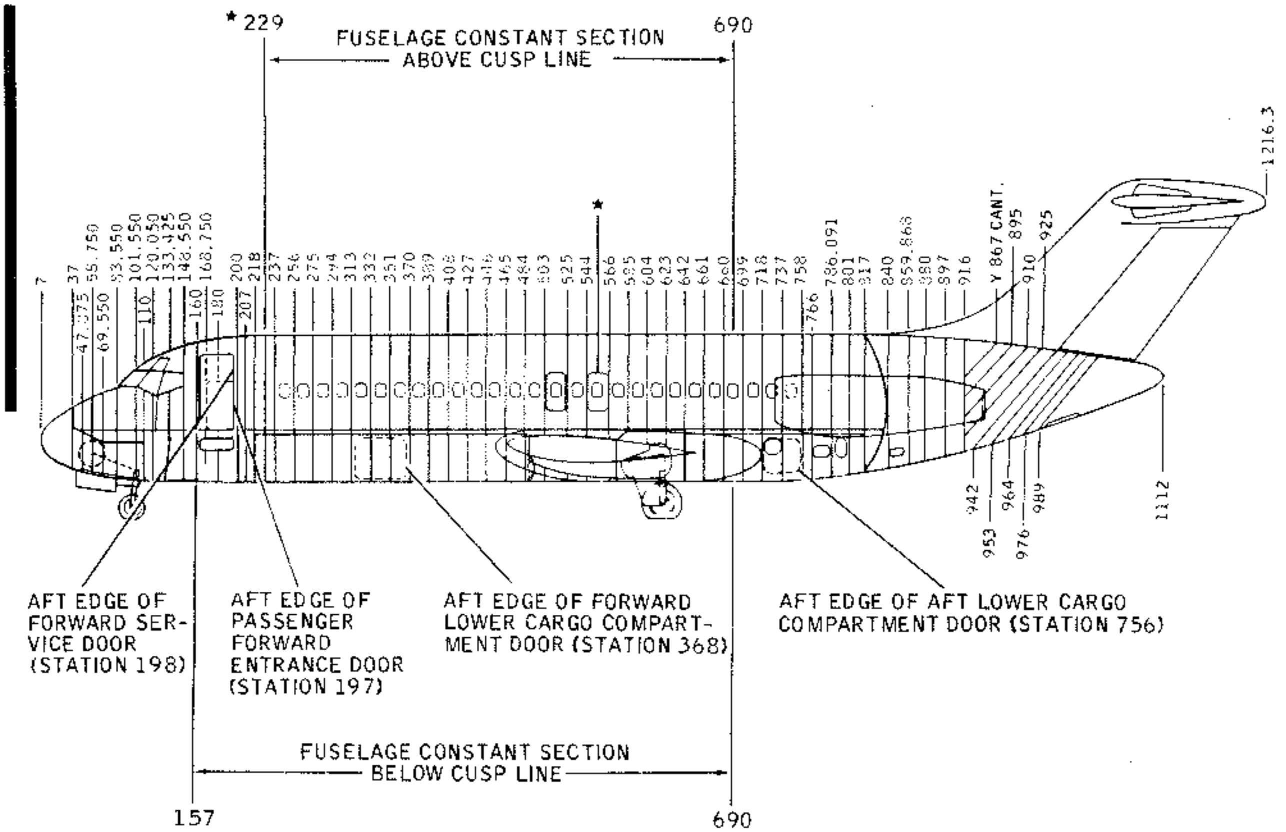
DC-9-10 Airplane Structural Component Index
Figure 2

1. RADOME
2. FUSELAGE NOSE LOWER STRUCTURE
3. FUSELAGE NOSE UPPER STRUCTURE
4. FORWARD SERVICE DOOR
5. FUSELAGE STA 229 TO 588 UPPER STRUCTURE
6. FUSELAGE STA 588 TO 996 UPPER STRUCTURE
7. UPPER COWL DOOR
8. PASSENGER AFT ENTRANCE STAIRWELL DOOR
9. FUSELAGE STA 996 TO 1087 LOWER STRUCTURE
10. FUSELAGE STA 996 TO 1087 UPPER STRUCTURE
11. DORSAL FIN
12. VERTICAL STABILIZER
13. VERTICAL STABILIZER TIP
14. REMOVABLE TIP FAIRING
15. ELEVATOR
16. ELEVATOR CONTROL TAB
17. ELEVATOR GEARED TAB
18. HORIZONTAL STABILIZER AFT SECTION
19. HORIZONTAL STABILIZER TIP ASSEMBLY
20. HORIZONTAL STABILIZER LEADING EDGE
21. RUDDER
22. RUDDER TAB
23. TAIL CONE
24. FUSELAGE TAIL STRUCTURE
25. PASSENGER AFT ENTRANCE DOOR STAIRWAY
26. PYLON AFT PANEL
27. THRUST REVERSER COWLING
28. LOWER COWL DOOR
29. PYLON CENTER PANEL
30. PYLON LEADING EDGE
31. ENGINE
32. NOSE COWL
33. FUSELAGE STA 756 TO 996 LOWER STRUCTURE
34. OVERWING EMERGENCY EXITS
35. FLAP VANE
36. SPOILER
37. WING FLAP
38. AILERON TABS
39. AILERON
40. WING TIP
41. WING MAIN STRUCTURE
42. WING SLAT
43. FLAP HINGE FAIRING
44. WING LEADING EDGE
45. MAIN GEAR
46. MAIN GEAR OUTBOARD DOOR
47. MAIN GEAR INBOARD DOOR
48. KEEL
49. WING-TO-FUSELAGE FILLET
50. FUSELAGE STA 229 TO 588 LOWER STRUCTURE
51. PASSENGER FORWARD ENTRANCE DOOR
52. FORWARD STAIRWELL DOOR
53. PASSENGER FORWARD ENTRANCE STAIRWAY
54. FORWARD NOSE GEAR DOORS
55. AFT NOSE GEAR DOORS
56. NOSE GEAR

NOTE:
ITEMS 8 AND 25 NOT ON ALL AIRPLANES.

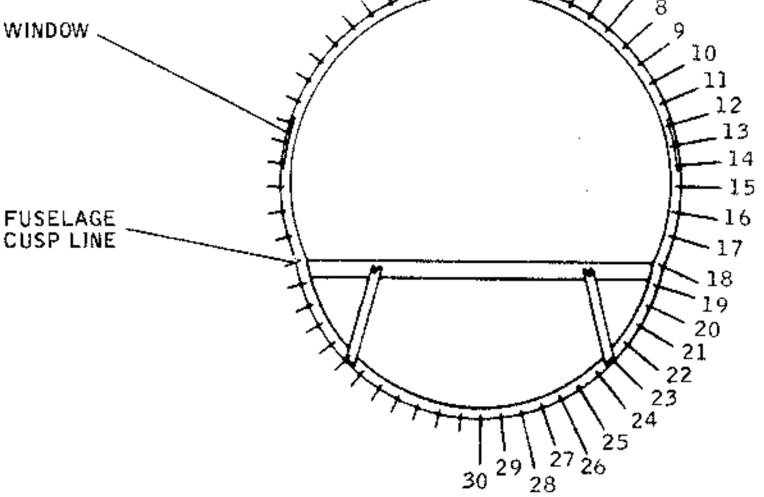


DC-9-30 Airplane Structural Component Index
Figure 2A



NOTE:

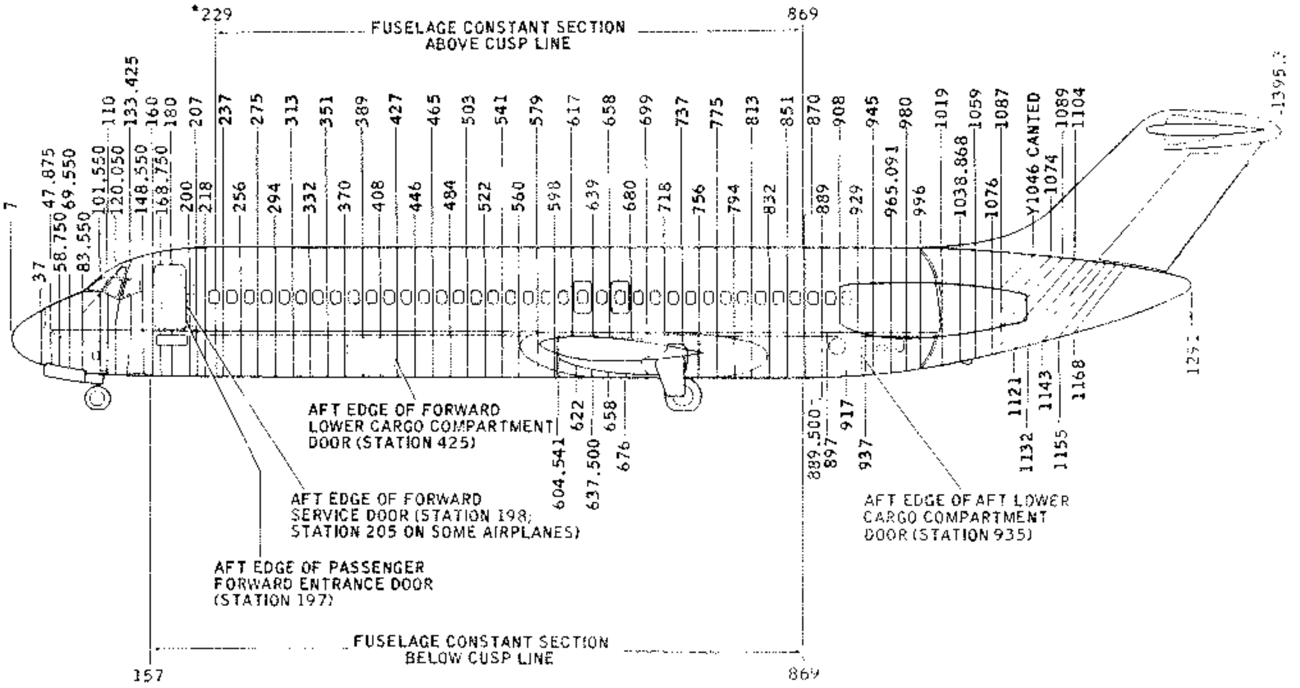
* WINDOW AT STATION 229 AND ADDITIONAL OVERWING EMERGENCY EXIT NOT ON ALL AIRPLANES.



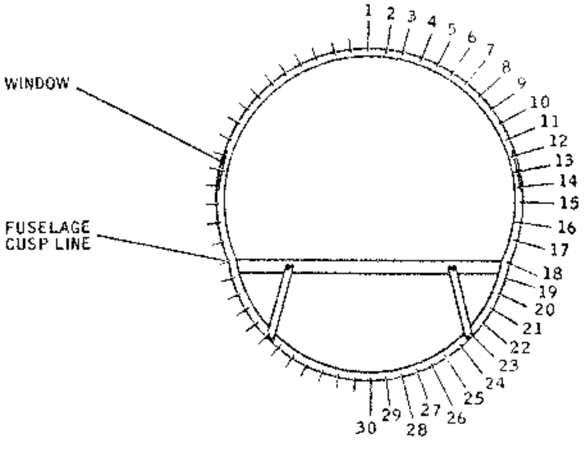
FUSELAGE LONGERON NUMBERING ARRANGEMENT

BB12-13A

DC-9-10 Fuselage Station Numbers and Longeron Arrangement
Figure 3



NOTE:
*WINDOW AT STATION 229 NOT ON ALL AIRPLANES.

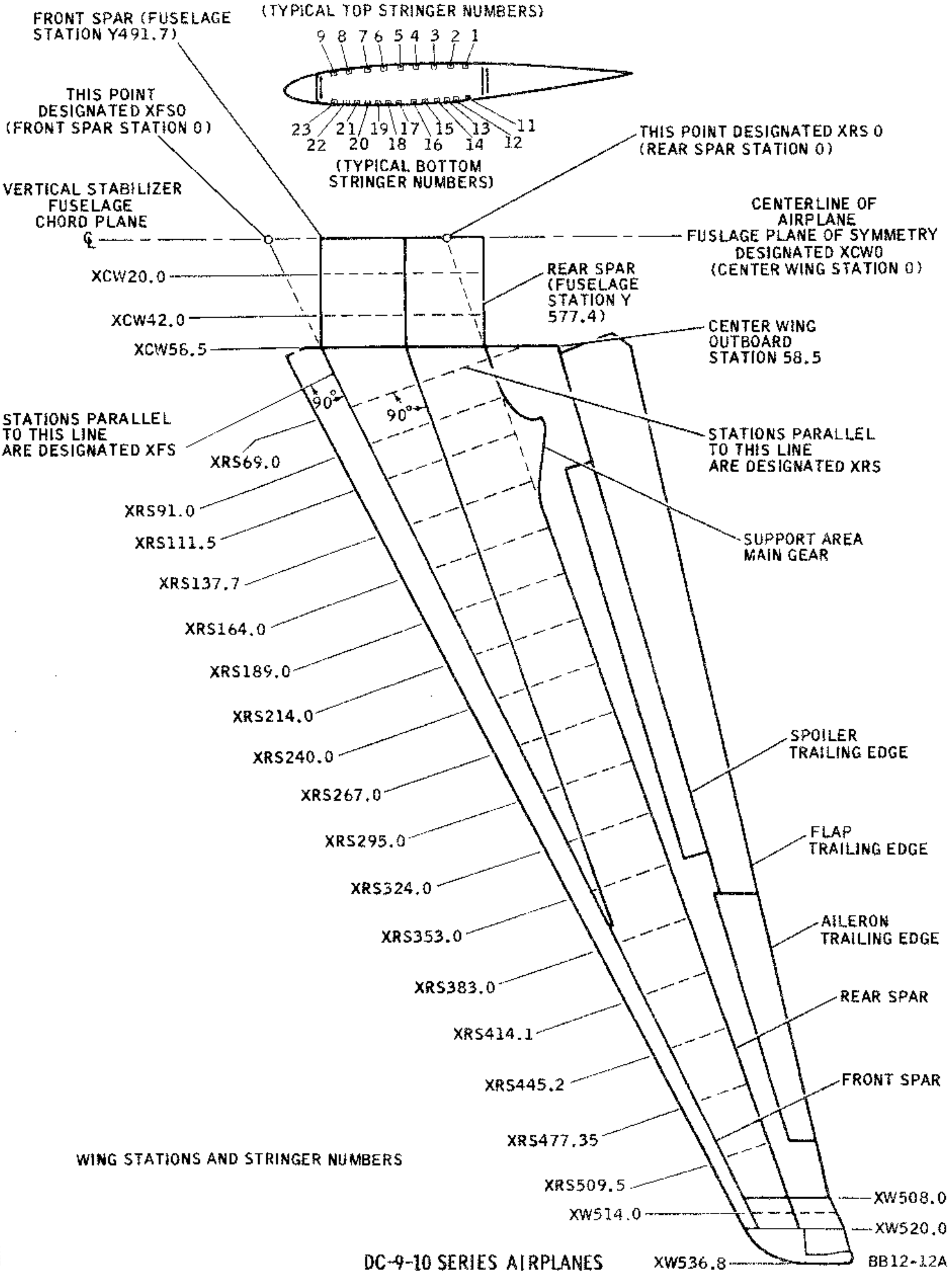


FUSELAGE LONGERON NUMBERING ARRANGEMENT

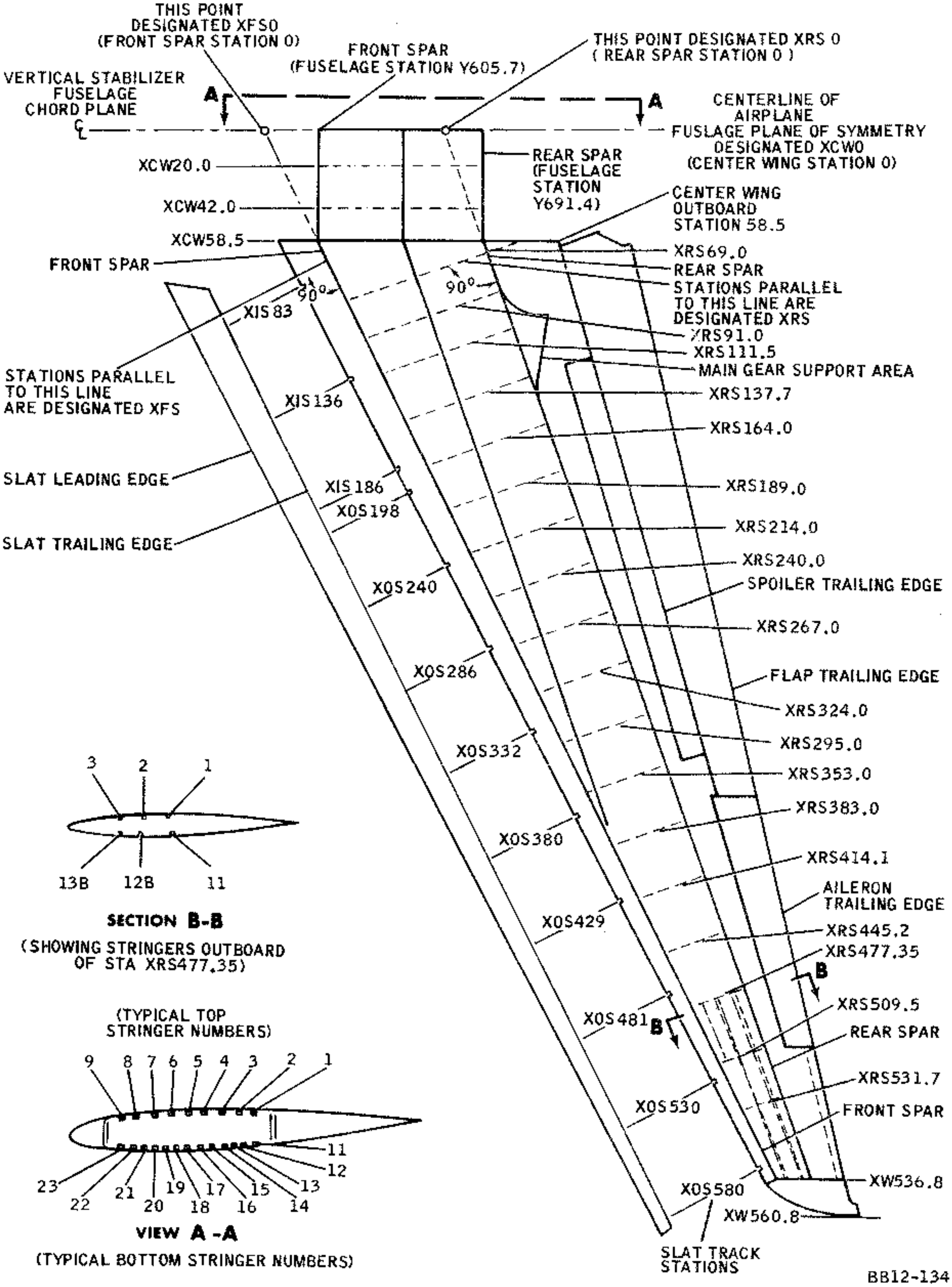
DC-9 30 SERIES AIRPLANES

BB12-133

DC-9-30 Fuselage Station Numbers and Longeron Arrangement
Figure 3A

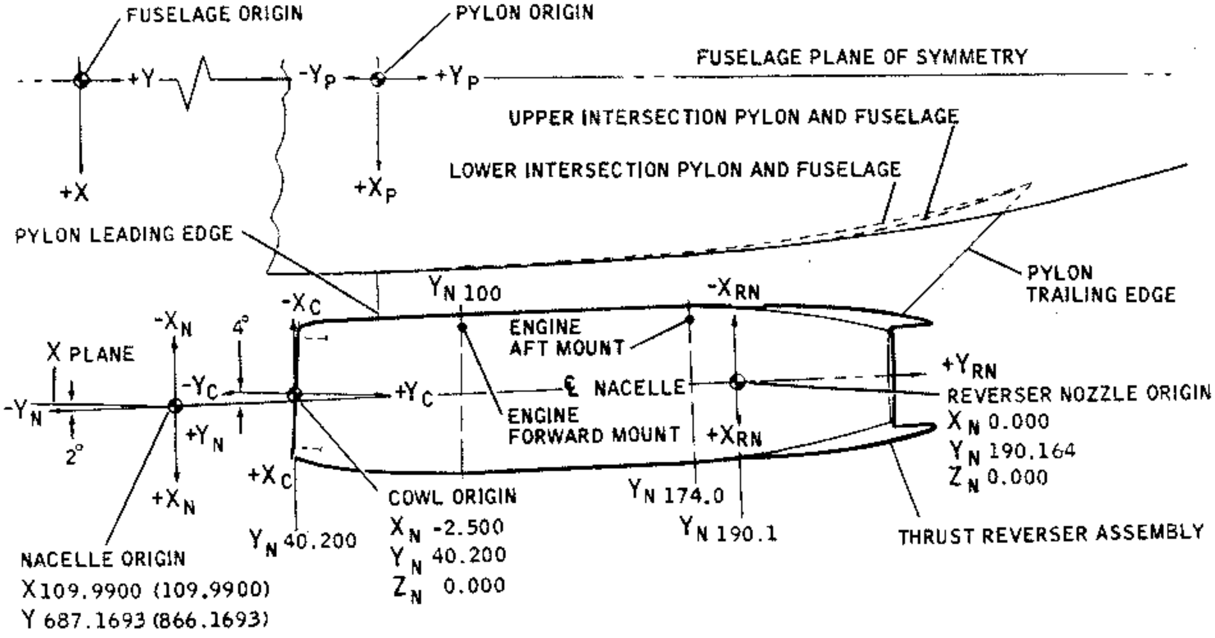


DC-9-10 Wing Station Numbers and Stringer Arrangement
Figure 4

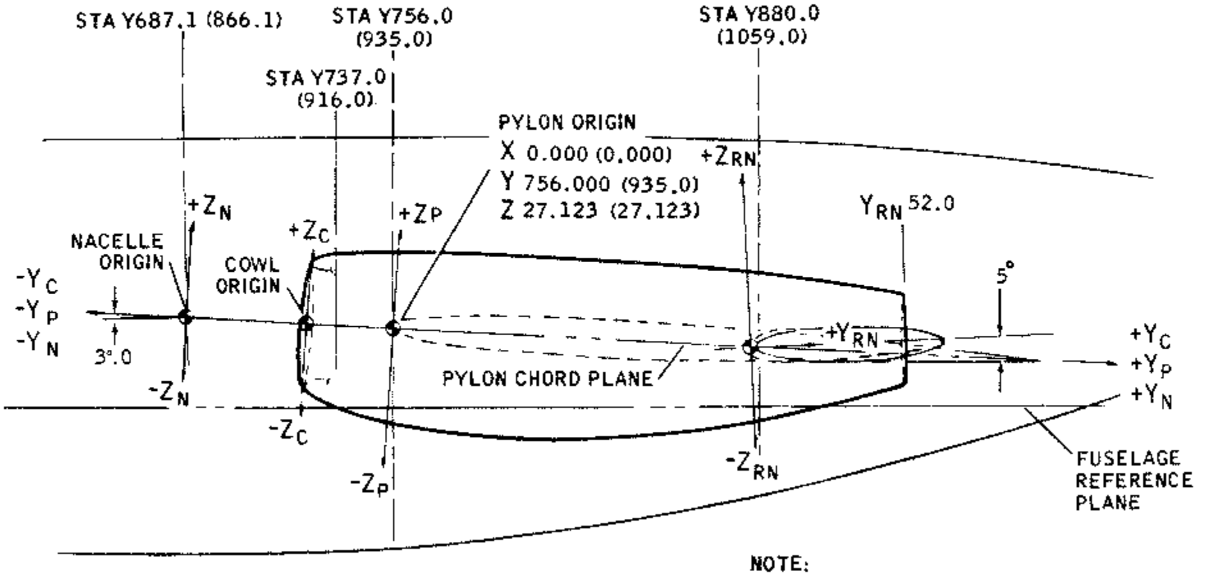


BB12-134

DC-9-30 Wing Station Numbers and Stringer Arrangement
Figure 4A



VIEW LOOKING DOWN
(IN PYLON PLANE)

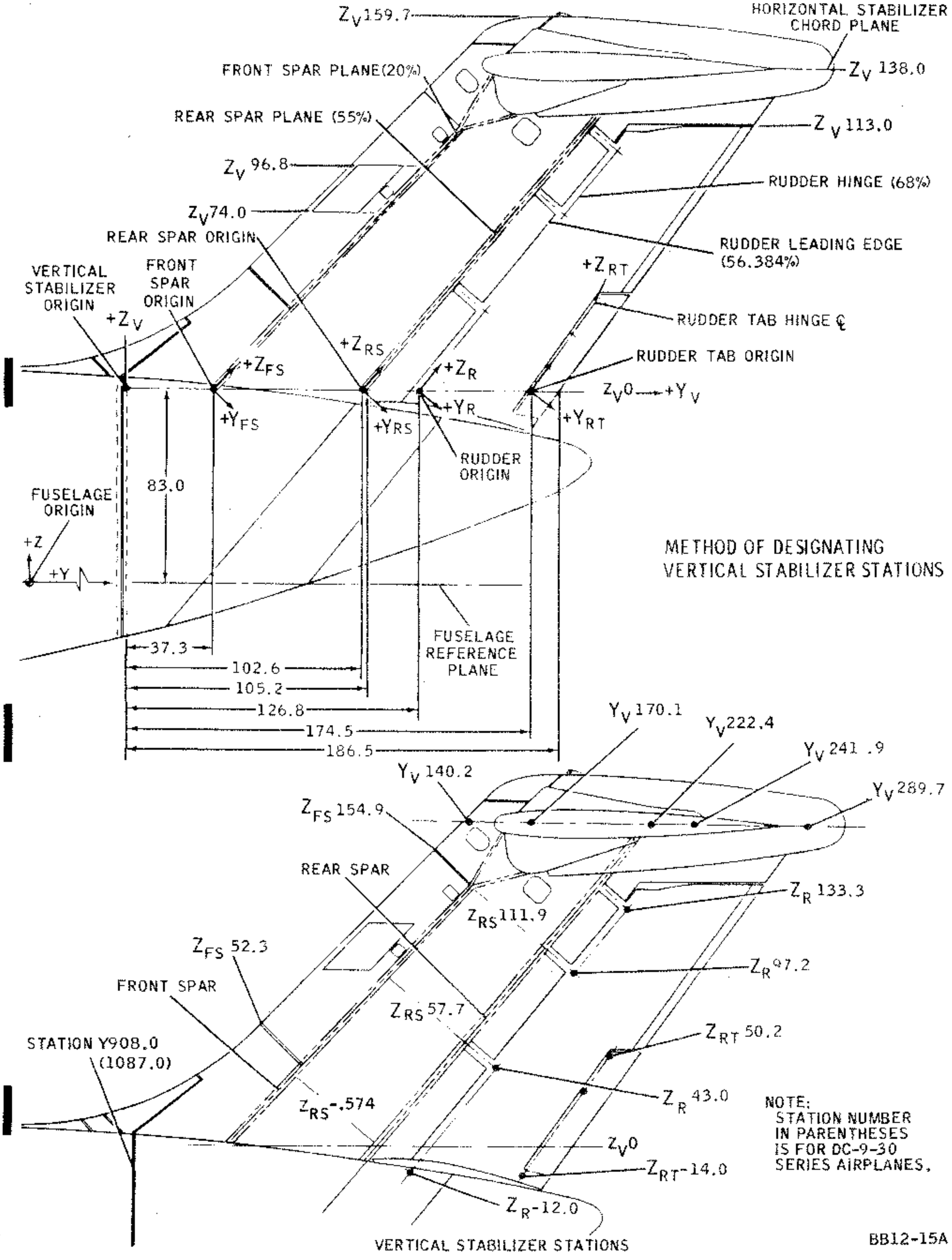


NOTE:
STATION NUMBERS IN PARENTHESES
ARE FOR DC-9-30 SERIES AIRPLANES.

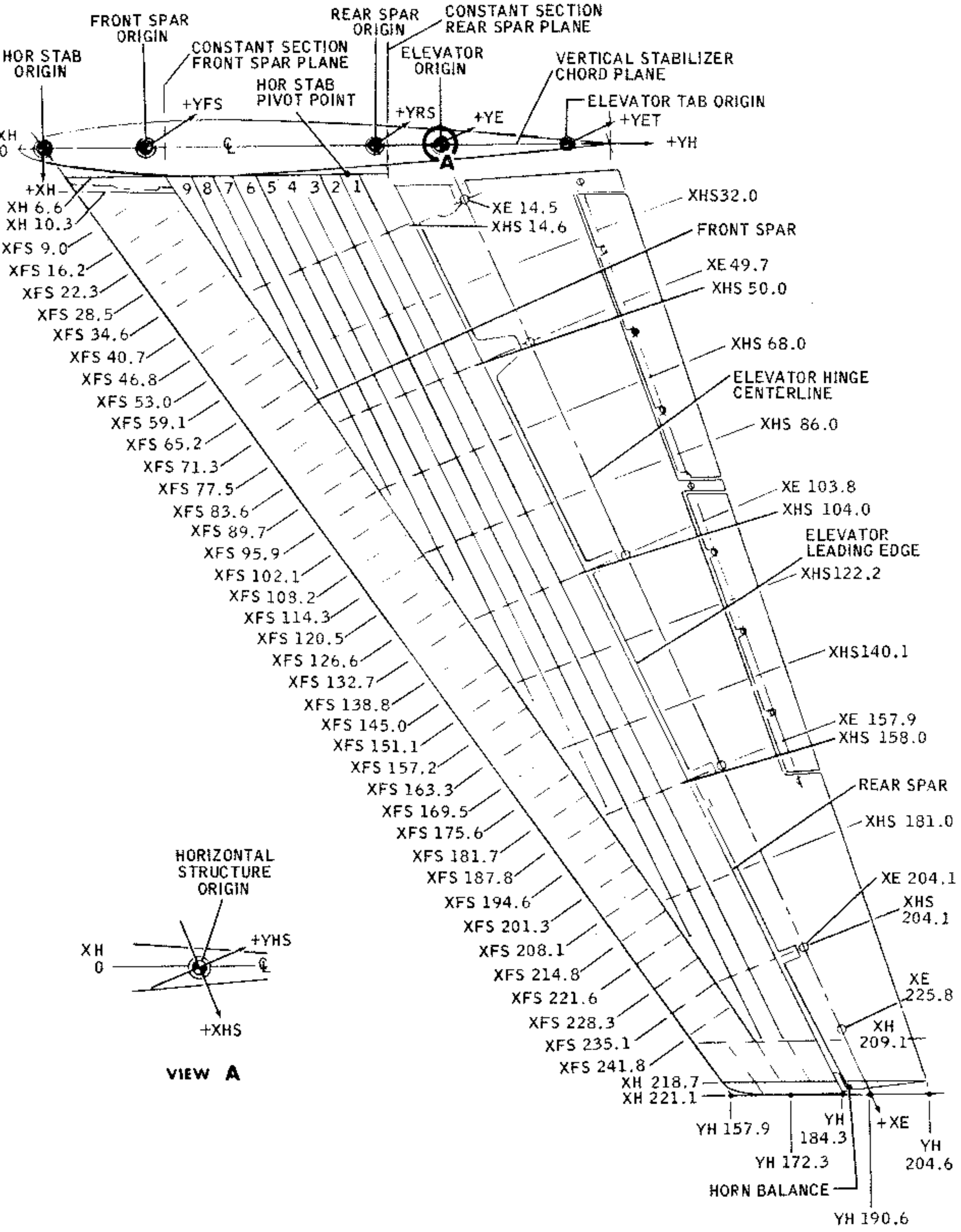
VIEW LOOKING INBOARD

BB12-14A

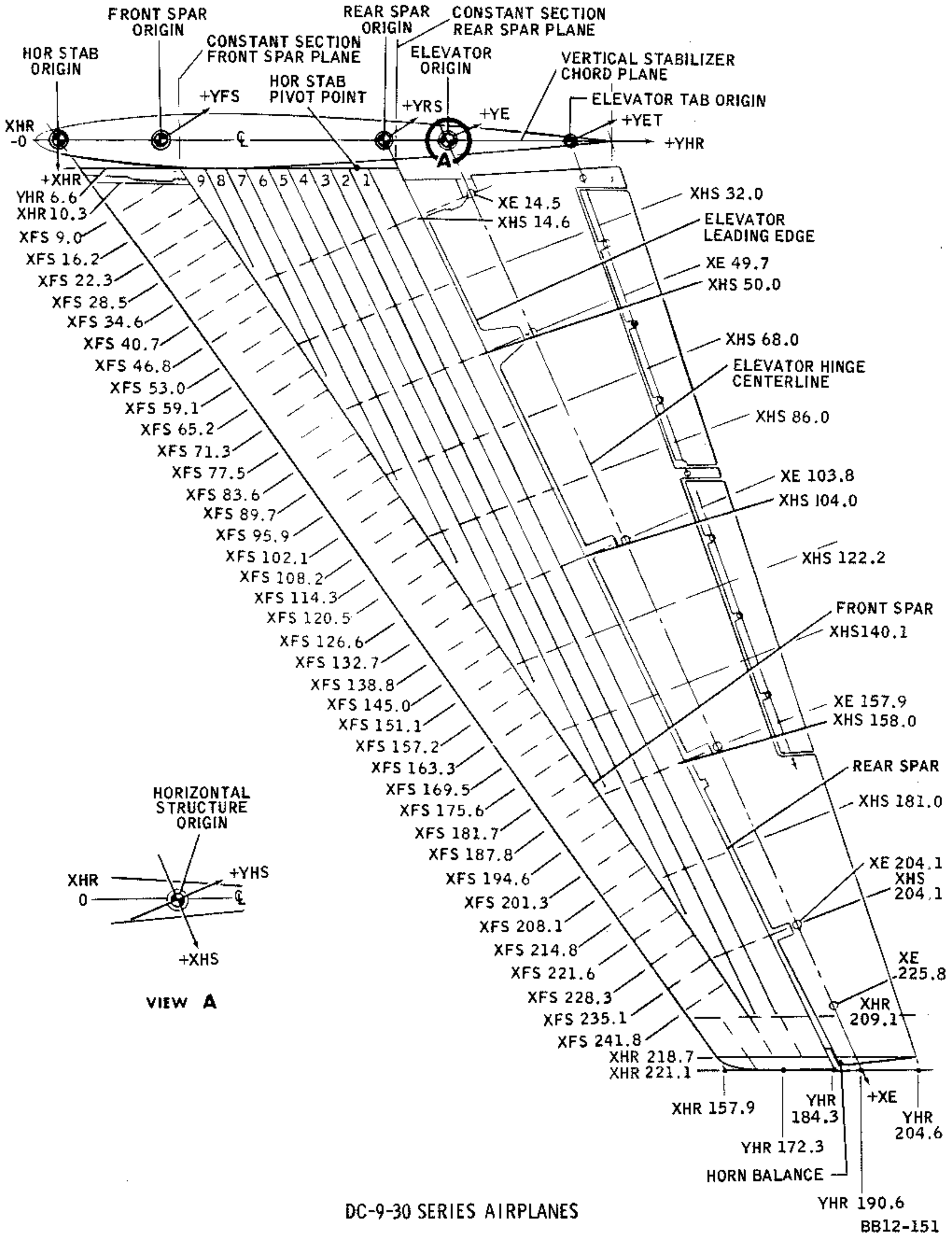
Nacelles/Pylons Station Identification
Figure 5



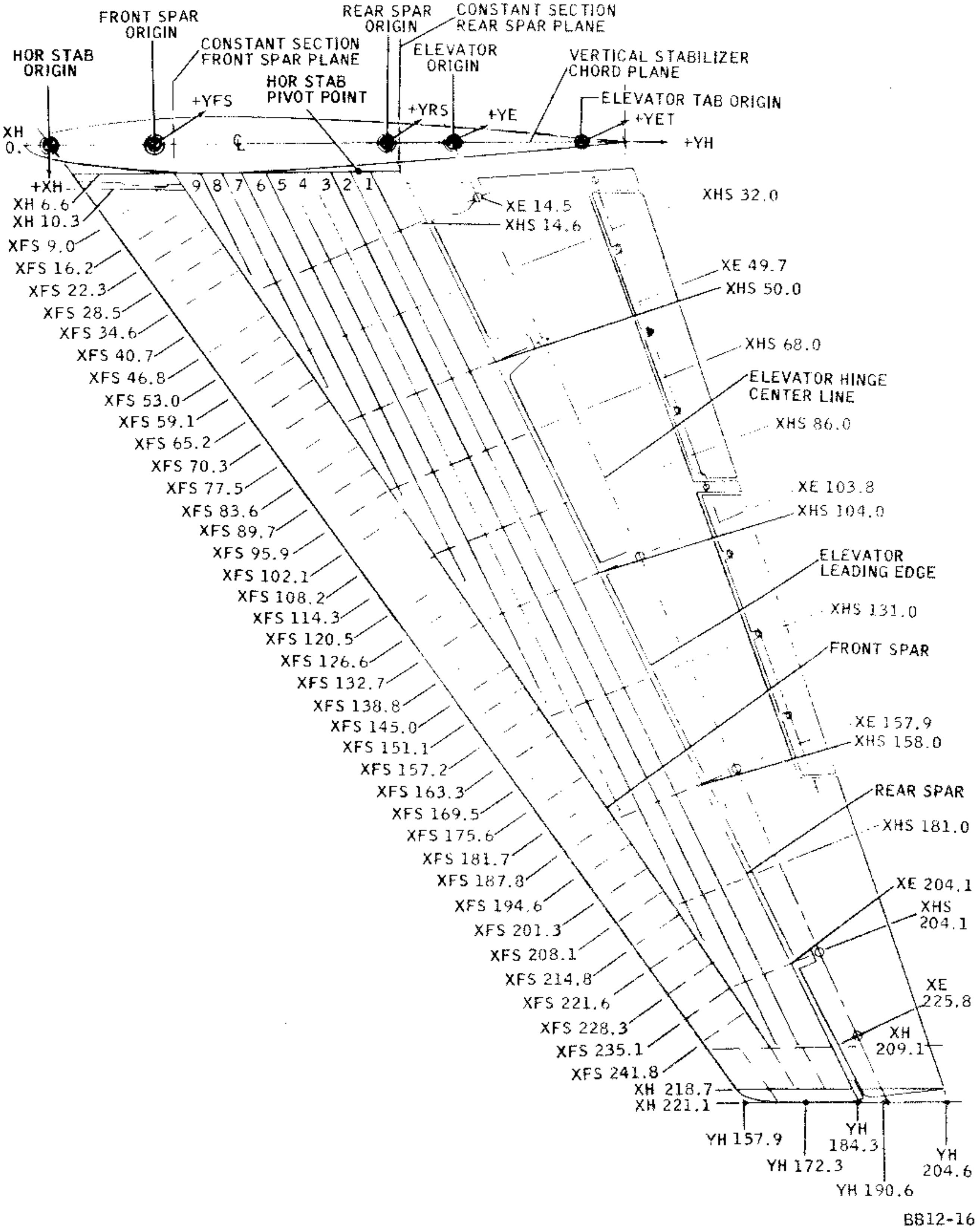
Vertical Stabilizer Station Identification
Figure 6



DC-9-10 Horizontal Stabilizer Station Identification
Figure 7



DC-9-30 Horizontal Stabilizer Station Identification
Figure 7A



Horizontal Stabilizer Station Identification
Figure 7

Printed in U.S.A.

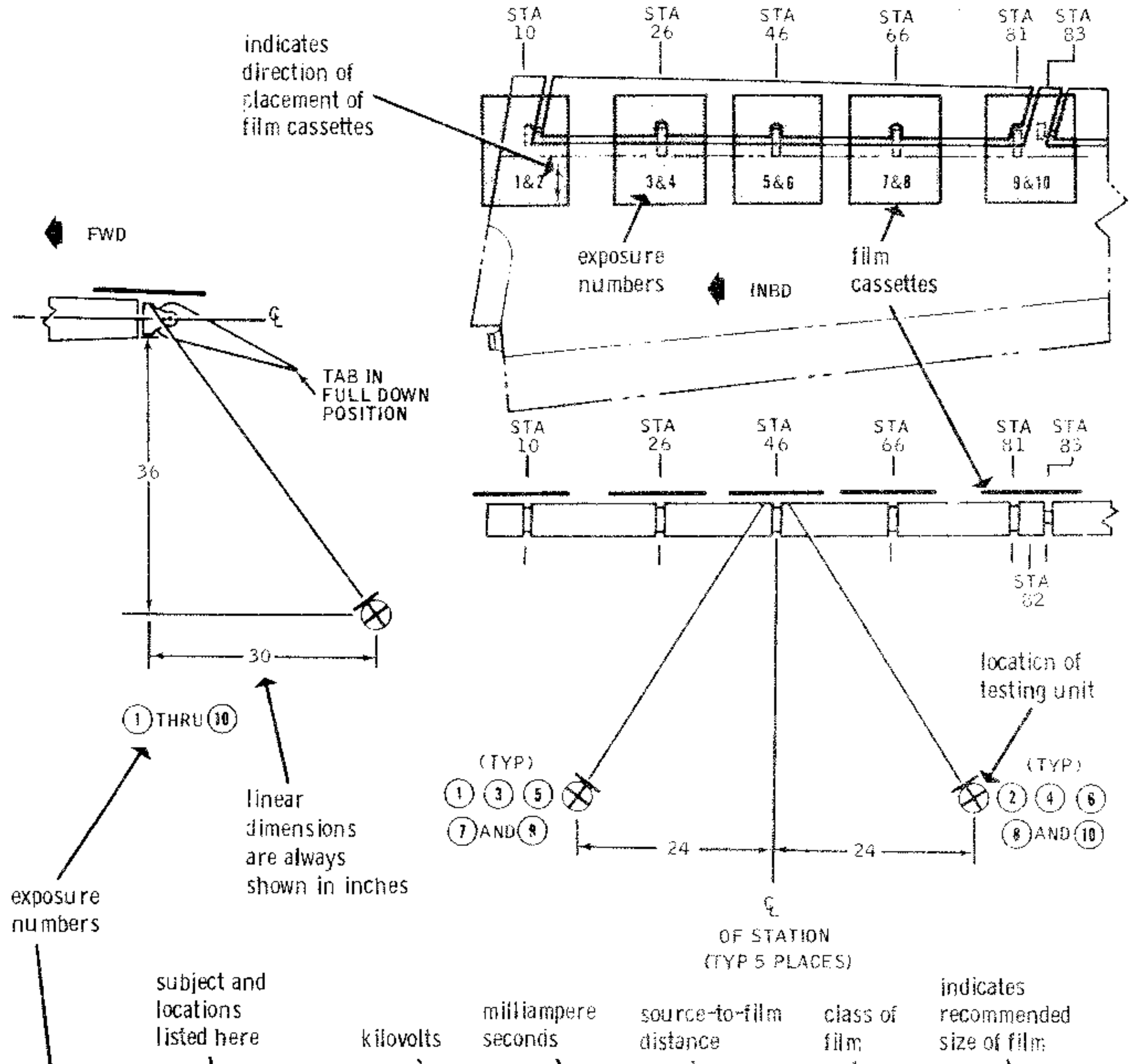
2. Aids in Use of the Manual

A. The DC-9 Nondestructive Testing Manual has been arranged in a similar manner to the other DC-9 manuals to aid the user in determining the location of material. Structural chapters contained within this manual carry the same titles as those within the DC-9 Maintenance Manual, DC-9 Parts Catalog, and the DC-9 Structural Repair Manual. For example, chapter titles are arranged in sequence as General Information, Doors, Fuselage, Nacelles/Pylons, Stabilizers, Windows, Wings, and Miscellaneous Airplane Components within this manual.

B. In addition, the illustration format of the DC-9 Structural Repair Manual has utilized orthographic projections wherever feasible to supply the technician, who desires to examine the structural materials, with a natural view of the structure. Supplementary structural inspection suggestions are also described in Section 51-10-5 of the Structural Repair Manual, and airplane extruded and formed section shapes have been illustrated in cross-sectional format in Section 51-10-1 of that manual. This has made it possible to eliminate the duplication of material identification illustrations within this publication.

C. The user of this manual will also find Chapter 5, Sections 5-51-0 thru 5-51-3 of the DC-9 Maintenance Manual a helpful aid in determining useful criteria in his understanding of the use of nondestructive testing applications to examine the components of the DC-9.

D. An illustrated example of radiographic symbols and abbreviations is presented in Figure 8.



EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1		110	300	56	II	8 x 10
2		110	300	56	II	8 x 10
3		110	300	56	II	8 x 10
4		110	300	56	II	8 x 10
5		110	300	56	II	8 x 10
6		110	300	56	II	8 x 10
7		110	300	56	II	8 x 10
8		110	300	56	II	8 x 10
9		110	300	56	II	8 x 10
10		110	300	56	II	8 x 10

RADIOGRAPHIC DATA

8B12-113

Radiographic Symbols and Abbreviations
Figure 8

RADIOGRAPHIC TESTING METHODS

1. Description

WARNING: THE USE OF RADIATION IN NONDESTRUCTIVE TESTING PRESENTS POTENTIAL HAZARDS TO OPERATING AND ADJACENT PERSONNEL UNLESS ALL SAFETY PRECAUTIONS AND REQUIREMENTS OF NATIONAL, STATE, AND LOCAL AGENCIES ARE OBSERVED.

A. Radiographic inspection is a nondestructive testing method utilizing a source of X-rays or gamma rays to detect discontinuities in material and present them on a recording medium. The recording medium, for purposes of this manual, is film, but it can be other means that convert radiation into a visible image. An X-ray film is coated with an emulsion that is sensitive to X-rays and to light. In radiography, the film is mounted on one side of the subject and the source on the other side. An exposure is made and the film subsequently developed. A radiograph therefore is a visible image on the developed film and is produced by the penetrating radiation passing through the subject being inspected thus exposing the film and forming a latent image on the film emulsion.

B. The nature and thickness of the material through which the rays pass regulates the amount of rays received at the film. Variations in density of the part will increase or decrease the radiation received at the film and effect the contrast of the developed film. When the film is developed, areas of high intensity will be dark and areas of low intensity will be light. Defects are distinguished by their contrast with the surrounding area.

C. The completed radiograph is also effected by the film contrast, as well as its subsequent development. A film of high characteristic contrast may result in a radiograph of low contrast if the subject contrast is very low. Conversely, a film of low contrast may result in a radiograph of high contrast if the subject contrast is high. The films listed in subsequent chapters of the manual have been selected to provide optimum detail of the subjects being inspected. The film is held in a lightproof container, or cassette. In some cases the film is double loaded, with film of different speeds in the same holder, to provide the required contrast where wide variations in subject density exist. In other cases, lead screens are used to improve the quality of the image.

D. To produce radiographs of the necessary detail required to resolve the integrity of a subject, it is also necessary to pay careful attention to the placement of the X-ray source and film. The plane of the x-ray beam must be oriented to be in line with the plane of a possible discontinuity. The unnecessary superimposing of extraneous images must be avoided.

E. The degree of film intensity is controlled by the power (kilovoltage), rate of current flow (milliamperes), exposure time (seconds), and the source-to-film distance (inches).

(1) The power (kilovoltage) used affects the penetration quality or energy of the radiation emitted from the X-ray tube.

(2) The rate of current flow through the X-ray tube controls the amount of radiation emitted. The radiation is directly proportional to the tube current. If a given amount of current is doubled, the amount of radiation will be doubled.

(3) Exposure is the length of time that the film is exposed to radiation. The primary radiation is directly proportional to the exposure time. If a given amount of time is doubled, the radiation is doubled.

(4) The distance from the X-ray source (tube) to the film is the source-to-film distance. Primary radiation reaching the film is inversely proportional to the square of this distance. Generally, if a change in source-to-film distance is required, it is also necessary to change the exposure time and/or current to compensate for the change and maintain the intensity. The inverse square law, represented by the following formula, will be useful in maintaining the required intensity when a need for adjustment exists.

$$\frac{(SFD_2)^2}{(SFD_1)^2} \text{ X } MAS_1 = MAS_2$$

Legend:

SFD_1 = Initial source-to-film distance

SFD_2 = New source-to-film distance

MAS_1 = Initial milliampere seconds

MAS_2 = New milliampere seconds

2. Radiographic Techniques

A. The radiographic techniques provided in subsequent chapters of the manual have been carefully developed for specific points of interest. The techniques are presented pictorially with regard to dimensional locations of the X-ray tube (source) and film. A radiographic data table is provided with each figure and includes tabular data and annotations pertinent to the exposure.

B. Use of the radiographic techniques will provide varying degrees of resolution in determining the presence of discontinuities. This resolution can be affected by such things as film quality, equipment condition, and location of film and source in relation to the defects. It should be understood that radiographic data cannot always produce conclusive results. In many instances, it will be desirable to use other testing procedures separately or in conjunction with radiography to resolve the integrity of an item. The specific points of interest have been chosen with regard to: areas in which radiography can save time and effort, historical background of problem areas of other aircraft, and engineering knowledge of the structural design.

C. Presentation of manual data is as follows:

(1) Radiographic techniques for specific airplane components are arranged into chapters comparable to the DC-9 Structural Repair Manual as listed below:

Chapter Title	Nondestructive Testing Manual Chapter	Structural Repair Manual Chapter
Doors	2	52
Fuselage	3	53
Pylons	4	54
Stabilizers	5	55
Windows	6	56
Wings	7	57

(2) Each radiographic chapter contains a number of illustrations or figures. Each figure provides radiographic procedures for a specific area or any group of compatible procedures identifiable by a common figure title.

(3) The information that is included and the terms used in the radiographic illustrations and data tables are explained as follows:

(a) Exposure	Numerical identification of one application of the X-ray source. This number identifies each location of the source and the film applicable to that exposure. In cases where film at more than one location is exposed simultaneously, each film location includes a letter suffix after the number (example: 6A, 6B).
(b) Subject	Description of the article or area to be X-rayed.
(c) Kilovolts (KV)	Recommended power setting of the X-ray equipment.

(d)	Milliampere seconds (MAS)	Recommended current (milliamperes) multiplied by the time (seconds) required for each X-ray exposure. This is listed in product form to allow the operator to vary the time and current to accommodate specific operation requirements.
(e)	Source-to-film Distance (SFD)	Distance of X-ray source to film, given in inches.
(f)	Film	Class of film recommended for each X-ray. See the Film Source and Equivalent Chart, Figure 1, to determine the corresponding specifications of various film suppliers. In cases where two or more film are used in order to increase the range of material densities to be covered, each recommended film class is given.
(g)	Size	The recommended film size to be used. It is generally a size available from a film supplier; however, when the film must be trimmed to accommodate a specific application, the trimmed size is given.
(h)	Film location and orientation	The film location is dimensioned, from reference points, in inches. The long direction of the film is indicated by small arrows in, or near, at least one film of each group.

FILM		SOURCE IDENTIFICATION			
CLASS	DESCRIPTION	EASTMAN	DUPONT	ANSCO	GAVAERT
I	Very slow speed Ultra fine grain Highest contrast	R		HD	D2
II	Slow speed Very fine grain High contrast	M	510	B	D4
III	Moderate speed Fine grain Medium contrast	AA	506	A	D7
IV	High speed Moderate grain Moderate contrast	F	504	D	D10

For the purposes of this manual the film listed for each class are equivalent. Results to be expected when using film from the various sources may vary slightly. Experience will generally guide the operator in his choice of the film sources listed below.

Eastman Kodak Company, Rochester, New York.

E. I. duPont de Nemours and Co., Inc., Chicago, Illinois.

Ansco Division of General Aniline and Film Corporation,
Binghamton, New York.

Agfa-Gevaert Inc., 275 North Street, Teterboro, New Jersey.

Equivalent Film Class and Source Chart
Figure 1

RADIOGRAPH REPORT FORM

OPERATOR ________________ AIRPLANE IDENTIFICATION NO. ________

AREA OF AIRPLANE ________________

SUBJECT OF RADIOGRAPH ________________

INSPECTING FOR ________________

TOTAL TIME ON PART ________ TIME SINCE LAST INSPECTION ________

DC-9 NONDESTRUCTIVE TESTING MANUAL TECHNIQUE NUMBER ________ DATE ________

NOTE: When reporting a radiographic technique, which is not included or exactly as indicated in the manual, record any pertinent information below. Provide locating dimensions for source and film on separate sketch.

EXP NO.	SUBJECT	KV	MAS	SFD	FILM	SIZE	*DENSITY

* Indicate density of developed radiograph in area of interest.

REMARKS ________________

Sample Radiograph Report Form
Figure 2

LIQUID PENETRANT TESTING METHODS

1. Description

A. Inspection for defects that are open to the surface by the liquid penetrant method is one of the easiest, quickest, and least expensive of the nondestructive testing methods. It is suitable for field or shop use and is a means for examining parts or materials for surface defects not only in metals, but in other homogenous materials, except those of a porous nature. Materials having a porous face will absorb excessive amounts of the penetrant and mask the individual defects. Liquid penetrants can also be used on glass and certain types of plastics; however, for use on Plexiglas, special penetrant types other than those presented herein are required. Those penetrants presented may craze Plexiglas surfaces.

B. Penetrant inspection is a process which reveals defects open to the surface which may be too small to be detected during ordinary visual inspection. Fine cracks, porosity, laps, seams, and leakage paths in castings and weld assemblies are examples of such defects. After thorough cleaning of the part, penetrants are applied to surfaces by dipping, brush, or spray. Thorough cleaning prior to application of penetrants is mandatory for satisfactory detection of defects. Avoid metal smearing processes such as sanding. After its application, capillary action draws the penetrant into the defect. After a suitable penetration period, to permit maximum capillary action, excess penetrant is removed from the surface leaving only the penetrant entrapped in the defect. A developer is then applied. The developer acts like a blotter and draws the trapped penetrant back to the surface so that an indication of a discontinuity is made available.

C. Liquid penetrants are of two types; visible dye and flourescent dye. Visible dye, sometimes called nonfluorescent dye, is visible under white or ordinary light. Approximately 100 foot-candles at the part being checked is generally recommended to illuminate the surface and make the dye visible. The fluorescent liquid penetrants contain a fluorescent dye in a highly penetrating liquid. When the developer draws trapped particles to the surface, they fluoresce brightly under ultraviolet (black) light of proper wavelength, and may be green, yellow, or greenish yellow in color.

D. Visible liquid penetrants are available in three types; water-washable, post-emulsifiable, and solvent-removable. Fluorescent liquid penetrants are available in two types; water-washable and post-emulsifiable. The water-washable penetrants, as the name implies, are removable by water-wash without the use of additional material. The post-emulsifiable types require the application of an emulsifier after the penetrant has been applied and sufficient penetration time has elapsed.

E. The water-washable fluorescent penetrants classified as Group IV in MIL-I-25135 (Reference Figure 1) provide the lowest level of sensivity. The post-emulsifiable penetrants classified as Group V and VI provide increased levels of medium and high sensitivity. Many penetrant manufacturers have carried this sensitivity increase into the additional levels of Extra-High, Super-High, and Ultra-High. The most recent development of penetrants not covered by Military Specification has been the establishment of comparable sensitivities in the water-washable type. The military approved Douglas Specification DMS 1908 provides for qualification of two such products in the Medium and High range. The simplicity of the Specification DMS 1908 water-washable penetrant process as compared to the post-emulsifiable penetrant process makes it highly advantageous for production use with increased reliability and over-all performance in a greatly reduced processing time.

NOTE: Although not listed as solvent-removable, fluorescent penetrants may also be removed by solvents.

2. Liquid Penetrant Inspection

A. The materials listed in Figure 1 are divided into groups according to the group within the specification under which they qualify.

(1) Group 1 materials consist of a solvent-removable visible dye penetrant, a penetrant remover (solvent), a dry, wet, or nonaqueous wet developer.

(2) Group II materials consist of a post-emulsifiable visible dye penetrant, an emulsifier, and a dry, wet, or nonaqueous wet developer.

(3) Group III materials consist of a water-washable visible dye penetrant and a dry, wet, or nonaqueous wet developer.

(4) Group IV materials consist of a water-washable fluorescent penetrant and a dry, wet, or nonaqueous wet developer.

(5) Group V materials consist of a post-emulsifiable fluorescent penetrant, an emulsifier, and a dry, wet, or nonaqueous wet developer.

(6) Group VI materials consist of a high-sensitivity post-emulsifiable fluorescent penetrant, an emulsifier, and a dry, wet, or nonaqueous wet developer.

For convenience, several materials and manufacturers which are qualified under the referenced specification are listed in the various groups. The materials listed do not necessarily comprise all of the products available, nor does the listing imply strict selection or recommendations of those manufacturers products. Materials, whether equivalents or excelling products, are to be selected at the operator's discretion. Although most like items are interchangeable, it is recommended, in order to assure compatibility, that the series of items selected for the operation be from the same manufacturer.

Name	Number	Manufacturer (CODE)	Use
Group I (Reference MIL-I-25135) Visible Dye Penetrants (Solvent-removable)	Spot Chek SKL-HF Chex-All DP-400 VP-31 P-300 Dy-Chek DD-60 Double-Check DP-40	1 2 3 4 5 6 8	Visible dye penetrant for detection of discontinuities. Generally used for spot inspection and when water-wash is not feasible.
Group II (Reference MIL-I-25135) Visible Dye Penetrants (Post-emulsifiable)	Spot Chek SKL-HF VP-31 P-300 Dy-Chek DD-60 Double Check DP-40	1 3 4 5 6 8	Visible dye penetrant for detection of discontinuities. Has higher sensitivity than Group III materials.
Group III (Reference MIL-I-25135) Visible Dye Penetrants (Water-washable)	Spot Chek SKL-W VP-30 P303A Dy-Chek DD-60W 9D6 Double Check DP-50	1 3 4 5 6 7 8	Visible dye penetrant for detection of discontinuities. Has lower sensitivity than Group II materials.
Group I (Reference MIL-I-25135) Cleaner/Remover	Spot Chek SKC-NF C-570 E-59 K-410 Dy-Chek No. 3 SD-80 DR-60	1 2 3 4 5 6 8	Remove excess surface penetrant.
Group II (Reference MIL-I-25135) Emulsifiers	Spot Chek SKC-W E-50 D-153 Dy-Chek JD-90 ER-70	1 3 4 5 6 8	Surfactant used to make post-emulsifiable penetrant removable by water-wash
Group I, II, and III (Reference MIL-I-25135) Dry Powder Developers	Zyglo ZP-4 D-493A Dy-Chek Fluoro-Finder 9D3 D-100	1 4 5 6 7 8	Draw trapped penetrant to surface (provides lowest sensitivity).

Liquid Penetrant Inspection Materials
Figure 1 (Sheet 1)

Name	Number	Manufacturer (CODE)	Use
Group I, II, and III (Reference MIL-I-25135) Wet Developers	Spot Chek SKD-W	1	Draw trapped penetrant to surface (provides higher sensitivity than dry powder).
	DW-530 (Group I)	2	
	D-492B	4	
	Dy-Chek	5	
	9D71		
Group I, II, and III (Reference MIL-I-25135) Nonaqueous Developers	Spot Chek SKD-NF	1	Draw trapped penetrant to surface (provides highest sensitivity).
	D-70	3	
	D-495	4	
	Dy-Chek	5	
	AD-70	6	
	9D1	7	
	9D2	7	
Group IV (Reference MIL-I-25135) Fluorescent Penetrants (Water-washable)	Zyglo ZL-1B	1	Fluorescent dye penetrant for detection of discontinuities (has lowest sensitivity in fluorescents).
	FPW-500	2	
	FP-90	3	
	P-138A	4	
	Fluoro-Chek AWW	5	
	FL 22W	6	
	970 P8 (Medium)	7	
	970 P2 (High)	7	
	FP-10	8	
Group V (Reference MIL-I-25135) Fluorescent Penetrants (Post-emulsifiable)	Zyglo ZL-2G	1	Fluorescent dye penetrant for detection of discontinuities (has higher sensitivity than Group IV).
	FPE-505	2	
	P-148A	4	
	Fluoro-Chek RS	5	
	FL-2	6	
	985 P1	7	
	FP-20	8	
Group VI (Reference MIL-I-25135) Fluorescent Penetrants (Post-emulsifiable)	Zyglo ZL-22G	1	Fluorescent dye penetrant for detection of discontinuities (has highest sensitivity).
	P-149	4	
	Fluoro-Chek HS	5	
	FL 22	6	
	985 P2	7	
Specification DMS 1908 Fluorescent Penetrant (Water-washable)	Approved sources available upon request to Douglas Aircraft Co., 3855 Lakewood Blvd., Long Beach, Calif.		Fluorescent dye penetrant for detection of discontinuities (sensitivity equal to or greater than Group IV, V, and VI).

Liquid Penetrant Inspection Materials
Figure 1 (Sheet 2)

Name	Number	Manufacturer (CODE)	Use
Group IV, V, and VI (Reference MIL-I-25135) Dry Power Developers	Zyglo ZP-4 DD-535 (Group IV & V) D-72 (Group IV) D-493A Fluoro-Chek 9 D3 D-90	1 2 3 4 5 7 8	Draw trapped penetrant to surface (provides lowest sensitivity).
Group IV, V, and VI (Reference MIL-I-25135) Wet Developers	Zyglo ZP-5 DW-530 (Group IV & V) D-78 (Group IV) D-492B Fluoro-Chek 9D 71 D-110	1 2 3 4 5 7 8	Draw trapped penetrant to surface (provides higher sensitivity than dry powder).
Group IV, V, and VI (Reference MIL-I-25135) Nonaqueous Developers	Zyglo ZP-9 D-70 (Group IV) D-495 Fluoro-Chek FD 33 D-100	1 3 4 5 6 8	Draw trapped penetrant to surface (provides highest sensitivity).
Group V and VI (Reference MIL-I-25135) Emulsifiers	Zyglo ZE-3G PE-520 (Group V) E-153 Fluoro-Chek Fluoro-Finder 9PR3 (Oil-based) 9PR4 (Water-based) ER-80	1 2 4 5 6 7 7 8	Surfactant used to make post-emulsifiable penetrant removable by water-wash.

Liquid Penetrant Inspection Materials
Figure 1 (Sheet 3)

B. There are several sequential steps to be followed in inspecting with penetrants. These are, (1) cleaning, (2) application of penetrant, (3) penetration period (dwell time) of penetrant, (4) application of emulsifier (if post-emulsifiable penetrant is used), (5) removal of excess penetrant and drying, and (6) inspection.

NOTE: The importance of cleaning cannot be overemphasized and generally should be extended to include a light de-oxidizing etch for the removal of light oxidation within the crack and to remove smeared metals following local rework.

Key to Manufacturers:

Manufacturer (CODE)	Name and Address
1	Magnaflux Corp., 7200 W. Lawrence Ave., Chicago, Illinois
2	Automation Industries Inc., Sperry Products Division, Danbury, Connecticut
3	Met-L-Check Co., 11919 South Western Ave., Los Angeles, Calif.
4	Shannon Luminous Materials Co., Tracer-Tech Division, 7356 Santa Monica Blvd., Los Angeles, Calif.
5	Turco Products Inc., 2600 South Main St., Wilmington, Calif.
6	Testing Systems Inc., 2826 Mt. Carmel Ave., Glenside, Penn. 19038
7	Ardrox Ltd., Post Office Box 200, Niagra on the Lake, Ontario, Canada -- European address: Brent Chemical Products Ltd., Commerce Road, Brentford, Middlesex, England
8	Sherwin Inc., 5007 East Washington Blvd., Los Angeles, Calif.

C. Thorough cleaning of the part is essential and must precede application of the materials. The surface must be free of foreign materials and smeared or abraded metals which would prevent adequate penetration into any discontinuities or hold unwanted penetrant and cause false indications. Cleaning should be by vapor degreasing where possible. Paint or primer must be removed as completely as possible with solvent materials. Any solvents used should be of non-oily base.

(1) When parts are to receive machining, sanding, vapor or grit blasting, honing, burring, or any other surface treatment, they should be inspected prior to those treatments. Such treatments tend to occlude penetrant paths.

NOTE: For a more thorough understanding of the effects of such treatments on penetrant inspection, interested personnel should refer to the publication Materials Evaluation (Society for Nondestructive Testing, 914 Chicago Avenue, Evanston, Illinois) dated December 1965 and study the article titled Effects of Finishing Processes on Detectability of Surface Flaws by Penetrant Process.

D. Liquid penetrants can be applied by brush, spray, or dip, depending on the design of the part. Small parts can be dipped into a tank of penetrant, either individually or in baskets, and then set on a rack for drain or penetration. Undue amounts of penetrant need not be applied. It is only necessary to cover the surface with a film of penetrant. If spray is used, particularly within an airplane or assembly, adjacent areas should be effectively masked. Many times a few drops carefully placed will serve the purpose better than spraying and preclude the need for the difficult removal of much excess penetrant. Parts should be positioned for effective drainage after application of penetrant.

E. After the surface is coated with penetrant, a penetration period (dwell time) must be allowed for it to pass into the discontinuities. The penetration time required for a given part depends on the type of material, method of manufacture, type of defect, and temperature. Extended penetration times should be avoided. If the penetration time is too long, partial drying of the penetrant may result, making exceptionally long cleaning and emulsification times necessary. If the penetration time is too short, dilution of any emulsifiers used by the penetrant may result, and penetration of discontinuities may not be complete. Examples of material forms and minimum penetration times are shown in Figure 2 for penetrants other than Specification DMS 1908 material. Penetration time for Specification DMS 1908 penetrant is five minutes, regardless of material form.

F. After the penetration period, if the penetrant used is of the post-emulsifiable type, an emulsifier is applied to the surface. Application of the emulsifier must be such that all surfaces are wetted and the excess drained off. The dwell time of emulsifiers is critical. The emulsifier must remain on the surface only long enough to lend its water-wash characteristic to the excess surface penetrant. It must not remain on the surface long enough to combine with any penetrant entrapped in discontinuities. Generally, 2 to 5 minutes is sufficient; however, this may vary. Sometimes 30 seconds or less is sufficient.

G. Removal of the excess surface penetrant is the next step. Cleaning of the surfaces must be such that only the excess surface penetrant is removed and the only penetrant remaining is that entrapped in discontinuities. Cleaning must be handled with great care. The use of hot water, detergents, high pressures such as those from an air-water gun, and lengthy washing must be avoided. Use of spray type equipment is highly desirable. Small parts can be washed individually or by using a basket in a tank, with either fixed or portable nozzles. Washing with a hand nozzle, on a hose, at standard water main pressures is also generally satisfactory.

<u>NOTE</u>: Where parts are installed on the airplane and do not lend themselves to water-wash, a penetrant cleaner such as Zyglo ZC-7 (Magnaflux Corp.) or K-410 (Shannon Luminous Materials Co.) may be used. Cleaners should be applied to a clean cloth and the area carefully wiped. Spray should be avoided to preclude dilution of entrapped penetrant.

Material	Form	Type of Discontinuity	Penetration Time at 60°F (15.6°C) in Minutes	
			Water-washable penetrants	Post-emulsifiable penetrants
Aluminum	Precision casting	Porosity	5 to 15	5
		Cold shuts	5 to 15	5
	Extrusions & forgings	Laps	Not Recommended	10
	Welds	Lack of fusion	30	5
		Porosity	30	5
	All	Cracks	30	10
	All	Fatigue Cracks	Not Recommended	30
Magnesium	Castings	Porosity	15	5
		Cold shuts	15	5
	Extrusions & forgings	Laps	Not Recommended	10
	Welds	Lack of fusion	30	10
		Porosity	30	10
	All	Cracks	30	10
	All	Fatigue Cracks	Not Recommended	30
Steel	Castings	Porosity	30	10
		Cold shuts	30	10
	Extrusions & forgings	Laps	Not Recommended	10
	Welds	Lack of fusion	60	20
		Porosity	60	20
	All	Cracks	30	20
	All	Fatigue Cracks	Not Recommended	30
Brass and bronze	Castings	Porosity	10	5
		Cold shuts	10	5
	Extrusions & forgings	Laps	Not Recommended	10

Minimum Penetration Times for Penetrants
Figure 2 (Sheet 1)

Material	Form	Type of Discontinuity	Penetration Time at 60°F (15.6°C) in Minutes	
			Water-washable penetrants	Post-emulsifiable penetrants
Brass and bronze (continued)	Brazed parts	Lack of fusion	15	10
		Porosity	15	10
	All	Cracks	30	10
Plastics (Do Not Use on Plexiglas)	All	Cracks	5 to 30	5
Glass	All	Cracks	5 to 30	5
Carbide tipped tools		Lack of fusion	30	5
		Porosity	30	5
		Cracks	30	20
Titanium and high-temperature alloys	All		Not Recommended	20 to 30
All metals	All	Stress or intergranular corrosion	Not Recommended	240

NOTE: Penetration time for Specification DMS 1908 penetrant is five minutes regardless of material or form.

Minimum Penetration Times for Penetrants
Figure 2 (Sheet 2)

(1) If a fluorescent penetrant is used, observe the part under black light during cleaning. Wash the part only until materials on the surface are removed.

(2) If a post-emulsifier has been used and the part does not wash clean (has a fluorescent background on the surface, or dye is still visible), the length of the emulsification period should be increased. In this event, rather than repeat emulsification only, the part should be dried and all steps repeated.

(3) After washing, the part must be dried before applying the developer. Drying may be accomplished by warm air, cloth, or paper towels. Excess water can be blown off with low-pressure compressed air prior to other drying operations. Excessive time in a dryer should be avoided as the penetrant will slowly evaporate.

H. The developer, which can be either a dry, wet, or nonaqueous type, causes minute quantities of penetrant to bleed to the surface and holds it there. The dwell time of developers is generally one-half of the penetrant dwell time.

(1) Dry powder developers, which provide the lowest sensitivity, can be applied by hand powder bulb, shaker, brush, or powder blower. A film of powder can be applied to small parts by the basketful by dipping into a tank of powder. The excess powder can be shaken off or blown off with light applications of compressed air.

(2) Wet developers, which provide a higher sensitivity than dry powders, can be applied without a prior drying operation of the washed part. Application may be by dip, brush, or spray. Spray applications provide the highest sensitivity. The sensitivity is also enhanced when the part is heated to a temperature not exceeding 200°F (93.3°C) for a period up to 15 minutes and the wet developer sprayed on the part while it is still hot enough to dry the developer quickly. Exercise care in the use of the developer and ensure that it is drained from recesses and trapped areas so that it will not mask any defects. The developer must be thoroughly agitated before and during use.

NOTE: When aluminum parts have a finish requirement prohibiting discoloration, apply the developer to a test strip of same material (before applying it to the part) and gage the results.

(3) Nonaqueous developers consist of a powder suspended in a volatile liquid and can be used for all types of inspections. They have the highest relative sensitivity and are used primarily for spot inspection where the surface being inspected is not heated in the process. When the part has been rinsed in water and dried by heat, permit the part to cool so that it can be comfortably held by hand before applying the developer. Spray applications of developer provide the highest sensitivity. Prior to application, agitate the developer thoroughly.

(4) After the developer has been permitted to dwell at least one-half of the penetrant dwell time, the part is inspected under ultraviolet, (black) light (see Paragraph 3) if fluorescent penetrant has been used. If visible dye penetrant has been used, the inspection is made under ordinary light.

3. Blacklight Inspection of Parts

A. Parts, to which liquid fluorescent penetrants have been applied, are inspected under ultraviolet (black) light. Inspections are carried out in a darkened booth, or by means of a portable light with sufficient curtaining placed around the inspection area to form a shield to prevent excess entry of white light from outside sources.

B. Blacklight Corning filters must be used which emit or pass ultraviolet light between 3200 and 4000 angstrom units in wavelength. A 100-watt projector flood or spot mercury-arc is highly satisfactory. Generally, a spot-type bulb together with a fluted Corning 3660A filter will provide the highest intensity of well dispersed light, although any combination is acceptable provided low energy dark spots do not occur in the projected beam.

C. Constant line voltage is essential for consistent light performance. Where voltage fluctuations exist, a constant voltage transformer must be used. Blacklight filters should be checked at least every 30 days as follows:

(1) Clean the lens before test to ensure that there is no visible leakage of white light due to damaged or defective marking.

(2) Allow the lamp to warm up at least 15 minutes.

(3) With the lens held by a fixture, adjust to 15 inches between the face of the light lens filter and the top face of a Weston No. 703 (Weston Instruments Inc., Archibald, Pa.), or equivalent, light meter unfiltered aperture using a 10X multiplier disc. The intensity should not be less than 125 foot-candles indicated.

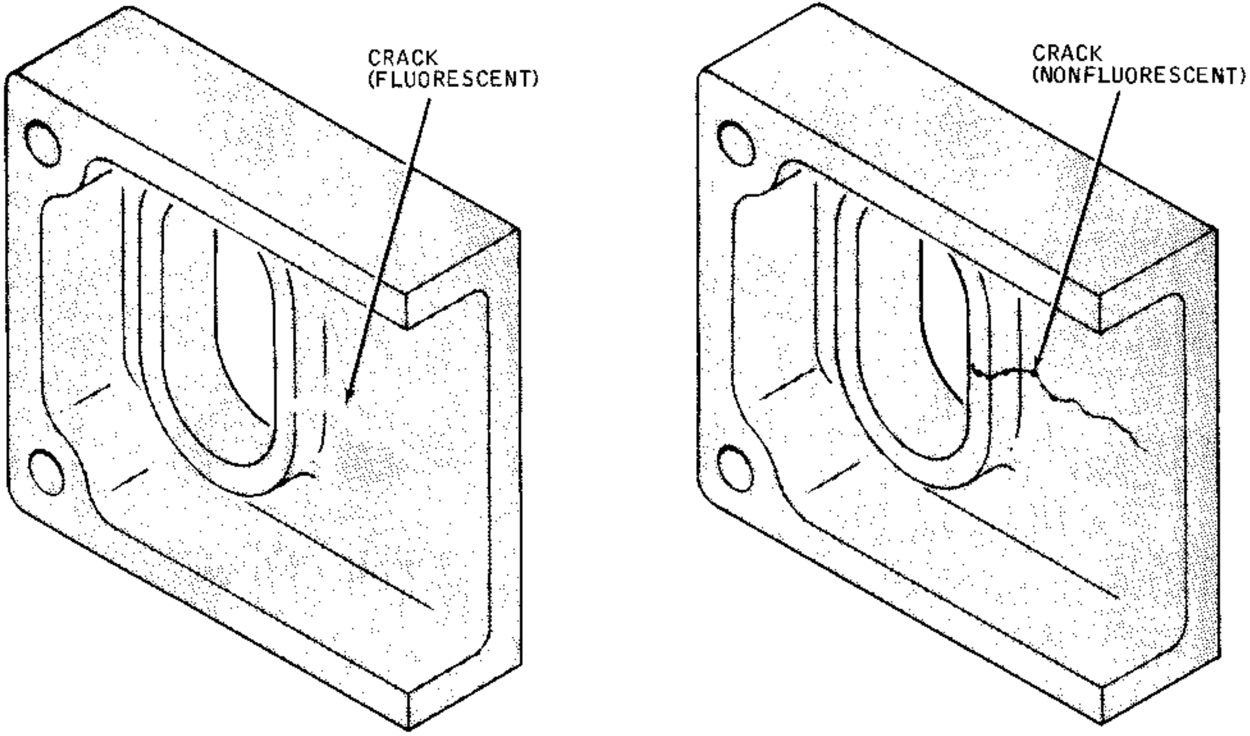
(4) Ensure that the light and filter combinations used provide an even light dispersal with no dark spots in the projected beam which drop below 125 foot-candles at 15 inches.

NOTE: The tests described above must be made in a darkened area where ambient light does not exceed 2 foot-candles.

D. Output of the blacklight should be checked at least every 30 days. Two methods of checking the amount of radiation are presented.

(1) One method utilizes a hand-held Ultraviolet Meter, Model J-221 (Ultraviolet Products Inc., 5114 Walnut Ave., San Gabriel, Calif., 91778) or equivalent. This meter screens out the visible light and measures only the radiation of the long wave ultraviolet light (3200 - 3800 Angstrom units), with direct readouts on the meter in microwatts per square centimeter. The meter has an expanded dial with two scales, an A scale with readouts from 0 to 1000 microwatts per square centimeter, and a B scale with readouts from 0 to 5000 microwatts per square centimeter. The sensor cell is removable from the unit and, when used with an available extension cord, can be placed at a point away from the meter for remote readouts.

(2) The other method utilizes a direct reading light meter (Weston No. 703, Weston Instruments Co., Archibald, Penn., or equivalent) and is sensitive to visible light. The intensity is read in foot-candles and a darkened area is required to prevent visible light from causing false indications.



FLUORESCENT PENETRANT INDICATION

VISIBLE PENETRANT INDICATION

BB12-114

Liquid Penetrant Indications
Figure 3

E. Check blacklight output using the Ultraviolet Meter as follows:

(1) Clean the lamp lens.

(2) Allow the lamp to warm up at least 15 minutes.

(3) Place ultraviolet meter sensor cell 15 inches from the light source.

(4) Read indication on meter. Minimum indication should be 800 microwatts per square centimeter.

F. Check blacklight output using direct reading light meter as follows:

(1) Clean the lens to ensure there is no visible leakage of white light due to damaged or defective marking.

(2) Place lamp in darkened area where white light does not exceed 2-foot candles.

(3) Allow the lamp to warm up at least 15 minutes.

(4) With the lens held by a fixture, adjust to 15 inches between the face of the light lens filter and the top face of a Weston No. 703, or equivalent, light meter unfiltered aperture using a 10X multiplier disc. The intensity should not be less than 125 foot-candles indicated.

(5) Ensure that the light and filter combinations used provide an even light dispersal with no dark spots in the projected beam which drop below 125 foot-candles at 15 inches.

G. When the blacklight is displayed on the part, and fluorescent penetrant is present in a discontinuity, intense fluorescence will mark the area (see Figure 3). Regions containing no defects will be nonfluorescent or a dead purple under the black light. The developer subdues the background, causing defects to stand out in sharp contrast.

H. The probable type and extent of defects is determined by noting the shape and area of indications. Cracks, seams, laps, lack of penetration, and cold shuts show up as fluorescent lines. Porosity is indicated by round fluorescent spots. Increasing spot size is indicative of a sub-surface cavity. The larger the defect, the greater the volume of entrapped penetrant to seep out during the development period. The size of such defects can be estimated by the relative size of the developed indication. In making such estimates, it is helpful to observe the indication under white light. The developed indication will then appear as a brown stain. To identify weldment defects, allow normal development time. If indications appear, wipe them off and redevelop. If the indications reappear, they are legitimate defects. On some parts, indications will be seen which are extraneous and may be ignored. Most sand castings will show slight general porosity and each pore will give a fluorescent indication. When the pores are well scattered over the part, they are considered normal in castings. A heavy concentration of pores, particularly at a stress point, may be expected to develop into failure under fatigue loading and should be a basis for rejection. Any fit joint in a part, such as a gear pressed onto a shaft, will give an indication at the joint. This is considered normal. Where washing has been incomplete, fluorescence will show the water drying spots. These are easily distinguishable from true indications by their nature and shape, but if doubt remains after the development, they should be run again and the washing improved.

I. After inspection, developer can be removed from the part by washing, by hand wipe with clean cloths and water, or by solvent.

MAGNETIC PARTICLE TESTING METHODS

1. Description

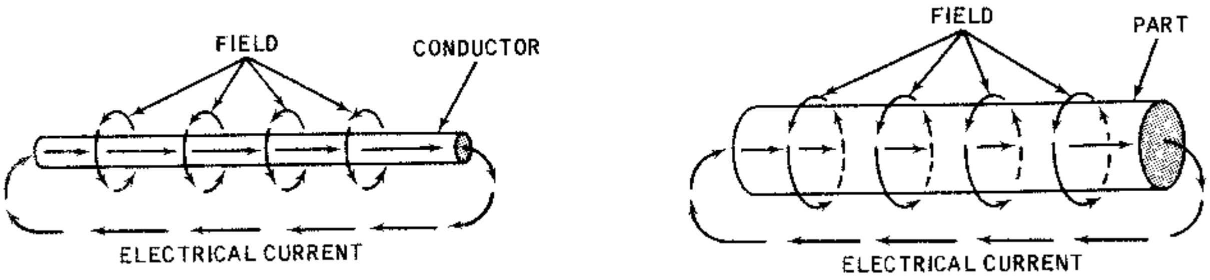
A. The magnetic particle method of testing is effective only on materials having ferromagnetic properties, principally iron and steel. Flaws or cracks located on the surface, or interior flaws that extend outward to within approximately 1/4 inch of the part surface can be detected by this method. This method will not reveal defects located well beneath the surface.

B. Testing by the magnetic particle method is based on the fact that magnetic lines of force, or flux, of an applied field tend to pass through the metal rather than through the air. If there is a surface crack or a defect near the surface, the distribution of the magnetic flux is disturbed and some of the flux is forced to pass out through the surface of the metal. Since the greater number of lines of force are cut by a flaw at right angles to the lines of force, the maximum amount of flux flow is obtained in the defect area. Thus in this area, the field strength is increased by the presence of the flaw and opposite magnetic poles form on either side of the defect. Then, when fine magnetic particles are applied to the part, the particles are attracted to these regions and form a pattern. In addition to cracks, the types of flaws that can be detected include seams, laps, non-metallic inclusions near the surface, and folds. Defects that are large and open to the surface can be detected by the use of either ac or dc equipment. Small cracks, or near surface defects, are generally better detected by dc equipment since direct current will provide deeper penetration.

C. To locate a defect, it is necessary for the magnetic flux to pass at approximately right angles to the defect. This is accomplished by control of the direction of magnetization. By controlling the direction of magnetization of the lines of force can be induced at right angles to the discontinuities. Since slight discontinuities can be oriented at any angle in the part, it is sometimes necessary to perform the operation in one direction and then magnetize in a direction 90 degrees from the first. Thus, two types of magnetization; circular and longitudinal, are used.

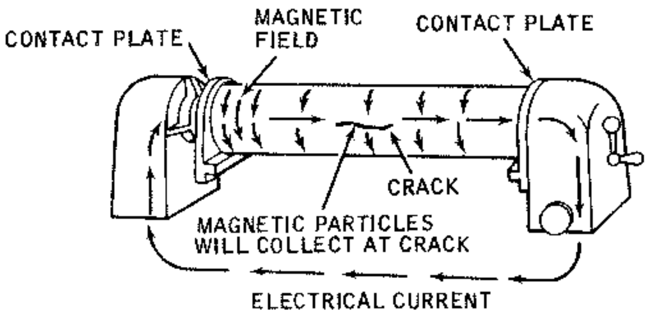
2. Circular Magnetization (see Figure 1)

A. Circular magnetization occurs when a circular magnetic field is induced in a part in such a manner that the magnetic lines of force (in any one plane normal to the axis of the current) takes the form of concentric rings about the axis of the current. This is accomplished by passing the current directly through the part or through a conductor which passes into or through a hole in the piece. As illustrated in Figure 1, circular magnetization can also be produced by prod contracts for localizing the field induced.

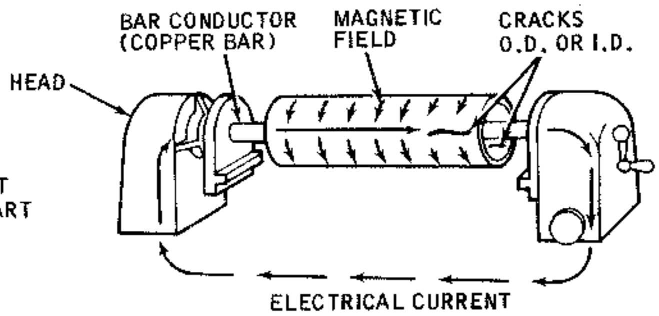


EXAMPLES OF CIRCULAR MAGNETIC FIELD
SURROUNDING A CONDUCTOR CARRYING AN ELECTRICAL CURRENT

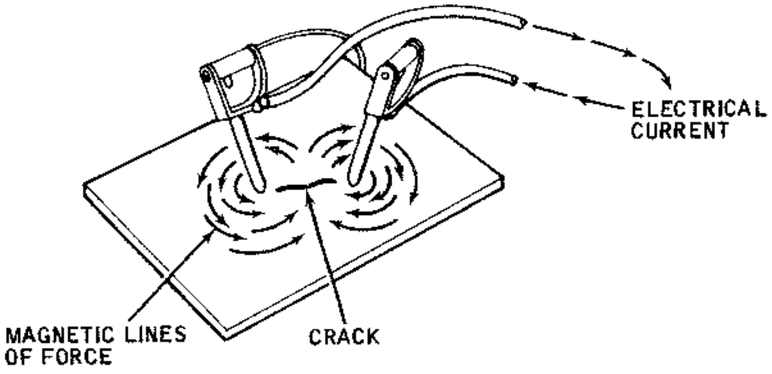
CIRCULAR MAGNETISM USED TO DETECT
LONGITUDINAL CRACK IN SOLID TEST PART



CIRCULAR MAGNETISM USED TO DETECT
LONGITUDINAL CRACK IN HOLLOW TEST PART



LOCALIZED CIRCULAR FIELD INDUCED
IN TEST PART BY PASSING ELECTRICAL
CURRENT BETWEEN CONTACT PRODS



BB12-25

Circular Magnetization Applications
Figure 1

B. A central conductor is used in cases where inspections of the inside surfaces of cylindrically shaped parts is required. Whenever possible, inspect hollow parts on a copper or 1100 aluminum bar between electrodes, keeping the central conductor against one side of the part.

C. When inspecting for grind cracks under chrome plate, the conductors used should be as near the size of the inside diameter of the part as is possible. When it is not possible to fill the inside diameter of the part with a central conductor, rotate the part on the conductor and use a separate magnetization at each position. One rotation should be made for approximately 7 inches of part circumference. Current from 800- to 1200- amperes per inch of cross-sectional part should be used on both hollow or solid sections. Exercise care so that parts will not be over-heated or burned and so that magnetic flux lines are not produced on the part. Energizing time delay should not be less that 1/2 second. Use repeated hit techniques until the entire ground area has been inspected.

NOTE: Although grind burns may be disclosed by this method, they can also be found by standard methods and are recognizable as spiral annular rings.

D. Where it is necessary to pass current through the part itself, exercise care to prevent burning at the electrode contact areas. The points of contact made with the part must be electrically sound to prevent arcing, and subsequent damage to the part.

3. Longitudinal Magnetization (see Figure 2)

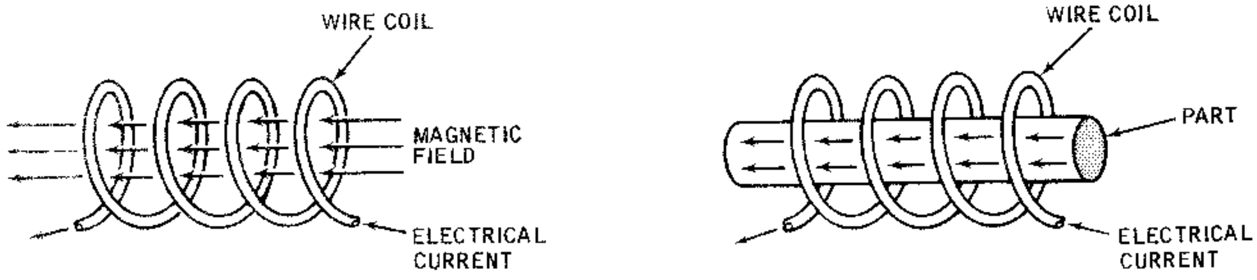
A. When current is passed through a coil wrapped around a part, or when a part is placed between the poles of magnet, lines of flux are created that are parallel to the axis of the part. This type of magnetization is called longitudinal magnetization and is useful for locating defects with axes transverse to the axis of the coil or to a line connecting the two points of application of the magnets.

B. In establishing the correct indicated current in amperes to be used for any specific part, the following factors should be considered:

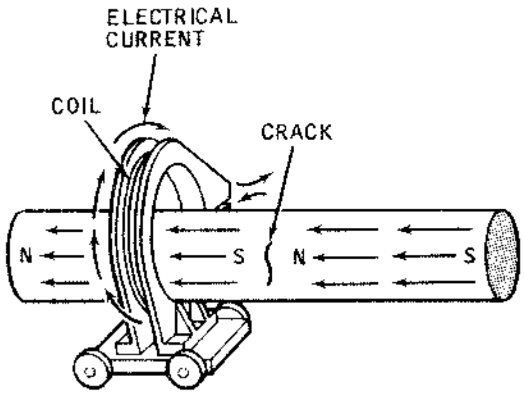
(1) The coil diameter must be at least two times as great as the thickness of the part to be inspected.

(2) The part must be held against the inside diameter of the coil and never positioned in the center.

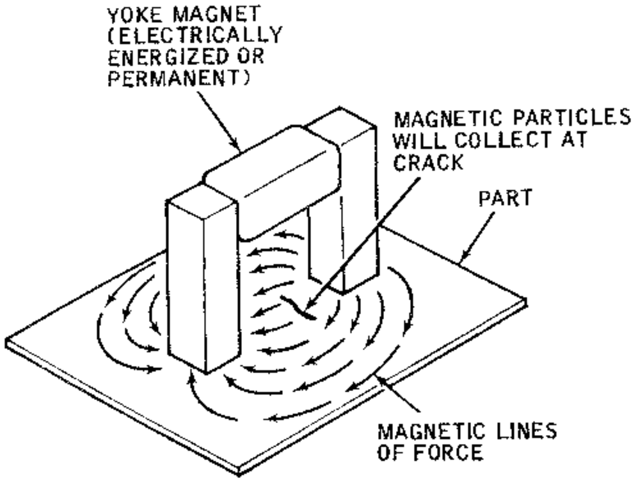
(3) The part is positioned in the coil with its longitudinal axis parallel to the applied magnetic field or the coil axis.



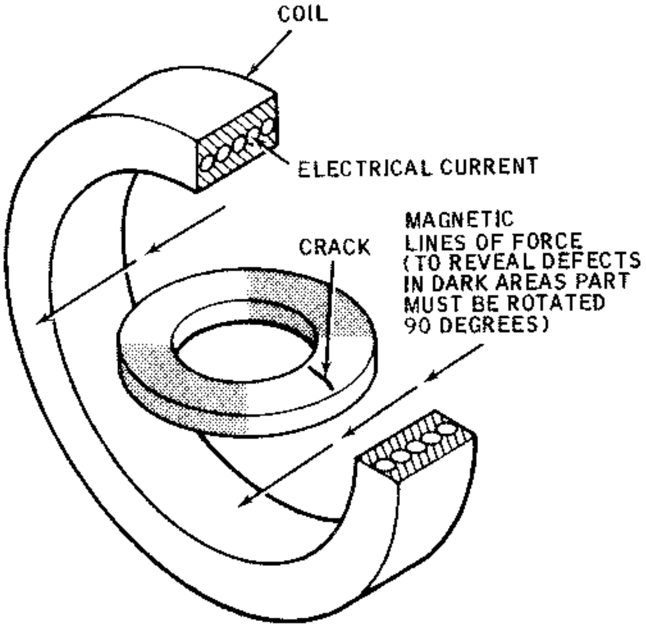
EXAMPLES OF LONGITUDINAL MAGNETIC FIELD AS PRODUCED BY A COIL



LONGITUDINAL MAGNETISM USED TO
DETECT A RADIAL CRACK IN SOLID TEST PART



LONGITUDINAL LINES OF FORCE
INDUCED IN A TEST PART BY A YOKE MAGNET

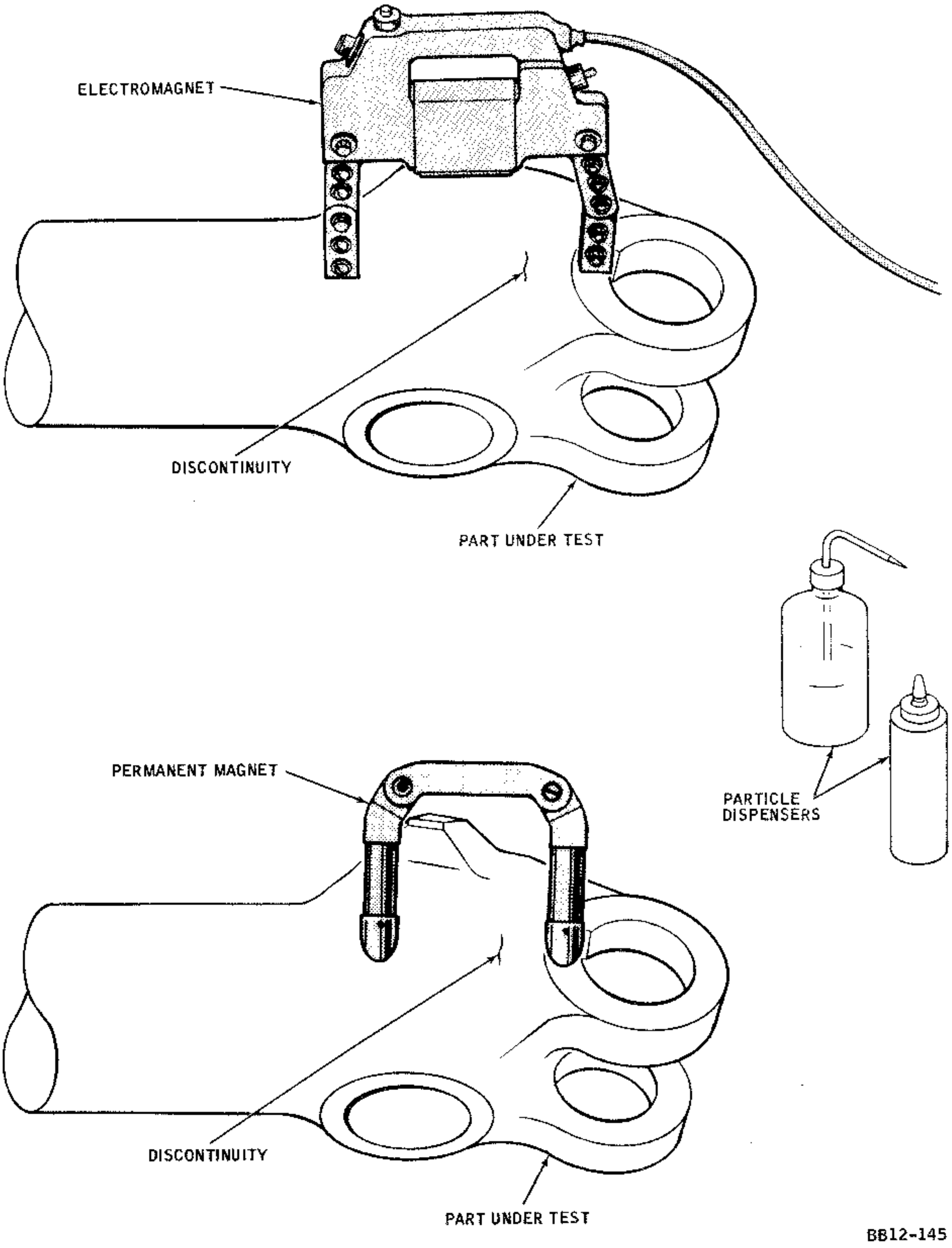


LONGITUDINAL MAGNETISM USED TO
DETECT CRACKS IN A RADIAL PART

BB12-24

Longitudinal Magnetism Applications
Figure 2

Printed in U.S.A.



Example of Longitudinal Magnetization in Detection of Discontinuity in Typical Landing Gear Part
Figure 2A

(4) If the part is more than 18 inches long, calculate the length to width ratio using 18 inches as the length.

(5) To find the L/D ratio (length to width or length to diameter) divide the part length by the part diameter or width, as applicable.

(6) When the calculated L/D is less than 2, use a ratio of 2 and when the calculation exceeds 15, use 15 as the ratio.

(7) To find the correct ampere turns, divide 45,000 by the L/D ratio.

(8) To find the correct indicated current in amperes, divide the ampere turns by the number of turns in the coil to be used.

EXAMPLE: L = 8, D = 2
L/D = 8/2 = 4
Ampere turns = 45,000/4 = 11,250
(Coil has 5 turns)
Indicated current = 11,250/5 = 2,250 amperes.

(9) For long parts, each 12 inches of length must be magnetized and inspected progressively; approximately 6 inches on either side of the coil vertical centerline is effectively magnetized.

(10) Leakage fields develop across sharp changes of section, such as radii under bolt heads, threads, and other sharp angles in parts. Keep longitudinal shots just below the intensity at which these leakage fields develop, except when inspecting ground chrome-plated parts for grind cracks.

C. Inspection of hollow chrome-plated parts by the circular magnetization method to detect grind cracks must be accomplished by using only a copper conductor of a diameter no greater than 1/2 inch under the inside diameter of the part being inspected and clamped firmly between the electrodes. When improvised methods are necessary due to part size, weight, or in-field applications, the induced magnetic fields must not overheat or burn the part.

D. There are definite advantages to the use of P.M. (permanent magnets) in conducting magnetic particle inspections of local, isolated or critical areas of small and large parts, as a constant magnetic field between the applied poles of the magnet is maintained during the actual inspection. Magnets used should have a dead weight lift capability of from 30 to 50 pounds, or more, depending mainly on the gap between the poles of the magnet.

(1) A magnet with not less than 30 pounds lifting power will render satisfactory inspection with 2- to 4- inch spread.

(2) For a 4- to 6- inch spread, a 50 pound lift magnet is recommended. When the magnet is too strong for its spread, immobility of the applied magnetic particles will result.

(3) The stability of the magnetic field generated by permanent magnets requires some agitation of the oxide particles within the field. The wet method therefore is considered most satisfactory. A mixture in the ratio of 1 ounce of solids, Magnaflux Concentrate No. 7C (Black Oxide), (Magnaflux Corp., 7200 W. Lawrence Ave., Chicago, Ill.), or equivalent, per gallon of Solvent Base Oil C, (Standard Oil Co., 225 Bush St., San Francisco, Calif.), or equivalent, is satisfactory. Use a plastic squeeze bottle for most effective application.

(a) Use of this method for detection of fine cracks in critical areas such as in thread roots of engine mount bolts, or for detection of fatigue cracks in localized areas of landing gear, etc., must be observed using 10X to 20X magnification. While under observation, flush the area several times to ensure that masking of microcracks by excessive oxides does not occur.

(b) When the directing of possible cracks in a suspect area is not known, or will not necessarily be normal to the lines of force between the poles of the magnet, reposition the magnet to best advantage and reinspect.

(c) After inspection, demagnetize the part (see Paragraph 5).

4. Residual Magnetization

A. In the residual method of inspection, the part is magnetized and the magnetizing current then cut off. The magnetic particles are applied to the part after the magnetization.

B. The residual method is dependent upon the retentivity of the part, the field strength applied, direction of magnetization, and shape of part.

C. The residual method is generally used only for further evaluation of indications revealed by the wet continuous method.

5. Demagnetization

A. Demagnetize parts by the ac method as follows:

(1) Hold the part approximately 1 foot in front of the A.C. demagnetizing coils and then move the part slowly and steadily through the coils and approximately 1 foot past the coils. Repeat this process until the part loses its residual magnetism. Rotate and tumble parts of complex configuration as they are passed through the coils.

B. Demagnetize parts by the dc method as follows:

(1) Place the part in the same relative position as when magnetized and apply reversing dc current. Gradually reduce the current to zero and repeat the process until the residual magnetic field is depleted.

C. When a magnetic yoke, such as the Contour Probe (Parker Research, Dunedin, Florida), or equivalent, is used, the magnetized areas may be progressively demagnetized by switching the probe from pulsed dc to ac after each inspection.

D. After demagnetization, test parts with a magnetic field indicator at several locations. Test parts of complex configuration at all significant changes in geometry. Repeat demagnetization if there is any appreciable deflection of the field indicator needle.

E. Thoroughly rinse the part with Solvent Base Oil C, or equivalent, until residual oxides are removed.

6. Materials and Application

A. The materials listed in Figure 3 are adaptable to various methods of magnetic particle testing. The items are listed for convenience and equivalent substitutes may be used.

Name and Number	Manufacturer
Magnaglo Dry Concentrate No. 10A	Magnaflux Corp., 7200 W. Lawrence Ave., Chicago, Ill.
Magnaflux Concentrate No. 7C (Black Oxide)	Magnaflux Corp.
Magnaglo No. 14A Fluorescent Powder	Magnaflux Corp.
Magnetic Particle Fluorescent Oxide (Magnaglo Prepared Bath No. 14AM)	Magnaflux Corp.
Magnetic Particle Fluorescent Paste (Sonoflux FP-100)	Automation Industries, Inc., Sperry Products Div., Danbury, Conn.
Solvent, Base Oil C	Standard Oil Co. of Calif. 225 Bush St. San Francisco, Calif.

Magnetic Particle Materials
Figure 3

B. Prior to application of the magnetic particles, the part must be free of grease, rust, scale, oil, paint, or other substances which might interfere with the concentration of magnetic particles at discontinuities, or which may improperly accumulate or concentrate magnetic particles in a nondefective area. Use cleaning methods that are not harmful to the part being inspected and that do not interfere with the inspection method.

C. The magnetic particles used can be nonfluorescent or fluorescent (dependent on the inspection required) and can be applied in the form of a dry powder, a paste, or suspended in a suitable vehicle.

(1) The dry powder can be sprayed or dusted directly on the area and excess powder removed. By lightly vibrating the part, a more uniform distribution of the powder will result. Exercise care in application of the powder to prevent excessive amounts being built up, as the excessive powder will interfere with effective indication of discontinuities. When removing the excess powder, avoid disturbing indications that are present. When the continuous method is used, apply the powder just before application of the magnetizing current. Keep the area magnetized during any vibrating, tapping, or blowing. When the residual method is used, apply the powder after magnetizing the part.

(2) The wet continuous process is used when inspecting for discontinuities just below the surface, such as nonmetallic inclusions. It is also used for most other inspections, except where the material, size, or shape of the part prohibits its use, in which case dry powder is used. An exception to this is when inspecting for grind cracks under chrome plate.

(3) Highly polished parts, 16 RMS finish or less, and all plated parts should be inspected using Magnaglo Dry Concentrate No. 10A or Magnaflux Concentrate No. 7C, or equivalent. Chrome-plated parts should be inspected before and after plating. If parts with strength levels of 180 KSI, or higher, are ground after chrome plating, they should be inspected after grinding using Magnaflux Concentrate No. 7C, or equivalent, with a suspension of 6 to 8 milliliters per 100 milliliters of solution. For other areas of the part, 1.7 to 2.4 milliliters per 100 milliliters of solution should be used. If fluorescent material is used there should be 0.1 to 0.5 milliliters per 100 milliliters of solution. Grinding burns appear as annular magnetic rings and are sometimes slow in appearing. After longitudinal magnetization, as the residual oxide flows across the changes in permeability, the indications become progressively more pronounced.

<u>CAUTION:</u> INSPECTION OF PARTS IN WATER-BASE MAGNETIC PARTICLE SOLUTION IS NOT RECOMMENDED FOR PARTS ABOVE 200,000 PSI HEAT TREATMENT. HYDROGEN EMBRITTLEMENT WILL RESULT, PARTICULARLY ON CADMIUM PLATED PARTS.

7. Inspection Lights

A. The fluorescent particles used are visible under ultraviolet, (black) light. They omit a fluorescent glow when seen under the black light. The black light used should be of the same intensity and qualifications as descricribed in Section 1-2.

B. When nonfluorescent particles are used, the lighting used should provide a minimum of 100 feet-candles measured at the working level.

CONVENTIONAL - EDDY CURRENT TESTING METHODS

1. Description

A. Eddy current equipment is considered useful for the detection of defects in accessible metallic surfaces. Several brands of good equipment are available for employing both absolute and differential methods of testing. Some of this equipment is designed for flaw detection, and some is designed for electrical conductivity measurement. Some of the recently developed units such as the Inductest FC2001 (Uresco Inc., 12412 Benedict Ave., Downey, Calif.), or equivalent, provide dual capability of flaw detection and direct reading International Annealed Copper Stantard Units (LACS) for conductivity measurement. The Inductest FC2001 unit is illustrated in block diagram form in Figure 1.

B. During aircraft maintenance, overhaul, and repair, the absolute method is the one most generally used. The absolute and differential methods both utilize coils as the detecting element, in a wide variety of selectable forms. The absolute method employs one coil on a ferrite core by which measurements are made of the material while it is placed in direct contact with the probe containing the coil. The differential method employs two coils which permits a comparison of the measurement obtained from the material standard in one coil and the unknown material in the other coil. It is generally used for sorting mixed materials or alloys.

2. Absolute Method of Flaw Detection in Nonferrous Material

A. Two typical absolute method probes are illustrated in Figures 2 and 3. One probe shown is used for hole examination and the other probe shown is used for surface scanning. The principles of operation are the same for either type probe shown.

B. When the coil shown is energized, a small hemispherical magnetic field approximately of the same diameter as the coil is established. The two characteristics of the coil -- inductive reactance and ohmic resistance -- are balanced by adjustment of the bridge circuit in the test equipment. This balance is affected whenever material is placed within range of the hemispherical magnetic field. The degree of effect the material has upon the balance of the coil's characteristics varies proportionately to the conductivity or permeability of the material. The effect of the material may be nullified by further balance of the bridge while the probe is held in contact with sound material. The bridge circuit will then remain in balance as the surface is scanned, provided other disturbances (surface roughness, defects, and conductivity variation) are not encountered.

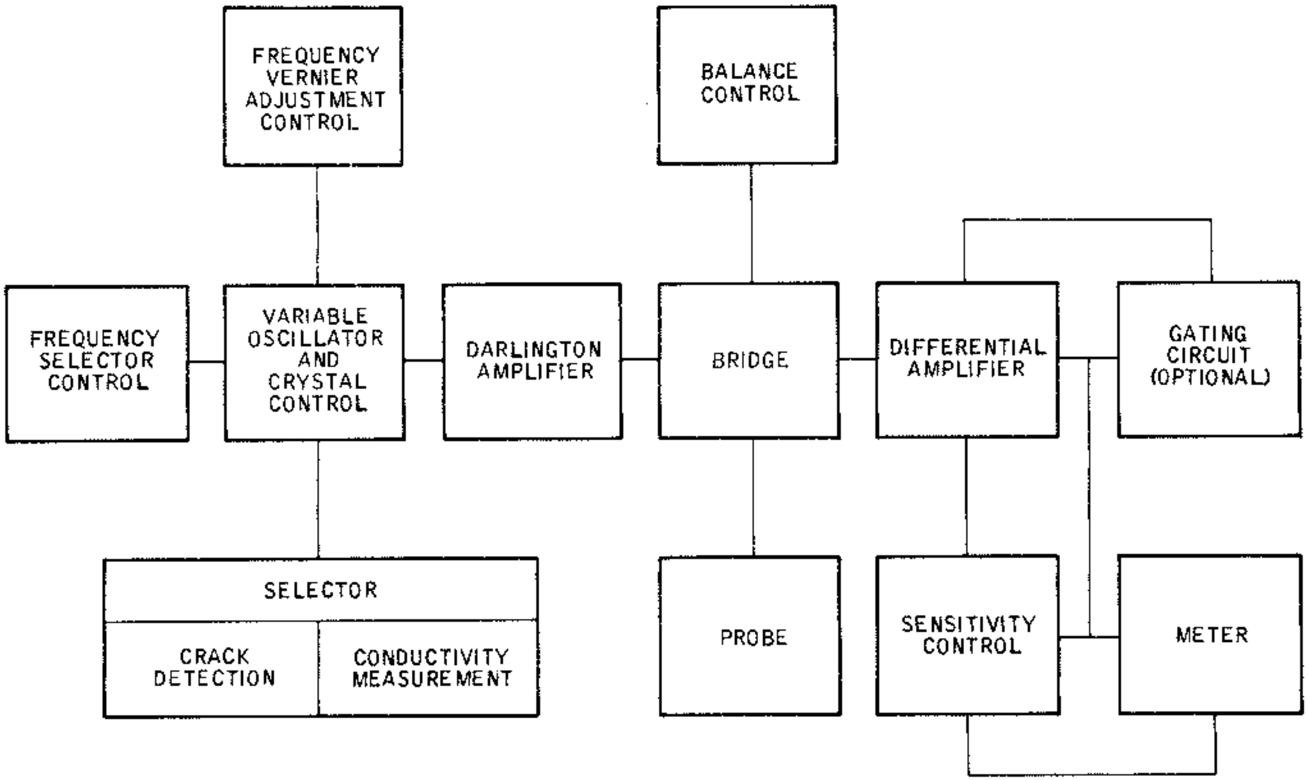
C. The remaining disturbing influences are surface roughness, material defects, and changes in conductivity. Of these, surface roughness can be nullified by further balance adjustments, leaving only material defects or change in conductivity to be interpreted by the operator of the equipment. Since defects cause an abrupt deflection of the indicator, it is relatively easy to differentiate between abrupt deflections caused by defects and the smooth deflections caused by conductivity changes.

D. The threshold of crack detection lies in crack depths of 0.010 to 0.020 inch. With a properly balanced instrument, cracks of this magnitude can be identified by slight but very abrupt deflection of the indicator as the coil passes over the discontinuity with the material under static-load conditions. Compressive loads may nullify effects while tension loads across areas being checked tend to enhance the detection capabilities of the equipment.

3. Conductivity Measurement

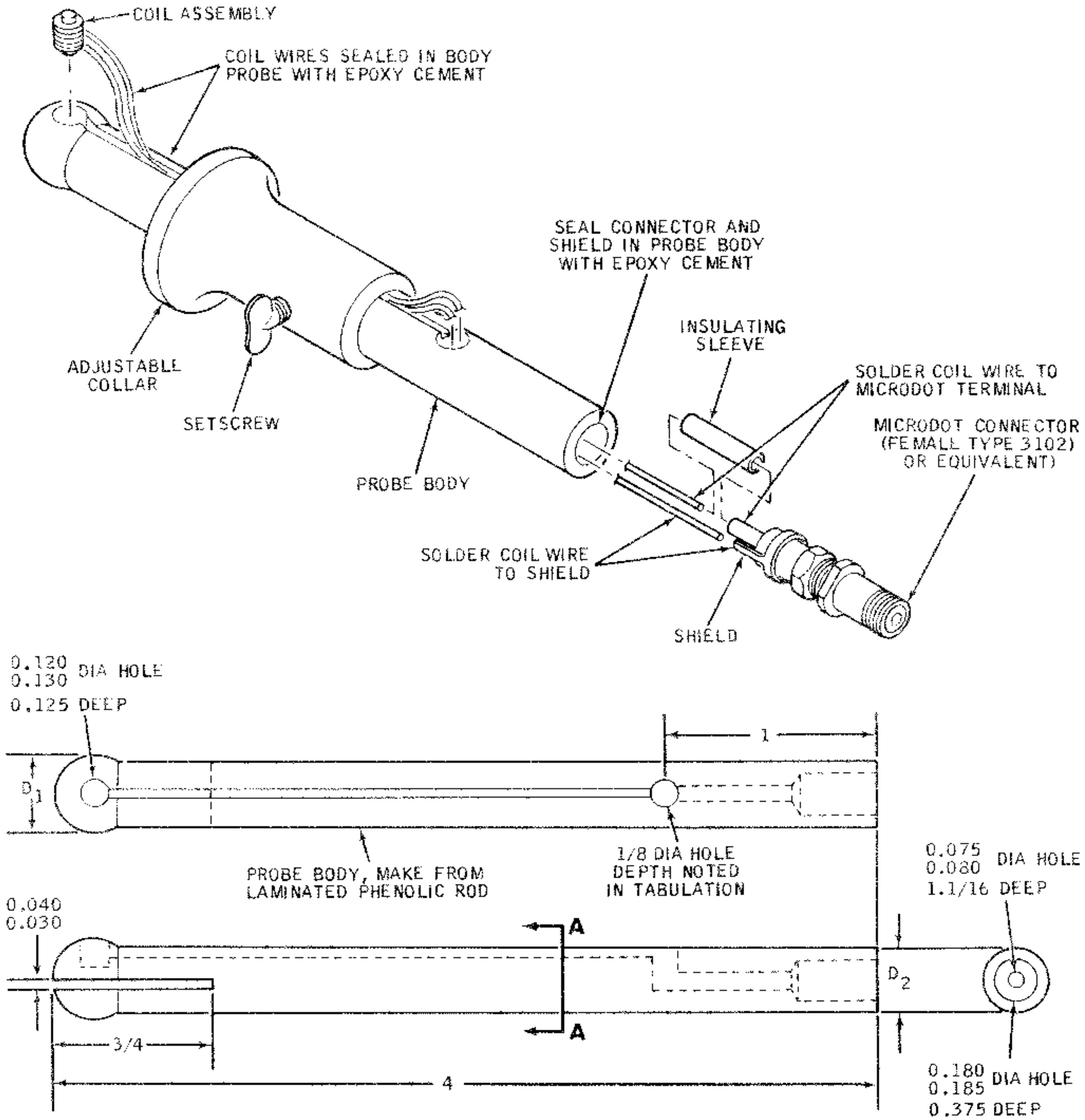
A. For conductivity measurement, a special instrument is generally required when exacting values of the percent conductivity in the International Annealed Copper Units (IACS) are required.

B. Electrical conductivity is controversial media for determining the heat treatment values of aluminum alloys, primarily because conductivity is affected by several material characteristics. These are: (1) changes in chemical composition (within the material specification), (2) the thickness of the clad coating on aluminum alloy sheet and plate, (3) the temperature of the material being tested, (4) where, in a heat treatment

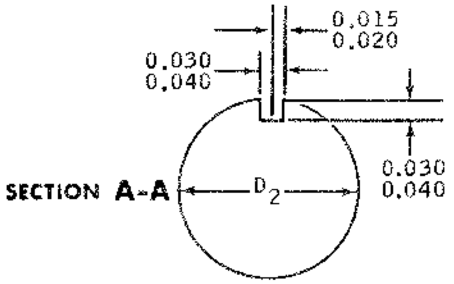


Block Diagram of Eddy Current Multi-Purpose Unit (Uresco Model FC2001)

Figure 1



PROBE SIZE	D1 DIA	D2 DIA	1/8 DIA HOLE DEPTH
1/4-INCH DIAMETER	0.248 0.253	0.205 0.195	0.139
5/16 DIA DIAMETER	0.310 0.315	0.260 0.240	0.170
3/8 DIA DIAMETER	0.373 0.378	0.312 0.302	0.195



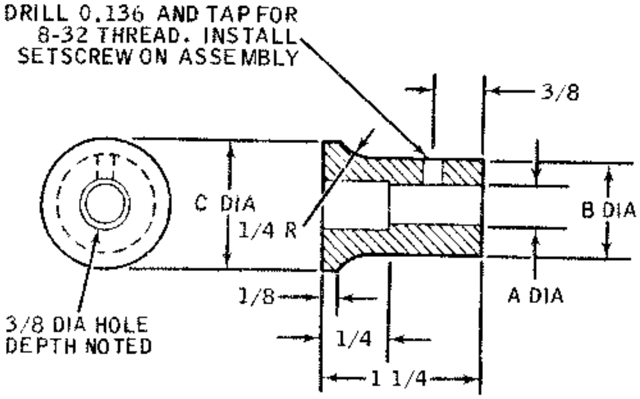
BB12-96

Typical Eddy Current Hole Probe
Figure 2 (Sheet 1)

sequence, the conductivity measurement is made, (5) heat damage (effects of time and at what temperature, material is subjected to), and (6) paint type and thickness.

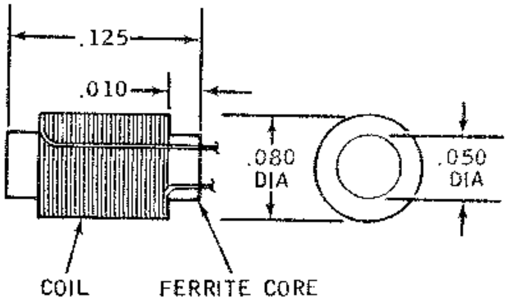
C. For the reasons listed in step B, above, direct conductivity (IACS) values are seldom used in evaluating fire damage to aircraft materials. Instead, the percentage points of difference between known good areas and questionable areas within each part or piece should be established and furnished to Douglas Aircraft Co., Inc., 3855 Lakewood Blvd., Long Beach, Calif., for comparison of these percentages with historical test data of similar materials. A typical example of such test data is shown in Figure 4. It can readily be seen that conductivity values alone are inconclusive.

D. The conductivity response range (scatter band) percentages for various gages of Clad 2024-T4 and Clad 7075-T6 materials is illustrated in Figure 5. Again it can be seen that the percentage points (IACS) difference within a given piece is more meaningful than a single reading taken at random.



ADJUSTABLE COLLAR
MAKE FROM NYLON OR TEFLON BAR

PROBE SIZE	A DIA	B DIA	C DIA
1/4-INCH DIAMETER	0.207 0.210	0.450	3/4
5/16-INCH DIAMETER	0.262 0.267	0.500	3/4
3/8-INCH DIAMETER	0.314 0.318	0.750	1

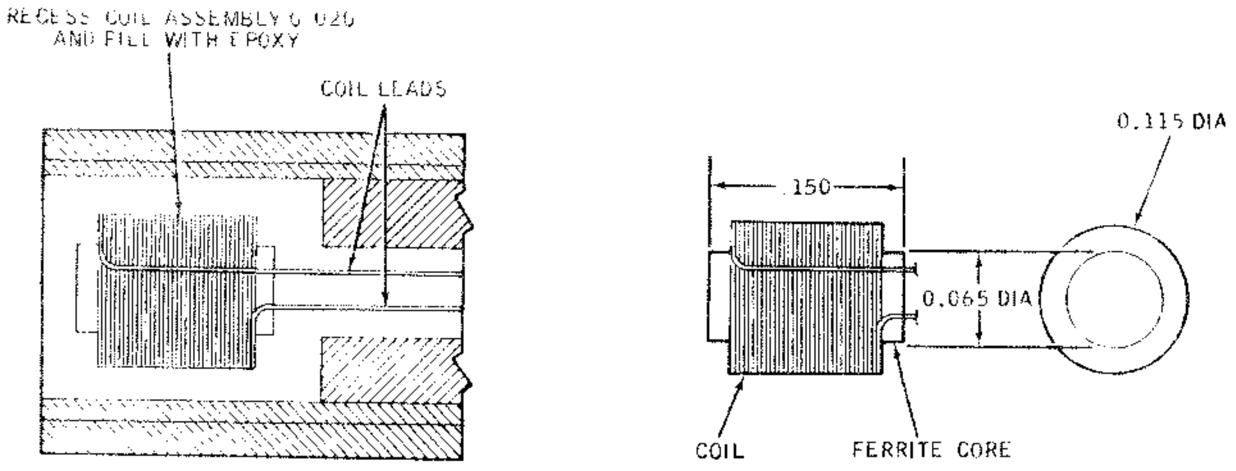


COIL ASSEMBLY

NOTE:
COIL - APPROXIMATELY 155 TURNS OF NO. 40 AWG ENAMELED WIRE. COMPLETED PROBE SHOULD BALANCE ON A FREQUENCY OF 95 KC TO 110 KC. USE EASTMAN NO. 910 ADHESIVE (EASTMAN CHEMICAL PRODUCTS, EASTMAN ROAD, KINGSPORT, TENN. 37662) OR EQUIVALENT TO SECURE COIL DURING WINDING OPERATION. FERRITE CORE TYPE MP34 (ARNOLD ENGINEERING CO. MARENGO, ILL., OR EQUIVALENT.)

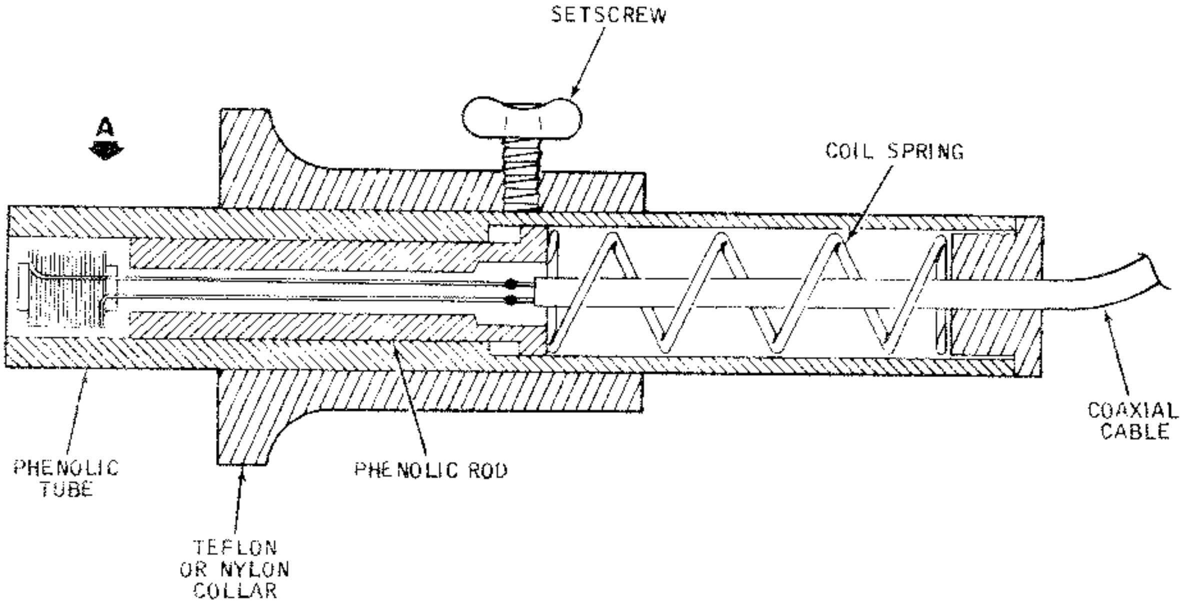
BB12-97

Typical Eddy Current Hole Probe
Figure 2 (Sheet 2)



VIEW **A**

COIL ASSEMBLY



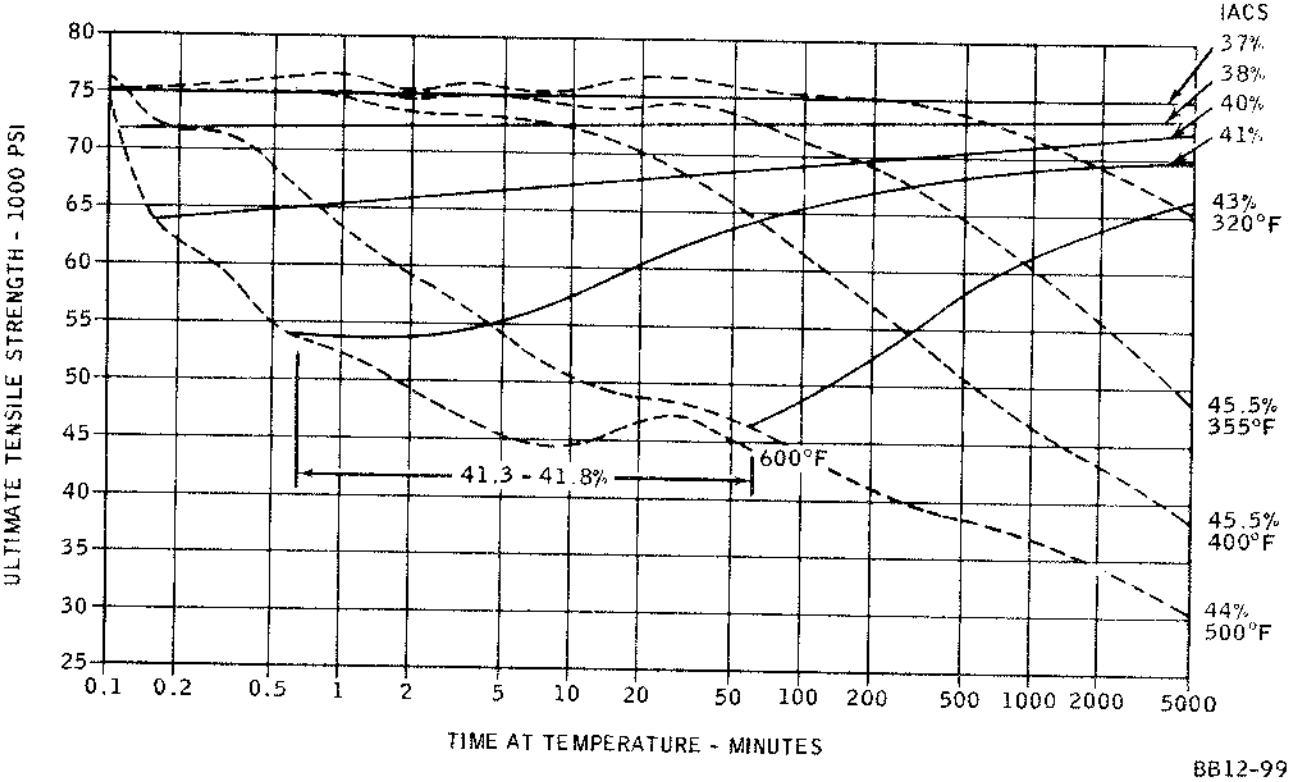
NOTE:

COIL - APPROXIMATELY 190 TURNS ENAMELED NO. 40 AWG (0.003 DIA) WIRE. COIL SHOULD BALANCE ON FREQUENCY OF 72.5 KC TO 77.5 KC. USE EASTMAN NO. 910 CEMENT TO SECURE COIL WINDINGS DURING FORMING. FERRITE CORE TYPE MP34 (ARNOLD ENGINEERING CO., MARENGO, ILL., OR EQUIVALENT.) SELECT PHENOLIC ROD AND SPRING TO SUIT. PREPARE COLLAR TO SLIP FIT. SELECT COAXIAL CABLE DIAMETER AND LENGTH TO FIT AND ATTACH CONNECTOR AS REQUIRED TO MATCH TEST INSTRUMENT.

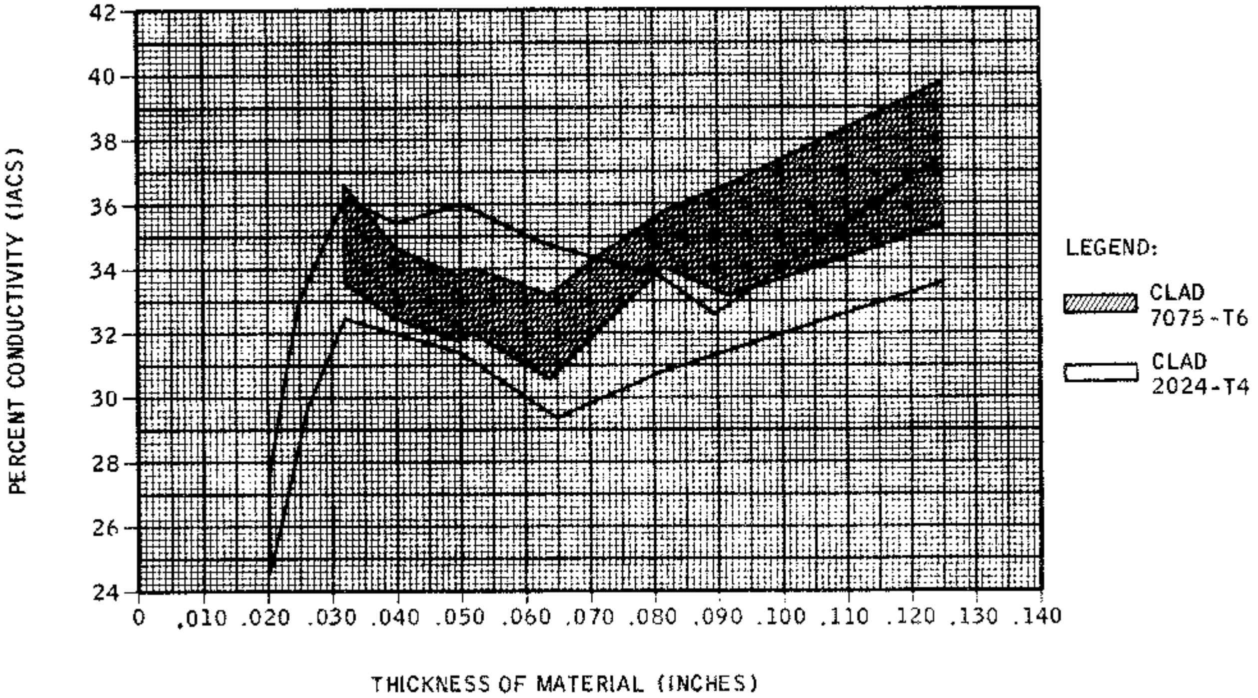
BB12-102

Printed in U.S.A.

Typical Eddy Current Surface Probe
Figure 3



Time and Temperature Effects on Conductivity and Room Temperature Mechanical Properties of 0.081 Clad 7075-T6
Figure 4



BB12-100

Conductivity Response Range (Scatterband) for Various Gages of Clad 2024-T4 and 7075-T6
Figure 5

SEPARATE FIELD/DETECTOR EDDY CURRENT TESTING EQUIPMENT

1. Description

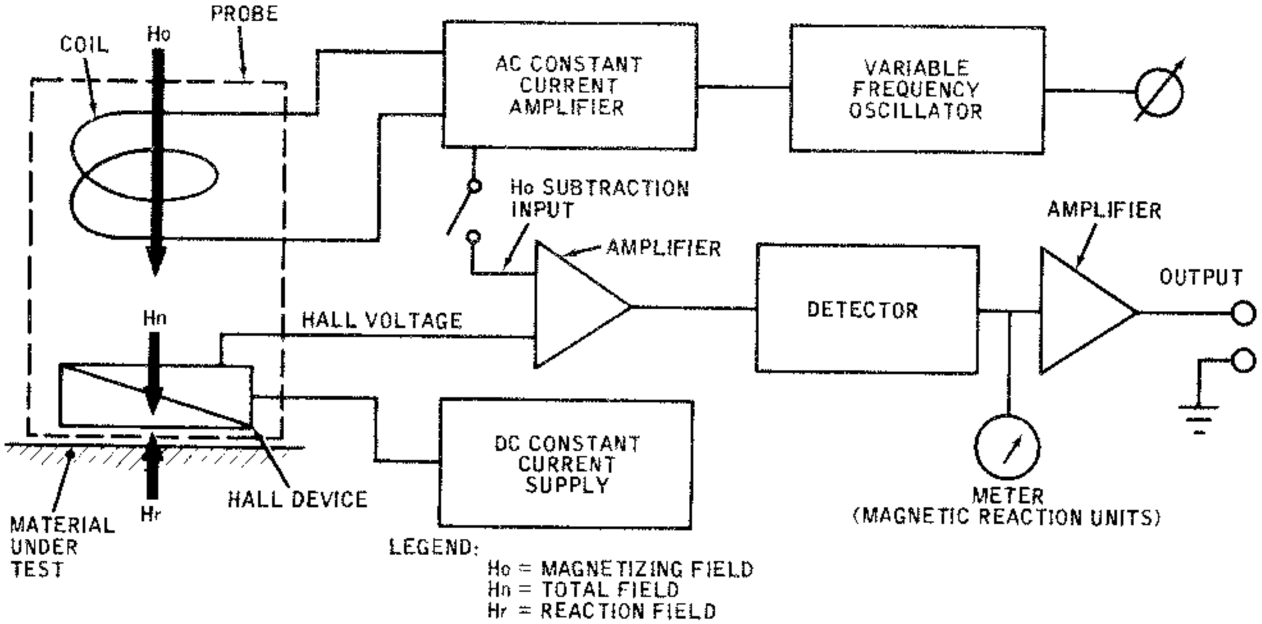
A. A recent development in eddy current testing equipment is the Magnetic Reaction Analyzer (F.W. Bell Inc., 1365 Norton Ave., Columbus, Ohio). Figure 1 shows a diagram of the Model 1090 unit and data on probes used. The equipment permits noncontacting measurement of the magnetic and electrical properties of metallic materials over a wide thickness range and over a frequency range of 20 Hertz units per second to 100 Kilohertz units.

B. Probes used with the equipment contain a separate magnetizing coil and separate detection devices. The detection devices are highly-coupled Hall-effect elements which are sensitive directly to the magnetic field produced by the coil (regardless of frequancy) and pick up the magnetic reaction of the material under test to the magnetizing field. This permits operation at low frequencies where the depth of penetration of the field into the material is greater.

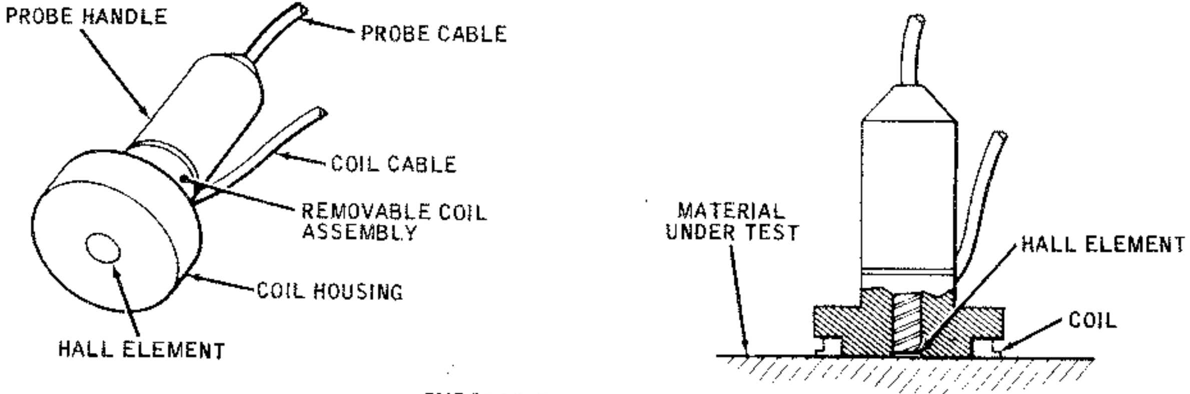
NOTE: In conventional eddy current testing systems the probe coil is used both as a magnetizing device and as a detector. The magnetic reaction is picked up by means of voltage induced into the coil with somewhat lower coupling results. The optimum response thus occurs at higher frequencies.

For coil excitation, the equipment embodies a highly-stabilized variable frequency oscillator coupled to an AC constant current amplifier. The coils magnetizing current is thus held constant over the frequency range.

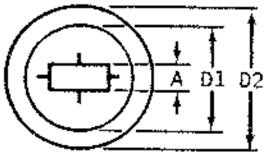
C. The equipment also contains stable, wide-band amplifiers and discriminator circuits. Display of the magnitudes of the magnetizing field H_o (see Figure 1), the test material reaction field H_r, and the net or total field H_n, is on a panel meter. For external connection of oscilloscope or other viewing or recording devices, output terminals are provided.



BLOCK DIAGRAM - ANALYZER AND PROBE

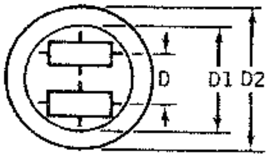


SURFACE PROBE ASSEMBLY



ABSOLUTE PROBE DATA

A	D1	D2	EFFECTIVE FREQUENCY RANGE (HERTZ UNITS)
0.030	1 11/32	1	20-100000
0.030	2 5/8	2	20-35000
0.030	5 1/4	4	20-3500
0.030	7 3/4	6	20-900
0.030	5/16	1/4	20-100000



DIFFERENTIAL PROBE DATA

A	D	D1	D2	EFFECTIVE FREQUENCY RANGE (HERTZ UNITS)
0.030	1/4	1 11/32	1	20-20000
0.030	1/8	5/16	1/4	20-20000

LEGEND:
A = EFFECTIVE HALL DETECTOR AREA
D = DISTANCE BETWEEN HALL ELEMENTS (INCHES)
D1 = PROBE FACE DIAMETER (INCHES)
D2 = COIL DIAMETER (INCHES)

BB12-147

Magnetic Reaction Analyzer Block Diagram and Probe Data
Figure 1

ULTRASONIC TESTING METHODS

1. Description

A. Ultrasonics provide an extremely sensitive method of nondestructive testing. Its limitations are few, and when direct coupling with the part being checked can be established, its resolving capabilities are excellent.

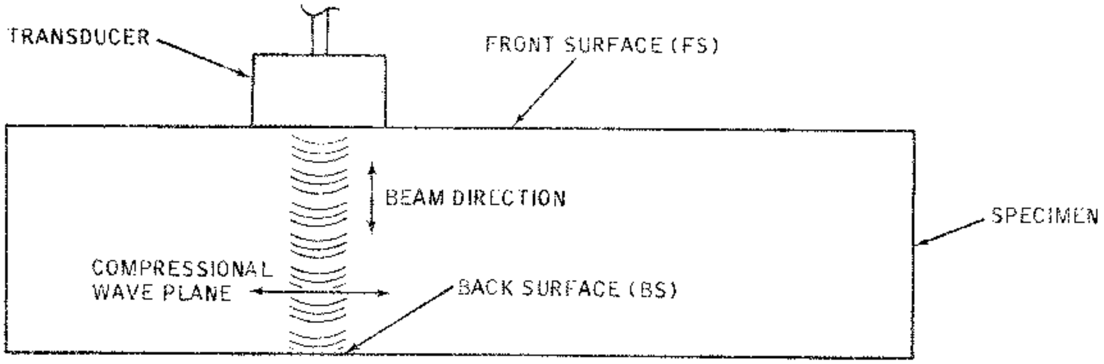
B. There are three basic ultrasonic methods; (1) resonance, (2) through transmission, and (3) pulse-echo. Of these methods, pulse-echo is most suitable for service and overhaul use and is the only ultrasonic testing method described herein.

C. In the pulse-echo method, acoustic energy in the form of pulsed envelopes of high-frequency waves is generated by a pulser element and transmitted through a piezoelectric transducer into the part being tested. Between pulses, the transducer also serves as a receiver for energy reflected from discontinuities, or defects, within the part. The reflected energy is displayed on a cathode ray tube, or other indicating device.

D. The pulse-echo method can be employed in several wave modes; (1) longitudinal, (2) shear, and (3) surface, or Rayleigh. Each mode is described and its general application and limitations are illustrated in Figures 1 through 5, and are described as follows:

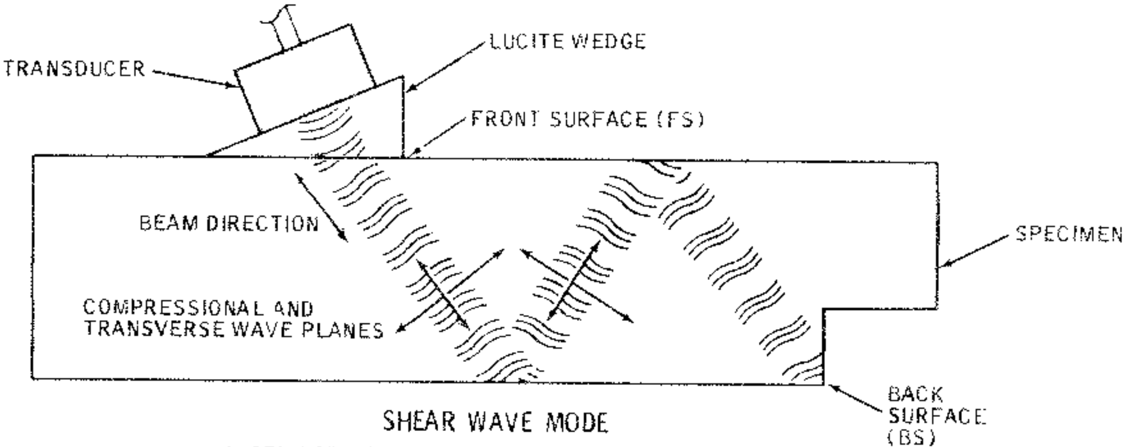
(1) Longitudinal waves are produced when the transducer is placed so that the angle of entry into the part being tested is at 90 degrees or normal to the surface (see Figures 1 and 2). The wave train in the material will conversely be 90 degrees to the surface of the part. The longitudinal wave can be used to test for laminar oriented discontinuities and for thickness measurement. Thickness measurements from 0.010 inch to several inches may be accurately accomplished. When checking parts having a back interface not parallel to the front, the longitudinal wave will be refracted internally, producing shear waves which could create ghost signals on the cathode ray tube and result in misinterpretations (see the wave mode conversion example in Figure 5). The longitudinal wave may be used as a refraced angular beam by using a lucite wedge to form an incident angle of entry. The longitudinal wave should not be used with incident angles greater than 10 degrees since interferences may be encountered from the shear wave mode. The refraction amplitude data table in Figure 5 illustrates this fact.

(2) The shear wave is produced when the longitudinal beam is refracted at the front interface. Refraction occurs whenever an angle of entry is established and the shear wave is a product of this phenomenon. When inspections using the angular beam are to be performed it is preferable to use the shear wave mode due to its higher degree of sensitivity resulting from compound wave motion. Examples of the shear wave mode are provided in Figures 1 and 3. The shear wave mode is most versatile since, by the use of selected lucite wedges, a wide range of beam angles is available to search out defects within the part or in opposite



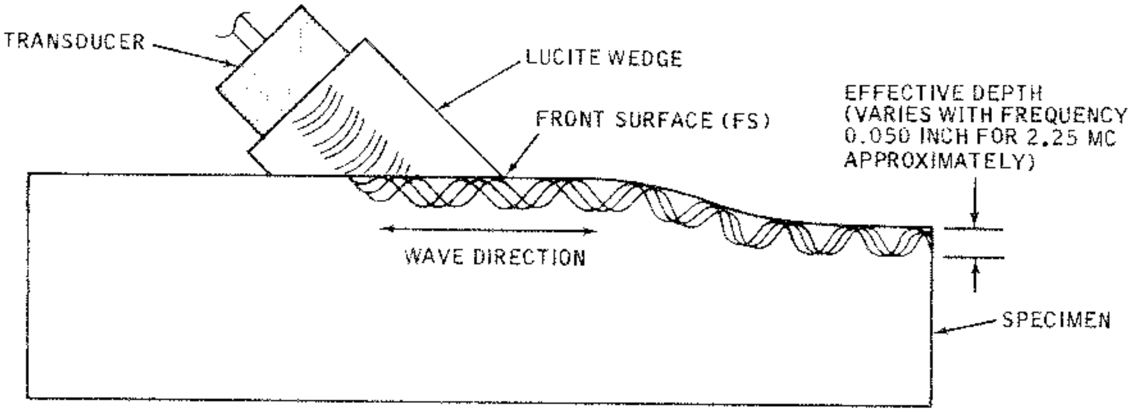
LONGITUDINAL WAVE MODE

(USED FOR DETECTION OF LAMINAR ORIENTED DISCONTINUITIES AND THICKNESS MEASUREMENTS).



SHEAR WAVE MODE

(USED FOR DETECTION OF DEFECTS NOT OPEN TO THE SURFACE OR DEFECTS IN THE OPPOSITE SURFACE).



SURFACE OR RAYLIEGH WAVE MODE

(USED FOR DETECTION OF DEFECTS WITHIN THE EFFECTIVE DEPTH OF THE ACCESSIBLE SURFACE).

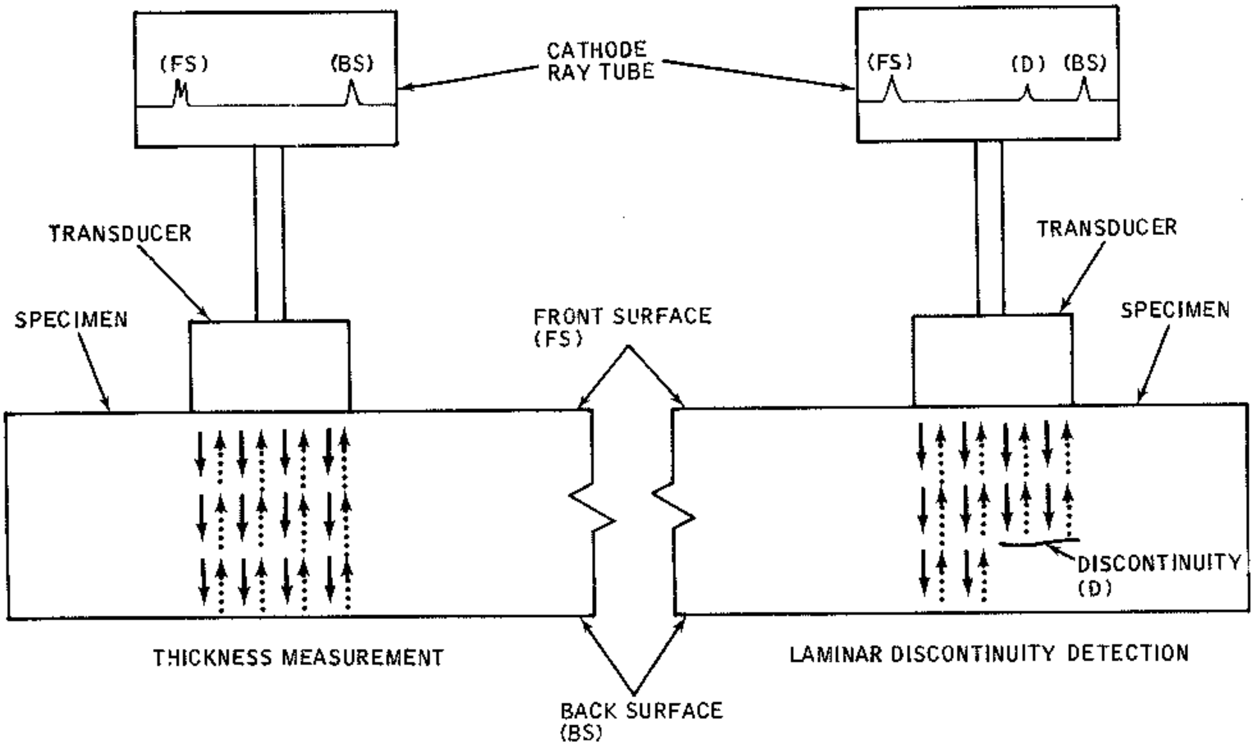
BB12-38

Ultrasonic Pulse-Echo Wave Modes
Figure 1

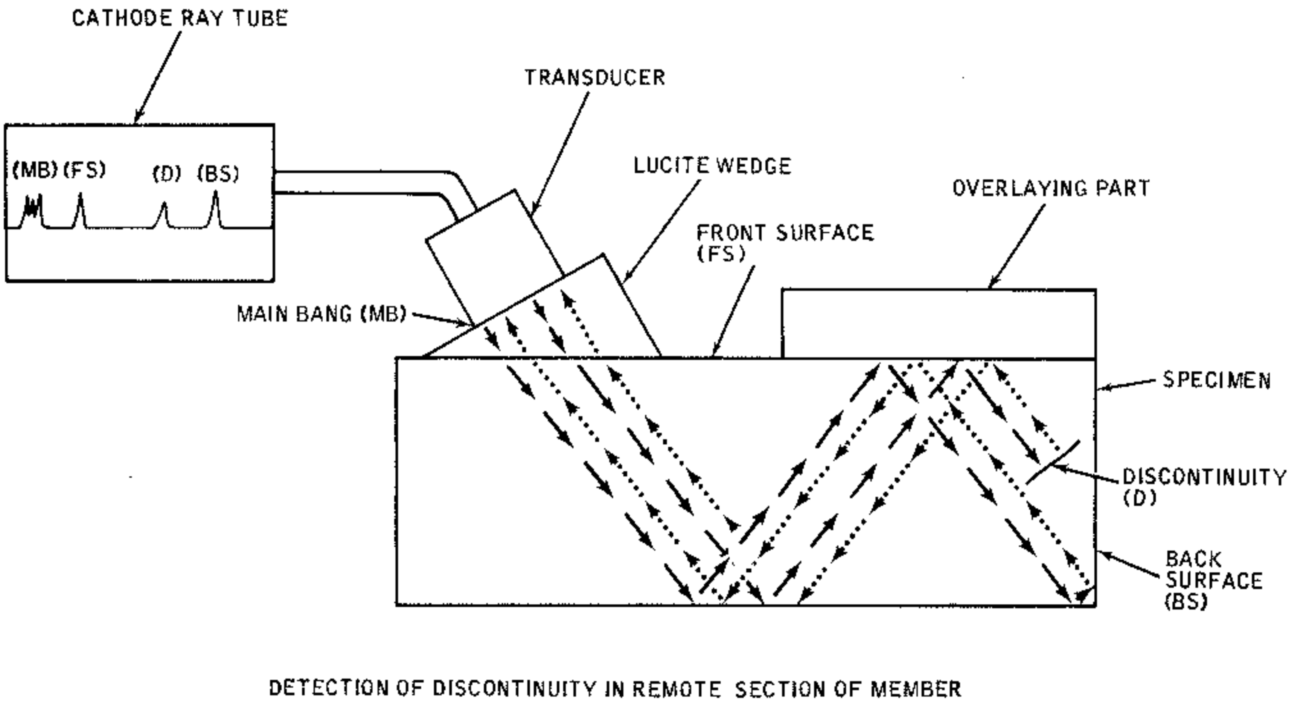
extremities of the part. Wedge angles required to obtain specific refracted angles are graphically shown, for steel, in Figure 5. Wedge angles for use with materials other than steel can be determined by substituting into the following formula, at V_1, V_2, V_3, the acoustical velocities of the specific material involved. Acoustic velocities (V) for materials are provided in Figure 5.

$$\frac{\text{Sin } \phi 1}{V_1} = \frac{\text{Sin } \phi 2}{V_2} = \frac{\text{Sin } \phi 3}{V_3}$$

(3) Surface (or Rayleigh) waves are produced by increasing the angle of incidence sufficiently to refract all of the energy to the surface of the part (see examples in Figures 1, 4, and 4A). The surface (or Rayleigh) wave mode is most useful in detecting defects open to the accessible surface. The optimum angle for producing the surface wave mode is approximately 64 degrees (see amplitude date in Figure 5). One of the most effective transducers for use in surface wave applications is the lithium sulphate type at a frequency of 2.25 megacycles.

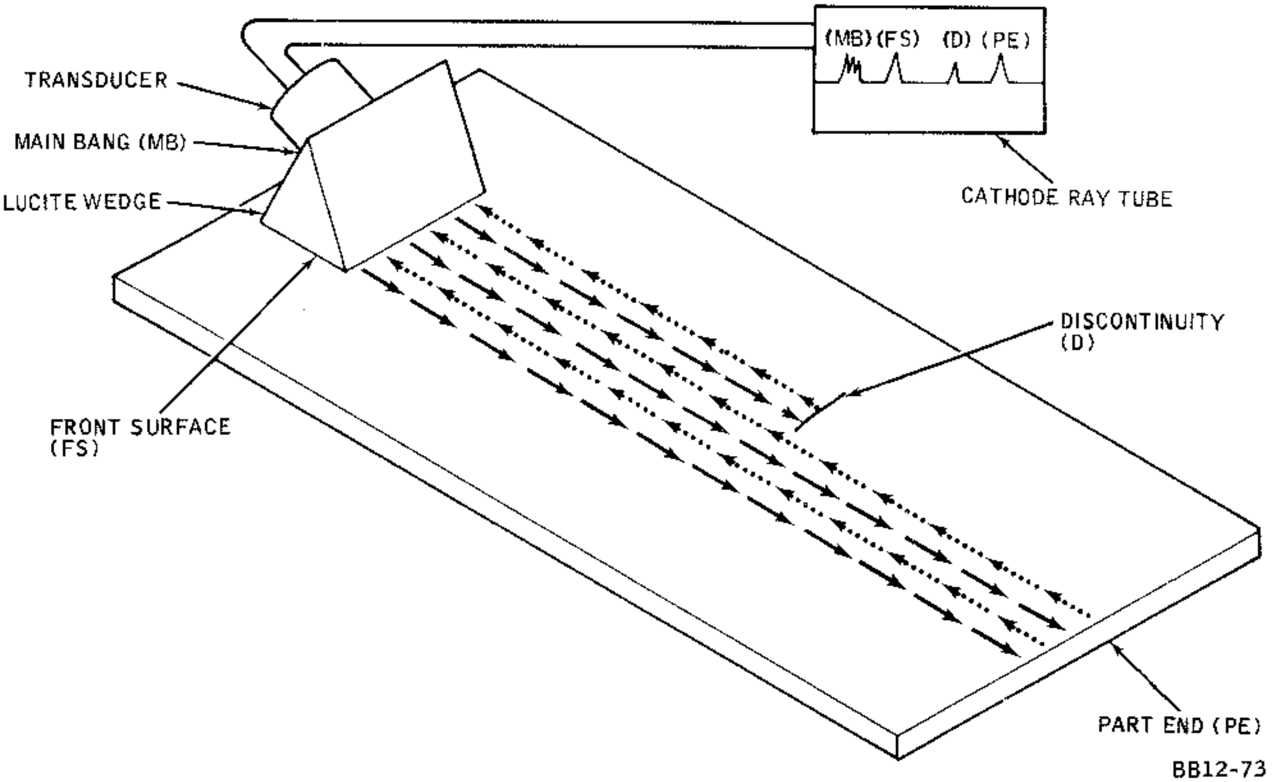


Longitudinal Wave Mode Application and Presentation
Figure 2



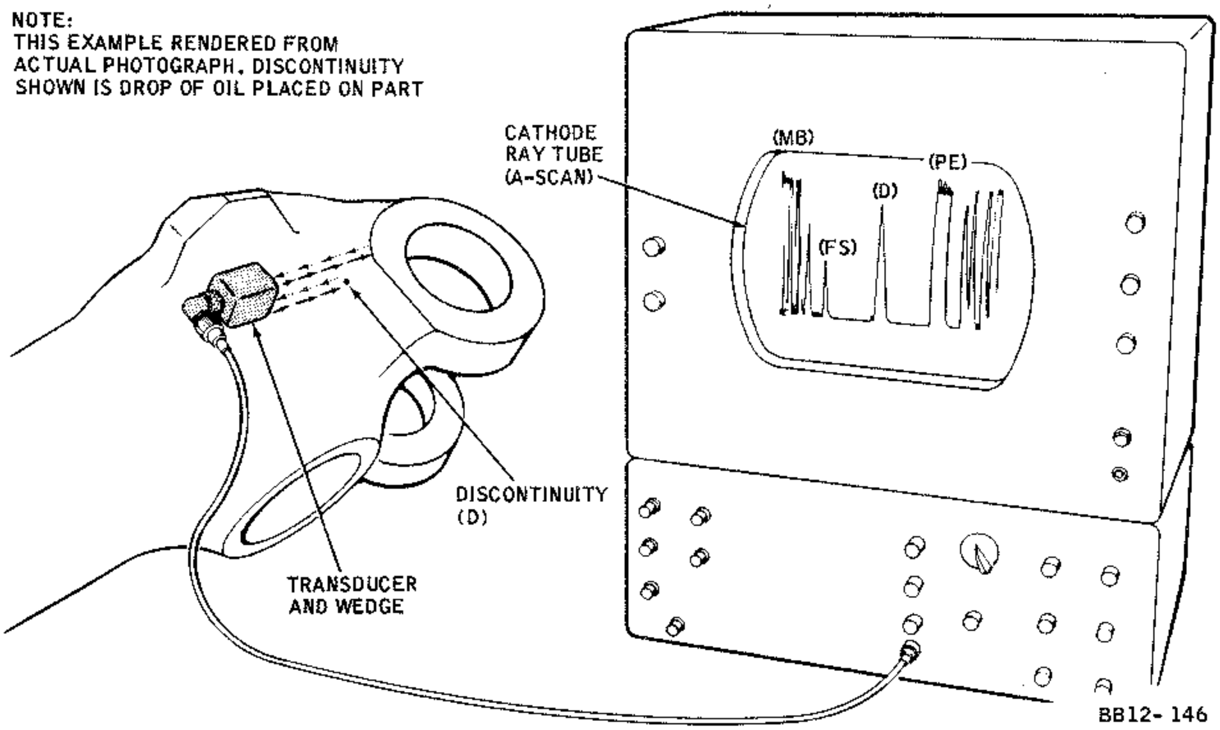
BB12-72

Shear Wave Mode Application and Presentation
Figure 3



BB12-73

Surface or Rayleigh Wave Mode Application and Presentation
Figure 4



Example of Surface or Rayleigh Wave Mode Application and Presentation in Detection of Discontinuity in Landing Gear Part
Figure 4A

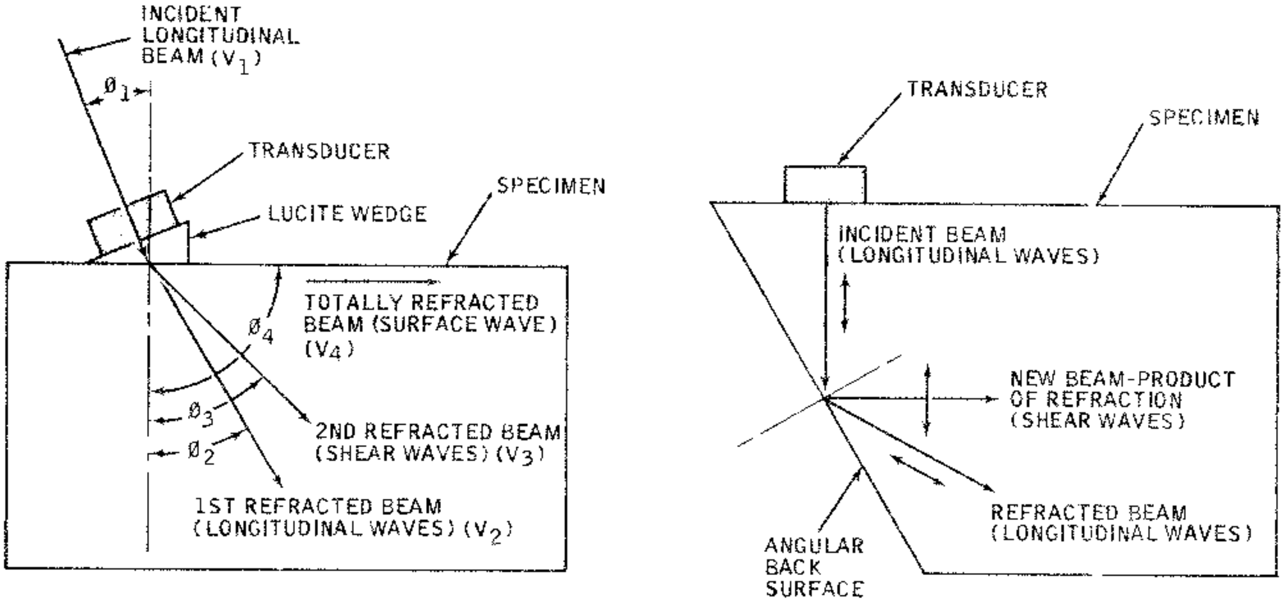
C. Reflected ultrasonic energy can be displayed, or recorded, in three ways as described below:

(1) The basic A-scan employs standard equipment. It is the method most commonly used in ultrasonic testing. The cathode ray tube horizontal baseline indicates elapsed time (see Figures 2, 3, and 4). The horizontal baseline is deflected vertically by reflected energy. The horizontal spacing of these deflections (from left to right) is related to the distance of energy travel within the part. The first deflection (left to right) of the baseline is caused by the signal received from the front surface or interface of the part. The deflection farthest to the right is caused by the signal received from the back surface or interface. Intervening deflections indicate internal discontinuities. The amplitude of these deflections are related to the amount of receiver gain and to the size and orientation of the reflecting element. The amplitude of the deflection may be used to estimate the discontinuity size when compared to a standard or a duplicate part with a discontinuity of known dimension. A discontinuity indication should only be termed a defect after making careful comparison or by verification through the use of other nondestructive testing methods or inspection.

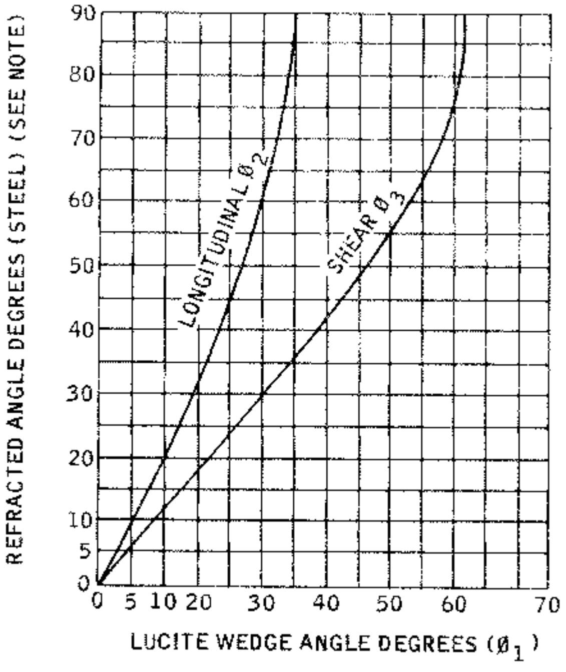
NOTE: When a transducer with a lucite wedge is being used a signal will be reflected from the transducer to the lucite wedge interface. This signal will then be the first deflection and will be located ahead of the front surface indication. This additional signal is termed the main bang (MB). Some instruments can be adjusted to move this deflection out of the viewed portion of the cathode ray tube.

(2) The B-scan type of presentation requires special equipment which does not lend itself to use for aircraft, except in rare and isolated applications. In B-scan, a cross-sectional plot of material thickness and internal discontinuities is recorded by the use of an image retention cathode ray tube, or on paper.

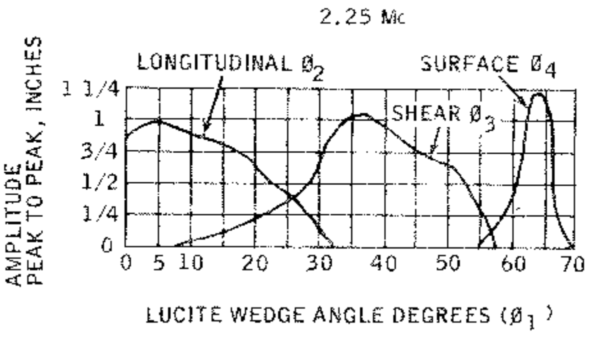
(3) The C-scan presentation requires equipment manufactured for specific applications. The C-scan provides a recorded facsimile flat plan view of the scanned area, which is useful in the detection or monitoring of intergranular corrosion or microbial attacks in wing plating and fuel tank areas, or other accessible areas. Figure 6 illustrates a modern portable unit (manufactured by Automation Industries Inc., Sperry Products Division, Danbury, Connecticut) which can be attached to any structural section. The unit has provisions for vacuum attaching to parts and may also be placed over an immersion tank for use in immersed scanning of a wide variety of parts and material. The type unit shown in Figure 6 is particularly adaptable for detecting and recording of corrosion in integral fuel tanks, or intergranular corrosion of wing skins and plating.



EXAMPLES OF WAVE REFRACTION AND MODE CONVERSION



REFRACTION ANGLE DATA



REFRACTION AMPLITUDE DATA

NOTE:
THE REFRACTION ANGLES (Ø) OF ULTRASONIC BEAMS CAN BE COMPUTED BY THE USE OF SNELLS LAW, GIVEN BELOW

$$\frac{\sin Ø_1}{V_1} = \frac{\sin Ø_2}{V_2} = \frac{\sin Ø_3}{V_3}$$

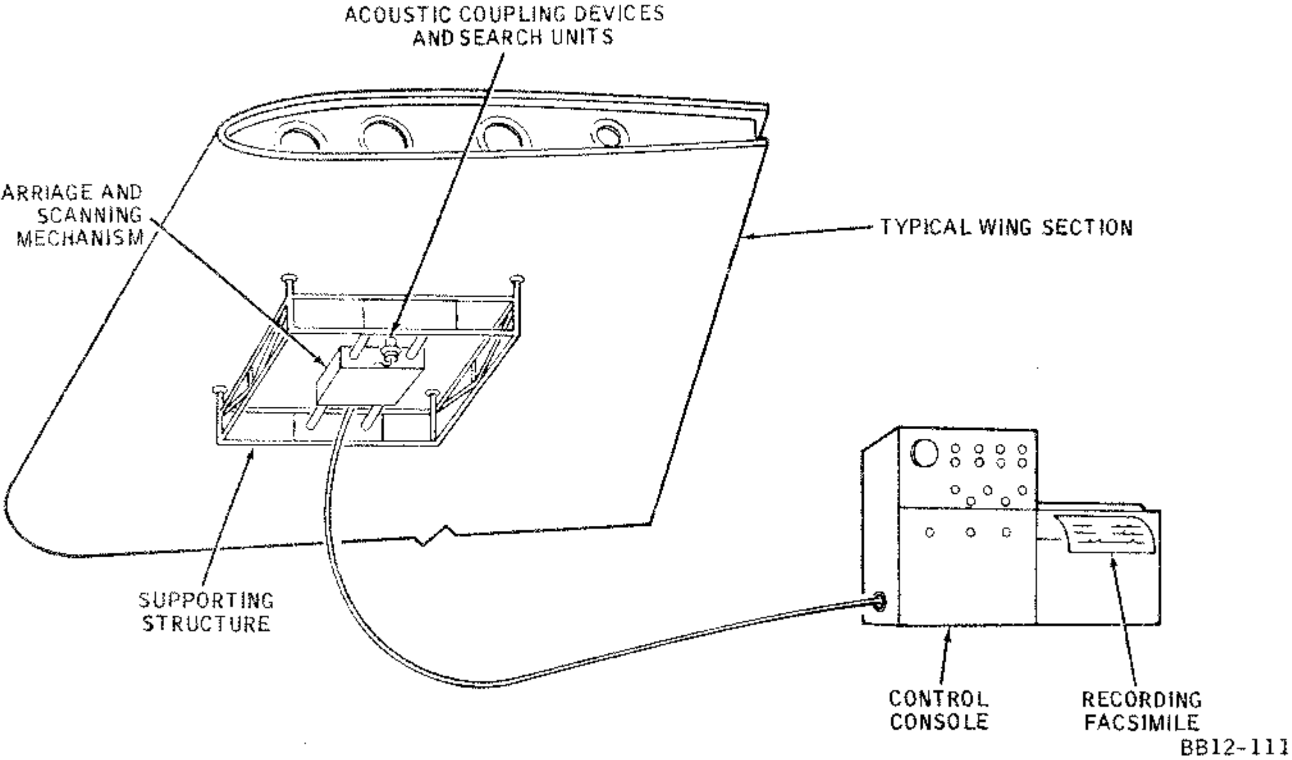
THE VELOCITIES (V) ENCOUNTERED IN SOLIDS AT ULTRASONIC FREQUENCIES ARE GIVEN ON SHEET 2.

BB12-39

Ultrasonic Wave Mode Data
Figure 5 (Sheet 1)

ACOUSTIC PROPERTIES OF MATERIALS						
Material	Acoustic Velocities (cm/sec) x 10^5			Acoustic Impedance, (gram/cm^2-sec)	Wavelength, (cm at 1 Mc)	Density, (gram/cm^3)
	V_1 & V_2	V_3	V_4			
Metals						
Aluminum 2SO	6.35	3.10	2.90	1.72 x 10^6	0.635	2.71
Aluminum 17ST	6.25	3.10	2.79	1.75	0.625	2.80
Beryllium	12.80	8.71	7.87	2.33	1.28	1.82
Brass (Naval)	4.43	2.12	1.95	3.61	0.443	8.1
Bronze, Phosphor (5%)	3.53	2.23	2.01	3.12	0.353	8.86
Copper	4.66	2.26	1.93	4.18	0.466	8.9
Lead, pure	2.16	0.70	0.63	2.46	0.216	11.4
Lead, antimony (6%)	2.16	0.81	0.74	2.36	0.216	10.90
Magnesium (Am35)	5.79	3.10	2.87	1.01	0.579	1.74
Mercury	1.42	...	...	1.85	0.142	13.00
Molybdenum	6.29	3.35	3.11	6.35	0.629	10.00
Nickel	5.63	2.96	2.64	4.95	0.563	8.8
Inconel (wrought)	7.82	3.02	2.79	6.45	0.782	8.25
Monel (wrought)	6.02	2.72	1.96	5.31	0.602	8.83
Silver-nickel (18%)	4.62	2.32	1.69	4.03	0.462	8.75
Steel	5.85	3.23	2.79	4.56	0.585	7.8
Stainless 302	5.66	3.12	3.12	4.55	0.566	8.03
Stainless 410	7.39	2.99	2.16	5.67	0.739	7.67
Titanium (Ti 150A)	6.10	3.12	2.79	2.77	0.610	4.54
Tungsten	5.18	2.87	2.65	9.98	0.518	19.25
Nonmetals						
Air	0.33	...	...	0.00033	0.033	0.001
Oil, transformer	1.38	...	...	0.127	0.138	0.92
Plastic (acrylic resin)	2.67	1.12	...	0.32	0.264	1.18
Quartz (natural)	5.73	...	...	1.52	0.573	2.65
Water	1.49	...	...	0.149	0.149	1.00
Fused, quartz	5.93	3.75	3.39	1.30	0.593	2.20
Pyrex	5.57	3.44	3.13	1.24	0.557	2.23
Plate glass	5.77	3.43	3.14	1.45	0.577	2.51
Ice	3.98	1.99	...	0.40	0.398	1

Ultrasonic Wave Mode Data
Figure 5 (Sheet 2)



Universal Remote Ultrasonic System
Figure 6

CHAPTER 2

DOORS

Printed in U.S.A.

Chapter 2

DOORS

1. General

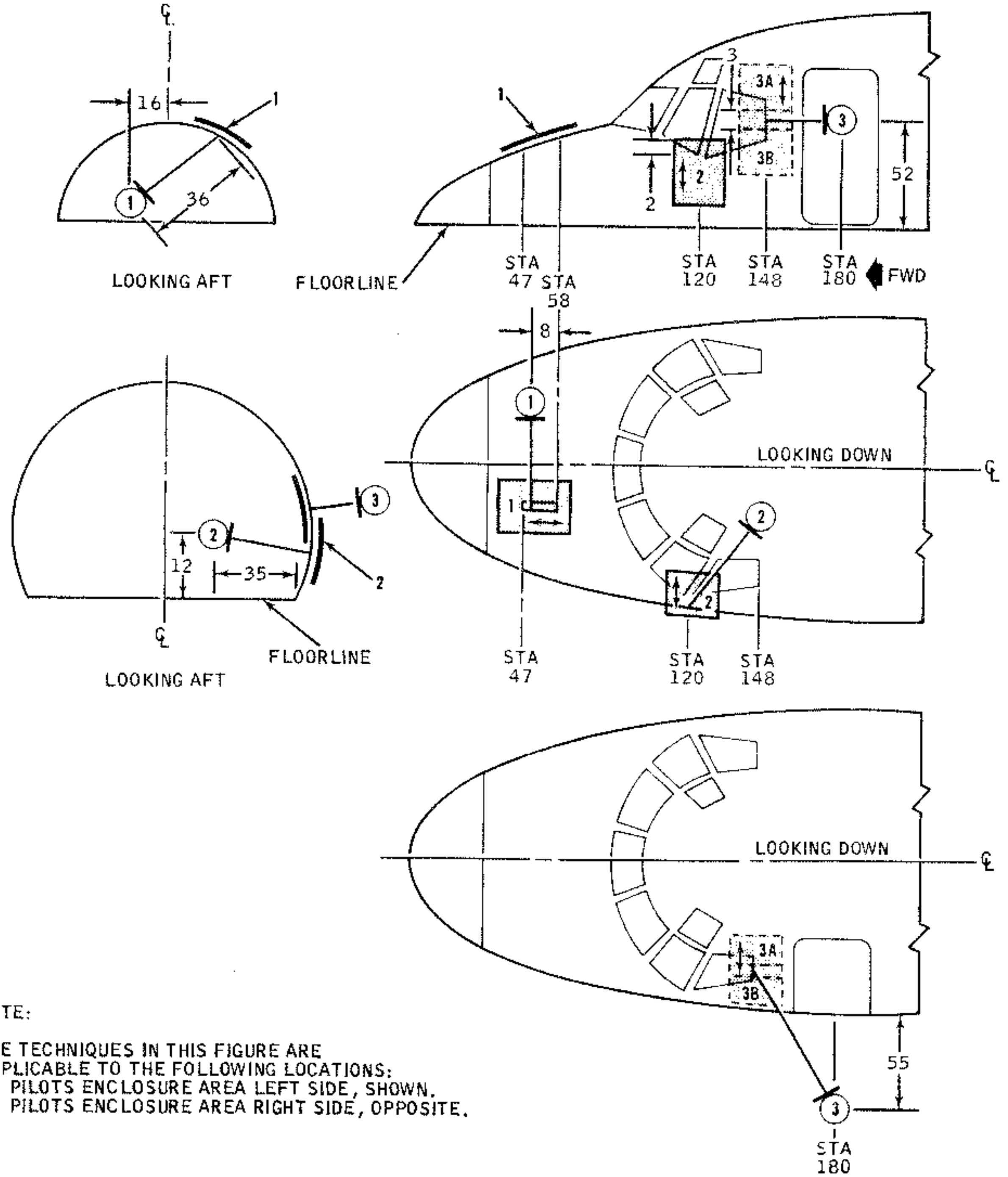
A. Information on doors is contained within the illustrations and information pertinent to the applicable area of fuselage and is presented in Chapter 3, Fuselage.

CHAPTER 3

FUSELAGE

CHAPTER 3

FUSELAGE



NOTE:

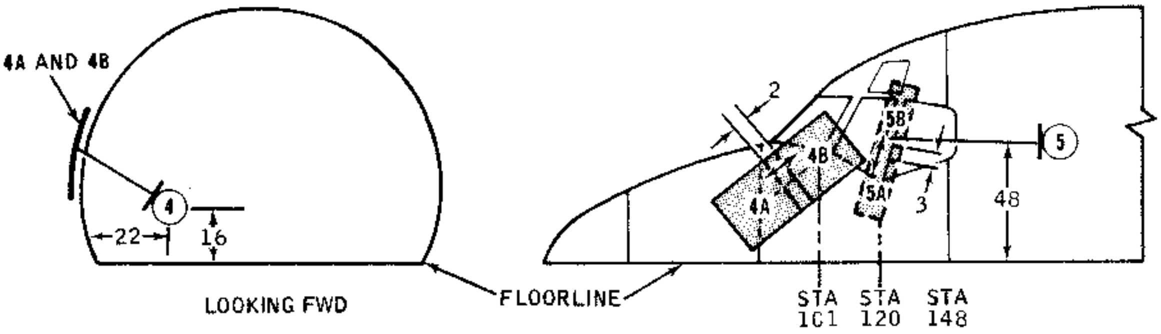
THE TECHNIQUES IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
A. PILOTS ENCLOSURE AREA LEFT SIDE, SHOWN.
B. PILOTS ENCLOSURE AREA RIGHT SIDE, OPPOSITE.

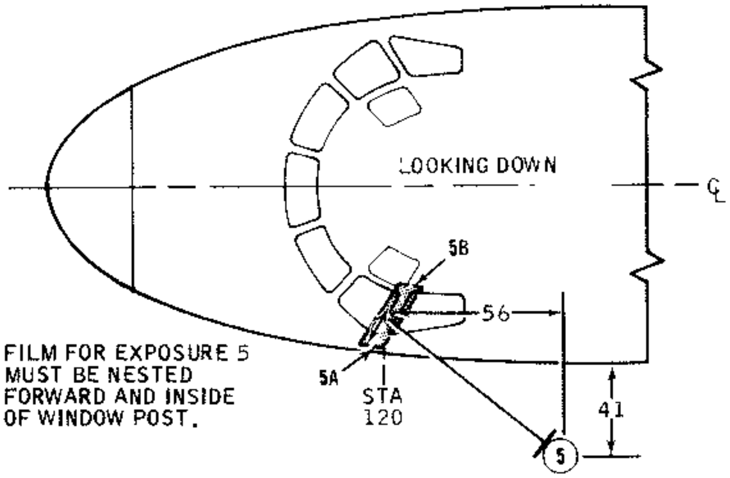
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	INTERCOSTAL STA 47 TO STA 58	90	225	36	II	14 x 17
2	FRAME STA 120	90	375	45	II	14 x 17
3 A B	FUSELAGE FRAME STA 148	130	1050	72	II & III II & III	14 x 17 14 x 17

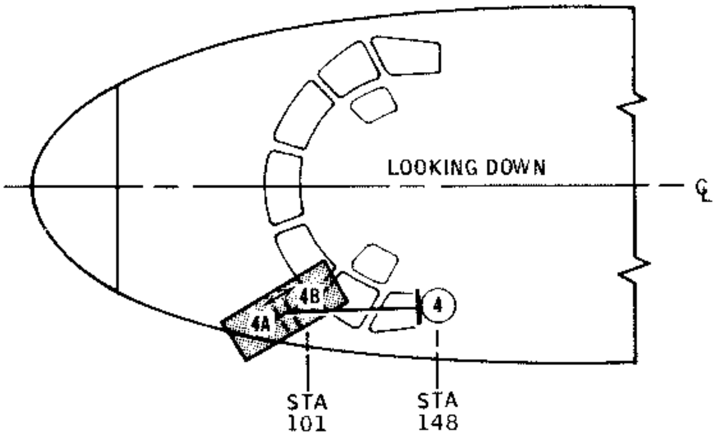
RADIOGRAPHIC DATA

BB12-63

Pilots' Enclosure Area
Figure 1 (Sheet 1)







NOTES:

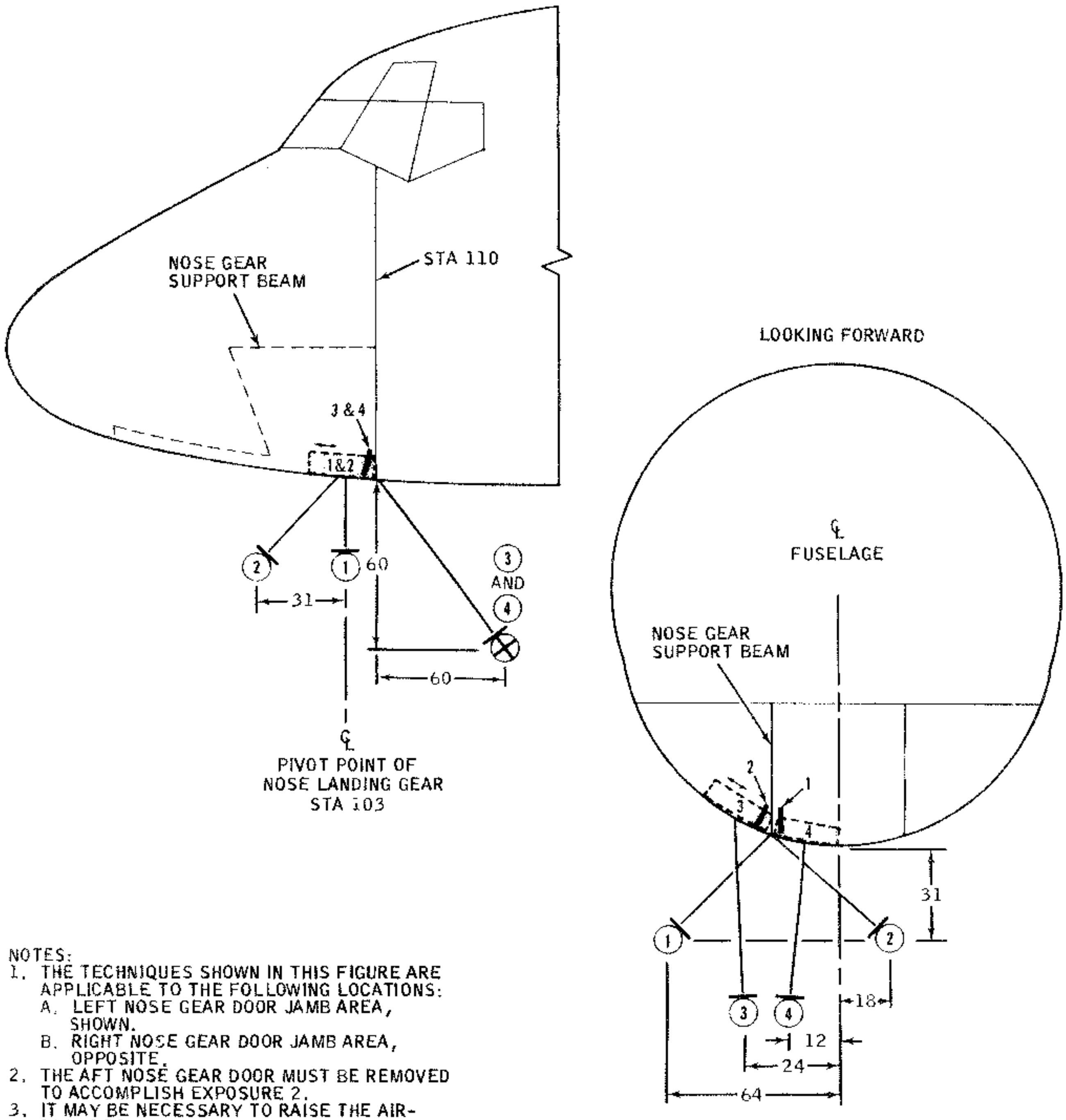
1. THE PILOTS SEAT MUST BE REMOVED TO ACCOMPLISH EXPOSURE 4.
2. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK OF FILM TO ACCOMPLISH EXPOSURE 5.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
4 A B	RADIAL MEMBER STA 101 (APPROX)	110	1050	60	II & III II & III	14 x 17 14 x 17
5 A B	WINDOW POST STA 120 (APPROX)	140	2400	72	II & III II & III	4 1/2 x 17 4 1/2 x 17

RADIOGRAPHIC DATA

BB12-60

Pilots' Enclosure Area
Figure 1 (Sheet 2)



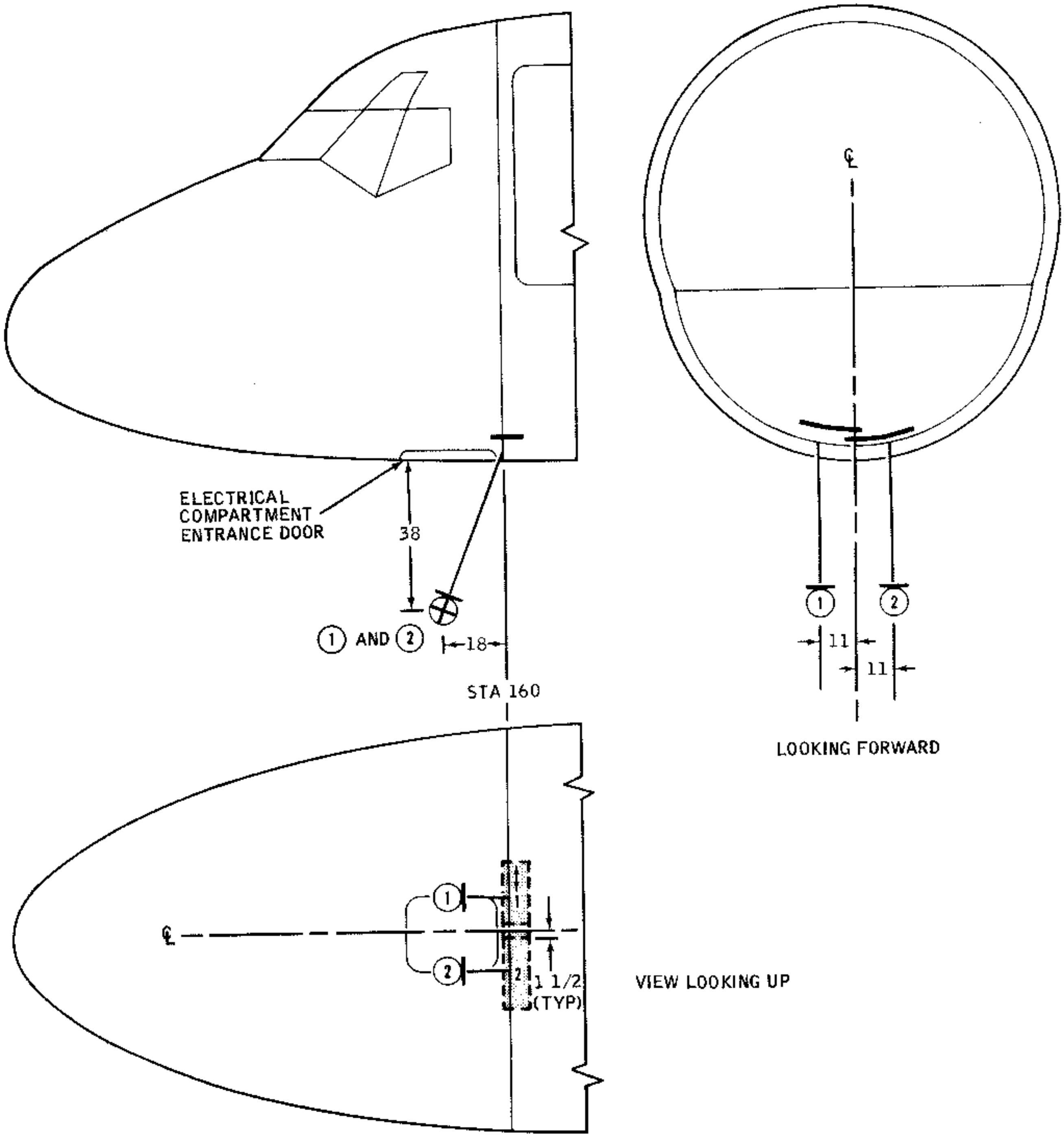
NOTES:
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. LEFT NOSE GEAR DOOR JAMB AREA, SHOWN.
   B. RIGHT NOSE GEAR DOOR JAMB AREA, OPPOSITE.
2. THE AFT NOSE GEAR DOOR MUST BE REMOVED TO ACCOMPLISH EXPOSURE 2.
3. IT MAY BE NECESSARY TO RAISE THE AIRPLANE TO INSURE PROPER SOURCE-TO-FILM DISTANCE.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 2	NOSE GEAR SUPPORT BEAM CAP ANGLE	110 110	300 300	72 72	II II	3 1/2 x 17 3 1/2 x 17
3 4	BULKHEAD STA 110 CAP ANGLE	130 130	1050 1050	80 80	II II	3 1/2 x 17 3 1/2 x 17

RADIOGRAPHIC DATA

BB12-80

Nose Gear Door Jamb Area
Figure 2

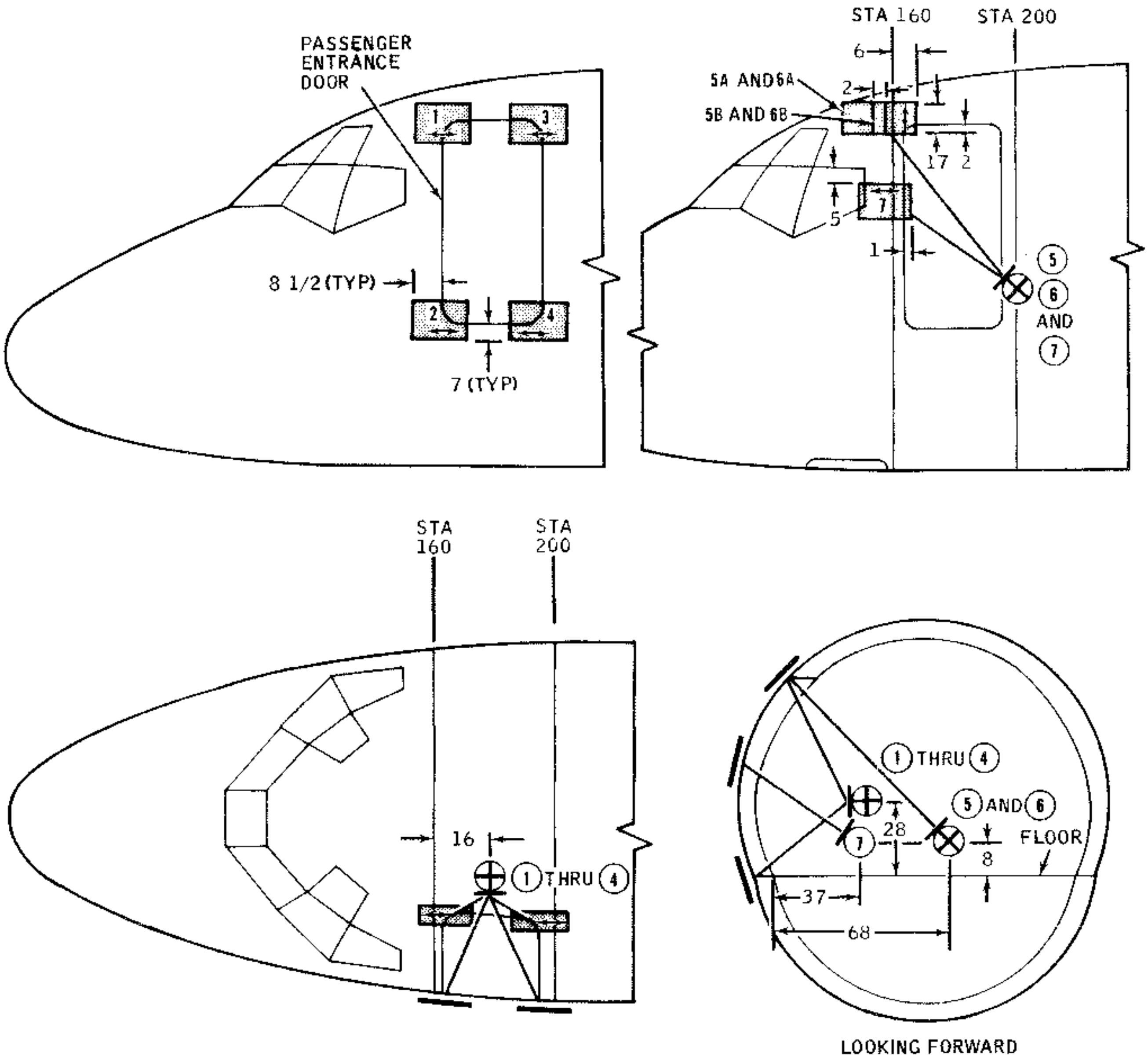


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	FRAME STATION 160 AT AFT SIDE OF DOOR JAMB	90	525	42	II	4 1/2 x 17
2		90	525	42	II	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-81

Electrical Compartment Door Jamb Area
Figure 3

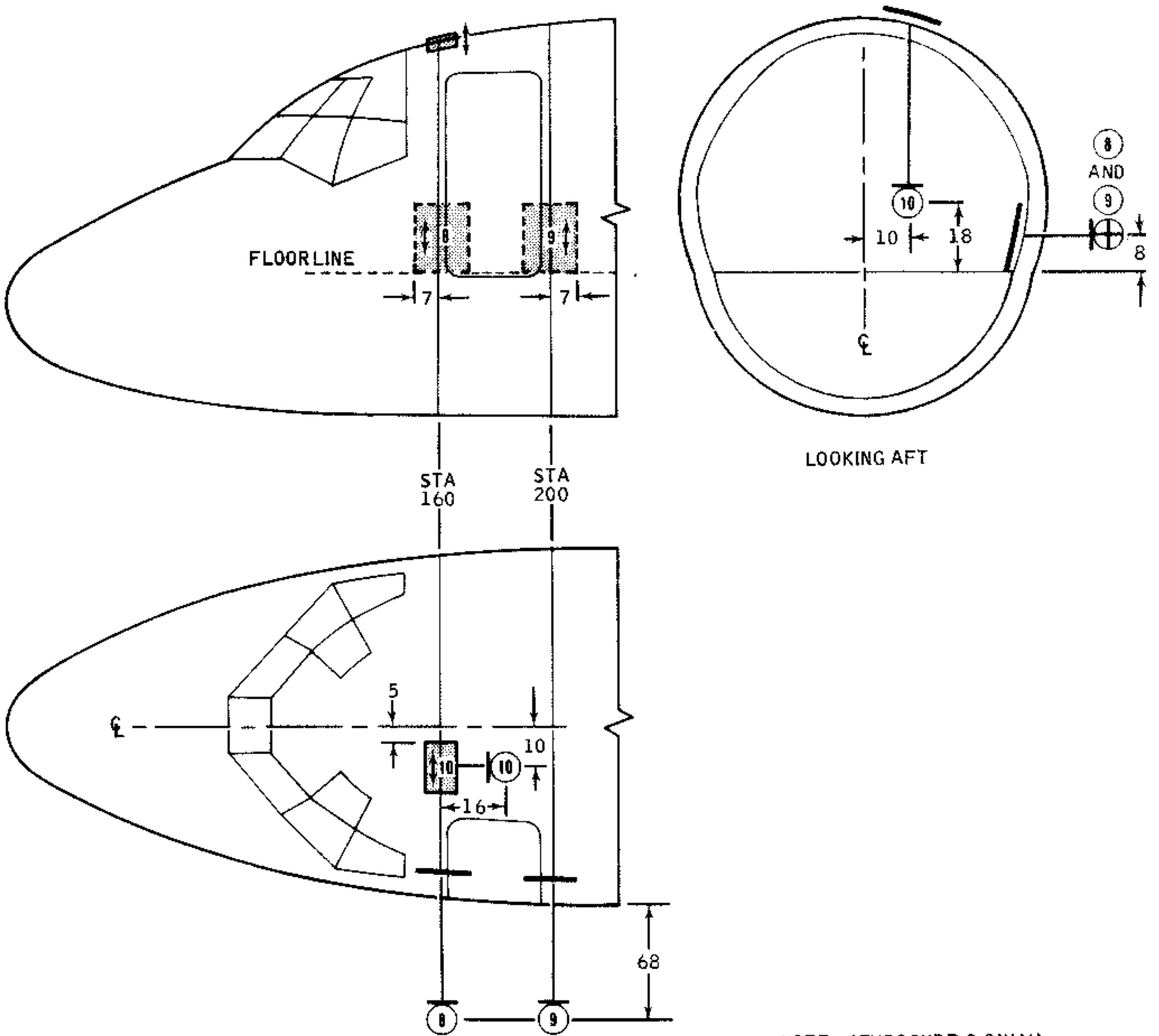


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	PLATING AND DOUBLERS					
1	UPPER FORWARD CORNER	130	750	48	II & III	14 x 17
2	LOWER FORWARD CORNER	130	750	48	II & III	14 x 17
3	UPPER AFT CORNER	130	750	48	II & III	14 x 17
4	LOWER AFT CORNER	130	750	48	II & III	14 x 17
5A	OUTER CAPS OF INTERCOSTALS AT TOP FORWARD CORNER OF DOOR	130	1050	78	II	14 x 17
B					II	14 x 17
6A		130	750	78	II	14 x 17
B					II	14 x 17
7	INNER AND OUTER CAPS OF INTERCOSTAL RUNNING FORWARD TO LOWER SILL OF ENCLOSURE	115	1050	60	II	14 x 17

RADIOGRAPHIC DATA

BB12-67

Passenger Forward Entrance Door Jamb Area
Figure 4 (Sheet 1)



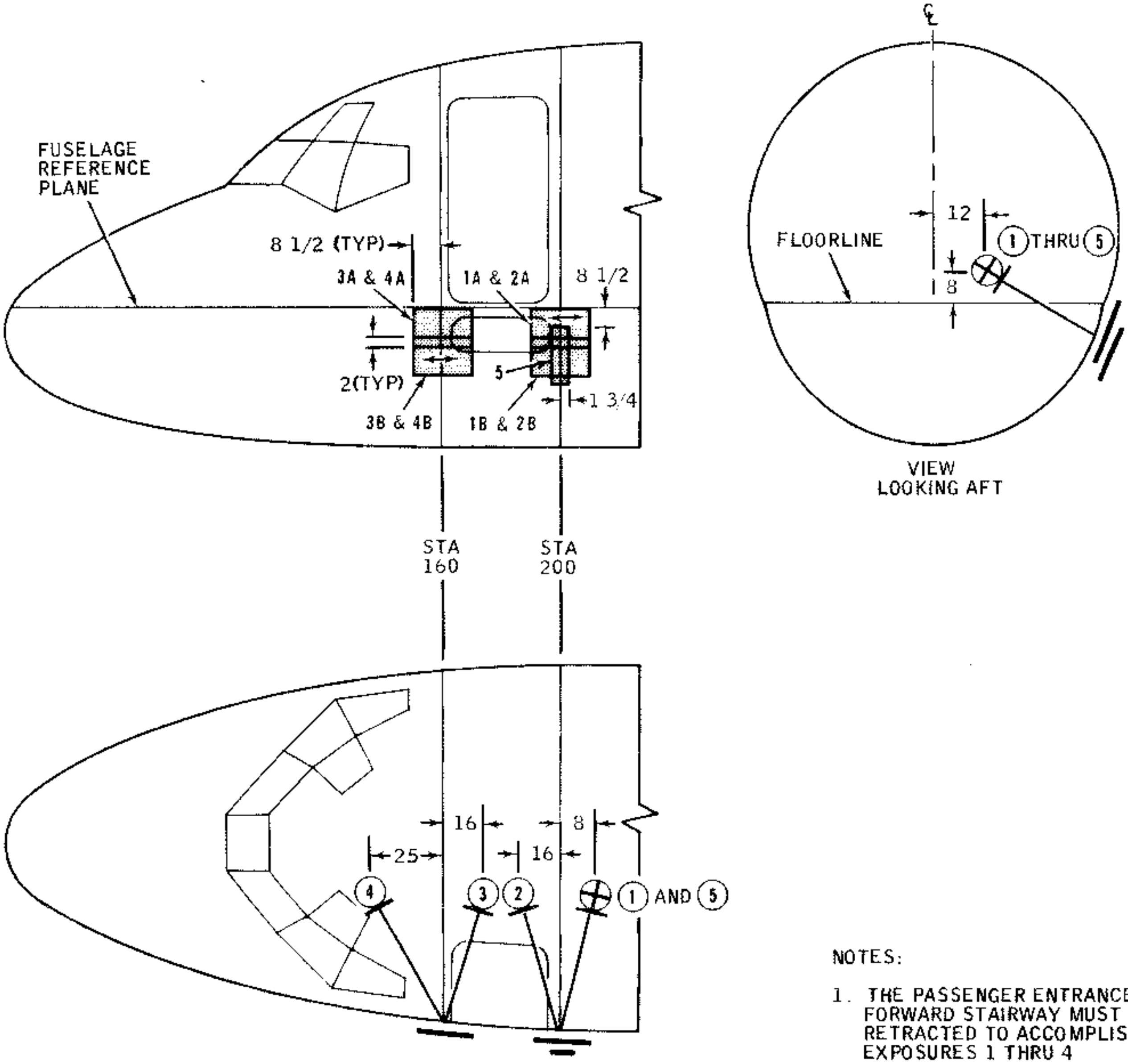
NOTE: (EXPOSURE 8 ONLY)
OPEN DOOR APPROXIMATELY 8 INCHES TO FACILITATE PLACEMENT OF FILM BEHIND HINGES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	FUS FRAMES, INNER AND OUTER CAPS, FROM FLOOR TO 17 IN. ABOVE					
8	STA 160	110	1400	72	II & III	14 x 17
9	STA 200	130	750	72	II & III	14 x 17
10	STA 160, INNER CAP BETWEEN LH L-1 & L-4	90	1500	72	II	8 x 10

RADIOGRAPHIC DATA

BB12-66

Passenger Forward Entrance Door Jamb Area
Figure 4 (Sheet 2)



NOTES:

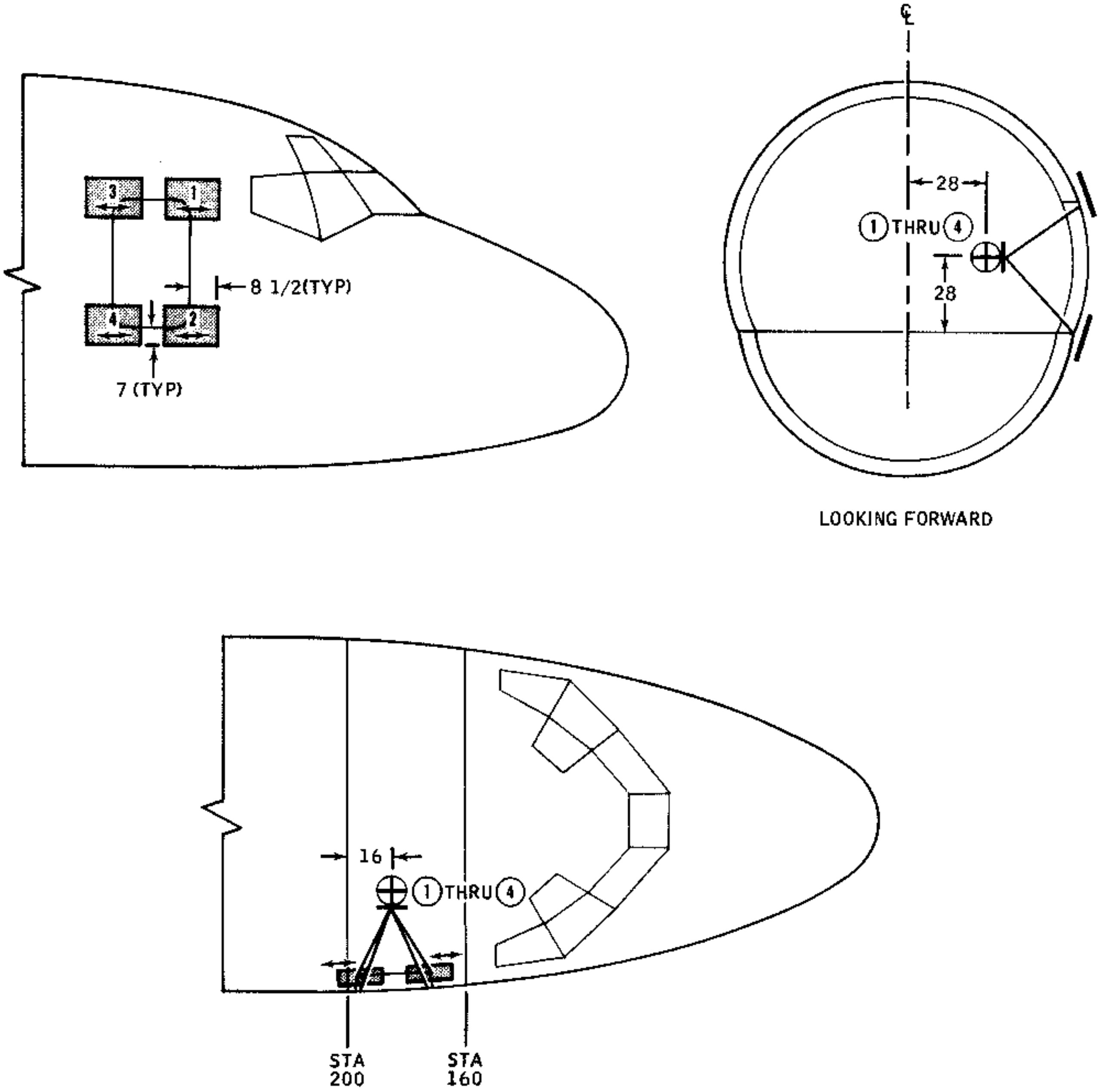
1. THE PASSENGER ENTRANCE FORWARD STAIRWAY MUST BE RETRACTED TO ACCOMPLISH EXPOSURES 1 THRU 4
2. THE PILOTS SEAT MUST BE REMOVED TO ACCOMPLISH EXPOSURE 4.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A	JAMB—AFT AREA	130	900	54	II & III	14 x 17
B					II & III	14 x 17
2A		130	900	54	II & III	14 x 17
B					II & III	14 x 17
3A	JAMB — FORWARD AREA	130	900	54	II & III	14 x 17
B					II & III	14 x 17
4A		130	1200	54	II & III	14 x 17
B					II & III	14 x 17
5	FRAME — STA 200	130	900	54	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-68

Stairwell Door Jamb Area
Figure 5



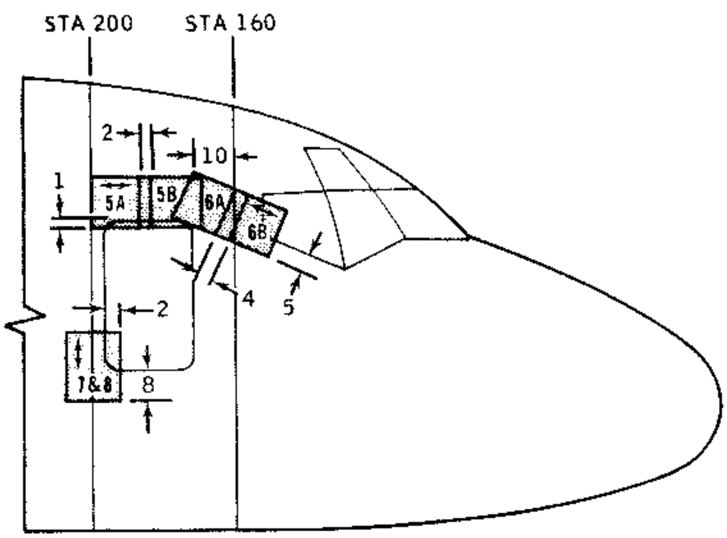
LOOKING FORWARD

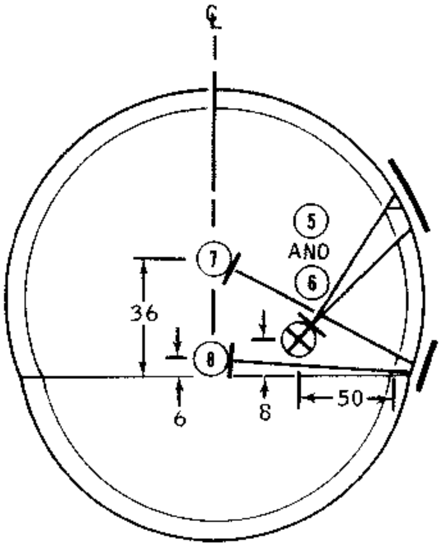
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	PLATING AND DOUBLERS					
1	UPPER FORWARD CORNER	130	750	48	II & III	14 x 17
2	LOWER FORWARD CORNER	130	750	48	II & III	14 x 17
3	UPPER AFT CORNER	130	750	48	II & III	14 x 17
4	LOWER AFT CORNER	130	750	48	II & III	14 x 17

RADIOGRAPHIC DATA

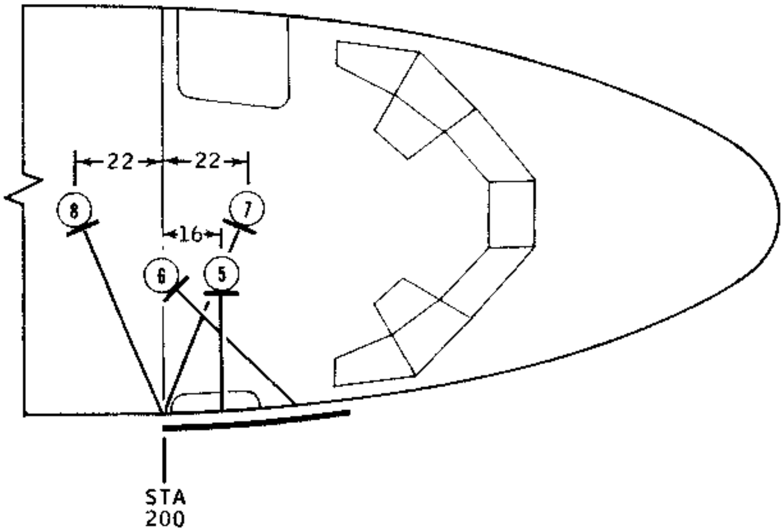
BB12-85

Service Door Jamb Area
Figure 6 (Sheet 1)





LOOKING FORWARD

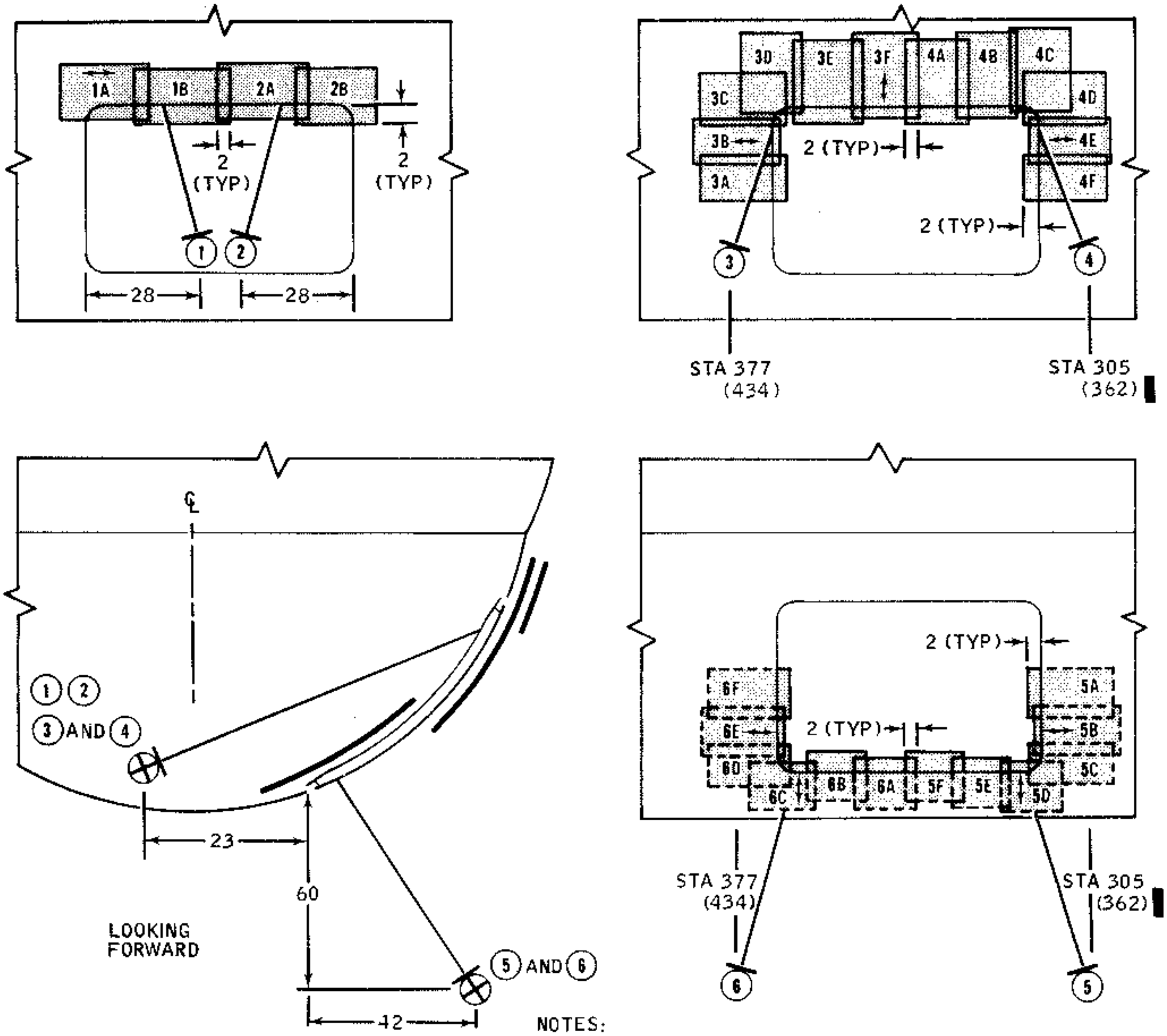


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	INTERCOSTALS					
5A	STA 168 TO STA 200	110	900	62	II	14 x 17
B					II	14 x 17
6A	STA 148 TO STA 168	110	1050	72	II	14 x 17
B					II	14 x 17
7	FRAME STA 200 AT	130	400	60	II & III	14 x 17
8	AFT LOWER CORNER	130	650	60	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-70

Service Door Jamb Area
Figure 6 (Sheet 2)



NOTES:

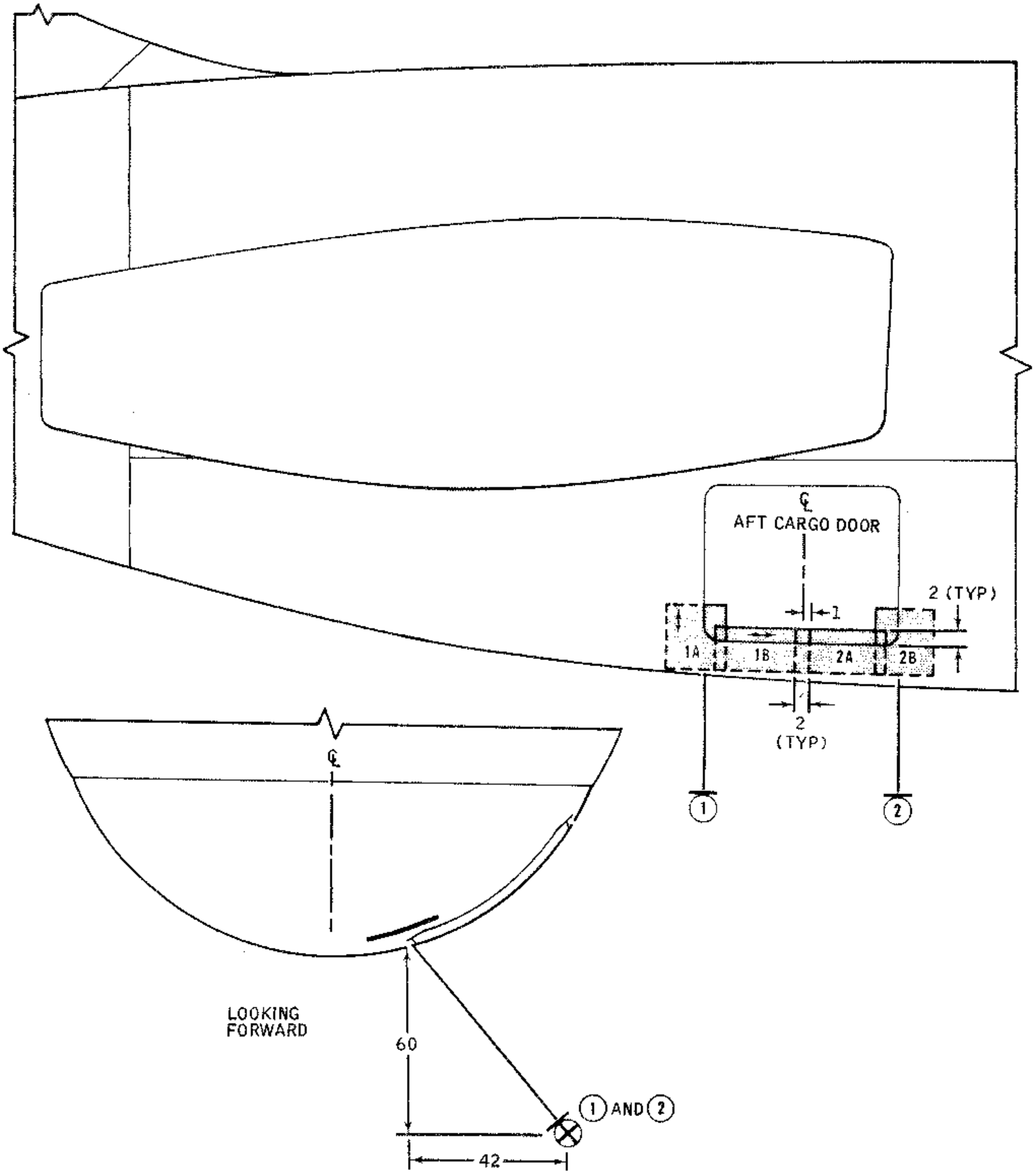
1. THE FORWARD LOWER CARGO DOOR MUST BE CLOSED TO ACCOMPLISH EXPOSURES 1, 2, 3, AND 4. DOOR MUST BE OPEN FOR EXPOSURES 5 AND 6.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A B	UPPER INTERCOSTALS AFT	130	750	72	II & III II & III	14 x 17 14 x 17
2A B	UPPER INTERCOSTALS FORWARD	130	750	72	II & III II & III	14 x 17 14 x 17
3A THRU F	UPPER AFT CORNER	130	600	72	II & III	14 x 17
4A THRU F	UPPER FORWARD CORNER	130	600	72	II & III	14 x 17
5A THRU F	LOWER FORWARD CORNER	130	600	72	II & III	14 x 17
6A THRU F	LOWER AFT CORNER	130	600	72	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-79A

Forward Lower Cargo Compartment Door Jamb Area
Figure 7

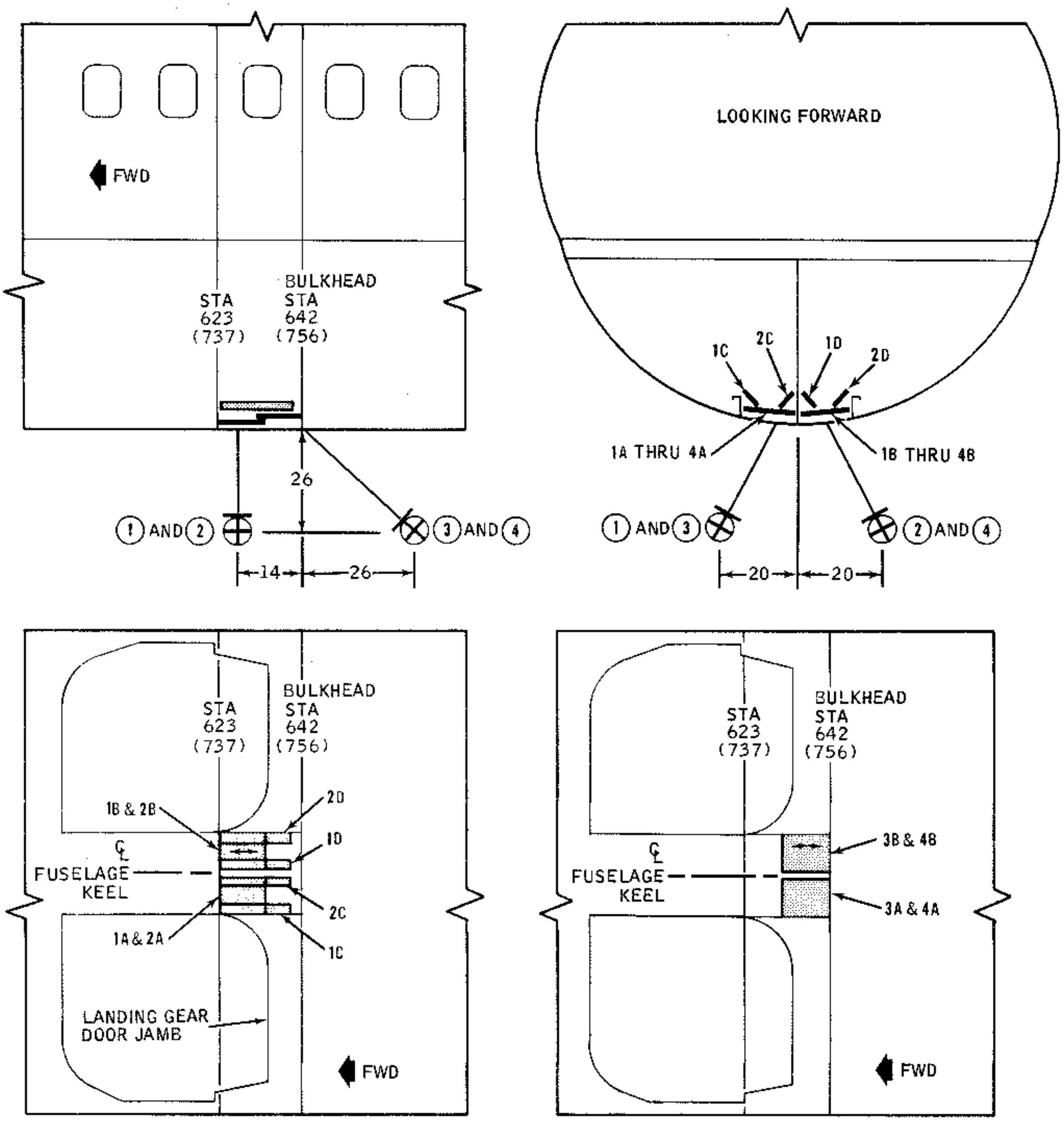


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A B	LOWER AFT CORNER	130	750	72	II & III II & III	14 x 17 14 x 17
2A B	LOWER FORWARD CORNER	130	750	72	II & III II & III	14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-75

Aft Lower Cargo Compartment Door Jamb Area
Figure 8



LOOKING DOWN

LOOKING DOWN

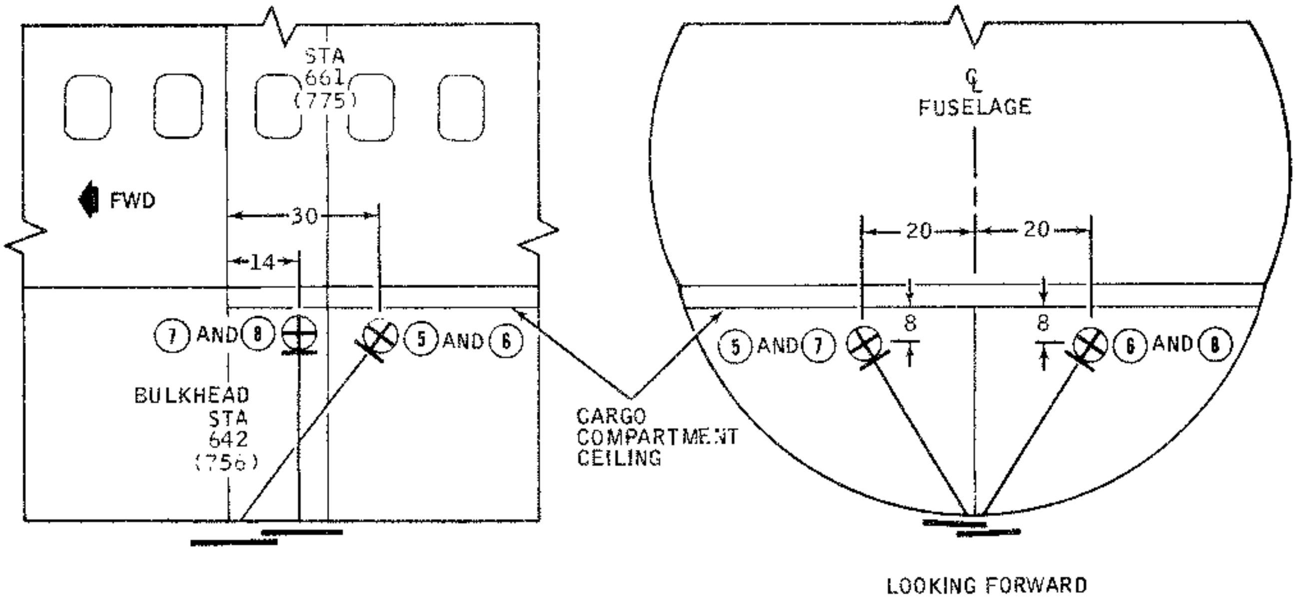
NOTE:
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

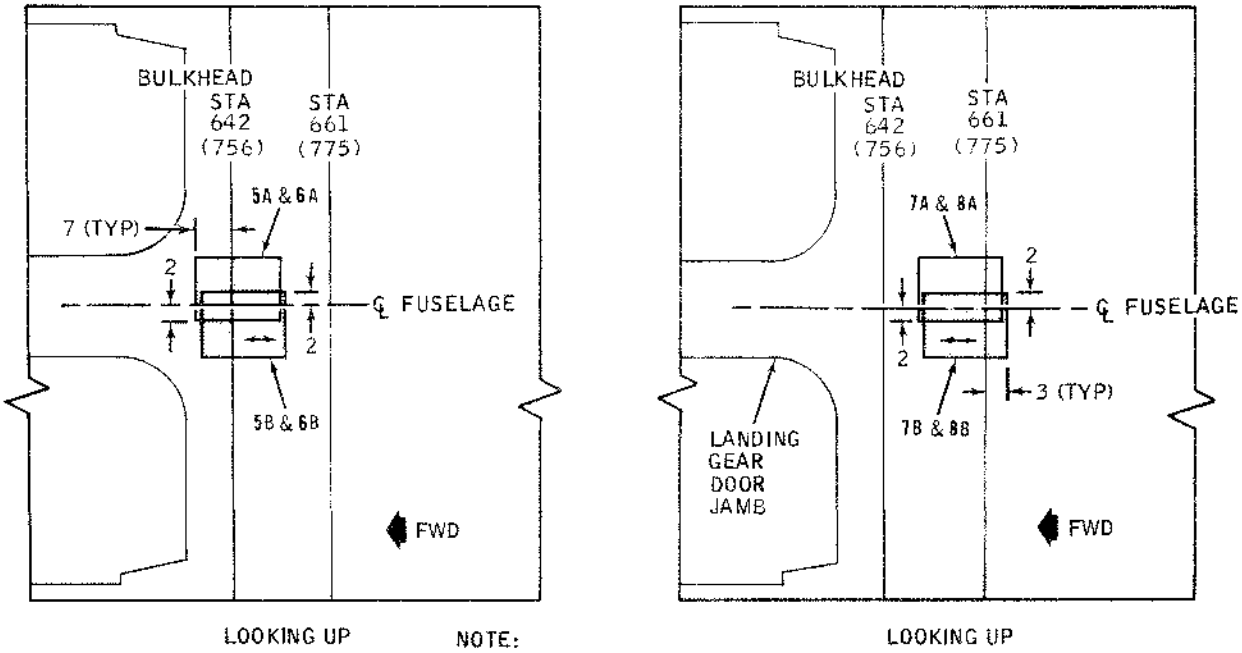
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B, C, & D	LONGERONS NEAR KEEL AT STA 623 (737) TO 642 (756)	105	300	36	II & III II & III	8 x 10 3 1/2 x 17
2A, B, C, & D		105	300	36	II & III II & III	8 x 10 3 1/2 x 17
3A & B		135	300	48	II & III	8 x 10
4A & B		135	300	48	II & III	8 x 10

RADIOGRAPHIC DATA

BB12-83A

Main Landing Gear Door Jamb Area
Figure 9 (Sheet 1)





NOTE:
STATION NUMBERS IN PARENTHESES
ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
5A & B	LONGERONS NEAR FUSELAGE ℄ AT STA 642 (756) TO 661 (775)	135	300	48	II & III	14 x 17
6A & B		135	300	48	II & III	14 x 17
7A & B		110	300	48	II & III	14 x 17
8A & B		110	300	48	II & III	14 x 17

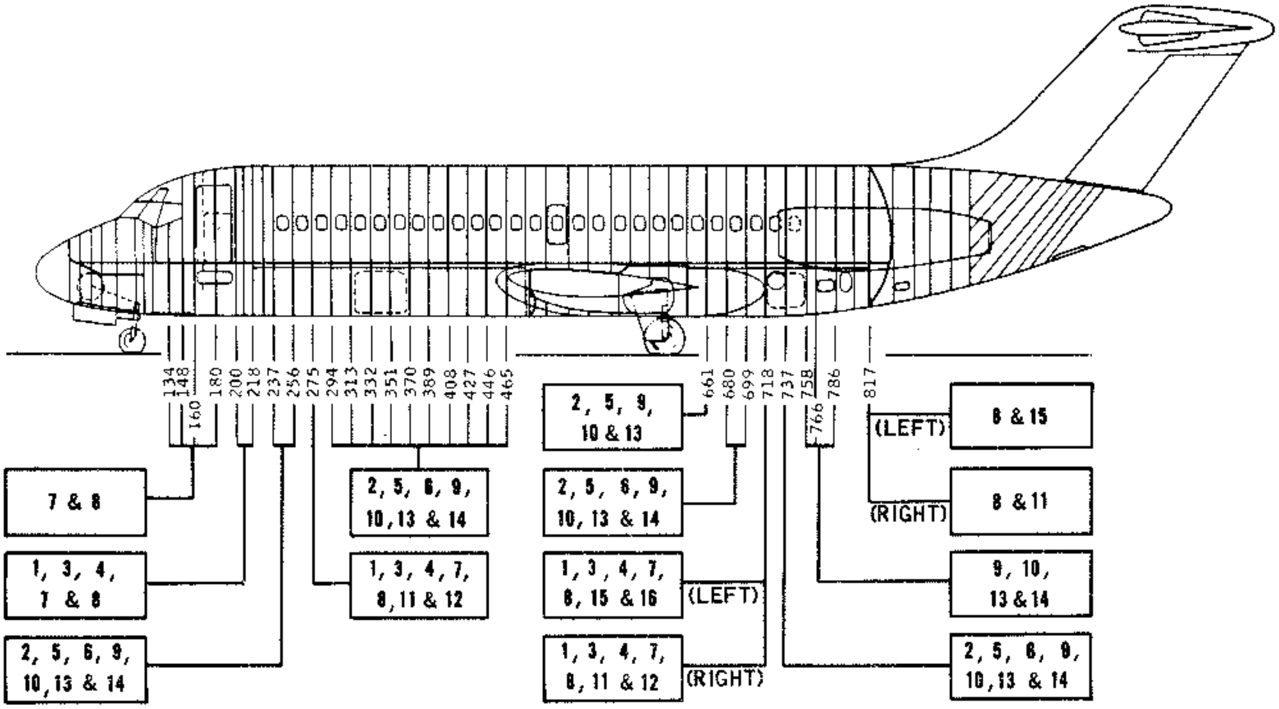
RADIOGRAPHIC DATA

BB12-84A

Main Landing Gear Door Jamb Area
Figure 9 (Sheet 2)

NOTES:

1. THE ILLUSTRATION BELOW INDICATES THE EXPOSURES THAT ARE APPLICABLE TO EACH FUSELAGE FRAME STATION. THE X-RAY SOURCE POSITIONS ARE LOCATED ON SHEET 2.
2. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. FUSELAGE CUSP AREA LEFT SIDE, SHOWN.
   B. FUSELAGE CUSP AREA RIGHT SIDE, OPPOSITE EXCEPT AS SHOWN.
3. EXPOSURES 7, 8, 11 12, 15, & 16 REQUIRE THE USE OF LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK.
4. CERTAIN EXPOSURE IN THIS FIGURE REQUIRE THE REMOVAL OF VARIOUS ITEMS, SUCH AS PILOT AND PASSENGER SEATS, CARGO COMPARTMENT SIDE PANELS, AND WING TO FUSELAGE LEADING EDGE FILLET. FLUID LINES MUST BE DRAINED AS REQUIRED. TECHNICIAN MUST DETERMINE ACCESSIBILITY REQUIRED IN EACH CASE.

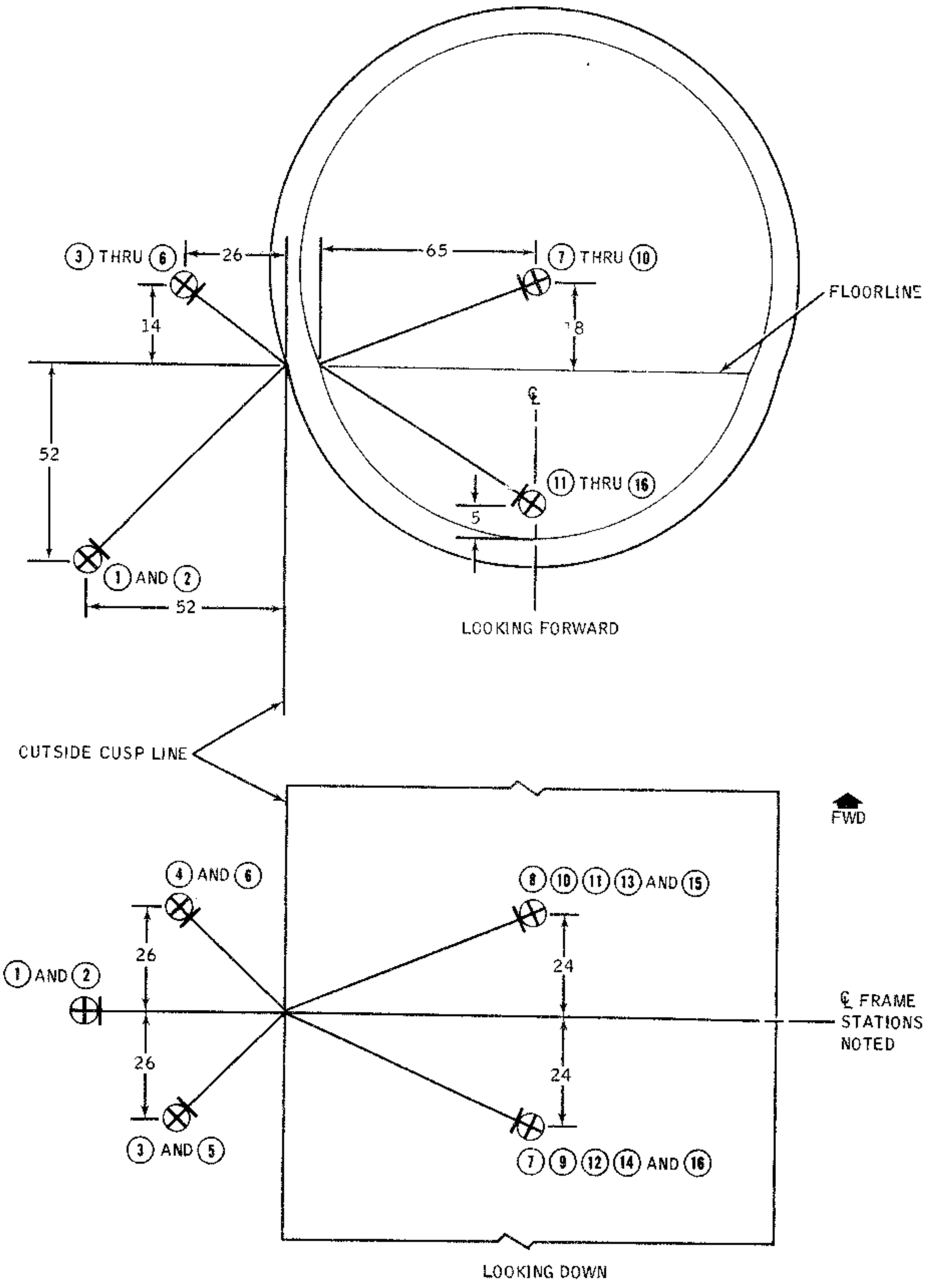


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	DETERMINE EXPOSURES APPLICABLE TO EACH FRAME STATION BY REFERRING TO DIAGRAM ABOVE	130	380	72	II & III	8 x 10
2		130	180	72	II & III	8 x 10
3		140	900	48	II & III	8 x 10
4		140	900	48	II & III	8 x 10
5		130	80	48	II & III	8 x 10
6		130	80	48	II & III	8 x 10
7		140	2200	65	II & III	8 x 10
8		140	2200	65	II & III	8 x 10
9		130	144	65	II & III	8 x 10
10		130	144	65	II & III	8 x 10
11		140	2700	72	II & III	8 x 10
12		140	2700	72	II & III	8 x 10
13		130	180	72	II & III	8 x 10
14		130	180	72	II & III	8 x 10
15		140	3000	72	II & III	8 x 10
16		140	3000	72	II & III	8 x 10

RADIOGRAPHIC DATA

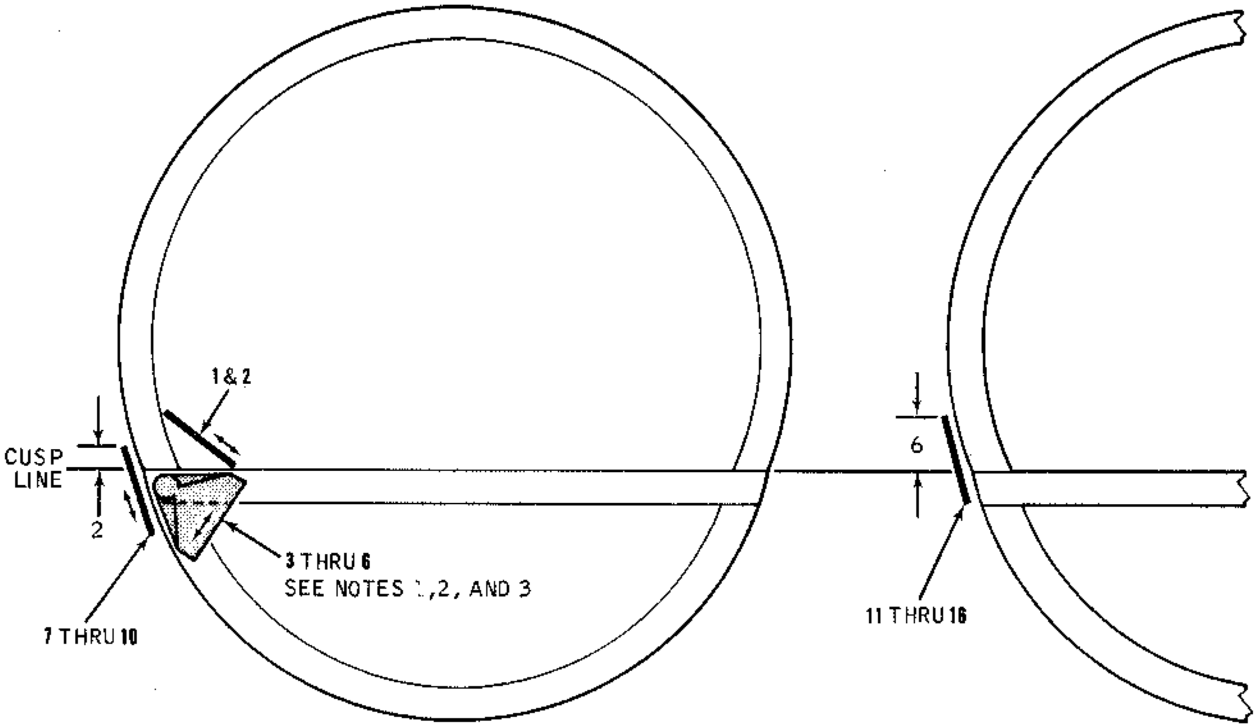
BB12-92

DC-9-10 Frame to Floor Beam Attach Area (Cusp) Excluding Wing to Fuselage Joining Area
Figure 10 (Sheet 1)

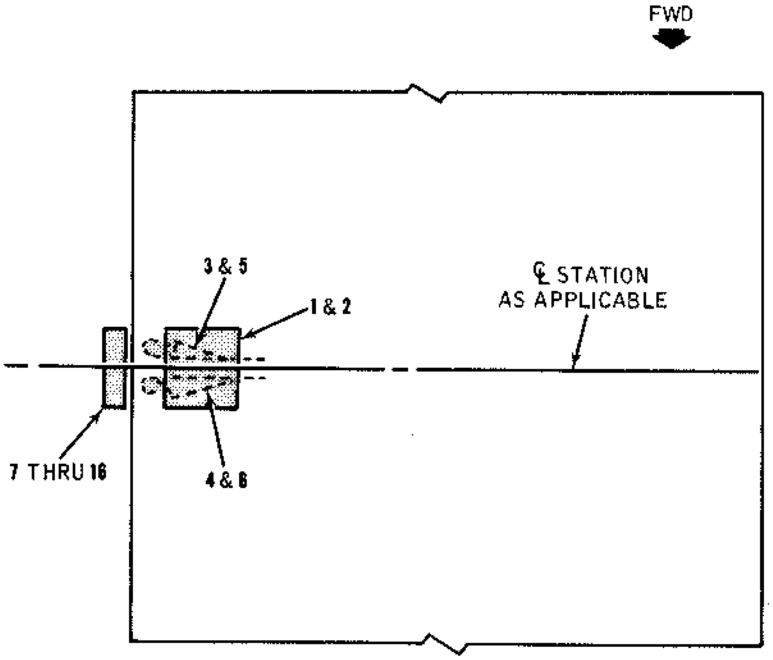


DC-9-10 Frame to Floor Beam Attach Area (Cusp) Excluding Wing to Fuselage Joining Area
Figure 10 (Sheet 2)

BB12-93



LOOKING FORWARD



NOTES:

1. FILM FOR EXPOSURES 4 & 6 SHOWN.
2. FILM FOR EXPOSURES 3 & 5 LOCATED SIMILARLY EXCEPT ON FORWARD SIDE OF FLOOR BEAM AND FRAME.
3. ROLL EDGES OF FILM 3 THRU 6 TO NEST INTO CORNER.

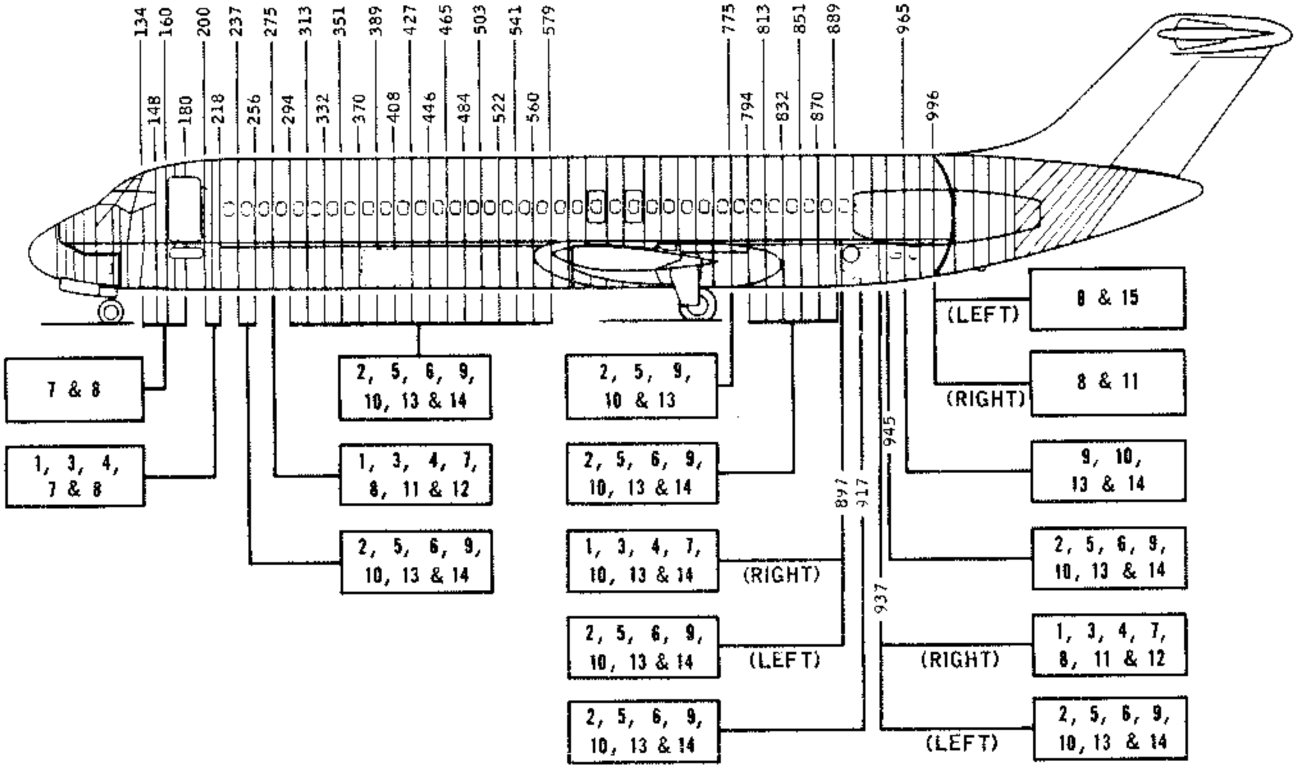
LOOKING DOWN

DC-9-10 Frame to Floor Beam Attach Area (Cusp) Excluding Wing to Fuselage Joining Area
Figure 10 (Sheet 3)

BB12-94

NOTES:

1. THE ILLUSTRATION BELOW INDICATES THE EXPOSURES THAT ARE APPLICABLE TO EACH FUSELAGE FRAME STATION. THE X-RAY SOURCE POSITIONS ARE LOCATED ON SHEET 2.
2. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   - A. FUSELAGE CUSP AREA LEFT SIDE, SHOWN.
   - B. FUSELAGE CUSP AREA RIGHT SIDE, OPPOSITE EXCEPT AS SHOWN.
3. EXPOSURES 7, 8, 11, 12, & 15 REQUIRE THE USE OF LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK.
4. CERTAIN EXPOSURE IN THIS FIGURE REQUIRE THE REMOVAL OF VARIOUS ITEMS, SUCH AS PILOT AND PASSENGER SEATS, CARGO COMPARTMENT SIDE PANELS, AND WING TO FUSELAGE LEADING EDGE FILLET. FLUID LINES MUST BE DRAINED AS REQUIRED. TECHNICIAN MUST DETERMINE ACCESSIBILITY REQUIRED IN EACH CASE.

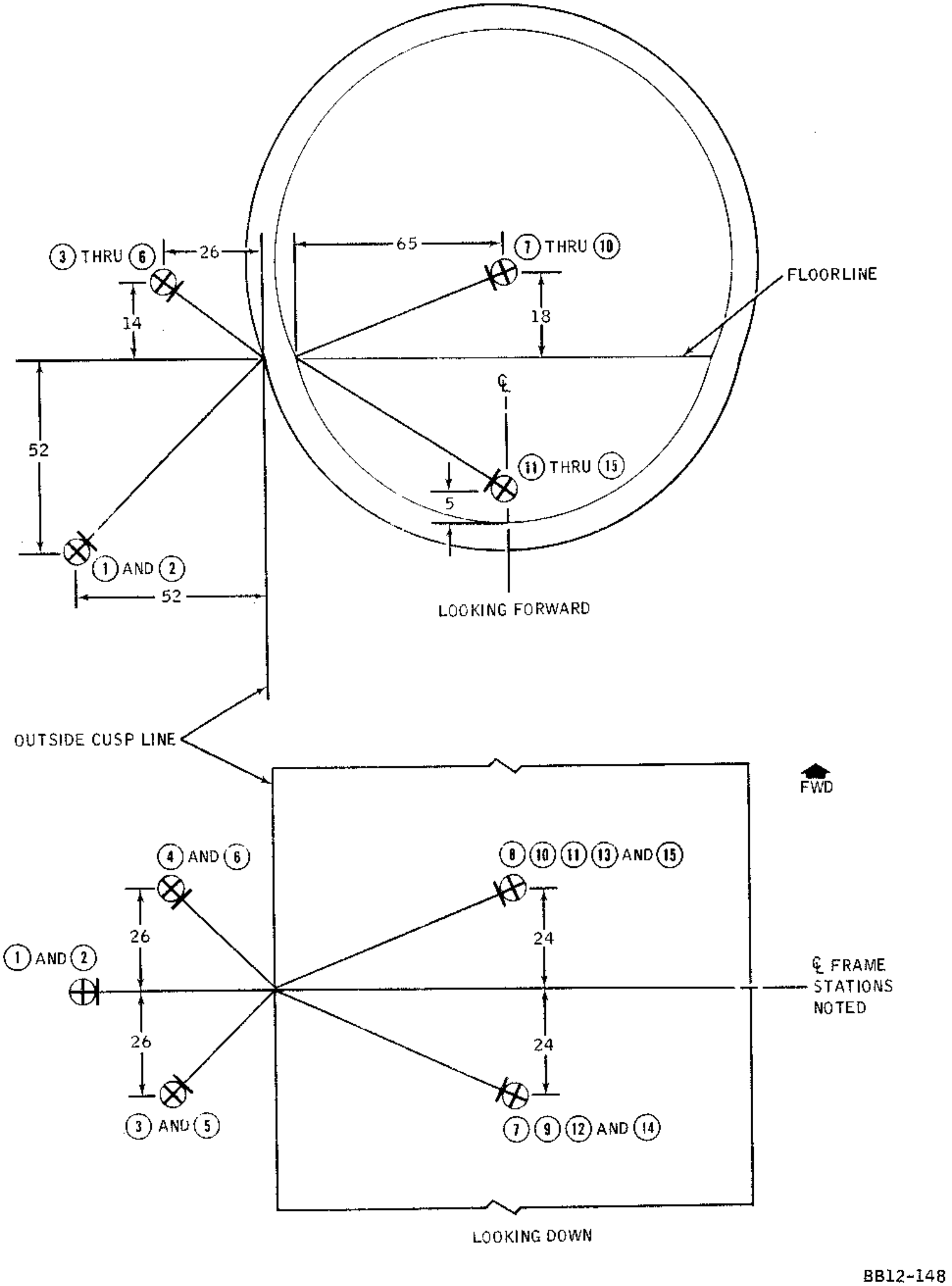


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	DETERMINE EXPOSURES APPLICABLE TO EACH FRAME STATION BY REFERRING TO DIAGRAM ABOVE	130	380	72	II & III	8 x 10
2		130	180	72	II & III	8 x 10
3		140	900	48	II & III	8 x 10
4		140	900	48	II & III	8 x 10
5		130	80	48	II & III	8 x 10
6		130	80	48	II & III	8 x 10
7		140	2200	65	II & III	8 x 10
8		140	2200	65	II & III	8 x 10
9		130	144	65	II & III	8 x 10
10		130	144	65	II & III	8 x 10
11		140	2700	72	II & III	8 x 10
12		140	2700	72	II & III	8 x 10
13		130	180	72	II & III	8 x 10
14		130	180	72	II & III	8 x 10
15		140	3000	72	II & III	8 x 10

RADIOGRAPHIC DATA

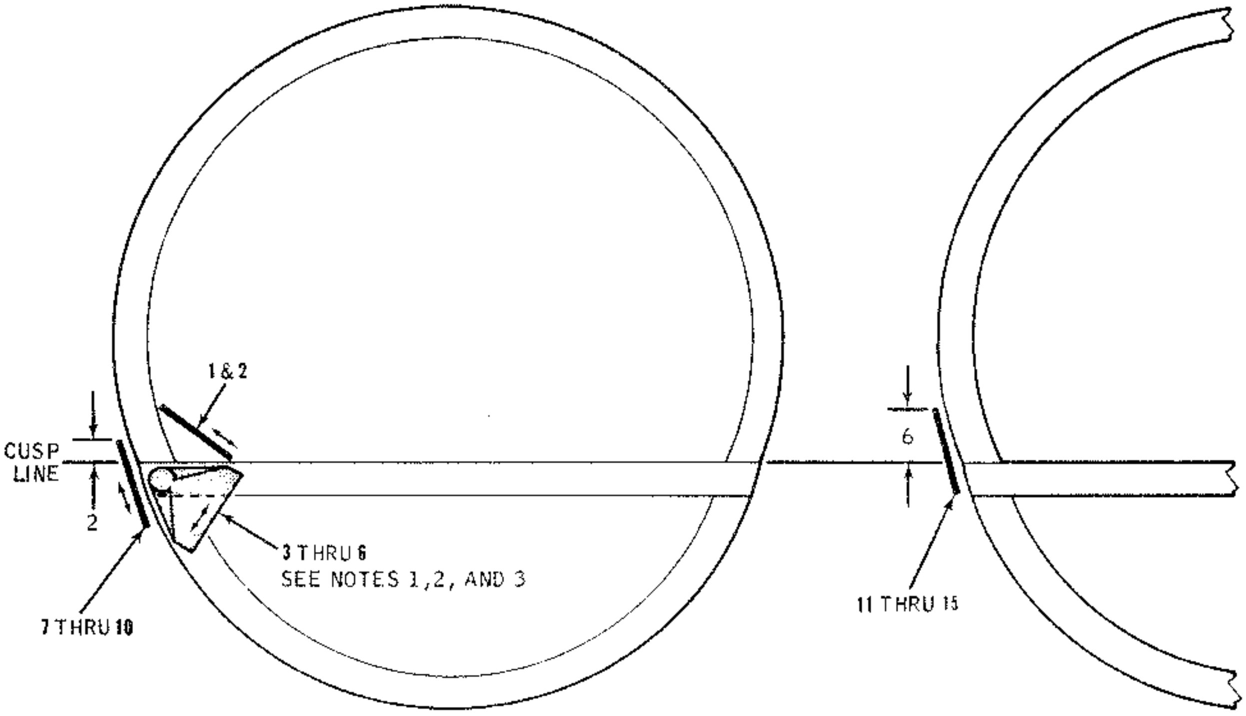
BB12-144

DC-9-30 Frame to Floor Beam Attach Area (Cusp)
Excluding Wing to Fuselage Joining Area
Figure 11 (Sheet 1)

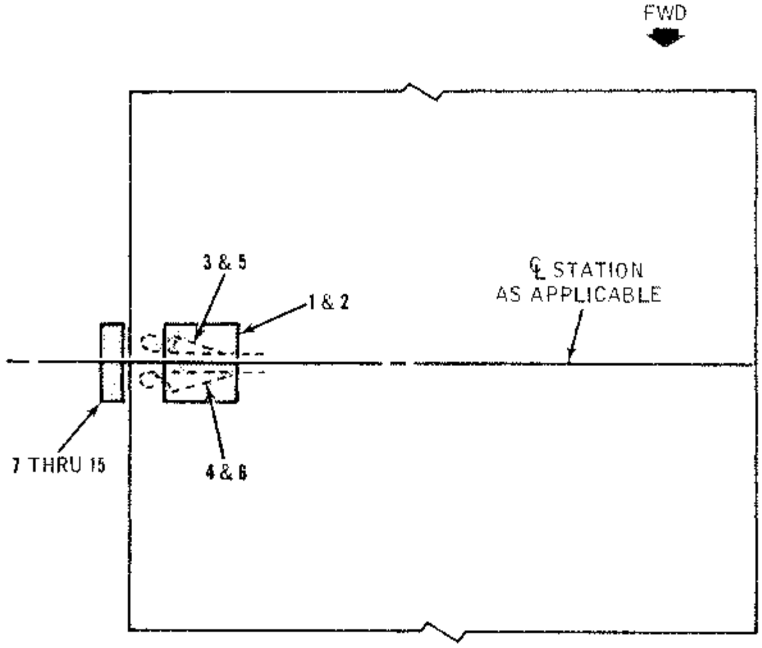


BB12-148

DC-9-30 Frame to Floor Beam Attach Area (Cusp)
Excluding Wing to Fuselage Joining Area
Figure 11 (Sheet 2)



LOOKING FORWARD



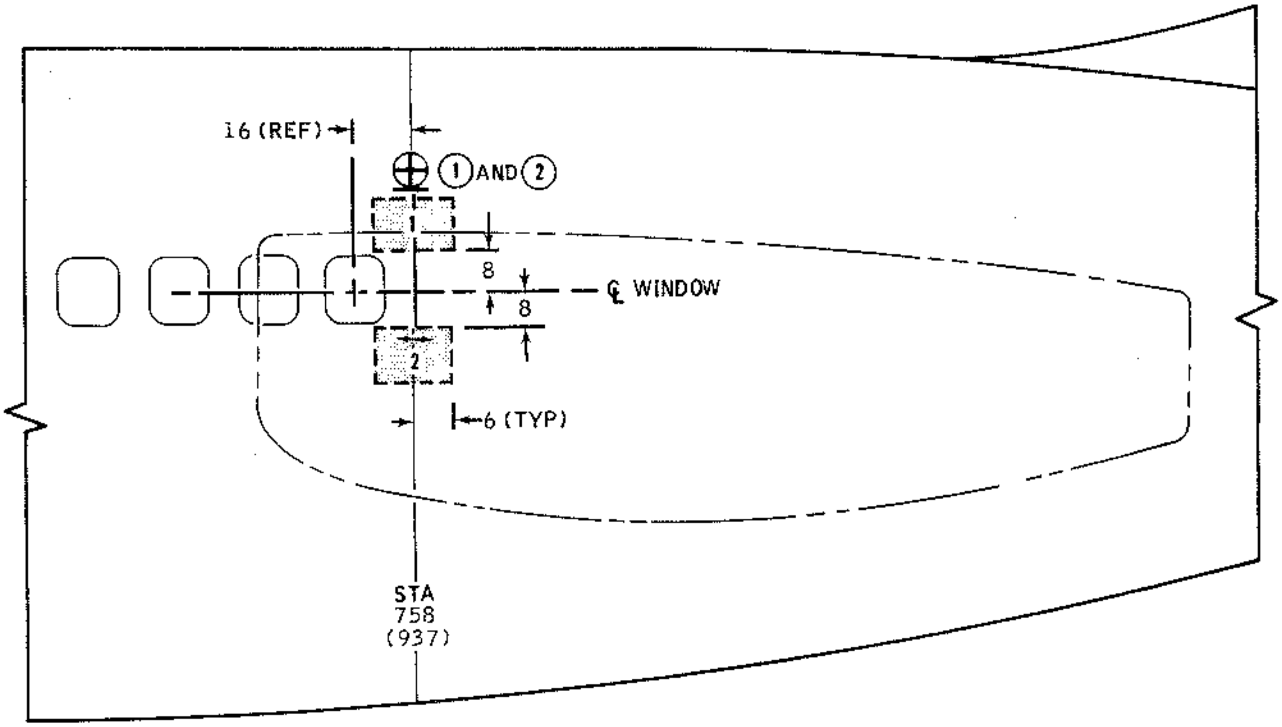
NOTES:

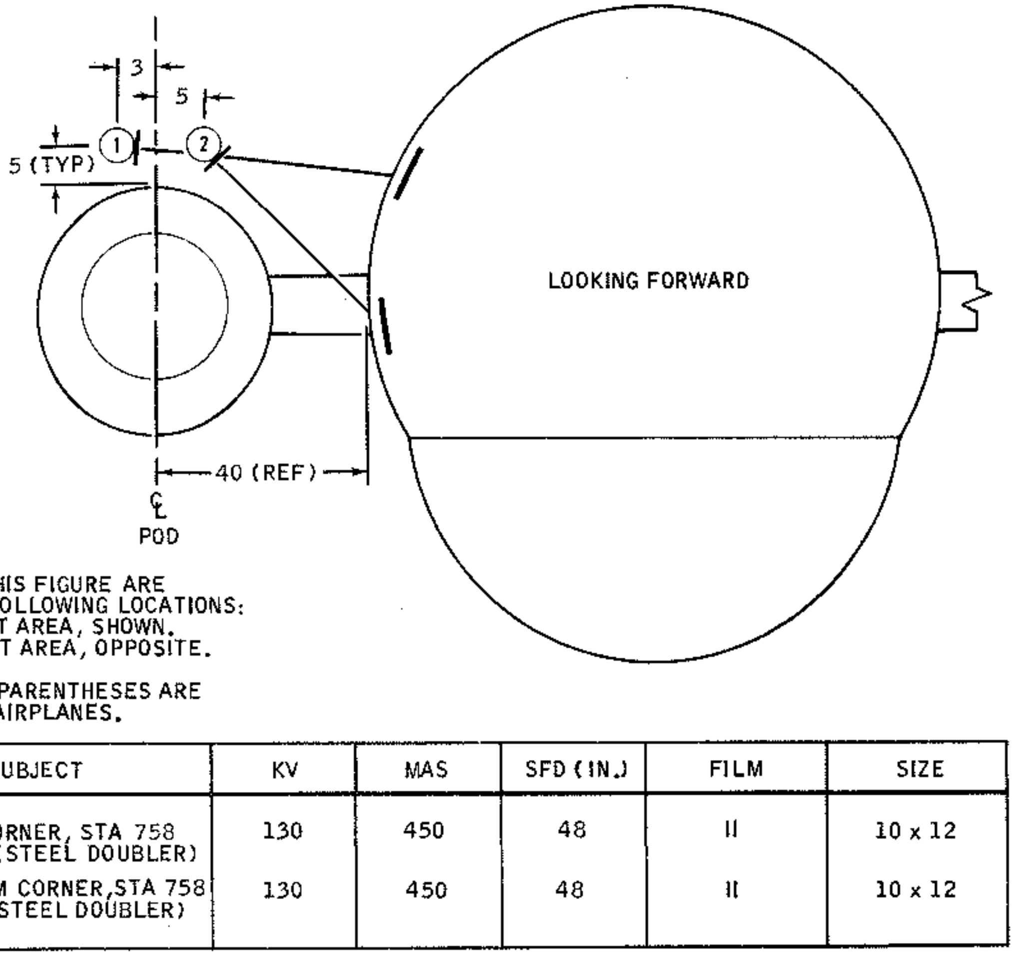
1. FILM FOR EXPOSURES 4 & 6 SHOWN.
2. FILM FOR EXPOSURES 3 & 5 LOCATED SIMILARLY EXCEPT ON FORWARD SIDE OF FLOOR BEAM AND FRAME.
3. ROLL EDGES OF FILM 3 THRU 6 TO NEST INTO CORNER.

LOOKING DOWN

BB12-149

DC-9-30 Frame to Floor Beam Attach Area (Cusp)
Excluding Wing to Fuselage Joining Area
Figure 11 (Sheet 3)





NOTE:

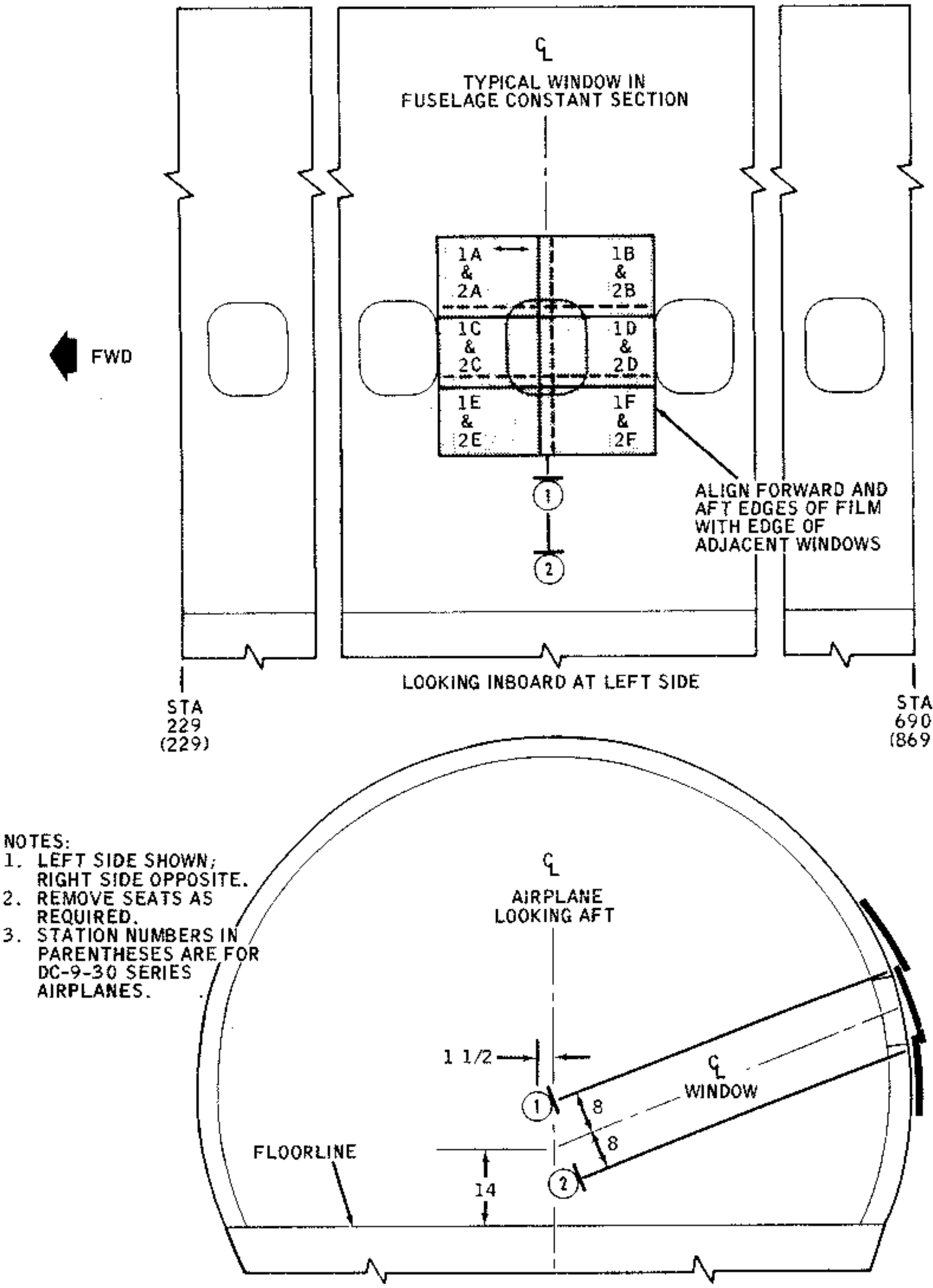
1. THE TECHNIQUES IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   - A. LEFT WINDOW BELT AREA, SHOWN.
   - B. RIGHT WINDOW BELT AREA, OPPOSITE.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	AFT TOP CORNER, STA 758 (STA 937) (STEEL DOUBLER)	130	450	48	II	10 x 12
2	AFT BOTTOM CORNER, STA 758 (STA 937) (STEEL DOUBLER)	130	450	48	II	10 x 12

RADIOGRAPHIC DATA

BB12-82A

Passenger Compartment Window Belt Area
Figure 12



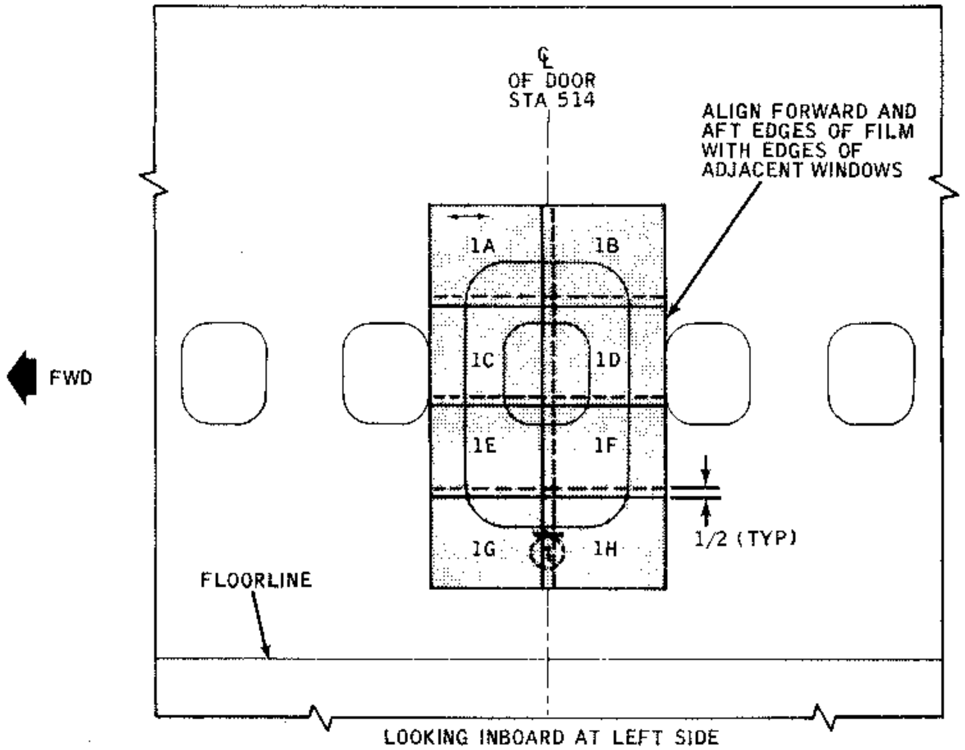
NOTES:
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. REMOVE SEATS AS REQUIRED.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN)	FILM	SIZE
1 AND 2	WINDOW AND WINDOW FRAMES	130	186	60	II	14 x 17

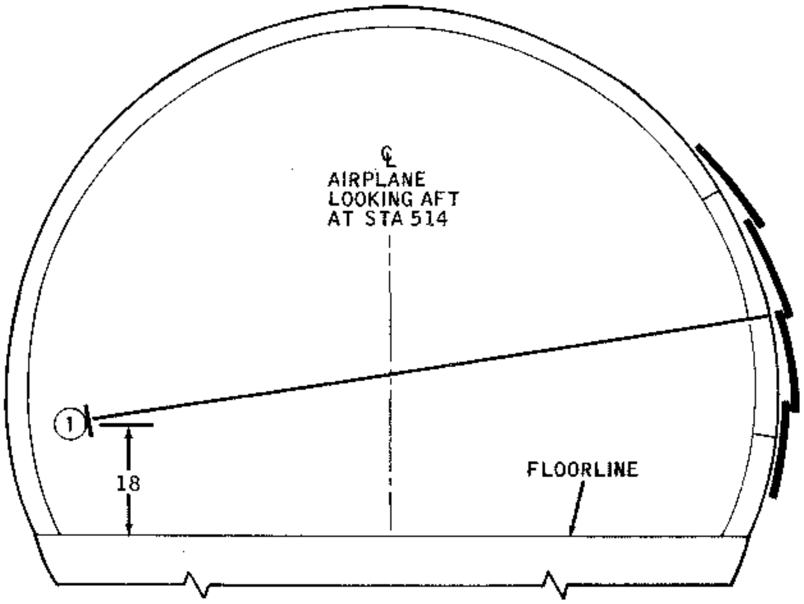
RADIOGRAPHIC DATA

BB12-142

Areas Around Passenger Compartment Windows
Figure 13



LOOKING INBOARD AT LEFT SIDE



NOTES:

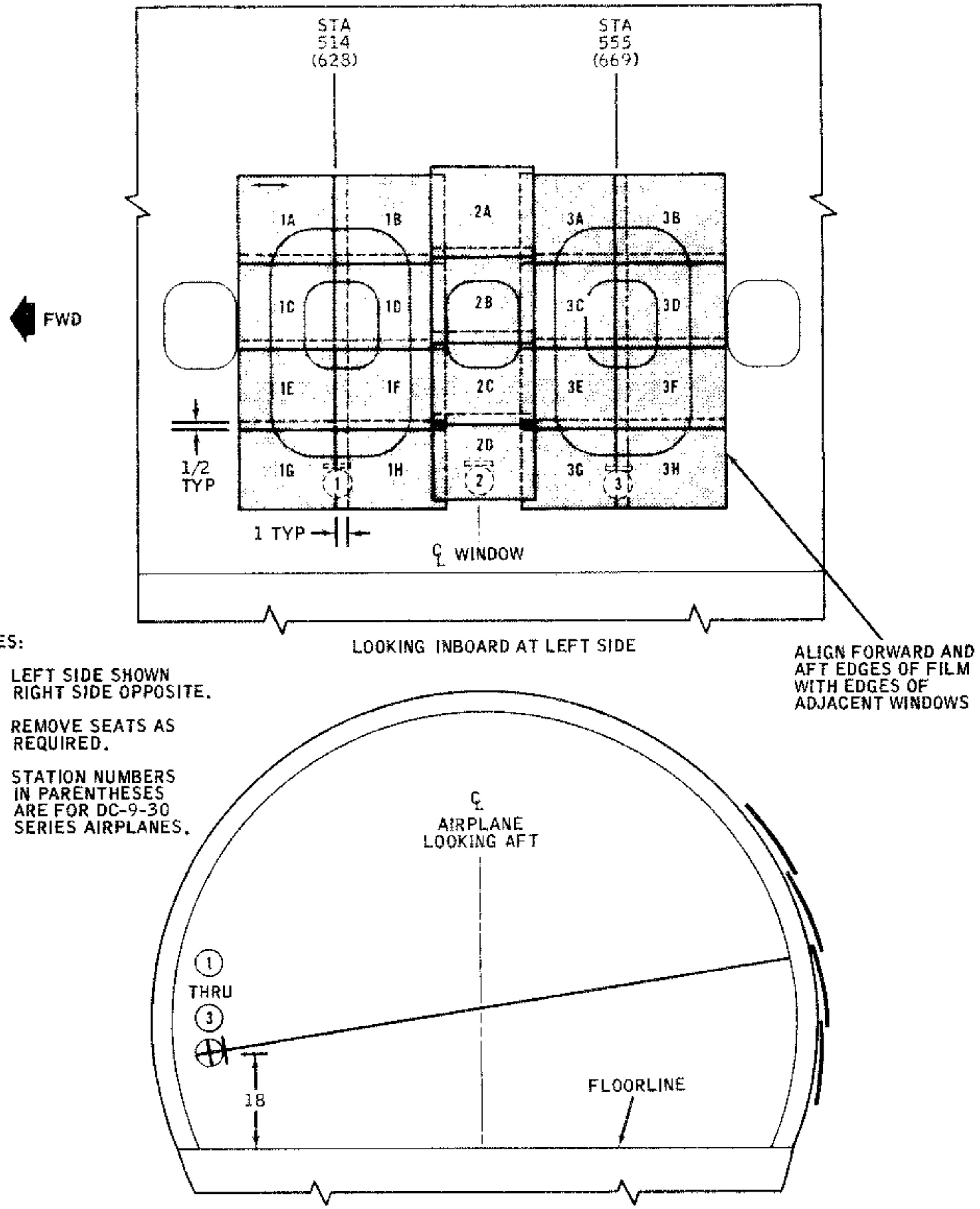
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. REMOVE SEATS AS REQUIRED.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	EMERGENCY EXIT DOOR AND DOOR JAMB	130	745	120	II	14 X 17

RADIOGRAPHIC DATA

BB12-141

DC-9-10 Overwing Emergency Exit Door and Door Jamb
Figure 14



NOTES:

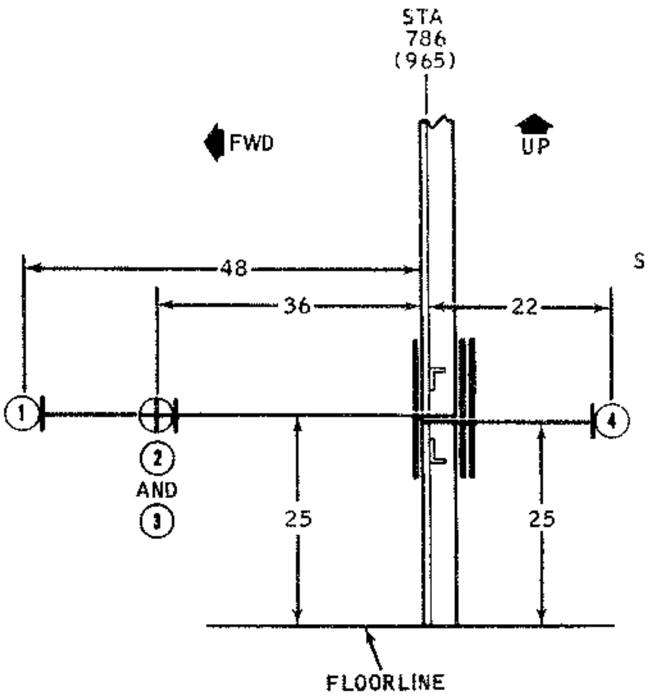
1. LEFT SIDE SHOWN RIGHT SIDE OPPOSITE.
2. REMOVE SEATS AS REQUIRED.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

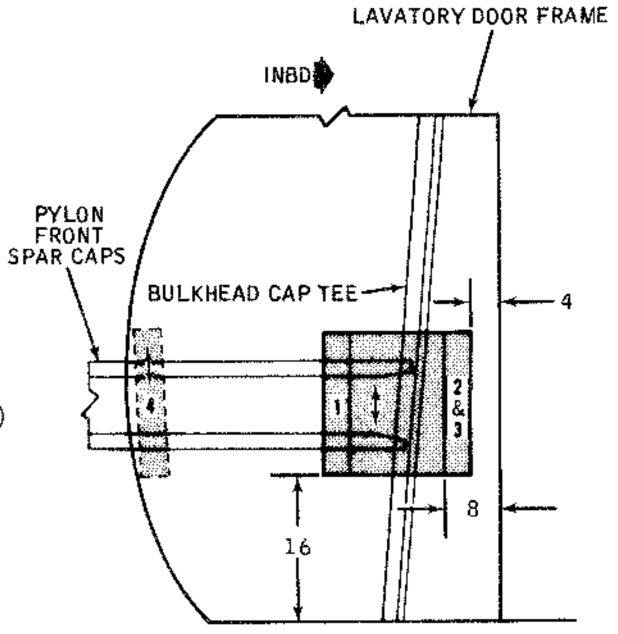
EXPOSURE	SUBJECT	KV	MAS	SFD(IN)	FILM	SIZE
1 THRU 3	EMERGENCY EXIT DOORS, DOOR JAMBS, AND ADJACENT WINDOW.	130	745	120	II	14 x 17

RADIOGRAPHIC DATA

BB12-143

Overwing Emergency Exit Doors and Adjacent Window
Figure 15

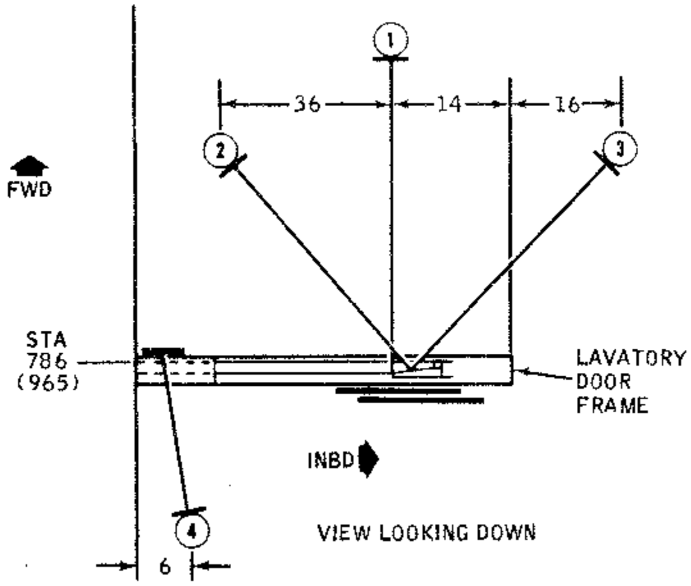




VIEW LOOKING FWD AT
STATION 786 (965) BULKHEAD

NOTES:

1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. STATION 786 (965) BULKHEAD LEFT SIDE, SHOWN.
   B. STATION 786 (965) BULKHEAD RIGHT SIDE, OPPOSITE.
2. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK OF FILM TO ACCOMPLISH EXPOSURE 1.
3. IT MAY BE NECESSARY TO REMOVE THE TWO AFT ROWS OF SEATS TO PROVIDE ROOM FOR THE X-RAY SOURCE FOR EXPOSURES 1 THRU 3.
4. REMOVE THE LINING FROM THE OUTER WALL BOTH FORWARD AND AFT OF BULKHEAD STATION 786(965) FOR EXPOSURE 4.
5. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.



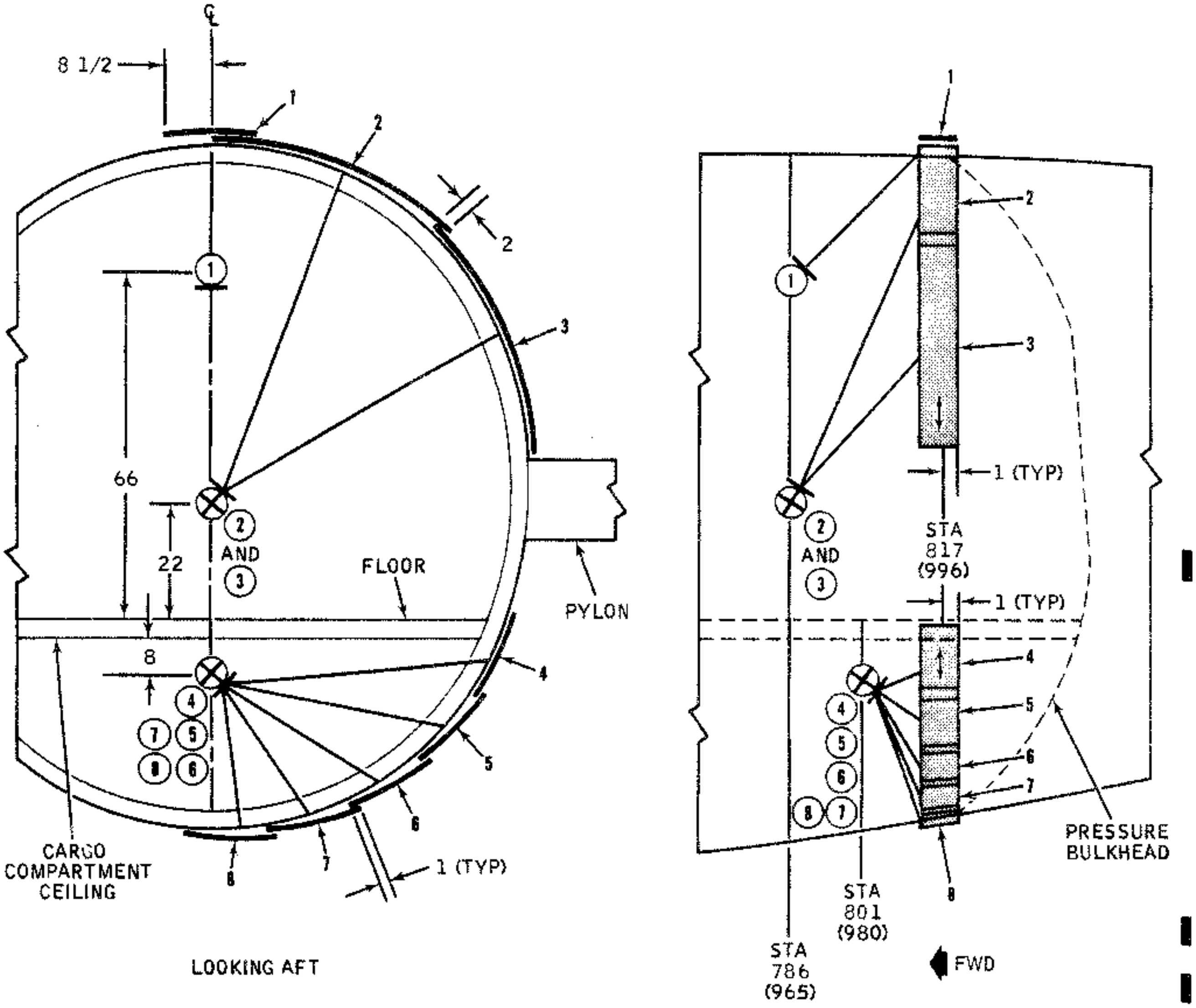
VIEW LOOKING DOWN

EXPOSURE	SUBJECT	KV	MAS	SFD(IN.)	FILM	SIZE
1	INBOARD END OF PYLON SPAR CAPS	135	600	48	II	14 x 17
2 3	BULKHEAD CAP TEE AT INBOARD END OF PYLON SPAR	120 120	300 300	48 48	II II	14 x 17 14 x 17
4	OUTER CAP ANGLE AT PYLON SPAR ATTACH	130	160	24	II	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-58A

Fuselage Bulkhead at Pylon Front Spar Attach
Figure 16



NOTES:

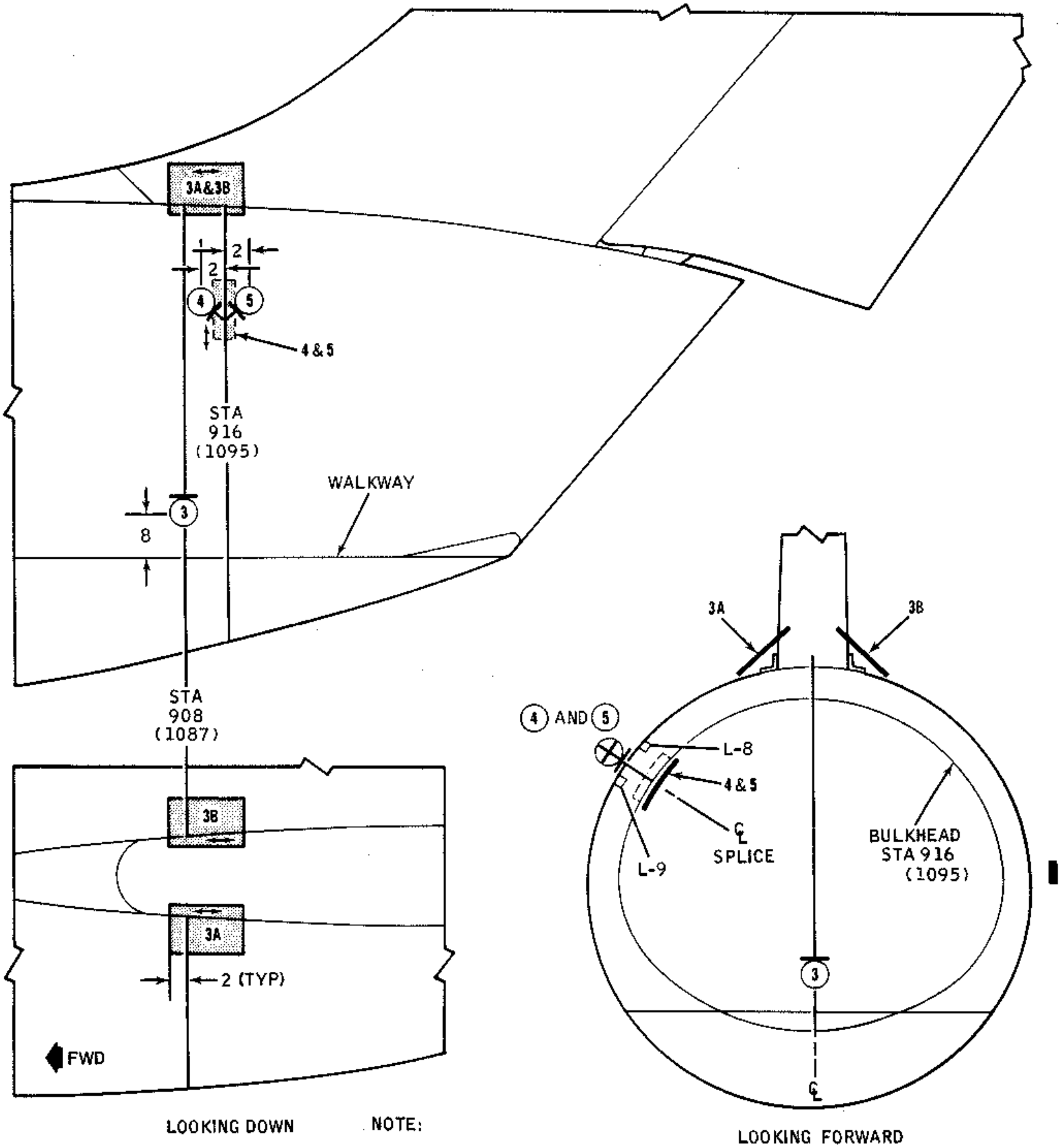
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE EXCEPT FOR EXPOSURE 1.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	EXTRUSION AND ATTACH LEGS					
1		130	75	48	II & III	4 1/2 x 17
2		130	150	69	II & III	4 1/2 x 50
3		130	150	69	II & III	4 1/2 x 50
4		130	135	62	II & III	4 1/2 x 17
5		130	105	55	II & III	4 1/2 x 17
6		130	75	48	II & III	4 1/2 x 17
7		130	60	41	II & III	4 1/2 x 17
8		130	52	34	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-105A

Pressure Bulkhead
Figure 17 (Sheet 1)



NOTE:

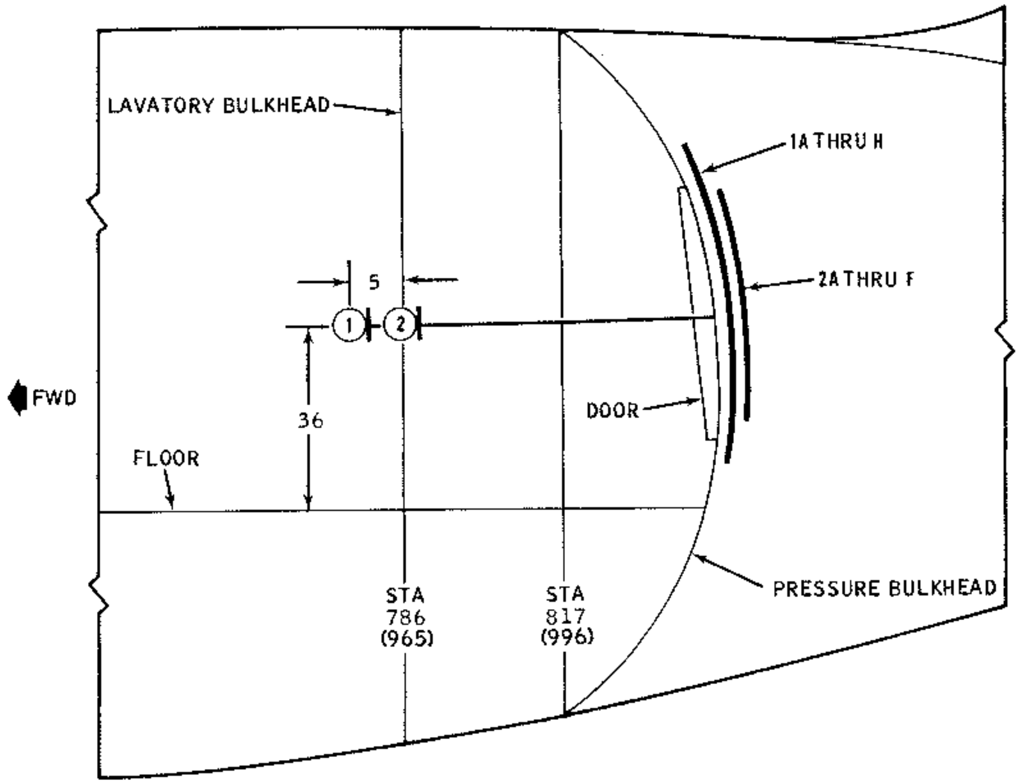
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

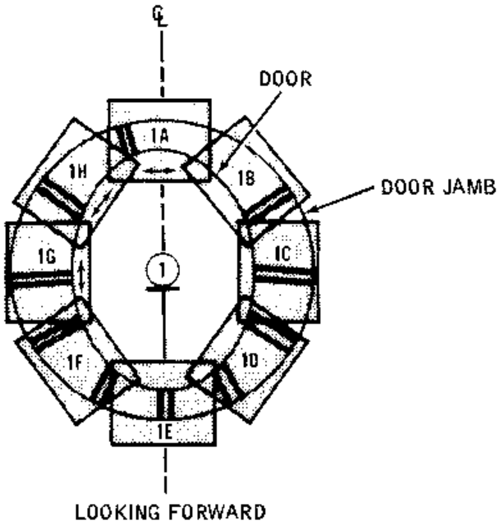
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
3	VERTICAL STABILIZER ATTACH ANGLE	130	600	84	II & III	14 x 17
4	STA 916 (1095) FRAME SPLICE	80	60	14	II & III	4 1/2 x 17
5		80	60	14	II & III	4 1/2 x 17

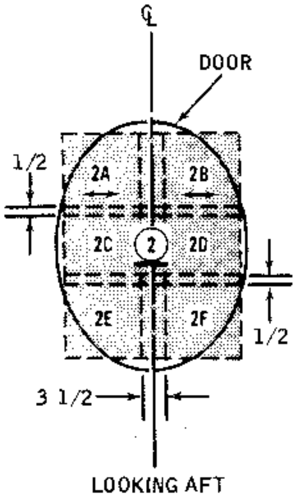
RADIOGRAPHIC DATA

8B12-89A

Pressure Bulkhead
Figure 17 (Sheet 2)







NOTE:

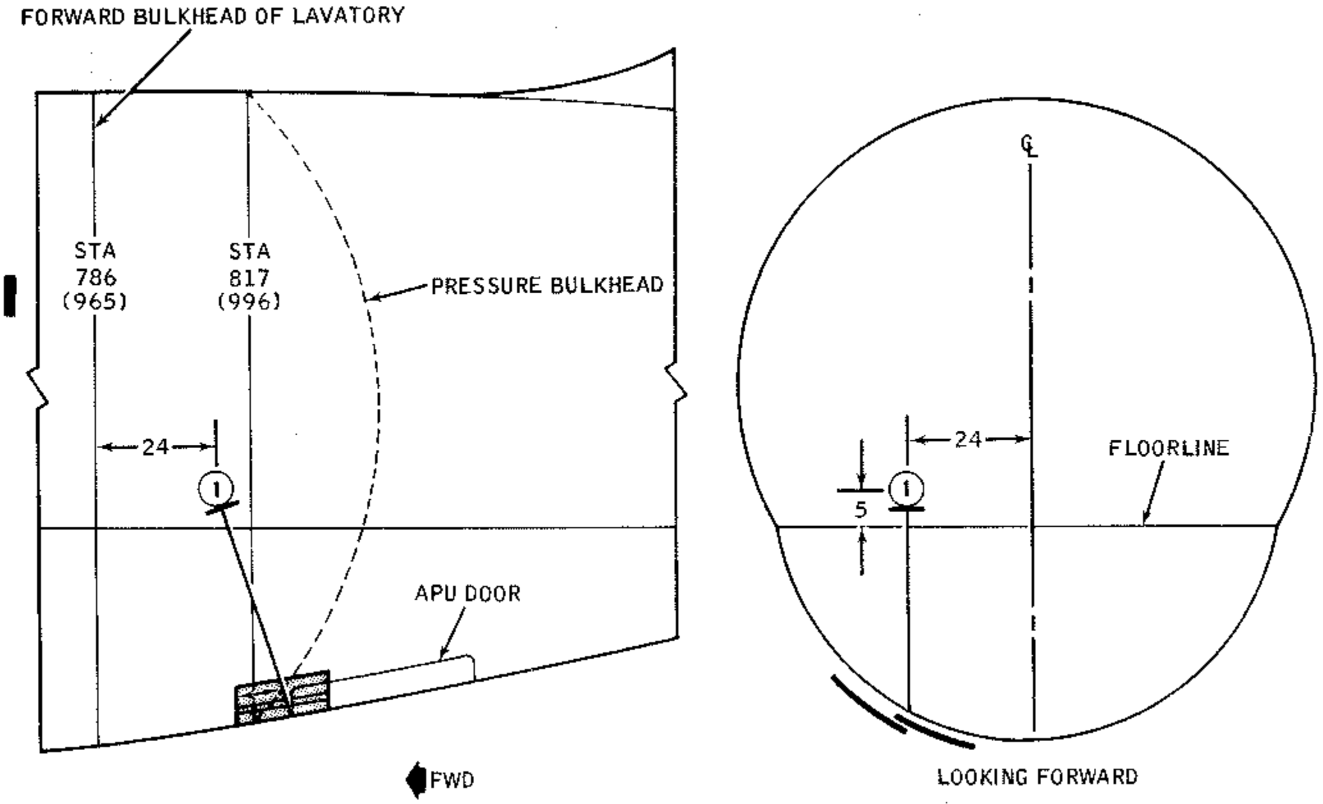
STATION NUMBERS IN PARENTHESES
ARE FOR DC-9-30 SERIES AIRPLANES.

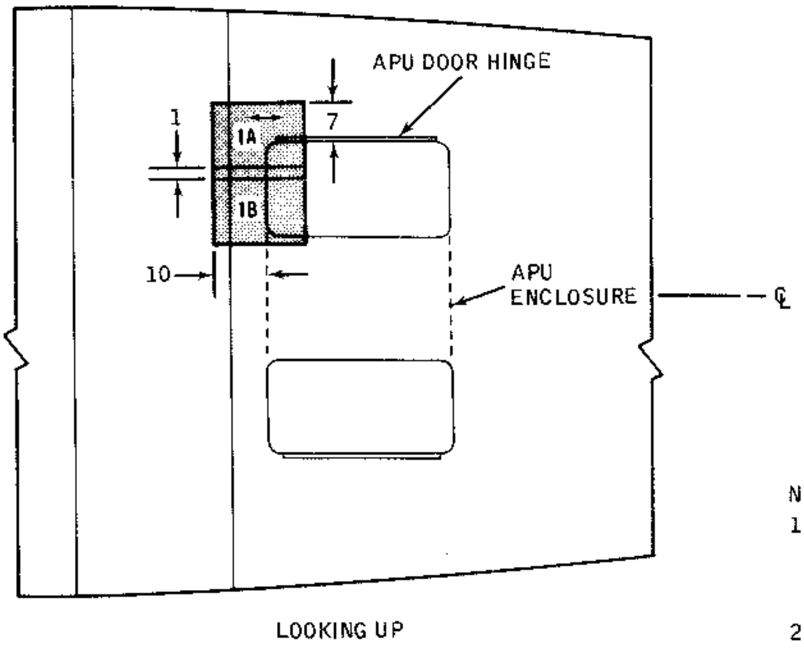
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A THRU H	STIFFENERS AT PERIMETER OF DOOR	130	480	60	II & III	14 x 17
2A THRU F	DOOR DOUBLERS	130	110	54	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-107A

Pressure Bulkhead
Figure 17 (Sheet 3)





NOTES:

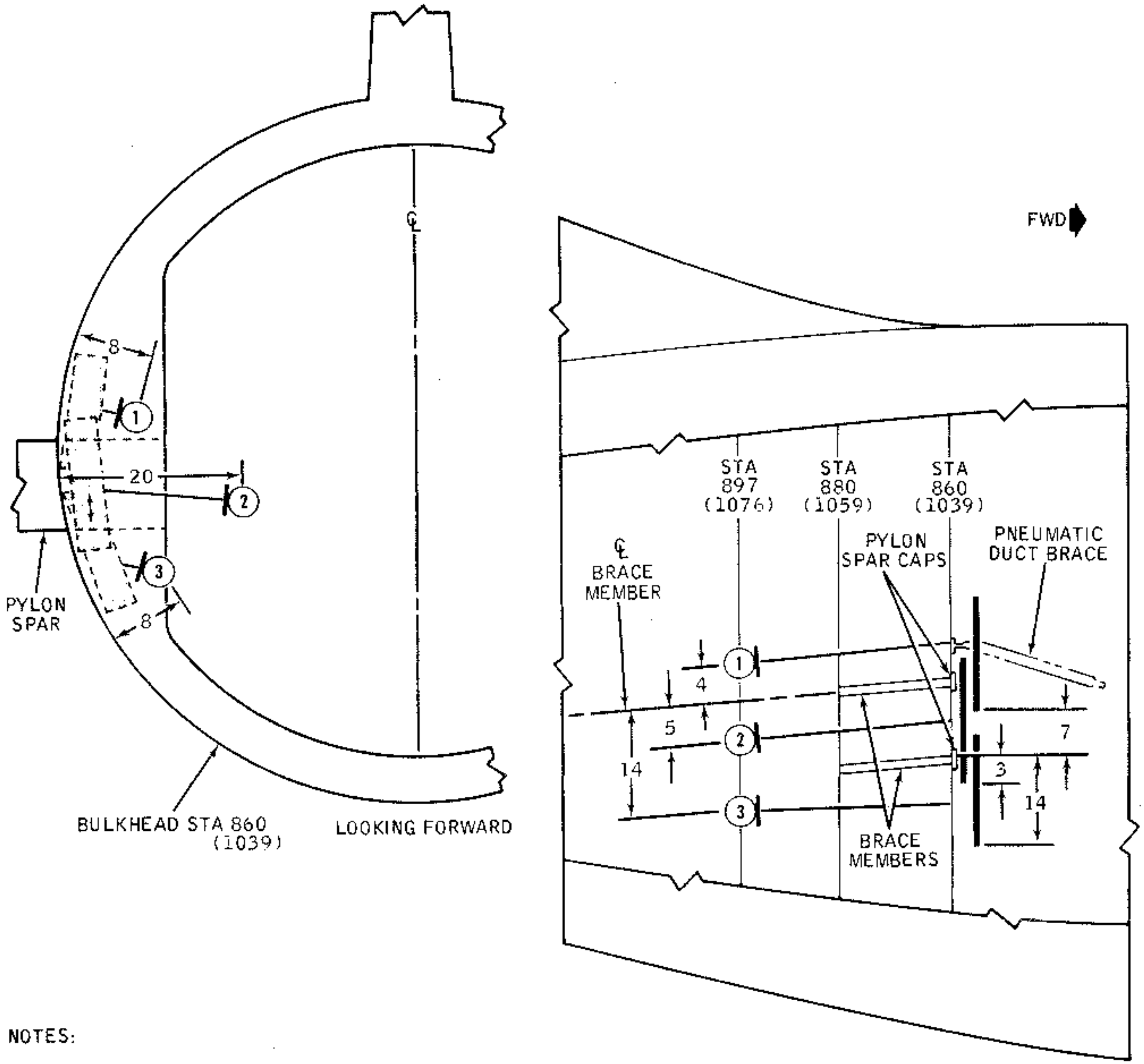
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   APU ENCLOSURE AREA LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A B	FORWARD CORNER	130	450	48	II & III II & III	14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-86A

Auxiliary Power Unit Enclosure Area
Figure 18



LOOKING FORWARD

LOOKING TO LEFT FROM AFT ACCESSORY COMPARTMENT

NOTES:

1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

   A. STATION 860 (1039) LEFT SIDE, SHOWN.

   B. STATION 860 (1039) RIGHT SIDE, OPPOSITE.

2. THE PNEUMATIC DUCT BRACE MUST BE DISCONNECTED TO ACCOMPLISH EXPOSURE 1.

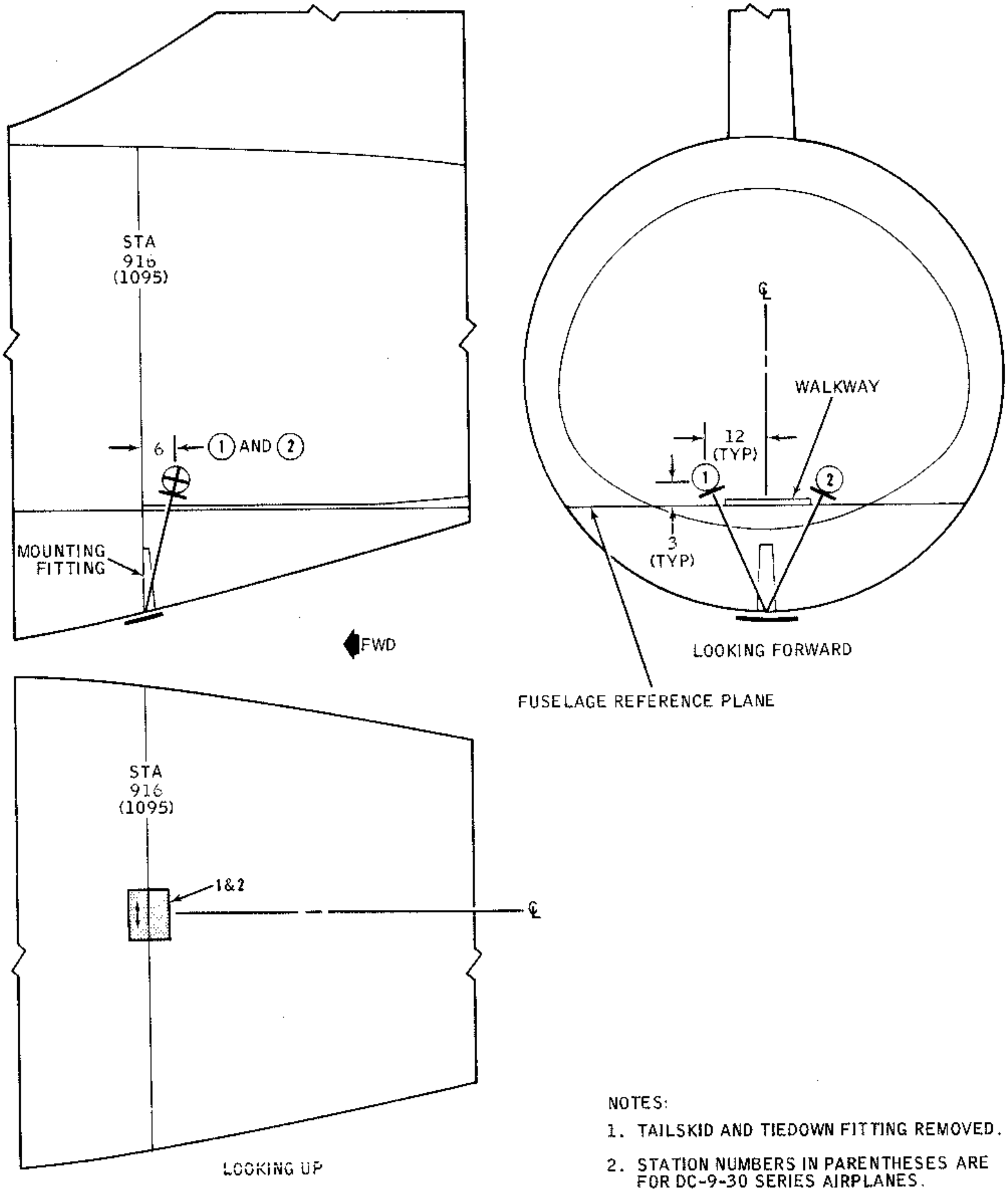
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	OUTER CAP, PYLON SPAR ATTACH ANGLE	130	160	40	II & III	4 1/2 x 17
2		130	160	40	II & III	4 1/2 x 17
3		130	160	40	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-91A

Fuselage Frame at Pylon Rear Spar Attach
Figure 19



NOTES:

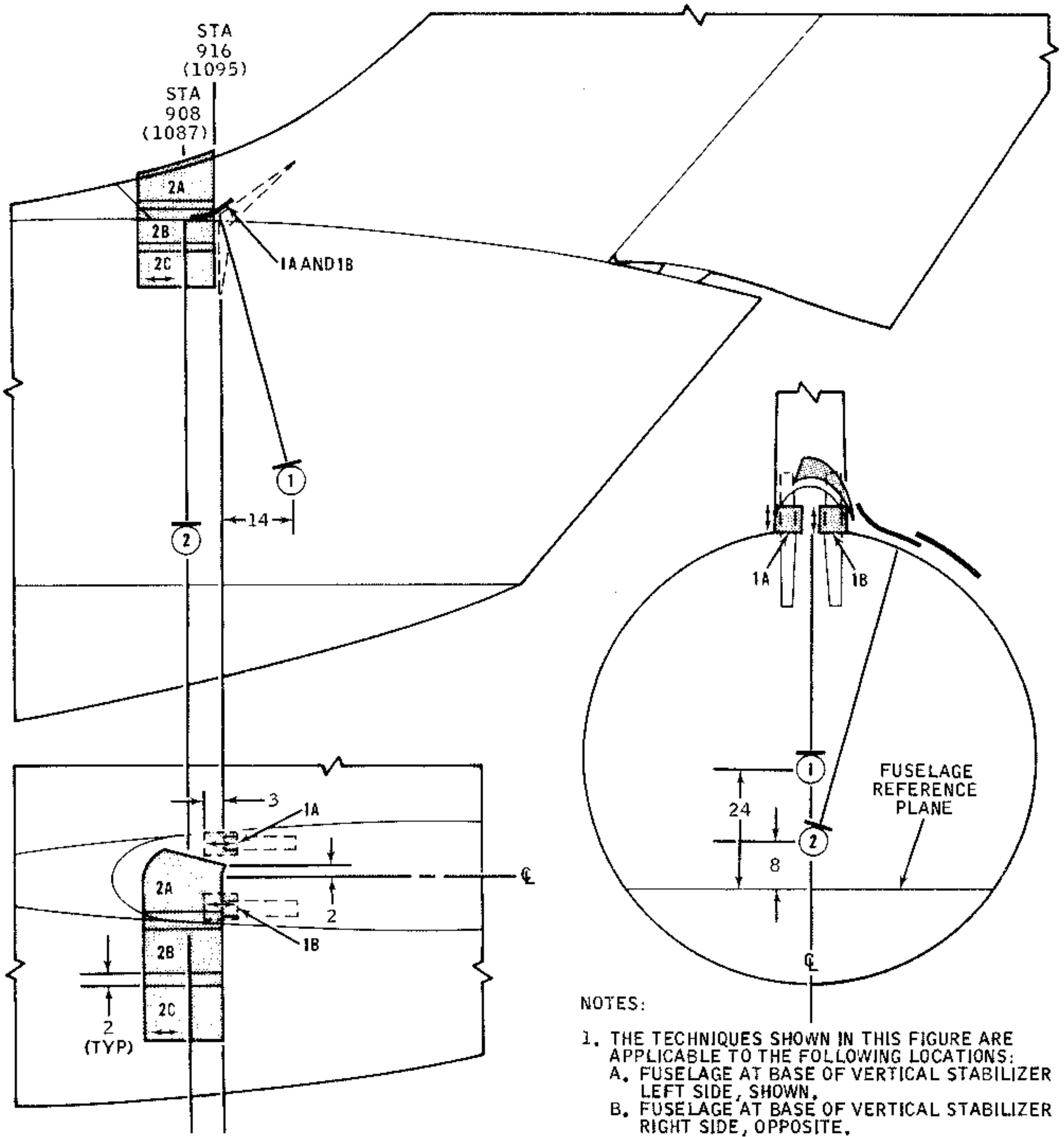
1. TAILSKID AND TIEDOWN FITTING REMOVED.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 2	TAILSKID AND TIEDOWN MOUNTING FITTING	130 130	300 300	24 24	II & III II & III	5 x 7 5 x 7

RADIOGRAPHIC DATA

BB12-90A

Tailskid and Tiedown Fitting Area
Figure 20



NOTES:

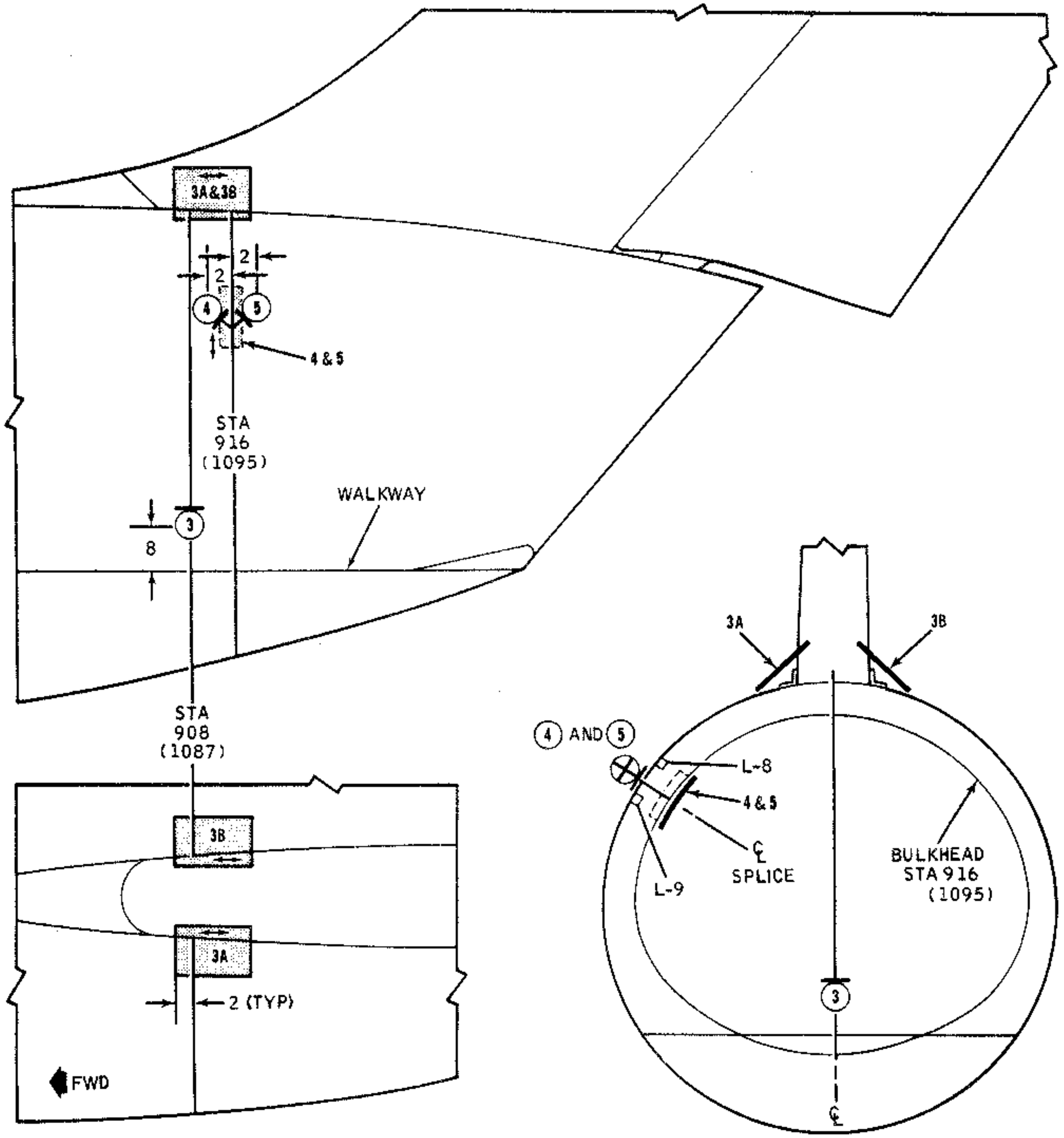
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. FUSELAGE AT BASE OF VERTICAL STABILIZER LEFT SIDE, SHOWN.
   B. FUSELAGE AT BASE OF VERTICAL STABILIZER RIGHT SIDE, OPPOSITE.
2. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK FOR EXPOSURE 1.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A B	FUSELAGE TO VERTICAL STAB ATTACH FITTING AT STA 916 (1095)	140	1500	60	II & III II & III	5 x 7 5 x 7
2A B C	PLATING SPLICE AT STA 908 (1087), LONG 1 TO LONG 7	130	600	84	II & III II & III II & III	14 x 17 14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-74A

Fuselage in Area of Vertical Stabilizer Leading Edge
Figure 21 (Sheet 1)



LOOKING DOWN

LOOKING FORWARD

NOTE:

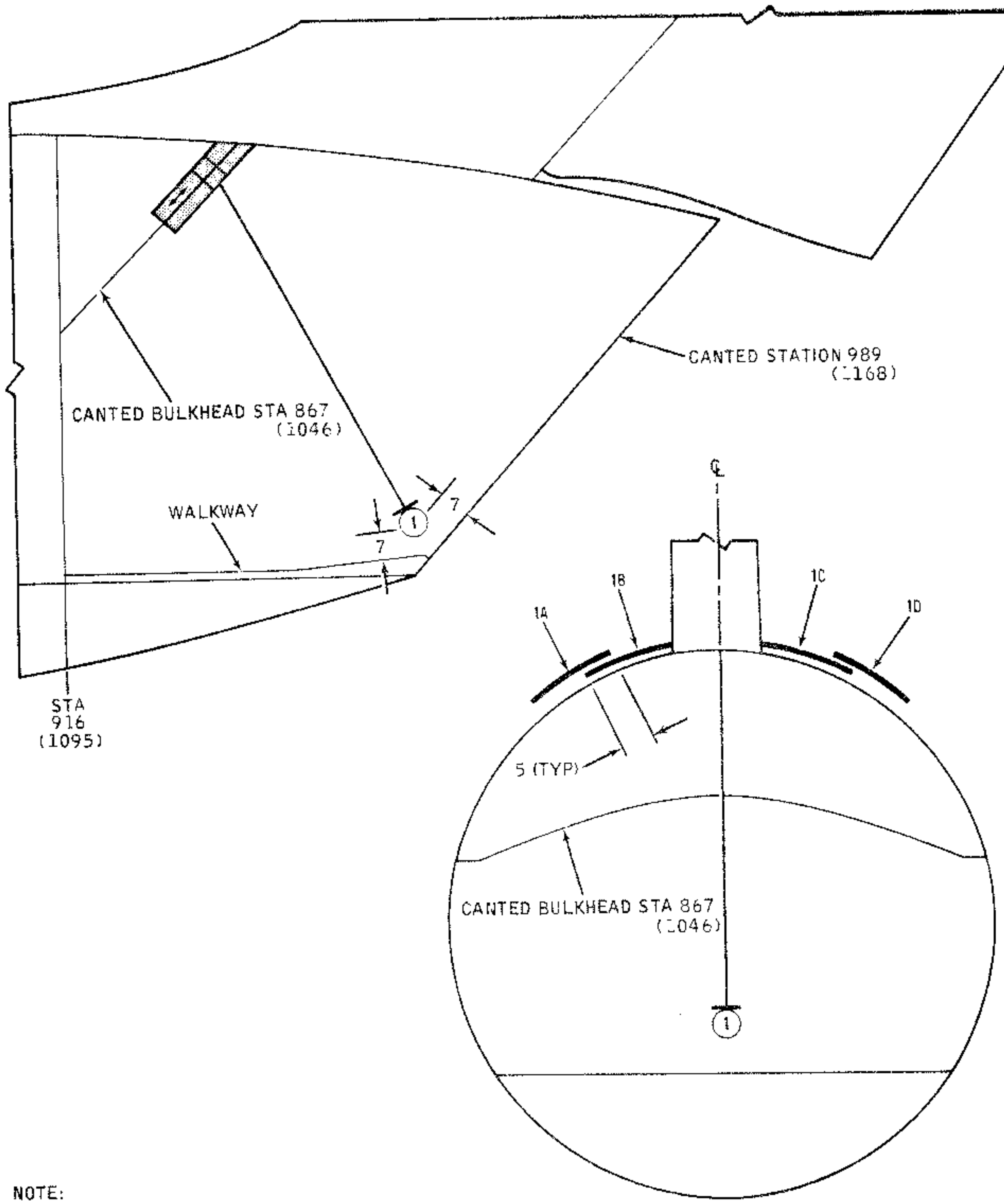
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
3	VERTICAL STABILIZER ATTACH ANGLE	130	600	84	II & III	14 x 17
4	STA 916 (1095) FRAME SPLICE	80	60	14	II & III	4 1/2 x 17
5		80	60	14	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-89A

Fuselage in Area of Vertical Stabilizer Leading Edge
Figure 21 (Sheet 2)



NOTE:

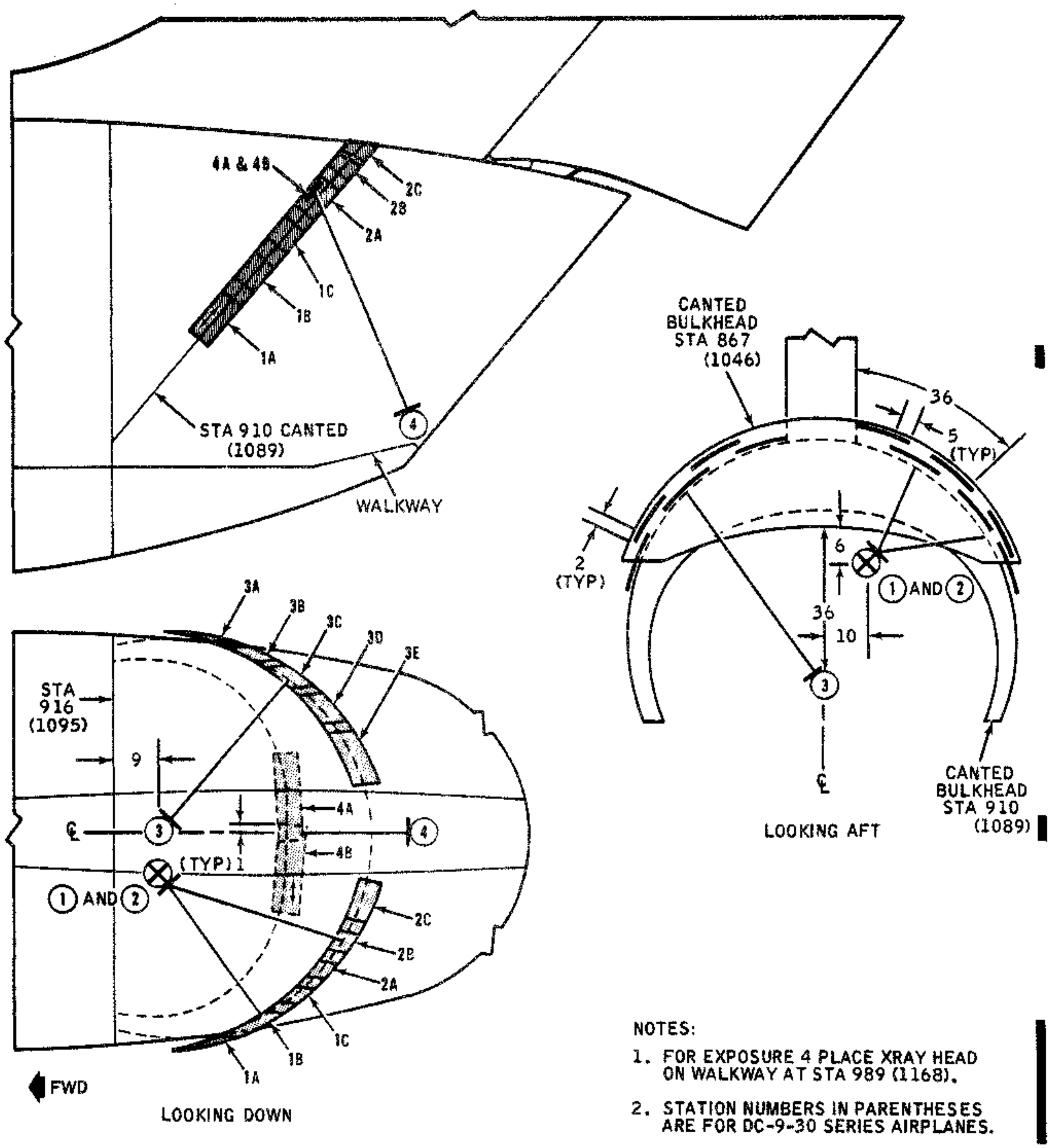
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A	FRAME FLANGE NEAR VERTICAL STABILIZER	130	300	80	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17
C					II & III	4 1/2 x 17
D					II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-88A

Fuselage Bulkhead for Stabilizer Front Spar
Figure 22



NOTES:

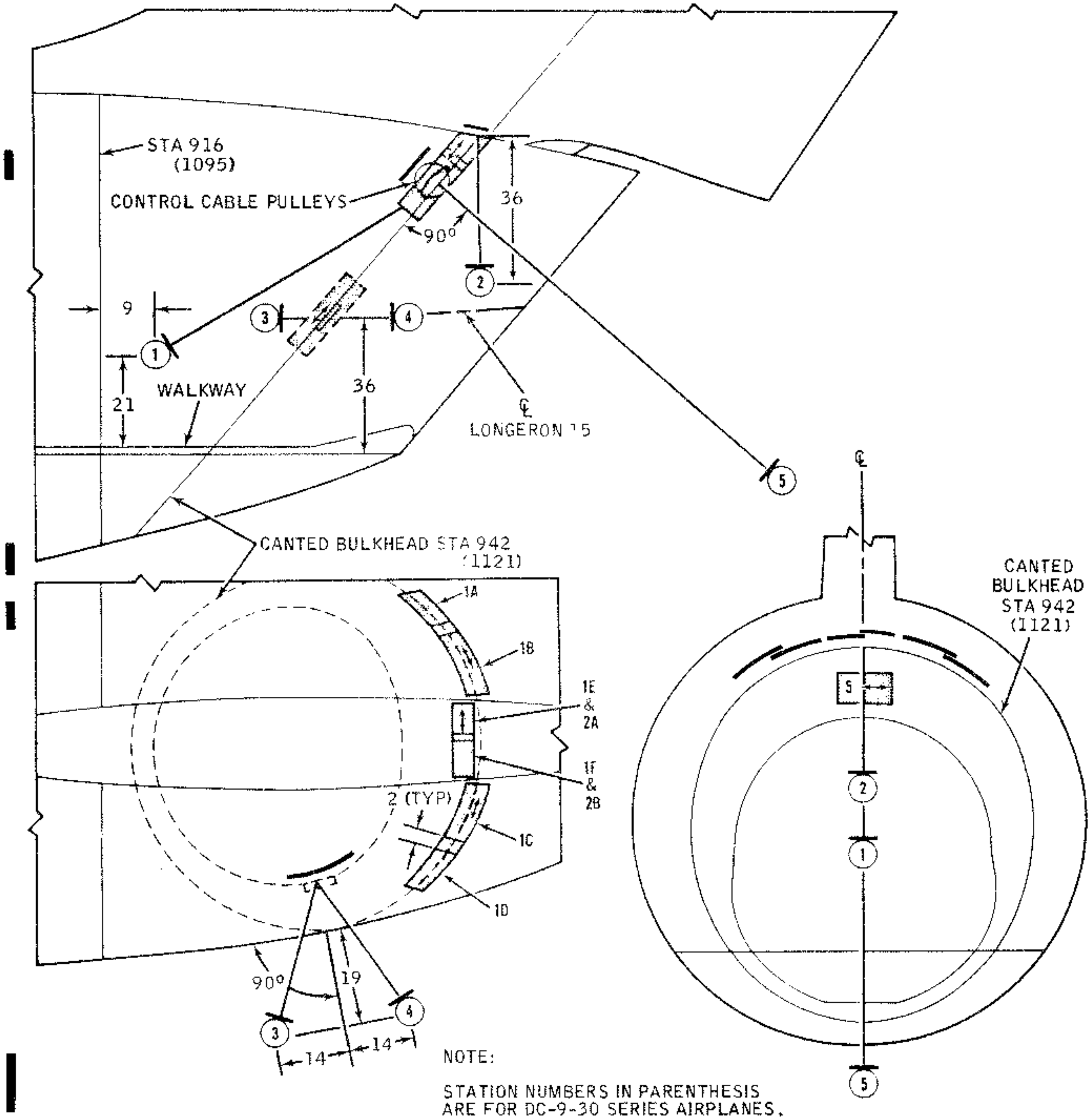
1. FOR EXPOSURE 4 PLACE XRAY HEAD ON WALKWAY AT STA 989 (1168).
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B, C	OUTER CAP	130	250	54	II & III	4 1/2 x 17
2A, B, C		130	250	54	II & III	4 1/2 x 17
3A, B, C D & E		130	600	80	II & III	4 1/2 x 17
4A B	INNER CAP	130	300	60	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-77A

Fuselage Canted Bulkhead for Stabilizer Center Spar
Figure 23



NOTE:

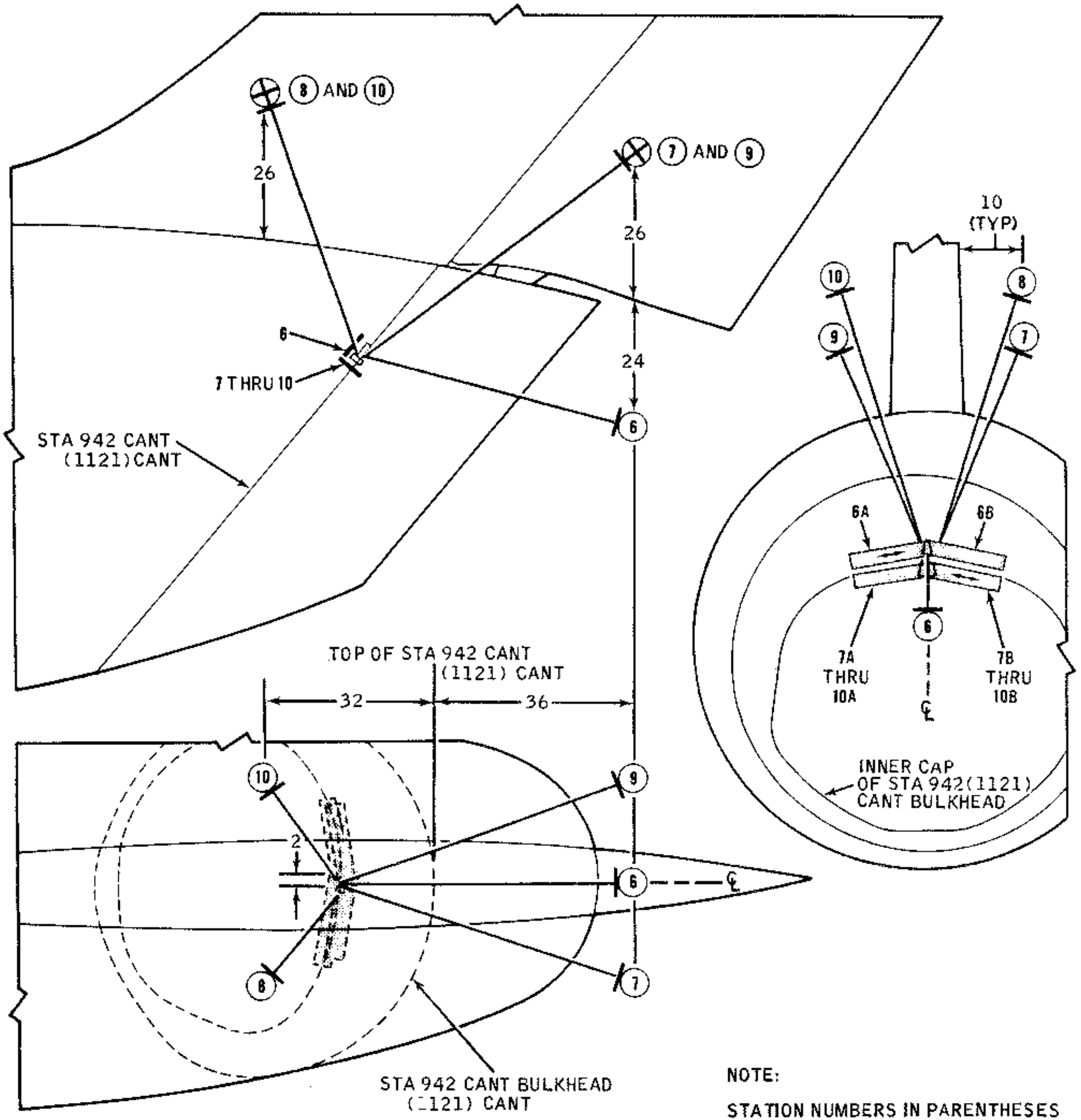
STATION NUMBERS IN PARENTHESIS ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B, C, D, E & F	OUTER CAP ANGLE NEAR TOP CENTERLINE	130	900	100	II & III II & III	4 1/2 x 17 4 1/2 x 17
2A B		130	60	36	II & III II & III	4 1/2 x 10 4 1/2 x 10
3	INNER CAP ANGLE SPLICE STA 942(1121) LONGERON 13 TO 15	130	300	42	II & III	4 1/2 x 17
4		130	300	42	II & III	4 1/2 x 17
5	CONTROL CABLE CUTOUT STA 942(1121) CANT BULKHEAD	130	1200	144	II	10 x 12

RADIOGRAPHIC DATA

BB12-76A

Fuselage Canted Bulkhead for Stabilizer Rear Spar
Figure 24 (Sheet 1)



NOTE:

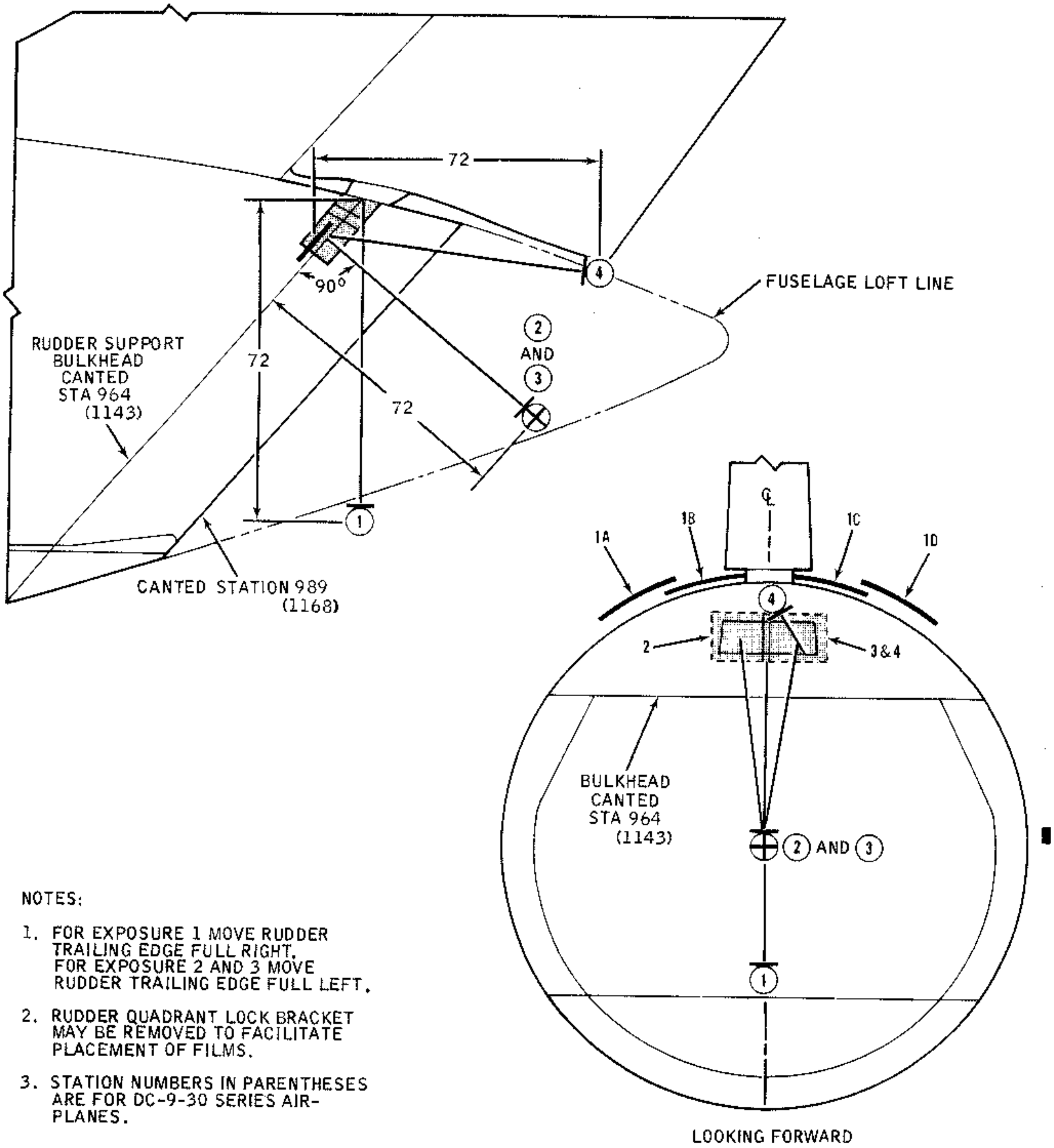
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
6A	INNER CAP ANGLE, TOP CENTER, STA 942 CANT (1121) CANT	130	300	60	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17
7A		130	750	60	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17
8A		130	750	60	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17
9A		130	750	60	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17
10A		130	750	60	II & III	4 1/2 x 17
B					II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-87A

Fuselage Canted Bulkhead for Stabilizer Rear Spar
Figure 24 (Sheet 2)



NOTES:

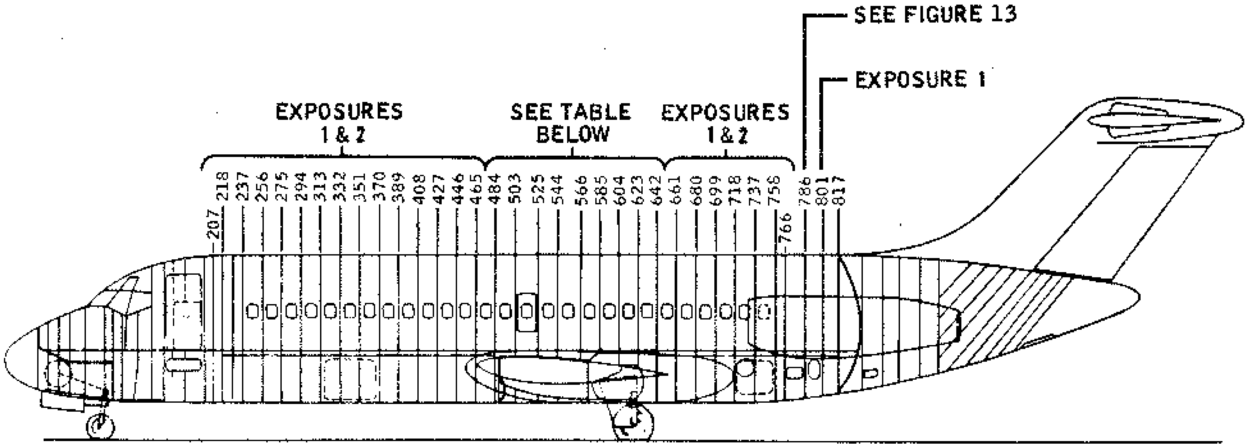
1. FOR EXPOSURE 1 MOVE RUDDER TRAILING EDGE FULL RIGHT. FOR EXPOSURE 2 AND 3 MOVE RUDDER TRAILING EDGE FULL LEFT.
2. RUDDER QUADRANT LOCK BRACKET MAY BE REMOVED TO FACILITATE PLACEMENT OF FILMS.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPS.	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B, C, & D	OUTER CAP ANGLE	130	600	72	II & III	4 1/2 x 17
2	CONTROLS CUTOUT, LEFT	130	550	72	II & III	8 x 10
3	CONTROLS CUTOUT, RIGHT	130	550	72	II & III	8 x 10
4		130	550	72	II & III	8 x 10

RADIOGRAPHIC DATA

BB12-78A

Rudder Support Bulkhead
Figure 25



STATION	APPLICABLE EXPOSURE
485	3, 4, 5, & 6
503	3, 4, 7, & 8
525	3, 4, 7, & 8
544	3, 4, 7, & 8
566	1 & 2

STATION	APPLICABLE EXPOSURE
585	3, 4, 9, & 10
604	3, 4, 5, & 6
623	3, 4, 9, & 10
642	3, 4, 5, & 6

NOTES:

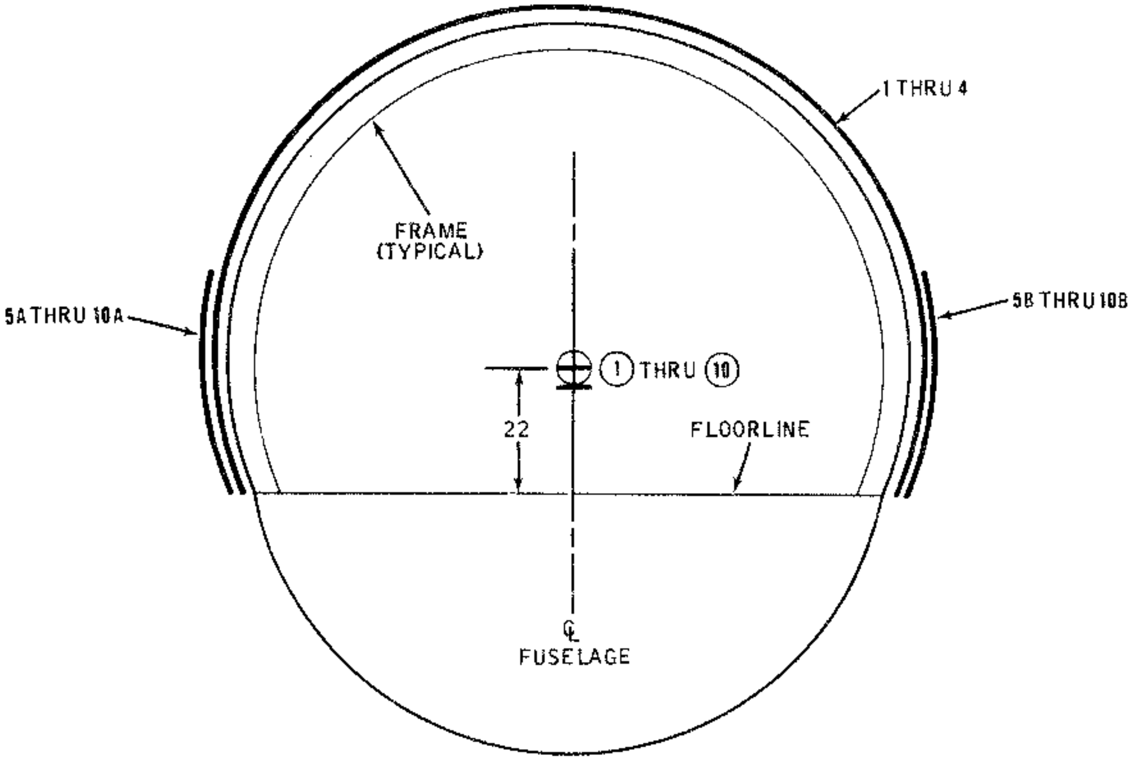
1. THE TECHNIQUES IN THIS FIGURE ARE BASED ON THE USE OF 360 DEGREE X-RAY EQUIPMENT. STRIP FILM IS USED IN LENGTHS ADEQUATE TO COVER THE PORTION OF FRAME WHICH MAY BE X-RAYED FROM A SPECIFIC SOURCE POSITION.
2. THE TABLE ABOVE INDICATES THE EXPOSURES APPLICABLE TO EACH FRAME STATION.
3. SHEET 2 PROVIDES DIMENSIONAL DATA FOR SOURCE POSITION AND FILM PLACEMENT.
4. FOR FRAMES ADJACENT TO PYLONS TERMINATE THE STRIP FILM AT TOP SURFACE OF PYLON.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	DETERMINE EXPOSURES APPLICABLE TO EACH FRAME STATION BY REFERRING TO DIAGRAM AND/OR TABLE ABOVE	130	240	66	II & III	4 1/2 x 324
2		130	240	66	II & III	4 1/2 x 324
3		130	350	66	II & III	4 1/2 x 324
4		130	350	66	II & III	4 1/2 x 324
5A & B		130	810	66	II & III	4 1/2 x 40
6A & B		130	810	66	II & III	4 1/2 x 40
7A & B		130	585	66	II & III	4 1/2 x 40
8A & B		130	585	66	II & III	4 1/2 x 40
9A & B		130	495	66	II & III	4 1/2 x 40
10A & B		130	495	66	II & III	4 1/2 x 40

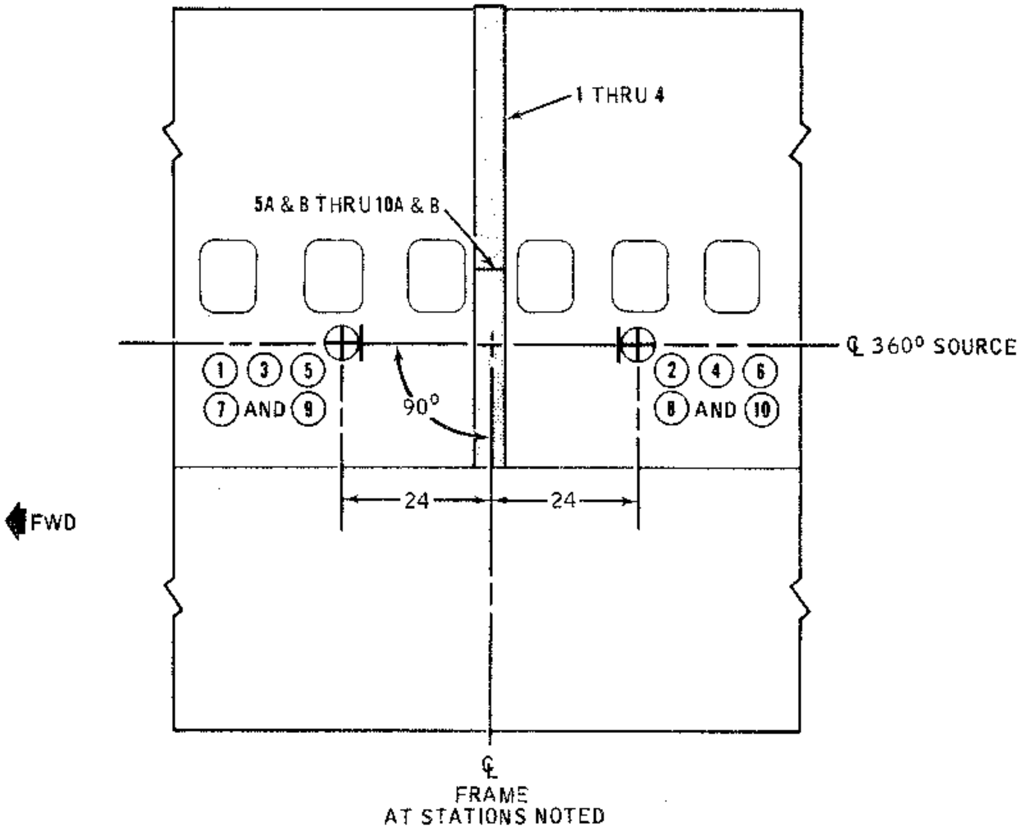
RADIOGRAPHIC DATA

BB12-103

DC-9-10 Fuselage Frames Above Floor, Using 360-Degree Equipment
Figure 26 (Sheet 1)

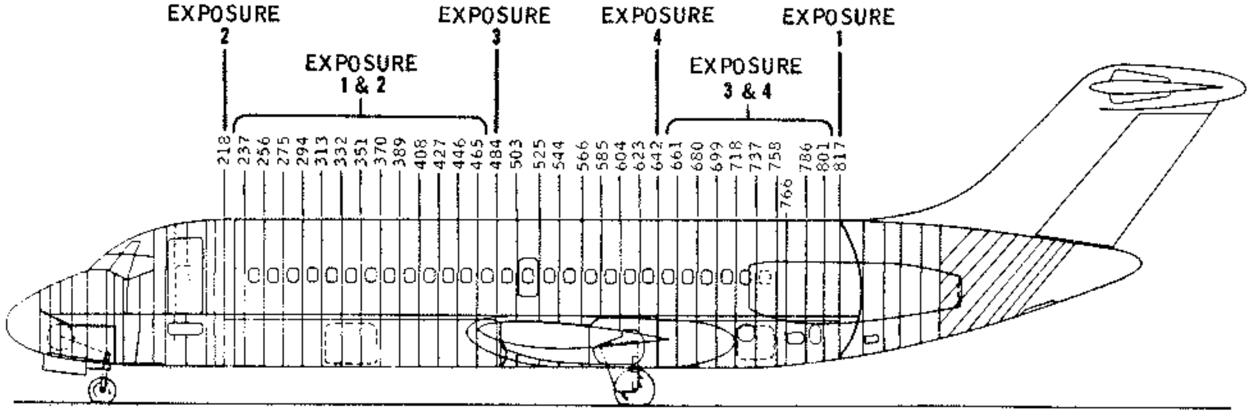


LOOKING FORWARD



BB12-104

DC-9-10 Fuselage Frames Above Floor, Using 360-Degree Equipment
Figure 26 (Sheet 2)



NOTES:

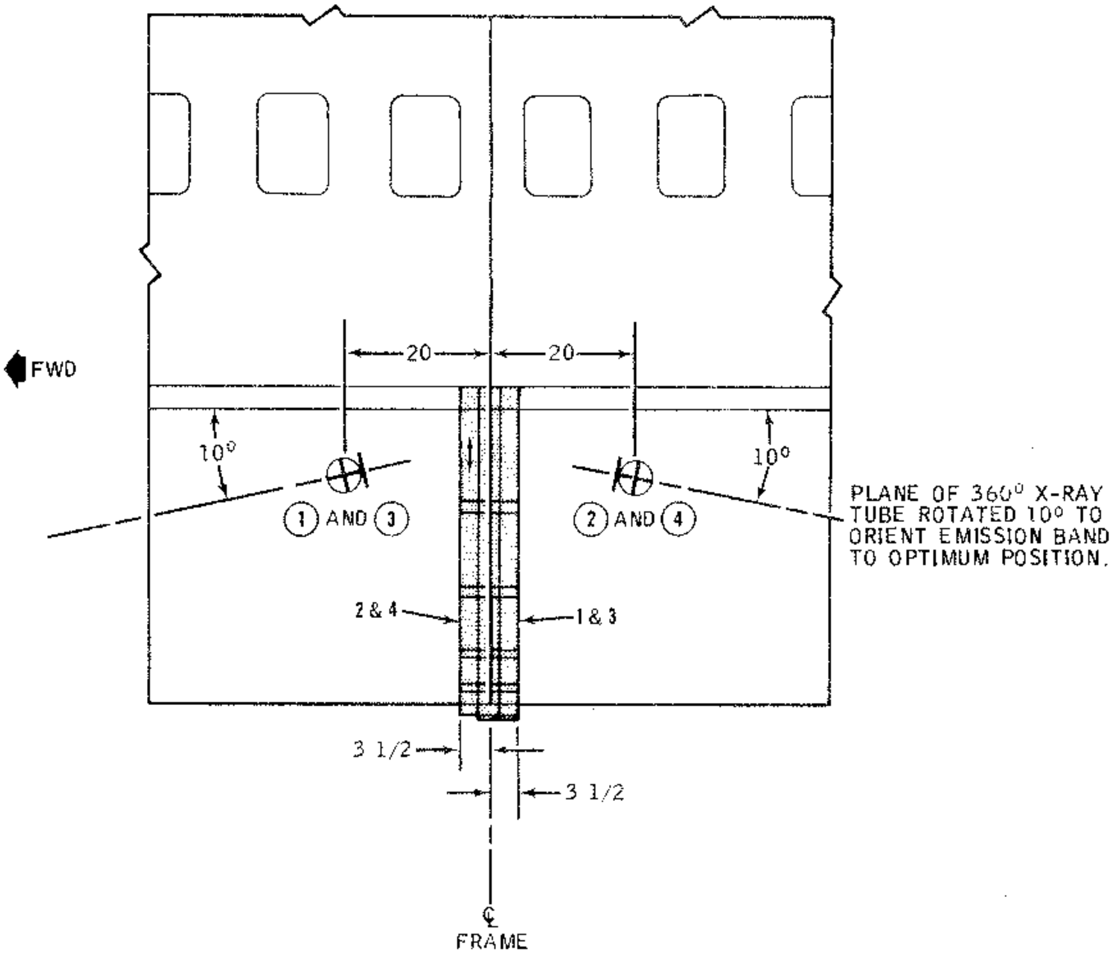
1. THE TECHNIQUES IN THIS FIGURE ARE BASED ON THE USE OF 360° X-RAY EQUIPMENT. THE VARIATIONS IN SOURCE-TO-FILM DISTANCE PREVENT THE USE OF CONTINUOUS STRIP FILM. THIS VARIATION IN SFD REQUIRES INTERRUPTION OF THE EXPOSURE AND REMOVAL OF INDIVIDUAL FILM AS THEY BECOME ADEQUATELY EXPOSED. PROCEED AS FOLLOWS:
   - A. PLACE FILM ON ENTIRE PORTION OF FRAME TO BE X-RAYED. (SEE SHEET 2)
   - B. POSITION SOURCE AS INDICATED ON SHEET 2.
   - C. AS EACH PAIR OF FILM IS EXPOSED, INTERRUPT THE EXPOSURE AND PROGRESSIVELY REMOVE THE APPROPRIATE FILM.
   - D. THE MAS VALUES IN CHART ARE CUMULATIVE THE OPERATOR MUST DETERMINE THE AMOUNT OF TIME REQUIRED TO COMPLETE EACH SUBSEQUENT PORTION OF THE EXPOSURE.
2. THE DIAGRAM ABOVE INDICATES THE EXPOSURES APPLICABLE TO EACH FRAME STATION.

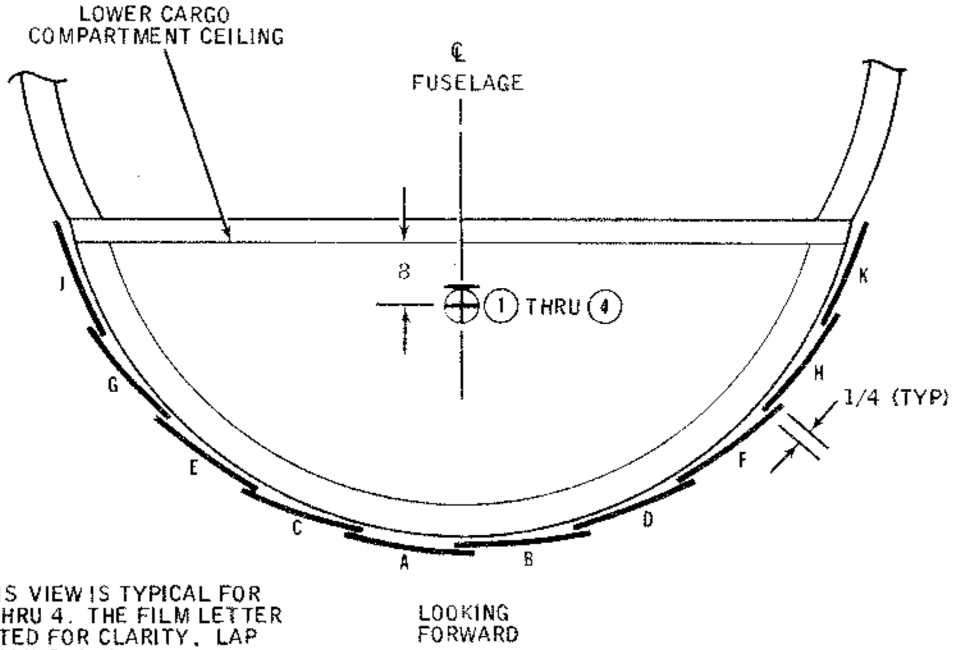
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B,	DETERMINE EXPOSURES APPLICABLE TO EACH FRAME STATION BY REFERRING TO TABLE ABOVE	130	90	36	II & III	4 1/2 x 17
C, D,		130	135	43	II & III	4 1/2 x 17
E, F,		130	180	50	II & III	4 1/2 x 17
G, H,		130	225	57	II & III	4 1/2 x 17
J & K		130	315	64	II & III	4 1/2 x 17
2A, B,		130	90	36	II & III	4 1/2 x 17
C, D,		130	135	43	II & III	4 1/2 x 17
E, F,		130	180	50	II & III	4 1/2 x 17
G, H,		130	225	57	II & III	4 1/2 x 17
J & K		130	315	64	II & III	4 1/2 x 17
3A, B,		130	90	36	II & III	4 1/2 x 17
C, D,		130	135	43	II & III	4 1/2 x 17
E, F,		130	180	50	II & III	4 1/2 x 17
G, H,		130	405	57	II & III	4 1/2 x 17
J & K		130	585	64	II & III	4 1/2 x 17
4A, B,		130	90	36	II & III	4 1/2 x 17
C, D,		130	135	43	II & III	4 1/2 x 17
E, F,		130	180	50	II & III	4 1/2 x 17
G, H,		130	405	57	II & III	4 1/2 x 17
J & K		130	585	64	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-108

DC-9-10 Fuselage Frames Below Floor,
Using 360-Degree X-ray Equipment
Figure 27 (Sheet 1)





NOTE:
THE FILM IN THIS VIEW IS TYPICAL FOR EXPOSURES 1 THRU 4. THE FILM LETTER ONLY IS INDICATED FOR CLARITY. LAP FILM IN DIRECTION SHOWN.

BB12-109

DC-9-10 Fuselage Frames Below Floor,
Using 360-Degree X-ray Equipment
Figure 27 (Sheet 2)

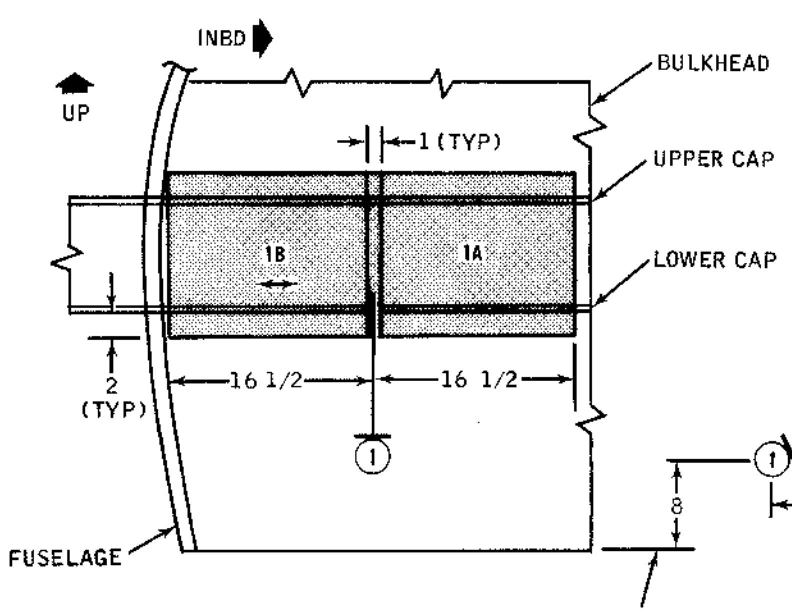
CHAPTER 4

PYLONS

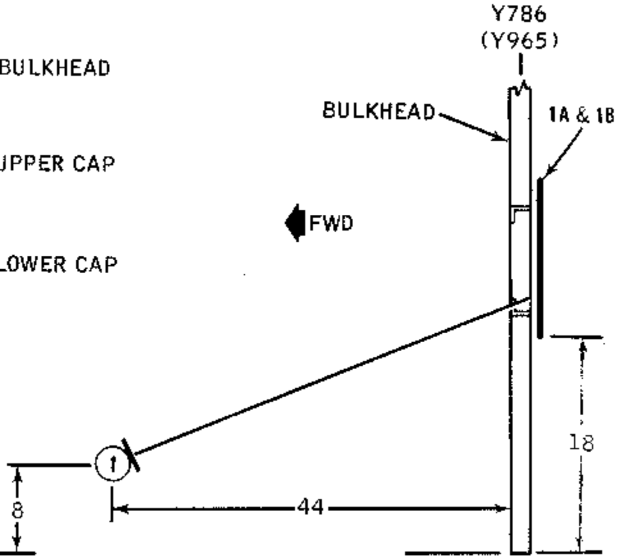
Chapter 4

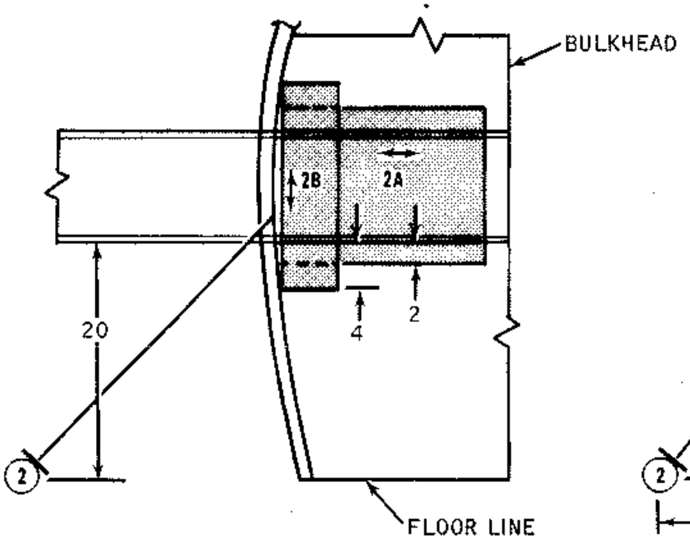
PYLONS

Printed in U.S.A.

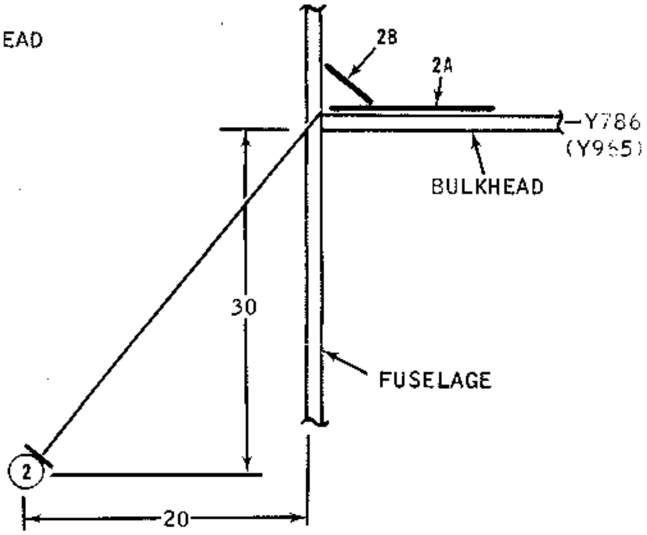


LEFT SIDE LOOKING FORWARD





LEFT SIDE LOOKING FORWARD



(VIEW LOOKING UP)

NOTES:

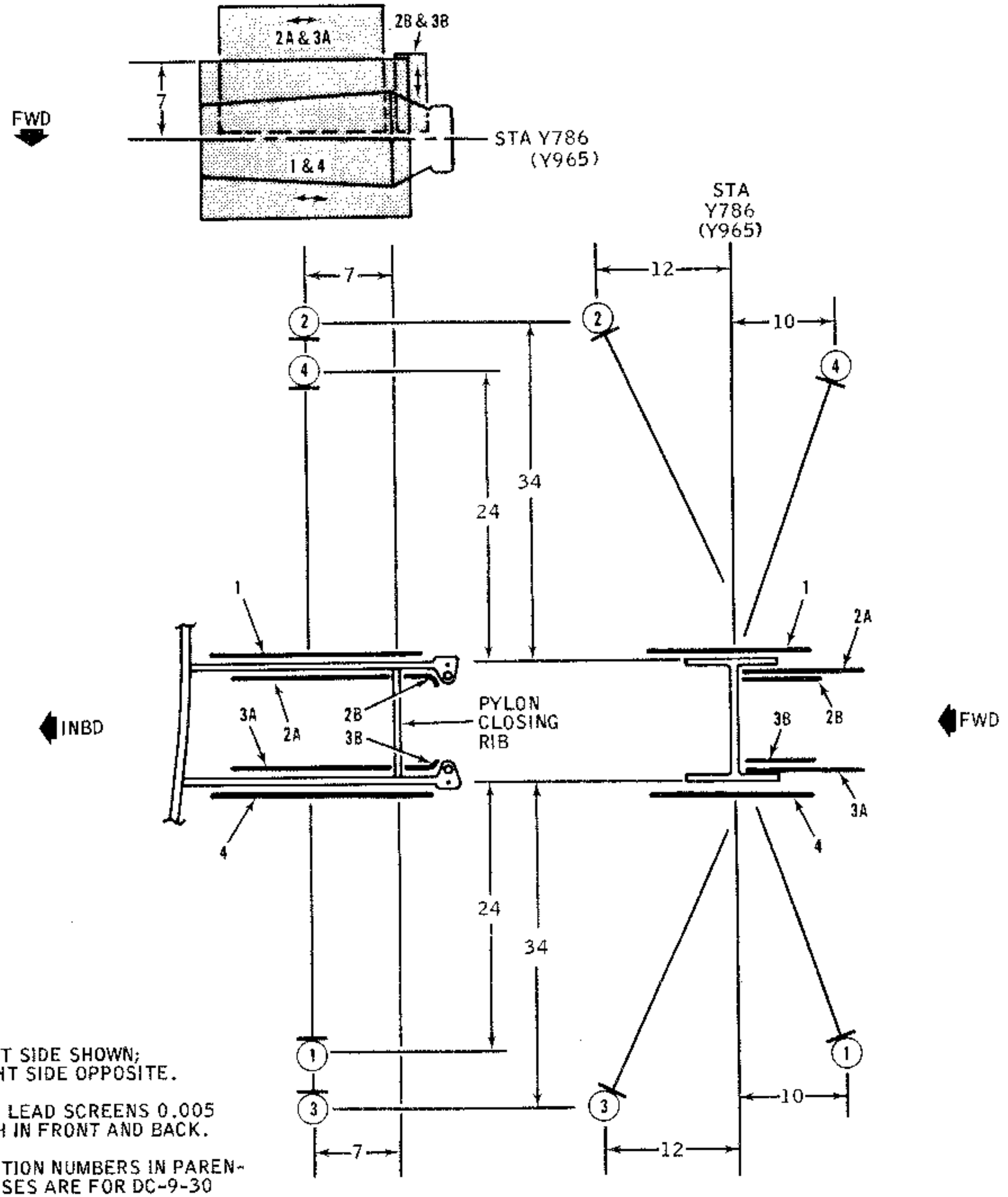
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. REMOVE SEATS AS REQUIRED.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 A B	FRONT SPAR LOWER CAP AT STA Y786 (Y965)	120	300	48	II & III II & III	14 x 17 14 x 17
2 A B		125	300	48	II & III II & III	14 x 17 4 1/2 x 17

RADIOGRAPHIC DATA

BB12-55A

Pylon Front Spar Lower Cap
Figure 1



NOTES:

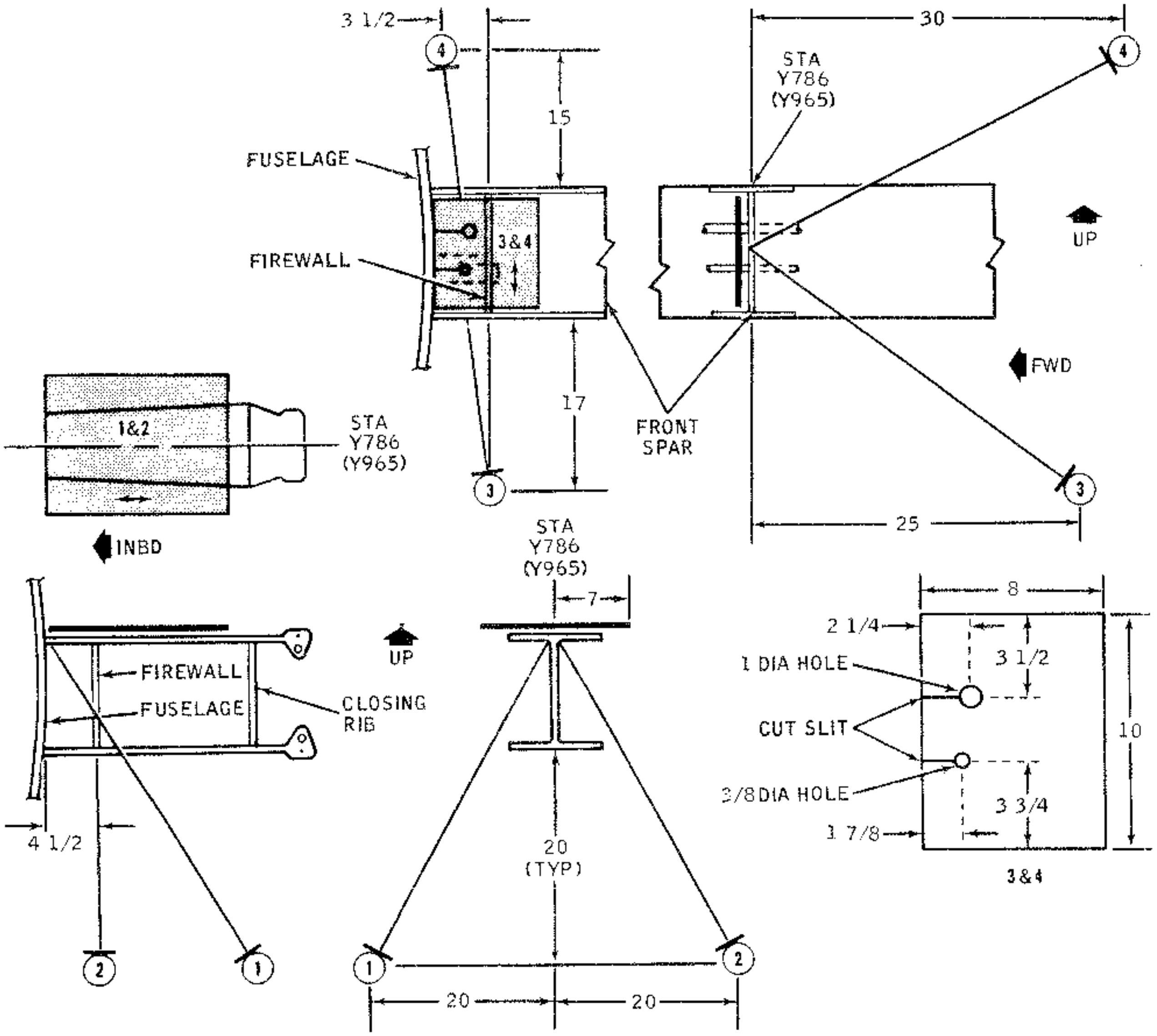
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. USE LEAD SCREENS 0.005 INCH IN FRONT AND BACK.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN)	FILM	SIZE
1	UPPER FITTING (SOURCE BELOW)	135	900	36	II & III	14 × 17
2A B	UPPER FITTING (SOURCE ABOVE)	130	900	36	II & III	10 × 12 5 × 7
3A B	LOWER FITTING (SOURCE BELOW)	130	900	36	II & III	10 × 12 5 × 7
4	LOWER FITTING (SOURCE ABOVE)	135	900	36	II & III	14 × 17

RADIOGRAPHIC DATA

BB12-57A

Pylon Front Spar Engine Yoke Support Fittings
Figure 2



NOTES:

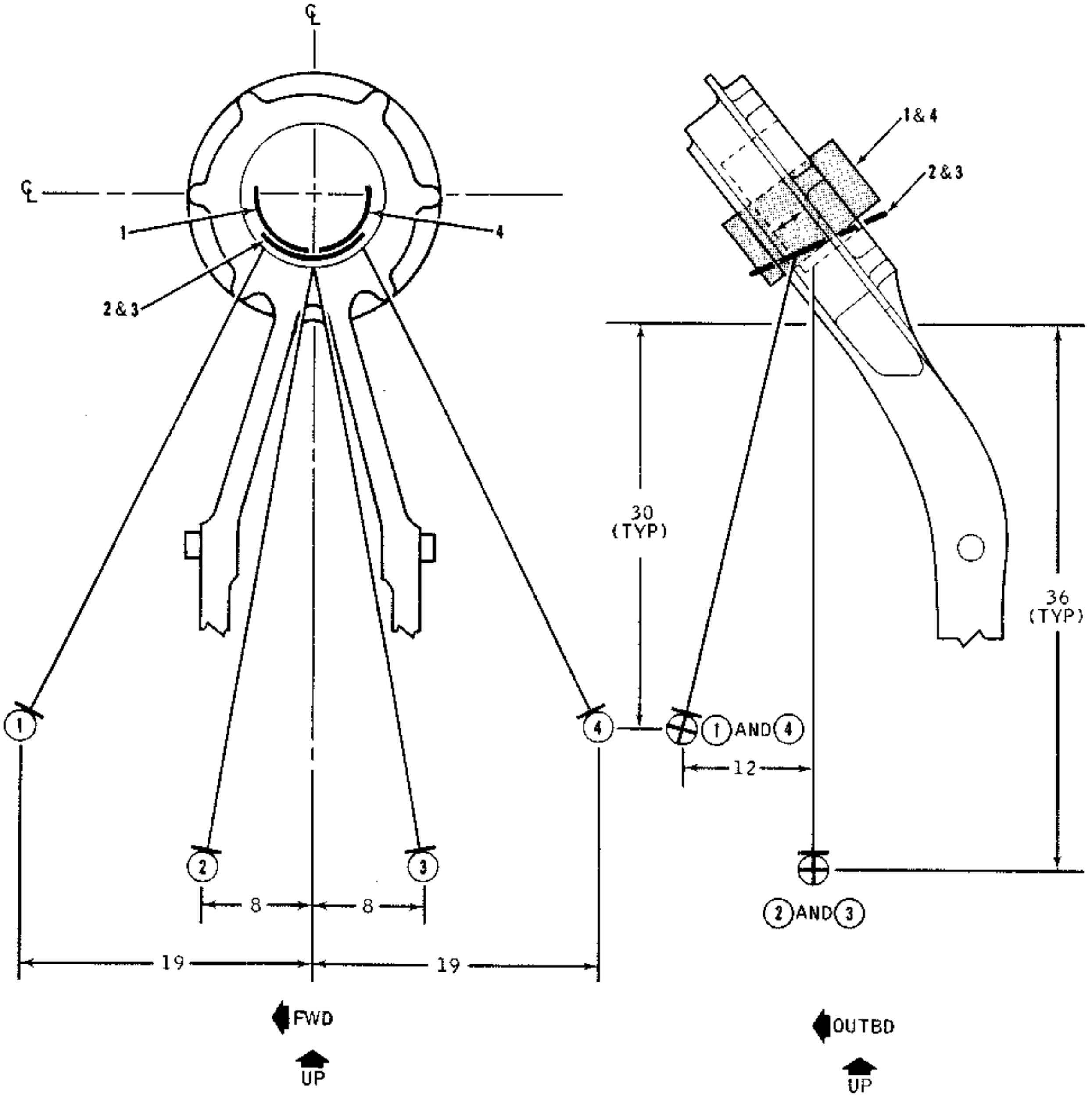
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. LEADING EDGE MUST BE REMOVED.
3. FILM MUST BE CUT AND MASKED TO FIT AROUND TUBING.
4. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	FRONT SPAR UPPER CAP AT STA Y786 (Y965)	135	900	40	II & III	14 x 17
2		135	1500	36	II & III	14 x 17
3	FRONT SPAR WEB CUTOUTS	120	300	36	II	8 x 10
4		120	300	36	II	8 x 10

RADIOGRAPHIC DATA

BB12-56A

Pylon Front Spar and Web Cutouts
Figure 3



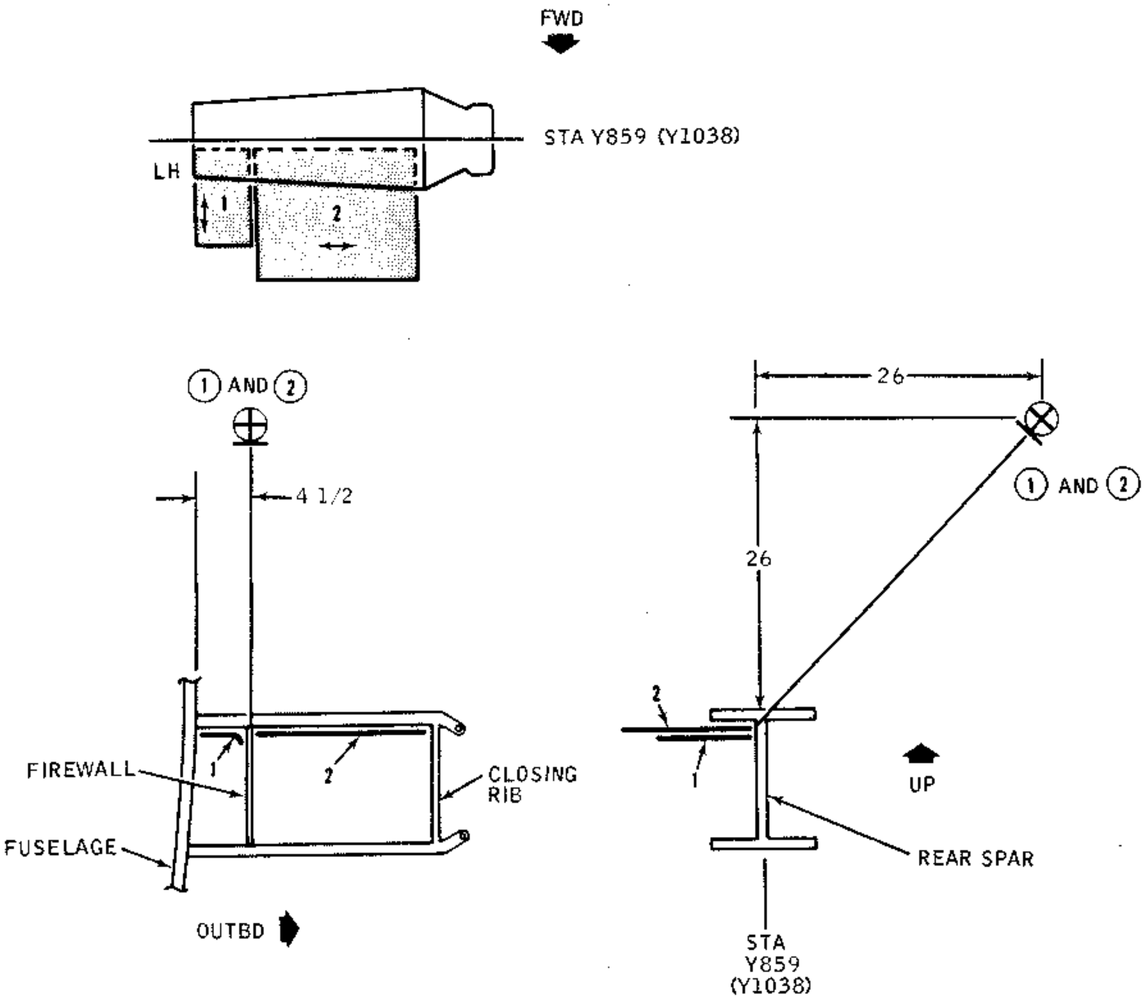
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FITTINGS INSIDE CUP MUST BE REMOVED.
4. USE LEAD SCREENS 0.005 INCH IN FRONT OF AND BACK OF CLASS II AND IN FRONT OF CLASS III. USE LEAD SCREEN 0.010 INCH IN BACK OF CLASS III.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	LOWER FWD QUADRANT	135	1800	36	II & III	5 x 7
2	LOWER CENTER QUADRANT AFT	135	1800	36	II & III	5 x 7
3	LOWER CENTER QUADRANT FWD	135	1800	36	II & III	5 x 7
4	LOWER AFT QUADRANT	135	1800	36	II & III	5 x 7

RADIOGRAPHIC DATA

BB12-54

Forward Engine Mount
Figure 4



NOTES:

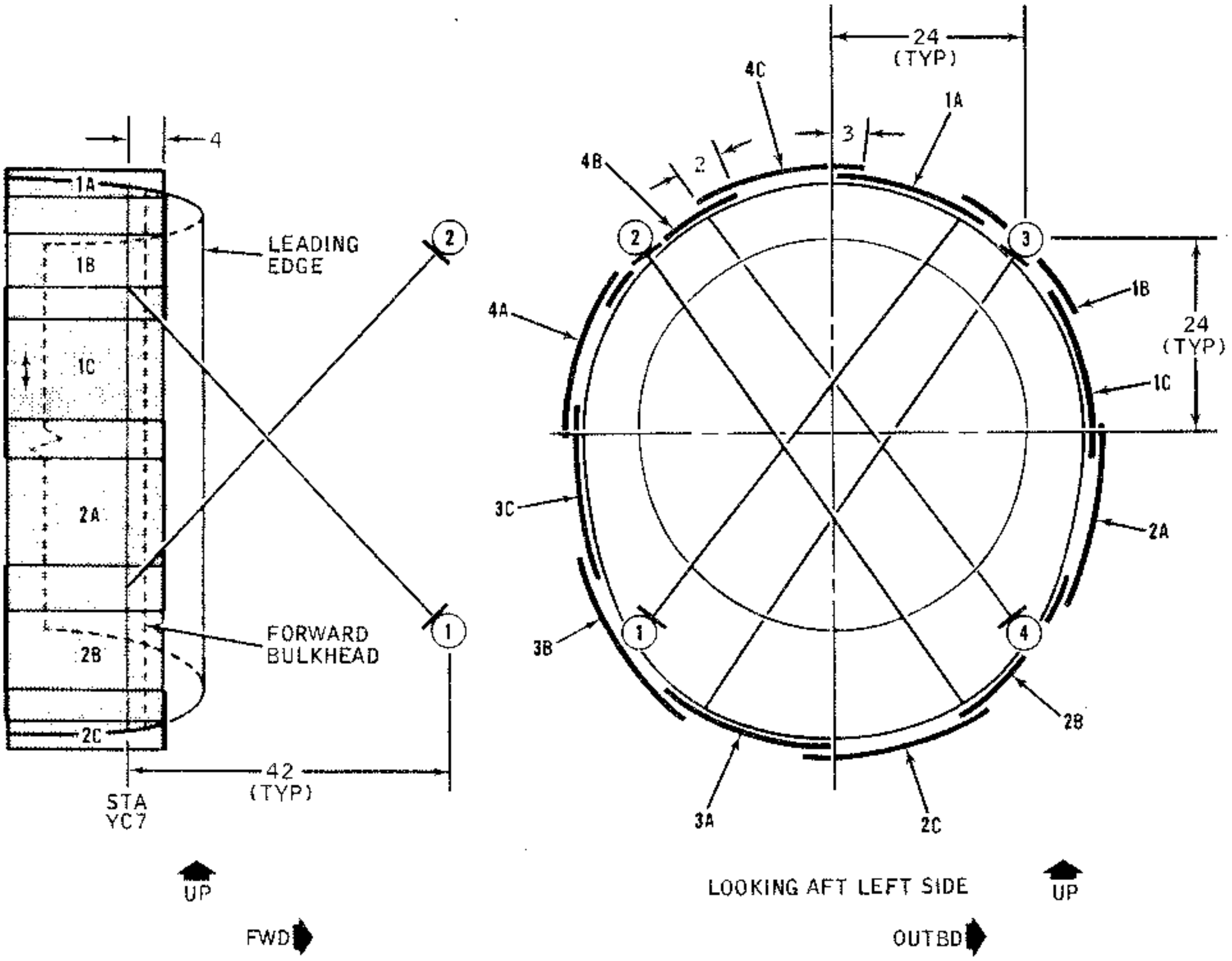
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. FOR RH SIDE PLACE FILM INSIDE AGAINST UNDERSIDE OF UPPER CAP AND SKIN.
3. ACCESS PANEL FORWARD OF REAR SPAR BETWEEN FIREWALL AND FUSELAGE MUST BE REMOVED.
4. ACCESS DOOR FORWARD OF REAR SPAR BETWEEN FIREWALL AND CLOSING RIB MUST BE OPENED.
5. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	UPPER CAP	130	300	36	II	5 x 7
2					II	10 x 12

RADIOGRAPHIC DATA

BB12-46A

Pylon Rear Spar Upper Cap
Figure 5



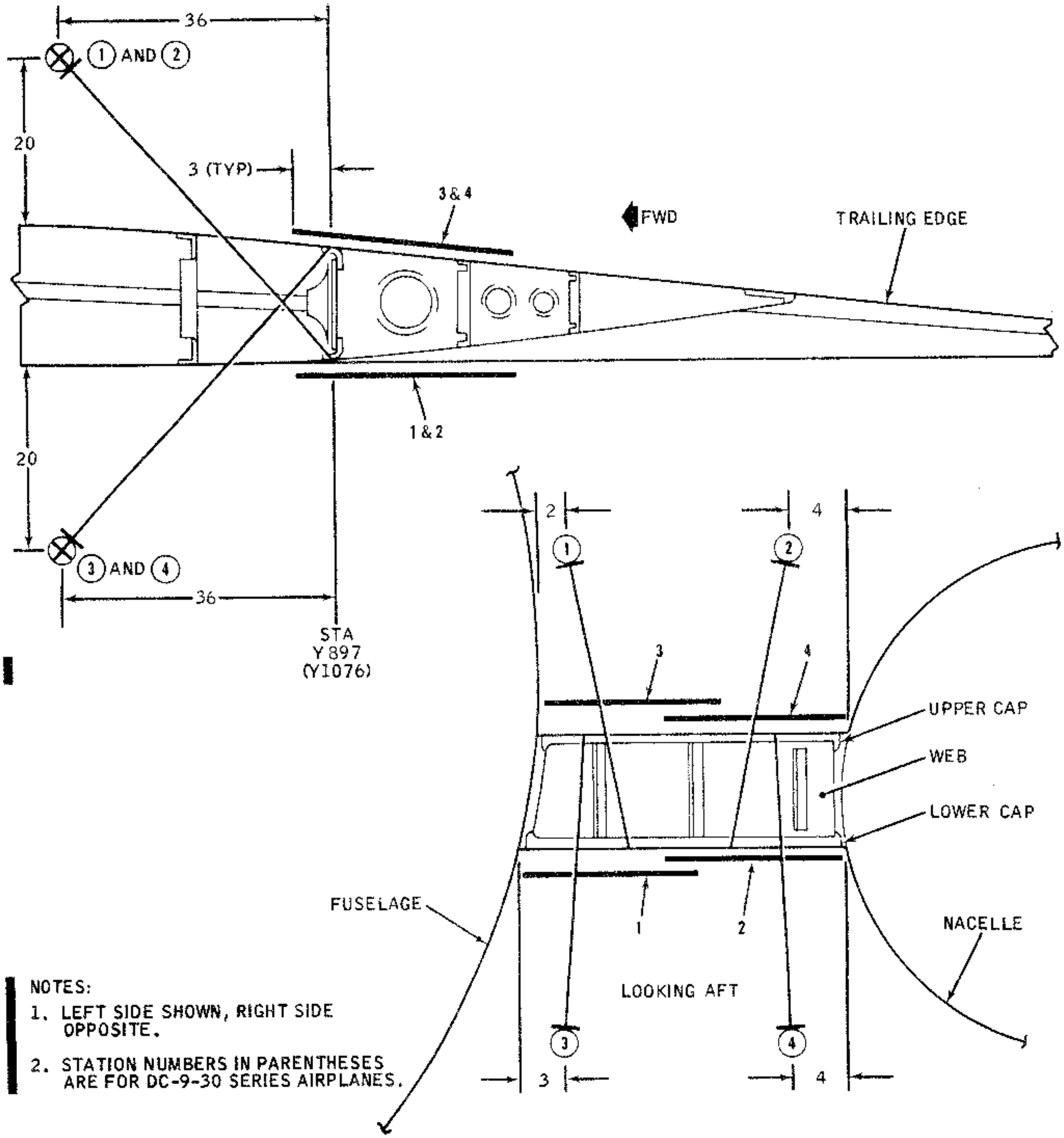
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A B C	UPPER LH QUADRANT	110	300	60	II	14 x 17
2A B C	LOWER LH QUADRANT	110	300	60	II	14 x 17
3A B C	UPPER RH QUADRANT	110	300	60	II	14 x 17
4A B C	LOWER RH QUADRANT	110	300	60	II	14 x 17

RADIOGRAPHIC DATA

BB12-51

Pylon Engine Nose Cowl D-Duct Bulkhead
Figure 6



NOTES:

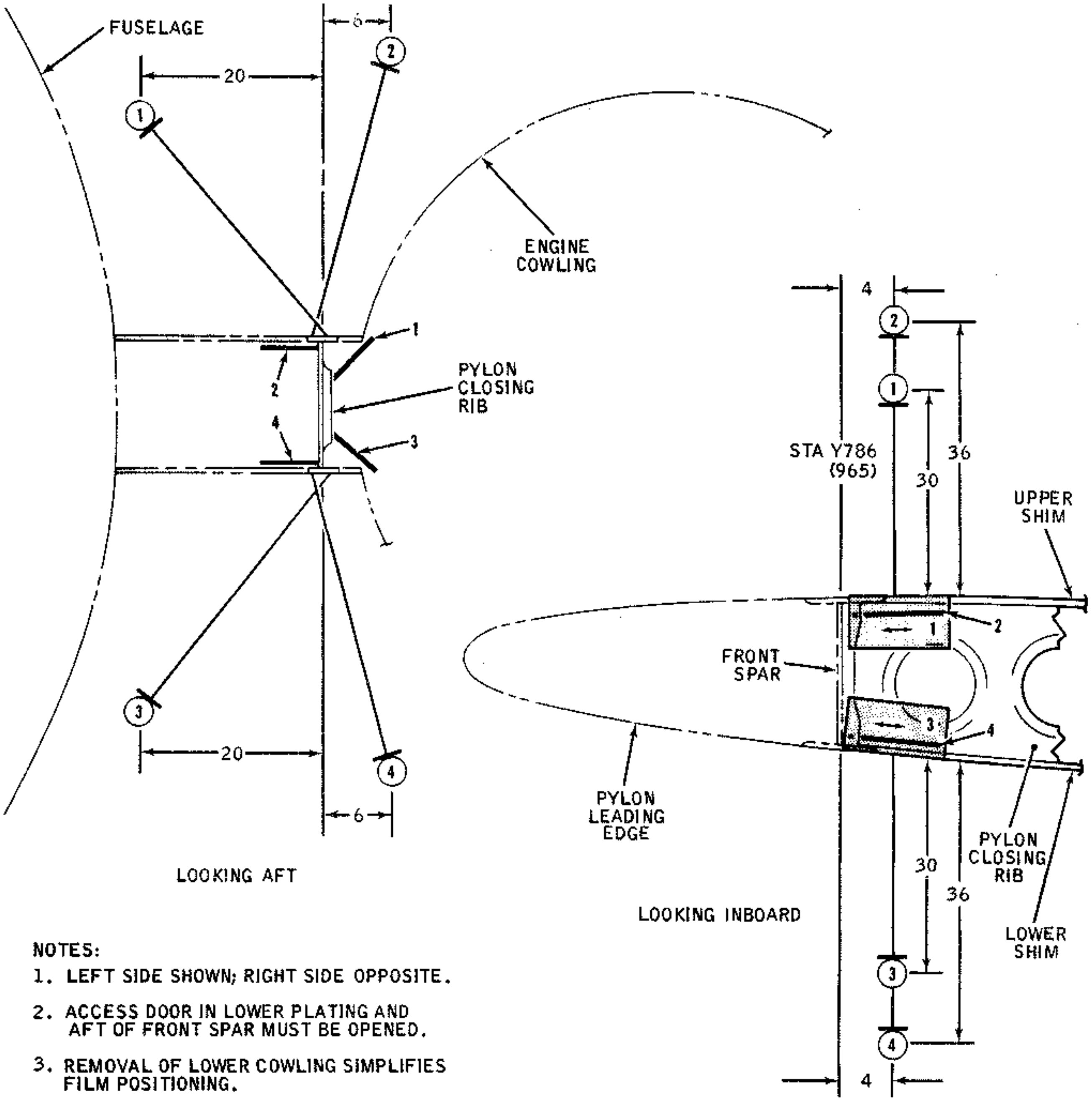
1. LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	INTERCOSTAL, STA Y897 (Y1076)					
1	WEB TO LOWER CAP INBD	125	300	45	II	14 x 17
2	WEB TO LOWER CAP OUTBD	125	300	45	II	14 x 17
3	WEB TO UPPER CAP INBD	125	300	45	II	14 x 17
4	WEB TO UPPER CAP OUTBD	125	300	45	II	14 x 17

RADIOGRAPHIC DATA

BB12-98A

Pylon Titanium Intercostal
Figure 7



NOTES:

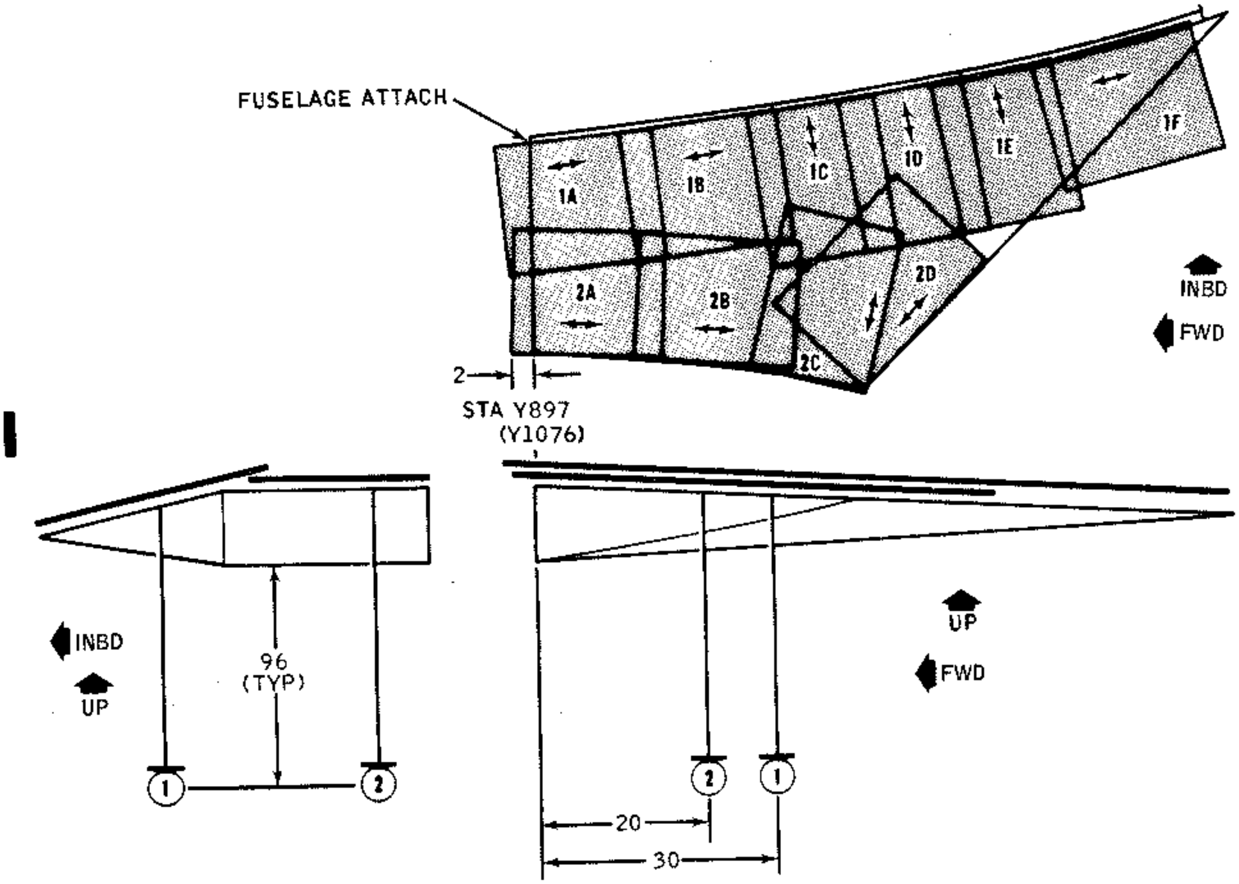
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. ACCESS DOOR IN LOWER PLATING AND AFT OF FRONT SPAR MUST BE OPENED.
3. REMOVAL OF LOWER COWLING SIMPLIFIES FILM POSITIONING.
4. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

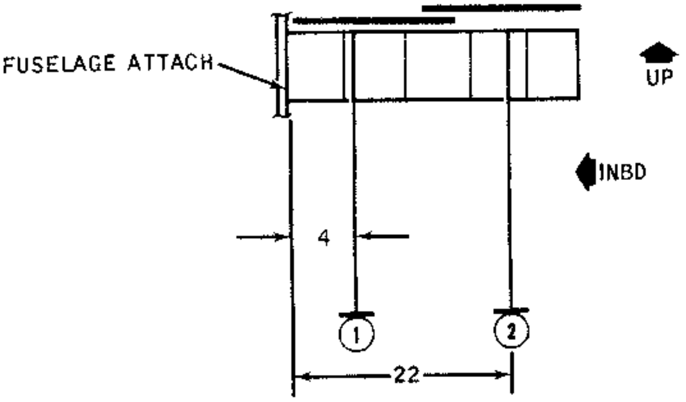
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	CLOSING RIB TITANIUM SHIMS					
1	UPPER SHIM OUTBOARD	125	300	36	II	5 x 7
2	UPPER SHIM INBOARD	125	300	36	II	5 x 7
3	LOWER SHIM OUTBOARD	125	300	36	II	5 x 7
4	LOWER SHIM INBOARD	125	300	36	II	5 x 7

RADIOGRAPHIC DATA

BB12-50A

Pylon Closing Rib Titanium Shims
Figure 8





NOTES:

1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. FOR BOTTOM PLATING PLACE FILM ON BOTTOM WITH SOURCE ABOVE.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A THRU F	TOP INBOARD PLATING	110	600	96	II	14 x 17
2A THRU D	TOP OUTBOARD PLATING	110	600	96	II	14 x 17

RADIOGRAPHIC DATA

BB12-59A

Pylon Trailing Edge Plating
Figure 9

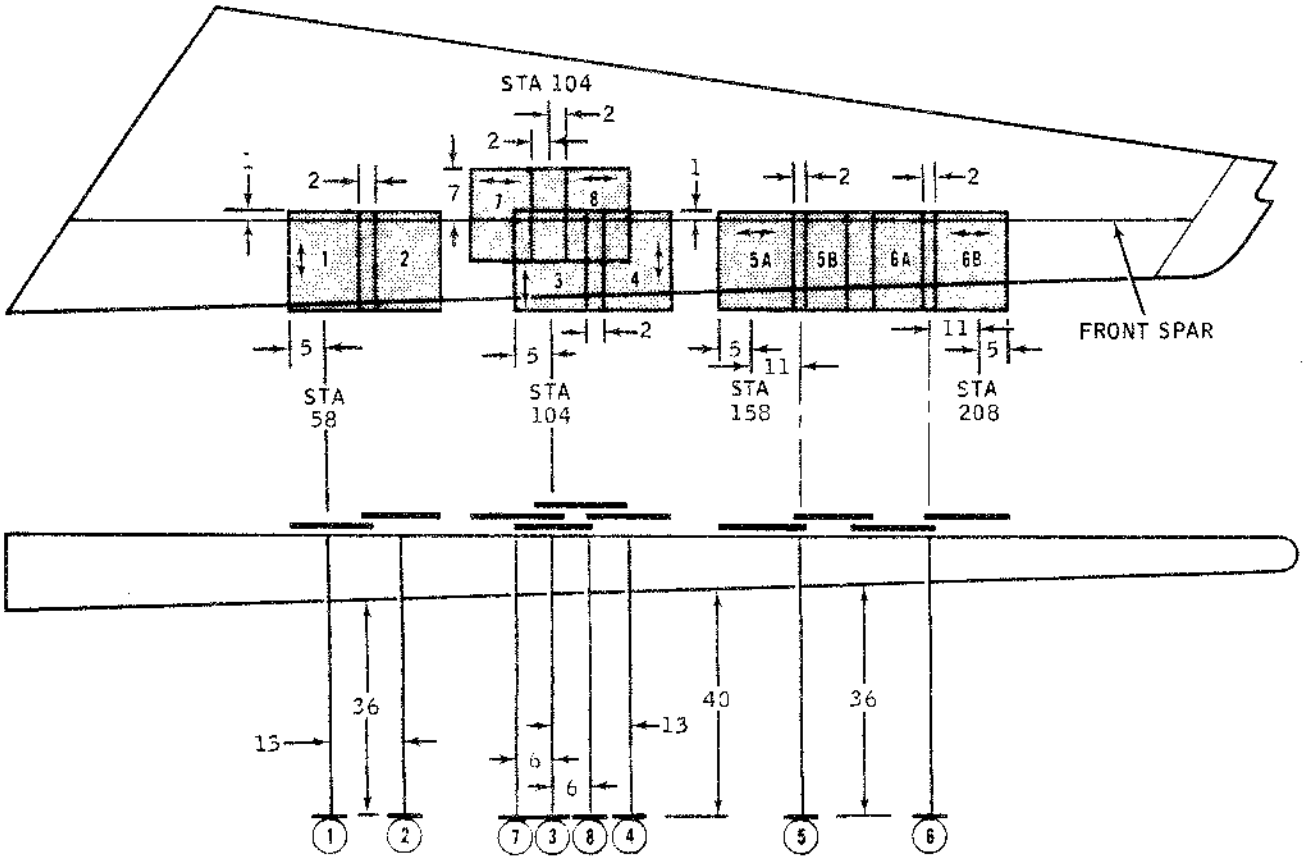
CHAPTER 5

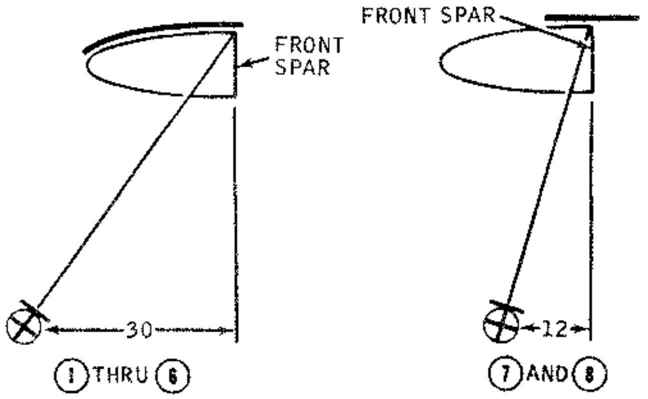
STABILIZERS

Chapter 5

STABILIZERS

Printed in U.S.A.





NOTE:

THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

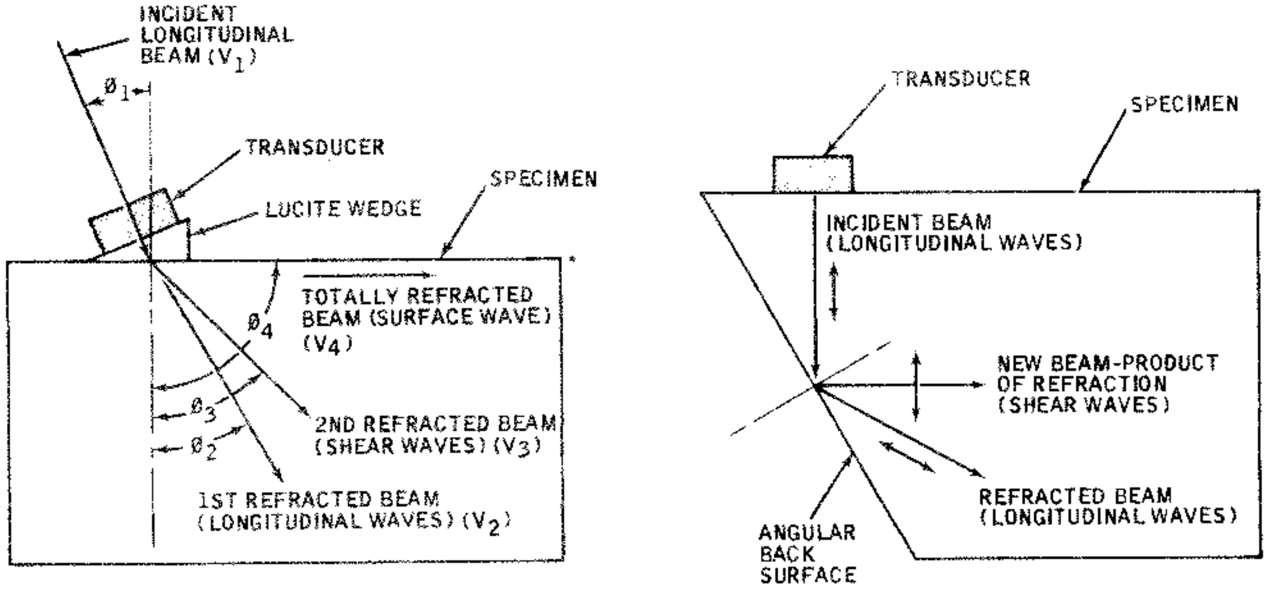
A. LEFT HORIZONTAL STABILIZER TOP SURFACE: SHOWN
B. RIGHT HORIZONTAL STABILIZER TOP SURFACE: OPPOSITE
C. LEFT HORIZONTAL STABILIZER BOTTOM SURFACE: PLACE FILM ON BOTTOM AND LOCATE X-RAY SOURCE ABOVE.
D. RIGHT HORIZONTAL STABILIZER BOTTOM SURFACE: OPPOSITE.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 2	PLATING, STA XFS 58 TO STA XFS 79	100	300	57	II	14 x 17
3 4	PLATING, STA XFS 104 TO STA XFS 125	100	300	57	II	14 x 17
5 6	PLATING, STA XFS 158 TO STA XFS 208	100	300	57	II	14 x 17
7 8	LEADING EDGE TO SPAR ATTACH AT STA XFS 104	100	300	50	II	14 x 17

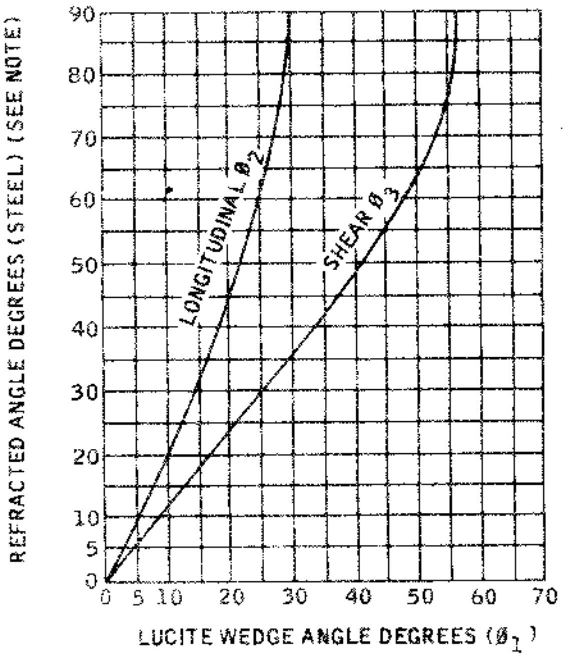
RADIOGRAPHIC DATA

BB12-1

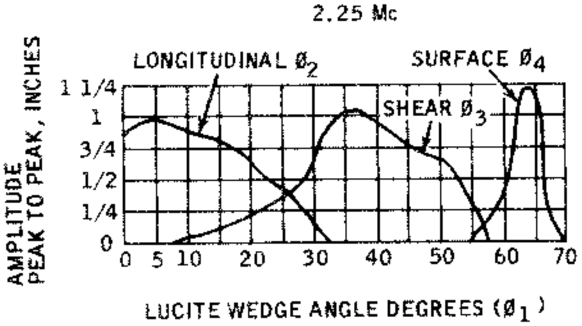
Horizontal Stabilizer Leading Edge and Tip Area
Figure 1 (Sheet 1)



EXAMPLES OF WAVE REFRACTION AND MODE CONVERSION



REFRACTION ANGLE DATA



REFRACTION AMPLITUDE DATA

NOTE:
THE REFRACTION ANGLES (Ø) OF ULTRASONIC BEAMS CAN BE COMPUTED BY THE USE OF SNELLS LAW, GIVEN BELOW

$$\frac{\mathrm{SIN}\ Ø_1}{V_1} = \frac{\mathrm{SIN}\ Ø_2}{V_2} = \frac{\mathrm{SIN}\ Ø_3}{V_3}$$

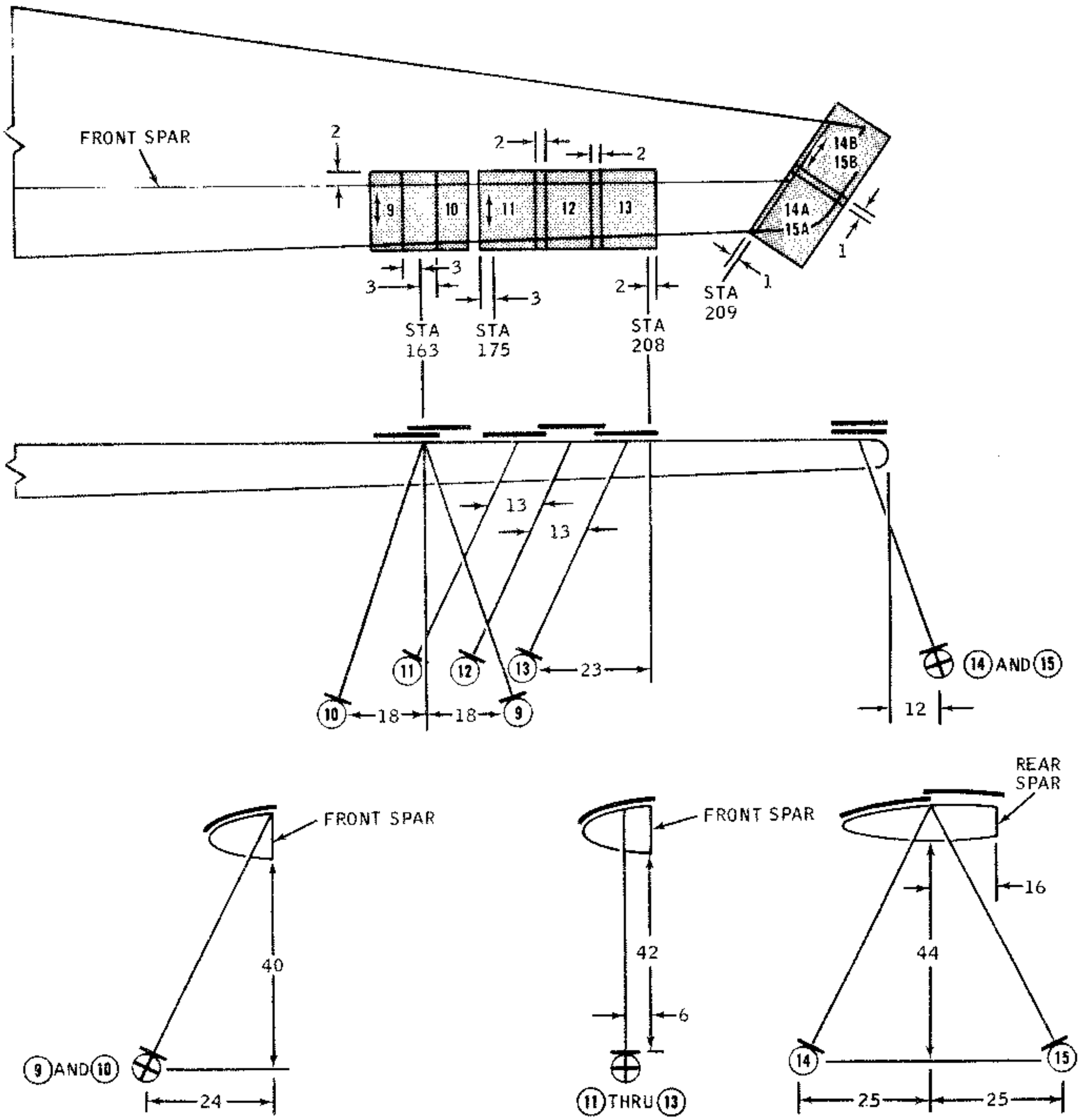
THE VELOCITIES (V) ENCOUNTERED IN SOLIDS AT ULTRASONIC FREQUENCIES ARE GIVEN ON SHEET 2.

B812-39A

Ultrasonic Wave Mode Data
Figure 5 (Sheet 1)

TEMPORARY REVISION 1-1

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following Section 1-5, Page 6. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Corrects Lucite Wedge Angle Refraction Graph.
EFFECTIVITY:	ALL

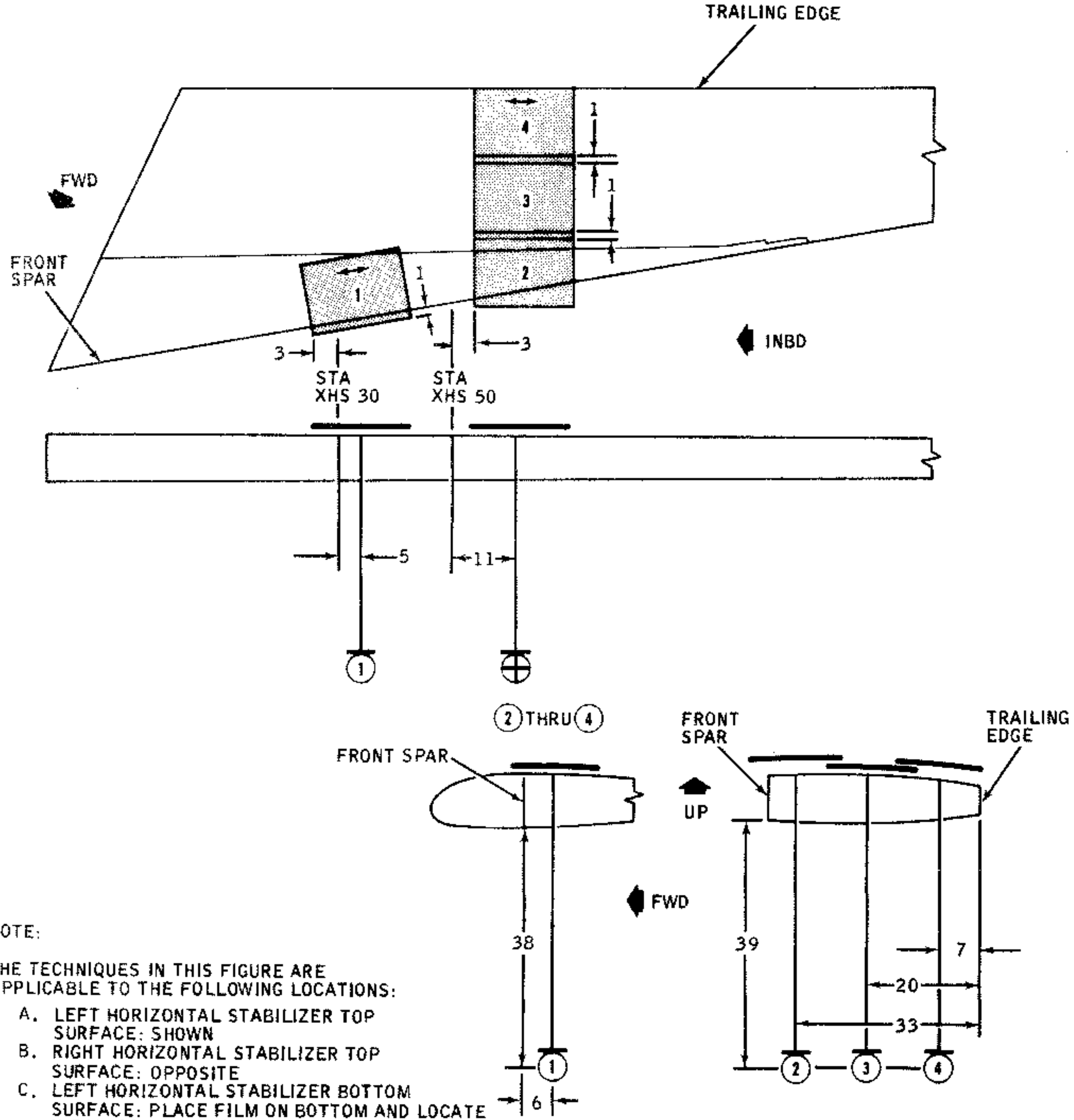


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
9 10	SPLICE, STA XFS 163	92	300	50	II	14 x 17
11 12 13	FORMER TO LEADING EDGE ATTACH FLANGE, STA XFS 175 TO STA XFS208	90	300	52	II	14 x 17
14 A&B 15 A&B	HORIZONTAL TIP SKIN AND ATTACH AREA, STA XH 209 AND OUTBOARD	90	300	55	II	14 x 17

RADIOGRAPHIC DATA

BB12-6

Horizontal Stabilizer Leading Edge and Tip Area
Figure 1 (Sheet 2)



NOTE:

THE TECHNIQUES IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

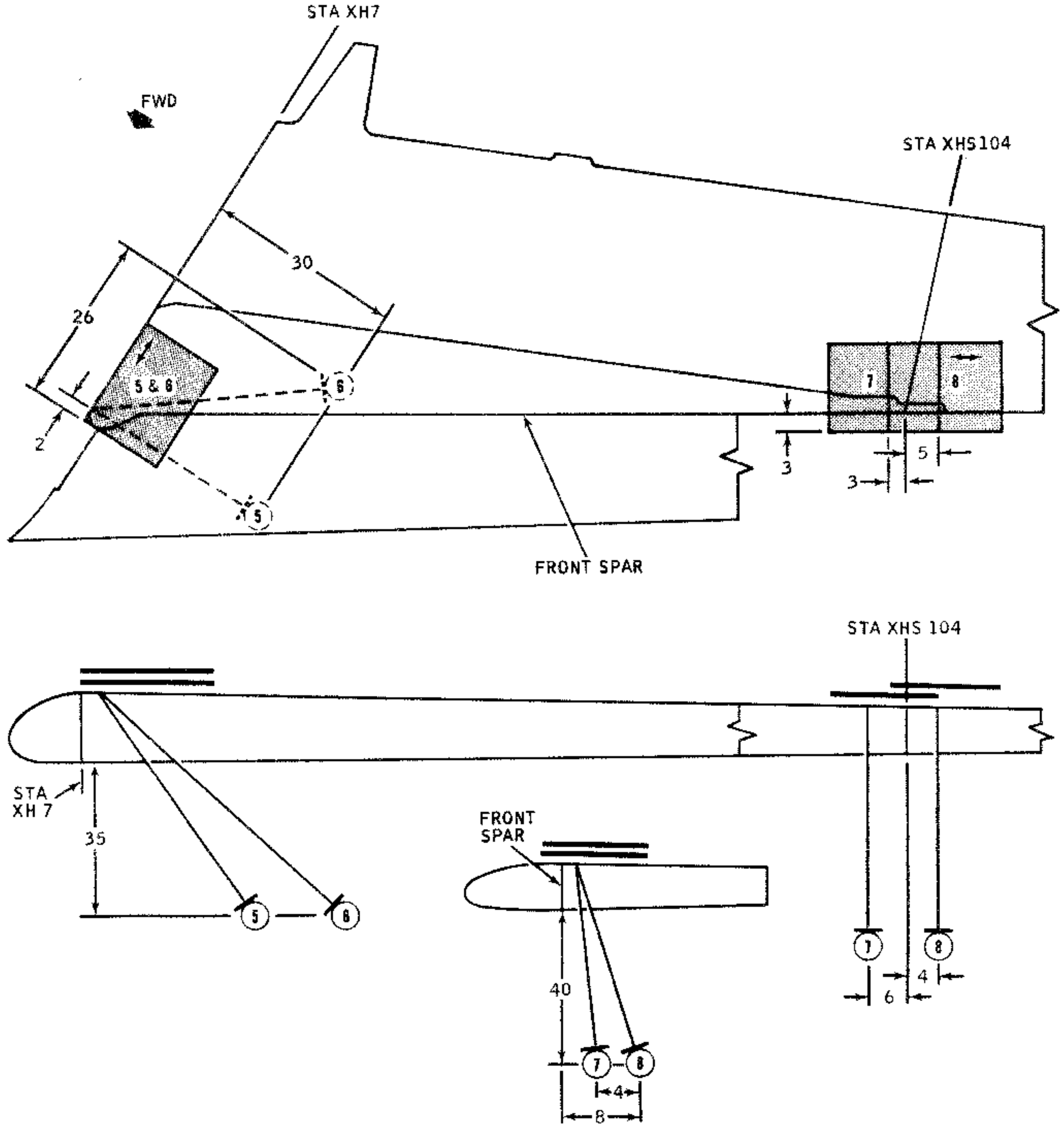
A. LEFT HORIZONTAL STABILIZER TOP SURFACE: SHOWN
B. RIGHT HORIZONTAL STABILIZER TOP SURFACE: OPPOSITE
C. LEFT HORIZONTAL STABILIZER BOTTOM SURFACE: PLACE FILM ON BOTTOM AND LOCATE X-RAY SOURCE ABOVE
D. RIGHT HORIZONTAL STABILIZER BOTTOM SURFACE: OPPOSITE

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	PANEL AT STA XHS30 AFT OF FRONT SPAR	95	300	48	II	14x17
2	PANEL AT STA XHS58 TO STA XHS64 FRONT TO REAR SPAR	95	300	48	II	14x17
3		95	300	48	II	14x17
4		95	300	48	II	14x17

RADIOGRAPHIC DATA

BB12-7

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 1)

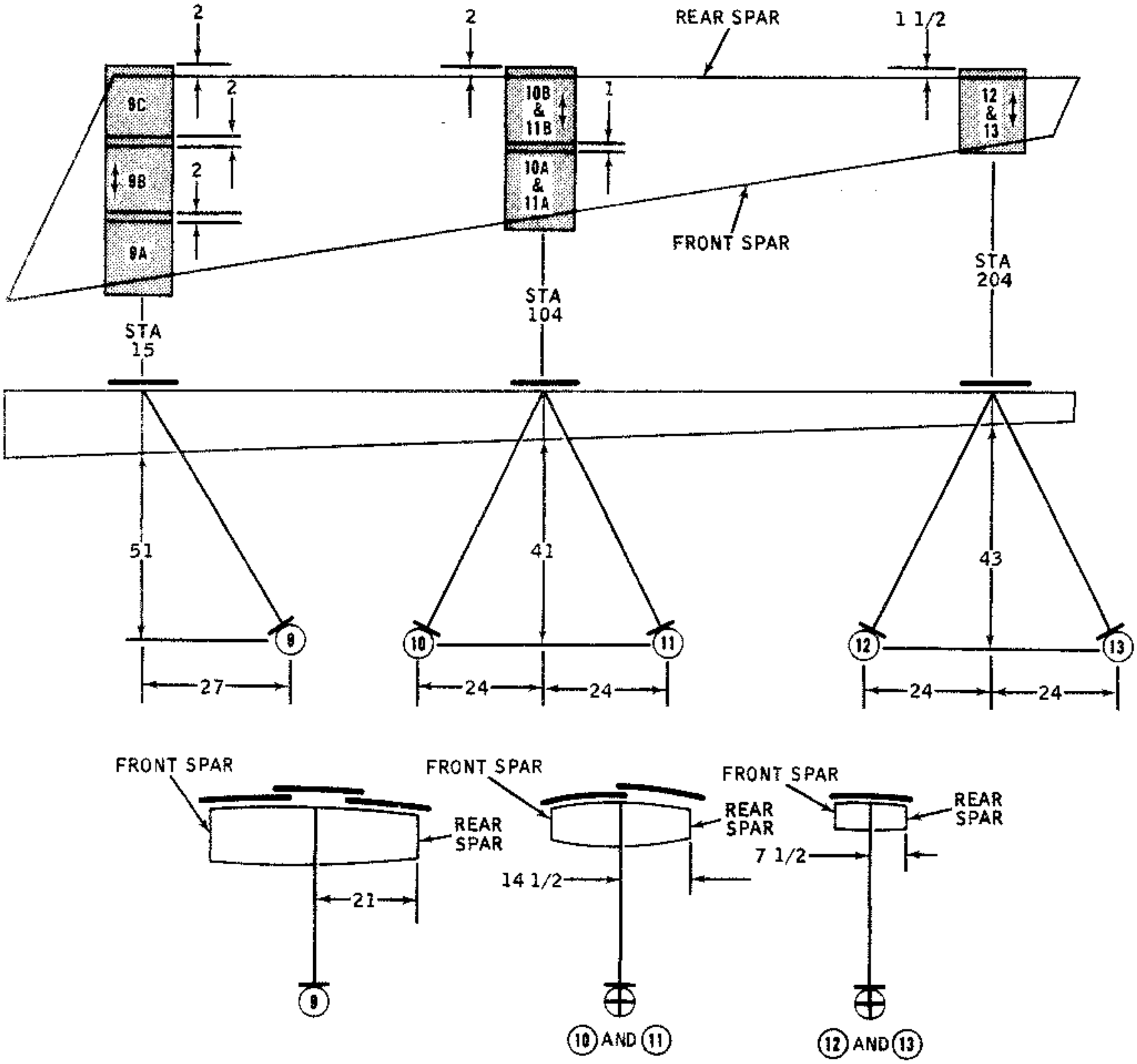


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
5	FRONT SPAR TO CENTER SECTION ATTACH STRUCTURE	110	300	56	II & III	14x17
6		120	300	61	II & III	14x17
7	PANEL INTERSECTION AT STA XHS104	100	300	50	II	14x17
8		100	300	50	II	14x17

RADIOGRAPHIC DATA

BB12-9

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 2)

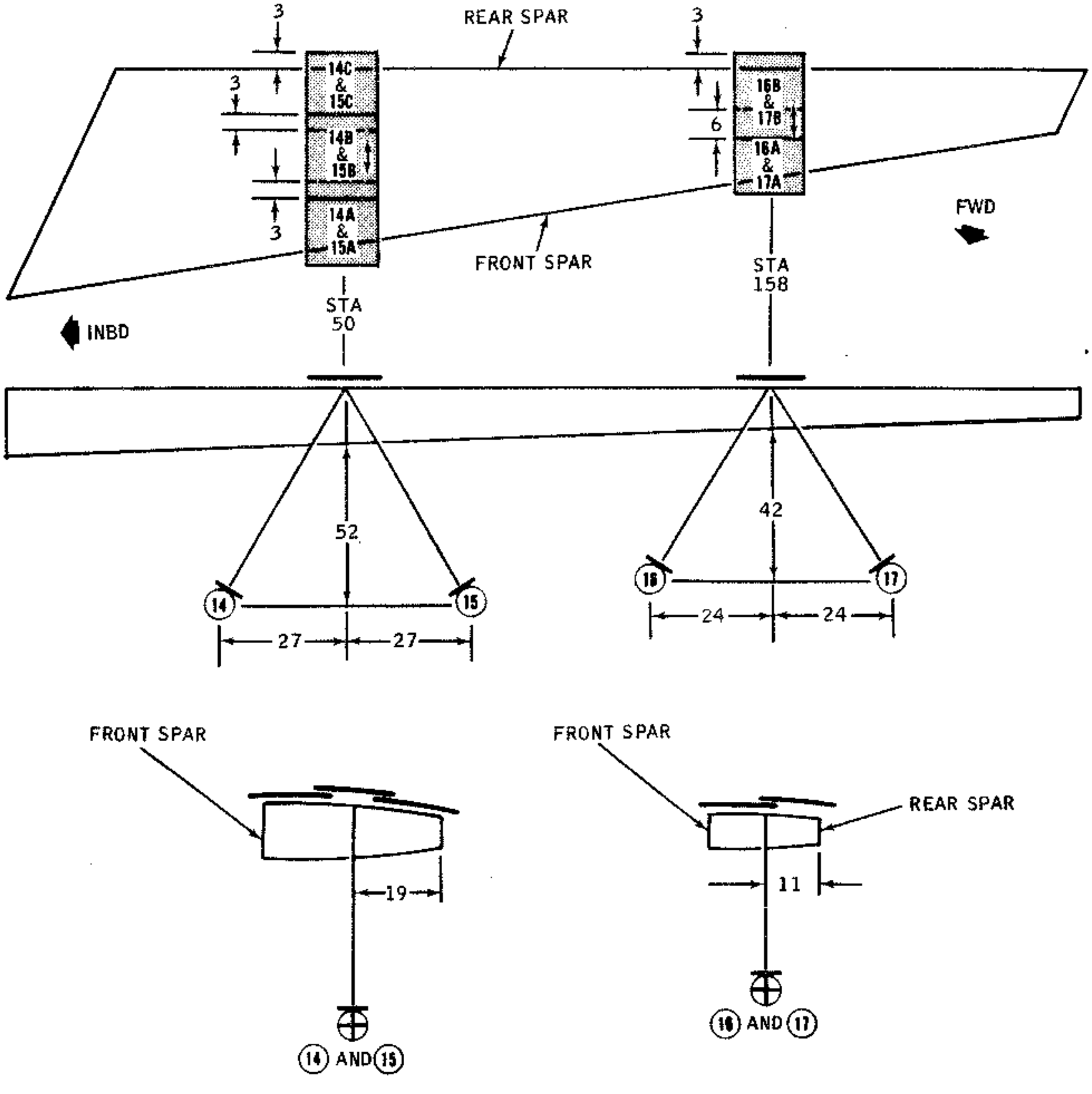


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
9A	FORMER, FRONT TO REAR SPAR STA XHS 15	115	450	85	II	14x17
B					II	14x17
C					II & III	14x17
10A	FORMER, FRONT TO REAR SPAR STA XHS104	100	300	54	II	14x17
B					II & III	14x17
11A		100	300	54	II	14x17
B					II & III	14x17
12	FORMER, FRONT TO REAR SPAR STA XHS204	90	300	54	II & III	14x17
13		90	300	54	II & III	14x17

RADIOGRAPHIC DATA

BB12-10

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 3)

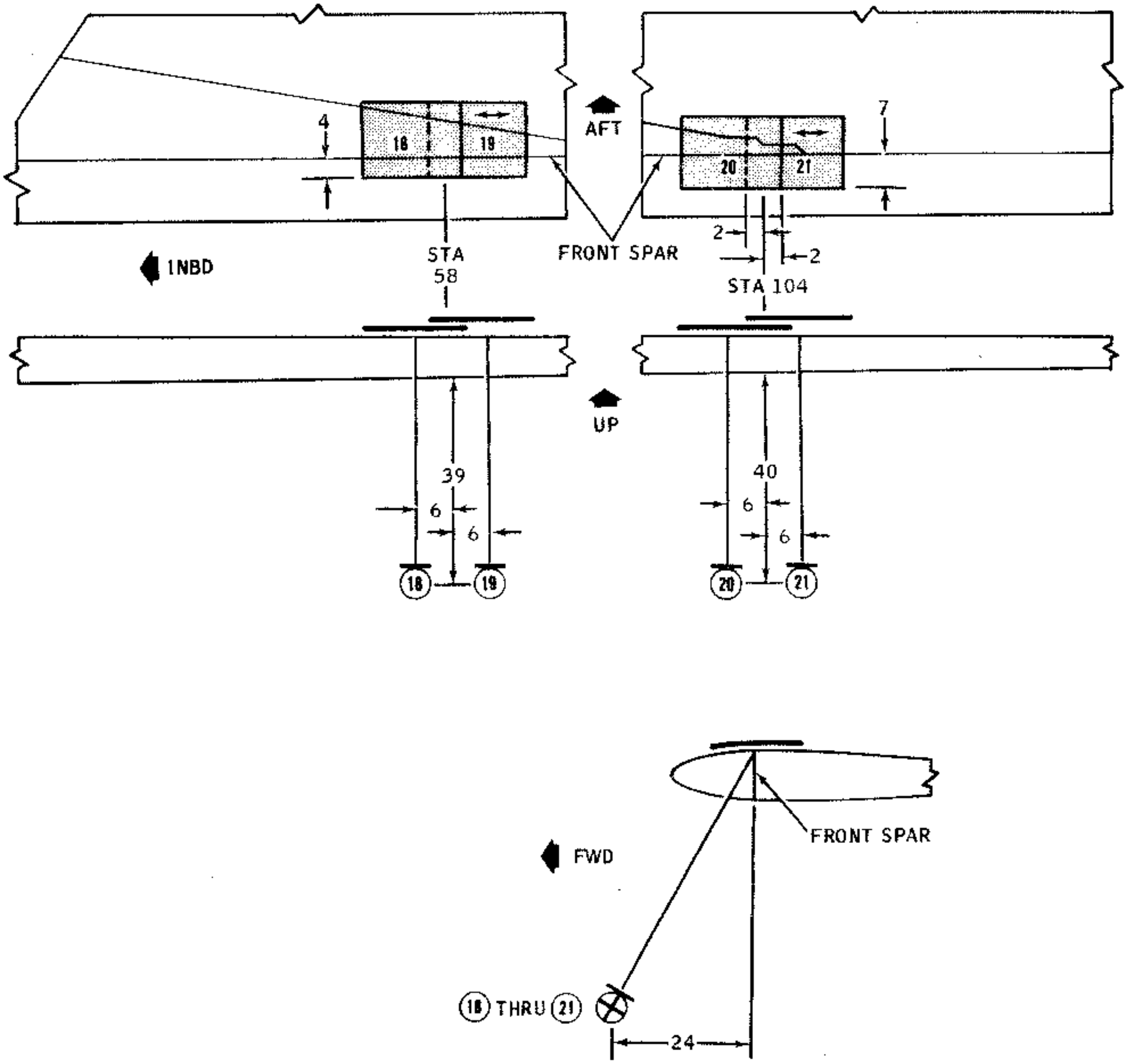


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
14A	FORMER, FRONT TO	110	450	85	II	14x17
B	REAR SPAR				II	14x17
C	STA XHS50				II & III	14x17
15A		110	450	85	II	14x17
B					II	14x17
C					II & III	14x17
16A	FORMER, FRONT TO	95	300	54	II	14x17
B	REAR SPAR				II & III	14x17
17A	STA XHS158	95	300	54	II	14x17
B					II & III	14x17

RADIOGRAPHIC DATA

BB12-49

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 4)

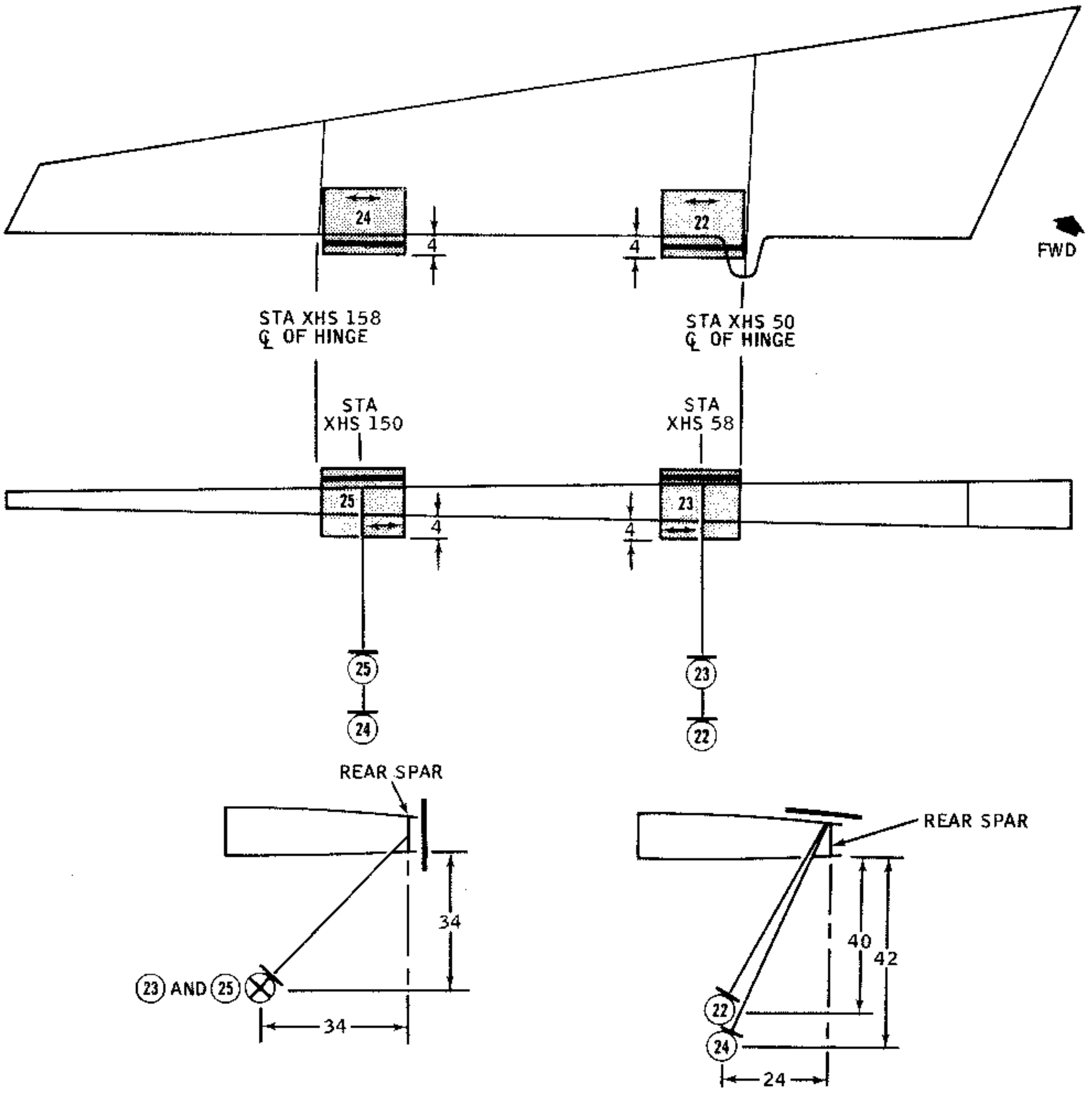


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
18	FRONT SPAR UPPER CAP AND WEB AT STA XHS58	100	300	54	II	14x17
19		100	300	54	II	14x17
20	FRONT SPAR UPPER CAP AND WEB AT STA XHS104	100	300	54	II&III	14x17
21		100	300	54	II&III	14x17

RADIOGRAPHIC DATA

BB12-48

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 5)



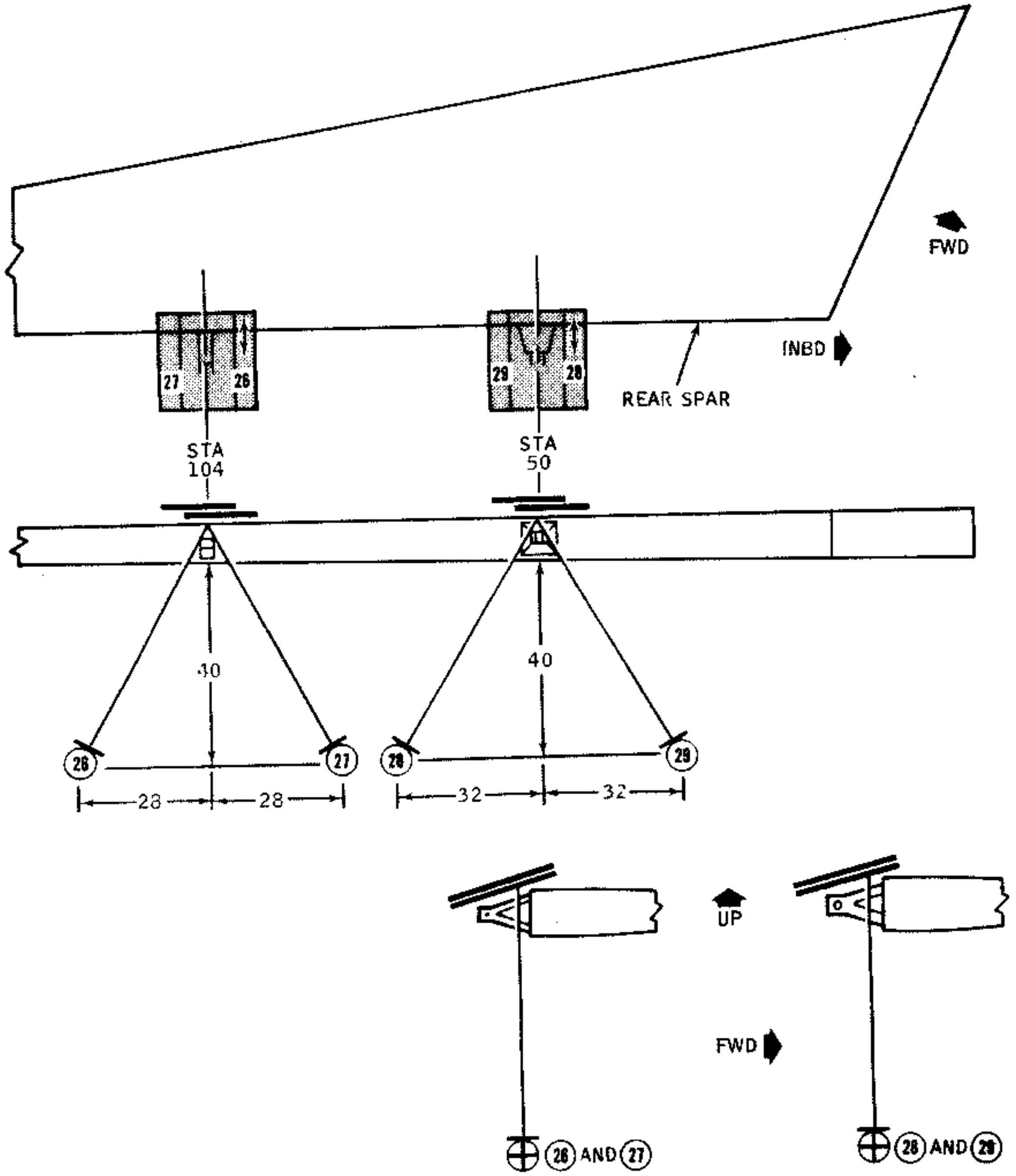
Printed in U.S.A.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
22	REAR SPAR UPPER CAP AND WEB AT STA XHS58	105	300	54	II	14 x 17
23	REAR SPAR WEB AT STA XHS58	100	300	48	II	14 x 17
24	REAR SPAR UPPER CAP AND WEB AT STA XHS150	105	300	54	II	14 x 17
25	REAR SPAR WEB AT STA XHS150	100	300	48	II	14 x 17

RADIOGRAPHIC DATA

BB12-47

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 6)



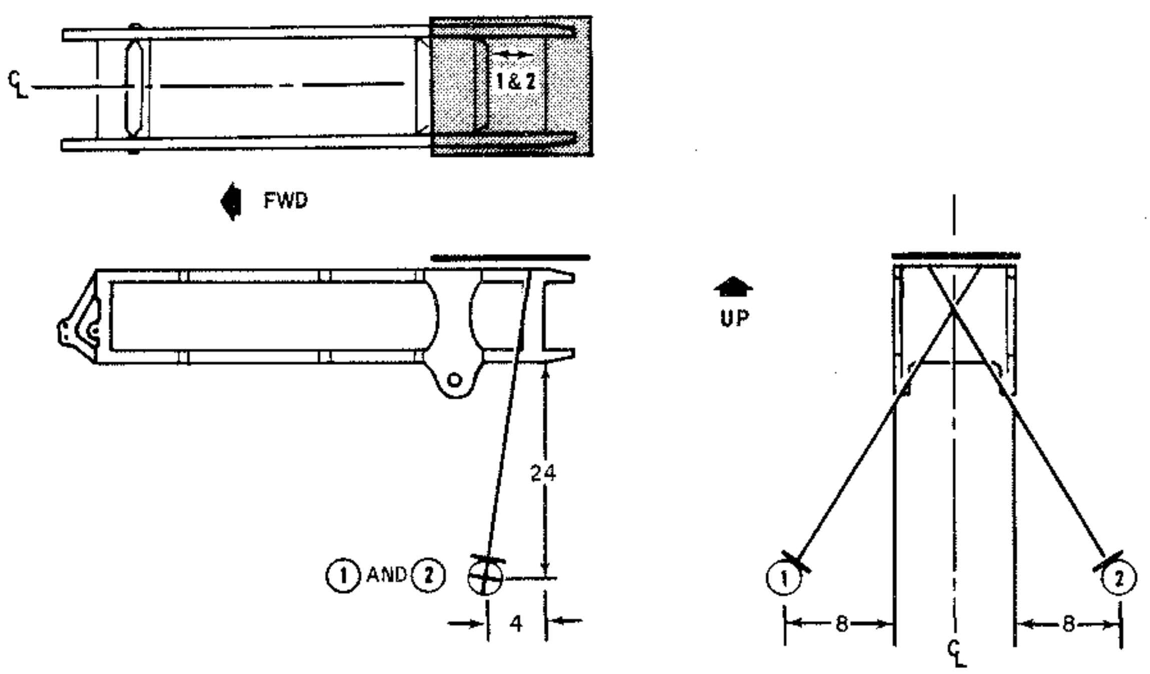
NOTES:
1. THE ELEVATORS MUST BE REMOVED TO X-RAY THE ELEVATOR HINGES, EXPOSURE NUMBERS 26 THROUGH 29. SEE MAINTENANCE MANUAL, CHAPTER 27.
2. THE RESULTS OF ELEVATOR HINGE X-RAY, EXPOSURE NUMBERS 26 THROUGH 29, MAY NOT BE CONCLUSIVE. THE USE OF PENETRANTS WILL ALSO BE USEFUL IN THE INSPECTION OF THESE HINGES.

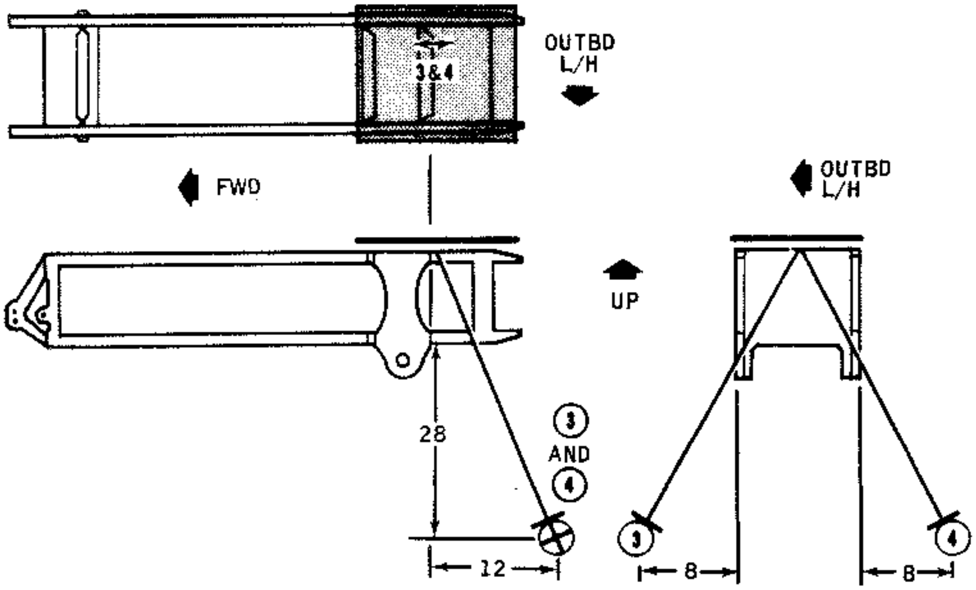
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
26 27	ELEVATOR HINGE STA XHS104	110 110	450 450	58 58	II II	14 x 17 14 x 17
28 29	ELEVATOR HINGE STA XHS50	110 110	450 450	58 58	II II	14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-8

Horizontal Stabilizer Aft Section
Figure 2 (Sheet 7)





NOTE:

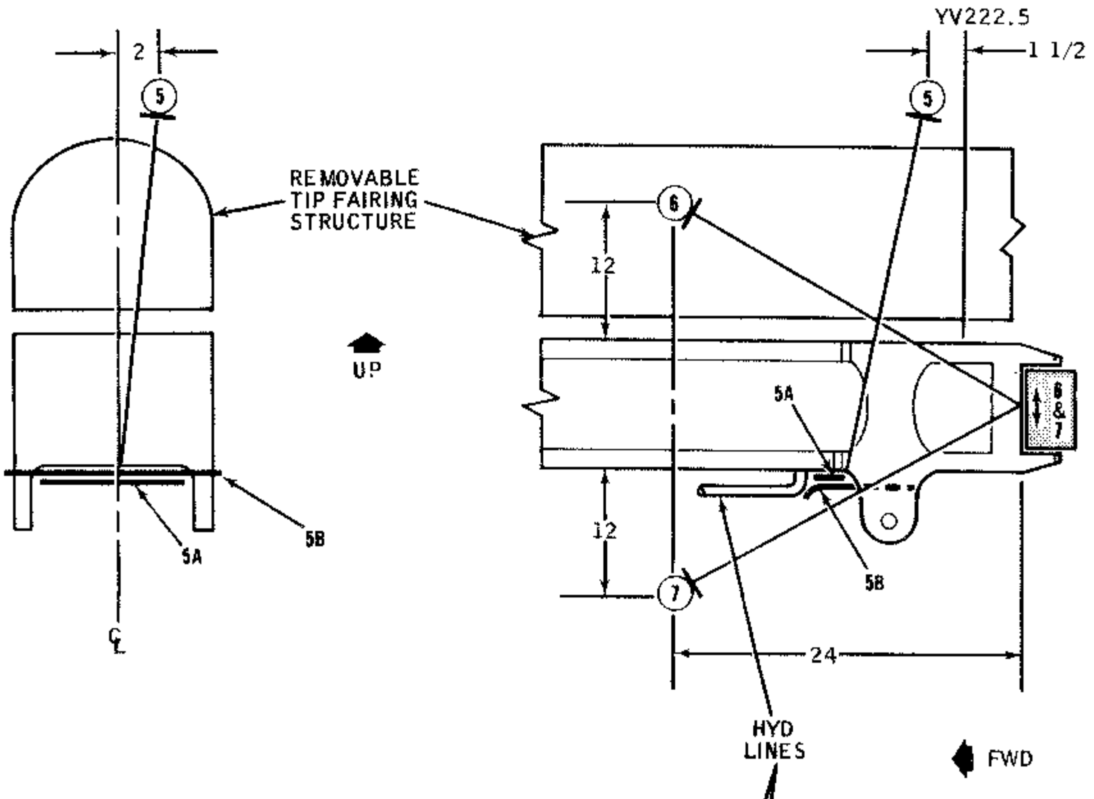
THE ELEVATOR BELLCRANK ACCESS COVER, NUMBER 6310, MUST BE REMOVED TO ACCOMPLISH EXPOSURES 1 THROUGH 4.

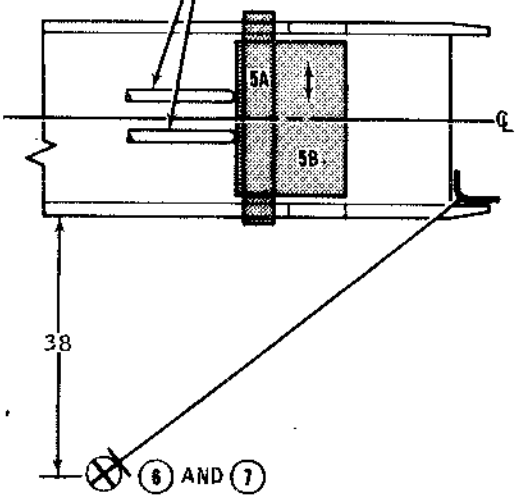
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	REAR SPAR FITTING (UPPER FLANGES)	100	720	40	II	14x17
2		100	720	40	II	14x17
3	PIVOT FITTING AT TOP AFT FLANGE	115	600	40	II	14x17
4		115	600	40	II	14x17

RADIOGRAPHIC DATA

BB12-17

Horizontal Stabilizer Center Section
Figure 3 (Sheet 1)





NOTES:

1. THE HORIZONTAL STABILIZER LEFT OR RIGHT LOWER FAIRING MUST BE REMOVED TO POSITION THE FILM FOR EXPOSURE 5.
2. THE ELEVATOR BELLCRANK ACCESS COVER, NUMBER 6310, MUST BE REMOVED TO ACCOMPLISH EXPOSURES 6 AND 7.
3. EXPOSURES 6 AND 7 ARE FOR THE FOLLOWING LOCATIONS:

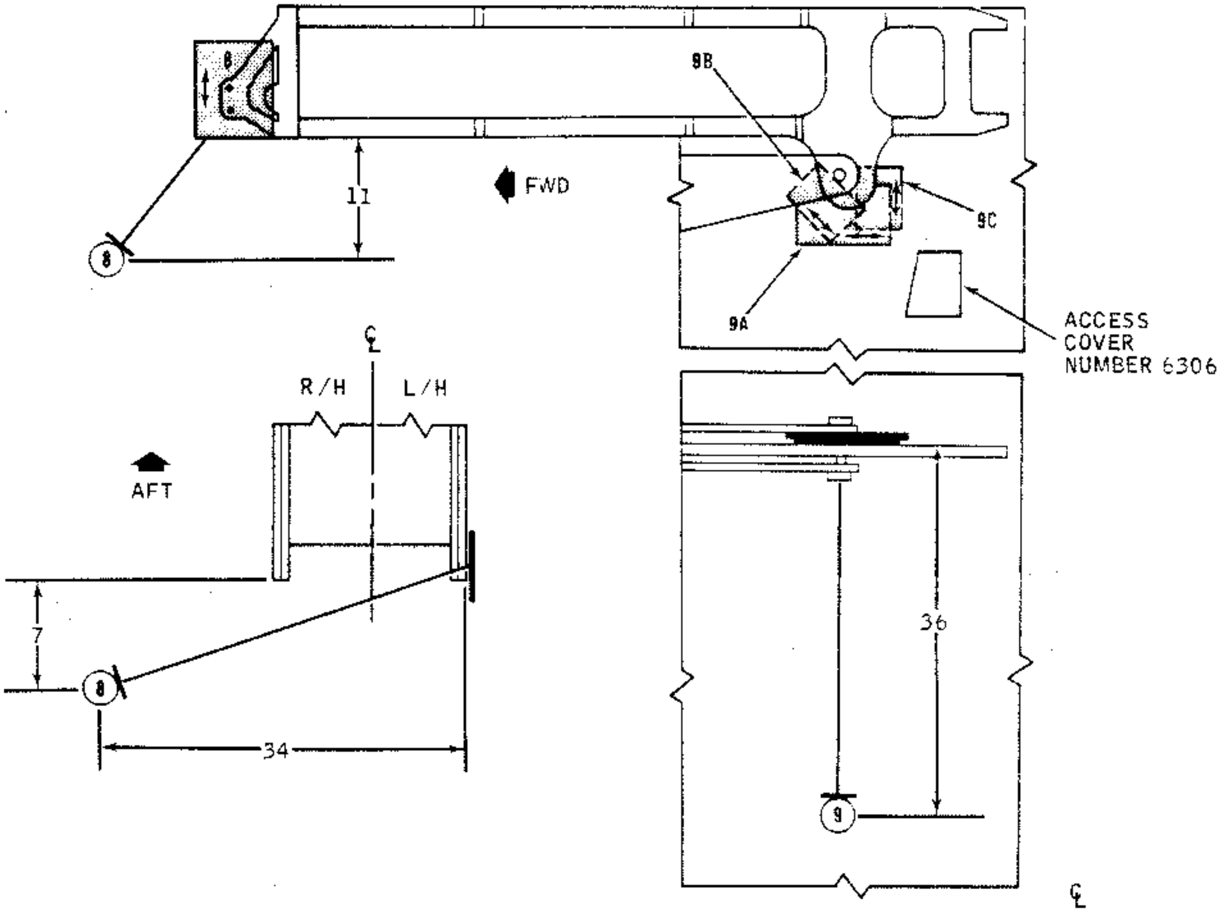
   A. LEFT SIDE: SHOWN
   B. RIGHT SIDE: OPPOSITE

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
5A B	PIVOT FITTING AT BOTTOM FORWARD FLANGE	100	300	30	II II	3 1/2 x 17 10 x 12
6 7	REAR SPAR FITTING (SIDE FLANGE)	120 120	900 900	48 48	II II	5 x 7 5 x 7

RADIOGRAPHIC DATA

BB12-18

Horizontal Stabilizer Center Section
Figure 3 (Sheet 2)



NOTES:

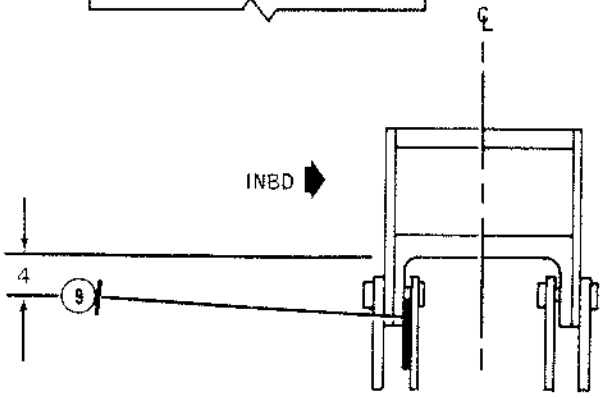
1. EXPOSURES 8 AND 9 ARE FOR THE FOLLOWING LOCATIONS:

   A. LEFT SIDE: SHOWN.
   B. RIGHT SIDE: OPPOSITE.

2. THE ACTUATOR ATTACHMENT MUST BE DISASSEMBLED TO ACCOMPLISH EXPOSURE 8.

3. THE HORIZONTAL STABILIZER BEARING LUBRICATION ACCESS COVER, NUMBER 6306, MUST BE REMOVED TO ACCOMPLISH EXPOSURE 9.

4. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK TO ACCOMPLISH EXPOSURE 9.

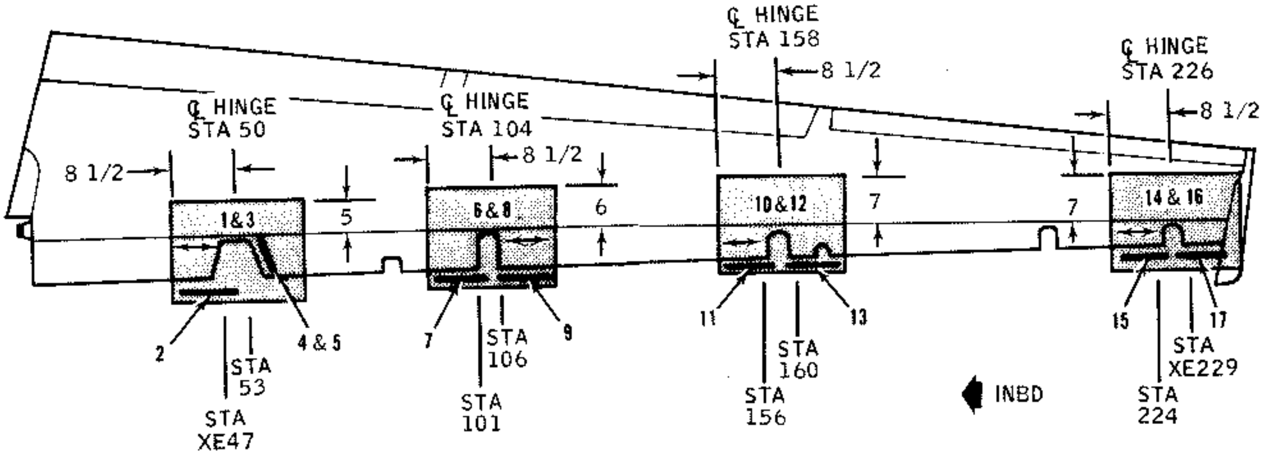


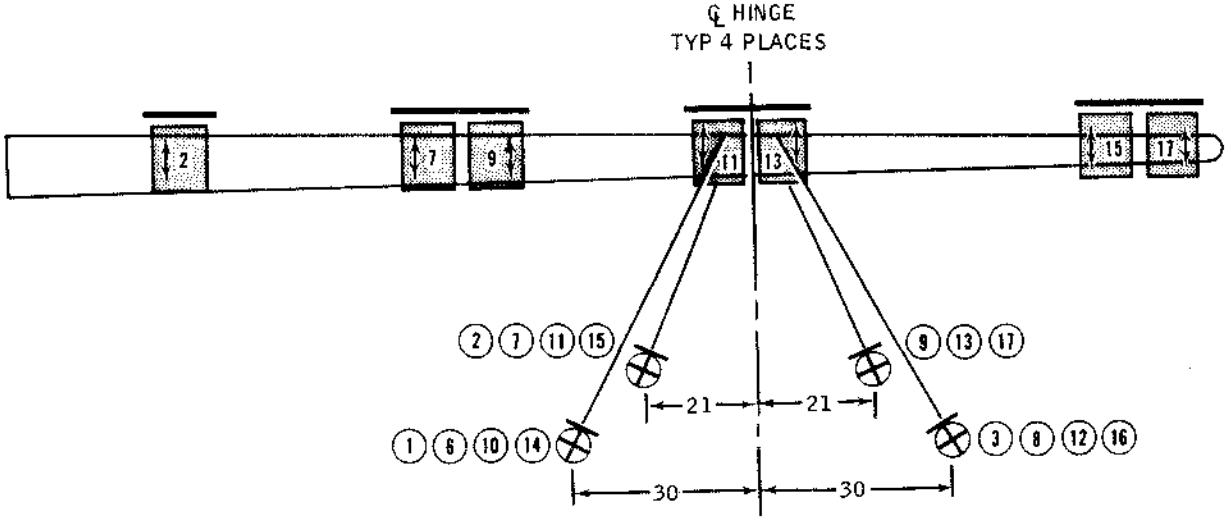
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
8	ACTUATOR ATTACH FITTING	110	600	36	II	5 x 7
9 A	PIVOT LUG (LOWER HALF)	140	750	36	II & III	5 x 7
B					II & III	3 1/2 x 5
C					II & III	3 1/2 x 5

RADIOGRAPHIC DATA

BB12-41

Horizontal Stabilizer Center Section
Figure 3 (Sheet 3)





NOTE:

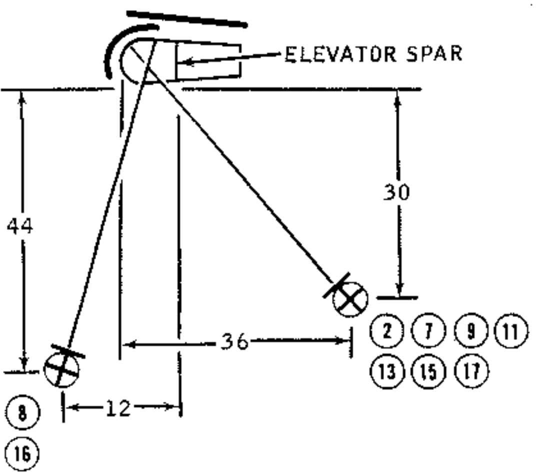
THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

A. LEFT ELEVATOR TOP SURFACE: SHOWN.

B. RIGHT ELEVATOR TOP SURFACE: OPPOSITE.

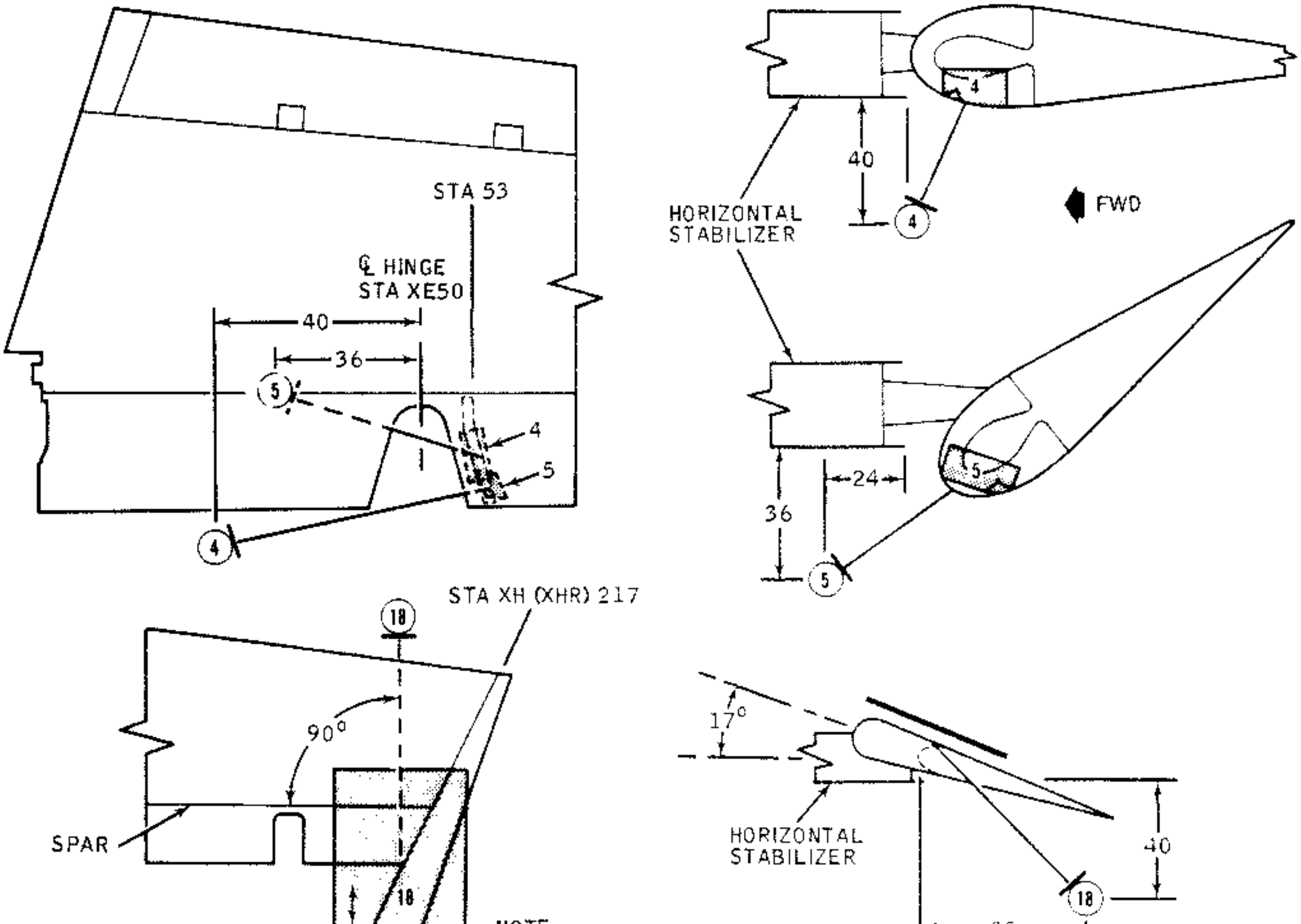
C. LEFT ELEVATOR BOTTOM SURFACE: PLACE FILM ON BOTTOM AND LOCATE X-RAY SOURCE ABOVE.

D. RIGHT ELEVATOR BOTTOM SURFACE: OPPOSITE.



BB12-2A

Elevator Leading Edge
Figure 4 (Sheet 1)



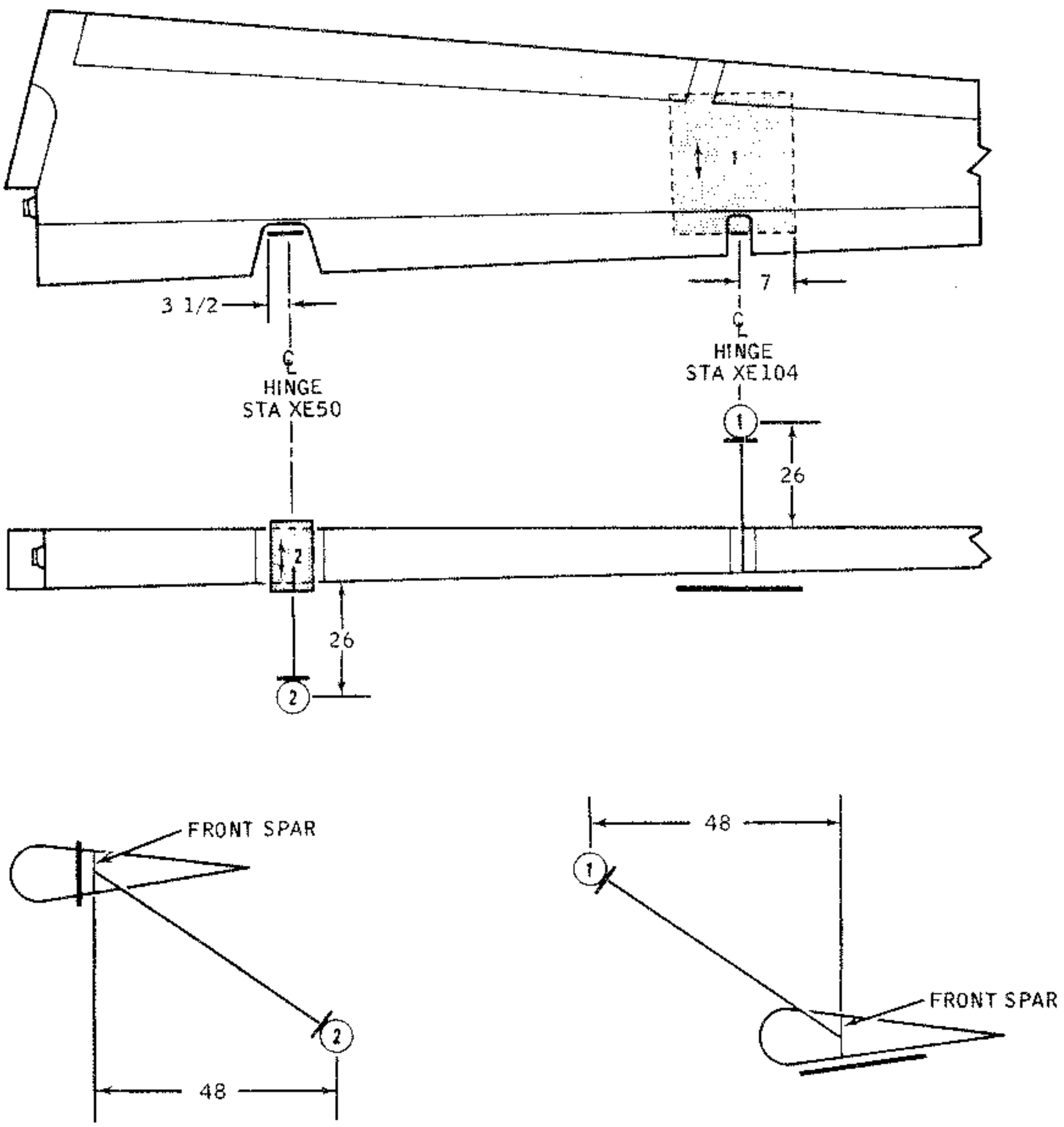
NOTE:
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	LEADING EDGE RIB SKIN ATTACH FLANGES					
1	STA XE47	110	300	57	II	14 x 17
2		110	300	57	II	8 x 10
3	STA XE53	110	300	57	II	14 x 17
4		110	300	57	II	3 1/2 x 5
5		110	300	57	II	3 1/2 x 5
6	STA XE101	110	300	57	II	14 x 17
7		110	300	57	II	8 x 10
8	STA XE106	110	300	57	II	14 x 17
9		110	300	57	II	8 x 10
10	STA XE156	110	300	57	II	14 x 17
11		110	300	57	II	8 x 10
12	STA XE160	110	300	57	II	14 x 17
13		110	300	57	II	8 x 10
14	STA XE224	110	300	57	II	14 x 17
15		110	300	57	II	8 x 10
16	STA XE229	110	300	57	II	14 x 17
17		110	300	57	II	8 x 10
18	STA XH (XHR) 217	105	300	57	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-19A

Elevator Leading Edge
Figure 4 (Sheet 2)



NOTES:

1. THE ELEVATOR MUST BE REMOVED TO PERFORM THESE TECHNIQUES.

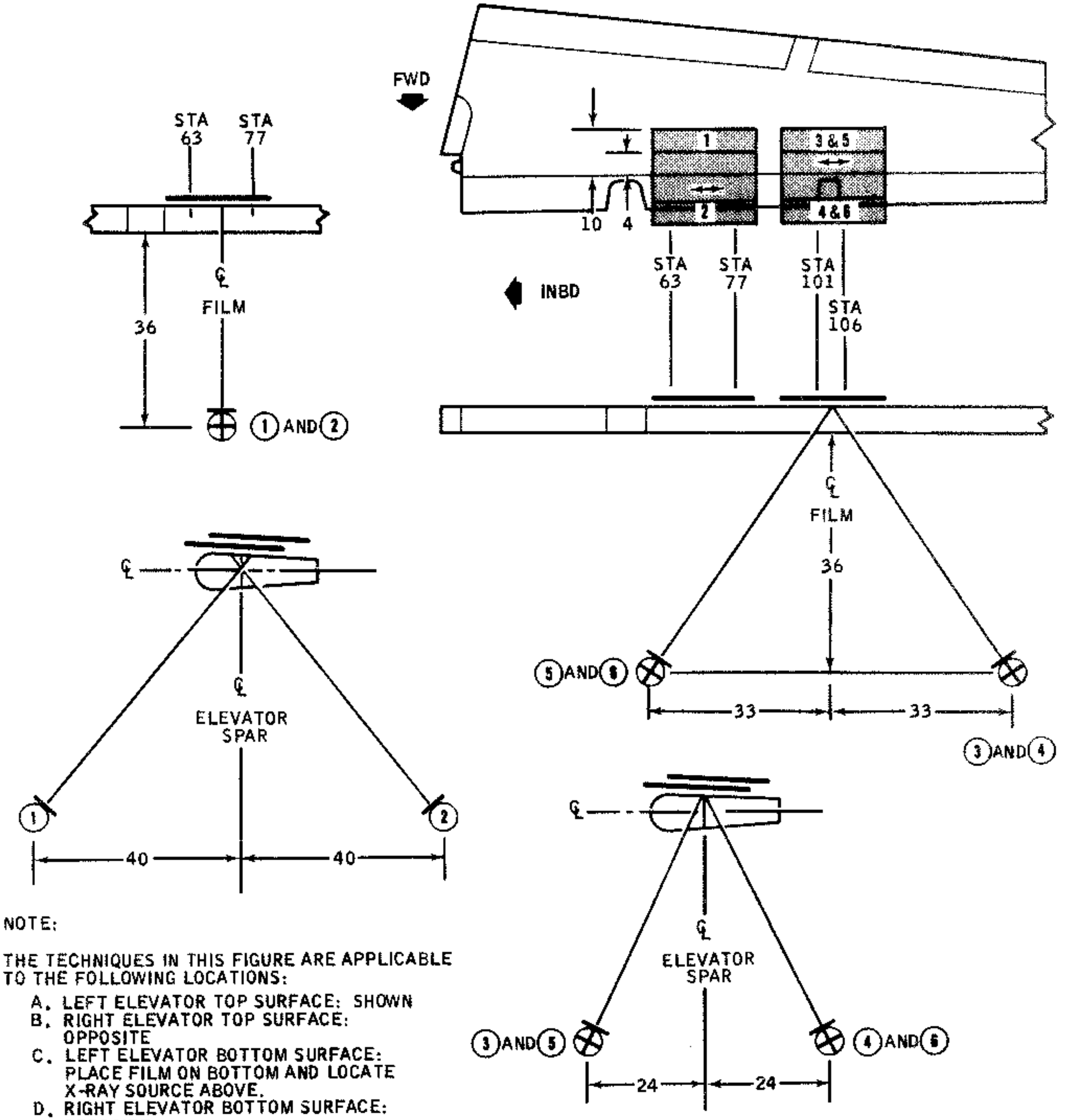
2. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. LEFT ELEVATOR, SHOWN
   B. RIGHT ELEVATOR, OPPOSITE

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	HINGE FITTINGS					
1	STA 104	120	450	60	II	14 x 17
2	STA 50	120	450	60	II	5 x 7

RADIOGRAPHIC DATA

BB12-35A

Elevator Hinge Fittings
Figure 5



NOTE:

THE TECHNIQUES IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

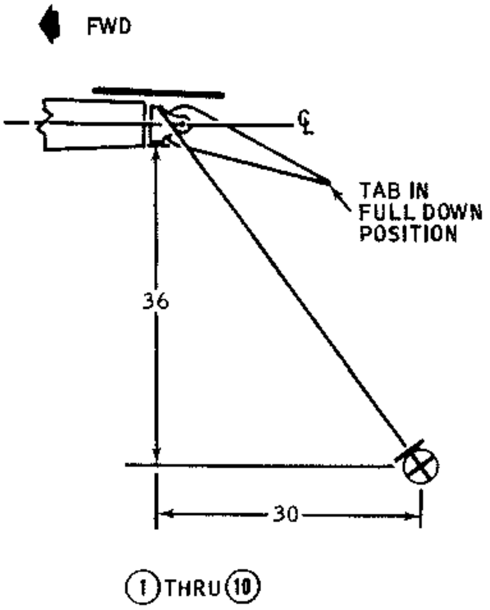
A. LEFT ELEVATOR TOP SURFACE: SHOWN
B. RIGHT ELEVATOR TOP SURFACE: OPPOSITE
C. LEFT ELEVATOR BOTTOM SURFACE: PLACE FILM ON BOTTOM AND LOCATE X-RAY SOURCE ABOVE.
D. RIGHT ELEVATOR BOTTOM SURFACE: OPPOSITE

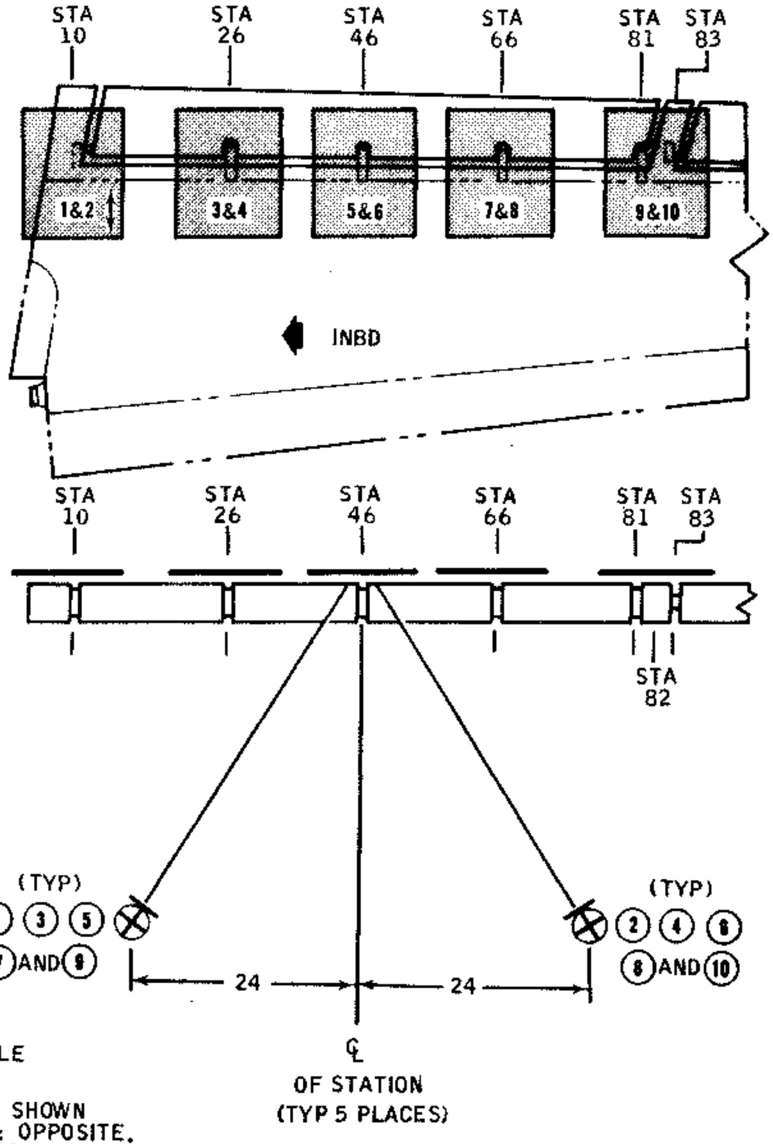
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	ELEVATOR SPAR CAP AND WEB					
1	STA XE63 TO XE77	115	300	57	II	14 x 17
2	STA XE63 TO XE77	115	300	57	II	14 x 17
3	STA XE101 TO XE106	120	450	57	II	14 x 17
4	STA XE101 TO XE106	120	450	57	II	14 x 17
5	STA XE101 TO XE106	120	450	57	II	14 x 17
6	STA XE101 TO XE106	120	450	57	II	14 x 17

RADIOGRAPHIC DATA

BB12-36

Elevator Spar
Figure 6





NOTE:

THE TECHNIQUES IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

A. LEFT ELEVATOR TAB HINGE TOP ATTACH: SHOWN
B. RIGHT ELEVATOR TAB HINGE TOP ATTACH: OPPOSITE.
C. LEFT ELEVATOR TAB HINGE BOTTOM ATTACH: PLACE FILM ON BOTTOM AND LOCATE X-RAY SOURCE ABOVE.
D. RIGHT ELEVATOR TAB HINGE BOTTOM ATTACH: OPPOSITE.

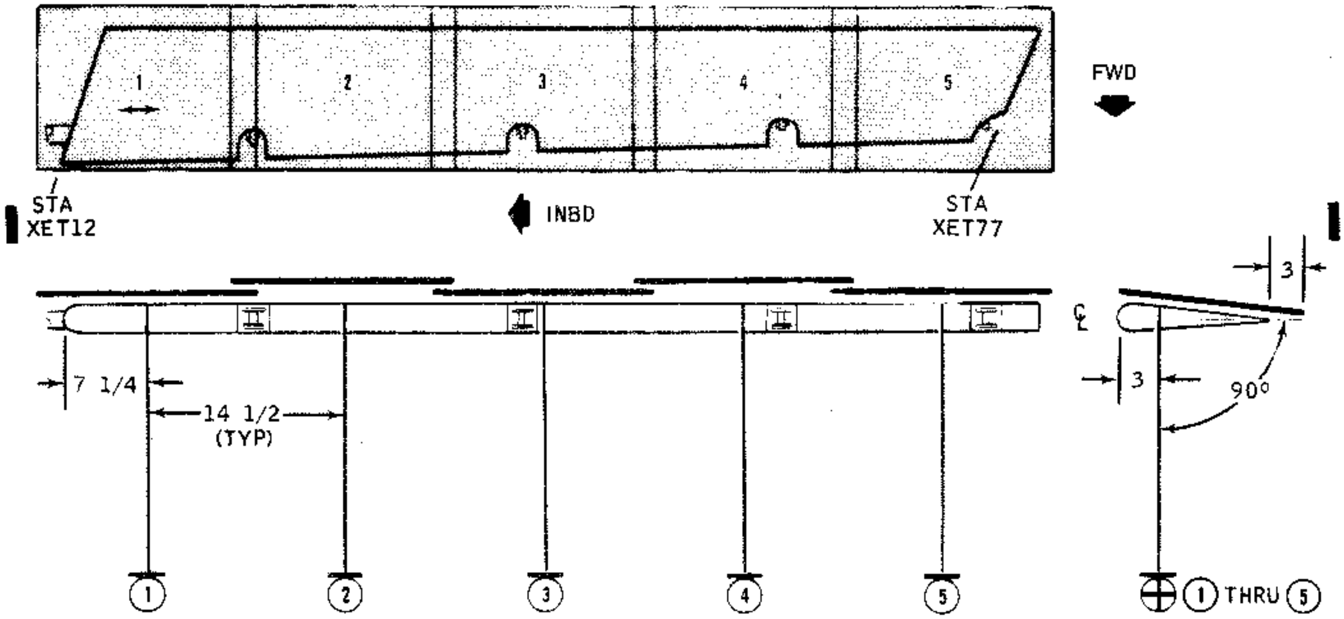
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	ELEVATOR TAB HINGE FITTINGS					
1	STA XET10	110	300	56	II	8 x 10
2	STA XET10	110	300	56	II	8 x 10
3	STA XET26	110	300	56	II	8 x 10
4	STA XET26	110	300	56	II	8 x 10
5	STA XET46	110	300	56	II	8 x 10
6	STA XET46	110	300	56	II	8 x 10
7	STA XET66	110	300	56	II	8 x 10
8	STA XET66	110	300	56	II	8 x 10
9	STA XET81AND83	110	300	56	II	8 x 10
10	STA XET81AND83	110	300	56	II	8 x 10

RADIOGRAPHIC DATA

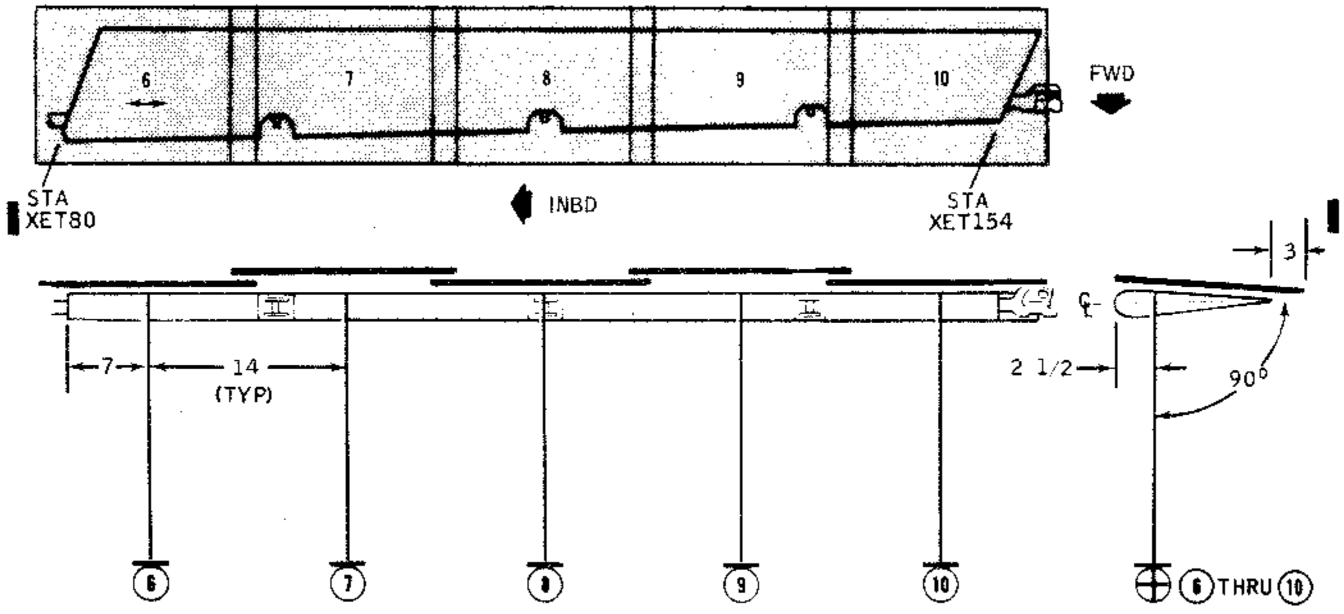
BB12-20

Elevator Tab Hinges
Figure 7

Printed in U.S.A.



ELEVATOR CONTROL TAB (INBD)



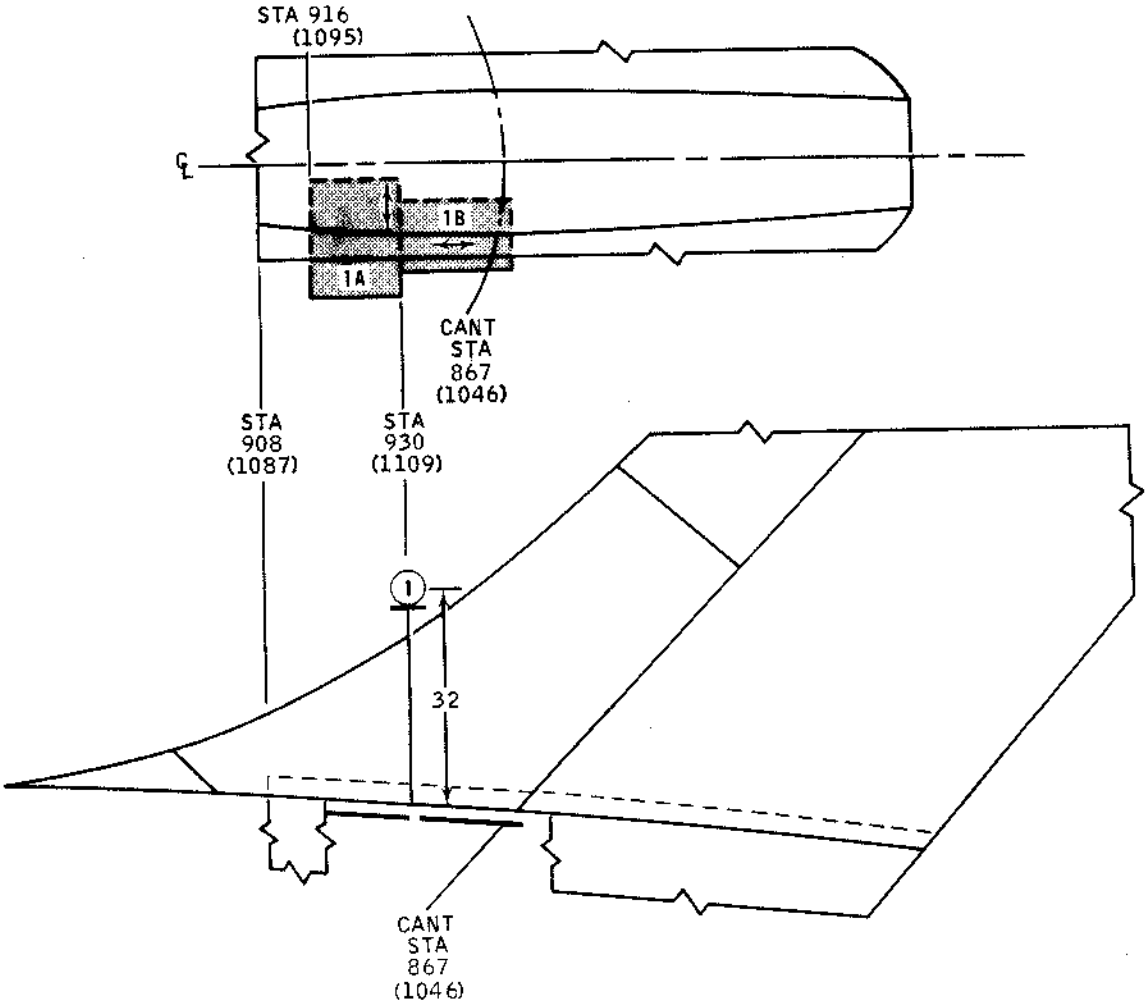
ELEVATOR GEARED TAB (OUTBD)

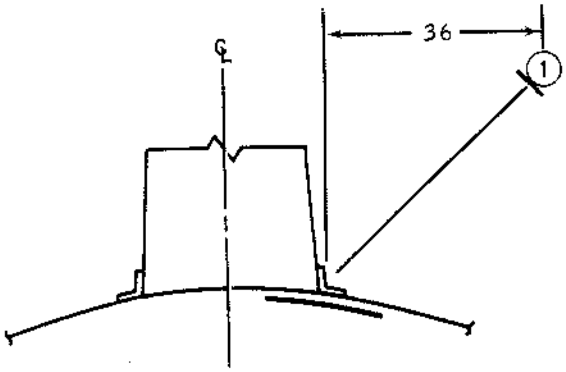
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	ELEV. CONTROL TAB	130	200	144	II	14 x 17
2	ELEV. CONTROL TAB	130	200	144	II	14 x 17
3	ELEV. CONTROL TAB	130	200	144	II	14 x 17
4	ELEV. CONTROL TAB	130	200	144	II	14 x 17
5	ELEV. CONTROL TAB	130	200	144	II	14 x 17
6	ELEV. GEARED TAB	130	200	144	II	14 x 17
7	ELEV. GEARED TAB	130	200	144	II	14 x 17
8	ELEV. GEARED TAB	130	200	144	II	14 x 17
9	ELEV. GEARED TAB	130	200	144	II	14 x 17
10	ELEV. GEARED TAB	130	200	144	II	14 x 17

RADIOGRAPHIC DATA

BB12-5A

Elevator Tabs for Water Absorption
Figure 8





NOTES:

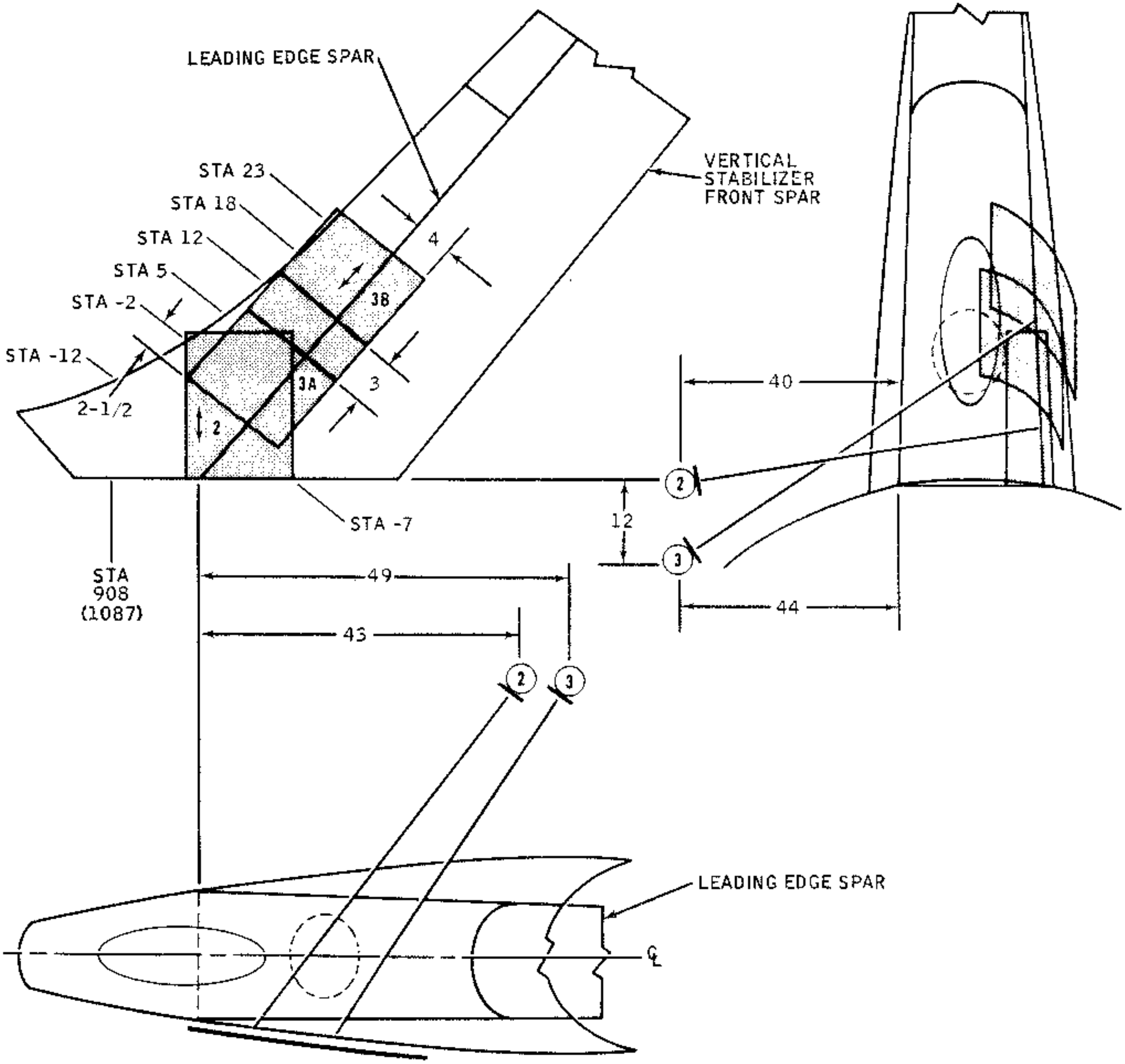
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   VERTICAL STABILIZER LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 A B	LEADING EDGE TO FUSELAGE ATTACH ANGLE STA 916 (1095) TO 867 (1046) CANT	105	300	48	II II	14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-22A

Vertical Stabilizer Leading Edge Area
Figure 9 (Sheet 1)



NOTE:

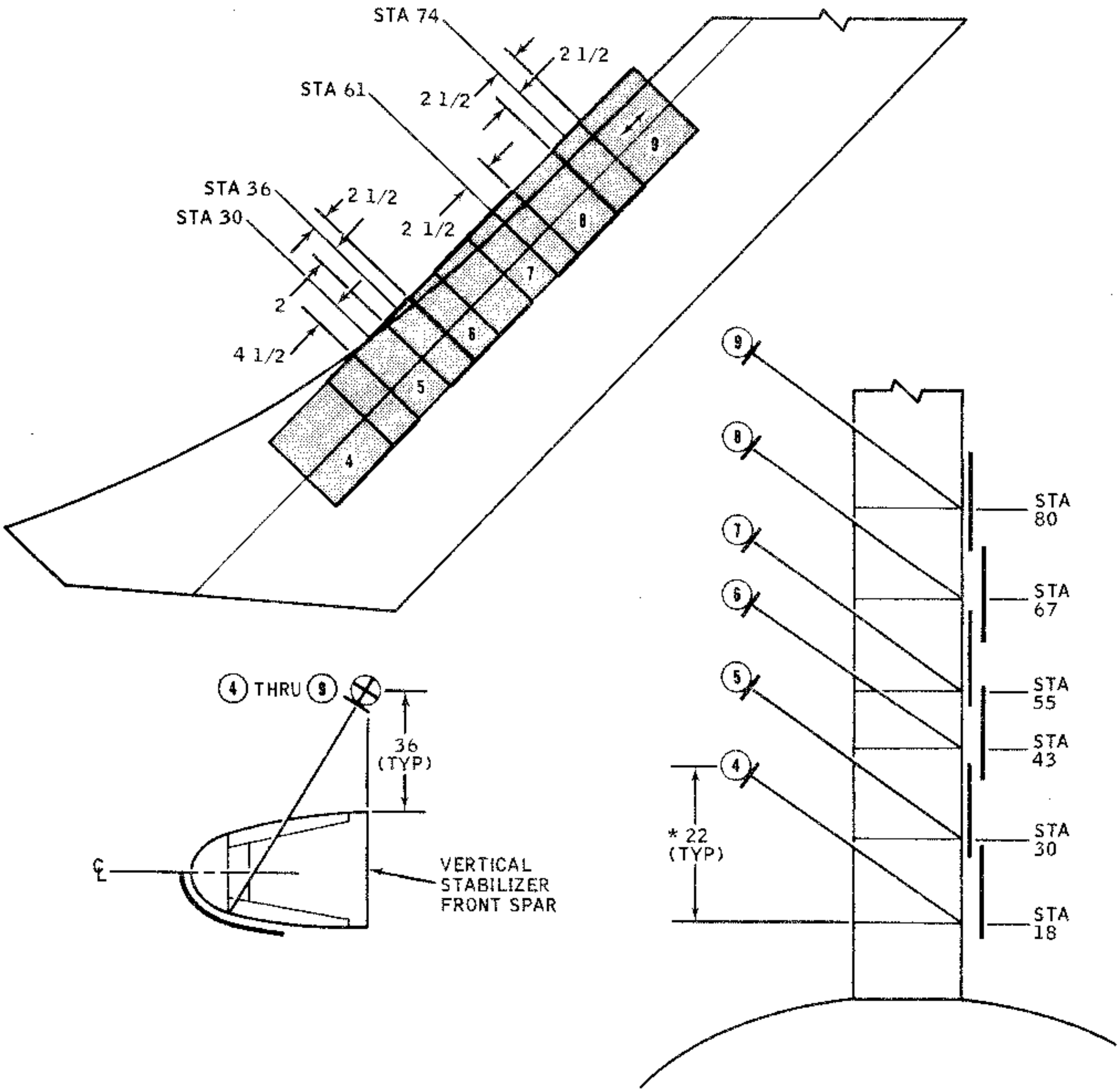
STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	LEADING EDGE SPAR CAP					
2	STA ZFS 0 TO FUSELAGE	115	300	72	II & III	14 x 17
3A	STA ZFS -6 TO +11	120	300	72	II & III	14 x 17
B	STA ZFS 8 TO 25				II & III	14 x 17

RADIOGRAPHIC DATA

BB12-30A

Vertical Stabilizer Leading Edge Area
Figure 9 (Sheet 2)



NOTE:

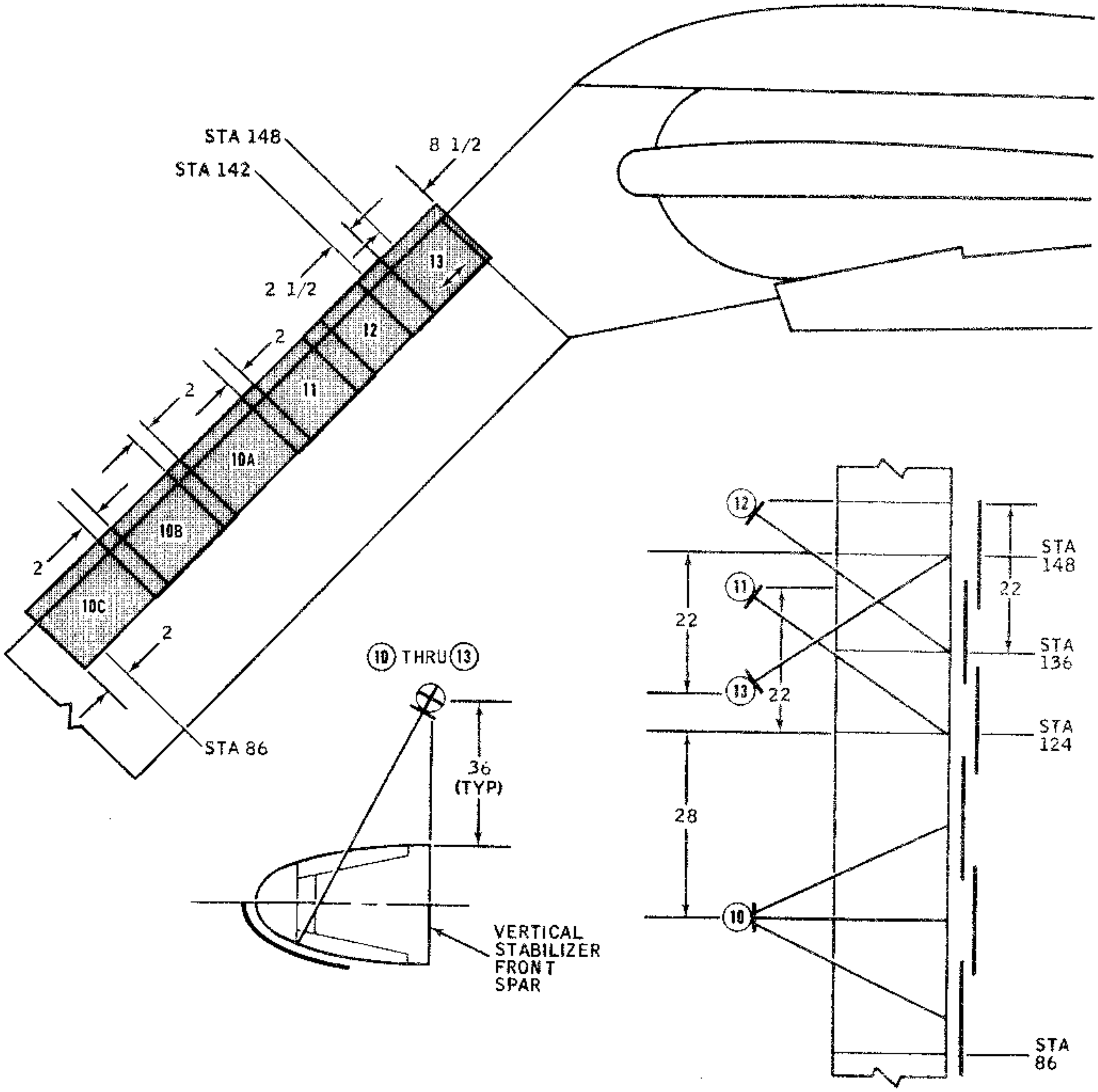
* SOURCE LOCATING DIMENSION FOR EXPOSURES 5, 6, 7, 8, AND 9 TYPICAL 22 INCHES ABOVE RESPECTIVE STATION IDENTIFICATION.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	LEADING EDGE FORMERS					
4	STA ZFS 18 & 23	120	300	52	II	14 x 17
5	STA ZFS 30 & 36	120	300	52	II	14 x 17
6	STA ZFS 43 & 50	120	300	52	II	14 x 17
7	STA ZFS 55 & 61	120	300	52	II	14 x 17
8	STA ZFS 67 & 74	120	300	52	II	14 x 17
9	STA ZFS 80 & 86	120	300	52	II	14 x 17

RADIOGRAPHIC DATA

BB12-31

Vertical Stabilizer Leading Edge Area
Figure 9 (Sheet 3)

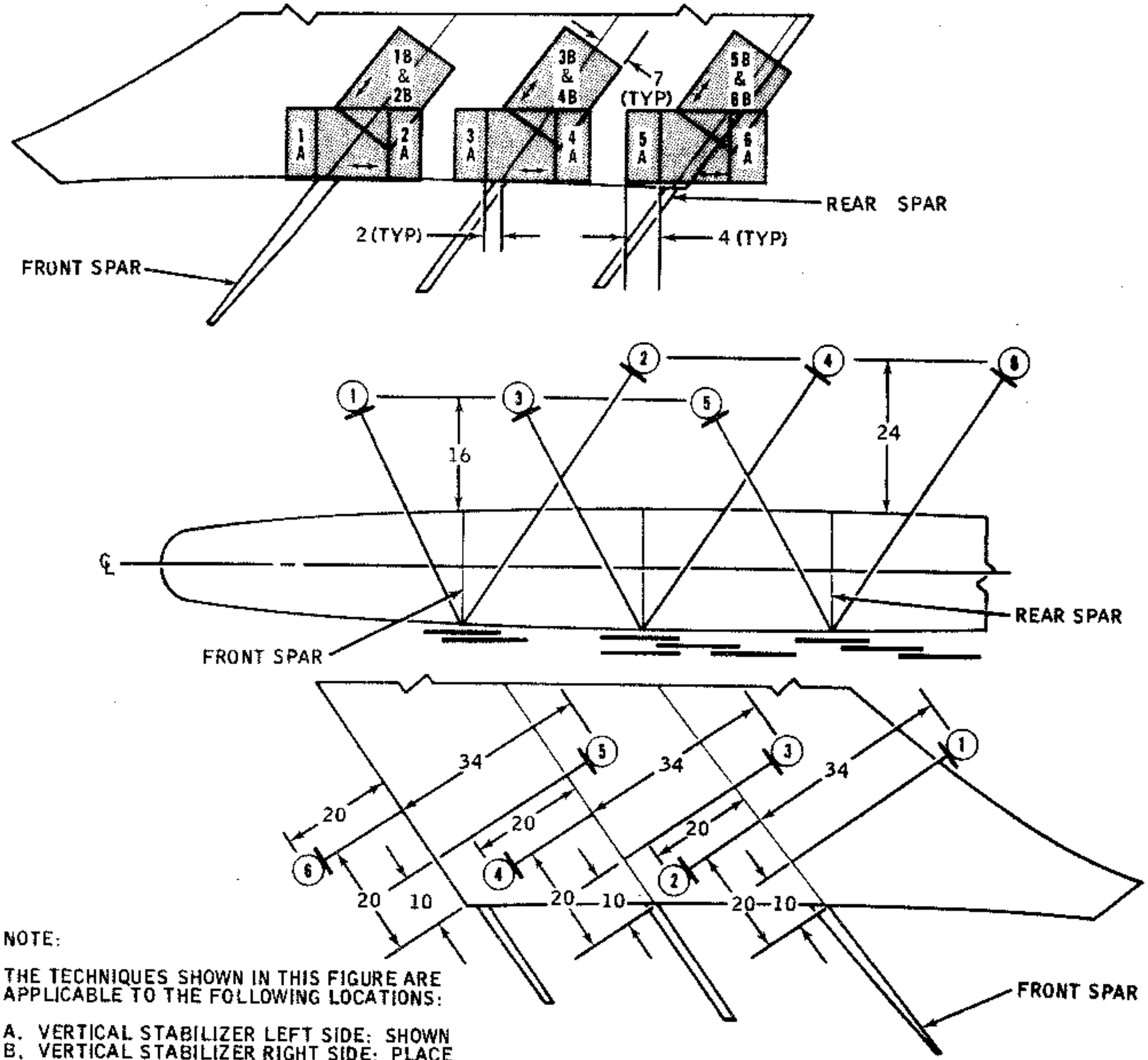


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	LEADING EDGE FORMERS					
10A	STA ZFS 90 THRU 120	120	300	52	II	14x17
B					II	14x17
C					II	14x17
11	STA ZFS 124 & 130	120	300	52	II	14x17
12	STA ZFS 136 & 142	120	300	52	II	14x17
13	STA ZFS 148	120	300	52	II	14x17

RADIOGRAPHIC DATA

BB12-32

Vertical Stabilizer Leading Edge Area
Figure 9 (Sheet 4)



NOTE:

THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

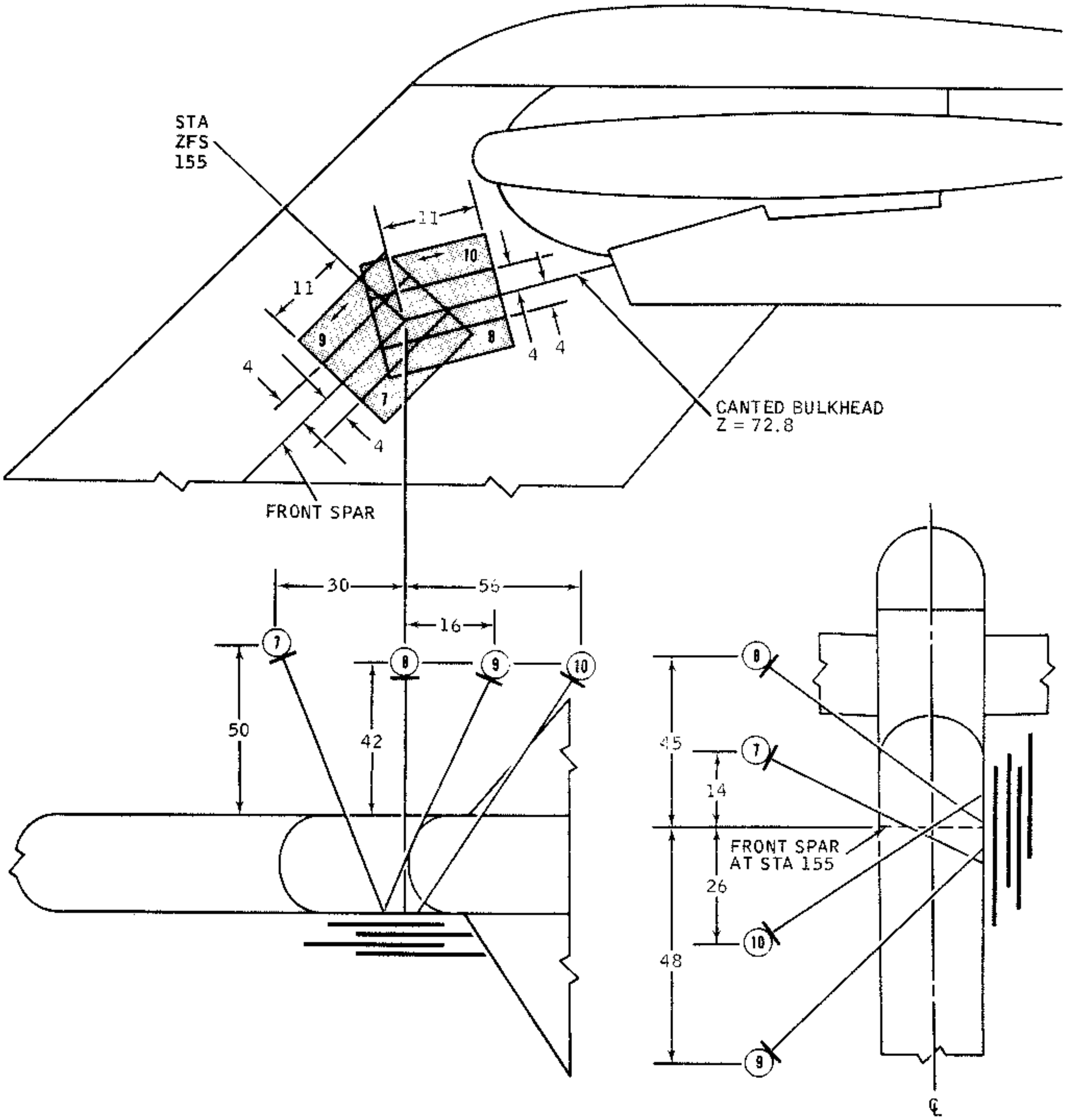
A. VERTICAL STABILIZER LEFT SIDE: SHOWN
B. VERTICAL STABILIZER RIGHT SIDE: PLACE FILM ON RIGHT SURFACE AND LOCATE X-RAY SOURCE TO LEFT.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	VERTICAL STABILIZER SPAR CAPS (JUST ABOVE FUSELAGE)					
1A	FRONT SPAR CAP	120	300	48	II & III	14 x 17
B					II & III	14 x 17
2A		120	300	48	II & III	14 x 17
B					II & III	14 x 17
3A	CENTER SPAR CAP	120	300	48	II & III	14 x 17
B					II & III	14 x 17
4A		120	300	48	II & III	14 x 17
B					II & III	14 x 17
5A	REAR SPAR CAP	120	300	48	II & III	14 x 17
B					II & III	14 x 17
6A		120	300	48	II & III	14 x 17
B					II & III	14 x 17

RADIOGRAPHIC DATA

BB12-21

Vertical Stabilizer Spars and Adjacent Area
Figure 10 (Sheet 1)

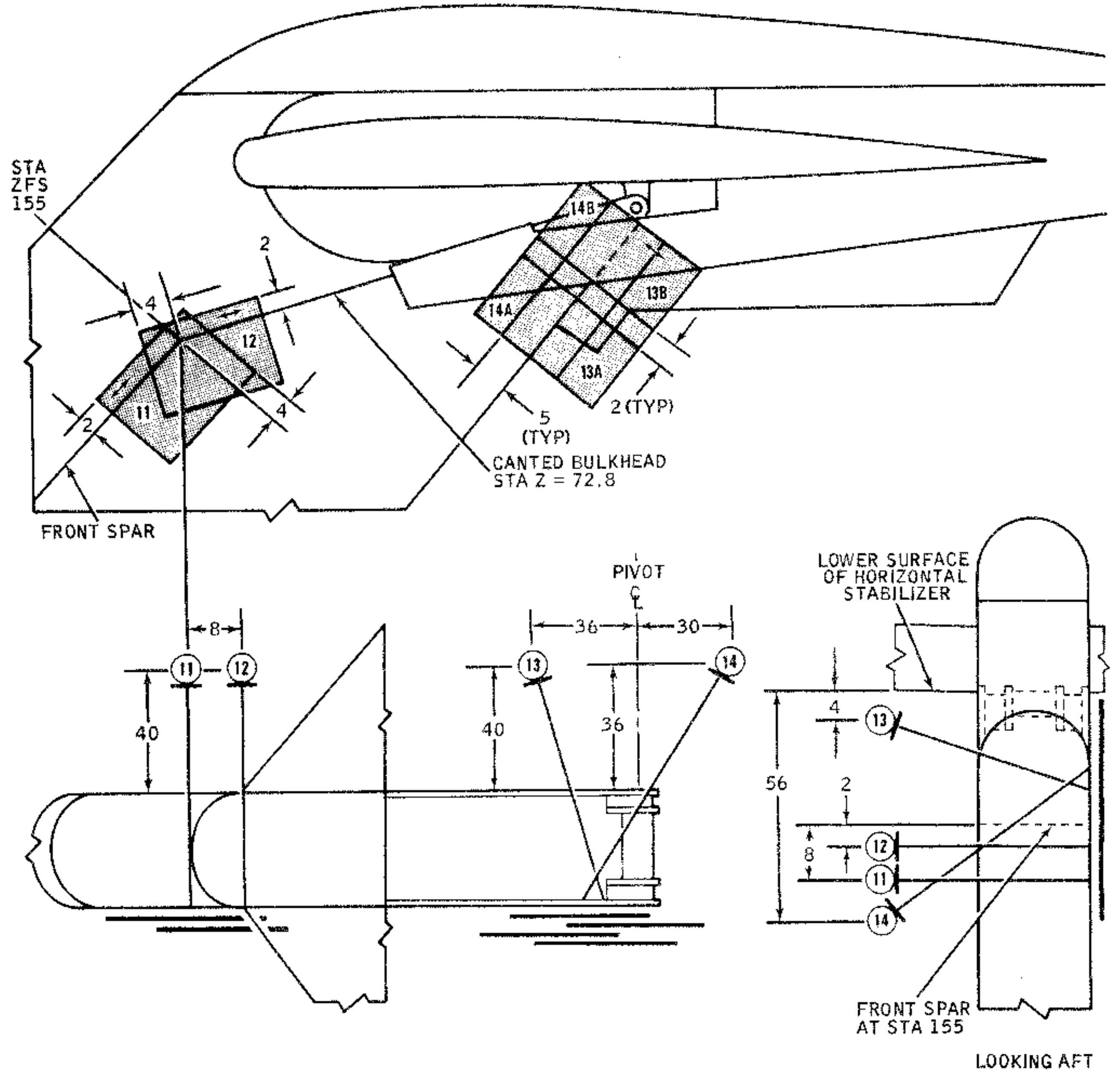


EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
7	FRONT SPAR CAP & WEB AT CANTED BULKHEAD Z = 72.8	130	600	72	II	14x17
8		130	600	72	II	14x17
9		130	600	72	II	14x17
10		130	600	72	II	14x17

RADIOGRAPHIC DATA

BB12-23A

Vertical Stabilizer Spars and Adjacent Area
Figure 10 (Sheet 2)



NOTE:

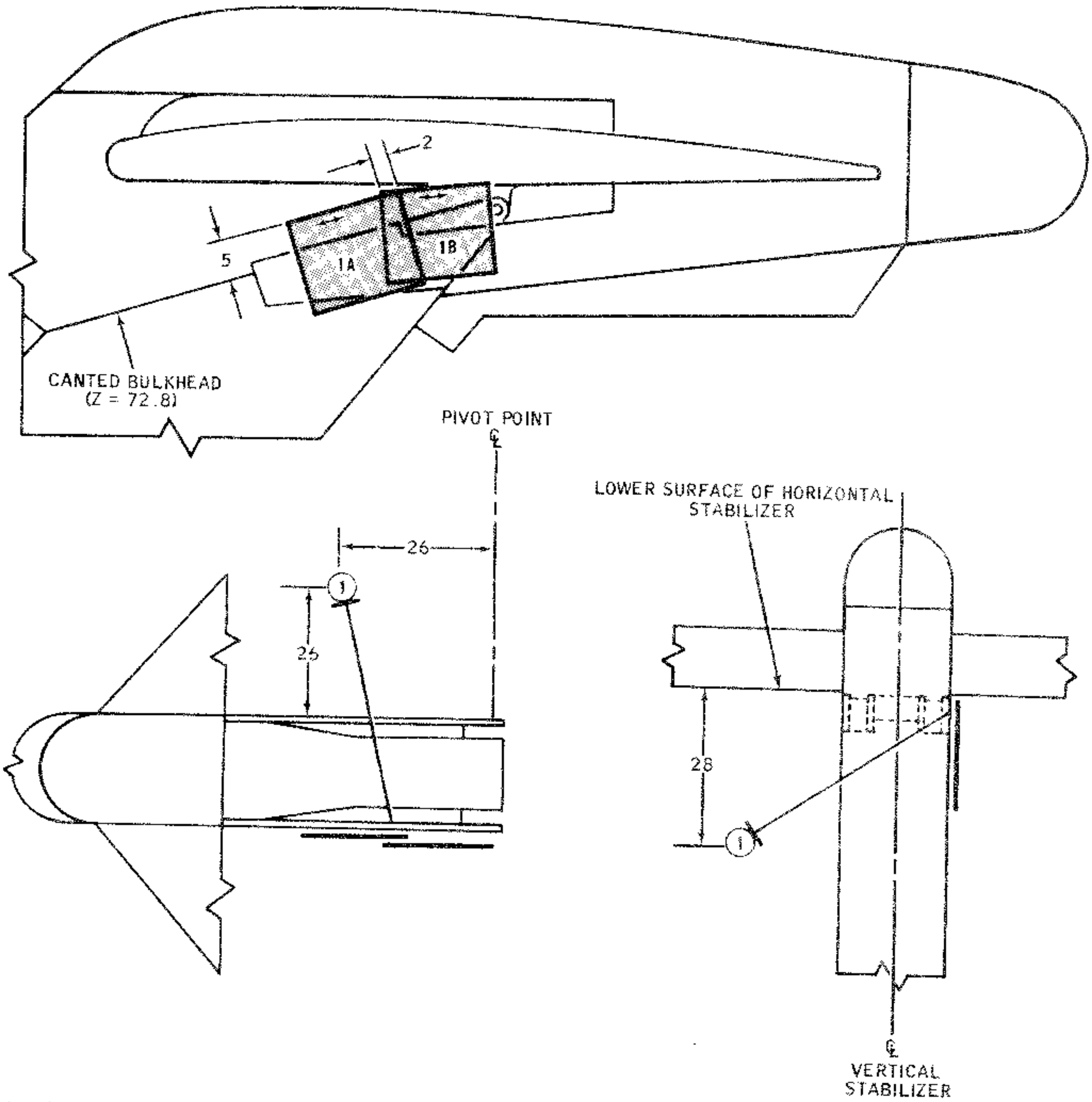
FILM 13B AND 14B AFT END BUTTED AGAINST PIVOT PIN.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
11	PLATING AT FRONT SPAR AND CANTED BULKHEAD Z = 72.8	110	300	60	II	14x17
12		110	300	60	II	14x17
13A	REAR SPAR BELOW HORIZONTAL STABILIZER PIVOT POINT	130	600	60	II & III	14x17
B					II & III	14x17
14A		130	600	60	II & III	14x17
B					II & III	14x17

RADIOGRAPHIC DATA

BB12-43

Vertical Stabilizer Spars and Adjacent Area
Figure 10 (Sheet 3)



NOTES:

1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

   A. VERTICAL STABILIZER LEFT SIDE: SHOWN
   B. VERTICAL STABILIZER RIGHT SIDE: OPPOSITE

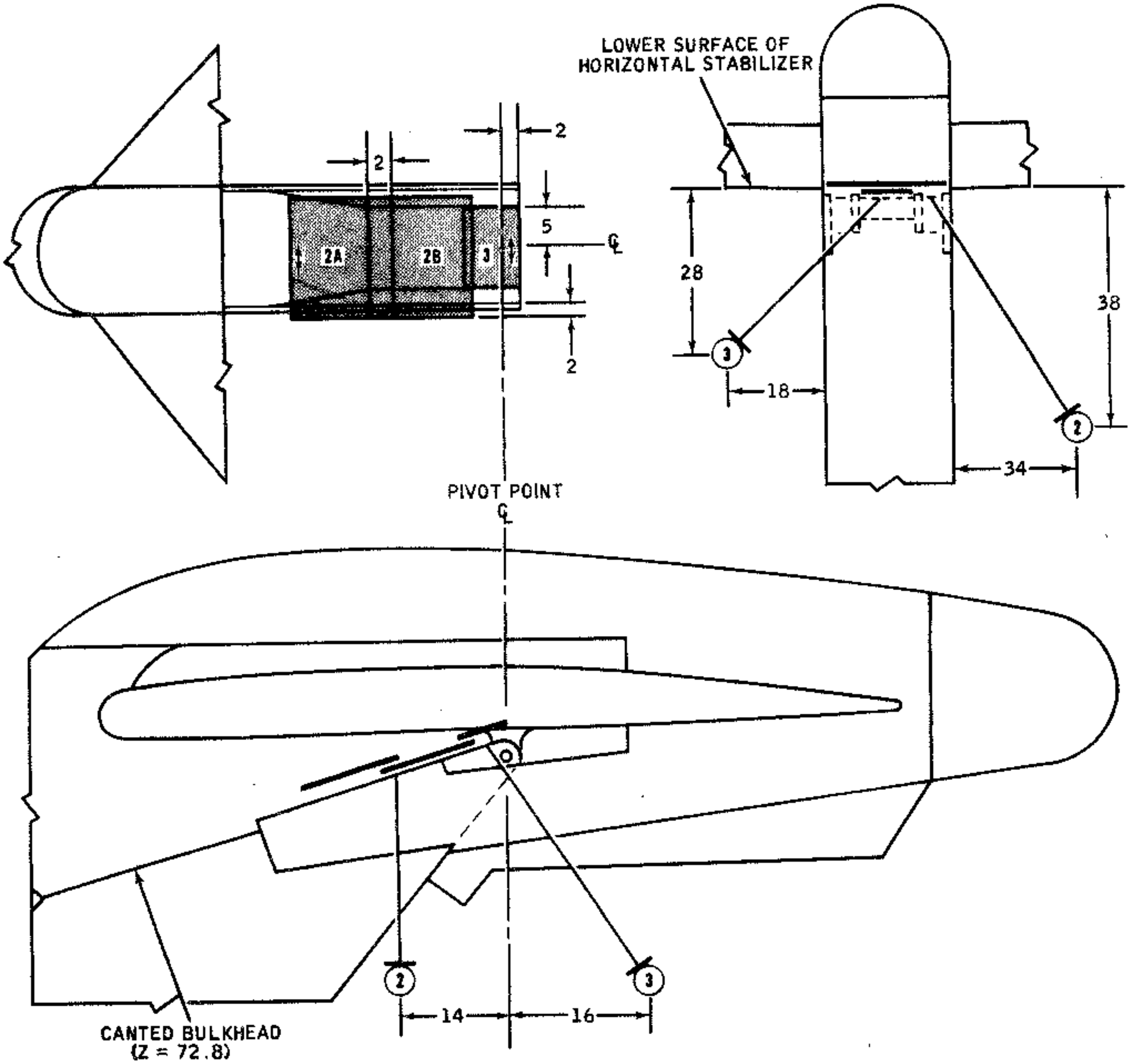
2. SEE EXPOSURE 2 ON SHEET 2 TO COMPLETE X-RAY OF BULKHEAD CAP ANGLES

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 A	BULKHEAD CAP ANGLES NEAR PIVOT POINT	130	600	50	II & III	14x17
B					II & III	14x17

RADIOGRAPHIC DATA

8812-44

Vertical Stabilizer Canted Bulkhead (Station Z = 72.8)
Figure 11 (Sheet 1)



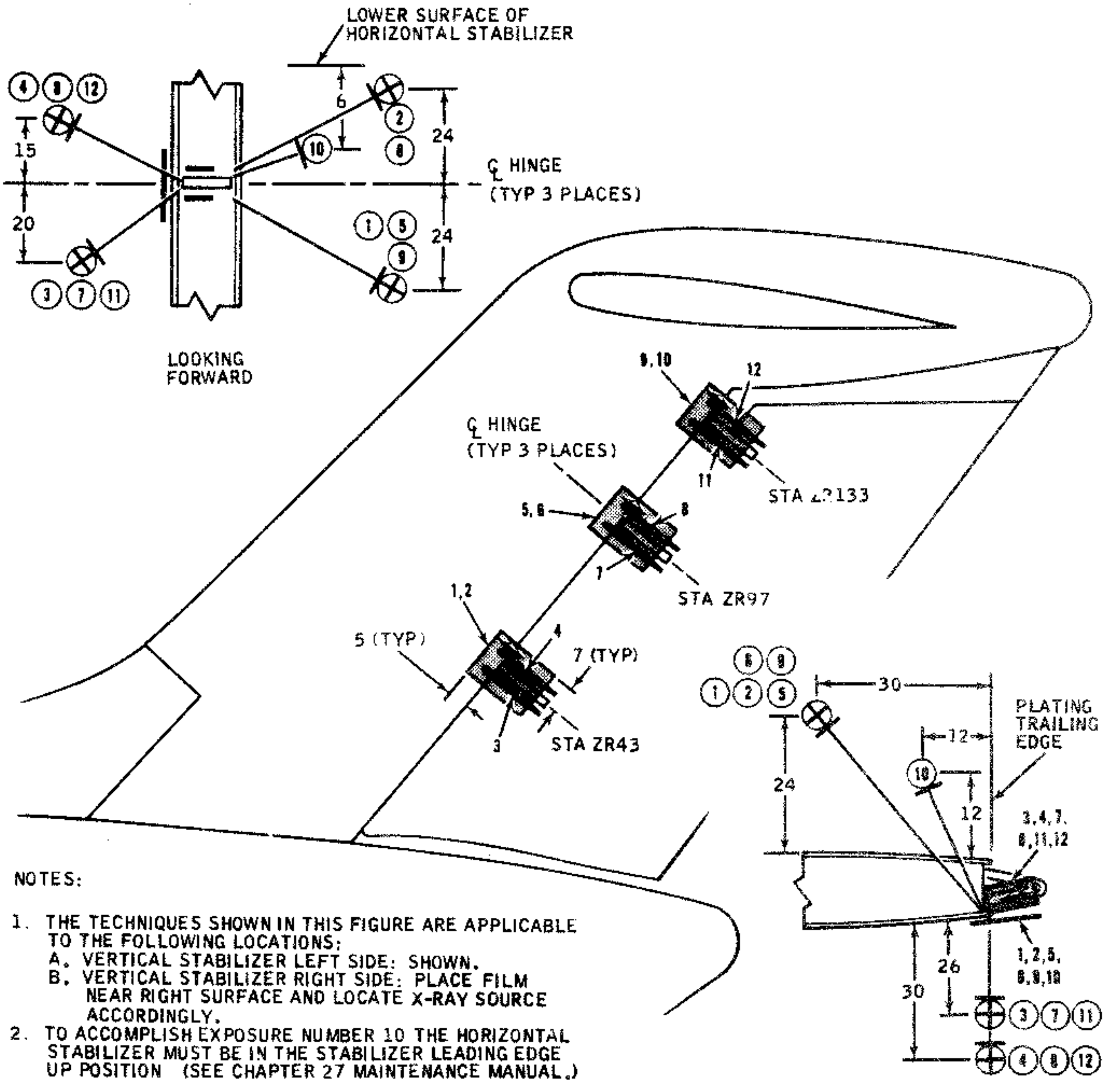
NOTE:
SEE EXPOSURE 1 ON SHEET 1 TO COMPLETE X-RAY OF BULKHEAD CAP ANGLES

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
2 A B	BULKHEAD CAP ANGLES NEAR PIVOT POINT	125	600	48	II & III II & III	14 x 17 14 x 17
3	BULKHEAD WEB NEAR PIVOT POINT	110	300	40	II	8 x 10

RADIOGRAPHIC DATA

BB12-45

Vertical Stabilizer Canted Bulkhead (Station Z = 72.8)
Figure 11 (Sheet 2)



NOTES:

1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. VERTICAL STABILIZER LEFT SIDE: SHOWN.
   B. VERTICAL STABILIZER RIGHT SIDE: PLACE FILM NEAR RIGHT SURFACE AND LOCATE X-RAY SOURCE ACCORDINGLY.
2. TO ACCOMPLISH EXPOSURE NUMBER 10 THE HORIZONTAL STABILIZER MUST BE IN THE STABILIZER LEADING EDGE UP POSITION (SEE CHAPTER 27 MAINTENANCE MANUAL.)

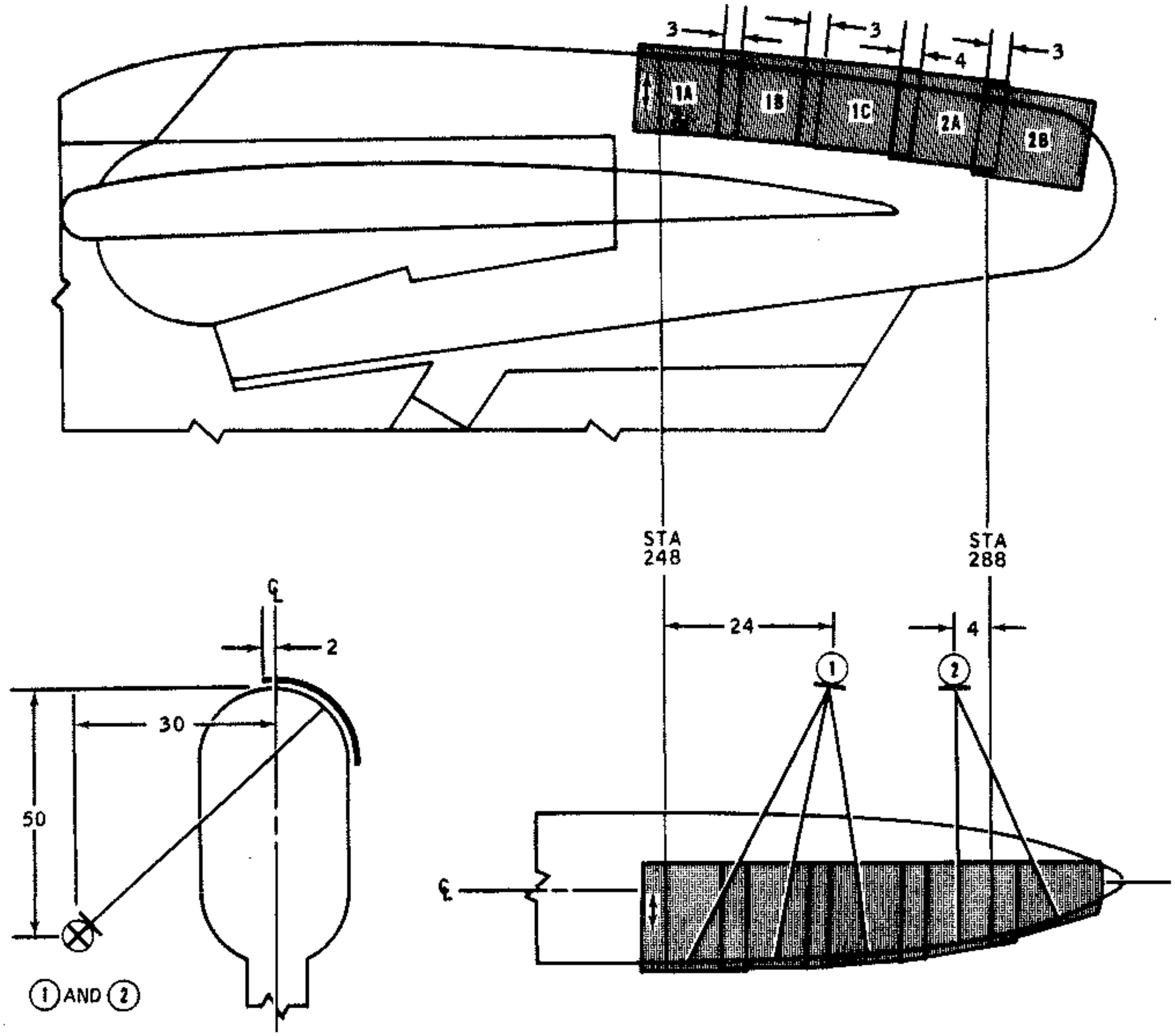
Printed in U.S.A.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	RUDDER HINGE BRACKETS					
1	STA ZR43	120	450	55	II & III	14 x 17
2		120	450	55	II & III	14 x 17
3		105	300	36	II	3 1/2 x 17
4		105	300	36	II	3 1/2 x 17
5	STA ZR97	120	450	55	II & III	14 x 17
6		120	450	55	II & III	14 x 17
7		105	300	36	II	3 1/2 x 17
8		105	300	36	II	3 1/2 x 17
9	STA ZR133	120	450	55	II & III	14 x 17
10		105	300	30	II & III	14 x 17
11		105	300	36	II	3 1/2 x 17
12		105	300	36	II	3 1/2 x 17

RADIOGRAPHIC DATA

BB12-3

Vertical Stabilizer Rudder Hinge Brackets
Figure 12



NOTE:

THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:

A. VERTICAL STABILIZER TIP FAIRING LEFT SIDE: SHOWN
B. VERTICAL STABILIZER TIP FAIRING RIGHT SIDE: PLACE FILM ON RIGHT SURFACE AND LOCATE X-RAY SOURCE TO LEFT

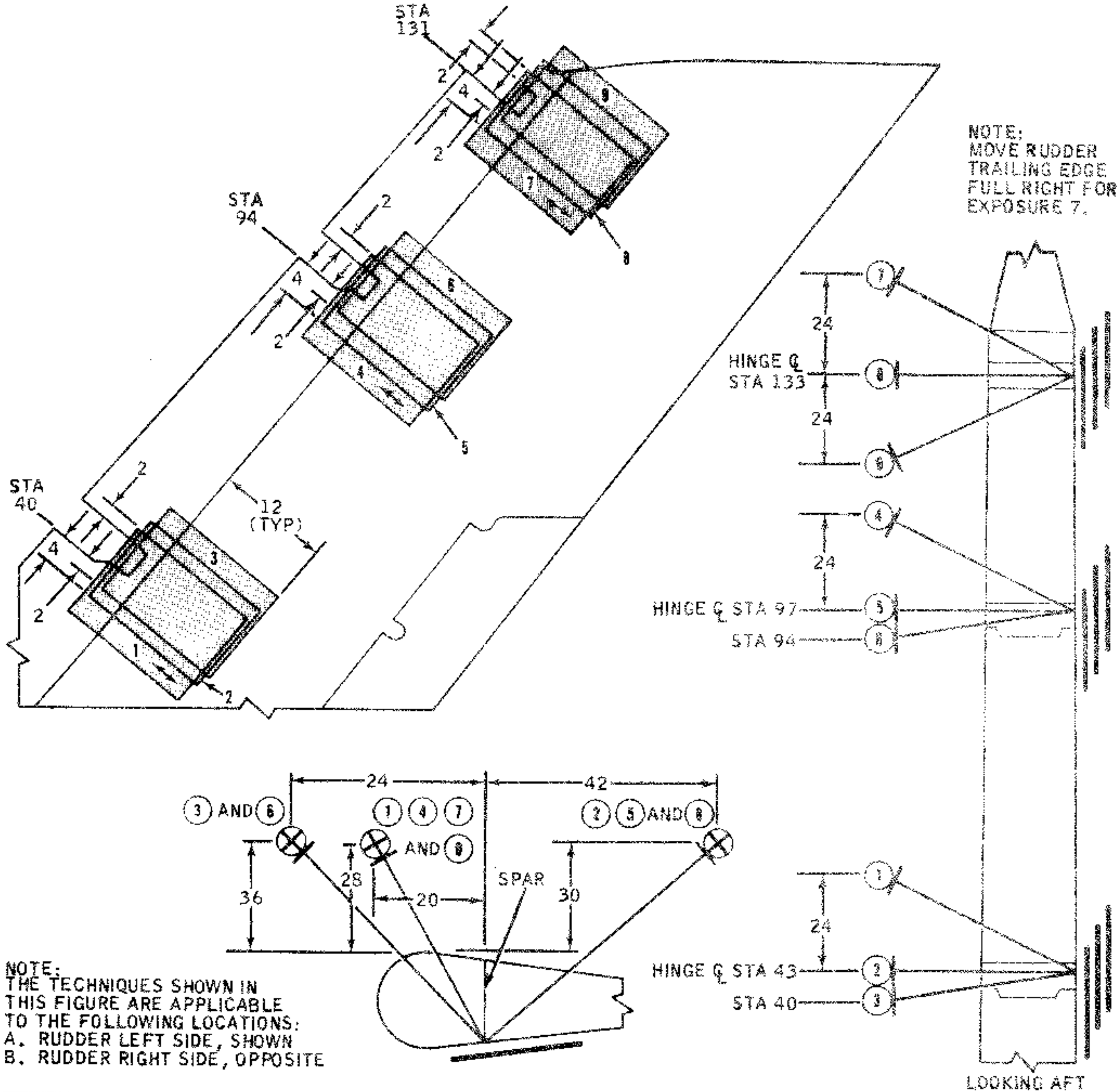
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	REMOVABLE TIP FAIRING					
1A	STA YV248 TO YV280	100	300	63	II	14 x 17
B					II	14 x 17
C					II	14 x 17
2A	STA YV280 TO YV296	100	300	63	II	14 x 17
B					II	14 x 17

RADIOGRAPHIC DATA

BB12-33

Vertical Stabilizer Tip Fairing
Figure 13

Printed in U.S.A.



NOTE:
MOVE RUDDER TRAILING EDGE FULL RIGHT FOR EXPOSURE 7.

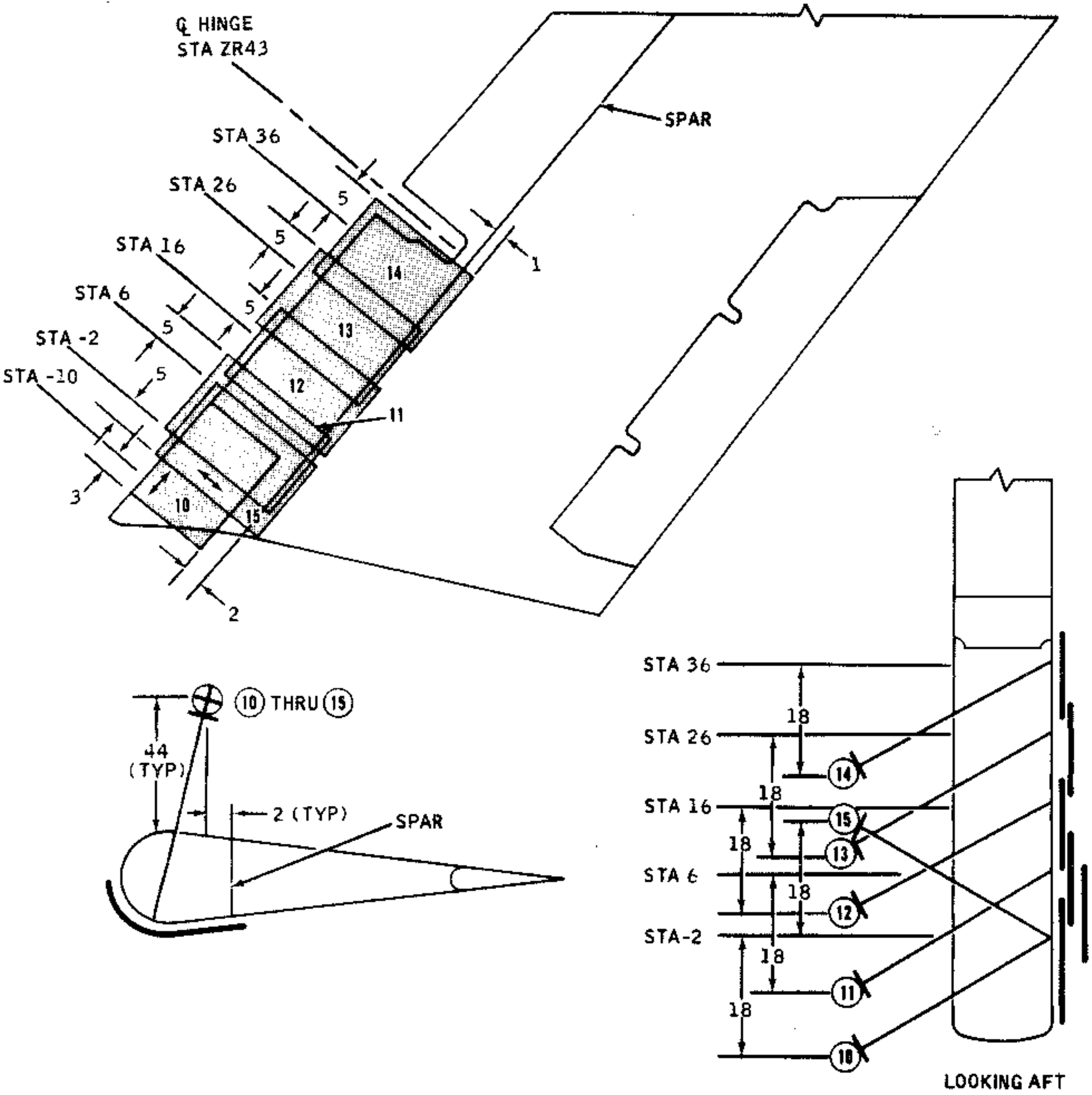
NOTE:
THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
A. RUDDER LEFT SIDE, SHOWN
B. RUDDER RIGHT SIDE, OPPOSITE

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	RUDDER HINGE WELL AREAS					
1	STA ZR43	110	450	54	II & III	14 x 17
2		110	300	54	II	14 x 17
3		110	450	54	II & III	14 x 17
4	STA ZR97	110	450	54	II & III	14 x 17
5		110	300	54	II	14 x 17
6		110	450	54	II & III	14 x 17
7	STA ZR133	110	450	54	II & III	14 x 17
8		110	300	54	II	14 x 17
9		110	450	54	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-29

Rudder Nose Cap Area
Figure 14 (Sheet 1)



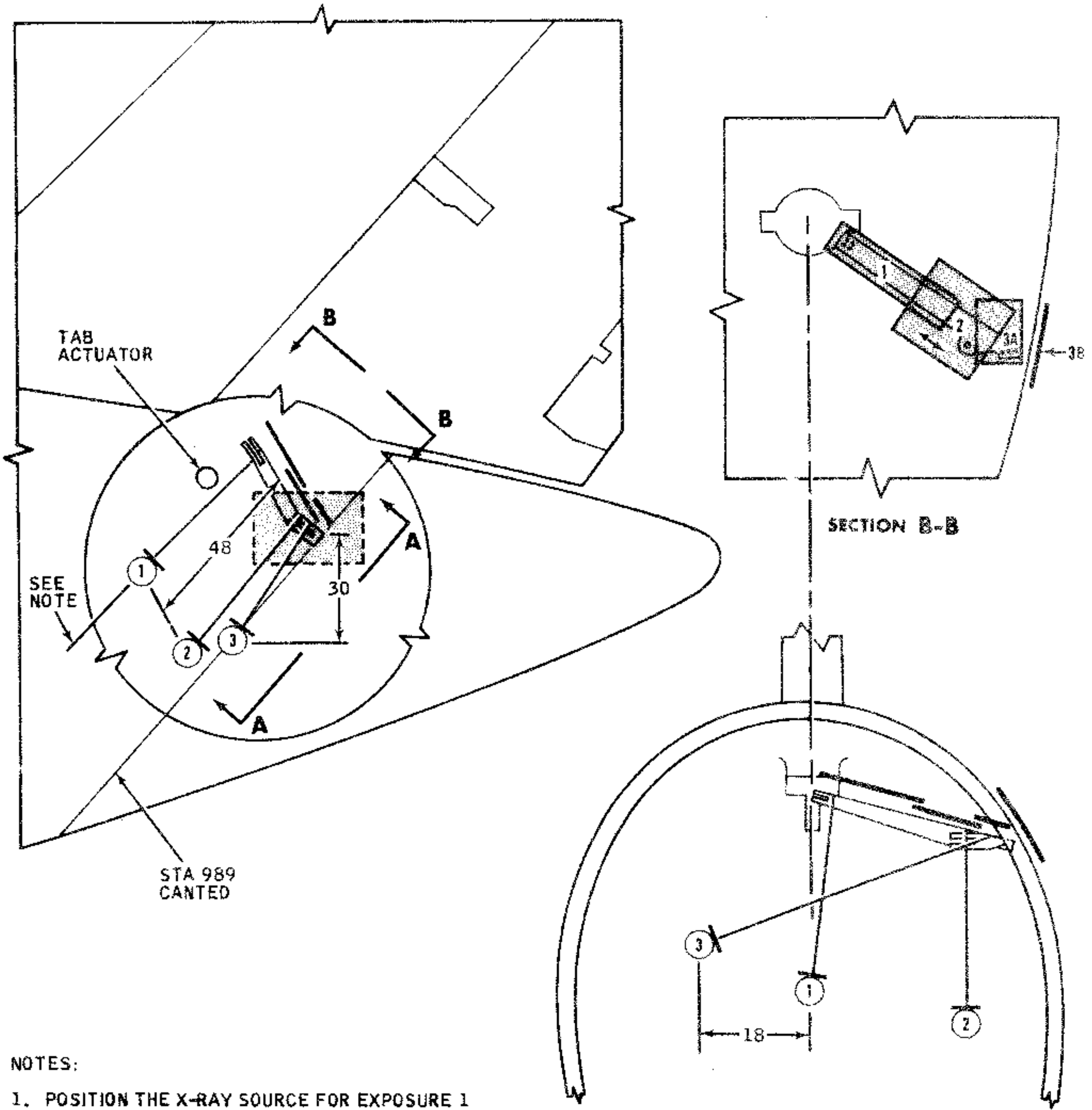
Printed in U.S.A.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	NOSE FORMERS					
10	STA ZR-10 TO ZR-2	105	300	60	II	14 x 17
11	STA ZR-2 TO ZR+6	105	300	60	II	14 x 17
12	STA ZR11 TO ZR16	105	300	60	II	14 x 17
13	STA ZR21 TO ZR26	105	300	60	II	14 x 17
14	STA ZR31 TO ZR40	105	300	60	II	14 x 17
15	STA ZR6 TO ZR-2	105	300	60	II	14 x 17

RADIOGRAPHIC DATA

BB12-4

Rudder Nose Cap Area
Figure 14 (Sheet 2)



NOTES:

1. POSITION THE X-RAY SOURCE FOR EXPOSURE 1 ON FUSELAGE CENTERLINE, BELOW AND FORWARD OF POINT OF INTEREST TO ALLOW X-RAY BEAM TO PASS BETWEEN RUDDER TRIM ACTUATOR AND RUDDER ACTUATOR CYLINDER.

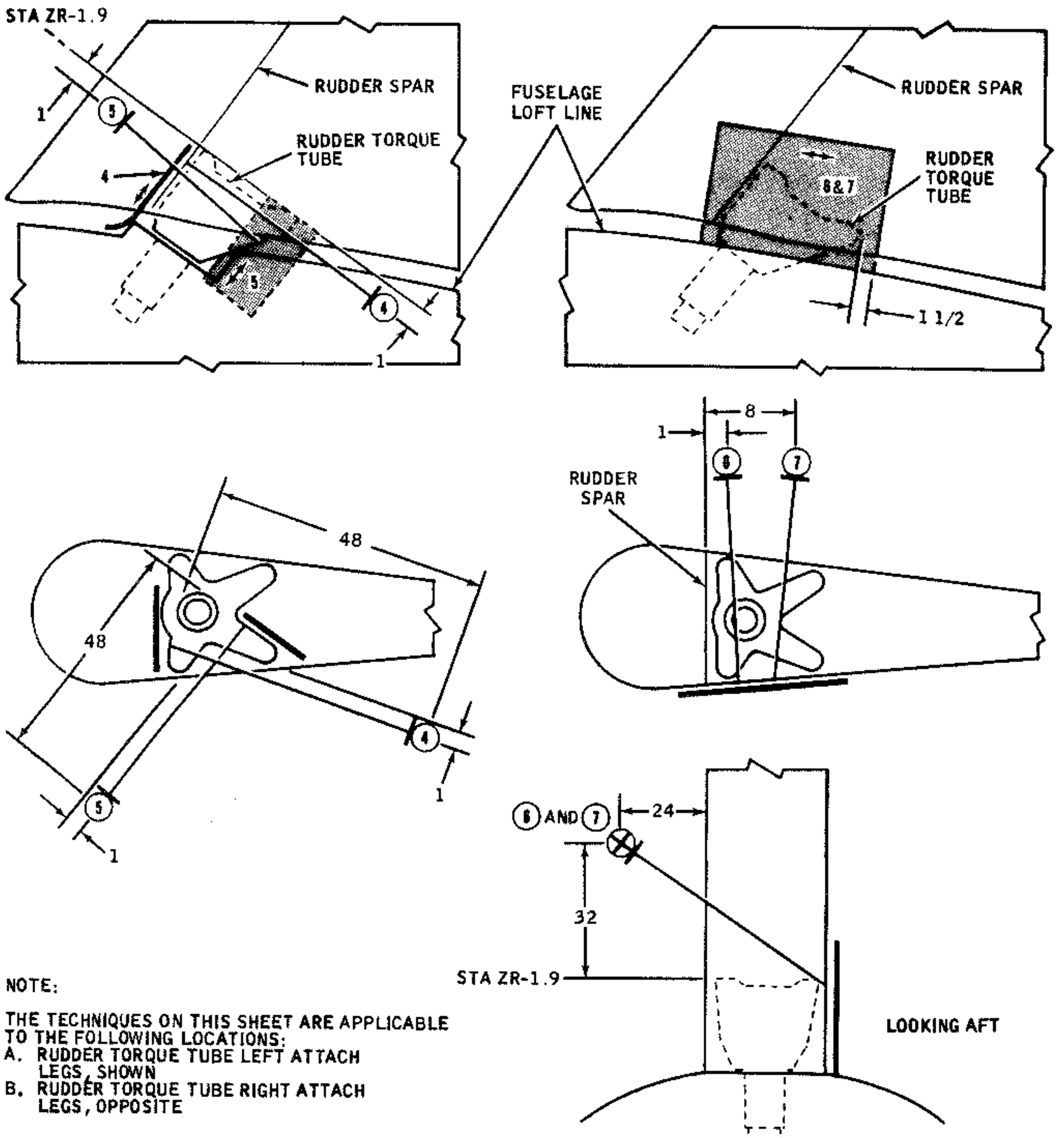
2. RUDDER ACTUATOR CYLINDER MUST BE REMOVED TO ACCOMPLISH EXPOSURE 2.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	RUDDER ACTUATOR CYLINDER SUPPORT LINK	130	450	50	II	3 1/2 x 17
2		130	450	48	II	8 x 10
3A		130	450	54	II	5 x 7
3B					II	14 x 17

RADIOGRAPHIC DATA

BB12-37

Rudder Torque Tube and Actuator Support
Figure 15 (Sheet 1)



NOTE:

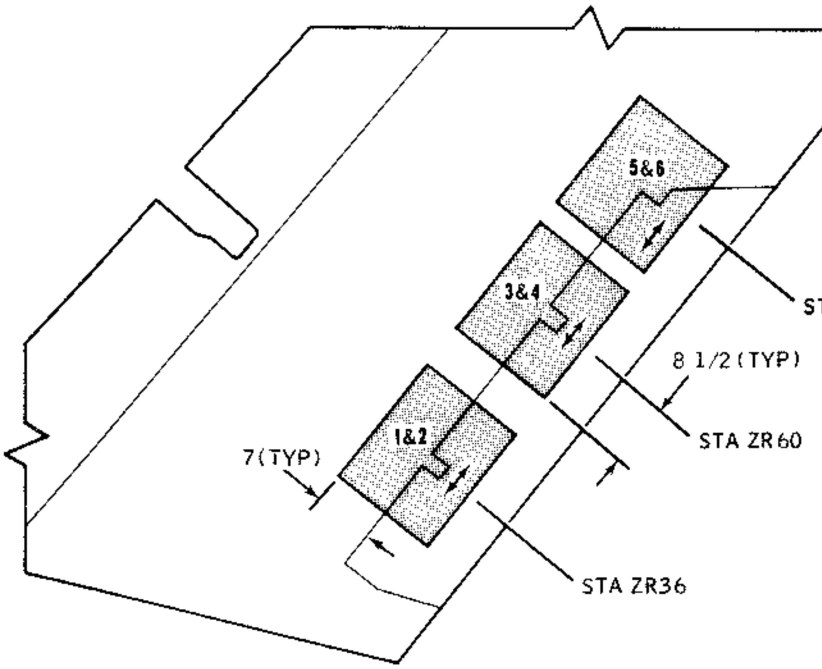
THE TECHNIQUES ON THIS SHEET ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
A. RUDDER TORQUE TUBE LEFT ATTACH LEGS, SHOWN
B. RUDDER TORQUE TUBE RIGHT ATTACH LEGS, OPPOSITE

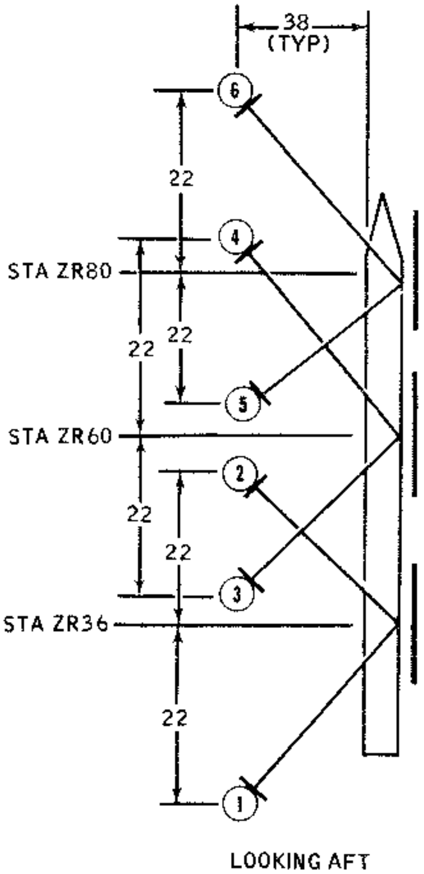
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
4	RUDDER TORQUE TUBE	130	300	48	II	8x10
5		130	300	48	II	8x10
6		130	450	48	II & III	14x17
7		130	450	48	II & III	14x17

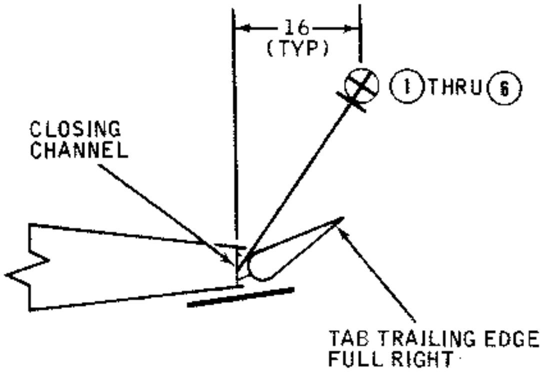
RADIOGRAPHIC DATA

BB12-26

Rudder Torque Tube and Actuator Support
Figure 15 (Sheet 2)







NOTES:

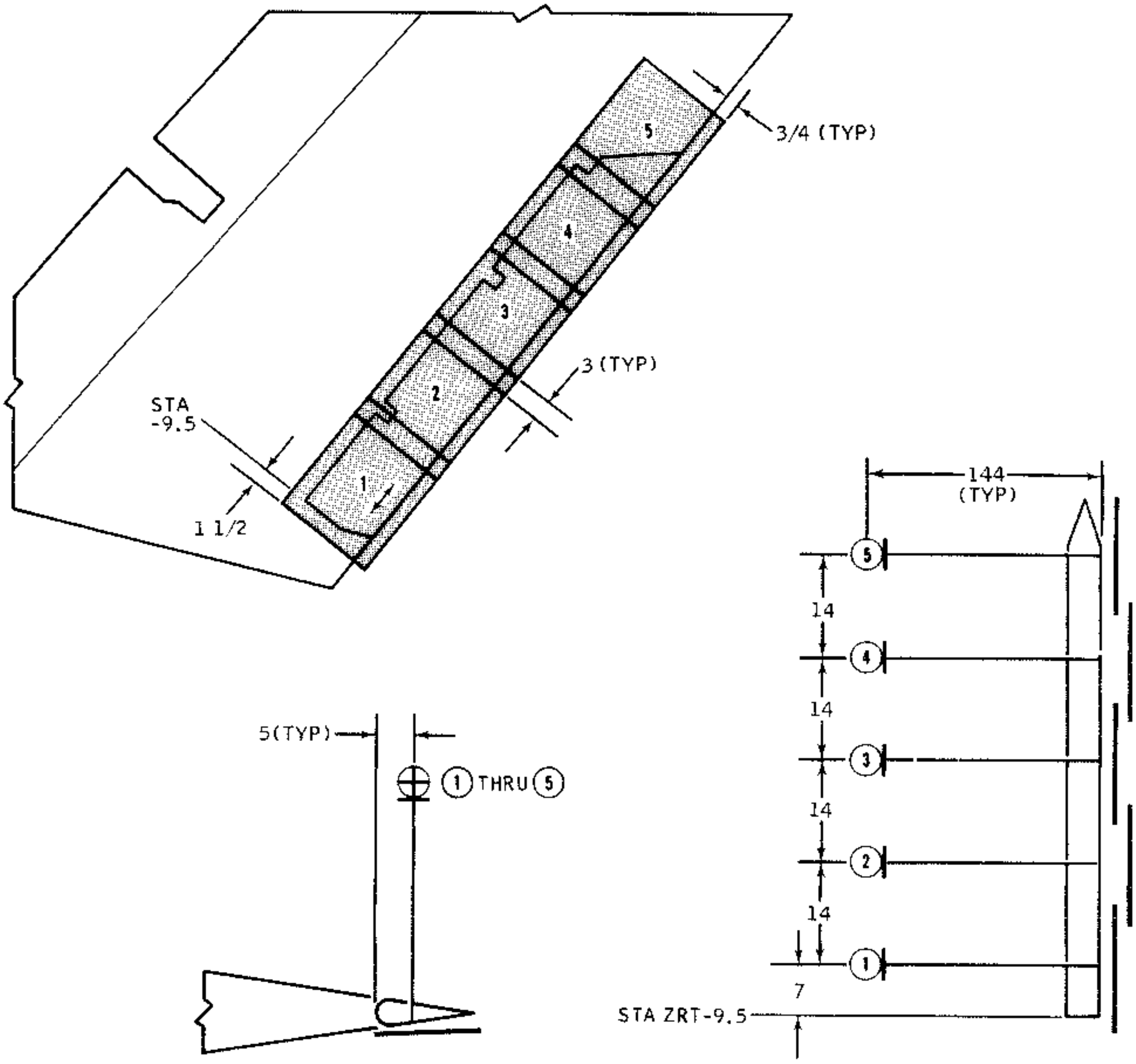
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. RUDDER TAB LEFT SIDE, SHOWN
   B. RUDDER TAB RIGHT SIDE, OPPOSITE
2. THIS RADIOGRAPHIC INSPECTION TECHNIQUE DOES NOT PROVIDE COVERAGE OF THE PIVOT AREAS OF THE RUDDER-TO-TAB HINGE FITTINGS. REMOVAL OF TAB AND INSPECTION USING DYE PENETRANTS IS RECOMMENDED FOR HINGE PIVOT AREAS.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	HINGE FITTINGS					
1	STA ZR36	110	300	48	II	14 x 17
2		110	300	48	II	14 x 17
3	STA ZR60	110	300	48	II	14 x 17
4		110	300	48	II	14 x 17
5	STA ZR80	110	300	48	II	14 x 17
6		110	300	48	II	14 x 17

RADIOGRAPHIC DATA

BB12-28

Rudder Tab Hinge Fittings
Figure 16



EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	RUDDER TAB	120	200	144	II	14 x 17
2		120	200	144	II	14 x 17
3		120	200	144	II	14 x 17
4		120	200	144	II	14 x 17
5		120	200	144	II	14 x 17

RADIOGRAPHIC DATA

BB12-27

Rudder Tab for Water Absorption
Figure 17

CHAPTER 6

WINDOWS

Chapter 6

WINDOWS

1. General

A. Radiographic techniques for the window components are not currently presented. Areas around windows are presented in Chapter 3, Fuselage.

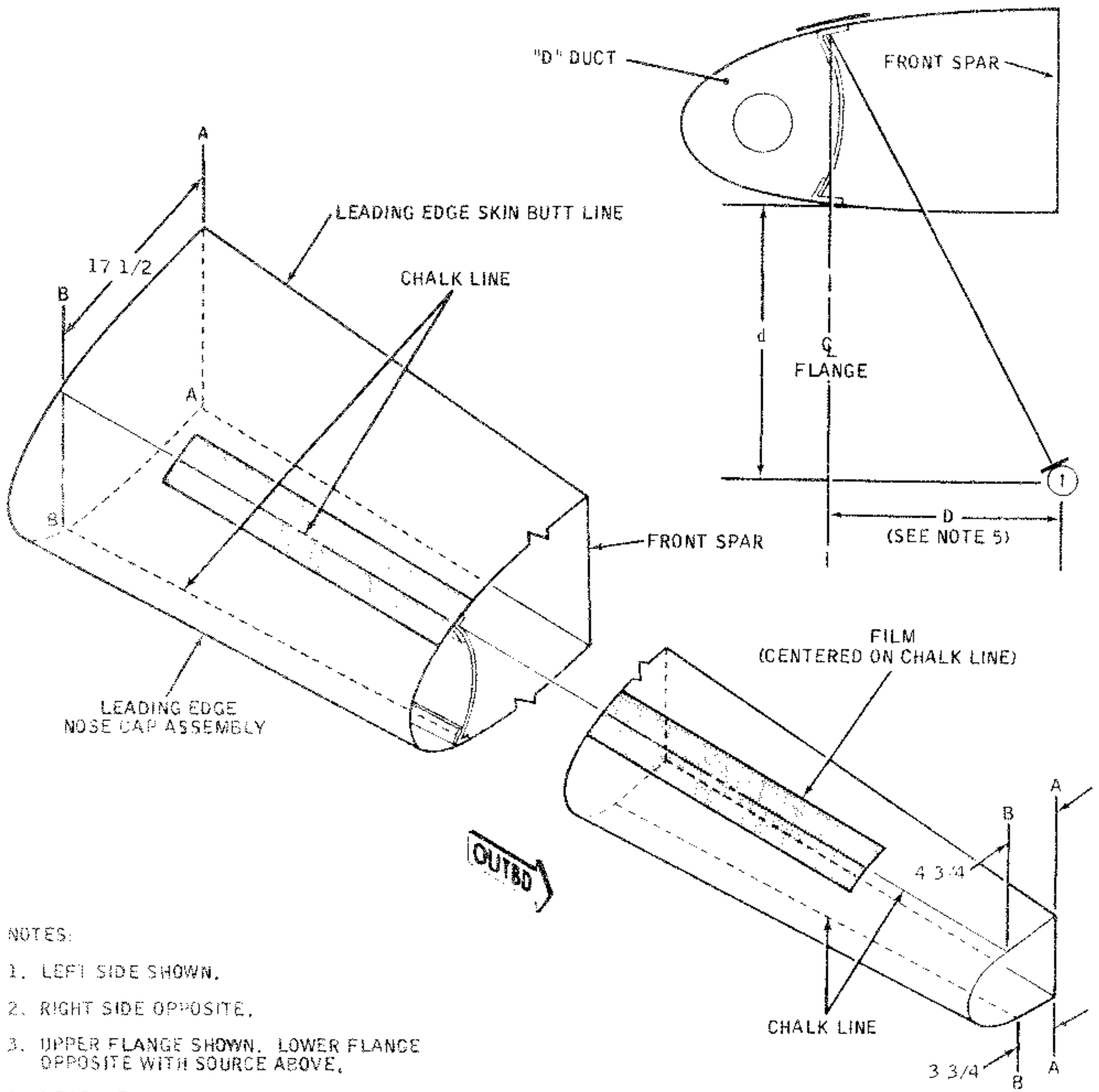
Printed in U.S.A.

CHAPTER 7

WINGS

CHAPTER 7

WINGS



NOTES:

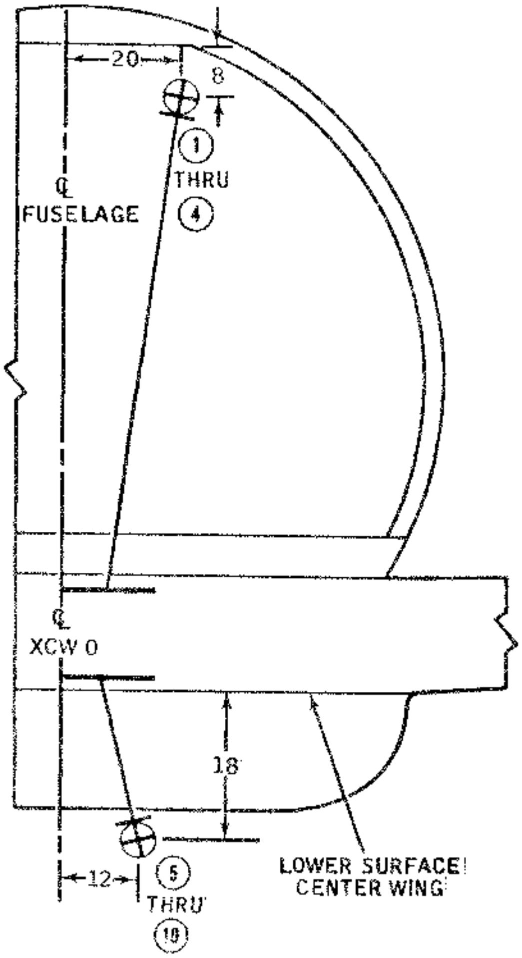
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. UPPER FLANGE SHOWN. LOWER FLANGE OPPOSITE WITH SOURCE ABOVE.
4. MEASURE BETWEEN POINTS A AND B AS SHOWN AND MARK CHALK LINE ON SURFACE TO LOCATE FLANGE.
5. D AND d MUST BE AT LEAST 24 INCHES.
   Dd - DISTANCE
   d = VERTICAL (PLUMB)
   D = HORIZONTAL (LEVEL)
   D = d
   AFTER CALCULATING LATERAL RADIATION SPREAD OF X-RAY TUBE, EXPOSE LENGTHS CONVENIENT TO LOCATION.
   USE FOLLOWING PARAMETER TO CALCULATE EXPOSURE.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	D-DUCT FLANGE	130	240	120	II & III	70 MM X LENGTH DESIRED

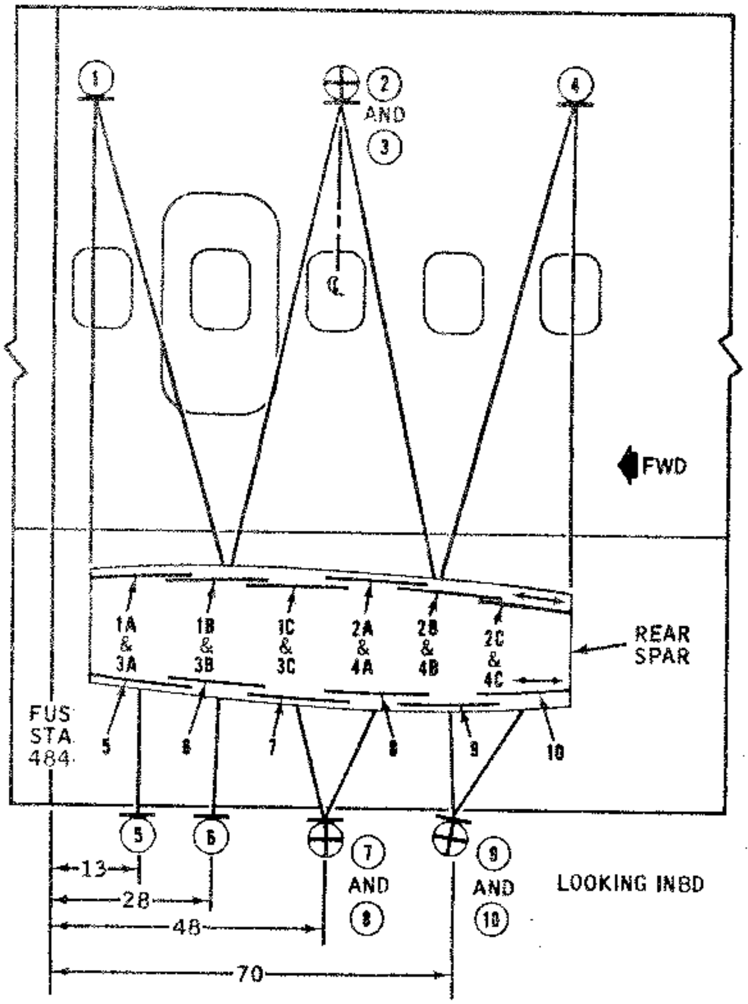
RADIOGRAPHIC DATA

8B12-117

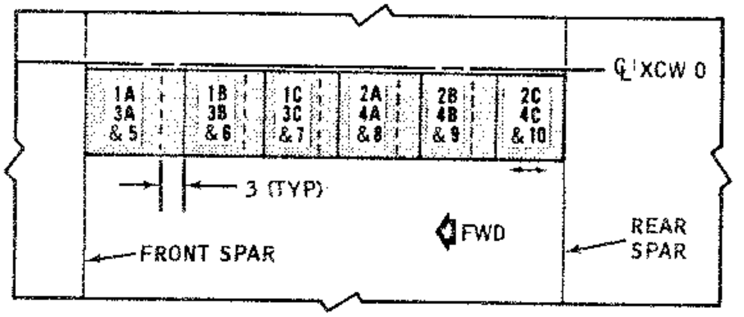
DC-9-10 Wing Leading Edge
Figure 1



LOOKING AFT



LOOKING INBD



LOOKING DOWN

NOTES:

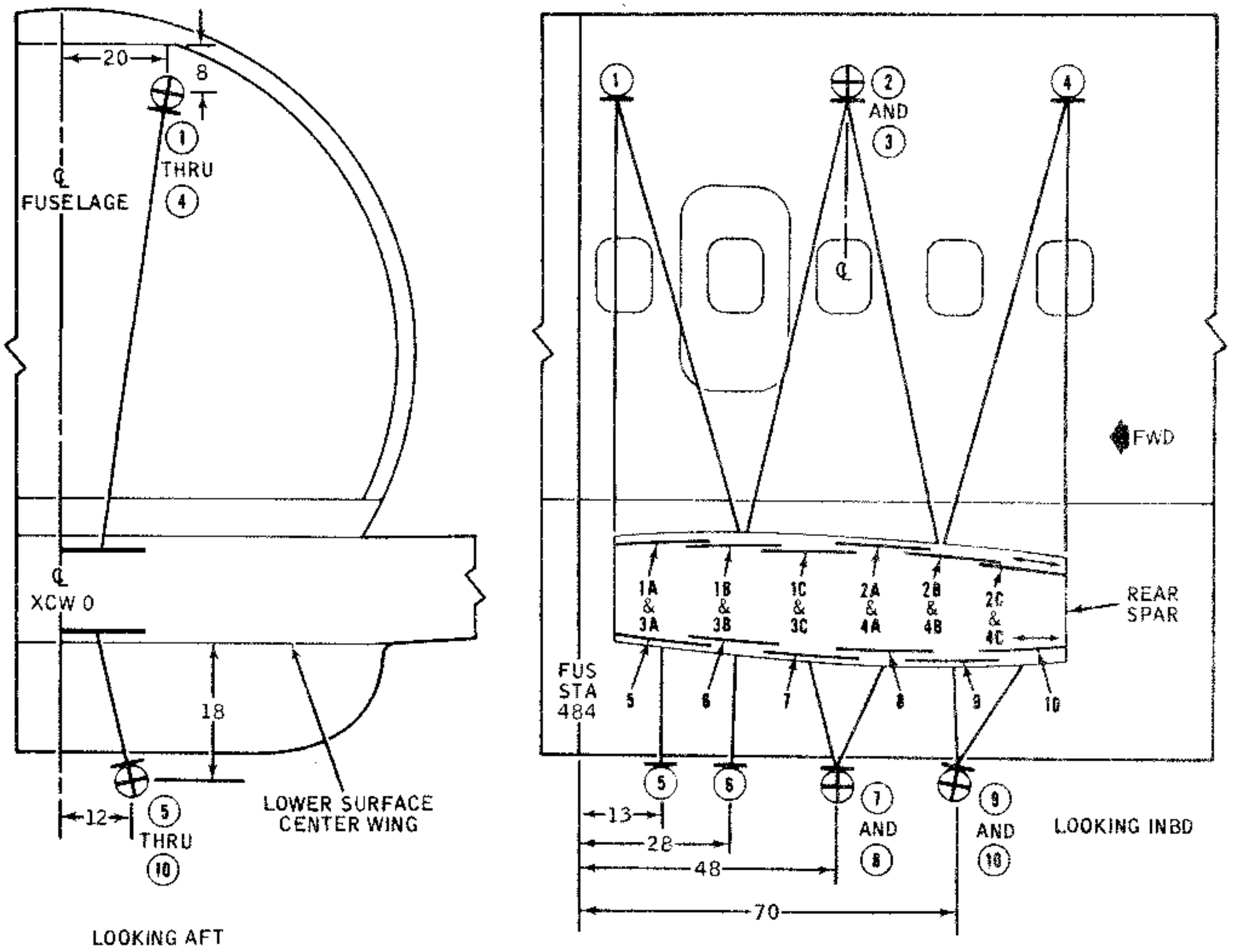
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	STATION XCW 0					
1 A, B & C THRU 4A, B & C	UPPER SPLICES AND WING SKIN JOINT	130	540	84	II & III	14 x 17
5 THRU 10	LOWER SPLICES AND WING SKIN JOINT	85	80	18	II & III	14 x 17

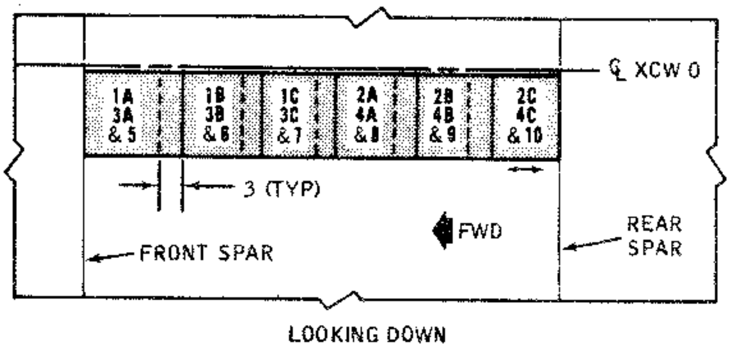
RADIOGRAPHIC DATA

BB12-123A

Wing Stringer Splices and Wing Skin Joints
Figure 2 (Sheet 1)



LOOKING INBD



LOOKING DOWN

NOTES:

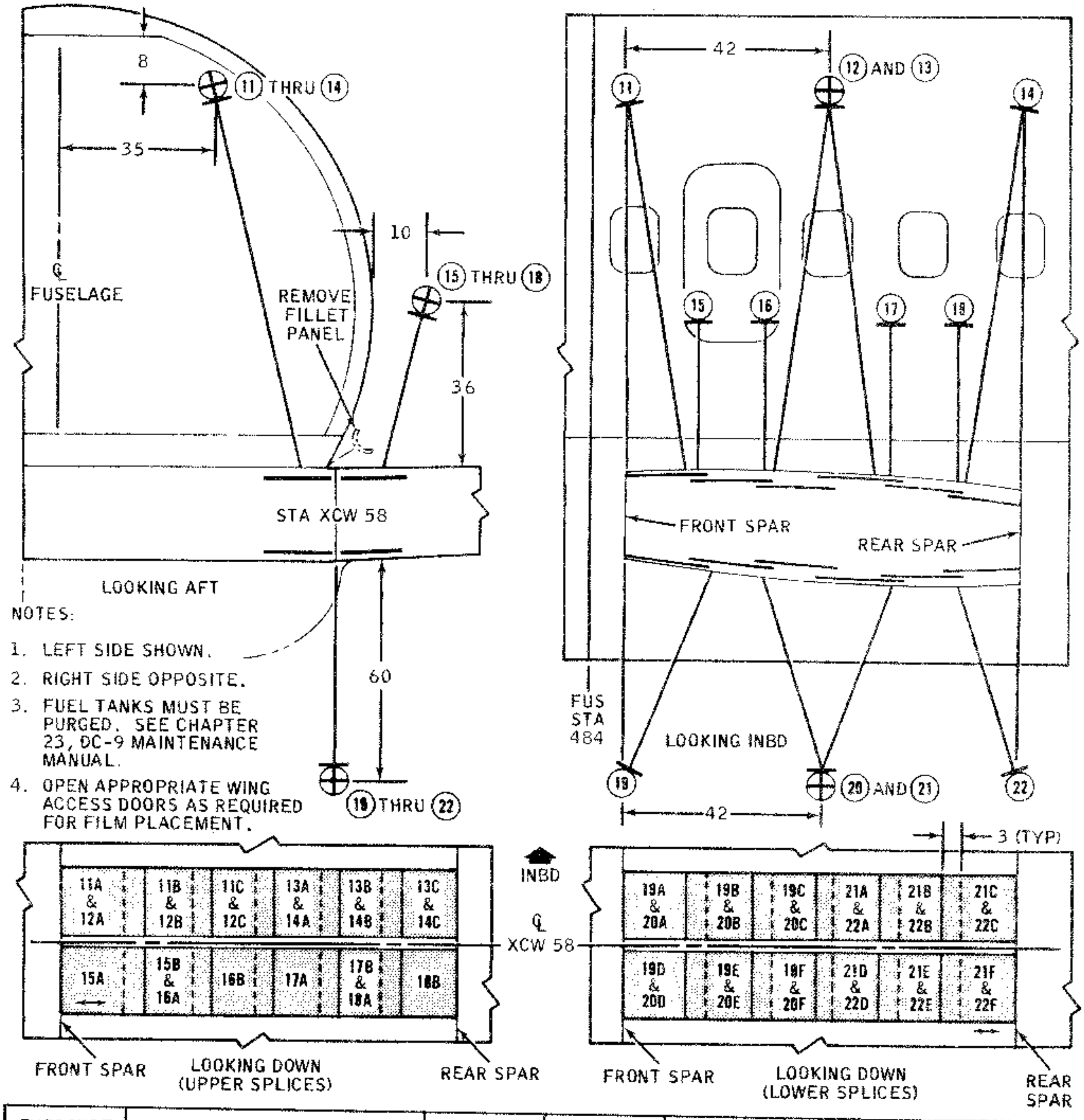
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1A, B & C THRU 4A, B & C	STATION XCW 0 UPPER SPLICES	130	540	84	II & III	14 x 17
5 THRU 10	LOWER SPLICES	85	80	18	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-123

Wing Stringer Splices
Figure 2 (Sheet 1)



NOTES:

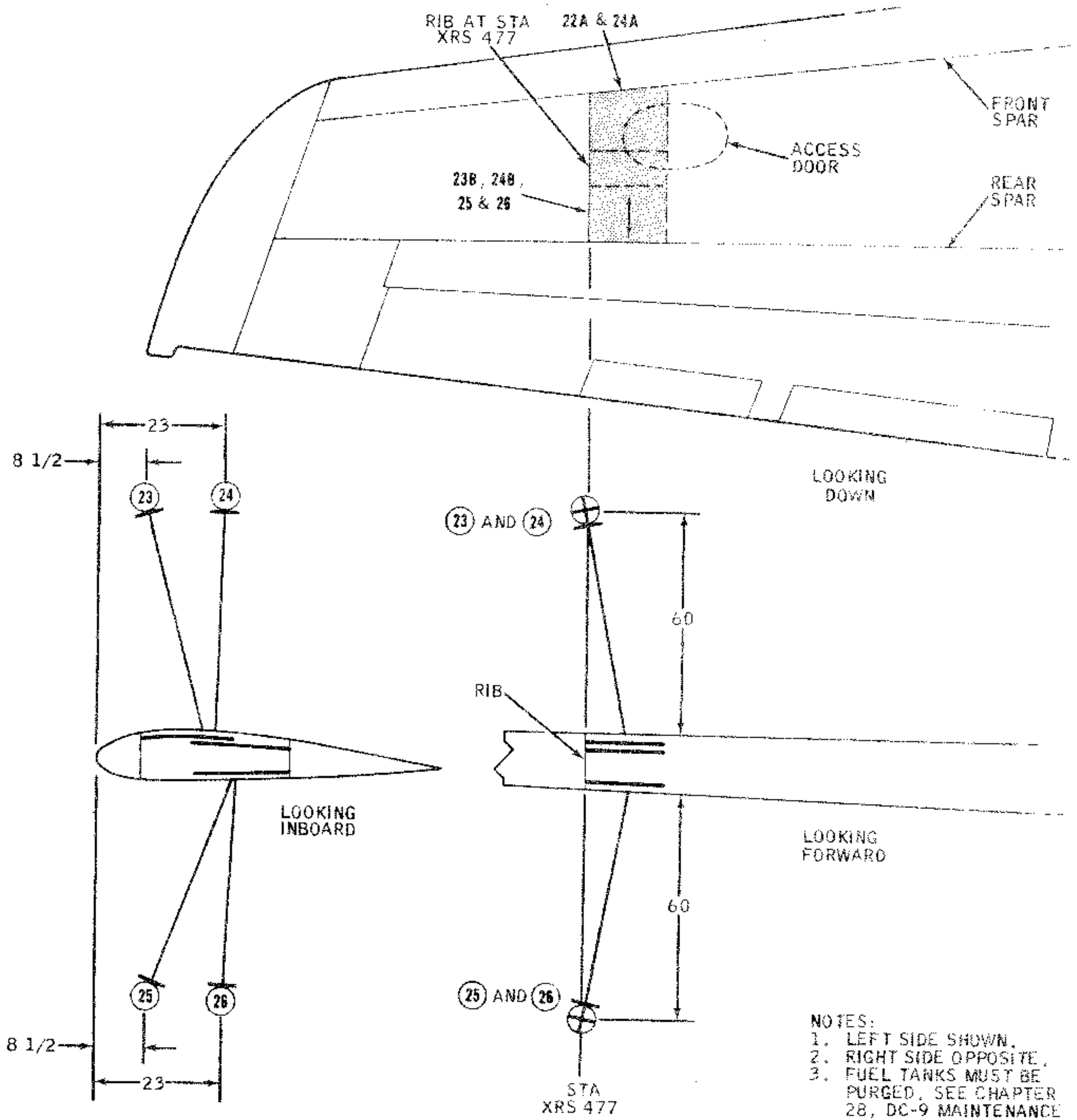
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 23, DC-9 MAINTENANCE MANUAL.
4. OPEN APPROPRIATE WING ACCESS DOORS AS REQUIRED FOR FILM PLACEMENT.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
11A, B, & C THRU 14A, B, & C	STATION XCW 58 UPPER SPLICES	130	600	84	II & III	14 x 17
15A & B THRU 18A & B		130	130	46	II & III	14 x 17
19A THRU F THRU 22A THRU F	LOWER SPLICES	130	245	60	II & III	14 x 17

RADIOGRAPHIC DATA

8B12-130

Wing Stringer Splices
Figure 2 (Sheet 2)



NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.
4. OPEN APPROPRIATE WING ACCESS DOOR TO PLACE FILM.

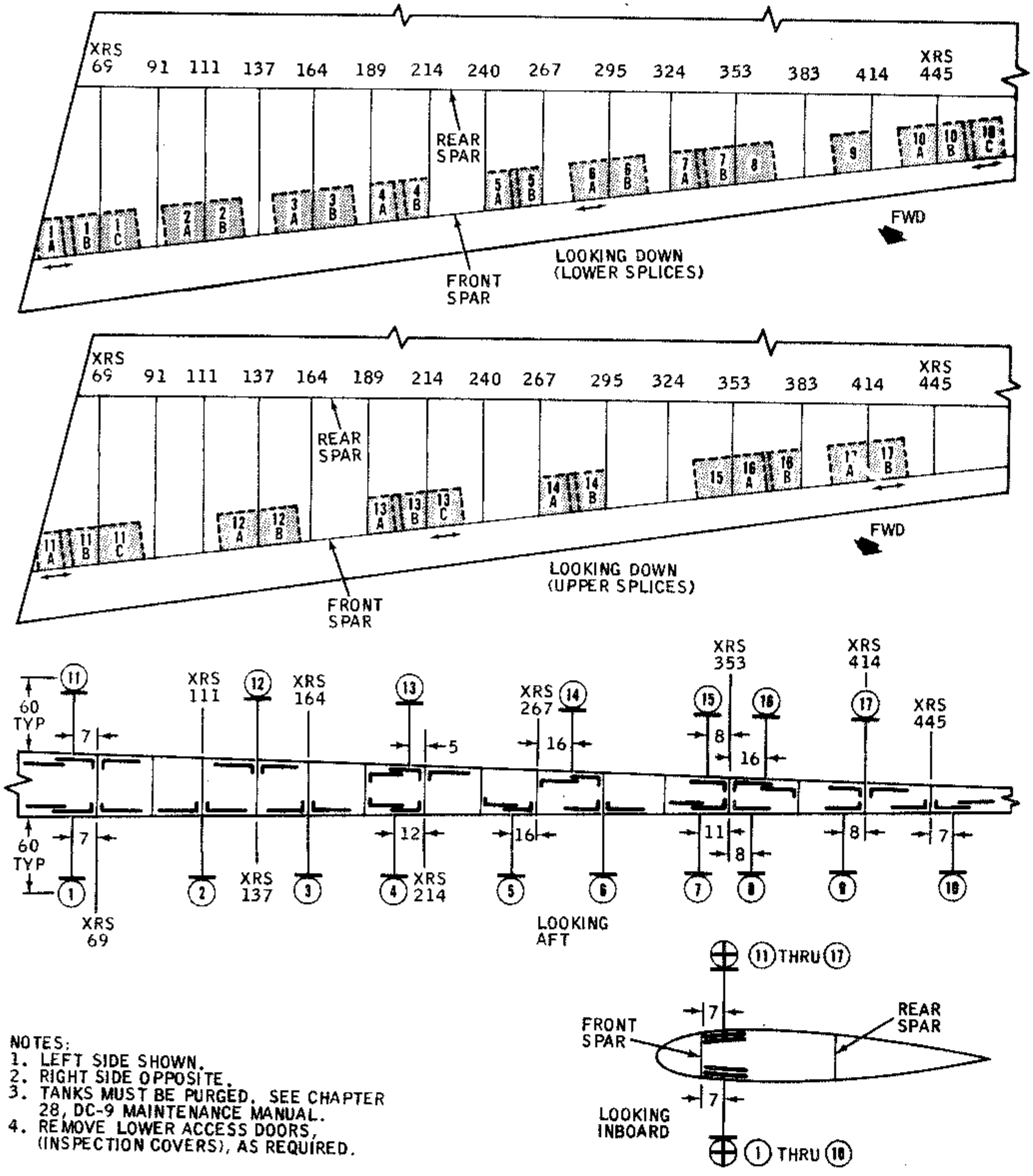
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	STATION XRS 477					
23A & B	UPPER SPLICES	130	200	60	II & III	14 x 17
24A & B		130	200	60	II & III	14 x 17
25	LOWER SPLICES	130	200	60	II & III	14 x 17
26		130	200	60	II & III	14 x 17

RADIOGRAPHIC DATA

8812-131

Wing Stringer Splices

Figure 2 (Sheet 3)



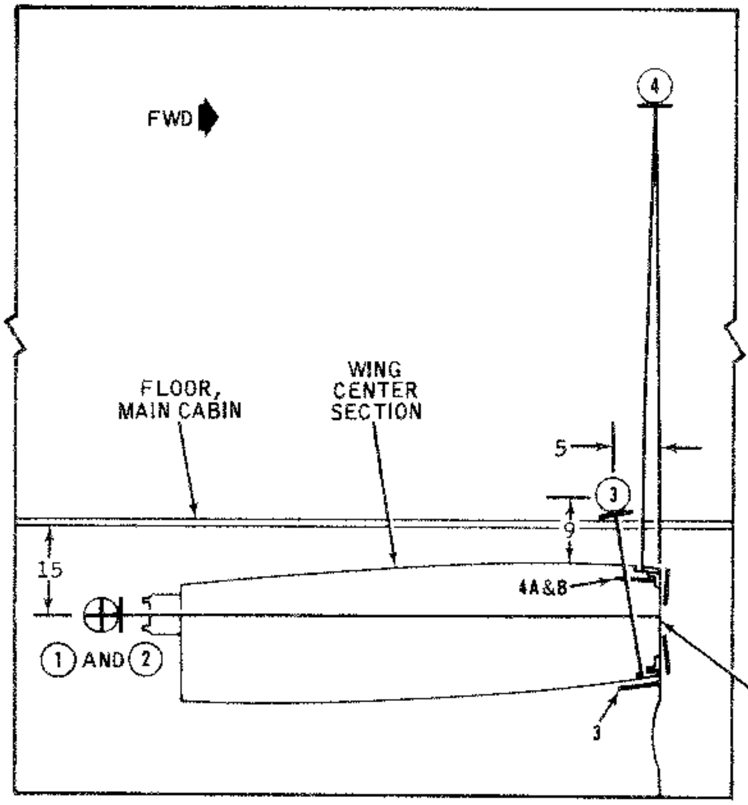
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.
4. REMOVE LOWER ACCESS DOORS (INSPECTION COVERS), AS REQUIRED.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 THRU 10	LOWER SPLICES (STA SHOWN)	130	250	60	II & III	14 x 17
11 THRU 17	UPPER SPLICES (STA SHOWN)	130	250	60	II & III	14 x 17

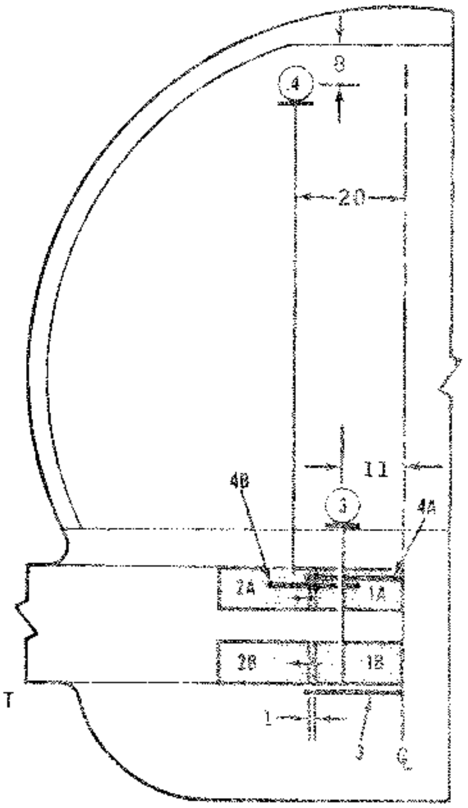
RADIOGRAPHIC DATA

BB12-124

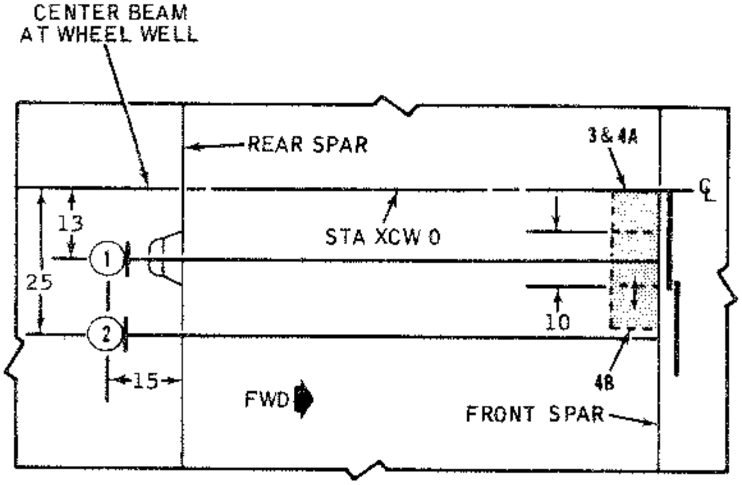
Wing Stringer to Front Spar Attach Fittings
Figure 3



LOOKING INBOARD



LOOKING AFT



LOOKING DOWN

NOTES:

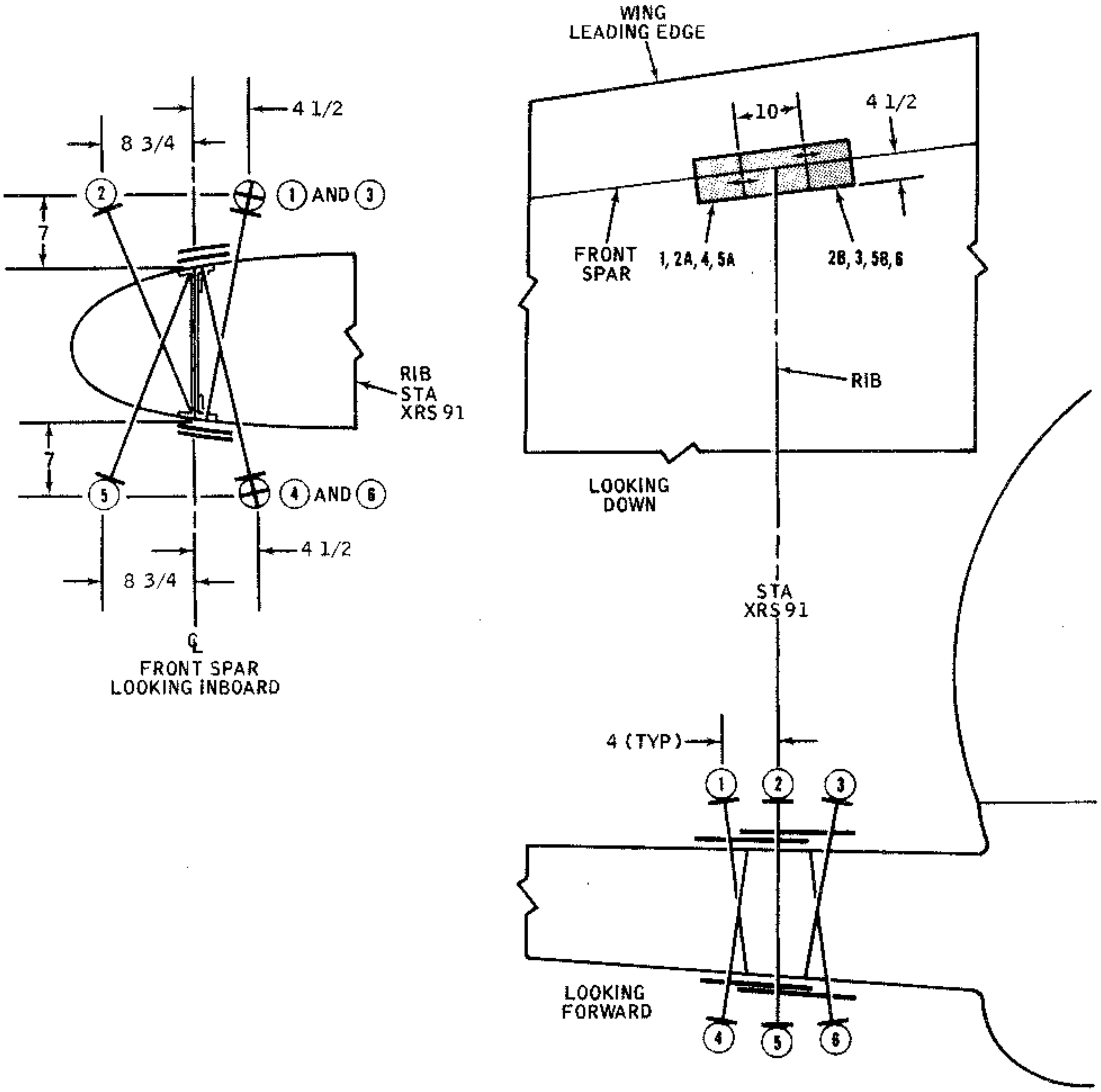
1. RIGHT SIDE SHOWN.
2. LEFT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.
4. FOR FILM 1 AND 2, GAIN ACCESS THROUGH ACCESS DOOR IN FORWARD CARGO COMPARTMENT. POSITIONING OF FILM 1A, 2A REQUIRES DETACHMENT OF SEVERAL CONDUIT BRACKETS.
5. FOR FILM 3, GAIN ACCESS THROUGH ACCESS DOOR UNDER WING (FORWARD OF WHEEL WELL). PLASTIC DOOR FORWARD OF WHEEL WELL MUST BE OPENED, POSITION FILM WITH AID OF SUITABLE POLE AND BUTT 17 INCH EDGE AGAINST BULKHEAD.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN)	FILM	SIZE
1A & B 2A & B	VERTICAL LEG	130 130	1320 1320	102 102	II & III II & III	7 x 17 7 x 17
3	LOWER SPLICE	130	240	30	II & III	7 x 17
4A & B	UPPER SPLICE	130	540	84	II & III	7 x 17

RADIOGRAPHIC DATA

3B12-121

Wing Front Spar Cap Splices at Station XCW 0
Figure 4



NOTES:

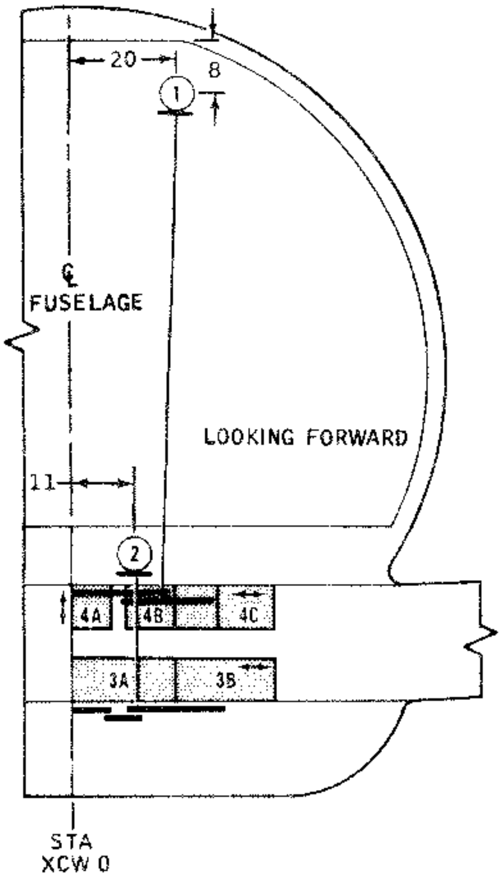
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.

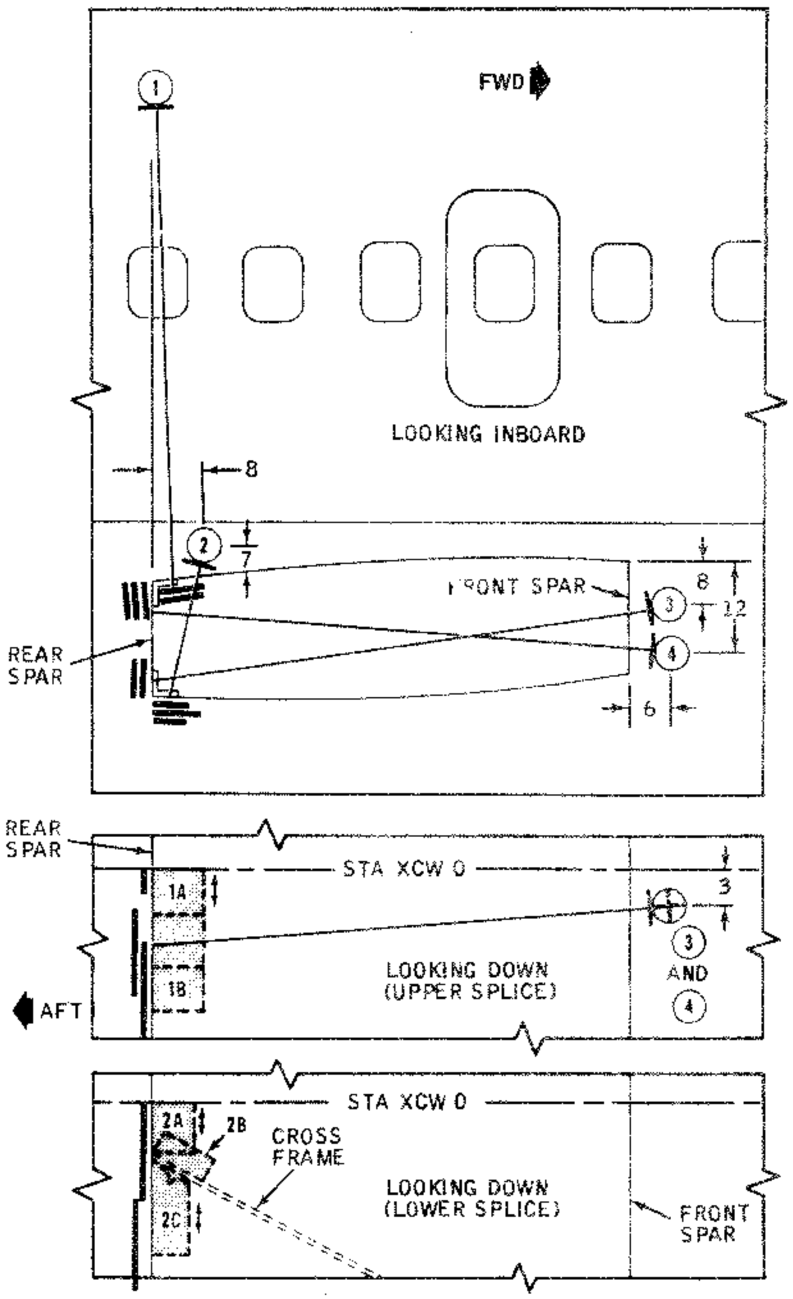
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	LOWER SPLICE	130	240	30	II & III	7 x 17
2A & B		130	180	30	II & III	7 x 17
3		130	240	30	II & III	7 x 17
4	UPPER SPLICE	130	240	30	II & III	7 x 17
5A & B		130	240	30	II & III	7 x 17
6		130	240	30	II & III	7 x 17

RADIOGRAPHIC DATA

BB12-127

Wing Front Spar Cap Splice at Station XRS 91
Figure 5





NOTES:

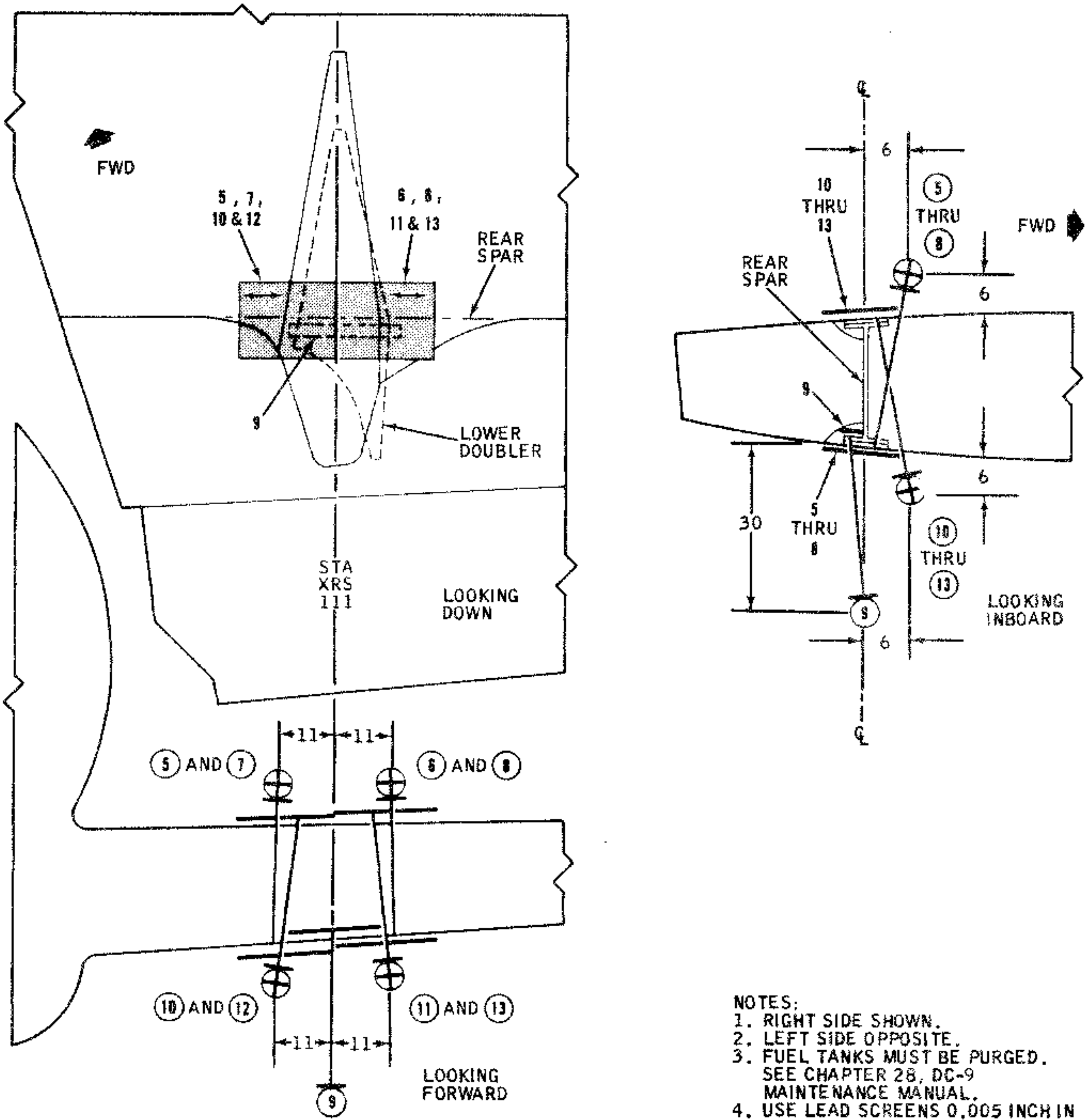
1. RIGHT SIDE SHOWN.
2. LEFT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.
4. FILM FOR EXPOSURE 4 IS SPECIALLY CUT TO CLEAR PULLEY AND BRACKET.
5. SOURCE FOR EXPOSURES 3 AND 4 IS PLACED AT AFT END OF FORWARD CARGO COMPARTMENT. OPEN PANEL IN CENTER OF AFT END TO GAIN ACCESS.
6. FOLD DOWN CORNER OF 2C TO NEST.
7. POSITIONING OF FILMS 3A, 3B, 4A, 4B AND 4C REQUIRES DETACHMENT OF SEVERAL CONDUIT BRACKETS.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	STATION XCW 0					
1A & B	UPPER SPLICE	130	540	84	II & III	7 x 17
2 A B C	LOWER SPLICE	130	240	30	II & III II & III II & III	5 x 7 6 x 2 3/4 17 x 4 1/2
3A & B	VERTICAL LEG	130	925	90	II & III	7 x 17
4A, B, & C		130	925	90	II & III II & III	6 x 7 7 x 17

RADIOGRAPHIC DATA

BB12-122

Wing Rear Spar Cap Splices
Figure 6 (Sheet 1)



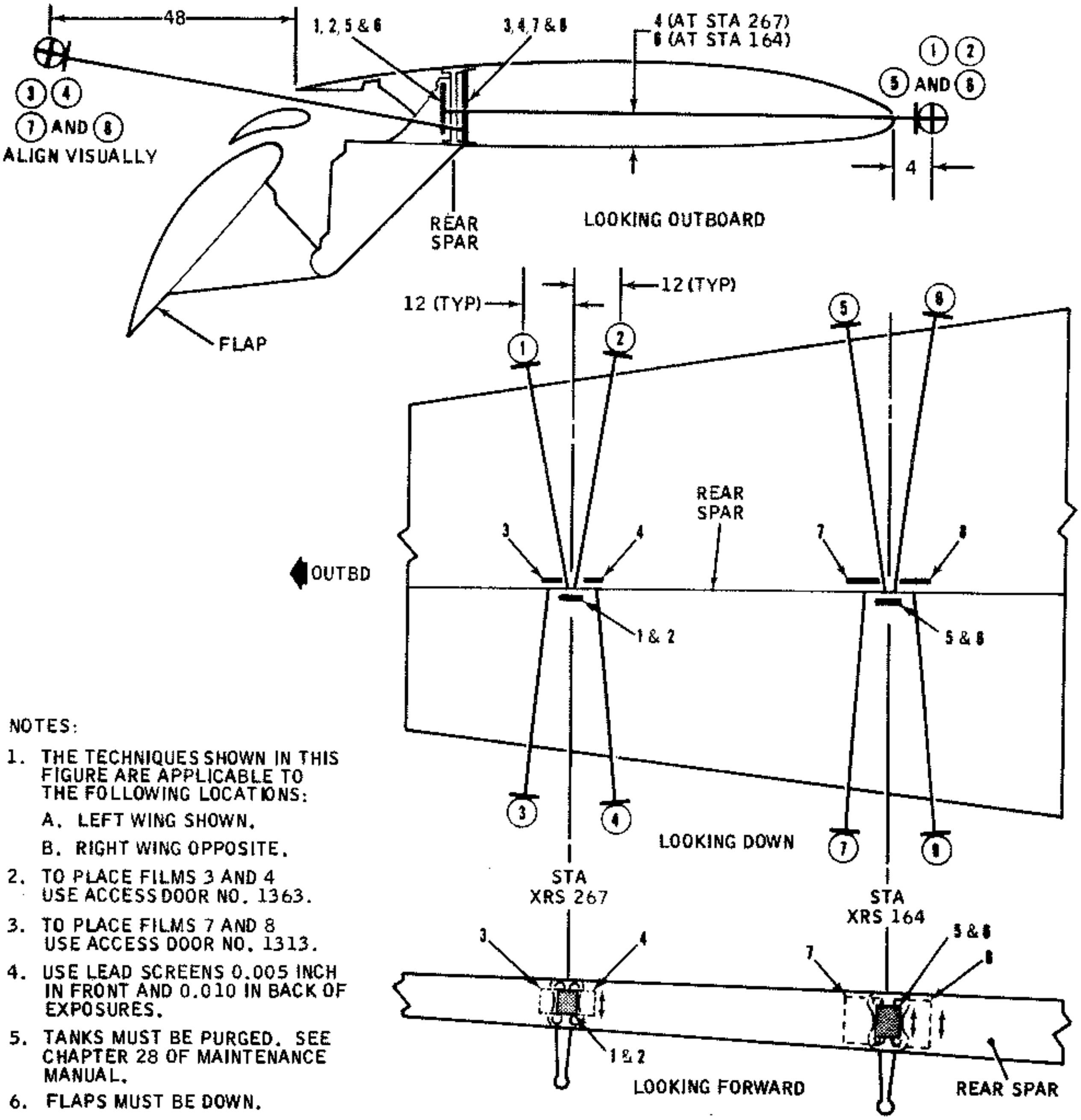
NOTES:
1. RIGHT SIDE SHOWN.
2. LEFT SIDE OPPOSITE.
3. FUEL TANKS MUST BE PURGED. SEE CHAPTER 28, DC-9 MAINTENANCE MANUAL.
4. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 IN BACK WITH DOUBLE LOADED CASSETTES FOR EXPOSURES 7, 8, 12, AND 13.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	STATION XRS 111					
5 AND 6	LOWER SPLICE	130	240	24	II & III	14 x 17
7 AND 8		130	860	24	III	14 x 17
9		130	240	30	II & III	1 3/8 x 17
10 AND 11	UPPER SPLICE	130	240	24	II & III	14 x 17
12 AND 13		130	860	24	III	14 x 17

RADIOGRAPHIC DATA

BB12-132

Wing Rear Spar Cap Splices
Figure 6 (Sheet 2)



NOTES:

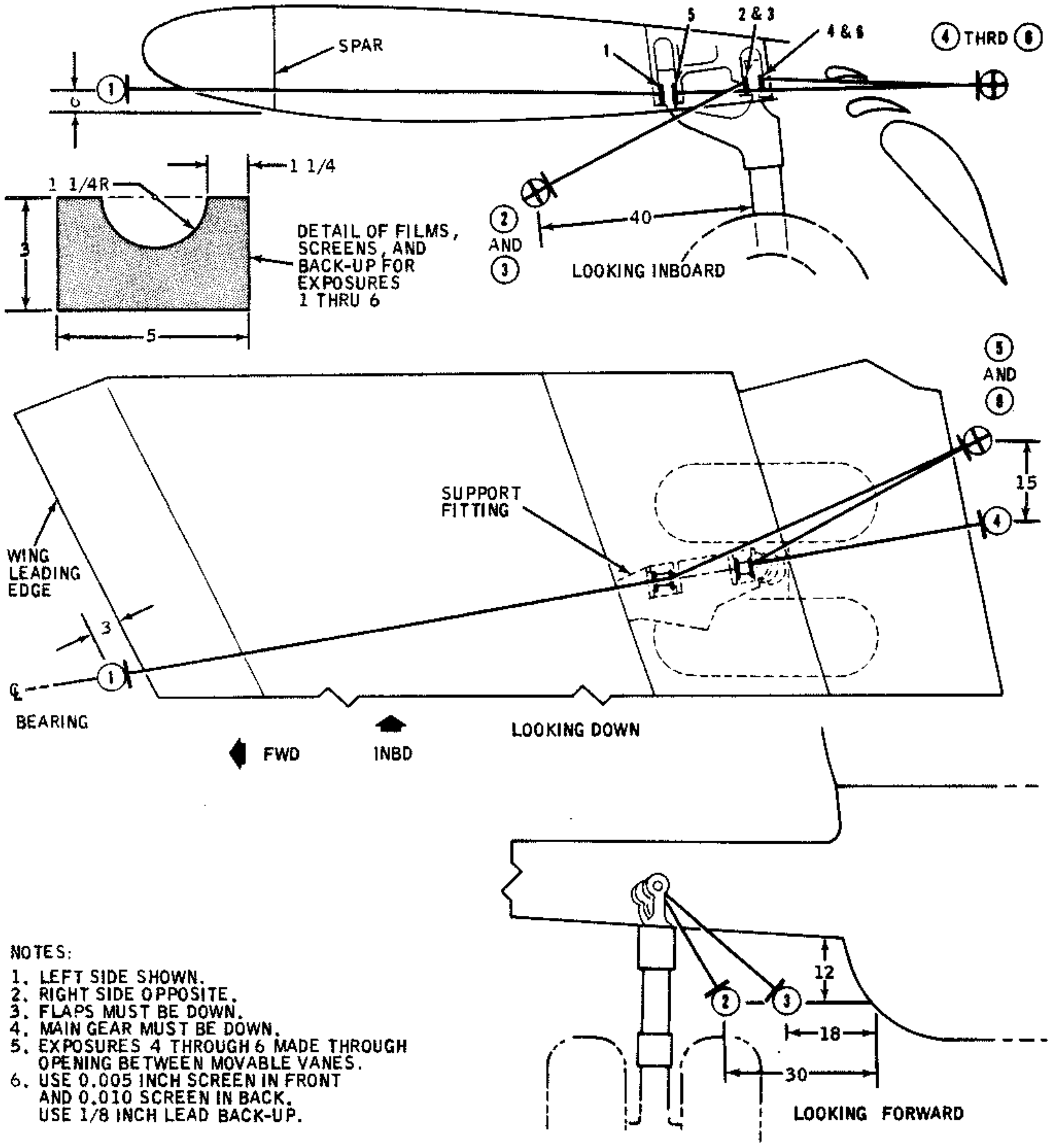
1. THE TECHNIQUES SHOWN IN THIS FIGURE ARE APPLICABLE TO THE FOLLOWING LOCATIONS:
   A. LEFT WING SHOWN.
   B. RIGHT WING OPPOSITE.
2. TO PLACE FILMS 3 AND 4 USE ACCESS DOOR NO. 1363.
3. TO PLACE FILMS 7 AND 8 USE ACCESS DOOR NO. 1313.
4. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 IN BACK OF EXPOSURES.
5. TANKS MUST BE PURGED. SEE CHAPTER 28 OF MAINTENANCE MANUAL.
6. FLAPS MUST BE DOWN.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	STA XRS 267					
1	WEB BETWEEN BARREL NUTS	130	360	69	II	5 x 7
2		130	360	69	II	5 x 7
3	LOWER CAP AND WEB	130	90	75	II	5 x 7
4		130	90	75	II	5 x 7
	STA XRS 164					
5	WEB BETWEEN BARREL NUTS	130	900	85	II	8 x 10
6		130	900	85	II	8 x 10
7	LOWER CAP AND WEB	130	240	81	II	10 x 12
8		130	240	81	II	10 x 12

RADIOGRAPHIC DATA

BB12-112

Wing Bulkhead Lower Cap at Flap Hinge Attach Points
Figure 7



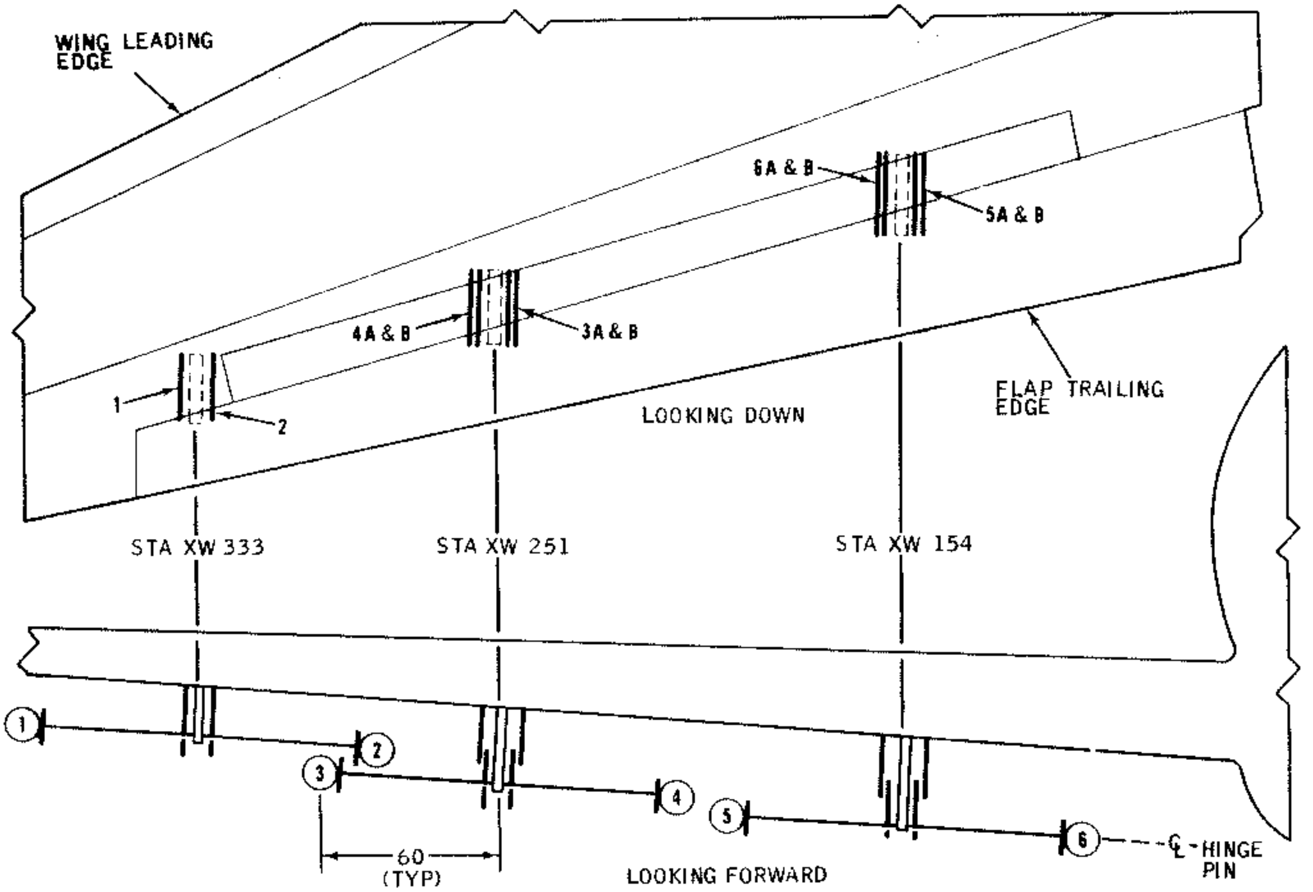
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FLAPS MUST BE DOWN.
4. MAIN GEAR MUST BE DOWN.
5. EXPOSURES 4 THROUGH 6 MADE THROUGH OPENING BETWEEN MOVABLE VANES.
6. USE 0.005 INCH SCREEN IN FRONT AND 0.010 SCREEN IN BACK. USE 1/8 INCH LEAD BACK-UP.

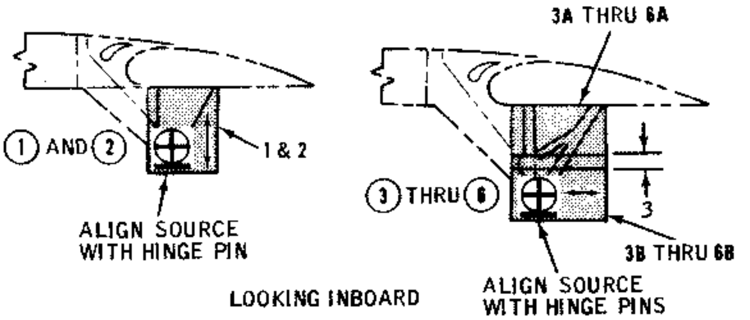
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	SUPPORT BEARING	130	2280	114	III	3 x 5
2		130	395	48	II	SPECIAL CUT (SEE DETAIL)
3		130	395	48	II	
4		130	395	48	II	
5		130	540	62	II	
6		130	395	48	II	

RADIOGRAPHIC DATA

BB12-125

Main Landing Gear Support (Trunnion) Fittings
Figure 8





Printed in U.S.A.

NOTES:

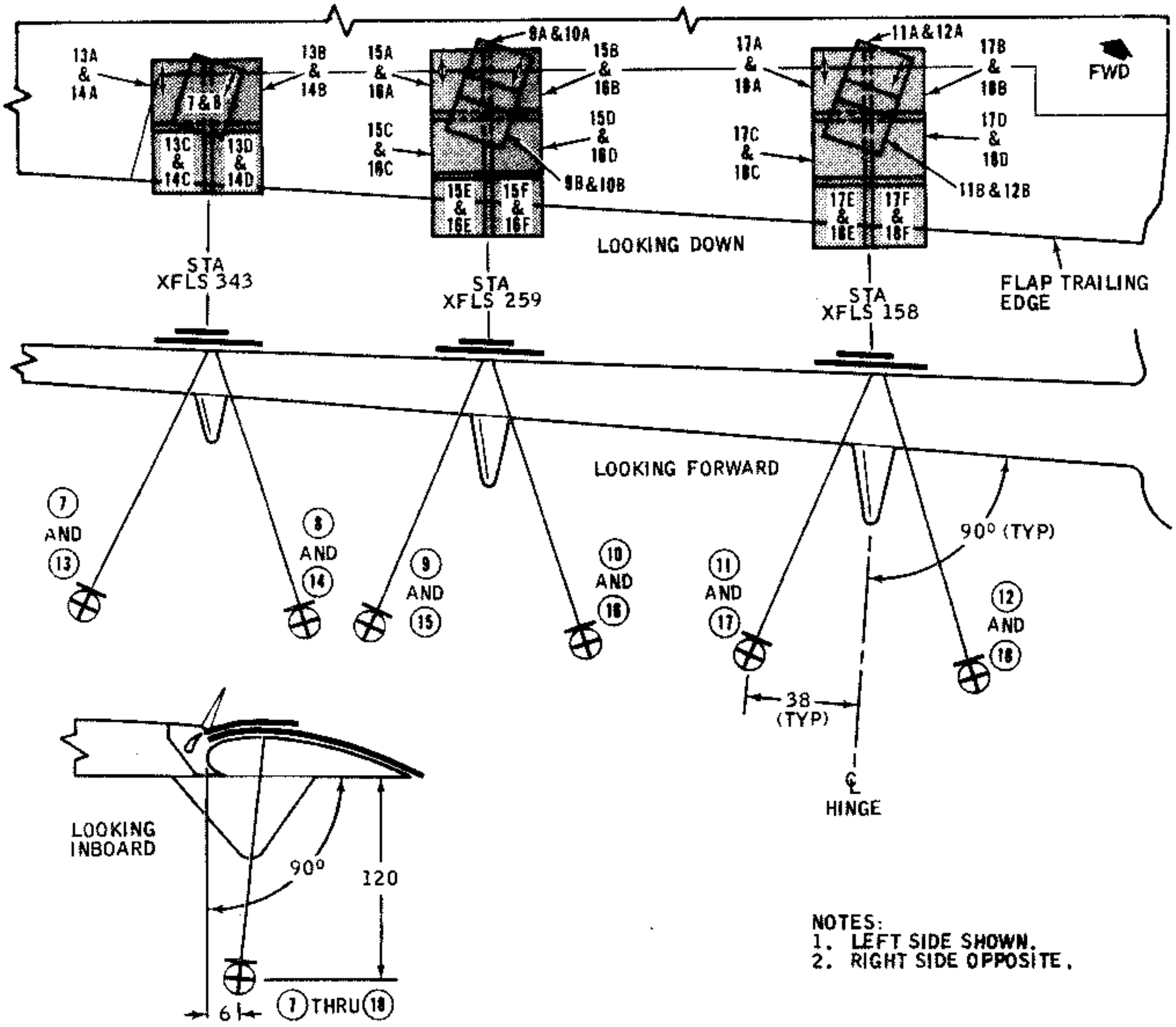
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK FOR EXPOSURES 1 THRU 6.
4. MAS VALUES FOR EXPOSURES 1 THRU 6 ARE WITH COVERS REMOVED. ADD 120 MAS TO VALUES IF COVERS ARE NOT REMOVED.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	EXTERNAL BRACKETS					
1	STA XW 154	180	210	60	II & III	14 × 17
2		180	210	60	II & III	14 × 17
3A & B	STA XW 251	180	210	60	II & III	14 × 17
4A & B		180	210	60	II & III	14 × 17
5A & B	STA XW 333	180	210	60	II & III	14 × 17
6A & B		180	210	60	II & III	14 × 17

RADIOGRAPHIC DATA

BB12-118

Flap Fittings
Figure 9 (Sheet 1)



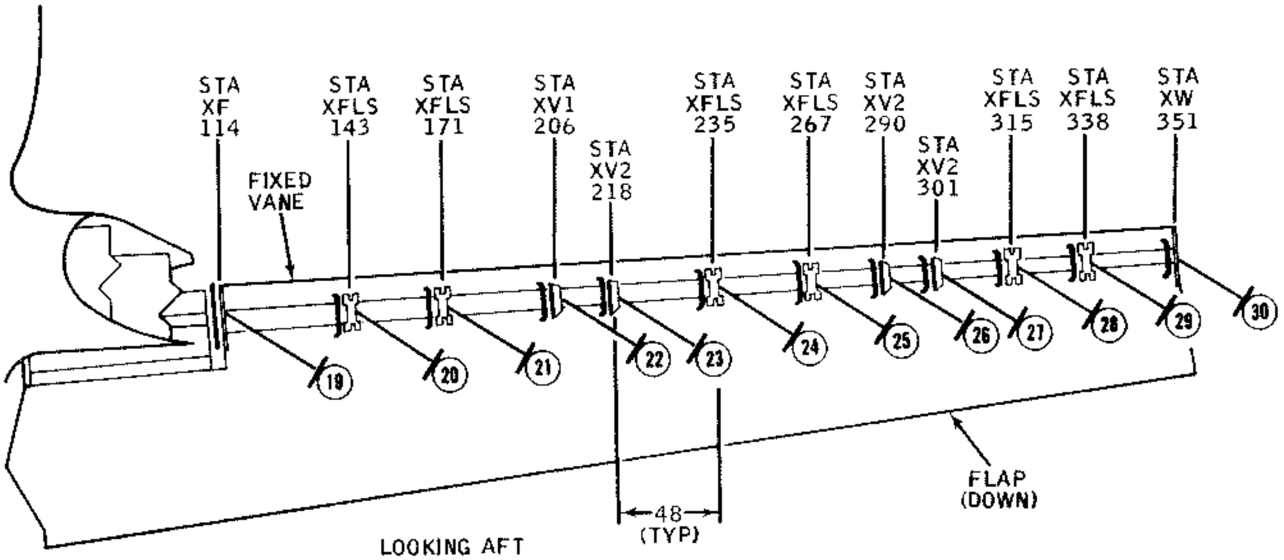
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.

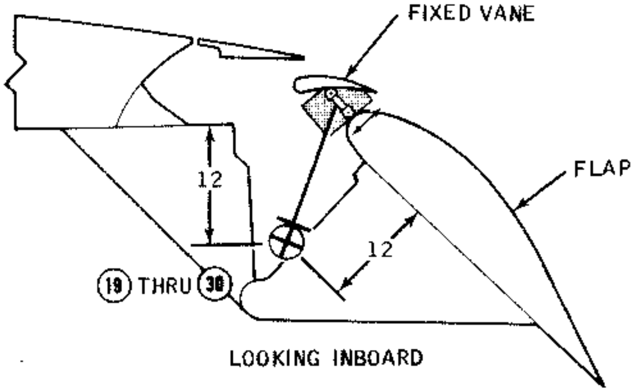
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	INTERNAL FITTINGS					
7 8	STA XFLS 343	130 130	1760 1760	120 120	II & III II & III	14 x 17 14 x 17
9A & B 10A & B	STA XFLS 259	130 130	1760 1760	120 120	II & III II & III	14 x 17 14 x 17
11A & B 12A & B	STA XFLS 158	130 130	1760 1760	120 120	II & III II & III	14 x 17 14 x 17
	RIBS SURROUNDING INTERNAL FITTINGS					
13A THRU D 14A THRU D	STA XFLS 343	130 130	1200 1200	120 120	II & III II & III	14 x 17 14 x 17
15A THRU F 16A THRU F	STA XFLS 259	130 130	1200 1200	120 120	II & III II & III	14 x 17 14 x 17
17A THRU F 18A THRU F	STA XFLS 158	130 130	1200 1200	120 120	II & III II & III	14 x 17 14 x 17

RADIOGRAPHIC DATA

BB12-128

Flap Fittings
Figure 9 (Sheet 2)





NOTES:

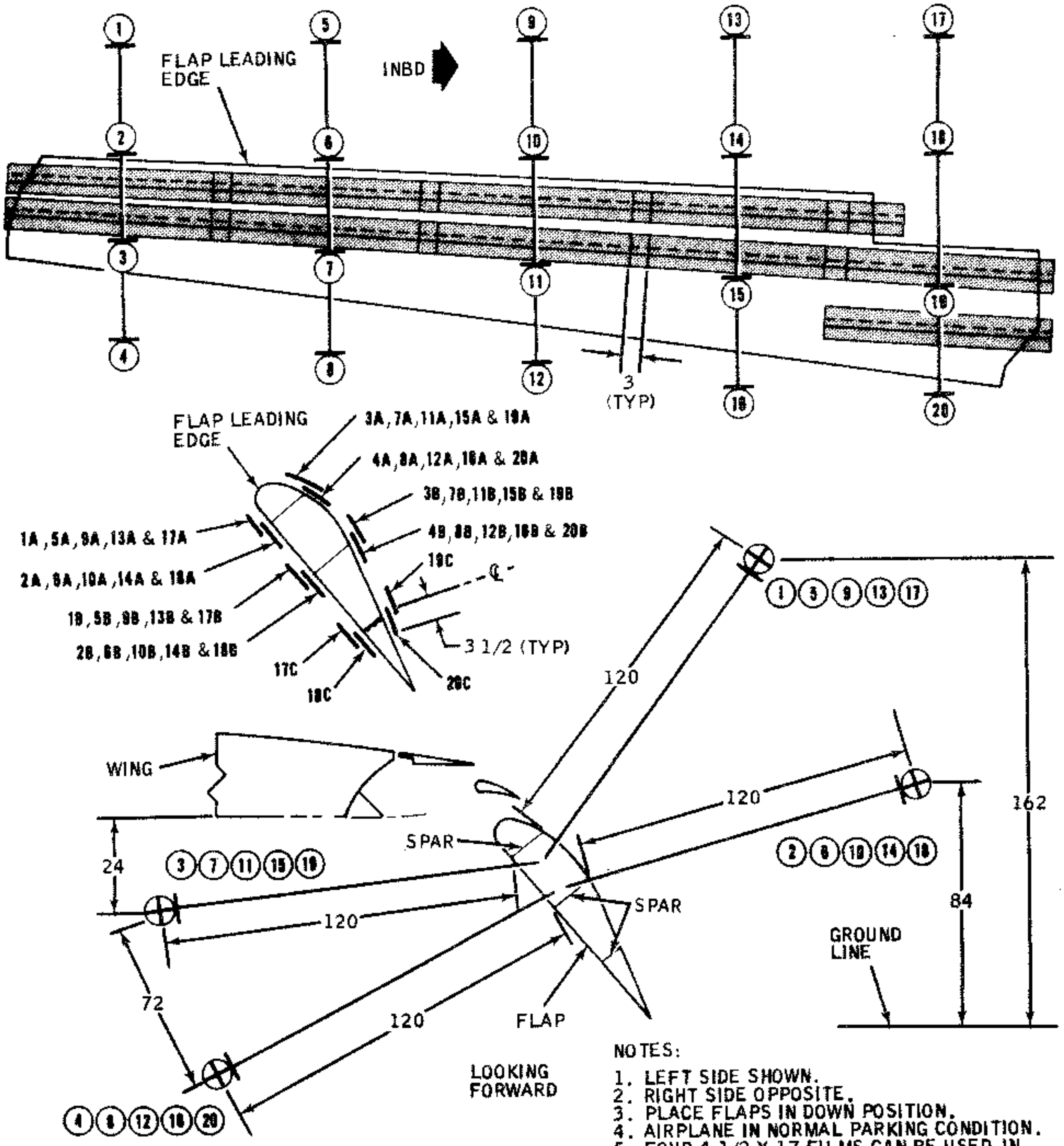
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FOR EXPOSURES 19 THRU 30 PLACE FLAPS IN DOWN POSITION.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	VANE ATTACH FITTINGS					
19	STA XF 114	130	105	48	II	8 x 10
20	STA XFLS 143	130	105	48	II	5 x 7
21	STA XFLS 171	130	105	48	II	5 x 7
22	STA XV1 206	130	105	48	II	5 x 7
23	STA XV2 218	130	105	48	II	5 x 7
24	STA XFLS 235	130	105	48	II	5 x 7
25	STA XFLS 267	130	105	48	II	5 x 7
26	STA XV2 290	130	105	48	II	5 x 7
27	STA XV2 301	130	105	48	II	5 x 7
28	STA XFLS 315	130	105	48	II	5 x 7
29	STA XFLS 338	130	105	48	II	5 x 7
30	STA XW 351	130	105	48	II	5 x 7

RADIOGRAPHIC DATA

BB12-129

Flap Fittings
Figure 9 (Sheet 3)



NOTES:

1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. PLACE FLAPS IN DOWN POSITION.
4. AIRPLANE IN NORMAL PARKING CONDITION.
5. FOUR 4 1/2 X 17 FILMS CAN BE USED IN PLACE OF ONE 4 1/2 X 66 FILM.

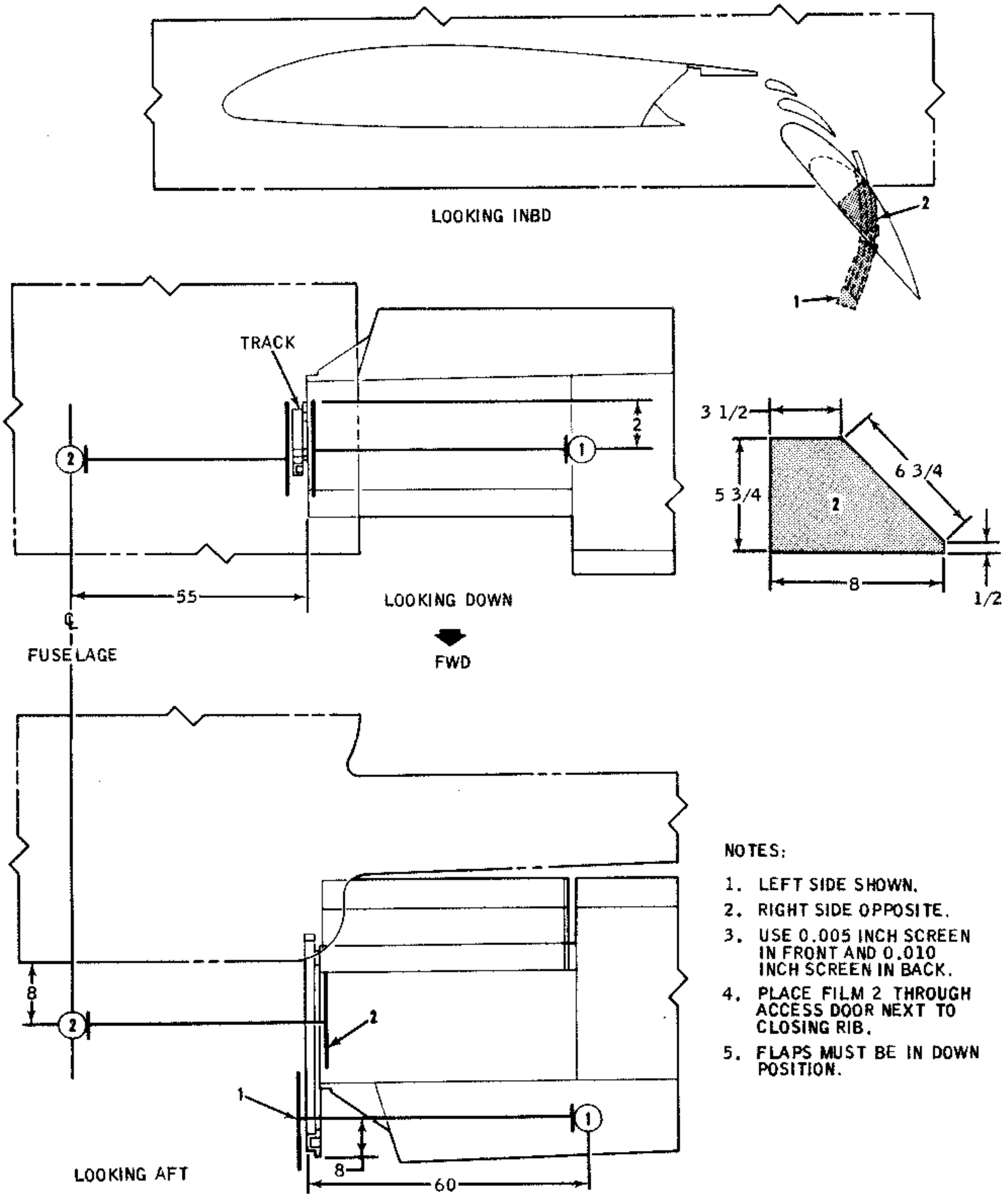
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 A & B THRU 16 A & B	FRONT AND REAR SPARS	130	900	126	II & III	4 1/2 x 66
17A, B & C		130	900	126	II & III II & III	4 1/2 x 17 4 1/2 x 66
18A B & C		130	900	126	II & III II & III	4 1/2 x 17 4 1/2 x 66
19A, B & C		130	900	126	II & III II & III	4 1/2 x 17 4 1/2 x 66
20A, B & C		130	900	126	II & III II & III	4 1/2 x 17 4 1/2 x 66

RADIOGRAPHIC DATA

BB12-119

Flap Front and Rear Spars
Figure 10

Printed in U.S.A.



NOTES:

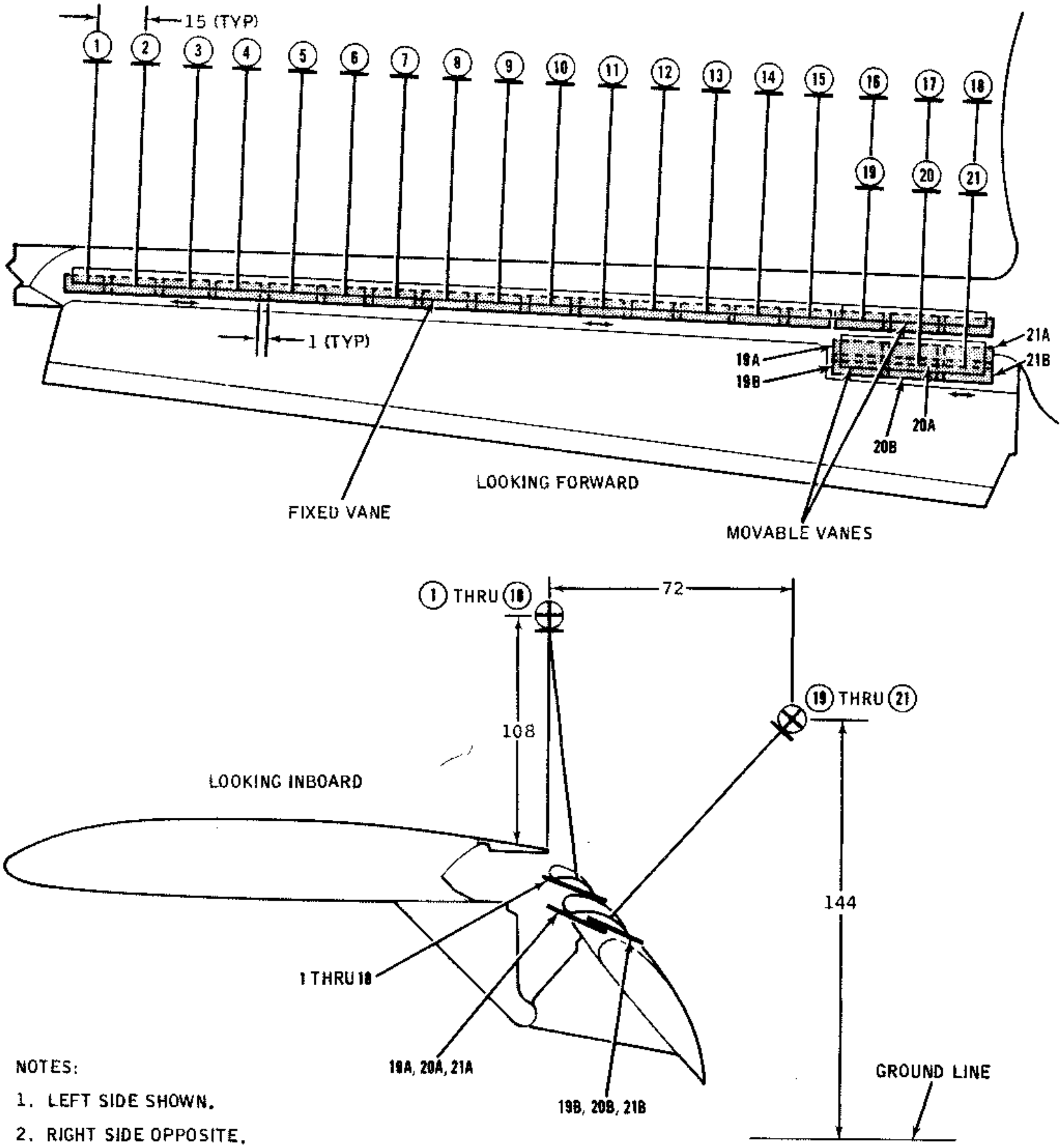
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. USE 0.005 INCH SCREEN IN FRONT AND 0.010 INCH SCREEN IN BACK.
4. PLACE FILM 2 THROUGH ACCESS DOOR NEXT TO CLOSING RIB.
5. FLAPS MUST BE IN DOWN POSITION.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1	TRACK BELOW FLAP	180	480	60	II & III	4 1/2 x 17
2	TRACK AT CLOSING RIB	180	480	55	II & III	SPECIAL CUT (SEE DETAIL)

RADIOGRAPHIC DATA

8B12-120

Flap Track
Figure 11



NOTES:

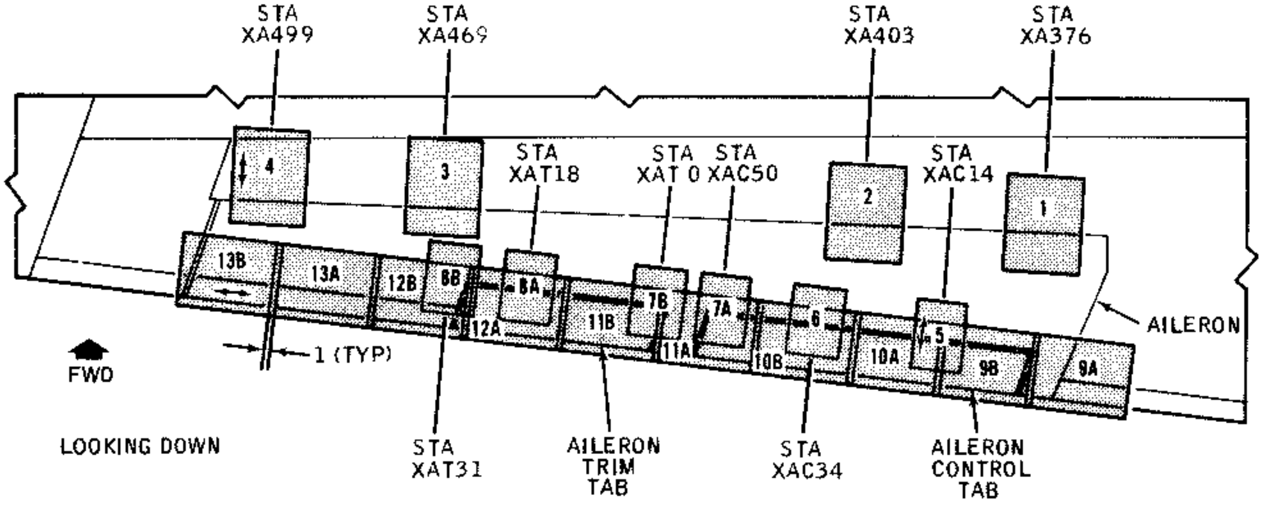
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. PLACE FLAPS IN DOWN POSITION.
4. AIRPLANE IN NORMAL PARKING CONDITION.

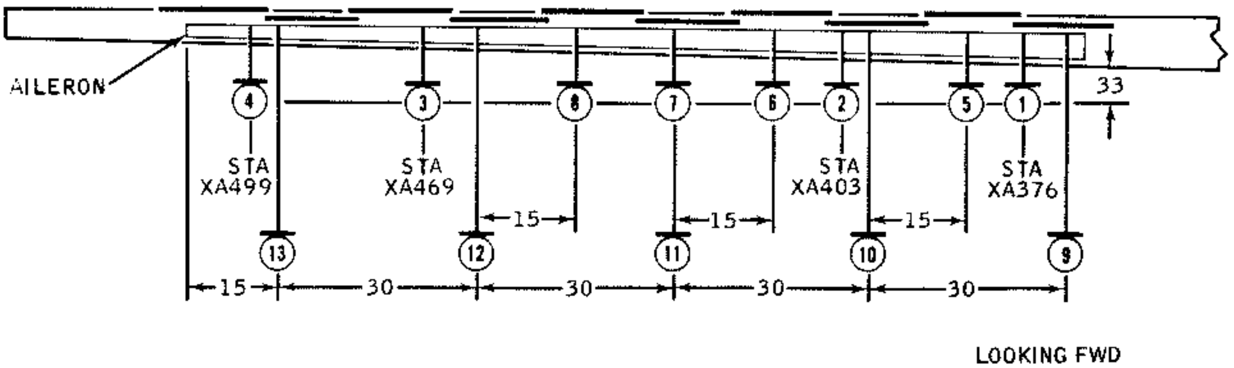
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 THRU 18	VANE HONEYCOMB CORE	130	120	120	III	14 x 17
19A & B THRU 21A & B	VANE HONEYCOMB CORE	130	120	120	III	14 x 17

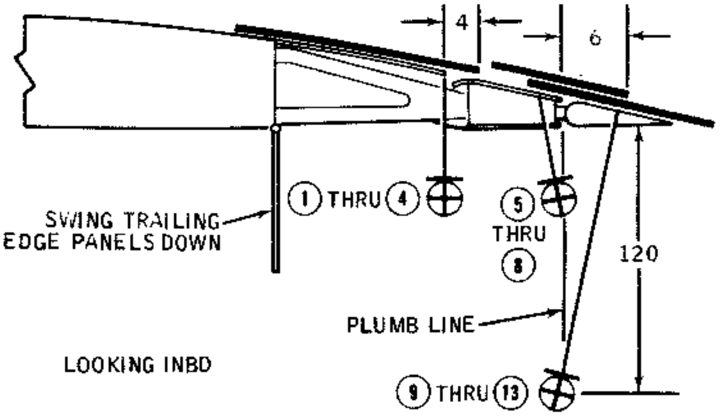
RADIOGRAPHIC DATA

BB12-116

Flap Vanes for Water Absorption
Figure 12







NOTES:

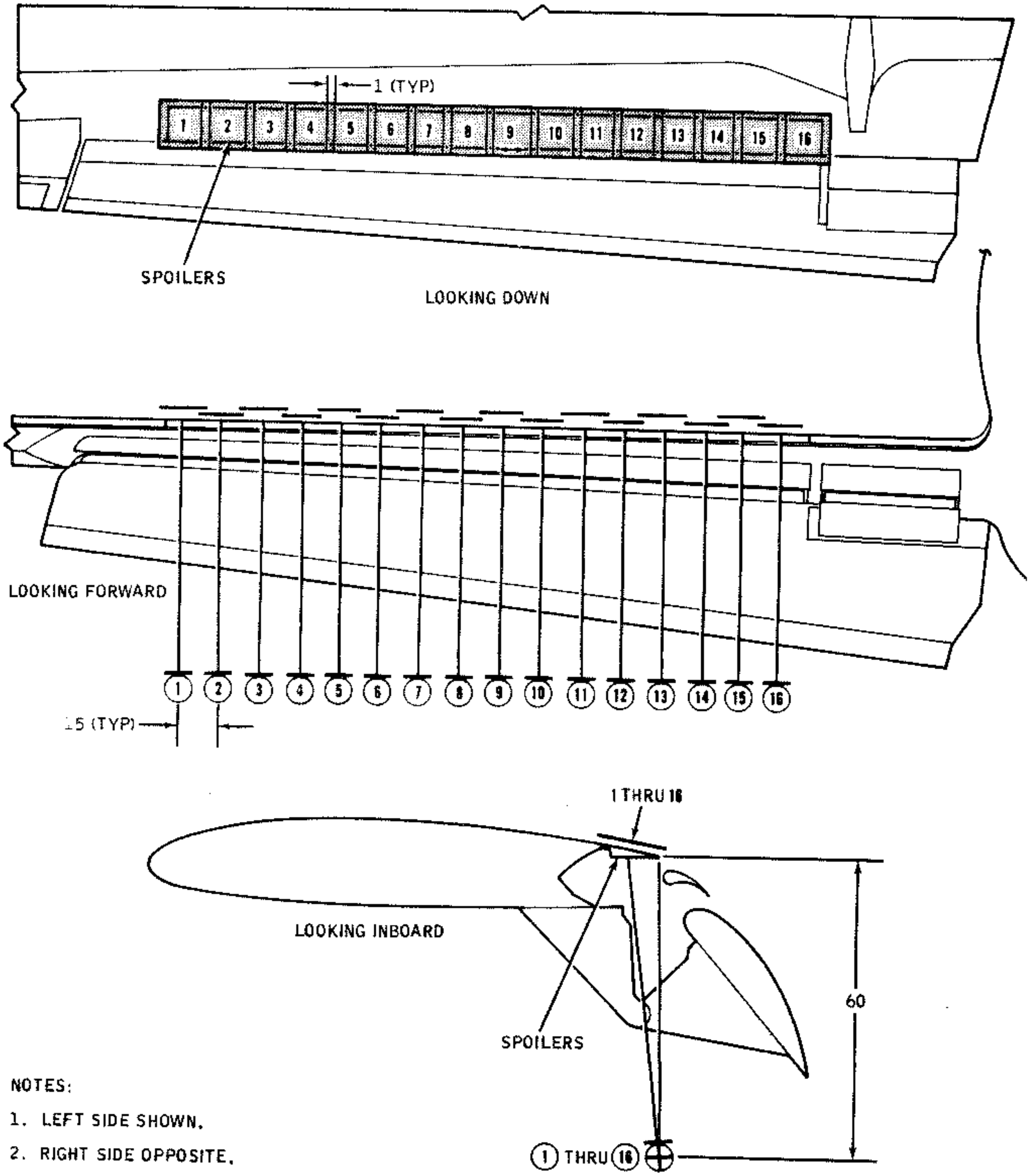
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. FOR EXPOSURES 1 THRUGH 8 USE 0.005 INCH LEAD SCREENS IN FRONT AND 0.010 INCH LEAD SCREENS IN BACK. FILM IS DOUBLE LOADED WITH ONE EACH CLASS II AND CLASS III.
4. AILERON AND TABS IN NEUTRAL POSITION.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 THRU 4	AILERON ATTACH FITTINGS	180	800	36	II & III	14 x 17
5, 6, 7A & B, AND 8A & B	AILERON TAB ATTACH FITTINGS	180	650	36	II & III	8 x 10
9A & B THRU 13A & B	AILERON TAB AND AILERON TRAILING EDGE	130	130	120	III	14 x 17

RADIOGRAPHIC DATA

BB12-126

Aileron and Aileron Tab Attach Fittings and Honeycomb Core
Figure 13



NOTES:

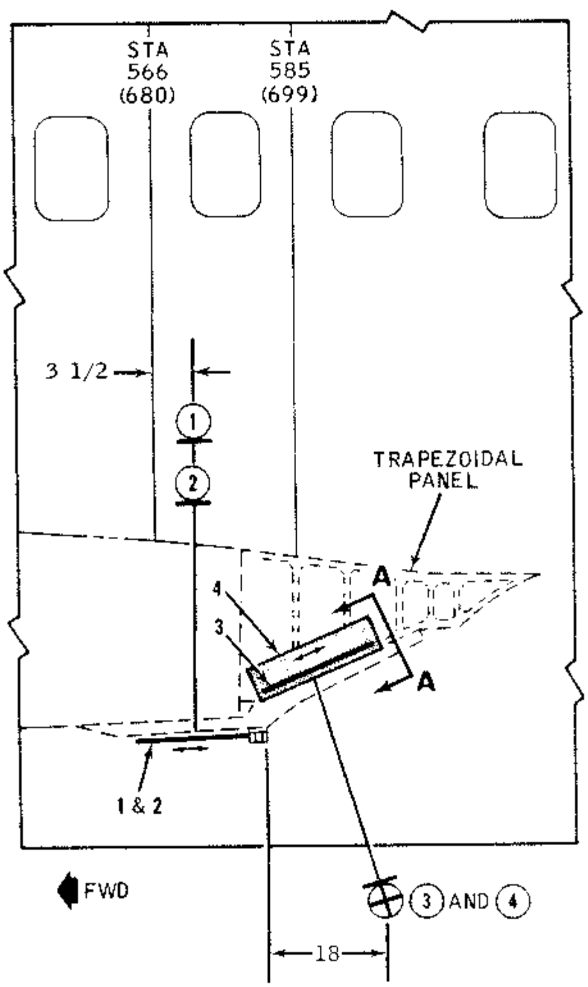
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. PLACE FLAPS IN DOWN POSITION.
4. AIRPLANE IN NORMAL PARKING CONDITION.

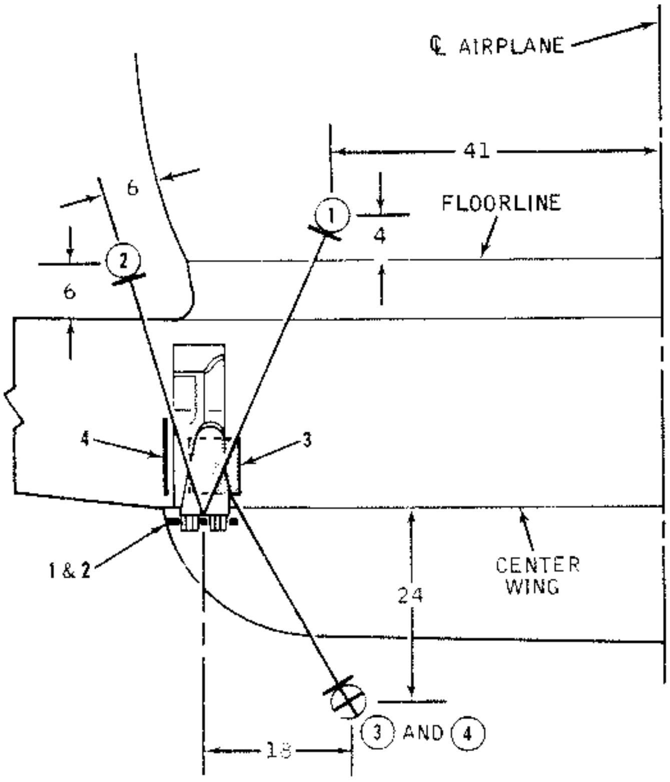
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
1 THRU 16	SPOILER HONEYCOMB CORE	80	120	60	III	14 x 17

RADIOGRAPHIC DATA

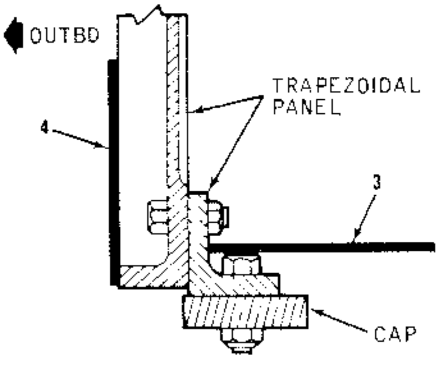
BB12-110

Spoilers for Water Absorption
Figure 14





LOOKING FORWARD



SECTION A-A

NOTES:

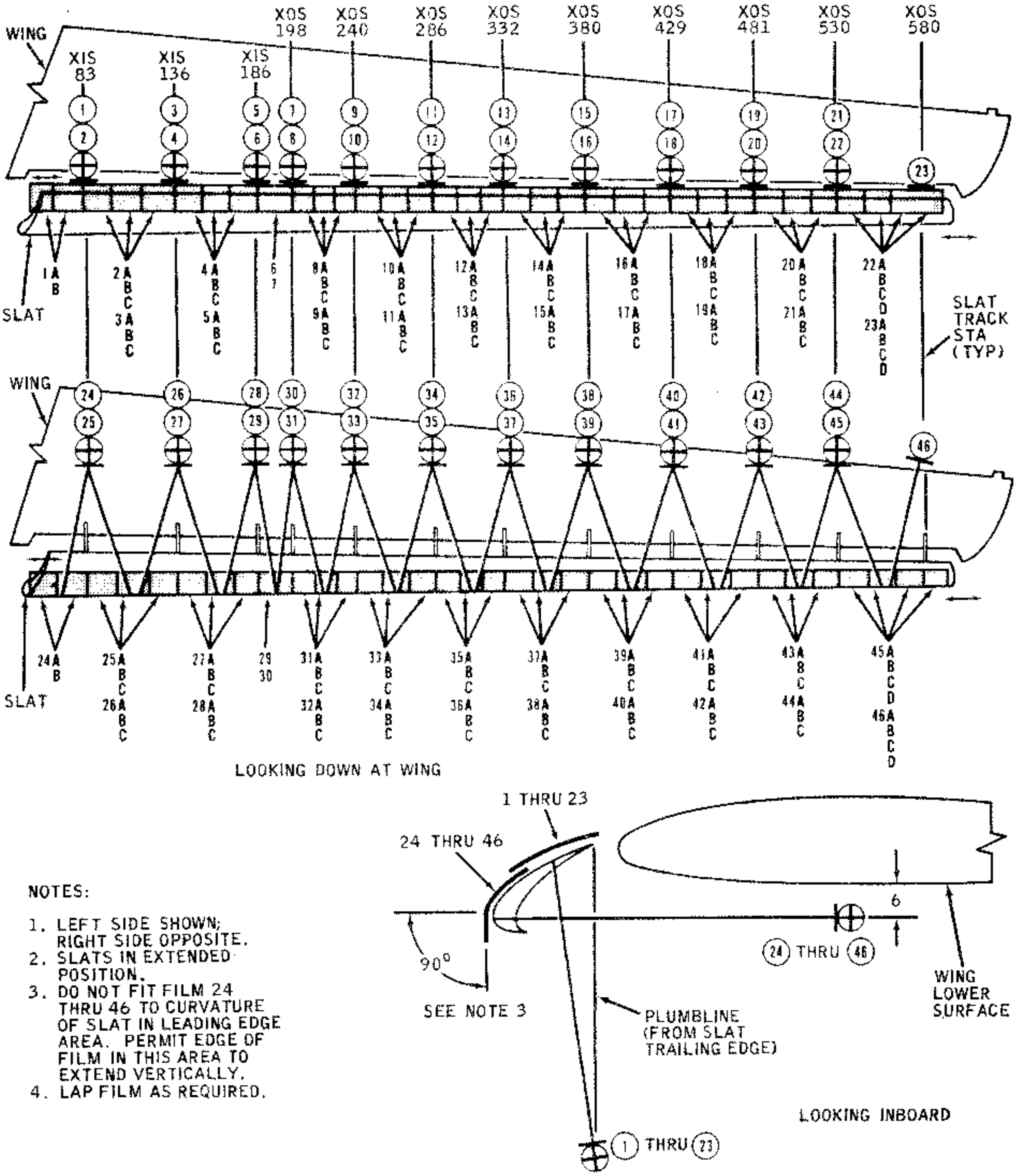
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. ALL EXPOSURES MADE WITH FIBERGLASS EMPENNAGE (FORWARD OF WHEEL WELL, UNDER WING) OPEN.
3. REMOVE SEATS AT STA 566 (680) AS REQUIRED.
4. REMOVE FLOOR (DECK) PANEL AT STA 566 (680) (OUTBOARD PANEL).
5. REMOVE FILLET PANEL, WING-FUSELAGE (AFT).
6. USE LEAD SCREENS 0.005 INCH IN FRONT AND 0.010 INCH IN BACK. USE ONE FILM PER CASSETTE.
7. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	FAYING SURFACES NEAR MACHINED JOGGLE					
1	FWD OF SPAR, INBD	130	410	39	II & III	8 x 10
2	FWD OF SPAR, OUTBD	130	200	25	II & III	8 x 10
3	AFT OF SPAR	130	190	40	II & III	4 1/2 x 17
4	AFT OF SPAR	130	525	40	II & III	4 1/2 x 17

RADIOGRAPHIC DATA

BB12-101A

Trapezoidal Panel, Forward and Aft of Rear Spar at Sta. XCW 58
Figure 15



NOTES:

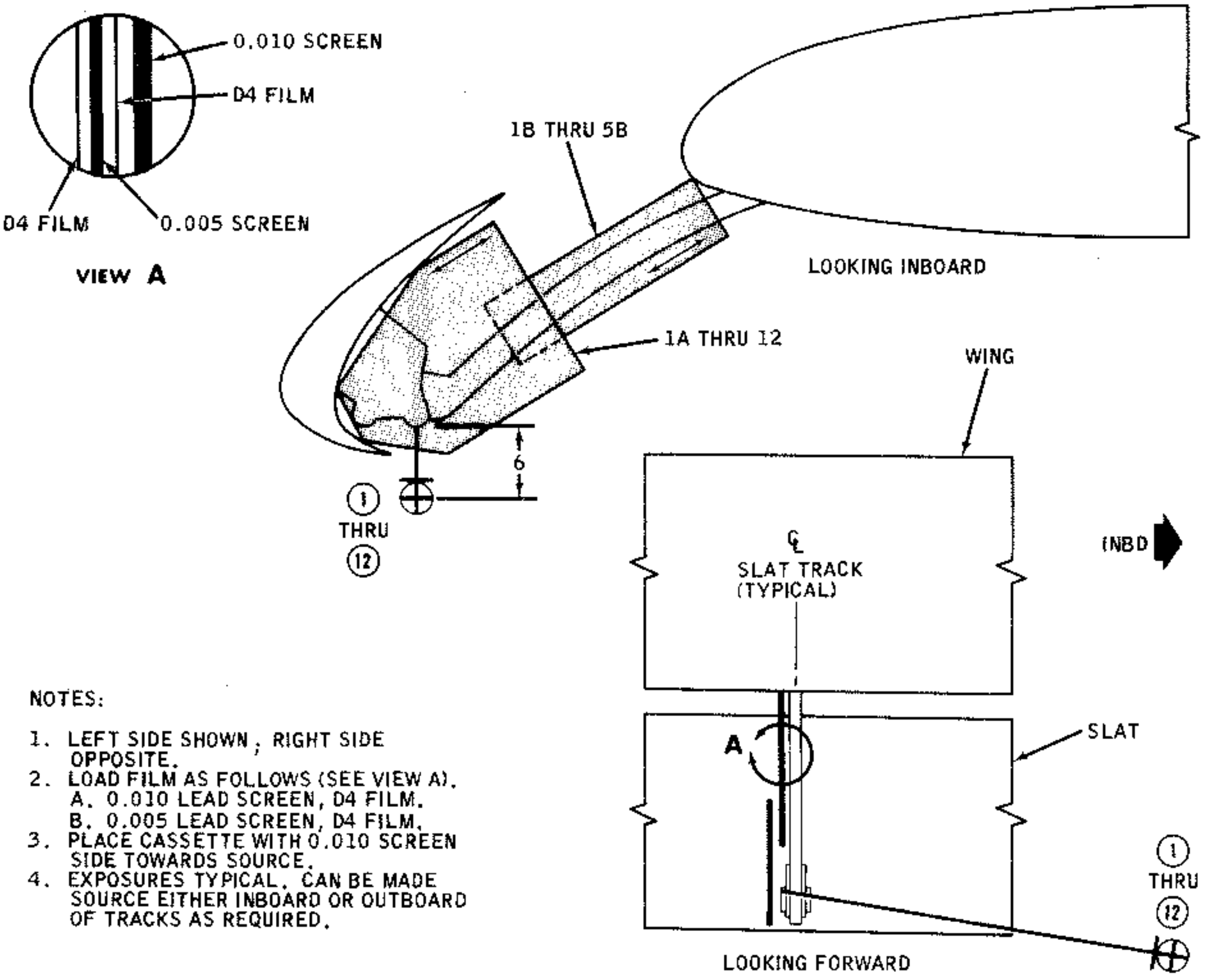
1. LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE.
2. SLATS IN EXTENDED POSITION.
3. DO NOT FIT FILM 24 THRU 46 TO CURVATURE OF SLAT IN LEADING EDGE AREA. PERMIT EDGE OF FILM IN THIS AREA TO EXTEND VERTICALLY.
4. LAP FILM AS REQUIRED.

EXP NO	SUBJECT	KV	MAS	SFD (IN)	FILM	SIZE
1 THRU 46	SLAT AND SLAT DUCT STRUCTURE	130	600	84	II	14 X 17

RADIOGRAPHIC DATA

BB12-137

DC-9-30 Slats and Slat Tracks
Figure 16 (Sheet 1)



NOTES:

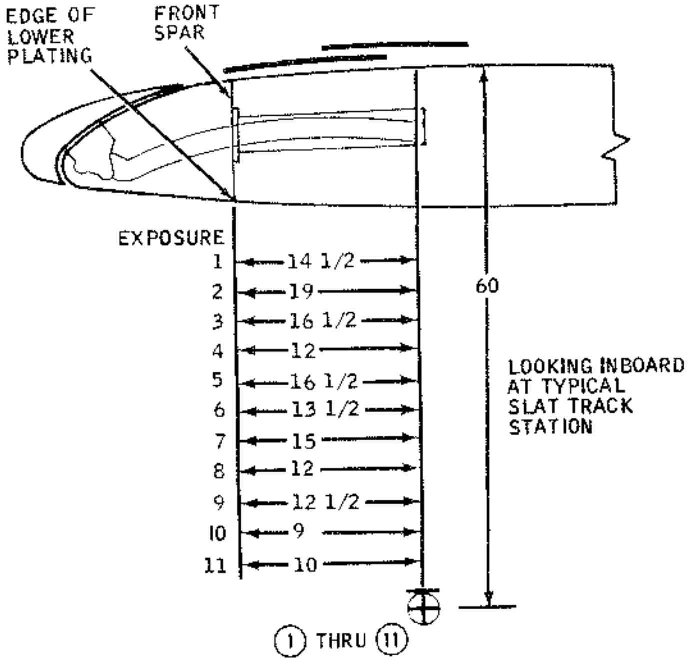
1. LEFT SIDE SHOWN, RIGHT SIDE OPPOSITE.
2. LOAD FILM AS FOLLOWS (SEE VIEW A).
   A. 0.010 LEAD SCREEN, D4 FILM.
   B. 0.005 LEAD SCREEN, D4 FILM.
3. PLACE CASSETTE WITH 0.010 SCREEN SIDE TOWARDS SOURCE.
4. EXPOSURES TYPICAL. CAN BE MADE SOURCE EITHER INBOARD OR OUTBOARD OF TRACKS AS REQUIRED.

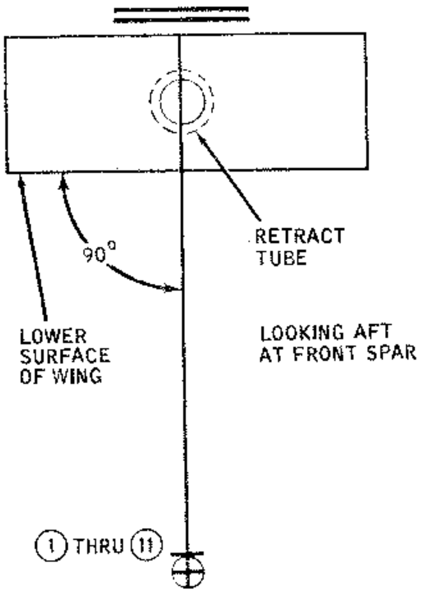
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	SLAT TRACKS					
1A	STA XIS 83	200	480	36	II	14 x 17
B					II	4 1/2 x 17
2A	STA XIS 136	200	360	36	II	14 x 17
B					II	4 1/2 x 17
3A	STA XIS 186	200	480	36	II	14 x 17
B					II	4 1/2 x 17
4A	STA XOS 199	200	480	36	II	14 x 17
B					II	4 1/2 x 17
5A	STA XOS 240	200	360	36	II	14 x 17
B					II	4 1/2 x 17
6	STA XOS 287	200	360	36	II	14 x 17
7	STA XOS 332	200	360	36	II	14 x 17
8	STA XOS 380	200	360	36	II	14 x 17
9	STA XOS 429	200	360	36	II	14 x 17
10	STA XOS 481	200	360	36	II	14 x 17
11	STA XOS 531	200	360	36	II	8 x 10
12	STA XOS 580	200	360	36	II	8 x 10

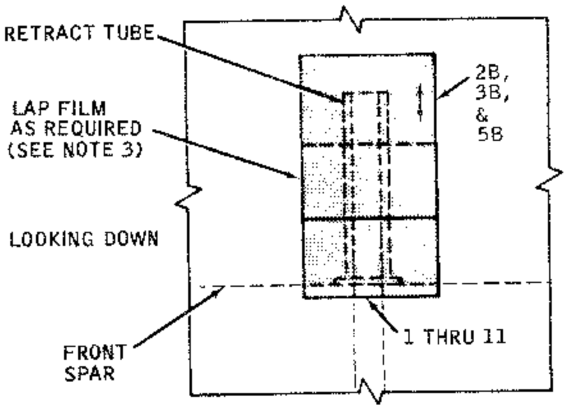
RADIOGRAPHIC DATA

BB12-138

DC-9-30 Slats and Slat Tracks
Figure 16 (Sheet 2)







NOTES:

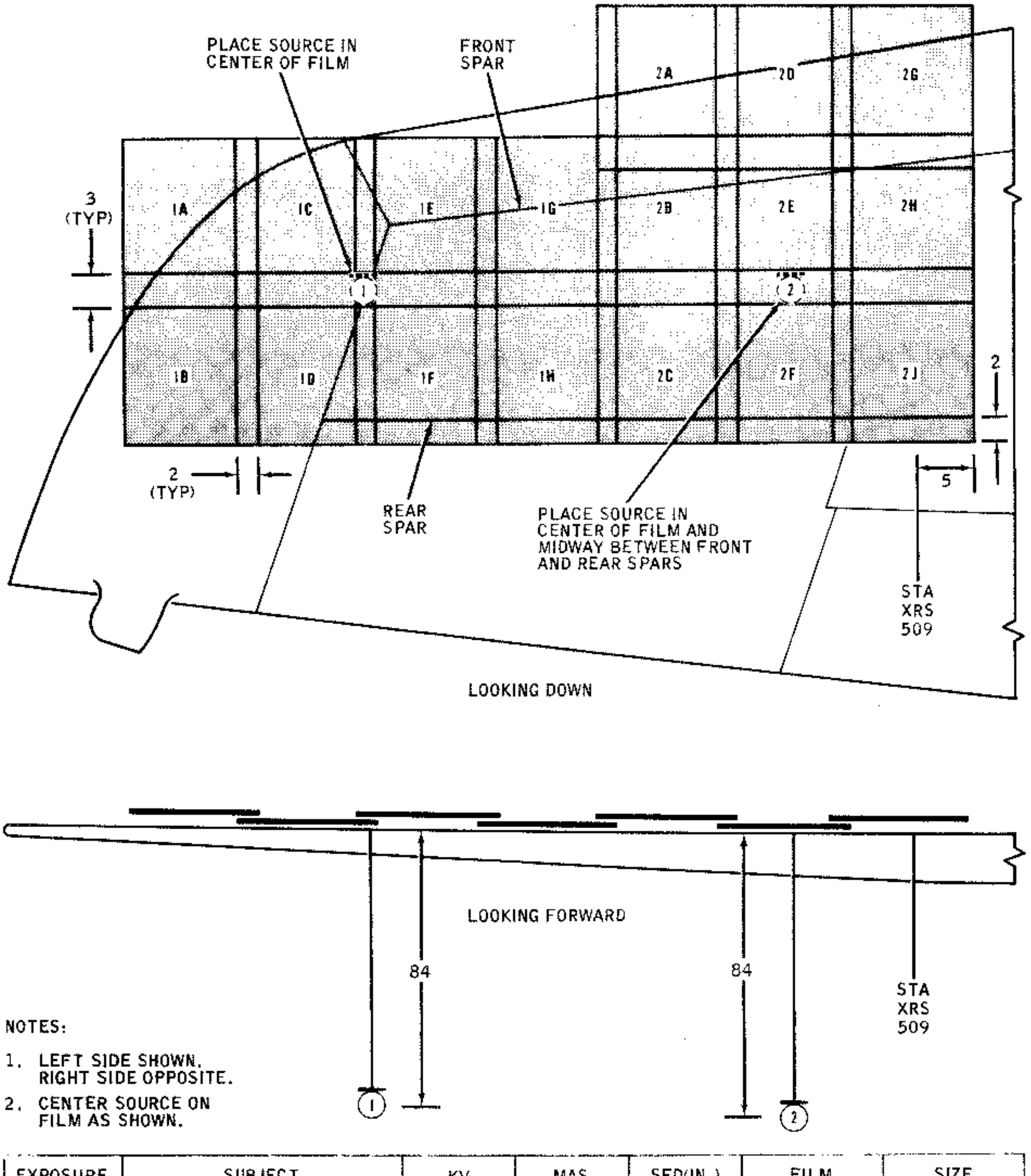
1. LEFT AND RIGHT SIDES SAME.
2. SLATS IN RETRACTED POSITION.
3. USE TWO FILM FOR EXPOSURES 2, 3, AND 5.
4. TANKS EMPTY.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	SLAT TRACK TO RETRACT TUBE CLEARANCE					
1	STA XIS 83	200	60	60	III	14 X 17
2A, B	STA XIS 136	200	60	60	III	14 X 17
3A, B	STA XIS 186	200	60	60	III	14 X 17
4	STA XOS 199	200	60	60	III	14 X 17
5A, B	STA XOS 240	200	60	60	III	14 X 17
6	STA XOS 287	200	60	60	III	14 X 17
7	STA XOS 332	200	60	60	III	14 X 17
8	STA XOS 380	200	60	60	III	14 X 17
9	STA XOS 429	200	60	60	III	14 X 17
10	STA XOS 481	200	60	60	III	14 X 17
11	STA XOS 531	200	60	60	III	14 X 17

RADIOGRAPHIC DATA

BB12-136

DC-9-30 Slats and Slat Tracks
Figure 16 (Sheet 3)



NOTES:

1. LEFT SIDE SHOWN. RIGHT SIDE OPPOSITE.
2. CENTER SOURCE ON FILM AS SHOWN.

EXPOSURE	SUBJECT	KV	MAS	SFD(IN.)	FILM	SIZE
1A THRU 1H 2A THRU 2J	WING TIP AND VENT BOX	130	600	84	II	14 X 17

RADIOGRAPHIC DATA

BB12-139

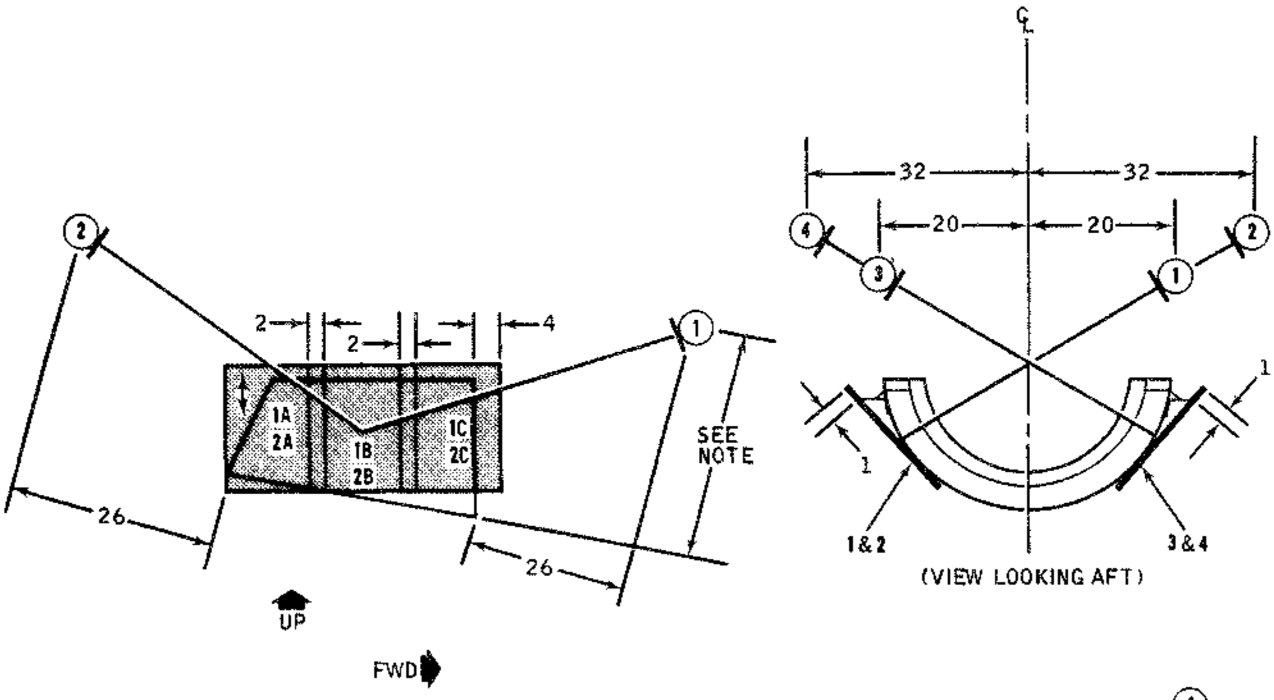
DC-9-30 Wing Tip and Vent Box Area
Figure 17

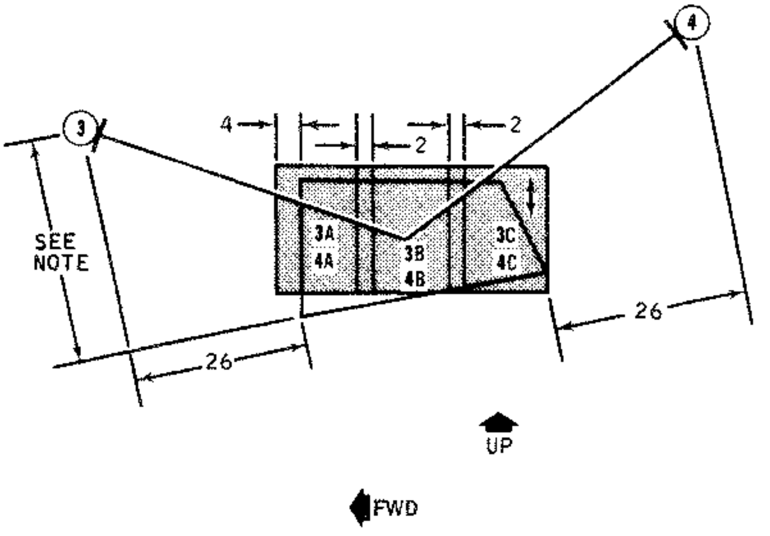
CHAPTER 8

MISCELLANEOUS AIRPLANE COMPONENTS

CHAPTER 8

MISCELLANEOUS AIRPLANE COMPONENTS





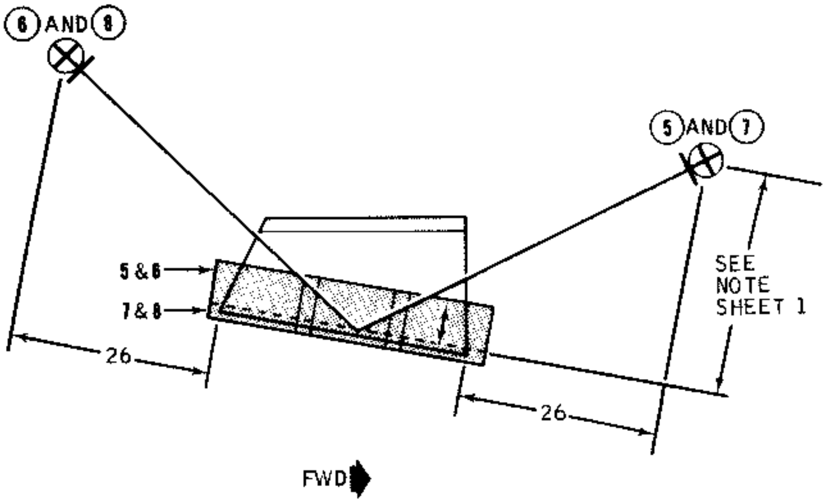
NOTES:
1. LEFT SIDE SHOWN.
2. RIGHT SIDE OPPOSITE.
3. LOWER DOOR SHOWN.
4. UPPER DOOR INVERSELY SAME.
5. DOORS MUST BE CLEANED AND OPENED TO APPROXIMATELY HALF TRAVEL.
6. SOURCE MAY BE LOCATED 42 INCHES PERPENDICULAR TO A LINE PARALLEL TO THE OUTSIDE SKIN AND PERPENDICULAR TO A TANGENT AT THE CENTER OF THE FILM AND/OR COINCIDENT WITH THE RADIUS (EXPOSURES 1 THRU 10).

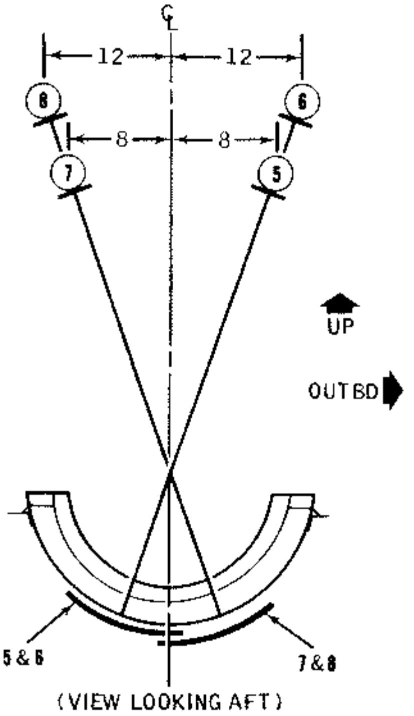
EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	THRUST REVERSER DOORS					
1A, B, & C	UPPER INBD	135	750	60	II & III	14 x 17
2A, B, & C	UPPER INBD	135	750	60	II & III	14 x 17
3A, B, & C	UPPER OUTBD	135	750	60	II & III	14 x 17
4A, B, & C	UPPER OUTBD	135	750	60	II & III	14 x 17

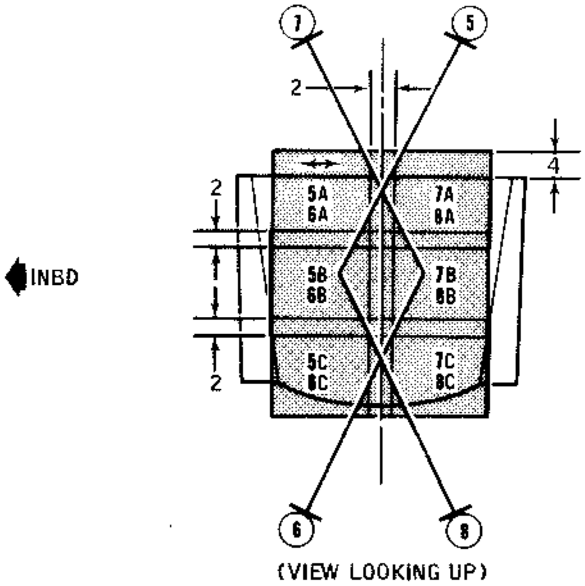
RADIOGRAPHIC DATA

BB12-53

Engine Thrust Reverser Doors
Figure 1 (Sheet 1)







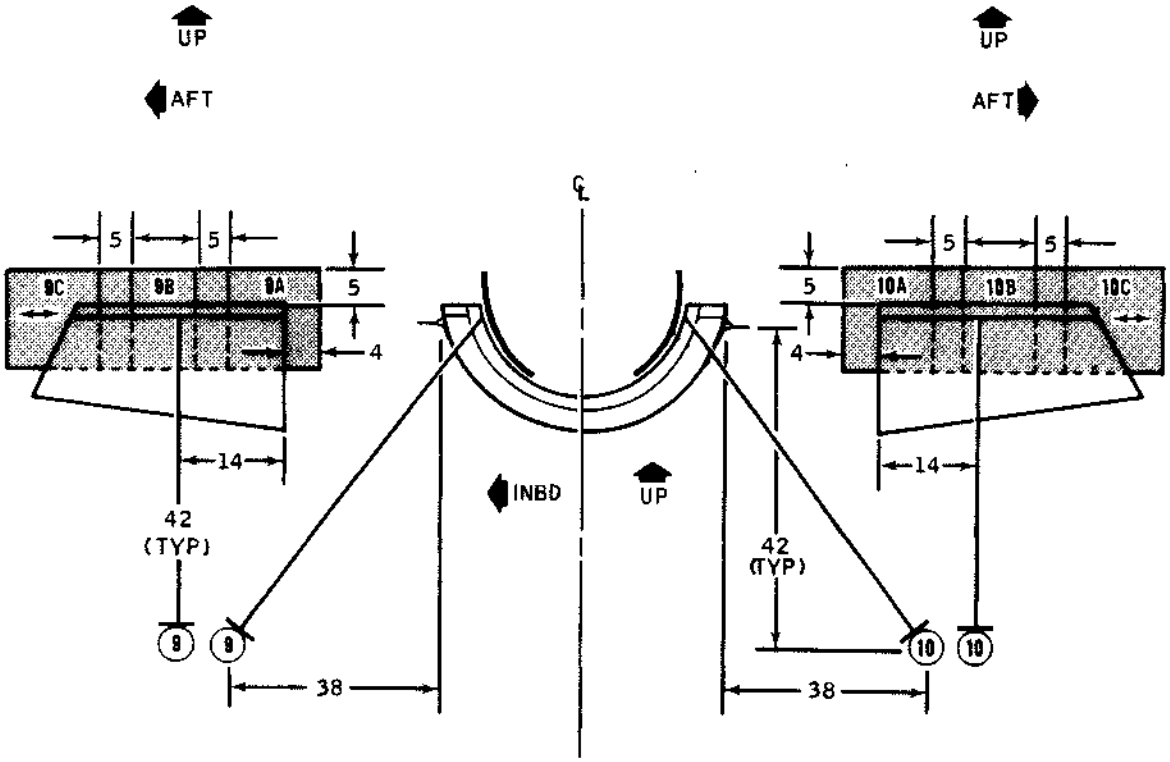
NOTE:
SEE NOTES, SHEET 1.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	THRUST REVERSER DOORS					
5A, B, & C	LOWER INBD	135	750	60	II & III	14 x 17
6A, B, & C	LOWER INBD	135	750	60	II & III	14 x 17
7A, B, & C	LOWER OUTBD	135	750	60	II & III	14 x 17
8A, B, & C	LOWER OUTBD	135	750	60	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-61

Engine Thrust Reverser Doors
Figure 1 (Sheet 2)



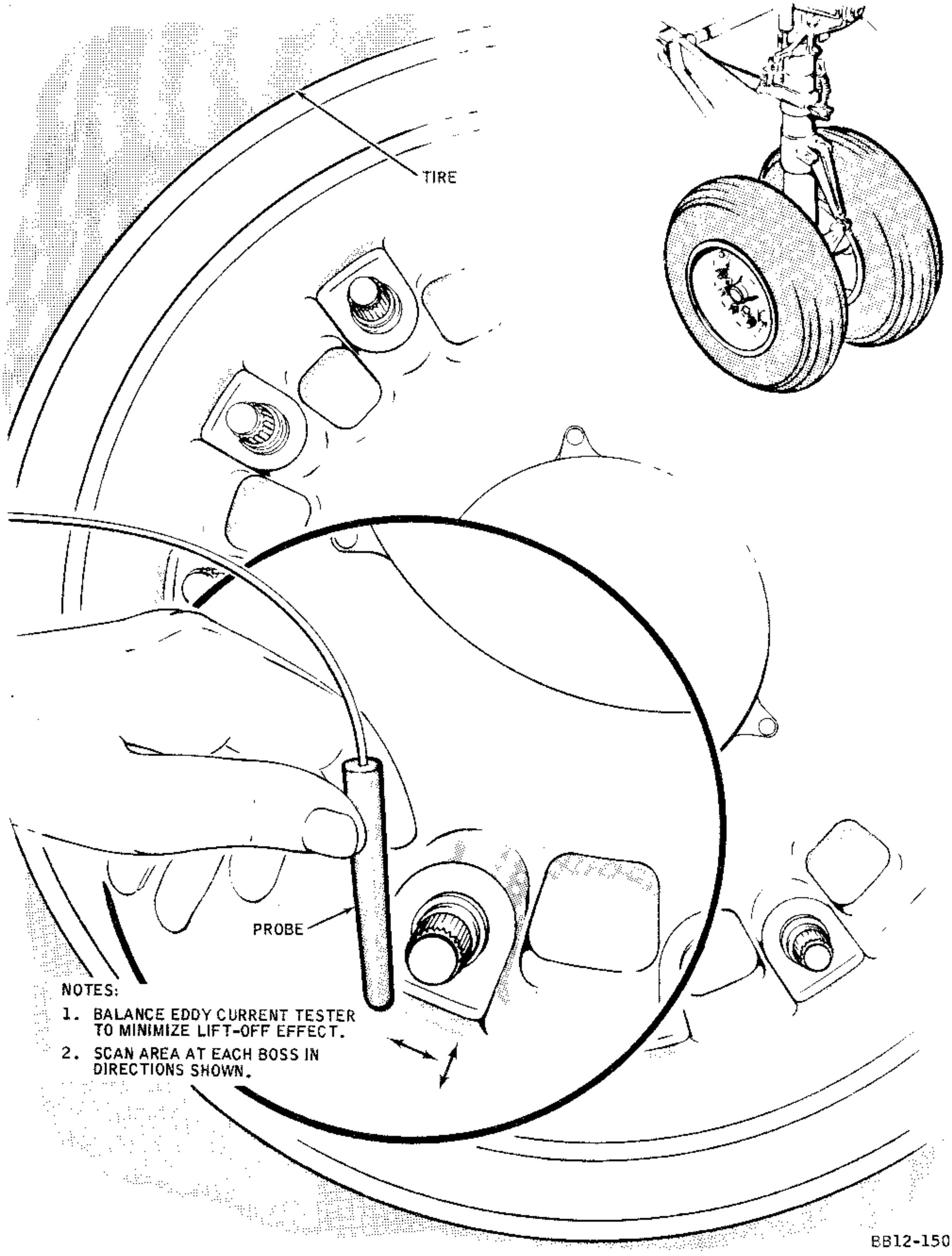
NOTE:
SEE NOTES, SHEET 1.

EXPOSURE	SUBJECT	KV	MAS	SFD (IN.)	FILM	SIZE
	THRUST REVERSER DOORS					
9A, B, & C	UPPER INBD	135	750	60	II & III	14 x 17
10A, B, & C	UPPER OUTBD	135	750	60	II & III	14 x 17

RADIOGRAPHIC DATA

BB12-62

Engine Thrust Reverser Doors
Figure 1 (Sheet 3)



NOTES:

1. BALANCE EDDY CURRENT TESTER TO MINIMIZE LIFT-OFF EFFECT.
2. SCAN AREA AT EACH BOSS IN DIRECTIONS SHOWN.

Eddy Current Testing of Main and Nose Gear Boss Areas
Figure 2

ALPHABETICAL INDEX

Printed in U.S.A.

Alphabetical Index

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Alpha-Title					
*Alpha-Eff.	1	Dec 1/66			
Alpha	1	Sep 1/66			
Alpha	2	Mar 1/66			
Alpha	2A	Mar 1/66			
Alpha	2B	Sep 1/66			
Alpha	3	Sep 1/66			
*Alpha	4	Dec 1/66			
Alpha	5	Mar 1/66			
Alpha	6	Sep 1/66			
Alpha	7	Sep 1/66			
Alpha	8	Sep 1/66			
Alpha	9	Sep 1/66			
*Alpha	10	Dec 1/66			
*Alpha	11	Dec 1/66			
Alpha	12	Sep 1/66			
Alpha	13	Sep 1/66			
Alpha	14	Sep 1/66			

*The asterisk indicates pages revised or added by the current revision.

ALPHABETICAL INDEX

CHAPTER 54

NACELLES/PYLONS

Chapter 54

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date
Title		
*54-Eff.	1	Dec 1/66
*54-Cont.	1	Dec 1/66
54-Sect App	1	Sep 1/66
54-00	1	Jun 1/66
54-00	2	Sep 1/66
54-01	1	Jun 1/66
54-01	2	Mar 1/66
54-01	3	Mar 1/66
54-01	4	Mar 1/66
54-01	5	Mar 1/66
54-01	6	Mar 1/66
54-01	7	Mar 1/66
54-01	8	Mar 1/66
54-01	9	Mar 1/66
54-01	10	Mar 1/66
54-01	11	Mar 1/66
54-01	12	Mar 1/66
54-01	13	Mar 1/66
54-01	14	Mar 1/66
54-02	1	Sep 1/66
54-02	2	Mar 1/66
54-02	3	Mar 1/66
54-02	4	Mar 1/66
*54-02	5	Dec 1/66
*54-02	6	Dec 1/66
*54-02	7	Dec 1/66
54-10-0	1	Jun 1/66
*54-10-0	2	Dec 1/66
*54-10-0	3	Dec 1/66
*54-10-0	4	Dec 1/66
*54-10-0	5	Dec 1/66
*54-10-0	6	Dec 1/66
*54-10-0	7	Dec 1/66
*54-10-0	8	Dec 1/66
*54-10-0	9	Dec 1/66
*54-10-0	10	Dec 1/66
*54-10-0	11	Dec 1/66
*54-20-0	1	Dec 1/66
*54-20-0	2	Dec 1/66
*54-20-0	3	Dec 1/66
54-30-0	1	Jun 1/66
*54-30-0	2	Dec 1/66
*54-30-0	3	Dec 1/66
*54-30-0	4	Dec 1/66
*54-30-0	5	Dec 1/66
*54-30-0	6	Dec 1/66
*54-30-0	7	Dec 1/66
*54-30-0	8	Dec 1/66
*54-30-0	9	Dec 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter 54

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
54-00	YES	YES
54-01	YES	YES
54-02	YES	YES
54-10-0	YES	YES
54-20-0	YES	YES
54-30-0	YES	YES

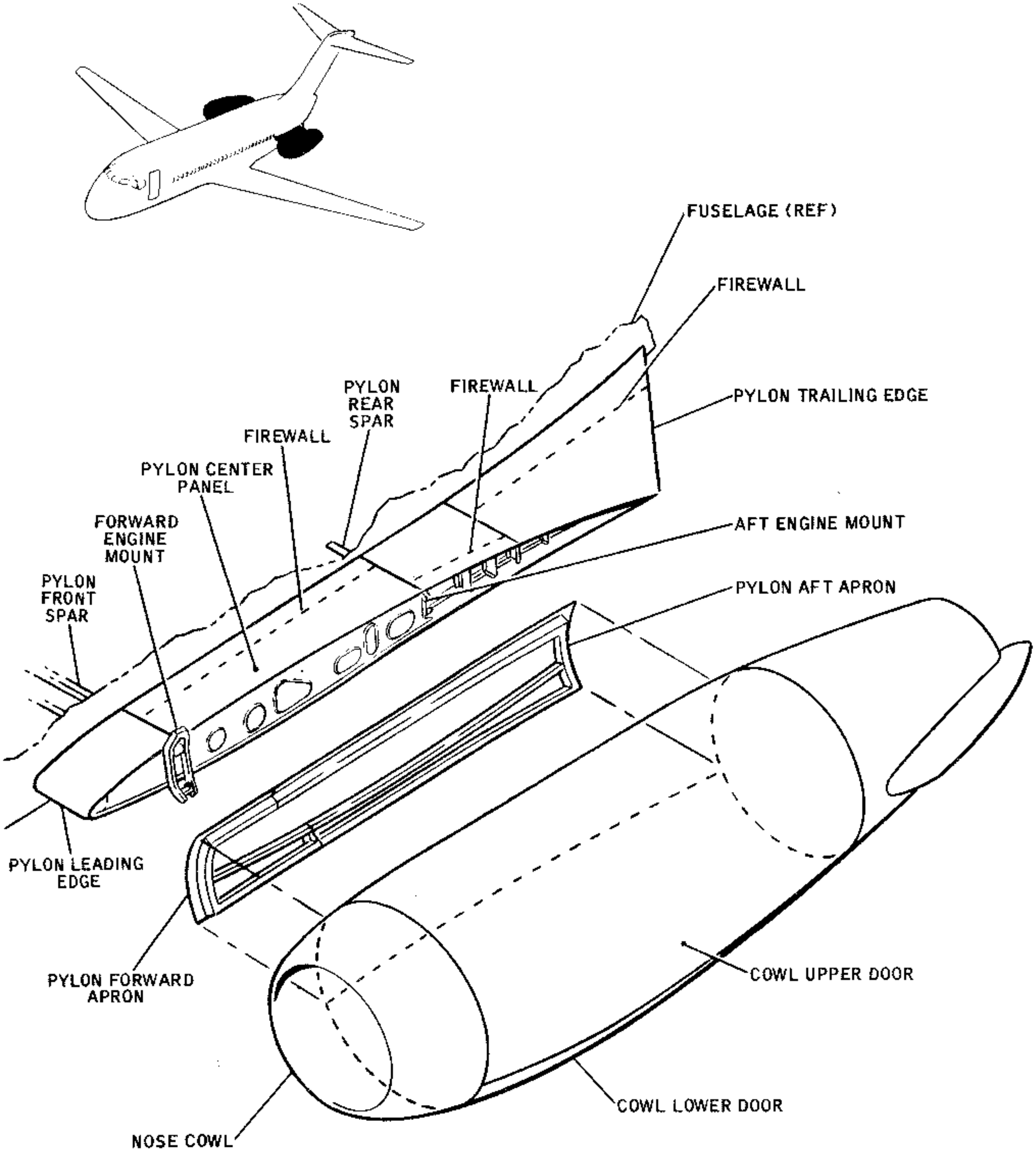
Chapter 54

TABLE OF CONTENTS

GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Repair instructions for nacelles/pylons are presented in the following pages. Material identification illustrations indicate the type of material and gages of the repairable structural components of the nacelles/pylons. Repair instructions are presented for the most common types of damage. For explanation of the classification of repairs and damage, see 51-00. For locations of the nacelles/pylon components refer to index illustration, Figure 1. A repair index is presented with each section of components.



BB3-231

Nacelles/Pylons Index Illustration
Figure 1

GENERAL REPAIR PROCEDURES AND PROCESSES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The following requirements are necessary to accomplish the repairs described and are in addition to the specific repair requirements listed with the individual repair.

(1) Recommended edge distance for all attachments in the repair areas is two diameters plus 1/16 inch, unless otherwise noted. Minimum edge distance is two diameters.

(2) All repair materials must be of the same material and heat-treat condition as the part being repaired, unless otherwise noted. See Chapter 51 for recommended substitutions. If forming operations require repair material to be in -O (soft) condition, the part must be heat-treated to the appropriate -T condition after forming. The word "clad" is placed before aluminum alloy material designations in the manual to indicate material which has a thin protective layer of pure aluminum on the surface. Absence of the word "clad" preceding a material designation indicates that the material does not have a thin layer of aluminum. After forming operations on titanium and heat-treatable stainless steels, heat-treat all material as required.

(3) All metal repair parts must be cleaned and corrosion protected in accordance with Chapter 51, unless otherwise noted in the individual repair.

(4) All repair parts must be free from cracks, burrs, dings, and sharp edges. This requirement also applies to parts to which repair parts are being attached.

(5) All attachment holes must be prepared in accordance with the recommended fastener hole size specified in the applicable section of Chapter 51.

(6) The minimum attachment spacing in the repair areas is four diameters, unless otherwise noted.

(7) Where external doublers are to be tapered for aerodynamic reasons, a seal-type taper may be substituted. See Repair Sealing section of Chapter 51.

2. General Repairs

A. The repairs described in this section are of a general nature and may be used separately or in conjunction with specific repairs that are described in subsequent sections of the chapter. When applicable, specific repairs are preferred. Repairs involving more than one illustration must comply with the requirements of each illustration. The following repairs are outlined in this section:

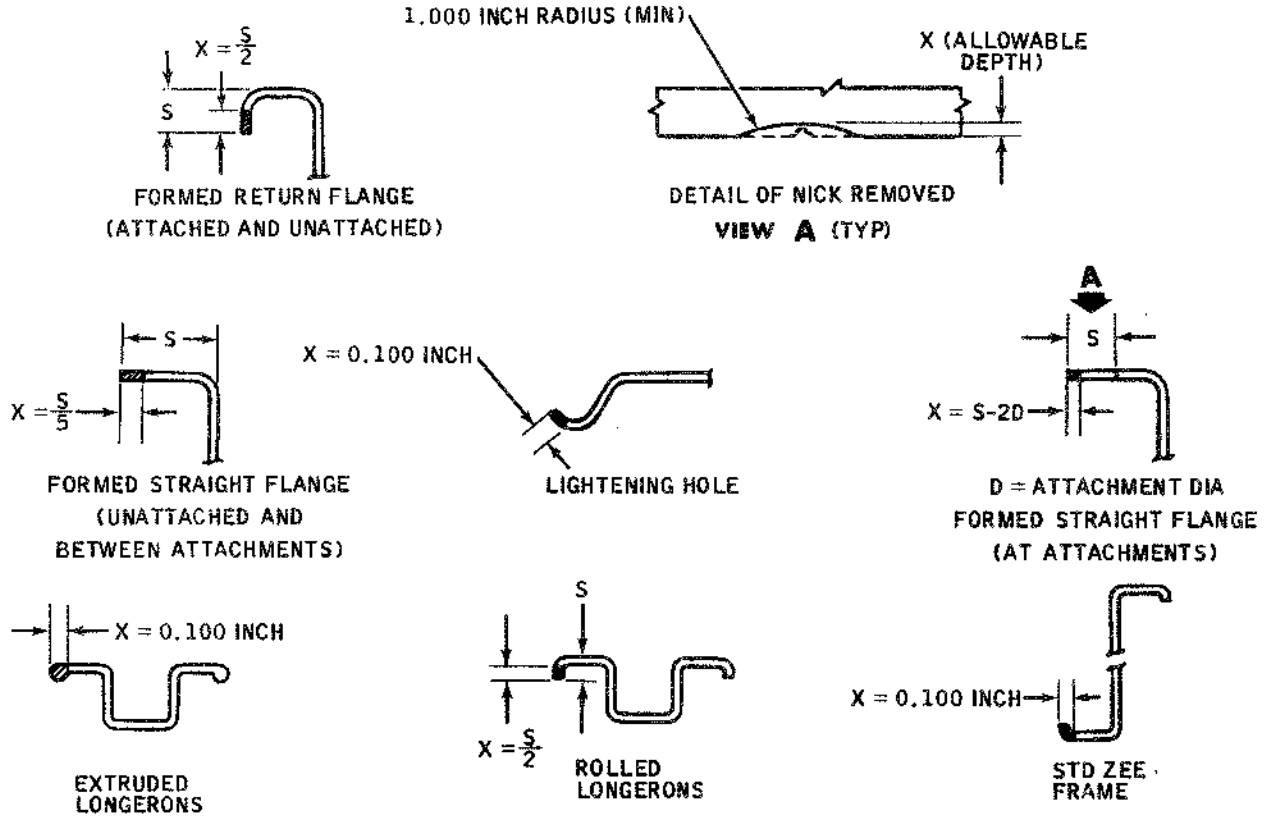
Printed in U.S.A.

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN NACELLE/PYLON STRUCTURE

(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
NICKS IN EXTRUSIONS, ROLLED, AND FORMED SECTIONS

1. NICKS THAT DO NOT PENETRATE BEYOND THE CLAD IN ALUMINUM DO NOT REQUIRE REPAIR.
2. NICKS UP TO THE DEPTH SHOWN IN THE SKETCHES BELOW SHOULD BE ROUNDED OUT TO 1.00 INCH RADIUS.
3. NICKS DEEPER THAN THE LIMIT SHOWN IN THE SKETCHES BELOW MUST BE SPLICED OR REINFORCED, AFTER THE NICK IS ROUNDED OUT. SEE THE CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.
4. NICKS IN A RADIUS AREA SHOULD BE REPAIRED AS A DING IN A RADIUS AREA AS DESCRIBED IN THE SKETCH ON SHEET 2.



1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS OF ALUMINUM SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

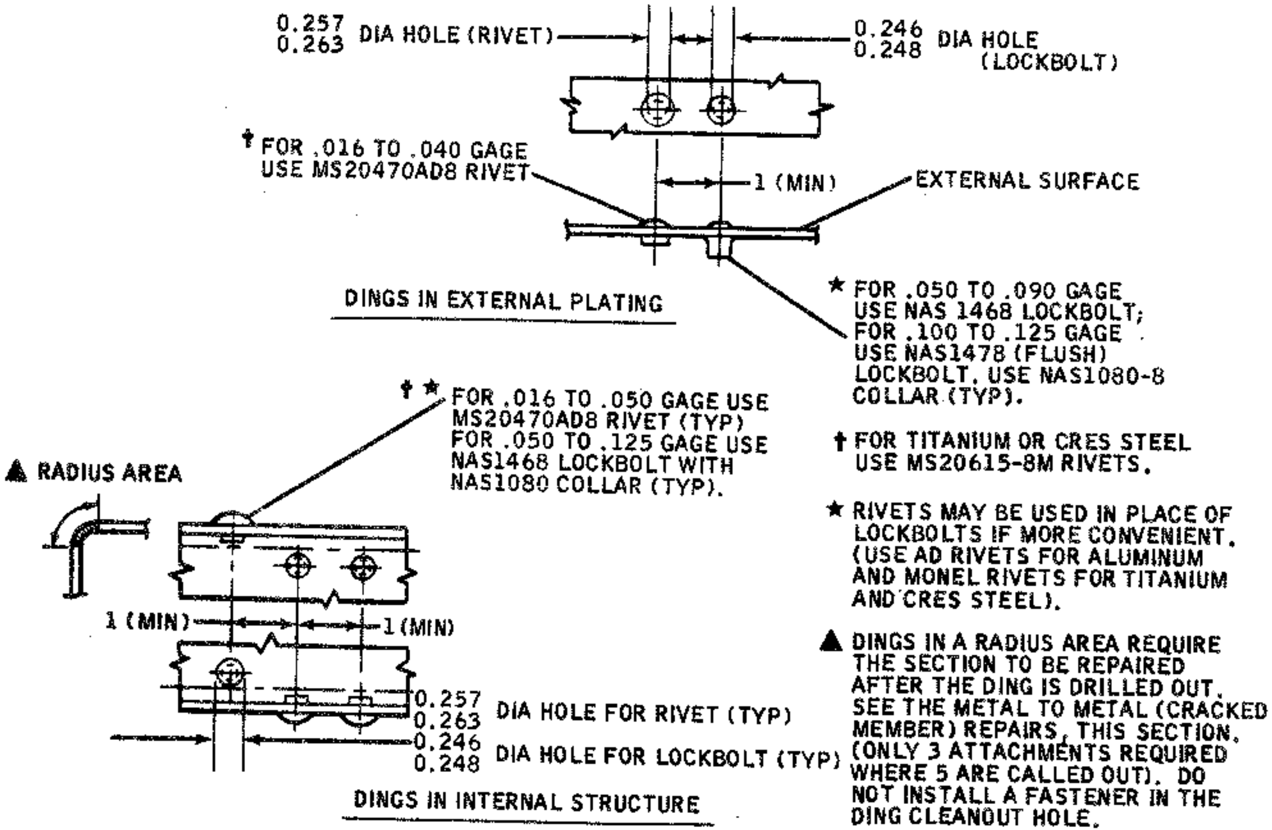
BB3-675

Cleanup of Scratches, Gouges, Nicks, and
Dings in Nacelle/Pylon Structure
Figure 1 (Sheet 1)

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN NACELLE/PYLON STRUCTURE

(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
DINGS
1. DINGS THAT DO NOT PENETRATE BEYOND THE CLAD IN ALUMINUM DO NOT REQUIRE REPAIR. 2. DINGS THAT PENETRATE BEYOND THE CLAD AND ARE NOT LARGER THAN 0.250 INCH DIAMETER SHOULD BE REMOVED AND PLUGGED. SEE SKETCHES BELOW. 3. DINGS LARGER THAN 0.250 INCH DIAMETER MUST BE REPAIRED. REPAIR IN SAME MANNER AS CRACKED MEMBERS, THIS SECTION. 4. THESE INSTRUCTIONS DO NOT APPLY TO THE VARIOUS SPAR FRAMES, BULKHEAD CAPS, OR MACHINED FITTINGS IN THE AREA.



† FOR TITANIUM OR CRES STEEL USE MS20615-8M RIVETS.

★ RIVETS MAY BE USED IN PLACE OF LOCKBOLTS IF MORE CONVENIENT. (USE AD RIVETS FOR ALUMINUM AND MONEL RIVETS FOR TITANIUM AND CRES STEEL).

▲ DINGS IN A RADIUS AREA REQUIRE THE SECTION TO BE REPAIRED AFTER THE DING IS DRILLED OUT. SEE THE METAL TO METAL (CRACKED MEMBER) REPAIRS, THIS SECTION. (ONLY 3 ATTACHMENTS REQUIRED WHERE 5 ARE CALLED OUT). DO NOT INSTALL A FASTENER IN THE DING CLEANOUT HOLE.

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS OF ALUMINUM SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-676

Cleanup of Scratches, Gouges, Nicks, and
Dings in Nacelle/Pylon Structure
Figure 1 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

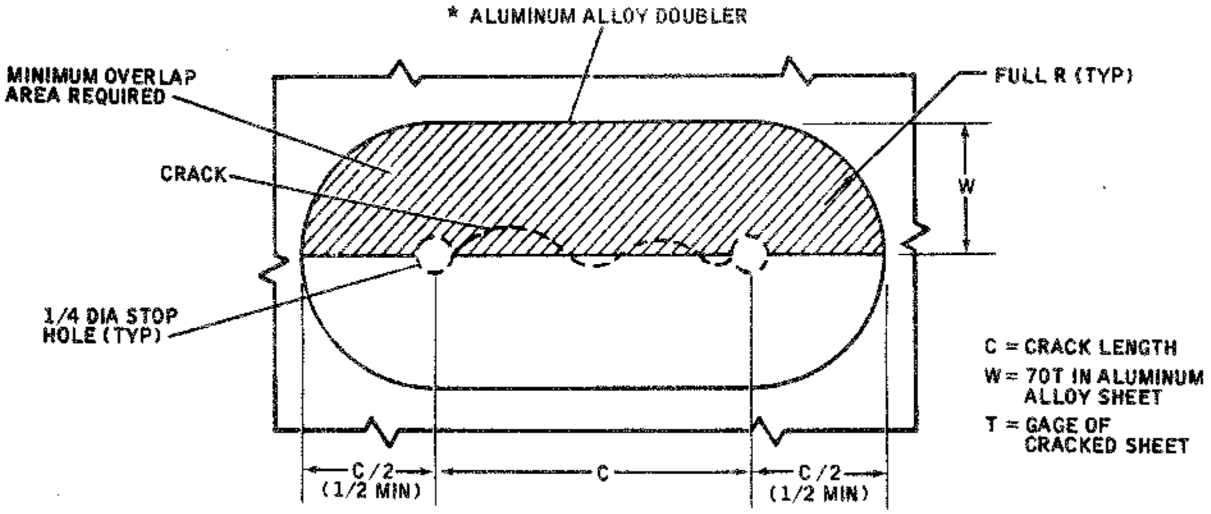
METAL TO METAL REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET

.010 TO .032 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE B BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 35T AND THE DOUBLER GAGE SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
5. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



C = CRACK LENGTH
W = 70T IN ALUMINUM ALLOY SHEET
T = GAGE OF CRACKED SHEET

EXAMPLE B

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR ALUMINUM REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
3. SEE CHAPTER 51-70-0, REPAIR BONDING PROCEDURES, FOR CLEANING, BONDING, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

* DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-677

Metal to Metal Repairs (Cracked Members)
Figure 2 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

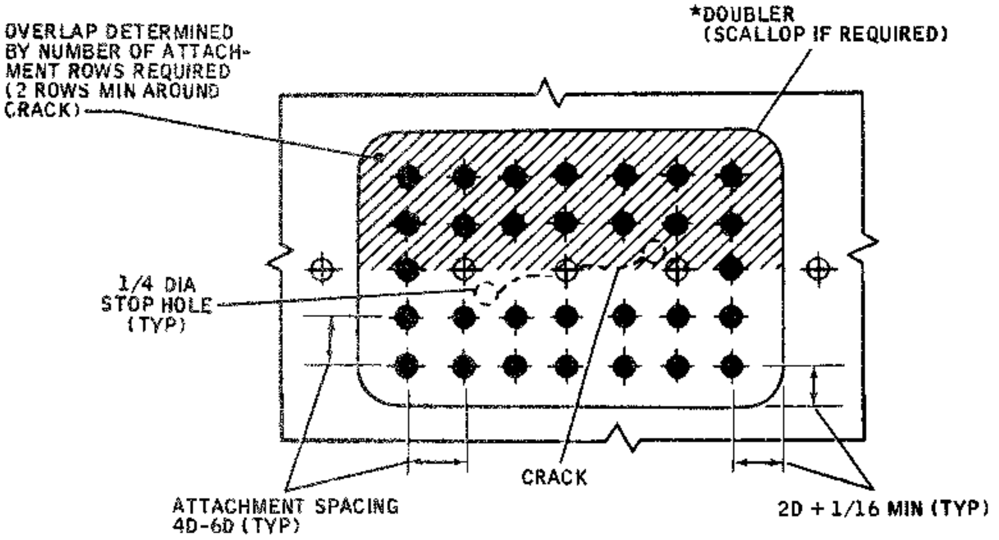
METAL TO METAL REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY, TITANIUM, OR CRES STEEL SHEET

.032 TO .090 GAGE

1. REPAIR SHEET CRACKS, USING A DOUBLER OF THE SAME GAGE AND MATERIAL AS THE CRACKED MEMBER. INSTALL DOUBLER USING ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE C BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE IN THIS SECTION MAY ALSO BE USED FOR SHEET ALUMINUM REPAIR. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE C

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR ALUMINUM REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F.)
3. SEE CHAPTER 51-70-0, REPAIR BONDING PROCEDURES, FOR CLEANING, BONDING, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

* DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-678

Metal to Metal Repairs (Cracked Members)
Figure 2 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

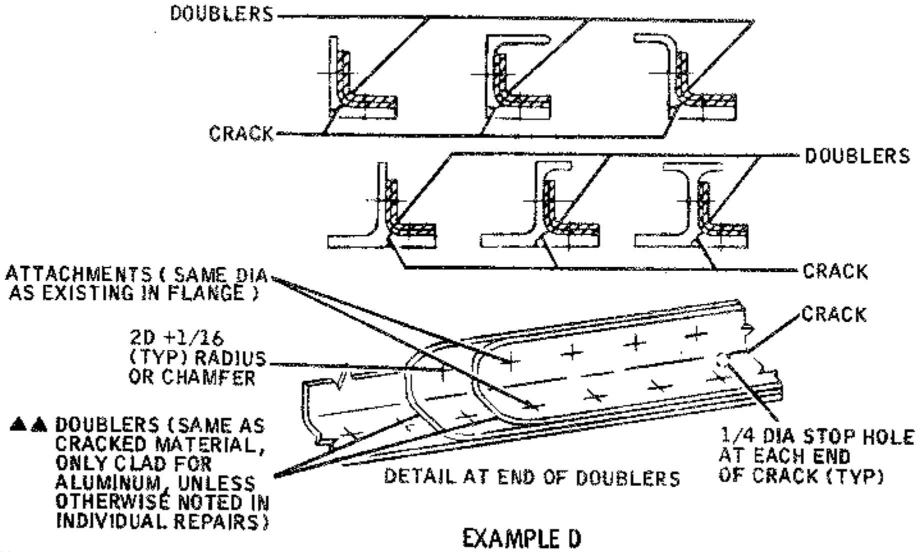
METAL TO METAL REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY, TITANIUM, OR CRES STEEL, EXTRUDED, FORMED AND ROLLED SECTIONS, EXCEPT PYLON SPAR CAPS

.016 TO .125 GAGE

1. REPAIR CRACKS PARALLEL TO THE ATTACHED FLANGE RADIUS OF EXTRUDED, FORMED, OR ROLLED SECTIONS, USING FORMED DOUBLERS. INSTALL PER EXAMPLE D, USING ATTACHMENTS AND BOND PER 51-70-2. (THE ADHESIVE WILL CAUSE THE DOUBLERS TO ACT AS A SINGLE DOUBLER, LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND ACT AS A SEALANT AT THE FAYING SURFACE).
2. PICK UP AT LEAST ONE ROW OF ATTACHMENTS EACH SIDE OF CRACK AND PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK IN EACH ROW AT EACH END AS SHOWN IN DETAIL BELOW.
3. THE DOUBLERS SHOULD BE EQUAL IN GAGE, IF POSSIBLE. THE THINNEST DOUBLER SHOULD BE INSTALLED NEXT TO CRACKED MEMBER.
4. IF THE CRACK IS PERPENDICULAR TO A FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED, OR ADDITIONAL DOUBLERS ADDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.
5. TWO THIN FORMED DOUBLERS ARE USED IN ORDER TO GET A SMALLER BEND RADIUS AND TO GET A TAPERED EFFECT IN LOAD PICKUP.



EXAMPLE D

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR ALUMINUM REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
3. SEE CHAPTER 51-70-0, REPAIR BONDING PROCEDURES, FOR CLEANING, BONDING, AND CURING INSTRUCTIONS.

▲THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

▲▲FOR FORMED AND ROLLED SECTIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE EQUAL TO OR GREATER THAN THE CRACKED MEMBER GAGE, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR. FOR EXTRUSIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE AT LEAST ONE GAGE HEAVIER THAN THE THICKEST LEG ADJACENT TO THE CRACK.

BB3-679

Metal to Metal Repairs (Cracked Members)
Figure 2 (Sheet 3)

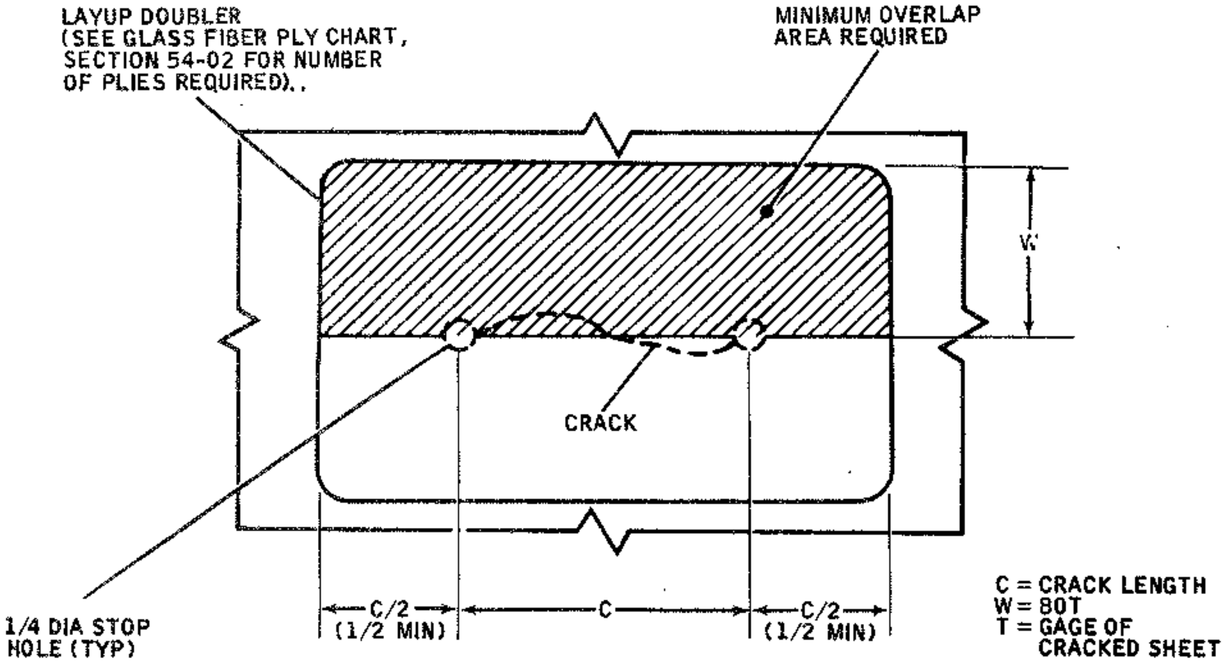
DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.010 TO .032 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE B BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. SEE SHEET 2.
3. IF A DOUBLER IS TO BE INSTALLED ON BOTH SURFACES OF THE CRACKED SHEET, THEN W = 40T AND THE NUMBER OF PLIES SHOULD BE HALVED.
4. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER (NAS1252) ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE B

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. SEE CHAPTER 51-70-0, REPAIR BONDING PROCEDURES, FOR CLEANING, BONDING, LAYUP, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-680

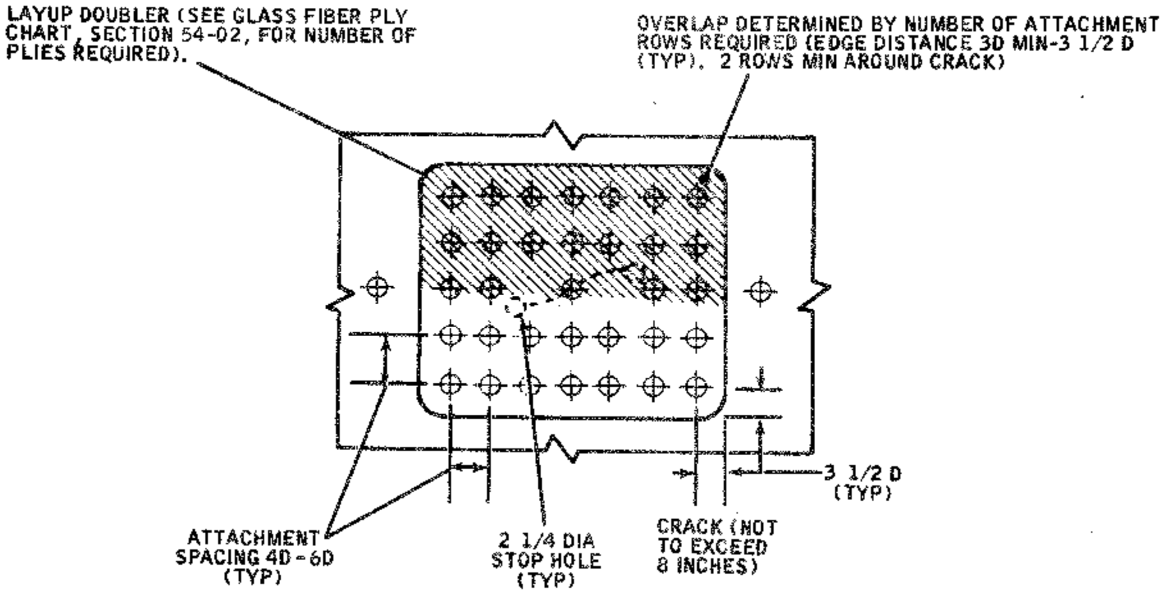
Glass Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR (PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.032 TO .050 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER, USING ATTACHMENTS AND BONDED PER 51-70-3. SEE EXAMPLE C BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE C

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. SEE CHAPTER 51-70-0, REPAIR BONDING, FOR CLEANUP, BONDING, LAYUP, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-681

Glass Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 2)

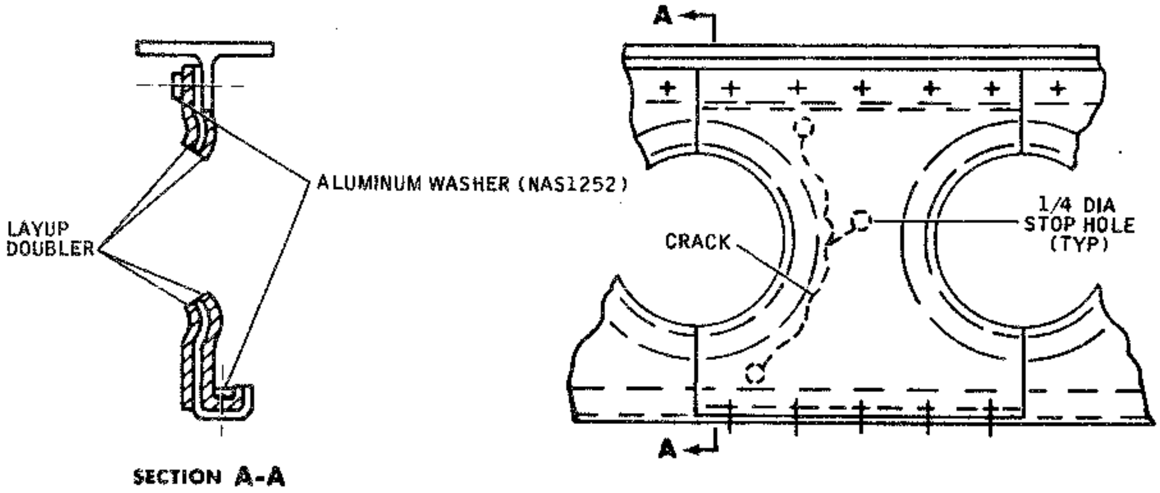
DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET, INTERCOSTALS, AND STIFFENERS
.016 TO .080 GAGE

1. REPAIR LIGHTENING HOLE RADIUS CRACKS USING A LAYUP DOUBLER OVER BOTH SURFACES OF THE CRACKED MEMBER BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF ALL CRACKS
3. EXTEND THE DOUBLERS IN THE CRACK DIRECTION TO PICK UP ATTACHMENTS AS SHOWN. MAKE CERTAIN THAT ALUMINUM ALLOY WASHERS (NAS1252) ARE INSTALLED ON THE GLASS FIBER SIDE OF THE REPAIR AT THE ATTACHMENTS.
4. EXTEND THE DOUBLERS ON BOTH SIDES OF THE CRACK TO THE APPROXIMATE CENTER OF THE LIGHTENING HOLE.

NOTE:
SEE GLASS FIBER PLY CHART, SECTION 54-02, FOR NUMBER OF PLIES REQUIRED IN DOUBLERS.



EXAMPLE D

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. SEE CHAPTER 51-70-0, REPAIR BONDING, FOR CLEANING, BONDING, LAYUP, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-682

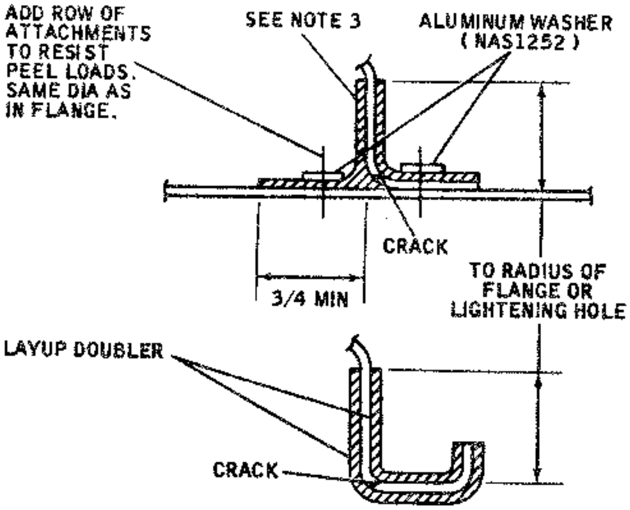
Glass Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY NACELLE/PYLON MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY FORMED AND ROLLED SECTIONS
.016 TO .080 GAGE

1. REPAIR CRACKS PARALLEL TO THE FLANGE RADIUS OF FORMED OR ROLLED SECTIONS USING LAYUP DOUBLERS BONDED PER 51-70-3. SEE EXAMPLE E BELOW.
2. IF THE CRACKED FLANGE IS ATTACHED, THEN PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK AT EACH END, AND ADD A ROW OF ATTACHMENTS AS SHOWN. MAKE BOTH DOUBLERS THE SAME LENGTH. INSTALL ATTACHMENTS AFTER CURING.
3. IF THE FLANGE IS NOT ATTACHED, THEN OVERLAP THE DOUBLERS BEYOND THE ENDS OF THE CRACK BY AT LEAST THREE INCHES.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER (NAS1252) ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE CRACK IS PERPENDICULAR TO THE FLANGE RADIUS, THEN THE DOUBLER SHOULD BE EXTENDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.



EXAMPLE E

NOTES:

1. SEE GLASS FIBER PLY CHART, SECTION 54-02, FOR NUMBER OF PLIES REQUIRED.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF CRACK.
3. IN .071 AND .080 GAGES, ADD ROW OF ATTACHMENT SAME DIA AS THOSE IN FLANGE.

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. SEE CHAPTER 51-70-0, REPAIR BONDING, FOR CLEANING, BONDING, LAYUP, AND CURING INSTRUCTIONS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED ALUMINUM MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-683

Glass Fiber Layup to Aluminum Alloy Repairs
(Cracked Members)
Figure 3 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN NACELLE/PYLON MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

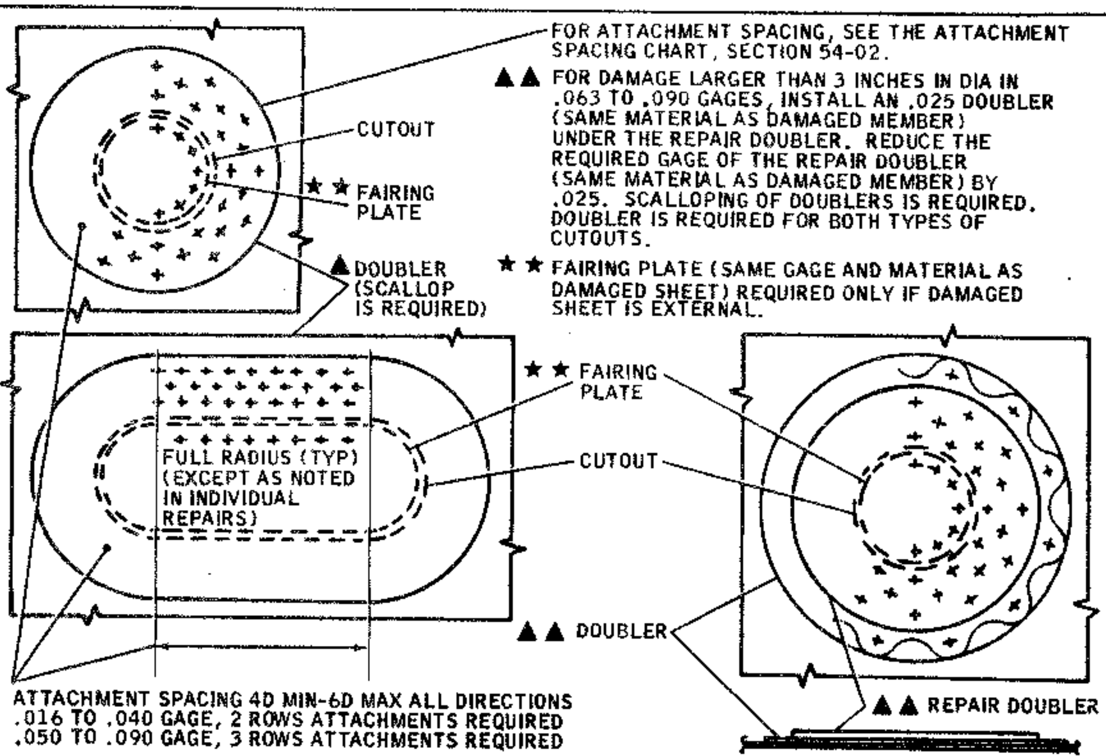
METAL TO METAL REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM ALLOY, TITANIUM, OR CRES STEEL SHEET

.016 TO .090 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A DOUBLER OF SAME GAGE AND MATERIAL AS DAMAGED MEMBER. INSTALL DOUBLER, USING ATTACHMENTS PER SKETCHES BELOW, AND BOND PER 51-70-2. (THE ADHESIVE HAS NOT BEEN CONSIDERED IN STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED, AND CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND ACT AS A SEALANT AT THE FAYING SURFACE).
2. MAXIMUM CUTOUT DIAMETER ALLOWABLE IS SHOWN ON THE ATTACHMENT SPACING CHART, THIS SECTION. EXTENSIVE DAMAGE REQUIRES A PRODUCTION TYPE SPLICING OF THE SHEET OR REPLACEMENT OF THE SHEET TO THE NEAREST PRODUCTION SPLICE.
3. GLASS FIBER LAYUP DOUBLERS MAY ALSO BE USED FOR ALUMINUM IN CUTOUT REPAIRS UP TO .040 GAGE AS ILLUSTRATED ON ANOTHER ILLUSTRATION, THIS SECTION. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



FOR ATTACHMENT SPACING, SEE THE ATTACHMENT SPACING CHART, SECTION 54-02.

▲▲ FOR DAMAGE LARGER THAN 3 INCHES IN DIA IN .063 TO .090 GAGES, INSTALL AN .025 DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) UNDER THE REPAIR DOUBLER. REDUCE THE REQUIRED GAGE OF THE REPAIR DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) BY .025. SCALLOPING OF DOUBLERS IS REQUIRED. DOUBLER IS REQUIRED FOR BOTH TYPES OF CUTOUTS.

★★ FAIRING PLATE (SAME GAGE AND MATERIAL AS DAMAGED SHEET) REQUIRED ONLY IF DAMAGED SHEET IS EXTERNAL.

ATTACHMENT SPACING 4D MIN-6D MAX ALL DIRECTIONS
.016 TO .040 GAGE, 2 ROWS ATTACHMENTS REQUIRED
.050 TO .090 GAGE, 3 ROWS ATTACHMENTS REQUIRED

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
3. SEE CHAPTER 51-70-0, REPAIR BONDING, FOR CLEANING, BONDING, AND CURING INSTRUCTIONS.

▲ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR REQUIREMENTS.

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED NACELLE/PYLON MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-684

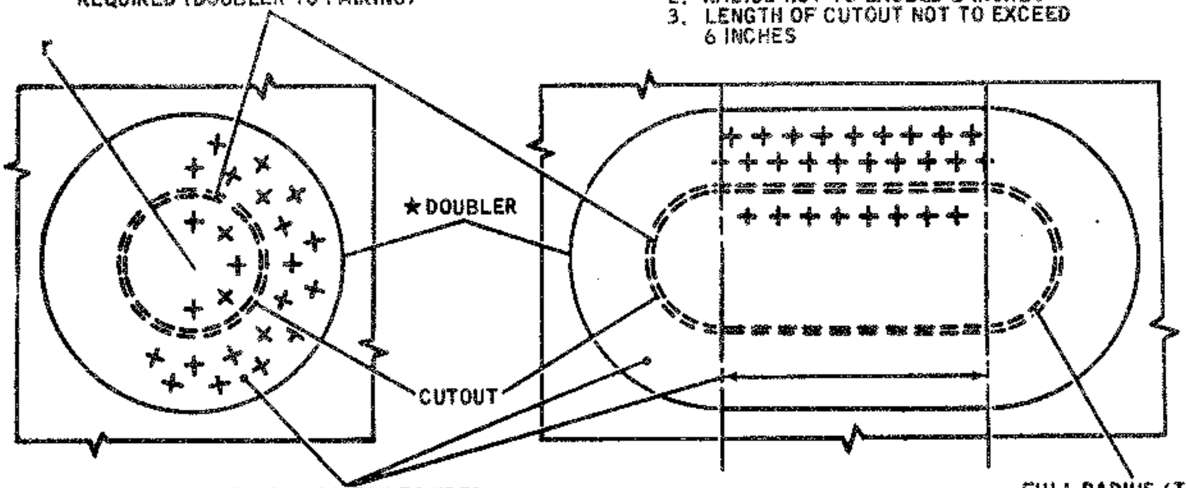
Metal to Metal Repairs
(Damage Requiring Cutouts)
Figure 4

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY NACELLE/PYLON MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .040 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER AND FAIRING PLATE, USING ATTACHMENTS AND BONDING PER 51-70-3. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAKE CERTAIN THAT A FAIRING PLATE IS ATTACHED AND BONDED IN THE CUTOUT. THE FAIRING PLATE WILL STIFFEN THE GLASS FIBER AND WILL SERVE AS SURFACE FOR LAYUP. INSTALL ATTACHMENTS AFTER CURING.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER (NAS1252) ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



FAIRING PLATE (SAME GAGE AND MATERIAL AS ORIGINAL SHEET). ONE ROW OF ATTACHMENTS REQUIRED (DOUBLER TO FAIRING)

NOTE:
1. RADIUS OF CUTOUT = r
2. RADIUS NOT TO EXCEED 2 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 6 INCHES

2 ROWS OF ATTACHMENTS REQUIRED (DOUBLER TO SHEET). ATTACHMENT SPACING 4D MIN - 6D MAX ALL DIRECTIONS. EDGE DISTANCE (GLASS FIBER) 3D MIN - 3 1/2 D TYP

FULL RADIUS (TYP) EXCEPT AS NOTED IN INDIVIDUAL REPAIRS

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. SEE CHAPTER 51-70-0, REPAIR BONDING, FOR CLEANING, BONDING, LAYUP, AND CURING INSTRUCTIONS.

★ GLASS FIBER LAYUP DOUBLER (SEE GLASS FIBER PLY CHART, SECTION 54-01, FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED ALUMINUM MEMBERS LISTED IN THE CHART THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-685

Glass Fiber Layup to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 5

B. Determine the number of 181 bidirectional glass cloth plies required for making glass cloth repairs as follows:

Damaged Aluminum Gage	Total Number of Plies
.016	3
.020	4
.025	5
.032	6
.040	7
.050	9
.063	11
.071	12
.080	14
.090	15

NOTES: 1. When applying the glass fiber cloth to both sides of the damaged aluminum alloy sheet, place half the total plies on each side. If the total number of plies is an odd number, add one more ply.

2. For members with extreme curvature, it may be desirable to use the thinner bidirectional cloth, Number 120. In this instance double the number of plies that is specified above.

3. Arrange the pattern of the glass cloth so that the threads are parallel to and 90 degrees from the direction of the crack.

4. This chart is for use only when specified in other repairs of this manual.

Glass Fiber Ply Chart
Figure 6

PLATING REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes methods for repairing the nacelle/pylon plating. These repairs are restricted and must not be used for repair of nose cowl leading edge or intake surfaces.

2. Plating Repairs Requiring Cutouts

A. Plating repairs may be made where the damaged area can be removed by making a hole and installing a repair doubler, provided the repair will clear adjacent structure.

B. Accomplish repair as follows:

(1) Determine size of hole and ascertain rivet size and spacing requirements in Figure 1.

(2) Using the same material and gage as the plating for the doubler and fairing, make repair as shown in Figure 2. It should be noted that the doubler and fairing must be in the same -T condition as the plating before installing.

3. Scratches, Gouges, or Dings

A. Scratches, gouges, or dings in aluminum that do not penetrate clad do not require repair. All other scratches, gouges, and dings must be repaired as follows:

(1) Round out and taper damage as shown in Figure 3, example A.

(2) Scratches, gouges, and dings exceeding limits shown in Figure 3, example A, should be repaired in accordance with paragraph 2.

4. Dents

A. Smooth dents without skin crack should be repaired as follows:

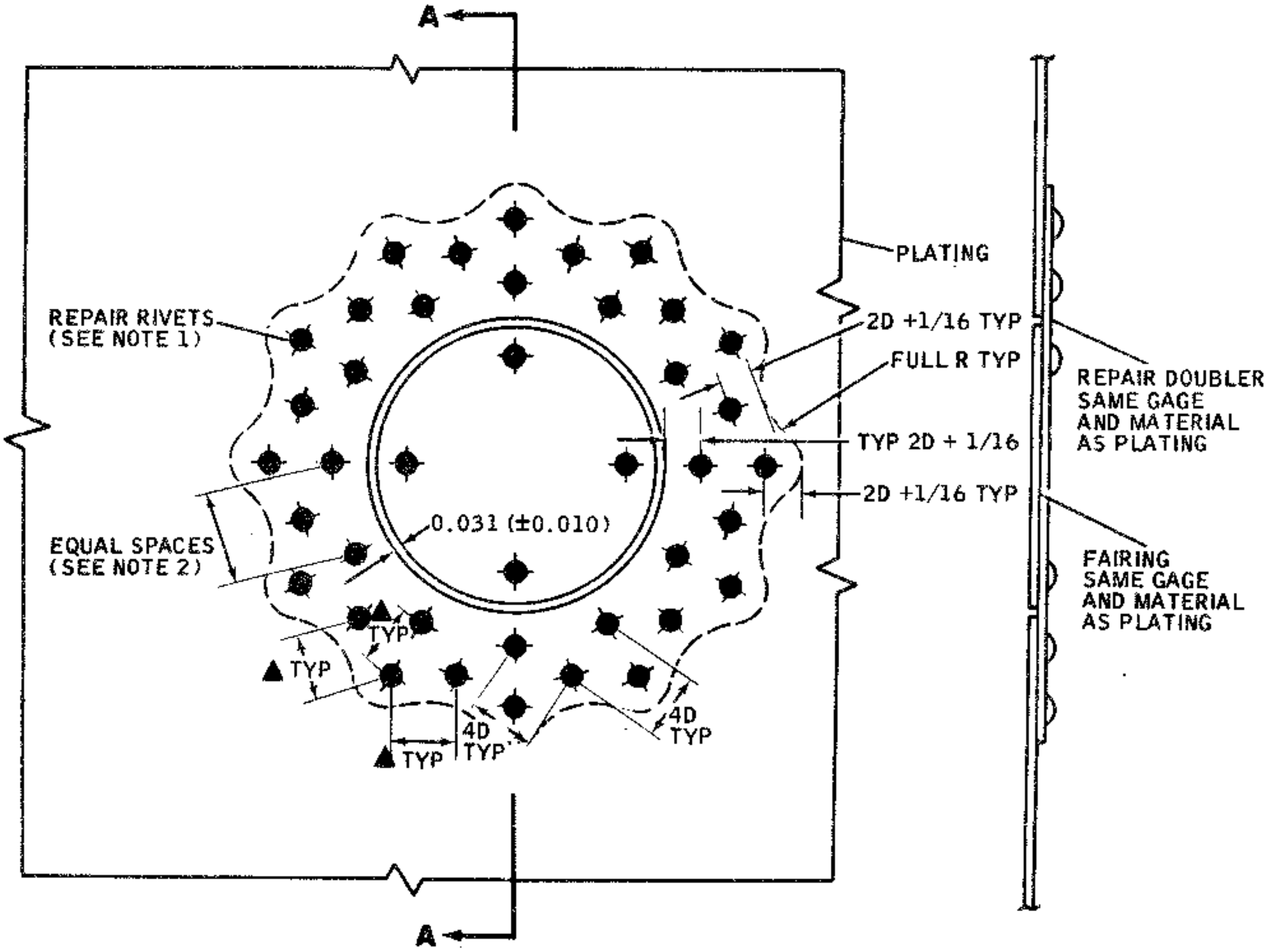
(1) Install rivets in dent area as shown in Figure 3, example B.

(2) Fill dent area with Pro-Seal 735 (Coast Pro-Seal & Manufacturing Co., Los Angeles, California) in accordance with 51-70-2. Repair must be fair.

Plating Repair Cutout Diameter (Inches)						Attachment Diameter
1 to 1 1/4	1 1/4 to 2	2 to 3 1/4	3 1/4 to 5 1/4	5 1/4 to 7	7 to 11	1/8
1 to 1 3/4	1 3/4 to 3	3 to 4	4 to 6 1/2	6 1/2 to 9	9 to 11 3/4	5/32
1 to 2	2 to 3	3 to 5	5 to 8	8 to 11	11 to 16 1/2	3/16
1 1/2 to 2 3/4	2 3/4 to 4	4 to 6 1/2	6 1/2 to 10 1/2	10 1/2 to 14 1/2	———	1/4
8 equal spaces	12 equal spaces	16 equal spaces	24 equal spaces	36 equal spaces	48 equal spaces	

NOTE: Do not use this chart in making repairs unless it is specifically referred to in a particular repair.

Attachment Spacing Chart
Figure 1



SECTION A-A
(CURVATURE OMITTED)

NOTES:

1. THREE ROWS OF ATTACHMENTS REQUIRED.
   A. FOR .032 AND .040 MATERIAL:
      (1) USE NAS1097AD4 RIVETS FOR ALUMINUM.
      (2) USE MS20615-4M RIVETS FOR TITANIUM
          (82° COUNTERSINK AND UPSET HEAD IN COUNTERSINK).
   B. FOR .050 AND .063 MATERIAL:
      (1) USE NAS1097AD5 RIVETS FOR ALUMINUM.
      (2) USE MS20427M4 RIVETS FOR TITANIUM.

2. SEE ATTACHMENT SPACING CHART, FIGURE 1, FOR NUMBER OF EQUAL SPACES.

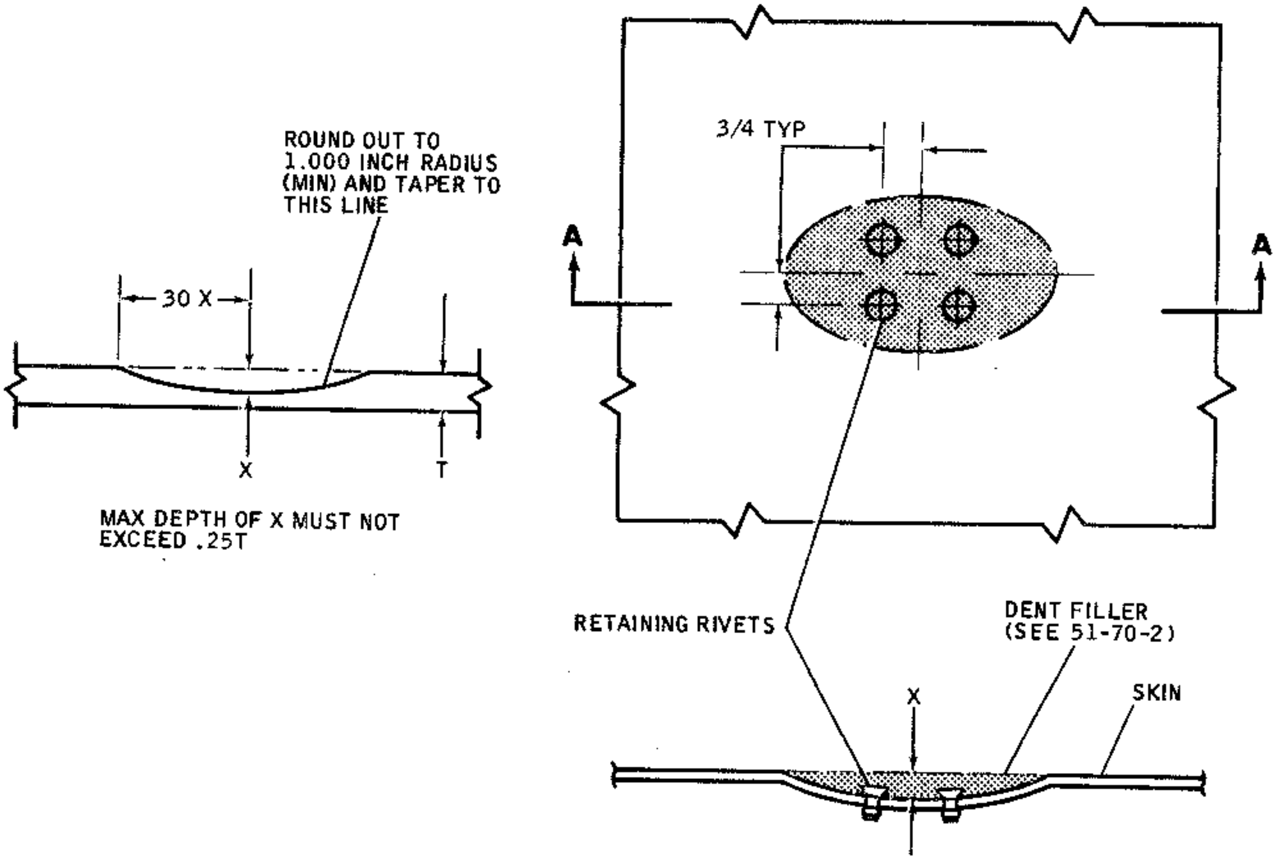
3. ▲ WHEN LOCATING THE THIRD ROW OF ATTACHMENTS, SPACING MUST BE 4D OR GREATER IN ALL THREE DIRECTIONS; NEVER LESS THAN 4D.

RIVET CODE:

● REPAIR RIVET

BB3-686

Plating Repairs
Figure 2



EXAMPLE A

DAMAGE LIMITS FOR SCRATCHES, GOUGES, OR DINGS

EXAMPLE B

DAMAGE LIMITS FOR DENTS

MAX DEPTH OF X MUST NOT EXCEED .25T

SECTION A-A

NOTES:

1. INSTALL DENT FILLER RETAINING RIVETS (MS20601M4 FOR TITANIUM SKIN) (MS20601AD4 FOR ALUMINUM ALLOY SKIN).
2. DO NOT COUNTERSINK RIVETS. THE HEAD ACTS AS A MECHANICAL RETAINING DEVICE FOR DENT FILLER.
3. FILL DENTS WITH PRO-SEAL 735. SEE 51-70-2.
4. MAX DEPTH OF X NOT TO EXCEED 3/4-INCH FOR DENTS.

8B3-687

Damage Limits and Repair -- Class B
Figure 3

TEMPORARY REVISION 54-4

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 54-02. Page 4 Retain this Temporary Revision until the Mar 1/67 revision to the Structural Repair Manual incorporates this information.
DESCRIPTION AND REASON:	Provides instructions for the repair of the pylon firewall.
EFFECTIVITY:	ALL

FIREWALL REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section describes methods for repairing pylon firewall made from B-stage phenolic, high silica fabric. This material is resistant to 1649°C (3000°F) flame impingement for 10 minutes.

NOTE: All patches and repairs should be made on the outboard side of the firewall laminate, and in position to receive full flame impact in the event of engine malfunction.

2. Repair of Fractures Over 2 Inches Long

A. Complete or partial fractures over 2 inches long should be repaired as follows:

(1) Drill a 3/16-inch-diameter hole at each end of crack to act as stop holes.

(2) Pre-cut patch to overlap damaged area by 1/2 inch to 3/4 inch on all sides. Patches may be secured from scrapped parts or from cured sheet material of equal thickness fabricated for this purpose.

(3) Locate patch over area to be repaired and drill two 1/8-inch-diameter holes in the most desirable area for inserting steel bolts. Whenever possible, utilize edge attachment hole(s) for this purpose.

(4) Wipe surface areas to remove any contamination, using acetone (O-A-51) or methyl isobutyl ketone (TT-M-268).

(5) Mix silicone rubber RTV-1016 (General Electric Corp., Silicone Products Div., Waterford, N. Y.), or equivalent, in accordance with the manufacturer's instructions, or use pre-mixed material held at zero degrees storage temperature.

(6) Apply a liberal quantity of catalyzed silicone rubber to the faying surfaces of the patch and the area to be repaired.

(7) Position the patch, and secure with two 1/8-inch AN515 steel bolts or equivalent, or where applicable, secure with standard attachment bolts.

(8) Allow repair to cure for 24 hours at room temperature.

NOTE: The curing cycle of all silicone rubber RTV-1016 repair material may be accelerated by use of a heat lamp or heat gun. Cure will completed in 2 hours at 93°C (200°F) or 4 hours at 66°C (150°F).

3. Repair of Small Fractures and Holes

A. Small fractures not exceeding 2 inches in length and holes not exceeding 1/2 inch in diameter should be repaired as follows:

(1) Wipe damaged area to remove any contamination, using acetone (O-A-51) or methyl isobutyl ketone (TT-M-268).

(2) Apply catalyzed silicone rubber RTV-1016, or equivalent, to the damaged area, overlapping each side of the fracture or hole by 1/2 inch, and build up to approximately 1/4-inch thickness.

(3) Allow repair to cure 24 hours at room temperature.

NOTE: The curing cycle of all silicone rubber RTV-1016 repair material may be accelerated by use of a heat lamp or heat gun. Cure will be completed in 2 hours at 93°C (200°F) or 4 hours at 66°C (150°F).

TEMPORARY REVISION 54-3

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 54-02, Page 4. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Adds pylon trailing edge repairs.
EFFECTIVITY:	All

5. Pylon Glass Fiber Trailing Edge Repairs - Class A

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge as outlined in Figure 4 and as follows:

(1) See 54-01 for general requirements.

(2) Cut out damaged section as shown in Figure 4.

(3) Prepare Lefkoweld 109 in accordance with 51-70-2.

(4) Fill repair area solid with mixture of Lefkoweld 109 and glass fibers. Contour to shape desired.

(5) Lay up glass fiber doubler, or doubler of Scotch No. 853 polyester tape, or equivalent, as shown in Figure 4.

(6) Bond glass fiber doubler in accordance with Section 51-70-2.

B. Repair extensive damage occurring to glass fiber trailing edge as outlined in Figure 5 and as follows:

(1) Cut out damaged section and remove existing rivets from structure in repair area.

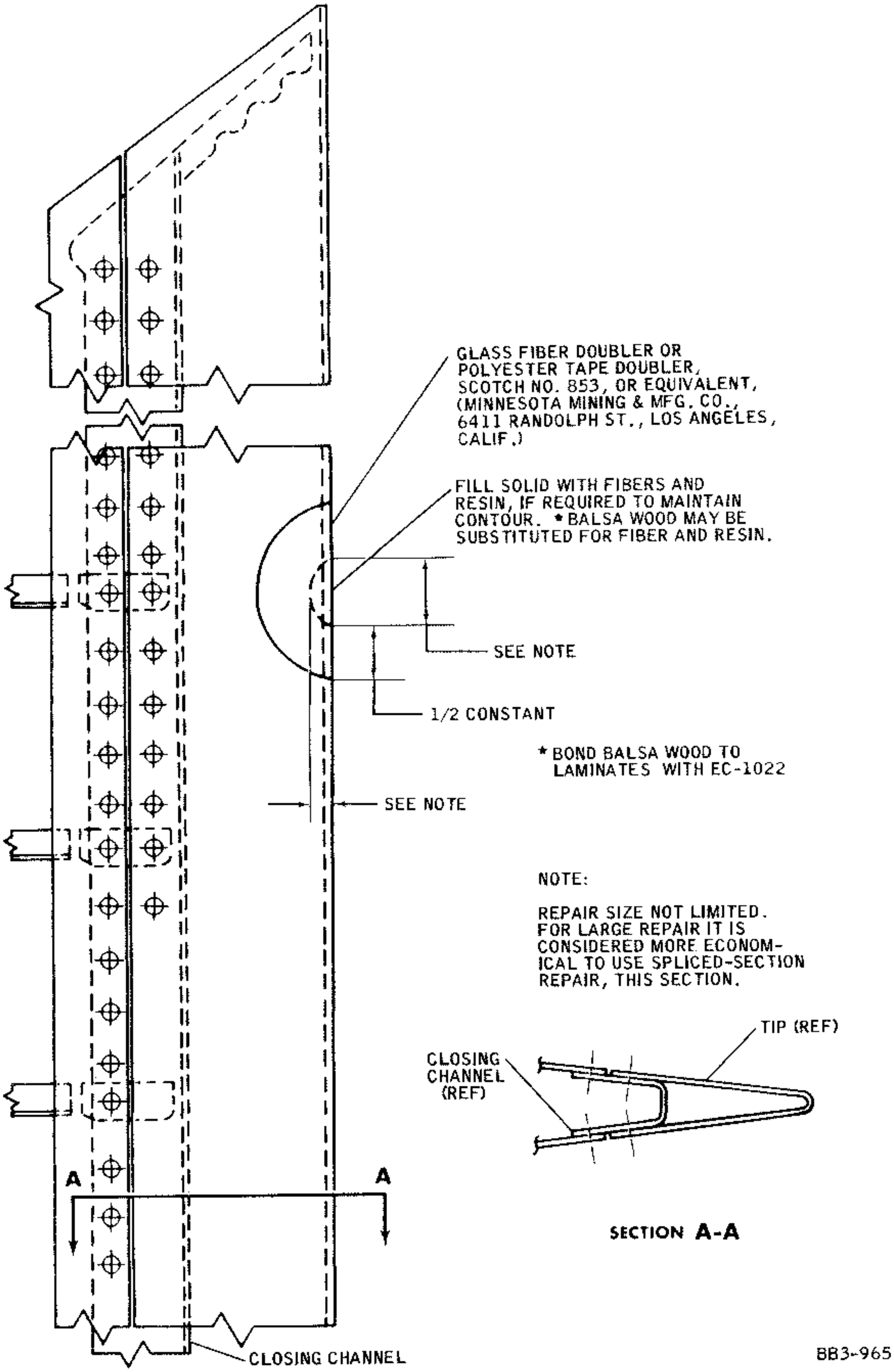
(2) Prepare replacement section of trailing edge formed section to fit cutout.

(3) Fabricate zee as shown in Figure 5.

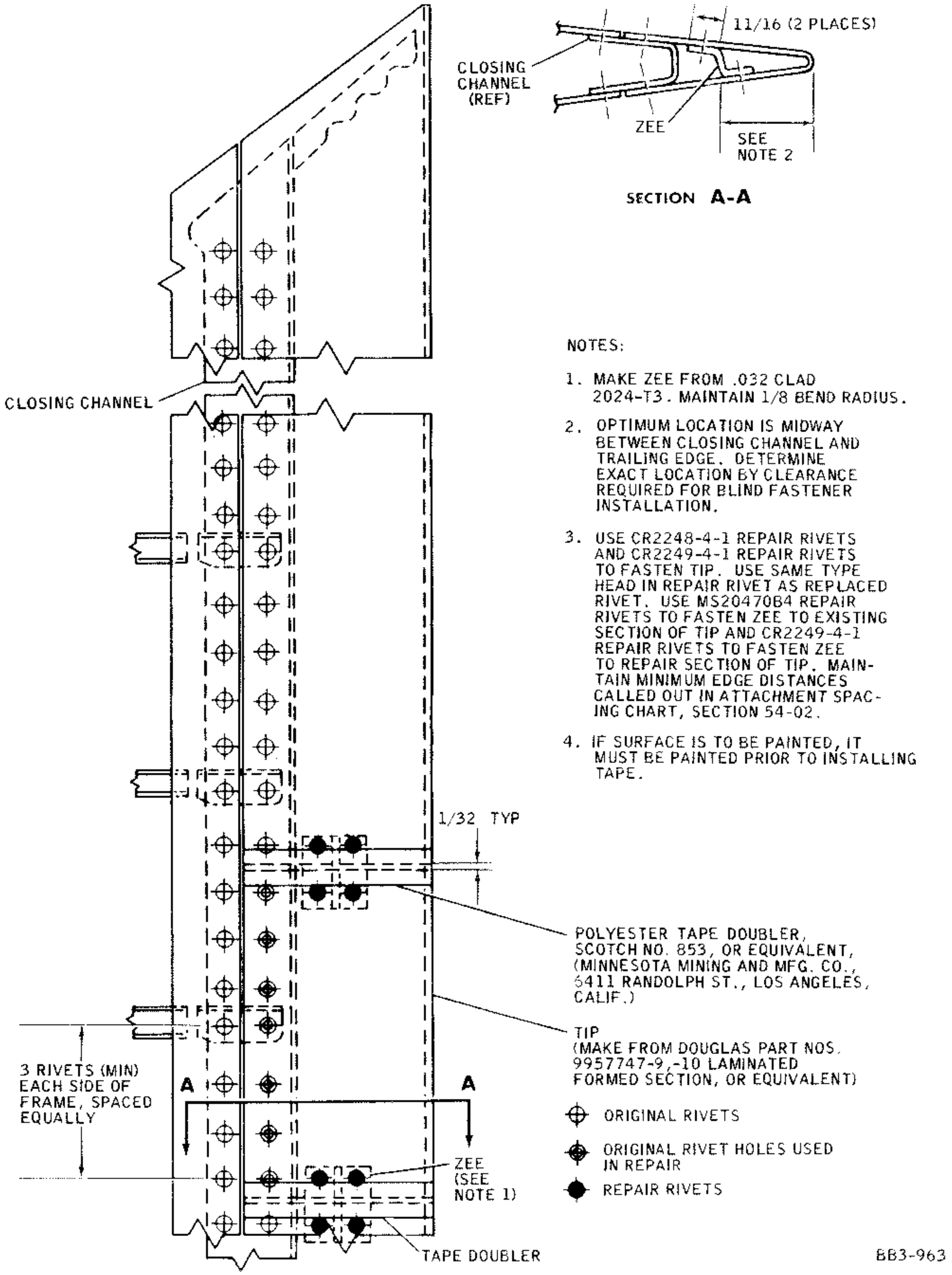
(4) Install zee and glass fiber section and install rivets as shown in Figure 5.

(5) Install doubler of Scotch No. 853 polyester tape, or equivalent, over both spliced ends as shown in Figure 5.

NOTE: If area is to be painted, it must be painted before applying tape.



Pylon Trailing Edge Gouge Repair - Class A
Figure 4



NOTES:

1. MAKE ZEE FROM .032 CLAD 2024-T3. MAINTAIN 1/8 BEND RADIUS.
2. OPTIMUM LOCATION IS MIDWAY BETWEEN CLOSING CHANNEL AND TRAILING EDGE. DETERMINE EXACT LOCATION BY CLEARANCE REQUIRED FOR BLIND FASTENER INSTALLATION.
3. USE CR2248-4-1 REPAIR RIVETS AND CR2249-4-1 REPAIR RIVETS TO FASTEN TIP. USE SAME TYPE HEAD IN REPAIR RIVET AS REPLACED RIVET. USE MS20470B4 REPAIR RIVETS TO FASTEN ZEE TO EXISTING SECTION OF TIP AND CR2249-4-1 REPAIR RIVETS TO FASTEN ZEE TO REPAIR SECTION OF TIP. MAINTAIN MINIMUM EDGE DISTANCES CALLED OUT IN ATTACHMENT SPACING CHART, SECTION 54-02.
4. IF SURFACE IS TO BE PAINTED, IT MUST BE PAINTED PRIOR TO INSTALLING TAPE.

Pylon Trailing Edge Spliced Section Repair - Class A
Figure 5

5. Pylon Glass Fiber Trailing Edge Repairs - Class A

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge as outlined in Figure 4 and as follows:

(1) See 54-01 for general requirements.

(2) Cut out damaged section as shown in Figure 4.

(3) Prepare Lefkoweld 109 in accordance with 51-70-2.

(4) Fill repair area solid with mixture of Lefkoweld 109 and glass fibers. Contour to shape desired.

(5) Lay up glass fiber doubler, or doubler of Scotch No. 853 polyester tape, or equivalent, as shown in Figure 4.

(6) Bond glass fiber doubler in accordance with Section 51-70-2.

B. Repair extensive damage occurring to glass fiber trailing edge as outlined in Figure 5 and as follows:

(1) Cut out damaged section and remove existing rivets from structure in repair area.

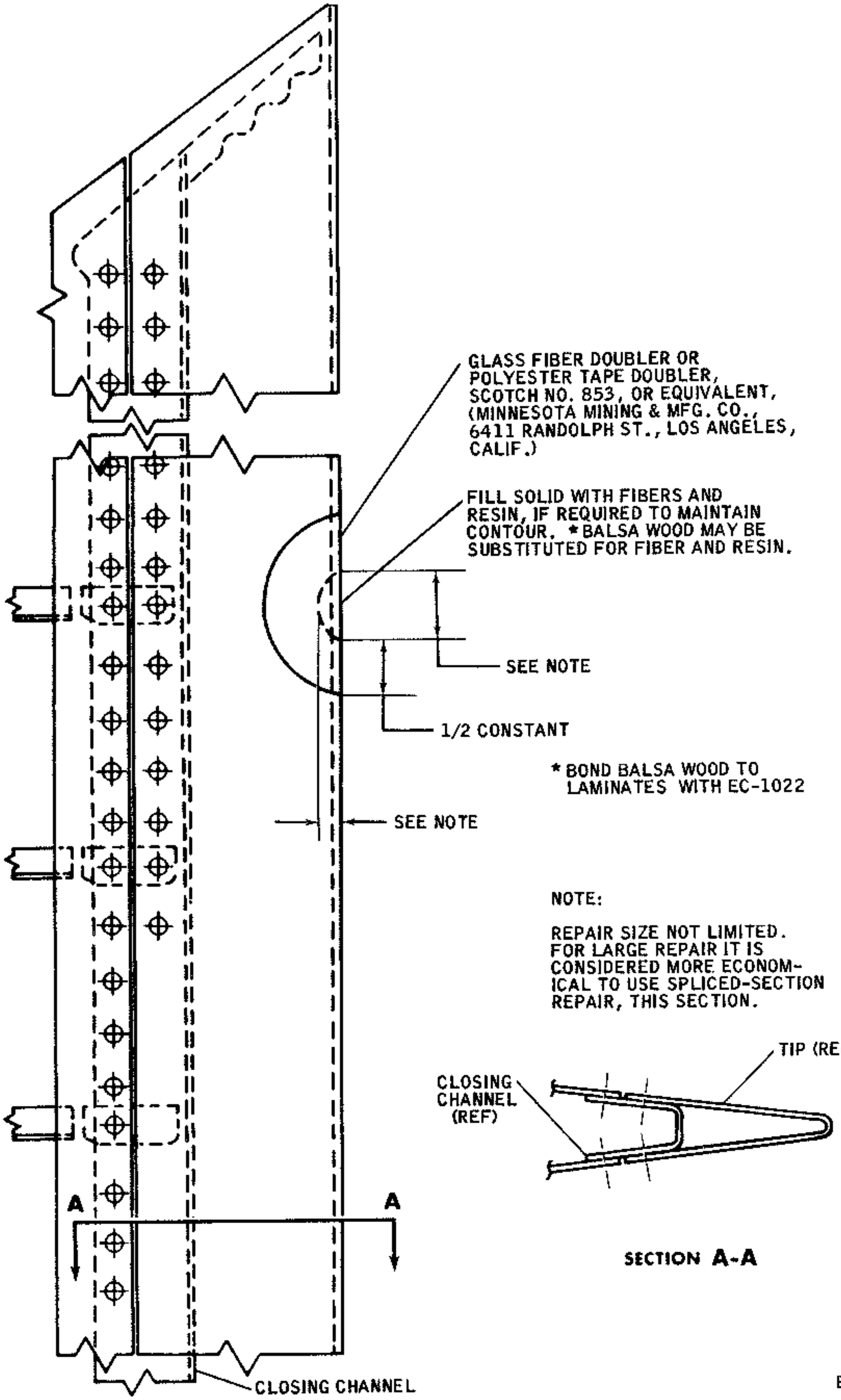
(2) Prepare replacement section of trailing edge formed section to fit cutout.

(3) Fabricate zee as shown in Figure 5.

(4) Install zee and glass fiber section and install rivets as shown in Figure 5.

(5) Install doubler of Scotch No. 853 polyester tape, or equivalent, over both spliced ends as shown in Figure 5.

<u>NOTE</u>: If area is to be painted, it must be painted before applying tape.

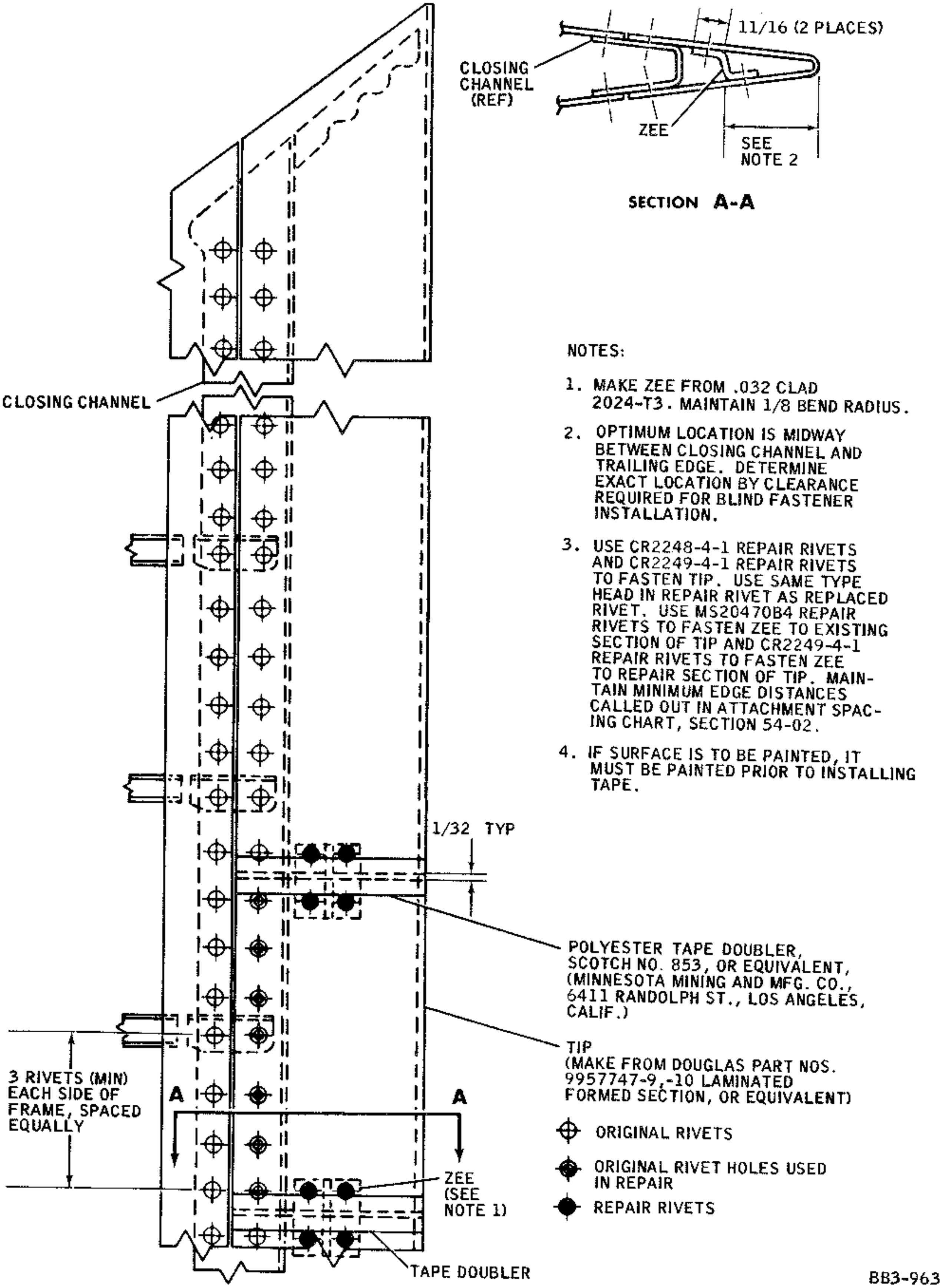


NOTE:

REPAIR SIZE NOT LIMITED. FOR LARGE REPAIR IT IS CONSIDERED MORE ECONOMICAL TO USE SPLICED-SECTION REPAIR, THIS SECTION.

BB3-965

Pylon Trailing Edge Gouge Repair - Class A
Figure 4



NOTES:

1. MAKE ZEE FROM .032 CLAD 2024-T3. MAINTAIN 1/8 BEND RADIUS.
2. OPTIMUM LOCATION IS MIDWAY BETWEEN CLOSING CHANNEL AND TRAILING EDGE. DETERMINE EXACT LOCATION BY CLEARANCE REQUIRED FOR BLIND FASTENER INSTALLATION.
3. USE CR2248-4-1 REPAIR RIVETS AND CR2249-4-1 REPAIR RIVETS TO FASTEN TIP. USE SAME TYPE HEAD IN REPAIR RIVET AS REPLACED RIVET. USE MS20470B4 REPAIR RIVETS TO FASTEN ZEE TO EXISTING SECTION OF TIP AND CR2249-4-1 REPAIR RIVETS TO FASTEN ZEE TO REPAIR SECTION OF TIP. MAINTAIN MINIMUM EDGE DISTANCES CALLED OUT IN ATTACHMENT SPACING CHART, SECTION 54-02.
4. IF SURFACE IS TO BE PAINTED, IT MUST BE PAINTED PRIOR TO INSTALLING TAPE.

Pylon Trailing Edge Spliced Section Repair - Class A
Figure 5

MAIN FRAME - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

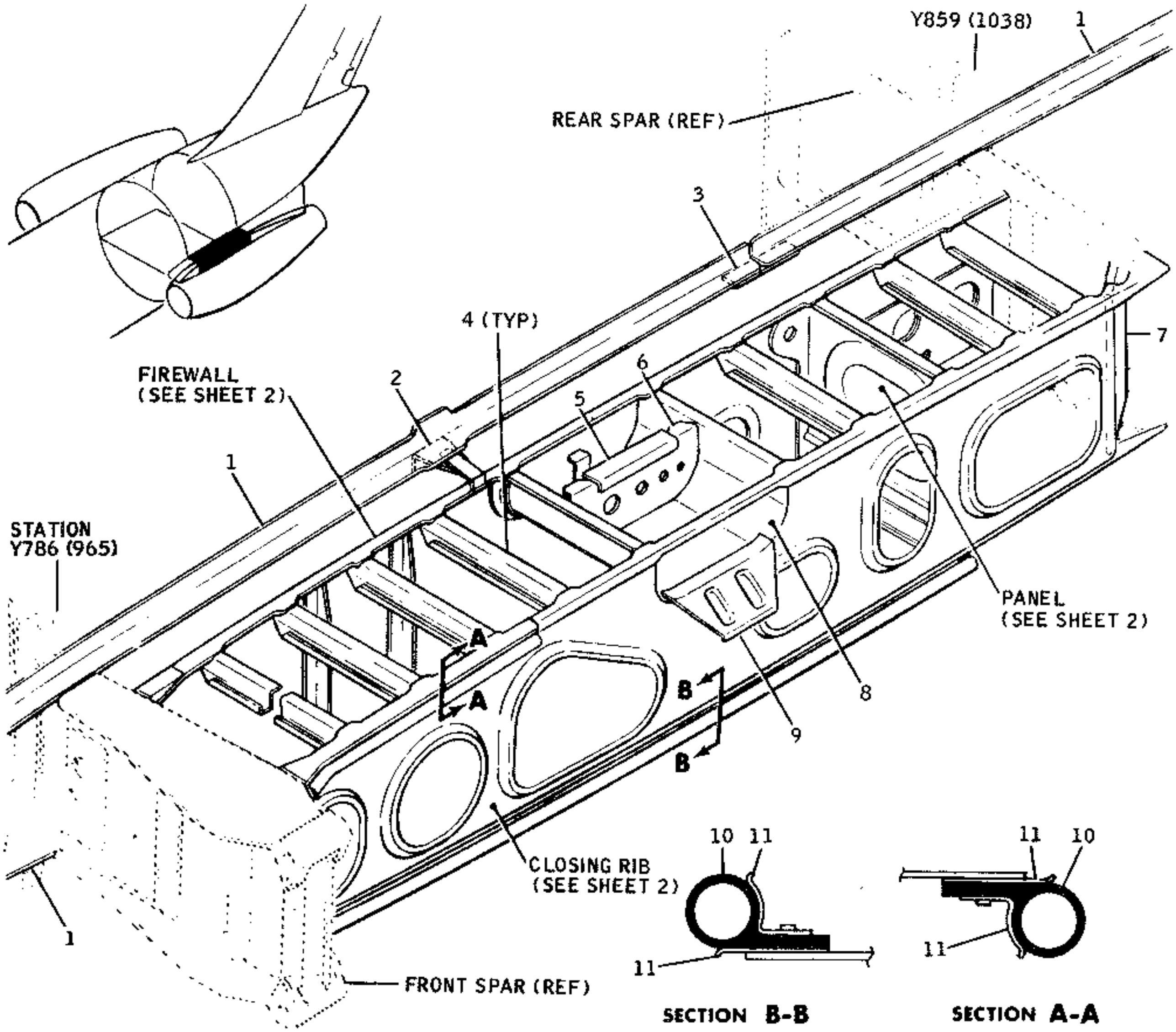
A. This section illustrates the main frame components of the nacelles/pylons. Materials used in construction are identified by item number in the material listings of each illustration.

2. Repair Index

A. A list of structural components and the applicable repairs which are used to restore the structural integrity and appearance is presented as follows:

Structural Component	Approved Repairs

THIS INFORMATION WILL BE FURNISHED WHEN AVAILABLE



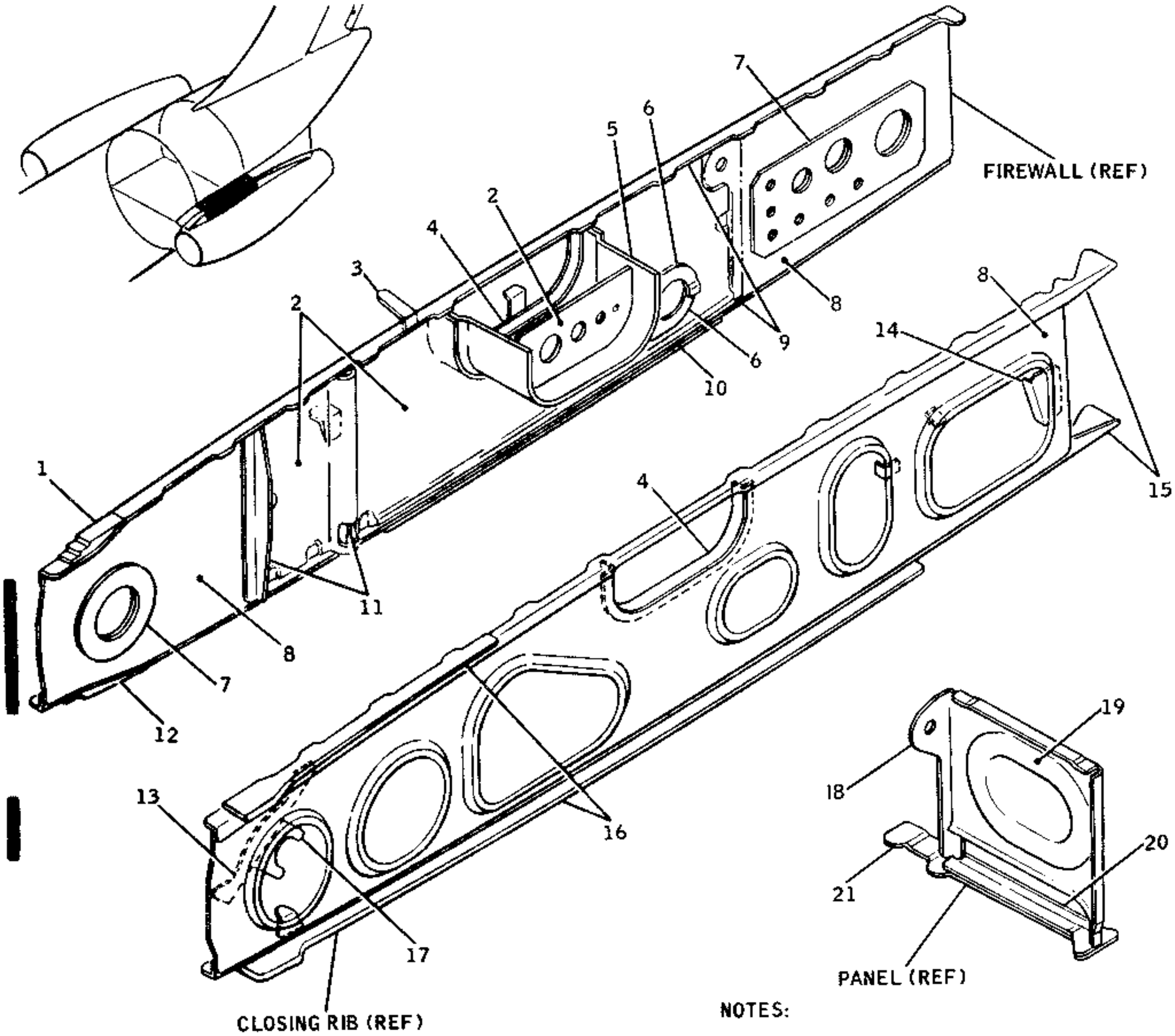
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.040	SEE NOTE 1
2	BRACKET	.080	SEE NOTE 1
3	STRAP	.040	SEE NOTE 1
4	ZEE	.040	CLAD 2024-T42
5	STIFFENER	.071	TITANIUM DMS1592
6	FIREWALL	.025	TITANIUM DMS1536
7	WEB	.025	TITANIUM DMS1536
	ANGLE	.040	TITANIUM DMS1536
8	TROUGH	.025	TITANIUM DMS1536
9	PAN	.040	CLAD 2024-T42
10	SEAL		4913975
11	RETAINER	.025	CLAD 2024-T3

NOTES:

1. MADE FROM MIL-S-25043, COND A, 2D FINISH, CRES SHEET, TYPE 17-7PH,
2. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
3. REFERENCE - DOUGLAS DRAWING 5910280.

BB3-233B

Pylon Center Panel Structure
Figure 1 (Sheet 1)



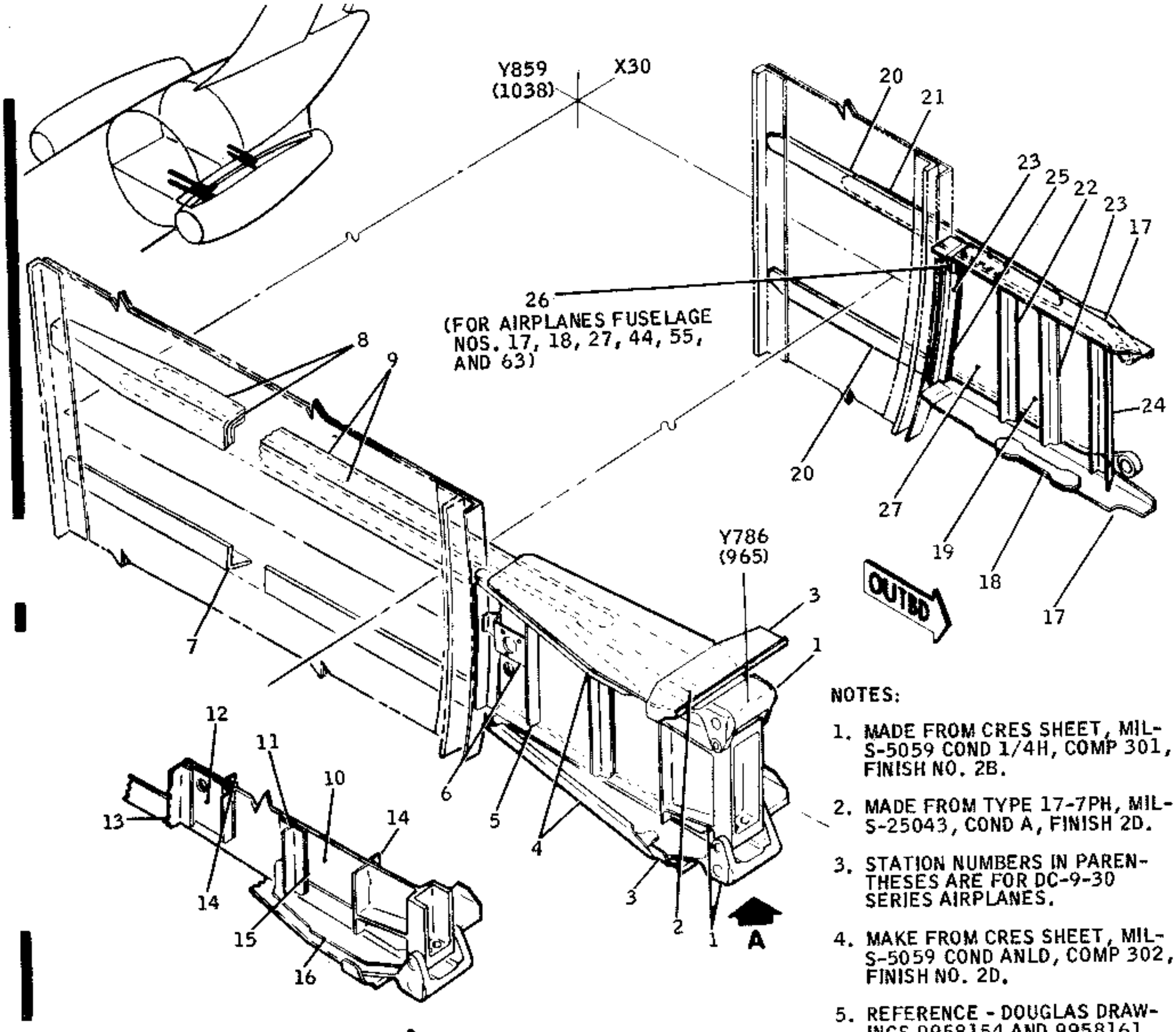
NOTES:

1. MADE FROM B STAGE PHENOLIC, HIGH SILICA FABRIC.
2. REFERENCE - DOUGLAS DRAWING 5910280.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TAPERED SHIM	.500	PLATE 7075-T651	12	TAPERED SHIM	.313	PLATE 7075-T651
2	SHIELD	.063	SEE NOTE 1	13	STIFFENER	.040	CLAD 7075-T6
3	CLIP	.032	TITANIUM DMS1536	14	CLIP	.050	CLAD 2024-T42
4	SUPPORT	.040	TITANIUM DMS1536	15	CAP	.040	TITANIUM DMS1592
5	TROUGH	.063	SEE NOTE 1	16	SHIM	.190	TITANIUM DMS1592
6	COVER	.063	SEE NOTE 1	17	BRACKET	.050	CLAD 7075-T6
7	DOUBLER	.040	TITANIUM DMS1536	18	ANGLE	.025	CLAD 2024-T42
8	WEB	.025	TITANIUM DMS1536	19	PANEL	.025	CLAD 2024-T42
9	CAP	.032	TITANIUM DMS1536	20	ANGLE	.032	CLAD 2024-T42
10	SHIM	.040	TITANIUM DMS1536	21	STRAP	.063	TITANIUM DMS1536
11	STIFFENER	.032	TITANIUM DMS1536				

BB3-445B

Pylon Center Panel Structure
Figure 1 (Sheet 2)



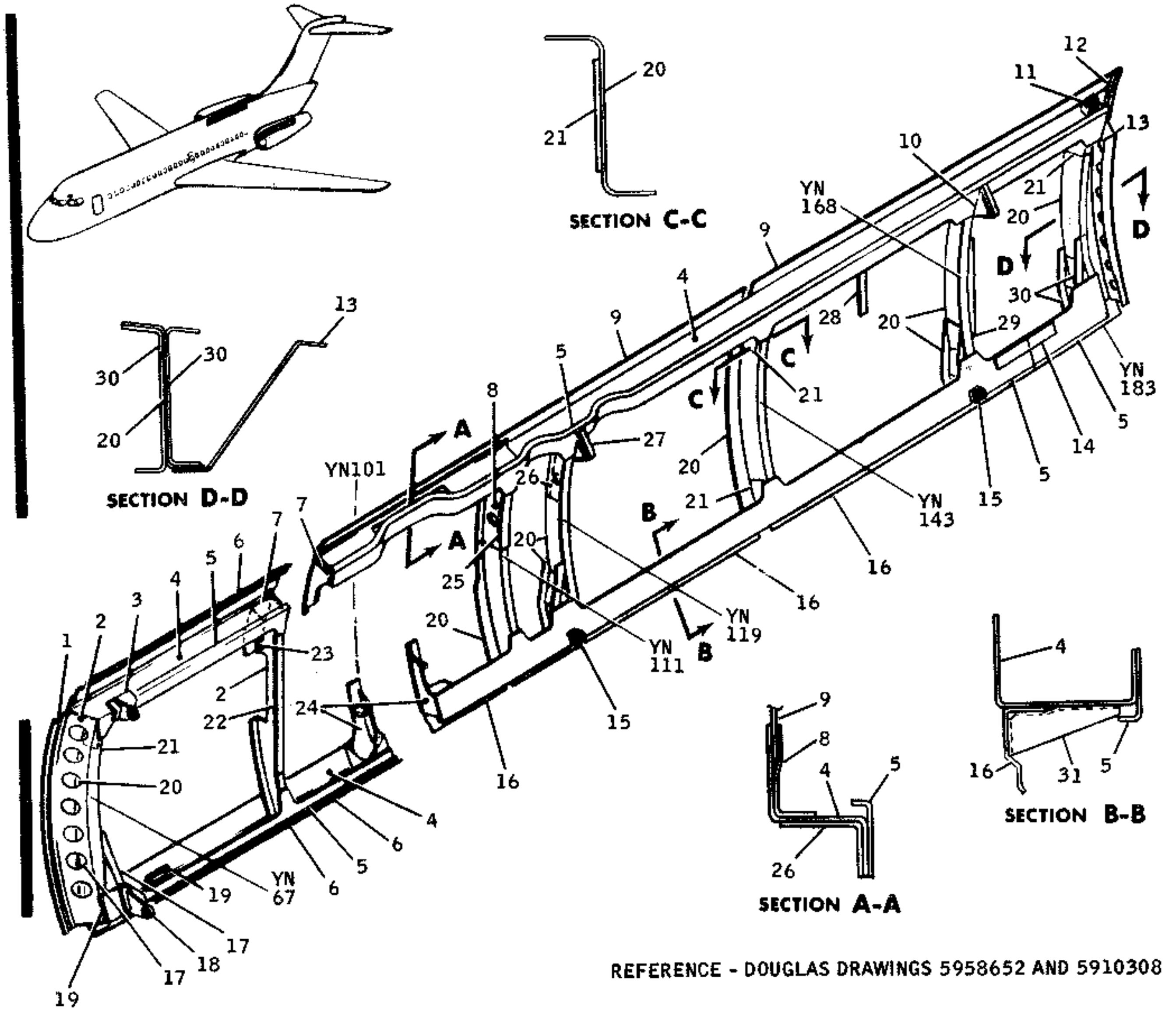
NOTES:

1. MADE FROM CRES SHEET, MIL-S-5059 COND 1/4H, COMP 301, FINISH NO. 2B.
2. MADE FROM TYPE 17-7PH, MIL-S-25043, COND A, FINISH 2D.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
4. MAKE FROM CRES SHEET, MIL-S-5059 COND ANLD, COMP 302, FINISH NO. 2D.
5. REFERENCE - DOUGLAS DRAWINGS 9958154 AND 9958161.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		4340 STEEL FORGING	15	SHIM	.090	CLAD 2024-T3
2	ANGLE	.090	SEE NOTE 2	16	CHANNEL	.090	SEE NOTE 2
3	RUB STRIP	.020	SEE NOTE 1	17	CAP ANGLE	.040	TITANIUM DMS 1592
4	STIFFENER	.063	SEE NOTE 2	18	SHIM	.050	CLAD 7075-T6
5	ANGLE		1250445	19	WEB	.032	TITANIUM DMS 1592
6	SUPPORT	.050	6061-T6	20	STRAP	.750	STEEL BAR 4140
7	SPAR CAP	2.00	STEEL BAR 4340	21	STRAP	.125	TITANIUM DMS 1592
8	SPAR CAP	.100	SEE NOTE 2	22	ANGLE	.040	TITANIUM DMS 1592
9	STRAP	.312	SEE NOTE 2	23	ANGLE	.063	CLAD 7075-T6
10	WEB	.040	TITANIUM DMS 1592	24	ANGLE	.063	TITANIUM DMS 1592
11	TEE	.040	2641024	25	ANGLE	.016	SEE NOTE 4
12	DOUBLER	.040	TITANIUM DMS 1592	26	FITTING	1.500	PLATE 7075-T651
13	CLIP	.040	TITANIUM DMS 1592	27	DOUBLER	.020	TITANIUM DMS 1592
14	CLIP	.032	TITANIUM DMS 1592				

BB3-232D

Pylon Front and Rear Spars
Figure 2

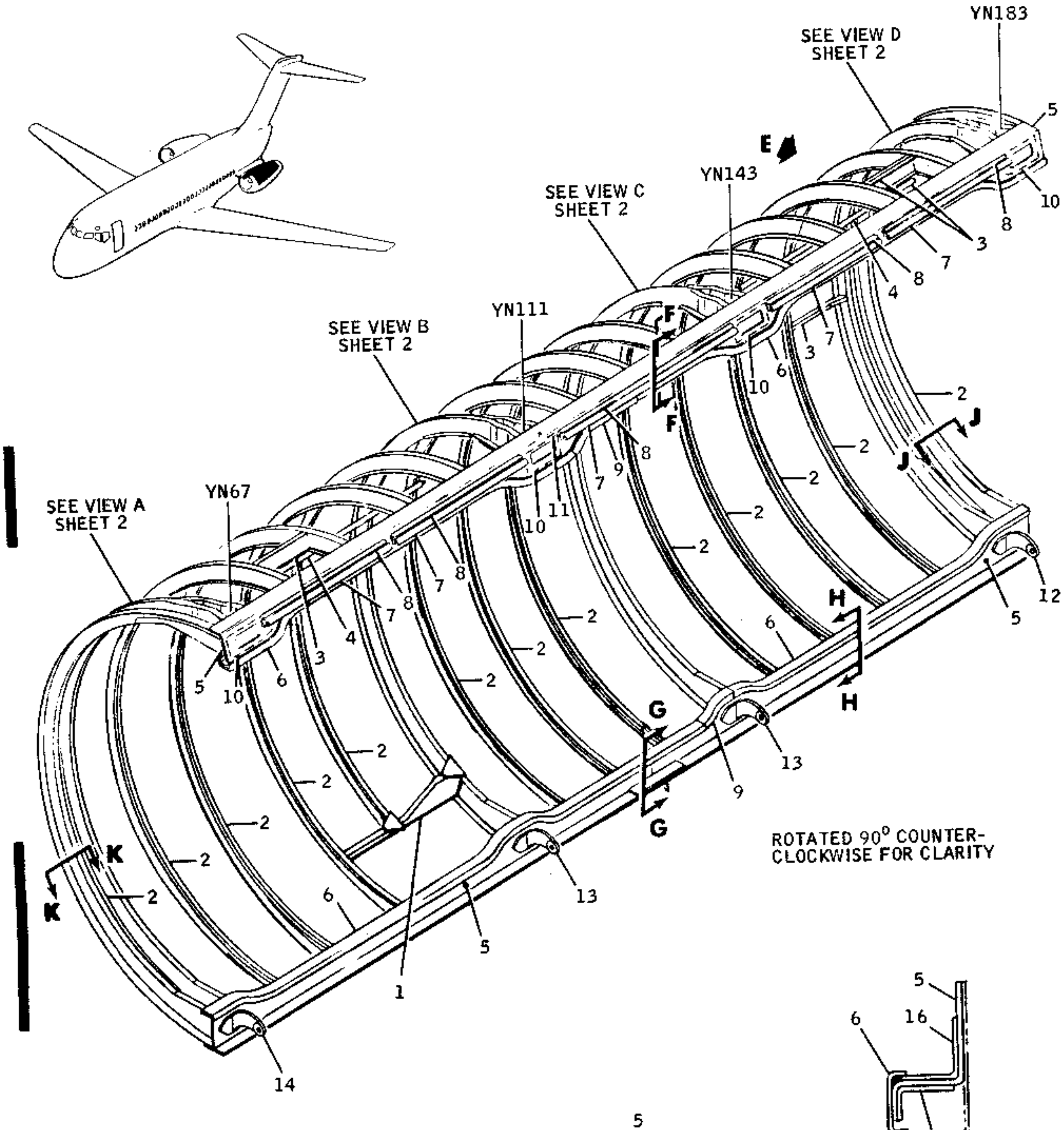


REFERENCE - DOUGLAS DRAWINGS 5958652 AND 5910308

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RUB STRIP	.040	CLAD 2024-T3	17	CHANNEL	.050	CLAD 2024-T42
2	FRAME	.050	CLAD 2024-T42	18	SUPPORT		17-4PH CASTING
3	SUPPORT		356-T6 CASTING	19	DOUBLER	.050	CLAD 2024-T3
4	LONGERON	.050	CLAD 2024-T42	20	FRAME	.063	CLAD 2024-T42
5	CAP	.063	CLAD 2024-T42	21	DOUBLER	.063	CLAD 2024-T3
6	SUPPORT	.040	CLAD 2024-T42	22	ZEE	.050	CLAD 2024-T3
7	SPLICE		17-4PH CASTING	23	CLIP	.050	CLAD 2024-T42
8	DOUBLER	.063	CLAD 2024-T42	24	SPLICE		17-4PH CASTING
9	SEAL	.040	CLAD 2024-T42	25	LAMINATED SHIM	.062	5052-H39
10	SUPPORT		17-4PH CASTING	26	ANGLE	.063	CLAD 2024-T42
11	BRACKET		17-4PH CASTING	27	SUPPORT		17-4PH CASTING
12	RUB STRIP		1250422	28	BRACKET	.050	CLAD 2024-T3
13	FRAME	.032	CLAD 2024-T42	29	STIFFENER	.063	CLAD 2024-T3
14	SPLICE	.063	CLAD 2024-T42	30	CHANNEL	.050	CLAD 2024-T42
15	SUPPORT		17-4PH CASTING	31	BRACKET	.032	2024-T42
16	RETAINER	.040	CLAD 2024-T42				

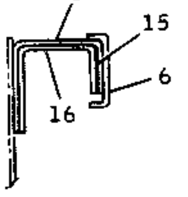
BB3-236A

Pylon Apron Structures
Figure 3



ROTATED 90° COUNTER-CLOCKWISE FOR CLARITY

NOTE:
1. FOR VIEWS A, B, C, D, E, H, J, K, L, AND M SEE SHEET 2.
2. FOR MATERIAL LIST, SEE SHEET 2
3. REFERENCE - DOUGLAS DRAWING 5910306

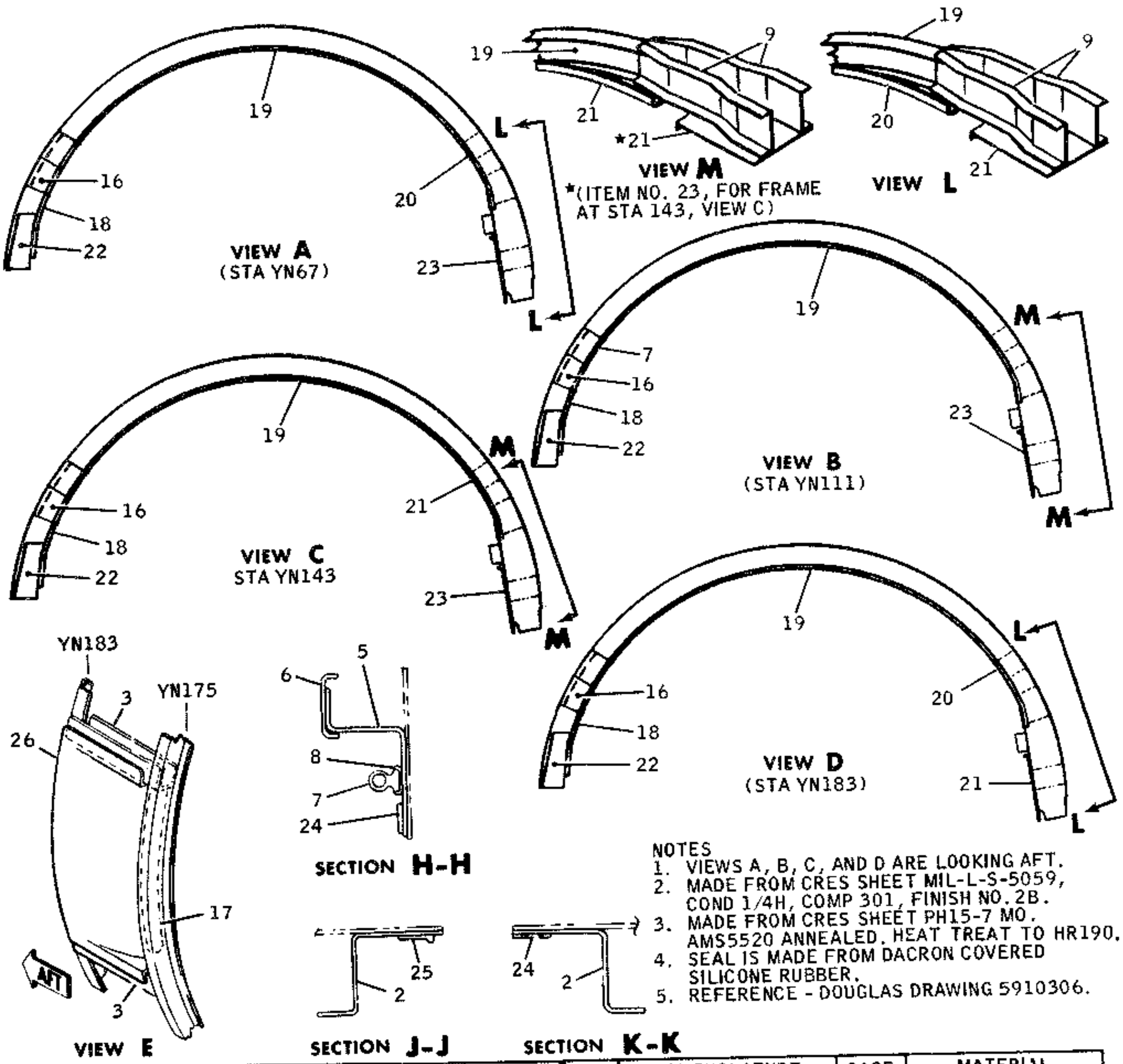


SECTION F-F

SECTION G-G

BB3-239B

Cowl Upper Door Structure
Figure 4 (Sheet 1)

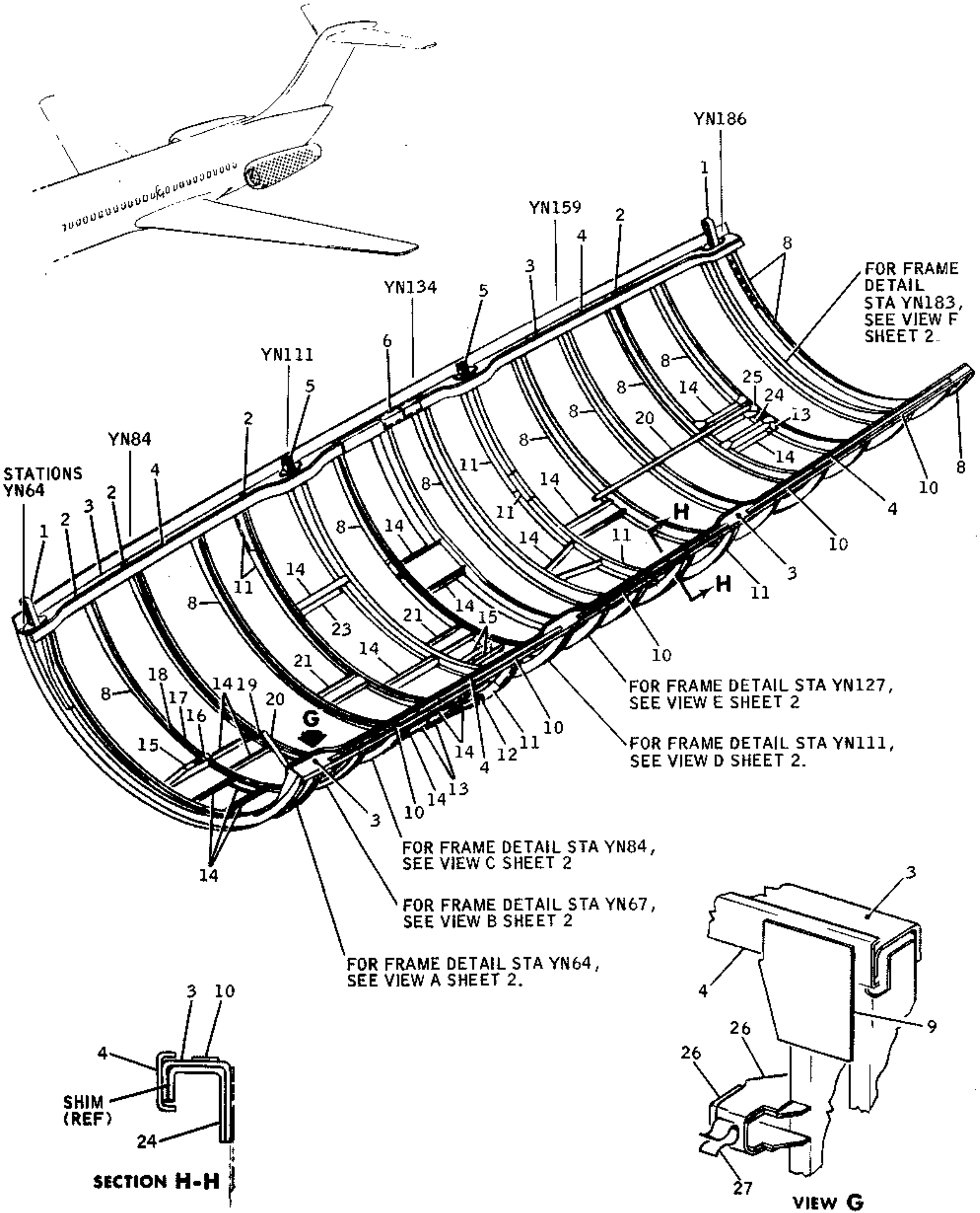


NOTES
1. VIEWS A, B, C, AND D ARE LOOKING AFT.
2. MADE FROM CRES SHEET MIL-L-S-5059, COND 1/4H, COMP 301, FINISH NO. 2B.
3. MADE FROM CRES SHEET PH15-7 MO, AMS5520 ANNEALED, HEAT TREAT TO HR190.
4. SEAL IS MADE FROM DACRON COVERED SILICONE RUBBER.
5. REFERENCE - DOUGLAS DRAWING 5910306.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.063	2024-T42
2	FRAME	.050	CLAD 2024-T42
3	INTERCOSTAL	.063	CLAD 2024-T42
4	ROD (.750 O.D.)	.049	2024-T3
5	LONGERON	.063	CLAD 2024-T42
6	CAP	.063	CLAD 2024-T42
7	SEAL (SEE NOTE 4)		2958600
8	RETAINER		1104821
9	CHANNEL	.063	CLAD 2024-T42
10	DOUBLER	.050	SEE NOTE 2
11	ANGLE	.063	SEE NOTE 3
12	HINGE, 5958725		17-4PH CASTING
13	HINGE, 5958705		17-4PH CASTING
14	HINGE, 5958714		17-4PH CASTING
15	SHIM		LAMINATED AL
16	SPLICE	.063	CLAD 2024-T42
17	CHANNEL	.050	6061-T6
18	STUB FRAME	.063	CLAD 2024-T42
19	FRAME	.063	CLAD 2024-T42
20	FLANGED STRAP	.063	CLAD 2024-T42
21	GUSSET	.063	CLAD 2024-T42
22	BEARING PLATE	.063	CLAD 2024-T3
23	GUSSET	.063	CLAD 2024-T3
24	WEAR STRIP	.040	CLAD 2024-T3
25	WEAR STRIP		1250422
26	SCOOP FAIRING	.040	6061-T6

BB3-545B

Cowl Upper Door Structure
Figure 4 (Sheet 2)

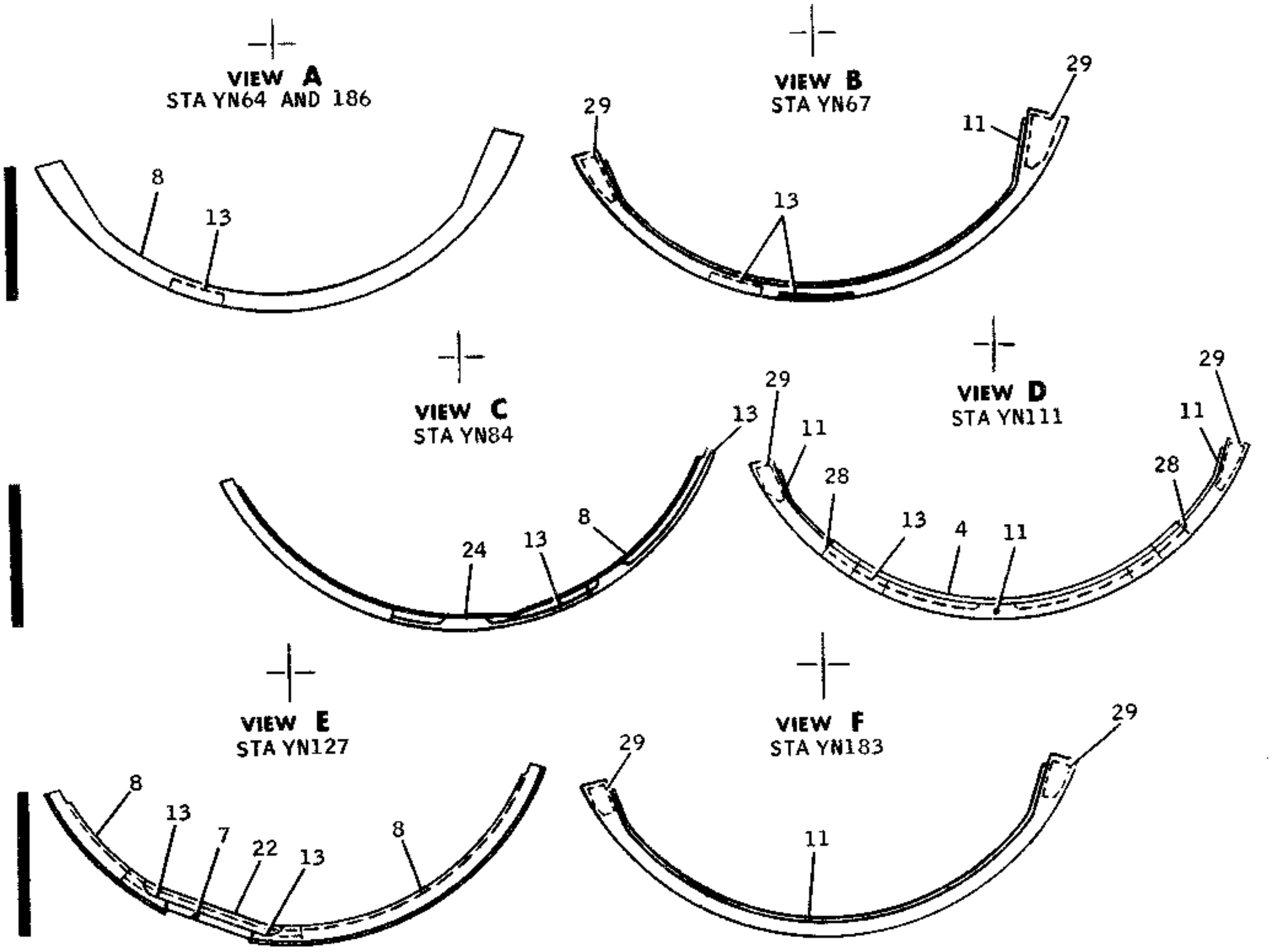


NOTES:

1. FOR MATERIAL LIST, SEE SHEET 2
2. REFERENCE - DOUGLAS DRAWINGS 5910307, 5958736.

BB3-240A

Cowl Lower Door Structure
Figure 5 (Sheet 1)



ALL VIEWS LOOKING AFT

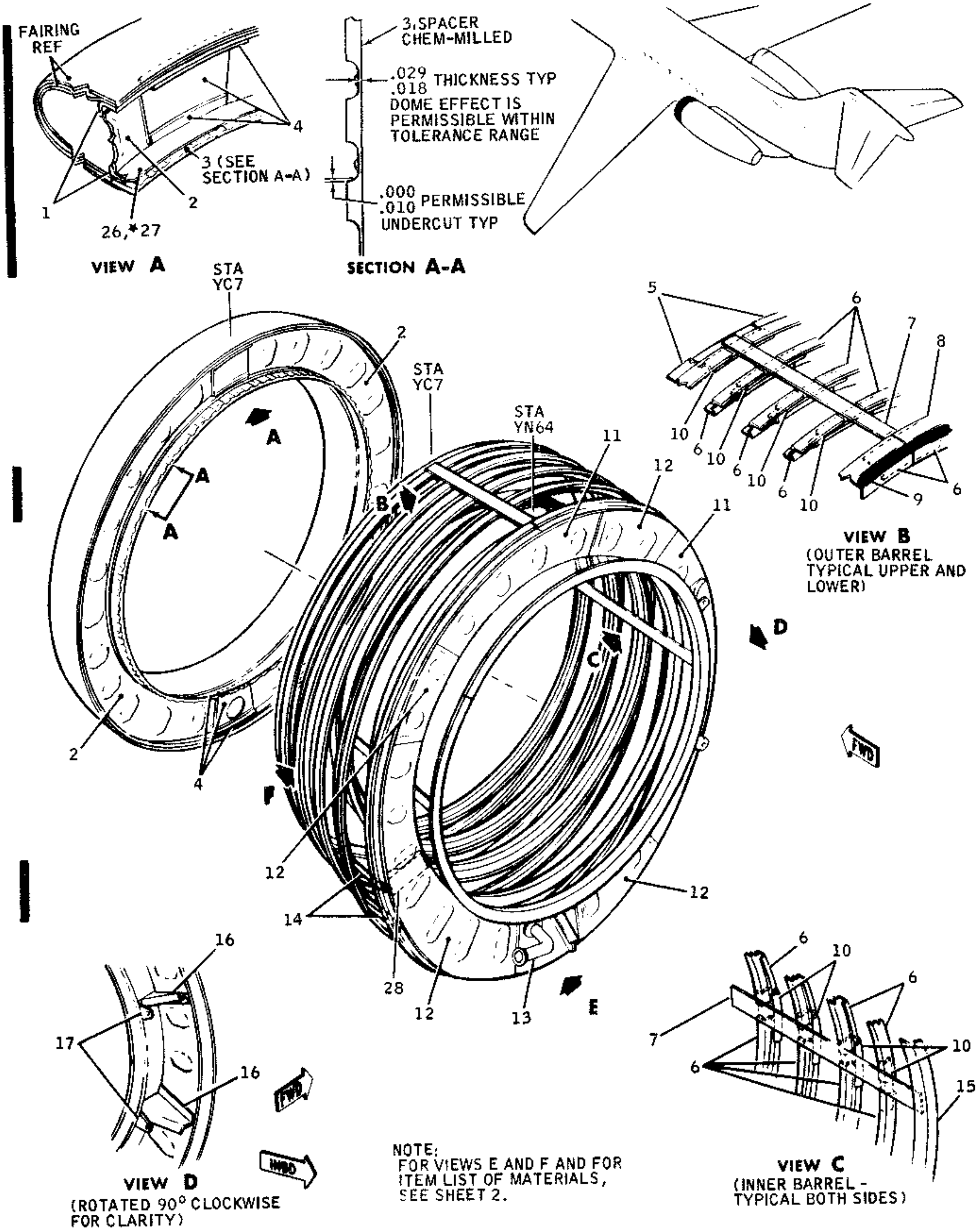
NOTES:

1. MIL-S, COND A, 1095 STEEL.
2. REFERENCE - DOUGLAS DRAWINGS 5910307, 5958736.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	HINGE		17-4PH CASTING	16	GUSSET	.050	CLAD 2024-T3
2	CLIP	.063	CLAD 2024-T42	17	STRAP	.100	CLAD 2024-T42
3	LONGERON	.063	CLAD 2024-T42	18	STIFFENER	.080	CLAD 2024-T42
4	CAP	.063	CLAD 2024-T42	19	BRACKET		17-4PH CASTING
5	CLEVIS		17-4PH CASTING	20	ROD (.750 O.D.)	.049	2024-T3 TUBE
6	ANGLE	.063	CLAD 2024-T42	21	INTERCOSTAL	.040	CLAD 2024-T42
7	STIFFENER	.050	CLAD 2024-T42	22	CAP	.050	CLAD 2024-T42
8	FRAME	.050	CLAD 2024-T42	23	ANGLE	.050	CLAD 2024-T3
9	GUSSET	.063	2024-T42	24	SPLICE	.063	CLAD 2024-T42
10	STRIP	.040	CLAD 2024-T3	25	BRACKET		17-4PH CASTING
11	FRAME	.063	CLAD 2024-T42	26	BRACKET	.050	CLAD 2024-T42
12	FILLER	.100	CLAD 2024-T3	27	RETAINER	.040	SEE NOTE 1
13	ANGLE	.050	CLAD 2024-T42	28	SPLICE	.063	CLAD 2024-T42
14	INTERCOSTAL	.050	CLAD 2024-T42	29	PLATE	.063	2024-T42
15	INTERCOSTAL	.063	CLAD 2024-T42				

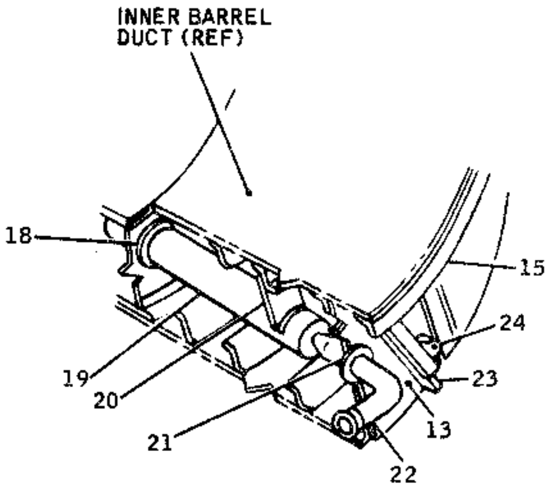
3B3-546A

Cowl Lower Door Structure
Figure 5 (Sheet 2)

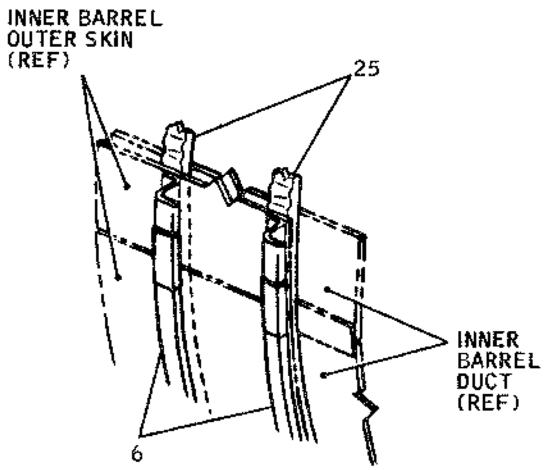


NOTE:
FOR VIEWS E AND F AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.

Nose Cowl Structure
Figure 6 (Sheet 1)



VIEW E
(DUCT ASSY)



VIEW F

NOTES:

1. NYLATRON RUB STRIP, OR EQUIVALENT, (POLYMER CORPORATION, READING, PA.)
2. CRES 321, COMP TI, ANNEALED, MIL-S-6721.
3. CRES 321, MIL-T-8808.
4. LAMINATED THERMO-SETTING ASBESTOS SHEET, MIL-P-8059 TYPE PBA, FORM S.
5. *USED ON FUSELAGE 84 AND SUBSEQUENT.
6. REFERENCE-DOUGLAS DRAWING 5910298.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP	.040	2219-T62	15	RING		2958748
2	BULKHEAD	.032	2219-T62	16	BRACKET	.063	CLAD 2024-T42
3	SPACER (SEC. A-A)	.190	2024-T6	17	SUPPORT		356-T6 CASTING
4	SPLICE	.040	2219-T62	18	PLATE	.032	SEE NOTE 2
5	RING HALF		2958750	19	TUBE(2.250 O.D.)	.020	SEE NOTE 3
6	FRAME	.050	CLAD 2024-T42	20	BRACKET	.032	SEE NOTE 2
7	SPLICE	.050	CLAD 2024-T42	21	SEAL	.060	SEE NOTE 4
8	FRAME TIE	.050	CLAD 2024-T42	22	TUBE (1.250 O.D.)	.028	SEE NOTE 3
9	RUB STRIP	.060	SEE NOTE 1	23	INTERCOSTAL	.090	CLAD 2024-T42
10	SPLICE	.050	CLAD 2024-T42	24	BRACKET		17-4PH CASTING
11	WEB	.040	CLAD 2024-T42	25	FILLER	.190	2024-T42
12	DOOR	.040	CLAD 2024-T42	26*	STRIP	.020	2219-T62
13	DOUBLER	.040	CLAD 2024-T3	27*	STRIP	.020	CLAD 2219-T62
14	ANGLE	.050	CLAD 2024-T42	28	INTERCOSTAL	.050	CLAD 2024-T42

BB3-555B

Nose Cowl Structure
Figure 6 (Sheet 2)

AUXILIARY STRUCTURE - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

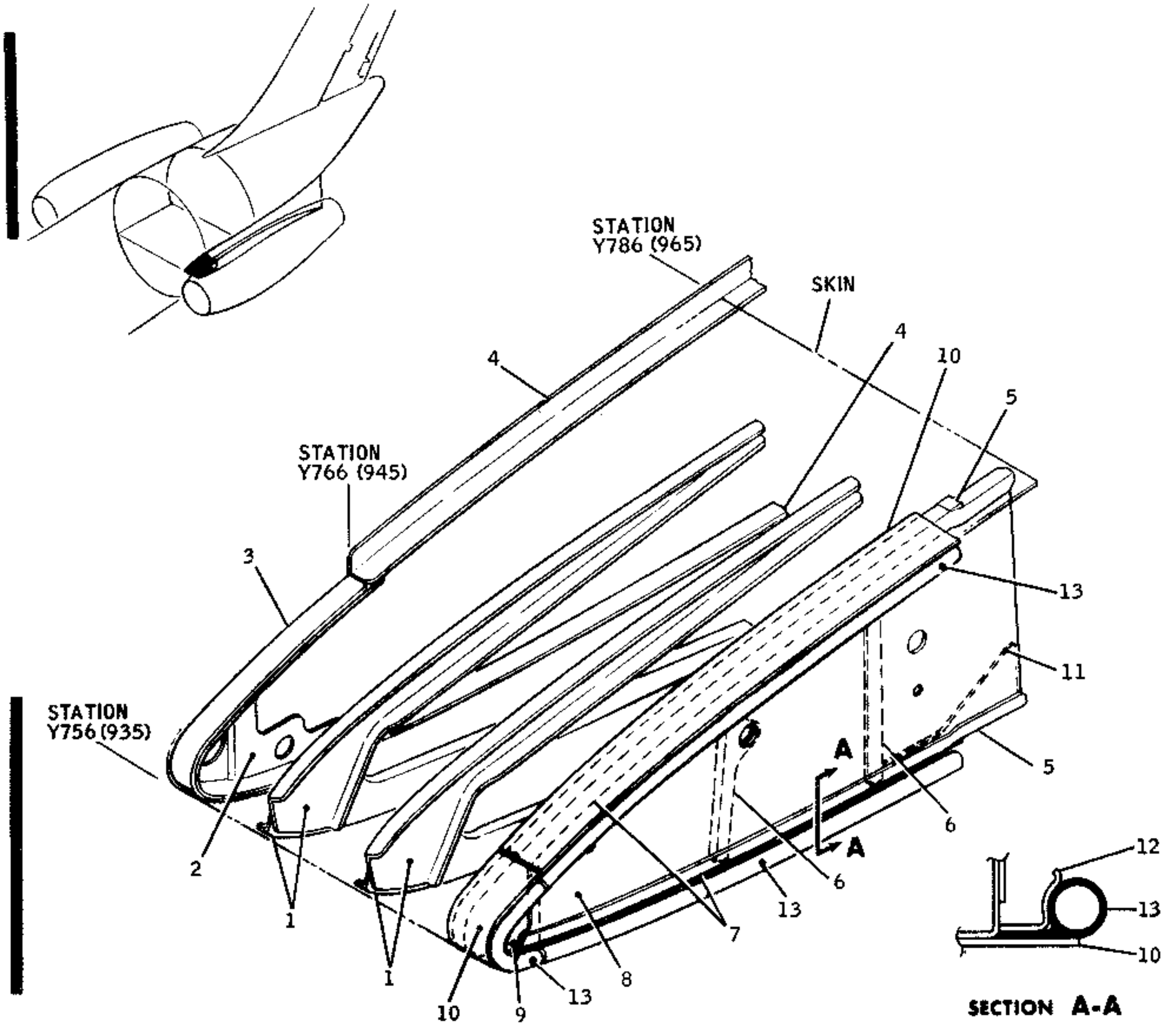
A. This section illustrates the auxiliary structural components of the nacelles/pylons. Materials used in construction are identified by item number in the material listings of each illustration.

2. Repair Index

A. A list of structural components and the applicable repairs which are used to restore the structural integrity and appearance is presented as follows:

Structural Component	Approved Repairs
All	Section 54-01
Trailing Edge Repairs	Section 54-02, Figures 4 and 5

Printed in U.S.A.



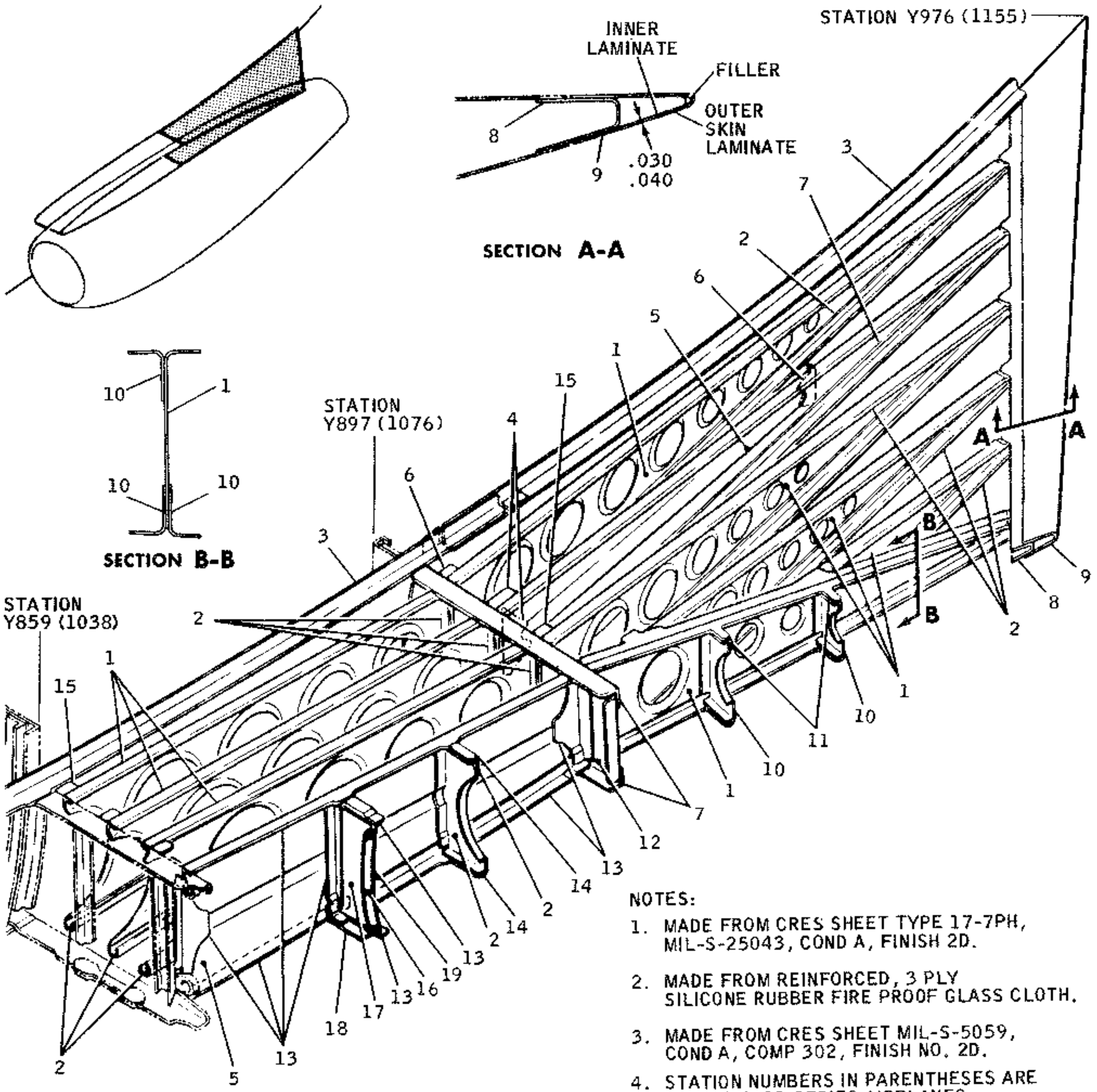
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.040	CLAD 7075-T6
2	FORMER	.050	6061-T6
3	SEAL(SEE NOTE 1)		4744637
4	ANGLE	.040	CRES TYPE 17-7PH
5	SHIM	.125	CLAD 2024-T3
6	STIFFENER	.040	CLAD 7075-T6
7	CAP	.032	TITANIUM DMS1592
8	WEB	.032	TITANIUM DMS1536
9	RIB	.032	(SEE NOTE 2)
10	STIFFENER	.040	(SEE NOTE 3)
11	GUSSET	.040	TITANIUM DMS1592
12	RETAINER	.025	CLAD 2024-T42
13	SEAL		4913975

NOTES:

1. SEAL IS MADE FROM EXTRUDED SILICONE RUBBER.
2. RIB IS MADE FROM MIL-S-6721, COMP T1, ANNEALED TYPE 321 CRES.
3. STIFFENER IS MADE FROM MIL-S-5059, ANNEALED COMP 302, FINISH NO. 2D.
4. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
5. REFERENCE - DOUGLAS DRAWING 9958220.

BB3-234B

Pylon Leading Edge Structure
Figure 1



NOTES:

1. MADE FROM CRES SHEET TYPE 17-7PH, MIL-S-25043, COND A, FINISH 2D.
2. MADE FROM REINFORCED, 3 PLY SILICONE RUBBER FIRE PROOF GLASS CLOTH.
3. MADE FROM CRES SHEET MIL-S-5059, COND A, COMP 302, FINISH NO. 2D.
4. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.

REFERENCE - DOUGLAS DRAWING 5915049.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.032	CLAD 2024-T42
2	ANGLE	.040	CLAD 2024-T42
3	ANGLE	.040	SEE NOTE 1
4	CLIP	.032	TITANIUM DMS 1536
5	WEB	.025	TITANIUM DMS 1536
6	CLIP	.032	CLAD 2024-T3
7	ANGLE	.032	TITANIUM DMS 1536
8	CHANNEL	.040	CLAD 2024-T3
9	OUTER SKIN LAMINATE INNER LAMINATE FILLER	SEE SECT. A-A	GLASS FIBER CLOTH GLASS FIBER CLOTH GLASS FIBER ROVINGS
10	ANGLE	.032	CLAD 2024-T42
11	CLIP	.032	CLAD 2024-T42
12	WEB	.025	TITANIUM DMS1536
13	ANGLE	.040	TITANIUM DMS1536
14	SHIM	.040	CLAD 2024-T42
15	CLIP	.040	CLAD 2024-T42
16	SEAL, 2916319		SEE NOTE 2
17	WEB	.040	TITANIUM DMS1536
18	DOUBLER	.040	TITANIUM DMS1536
19	RETAINER	.020	SEE NOTE 3

BB3-235C

Pylon Trailing Edge Structure
Figure 2

PLATES/SKIN - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

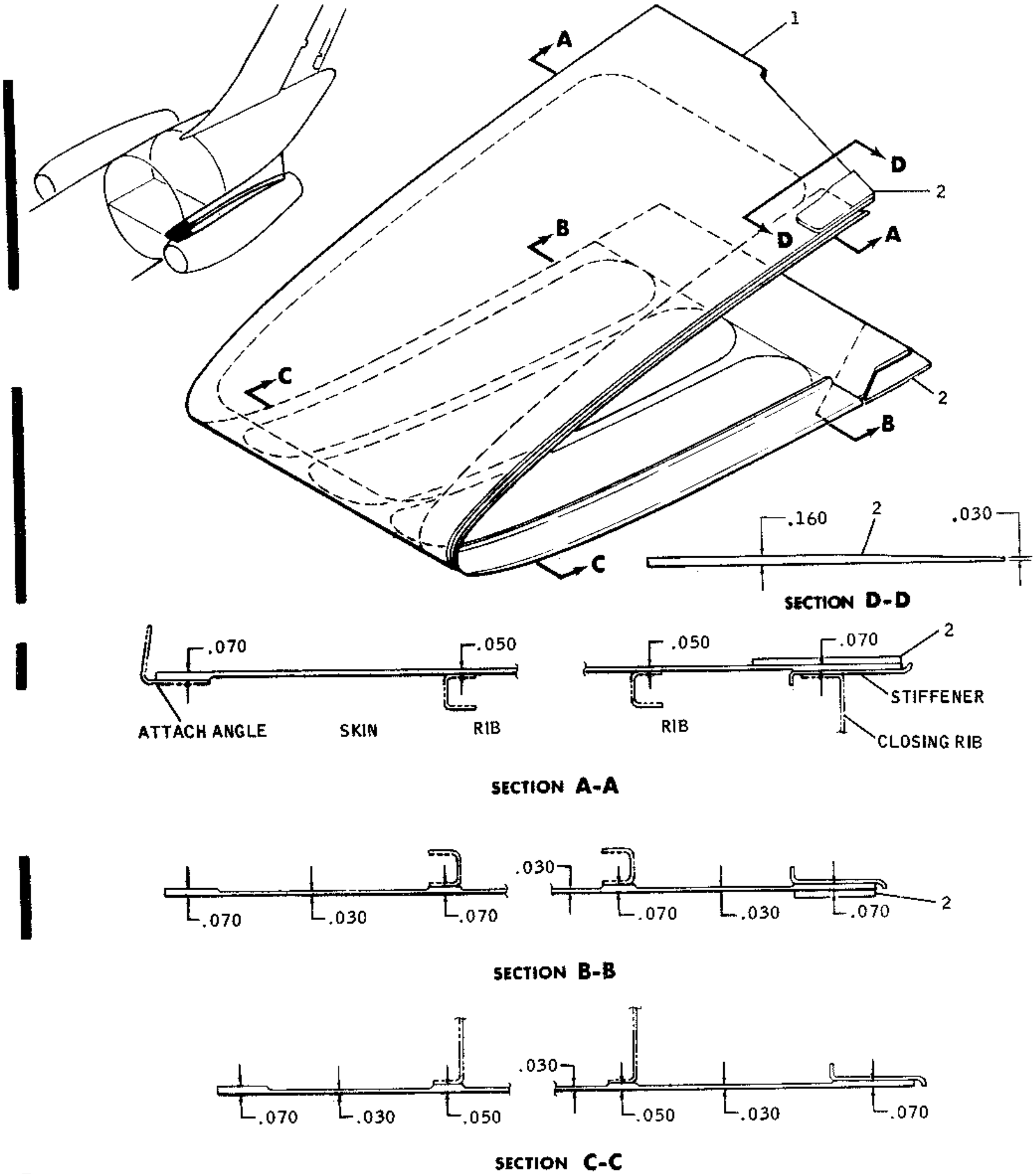
A. This section illustrates the plates/skin of the nacelles/pylons. Materials used in construction are identified by item number in the material listings of each illustration.

2. Repair Index

A. A list of structural components and the applicable repairs which are used to restore the structural integrity and appearance is presented as follows:

Structural Component	Approved Repairs

THIS INFORMATION WILL BE FURNISHED WHEN AVAILABLE

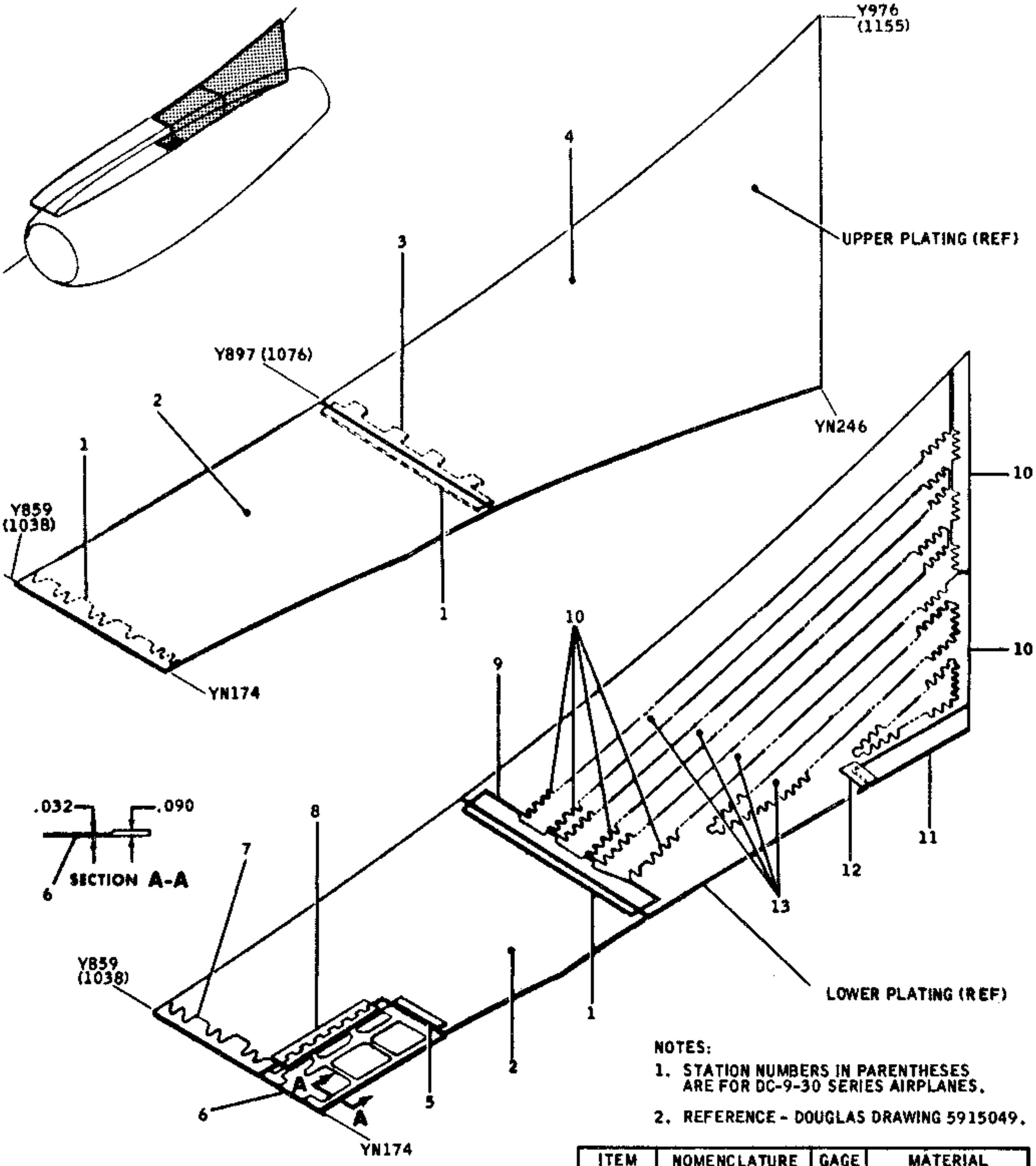


NOTES:
1. *.090 SKIN STOCK SIZE, REFER TO SECTION VIEWS FOR CHEM-MILLED FINISH GAGE VARIATIONS.
2. REFERENCE- DOUGLAS DRAWING 9958220

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.090*	TITANIUM DMS1536
2	STRAP	.160	CLAD 2024-T3

BB3-242 A

Pylon Leading Edge Plating
Figure 1



NOTES:

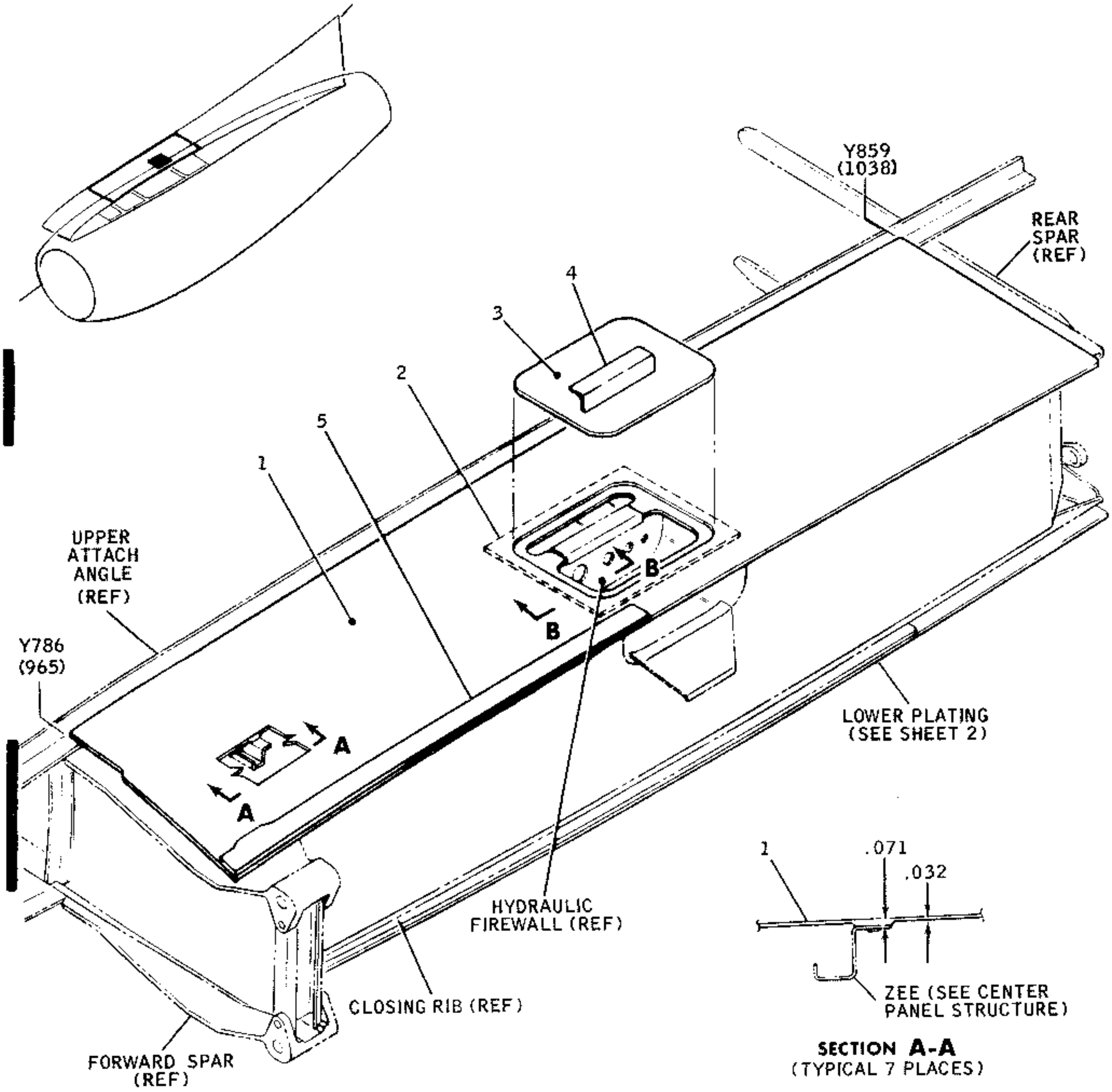
1. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
2. REFERENCE - DOUGLAS DRAWING 5915049.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.032	TITANIUM DMS1536
2	SKIN	.032	TITANIUM DMS1536
3	STRAP	.032	CLAD 2024-T3
4	SKIN	.040	CLAD 2024-T3

ITEM	NOMENCLATURE	GAGE	MATERIAL
5	DOUBLER	.050	TITANIUM DMS1536
6	DOOR SKIN	.090	TITANIUM DMS1536
7	DOUBLER	.063	TITANIUM DMS1536
8	HINGE		1383066
9	DOUBLER	.050	CLAD 2014-T6
10	DOUBLER	.020	CLAD 2014-T6
11	DOOR	.040	CLAD 2024-T3
12	DOUBLER	.040	CLAD 2024-T3
13	SKIN	.020	CLAD 2014-T6

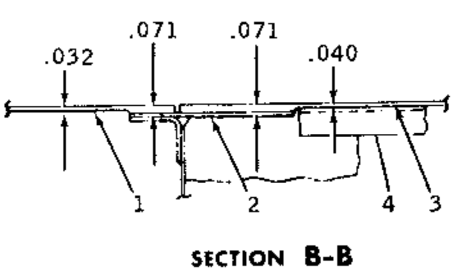
BB3-243B

Pylon Trailing Edge Plating
Figure 2



NOTES:

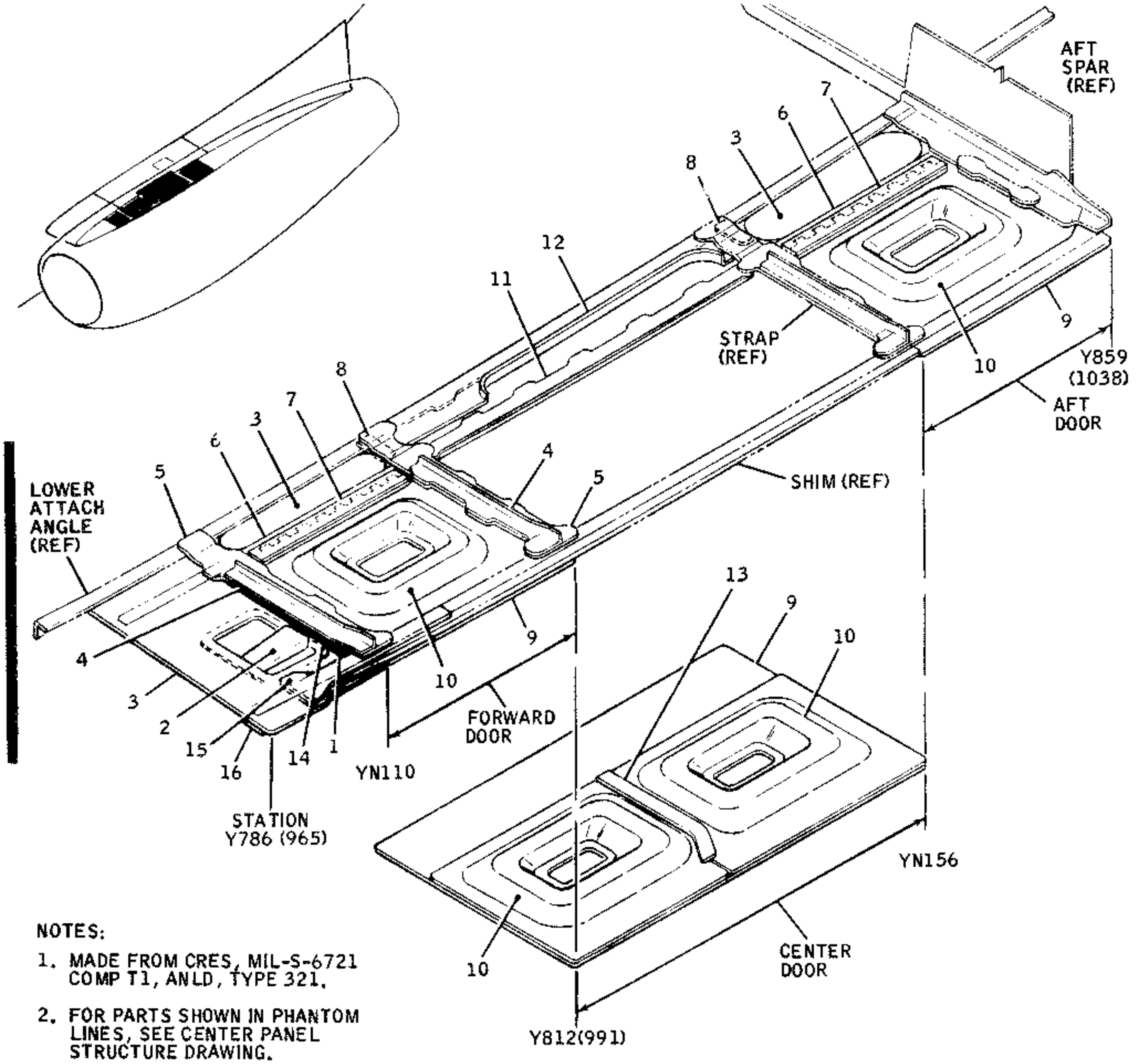
1. FOR PARTS SHOWN IN PHANTOM LINE, SEE SPAR AND CENTER PANEL STRUCTURE DRAWINGS.
2. *SEE SECTIONS A-A AND B-B FOR SKIN GAGES.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
4. REFERENCE - DOUGLAS DRAWING 9958191.



ITEM	NOMENCLATURE	GAGE	MATERIAL
*1	SKIN	NOTED	TITANIUM DMS1592
2	DOUBLER	.040	TITANIUM DMS1592
3	DOOR	.071	TITANIUM DMS1592
4	STIFFENER	.071	TITANIUM DMS1592
5	STRAP	.190	TITANIUM DMS1592

BB3-241B

Pylon Center Panel Plating
Figure 3 (Sheet 1)



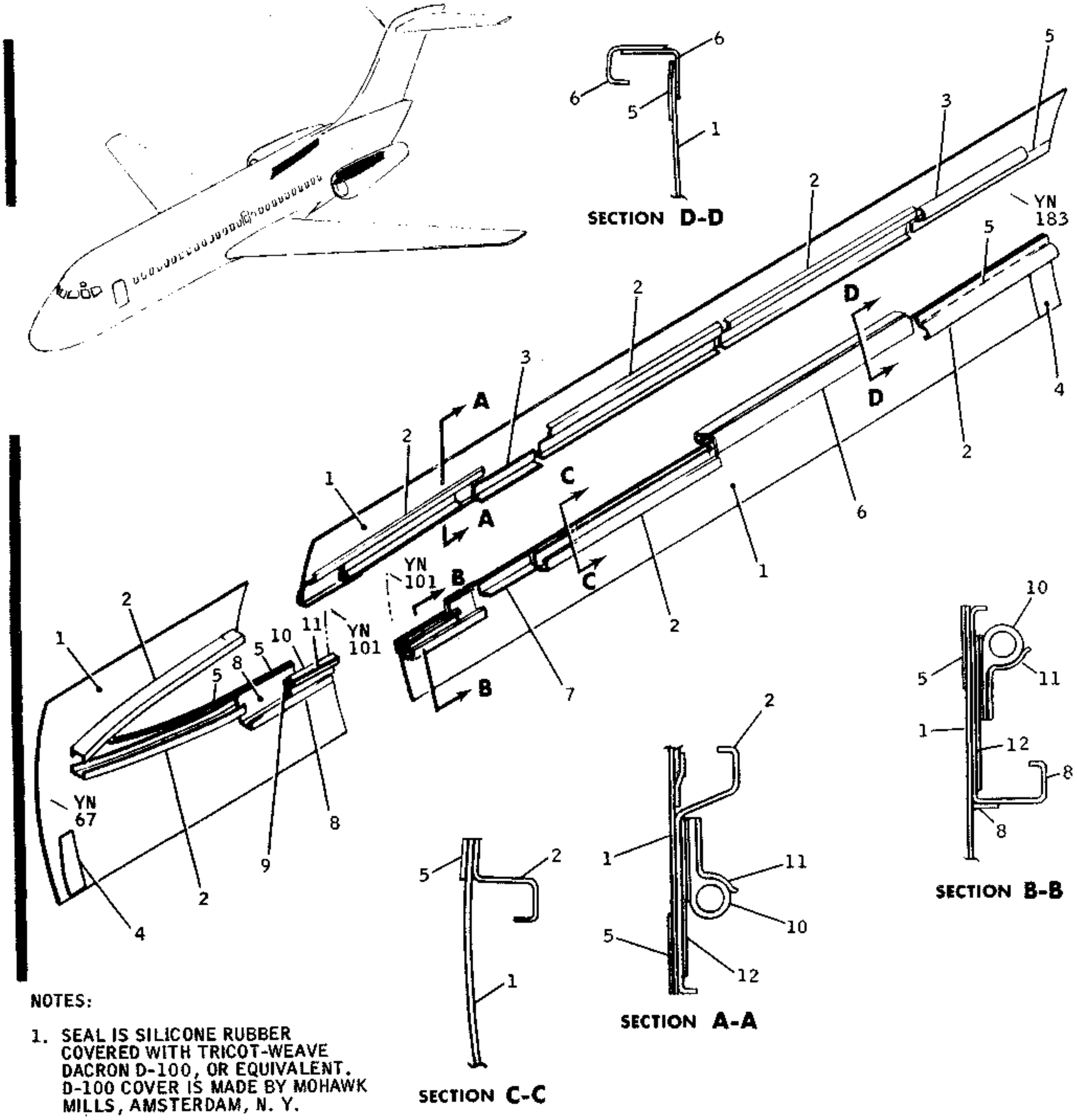
NOTES:

1. MADE FROM CRES, MIL-S-6721 COMP T1, ANLD, TYPE 321.
2. FOR PARTS SHOWN IN PHANTOM LINES, SEE CENTER PANEL STRUCTURE DRAWING.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
4. REFERENCE - DOUGLAS DRAWINGS 9958216, 9958217, 9958218.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FILLER	.375	PLATE 2024-T351	9	SKIN	.040	TITANIUM DMS1592
2	VENT	.032	SEE NOTE 1	10	STIFFENER	.050	CLAD 7075-T6
3	PANEL	.090	TITANIUM DMS1592	11	STIFFENER	.050	TITANIUM DMS1592
4	ANGLE	.040	TITANIUM DMS1536	12	STIFFENER	.090	CLAD 2024-T42
5	STRAP	.063	TITANIUM DMS1536	13	STRAP	.040	TITANIUM DMS1592
6	HINGE		1383066	14	DOUBLER	.313	PLATE 2024-T351
7	SEAL	.016	TITANIUM DMS1592	15	SPACER	.500	PLATE 2024-T351
8	SHIM	.040	TITANIUM DMS1592	16	STRAP	.190	TITANIUM DMS1592

BB3-444B

Pylon Center Panel Plating
Figure 3 (Sheet 2)



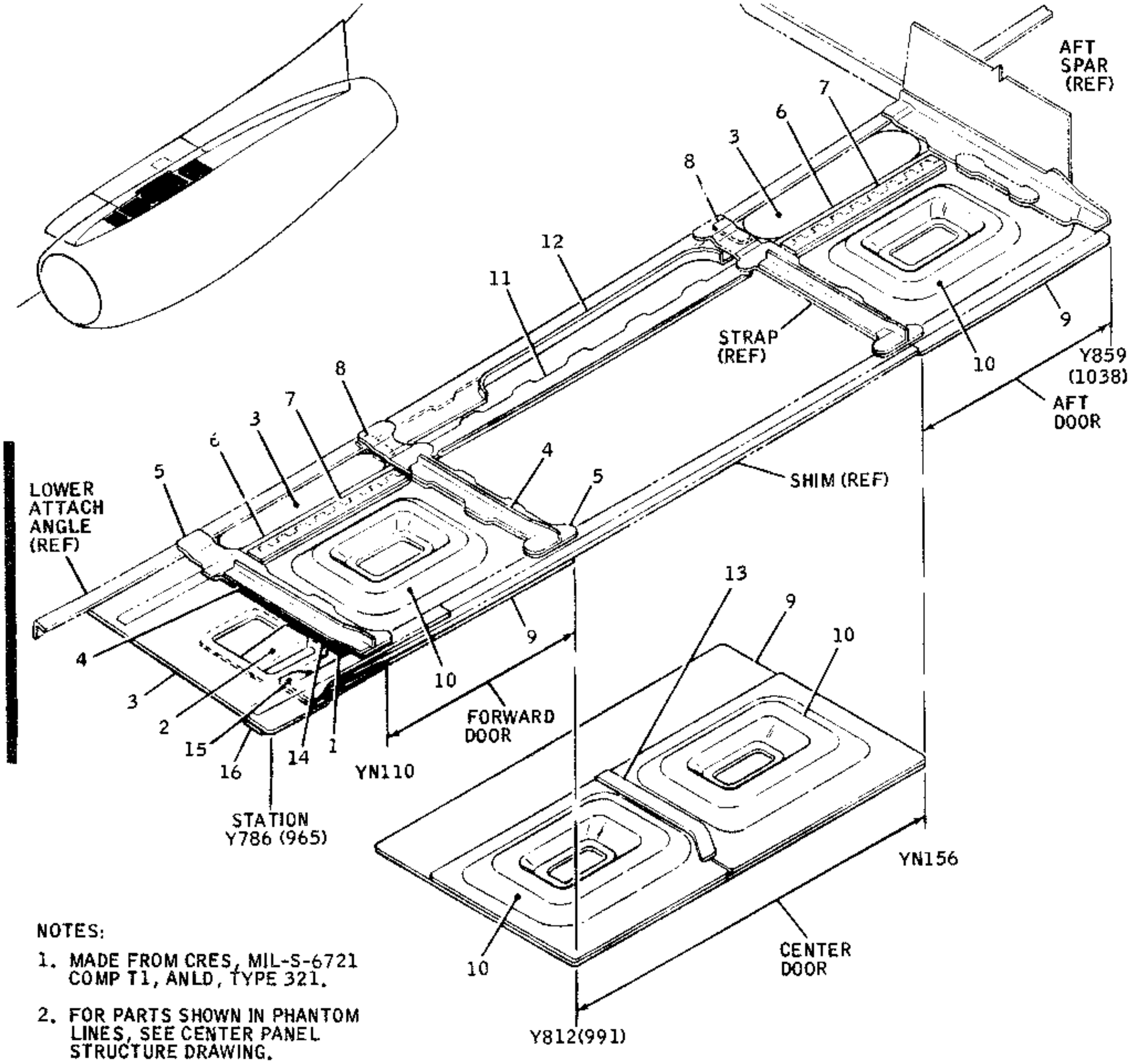
NOTES:

1. SEAL IS SILICONE RUBBER COVERED WITH TRICOT-WEAVE DACRON D-100, OR EQUIVALENT. D-100 COVER IS MADE BY MOHAWK MILLS, AMSTERDAM, N. Y.
2. REFERENCE - DOUGLAS DRAWINGS 5910308 AND 5958652

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	CLAD 2024-T42	7	STIFFENER	.040	CLAD 2024-T42
2	STIFFENER	.063	CLAD 2024-T42	8	CHANNEL	.063	CLAD 2024-T42
3	STIFFENER	.050	CLAD 2024-T42	9	RETAINER		2958603
4	DOUBLER	.063	CLAD 2024-T42	10	SEAL (SEE NOTE 1)		2958601
5	STRIP	.040	CLAD 2024-T3	11	RETAINER		2958602
6	STIFFENER	.020	PH15-7MO(HR190)	12	RETAINER	.016	PH15-7MO(HR190)

BB3-244A

Pylon Apron Plating
Figure 4



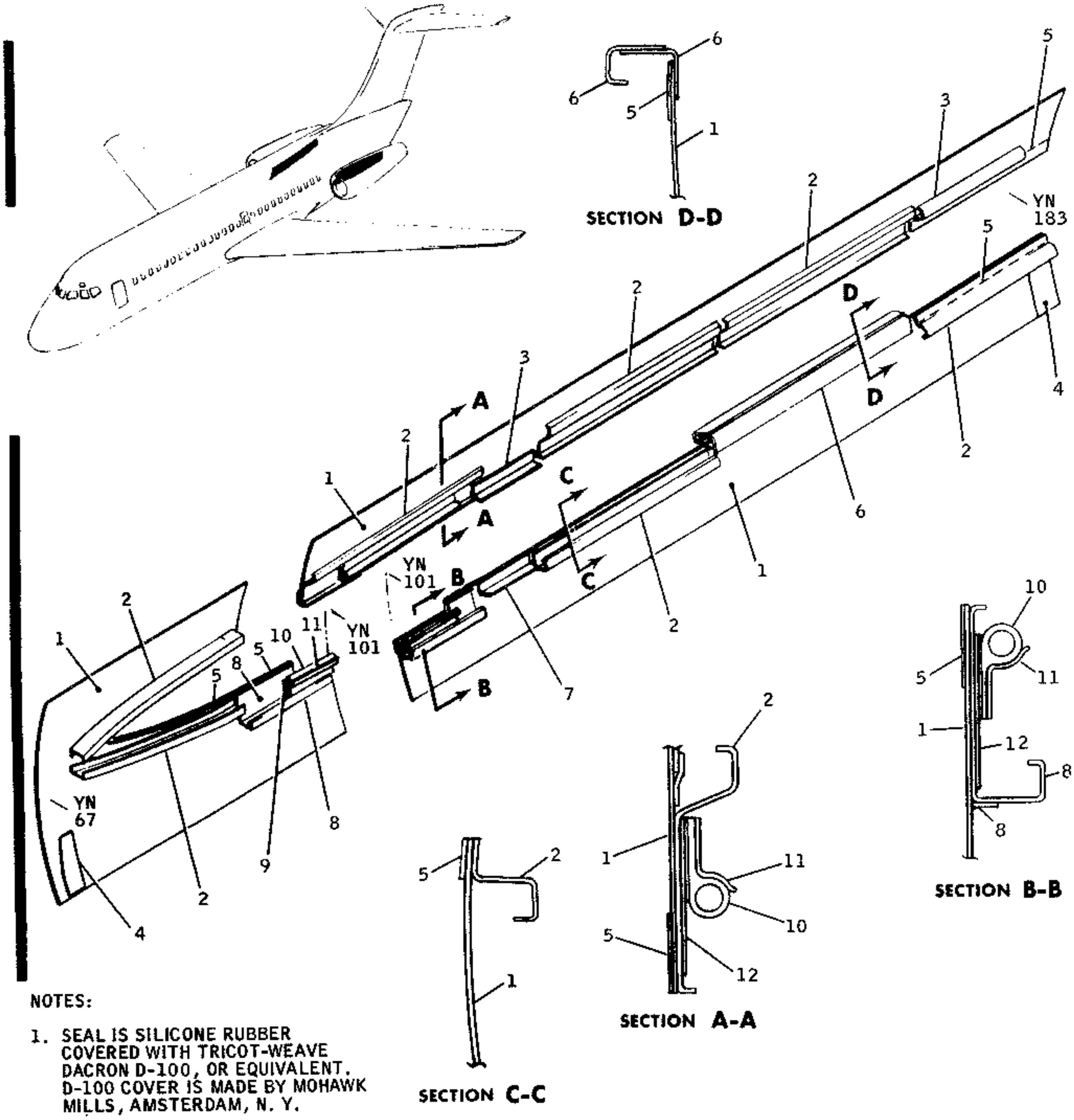
NOTES:

1. MADE FROM CRES, MIL-S-6721 COMP T1, ANLD, TYPE 321.
2. FOR PARTS SHOWN IN PHANTOM LINES, SEE CENTER PANEL STRUCTURE DRAWING.
3. STATION NUMBERS IN PARENTHESES ARE FOR DC-9-30 SERIES AIRPLANES.
4. REFERENCE - DOUGLAS DRAWINGS 9958216, 9958217, 9958218.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FILLER	.375	PLATE 2024-T351	9	SKIN	.040	TITANIUM DMS1592
2	VENT	.032	SEE NOTE 1	10	STIFFENER	.050	CLAD 7075-T6
3	PANEL	.090	TITANIUM DMS1592	11	STIFFENER	.050	TITANIUM DMS1592
4	ANGLE	.040	TITANIUM DMS1536	12	STIFFENER	.090	CLAD 2024-T42
5	STRAP	.063	TITANIUM DMS1536	13	STRAP	.040	TITANIUM DMS1592
6	HINGE		1383066	14	DOUBLER	.313	PLATE 2024-T351
7	SEAL	.016	TITANIUM DMS1592	15	SPACER	.500	PLATE 2024-T351
8	SHIM	.040	TITANIUM DMS1592	16	STRAP	.190	TITANIUM DMS1592

BB3-444B

Pylon Center Panel Plating
Figure 3 (Sheet 2)



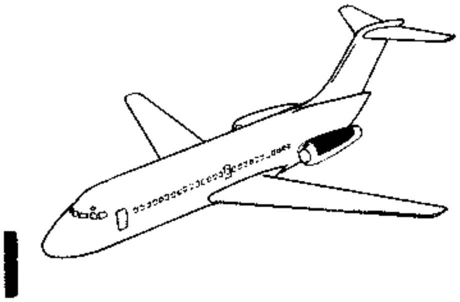
NOTES:

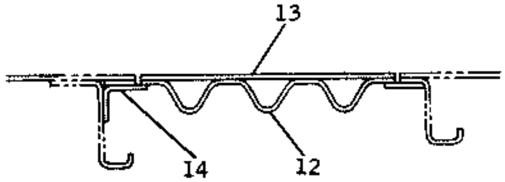
1. SEAL IS SILICONE RUBBER COVERED WITH TRICOT-WEAVE DACRON D-100, OR EQUIVALENT. D-100 COVER IS MADE BY MOHAWK MILLS, AMSTERDAM, N. Y.
2. REFERENCE - DOUGLAS DRAWINGS 5910308 AND 5958652

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	CLAD 2024-T42	7	STIFFENER	.040	CLAD 2024-T42
2	STIFFENER	.063	CLAD 2024-T42	8	CHANNEL	.063	CLAD 2024-T42
3	STIFFENER	.050	CLAD 2024-T42	9	RETAINER		2958603
4	DOUBLER	.063	CLAD 2024-T42	10	SEAL (SEE NOTE 1)		2958601
5	STRIP	.040	CLAD 2024-T3	11	RETAINER		2958602
6	STIFFENER	.020	PH15-7MO(HR190)	12	RETAINER	.016	PH15-7MO(HR190)

BB3-244A

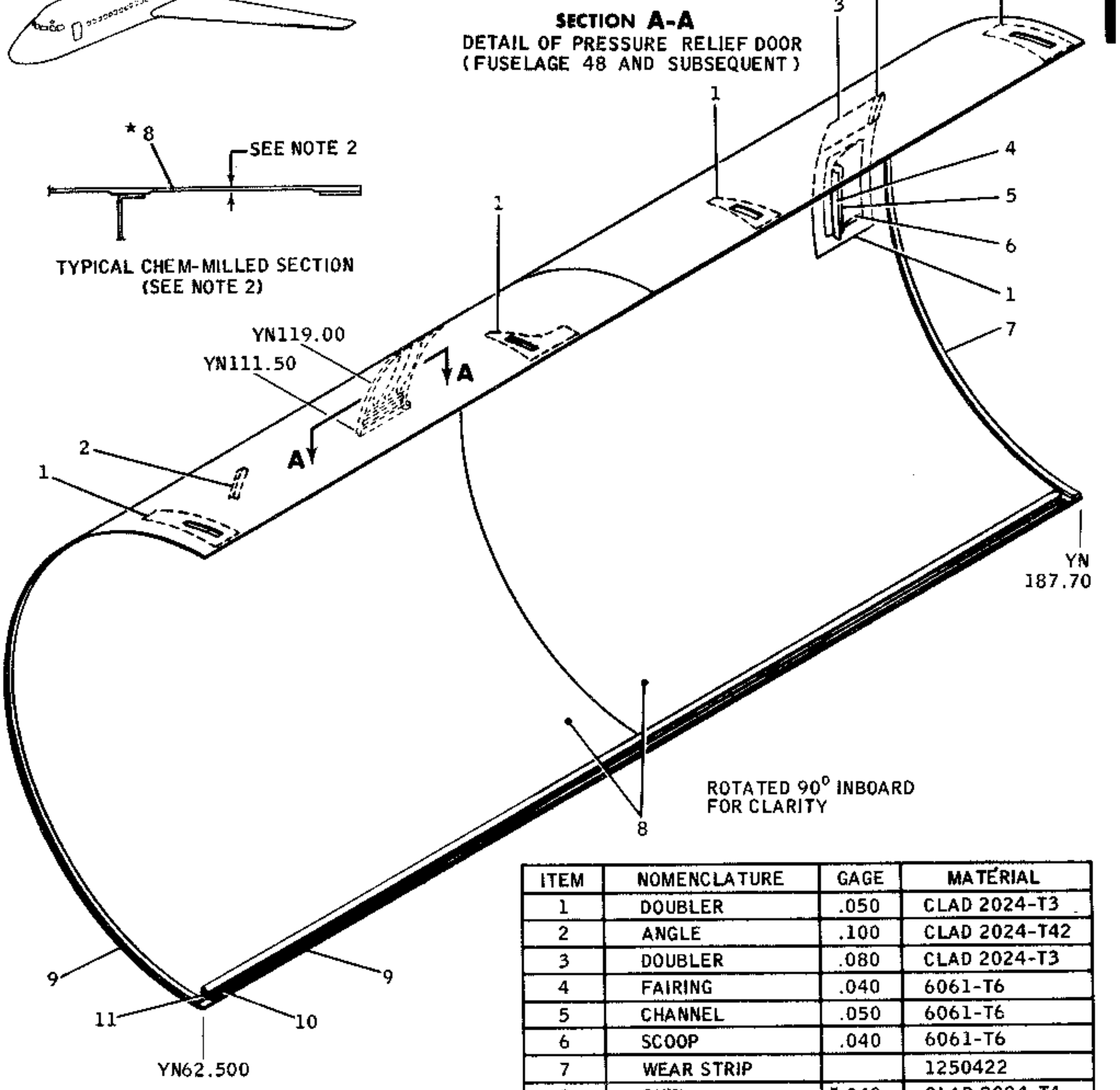
Pylon Apron Plating
Figure 4





SECTION A-A
DETAIL OF PRESSURE RELIEF DOOR
(FUSELAGE 48 AND SUBSEQUENT)

TYPICAL CHEM-MILLED SECTION
(SEE NOTE 2)



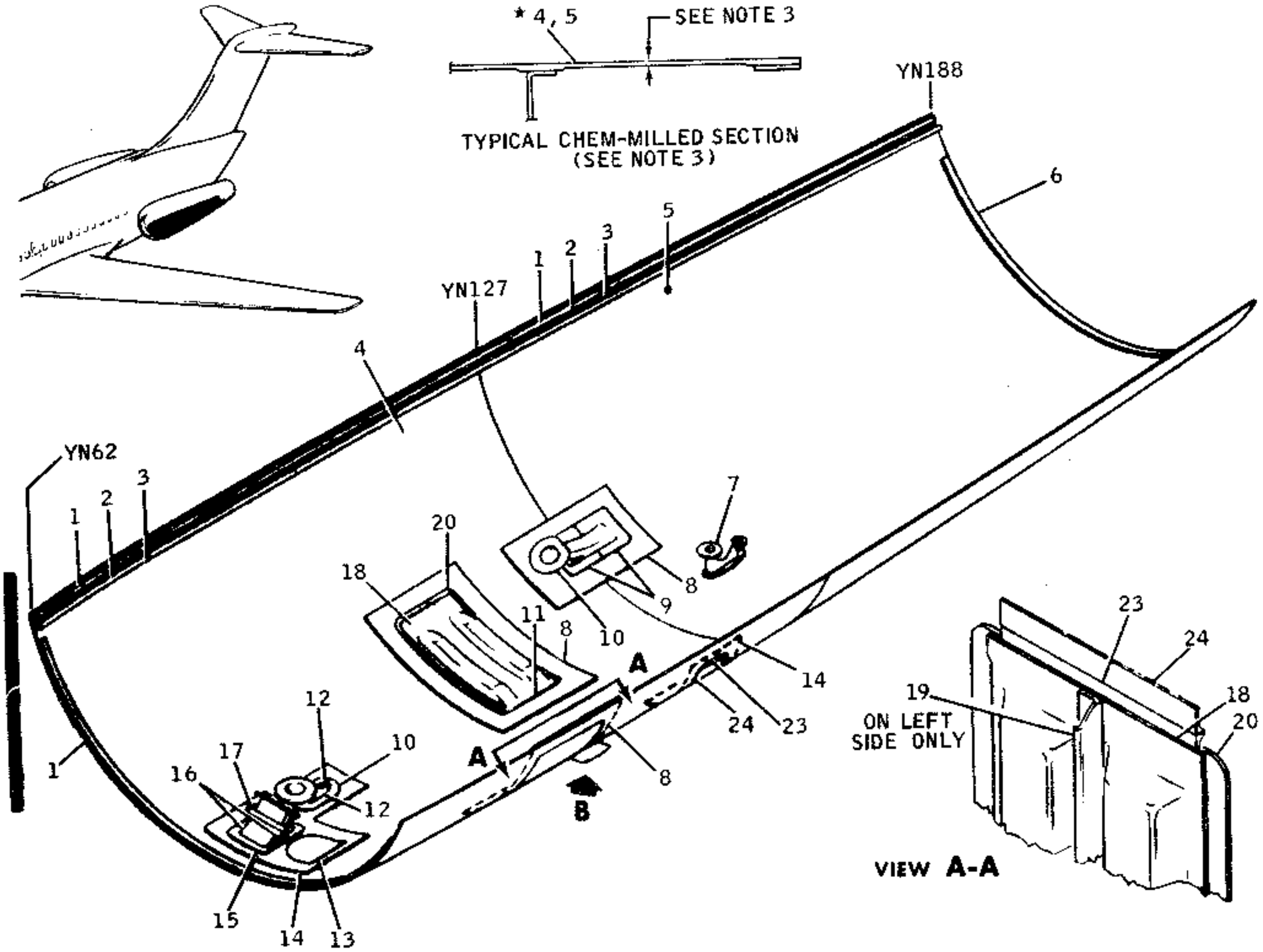
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.050	CLAD 2024-T3
2	ANGLE	.100	CLAD 2024-T42
3	DOUBLER	.080	CLAD 2024-T3
4	FAIRING	.040	6061-T6
5	CHANNEL	.050	6061-T6
6	SCOOP	.040	6061-T6
7	WEAR STRIP		1250422
8	SKIN	*.040	CLAD 2024-T4
9	WEAR STRIP	.063	CLAD 2024-T3
10	SEAL, 2958600		SEE NOTE 1
11	SEAL RETAINER		1104821
12	PAN	.063	CLAD 2024-T42
13	SKIN	.040	CLAD 2024-T42
14	DOUBLER	.063	CLAD 2024-T42

NOTES:

1. SEAL NO. 2948600-1 MADE FROM SILICONE RUBBER.
2. *.040 SKIN STOCK CHEM-MILLED TO .033 ± .003 BETWEEN LANDS FOR FUSELAGE 29 AND SUBSEQUENT. (FUSELAGE 1 THROUGH 28 NOT CHEM-MILLED).
3. REFERENCE-DOUGLAS DRAWING 5910306.

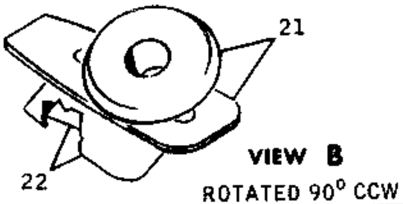
BB3-247C

Cowl Upper Door Plating
Figure 5



NOTES:

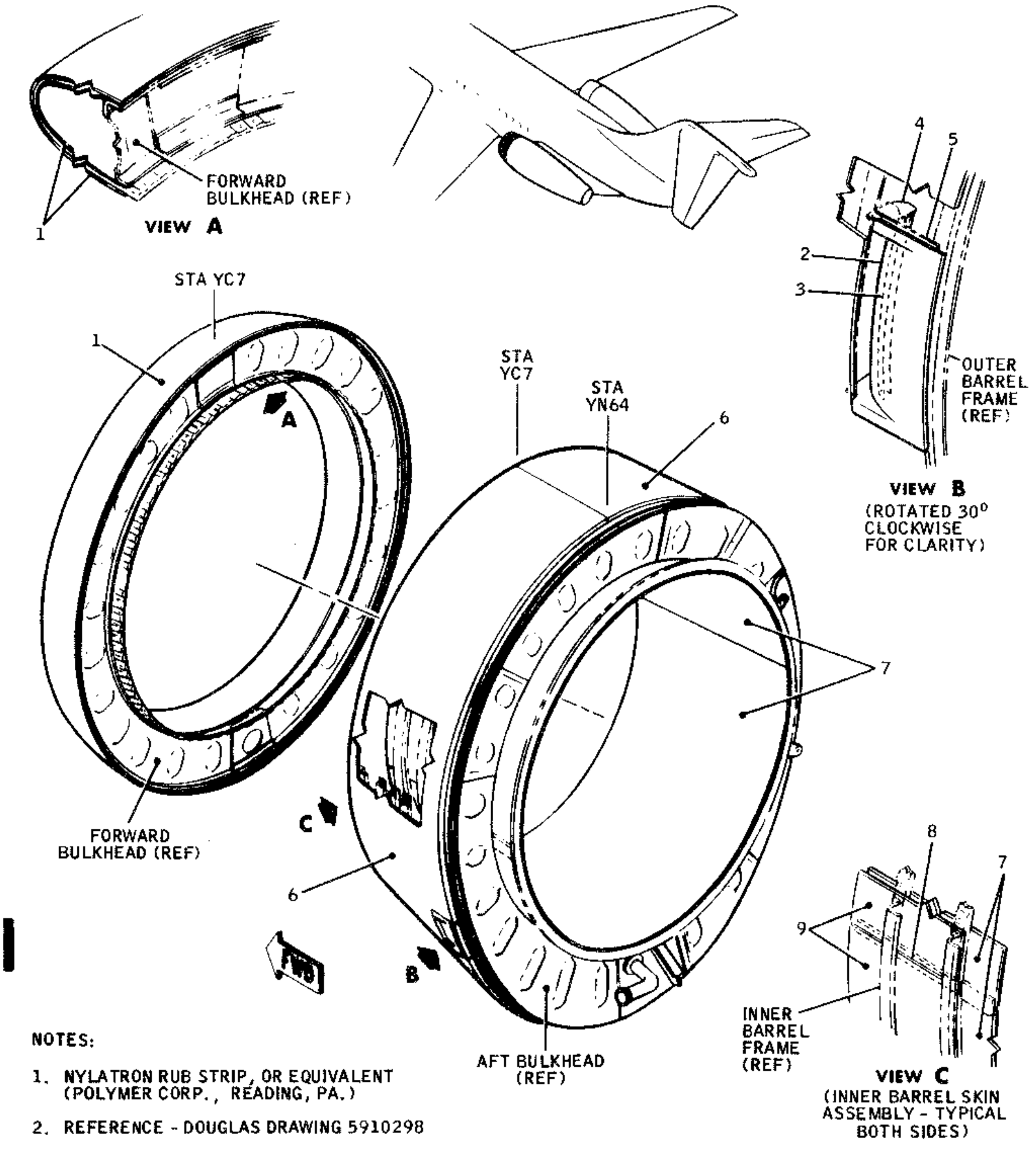
1. MADE FROM CRES SHEET, TYPE 321, MIL-S-6721, COMP T1, ANNEALED.
2. SEAL IS MADE FROM DACRON-COVERED SILICONE RUBBER.
3. *.040 SKIN STOCK CHEM-MILLED TO .033 ±.003 BETWEEN LANDS FOR FUSELAGE 29 AND SUBSEQUENT. (FUSELAGE 1 THROUGH 28 NOT CHEM-MILLED).
4. HINGE 4959062 IS MADE FROM 2505326 EXTRUSION.
5. REFERENCE - DOUGLAS DRAWINGS 5910307 AND 5958736.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RUB STRIP	.040	CLAD 2024-T3
2	RETAINER		1104821
3	SEAL (SEE NOTE 2)		2953600
4	SKIN	*.040	CLAD 2024-T4
5	SKIN	*.040	CLAD 2024-T3
6	RUB STRIP		1250422
7	MAST		356-T6 CASTING
8	DOUBLER	.050	CLAD 2024-T3
9	BASE	.035	SEE NOTE 1
10	FLANGE	.035	SEE NOTE 1
11	HINGE (SEE NOTE 4)		4959062
12	DUCT	.035	SEE NOTE 1
13	SKIN	.090	CLAD 2024-T42
14	DOUBLER	.050	CLAD 2024-T42
15	FLANGE	.050	CLAD 6061-T6
16	DUCT HALF	.050	CLAD 6061-T6
17	STIFFENER	.050	CLAD 6061-T6
18	PAN	.040	CLAD 2024-T42
19	CHANNEL	.050	CLAD 2024-T42
20	SKIN	*.160	CLAD 2024-T42
21	FLANGE	.040	TITANIUM DMS1536
22	MAST HALF	.040	TITANIUM DMS1536
23	HINGE		MS20001-X5
24	DOOR	.125	CLAD 2024-T42

BB3-248B

Cowl Lower Door Plating
Figure 6



NOTES:

1. NYLATRON RUB STRIP, OR EQUIVALENT (POLYMER CORP., READING, PA.)
2. REFERENCE - DOUGLAS DRAWING 5910298

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	2219-T62	6	SKIN	.040	CLAD 2024-T42
2	FAIRING	.040	6061-T6	7	DUCT	.063	CLAD 2219-T62
3	CHANNEL	.040	6061-T6	8	SPLICE	.050	CLAD 2024-T42
4	CLIP	.040	6061-T6	9	SKIN	.032	CLAD 2219-T62
5	SCOOP	.040	6061-T6				

BB3-246A

Nose Cowl Plating
Figure 7

CHAPTER 55

STABILIZERS

Printed in U.S.A.

Chapter 55

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Title			55-03	1	Jun 1/66
*55-Eff.	1-2	Dec 1/66	55-03	2	Sep 1/65
55-Cont.	1	Jun 1/66	55-03	3	Sep 1/65
55-Cont.	2	Jun 1/66	55-03	4	Mar 1/66
*55-Typ Var	1	Dec 1/66	55-03	5	Sep 1/65
55-Sect App	1	Sep 1/66	55-03	6	Mar 1/66
55-00	1	Sep 1/66	55-03	7	Mar 1/66
55-00	2	Sep 1/65	*55-03	8	Dec 1/66
55-00	3	Jun 1/66	*55-03	9	Dec 1/66
55-01	1	Jun 1/66	*55-03	10	Dec 1/66
55-01	2	Sep 1/65	*55-03	11	Dec 1/66
55-01	3	Sep 1/65	*55-03	12	Dec 1/66
55-01	4	Mar 1/66	*55-03	13	Dec 1/66
55-01	5	Sep 1/65	55-04	1	Jun 1/66
55-01	6	Mar 1/66	55-04	2	Sep 1/65
55-01	7	Mar 1/66	55-04	3	Sep 1/65
55-01	8	Mar 1/66	55-04	4	Sep 1/65
55-01	9	Mar 1/66	55-04	5	Sep 1/65
55-01	10	Mar 1/66	55-04	6	Sep 1/65
55-01	11	Mar 1/66	55-10-0	1	Jun 1/66
55-01	12	Mar 1/66	*55-10-0	2	Dec 1/66
55-01	13	Mar 1/66	*55-10-0	3	Dec 1/66
55-01	14	Mar 1/66	*55-10-0	4	Dec 1/66
55-01	15	Mar 1/66	55-10-0	5	Jun 1/66
55-01	16	Mar 1/66	*55-10-0	6	Dec 1/66
55-01	17	Sep 1/65	*55-10-0	7	Dec 1/66
55-01	18	Sep 1/65	55-10-0	8	Jun 1/66
55-01	19	Jun 1/66	55-10-0	9	Sep 1/65
55-01	20	Dec 1/65	55-10-0	10	Mar 1/66
55-01	21	Dec 1/65	55-10-0	11	Mar 1/66
55-01	22	Dec 1/65	55-10-0	12	Mar 1/66
55-02	1	Jun 1/66	55-11-0	1	Jun 1/66
55-02	2	Sep 1/65	*55-11-0	2	Dec 1/66
55-02	3	Sep 1/65	*55-11-0	3	Dec 1/66
55-02	4	Mar 1/66	*55-11-0	4	Dec 1/66
55-02	5	Sep 1/65	55-11-0	5	Jun 1/66
55-02	6	Sep 1/65	*55-11-0	6	Dec 1/66
55-02	7	Sep 1/65	*55-11-0	7	Dec 1/66
55-02	8	Sep 1/65	*55-11-0	8	Dec 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
55-11-0	9	Jun 1/66
55-11-0	10	Jun 1/66
55-11-0	11	Jun 1/66
55-11-0	12	Jun 1/66
55-20-0	1	Jun 1/66
*55-20-0	2	Dec 1/66
*55-20-0	3	Dec 1/66
*55-20-0	4	Dec 1/66
*55-20-0	5	Dec 1/66
*55-20-0	6	Dec 1/66
*55-20-0	7	Dec 1/66
*55-20-0	8	Dec 1/66
*55-20-0	9	Dec 1/66
55-20-1	1	Jun 1/66
55-20-1	2	Mar 1/66
55-20-1	3	Mar 1/66
55-20-1	4	Mar 1/66
55-20-1	5	Mar 1/66
55-20-1	6	Mar 1/66
55-20-1	7	Mar 1/66
55-20-1	8	Mar 1/66
55-20-1	9	Mar 1/66
55-20-1	10	Mar 1/66
55-20-1	11	Mar 1/66
55-20-1	12	Mar 1/66
55-20-1	13	Mar 1/66
55-20-1	14	Mar 1/66
55-20-1	15	Mar 1/66
55-20-1	16	Mar 1/66
55-20-1	17	Mar 1/66
55-20-1	18	Mar 1/66
55-20-1	19	Mar 1/66
55-20-1	20	Mar 1/66
55-20-1	21	Mar 1/66
55-20-1	22	Mar 1/66
55-20-1	23	Mar 1/66
55-20-1	24	Mar 1/66
55-20-1	25	Mar 1/66
55-21-0	1	Jun 1/66
*55-21-0	2	Dec 1/66
*55-21-0	3	Dec 1/66
55-21-0	4	Jun 1/66
*55-21-0	5	Dec 1/66
*55-21-0	6	Dec 1/66
*55-21-0	7	Dec 1/66
*55-21-0	8	Dec 1/66
*55-21-0	9	Dec 1/66
55-30-0	1	Jun 1/66
55-30-0	2	Sep 1/65
55-30-0	3	Sep 1/65
*55-30-0	4	Dec 1/66
55-30-0	5	Mar 1/66
55-30-0	6	Sep 1/65
55-30-0	7	Sep 1/65
55-30-0	8	Sep 1/65
55-30-0	9	Sep 1/65
*55-30-0	10	Dec 1/66
*55-30-0	11	Dec 1/66
55-40-0	1	Jun 1/66
55-40-0	2	Dec 1/65
55-40-0	3	Sep 1/65
55-40-0	4	Sep 1/65
55-40-0	5	Dec 1/65
55-40-0	6	Sep 1/65
55-40-0	7	Dec 1/65
55-40-1	1	Jun 1/66
55-40-1	2	Jun 1/66
55-40-1	3	Jun 1/66
55-40-1	4	Jun 1/66
55-40-1	5	Jun 1/66
55-40-1	6	Jun 1/66
55-40-1	7	Jun 1/66
55-40-1	8	Jun 1/66
55-40-1	9	Jun 1/66
55-40-1	10	Jun 1/66
55-40-1	11	Jun 1/66
55-40-1	12	Jun 1/66
55-40-1	13	Jun 1/66
55-40-1	14	Jun 1/66
55-40-1	15	Jun 1/66
55-40-1	16	Jun 1/66
55-40-1	17	Jun 1/66
55-40-1	18	Jun 1/66
55-40-1	19	Jun 1/66
55-40-1	20	Jun 1/66
55-40-1	21	Jun 1/66
55-40-1	22	Jun 1/66
55-40-1	23	Jun 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter 55

TABLE OF CONTENTS

Chapter 55

TYPE VARIATIONS

The illustrations listed below, in numerical sequence by chapter, section, and subject, reflect structural differences in the stabilizers. These differences are indicated as type variations. The effectivity of each type is indicated by fuselage serial numbers.

Figure	Title	Effectivity
	55-10-0	
1	Leading Edge and Tip Plating -- Type I	All DC-9-10 airplanes except Type II listings.
1	Leading Edge and Tip Plating -- Type II	45711-45713, 45725-45727.
	55-11-0	
1	Leading Edge and Tip Plating -- Type A1	All DC-9-30 airplanes except Type A2 listings.
1	Leading Edge and Tip Plating -- Type A2	45845, 45846, 47019-47022, 47067.

Printed in U.S.A.

Chapter 55

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
55-00	YES	YES
55-01	YES	YES
55-02	YES	YES
55-03	YES	YES
55-04	YES	YES
55-10-0	YES	NO
55-11-0	NO	YES
55-20-0	YES	NO
55-20-1	YES	YES
55-21-0	NO	YES
55-30-0	YES	YES
55-40-0	YES	YES
55-40-1	YES	YES

Chapter 55

STABILIZERS

GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

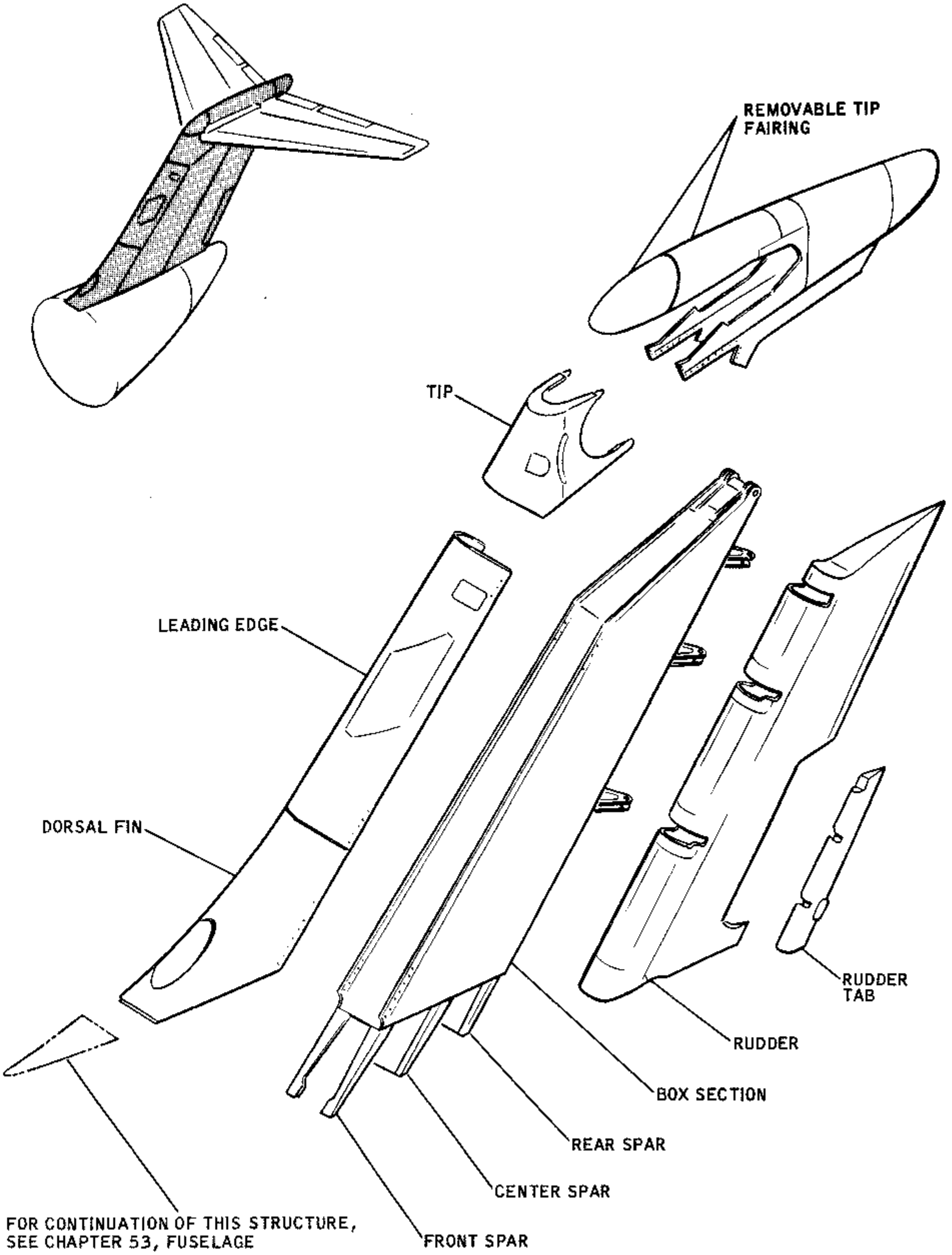
1. Description

A. Repair instructions for stabilizers are outlined in this chapter. Material identification illustrations indicate the type of material and the gages of the reparable stabilizer components. Repair instructions are described for the most common types of damage encountered. For an explanation of the classification of repairs and damages, see 51-00. For locations of the stabilizer components described in this chapter, refer to the index illustration (see Figure 1). A repair index is presented with each section of components.

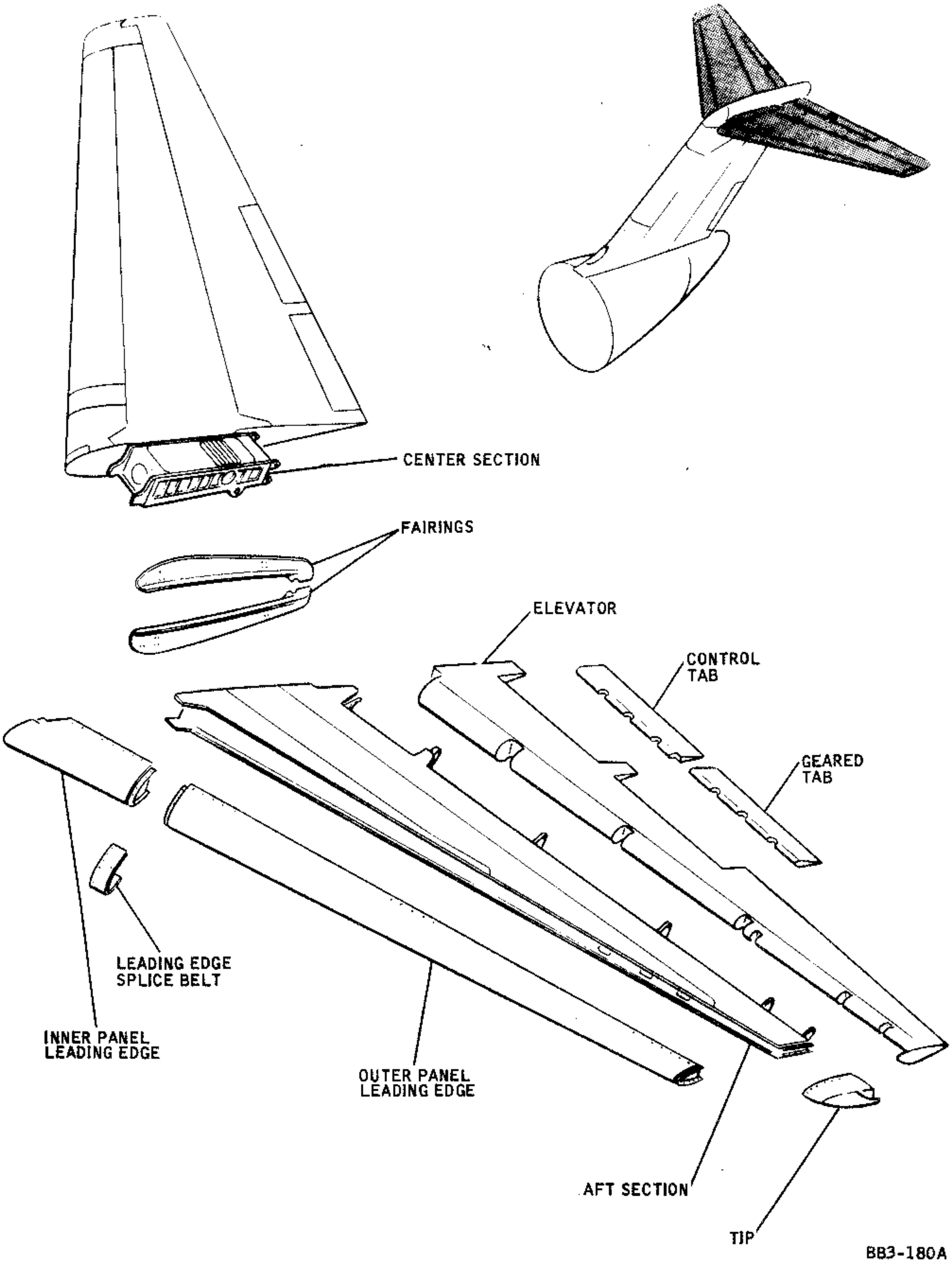
B. Also presented in this chapter are procedures for balancing the control surfaces. Balancing procedures are contained in the applicable section for the surface involved.

C. When an elevator, a rudder, an elevator control tab, or the rudder tab is to be repaired, the surfaces must be rebalanced according to the applicable balancing procedures. When an elevator control tab, elevator-geared tab, or a rudder tab is to be repaired, the tab must also be weighed to ensure that maximum allowable tab weight is not exceeded. Maximum allowable weights for tabs are given in the applicable balancing procedures for the surfaces involved. Balancing of control surfaces by the calculation method is also described in Section 55-40-1. This is an alternative method to the balance of surfaces methods requiring the removal of surfaces from the airplane.

D. Any repairs of vertical or horizontal stabilizer skins between spars require specific engineering approval.



Stabilizers -- Index Illustration
Figure 1 (Sheet 1)



Stabilizers -- Index Illustration
Figure 1 (Sheet 2)

GENERAL REPAIR PROCEDURES AND PROCESSES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General Requirements

A. The following requirements are necessary to accomplish the repairs mentioned in this chapter and are additional to the specific repair requirements listed with the individual repairs:

(1) Recommended edge distance for all attachments in the repair areas is 2 diameters plus 1/16 inch, unless otherwise noted. Minimum edge distance is 2 diameters.

(2) All repair materials must have identical material and heat-treated condition as the part being repaired, unless otherwise noted. See Chapter 51 for recommended substitutions. If forming operations require repair material to be in the -O (soft) condition, the part must be heat-treated to the appropriate -T condition after forming. The word "clad" precedes aluminum alloy material designations to indicate material having thin protective coating of pure aluminum on both sides; absence of the word "clad" indicates material does not have this thin layer of aluminum.

(3) All metal repair parts must be cleaned and corrosion protected in accordance with Chapter 51, unless otherwise noted in the individual repair.

(4) All repair parts must be free from cracks, burrs, dings, and sharp edges. This requirement applies also to parts to which repair parts are being attached.

(5) All attachment holes must be prepared in accordance with recommended fastener hole sizes specified in Chapter 51.

(6) Minimum attachment spacing in the repair areas is 4 diameters, unless otherwise noted.

(7) All repairs within the pressure boundary of the fuselage require sealing as described in the Repair Sealing Section of Chapter 51.

(8) Where external doublers are to be tapered for aerodynamic reasons, a seal-type taper may be substituted. See Repair Sealing Section of Chapter 51.

2. General Repairs

A. Repairs mentioned in this section are general and may be used separately or in conjunction with specific repairs provided in subsequent sections of this chapter. When applicable, specific repairs are preferred. Repairs involving more than one illustration must comply with the requirements of each illustration. The following repairs are in this section:

B. Determine number of 181 bidirectional glass fiber cloth plies required for making glass cloth repairs as shown in Figure 6.

3. Attachment Spacing Chart

A. Determine number of equal spaces required in first row of attachments around a repaired hole from Figure 7. Repair hole diameters must not be smaller than minimum diameters given in the 8 Equal Spaces column also shown in Figure 7.

ALLOWABLE CLEANUP OF SCRATCHES, NICKS, GOUGES, AND DINGS IN STABILIZER STRUCTURE (IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

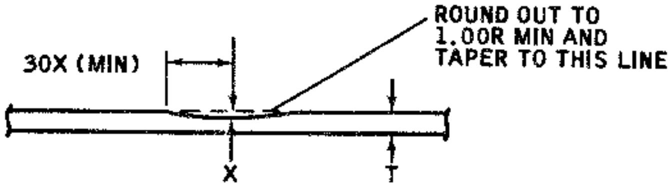
TYPE OF DAMAGE

SCRATCHES AND GOUGES

1. SCRATCHES OR GOUGES THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. SCRATCHES OR GOUGES THAT PENETRATE BEYOND THE CLAD UP TO THE DEPTH SHOWN IN THE TABLE BELOW SHOULD BE ROUNDED OUT AND TAPERED. SEE EXAMPLE BELOW.
3. SCRATCHES OR GOUGES DEEPER THAN THE LIMIT SHOWN IN THE TABLE BELOW MUST BE REPAIRED. REPAIR IN THE SAME MANNER AS CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.

STRUCTURE	ITEM	X
HORIZONTAL STABILIZER PLATING	ALL	.20t
HORIZONTAL STABILIZER STRUCTURE	ALL EXCEPT SPAR CAPS AND OPERATING BULKHEAD	.20t
ELEVATOR AND TAB PLATING	ALL	.20t
ELEVATOR AND TAB STRUCTURE	ALL EXCEPT SPAR CAPS	.20t
VERTICAL STABILIZER PLATING	ALL	.20t
VERTICAL STABILIZER STRUCTURE	ALL EXCEPT SPAR CAPS AND PLASTIC PARTS	.20t
RUDDER AND TAB PLATING	ALL	.20t
RUDDER AND TAB STRUCTURE	ALL EXCEPT SPAR CAPS AND PLASTIC PARTS	.20t

T = MATERIAL THICKNESS
X = ALLOWABLE DEPTH



NOTE:

CLEAN UP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL).

BB3-528

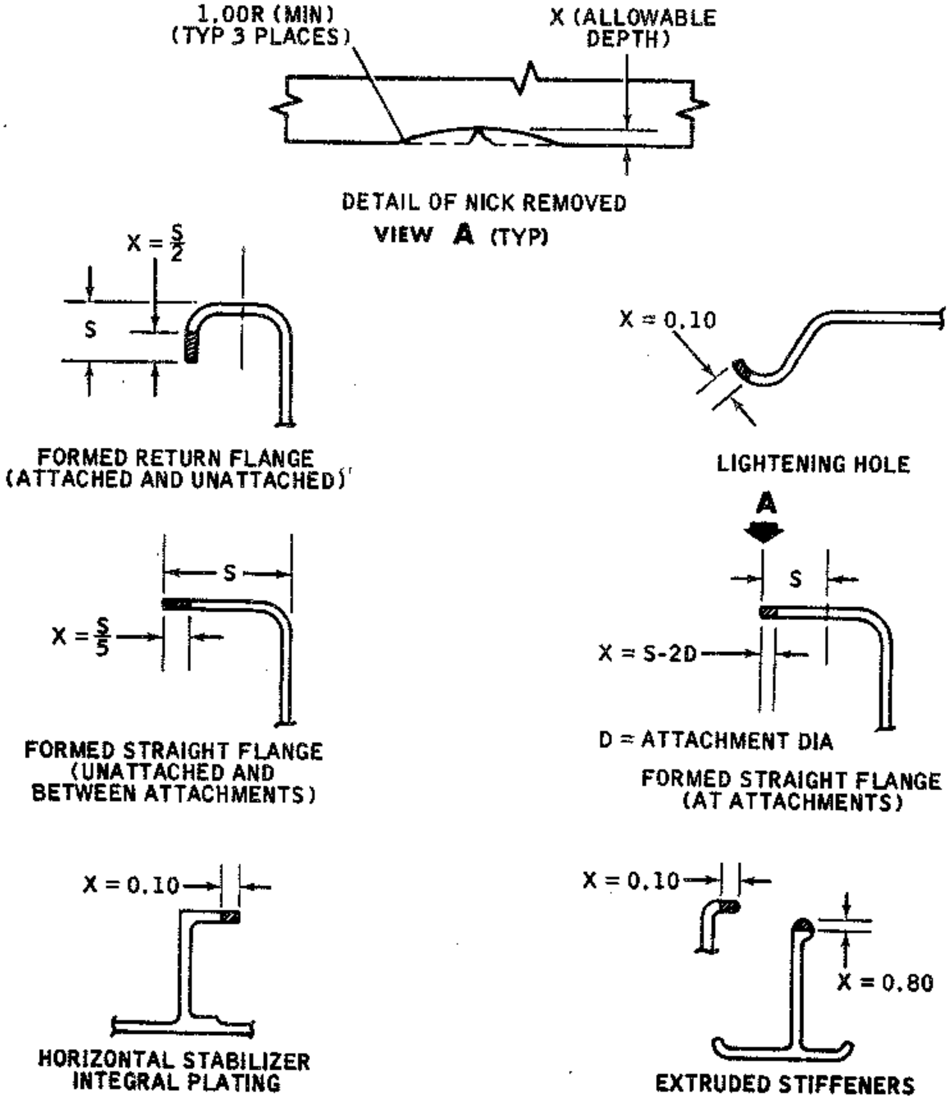
Cleanup of Scratches, Gouges, Nicks and Dings in Stabilizer Structures
Figure 1 (Sheet 1)

ALLOWABLE CLEANUP OF SCRATCHES, NICKS, GOUGES, AND DINGS IN STABILIZER STRUCTURE (IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE

NICKS IN EXTRUSIONS, ROLLED, AND FORMED SECTIONS

1. NICKS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. NICKS UP TO THE DEPTH SHOWN IN THE EXAMPLE BELOW SHOULD BE ROUNDED OUT TO 1.00-INCH RADIUS.
3. NICKS DEEPER THAN THE LIMIT SHOWN IN THE EXAMPLE BELOW MUST BE SPLICED OR REINFORCED AFTER THE NICK IS ROUNDED OUT.
4. NICKS IN RADIUS AREA SHOULD BE REPAIRED AS A DING IN A RADIUS AREA AS DESCRIBED IN THE CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.



1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED. UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS-SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEAN UP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION.

BB3-529 A

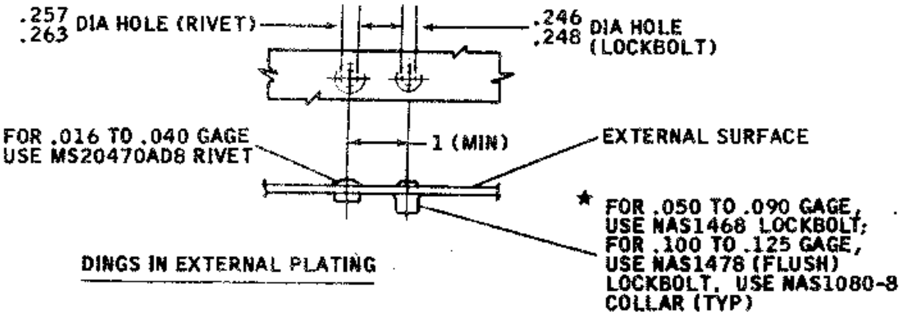
Cleanup of Scratches, Gouges, Nicks and Dings
in Stabilizer Structures
Figure 1 (Sheet 2)

ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN STABILIZER STRUCTURE

(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
DINGS

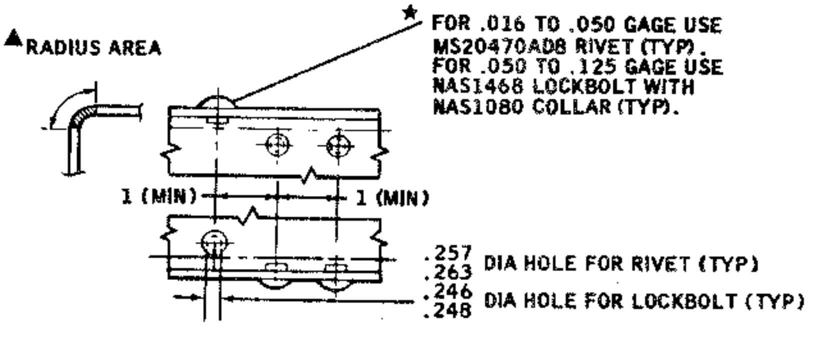
1. DINGS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. DINGS THAT PENETRATE BEYOND THE CLAD AND ARE NOT LARGER THAN 0.250 INCH DIAMETER SHOULD BE REMOVED AND PLUGGED. SEE SKETCHES BELOW. SEE CHAPTER 51 FOR DING REPAIRS IN ALUMINUM HONEYCOMB PANELS.
3. DINGS LARGER THAN 0.250 INCH DIAMETER MUST BE REPAIRED. REPAIR IN SAME MANNER AS CRACKED MEMBERS, THIS SECTION.
4. THESE INSTRUCTIONS DO NOT APPLY TO MACHINED FITTINGS IN THE DOORS.



★ FOR .016 TO .040 GAGE USE MS20470AD8 RIVET

★ FOR .050 TO .090 GAGE, USE NAS1468 LOCKBOLT; FOR .100 TO .125 GAGE, USE NAS1478 (FLUSH) LOCKBOLT. USE NAS1080-8 COLLAR (TYP)

DINGS IN EXTERNAL PLATING



★ FOR .016 TO .050 GAGE USE MS20470AD8 RIVET (TYP). FOR .050 TO .125 GAGE USE NAS1468 LOCKBOLT WITH NAS1080 COLLAR (TYP).

DINGS IN INTERNAL STRUCTURE

★ MS20470AD8 RIVET MAY BE USED IN PLACE OF LOCKBOLT IF MORE CONVENIENT.

▲ DINGS IN A RADIUS AREA REQUIRE THE SECTION TO BE REPAIRED AFTER THE DING IS DRILLED OUT. SEE THE ALUMINUM ALLOY TO ALUMINUM ALLOY (CRACKED MEMBER) REPAIRS, THIS SECTION, (ONLY 3 ATTACHMENTS REQUIRED WHERE 5 ARE CALLED OUT). DO NOT INSTALL A FASTENER IN THE DING CLEANOUT HOLE.

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-530

Cleanup of Scratches, Gouges, Nicks and Dings
in Stabilizer Structures
Figure 1 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

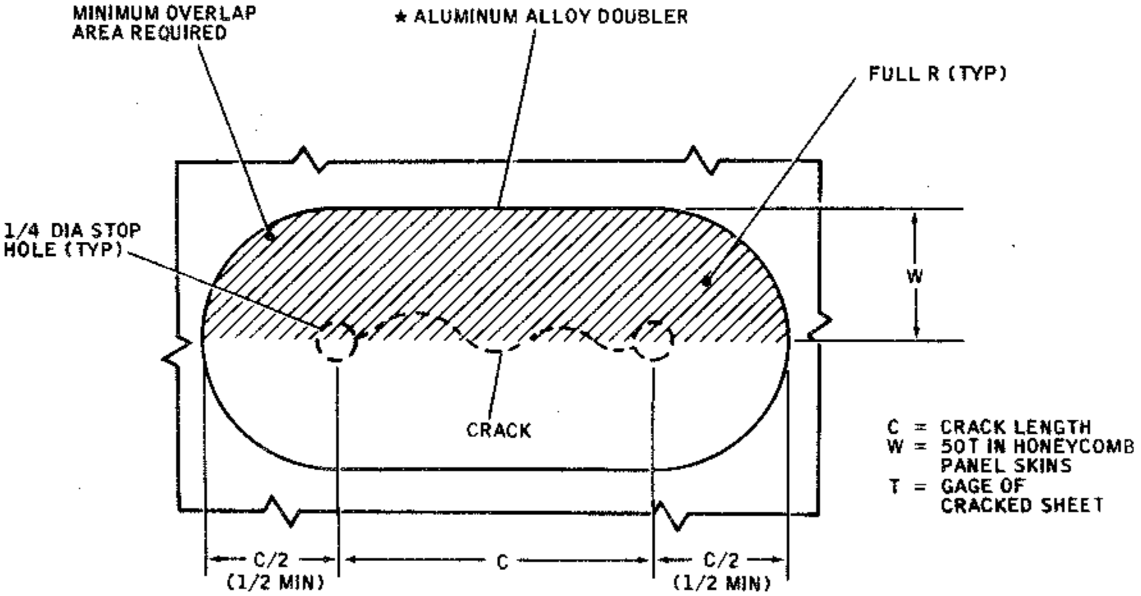
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE A BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 2, SHEET 3.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
4. IF CRACKS ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE SKIN IN THE SHORTEST DIRECTION, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE SKIN SURFACE, THEN THE SKIN SHOULD BE REPLACED.
5. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE A

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125°F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

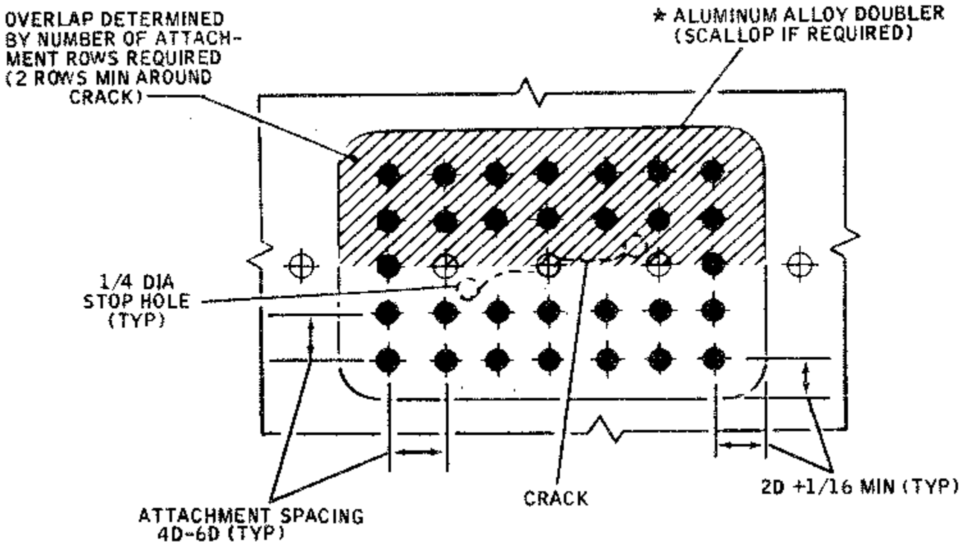
883-517A

Aluminum Alloy to Aluminum Alloy Repairs -- Cracked Members
Figure 2 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .090 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE IN THIS SECTION MAY ALSO BE USED. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE B

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F.).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-518A

Aluminum Alloy to Aluminum Alloy Repairs -- Cracked Members
Figure 2 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

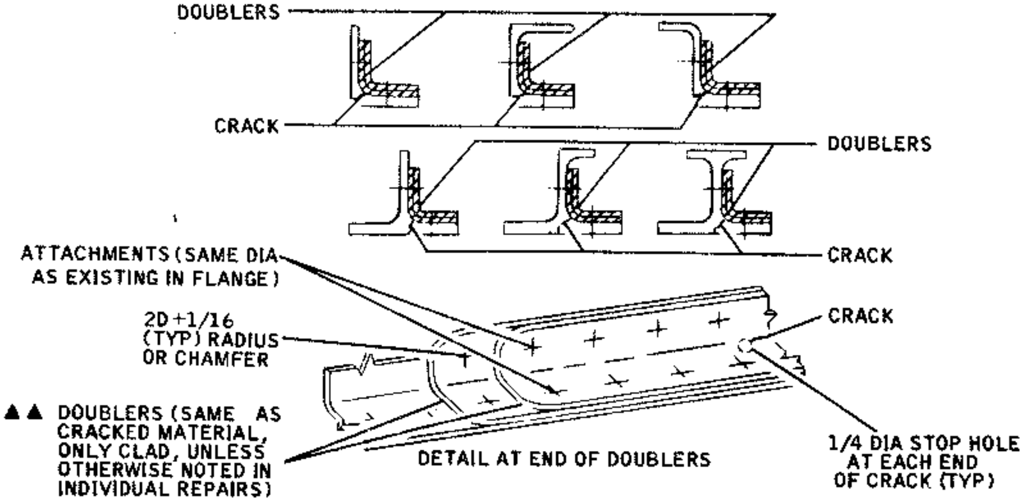
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY EXTRUDED, FORMED AND ROLLED SECTIONS

.016 TO .125 GAGE

1. REPAIR CRACKS PARALLEL TO THE ATTACHED FLANGE RADIUS OF EXTRUDED, FORMED, OR ROLLED SECTIONS, USING FORMED DOUBLERS. INSTALL WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE C.
2. THE ADHESIVE WILL CAUSE THE DOUBLERS TO ACT AS A SINGLE DOUBLER, LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. PICK UP AT LEAST ONE ROW OF ATTACHMENTS EACH SIDE OF CRACK AND PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK IN EACH ROW AT EACH END AS SHOWN IN DETAIL BELOW.
4. THE DOUBLERS SHOULD BE EQUAL IN GAGE, IF POSSIBLE. THE THINNEST DOUBLER SHOULD BE INSTALLED NEXT TO CRACKED MEMBER.
5. IF THE CRACK IS PERPENDICULAR TO A FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED, OR ADDITIONAL DOUBLERS ADDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.
6. THESE INSTRUCTIONS ARE NOT APPLICABLE FOR SPAR CAPS.



EXAMPLE C

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

▲▲ FOR FORMED AND ROLLED SECTIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE EQUAL TO OR GREATER THAN THE CRACKED MEMBER GAGE, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR. FOR EXTRUSIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE AT LEAST ONE GAGE HEAVIER THAN THE THICKEST LEG ADJACENT TO THE CRACK.

BB3-519A

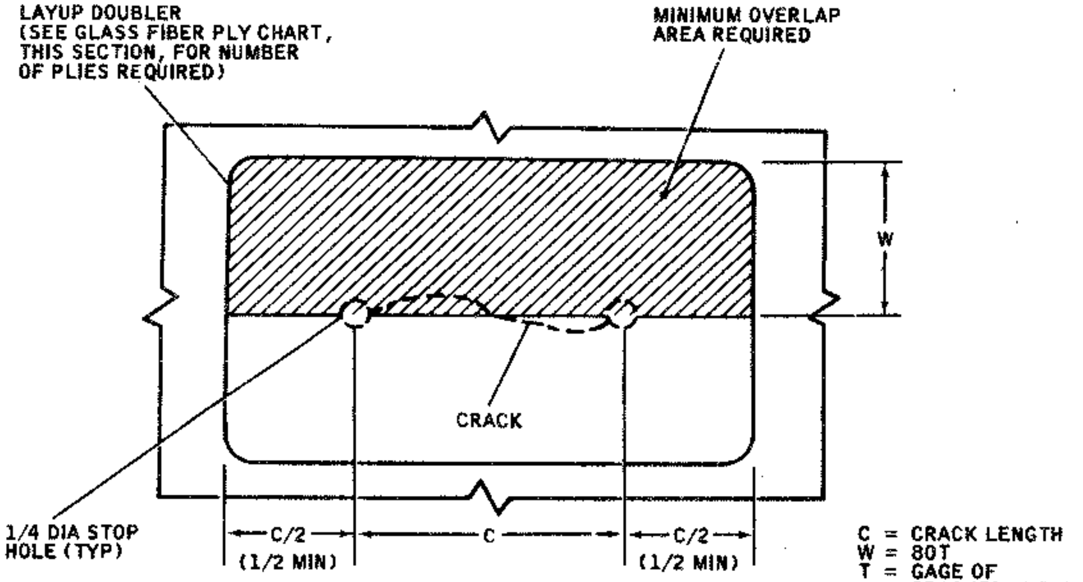
Aluminum Alloy to Aluminum Alloy Repairs -- Cracked Members
Figure 2 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE A BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL. USE FIGURE 3, SHEET 2.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR ATTACHMENTS.
5. CRACKS IN THE CONTROL SURFACE TAB SKINS LONGER THAN ONE-FOURTH OF THE CHORD LENGTH ON THE CHORD DIRECTION, OR 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.



C = CRACK LENGTH
W = 80T
T = GAGE OF CRACKED SHEET

EXAMPLE A

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

883-520A

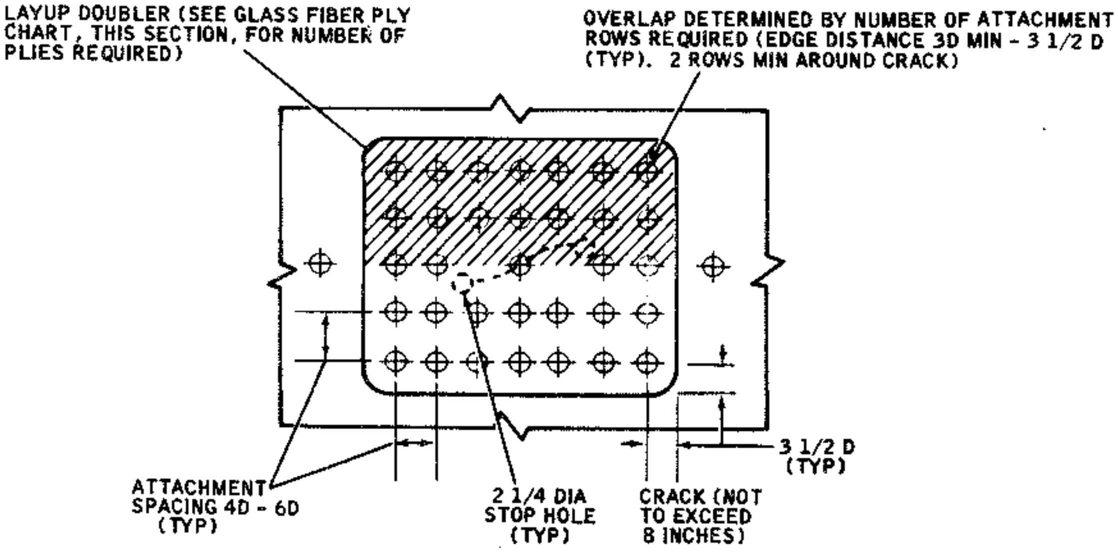
Glass Fiber Layup to Aluminum Alloy Repairs -- Cracked Members
Figure 3 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .050 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-3. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. DO NOT USE LAYUP DOUBLERS ON THE FUSELAGE PRESSURIZED DOOR PLATING.
5. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE B

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-521A

Glass Fiber Layup to Aluminum Alloy Repairs -- Cracked Members
Figure 3 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET,
INTERCOSTALS, AND STIFFENERS

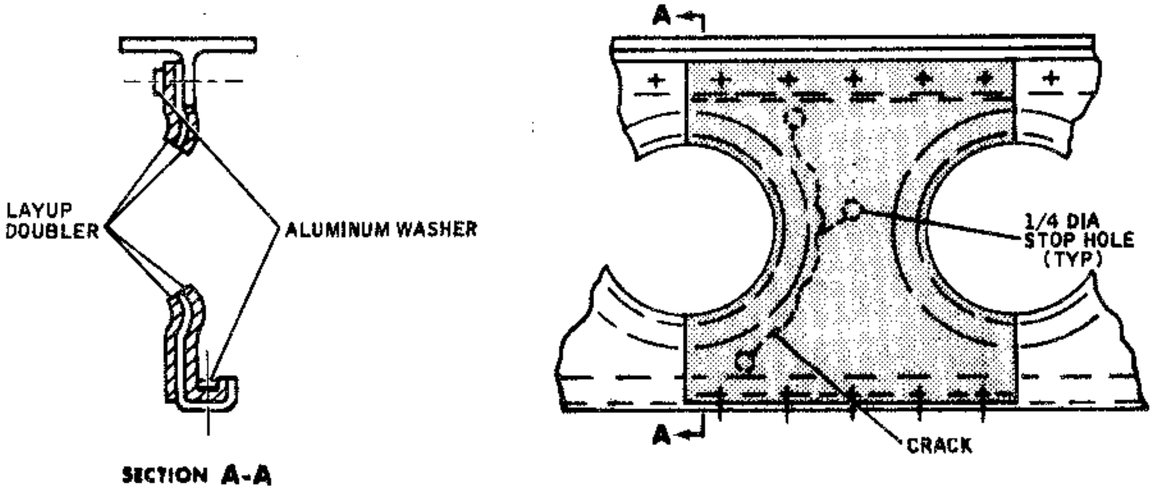
.016 TO .080 GAGE

---

1. REPAIR LIGHTENING HOLE RADIUS CRACKS USING A LAYUP DOUBLER OVER BOTH SURFACES OF THE CRACKED MEMBER BONDED PER 51-70-3. SEE EXAMPLE C BELOW.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF THE MAIN CRACKS.
3. EXTEND THE DOUBLERS IN THE CRACK DIRECTION TO PICK UP ATTACHMENTS AS SHOWN. MAKE CERTAIN THAT ALUMINUM ALLOY WASHERS ARE INSTALLED ON THE GLASS FIBER SIDE OF THE REPAIR AT THE ATTACHMENTS.
4. EXTEND THE DOUBLERS ON BOTH SIDES OF THE CRACK TO THE APPROXIMATE CENTER OF THE LIGHTENING HOLE.

NOTE:

SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED IN DOUBLERS.



SECTION A-A

EXAMPLE C

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-522A

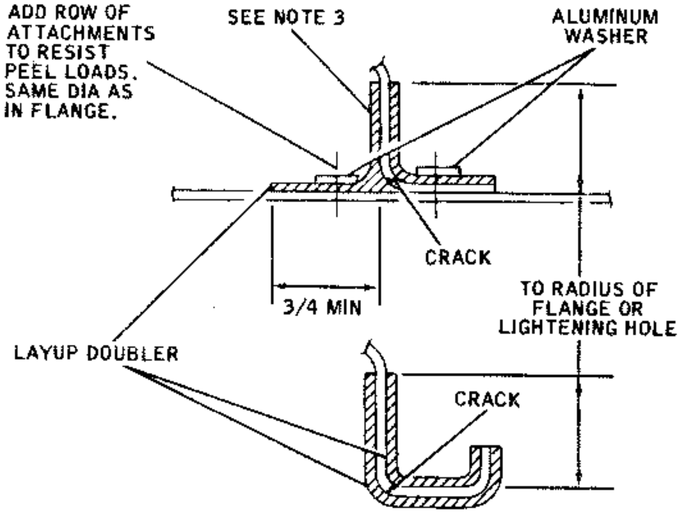
Glass Fiber Layup to Aluminum Alloy Repairs -- Cracked Members
Figure 3 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY FORMED AND ROLLED SECTIONS
.016 TO .080 GAGE

1. REPAIR CRACKS PARALLEL TO THE FLANGE RADIUS OF FORMED OR ROLLED SECTIONS USING LAYUP DOUBLERS BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. IF THE CRACKED FLANGE IS ATTACHED, THEN PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK AT EACH END, AND ADD A ROW OF ATTACHMENTS AS SHOWN. MAKE BOTH DOUBLERS THE SAME LENGTH. INSTALL ATTACHMENTS AFTER CURING.
3. IF THE FLANGE IS NOT ATTACHED, THEN OVERLAP THE DOUBLERS BEYOND THE ENDS OF THE CRACK BY AT LEAST THREE INCHES.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE CRACK IS PERPENDICULAR TO THE FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.



EXAMPLE D

NOTES:

1. SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF CRACK.
3. IN .071 AND .080 GAGES, ADD ROW OF ATTACHMENTS SAME DIA AS THOSE IN FLANGE.

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

BB3-523A

Glass Fiber Layup to Aluminum Alloy Repairs -- Cracked Members
Figure 3 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

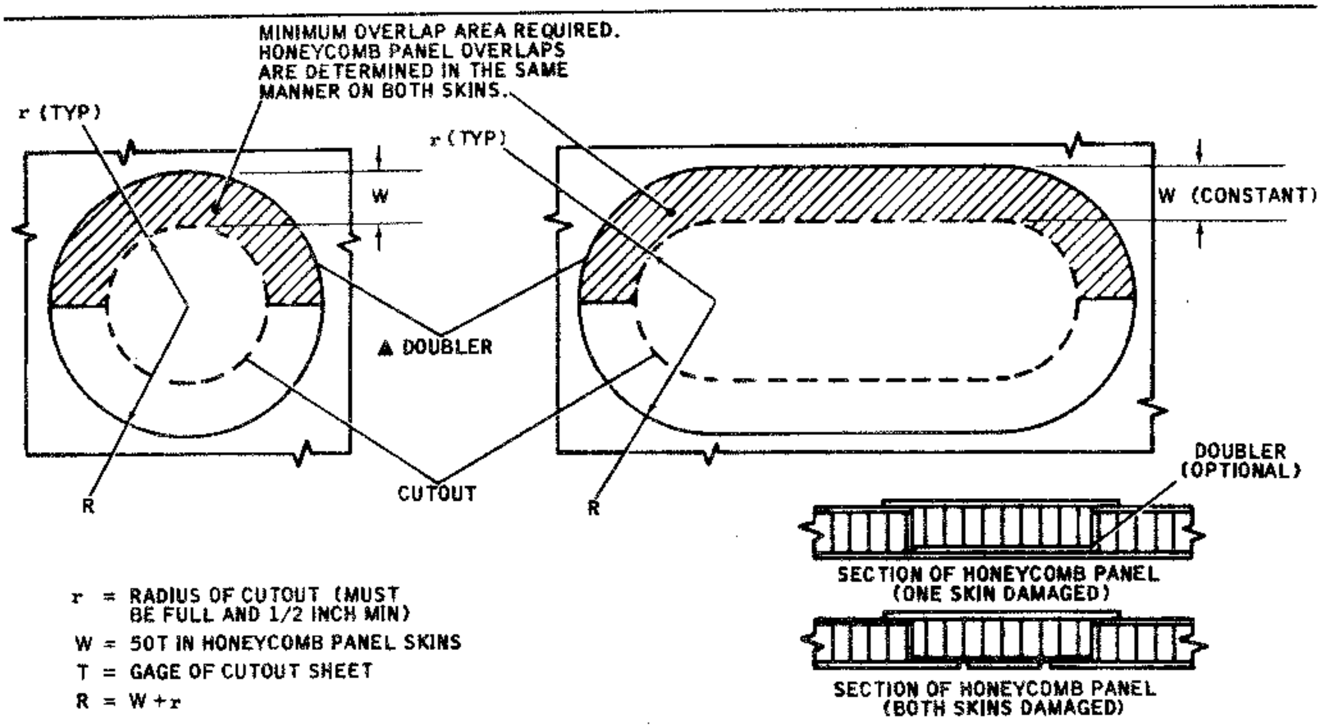
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE FROM A REPAIR PANEL OR ALUMINUM ALLOY DOUBLERS AND A REPAIR CORE BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
3. GLASS FIBER LAYUP SHOWN ON ANOTHER ILLUSTRATION, THIS SECTION, MAY BE USED AS A SUBSTITUTE FOR THE ALUMINUM ALLOY DOUBLERS. HOWEVER, ALUMINUM ALLOY DOUBLERS ARE PREFERRED.
4. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS), IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
5. DAMAGE TO THE CONTROL SURFACE TAB SKINS, GREATER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION, OR GREATER THAN 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2 INCH MIN)
W = 50T IN HONEYCOMB PANEL SKINS
T = GAGE OF CUTOUT SHEET
R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-524A

Aluminum Alloy to Aluminum Alloy Repairs -- Damage Requiring Cutouts
Figure 4 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

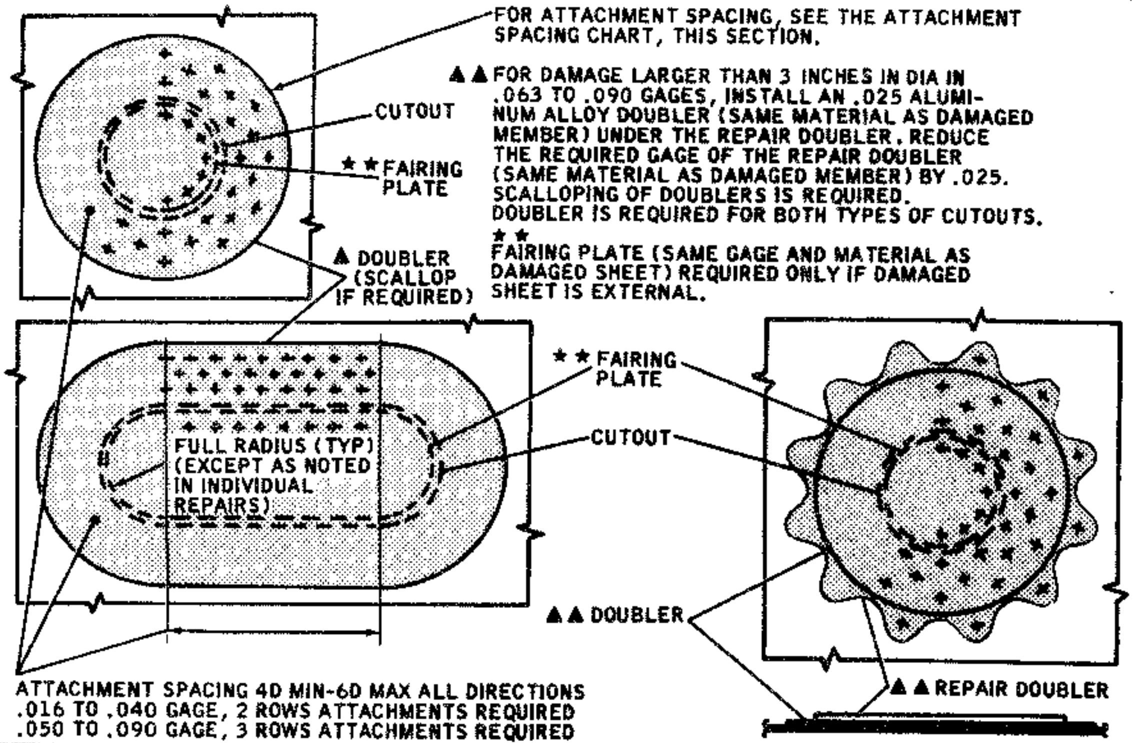
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM ALLOY SHEET

.016 TO .090 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED, AND CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAXIMUM CUTOUT DIAMETER ALLOWABLE IS SHOWN ON THE ATTACHMENT SPACING CHART, THIS SECTION. EXTENSIVE DAMAGE REQUIRES A PRODUCTION-TYPE SPLICING OF THE SHEET OR REPLACEMENT OF THE SHEET TO THE NEAREST PRODUCTION SPLICE.
4. GLASS FIBER LAYUP DOUBLERS MAY ALSO BE USED IN CUTOUT REPAIRS UP TO .040 GAGE AS ILLUSTRATED ON ANOTHER ILLUSTRATION, THIS SECTION. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



FOR ATTACHMENT SPACING, SEE THE ATTACHMENT SPACING CHART, THIS SECTION.

▲ ▲ FOR DAMAGE LARGER THAN 3 INCHES IN DIA IN .063 TO .090 GAGES, INSTALL AN .025 ALUMINUM ALLOY DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) UNDER THE REPAIR DOUBLER. REDUCE THE REQUIRED GAGE OF THE REPAIR DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) BY .025. SCALLOPING OF DOUBLERS IS REQUIRED. DOUBLER IS REQUIRED FOR BOTH TYPES OF CUTOUTS.

★ ★ FAIRING PLATE (SAME GAGE AND MATERIAL AS DAMAGED SHEET) REQUIRED ONLY IF DAMAGED SHEET IS EXTERNAL.

ATTACHMENT SPACING 4D MIN-6D MAX ALL DIRECTIONS
.016 TO .040 GAGE, 2 ROWS ATTACHMENTS REQUIRED
.050 TO .090 GAGE, 3 ROWS ATTACHMENTS REQUIRED

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.

▲ ALUMINUM ALLOY DOUBLER (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-525A

Aluminum Alloy to Aluminum Alloy Repairs --
Damage Requiring Cutouts
Figure 4 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

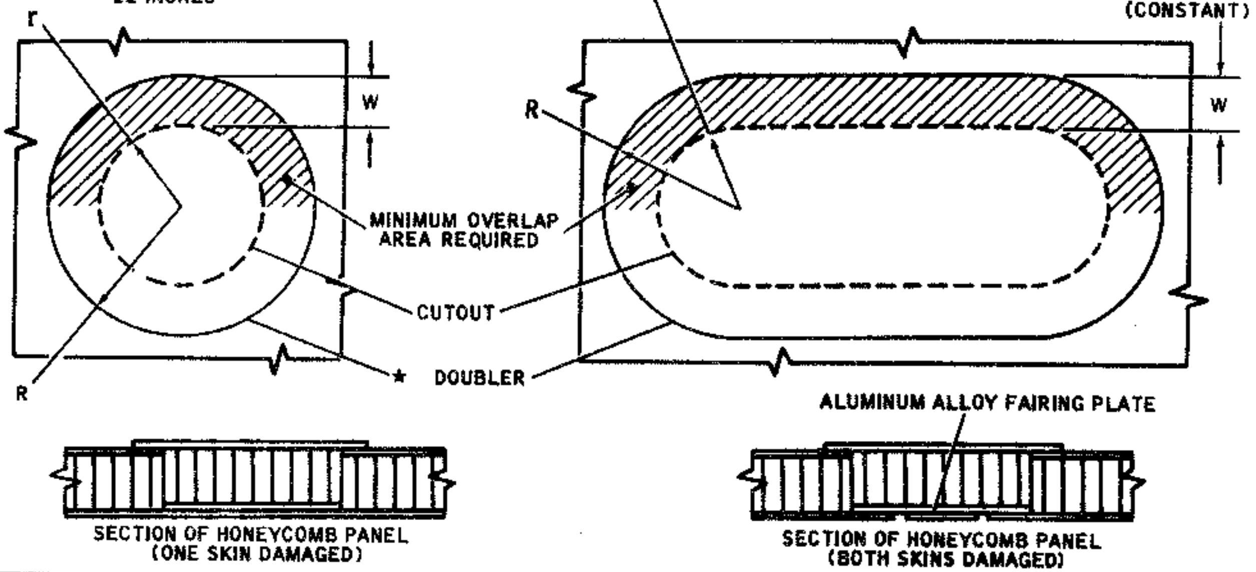
1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE WITH GLASS FIBER LAYUP DOUBLERS, AND REPAIR CORE BONDED PER 51-70-3. SEE SKETCHES BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. DAMAGE TO THE CONTROL SURFACE TAB SKINS GREATER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION, OR GREATER THAN 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.

NOTES:

1. HONEYCOMB PANEL OVERLAPS ARE DETERMINED IN THE SAME MANNER ON BOTH SKINS
2. RADIUS r NOT TO EXCEED 4 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 12 INCHES

r = RADIUS OF CUTOUT
W = 80T
T = GAGE OF CUTOUT SKIN
R = W + r

r MUST BE FULL RADIUS AND NOT LESS THAN 1/2 INCH



SECTION OF HONEYCOMB PANEL (ONE SKIN DAMAGED)

SECTION OF HONEYCOMB PANEL (BOTH SKINS DAMAGED)

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER AND REPAIR CORE (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-526A

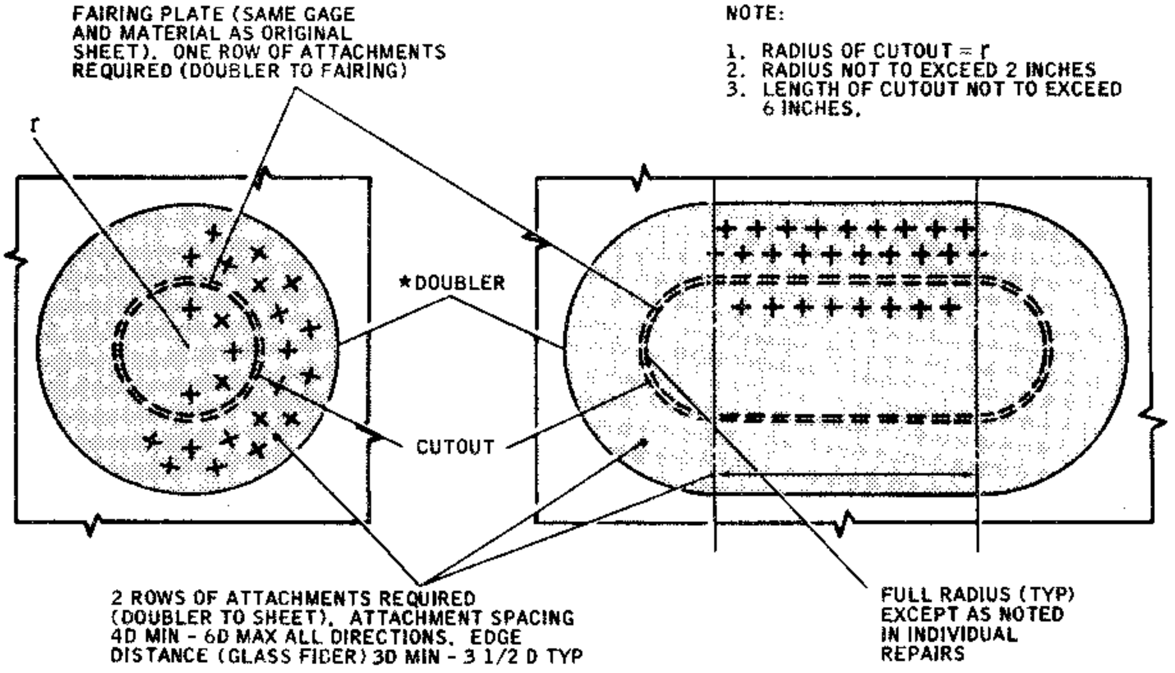
Glass Fiber Layup to Aluminum Alloy Repairs --
Damage Requiring Cutouts
Figure 5 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY STABILIZER MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .040 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER AND FAIRING PLATE WITH ATTACHMENTS AND BOND PER 51-70-3. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAKE CERTAIN THAT A FAIRING PLATE IS ATTACHED AND BONDED IN THE CUTOUT. THE FAIRING PLATE WILL STIFFEN THE GLASS FIBER AND WILL SERVE AS SURFACE FOR LAYUP. INSTALL ATTACHMENTS AFTER CURING.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. DO NOT USE GLASS FIBER REPAIRS ON THE HORIZONTAL STABILIZER INTEGRAL PLATING.



NOTE:

1. RADIUS OF CUTOUT = r
2. RADIUS NOT TO EXCEED 2 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 6 INCHES.

DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52° C (125° F).

★ GLASS FIBER LAYUP DOUBLER. (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED STABILIZER MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-527A

Glass Fiber Layup to Aluminum Alloy Repairs --
Damage Requiring Cutouts
Figure 5 (Sheet 2)

Damaged Aluminum Gage	Total Number of Plies
.016	3
.020	4
.025	5
.032	6
.040	7
.050	9
.063	11
.071	12
.080	14
.090	15

NOTE: 1. When applying a number of glass fiber cloth plies to both sides of damaged aluminum alloy sheet, place half on each side; if uneven number, add another ply.

2. The thinner bidirectional cloth Number 120 may be used for parts extremely curved. In this instance, double number of plies specified above.

3. Arrange pattern of glass cloth so threads are parallel to, and 90 degrees from the direction of the crack.

4. This chart is used only when specified in other repairs in this manual.

Glass Fiber Ply Chart
Figure 6

Plating Repair Cutout Diameter (Inches)						Attachment Diameter
1 to 1 1/4	1 1/4 to 2	2 to 3 1/4	3 1/4 to 5 1/4	5 1/4 to 7	7 to 11	1/8
1 to 1 3/4	1 3/4 to 3	3 to 4	4 to 6 1/2	6 1/2 to 9	9 to 11 3/4	5/32
1 to 2	2 to 3	3 to 5	5 to 8	8 to 11	11 to 16 1/2	3/16
1 1/2 to 2 3/4	2 3/4 to 4	4 to 6 1/2	6 1/2 to 10 1/2	10 1/2 to 14 1/2	———	1/4
8 Equal Spaces	12 Equal Spaces	16 Equal Spaces	24 Equal Spaces	36 Equal Spaces	48 Equal Spaces	

NOTE: Do not use this chart in making repairs unless it is specifically referred to in a particular repair.

Attachment Spacing Chart
Figure 7

4. Restricted Repair Areas

A. Repairs provided in this section are restricted in areas outlined in Figure 8.

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 2 Aluminum alloy to aluminum alloy repairs (cracked members)	Bonded	Aluminum Honeycomb panel skin, 0.010 to 0.040 gage	Elevator control tab: Inboard end for 15 in. outboard
	Bonded and riveted	Aluminum alloy extruded, rolled, and formed sections, 0.016 to 0.125 gage	none
		Aluminum alloy sheet 0.016 to 0.090 gage	Horizontal stabilizer: Integrally stiffened plating from inboard end to outboard end on upper and lower surface.
			leading edge
			Elevator: Inboard end to sta XE204
			Vertical stabilizer: Entire assembly

Restricted Repair Area Chart
Figure 8 (Sheet 1)

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 3 Glass fiber layup to aluminum alloy repairs (cracked member)	Bonded	Aluminum honeycomb panel skin, 0.010 to 0.040 gage	Elevator tabs
			Rudder tabs: Sta ZR 31 to ZR 41 Sta ZR 56 to ZR 65
		Aluminum alloy ribs, intercostals, and stiffeners, 0.016 to 0.080 gage	Horizontal stabilizer: See 55-10-0
			Elevator: See 55-20-0
			Vertical stabilizer: See 55-30-0
			Rudder: See 55-40-0
	Bonded and riveted	Aluminum alloy sheet 0.016 to 0.050 gage	Horizontal stabilizer: All integrally stiffened plating; all leading edge
			Elevator: Inboard end to sta XE 212
			Vertical Stabilizer: Main box root to sta ZR 170 leading edge D-duct area and root to sta ZFS 155
			Rudder: Root to sta ZR 135

Restricted Repair Area Chart
Figure 8 (Sheet 2)

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 3 Glass fiber layup to aluminum alloy repairs (cracked member)	Bonded and riveted	Aluminum alloy formed and rolled sections, 0.016 to 0.080 gage	Rudder: Trailing edge closing channels
			cracks perpendicular to fillets
Figure 4 Aluminum alloy to aluminum alloy repairs (damage requiring cutouts)	Bonded	Aluminum honeycomb panel skin, 0.010 to 0.040 gage	Elevator control tab: sta XET 32 to XET 71
			Elevator geared tab: sta XET 87 to XET 129
	Bonded and riveted	Aluminum alloy sheet, 0.016 to 0.090 gage	Horizontal stabilizer: All integrally stiffened plating from inboard end to outboard end on upper and lower surface
			Horizontal stabilizer: Leading edge area
			Elevator: Inboard end to sta XE 212
			Vertical stabilizer: All main box plating root to sta ZP 173; leading edge area (See 55-30-0.)
			Rudder: Leading edge plating base to sta ZR 131

Restricted Repair Area Chart
Figure 8 (Sheet 3)

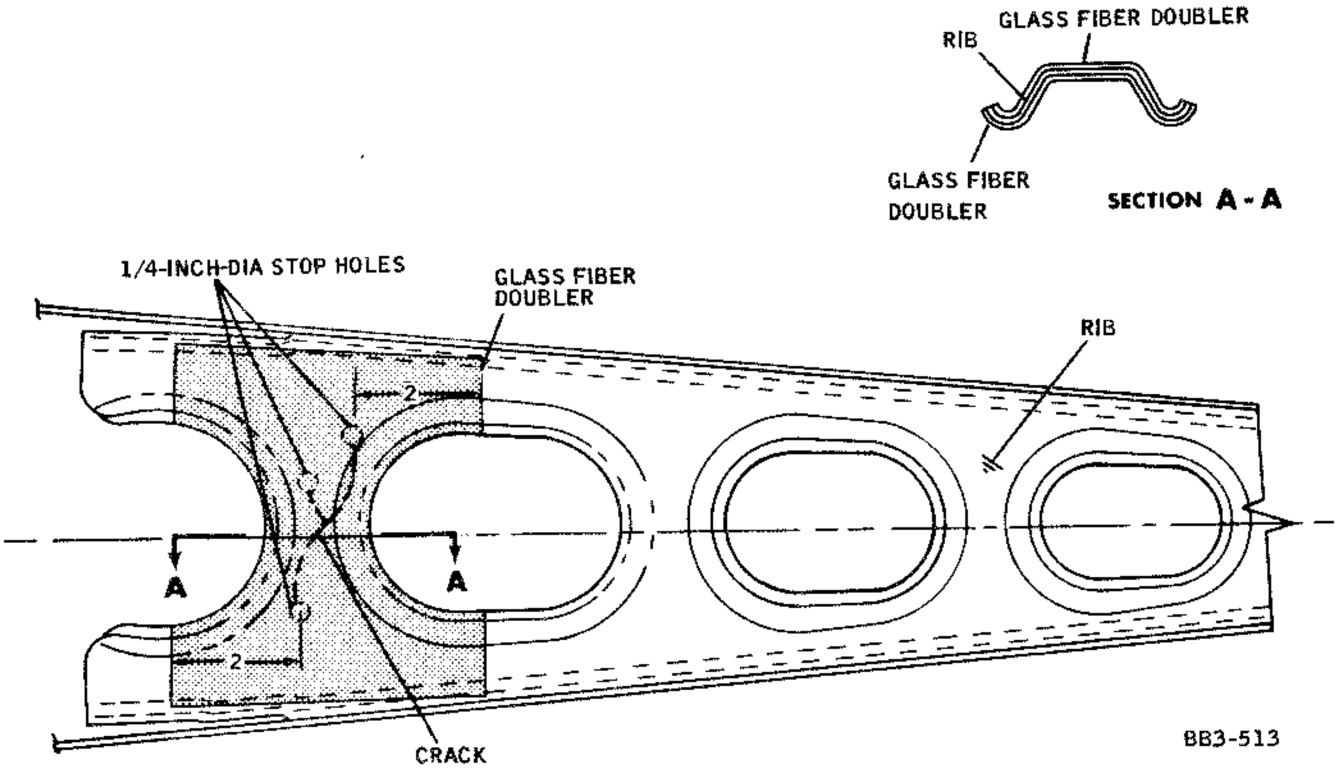
B. Repair as follows:

(1) Drill 1/4-inch-diameter stop holes at ends of crack.

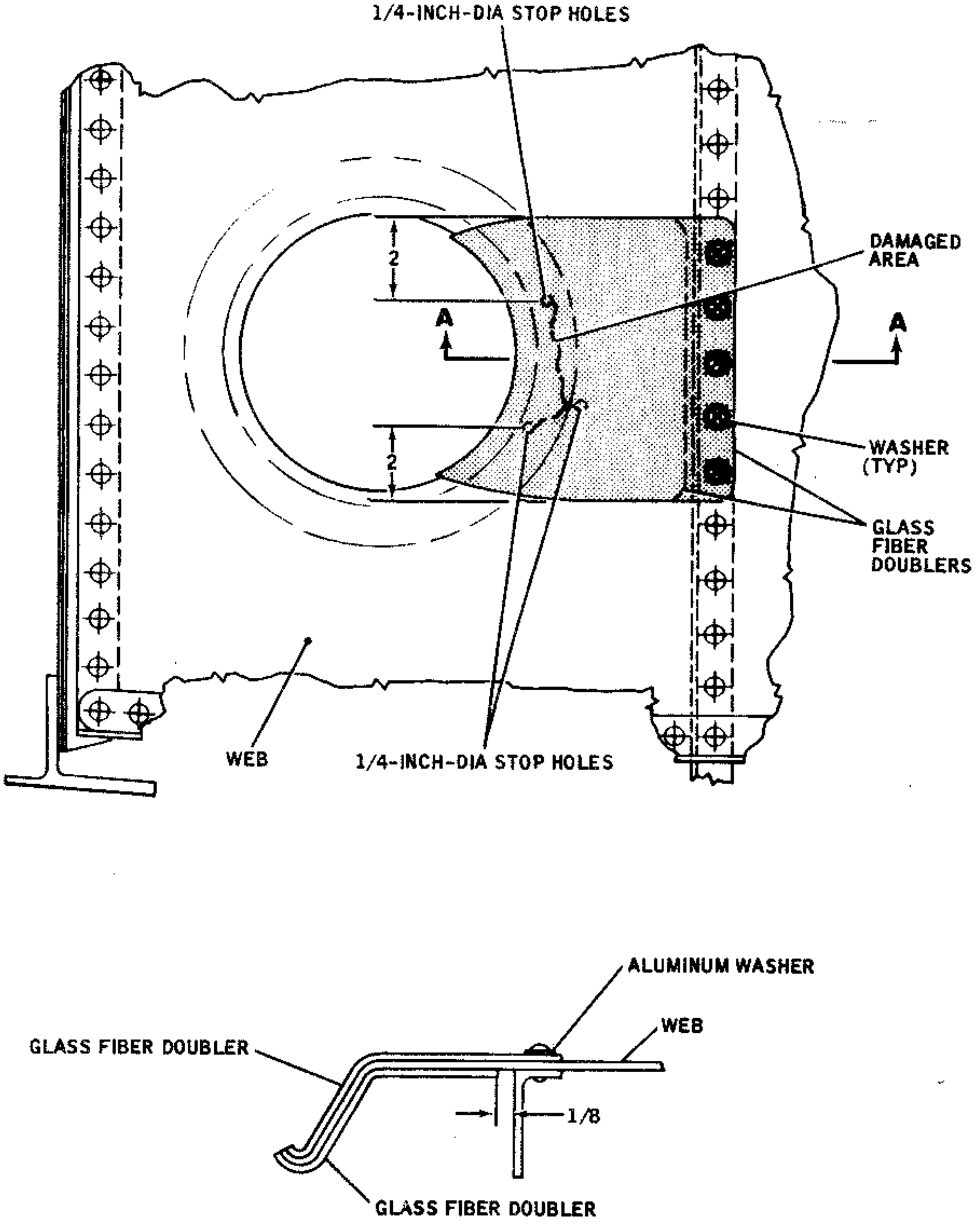
(2) Determine number of plies of glass fiber doubler required (see 55-01, Figure 6).

(3) Apply adhesive and lay up glass fiber doublers on both sides of rib in area of crack. See 55-01 for general requirements.

(4) Bond in accordance with 51-70-3.



Elevator Intermediate Rib Repair (Except Hinge Ribs) -- Class A
Figure 1



SECTION A-A

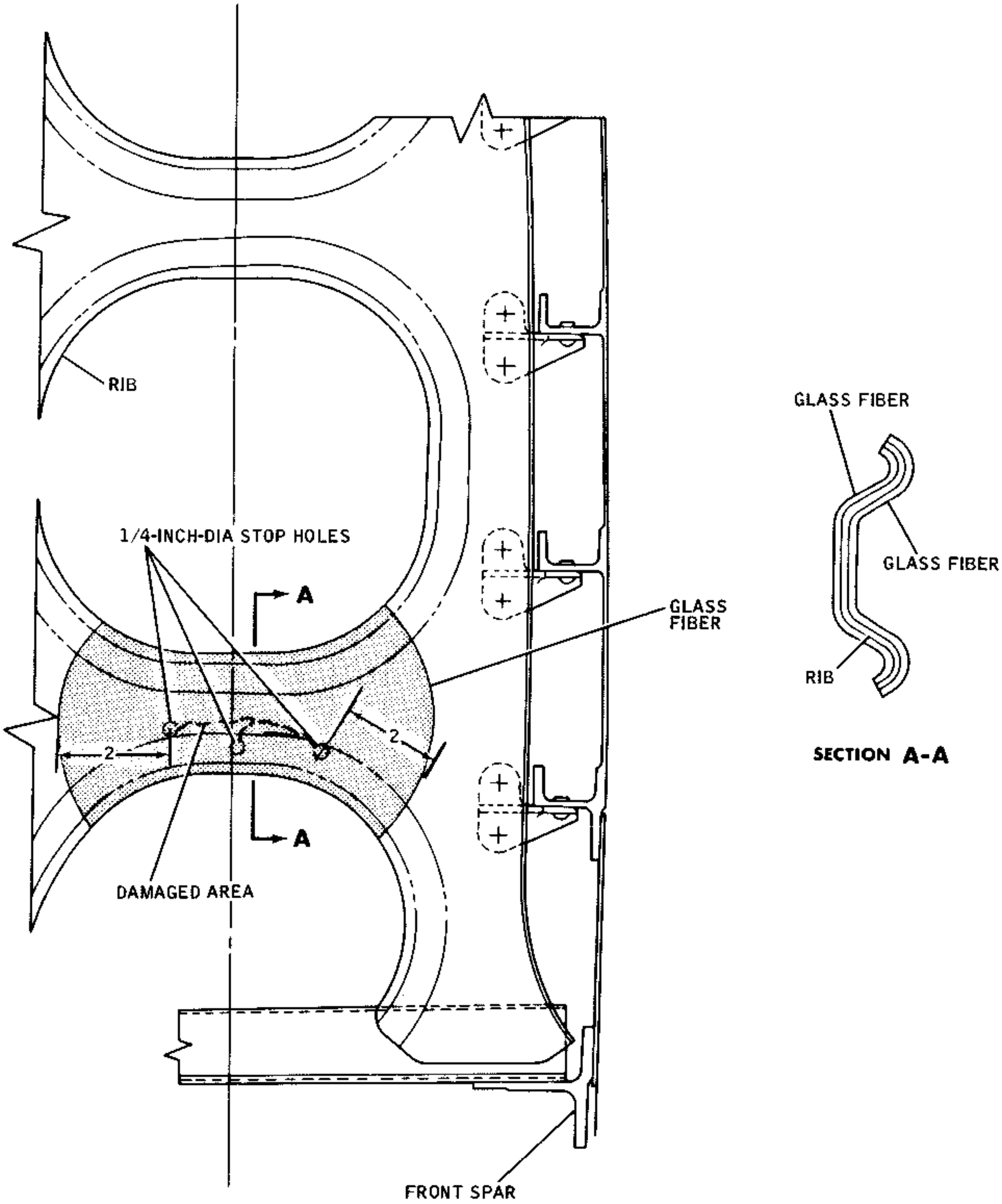
⊕ ORIGINAL RIVET HOLE, USED IN REPAIR

⊕ EXISTING RIVETS

BB3-507

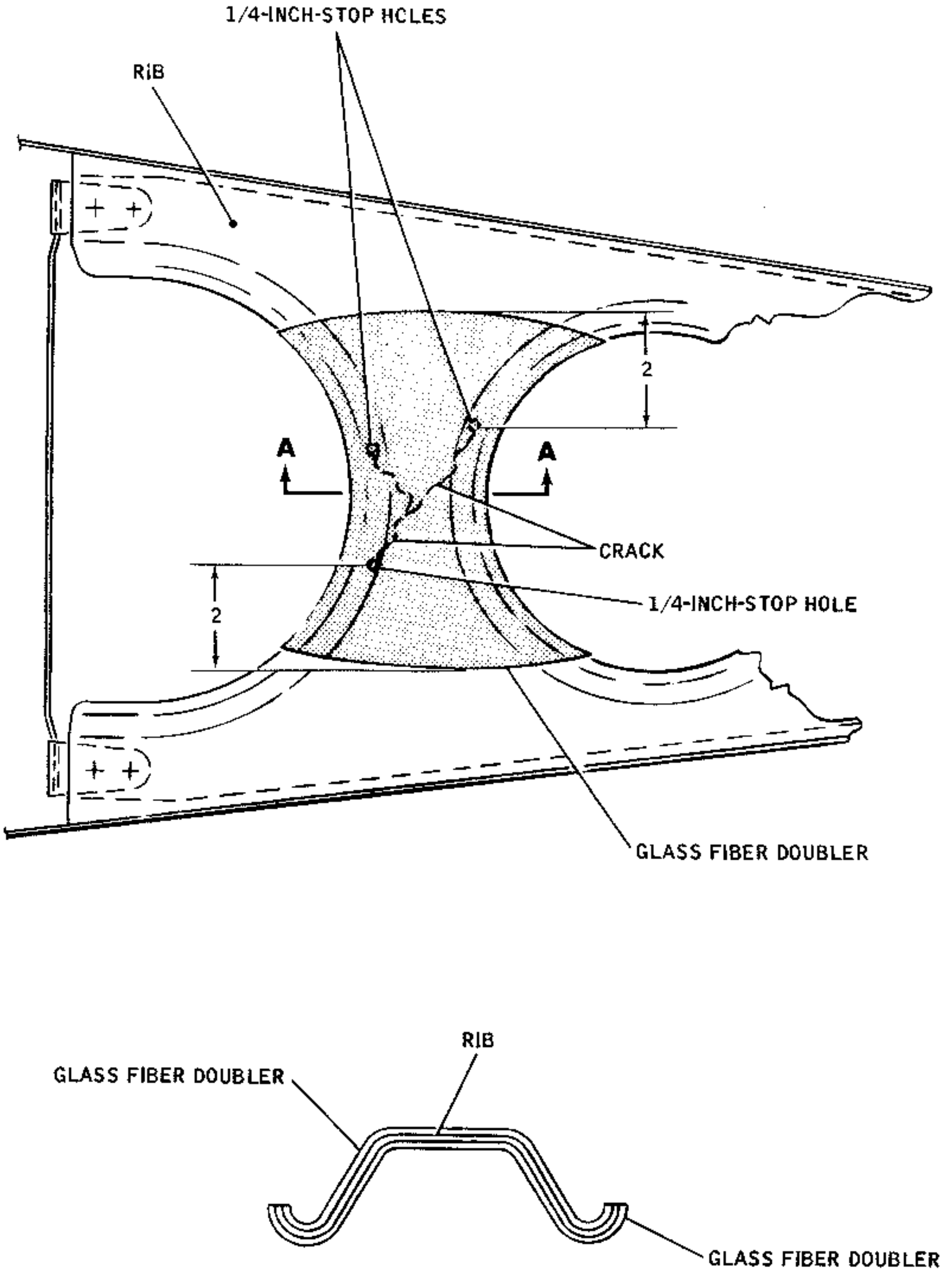
Vertical Stabilizer Intermediate Rib Repair -- Class A
Figure 2

Figure 3 deleted



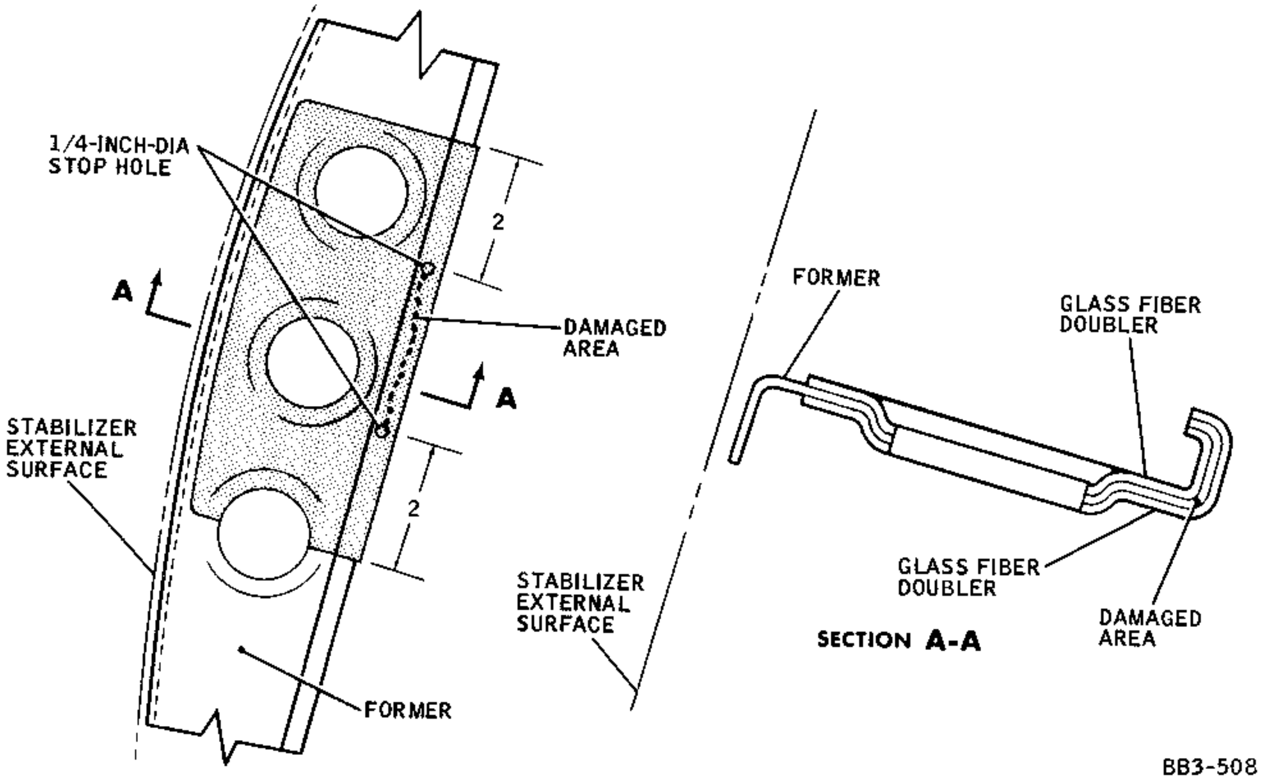
BB3-514

Horizontal Stabilizer Intermediate Rib Repair
(Except Hinge Ribs) -- Class A
Figure 4

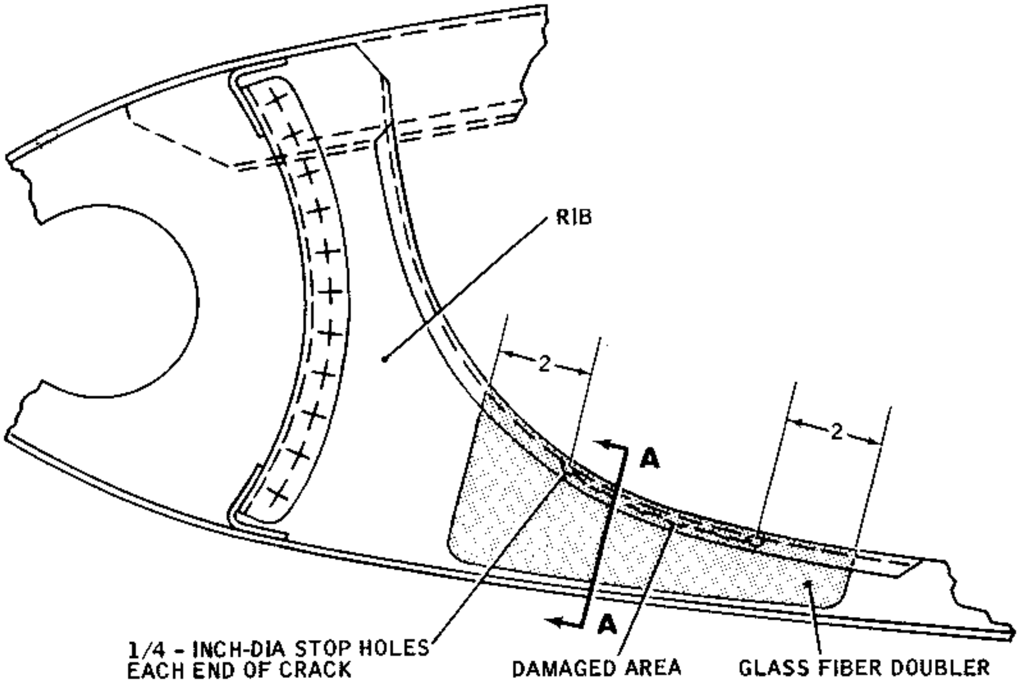


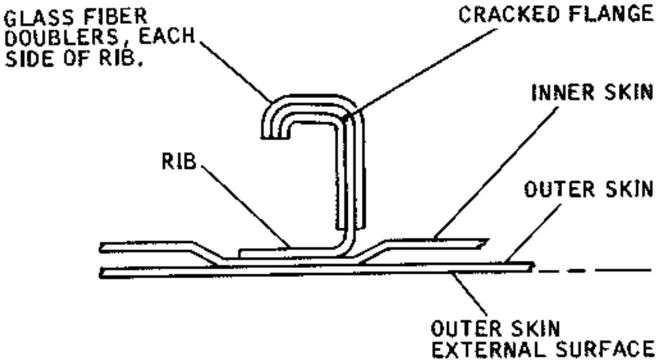
SECTION A-A

Rudder Trailing Edge Intermediate Rib Repair -- Class A
Figure 5



Vertical Stabilizer Leading Edge Former Repair -- Class A
Figure 6





SECTION **A-A**

Printed in U.S.A.

BB3-502

Horizontal Stabilizer Leading Edge Former Repair -- Class A
Figure 7

PLATING AND TRAILING EDGE REPAIRS (DC-9-ALL)

1. Elevator Plating Crack Repair - Class A (See Figures 1 and 2.)

   A. Repair cracks, occurring to plating, which are no longer than 4 inches (see Figure 1) as follows:

      (1) Drill 1/4-inch-diameter stop holes at end of crack or cracks.

      (2) See 55-01 for general requirements.

      (3) Determine number of plies of glass fiber doublers required (see 55-01, Figure 6).

      (4) Apply adhesive and lay up glass fiber doublers.

      (5) Bond in accordance with 51-70-3.

      (6) Install repair rivets, using AN960 aluminum washers on glass fiber side of repair.

      (7) Check balance condition of elevator in accordance with 55-20-1.

   B. Repair damage not over 2 inches long which does not extend into bonded doubler (see Figure 2) as follows:

      (1) See 55-01 for general requirements.

      (2) Remove damaged plating, making circular cutout as shown in Figure 2.

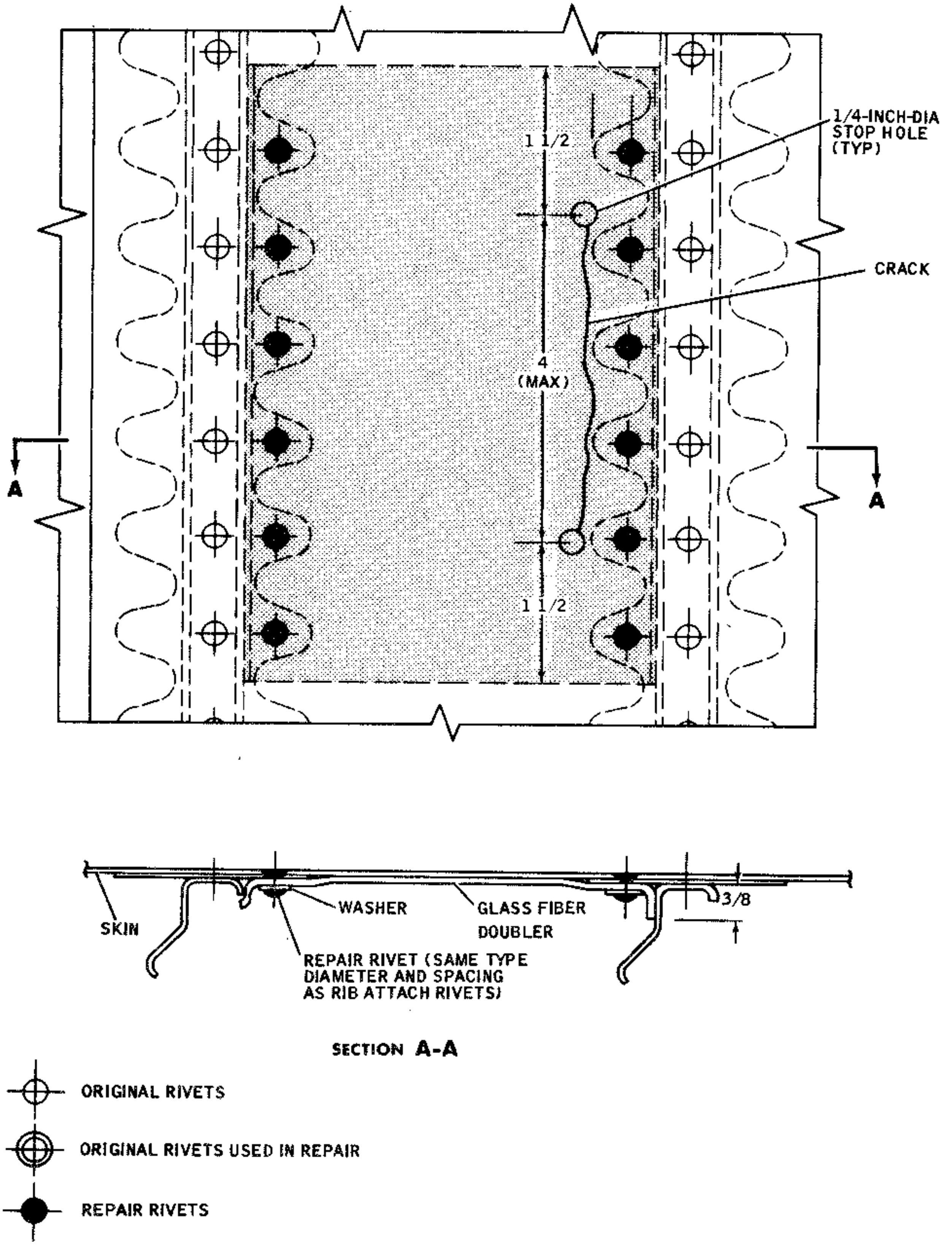
      (3) Determine number of plies of glass fiber doubler required (see 55-01, Figure 6).

      (4) Fabricate fairing disk to fit cutout.

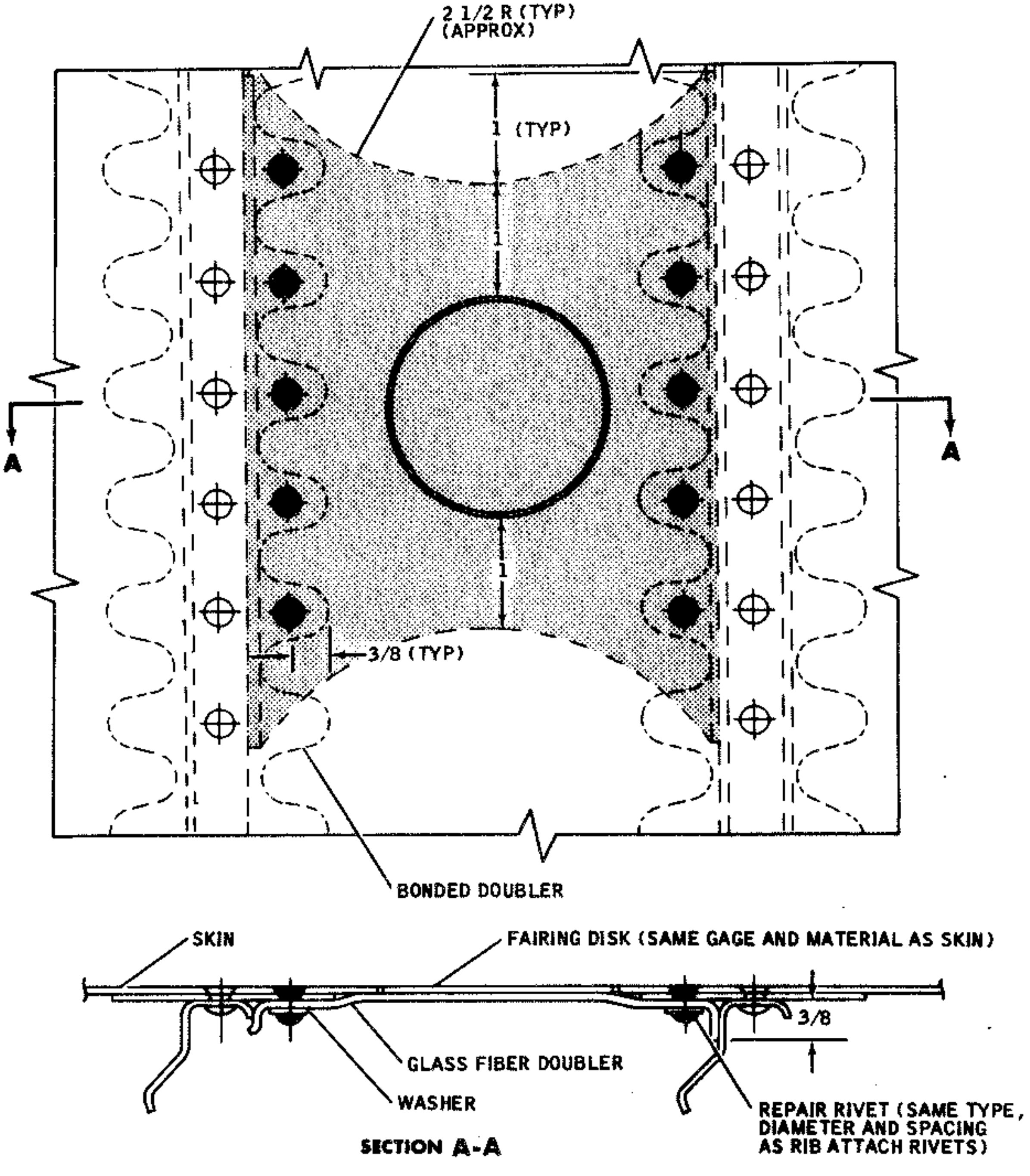
      (5) Apply adhesive and lay up the glass fiber doubler and fairing disk. Bond in accordance with 51-70-3.

      (6) Install repair rivets, using AN960 aluminum washers on glass fiber side of repair.

      (7) Check balance condition of elevator in accordance with 55-20-1.



Typical Skin Crack Repair -- Class A
Figure 1



⊕ **ORIGINAL RIVETS**

⊕ **ORIGINAL RIVETS USED IN REPAIR**

● **REPAIR RIVETS**

BB3-512

Typical Skin Repair (Requiring Damage Cutout) -- Class A
Figure 2

2. Rudder Trailing Edge Plating Crack Repair - Class A (See Figure 1.)

A. Repair cracks, occurring in plating, which are no longer than 4 inches (see Figure 1) as follows:

(1) See 55-01 for general requirements and 55-01, paragraph 4, for repair location.

(2) Drill 1/4-inch-diameter stop holes at end of crack or cracks.

(3) Determine number of plies of glass fiber doublers required (see 55-01, Figure 6).

(4) Apply adhesive and lay up glass fiber doublers. Bond in accordance with 51-70-3.

(5) Install repair rivets using AN960 aluminum washers on glass fiber side of repairs.

(6) Check balance condition of rudder in accordance with 55-40-1.

3. Rudder Trailing Edge Plating Repair - Class A (See Figure 2.)

A. Repair damage considered detrimental, which are no more than 2 inches in diameter and which do not extend into bonded doubler (see Figure 2) as follows:

(1) See 55-01 for general requirements.

(2) Remove damaged plating, making circular-shaped cutout.

(3) Determine number of plies of glass fiber doubler required (see 55-01, Figure 6).

(4) Apply adhesive and lay up glass fiber doubler. Bond in accordance with 51-70-3.

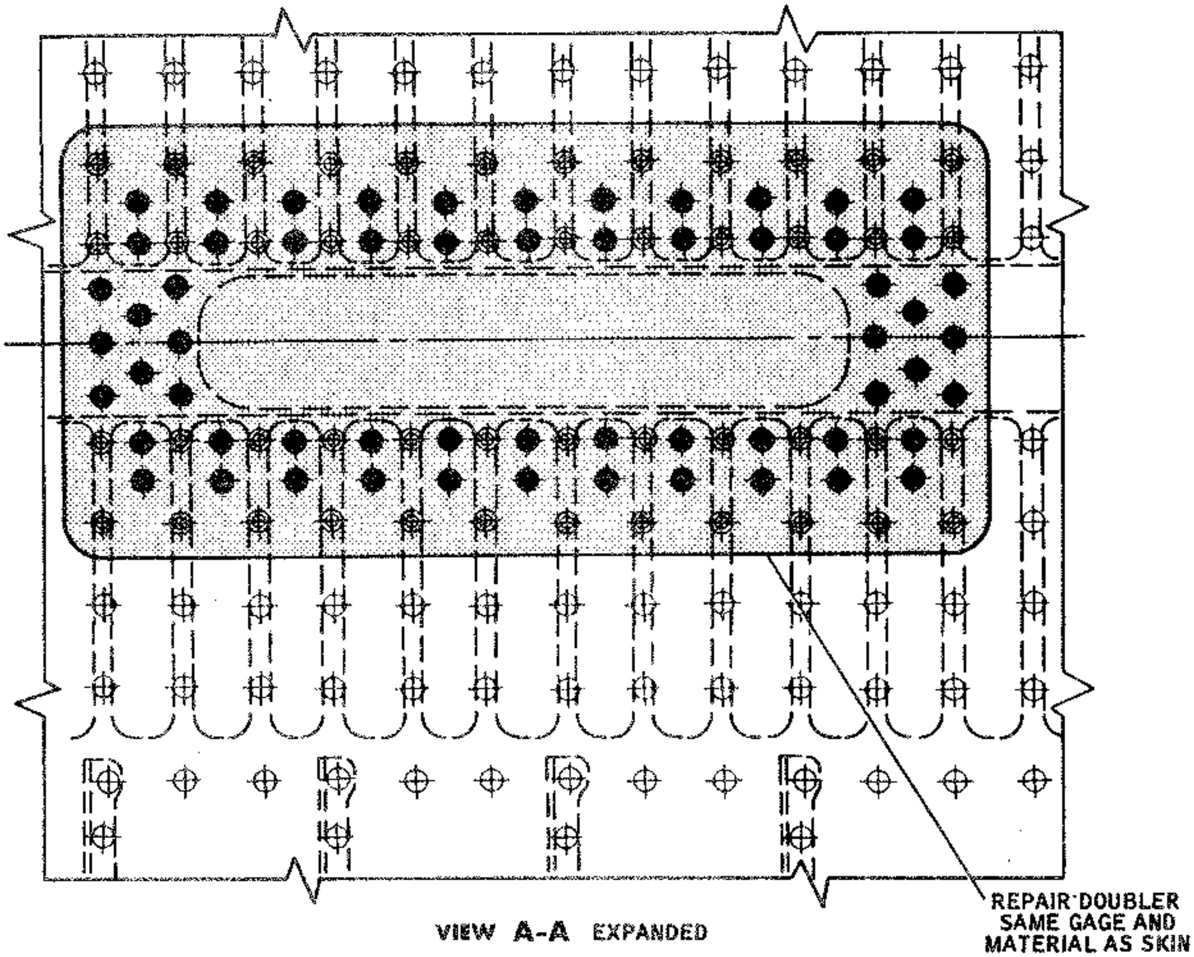
(5) Install repair rivets, using AN960 aluminum washers on glass fiber side of repair.

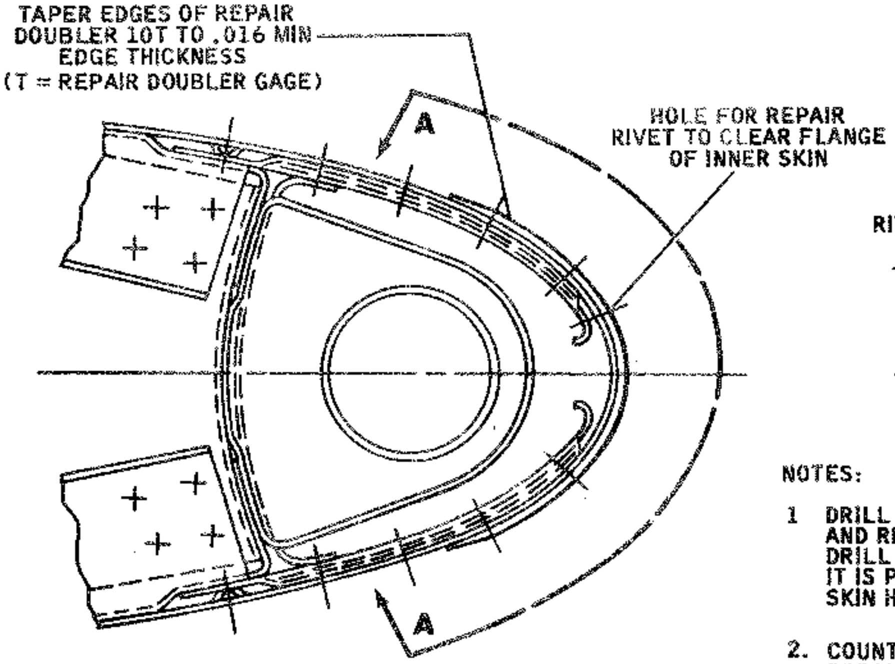
(6) Check balance condition of rudder in accordance with 55-40-1.

4. Horizontal Stabilizer Leading Edge Plating Repair (See Figure 3.)

A. Repair puncture damage occurring to external and internal plating in D-duct area as follows:

(1) See 55-01 for general requirements.





RIVET CODE:

- ⌖ ORIGINAL RIVETS
- ⌖ NAS1399D4 BLIND REPAIR RIVETS
- ● ORIGINAL RIVET HOLE USED IN REPAIR (SEE NOTE 1)

NOTES:

1 DRILL OUT EXISTING ATTACHMENTS AND REPLACE WITH NAS1399D4 RIVETS. DRILL THRU INNER SKIN TO INSTALL. IT IS PERMISSIBLE TO LEAVE INNER SKIN HOLES UNPLUGGED.

2. COUNTER SINK 100° FOR 1/8 DIA FLUSH REPAIR RIVETS.

BB3-504

Horizontal Stabilizer Leading Edge Skin Repair -- Class B
Figure 3

(2) Cut out damaged portion of plating to shape similar to that shown in Figure 3.

(3) Fabricate repair doubler and rivet doubler to external plating as shown in Figure 3.

(4) Hand- or machine-taper edge of doubler as shown in Figure 3.

5. Horizontal Stabilizer and Vertical Stabilizer Leading Edge Repairs - Class B

A. Scratches, Gouges, or Dings

(1) Scratches, gouges, or dings that do not penetrate clad do not require repair.

(2) Scratches, gouges, or dings that penetrate clad up to depth shown in Figure 4, Example A, should be rounded out and tapered.

(3) Scratches, gouges, or dings exceeding limits shown in Figure 4, Example A, should be repaired in accordance with paragraph C, below.

B. Dents

(1) Smooth dents without skin crack and within limits shown in Figure 4, Example B, do not require repair.

(2) Smooth dents without skin crack that exceed limits shown in Figure 4 are to be repaired as follows:

(a) Install rivets in dent areas shown in Figure 4.

(b) Fill dent area with Pro-Seal 735 and fair in accordance with 51-70-2.

C. Cracks, Punctures, or Tears

(1) Remove leading edge from airplane if repair cannot be reached through inspection cover openings. See Chapter 55 of DC-9 Maintenance Manual.

(2) See 55-01 for general requirements.

(3) Straighten beaded inner plating to prevent restriction to airflow. Stop-drill cracks in inner beaded plating, using a 1/4-inch diameter drill.

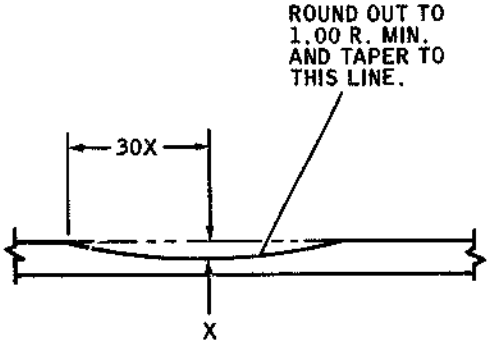
(4) Fabricate and install external repair doubler as shown in Figure 3.

(5) Seal repair area, using RTV-1016 sealant. See 51-20-0.

(6) Install leading edge, if removed.

DAMAGE LIMITS FOR SCRATCHES, GOUGES, OR DINGS.

EXAMPLE A

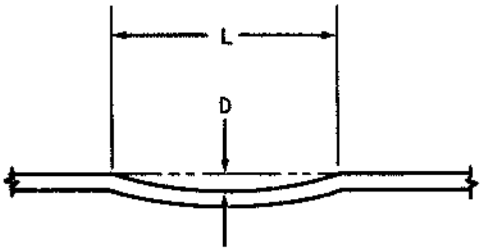


NOTES:

1. MAX. DEPTH OF X MUST NOT EXCEED .010.
2. IF DAMAGE EXCEEDS LIMITS SHOWN, REPAIR AS SHOWN. IN EXAMPLE C.

DAMAGE LIMITS FOR DENTS (NOT CRACKED)

EXAMPLE B

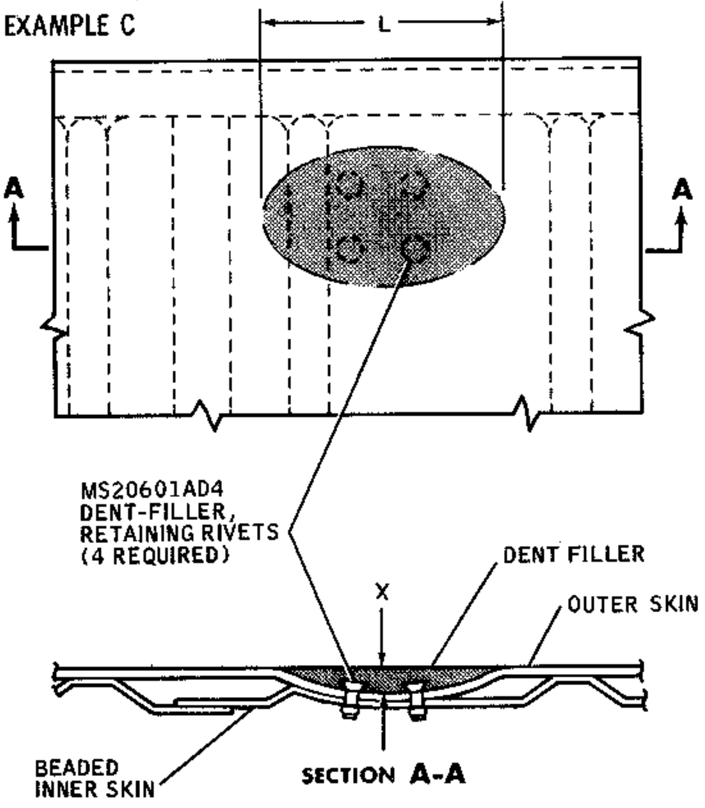


NOTES:

1. L MULTIPLIED BY .003 MUST BE EQUAL TO OR GREATER THAN D; D MUST NOT EXCEED .064.
2. IF DENT IS CRACKED OR EXCEEDS LIMIT SHOWN REPAIR AS SHOWN IN EXAMPLE C.

DAMAGE LIMITS FOR CRACKS PUNCTURES, OR TEARS.

EXAMPLE C



(HORIZONTAL STABILIZER LEADING EDGE SHOWN)

NOTES:

1. L MUST NOT EXCEED 12 INCHES. MAXIMUM TOTAL LENGTH OF DENTS MUST NOT EXCEED 24 INCHES PER SIDE OF AIRPLANE.
2. X MUST NOT EXCEED 1/2 INCH.
3. DO NOT COUNTERSINK RETAINING RIVETS. (THE HEADS ACT AS A MECHANICAL RETAINING DEVICE FOR DENT FILLER.
4. DENT FILLER RETAINING RIVETS MAY GO THRU OUTER SKIN ONLY OR THRU INNER AND OUTER SKINS, (HORIZONTAL STABILIZER) IF AIR FLOW IS NOT RESTRICTED. IF AIR FLOW IS RESTRICTED, STRAIGHTEN THE INNER SKIN TO PERMIT AIR FLOW AND OMIT RIVETS AS SHOWN IN SECTION 51-70-2.
5. DENT FILLER REPAIR IS ALSO APPLICABLE FOR VERTICAL STABILIZER WHERE BEADED INNER SKIN IS NOT INSTALLED. RIVETS IN VERTICAL STABILIZER ARE INSTALLED THRU OUTER SKIN.
6. STOP DRILL CRACKS WITH A 1/4-INCH DRILL

Printed in U.S.A.

BB3-538A

Stabilizer Leading Edge Damage Limits and Repair - Class B
Figure 4

6. Rudder and Elevator Glass Fiber Trailing Edge Repairs - Class A

A. Repair minor damage of gouge nature occurring to rudder or elevator glass fiber trailing edge as outlined in Figure 5 and as follows:

(1) See 55-01 for general requirements.

(2) Cut out damaged section as shown in Figure 5.

(3) Prepare Lefkoweld 109 in accordance with 51-70-2.

(4) Fill repair area solid with mixture of Lefkoweld 109 and glass fibers. Contour to shape desired.

<u>NOTE</u>: Depending on balance requirements, balsa wood may be used in place of Lefkoweld 109 and glass fibers. If balsa wood is used, sand with number 80 grit sandpaper. Clean with clean, dry cloth.

(5) Lay up glass fiber doubler, or doubler of Scotch No. 853 polyester tape, or equivalent, as shown in Figure 5.

(6) Bond glass fiber doubler in accordance with Section 51-70-2.

(7) Check balance condition of elevator in accordance with Section 55-20-1, and rudder in accordance with Section 55-40-1.

B. Repair extensive damage occurring to rudder or elevator glass fiber trailing edge as outlined in Figure 6 and as follows:

(1) Cut out damaged section and remove existing rivets from structure in repair area.

(2) Prepare replacement section of applicable trailing edge formed section (see Figure 6) to fit cutout.

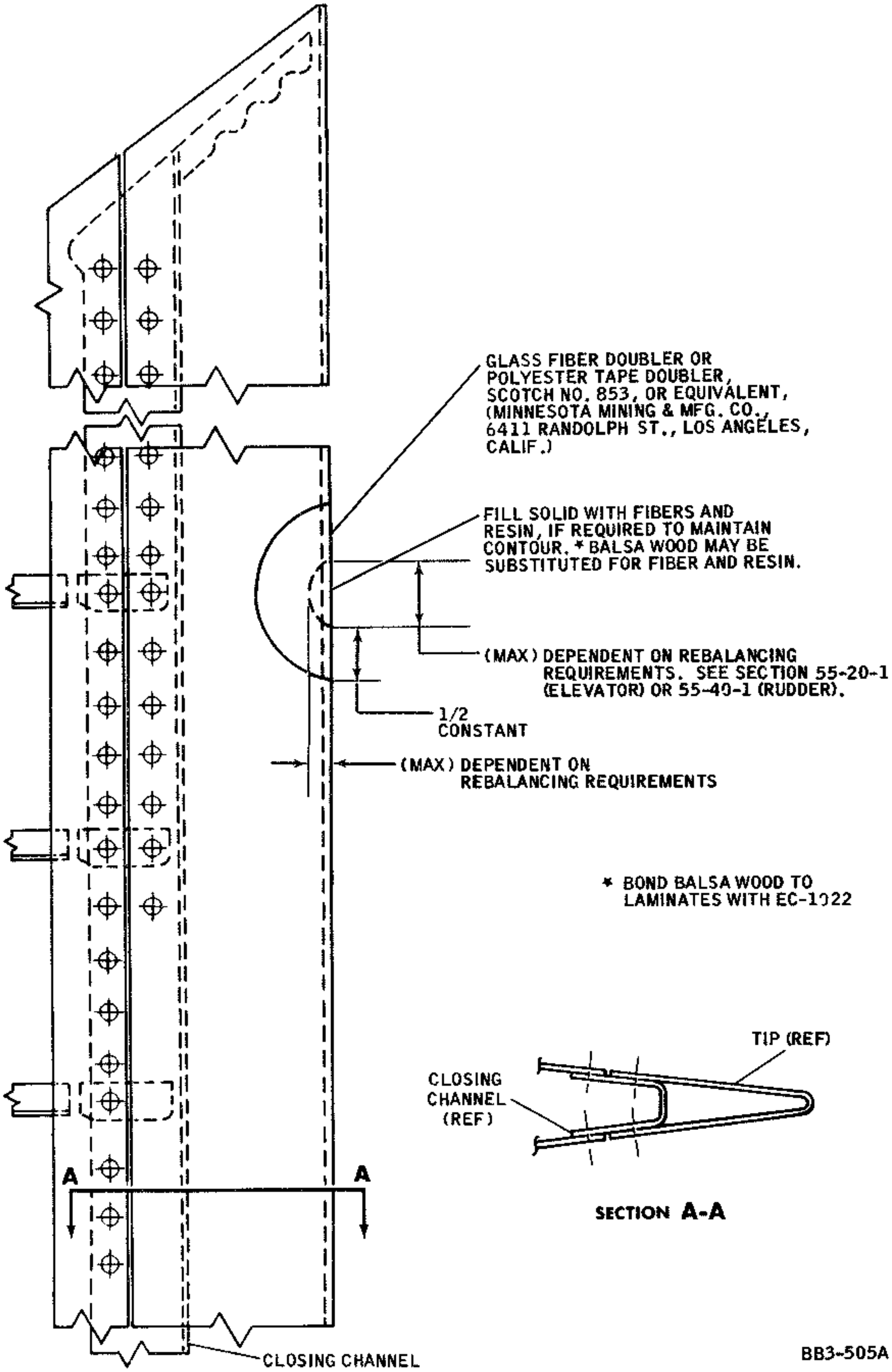
(3) Fabricate zee as shown in Figure 6.

(4) Install zee and glass fiber section and install rivets as shown in Figure 6.

(5) Install doubler of Scotch No. 853 polyester tape, or equivalent, over both spliced ends as shown in Figure 6.

<u>NOTE</u>: If area is to be painted, it must be painted before applying tape.

(6) Check balance condition of elevator in accordance with Section 55-20-1, and rudder in accordance with Section 55-40-1.



GLASS FIBER DOUBLER OR POLYESTER TAPE DOUBLER, SCOTCH NO. 853, OR EQUIVALENT, (MINNESOTA MINING & MFG. CO., 6411 RANDOLPH ST., LOS ANGELES, CALIF.)

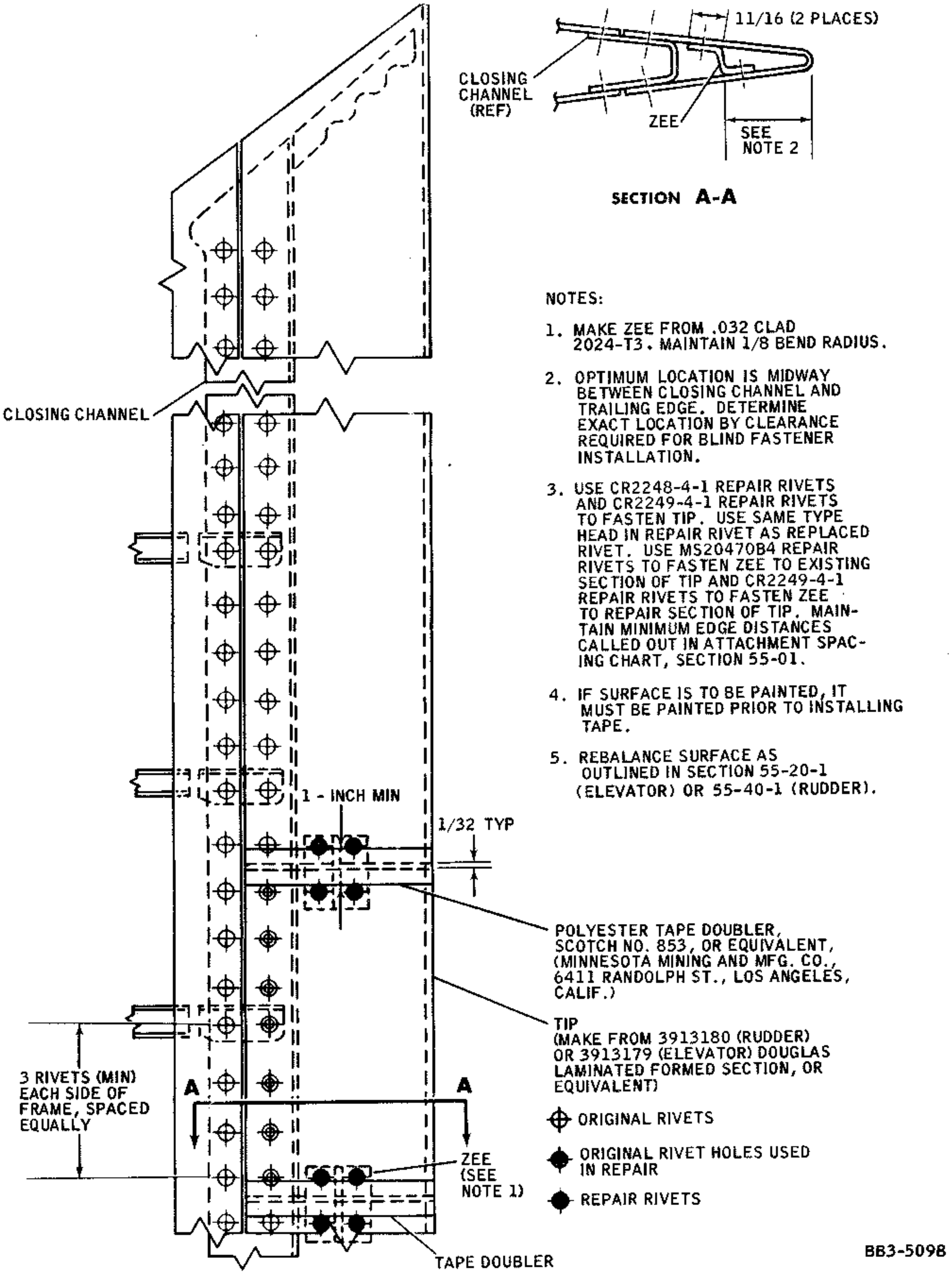
FILL SOLID WITH FIBERS AND RESIN, IF REQUIRED TO MAINTAIN CONTOUR. * BALSA WOOD MAY BE SUBSTITUTED FOR FIBER AND RESIN.

(MAX) DEPENDENT ON REBALANCING REQUIREMENTS. SEE SECTION 55-20-1 (ELEVATOR) OR 55-40-1 (RUDDER).

(MAX) DEPENDENT ON REBALANCING REQUIREMENTS

* BOND BALSA WOOD TO LAMINATES WITH EC-1022

Rudder and Elevator Trailing Edge Gouge Repair - Class A
Figure 5



NOTES:

1. MAKE ZEE FROM .032 CLAD 2024-T3. MAINTAIN 1/8 BEND RADIUS.
2. OPTIMUM LOCATION IS MIDWAY BETWEEN CLOSING CHANNEL AND TRAILING EDGE. DETERMINE EXACT LOCATION BY CLEARANCE REQUIRED FOR BLIND FASTENER INSTALLATION.
3. USE CR2248-4-1 REPAIR RIVETS AND CR2249-4-1 REPAIR RIVETS TO FASTEN TIP. USE SAME TYPE HEAD IN REPAIR RIVET AS REPLACED RIVET. USE MS20470B4 REPAIR RIVETS TO FASTEN ZEE TO EXISTING SECTION OF TIP AND CR2249-4-1 REPAIR RIVETS TO FASTEN ZEE TO REPAIR SECTION OF TIP. MAINTAIN MINIMUM EDGE DISTANCES CALLED OUT IN ATTACHMENT SPACING CHART, SECTION 55-01.
4. IF SURFACE IS TO BE PAINTED, IT MUST BE PAINTED PRIOR TO INSTALLING TAPE.
5. REBALANCE SURFACE AS OUTLINED IN SECTION 55-20-1 (ELEVATOR) OR 55-40-1 (RUDDER).

Rudder and Elevator Trailing Edge Spliced Section Repair - Class A
Figure 6

7. Vertical Stabilizer Metalized Mylar Covers Bonding Application

A. Repair or replacement of the Mylar covers on the Vertical Stabilizer should be accomplished in accordance with the following procedures.

(1) Strip any lacquer, enamel, and/or primer from the Vertical Stabilizer skin areas (see figure 7) with ethyl acetate, Specification No. TT-E-751.

NOTE: It is not necessary to remove FR primer, if it has been applied to referenced work area. The stripper, ethyl acetate, will not remove FR primer.

(2) Wipe the Vertical Stabilizer skin area or FR-primed faying surfaces with a clean cotton cloth dampened with ethyl acetate. Wipe dry with a clean, dry, cotton cloth before stripper evaporates.

WARNING: ENSURE THAT ALL OPEN STRIPPER AND SOLVENT CONTAINERS ARE KEPT AWAY FROM THE WORK AREA AS THE MYLAR CLEANING OPERATION TENDS TO BUILD UP A STATIC CHARGE.

(3) Continue the cleaning action, by wiping skin area and the MYLAR cover faying surfaces with a clean cotton cloth dampened with light-duty, solvent-type stripper, TL-4119 (W.P.Fuller Co., 222 N. Ave., Los Angeles 23, Calif.). Use another clean cloth to wipe dry the areas before the stripper evaporates.

(4) On FR-primed surfaces, apply brush coat of A-4094 (Dow Corning Corp., Alhambra, California) or RTV-1200 primer (Dow Corning Corp., Midland, Michigan). Refer to 51-20-0 for application of RTV-1200 silastic silicone primer.

(5) Allow primer to dry one hour.

(6) A liquid adhesive is used to form a bond between metal faying surfaces of the covers and the Vertical Stabilizer skin. Preparation of the bonding adhesive is as follows:

(a) Use clean non-absorbent container to mix adhesive and accelerator.

(b) To 100 parts, by weight, of Pro-Seal 501 adhesive (Coast Pro-Seal Manufacturing Co., Los Angeles, Calif.) add 30 parts, by weight, of Pro-Seal 501A accelerator, and mix thoroughly for five minutes.

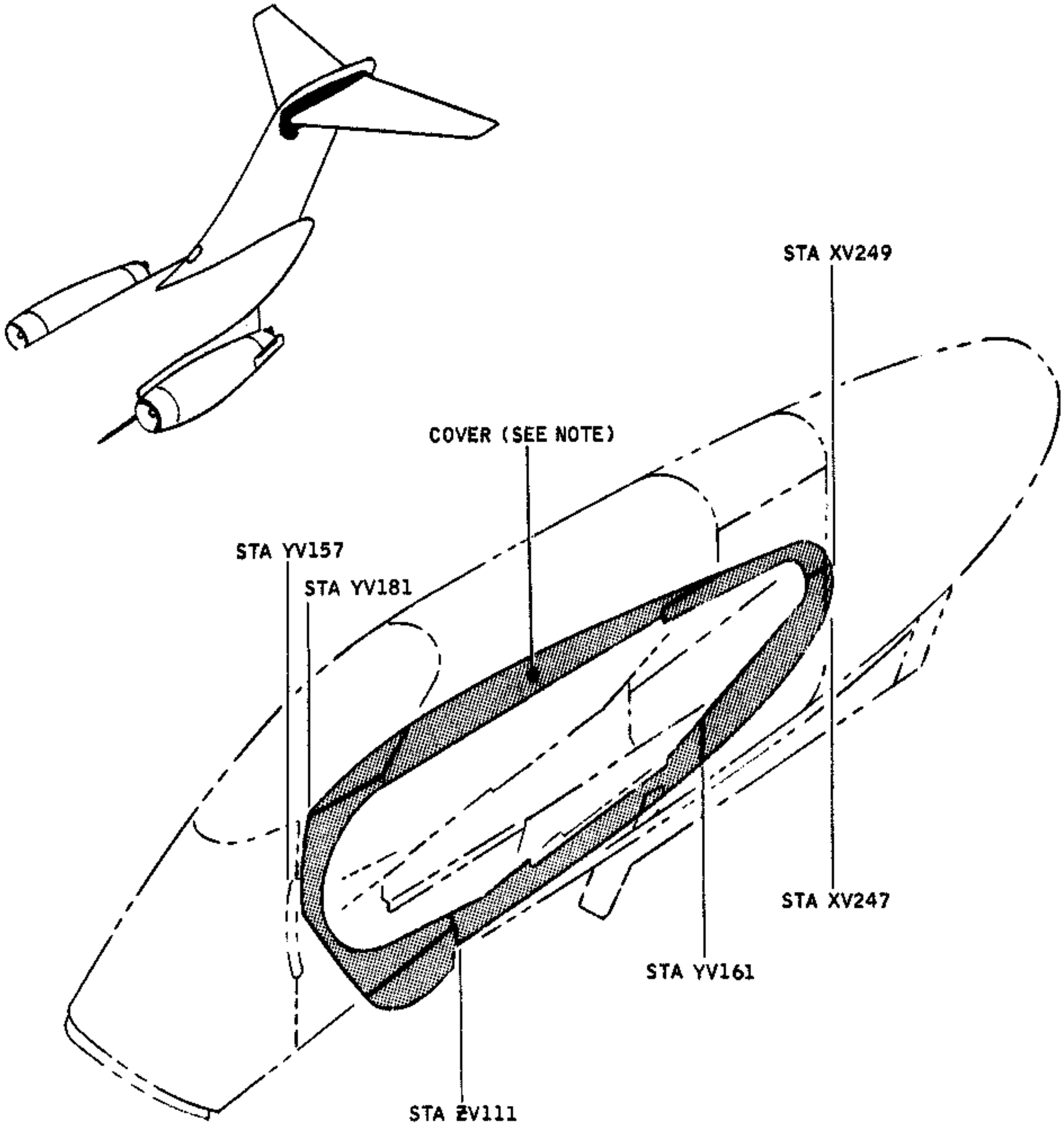
NOTE: Usable pot life of mixed Pro-Seal 501 is approximately 30 minutes. Mix adhesive only as required, and apply immediately. Installation should be accomplished when ambient temperature is between 16° to 32°C (60° to 90°F).

(c) Use a spatula or spreader to apply thin film of mixed adhesive to the metal faying surface of the Mylar covers. Work out all air bubbles with the spatula.

(d) Join cover and Vertical Stabilizer faying surfaces. Remove excess adhesive by means of a plastic scraper or with a cloth dampened in ethyl acetate. Cleanup procedure should be accomplished before adhesive has cured.

<u>NOTE</u>: Ensure that the mixed adhesive is applied to the metalized side of the cover so that there is a metal-to-metal bond.

(e) Cure repair for a period of 12 hours at 21°C (70°F) to accelerate the curing cycle, apply heat with a hot air blower or heat lamp at maximum temperature of 49°C (120°F) for one hour.



NOTE:

MYLAR COVERS MADE FROM 0.010 SHEET, ALUMINIZED ONE SIDE. (TRANSPARENT PRODUCTS, 1739 W. PICO, LOS ANGELES, CALIF.)

BB3-975

Cementing Mylar Covers to Aluminum Alloy - Vertical Stabilizer Protective Covers
Figure 7

TAB DENT AND HONEYCOMB REPAIRS (DC-9-ALL)

1. Elevator and Rudder Tab Dent Repair - Class A

A. Repair skin dents in elevator control tab (5910413), elevator geared tab (5910414), and rudder tab (5910257), meeting following requirements.

(1) Repair is applicable if following conditions exist:

(a) Dents must be between 1 and 3 inches in diameter.

(b) Dents must be less than 0.093 inch in depth.

(c) Dents must be smooth, single radius, with no evidence of punctures, cracks, or scratches that cannot be polished out.

(d) Edge of one repair must not be closer than 2 inches to edge of another repair.

NOTE: Dents do not require repairing if they are less than 1 inch in diameter, less than 0.063 inch in depth, and are smooth, single radius, with no evidence of punctures, cracks, or scratches that cannot be polished out.

(2) Fill dents, meeting above requirements with Pro-Seal 735, as outlined in 51-70-2.

(3) Check balance and maximum allowable weight condition of elevator control tab and geared tab in accordance with 55-20-1, and rudder tab in accordance with 55-40-1.

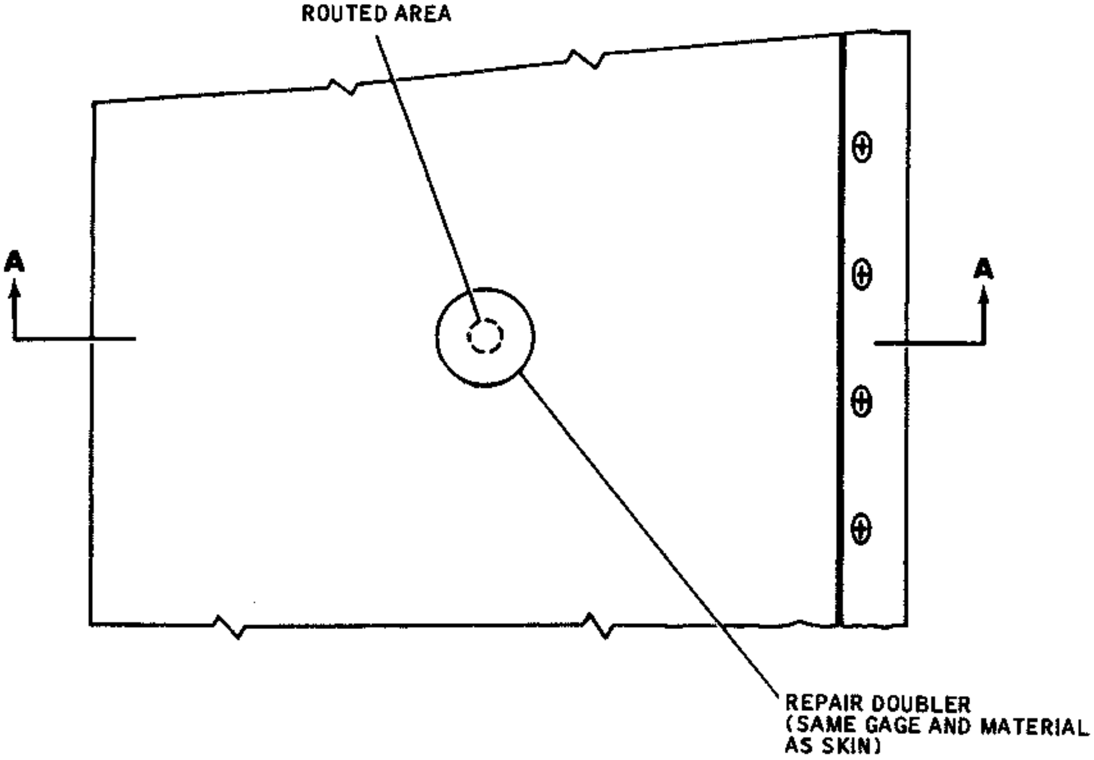
NOTE: The number of repairs allowed on a tab is controlled by the ability to maintain the control surface within its balance and maximum allowable weight limits.

2. Elevator and Rudder Tab Dent Repair - Class B (See Figure 1.)

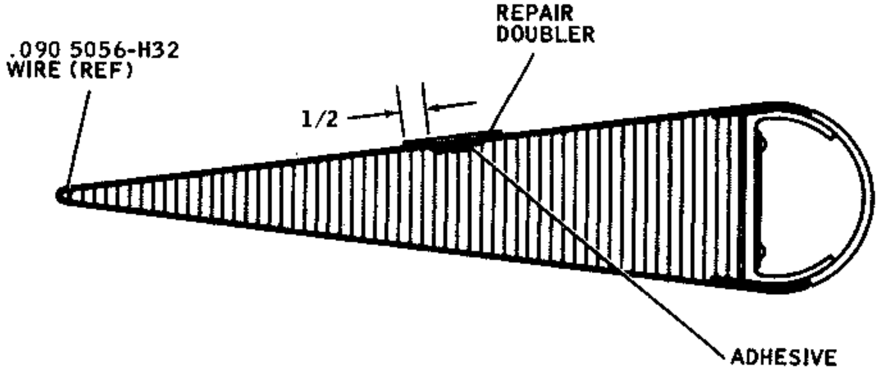
A. Repair skin dents in elevator control tab (5910413), elevator geared tab (5910414), and rudder tab (5910257) that are not smooth (more than one radius), punctured, cracked, or deeply scratched. The extent of damage must be between 3/8 inch and 1 1/4 inch, with no more than six cells damaged. Repair as follows:

(1) See 55-01 for general requirements. Edge of one repair must be no closer than 2 inches to edge of another repair.

(2) Remove damaged skin with hole saw, leaving a circular hole. Exercise care so cut does not enter core more than 1/16 inch. Portions of bonding tape that are securely fastened to undamaged honeycomb cells should not be removed.



DENTED SKIN
BEFORE REPAIR



SECTION A-A

RUDDER TAB SHOWN
(REPAIR IS TYPICAL FOR ELEVATOR TABS)

BB3-516

Typical Tab Dent Repair -- Class B
Figure 1

(3) Fabricate repair doubler as shown in Figure 1, and bond doubler to panel in accordance with 51-70-2. Ensure doubler overlaps hole by 1/2 inch.

(4) Check balance and maximum allowable weight condition of elevator control, geared tab in accordance with 55-20-1, and rudder tab in accordance with 55-40-1.

NOTE: The number of repairs of this type should not exceed four. The number is controlled by the ability to maintain the control surface within its balance and maximum allowable weight limits.

3. Elevator and Rudder Tab Trailing Edge Honeycomb Repair - Class A (See Figure 2)

A. Repair damage to elevator control tab (5910413), elevator geared tab (5910414), and rudder tab (5910257) occurring at trailing edge as follows:

(1) See 55-01 for general requirements.

(2) Cut out damage and make bonded repair in accordance with 51-70-2. Maintain dimensions shown in Figure 2.

(3) Check elevator control tab and geared tab balance and maximum allowable weight condition in accordance with 55-20-1, and rudder tab in accordance with 55-40-1.

NOTE: The number of repairs on tabs depend on the ability to maintain control surface within its balance and maximum allowable weight limits.

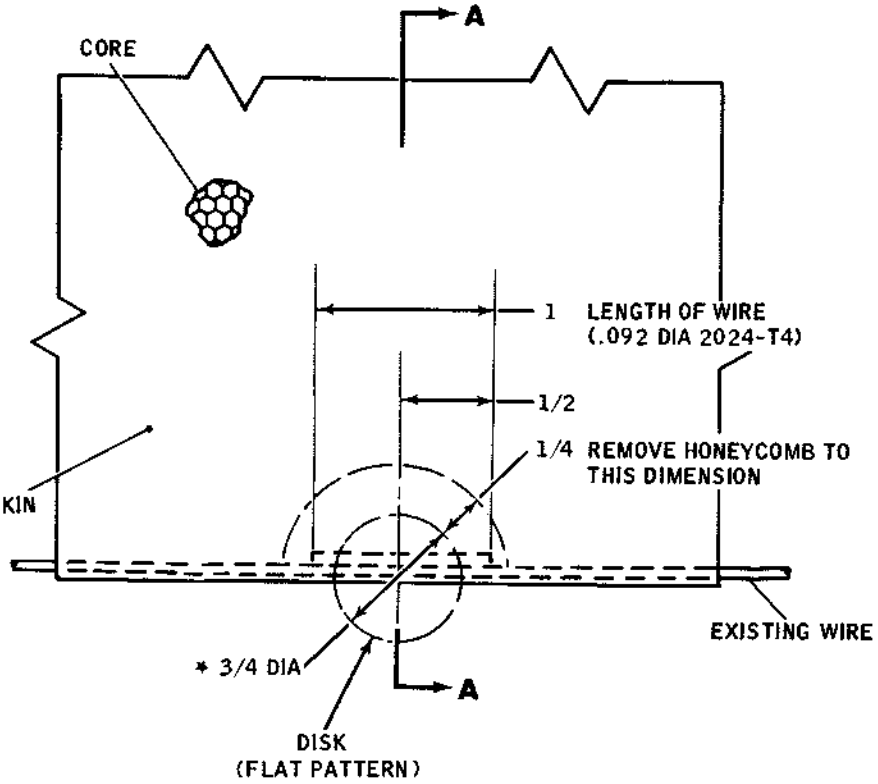
4. Elevator and Rudder Tab Skin and Core Repair - Class B (See Figure 3)

A. Repair damage not exceeding 2 inches in diameter to skin and core of elevator control tab (5910413), elevator geared tab (5910414), and rudder tab (5910257) as follows:

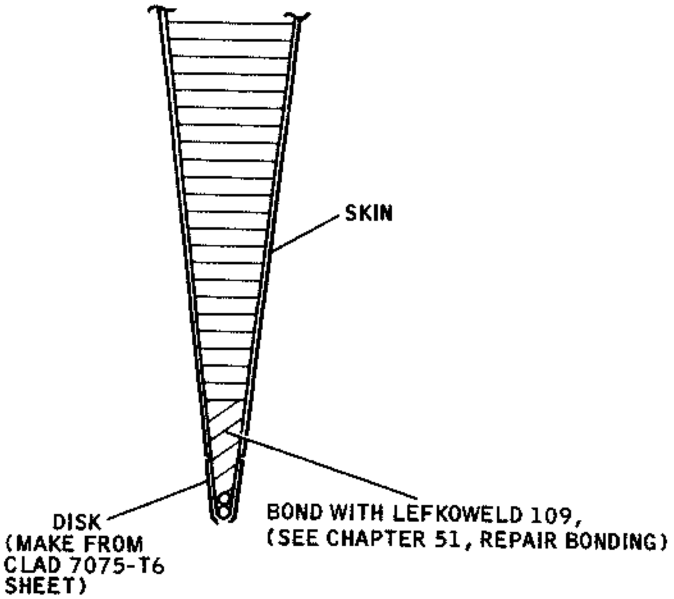
(1) See 55-01 for general requirements. Edge of one repair must be no closer than 2 inches to edge of another repair.

(2) Cut out damage and make bonded repair in accordance with 51-70-2. Maintain dimensions shown in Figure 3.

NOTE: Panels may be repaired using a 2 X 3/16 X 0.001 thick nonperforated aluminum foil honeycomb repair core (Hexcel Products, Inc., 2332 Fourth St., Berkeley, Calif.). Machine repair core to proper taper as outlined in 51-70-2.



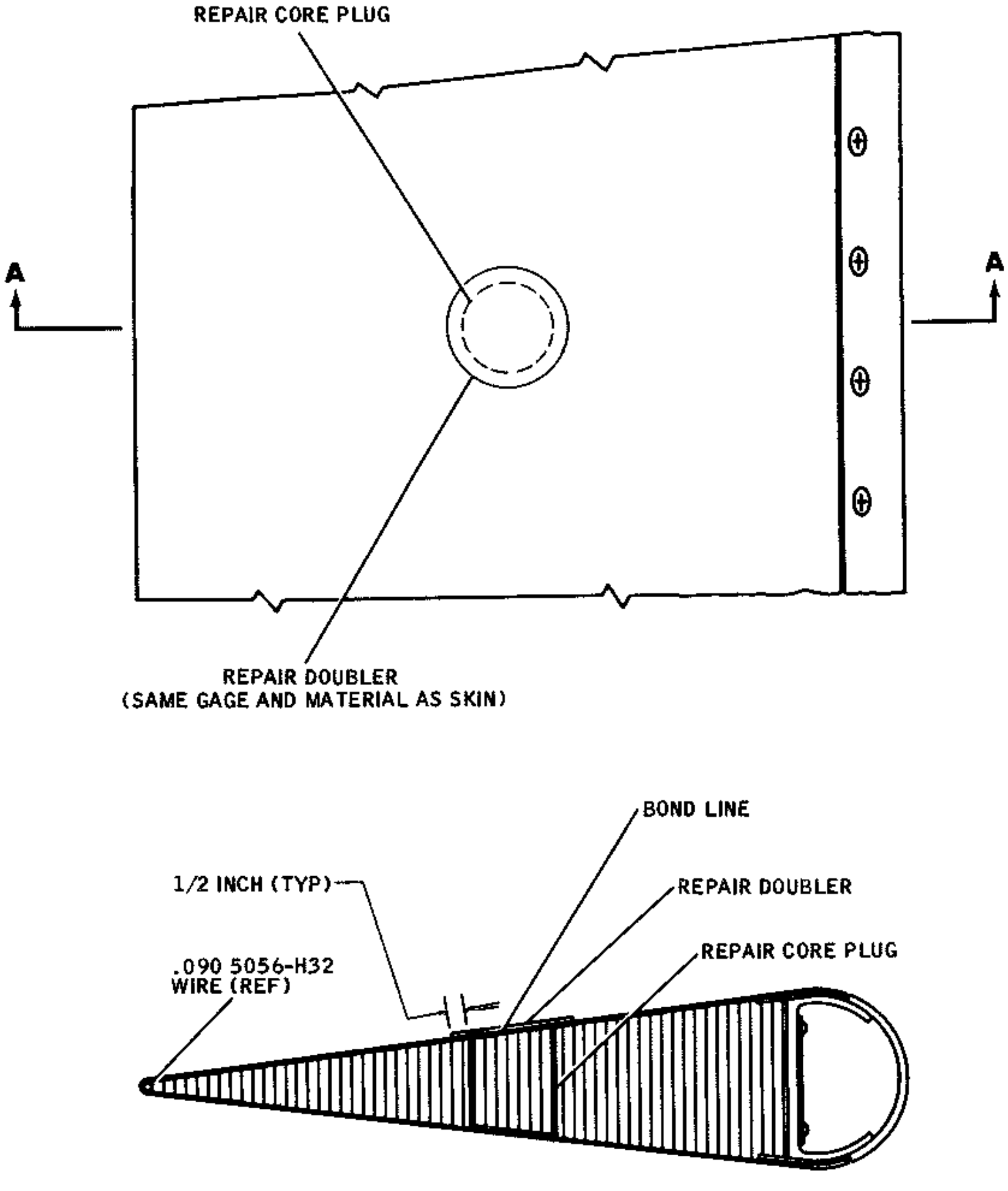
* MAX. REPAIR IS DEPENDENT
ON REBALANCING REQUIREMENTS



SECTION A-A

BB3-506

Rudder and Elevator Tab Trailing Edge Repair -- Class A
Figure 2



SECTION A-A

RUDDER TAB SHOWN
(REPAIR IS TYPICAL FOR ELEVATOR TABS)

BB3-515

Typical Tab Core Repair -- Class B
Figure 3

(3) Check elevator control and geared tab balance and maximum allowable weight condition in accordance with 55-20-1, and rudder tab in accordance with 55-40-1.

NOTE: The number of repairs on tabs depends on the ability to maintain control surface within its balance and maximum allowable weight limits.

HORIZONTAL STABILIZER - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates the horizontal stabilizer components. Types and gages of material used in construction of assemblies are identified in the illustrations.

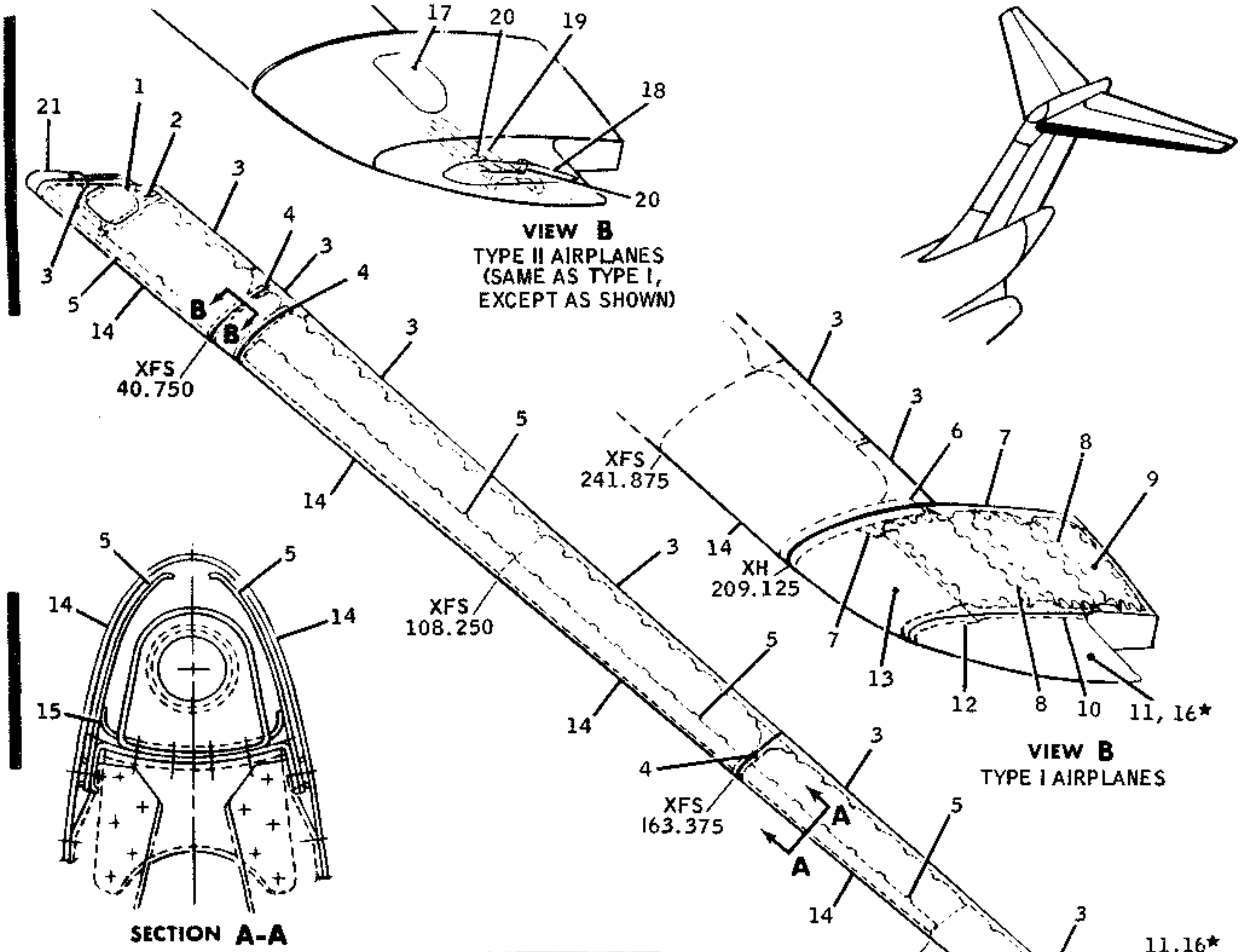
2. Repair Index

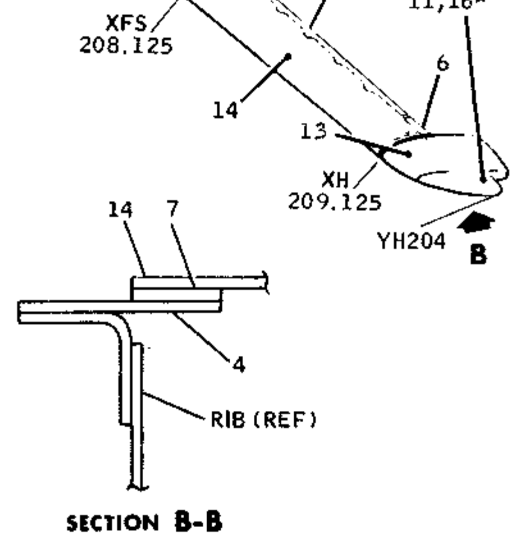
A. The following list of structural components and applicable repairs may be used to restore structural integrity and appearance of components.

B. Any repairs to horizontal stabilizer skins between spars require specific engineering approval.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 4
Skins (See note.)	Section 55-03, Figures 3 and 4

NOTE: Any repairs to skins between spars requires specific engineering approval.





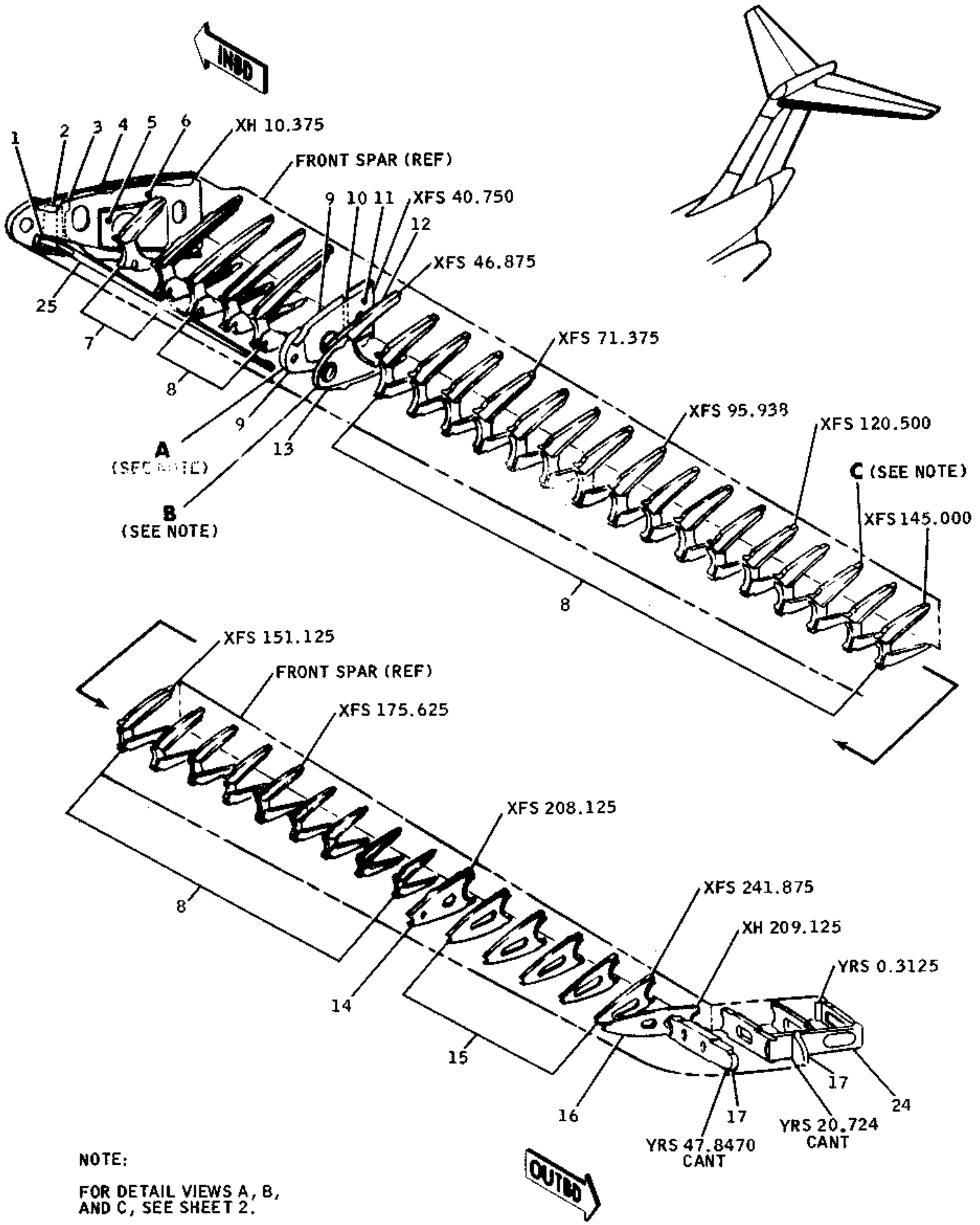
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOOR	.100	CLAD 7075-T6
2	DOUBLER	.080	CLAD 7075-T6
3	DOUBLER	.050	CLAD 7075-T6
4	SPLICE	.063	CLAD 7075-T6
5	INNER SKIN	.016	CLAD 2014-T6
6	SPLICE	.050	CLAD 7075-T6
7	BONDED DOUBLER	.050	CLAD 7075-T6
8	BONDED DOUBLER	.016	CLAD 7075-T6
9	SKIN	.025	CLAD 7075-T6
10	DOUBLER	.050	CLAD 2024-T42
11	SKIN	.040	CLAD 2024-T42
12	DOUBLER	.040	CLAD 2024-T42
13	SKIN	.040	CLAD 7075-T6
14	OUTER SKIN	.050	CLAD 7075-T6
15	INSULATION		SEE NOTE 1
16	SKIN	.040	AL SHEET 6061-T6X
17	DOOR	.090	CLAD 7075-T6
18	NOZZLE FAIRING	.050	AL SHEET 6061-T6X
19	TUBE 5/8 O.D. x .035 WALL		AL 6061-T4
20	TUBE 1/2O.D. x .058 WALL		AL 6061-T4
21	FAIRING	.050	CLAD 7075-T6

NOTES:

1. ITEM 15, INSULATION, IS B-STAGE PHENOLIC NO. 181 GLASS FABRIC.
2. *ITEM 16 USED ON TYPE II ONLY.
3. REFERENCE DOUGLAS DRAWING 5910404, 5918015, AND 5918007.

BB3-181B

Leading Edge and Tip Plating -- Types I and II
Figure 1

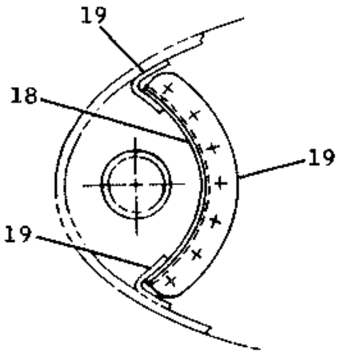


NOTE:

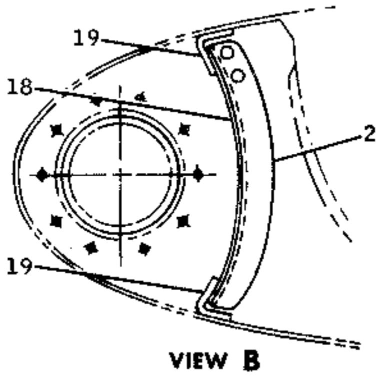
FOR DETAIL VIEWS A, B, AND C, SEE SHEET 2.

BB3-182A

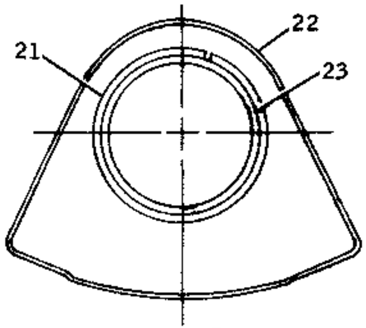
Leading Edge and Tip Structure
Figure 2 (Sheet 1)



VIEW A
LOOKING INBOARD AT
STATION XFS40.750
DETAIL SHOWING "D" DUCT
ASSEMBLY ("D" DUCT OMITTED
FROM MAIN VIEW FOR CLARITY)



VIEW B
LOOKING INBOARD AT
STATION XFS46.875
DETAIL SHOWING "D" DUCT
ASSEMBLY ("D" DUCT OMITTED
FROM MAIN VIEW FOR CLARITY)



VIEW C
DETAIL OF ICE PROTECTION
BRACKET ASSEMBLY (TYPICAL)

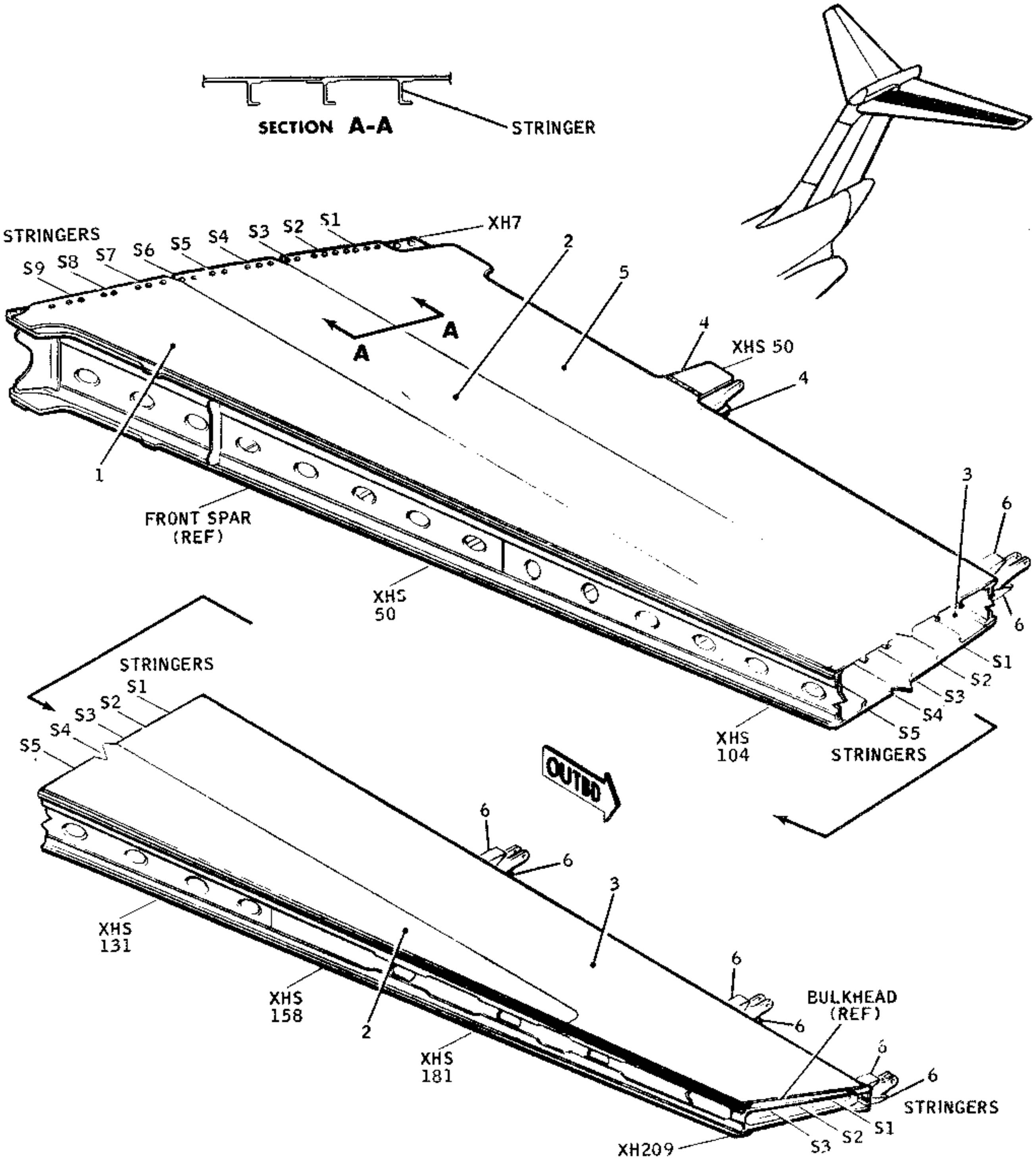
NOTES:

1. ITEM 23 MAY BE PURCHASED FROM RAYBESTOS - MANHATTAN INC., MANHATTAN RUBBER DIVISION, PASSAIC, N.J.
2. REFERENCE - DOUGLAS DRAWING 5910404, 5918007, AND 5918015

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP	2.500	PLATE 7075-T651
2	FITTING	2.000	PLATE 7075-T651
3	ANGLE	.040	CLAD 7075-T6
4	CAP	2.500	PLATE 7075-T651
5	DOUBLER	.050	CLAD 7075-T6
6	WEB	.063	CLAD 7075-T6
7	FORMER		
	ZEE	.040	CLAD 7075-T6
	SPLICE PLATE	.040	CLAD 2014-T6
8	FORMER		
	ZEE	.040	CLAD 7075-T6
	GUSSET	.040	CLAD 2014-T6
9	CAP	.050	CLAD 7075-T6
10	STIFFENER		1465089
11	WEB	.040	CLAD 2014-T6
12	CHANNEL	.040	CLAD 7075-T6
13	RIB	.040	CLAD 7075-T6
14	FORMER	.040	CLAD 2014-T6
15	FORMER	.040	CLAD 2024-T42
16	FORMER	.040	CLAD 2024-T42
17	RIB	.040	CLAD 2024-T42
18	WEB	.016	CLAD 2014-T6
19	ANGLE	.040	CLAD 2014-T6
20	STIFFENER	.040	CLAD 2014-T6
21	END	.040	CLAD 6061-T6
22	CAP	.040	CLAD 6061-T6
23	ETCHED TAPE	LS9280 - .090 X .625	
24	INTERCOSTAL	.050	CLAD 2024-T42
25	FITTING	2.000	PLATE 2014-T651

BB3-448A

Leading Edge and Tip Structure
Figure 2 (Sheet 2)



NOTES:

1. UPPER AND LOWER LEFT AND RIGHT PANELS MADE FROM 4912264-1 ALUMINUM PLATE 7075-T651

2. UPPER AND LOWER LEFT AND RIGHT PANELS MADE FROM 3918004-1 ALUMINUM PLATE 7075-T651

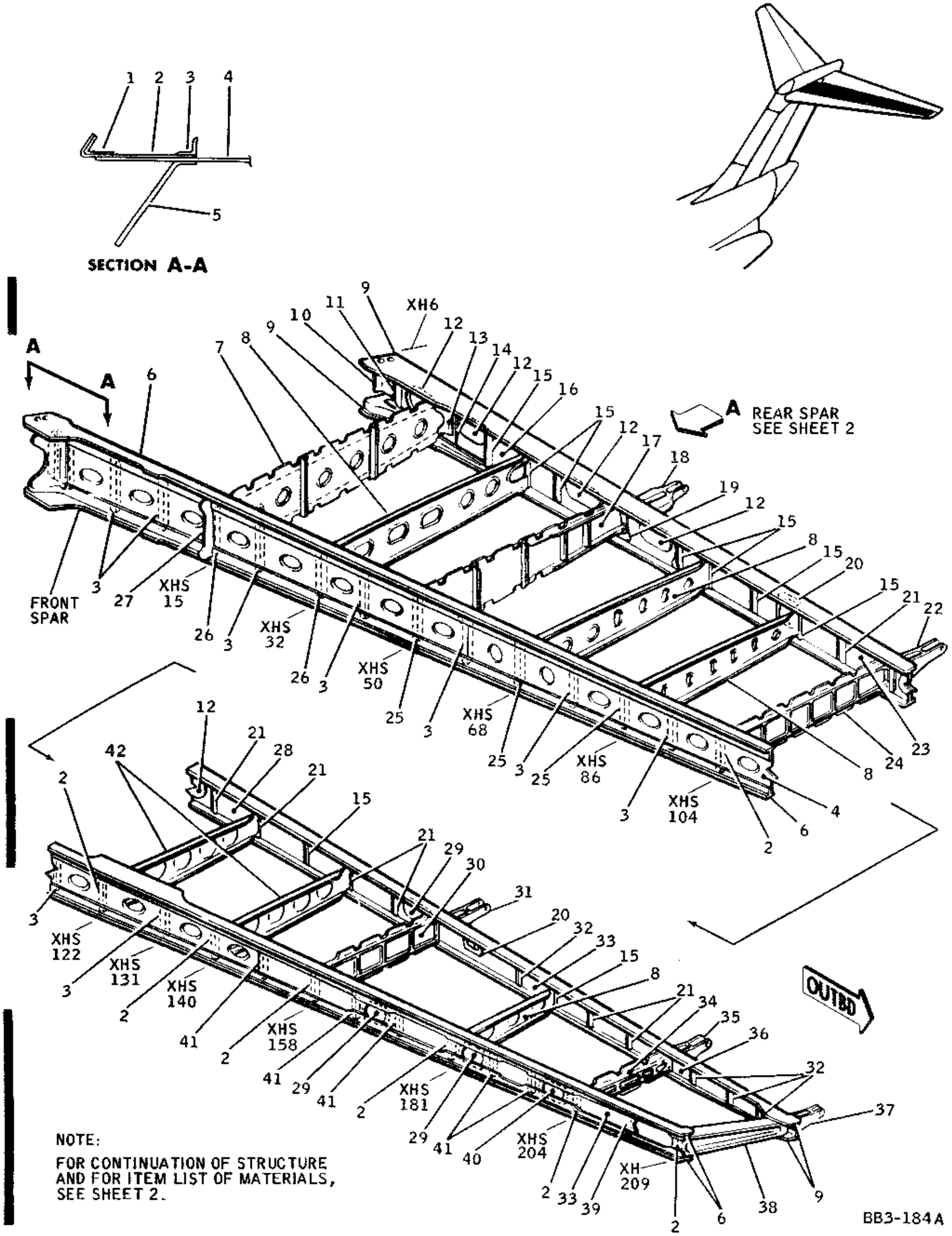
3. REFERENCE - DOUGLAS DRAWING 5918003

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL 5918014,-1,-2		SEE NOTE 1
2	PANEL 5918001,-1,-2		SEE NOTE 1
3	PANEL 5918002,-1,-2		SEE NOTE 2
4	DOOR	.190	CLAD 2014-T6
5	PANEL 5918002, -501, -502		SEE NOTE 2
6	FAIRING	.040	2024-T42

BB3-183B

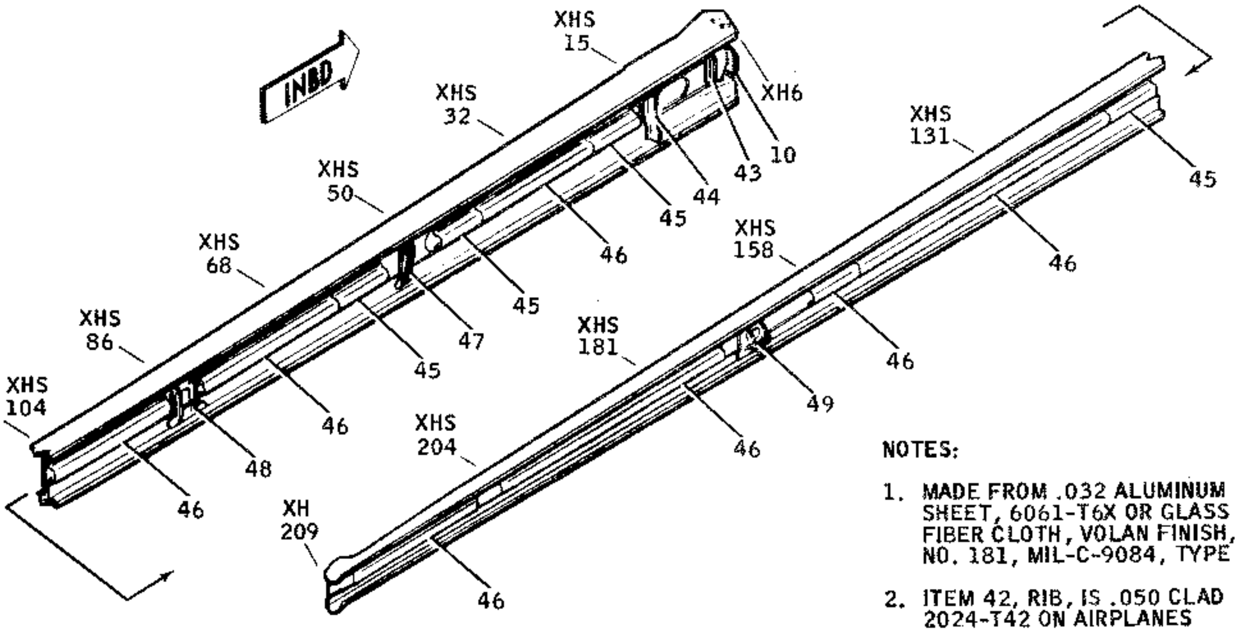
Aft Section Plating -- Type I
Figure 3

Printed in U.S.A.



NOTE:
FOR CONTINUATION OF STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.

Aft Section Structure
Figure 4 (Sheet 1)



VIEW A
REAR SPAR
LOOKING FORWARD

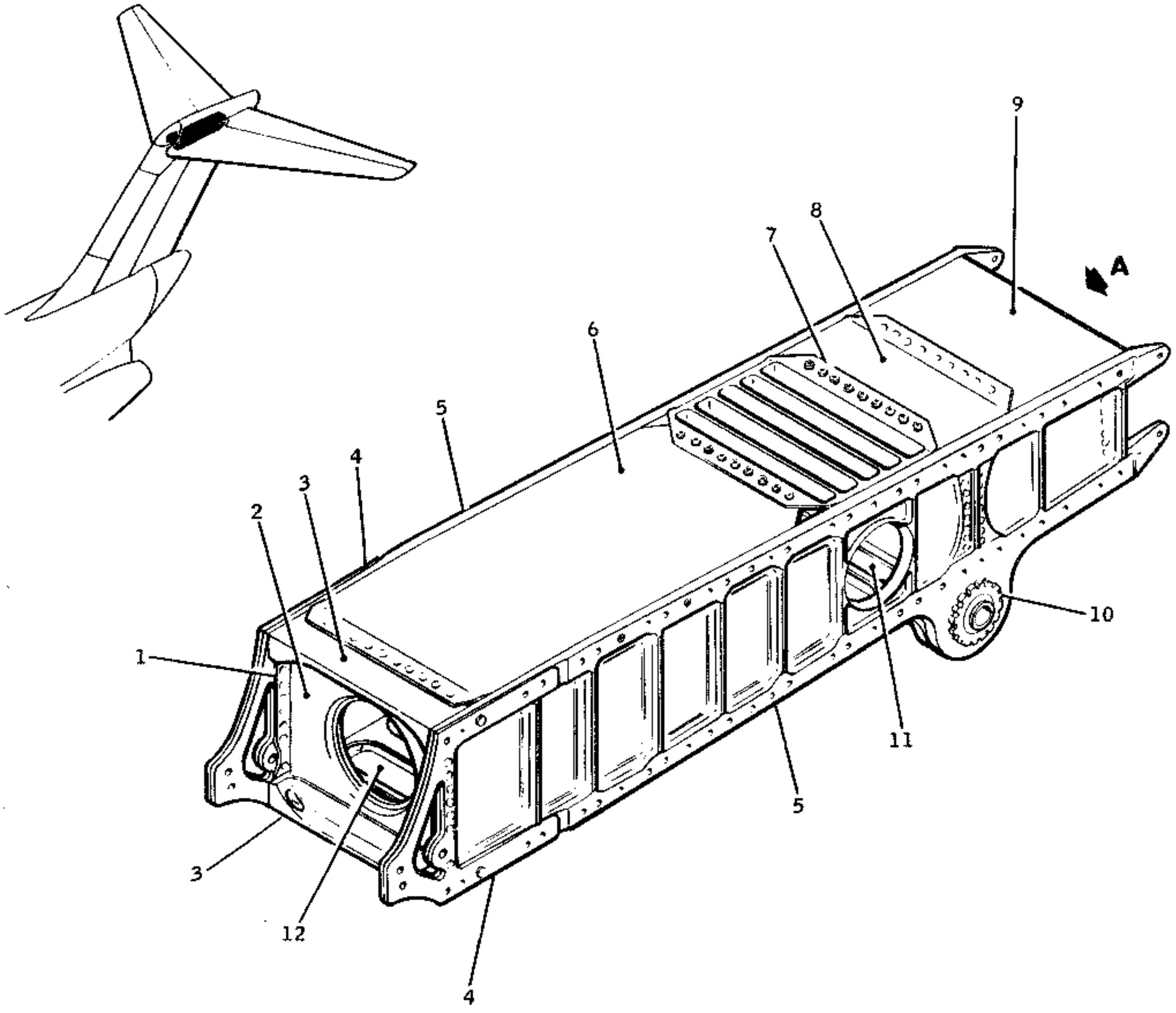
NOTES:

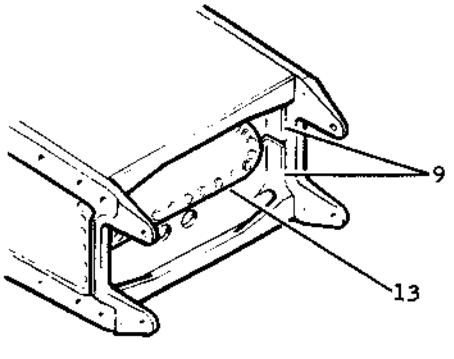
1. MADE FROM .032 ALUMINUM SHEET, 6061-T6X OR GLASS FIBER CLOTH, VOLAN FINISH, NO. 181, MIL-C-9084, TYPE 8.
2. ITEM 42, RIB, IS .050 CLAD 2024-T42 ON AIRPLANES 1 THROUGH 4.
3. REFERENCE - DOUGLAS DRAWING 5918003.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ATTACH DOUBLER	.063	CLAD 7075-T6
2	ATTACH ANGLE	.063	CLAD 7075-T6
3	STIFFENER		1418821
4	WEB	.063	CLAD 7075-T6
5	ANGLE GUSSET	.125	CLAD 7075-T6
6	CAP		3912303
7	WEB STIFFENER TEE	.032	CLAD 7075-T6 127648 1221366
8	WEB	.050	CLAD 7075-T6
9	CAP		3924662
10	ANGLE	.125	CLAD 7075-T6
11	TEE		1440004
12	DOOR	.080	CLAD 7075-T6
13	TEE		2615551
14	DOUBLER	.050	CLAD 7075-T6
15	ANGLE		1415741
16	WEB	.080	CLAD 7075-T6
17	WEB STIFFENER STIFFENER CAP	.025 2.500	CLAD 7075-T6 1418821 1276248 BAR 7075-T651
18	BRACKET, 5918084		FORGING 7075-T411
19	FITTING		2918143
20	CUP		SEE NOTE 1
21	ANGLE		1294834
22	BRACKET	1.750	PLATE 7075-T7351
23	WEB	.071	CLAD 7075-T6
24	RIB	1.250	PLATE 7075-T651
25	ATTACH ANGLE	.090	CLAD 7075-T6
26	ATTACH ANGLE	.125	CLAD 7075-T6
27	ANGLE	.050	CLAD 7075-T6
28	WEB	.040	CLAD 7075-T6
29	DOOR	.050	CLAD 7075-T6
30	BULKHEAD	1.000	PLATE 7075-T651
31	BRACKET	1.750	PLATE 7075-T7351
32	ANGLE		1242527
33	WEB	.032	CLAD 7075-T6
34	BULKHEAD	1.125	PLATE 7075-T651
35	BRACKET	1.375	PLATE 7075-T7351
36	WEB	.025	CLAD 7075-T6
37	SUPPORT	1.500	PLATE 7075-T7351
38	BULKHEAD	2.000	PLATE 7075-T651
39	STIFFENER TEE		1440048
40	COVER	.032	CLAD 7075-T6
41	STIFFENER		1415595
42	RIB (SEE NOTE 2)	.050	CLAD 7075-T6
43	TEE		1329805
44	TEE		2620678
45	SEAL	.020	SHEET 6061-T6
46	SEAL	.012	SHEET 6061-T6
47	FITTING	2.000	PLATE 7075-T7351
48	FITTING, 5918149		FORGING 7075-T6
49	FITTING, 5918148		FORGING 7075-T6

BB3-185A

Aft Section Structure
Figure 4 (Sheet 2)





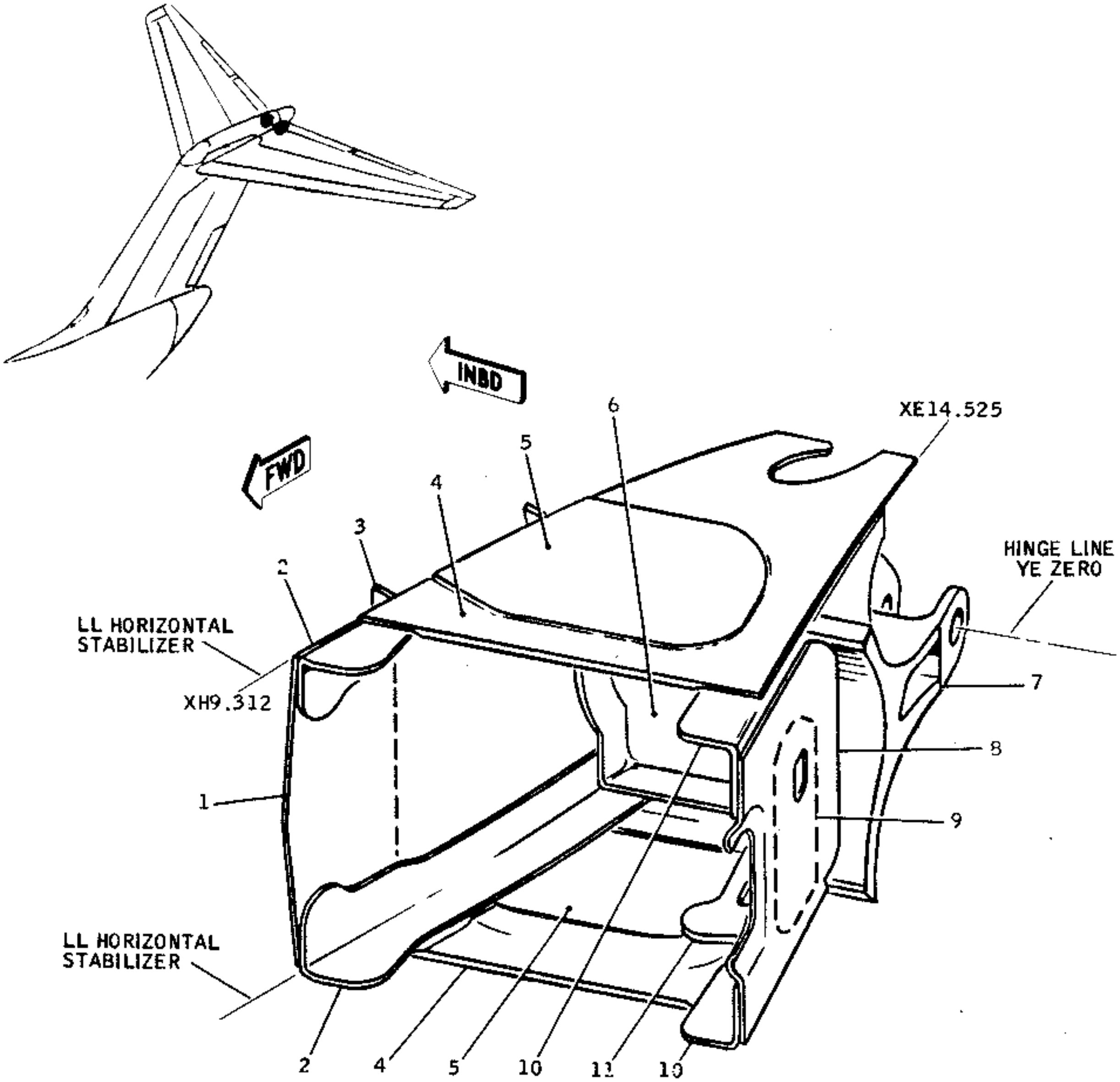
VIEW A

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE		1416793
2	WEB	.125	CLAD 7075-T6
3	CAP, NO. 3912142-1, -501		PLATE 7075-T651
4	FITTING		PLATE 7075-T651
5	RIB		PLATE 7075-T651
6	PLATE, NO. 9911861		PLATE 7075-T651
7	PLATE, NO. 9911862		PLATE 7075-T651
8	FITTING, NO. 5918098		FORGING 7075-T411
9	FITTING, NO. 5912481		FORGING 7075-T6
10	LOCKNUT, NO. 4646246 LOCKWASHER NO. 4646247 BUSHING, NO. 4912480		4340 STEEL 347 CRES AISI 431 CRES
11	PLATE, NO. 9918441		PLATE 7075-T651
12	PLATE, NO. 9918440		PLATE 7075-T651
13	COVER	.160	CLAD 7075-T6

REFERENCE DOUGLAS DRAWING 5910405

BB3-187B

Center Section Plating and Structure -- Type I
Figure 5



VIEW LOOKING DOWN AT
UPPER SURFACE, LEFT SIDE

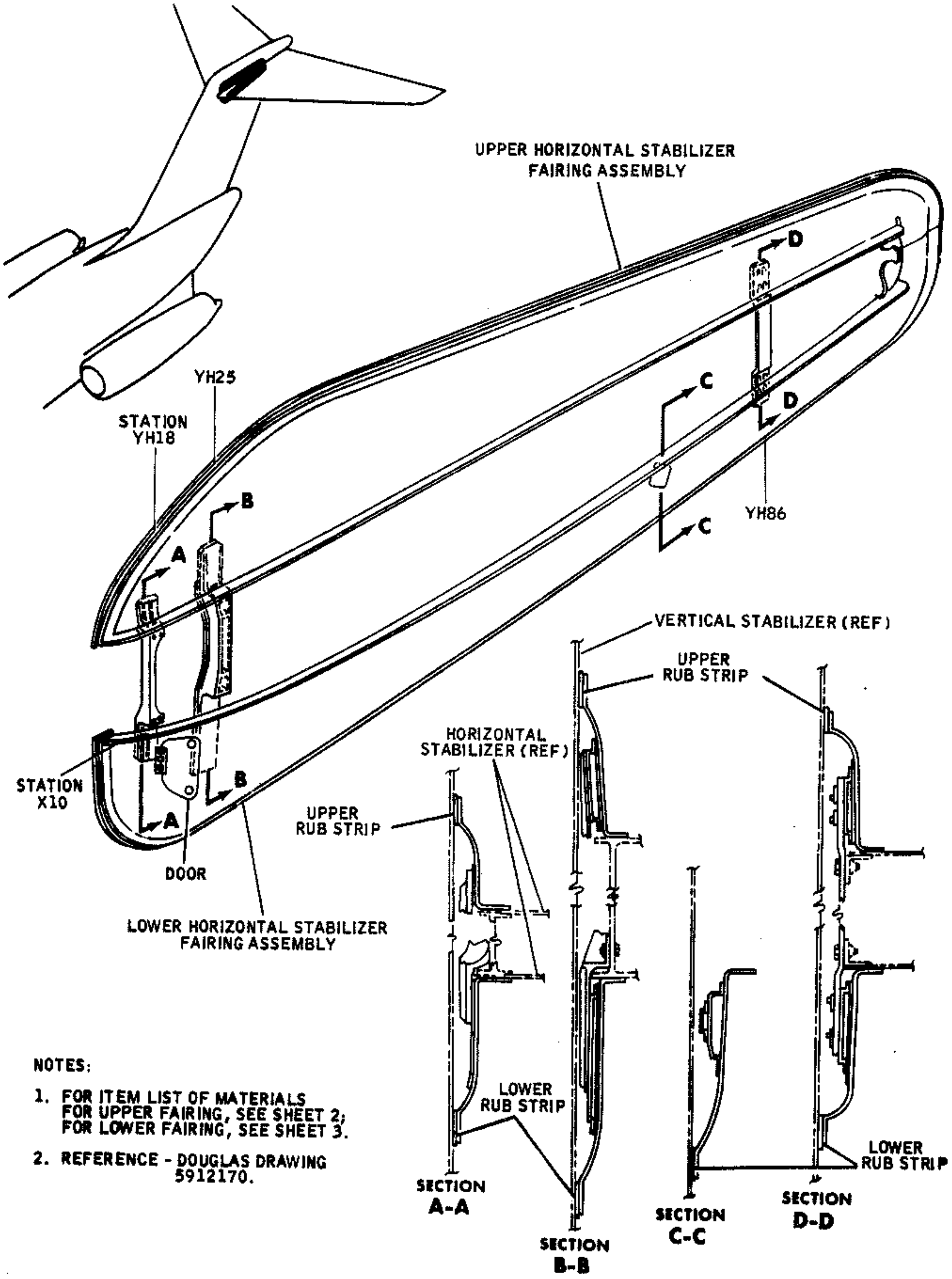
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.040	CLAD 7075-T6
2	CAP 3918023-1, -2		1152375
3	DOUBLER	.040	CLAD 7075-T6
4	SKIN	.160	CLAD 7075-T6
5	DOOR 9918533-1,-2	.090	CLAD 7075-T6
6	FITTING 3918022-1		FORGING 7075-T6
7	FITTING 5918113-1		FORGING 7075-T6
8	WEB	.050	CLAD 7075-T6
9	FITTING 4918058-1		PLATE 7075-T651
10	CAP 3918021-1, -2		1285511
11	ANGLE		1223583

REFERENCE DOUGLAS DRAWING 5918020

BB3-186

Hinge Support
Figure 6

Printed in U.S.A.

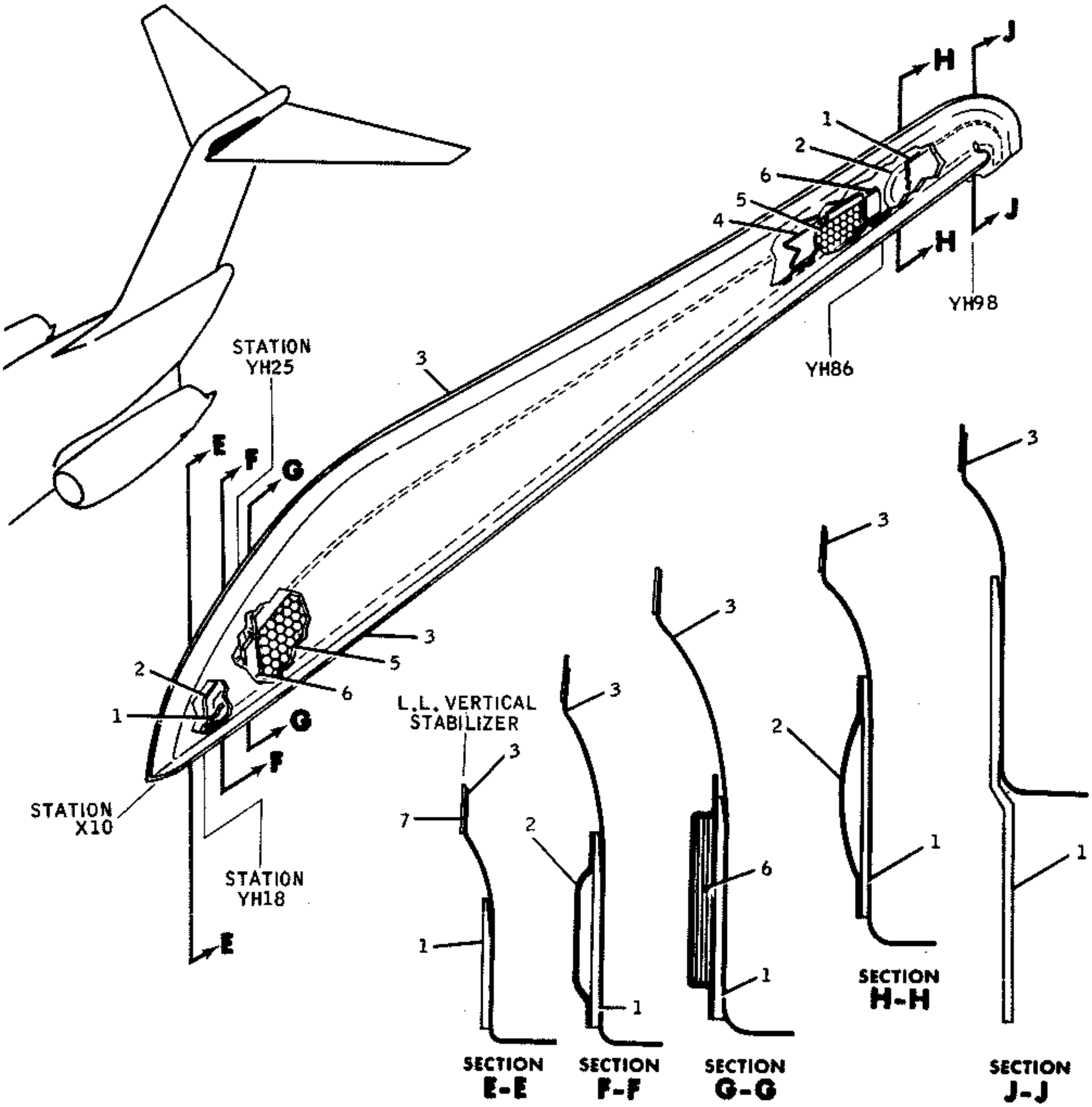


NOTES:

1. FOR ITEM LIST OF MATERIALS FOR UPPER FAIRING, SEE SHEET 2; FOR LOWER FAIRING, SEE SHEET 3.
2. REFERENCE - DOUGLAS DRAWING 5912170.

BB3-690

Horizontal Stabilizer Fairings
Figure 7 (Sheet 1)



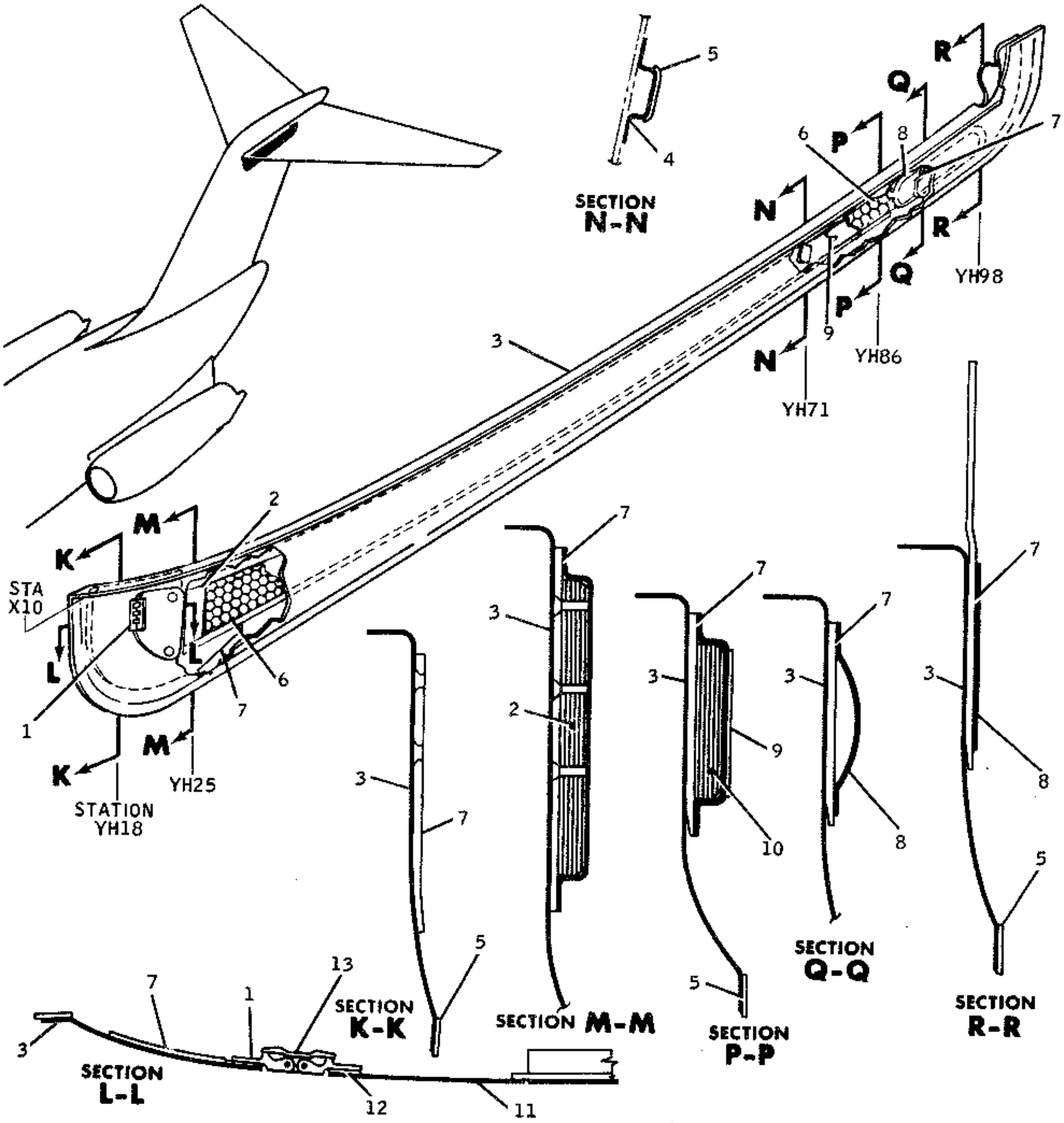
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATE	.100	CLAD 7075-T6
2	STIFFENER	.040	6061-T6
3	SKIN	.032	CLAD 7075-T6
4	DOUBLER	.032	CLAD 7075-T6
5	HONEYCOMB	.001	SEE NOTE 2
6	FILLER	.375	SEE NOTE 1
7	RUB STRIP	.031	SEE NOTE 3

NOTES:

1. ITEM 6, FILLER, MADE FROM SHEET LAMINATED PHENOLIC NON-AFTER GLOW, AMS 3607.
2. ITEM 5, HONEYCOMB, MADE FROM 0.500 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
3. ITEM 7, RUBSTRIP, MADE FROM STRIP POLYTETRAFLOUROETHYLENE, AMS 3651.
4. REFERENCE - DOUGLAS DRAWING 5912175.

BB3-691

Horizontal Stabilizer Fairings
Figure 7 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	HINGE		2546396
2	FILLER	.437	SEE NOTE 1
3	SKIN	.032	CLAD 7075-T6
4	SPACER	.032	CLAD 7075-T6
5	RUB STRIP	.031	SEE NOTE 2
6	HONEYCOMB	.001	SEE NOTE 3
7	PLATE	.100	CLAD 7075-T6
8	STIFFENER	.040	6061-T6
9	DOUBLER	.032	CLAD 7075-T6
10	FILLER	.500	SEE NOTE 1
11	DOOR	.071	CLAD 7075-T6
12	SPACER	.025	CLAD 7075-T6
13	LINK		2546397

NOTES:

1. ITEM 2 AND 10, FILLER, MADE FROM SHEET LAMINATED PHENOLIC NON-AFTER-GLOW, AMS 3607.
2. ITEM 5, RUB STRIP, MADE FROM STRIP POLYTETRAFLUOROETHYLENE, AMS 3651.
3. ITEM 6, HONEYCOMB, MADE FROM 0.500 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
4. REFERENCE - DOUGLAS DRAWING 5912176.

BB3-705

Horizontal Stabilizer Fairings
Figure 7 (Sheet 3)

HORIZONTAL STABILIZER - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates the horizontal stabilizer components. Types and gages of material used in construction of assemblies are identified in the illustrations.

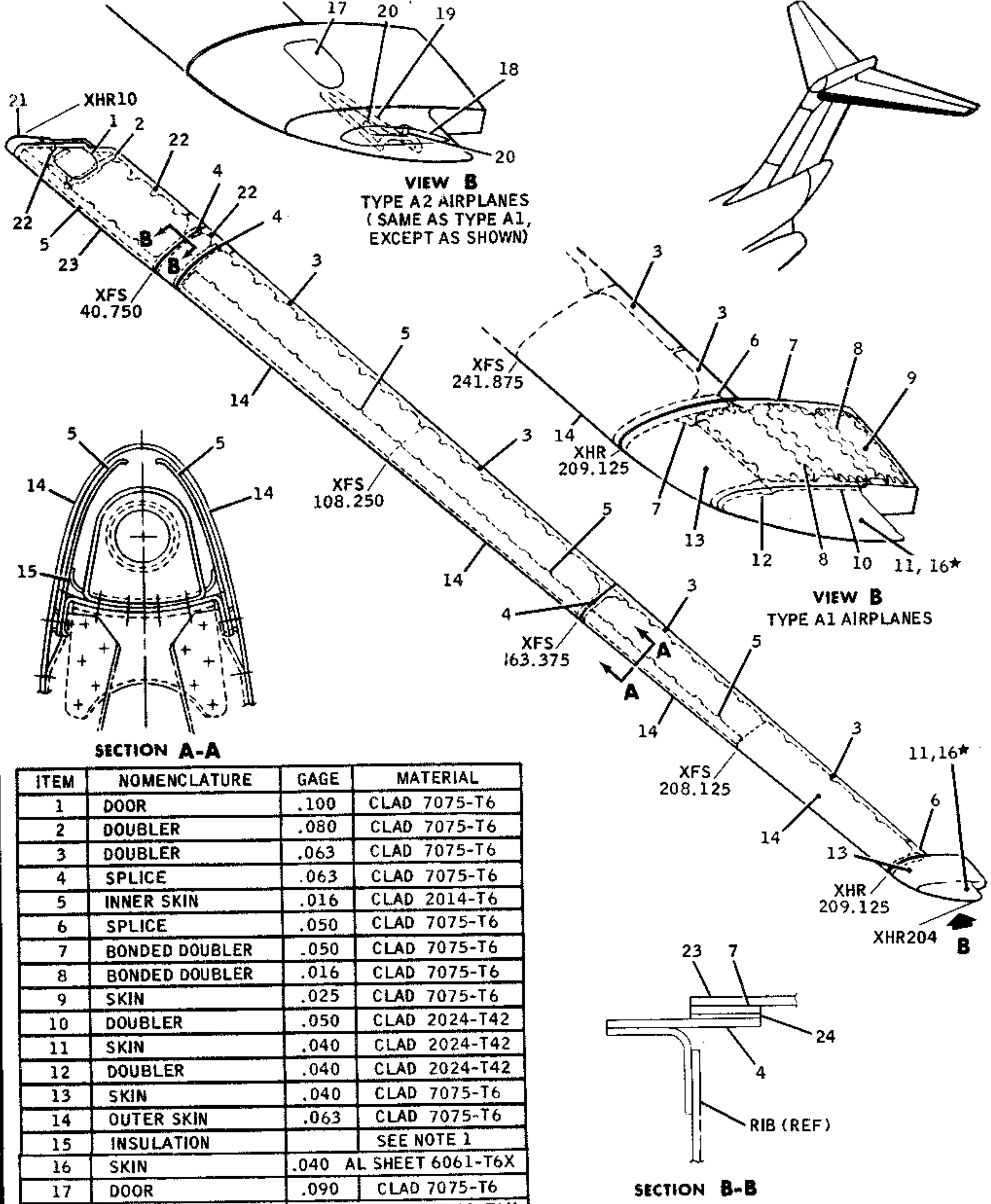
2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore structural integrity and appearance of components.

B. Any repairs to horizontal stabilizer skins between spars require specific engineering approval.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 4
Skins (See note.)	Section 55-03, Figures 3 and 4

NOTE: Any repairs to skins between spars require specific engineering approval.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOOR	.100	CLAD 7075-T6
2	DOUBLER	.080	CLAD 7075-T6
3	DOUBLER	.063	CLAD 7075-T6
4	SPLICE	.063	CLAD 7075-T6
5	INNER SKIN	.016	CLAD 2014-T6
6	SPLICE	.050	CLAD 7075-T6
7	BONDED DOUBLER	.050	CLAD 7075-T6
8	BONDED DOUBLER	.016	CLAD 7075-T6
9	SKIN	.025	CLAD 7075-T6
10	DOUBLER	.050	CLAD 2024-T42
11	SKIN	.040	CLAD 2024-T42
12	DOUBLER	.040	CLAD 2024-T42
13	SKIN	.040	CLAD 7075-T6
14	OUTER SKIN	.063	CLAD 7075-T6
15	INSULATION		SEE NOTE 1
16	SKIN	.040	AL SHEET 6061-T6X
17	DOOR	.090	CLAD 7075-T6
18	NOZZLE FAIRING	.050	AL SHEET 6061-T6X
19	TUBE 5/8 O.D. x .035 WALL		AL 6061-T4
20	TUBE 1/2O.D. x .058 WALL		AL 6061-T4
21	FAIRING	.050	CLAD 7075-T6
22	DOUBLER	.050	CLAD 7075-T6
23	OUTER SKIN	.050	CLAD 7075-T6
24	SHIM	.012	CLAD 2024-T3

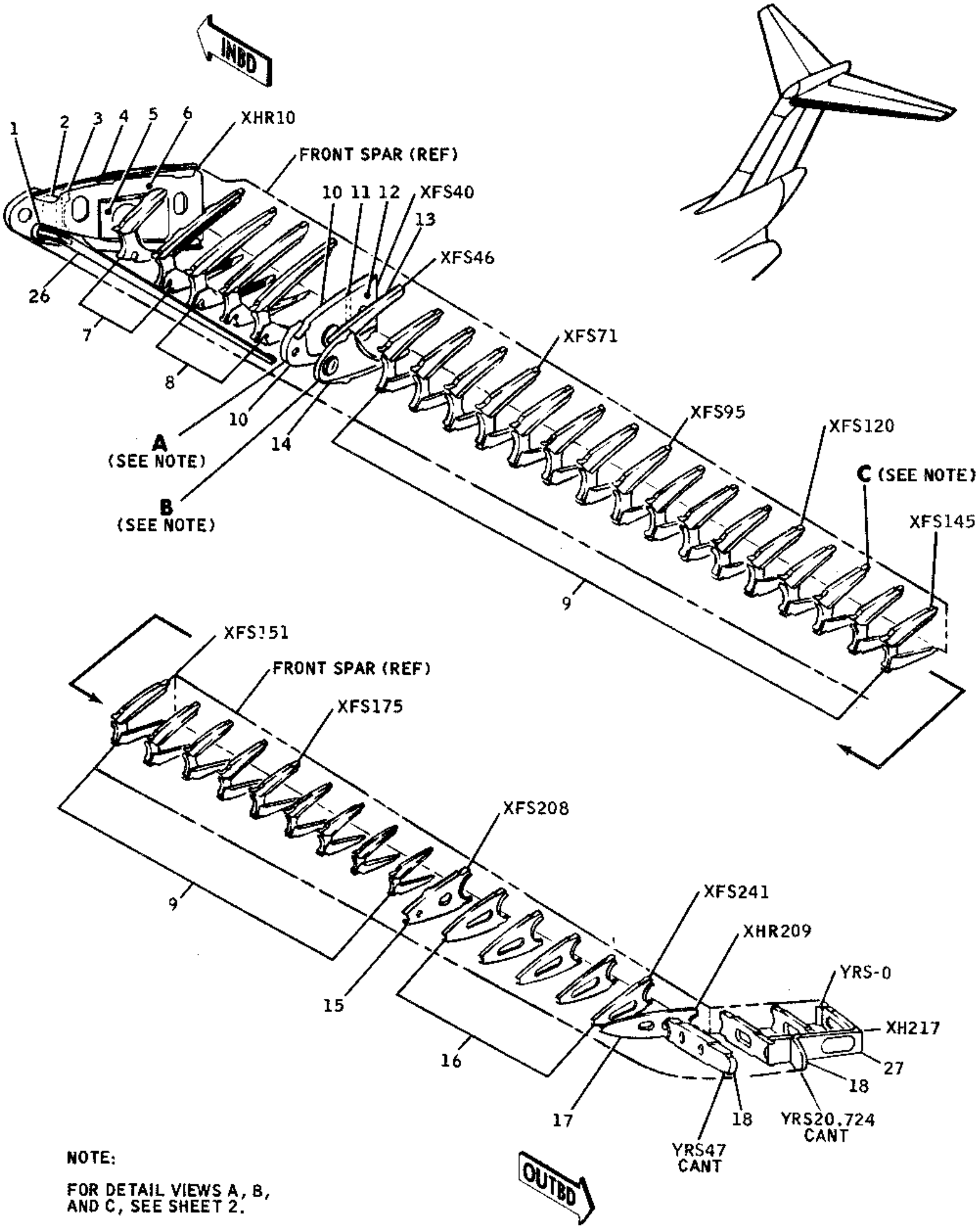
NOTES:

1. ITEM 15, INSULATION, IS B-STAGE PHENOLIC NO. 181 GLASS FABRIC.
2. ★ITEM 16 USED ON TYPE A2 ONLY.
3. REFERENCE DOUGLAS DRAWING 5910625, 5918015, AND 5918007.

3B3-825A

Leading Edge and Tip Plating -- Type A
Figure 1

Printed in U.S.A.

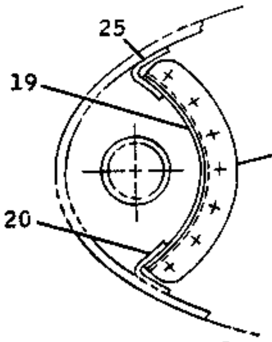


NOTE:

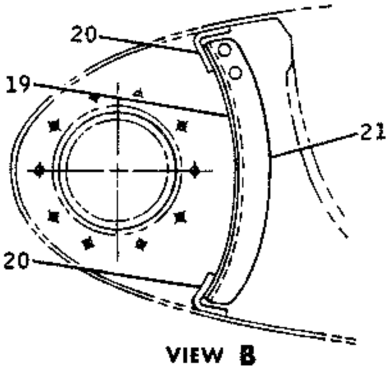
FOR DETAIL VIEWS A, B, AND C, SEE SHEET 2.

BB3-823A

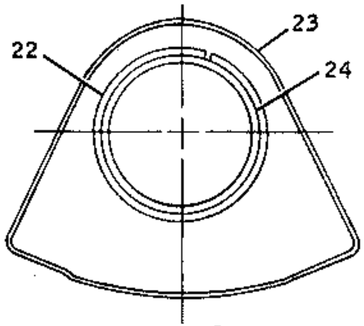
Leading Edge and Tip Structure -- Type A
Figure 2 (Sheet 1)



VIEW A
LOOKING INBOARD AT STATION XFS40.750 DETAIL SHOWING D-DUCT ASSEMBLY (D-DUCT OMITTED FROM MAIN VIEW FOR CLARITY)



VIEW B
LOOKING INBOARD AT STATION XFS46.875 DETAIL SHOWING D-DUCT ASSEMBLY (D-DUCT OMITTED FROM MAIN VIEW FOR CLARITY)



VIEW C
DETAIL OF ICE PROTECTION BRACKET ASSEMBLY (TYPICAL)

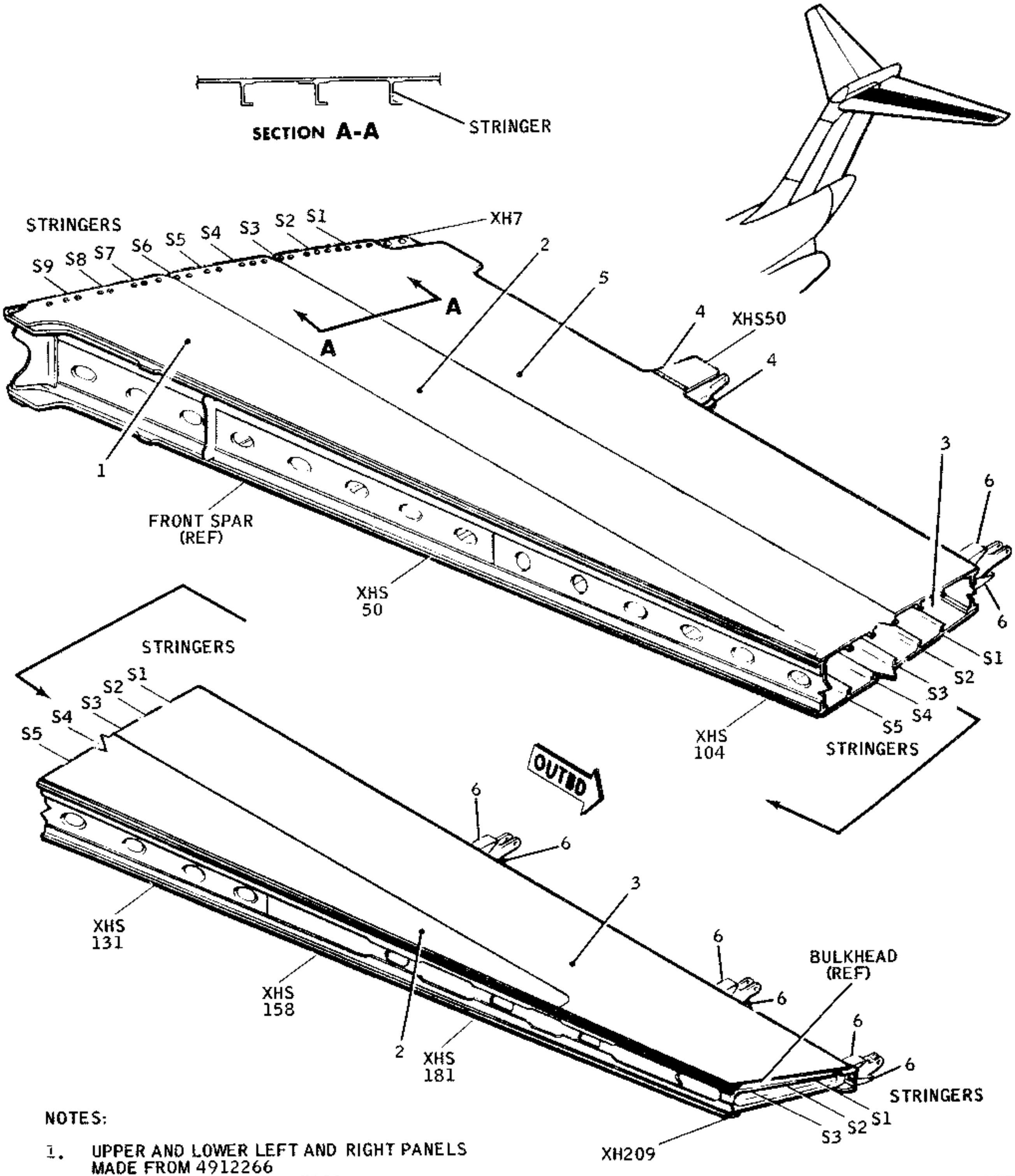
NOTES:

1. ITEM 24 MAY BE PURCHASED FROM RAYBESTOS - MANHATTAN INC., MANHATTAN RUBBER DIVISION, PASSAIC, N.J.
2. REFERENCE - DOUGLAS DRAWING 5910403, 5910625, 5918007, AND 5918015.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP	2.500	PLATE 7075-T651
2	FITTING	2.000	PLATE 7075-T651
3	ANGLE	.040	CLAD 7075-T6
4	CAP	2.500	PLATE 7075-T651
5	DOUBLER	.050	CLAD 7075-T6
6	WEB	.063	CLAD 7075-T6
7	FORMER		
	ZEE	.040	CLAD 7075-T6
	SPLICE PLATE	.040	CLAD 2014-T6
8	FORMER		
	ZEE	.040	CLAD 7075-T6
	GUSSET	.040	CLAD 2014-T6
9	FORMER		
	ZEE	.050	CLAD 7075-T6
	GUSSET	.050	CLAD 2014-T6
10	CAP	.050	CLAD 7075-T6
11	STIFFENER		1465089
12	WEB	.040	CLAD 2014-T6
13	CHANNEL	.040	CLAD 7075-T6
14	RIB	.040	CLAD 7075-T6
15	FORMER	.050	CLAD 2014-T6
16	FORMER	.050	CLAD 7075-T6
17	FORMER	.040	CLAD 2024-T42
18	RIB	.040	CLAD 2024-T42
19	WEB	.016	CLAD 2014-T6
20	ANGLE	.050	CLAD 7075-T6
21	STIFFENER	.040	CLAD 2014-T6
22	END	.040	CLAD 6061-T6
23	CAP	.040	CLAD 6061-T6
24	ETCHED TAPE	LS9280 - .090 X .625	
25	ANGLE	.040	CLAD 2014-T6
26	FITTING	2.000	PLATE 2014-T651
27	INTERCOSTAL	.050	CLAD 2024-T42

BB3-824A

Leading Edge and Tip Structure -- Type A
Figure 2 (Sheet 2)



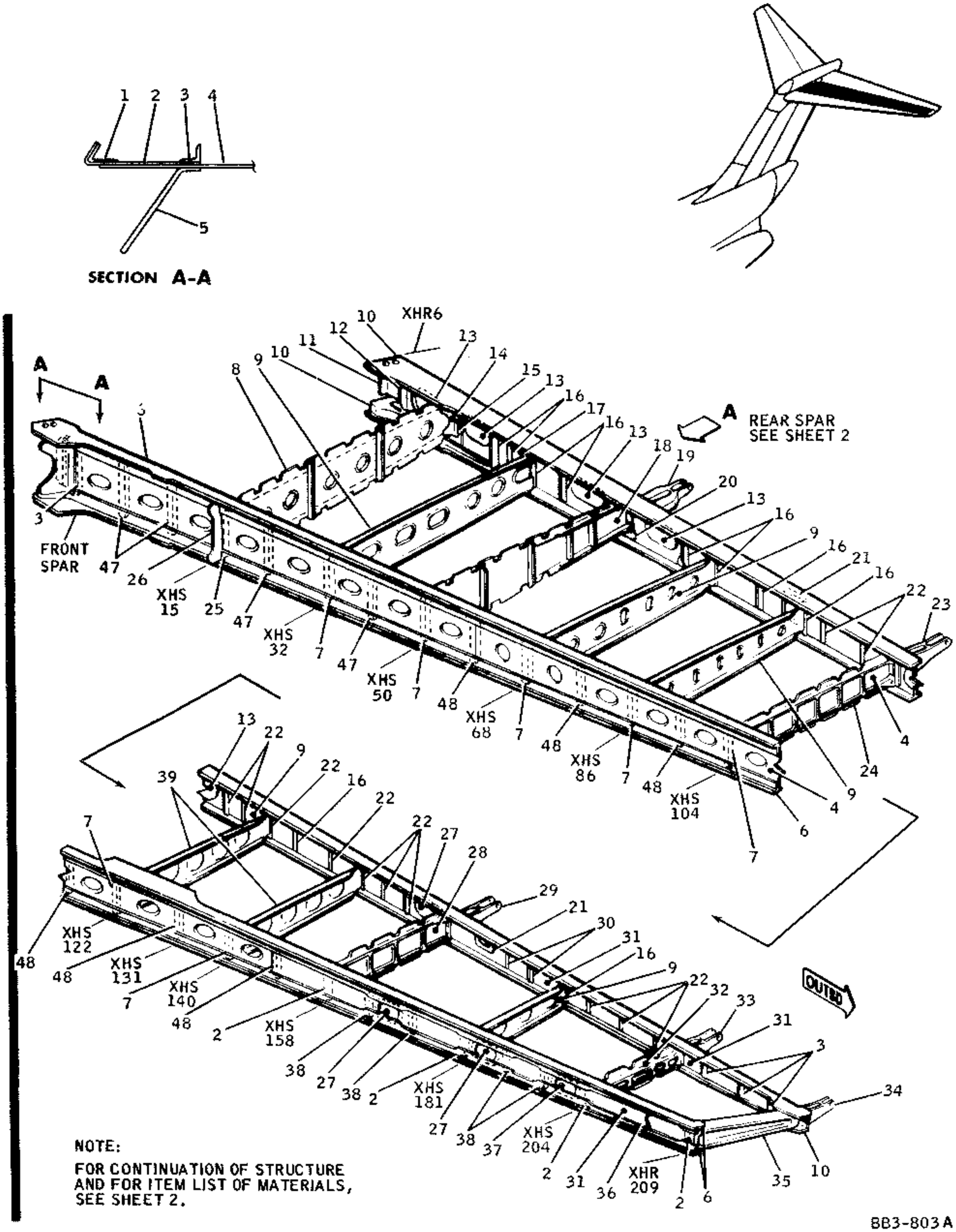
NOTES:

1. UPPER AND LOWER LEFT AND RIGHT PANELS MADE FROM 4912266 ALUMINUM PLATE 7075-T651.
2. UPPER AND LOWER LEFT AND RIGHT PANELS MADE FROM 4912264 ALUMINUM PLATE 7075-T651.
3. UPPER AND LOWER LEFT AND RIGHT PANELS MADE FROM 3918004 ALUMINUM PLATE 7075-T651.
4. REFERENCE-DOUGLAS DRAWING 5922575.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL 5922576,-501,-502		SEE NOTE 1
2	PANEL 5922577,-501,-502		SEE NOTE 2
3	PANEL 5922578,-501,-502		SEE NOTE 3
4	DOOR	.190	CLAD 2014-T6
5	PANEL 5922578,-1,-2		SEE NOTE 3
6	FAIRING	.040	2024-T42

BB3-802

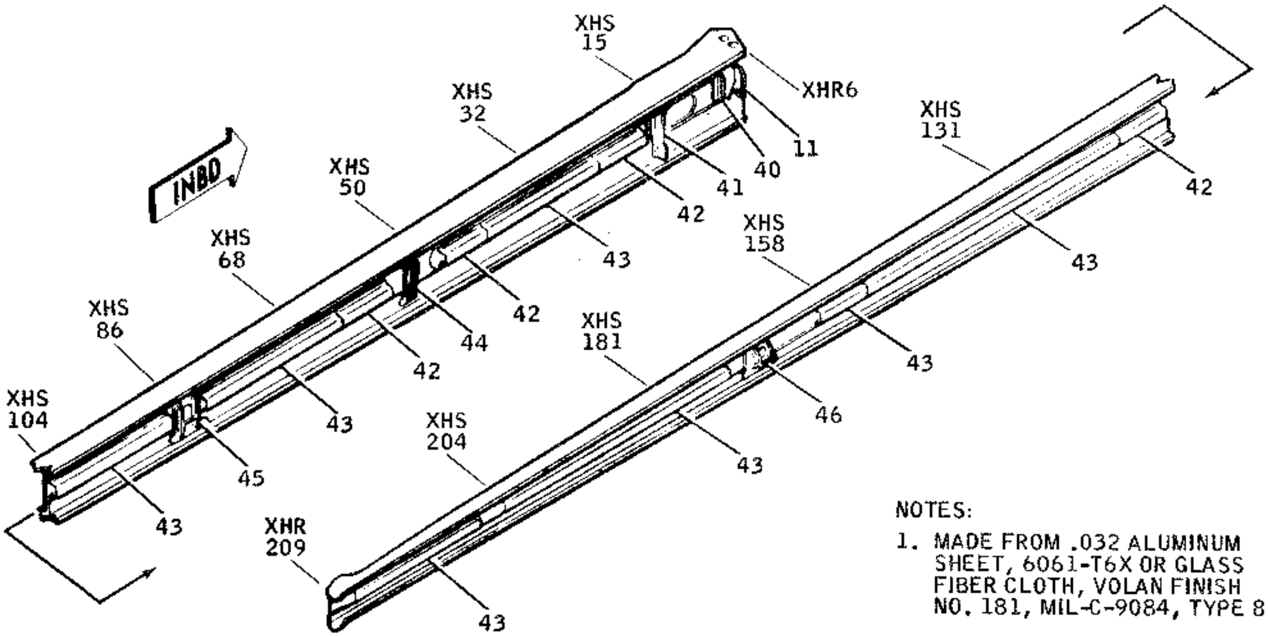
Aft Section Plating -- Type A
Figure 3



NOTE:
FOR CONTINUATION OF STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.

8B3-803A

Aft Section Structure -- Type A
Figure 4 (Sheet 1)



VIEW A

REAR SPAR
LOOKING FORWARD

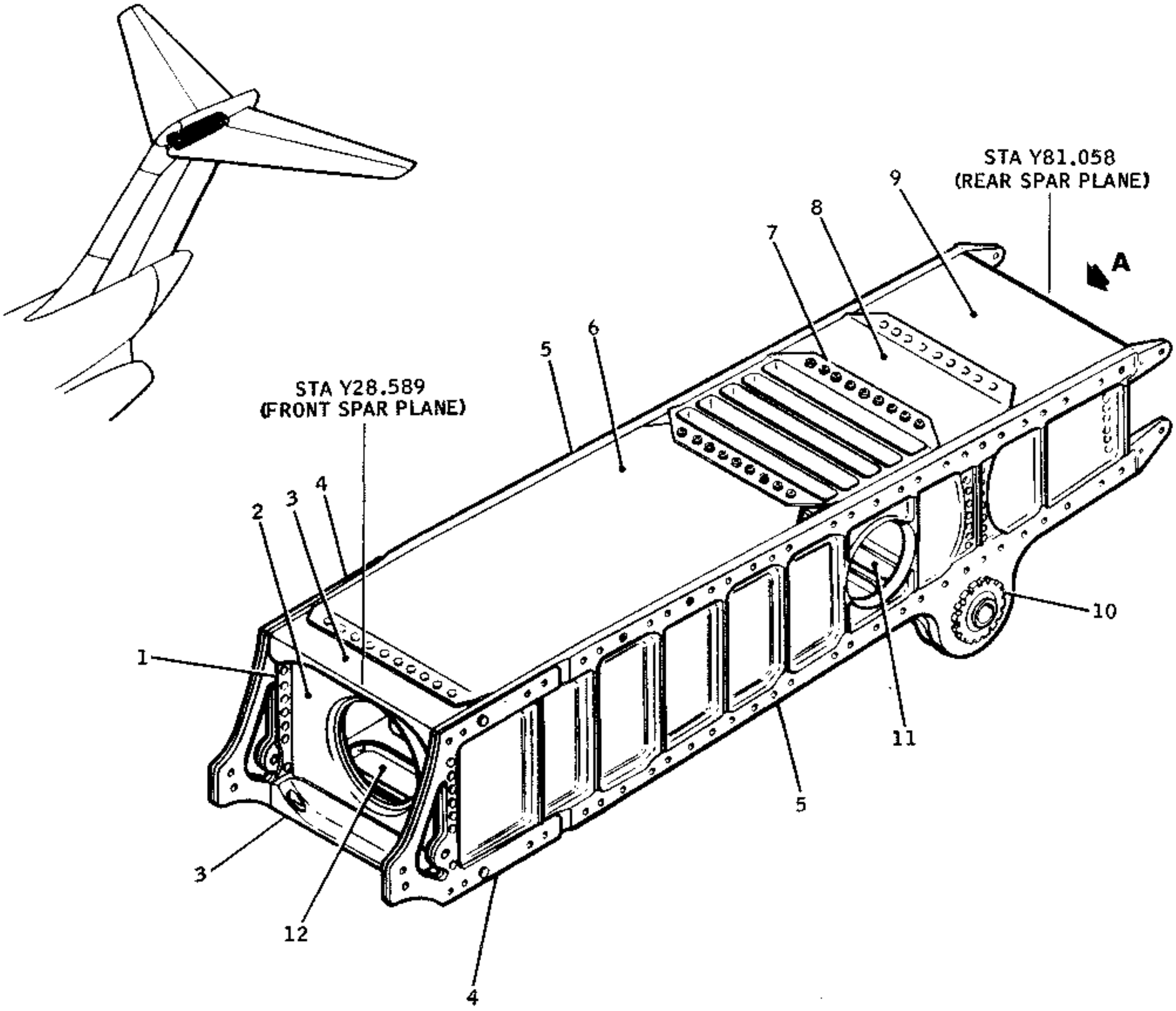
NOTES:

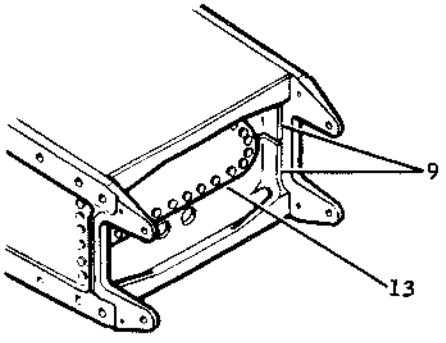
1. MADE FROM .032 ALUMINUM SHEET, 6061-T6X OR GLASS FIBER CLOTH, VOLAN FINISH NO. 181, MIL-C-9084, TYPE 8.
2. REFERENCE - DOUGLAS DRAWING 5922575.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ATTACH DOUBLER	.063	CLAD 7075-T6
2	ATTACH ANGLE	.063	CLAD 7075-T6
3	STIFFENER		1418821
4	WEB	.080	CLAD 7075-T6
5	ANGLE GUSSET	.125	CLAD 7075-T6
6	CAP		3912303
7	ATTACH CHANNEL	.125	CLAD 7075-T6
8	WEB STIFFENER TEE	.032	CLAD 7075-T6 1276248 1221366
9	WEB	.050	CLAD 7075-T6
10	CAP		3924662
11	ANGLE	.125	CLAD 7075-T6
12	TEE		1440004
13	DOOR	.080	CLAD 7075-T6
14	TEE		2615551
15	DOUBLER	.050	CLAD 7075-T6
16	ANGLE		1415741
17	WEB	.080	CLAD 7075-T6
18	WEB STIFFENER STIFFENER CAP	.040 2.500	CLAD 7075-T6 1418821 1276248 BAR 7075-T651
19	BRACKET, 5918084		FORGING 7075-T411
20	TEE		1383060
21	CUP		SEE NOTE 1
22	ANGLE		1294834
23	BRACKET	1.750	PLATE 7075-T7351
24	RIB	1.250	PLATE 7075-T651
25	ATTACH ANGLE	.125	CLAD 7075-T6
26	ANGLE	.050	CLAD 7075-T6
27	DOOR	.032	CLAD 7075-T6
28	BULKHEAD	1.000	PLATE 7075-T651
29	BRACKET	1.750	PLATE 7075-T7351
30	ANGLE		1242527
31	WEB	.032	CLAD 7075-T6
32	RIB	1.125	PLATE 7075-T651
33	BRACKET	1.375	PLATE 7075-T7351
34	SUPPORT	1.500	PLATE 7075-T7351
35	BULKHEAD	2.000	PLATE 7075-T651
36	STIFFENER TEE		1440048
37	COVER	.032	CLAD 7075-T6
38	STIFFENER		1415595
39	RIB	.050	CLAD 7075-T6
40	TEE		1329805
41	TEE		2620678
42	SEAL	.020	SHEET 6061-T6
43	SEAL	.012	SHEET 6061-T6
44	FITTING	2.000	PLATE 7075-T7351
45	FITTING		FORGING 7075-T651
46	FITTING		FORGING 7075-T651
47	STIFFENER		1290336
48	STIFFENER		1290337

BB3-804A

Aft Section Structure -- Type A
Figure 4 (Sheet 2)





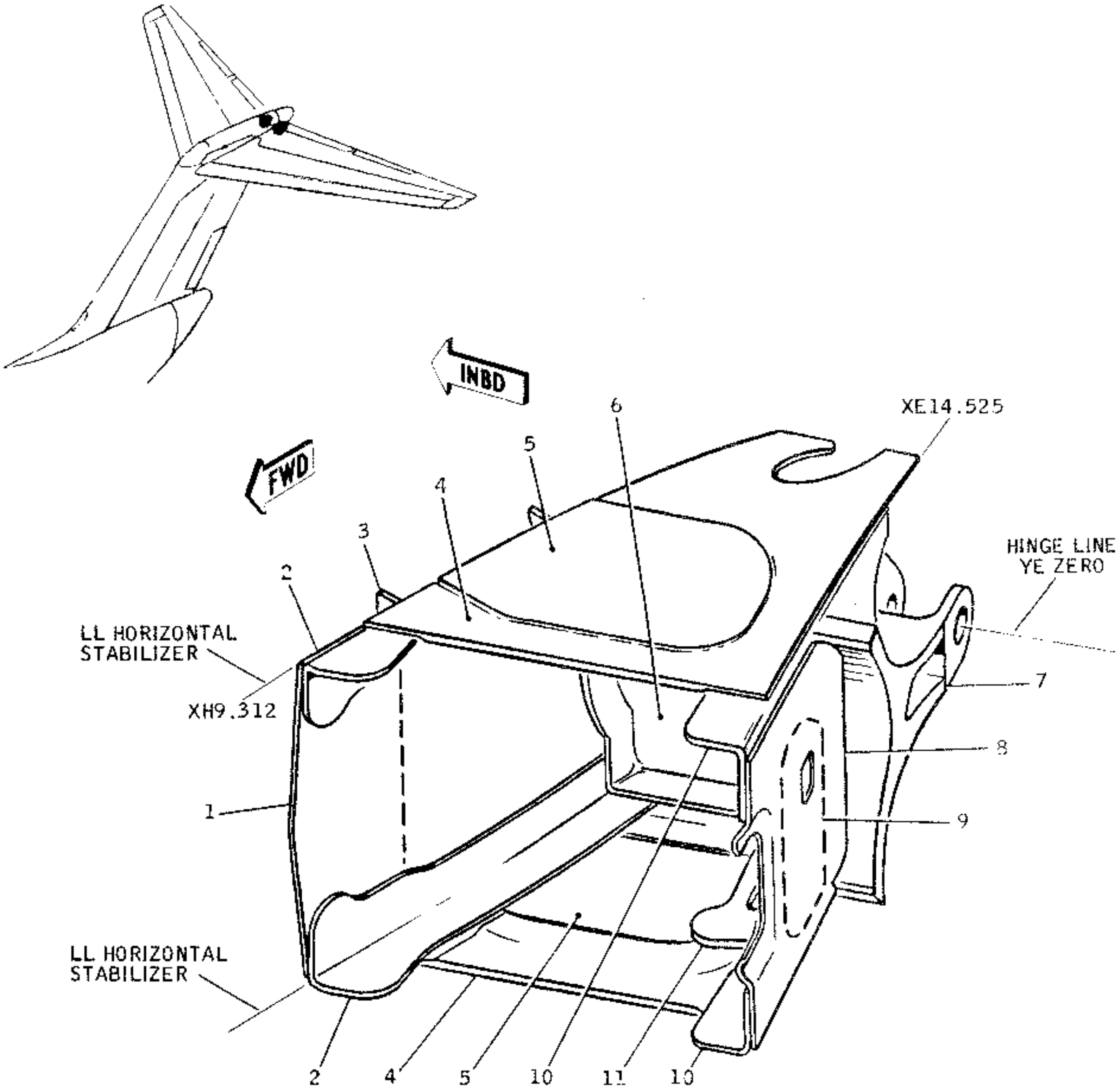
VIEW **A**

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE		1416793
2	WEB	.125	CLAD 7075-T6
3	CAP	2.000	PLATE 7075-T651
4	FITTING	.375	PLATE 7075-T651
5	RIB	.750	PLATE 7075-T651
6	PLATE	1.750	PLATE 7075-T651
7	PLATE	1.500	PLATE 7075-T651
8	FITTING, NO. 5918098		FORGING 7075-T411
9	FITTING, NO. 5912481		FORGING 7075-T6
10	LOCKNUT, NO. 4646246 LOCKWASHER NO. 4646247 BUSHING, NO. 4912480		4340 STEEL 347 CRES AISI 431 CRES
11	PLATE	1.625	PLATE 7075-T651
12	PLATE	1.750	PLATE 7075-T651
13	COVER	.160	CLAD 7075-T6

REFERENCE DOUGLAS DRAWING 5910405

BB3-187C

Center Section Plating and Structure -- Type A
Figure 5



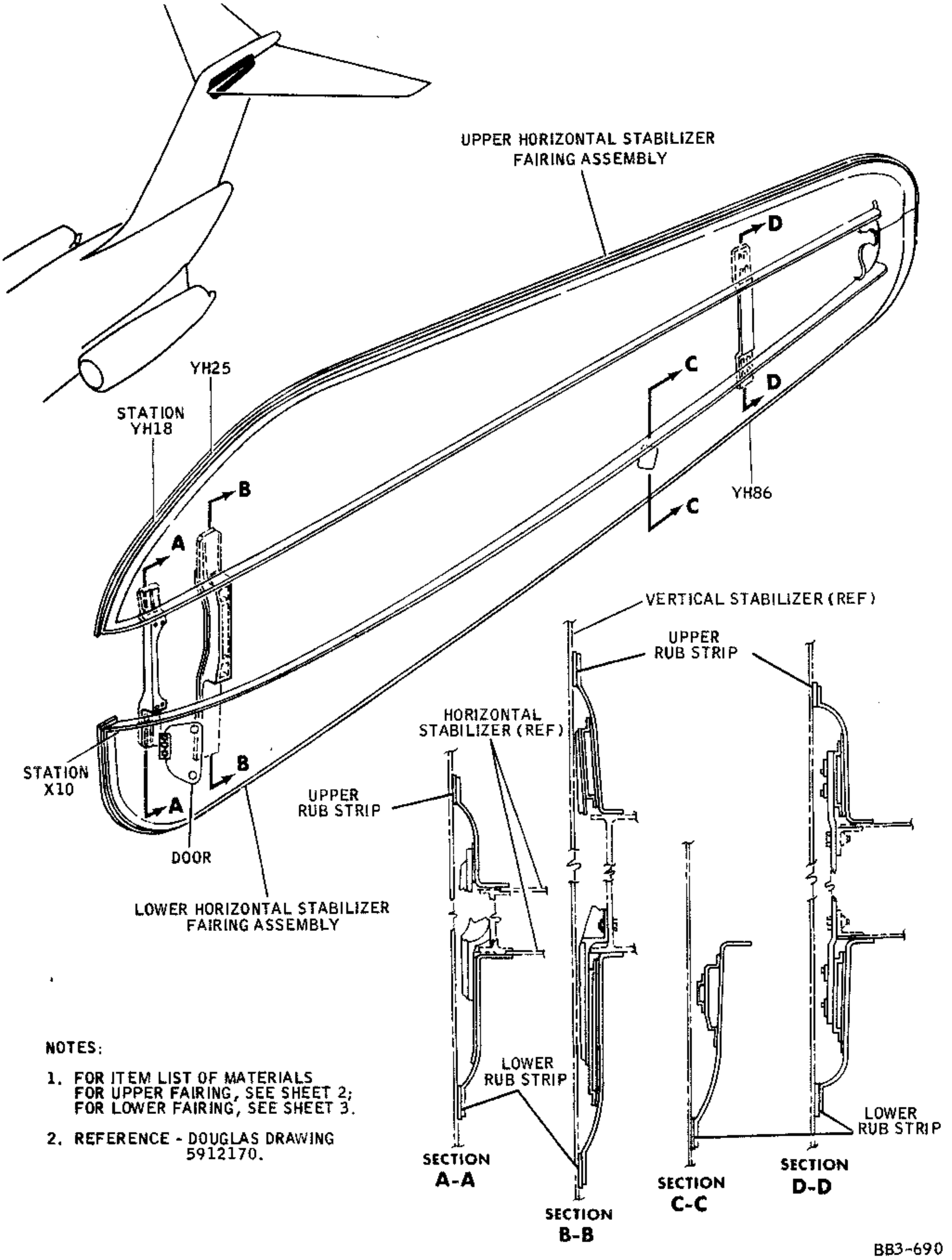
VIEW LOOKING DOWN AT
UPPER SURFACE, LEFT SIDE

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.040	CLAD 7075-T6
2	CAP 3918023-1, -2		1152375
3	DOUBLER	.040	CLAD 7075-T6
4	SKIN	.160	CLAD 7075-T6
5	DOOR 9918533-1,-2	.090	CLAD 7075-T6
6	FITTING 3918022-1		FORGING 7075-T6
7	FITTING 5918113-1		FORGING 7075-T6
8	WEB	.050	CLAD 7075-T6
9	FITTING 4918058-1		PLATE 7075-T651
10	CAP 3918021-1, -2		1285511
11	ANGLE		1223583

REFERENCE DOUGLAS DRAWING 5918020

BB3-186

Hinge Support - Type A
Figure 6



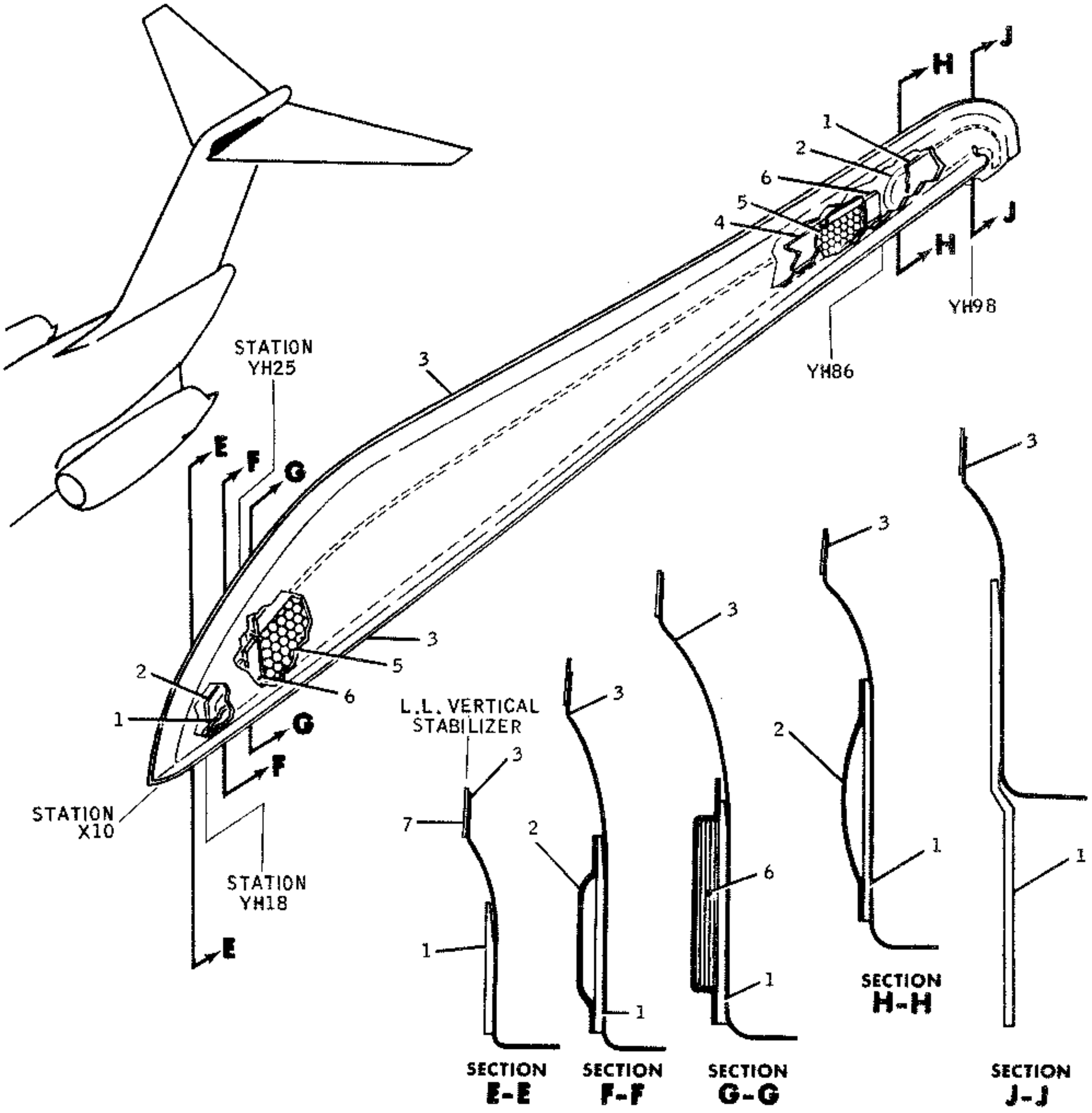
NOTES:

1. FOR ITEM LIST OF MATERIALS FOR UPPER FAIRING, SEE SHEET 2; FOR LOWER FAIRING, SEE SHEET 3.
2. REFERENCE - DOUGLAS DRAWING 5912170.

BB3-690

Printed in U.S.A.

Horizontal Stabilizer Fairings -- Type A
Figure 7 (Sheet 1)



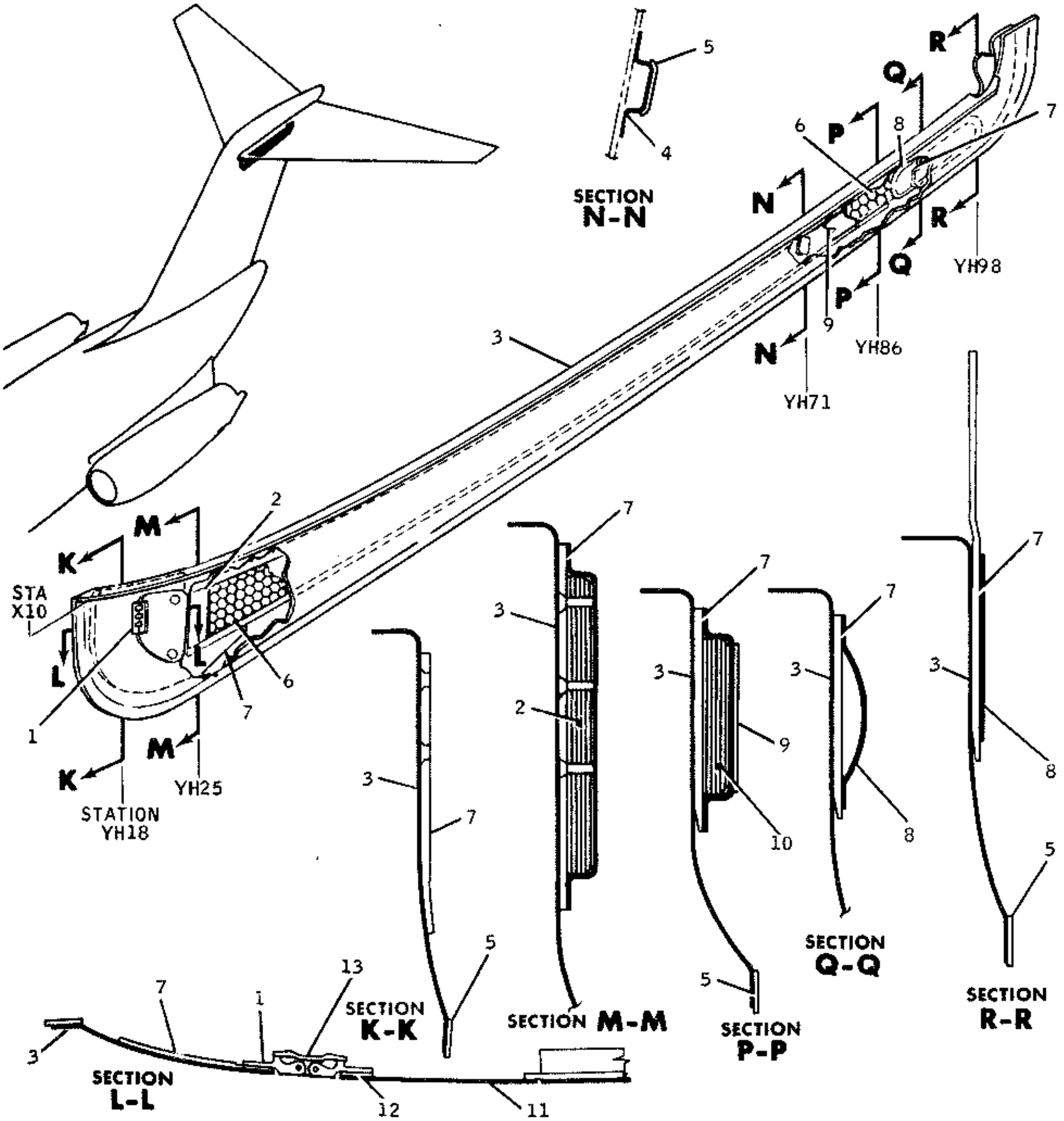
NOTES:

1. ITEM 6, FILLER, MADE FROM SHEET LAMINATED PHENOLIC NON-AFTER GLOW, AMS 3607.
2. ITEM 5, HONEYCOMB, MADE FROM 0.500 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
3. ITEM 7, RUBSTRIP, MADE FROM STRIP POLYTETRAFLOUROETHYLENE, AMS 3651.
4. REFERENCE - DOUGLAS DRAWING 5912175.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PLATE	.100	CLAD 7075-T6
2	STIFFENER	.040	6061-T6
3	SKIN	.032	CLAD 7075-T6
4	DOUBLER	.032	CLAD 7075-T6
5	HONEYCOMB	.001	SEE NOTE 2
6	FILLER	.375	SEE NOTE 1
7	RUB STRIP	.031	SEE NOTE 3

BB3-691

Horizontal Stabilizer Fairings -- Type A
Figure 7 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	HINGE		2546396
2	FILLER	.437	SEE NOTE 1
3	SKIN	.032	CLAD 7075-T6
4	SPACER	.032	CLAD 7075-T6
5	RUB STRIP	.031	SEE NOTE 2
6	HONEYCOMB	.001	SEE NOTE 3
7	PLATE	.100	CLAD 7075-T6
8	STIFFENER	.040	6061-T6
9	DOUBLER	.032	CLAD 7075-T6
10	FILLER	.500	SEE NOTE 1
11	DOOR	.071	CLAD 7075-T6
12	SPACER	.025	CLAD 7075-T6
13	LINK		2546397

NOTES:

1. ITEM 2 AND 10, FILLER, MADE FROM SHEET LAMINATED PHENOLIC NON-AFTER-GLOW, AMS 3607.
2. ITEM 5, RUB STRIP, MADE FROM STRIP POLYTETRAFLUOROETHYLENE, AMS 3651.
3. ITEM 6, HONEYCOMB, MADE FROM 0.500 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
4. REFERENCE - DOUGLAS DRAWING 5912176.

BB3-705

Horizontal Stabilizer Fairings -- Type A
Figure 7 (Sheet 3)

ELEVATOR - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates elevator components. Types and gages of material used in construction of the assemblies are identified in the illustrations.

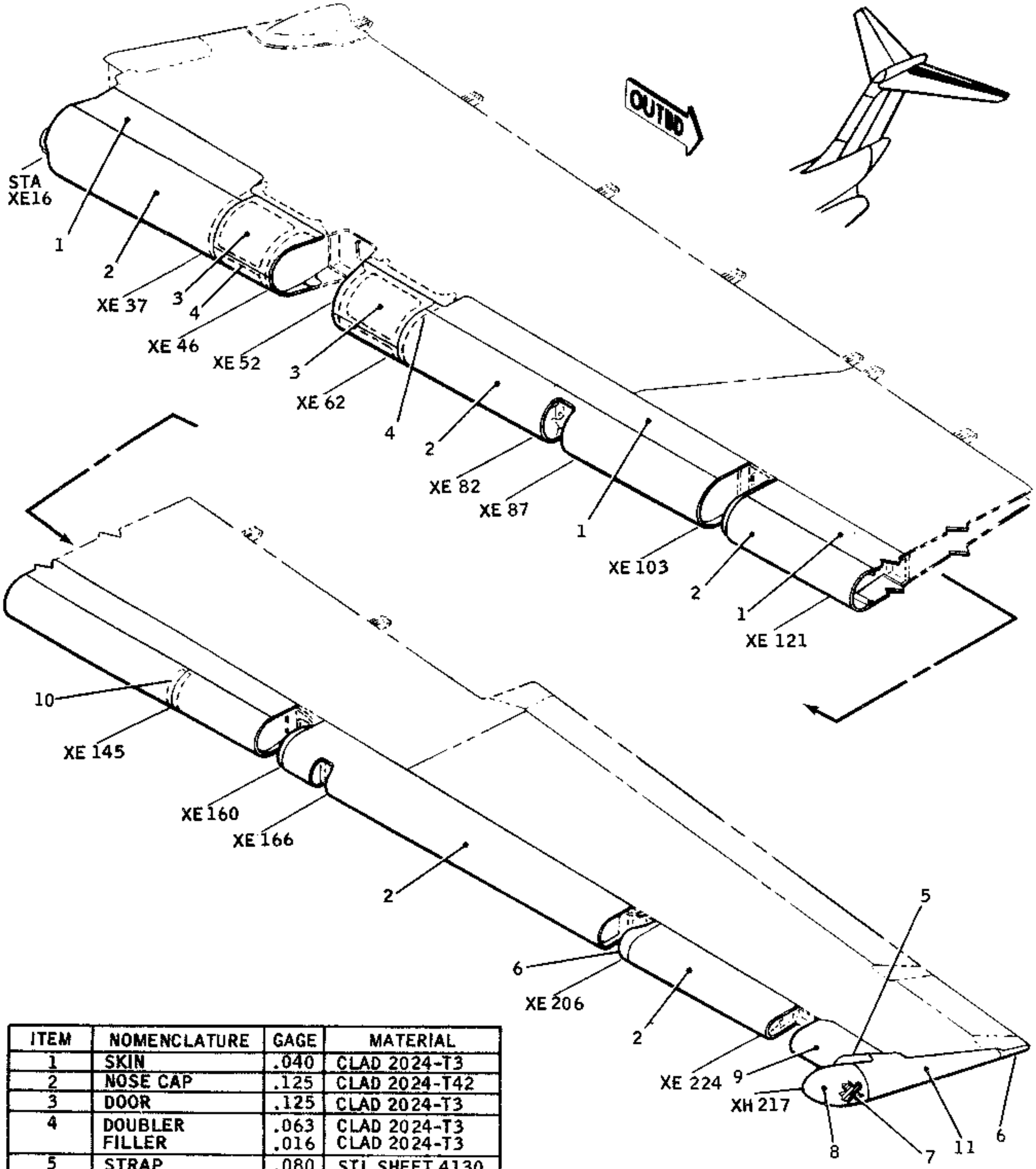
B. This section also contains balancing procedures for the elevator and elevator control tab (see 55-20-1). When a repair is made to an elevator or elevator control tab, the surface must be rebalanced. When a repair is made to an elevator control tab or geared tab, the surface must be weighed as outlined in the balancing procedure.

NOTE: The elevator geared tab does not require balancing. Weight data is provided in the balancing procedure (see 55-20-1).

2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore structural integrity and appearance of components.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 1
Skins (including trailing edge)	Section 55-03, Figures 1, 2, 5, and 6
Honeycomb	Section 55-04 Figures 1 through 3

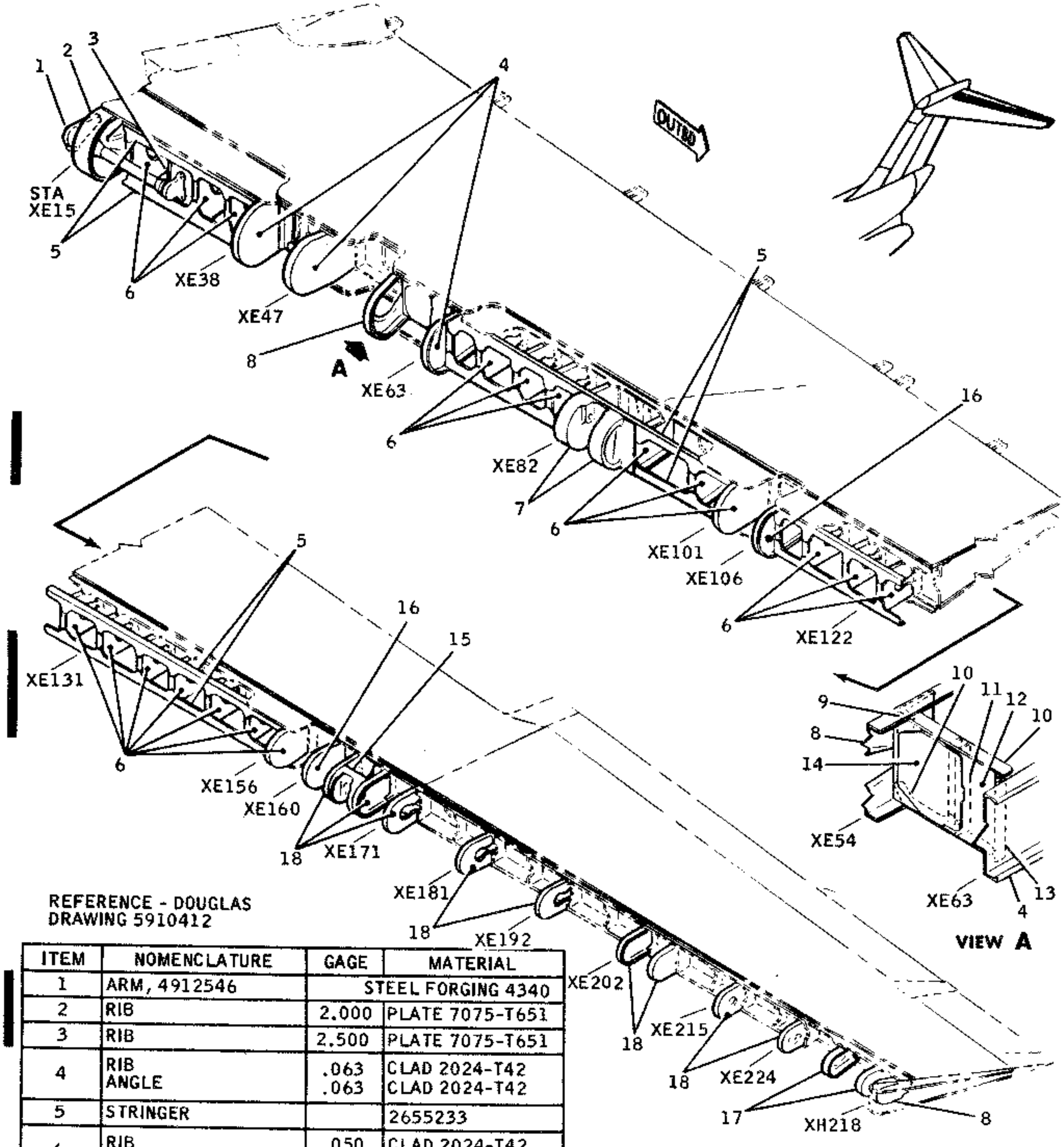


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.040	CLAD 2024-T3
2	NOSE CAP	.125	CLAD 2024-T42
3	DOOR	.125	CLAD 2024-T3
4	DOUBLER FILLER	.063 .016	CLAD 2024-T3 CLAD 2024-T3
5	STRAP PLATE	.080 .080	STL SHEET 4130 STL SHEET 4130
6	TIP END	.020	CLAD 2024-T42
7	WEIGHT		SEE NOTE 1
8	COVER FORMER	.063 .063	STL SHEET 4130 STL SHEET 4130
9	NOSE CAP	.063	CLAD 2024-T42
10	DOUBLER	.125	CLAD 2024-T3
11	TIP COVER	.071	CLAD 2024-T42

NOTES:
1. CAST LEAD COUNTERWEIGHT ALLOY.
2. REFERENCE - DOUGLAS DRAWING 5910412.

BB3-188A

Elevator Leading Edge Plating
Figure 1



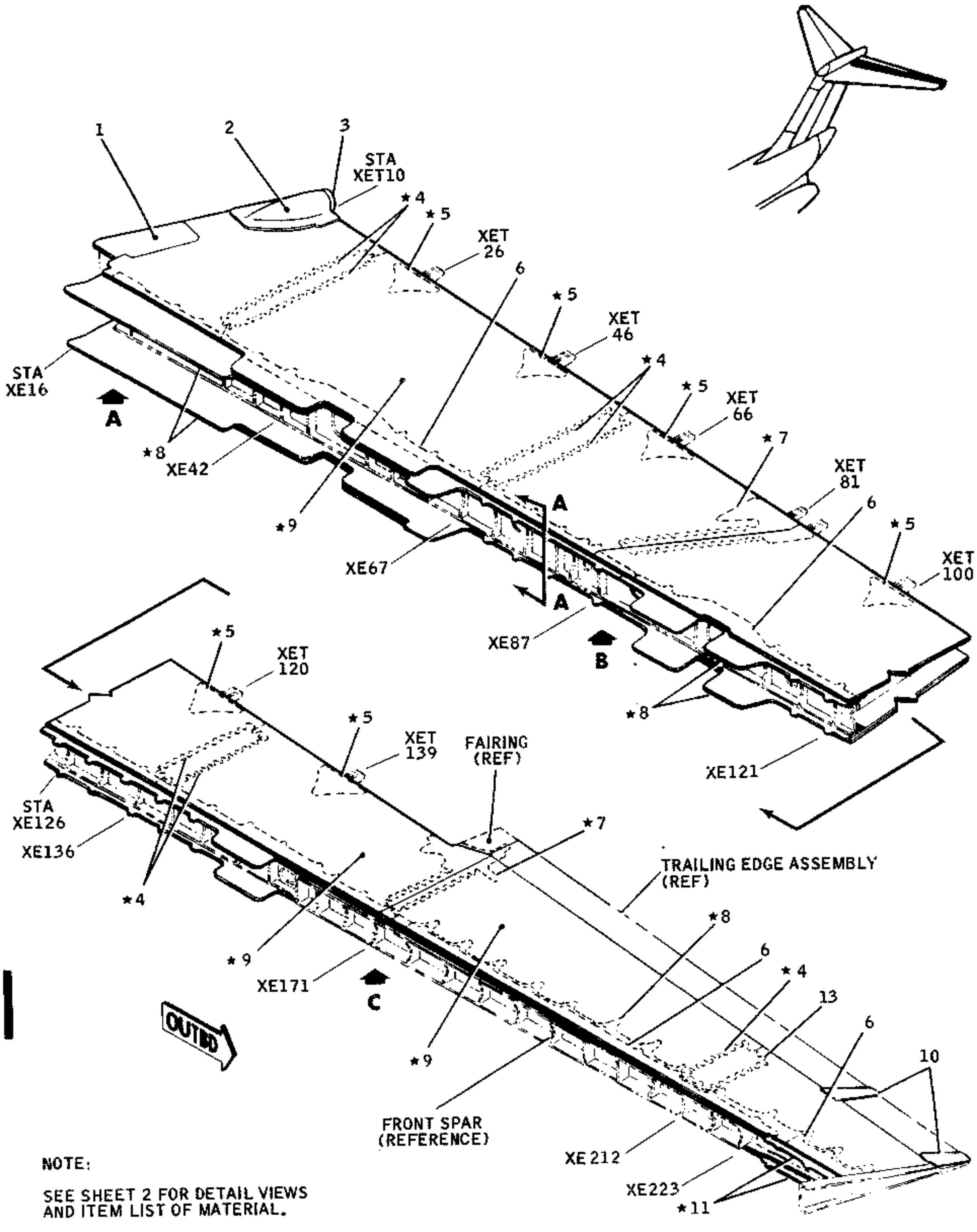
REFERENCE - DOUGLAS DRAWING 5910412

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ARM, 4912546		STEEL FORGING 4340
2	RIB	2.000	PLATE 7075-T651
3	RIB	2.500	PLATE 7075-T651
4	RIB ANGLE	.063 .063	CLAD 2024-T42 CLAD 2024-T42
5	STRINGER		2655233
6	RIB ANGLE	.050 .063	CLAD 2024-T42 CLAD 2024-T42
7	FITTING, 3918047		FORGING 7075-T411
8	RIB	.063	CLAD 2024-T42
9	FITTING		1372665
10	ANGLE	.080	CLAD 2024-T42
11	CHANNEL	.080	CLAD 2024-T42
12	WEB	.040	CLAD 2024-T3
13	ANGLE	.063	CLAD 2024-T42

ITEM	NOMENCLATURE	GAGE	MATERIAL
14	COVER	.040	CLAD 2024-T3
15	FITTING, 3918033		FORGING 7075-T411
16	RIB ANGLE	.050	CLAD 2024-T42 1701177
17	RIB STRAP	.063 .040	CLAD 2024-T42 CLAD 2024-T3
18	RIB	.050	CLAD 2024-T42

BB3-189A

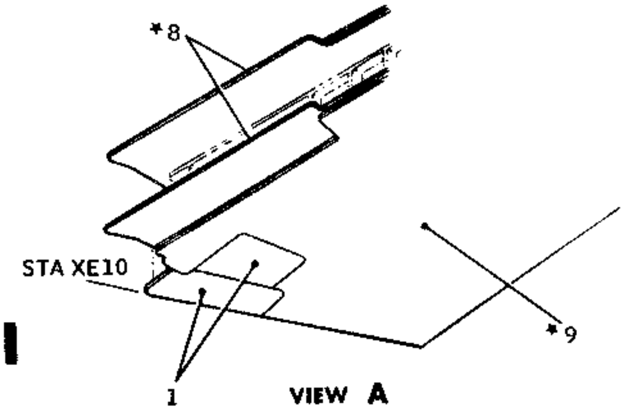
Elevator Leading Edge Structure
Figure 2



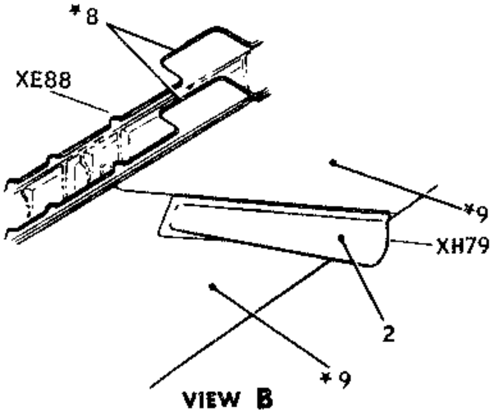
NOTE:

SEE SHEET 2 FOR DETAIL VIEWS AND ITEM LIST OF MATERIAL.

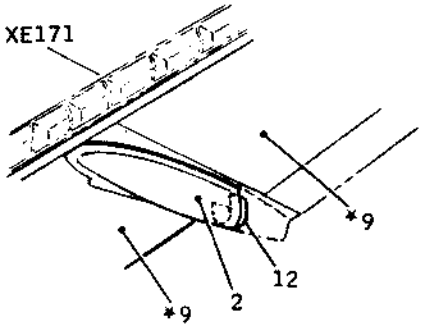
Elevator Center Section Plating
Figure 3 (Sheet 1)



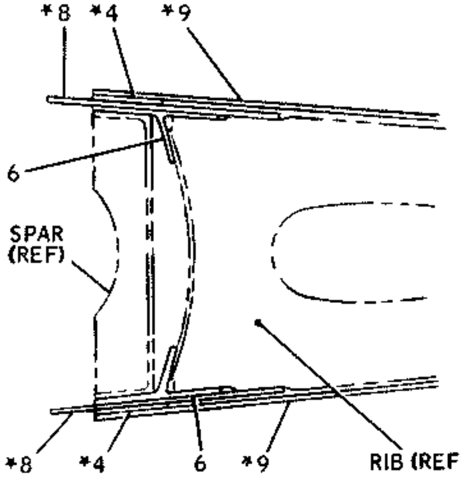
VIEW A
VIEW LOOKING UP



VIEW B
VIEW LOOKING UP



VIEW C
VIEW LOOKING UP



SECTION A-A

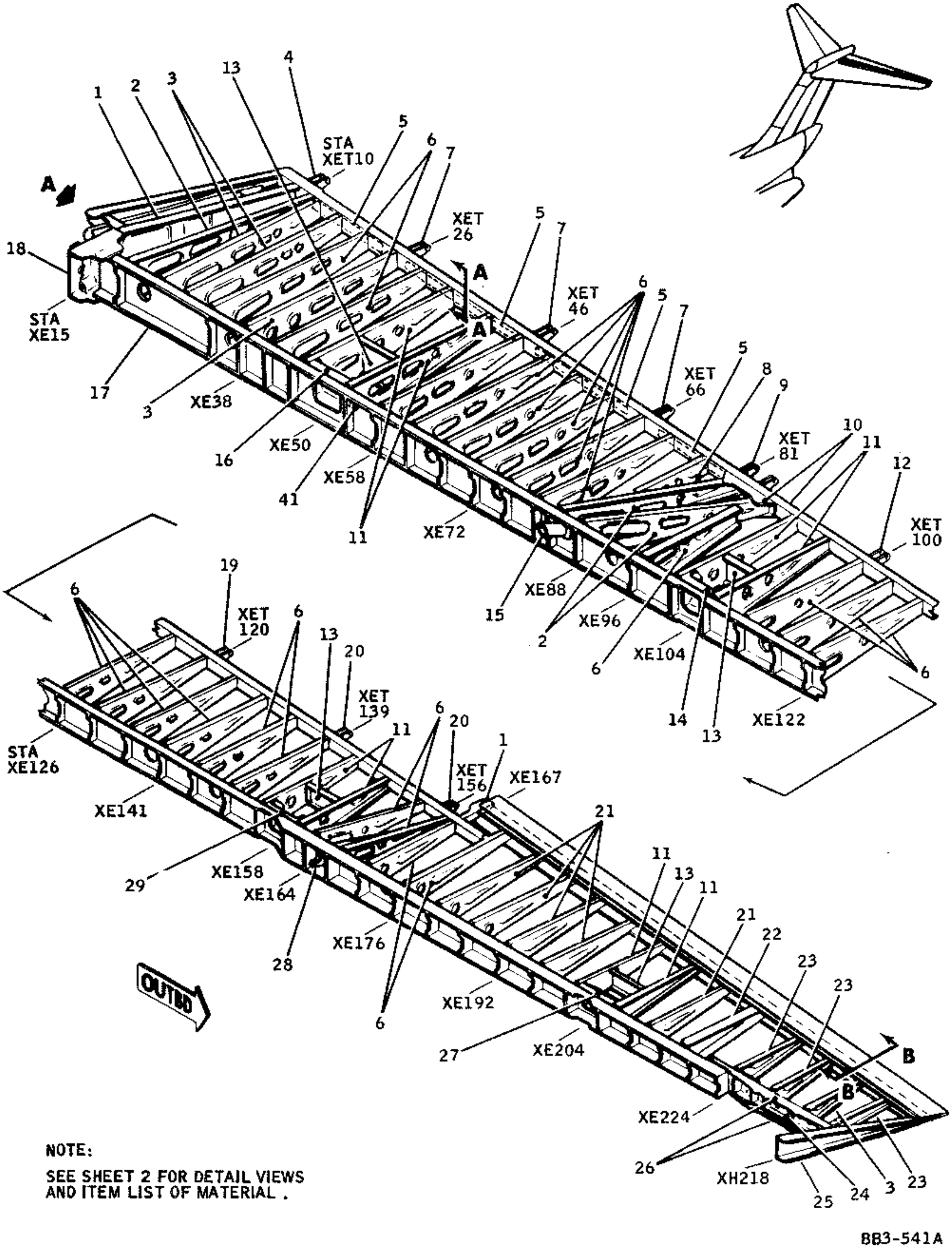
ITEM	NOMENCLATURE	GAGE	MATERIAL	
1	DOOR	.040	CLAD 2024-T3	
2	FAIRING	.032	CLAD 2024-T42	
3	INTERCOSTAL SPACER	.040 .032	CLAD 2024-T42 CLAD 2024-T3	
* 4	FINGER DOUBLER	.012	CLAD 2014-T6	SEE NOTE 2
* 5	GUSSET	.025	CLAD 2014-T6	
6	TEE		2918090	
* 7	SPLICE DOUBLER	.025	CLAD 2014-T6	
* 8	STRAP DOUBLER	.063	CLAD 2014-T6	
* 9	SKIN	.016	CLAD 2014-T6	
10	DOUBLER	.020	CLAD 2024-T42	
* 11	SPACER	.032	CLAD 2014-T6	
12	STRAP	.050	CLAD 2024-T3	
13	FINGER DOUBLER	.025	CLAD 2014-T6	

NOTES:

1. * INDICATES BONDED ITEM.
2. ITEMS 4, 5, 6, 7, 8 AND 9 ARE TYPICAL FOR UPPER AND LOWER SKIN INSTALLATIONS.
3. REFERENCE - DOUGLAS DRAWING 5910412.

BB3-540A

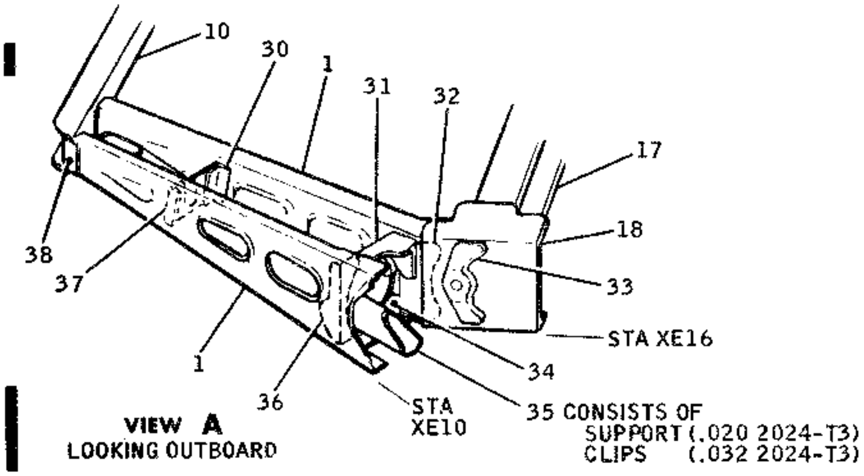
Elevator Center Section Plating
Figure 3 (Sheet 2)



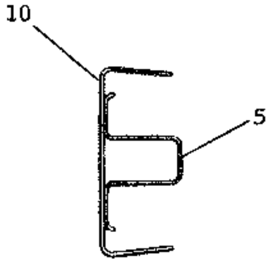
NOTE:
SEE SHEET 2 FOR DETAIL VIEWS AND ITEM LIST OF MATERIAL.

Elevator Center Section Structure
Figure 4 (Sheet 1)

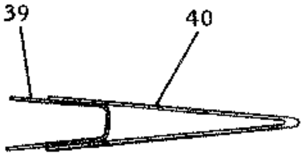
Printed in U.S.A.



VIEW A
LOOKING OUTBOARD



SECTION A-A



SECTION B-B

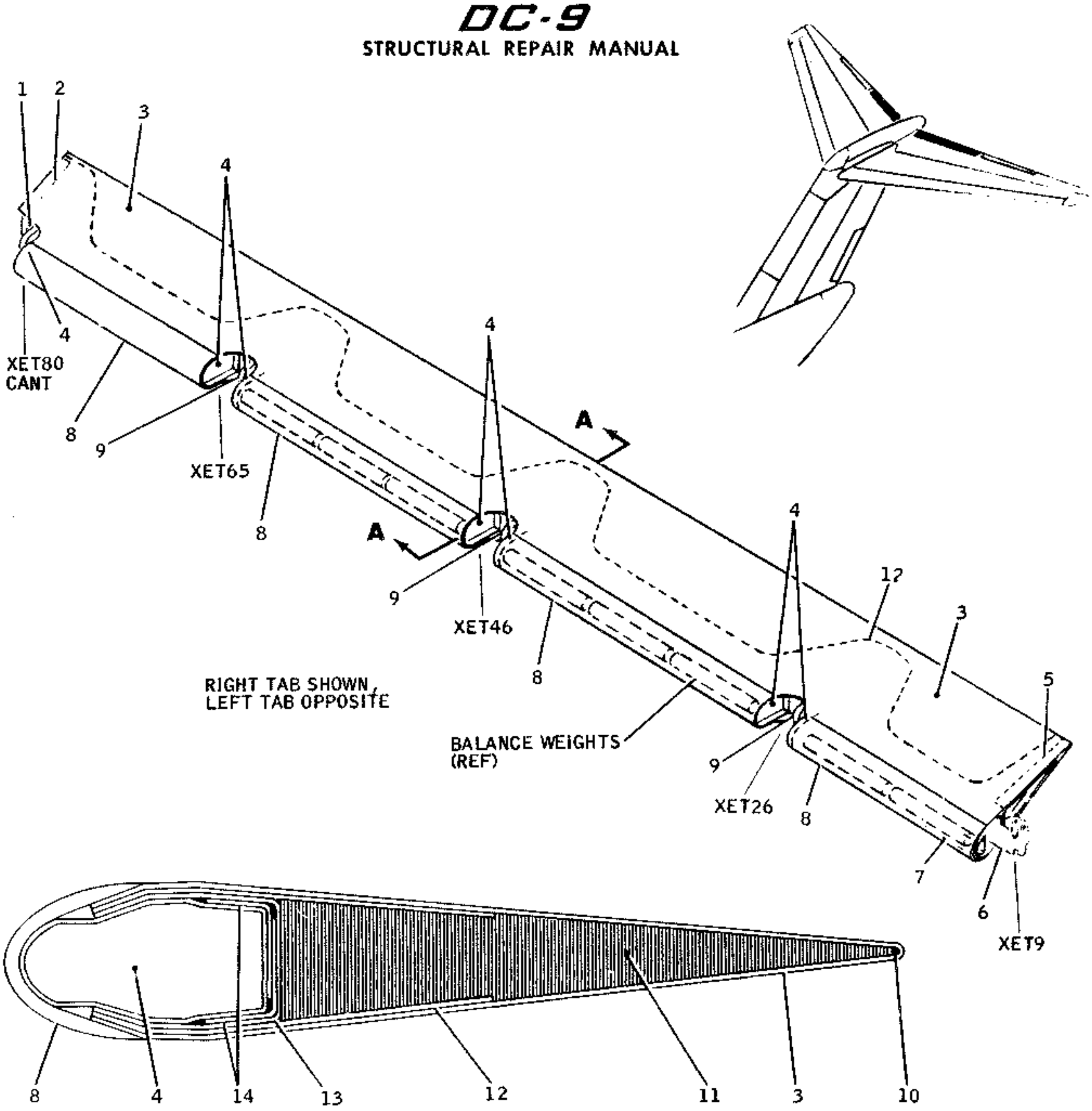
NOTES:

1. ITEM 40, TIP, OUTER SKIN IS NO. 120 MOLDED GLASS FIBER LAMINATE; INNER LAMINATE IS NO. 180 GLASS FIBER; FILLER IS CHROME-SILANE COMPLEX GLASS FIBER ROVING.
2. REFERENCE - DOUGLAS DRAWING 5910412.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.040	CLAD 2024-T42	21	RIB	.025	CLAD 2024-T42
2	RIB	.040	CLAD 2024-T42		ANGLE	.032	CLAD 2024-T42
	ANGLE	.050	CLAD 2024-T42	22	RIB	.063	CLAD 2024-T42
3	RIB	.040	CLAD 2024-T42		ANGLE	.063	CLAD 2024-T42
	ANGLE	.040	CLAD 2024-T42	23	RIB	.050	CLAD 2024-T42
4	FITTING	2.000	PLATE 7075-T7351		ANGLE	.050	CLAD 2024-T42
5	BAFFLE	.012	SHEET 6061-T6	24	FITTING	1.500	PLATE 2014-T651
6	RIB	.032	CLAD 2024-T42	25	RIB	.063	CLAD 7075-T6
	ANGLE	.040	CLAD 2024-T42	26	SPLICE	.160	CLAD 7075-T6
7	FITTING	2.000	PLATE 7075-T7351	27	FITTING, 5918031		FORGING 2014-T6
8	RIB	.032	CLAD 2024-T42	28	SUPPORT	.020	SHEET 6061-T6
	ANGLE	.040	CLAD 2024-T3		BRACKET	.032	SHEET 6061-T6
9	FITTING	1.500	PLATE 7075-T7351		CLIP	.020	SHEET 6061-T6X
10	CHANNEL	.025	CLAD 2024-T42	29	FITTING, 5918030		FORGING 7075-T6
11	RIB	.050	CLAD 2024-T42	30	ANGLE	.040	CLAD 2024-T42
12	FITTING	1.375	PLATE 7075-T7351	31	SUPPORT	2.000	PLATE 7075-T7351
13	INTERCOSTAL	.032	CLAD 2024-T3	32	CLIP	.050	CLAD 2024-T42
	ANGLE	.032	CLAD 2024-T3	33	FITTING, 3918037		FORGING 2014-T6
14	FITTING, 5918029		FORGING 7075-T6	34	ANGLE	.050	CLAD 2024-T42
15	TUBE	.020	SHEET 6061-T6	35	SUPPORT, CLIPS	(SEE CALLOUT 35 ABOVE)	
	TROUGH	.020	SHEET 6061-T6X	36	BRACKET	.040	CLAD 2024-T42
16	FITTING, 5918028		FORGING 2014-T6	37	WEB	.032	CLAD 2024-T3
17	SPAR, 9918450		PLATE 7075-T651	38	CLIP	.063	CLAD 2024-T3
18	FITTING, 5918050		FORGING 7075-T6	39	CHANNEL	.025	CLAD 2024-T3
19	FITTING	1.375	PLATE 7075-T7351	40	TIP, 3913179		SEE NOTE 1
20	FITTING	1.250	PLATE 7075-T7351	41	SEAL CAP	.040	SHEET 6061-T6X

BB3-542A

Elevator Center Section Structure
Figure 4 (Sheet 2)



SECTION A-A

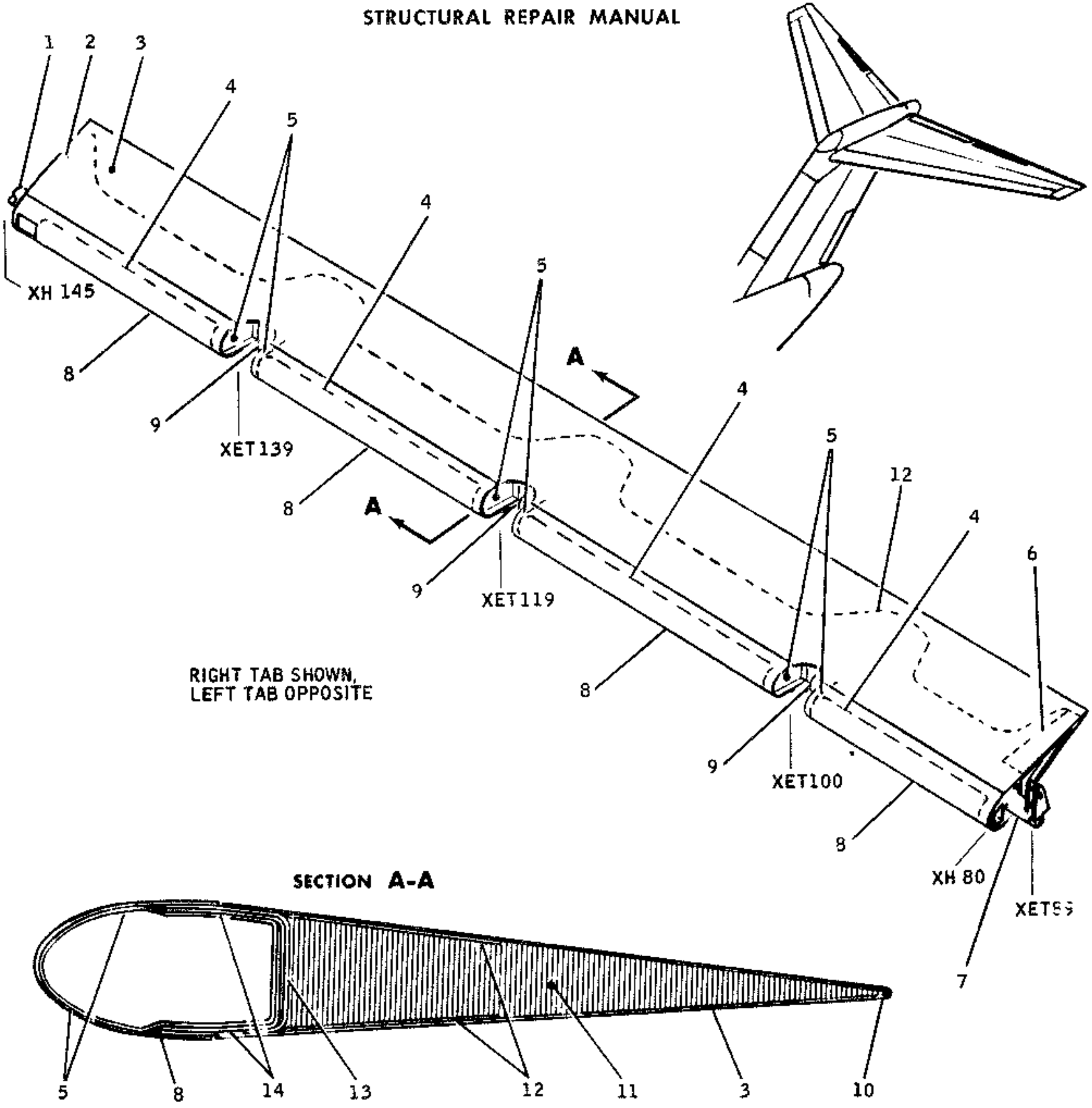
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	1.500	BAR 7075-T7351
2	RIB	1.250	PLATE 7075-T651
3	SKIN	.012	CLAD 7075-T6
4	RIB	.040	CLAD 7075-T6
5	RIB	1.250	PLATE 7075-T651
* 6	FITTING, 5918066		AL FORG 7075-T411
7	CHANNEL	.040	CLAD 7075-T6
8	NOSE CAP		2914935
9	FITTING	1.500	PLATE 7075-T7351
10	WIRE	.092 DIA	5056-H32
11	CORE	1.6W	SEE NOTE 1
12	BONDED DOUBLER	.016	CLAD 7075-T6
13	SPAR	.050	SHEET 6061-T6
14	ANGLE	.025	CLAD 7075-T6

NOTES:

1. ITEM 11, CORE, 1.600 X 3/16 HEX X .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
*2. ITEM 6 MADE FROM FORGING 7075-T6 FOR AIRPLANES 91 AND SUBSEQUENT
3. REFERENCE DOUGLAS DRAWING 5910413.

BB3-190A

Elevator Control Tab Plating
Figure 5



ITEM	NOMENCLATURE	GAGE	MATERIAL
* 1	FITTING 5918074		FORGING 7075-T411
2	RIB	1.000	PLATE 7075-T651
3	SKIN	.012	CLAD 7075-T6
4	DOUBLER	.012	CLAD 7075-T6
5	RIB	.040	CLAD 7075-T6
6	RIB	1.125	PLATE 7075-T651
* 7	FITTING 5918073		FORGING 7075-T411
8	NOSE SKIN	.020	CLAD 7075-T6
9	FITTING ASSEMBLY	1.250	PLATE 7075-T7351
10	WIRE	.090	5056-H32
11	CORE		SEE NOTE 1
12	DOUBLER	.016	CLAD 7075-T6
13	SPAR	.025	CLAD 7075-T6
14	DOUBLER	.025	CLAD 7075-T6

NOTES:

1. ITEM 11, CORE 1.600 X 3/16 HEX X .001 THICK, NON-PERFORATED ALUMINUM FOIL HONEYCOMB.

*2. ITEMS 1 AND 7 MADE FROM FORGING 7075-T6 FOR AIRPLANES 91 AND SUBSEQUENT.

3. REFERENCE - DOUGLAS DRAWING 5910414.

BB3-191A

Elevator Geared Tab Plating
Figure 6

TEMPORARY REVISION 55-17

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately preceding existing 55-20-1, Page 1. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Elevator and Elevator Control Tab Balancing Procedures completely revised to clarify and amplify instructions.
EFFECTIVITY:	ALL

ELEVATOR AND ELEVATOR CONTROL TAB BALANCING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplate structure, the elevator and elevator control tab must be balanced nose-heavy about their hinge lines.

CAUTION: TO ENSURE THAT REQUIRED BALANCE LIMITS ARE MAINTAINED, BALANCE CHECKS REQUIRE THAT THE SURFACE BE IN A SPECIFIC CONDITION. THE CONDITION OF THE SURFACES FOR BALANCING MUST BE AS OUTLINED IN SUBSEQUENT PARAGRAPHS FOR THE SURFACE INVOLVED. ALL EQUIPMENT USED MUST BE IN GOOD WORKING ORDER. SCALES USED MUST BE ACCURATE AND IN CALIBRATION. WEIGHTS USED MUST BE ACCURATE. BALANCE CHECKS MUST BE ACCOMPLISHED IN A WIND-FREE AREA AND ON A RELATIVELY LEVEL FLOOR. THE CONTROL SURFACE MUST BE FREE OF DIRT AND FOREIGN MATTER.

NOTE: The elevator geared tab does not require balancing, but must not exceed the maximum allowable weight of 5.95 pounds.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of nose overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the capability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs.

(1) The balance condition of the elevator may be checked by calculation method after repairs or repainting (see paragraph 15).

(2) The balance condition of the elevator control tab may be checked by calculation method after repainting (see paragraph 15); however, due to its close tolerance, it must be removed from the airplane in order to check the balance condition after repairs.

E. The weight of the elevator control tab and the elevator geared tab must be checked whenever repainted or reworked. The weight may be checked by calculation method after repainting (see paragraph 15). The weight condition must never exceed the maximum allowable weight; 24.90 pounds for control tab, 5.95 pounds for geared tab.

F. The balance condition of all control surfaces and weight of all tabs, is recorded on a weight and balance tag, generally located on inboard closing rib. Any change must be recorded on the tag.

G. Two methods of balancing the control surfaces while off the airplane are presented. One method utilizes a calibrated beam, with sliding weight, affixed to the control surface. The sliding weight is moved along the beam until the surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable values of checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition. Either method may be used.

H. Both methods of balancing the surfaces while off the airplane utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing oiled hinge pins (bolts) through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms. Hinge pins used must be undersize so as not to pick-up any bearing friction.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the elevator and elevator control tab are control surfaces and are movable portions of the horizontal tail which are used as pitch attitude controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) The established minimum to maximum nose-heaby moment is the required balance limits.

E. Minimum Balance Limit

(1) The established minimum nose-heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate nose-heavy moment established to provide an optimum point when rebalance is required is the recommended balance limit.

G. Maximum Balance Limit

(1) The established maximum nose-heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to nose caps which constitute minor increments of balance moment. During balance checks, the smount of balance moment adjustment required is usually within the range of the adjustment weights.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in Figures 1 and 2; however, if the calibrated beam method is used, beam and weight assemblies must conform to Douglas drawings 5916761 C change or later, and 5916773, B change or later, and be calibrated to conform to Douglas drawing 5923792, B change or later, to ensure accurate balance indications. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (hinge pins resting on knife edges). Hinge pins used should be lightly oiled, and undersized so as not to pick up any bearing friction.

A. Tool and Equipment Required for Calibrated Beam Method (see Figure 1)

Item	Name	Number	Manufacturer	Use
A	Two Each Control Surface Balance Stand Assemblies	5916761-3	Douglas Aircraft Co., Inc., Long Beach, Calif.	Stands to support elevator during balance checks
B	Two Each Control Surface Balance Stand Assemblies	5916773-79		Stands to support elevator control tab during balance checks

Tools and Equipment Required for Calibrated Beam Method
Figure 1 (Sheet 1)

Item	Name	Number	Manufacturer	Use
C	Two Each Weight Assemblies	5916761-119	Douglas Aircraft Co., Inc., Long Beach, Calif.	Standards of known weight and balance moment for checking elevator balance condition
D	Beam Assembly	5916761-65		Direct reading scale for checking elevator balance condition
E	Weight Assembly	5916761-71		Sliding weight for beam assembly (Item D)
F	Beam Assembly	5916773-31		Direct reading scale for checking elevator control tab balance condition
G	Weight Assembly	5916773-37		Sliding weight for beam assembly (Item F)
H	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	To weigh tabs

Tools and Equipment Required for Calibrated Beam Method
Figure 1 (Sheet 2)

B. Tools and Equipment Required for Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Two Each Control Surface Balance Stand Assemblies	5916761-3	Douglas Aircraft Co., Inc., Long Beach, Calif.	Stands to support elevator during balance checks
B	Two Each Control Surface Balance Stand Assemblies	5916773-79		Stands to support elevator control tab during balance checks
C	Standard 7.00 pound checkweight		Local manufacture	Standards of known weight and balance moment for checking elevator balance condition
D	Standard 8.00 pound checkweight			
E	Checkweight of various weight values			Checkweights of various values for checking elevator and elevator control tab balance condition
F	Metal container			Suspension device to hold checkweights during balance check of elevator and elevator control tab
G	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	To weigh checkweights and tabs

Tools and Equipment Required for Checkweight Method
Figure 2

4. Check Condition of Elevator Prior to Balance Check

A. Ensure that the elevator is complete and in required condition for balancing (see Figure 3). All painting and rework must be accomplished. Control tab and geared tab must not be installed. Surface must be free of dirt and foreign matter.

CAUTION: FOR BALANCE CHECKS THE ELEVATOR MUST BE COMPLETE EXCEPT FOR THE ITEMS WHICH ARE NOT INSTALLED, OR SPECIFICALLY POSITIONED AS SHOWN IN FIGURE 3.

B. Ensure that the YD211-B eyebolt installed at station XE 49.7 and that the YD235-D eyebolt installed at station XE 204.1 are tightened to a torque of 200 to 300 pounds-inch and that the eyebolt bearings are perpindicular to the elevator axis of rotation. Ensure that the NAS1105-22 bolts that are installed through the eyebolt bearings are lightly oiled and centered in the bearing.

CAUTION: THE TORQUE VALUES SPECIFIEC ABOVE FOR THE EYEBOLTS ARE FOR BALANCE CHECKS ONLY. FOR INSTALLATION OF ELEVATOR ON THE AIRPLANE, EYEBOLTS ARE INSTALLED AND TIGHTENED AS OUTLINED IN CHAPTER 27, DC-9 MAINTENANCE MANUAL.

C. Ensure that the eyebolts and attaching parts installed at stations XET 9.7, XET 83.5, and XET 156.3 are installed as shown in Figure 3.

D. Ensure that the tab hinge attach parts (bolt, two washers, nut, and cotter-pin) installed at stations XET 26.1, XET 46.2, XET 65.6, XET 80.7, XET 100.1, XET 119.7, and XET 139.3 are installed as shown in Figure 3.

E. Ensure that the links of the damper assembly and geared tab pushrods are positioned as shown in Figure 3 and taped down with the smallest piece of masking tape possible to prohibit movement of the links.

5. Elevator Balance Limits

A. Elevator Balance Limits are shown in Figure 4.

B. It is recommended that the elevator balance condition be maintained as near to maximum balance limit as is possible and preferably at or between recommended balance and maximum balance limit; however, any point between minimum balance limit and maximum balance limit is permissible.

NOTE: Maintaining the elevator balance condition at the upper end of the balance limits provides more available balance moment for any subsequent repairs aft of the elevator hinge line.

Minimum Balance Limit ----------------	730 Inch-Pounds (Nose-Heavy)
Recommended Balance ------------------	735 Inch-Pounds (Nose-Heavy)
Maximum Balance Limit-----------------	737.5 Inch-Pounds (Nose-Heavy)

Elevator Balance Limits
Figure 4

6. Elevator Balance Weights and Adjustment Weights

A. Elevator balance weights are those weights installed in the elevator nose cap which constitute major increments of balance moment. During balance checks, adjustment of the balance weights is seldom necessary.

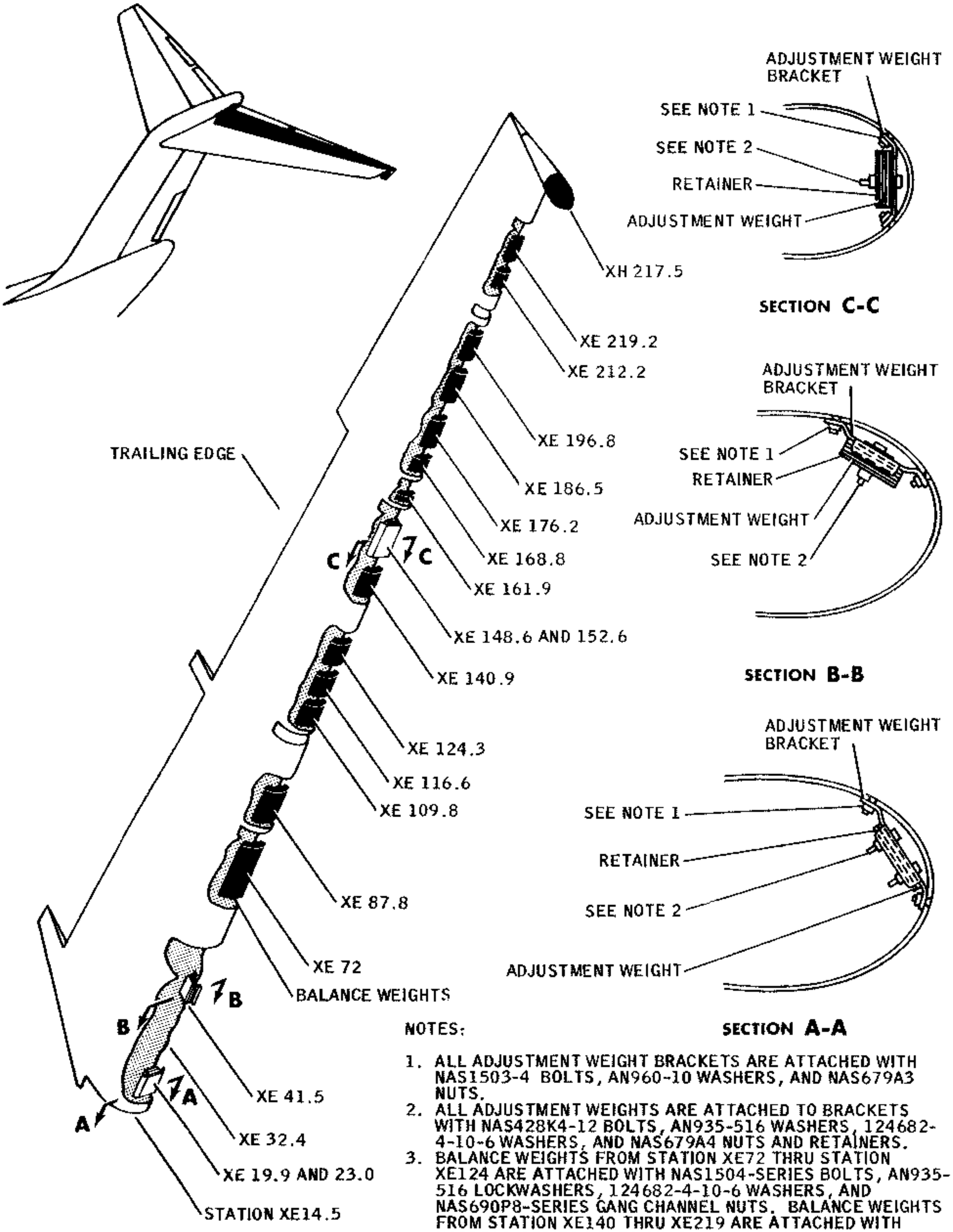
(1) Balance weight locations and attachment are shown in Figure 5.

(2) Balance weight numbers, locations, and approximate weight values are shown in Figure 6.

B. Elevator adjustment weights are those weights installed in the elevator nose cap which constitute minor increments of balance moment. The amount of balance moment adjustment required during balance checks is usually possible by addition or removal of adjustment weights. The nose-heavy moment contribution of the adjustment weights is a product of the weight value of the adjustment weights times the moment arm. By selection of the proper weight value and mement are, various moment contribution is possible.

(1) Adjustment weight locations and attachment are shown in Figure 5.

(2) Adjustment weight numbers, locations, weight, and moment contribution are shown in Figure 7.



NOTES:

1. ALL ADJUSTMENT WEIGHT BRACKETS ARE ATTACHED WITH NAS1503-4 BOLTS, AN960-10 WASHERS, AND NAS679A3 NUTS.
2. ALL ADJUSTMENT WEIGHTS ARE ATTACHED TO BRACKETS WITH NAS428K4-12 BOLTS, AN935-516 WASHERS, 124682-4-10-6 WASHERS, AND NAS679A4 NUTS AND RETAINERS.
3. BALANCE WEIGHTS FROM STATION XE72 THRU STATION XE124 ARE ATTACHED WITH NAS1504-SERIES BOLTS, AN935-516 LOCKWASHERS, 124682-4-10-6 WASHERS, AND NAS690P8-SERIES GANG CHANNEL NUTS. BALANCE WEIGHTS FROM STATION XE140 THRU XE219 ARE ATTACHED WITH NAS1503-SERIES BOLTS, AN935-416 LOCKWASHERS, 124682-3-8-6 WASHERS, AND NAS689P8-SERIES GANG CHANNEL NUTS OR NAS679A3 NUTS.
4. REFERENCE DOUGLAS DRAWING 5918035.

BB3-335A

Elevator Weight Location and Attachment
Figure 5

Number	Location (Elevator Station)	Approximate Weight (Pounds)
5918036		
-501	XE 72	12.69
-503	XE 89.5	7.31
-505	XE 109.8 and XE 116.6	4.43
-507	XE 124.3	4.05
-509	XE 140.9	3.17
-511	XE 161.9	.78
-513	XE 176.2 and XE 186.5	4.58
-515	XE 196.8	4.89
-517	XE 168.8	1.55
-525	XE 212.2	3.92
-527	XE 219.2	3.38
5919752-19 (Part of horn)	XH 217	20.0 to 20.2

Elevator Balance Weight Locations and Weights
Figure 6

Adjustment Weight Number (see Figure 9 for suggested quantity)	Location Elevator Station (XE)	Moment Arm (Forward of hinge line) (Inches)	Nose-Heavy Moment (each) (Inch-Pound)	Weight (each) (Pounds)
5918036-519	19.9	10.0	4.0	0.39
-519	23.0	10.5	4.0	0.39
-523	41.5	9.1	4.8	0.53
-521	148.6	6.9	2.1	0.31
-521	152.6	6.8	2.1	0.31

Elevator Adjustment Weight Numbers, Locations, and Contribution
Figure 7

7. Check Elevator Balance Condition Using Calibrated Beam Method

A. Ensure that elevator is in required condition for balancing (see paragraph 4).

B. Mount the elevator on balance stands (see Figures 1 and 8). Suspend the surface by resting the NAS 1105-22 bolts (installed through the eyebolt bearings at stations XE 49.7 and XE 204.1) across the knife edges of the balance stand arms. Position the surface so that it is free to rotate about its hinge axis.

C. Suspend a No. 5916761-119 weight assembly from tab hinge locations at stations XET 46.2 and 65.6 (see Figures 1 and 8). Ensure that the weights do not interfere with movement of the surface.

D. Mount the No. 5916761-65 beam assembly and the No. 5916761-71 weight assembly on the elevator as shown in Figure 8 (sheet 1).

E. Measure the distance from the floor (baseline) to the centerline of the bolts installed through the eyebolt bearings at stations XE 49.7 and XE 204.1.

NOTE: An inspection type height gage as shown in Figure 8 is recommended for measurement so that it can be easily moved to the trailing edge and provide a visual reference.

F. Slide the weight assembly along the beam assembly until the elevator assumes a horizontal attitude.

NOTE: The elevator is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points within a tolerance of ±0.10 inch.

G. Deflect the elevator three or four times and ensure that it returns to the horizontal position without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

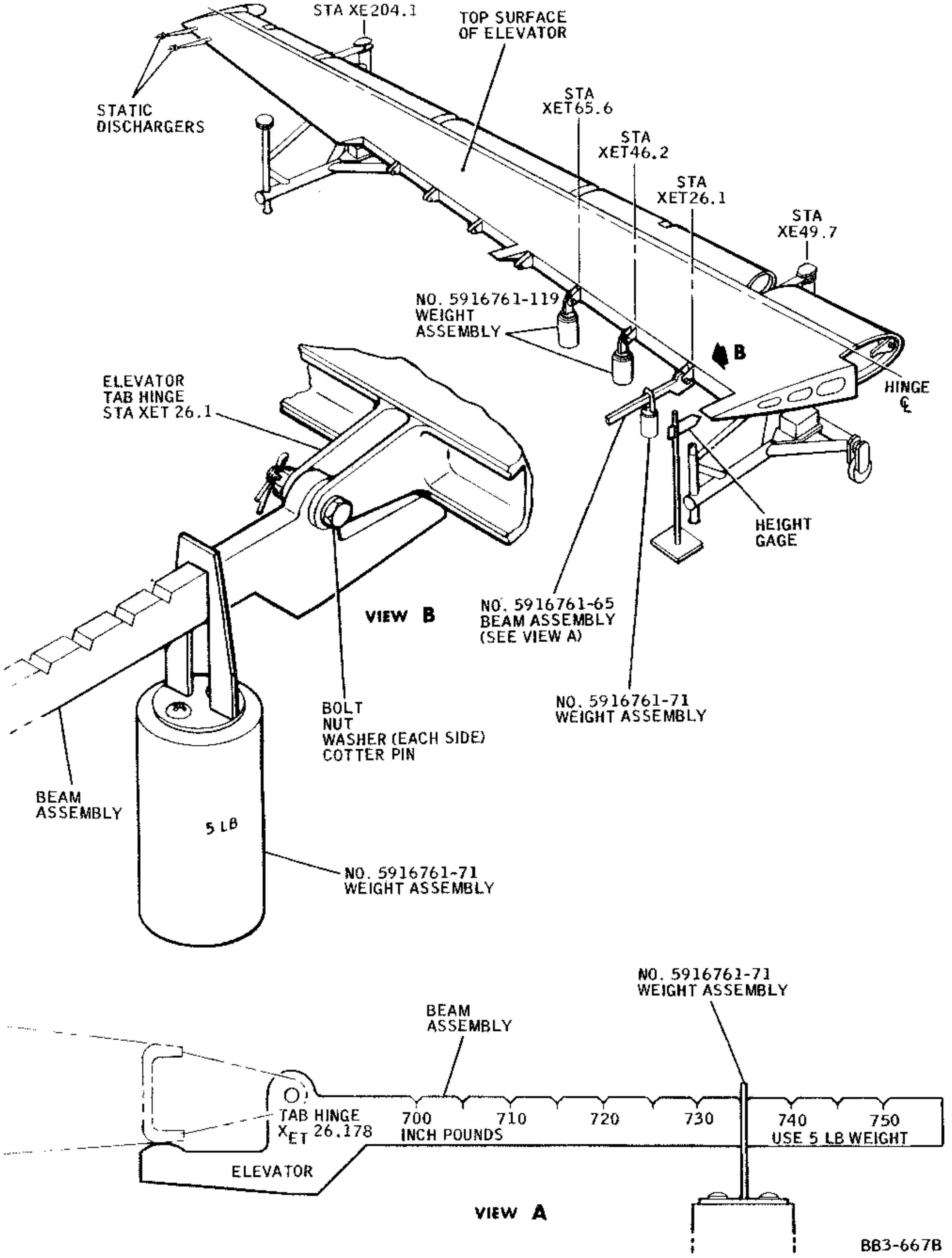
H. When the elevator is in a horizontal attitude, read the balance indication on the beam assembly.

I. If the balance indication is not within limits (see paragraph 5), make the necessary changes to the quantity of adjustment weights as shown in Figure 8 (Sheet 2).

NOTE: See Figures 5 and 7 for adjustment weight numbers and locations.

J. Repeat paragraphs E through I until balance indication is correct.

K. Engrave balance condition on the weight and balance tag and enter the condition on any other records required.



Elevator Balancing Using Calibrated Beam Method
Figure 8 (Sheet 1)

Weight Beam Reading	Suggested quantity of adjustment weights to add/remove per station for indicated beam reading (see Figure 7 for adjustment weight numbers)					
	Elevator Station (XE)					
Inch-Pounds	19.9	23.0	41.5	148.6	152.6	
700 to 705	2	2	2	1	1	Add adjustment weights for these readings
705 to 710	2	2	1	1	1	
710 to 715	1	1	2		1	
715 to 720	1	1	1		1	
720 to 725	1	1			1	
725 to 730			1			
730 to 737.5	WITHIN BALANCE LIMITS					
737.5 to 740			1			Remove adjustment weights for these readings
740 to 745	1	1			1	
745 to 750	1	1	1		1	

Elevator Balancing Using Calibrated Beam Method
Figure 8 (Sheet 2)

8. Check Elevator Balance Condition Using Checkweight Method

A. Ensure that elevator is in required condition for balancing (see Paragraph 4).

B. Mount the elevator on balance stands (see Figures 1 and 9). Suspend the surface by resting the NAS 1105-22 bolts (installed through the eyebolt bearings at stations XE 49.7 and XE 204.1) across the knife edges of the balance stand arms. Position the surfaces so that it is free to rotate about its hinge axis.

C. Measure the distance from the floor (baseline) to the centerline of the bolts installed through the eyebolt bearings at stations XE 49.7 and XE204.1.

NOTE: An inspection type height gage as shown in Figure 9 is recommended for measurement so that it can easily be moved to the trailing edge and provide a visual reference.

D. Suspend 7.00 pound checkweight (see Figure 10) and 8.00 pound checkweight (see Figure 11) from the control tab hinge point at station XET 46.2 (see Figure 9).

NOTE: Total checkweight suspended from tab hinge point at station XET 46.2 is 15.00 pounds. The moment arm at this hinge point is 23.83 inches from the elevator hinge axis.

E. Suspend variable checkweights from the control tab hinge point at station XET 26.1 (see Figure 9) until the elevator assumes a horizontal attitude.

NOTE: The elevator is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points within a tolerance of ±0.10 inch. The moment arm at tab hinge point XET 26.1 is 25.34 inches from the elevator hinge axis.

F. Deflect the elevator three or four times and ensure that it returns to the horizontal attitude without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

G. When the elevator is in a horizontal attitude, weigh (to the nearest hundreth pound) the variable checkweights (including any container or other suspension device) that are suspended from station XET 26.1 hinge point.

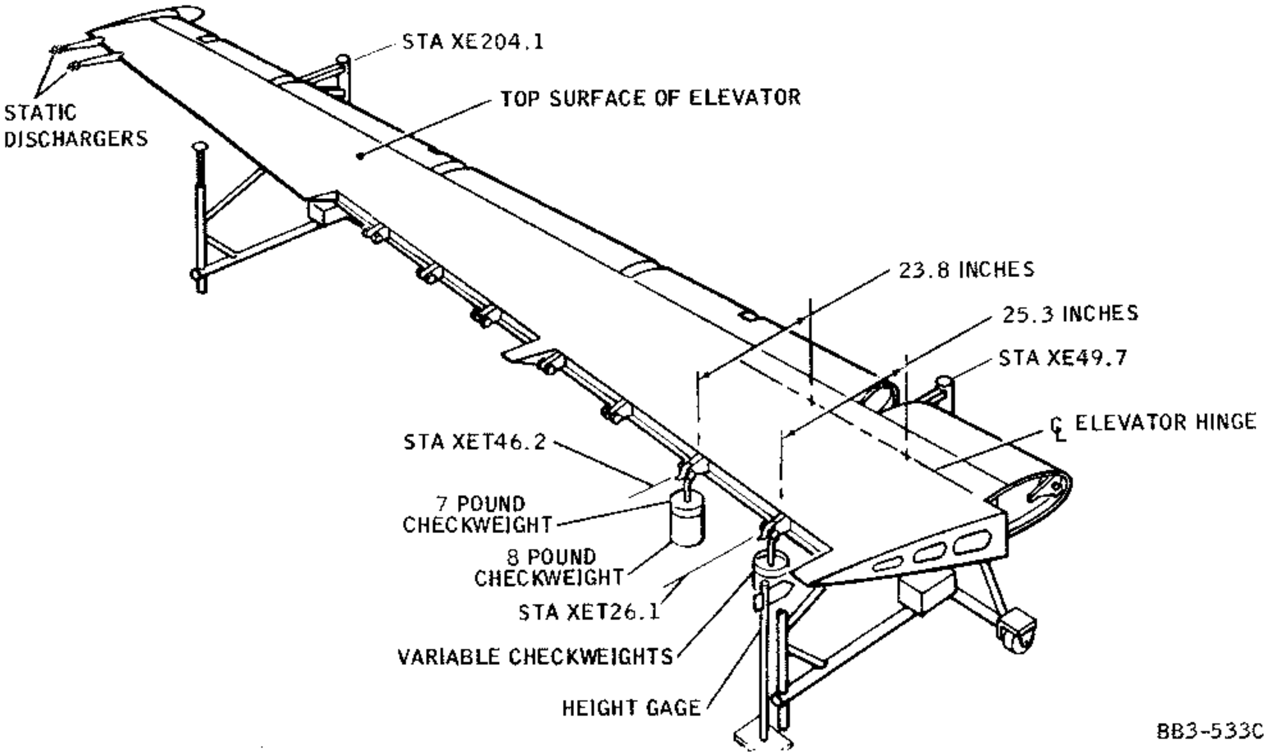
H. Compare the weight value obtained in paragraph G, above, with the weight values shown in Figure 12.

I. If the balance condition is not within limits, make the necessary changes to the adjustment weights as shown in Figure 12, Sheet 2.

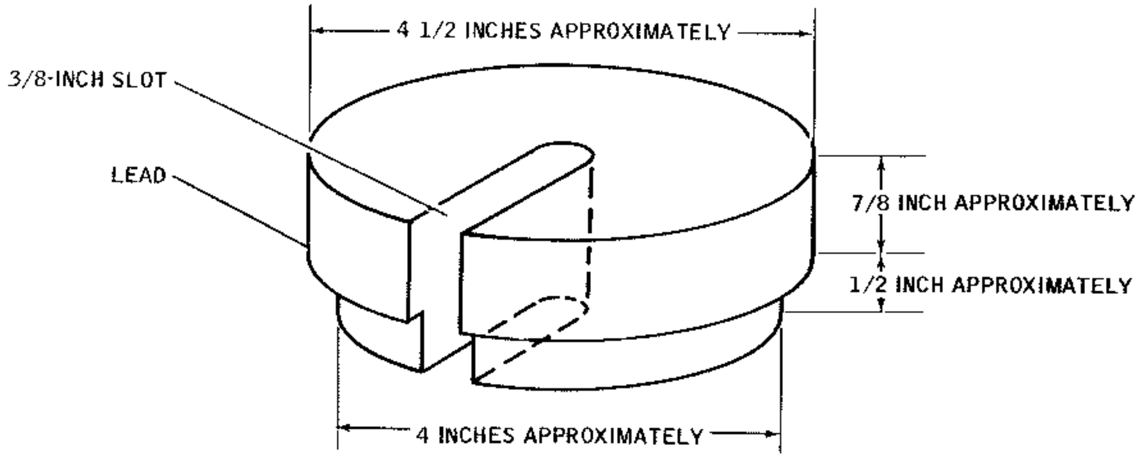
NOTE: See Figures 5 and 7 for adjustment weight numbers, locations, and contribution.

J. Repeat paragraphs C through I until balance condition is correct.

K. Engrave balance condition on any other records required.



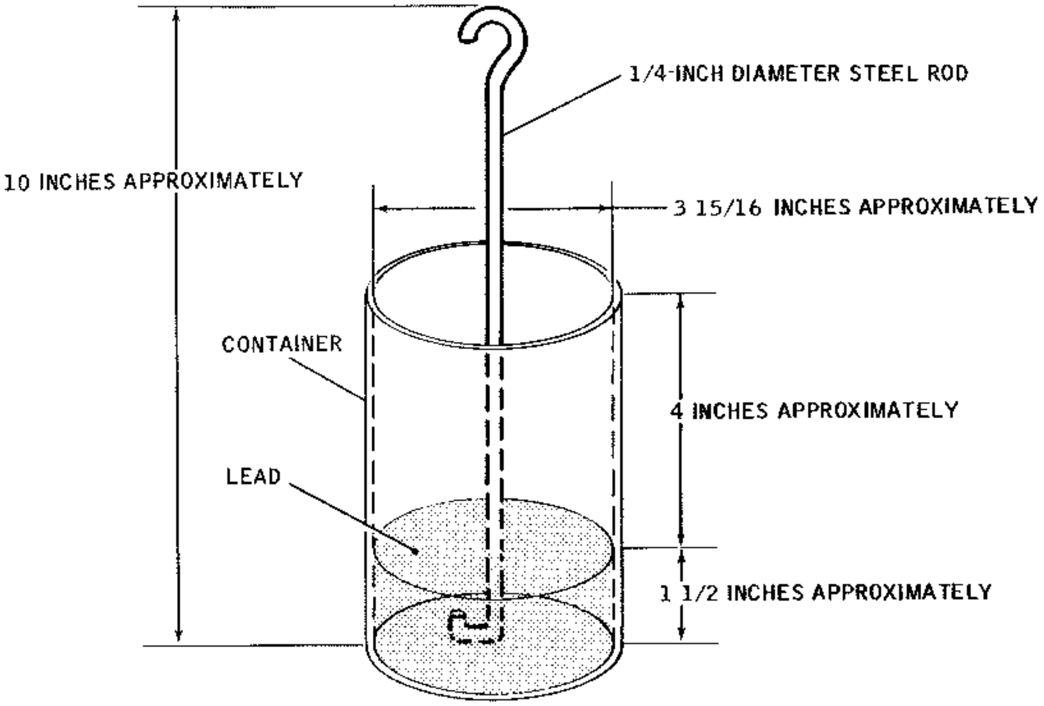
Elevator Balancing Using Checkweight Method
Figure 9



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 7.00 POUNDS.

BB3-433

Seven Pound Standard Checkweight
Figure 10



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 8.00 POUNDS.

BB3-432

Eight Pound Standard Checkweight
Figure 11

Weight Value of Variable Checkweights Suspended From Tab Hinge Point at Station XET 26.1 (Pounds)	Equivalent Elevator Nose-Heavy Balance Condition (Inch-Pounds)	
13.21 to 15.41	Low. Add adjustment weights per sheet 2.	
15.42	730.04	WITHIN BALANCE LIMITS
15.43	730.30	
15.44	730.55	
15.45	730.80	
15.46	731.06	
15.47	731.31	
15.48	731.56	
15.49	731.82	
15.50	732.07	
15.51	732.32	
15.52	732.58	
15.53	732.83	
15.54	733.08	
15.55	733.34	
15.56	733.59	
15.57	733.84	
15.58	734.10	
15.59	734.35	
15.60	734.60	
15.61	734.86	
15.62	735.11	
15.63	735.36	
15.64	735.62	
15.65	735.87	
15.66	736.12	
15.67	736.38	
15.68	736.63	
15.69	736.88	
15.70	737.14	
15.71	737.39	
15.714	737.50	
15.72 to 18.08	High. Remove adjustment weights per sheet 2.	

Elevator Checkweight Values and Adjustment Weight Change Required
Figure 12 (Sheet 1)

Weight Value of Variable Checkweights Suspended From Tab Hinge Point at Station XET 26.1 (Pounds)	Suggested Quantity of Adjustment Weights To Add Or Remove At Station Indicated					Total Moment Being Added/ removed (Inch-Pounds)	
	Elevator Station XE						
	19.9	23.0	41.5	148.6	152.6		
13.21 to 13.36	3	4	4	3	3	59.8	Add quantities of adjustment weights at stations indicated
13.37 to 13.51	2	4	4	3	3	55.8	
13.53 to 13.67	1	4	4	3	3	51.8	
13.68 to 13.83	1	3	4	3	3	47.8	
13.84 to 13.99	1	2	4	3	3	43.8	
14.01 to 14.15	1	2	4	2	2	39.6	
14.20 to 14.34	1	2	3	2	2	34.8	
14.44 to 14.54	0	2	3	1	2	28.7	
14.54 to 14.69	0	2	2	2	2	26.0	
14.73 to 14.88	0	2	1	2	2	21.2	
14.92 to 15.07	0	2	0	2	2	16.4	
15.08 to 15.23	0	1	0	2	2	12.4	
15.25 to 15.39	0	1	0	1	1	8.2	
15.40 to 15.43	0	0	0	1	1	4.2	
15.44 to 15.714	WITHIN BALANCE LIMITS (SEE SHEET 1)						
15.74 to 15.88	0	0	0	1	1	4.2	Remove quantities of adjustment weights at stations indicated
15.89 to 16.04	0	1	0	1	1	8.2	
16.06 to 16.20	0	1	0	2	2	12.4	
16.22 to 16.36	0	2	0	2	2	16.4	
16.41 to 16.55	0	2	1	2	2	21.2	
16.60 to 16.74	0	2	2	2	2	26.0	
16.70 to 16.85	0	2	3	1	2	28.7	
16.86 to 17.01	1	2	3	1	2	32.7	
17.05 to 17.19	1	2	4	1	2	37.5	
17.22 to 17.36	1	2	4	2	3	41.7	
17.37 to 17.52	1	3	4	2	3	45.7	
17.53 to 17.68	1	4	4	2	3	49.7	
17.69 to 17.83	2	4	4	2	3	53.7	
17.84 to 18.03	3	4	4	2	3	58.6	
17.93 to 18.08	3	4	4	3	3	59.8	

Elevator Checkweight Values and Adjustment Weight Change Required
Figure 12 (Sheet 2)

9. Check Condition of Elevator Control Tab for Weight and Balance Check

A. Ensure that the elevator control tab is structurally complete. All painting and rework must be accomplished.

B. Ensure that surface is free of dirt and foreign matter.

10. Elevator Control Tab Weight and Balance Limits

A. Figure 13 shows elevator control tab weight limits.

Minimum Weight Limit (Pounds)	Maximum Weight Limit (Pounds)
None	24.90

Elevator Control Tab Weight Limits
Figure 13

B. Figure 14 shows elevator control tab balance limits.

Minimum Balance Limit-------------------12.5 Inch-Pounds (Nose-Heavy)

Recommended Balance---------------------13.5 Inch-Pounds (Nose-Heavy)

Maximum Balance Limit-------------------14.0 Inch-Pounds (Nose-Heavy)

Elevator Control Tab Balance Limits
Figure 14

11. Elevator Control Tab Adjustment Weights

A. Elevator control tab adjustment weight number, weight, and moment contri contribution is shown in Figure 15.

Adjustment Weight No.	Weight (Each) (Pounds)	Moment Contribution (Each) (Inch-Pounds)
3918060-503	0.56	0.72

Elevator Control Tab Adjustment Weights and Contribution
Figure 15

12. Check Elevator Control Tab Balance Condition Using Calibrated Beam Method

A. Ensure that the control tab is in required condition for balancing (see paragraph 9).

B. Install NAS 1103-13 bolts through the eyebolt bearings at stations XET 26.1 and XET 80.7 tab hinge locations (see Figure 17). Lightly oil each bolt.

C. Mount the elevator control tab on balance stands (see Figures 1 and 17). Suspend the surface by resting the NAS 1103-13 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Mount the No. 5916773-31 beam assembly and the No. 5916773-37 weight assembly on the elevator control tab as shown in Figure 17.

E. Measure the distance from the floor, or table,(baseline) to the centerline of the bolts installed through the eyebolt bearings at stations XET 26.1 and XET 80.7.

NOTE: An inspection type height gage as shown in Figure 17 is recommended so that it can easily be moved to the trailing edge and provide a visual reference.

F. Slide the weight assembly along the beam assembly until the control tab assumes a horizontal attitude.

NOTE: The control tab is in a horizontal attitude when the centeline of the trailing edge is the same distance from the floor, or table, (baseline) as the centerline of the mount bolts within a tolerance of ±0.10 inch.

G. Deflect the control tab three or four times and ensure that it returns to the horizontal position without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

H. When the control tab is in a horizontal attitude, read the balance indication on the beam assembly.

I. If the balance indication is not within limits (see Figure 14), make the necessary changes to the quantity of adjustment weights as shown in Figure 16.

NOTE: See Figure 15 for adjustment weight numbers and contribution.

J. Repeat paragraphs C through I until balance indication is correct.

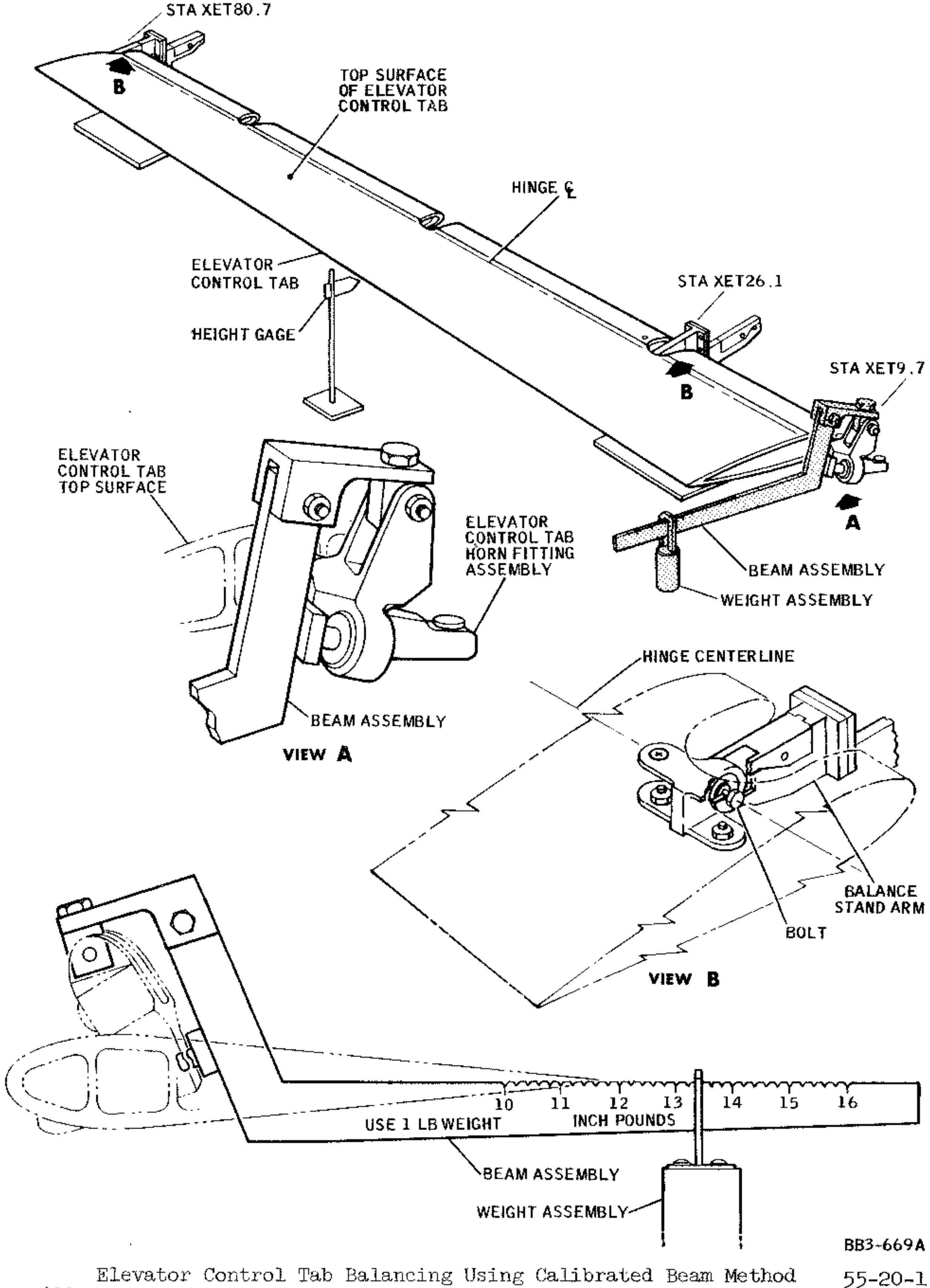
K. Engrave the balance condition on the weight and balance tag and enter the condition on any other records required.

L. Weigh the control tab as outlined in paragraph 14, engrave the weight condition on the weight and balance tag, and enter the condition on any other records required.

Beam Reading	Suggested Quantity of NO. 3918060-503 Adjustment Weights to Add or Remove	Approximate New Balance Condition	Approximate Weight Added or Removed
(Inch-Pounds)		(Inch-Pounds)	(Pounds)
10.4 to 11.8	Add 3	12.56 to 13.96	1.68 Added
11.1 to 12.5	Add 2	12.54 to 13.94	1.12 Added
11.8 to 13.2	Add 1	12.52 to 13.92	0.56 Added
13.3 to 14.7	Remove 1	12.58 to 13.98	0.56 Removed
14.0 to 15.4	Remove 2	12.56 to 13.96	1.12 Removed
14.7 to 16.1	Remove 3	12.54 to 13.94	1.68 Removed

<u>NOTE</u>: If addition or removal of adjustment weights is required, weigh the elevator control tab prior to installing or removing the adjustment weights. Exercise care in selecting the quantity of weights and select a quantity that will achieve the correct balance condition and which will not cause the weight of the surface to exceed the maximum allowable weight of 24.90 pounds.

Elevator Control Tab Balance Condition and
Adjustment Weight Change Required
Figure 16



Elevator Control Tab Balancing Using Calibrated Beam Method
Figure 17

13. Check Elevator Control Tab Balance Using Checkweight Method

A. Ensure that control tab is in required condition for balancing (see paragraph 9).

B. Install NAS 1103-13 bolts through the eyebolt bearings at stations XET 26.1 and XET 80.7 tab hinge locations (see Figure 18). Lightly oil each bolt.

C. Mount the surface on balance stands (see Figures 1 and 18). Suspend the surface by resting the NAS 1103-13 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Measure the distance from the floor, or table, (baseline) to the centerline of the bolts installed through the eyebolt bearings, at stations XET 26.1 and XET 80.7.

NOTE: An inspection type height gage is recommended for measurement so that it can easily be moved to the trailing edge and provide a visual reference.

E. Loosen the second nose cap attach screw outboard of station XET 26.1 hinge location (see Figure 18).

F. Select a length of nylon cord or soft safety wire of sufficient length to attach to the screw and suspend over trailing edge.

G. Attach one end of the cord to the nose cap attach screw and the other end to a container (see Figure 18).

H. Suspend container over the trailing edge in location directly aft of the nose cap attach screw. Ensure that the container does not contact surface or any other object.

I. Add variable checkweights to the container until the control tab assumes a horizontal attitude.

NOTE: The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor, or table, (baseline) as the centeline of the mount bolts, within a tolerance of ±0.10 inch. The moment arm at the trailing edge is 8.125 inches from the control tab hinge axis.

J. Deflect the control tab three or four times and ensure that it returns to the the horizontal attitude without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

K. When the surface is in a horizontal attitude, weigh (to the nearest hundreth pound) the variable checkweights (including container or other suspension device) that are suspended over the trailing edge.

L. Compare the weight value (obtained in paragraph K, above) with the weight values shown in Figure 19.

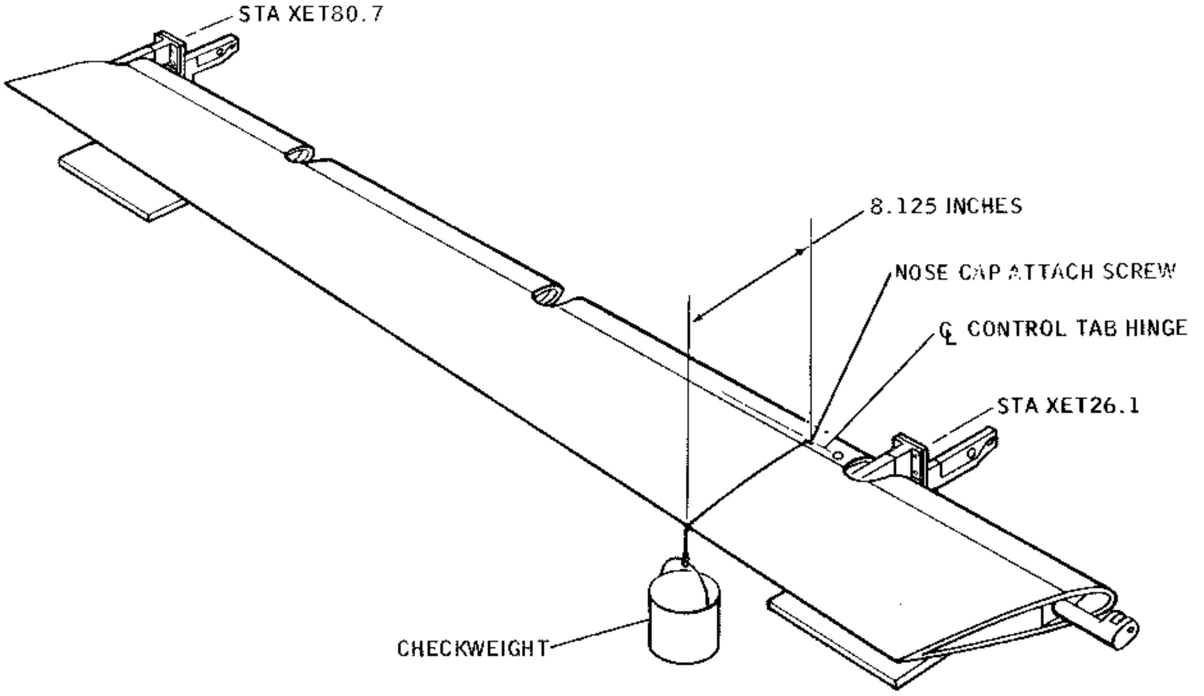
NOTE: See Figure 15 for weight number and contribution and Figure 20 for attachment and location.

M. If the balance condition is not within limits, make the necessary changes to the quantity of adjustment weights as shown in Figure 19.

N. Repeat paragraphs D through M until balance condition is correct.

O. Engrave balance condition on weight and balance tag and enter the condition on any other records required.

P. Weigh the control tab as outlined in paragraph 14 and engrave the exact weight (to the nearest hundredth pound) on the weight and balance tag. Enter the weight on any other records required.



Elevator Control Tab Balancing Using Checkweight Method
Figure 18

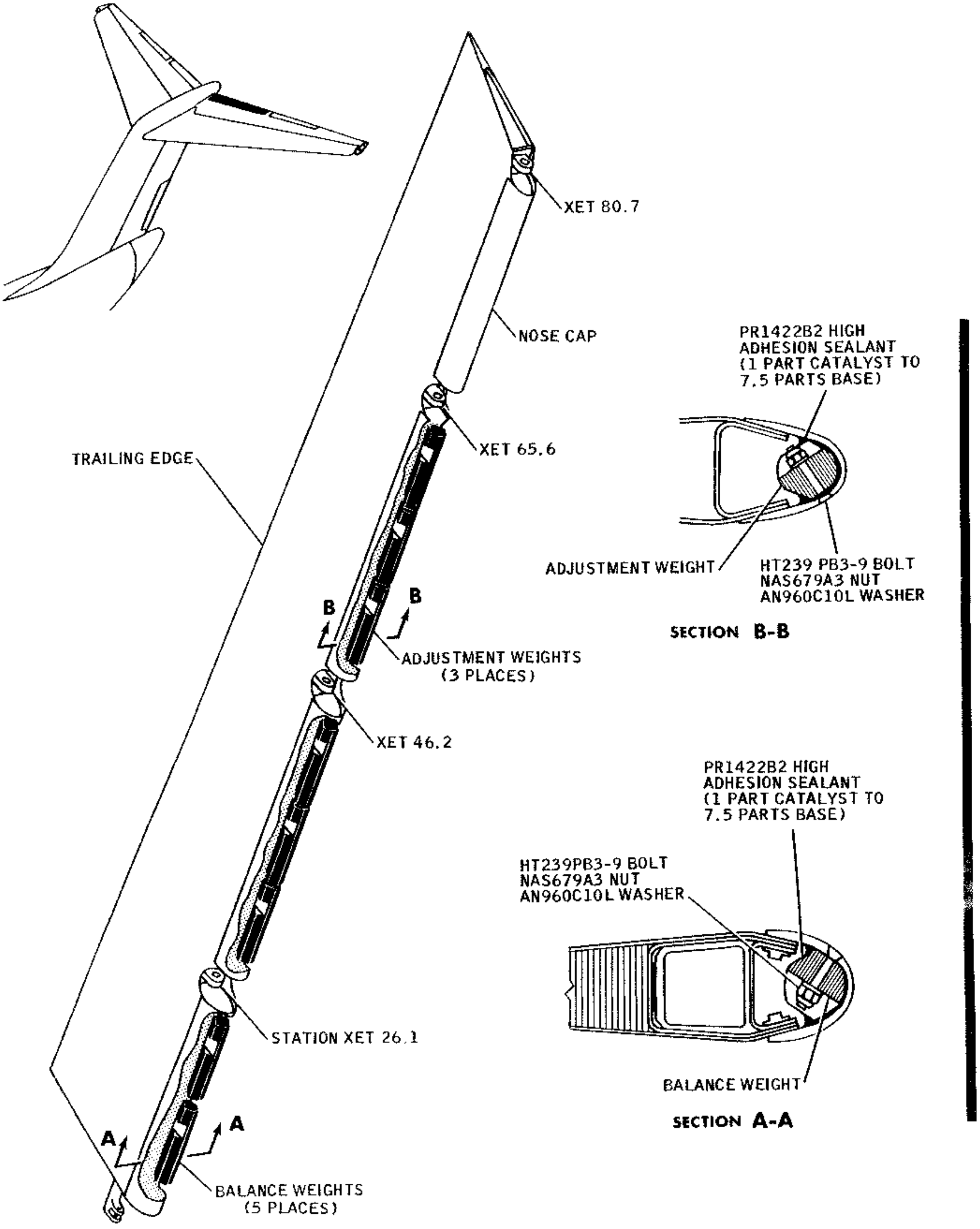
Weight Value of Variable Checkweights (including container) Suspended Over Trailing Edge	Equivalent Elevator Control Tab Nose-Heavy Balance Condition	
(Pounds)	(Inch-Pounds)	
1.28 to 1.53	Low. Add adjustment weights per sheet 2.	
1.54	12.51	W
1.55	12.59	I
1.56	12.68	T
1.57	12.76	H
1.58	12.84	I
1.59	12.92	N
1.60	13.00	
1.61	13.08	B
1.62	13.16	A
1.63	13.24	L
1.64	13.33	A
1.65	13.40	N
1.66	13.49	C
1.67	13.57	E
1.68	13.65	L
1.69	13.73	I
1.70	13.81	M
1.71	13.89	I
1.72	13.98	T
		S
1.73 to 1.98	High. Remove adjustment weights per sheet 2.	

Elevator Control Tab Checkweight Values and Adjustment Weight Change Required
Figure 19 (Sheet 1)

Weight Value of Variable Checkweights (including container) Suspended Over Trailing Edge	Equivalent Elevator Control Tab Nose-Heavy Balance Condition	Suggested Quantity of NO. 3918060-503 Adjustment Weights to Add or Remove	Approximate New Balance Condition	Approximate Weight Added or Removed
(Pounds)	(Inch-Pounds)		(Inch-Pounds)	(Pounds)
1.28 to 1.45	10.40 to 11.78	Add 3	12.56 to 13.94	1.68 Added
1.37 to 1.54	11.13 to 12.51	Add 2	12.57 to 13.95	1.12 Added
1.45 to 1.63	11.78 to 13.24	Add 1	12.50 to 13.96	0.56 Added
1.63 to 1.81	13.24 to 14.71	Remove 1	12.52 to 13.99	0.56 Removed
1.72 to 1.90	13.98 to 15.44	Remove 2	12.54 to 14.00	1.12 Removed
1.81 to 1.98	14.71 to 16.09	Remove 3	12.55 to 13.93	1.68 Removed

NOTE: If addition or removal of adjustment weights is required, weigh the elevator control tab prior to installing or removing the adjustment weights. Exercise care in selecting the quantity of weights and select a quantity that will achieve the correct balance condition and which will not cause the weight of the surface to exceed the maximum allowable weight of 24.90 pounds.

Elevator Control Tab Balance Condition and Adjustment Weight Change Required
Figure 19 (Sheet 2)



Elevator Control Tab Weight Location and Attachment
Figure 20

14. Elevator Tab Weight Determination

A. Ensure that weight scale (see Figure 1) is in calibration and in good working order.

B. With no load on the scale, ensure that the weight indicating mechanism reads zero weight. Adjust as required.

C. Carefully place the tab on the scale.

CAUTION: EXERCISE EXTREME CARE TO AVOID DAMAGE TO SURFACE.

D. Read the exact weight (to the nearest hundredth pound).

NOTE: Do not exceed maximum allowable weight of tab; 24.90 pounds for elevator control tab, 5.95 pounds for elevator geared tab.

E. Engrave the exact weight (to the nearest hundredth pound) on the weight and balance tag and enter on any other records required.

15. Balance Elevator By Calculation Method

A. Calculation Method For Elevators to Be Repaired

CAUTION: THE FOLLOWING PROCEDURE CHANGES BALANCE CONDITION OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS, AND THE BALANCE CONDITION AFTER REPAIR MUST BE PERMANENTLY RECORDED ON DECAL.

(1) Weigh removed damaged material to nearest 0.01 pound.

(2) Weigh repair material to be added to nearest 0.01 pound.

(3) Subtract the removed material weight from the repair material weight. The remainder is the net weight.

Example 1:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.20 pound
Net weight change (0.20 - 0.10)	0.10 pound

Example 2:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.40 pound
Net weight change (0.40 - 0.10)	0.30 pound

(4) Attach cord to hinge centerline at each end of control surface and stretch cord taut across surface to establish hinge centerline across surface.

(5) Measure the distance in inches (to the nearest 0.1 inch) from the hinge centerline to the centerline of the repair (see Figure 21).

NOTE: The example given in Figure 21 shows repair aft of hinge line. If repair is forward of hinge line, measure distance forward of hinge line to center of repair.

(6) Multiply this dimension by the net weight change obtained in step (3). The product is the amount of moment added by repair. See examples:

Example 3:

Net weight change from step (3), Example 1	0.10 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added Moment) (0.10 lb x 10 in.)	1 inch-pound

Example 4:

Net weight change from step (3), Example 2	0.30 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added Moment) (0.30 lb x 10 in.)	3 inch-pounds

NOTE: If the repair is aft of the hinge line, the moment added is to the trailing edge. If the repair is forward of the hinge line the moment added is to the nose-heavy condition.

(7) Note the recorded balance condition on the weight and balance tag (generally located on inboard closing rib).

(8) If the repair is aft of the hinge centerline, subtract the trailing edge heavy moment added by the repair from the recorded balance condition. The remainder indicates nose-heavy balance condition of surface.

Example 5:

Recorded balance condition	735 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pounds
Remainder (nose heavy balance condition)	734 inch-pounds

Example 6:

Recorded balance condition	732 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
Remainder (nose heavy balance condition)	729 inch-pounds

(a) If the remainder is within the elevator balance limits of 730 inch-pounds to 737.5 inch-pounds nose-heavy (see paragraph 4), no further balance action is required. Permanently record the balance condition on the weight and balance tag and enter the condition on any other records required.

(b) If the remainder is less than the minimum elevator balance limit of 730 inch-pounds (Example 6), balance moment (weight) must be added to nose cap.

Example 7:

Minimum elevator balance limit	730 inch-pounds
Nose heavy balance condition after repair (Example 6)	729 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	1 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added, select weights from Figure 7, Elevator Adjustment Weight Numbers and Moment Contribution, and add to nose cap installation. Weights added should be as near in line with repair as possible. Permanently record balance condition on weight and balance tag and any other records required.

Example 8:

Assuming the condition shown in Example 7, selecting one No. 5918036-523 adjustment weight for installation at elevator station XE 41.5 will provide 4.8 inch-pounds of moment. The 4.8 inch-pounds provides sufficient balance moment to counteract the trailing edge heavy moment added by repair and is within the 10 percent factor.

(9) If the repair is forward of the hinge centerline, add the nose-heavy moment added by the repair to the recorded balance condition. The sum indicates nose-heavy balance condition of surface.

Example 9:

Recorded balance condition	735 inch-pounds
Nose-heavy moment added by repair (Example 3)	1 inch-pounds
Sum (nose-heavy balance condition)	736 inch-pounds

Example 10:

Recorded balance condition	732 inch-pounds
Nose-heavy moment added by repair (Example 4)	3 inch-pounds
Sum (nose-heavy balance condition)	735 inch-pounds

(a) If the sum is within the elevator balance limits of 730 inch-pounds to 737.5 inch-pounds nose-heavy, no further balance action is required. Permanently record the balance condition on the weight and balance tag and on any other records required.

(b) If the sum is more than the maximum elevator balance limit of 737.5 inch-pounds, balance moment must be removed from the nose cap.

Example 11:

Maximum elevator balance limit	737.5 inch-pounds
Nose-heavy balance condition after repair	740.5 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	2.5 inch-pounds

NOTE: The maximum amount should always be increased by a factor of 10 percent so as to provide a working margin.

(c) If balance moment must be removed, select weights from Figure 7, Elevator Adjustment Weight Numbers and Moment Contribution, and remove from nose cap installation. Permanently record balance condition on weight and balance tag and on any other records required.

Example 12: Assuming the condition shown in Example 11, selecting one No. 5918036-523 adjustment weight for removal from elevator station XE 41.5 will provide 4.8 inch-pounds of moment. Removing the 4.8 inch-pounds provides sufficient moment to counteract the excessive nose-heavy condition added by repair and is within the 10 percent factor.

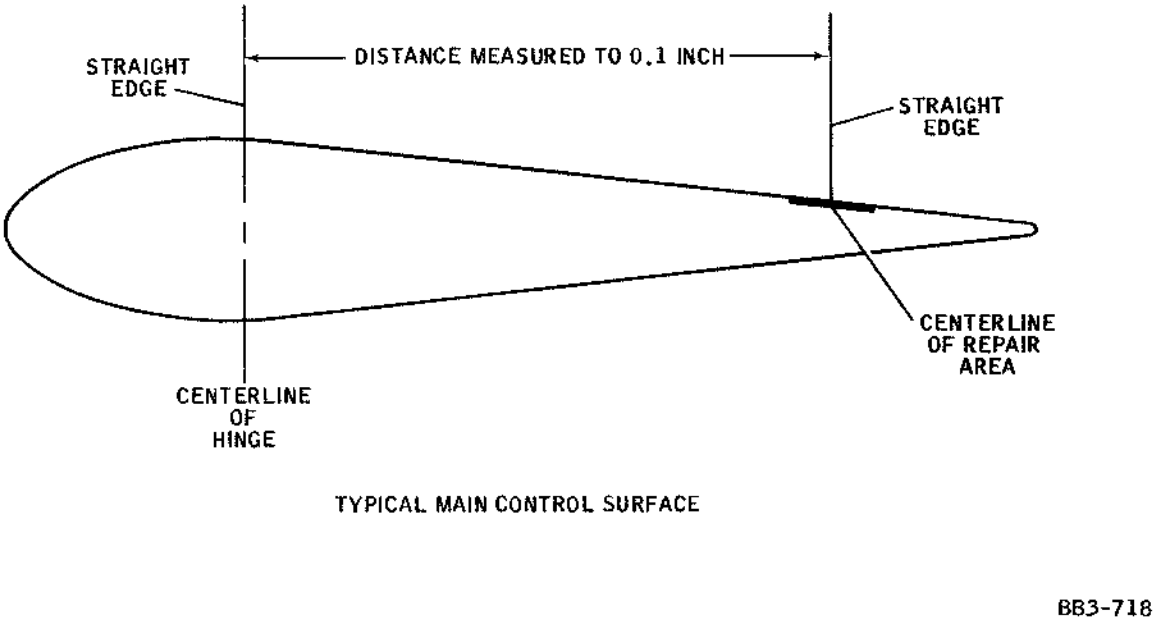
B. Calculation Method for Elevator and Elevator Control Tab to be Repainted

CAUTION: THE FOLLOWING PROCEDURES CHANGE THE BALANCE CONDITION AND WEIGHT OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS, AND MAXIMUM ALLOWABLE WEIGHT, IF TAB. THE BALANCE CONDITION, AND WEIGHT IF TAB, MUST BE PERMANENTLY RECORDED ON WEIGHT AND BALANCE TAG AND ON ANY OTHER RECORDS REQUIRED.

(1) Determine location (forward or aft of hinge centerline) of area to be repainted and distance from hinge centerline to center of area (see Figure 21).

(2) Determine size of area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the elevator, exclusive of tabs, is 92.1 square feet. Of the 92.1 square feet, 27.4 square feet are forward of the hinge centerline and 64.7 square feet are aft of the hinge centerline. The total surface area of the elevator control tab is 9.05 square feet. Of the 9.05 square feet, 1.75 square feet are forward of the hinge centerline and 7.30 square feet are aft of the hinge centerline.



Determining Distance from Hinge Centerline to Repair Centerline
Figure 21

(3) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat applied. The product is the amount of weight added.

Example 13:

Area to be repainted	5 square feet
1 coat primer and 1 top coat to be painted over area (0.015 x 2)	0.03 pound/square foot
Product (weight added by repaint)	0.15 pound

(4) Multiply the weight added by repaint by the distance from the hinge centerline to the center of the repaint. The product is the amount of moment added.

Example 14:

Weight added by repaint (Example 13)	0.15 pound
Distance from hinge centerline to centerline of repaint area	10 inches
Product (moment added)	1.5 inch-pounds

NOTE: If the repaint is aft of the hinge centerline, the moment added is to the trailing edge. If the repaint is forward of the hinge centerline, the moment added is nose-heavy.

(5) Note the recorded balance condition on weight and balance tag (generally located on inboard closing rib).

(6) If the repaint is aft of the hinge centerline, subtract the trailing edge moment added by repaint from the recorded balance condition. The remainder indicates nose-heavy balance condition of the surface.

Example 15 (Elevator):

Recorded balance condition	735 inch-pounds
Trailing edge moment added by repaint (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	733.5 inch-pounds

Example 16 (Elevator Control Tab):

Recorded balance condition	13.5 inch-pounds
Trailing edge moment added by repaint (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	12.0 inch-pounds

(a) If the remainder is within the balance limits for the surface involved, (730.0 inch-pounds nose-heavy to 737.5 inch-pounds nose-heavy for elevator, 12.5 inch-pounds nose-heavy to 14.0 inch-pounds nose-heavy for elevator control tab) no further balance action is required. Permanently record balance condition (and weight condition if control tab) on weight and balance tag and on any other records required.

(b) If the remainder is less than the minimum nose-heavy balance limit for the surface involved (730 inch-pounds nose-heavy for elevator, 12.5 inch-pounds nose-heavy for elevator control tab), balance moment (weight) must be added to the nose cap installation.

Example 17:

Minimum elevator control tab balance limit	12.5 inch-pounds
Nose-heavy balance condition after repaint (Example 16)	12.0 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	0.5 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added, select weights from Figure 7, Elevator Adjustment Weight Numbers and Moment Contribution, for elevator, or from Figure 15, Elevator Control Tab Balance Limits and Adjustment Weight Contribution, for elevator control tab, and add to nose cap installation. Permanently record the balance condition (and weight condition if control tab) on weight and balance tag and on any other records required.

Example 18: Assuming the condition shown in Example 17, adding one number 3918060-503 adjustment weight to elevator control tab nose cap installation will add 0.72 inch-pound of moment to the nose-heavy condition. The 0.72 inch-pound provides sufficient moment to counteract the moment added to the trailing edge by the repaint and is within the 10 percent factor. The one number 3918060-503 adjustment weight addes 0.56 pound to weight of surface.

NOTE: When adding weight to the elevator control tab, add the amount of weight added by repaint to the recorded balance condition and then add the amount of weight added by the adjustment weights.

(7) If the repaint is forward of the hinge centerline, add the nose-heavy moment added by the repaint to the recorded balance condition. The sum indicates nose-heavy balance condition.

Example 19 (Elevator):

Recorded balance condition	735.0 inch-pounds
Nose-heavy moment added by repaint (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	736.5 inch-pounds

Example 20 (Elevator Control Tab):

Recorded balance condition	13.5 inch-pounds
Nose-heavy moment added by repaint (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	15.0 inch-pounds

(a) If the sum is less than the maximum balance limit for surface involved, (737.5 inch-pounds nose-heavy for elevator, 14.0 inch-pounds nose-heavy for elevator control tab), no further balance action is required. Permanently record balance condition (and weight condition if control tab) on weight and balance tag and on any other records required.

(b) If the sum is within the balance limits for surface involved, no further balance action is required. Permanently record balance condition (and weight condition if control tab) on weight and balance tag and on any other records required.

(c) If the sum is more than the maximum balance limit for the surface involved, balance moment must be removed from the nose cap.

Example 21 (Elevator Control Tab):

Maximum balance limit	14.0 inch-pounds
Nose-heavy balance condition after repaint	15.0 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	1.0 inch-pound

(d) If balance moment must be removed, select weights from Figure 7, Elevator Adjustment Weight Numbers and Moment Contribution, for elevator, or from Figure 15, Elevator Control Tab Balance Limits and Adjustment Weight Contribution, for elevator control tab, and remove from nose cap installation. Permanently record the balance condition (and weight condition if control tab) on weight and balance tag and on any other records required.

Example 22: Assuming the condition shown in Example 21, removing two No. 3918060-503 adjustment weights from elevator control tab nose cap will subtract 1.44 inch-pounds (0.72 inch-pounds x 2) from balance condition.

NOTE: When removing weight from elevator control tab, add the amount of weight added by the repaint to the recorded weight condition and then subtract the amount of weight removed as a result of removal of adjustment weight. In the example shown above, the weight value of the two number 3918060-503 adjustment weights is 1.12 pounds (0.56 pound x 2).

C. Calculation of Weight Added for Elevator Geared Tabs to be Repainted

CAUTION: THE PROCEDURE FOLLOWING INVOLVES ADDITION OF WEIGHT TO GEARED TAB. DO NOT EXCEED THE MAXIMUM ALLOWABLE WEIGHT OF 5.95 POUNDS. ALWAYS RECORD WEIGHT CONDITION AFTER REPAINTING.

(1) Determine area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the elevator geared tab is 5.5 square feet.

(2) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat to be applied. The product is the amount of weight added.

Example 23:

Area to be repainted	2.75 square feet
1 coat primer and 1 top coat to be painted over area (0.015 x 2)	.03 pound/square foot
Product (weight added)	0.08 pound

(3) Note the recorded weight condition of the surface.

(4) Add the weight added by the repaint to the recorded weight. The sum is the weight condition of the surface. Permanently record weight condition on weight and balance tag and on any other records required.

NOTE: Total weight of geared tab must not exceed 5.95 pounds.

ELEVATOR AND ELEVATOR CONTROL TAB BALANCING -

DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplane structure, the elevator and elevator control tab must be balanced nose-heavy about their hinge lines.

NOTE: The elevator geared tab does not require balancing, but must not exceed the maximum allowable weight of 5.95 pounds.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of nose overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the ability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever a surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs. The balance condition of the elevator may be checked by calculation method after repairs or repainting (see paragraph 6). The balance condition of the elevator control tab may be checked by calculation method after repainting (see paragraph 6); however, due to its close tolerance, it must be removed from the airplane in order to check the balance condition after repairs.

E. The weight of the elevator control tab and the elevator geared tab must be checked whenever repainted or reworked. The weight may be checked by calculation method after repainting (see paragraph 6). The weight condition must never exceed the maximum allowable weight; 24.90 pounds for control tab, 5.95 pounds for geared tab.

F. Two methods of balancing the control surfaces while off the airplane are presented. One method utilizes a calibrated weight beam, with sliding weight, affixed to the control surface. The sliding weight is moved along the beam until the surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition. Either method may be used.

G. Both methods of balancing the surfaces while off the airplane utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing well-oiled undersized hinge pins through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the elevator and elevator control tab are control surfaces and are movable portions of the horizontal tail which are used as pitch attitude controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) The established minimum to maximum nose-heavy moment is the required balance limits.

E. Minimum Balance Limit

(1) The established minimum nose-heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate nose-heavy moment established to provide an optimum point when rebalance is required is the recommended balance limit.

G. Maximum Balance Limit

(1) The established maximum nose-heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to nose caps which constitute minor increments of balance moment. During balance checks, the amount of balance moment adjustment required is usually within the range of the adjustment weights.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in paragraphs A and B. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (hinge pins resting on knife edges) and that the hinge pins used be sufficiently undersize, and well-oiled, so as not to pick up any eyebolt bearing friction.

A. Calibrated Beam Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for elevator balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for elevator control tab balancing
C	Weight Assembly (12 pound)	5916761-73		Standards of known weight and balance moment for balancing elevator
D	Beam	5916761-65		Direct reading scale for balancing elevator
E	Weight Assembly (5 pound)	5916761-71		Elevator balancing with beam
F	Beam Assembly	5916773-31		Direct reading scale for elevator control tab balancing

Printed in U.S.A.

Item	Name	Number	Manufacturer	Use
G	Weight Assembly (1 pound)	5916773-37		Control tab balancing with beam
H	Sensitive weighing scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co. Chicago, Ill.	Weigh tab

B. Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for elevator balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for elevator control tab balancing
C	Standard 7.00 pound checkweight		Local manufacturer	Standards of known weight and balance moment for balancing elevator
D	Standard 8.00 pound checkweight, including container			
E	Standard 12.00 pound checkweight, including container			
F	Lead shot of various sizes		Local supply	Checkweights of various values for balancing elevator control tab

Printed in U.S.A.

Item	Name	Number	Manufacturer	Use
G	Metal container			Suspension device to hold check-weights during balancing of elevator control tab
H	Sensitive weighing scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co. Chicago, Ill.	Weigh check-weights and tabs

4. Balance Elevator and Elevator Control Tab Using Beam and Weight

A. Check Elevator Balance

(1) Make certain that elevator is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and geared tab must not be installed.

(2) Mount elevator on balance stands (see Figure 1). Use well-oiled, undersize hinge pins.

(3) Suspend a 12.00-pound weight assembly from station XET 46.2 hinge location and a 12.00-pound weight from station XET 65.6 hinge location (see Figure 1).

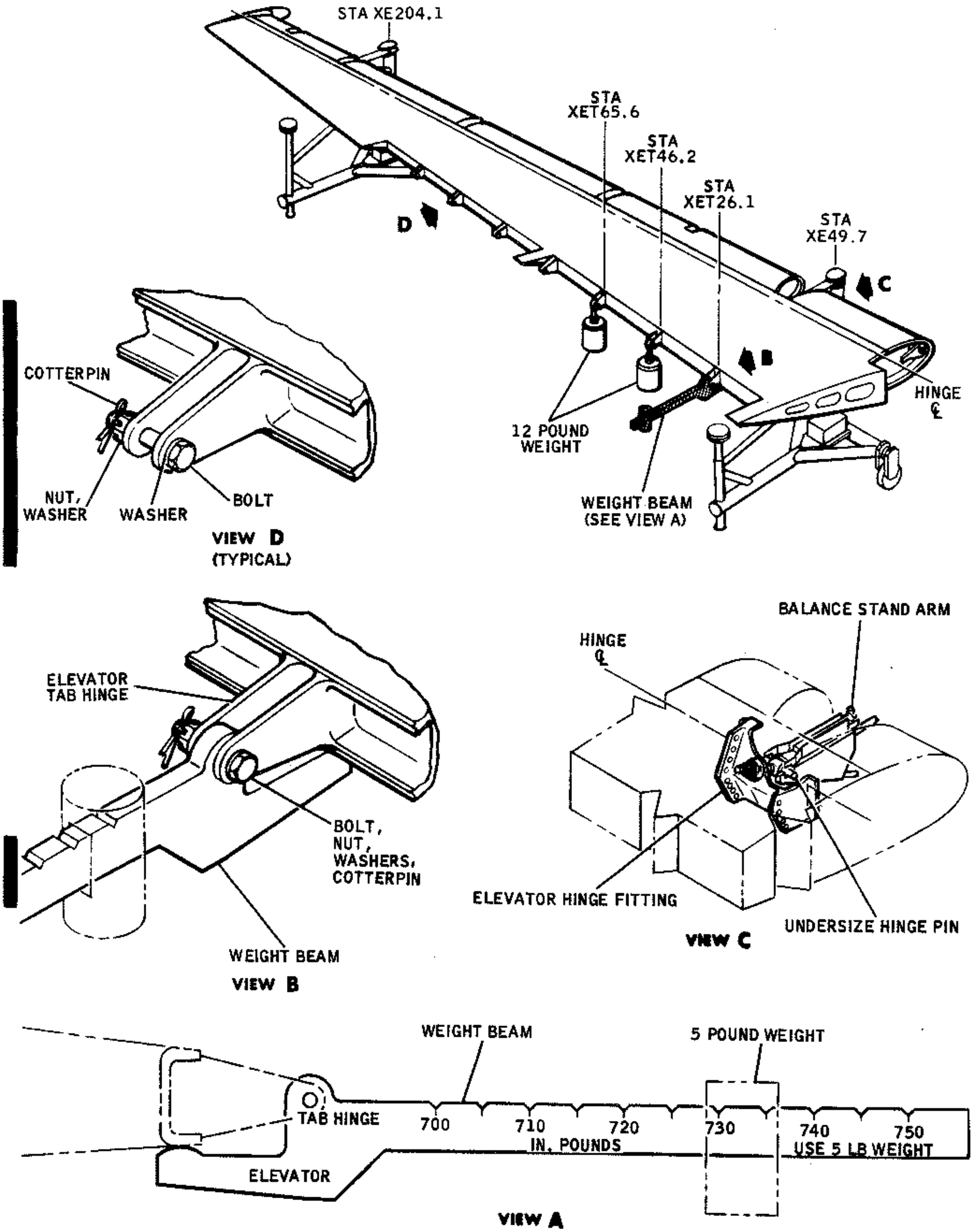
(4) Mount the beam and 5-pound weight assembly at station XET 26.1 hinge location as shown in Figure 1.

(5) Slide the 5-pound weight along the beam until the elevator assumes a horizontal attitude.

NOTE: The elevator is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(6) Read the balance indication on the beam. Balance limits for the elevator are 730.0 inch-pounds minimum to 737.5 inch-pounds maximum nose-heavy. Recommended balance is 735.0 inch-pounds nose-heavy.

(7) If the balance indication is not within limits, compare the indication with the balance conditions shown in Figure 2.



BB3-667A

Elevator Balancing with Beam
Figure 1

(8) Add, or remove, adjustment weights as necessary. See Figure 3 and 4 for adjustment weight numbers, location, and attachment. See Figure 5 for location of balance weights.

NOTE: A beam reading above maximum limits requires removal of adjustment weights. A beam reading below minimum limit requires addition of adjustment weights.

(9) Recheck balance condition.

(10) Permanently record balance condition on decal.

B. Check Elevator Control Tab Balance

(1) Make certain control tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 24.90 pounds.

(2) Mount control tab on balance stand (see Figure 6). Use station XET 26.1 and XET 80.7 hinge locations. Use well-oiled, undersize hinge pins.

Weight Beam Beading	Suggested quantity of adjustment weights to add/remove per station for indicating beam reading (see Figure 3 for adjustment weight numbers)				
	Elevator Station (XE)				
Inch-Pounds	19.9	23.0	41.5	148.6	152.6
700 to 705	2	2	2	1	1
705 to 710	2	2	1	1	1
710 to 715	1	1	2		1
715 to 720	1	1	1		1
720 to 725	1	1			1
725 to 730			1		
730 to 737.5	WITHIN BALANCE LIMITS				
737.5 to 740			1		
740 to 745	1	1			1
745 to 750	1	1	1		1

Elevator Balance Condition and Adjustment Weight Change Required
Figure 2

Adjustment Weight Number (see Figure 2 for suggested quantity)	Location Elevator Station (XE)	Moment Arm (Forward of hinge line)	Nose-Heavy Moment (each) (Inch-Pound)	Weight (each) (Pounds)
5918036-519	19.9	10.6	4.0	0.38
-519	23.0	10.5	4.0	0.38
-523	41.5	9.1	4.8	0.53
-521	148.6	6.9	2.1	0.31
-521	152.6	6.8	2.1	0.31

Elevator Adjustment Weight Numbers and Locations
Figure 3

(3) Mount the beam assembly and weight (1 pound) assembly on the control tab horn fitting assembly at station XET 9.7 (see Figure 6).

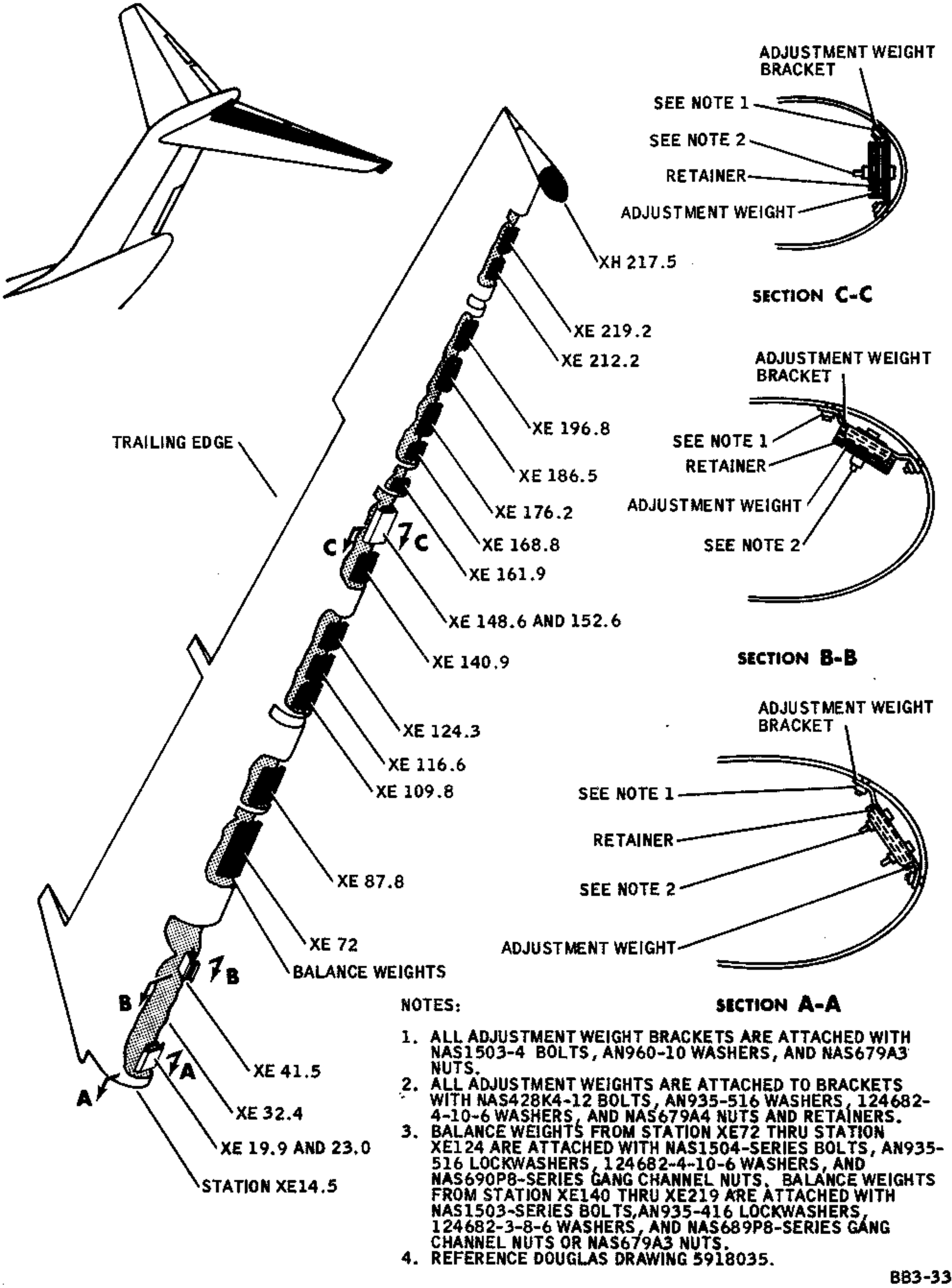
(4) Slide the 1 pound weight along the beam fixture until the control tab assumes a horizontal attitude.

<u>NOTE</u>: The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points.

(5) Read the balance indication on the beam. Balance limits for the elevator control tab are 12.5 inch-pounds minimum to 14 inch-pounds maximum nose-heavy. Recommended balance is 13.5 inch-pounds nose-heavy.

(6) If the balance indication is not within limits, add, or remove adjustment weights as necessary. See Figure 7 for adjustment weight number and contribution and Figure 8 for location and attachment.

<u>NOTE</u>: A beam reading above balance limits requires removal of adjustment weights and a beam reading below balance limits requires addition of adjustment weights.



NOTES:

1. ALL ADJUSTMENT WEIGHT BRACKETS ARE ATTACHED WITH NAS1503-4 BOLTS, AN960-10 WASHERS, AND NAS679A3 NUTS.
2. ALL ADJUSTMENT WEIGHTS ARE ATTACHED TO BRACKETS WITH NAS428K4-12 BOLTS, AN935-516 WASHERS, 124682-4-10-6 WASHERS, AND NAS679A4 NUTS AND RETAINERS.
3. BALANCE WEIGHTS FROM STATION XE72 THRU STATION XE124 ARE ATTACHED WITH NAS1504-SERIES BOLTS, AN935-516 LOCKWASHERS, 124682-4-10-6 WASHERS, AND NAS690P8-SERIES GANG CHANNEL NUTS. BALANCE WEIGHTS FROM STATION XE140 THRU XE219 ARE ATTACHED WITH NAS1503-SERIES BOLTS, AN935-416 LOCKWASHERS, 124682-3-8-6 WASHERS, AND NAS689P8-SERIES GANG CHANNEL NUTS OR NAS679A3 NUTS.
4. REFERENCE DOUGLAS DRAWING 5918035.

BB3-335A

Elevator Weight Location and Attachment
Figure 4

Number	Location (Elevator Station)	Approximate Weight (Pounds)
5918036		
-501	XE 72	12.69
-503	XE 89.5	7.31
-505	XE 109.8 and XE 116.6	4.43
-507	XE 124.3	4.05
-509	XE 140.9	3.17
-511	XE 16.9	.78
-513	XE 176.2 and XE 186.5	4.58
-515	XE 196.8	4.89
-517	XE 168.8	1.55
-525	XE 212.2	3.92
-527	XE 219.2	3.38
5919752-19 (Part of horn)	XH 217	20.0 to 20.2

Elevator Balance Weight Locations
Figure 5

(7) Recheck balance condition.

(8) Weigh control tab to ensure that the maximum allowable weight of 24.90 pounds is not exceeded.

(9) Permanently record balance condition and weight on decal.

5. Balance Elevator and Elevator Control Tab Using Checkweight Method

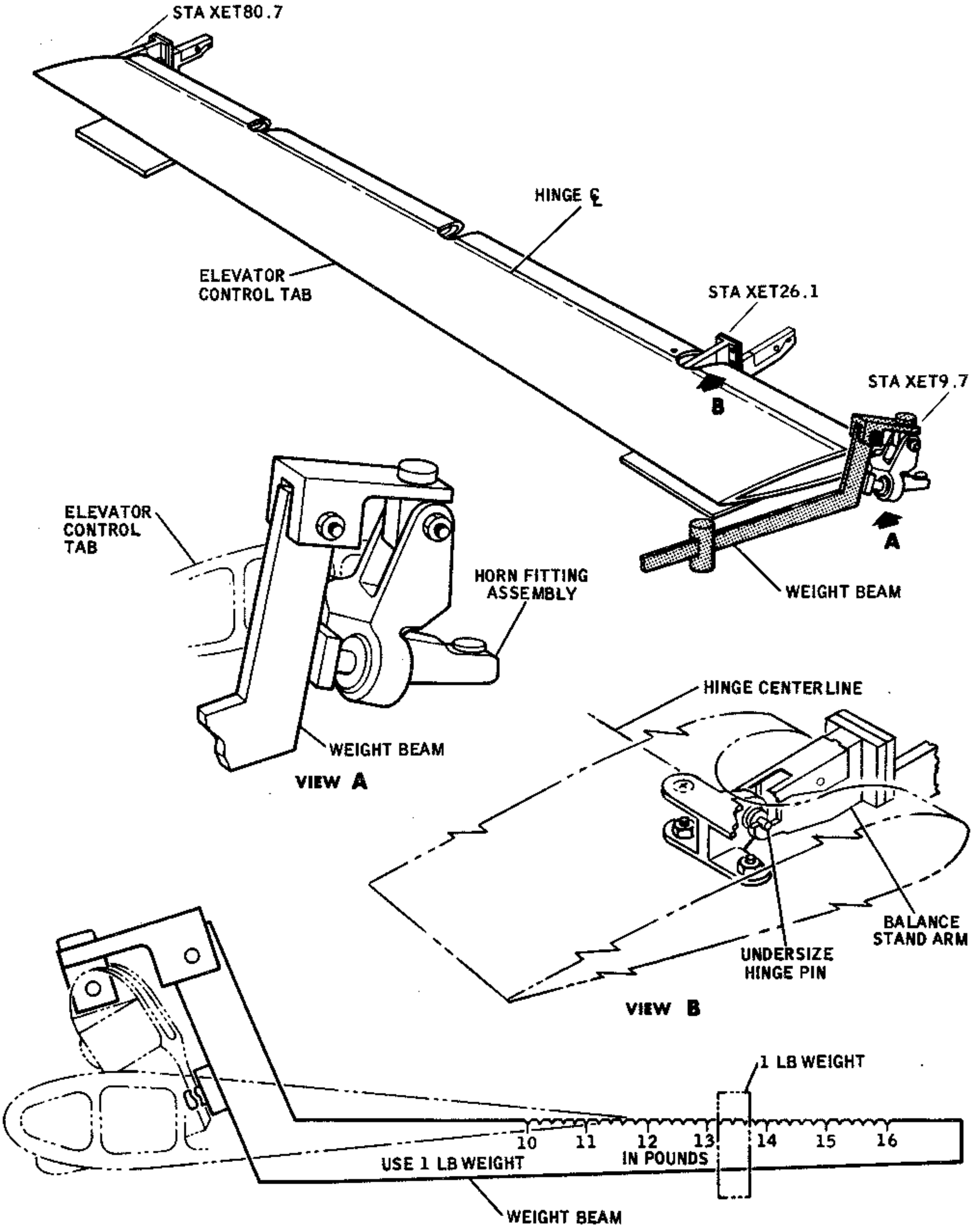
A. Check Elevator Balance

(1) Make certain that elevator is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and geared tab must not be installed.

(2) Mount elevator on balance stands (see Figure 9). Use station XE 49.7 and XE 204.1 hinge locations. Use well-oiled, undersize hinge pins.

(3) Suspend 7.00 pound checkweight (see Figure 10) and 8 pound checkweight (see Figure 11) from hinge point at station XTE 46.29 (see Figure 9).

<u>NOTE</u>: Moment arm is 23.83 inches.



Elevator Control Tab Balancing with Beam
Figure 6

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Contribution of Each Number 3918060-503 Adjustment Weight	
		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	12.5	0.55	0.72
Recommended	13.5		
Maximum	14		

Elevator Control Tab Balance Limits and Adjustment Weight Contribution
Figure 7

(4) Suspend 12.00 pound checkweight (see Figure 12) from hinge point at station XTE 26.1 (see Figure 9).

<u>NOTE</u>: Moment arm is 25.34 inches.

(5) Add checkweights (lead shot) to the 12.00 pound checkweight container until elevator assumes a horizontal attitude.

<u>NOTE</u>: Elevator is in a horizontal attitude when the centerline of the checkweight suspension points is the same distance from the floor (baseline) as centerline of the mount points.

(6) Weight total checkweights suspended from station XTE 26.1.

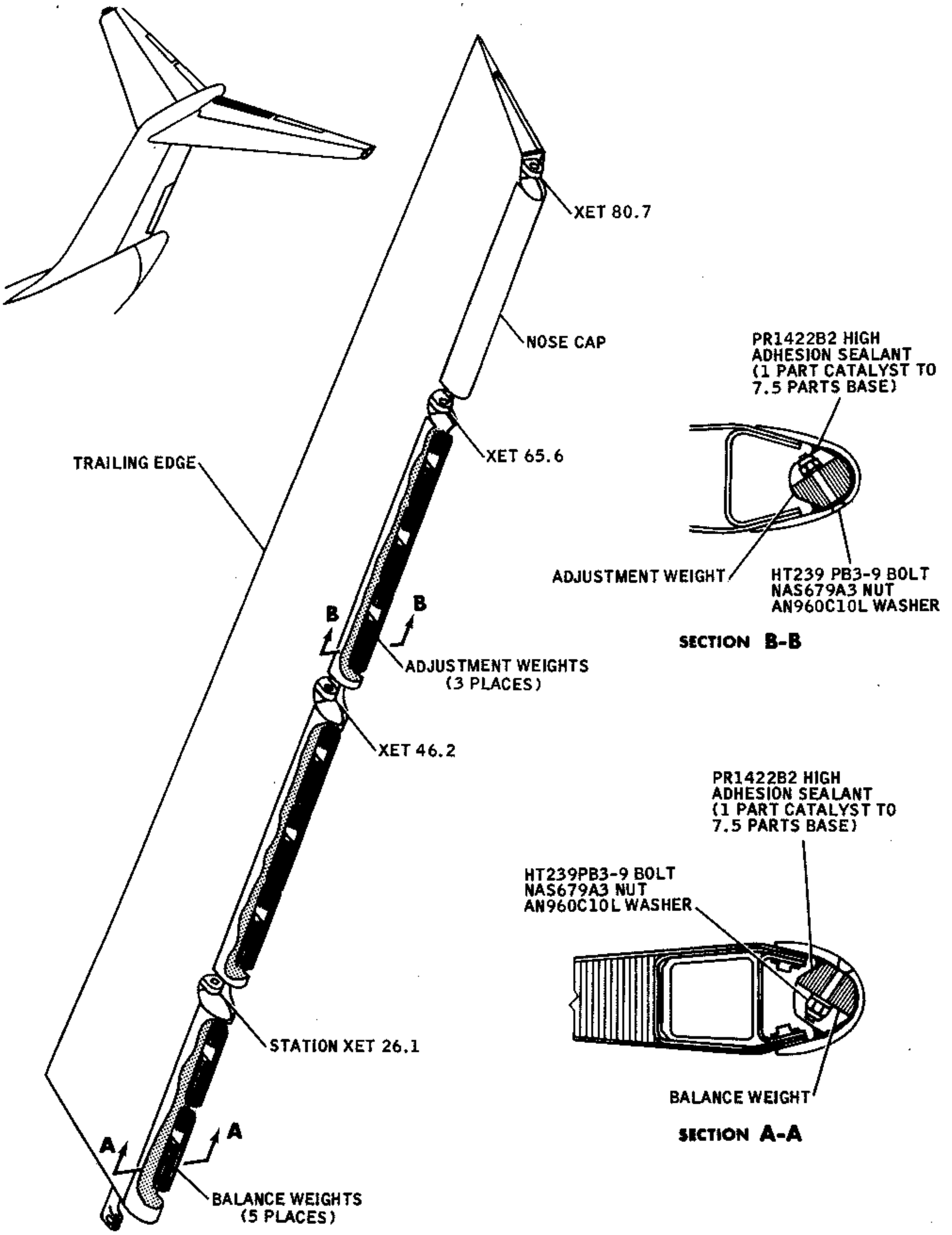
(7) Compare total weight with balance condition shown in Figure 13.

(8) Add, or remove, adjustment weights as required. See Figure 3 for adjustment weight numbers and location and Figure 4 for location and attachment.

(9) Recheck balance condition.

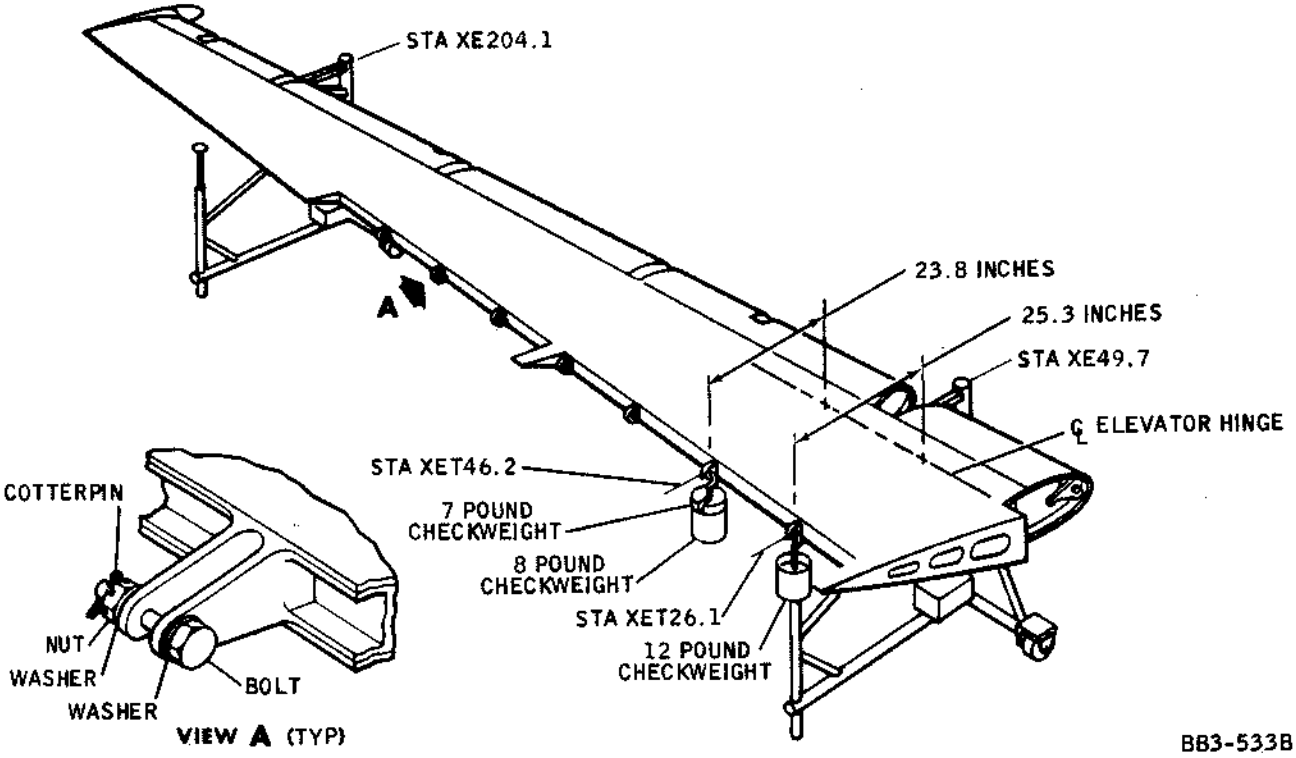
<u>NOTE</u>: Balance limits for elevator are 730.0 inch-pounds minimum to 737.5 inch-pounds maximum nose-heavy. Recommended balance is 735.0 inch-pounds nose-heavy. The total amount of checkweights required to equal recommended balance limit is 29.89 pounds (15.00 pounds suspended from station STE 46.29 and 14.89 pounds suspended from station XTE 26.1).

(10) Permanently record balance condition on decal.

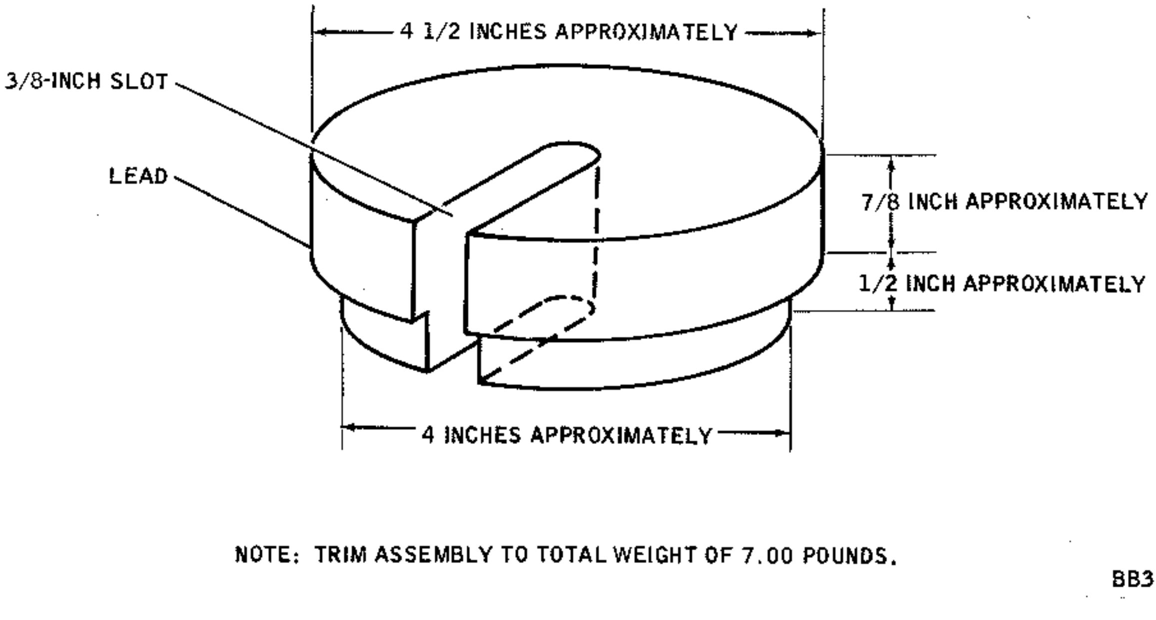


BB3-334A

Elevator Control Tab Weight Location and Attachment
Figure 8



Elevator Balancing and Checkweight Suspension
Figure 9



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 7.00 POUNDS.

Seven Pound Standard Checkweight
Figure 10

B. Check Elevator Control Tab Balance

(1) Make certain control tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 24.90 pounds.

(2) Mount control tab on balance stand (see Figure 14). Use station XET 26.1 and XET 80.7 hinge locations. Use well-oiled, undersize hinge pins.

(3) Loosen nose cap attach screw (see Figure 14).

(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge (see Figure 14).

(5) Attach one end of the cord or soft safety wire to the screw and the other end to a container.

(6) Suspend container over trailing edge.

NOTE: Moment arm is 8.125 inches.

(7) Add checkweights (lead shot) to container until control tab assumes a horizontal attitude.

NOTE: Control tab is in a horizontal attitude when centerline of trailing edge is the same distance from floor (baseline) as centerline of mount points.

(8) Weigh container and checkweights.

(9) Compare weight with values specified in Figure 15.

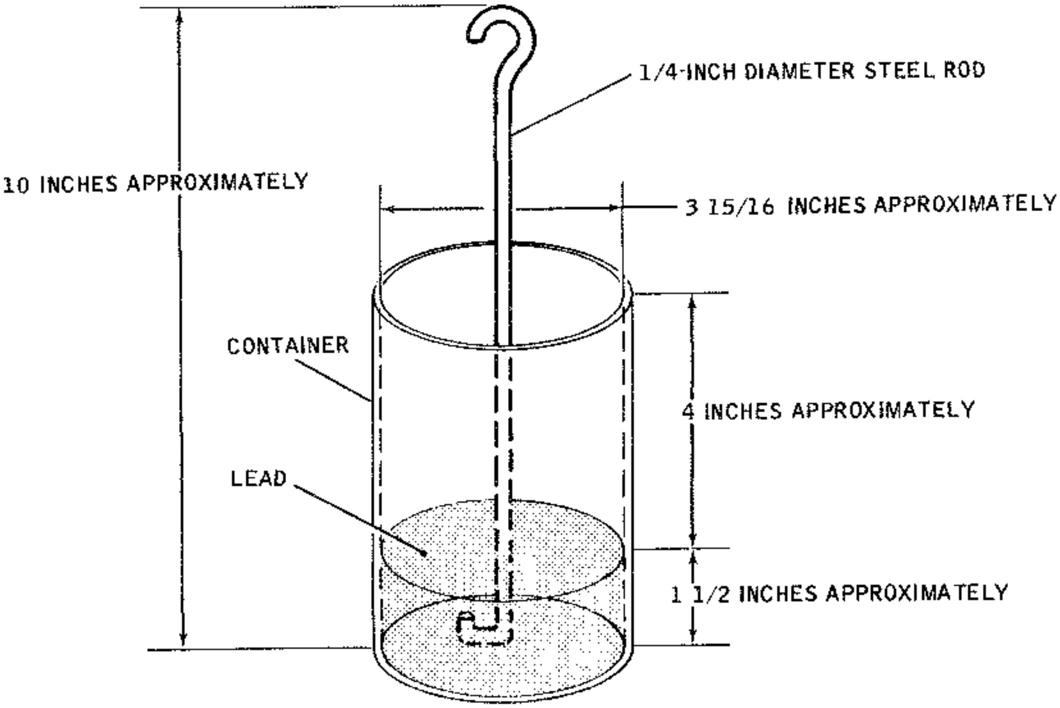
(10) Add, or remove, adjustment weights (see Figure 8 for location and attachment) as required to maintain correct balance limits.

NOTE: Balance limits for the elevator control tab are 12.5 inch-pounds minimum to 14 inch-pounds maximum nose-heavy. Recommended balance is 13.5 inch-pounds nose-heavy.

(11) Recheck balance condition.

(12) Weigh control tab to ensure that the maximum allowable weight of 24.90 pounds is not exceeded.

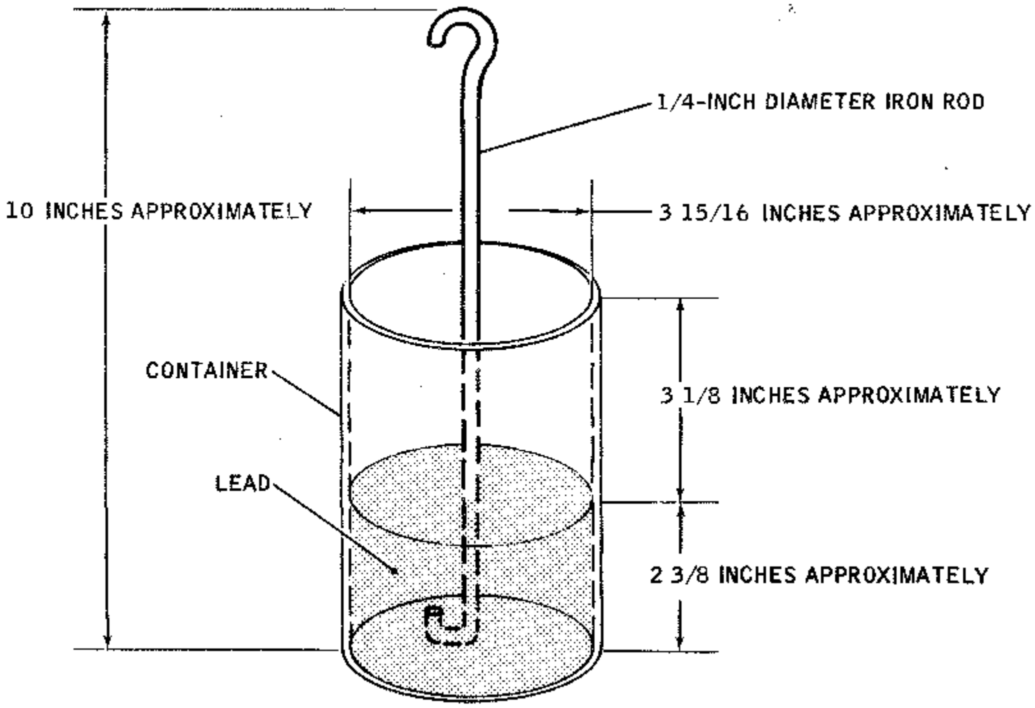
(13) Permanently record balance condition and weight on decal.



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 8.00 POUNDS.

BB3-432

Eight Pound Standard Checkweight
Figure 11



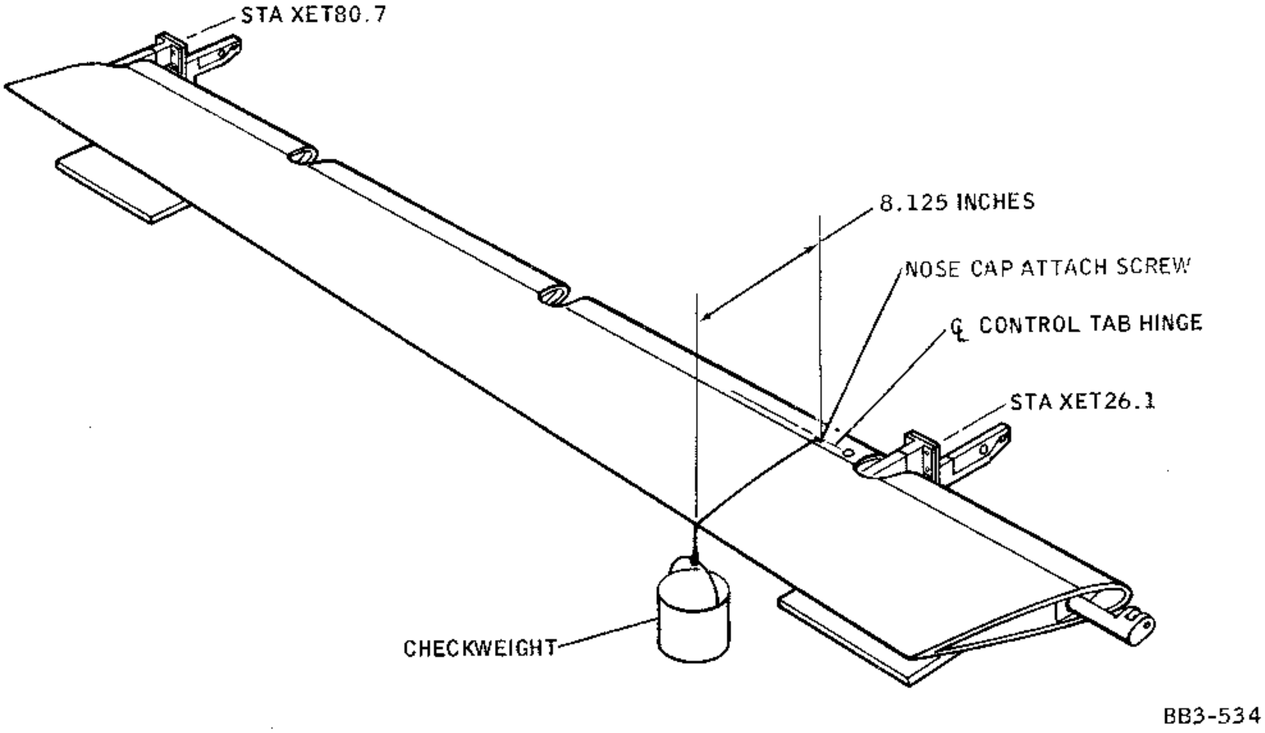
NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 12.00 POUNDS.

BB3-431

Twelve Pound Standard Checkweight
Figure 12

Balance Condition		Suggested quantity of adjustment weights to add/remove per station for indicated unbalance condition (see Figure 3 for adjustment weight numbers).				
Checkweight above or below recommended weight of 14.89 pounds at station XTE 26.1	(Equivalent) Hinge moment above or below recommended moment of 735					
Pounds	Inch-Pounds	Elevator Station (XE)				
		19.9	23.0	41.5	148.6	152.6
0 to 0.10	0. to 2.5	WITHIN BALANCE LIMITS				
0.10 to 0.29	2.5 to 7.5			1		
0.29 to 0.49	7.5 to 12.5	1	1			1
0.49 to 0.69	12.5 to 17.5	1	1	1		1
0.69 to 0.89	17.5 to 22.5	1	1	2		1
0.89 to 1.08	22.5 to 27.5	2	2	1	1	1
1.08 to 1.28	27.5 to 32.5	2	2	2	1	1
1.28 to 1.48	32.5 to 37.5	2	2	3	2	2
1.48 to 1.67	37.5 to 42.5	2	3	3	2	2
1.67 to 1.87	42.5 to 47.5	2	3	4	1	2
1.87 to 2.07	47.5 to 52.5	3	4	3	3	3
2.07 to 2.26	52.5 to 57.5	3	4	4	3	3

Elevator Balance Condition and Adjustment Weight Change Required
Figure 13



Elevator Control Tab Balancing and Checkweight Suspension
Figure 14

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Equivalent Checkweight (Pounds)	Contribution of Each Number 3918060-503 Adjustment Weight	
			Weight (Pounds)	Moment (Inch-Pounds)
Minimum	12.5	1.54	0.55	0.72
Recommended	13.5	1.66		
Maximum	14	1.72		

Elevator Control Tab Balance Limits and Adjustment Weight Contribution
Figure 15

6. Balance Elevator By Calculation Method

A. Calculation Method For Elevators to Be Repaired

CAUTION: THE FOLLOWING PROCEDURE CHANGES BALANCE CONDITION OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS, AND THE BALANCE CONDITION AFTER REPAIR MUST BE PERMANENTLY RECORDED ON DECAL.

(1) Weigh removed damaged material to nearest 0.01 pound.

(2) Weigh repair material to be added to nearest 0.01 pound.

(3) Subtract the removed material weight from the repair material weight. The remainder is the net weight.

Example 1:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.20 pound
Net weight change (0.20 - 0.10)	0.10 pound

Example 2:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.40 pound
Net weight change (0.40 - 0.10)	0.30 pound

(4) Attach cord to hinge centerline at each end of control surface and stretch cord taut across surface to establish hinge centerline across surface.

(5) Measure the distance in inches (to the nearest 0.1 inch) from the hinge centerline to the centerline of the repair (see Figure 16).

NOTE: The example given in Figure 16 shows repair aft of hinge line. If repair is forward of hinge line, measure distance forward of hinge line to center of repair.

(6) Multiply this dimension by the net weight change obtained in step (3). The product is the amount of moment added by repair. See examples:

Example 3:

Net weight change from step (3), Example 1	0.10 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added Moment) (0.10 lb x 10 in.)	1 inch-pound

Example 4:

Net weight change from step (3), Example 2	0.30 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added Moment) (0.30 lb x 10 in.)	3 inch-pounds

NOTE: If the repair is aft of the hinge line, the moment added is to the trailing edge. If the repair is forward of the hinge line the moment added is to the nose-heavy condition.

(7) Note the recorded balance condition on the decal, or stencil (generally located on inboard closing rib).

(8) If the repair is aft of the hinge centerline, subtract the trailing edge heavy moment added by the repair from the recorded balance condition. The remainder indicates nose-heavy balance condition of surface.

Example 5:

Recorded balance condition	735 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pounds
Remainder (nose heavy balance condition)	734 inch-pounds

Example 6:

Recorded balance condition	732 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
Remainder (nose heavy balance condition)	729 inch-pounds

(a) If the remainder is within the elevator balance limits of 730 inch-pounds to 737.5 inch-pounds nose-heavy (see paragraph 4), no further balance action is required. Permanently record the balance condition on the decal.

(b) If the remainder is less than the minimum elevator balance limit of 730 inch-pounds (Example 6), balance moment (weight) must be added to nose cap.

Example 7:

Minimum elevator balance limit	730 inch-pounds
Nose heavy balance condition after repair (Example 6)	729 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	1 inch-pound

<u>NOTE</u>: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added, select weights from Figure 3, Elevator Adjustment Weight Numbers and Moment Contribution, and add to nose cap installation. Weights added should be as near in line with repair as possible. Permanently record balance condition on decal.

Example 8: Assuming the condition shown in Example 7, selecting one No. 5918036-523 adjustment weight for installation at elevator station XE 41.5 will provide 4.8 inch-pounds of moment. The 4.8 inch-pounds provides sufficient balance moment to counteract the trailing edge heavy moment added by repair and is within the 10 percent factor.

(9) If the repair is forward of the hinge centerline, add the nose-heavy moment added by the repair to the recorded balance condition. The sum indicates nose-heavy balance condition of surface.

Example 9:

Recorded balance condition	735 inch-pounds
Nose heavy moment added by repair (Example 3)	1 inch-pounds
Sum (nose-heavy balance condition)	736 inch-pounds

Example 10:

Recorded balance condition	732 inch-pounds
Nose-heavy moment added by repair (Example 4)	3 inch-pounds
Sum (nose-heavy balance condition)	735 inch-pounds

(a) If the sum is within the elevator balance limits of 730 inch-pounds to 737.5 inch-pounds nose-heavy, no further balance action is required. Permanently record the balance condition on the decal.

(b) If the sum is more than the maximum elevator balance limit of 737.5 inch-pounds, balance moment must be removed from the nose cap.

Example 11:

Maximum elevator balance limit	737.5 inch-pounds
Nose-heavy balance condition after repair	740.5 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	2.5 inch-pounds

NOTE: The maximum amount should always be increased by a factor of 10 percent so as to provide a working margin.

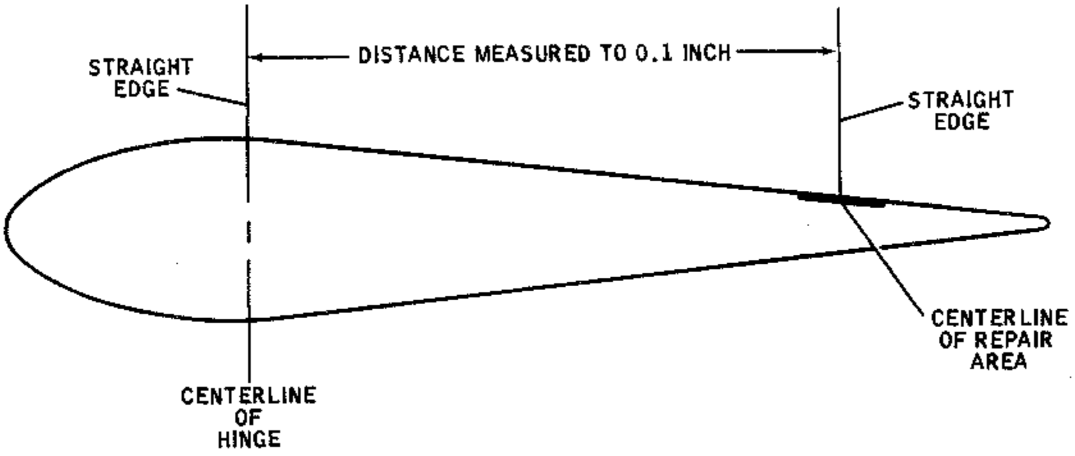
(c) If balance moment must be removed, select weights from Figure 3, Elevator Adjustment Weight Numbers and Moment Contribution, and remove from nose cap installation. Permanently record balance condition on decal.

Example 12: Assuming the condition shown in example 11, selecting one No. 5918036-523 adjustment weight for removal from elevator station XE 41.5 will provide 4.8 inch-pounds of moment. Removing the 4.8 inch-pounds provides sufficient moment to counteract the excessive nose-heavy condition added by repair and is within the 10 percent factor.

B. Calculation Method for Elevator and Elevator Control Tab to be Repainted

CAUTION: THE FOLLOWING PROCEDURES CHANGE THE BALANCE CONDITION AND WEIGHT OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS, AND MAXIMUM ALLOWABLE WEIGHT, IF TAB. THE BALANCE CONDITION, AND WEIGHT IF TAB, MUST BE PERMANENTLY RECORDED ON DECAL AFFIXED TO SURFACE.

(1) Determine location (forward or aft of hinge centerline) of area to be repainted and distance from hinge centerline to center of area (see Figure 16).



TYPICAL MAIN CONTROL SURFACE

8B3-718

Determining Distance from Hinge Centerline to Repair Centerline
Figure 16

(2) Determine size of area (in square feet) to be repainted.

<u>NOTE</u>: The total surface area (both sides) of the elevator, exclusive of tabs, is 92.1 square feet. Of the 92.1 square feet, 27.4 square feet are forward of the hinge centerline and 64.7 square feet are aft of the hinge centerline. The total surface area of the elevator control tab is 9.05 square feet. Of the 9.05 square feet, 1.75 square feet are forward of the hinge centerline and 7.30 square feet are aft of the hinge centerline.

(3) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat applied. The product is the amount of weight added.

Example 13:

Area to be repainted	5 square feet
1 coat primer and 1 top coat to be painted over area (0.015 x 2)	0.03 pound/square foot
Product (weight added by repaint)	0.15 pound

(4) Multiply the weight added by repaint by the distance from the hinge centerline to the center of the repaint. The product is the amount of moment added.

Example 14:

Weight added by repaint (Example 13)	0.15 pound
Distance from hinge centerline to centerline of repaint area	10 inches
Product (moment added)	1.5 inch-pounds

NOTE: If the repaint is aft of the hinge centerline, the moment added is to the trailing edge. If the repaint is forward of the hinge centerline, the moment added is nose heavy.

(5) Note the recorded balance condition on decal, or stencil (generally located on inboard closing rib).

(6) If the repaint is aft of the hinge centerline, subtract the trailing edge moment added by repaint from the recorded balance condition. The remainder indicates nose-heavy balance condition of the surface.

Example 15 (Elevator):

Recorded balance condition	735 inch-pounds
Trailing edge moment added by repaint (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	733.5 inch-pounds

Example 16 (Elevator Control Tab):

Recorded balance condition	13.5 inch-pounds
Trailing edge moment added by repaint (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	12.0 inch-pounds

(a) If the remainder is within the balance limits for the surface involved, (730.0 inch-pounds nose-heavy to 737.5 inch-pounds nose-heavy for elevator, 12.5 inch-pounds nose-heavy to 14.0 inch-pounds nose-heavy for elevator control tab) no further balance action is required. Permanently record balance condition (and weight condition if control tab) on decal.

(b) If the remainder is less than the minimum nose-heavy balance limit for the surface involved (730 inch-pounds nose-heavy for elevator, 12.5 inch-pounds nose-heavy for elevator control tab), balance moment (weight) must be added to the nose cap installation.

Example 17:

Minimum elevator control tab balance limit	12.5 inch-pounds
Nose-heavy balance condition after repaint (Example 16)	12.0 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	0.5 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added, select weights from Figure 3, Elevator Adjustment Weight Numbers and Moment Contribution, for elevator, or from Figure 7, Elevator Control Tab Balance Limits and Adjustment Weight Contribution, for elevator control tab, and add to nose cap installation. Permanently record the balance condition (and weight condition if control tab) on decal.

Example 18: Assuming the condition shown in Example 17, adding one number 3918060-503 adjustment weight to elevator control tab nose cap installation will add 0.72 inch-pound of moment to the nose-heavy condition. The 0.72 inch-pound provides sufficient moment to counteract the moment added to the trailing edge by the repaint and is within the 10 percent factor. The one number 3918060-503 adjustment weight adds 0.55 pound to weight of surface.

NOTE: When adding weight to the elevator control tab, add the amount of weight added by repaint to the recorded balance condition and then add the amount of weight added by the adjustment weights.

(7) If the repaint is forward of the hinge centerline, add the nose-heavy moment added by the repaint to the recorded balance condition. The sum indicates nose-heavy balance condition.

Example 19 (Elevator):

Recorded balance condition	735.0 inch-pounds
Nose-heavy moment added by repaint (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	736.5 inch-pounds

Example 20 (Elevator Control Tab):

Recorded balance condition	13.5 inch-pounds
Nose-heavy moment added by repaint (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	15.0 inch-pounds

(a) If the sum is less than the maximum balance limit for surface involved, (737.5 inch-pounds nose-heavy for elevator, 14.0 inch-pounds nose-heavy for elevator control tab), no further balance action is required. Permanently record balance condition (and weight condition if control tab) on decal.

(b) If the sum is within the balance limits for surface involved, no further balance action is required. Permanently record balance condition (and weight condition if control tab) on decal.

(c) If the sum is more than the maximum balance limit for the surface involved, balance moment must be removed from the nose cap.

Example 21 (Elevator Control Tab):

Maximum balance limit	14.0 inch-pounds
Nose-heavy balance condition after repaint	15.0 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	1.0 inch-pound

(d) If balance moment must be removed, select weights from Figure 3, Elevator Adjustment Weight Numbers and Moment Contribution, for elevator, or from Figure 7, Elevator Control Tab Balance Limits and Adjustment Weight Contribution, for elevator control tab, and remove from nose cap installation. Permanently record the balance condition (and weight condition if control tab) on decal.

Example 22: Assuming the condition shown in Example 21, removing two No. 3918060-503 adjustment weights from elevator control tab nose cap will subtract 1.44 inch-pounds (0.72 inch-pounds x 2) from balance condition.

NOTE: When removing weight from elevator control tab, add the amount of weight added by the repaint to the recorded weight condition and then subtract the amount of weight removed as a result of removal of adjustment weight. In the example shown above, the weight value of the two number 3918060-503 adjustment weights is 1.10 pounds (0.55 pound x 2).

C. Calculation of Weight Added for Elevator Geared Tabs to be Repainted

CAUTION: THE PROCEDURE FOLLOWING INVOLVES ADDITION OF WEIGHT TO GEARED TAB. DO NOT EXCEED THE MAXIMUM ALLOWABLE WEIGHT OF 5.95 POUNDS. ALWAYS RECORD WEIGHT CONDITION AFTER REPAINTING.

(1) Determine area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the elevator geared tab is 5.5 square feet.

(2) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat to be applied. The product is the amount of weight added.

Example 23:

Area to be repainted	2.75 square feet
1 coat primer and 1 top coat to be painted over area (0.015 x 2)	.03 pound/square foot
Product (weight added)	0.08 pound

(3) Note the recorded weight condition of the surface.

(4) Add the weight added by the repaint to the recorded weight. The sum is the weight condition of the surface. Permanently record weight condition on decal.

NOTE: Total weight of geared tab must not exceed 5.95 pounds.

ELEVATOR - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates elevator components. Types and gages of material used in construction of the assemblies are identified in the illustration.

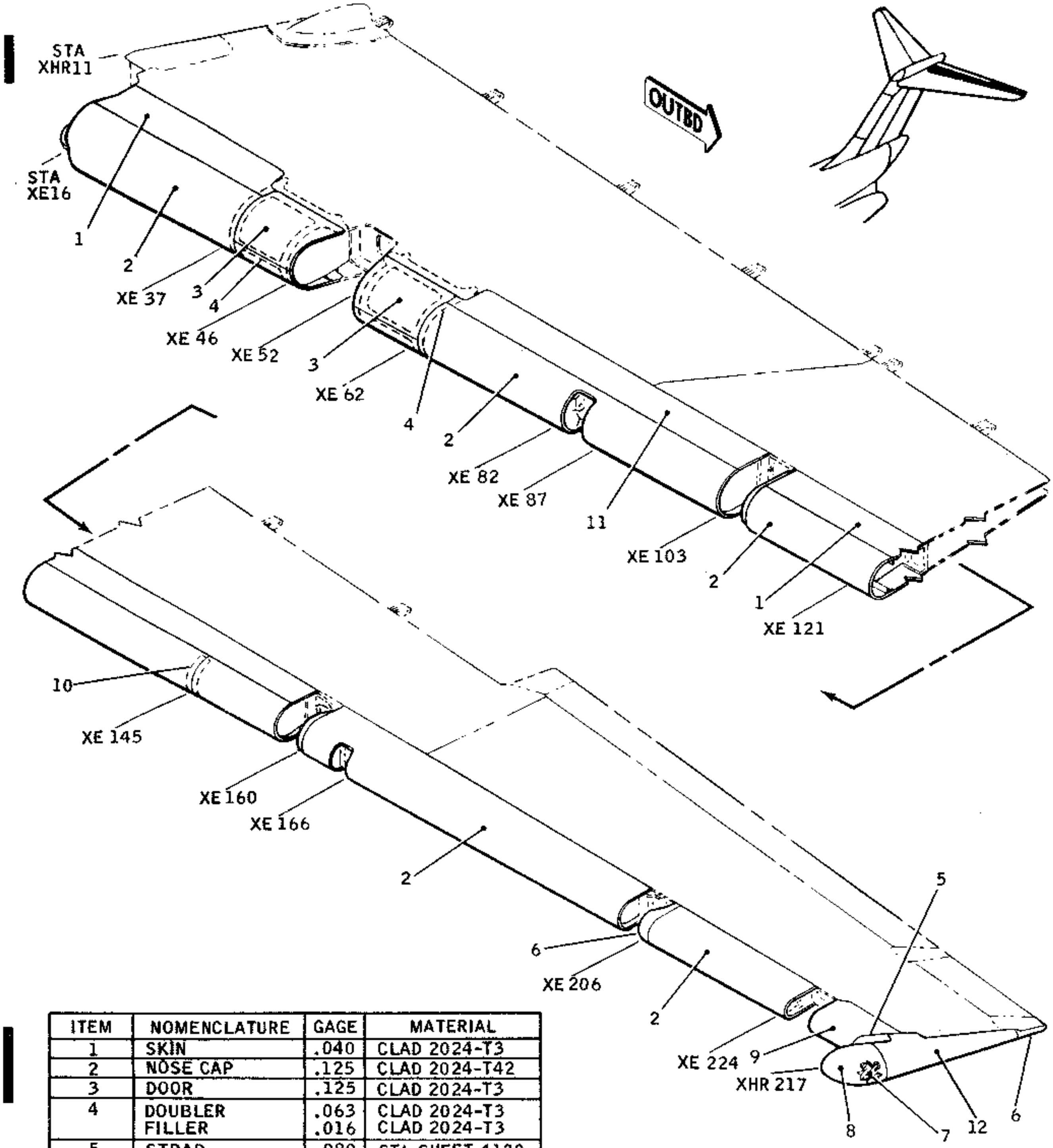
B. This section also contains balancing procedures for the elevator and elevator control tab (see 55-20-1). When a repair is made to an elevator or elevator control tab, the surface must be rebalanced. When a repair is made to an elevator control tab or geared tab, the surface must be weighed as outlined in the balancing procedure.

<u>NOTE</u>: The elevator geared tab does not require balancing. Weight data is provided in the balancing procedure (see 55-20-1).

2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore structural integrity and appearance of components.

Structural Component	Approved Repairs
Formers, Ribs, and internal structure	Section 55-02, Figure 1
Skins (including trailing edge)	Section 55-03, Figures 1, 2, 5, and 6
Honeycomb	Section 55-04, Figures 1 through 3

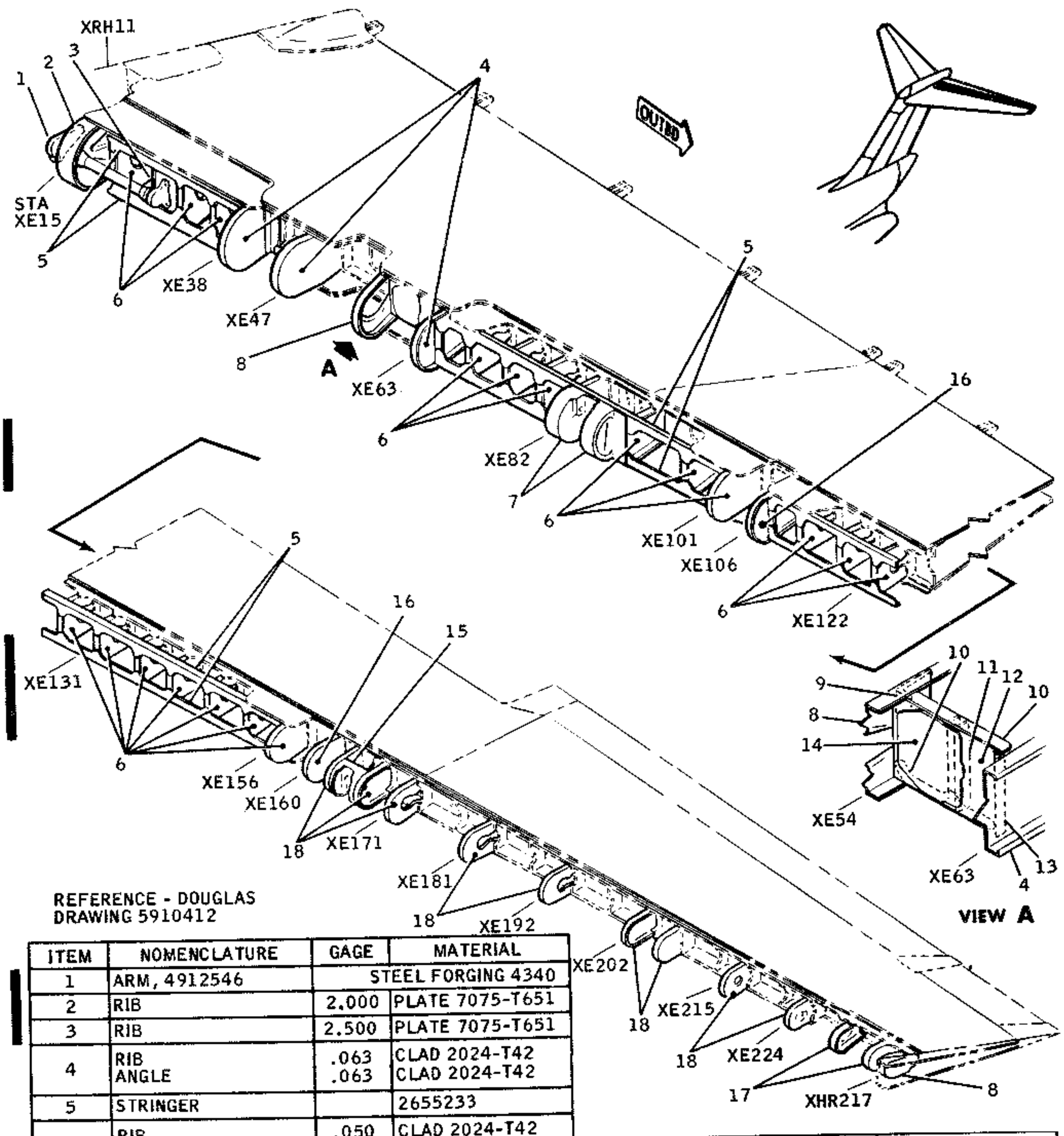


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.040	CLAD 2024-T3
2	NOSE CAP	.125	CLAD 2024-T42
3	DOOR	.125	CLAD 2024-T3
4	DOUBLER FILLER	.063 .016	CLAD 2024-T3 CLAD 2024-T3
5	STRAP PLATE	.080 .080	STL SHEET 4130 STL SHEET 4130
6	TIP END	.020	CLAD 2024-T42
7	WEIGHT		SEE NOTE 1
8	COVER FORMER	.063 .063	STL SHEET 4130 STL SHEET 4130
9	NOSE CAP	.063	CLAD 2024-T42
10	DOUBLER	.125	CLAD 2024-T3
11	SKIN	.050	CLAD 2024-T3
12	TIP COVER	.071	CLAD 2024-T4

NOTES:
1. CAST LEAD COUNTERWEIGHT ALLOY.
2. REFERENCE - DOUGLAS DRAWING 5910412.

BB3-820A

Elevator Leading Edge Plating -- Type A
Figure 1

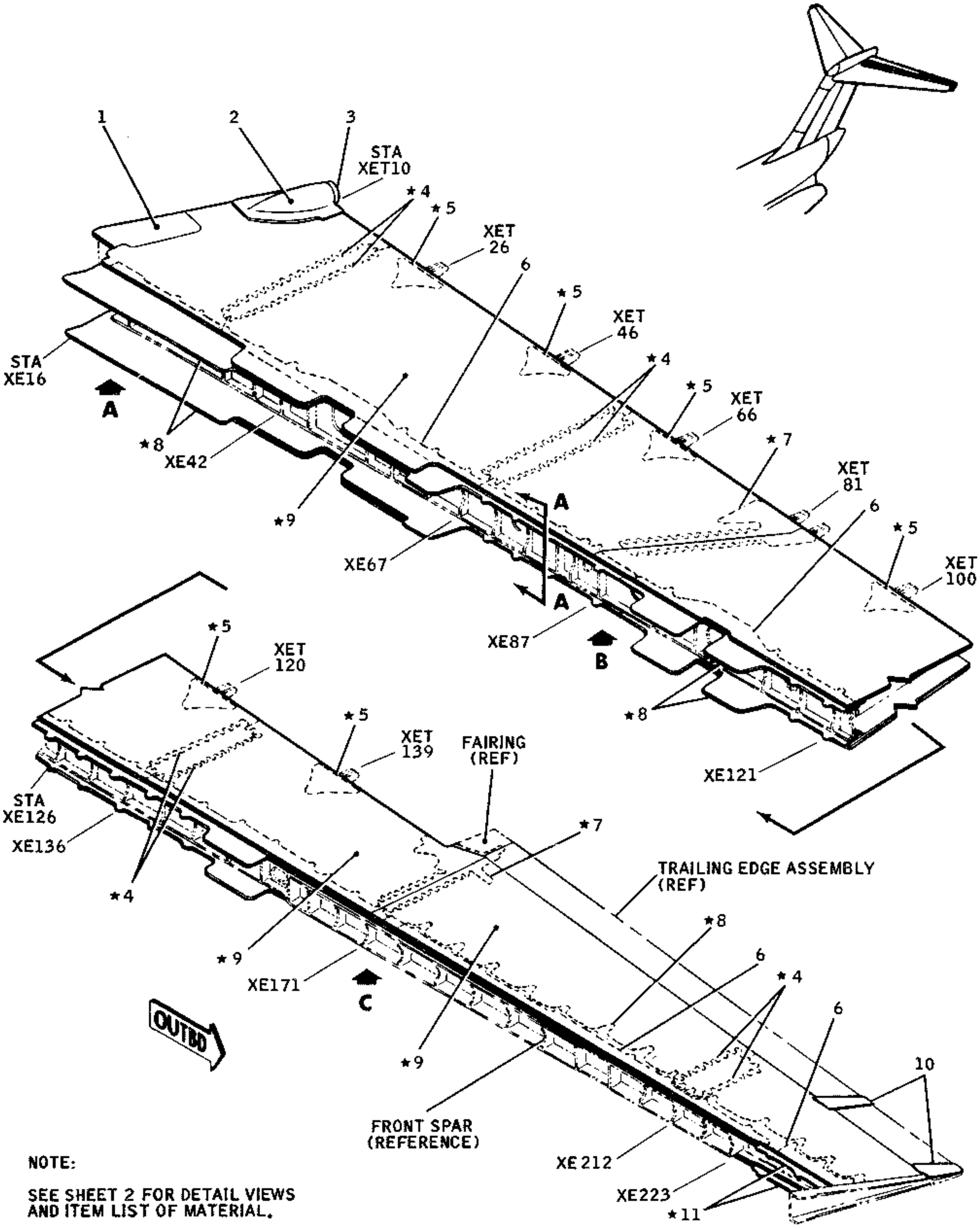


REFERENCE - DOUGLAS DRAWING 5910412

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ARM, 4912546		STEEL FORGING 4340
2	RIB	2.000	PLATE 7075-T651
3	RIB	2.500	PLATE 7075-T651
4	RIB ANGLE	.063 .063	CLAD 2024-T42 CLAD 2024-T42
5	STRINGER		2655233
6	RIB ANGLE	.050 .063	CLAD 2024-T42 CLAD 2024-T42
7	FITTING, 3918047		FORGING 7075-T411
8	RIB	.063	CLAD 2024-T42
9	FITTING		1372665
10	ANGLE	.080	CLAD 2024-T42
11	CHANNEL	.080	CLAD 2024-T42
12	WEB	.040	CLAD 2024-T3
13	ANGLE	.063	CLAD 2024-T42
14	COVER	.040	CLAD 2024-T3
15	FITTING, 3918033		FORGING 7075-T411
16	RIB ANGLE	.050	CLAD 2024-T42 1701177
17	RIB STRAP	.063 .040	CLAD 2024-T42 CLAD 2024-T3
18	RIB	.050	CLAD 2024-T42

BB3-987

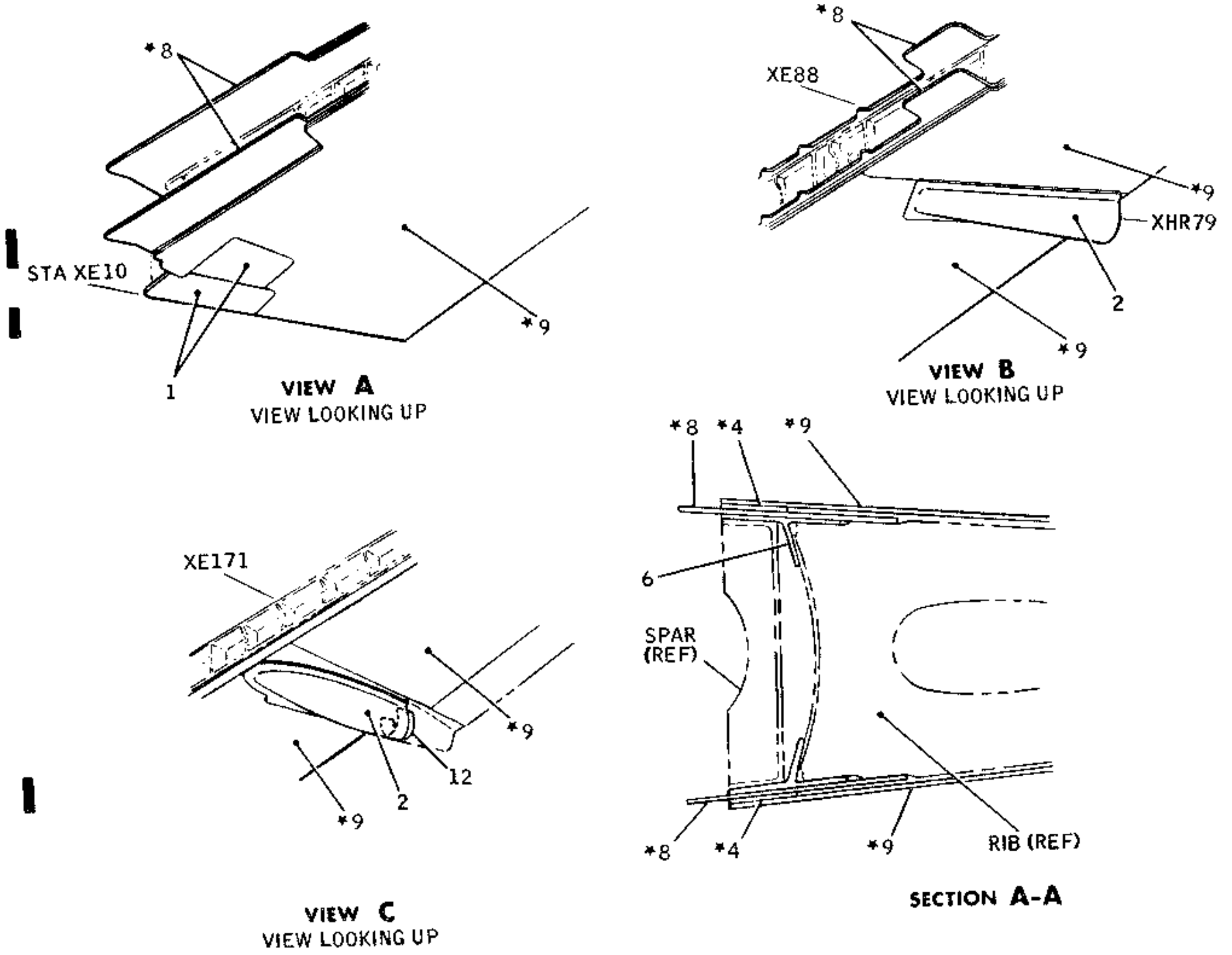
Elevator Leading Edge Structure -- Type A
Figure 2



NOTE:

SEE SHEET 2 FOR DETAIL VIEWS AND ITEM LIST OF MATERIAL.

Elevator Center Section Plating -- Type A
Figure 3 (Sheet 1)



VIEW A
VIEW LOOKING UP

VIEW B
VIEW LOOKING UP

VIEW C
VIEW LOOKING UP

SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOOR	.040	CLAD 2024-T3
2	FAIRING	.032	CLAD 2024-T42
3	INTERCOSTAL	.040	CLAD 2024-T42
	SPACER	.032	CLAD 2024-T3
* 4	FINGER DOUBLER	.012	CLAD 2014-T6
* 5	GUSSET	.025	CLAD 2014-T6
6	TEE		2918090
* 7	SPLICE DOUBLER	.025	CLAD 2014-T6
* 8	STRAP DOUBLER	.063	CLAD 2014-T6
* 9	SKIN	.020	CLAD 2014-T6
10	DOUBLER	.020	CLAD 2024-T42
* 11	SPACER	.032	CLAD 2014-T6
12	STRAP	.050	CLAD 2024-T3

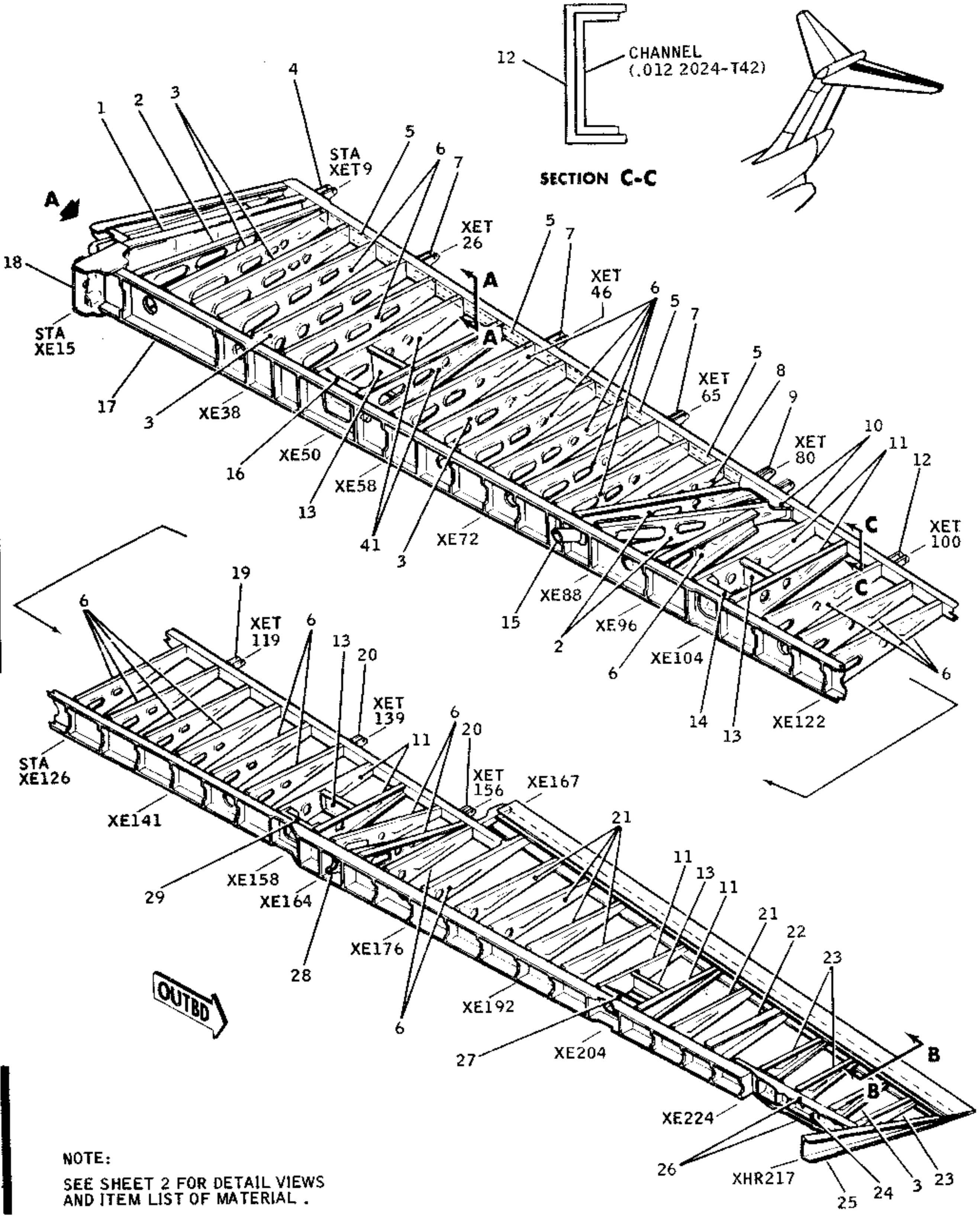
SEE NOTE 2

NOTES:

1. * INDICATES BONDED ITEM.
2. ITEMS 4, 5, 6, 7, 8, 9 AND 11 ARE TYPICAL FOR UPPER AND LOWER SKIN INSTALLATIONS.
3. REFERENCE - DOUGLAS DRAWING 5910412.

BB3-827A

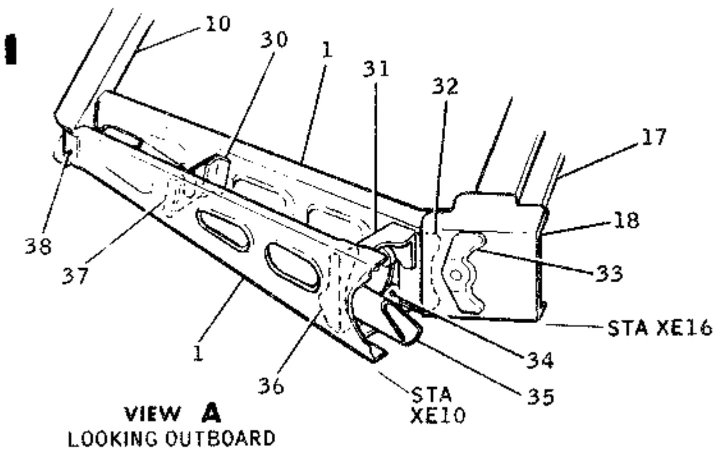
Elevator Center Section Plating -- Type A
Figure 3 (Sheet 2)



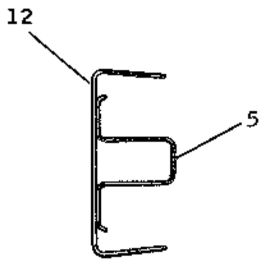
NOTE:
SEE SHEET 2 FOR DETAIL VIEWS AND ITEM LIST OF MATERIAL.

BB3-821A

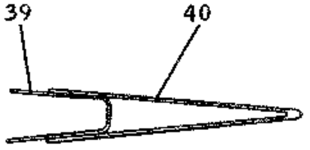
Elevator Center Section Structure -- Type A
Figure 4 (Sheet 1)



VIEW A
LOOKING OUTBOARD



SECTION A-A



SECTION B-B

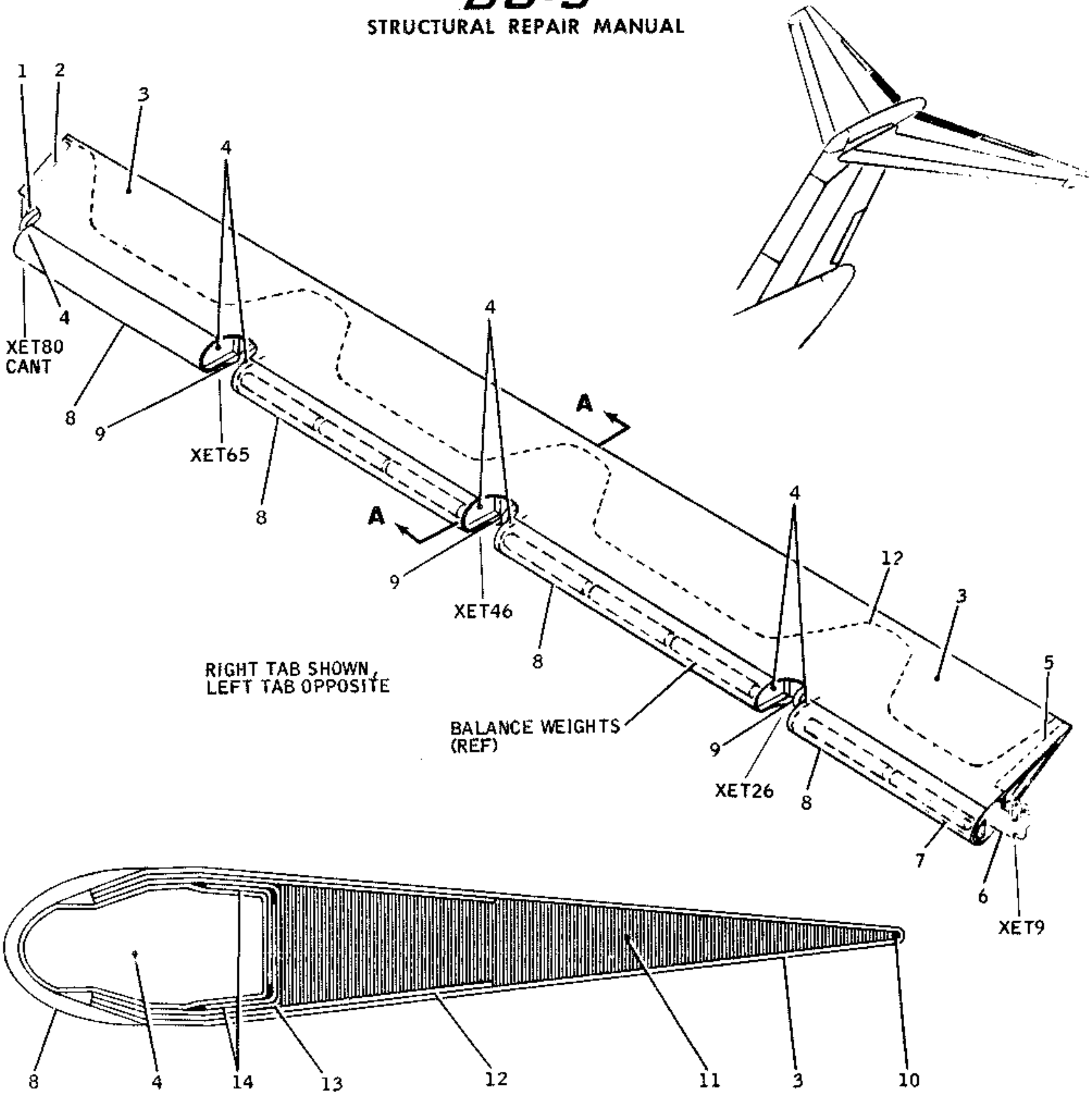
NOTES:

1. ITEM 40, TIP, OUTER SKIN IS NO. 120 MOLDED GLASS FIBER LAMINATE; INNER LAMINATE IS NO. 180 GLASS FIBER; FILLER IS CHROME-SILANE COMPLEX GLASS FIBER ROVING.
2. REFERENCE - DOUGLAS DRAWING 5910412.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.040	CLAD 2024-T42	21	RIB	.025	CLAD 2024-T42
2	RIB	.040	CLAD 2024-T42		ANGLE	.032	CLAD 2024-T42
	ANGLE	.050	CLAD 2024-T42	22	RIB	.063	CLAD 2024-T42
3	RIB	.040	CLAD 2024-T42		ANGLE	.063	CLAD 2024-T42
	ANGLE	.040	CLAD 2024-T42	23	RIB	.050	CLAD 2024-T42
4	FITTING	2.000	PLATE 7075-T7351		ANGLE	.050	CLAD 2024-T42
5	BAFFLE	.012	SHEET 6061-T6	24	FITTING, 5918117	1.500	PLATE 2014-T651
6	RIB	.032	CLAD 2024-T42	25	RIB	.063	CLAD 7075-T651
	ANGLE	.040	CLAD 2024-T42	26	SPLICE	.160	CLAD 7075-T6
7	FITTING	1.750	PLATE 7075-T7351	27	FITTING, 5918031		FORGING 2014-T6
8	RIB	.032	CLAD 2024-T42	28	SUPPORT	.020	SHEET 6061-T6
	ANGLE	.040	CLAD 2024-T3		BRACKET	.032	SHEET 6061-T6
9	FITTING	1.500	PLATE 7075-T7351		CLIP	.020	SHEET 6061-T6X
10	CHANNEL	.025	CLAD 2024-T42	29	FITTING, 5918030		FORGING 7075-T6
11	RIB	.050	CLAD 2024-T42	30	ANGLE	.040	CLAD 2024-T42
12	FITTING	1.375	PLATE 7075-T7351	31	SUPPORT	2.000	PLATE 7075-T7351
13	INTERCOSTAL	.032	CLAD 2024-T3	32	CLIP	.050	CLAD 2024-T42
	ANGLE	.032	CLAD 2024-T3	33	FITTING, 3918037		FORGING 2014-T6
14	FITTING, 5918029		FORGING 7075-T6	34	ANGLE	.050	CLAD 2024-T42
15	TUBE	.020	SHEET 6061-T6	35	SUPPORT	.020	CLAD 2024-T3
	TROUGH	.020	SHEET 6061-T6X	36	BRACKET	.040	CLAD 2024-T42
16	FITTING, 5918028		FORGING 2014-T6	37	WEB	.032	CLAD 2024-T3
17	CAP, 9918450		PLATE 7075-T651	38	CLIP	.063	CLAD 2024-T3
18	FITTING, 5918050		FORGING 7075-T6	39	CHANNEL	.025	CLAD 2024-T3
19	FITTING	1.375	PLATE 7075-T7351	40	TIP, 3913179		SEE NOTE 1
20	FITTING	1.250	PLATE 7075-T7351	41	RIB	.050	CLAD 7075-T6

BB3-822A

Elevator Center Section Structure -- Type A
Figure 4 (Sheet 2)



SECTION A-A

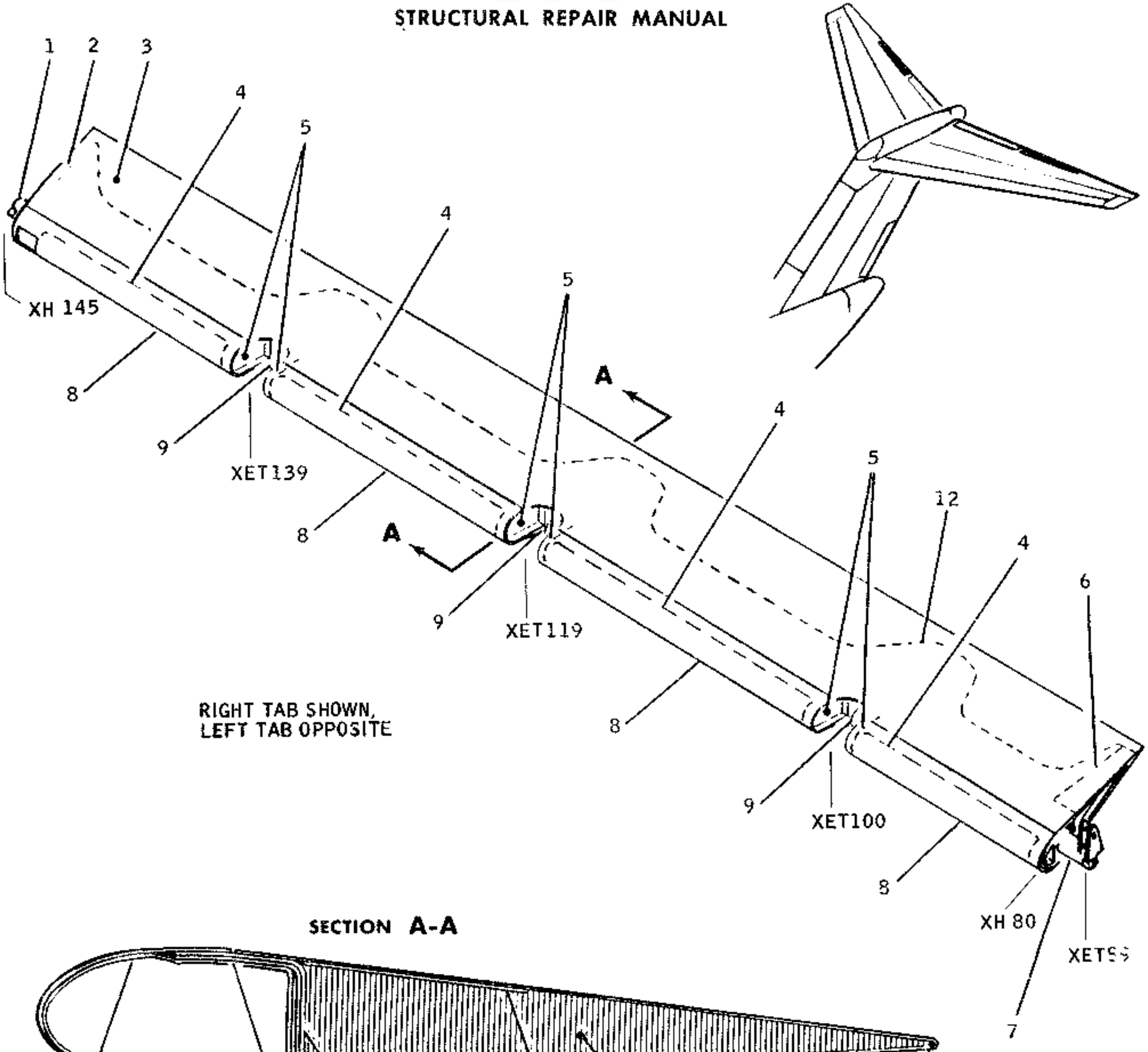
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING	1.500	BAR 7075-T7351
2	RIB	1.250	PLATE 7075-T651
3	SKIN	.012	CLAD 7075-T6
4	RIB	.040	CLAD 7075-T6
5	RIB	1.250	PLATE 7075-T651
* 6	FITTING,5918066		AL FORG 7075-T411
7	CHANNEL	.040	CLAD 7075-T6
8	NOSE CAP		2914935
9	FITTING	1.500	PLATE 7075-T7351
10	WIRE	.092 DIA	5056-H32
11	CORE	1.6W	SEE NOTE 1
12.	BONDED DOUBLER	.016	CLAD 7075-T6
13	SPAR	.050	SHEET 6061-T6
14	ANGLE	.025	CLAD 7075-T6

NOTES:

1. ITEM 11, CORE, 1.600 X 3/16 HEX X .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
*2. ITEM 6 MADE FROM FORGING 7075-T6 FOR AIRPLANES 91 AND SUBSEQUENT
3. REFERENCE DOUGLAS DRAWING 5910413.

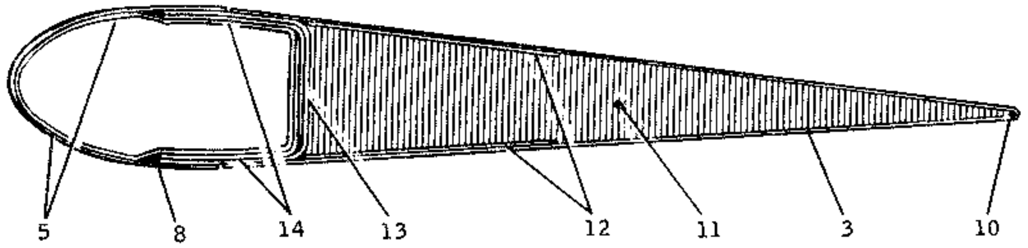
BB3-190A

Elevator Control Tab Plating -- Type A
Figure 5



RIGHT TAB SHOWN,
LEFT TAB OPPOSITE

SECTION **A-A**



ITEM	NOMENCLATURE	GAGE	MATERIAL
* 1	FITTING 5918074		FORGING 7075-T411
2	RIB	1.000	PLATE 7075-T651
3	SKIN	.012	CLAD 7075-T6
4	DOUBLER	.012	CLAD 7075-T6
5	RIB	.040	CLAD 7075-T6
6	RIB	1.125	PLATE 7075-T651
* 7	FITTING 5918073		FORGING 7075-T411
8	NOSE SKIN	.020	CLAD 7075-T6
9	FITTING ASSEMBLY	1.250	PLATE 7075-T7351
10	WIRE	.090	5056-H32
11	CORE		SEE NOTE 1
12	DOUBLER	.016	CLAD 7075-T6
13	SPAR	.025	CLAD 7075-T6
14	DOUBLER	.025	CLAD 7075-T6

NOTES:

1. ITEM 11, CORE 1.600 X 3/16 HEX X .001 THICK, NON-PERFORATED ALUMINUM FOIL HONEYCOMB.

*2. ITEMS 1 AND 7 MADE FROM FORGING 7075-T6 FOR AIRPLANES 91 AND SUBSEQUENT.

3. REFERENCE - DOUGLAS DRAWING 5910414.

BB3-191A

Elevator Geared Tab Plating -- Type A
Figure 6

VERTICAL STABILIZER - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates components of the vertical stabilizer. Types and gages of material used in construction of the assemblies are identified in the illustrations.

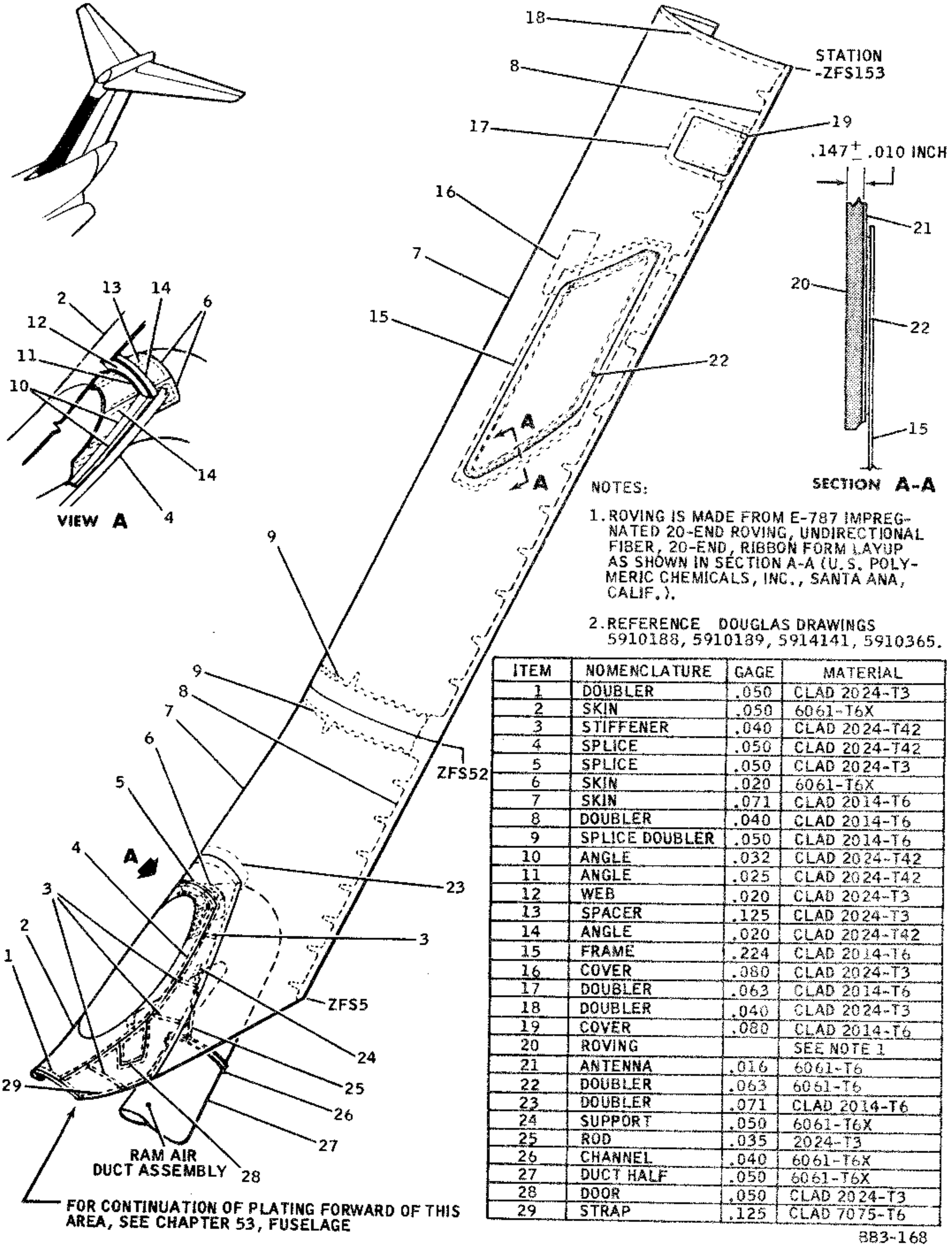
2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore the structural integrity and appearance of components.

B. Any repairs to vertical stabilizer skins between spars require specific engineering approval.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 2
Skins (see note.)	Section 55-03, Figure 4

NOTE: Any repairs to skins between spars requires specific engineering approval.



NOTES:

1. ROVING IS MADE FROM E-787 IMPREGNATED 20-END ROVING, UNDIRECTIONAL FIBER, 20-END, RIBBON FORM LAYUP AS SHOWN IN SECTION A-A (U.S. POLYMERIC CHEMICALS, INC., SANTA ANA, CALIF.).

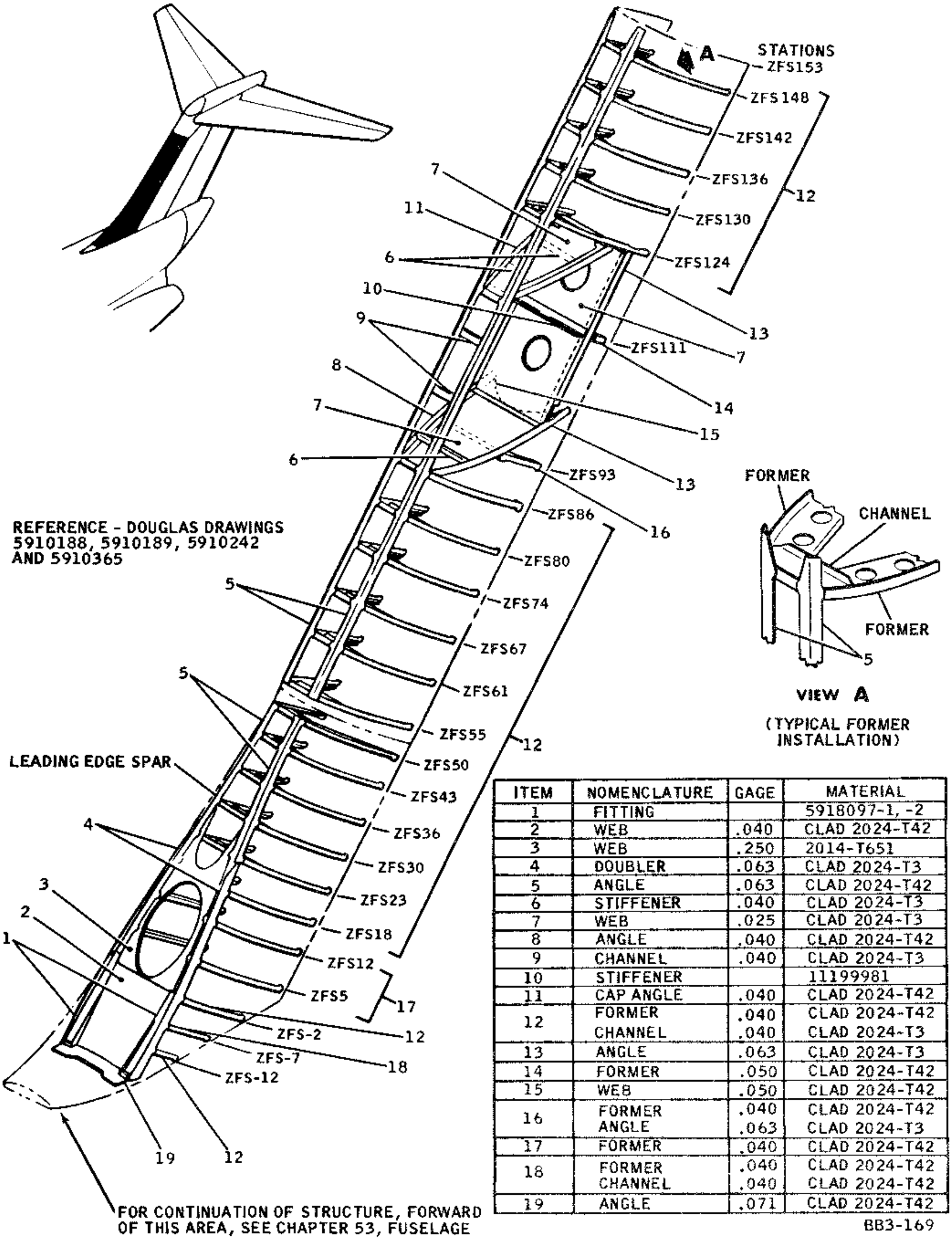
2. REFERENCE DOUGLAS DRAWINGS 5910188, 5910189, 5914141, 5910365.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.050	CLAD 2024-T3
2	SKIN	.050	6061-T6X
3	STIFFENER	.040	CLAD 2024-T42
4	SPLICE	.050	CLAD 2024-T42
5	SPLICE	.050	CLAD 2024-T3
6	SKIN	.020	6061-T6X
7	SKIN	.071	CLAD 2014-T6
8	DOUBLER	.040	CLAD 2014-T6
9	SPLICE DOUBLER	.050	CLAD 2014-T6
10	ANGLE	.032	CLAD 2024-T42
11	ANGLE	.025	CLAD 2024-T42
12	WEB	.020	CLAD 2024-T3
13	SPACER	.125	CLAD 2024-T3
14	ANGLE	.020	CLAD 2024-T42
15	FRAME	.224	CLAD 2014-T6
16	COVER	.080	CLAD 2024-T3
17	DOUBLER	.063	CLAD 2014-T6
18	DOUBLER	.040	CLAD 2024-T3
19	COVER	.080	CLAD 2014-T6
20	ROVING		SEE NOTE 1
21	ANTENNA	.016	6061-T6
22	DOUBLER	.063	6061-T6
23	DOUBLER	.071	CLAD 2014-T6
24	SUPPORT	.050	6061-T6X
25	ROD	.035	2024-T3
26	CHANNEL	.040	6061-T6X
27	DUCT HALF	.050	6061-T6X
28	DOOR	.050	CLAD 2024-T3
29	STRAP	.125	CLAD 7075-T6

FOR CONTINUATION OF PLATING FORWARD OF THIS AREA, SEE CHAPTER 53, FUSELAGE

883-168

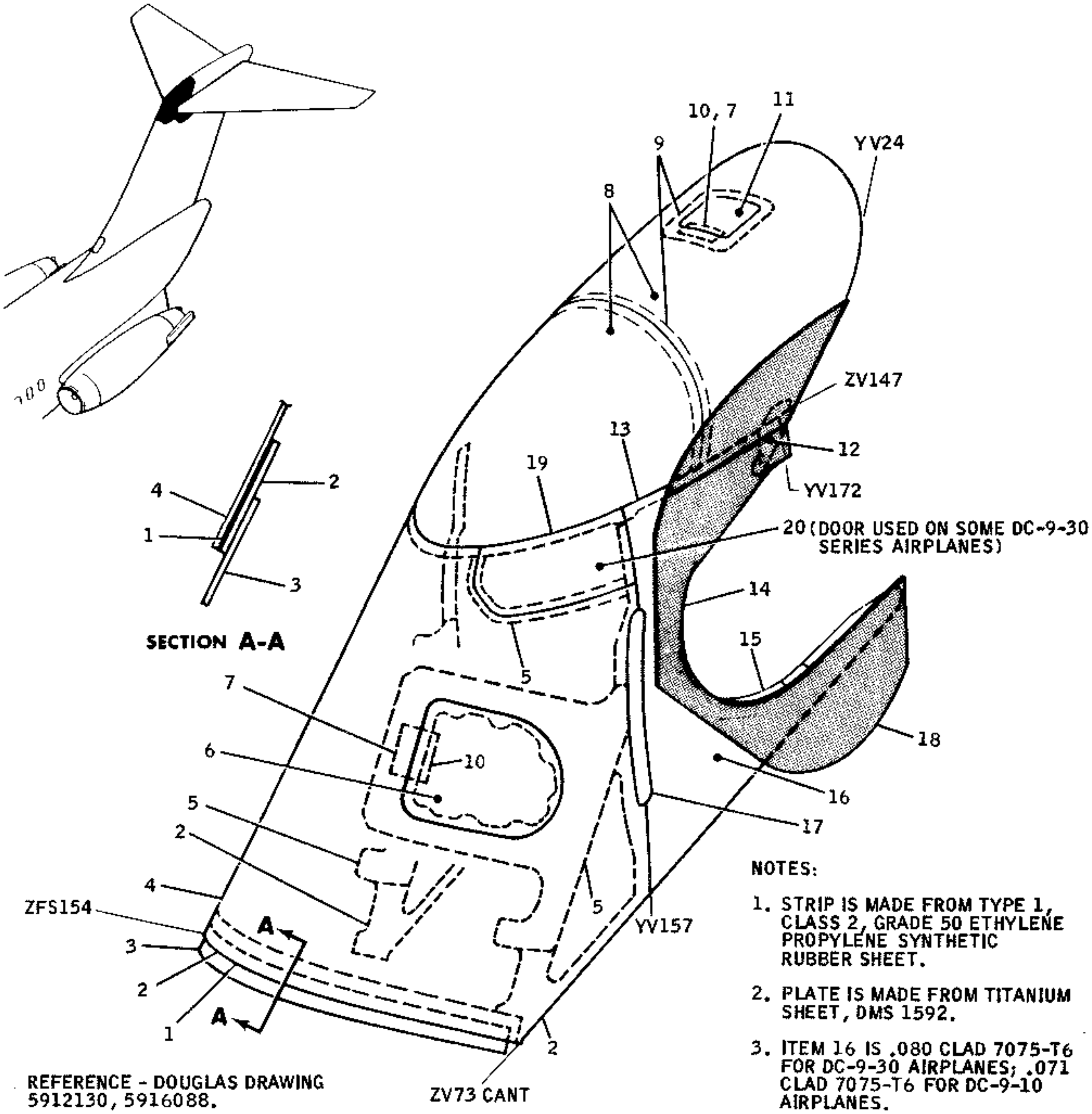
Dorsal Fin and Leading Edge Plating
Figure 1



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		5918097-1, -2
2	WEB	.040	CLAD 2024-T42
3	WEB	.250	2014-T651
4	DOUBLER	.063	CLAD 2024-T3
5	ANGLE	.063	CLAD 2024-T42
6	STIFFENER	.040	CLAD 2024-T3
7	WEB	.025	CLAD 2024-T3
8	ANGLE	.040	CLAD 2024-T42
9	CHANNEL	.040	CLAD 2024-T3
10	STIFFENER		11199981
11	CAP ANGLE	.040	CLAD 2024-T42
12	FORMER CHANNEL	.040 .040	CLAD 2024-T42 CLAD 2024-T3
13	ANGLE	.063	CLAD 2024-T3
14	FORMER	.050	CLAD 2024-T42
15	WEB	.050	CLAD 2024-T42
16	FORMER ANGLE	.040 .063	CLAD 2024-T42 CLAD 2024-T3
17	FORMER	.040	CLAD 2024-T42
18	FORMER CHANNEL	.040 .040	CLAD 2024-T42 CLAD 2024-T42
19	ANGLE	.071	CLAD 2024-T42

BB3-169

Dorsal Fin and Leading Edge Structure
Figure 2



REFERENCE - DOUGLAS DRAWING 5912130, 5916088.

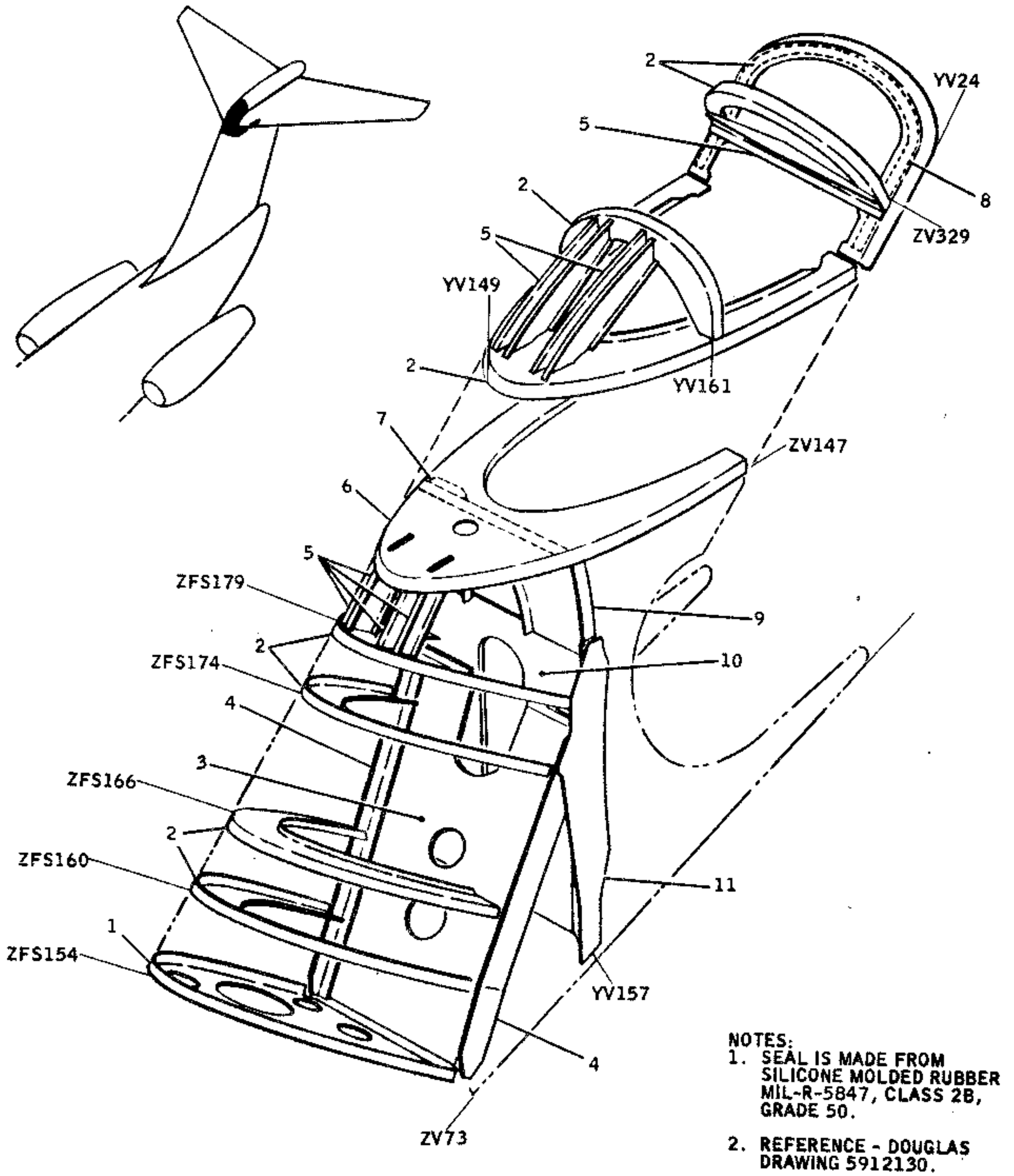
NOTES:

1. STRIP IS MADE FROM TYPE 1, CLASS 2, GRADE 50 ETHYLENE PROPYLENE SYNTHETIC RUBBER SHEET.
2. PLATE IS MADE FROM TITANIUM SHEET, DMS 1592.
3. ITEM 16 IS .080 CLAD 7075-T6 FOR DC-9-30 AIRPLANES; .071 CLAD 7075-T6 FOR DC-9-10 AIRPLANES.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.020	CLAD 7075-T6	11	DOOR	.050	CLAD 2024-T42
2	DOUBLER	.032	CLAD 7075-T6	12	SPLICE PLATE	.250	CLAD 2024-T351
3	DOUBLER	.071	CLAD 7075-T6	13	DOUBLER	.032	CLAD 7075-T6
4	SKIN	.050	CLAD 7075-T6	14	STRIP	.063	SEE NOTE 1
5	DOUBLER	.050	CLAD 7075-T6	15	RETAINER		1152357
6	DOOR	.071	CLAD 7075-T6	16	SKIN		SEE NOTE 3
7	HINGE		M20001PY4	17	PLATE	.125	SEE NOTE 2
8	SKIN	.050	CLAD 2024-T42	18	COVER	.010	ALUMINIZED MYLAR
9	DOUBLER	.050	CLAD 2024-T42	19	DOUBLER	.040	CLAD 7075-T6
10	HINGE		2415533	20	SKIN (DOOR)	.050	6061-T6X

BB3-170B

Tip Plating
Figure 3



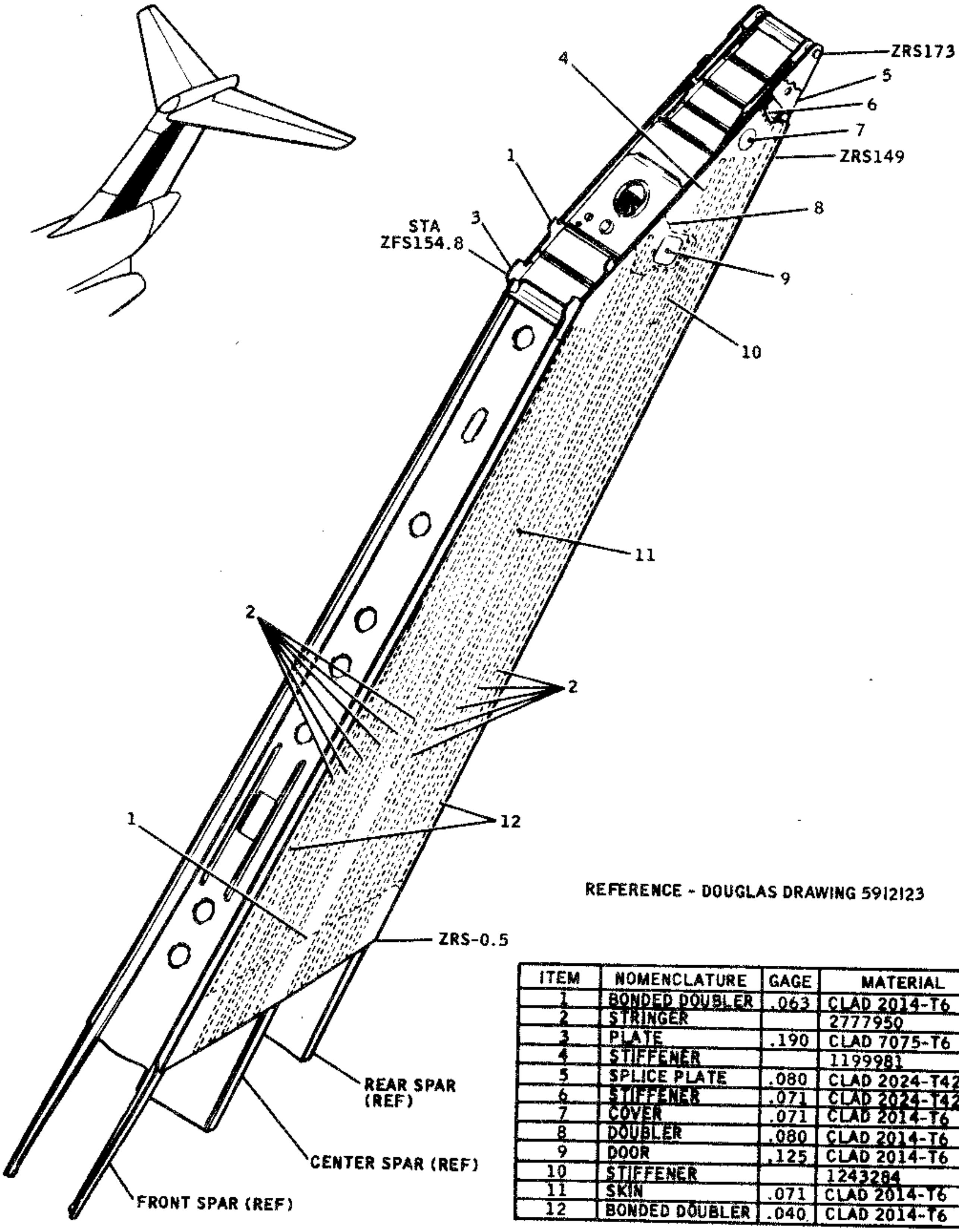
NOTES:
1. SEAL IS MADE FROM SILICONE MOLDED RUBBER MIL-R-5847, CLASS 2B, GRADE 50.
2. REFERENCE - DOUGLAS DRAWING 5912130.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.071	CLAD 7075-T6
2	FORMER	.040	CLAD 7075-T6
3	WEB	.500	PLATE 7075-T651
4	CAP		1363992
5	INTERCOSTAL	.040	CLAD 7075-T6
6	FORMER	.050	CLAD 7075-T6

ITEM	NOMENCLATURE	GAGE	MATERIAL
7	SUPPORT	.071	CLAD 6061-T6
8	SEAL		SEE NOTE
9	WEB	.050	CLAD 7075-T6
10	WEB	.375	PLATE 7075-T651
11	CAP		4914686

BB3-171A

Tip Structure
Figure 4



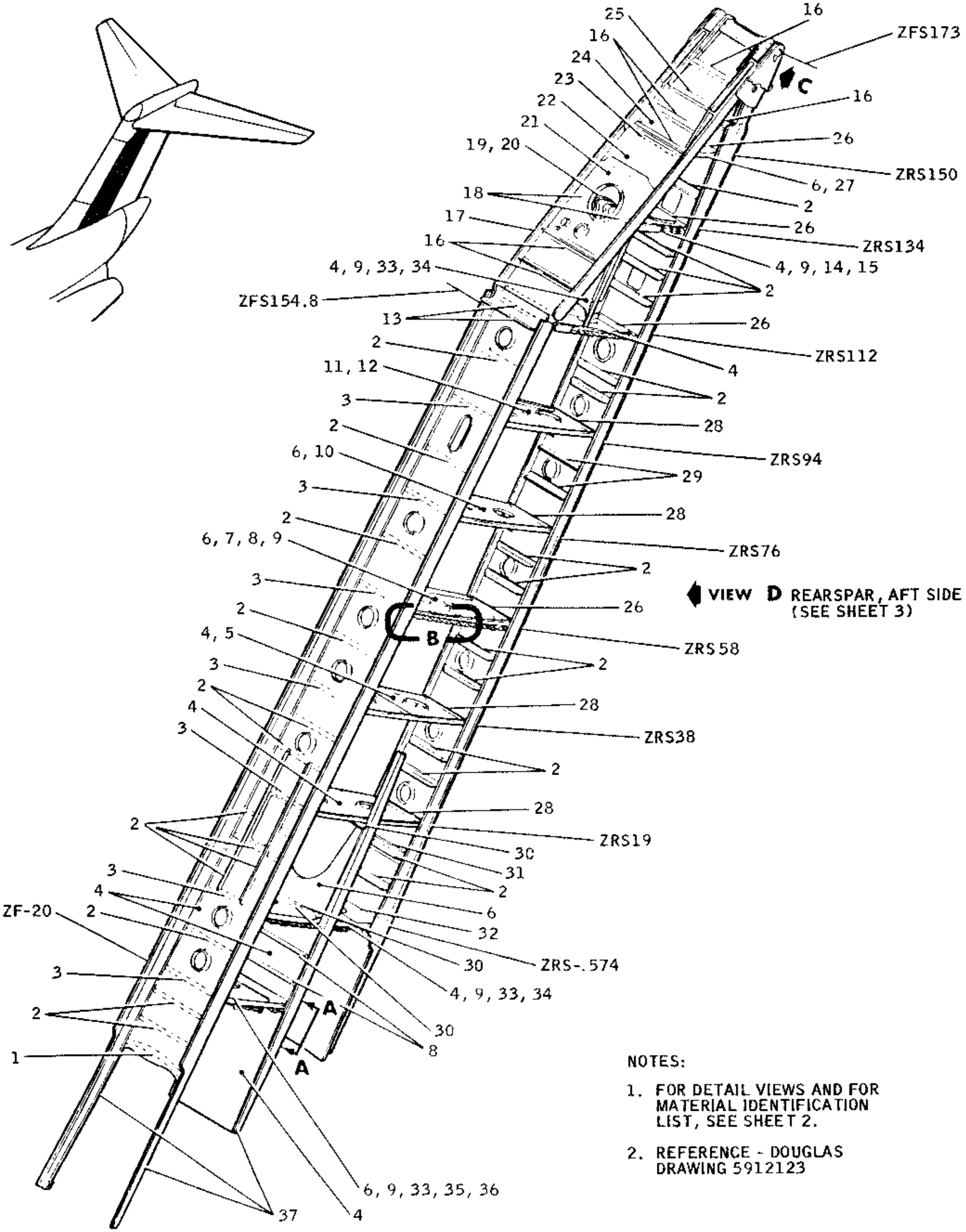
REFERENCE - DOUGLAS DRAWING 5912123

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.063	CLAD 2014-T6
2	STRINGER		2777950
3	PLATE	.190	CLAD 7075-T6
4	STIFFENER		1199981
5	SPLICE PLATE	.080	CLAD 2024-T42
6	STIFFENER	.071	CLAD 2024-T42
7	COVER	.071	CLAD 2014-T6
8	DOUBLER	.080	CLAD 2014-T6
9	DOOR	.125	CLAD 2014-T6
10	STIFFENER		1243284
11	SKIN	.071	CLAD 2014-T6
12	BONDED DOUBLER	.040	CLAD 2014-T6

BB3-172

Center Section Plating
Figure 5

Printed in U.S.A.

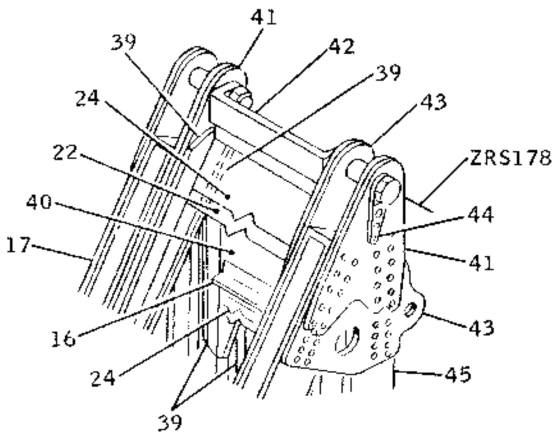


NOTES:

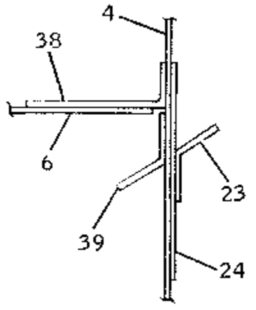
1. FOR DETAIL VIEWS AND FOR MATERIAL IDENTIFICATION LIST, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 5912123

BB3-173

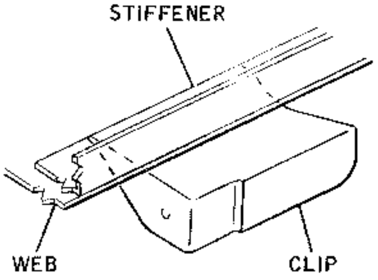
Center Section Structure
Figure 6 (Sheet 1)



VIEW C



SECTION A-A



VIEW B

(TYPICAL CLIP INSTALLATION)

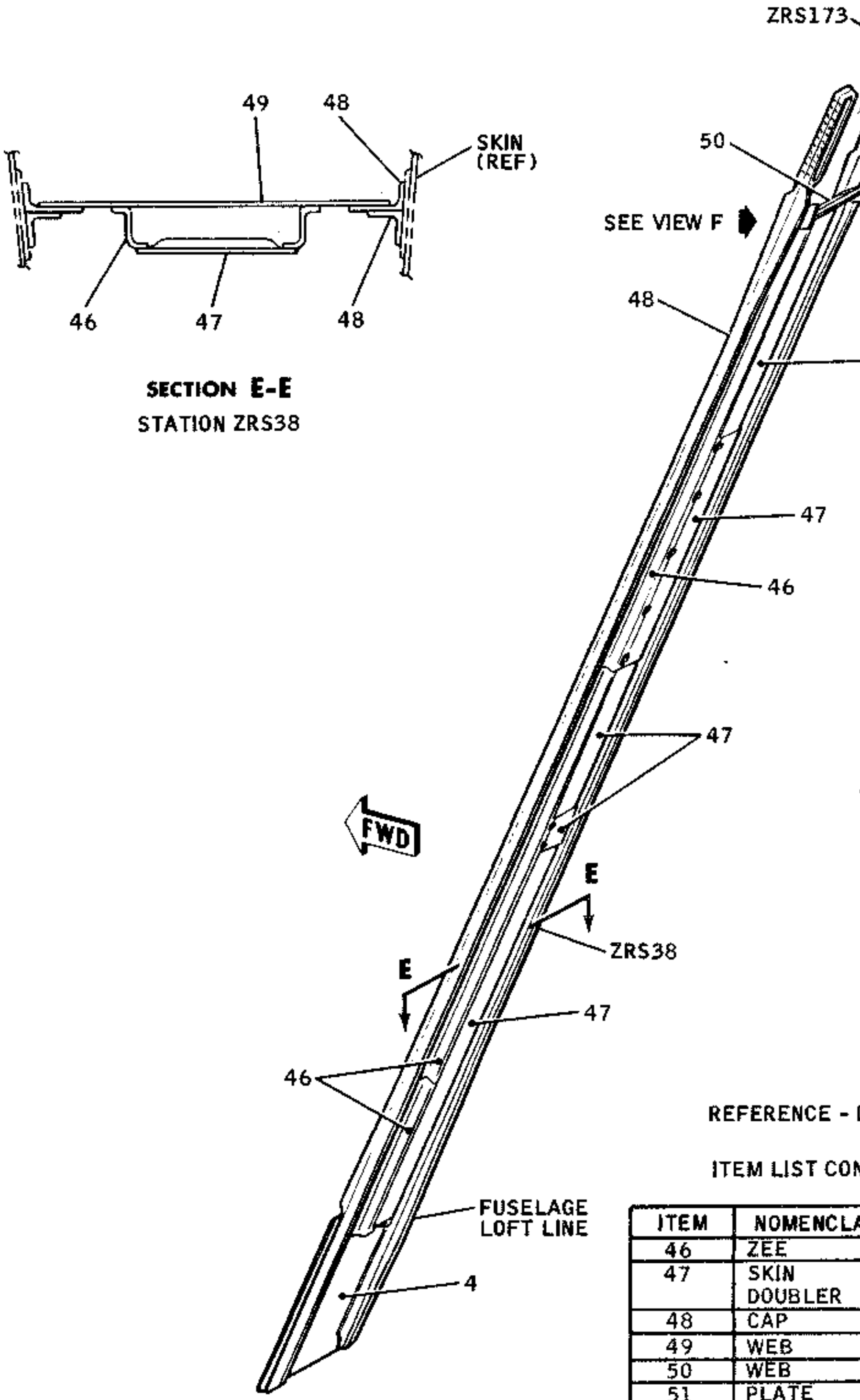
NOTES:

1. CLIP MADE FROM 4911344 FORGING.
2. RIB CAP LEFT SIDE PART NO. 9911856-3, -5.
   RIB CAP RIGHT SIDE PART NO. 9911856-4, -6.
3. CHANNEL FITTING MADE FROM 4914583.
4. ANGLE FITTING MADE FROM 4914574.
5. CAP MADE FROM 2777964.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.070	CLAD 2024-T42	24	DOUBLER	.032	CLAD 7075-T6
2	ANGLE		1199981	25	STIFFENER		1277788
3	TEE		2913581	26	TEE		2640548
4	WEB	.050	CLAD 7075-T6	27	ANGLE	.063	CLAD 2024-T42
5	CHANNEL	.063	CLAD 2024-T42	28	TEE		1414813
6	WEB	.040	CLAD 7075-T6	29	ANGLE		1418201
7	STIFFENER		2912830	30	ANGLE	.063	CLAD 2024-T3
8	STIFFENER		1243284	31	DOUBLER	.080	CLAD 7075-T6
9	CLIP		SEE NOTE 1	32	TEE		2615551
10	STIFFENER	.063	CLAD 7075-T6	33	STIFFENER		1858549
11	WEB	.050	CLAD 2024-T42	34	CAP		1329331
12	CHANNEL	.063	CLAD 2024-T3	35	CLIP	.080	CLAD 2024-T42
13	ANGLE	.090	CLAD 7075-T6	36	ANGLE		1059659
14	ANGLE	.071	CLAD 7075-T6	37	CAP		SEE NOTE 5
15	CHANNEL	.071	CLAD 7075-T6	38	STIFFENER		1619970
16	STIFFENER		1482282	39	ANGLE	1.250	2024-T351
17	RIB CAP		SEE NOTE 2	40	WEB	.090	CLAD 7075-T6
18	SPACER	.250	CLAD 2024-T351	41	PLATE	.3125	TITANIUM DMS 1592
19	CHANNEL FITTING		SEE NOTE 3	42	FITTING		3912060
20	ANGLE FITTING		SEE NOTE 4	43	PLATE	.4375	TITANIUM DMS 1592
21	DOUBLER	.090	CLAD 7075-T6	44	RETAINER	.375	4130 STEEL
22	WEB	.071	CLAD 7075-T6	45	CAP		5911384
23	ANGLE	.071	CLAD 2024-T3	ITEM LIST CONTINUED ON SHEET 3			

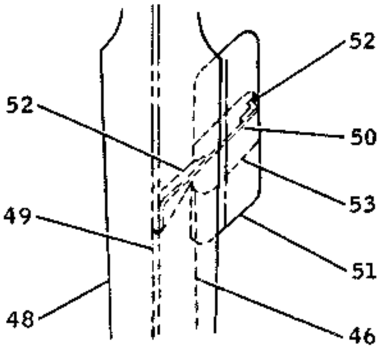
BB3-374

Center Section Structure
Figure 6 (Sheet 2)



SECTION E-E
STATION ZRS38

VIEW D



VIEW F
STATION ZRS150

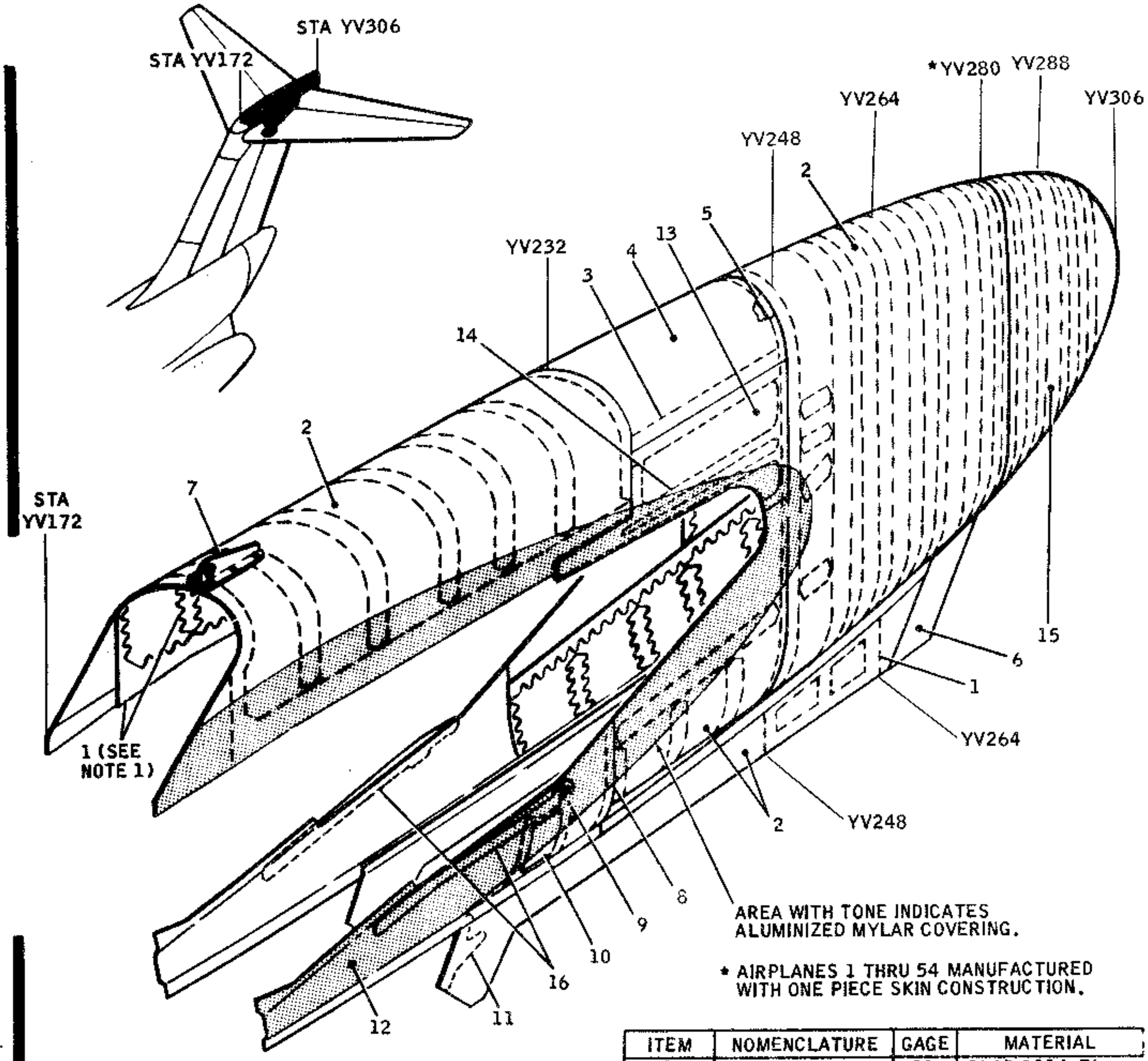
REFERENCE - DOUGLAS DRAWING 5912123

ITEM LIST CONTINUED FROM SHEET 2

ITEM	NOMENCLATURE	GAGE	MATERIAL
46	ZEE	.040	CLAD 2024-T3
47	SKIN DOUBLER	.016 .016	CLAD 2014-T6 6061-T6
48	CAP		5911384
49	WEB	.071	CLAD 7075-T6
50	WEB	.063	CLAD 2024-T3
51	PLATE	.063	CLAD 2024-T3
52	ANGLE		1245072
53	TEE		1440049

BB3-375

Center Section Structure
Figure 6 (Sheet 3)



AREA WITH TONE INDICATES ALUMINIZED MYLAR COVERING.

* AIRPLANES 1 THRU 54 MANUFACTURED WITH ONE PIECE SKIN CONSTRUCTION.

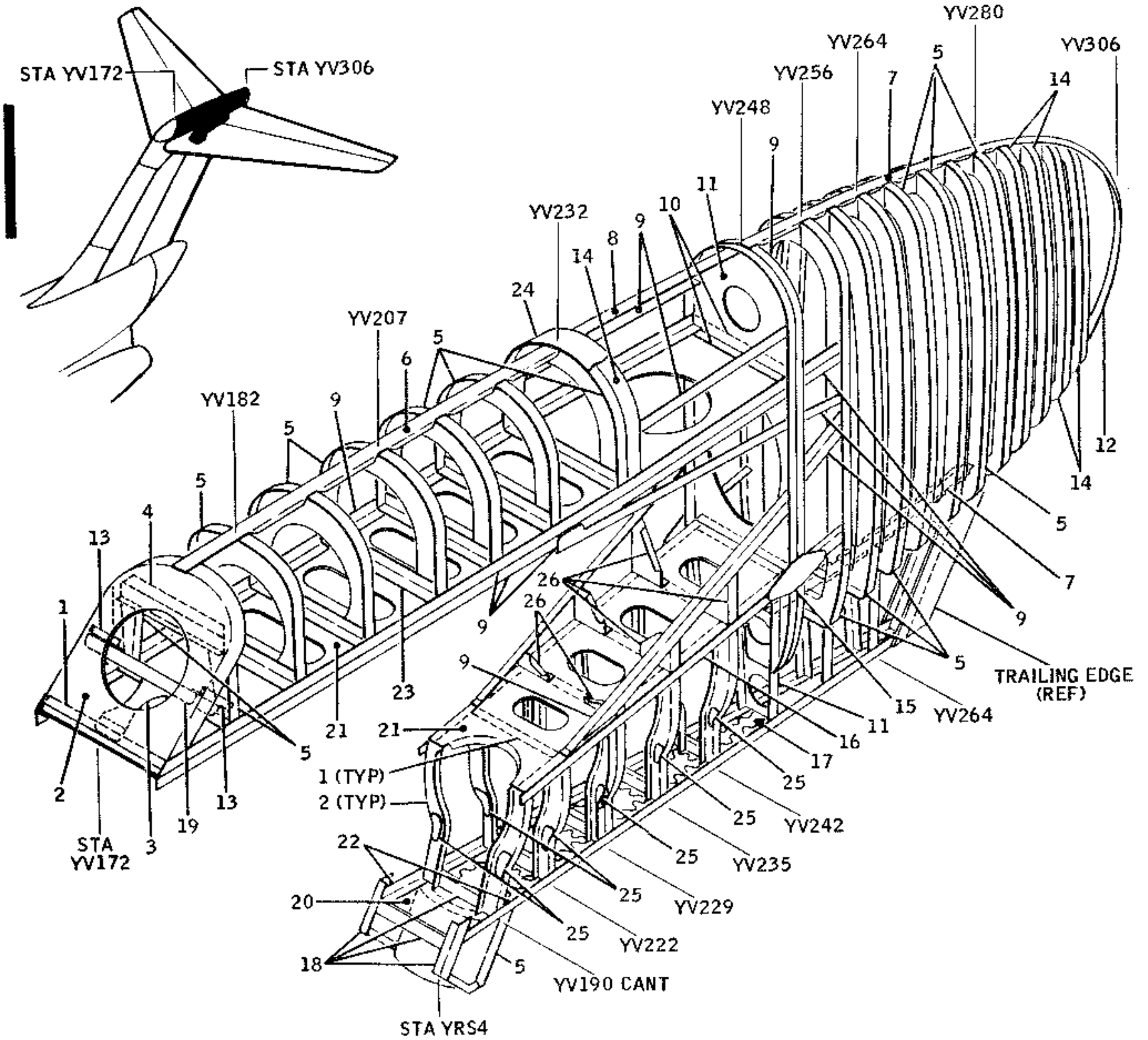
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.016	CLAD 2014-T6
2	SKIN	.025	CLAD 2014-T6
3	DOUBLER	.032	CLAD 2014-T6
4	DOOR	.080	CLAD 2014-T6
5	SPLICE PLATE	.032	CLAD 2024-T3
6	TRAILING EDGE		3913180
7	RECEPTACLE		1328571
8	SPLICE PLATE	.040	CLAD 2024-T3
9	DOUBLER	.071	CLAD 7075-T6
10	DOOR	.071	CLAD 2014-T6
11	DOUBLER	.125	CLAD 2014-T6
12	SKIN	.071	CLAD 2014-T6
13	SKIN	.050	CLAD 2014-T6
14	DOUBLER	.025	CLAD 2014-T6
15	CLOTH		SEE NOTE 3
16	SPLICE	1.000	PLATE 2014-T651

NOTES:

1. MATERIAL AND SCALLOP EDGE OF ITEM 1 (DOUBLER) IS TYPICAL THROUGHOUT, EXCEPT AS NOTED FOR ITEMS 3, 9, AND 14.
2. ITEM 6 (TRAILING EDGE) PART NO. 3913180, IS MADE FROM NO. 181 AND NO. 120 GLASS FIBER LAMINATE
3. GLASS FIBER LAMINATE MIL-C-9084 OR EQUIVALENT.
4. REFERENCE - DOUGLAS DRAWING 5912166

BB3-174C

Removable Tip Fairing Plating
Figure 7



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.050	CLAD 2024-T42	14	FORMER	.025	CLAD 2024-T42
2	FORMER	.050	CLAD 2024-T42	15	SPLICE PLATE	.063	CLAD 2024-T3
3	STIFFENER	.063	CLAD 2024-T3	16	ANGLE	.063	CLAD 2024-T42
4	ZEE	.050	CLAD 2024-T42	17	DOUBLER	.016	CLAD 2014-T6
5	FORMER	.040	CLAD 2024-T42	18	STIFFENER	.050	CLAD 2024-T42
6	CHANNEL	.025	CLAD 2024-T3	19	CHANNEL	.040	CLAD 7075-T6
7	CHANNEL	.016	CLAD 2014-T6	20	WEB	.025	CLAD 2014-T6
8	TEE		1363992	21	WEB	.025	CLAD 2024-T42
9	ANGLE	.032	CLAD 2024-T42	22	CAP	.032	CLAD 2024-T3
10	ANGLE	.032	CLAD 2024-T3	23	STIFFENER	.032	CLAD 2024-T3
11	WEB	.050	CLAD 2024-T42	24	SPLICE PLATE	.040	CLAD 2024-T42
12	CHANNEL	.025	CLAD 2024-T42	25	SPLICE PLATE	.071	CLAD 7075-T6
13	ANGLE	.050	CLAD 7075-T6	26	GUSSET	.032	CLAD 7075-T6

BB3-175B

Removable Tip Fairing Structure
Figure 8

....

RUDDER - DESCRIPTION AND OPERATION

1. General

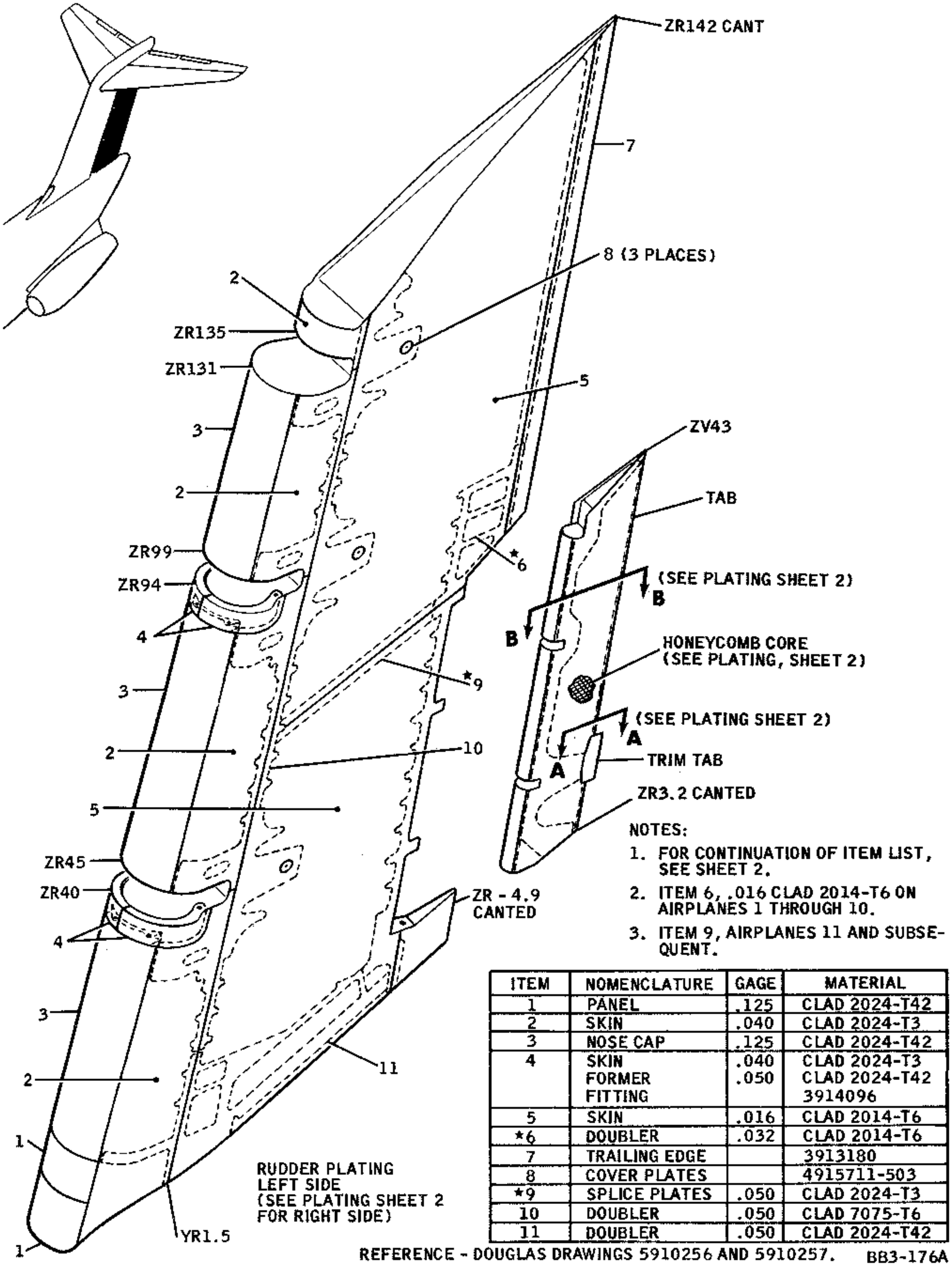
A. This section illustrates rudder components. Types and gages of material used in construction of the assemblies are identified in the illustrations.

B. This section also contains balancing procedures for the rudder and rudder tab (see 55-40-1). When a repair is made to a rudder or a rudder tab, the surface must be rebalanced. When a repair is made to a rudder tab, the surface must also be weighed as outlined in the balancing procedure.

2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore the structural integrity and appearance of components.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 1
Skins (including trailing edge)	Section 55-03, Figures 1, 2, 5, and 6
Honeycomb	Section 55-04, Figures 1 through 3



NOTES:

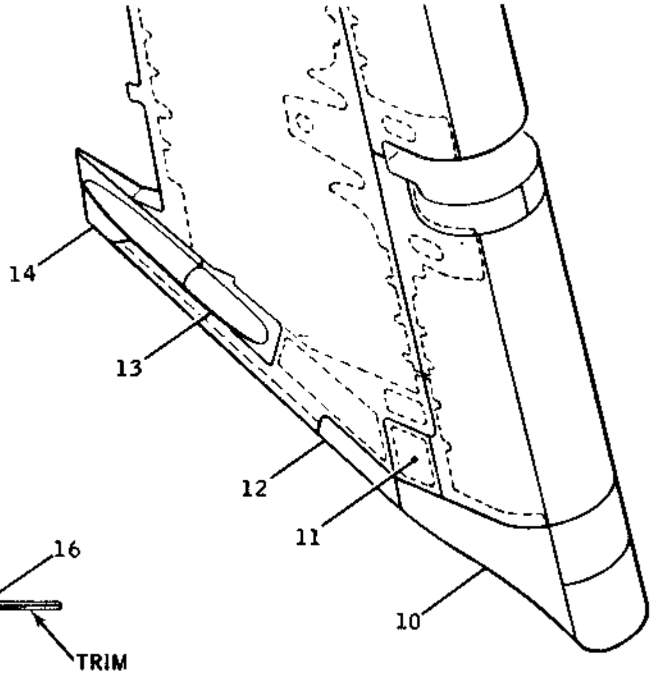
1. FOR CONTINUATION OF ITEM LIST, SEE SHEET 2.
2. ITEM 6, .016 CLAD 2014-T6 ON AIRPLANES 1 THROUGH 10.
3. ITEM 9, AIRPLANES 11 AND SUBSEQUENT.

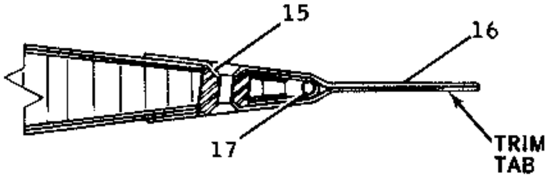
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL	.125	CLAD 2024-T42
2	SKIN	.040	CLAD 2024-T3
3	NOSE CAP	.125	CLAD 2024-T42
4	SKIN	.040	CLAD 2024-T3
	FORMER	.050	CLAD 2024-T42
	FITTING		3914096
5	SKIN	.016	CLAD 2014-T6
*6	DOUBLER	.032	CLAD 2014-T6
7	TRAILING EDGE		3913180
8	COVER PLATES		4915711-503
*9	SPLICE PLATES	.050	CLAD 2024-T3
10	DOUBLER	.050	CLAD 7075-T6
11	DOUBLER	.050	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWINGS 5910256 AND 5910257.

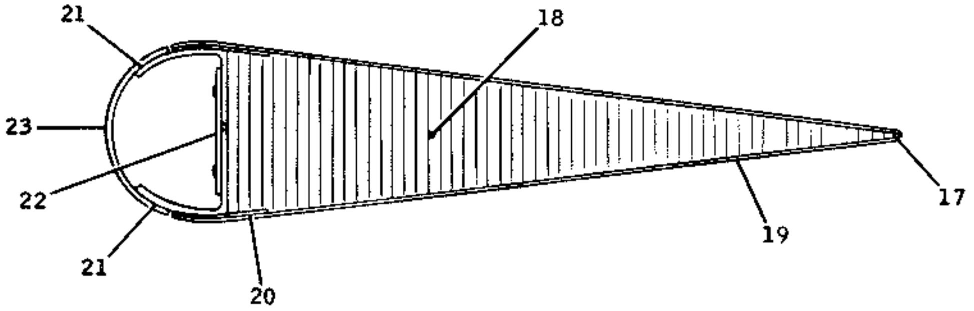
Rudder and Rudder Tab Plating
Figure 1 (Sheet 1)

RUDDER PLATING - RIGHT SIDE
(LEFT AND RIGHT SIDES
IDENTICAL EXCEPT AS SHOWN)





TAB SECTION **A-A**
(SEE PLATING, SHEET 1, FOR ORIGIN)



TAB SECTION **B-B**
(SEE PLATING, SHEET 1, FOR ORIGIN)

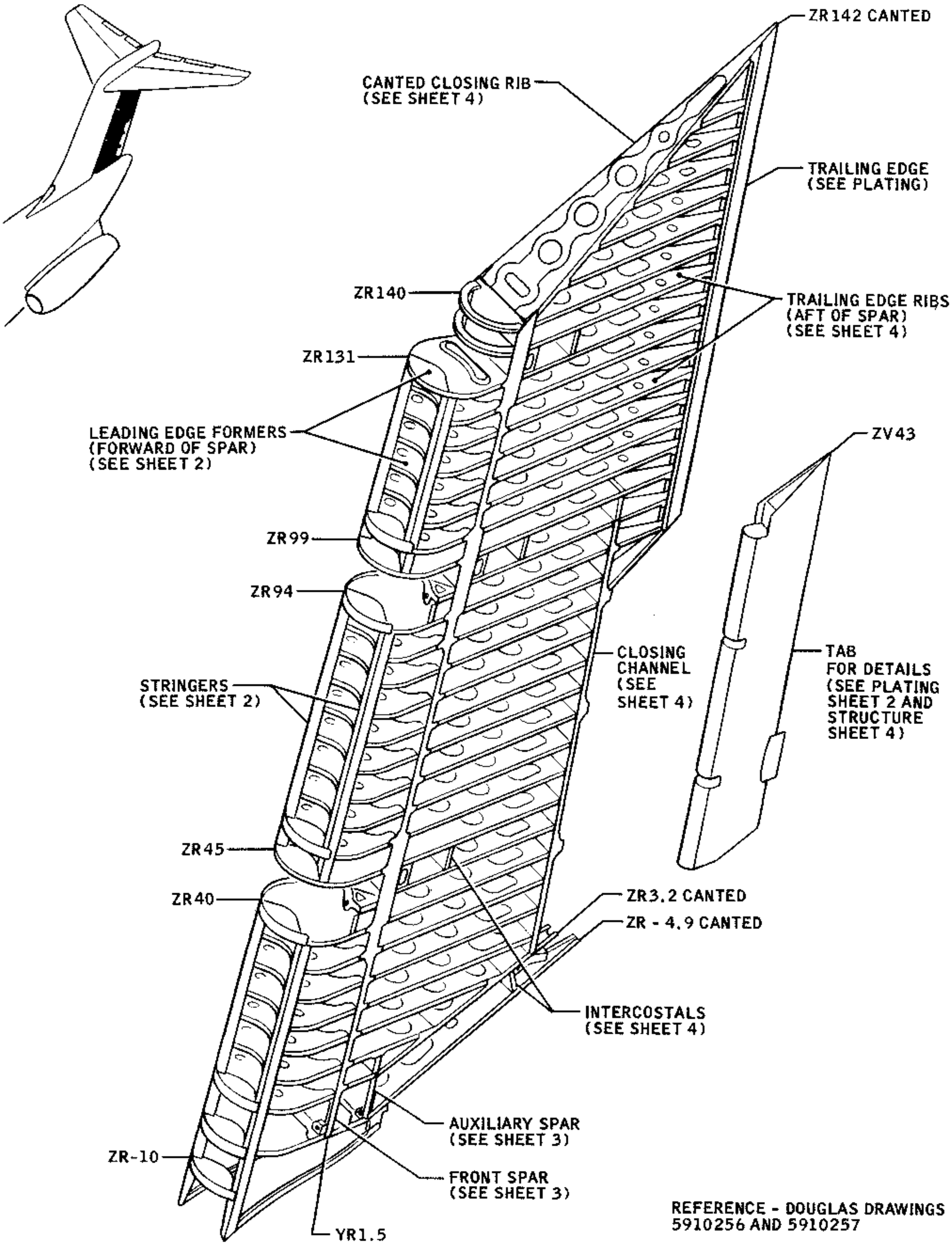
NOTES:

1. ITEM 18, CORE, 1.600 X 3/16 HEX X .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. ITEM 15, INSERT, MAY BE PURCHASED FROM DELRON CO., INC., 5224 SOUTHERN AVE., SOUTH GATE, CALIF.
3. REFERENCE - DOUGLAS DRAWINGS 5910256, 5910257, 5957084, AND 5957085.

ITEM	NOMENCLATURE	GAGE	MATERIAL
10	PANEL	.040	CLAD 2024-T42
11	PANEL	.040	CLAD 2024-T3
12	SKIRT	.040	CLAD 2024-T3
13	FAIRING (FWD)	.040	CLAD 2024-T42
14	FAIRING (AFT)	.032	CLAD 2024-T42
15	INSERT		1806-R18-1-05
16	TRIM TAB	.016	6061-T6
17	WIRE	.090	5056-H32
18	CORE		SEE NOTE 1
19	SKIN	.012	CLAD 7075-T6
20	DOUBLER	.016	CLAD 7075-T6
21	SHAPE		2914046-1
22	SPLICE	.050	CLAD 7075-T6
23	NOSE SKIN	.090	MIL-S-5059

BB3-343

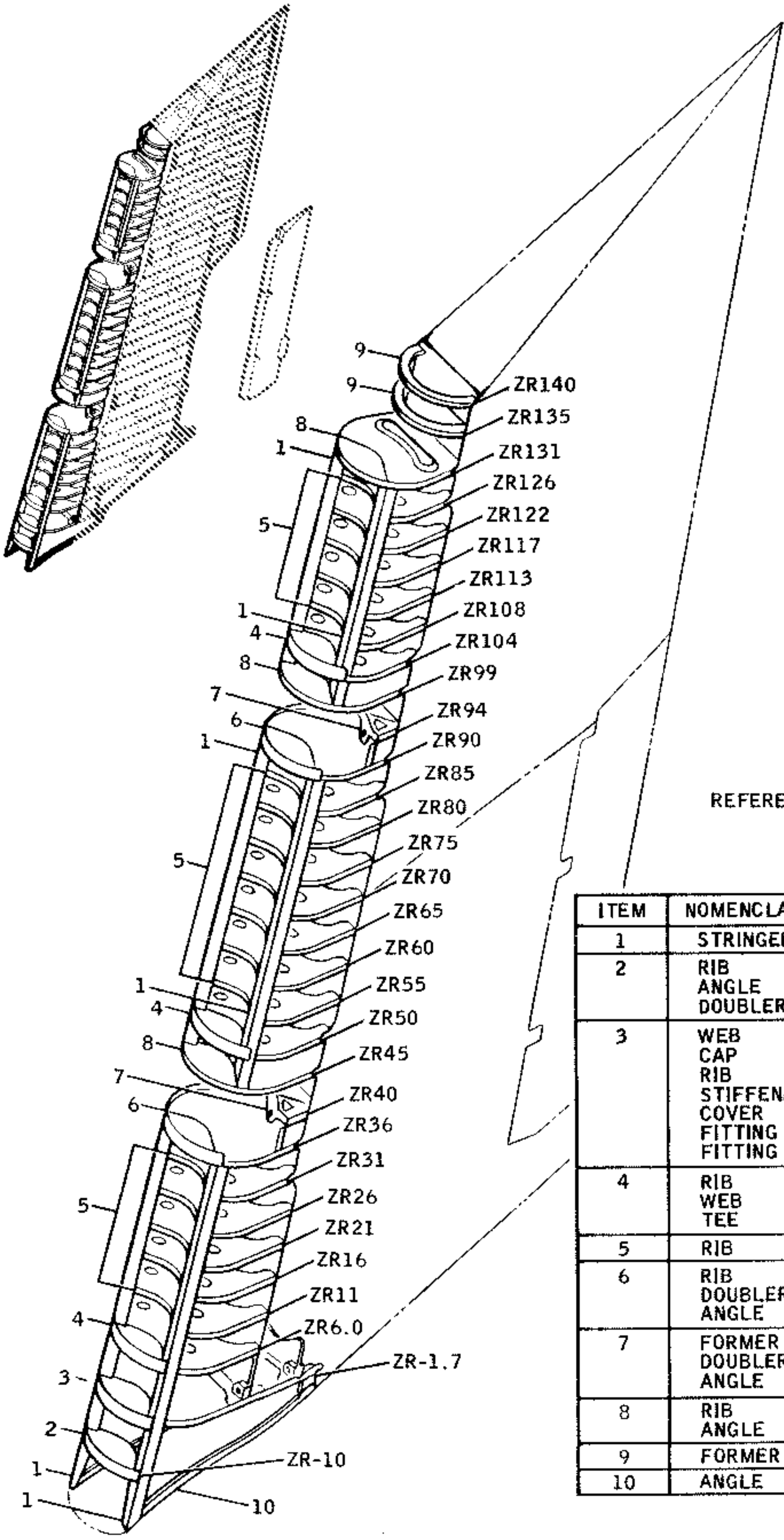
Rudder and Rudder Tab Plating
Figure 1 (Sheet 2)



REFERENCE - DOUGLAS DRAWINGS
5910256 AND 5910257

BB3-177

Rudder and Rudder Tab Structure
Figure 2 (Sheet 1)

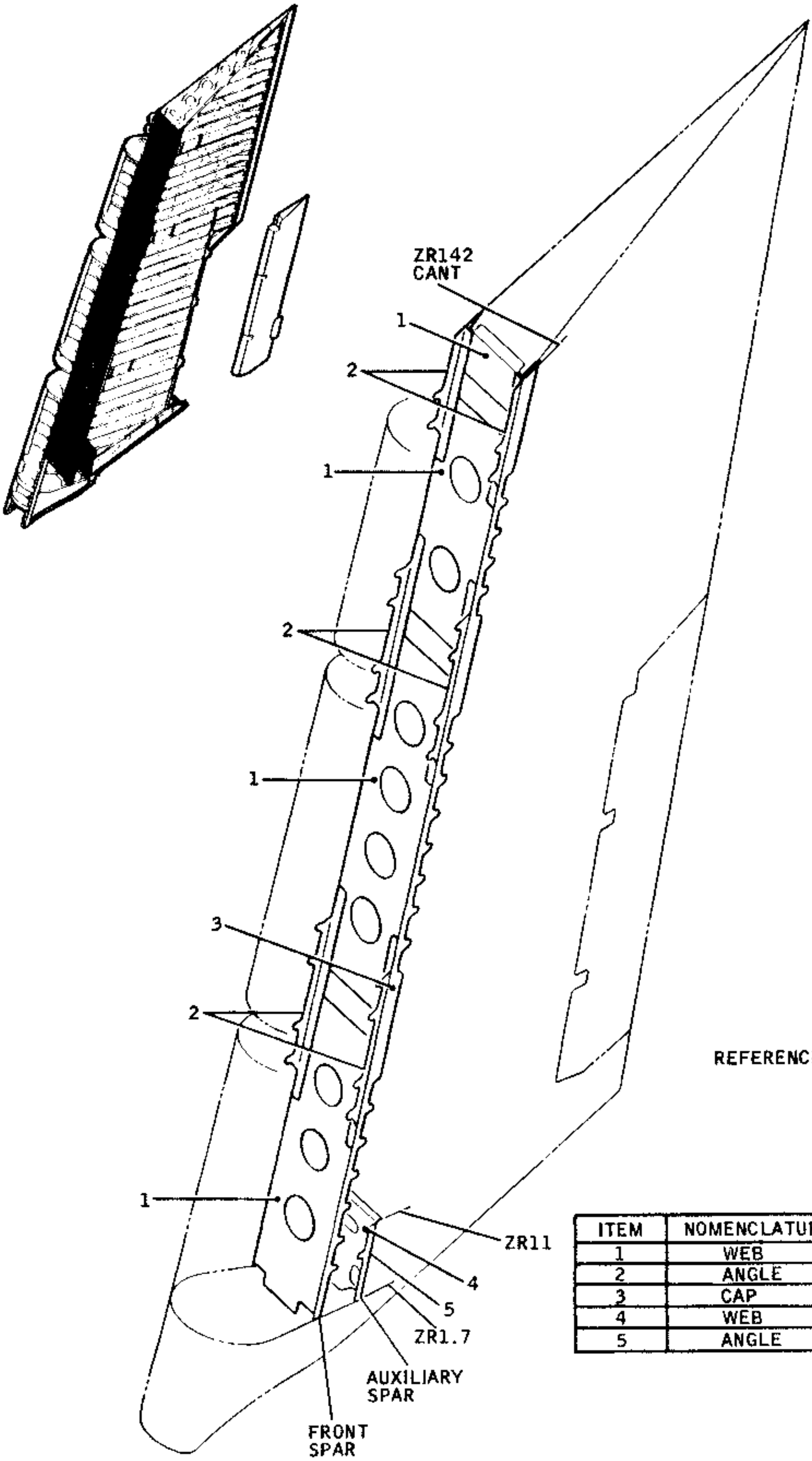


REFERENCE- DOUGLAS DRAWING 5910256

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		2655233
2	RIB ANGLE DOUBLER	.063 .063 .063	CLAD 2024-T42 CLAD 2024-T42 CLAD 2024-T3
3	WEB CAP RIB STIFFENER COVER FITTING FITTING	.050 .063 .032	CLAD 2024-T42 1464579 1440049 CLAD 2024-T42 CLAD 2024-T3 3913410 3913411
4	RIB WEB TEE	.040 .040	CLAD 2024-T42 CLAD 2024-T42 1440049
5	RIB	.040	CLAD 2024-T42
6	RIB DOUBLER ANGLE	.063 .063 .063	CLAD 2024-T42 CLAD 2024-T42 CLAD 2024-T42
7	FORMER DOUBLER ANGLE	.063 .063 .063	CLAD 2024-T42 CLAD 2024-T42 CLAD 2024-T42
8	RIB ANGLE	.063 .063	CLAD 2024-T42 CLAD 2024-T42
9	FORMER	.040	CLAD 2024-T42
10	ANGLE	.040	CLAD 2024-T42

BB3-321A

Rudder and Rudder Tab Structure
Figure 2 (Sheet 2)

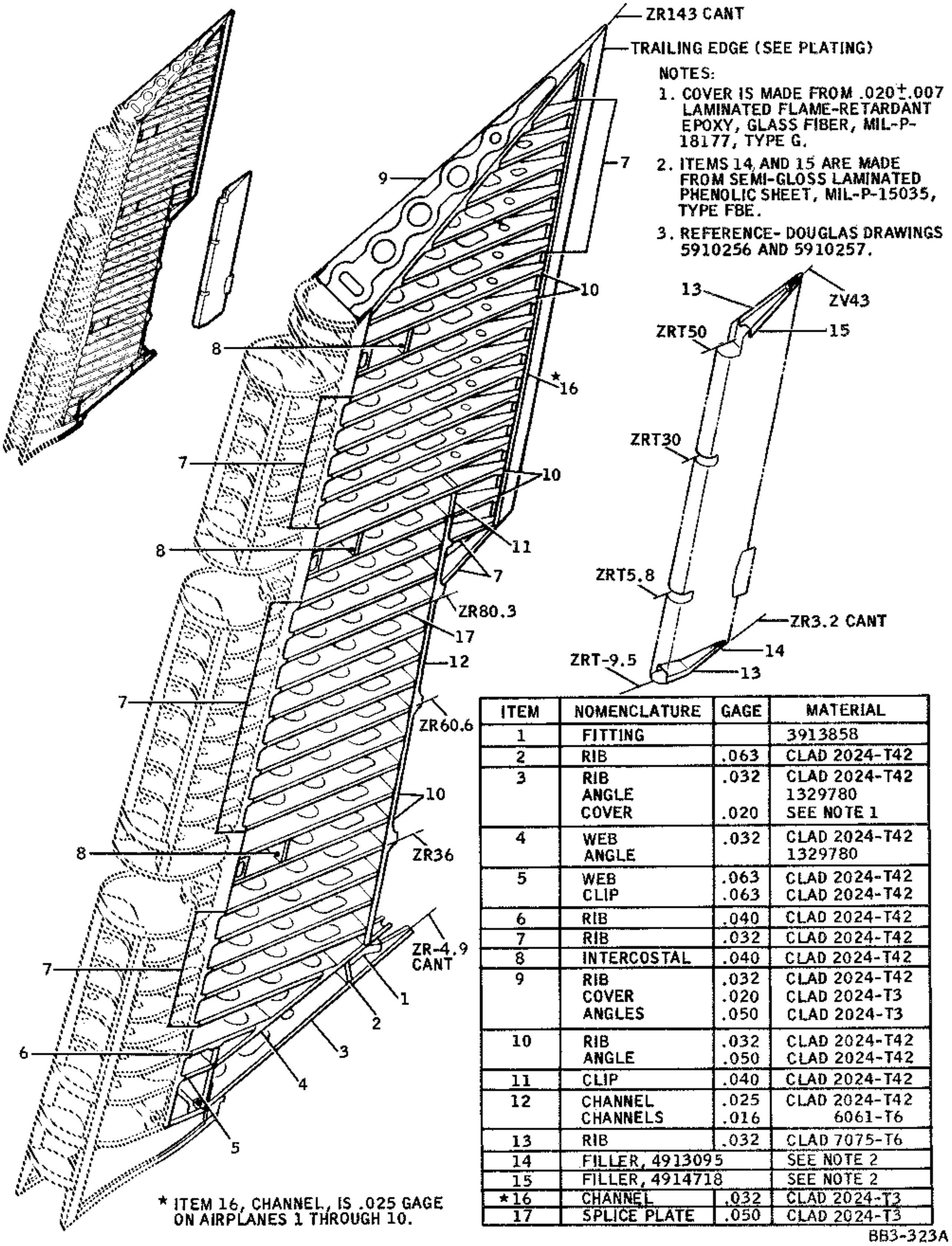


REFERENCE DOUGLAS DRAWING 5910256

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.032	CLAD 2024-T42
2	ANGLE		1074863
3	CAP		2912118
4	WEB	.050	CLAD 2024-T42
5	ANGLE		1074863

BB3-322

Rudder and Rudder Tab Structure
Figure 2 (Sheet 3)



NOTES:

1. COVER IS MADE FROM .020±.007 LAMINATED FLAME-RETARDANT EPOXY, GLASS FIBER, MIL-P-18177, TYPE G.
2. ITEMS 14 AND 15 ARE MADE FROM SEMI-GLOSS LAMINATED PHENOLIC SHEET, MIL-P-15035, TYPE FBE.
3. REFERENCE- DOUGLAS DRAWINGS 5910256 AND 5910257.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		3913858
2	RIB	.063	CLAD 2024-T42
3	RIB ANGLE COVER	.032 .020	CLAD 2024-T42 1329780 SEE NOTE 1
4	WEB ANGLE	.032	CLAD 2024-T42 1329780
5	WEB CLIP	.063 .063	CLAD 2024-T42 CLAD 2024-T42
6	RIB	.040	CLAD 2024-T42
7	RIB	.032	CLAD 2024-T42
8	INTERCOSTAL	.040	CLAD 2024-T42
9	RIB COVER ANGLES	.032 .020 .050	CLAD 2024-T42 CLAD 2024-T3 CLAD 2024-T3
10	RIB ANGLE	.032 .050	CLAD 2024-T42 CLAD 2024-T42
11	CLIP	.040	CLAD 2024-T42
12	CHANNEL CHANNELS	.025 .016	CLAD 2024-T42 6061-T6
13	RIB	.032	CLAD 7075-T6
14	FILLER, 4913095		SEE NOTE 2
15	FILLER, 4914718		SEE NOTE 2
*16	CHANNEL	.032	CLAD 2024-T3
17	SPLICE PLATE	.050	CLAD 2024-T3

* ITEM 16, CHANNEL, IS .025 GAGE ON AIRPLANES 1 THROUGH 10.

BB3-323A

Rudder and Rudder Tab Structure
Figure 2 (Sheet 4)

RUDDER - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

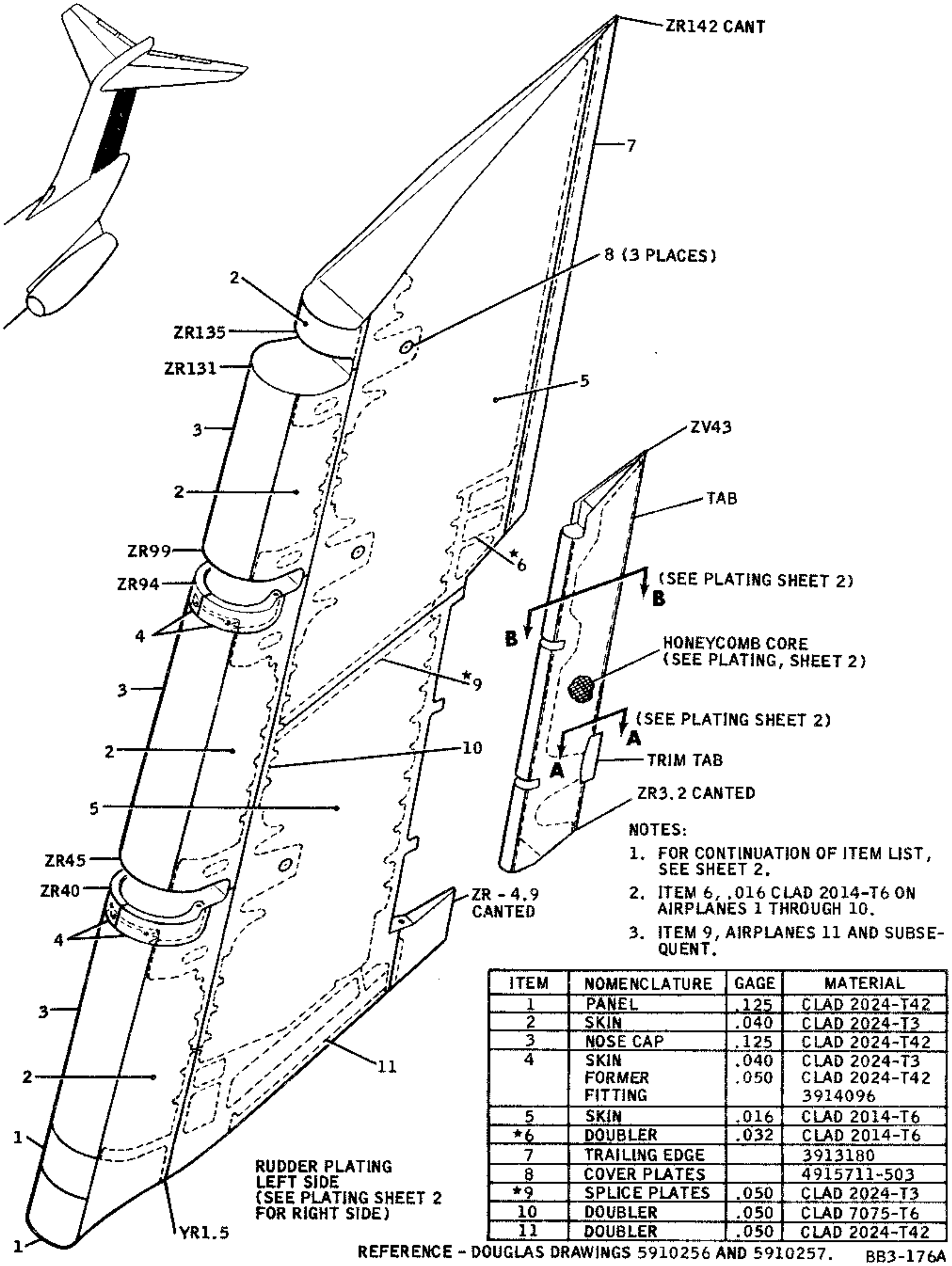
A. This section illustrates rudder components. Types and gages of material used in construction of the assemblies are identified in the illustrations.

B. This section also contains balancing procedures for the rudder and rudder tab (see 55-40-1). When a repair is made to a rudder or a rudder tab, the surface must be rebalanced. When a repair is made to a rudder tab, the surface must also be weighed as outlined in the balancing procedure.

2. Repair Index

A. The following list of structural components and applicable repairs may be used to restore the structural integrity and appearance of components.

Structural Component	Approved Repairs
Formers, ribs, and internal structure	Section 55-02, Figure 1
Skins (including trailing edge)	Section 55-03, Figures 1, 2, 5, and 6
Honeycomb	Section 55-04, Figures 1 through 3



NOTES:

1. FOR CONTINUATION OF ITEM LIST, SEE SHEET 2.
2. ITEM 6, .016 CLAD 2014-T6 ON AIRPLANES 1 THROUGH 10.
3. ITEM 9, AIRPLANES 11 AND SUBSEQUENT.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	PANEL	.125	CLAD 2024-T42
2	SKIN	.040	CLAD 2024-T3
3	NOSE CAP	.125	CLAD 2024-T42
4	SKIN FORMER FITTING	.040 .050	CLAD 2024-T3 CLAD 2024-T42 3914096
5	SKIN	.016	CLAD 2014-T6
*6	DOUBLER	.032	CLAD 2014-T6
7	TRAILING EDGE		3913180
8	COVER PLATES		4915711-503
*9	SPLICE PLATES	.050	CLAD 2024-T3
10	DOUBLER	.050	CLAD 7075-T6
11	DOUBLER	.050	CLAD 2024-T42

REFERENCE - DOUGLAS DRAWINGS 5910256 AND 5910257. BB3-176A

Rudder and Rudder Tab Plating
Figure 1 (Sheet 1)

RUDDER AND RUDDER TAB BALANCING - DESCRIPTION AND OPERATION

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplane structure, the rudder tab must be balanced nose-heavy about its hinge line. The rudder is not a flutter-critical surface and is permitted a certain amount of trailing edge heavy moment.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes the minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the ability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever a surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs. The balance condition of the rudder may be checked by the calculation method after repairs or repainting. The balance condition, and weight, of the rudder tab may be checked by the calculation method after repainting; however, due to its close tolerances, the rudder tab must be removed from the airplane in order to check balance condition after repairs.

E. The weight of the rudder tab must be checked whenever repainted or reworked. The weight may be checked by calculation method after repainting (see paragraph 6). The weight condition must never exceed maximum allowable weight of 21.30 pounds.

F. Two methods of balancing the control surfaces while off the airplane are presented. One method utilizes a calibrated weight beam, with sliding weight, affixed to the control surface. The sliding weight is moved along the beam until the surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition. Either method may be used.

G. Both methods of balancing the surfaces while off the airplane utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing well-oiled undersized hinge pins through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms.

H. The balance condition, and weight if tab, is recorded on decal, or stencil, located on closing rib of surface. Any change to the recorded condition must be permamently recorded so that a continual reference is available.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the rudder and rudder tab are control surfaces and are movable portions of the vertical tail which are used as yaw attitude controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) Rudder: The established maximum trailing edge heavy moment to maximum nose heavy moment are the required balance limits.

(2) Rudder tab: The established minimum to maximum nose-heavy moment is the required balance limits.

E. Minimum Balance Limit

(1) Rudder: No minimum trailing edge heavy moment is established. (The rudder trailing edge heavy moment may be less than maximum specified).

(2) Rudder tab: The established minimum nose-heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate moment established to provide an optimum point when rebalance is required is the recommended balance limit.

(a) The intermediate nose-heavy moment is the recommended balance limit for the rudder tab.

(b) There is no intermediate moment established for the rudder.

G. Maximum Balance Limit

(1) Rudder: The established maximum trailing edge heavy moment is the maximum balance limit.

(2) Rudder tab: The established maximum nose-heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to nose caps which constitute minor increments of balance moment. During balance checks, the amount of balance moment adjustment required is usually within the range of the adjustment weights.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in paragraphs A and B. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (hinge pins resting on knife edges) and that the hinge pins used be sufficiently undersize, and well-oiled, so as not to pick up any eyebolt bearing friction.

A. Calibrated Beam Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for rudder balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for rudder tab balancing
C	Beam Assembly	5916761-63		Direct reading scale for rudder balancing
D	Weight Assembly (5 pound)	5916761-71		Rudder balancing with beam
E	Beam Assembly	5916773-29		Direct reading scale for rudder tab balancing

Item	Name	Number	Manufacturer	Use
F	Weight Assembly (1 pound)	5916773-37		Rudder tab balancing with beam
G	Sensitive weighing scale	0 to 100 pounds with reliability to 0.01 pound	Trinner Scale and Manufacturing Co., Chicago, Ill.	Weigh rudder weights and tab

B. Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for rudder balancing
B	Control surface balance fixture (balance stand)	5916763		Mount for rudder tab balancing
C	Standard 8.00 pound checkweight (including container)		Local manufacturer	Standard of known weight and balance moment for balancing rudder
D	Lead shot of various sizes		Local supply	Checkweights of various values for balancing rudder and rudder tab
E	Metal container		Local supply	Suspension device to hold checkweights during balancing of rudder tab
F	Sensitive weighing scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	Weigh weights and tab

4. Balance Rudder and Rudder Tab Using Beam and Weight

A. Check Rudder Balance

(1) Weigh adjustment weights and balance weights installed, including retainers, support brackets, and attachments.

(2) To maintain surface at, or less than, maximum trailing edge heavy moment of 145 inch-pounds, add, or remove, adjustment weights, as required, to provide weight of 28 pounds. See Figure 1 for location and attachment.

NOTE: Increasing the weight above 28 pounds will decrease the trailing edge heavy moment.

(3) Make certain that rudder is complete and in required configuration for balancing with all painting and rework accomplished. Dampers and push-rods must be installed. Tab must not be installed.

(4) Mount rudder on balance stands (See Figure 2). Use well-oiled, under-sized hinge pins.

(5) Mount the beam assembly and weight assembly (5 pounds) at location and as shown in Figure 2.

(6) Slide the 5 pound weight along the beam until the rudder assumes a horizontal attitude.

NOTE: The rudder is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

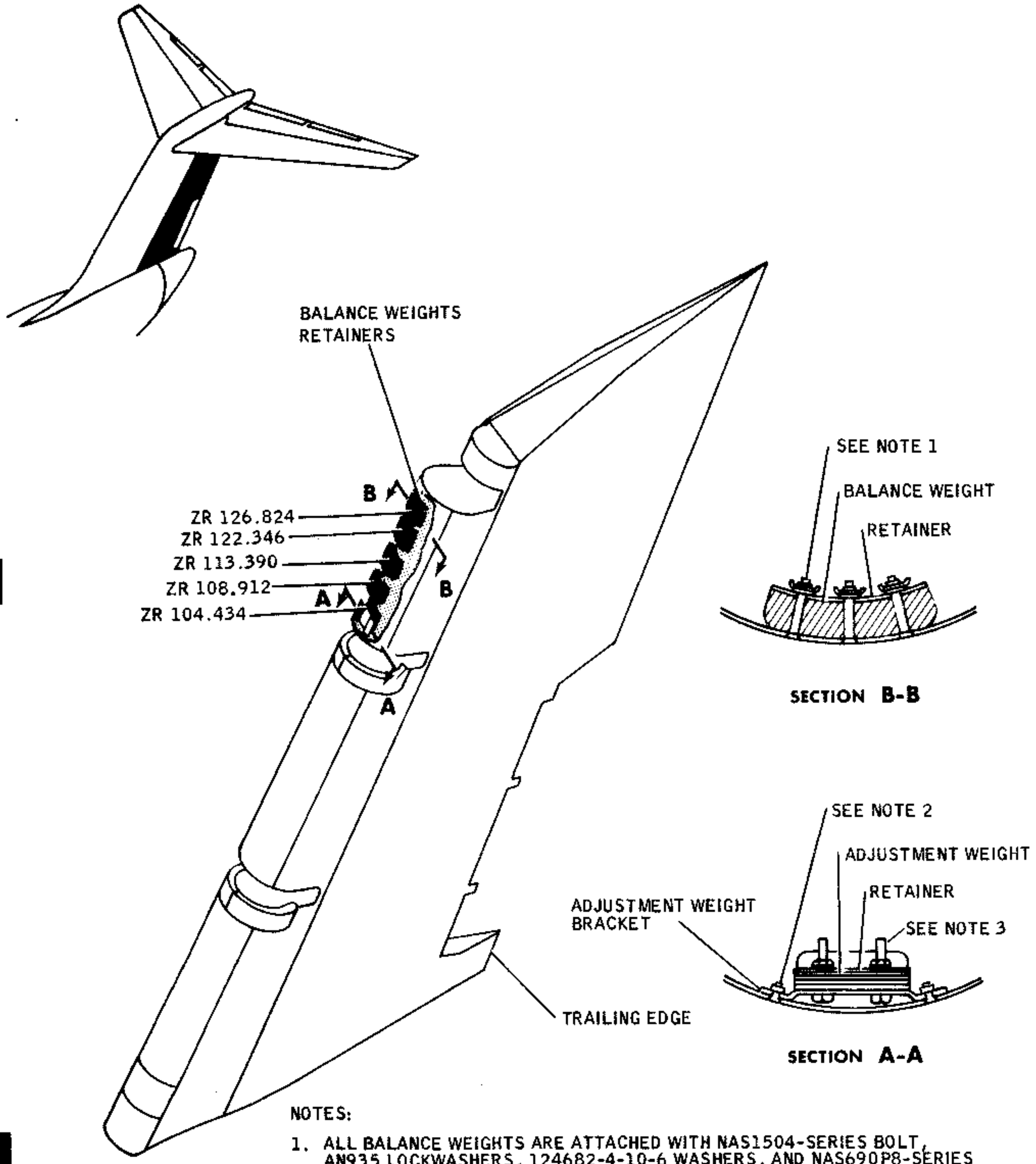
(7) Read the balance indication on the beam. The maximum trailing edge heavy mount permissible is 145 inch-pounds.

NOTE: The rudder balance may vary from 60 inch-pounds nose heavy to 145 inch-pounds trailing edge heavy, dependent upon the amount of weight forward of hinge line. If the rudder is in a nose heavy balance condition, the check-weight method of balancing is required instead of the beam method. The maximum trailing edge heavy moment is established with certain flutter characteristics in mind.

(8) If the rudder trailing edge heavy moment is above the maximum, add adjustment weights as required. See Figure 1 for location and attachment. See Figure 3 for suggested quantities to add if maximum trailing edge heavy moment exceeds 145 inch-pounds.

(9) Recheck balance condition.

(10) Permanently record balance condition on decal.

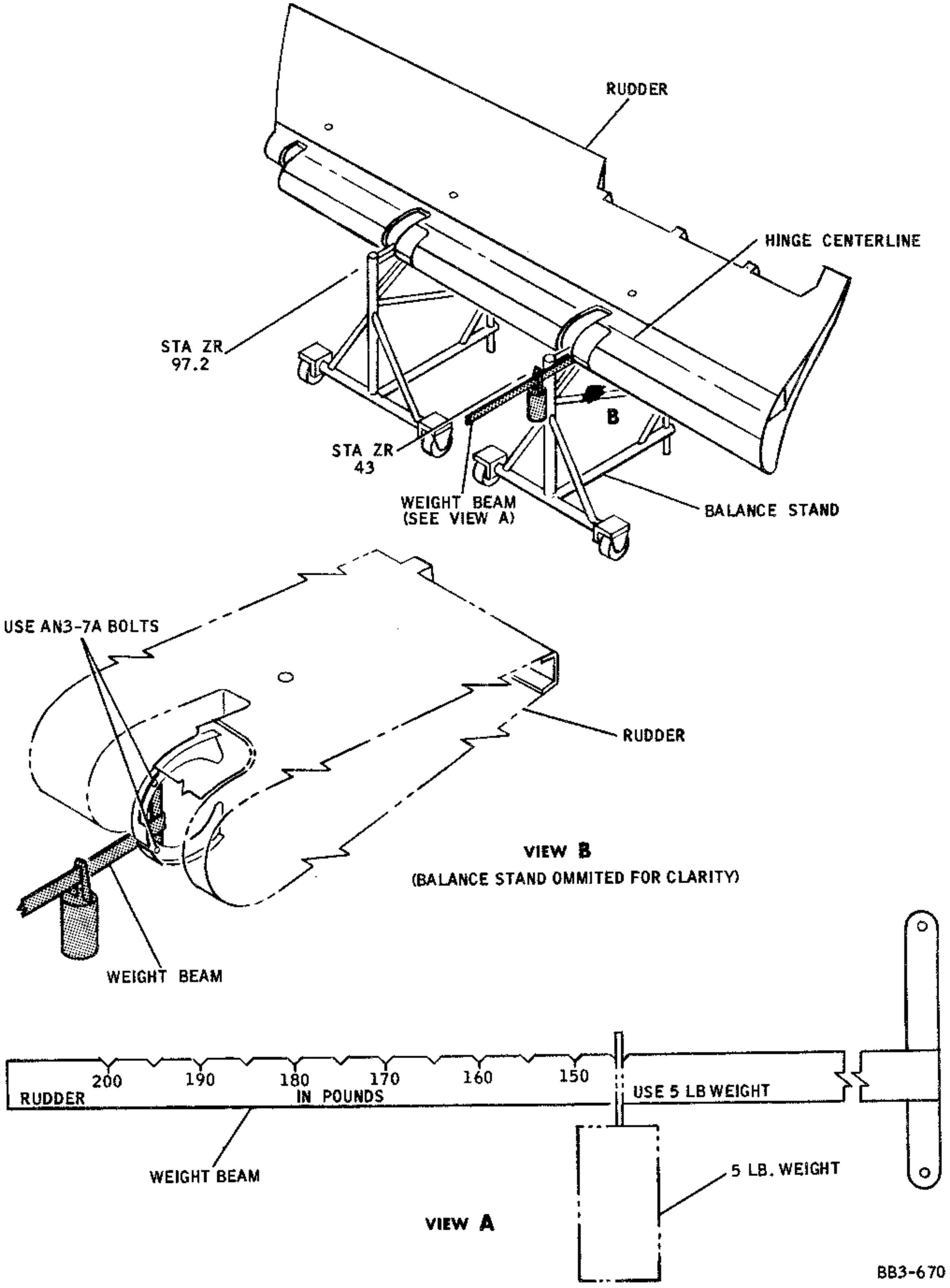


NOTES:

1. ALL BALANCE WEIGHTS ARE ATTACHED WITH NAS1504-SERIES BOLT, AN935 LOCKWASHERS, 124682-4-10-6 WASHERS, AND NAS690P8-SERIES GANG CHANNEL NUTS, AND RETAINERS.
2. ALL ADJUSTMENT WEIGHT BRACKETS ARE ATTACHED WITH NAS1504-4 BOLTS, AN960-416 WASHERS, AND NAS679A4 NUTS.
3. ALL ADJUSTMENT WEIGHTS ARE ATTACHED TO BRACKETS WITH NAS428K4-SERIES BOLTS, AN935-416 LOCKWASHERS, AND AN315-4R NUTS.
4. BALANCE WEIGHTS SHOWN TYPICAL FOR FACTORY INSTALLATION ON AIRPLANES 1-35. FACTORY INSTALLATION FOR AIRPLANES 35 AND SUBSEQUENT HAS 2 BALANCE WEIGHTS WHICH ARE LOCATED AT STATIONS 127.8 AND 120.8.
5. REFERENCE - DOUGLAS DRAWING 5957093.

BB3-230A

Rudder Weight Location and Attachment
Figure 1



Rudder Balancing with Beam
Figure 2

B. Check Rudder Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing, with all painting and rework accomplished.

(2) Weigh tab. Total weight must not exceed 21.30 pounds.

(3) Mount the beam assembly and weight assembly (1 pound) on the tab horn fitting and the tab on the balance stands as shown in Figure 4.

Weight Beam Reading (Inch-pounds)	Suggested quantity of number 2914554 adjustment weights to add for indicated weight beam reading (see Figure 1 for location)	Weight and balance moment contribution of suggested quantity of number 2914554 weights	
		Weight (Pounds)	Moment (Inch-pounds)
145	WITHIN BALANCE LIMITS		
150	1	0.51	7.0
155	2	1.02	14.0
160	3	1.53	21.0
165	4	2.04	28.0
170	4	2.04	28.0
175	5	2.55	35.0

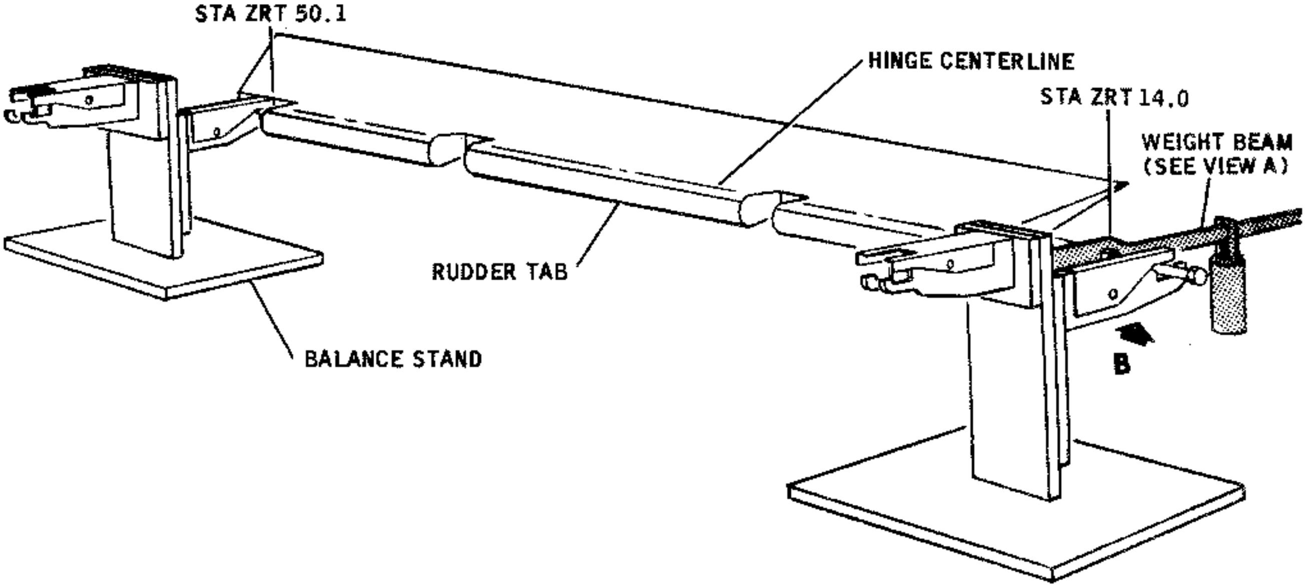
Rudder Balance Condition and Adjustment Weight Change Required
Figure 3

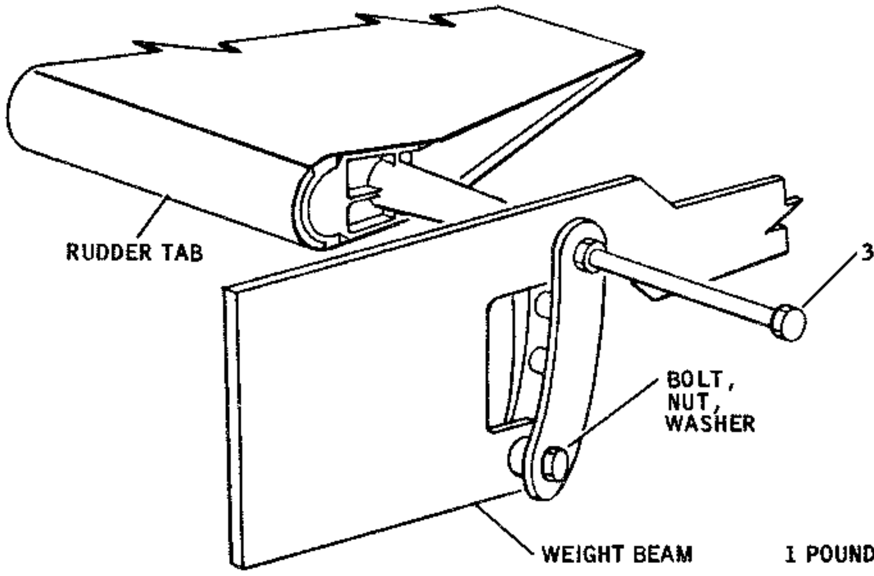
(4) Slide the 1 pound weight along the beam until the tab assumes a horizontal attitude.

NOTE: The tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points.

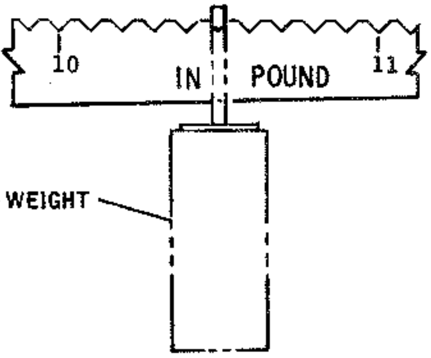
(5) Read the balance indication on the beam. Balance limits for the rudder tab are 9.5 inch-pounds minimum to 11.5 inch-pounds maximum nose heavy. Recommended balance is 10.5 inch-pounds nose heavy.

(6) If the balance indication is not within limits, add, or remove adjustment weights as necessary. See Figure 5 for adjustment weight number and contribution and Figure 6 for location and attachment.

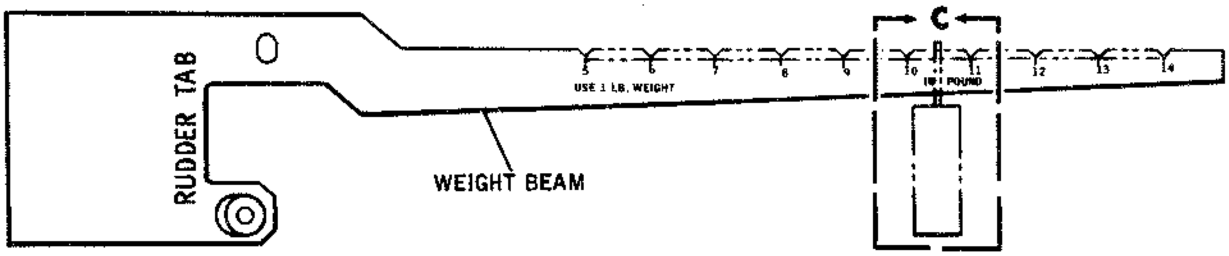




VIEW B
(BALANCE STAND OMITTED FOR CLARITY)



VIEW C
(TYPICAL)



VIEW A

BB3-671

Rudder Tab Balancing with Beam
Figure 4

(7) Permanently record balance condition and weight on decal.

5. Balance Rudder and Rudder Tab Using Checkweight Method

A. Check Rudder Balances

(1) Weigh adjustment weights and balance weights installed, including retainers, support brackets, and attachments.

(2) To maintain surface at, or less than, maximum trailing edge heavy moment of 145 inch-pounds, add, or remove, adjustment weights, as required, to provide weight of 28 pounds. See Figure 1 for location and attachment.

NOTE: Increasing the weight above 28 pounds will decrease the trailing edge heavy moment.

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Contribution of Each Number 4917173 Adjustment Weight	
		Weight (Pounds)	Moment (Inch-pounds)
Minimum	9.5	0.08	0.2
Recommended	10.5		
Maximum	11.5		

Rudder Tab Balance Limits and Adjustment Weight Contribution
Figure 5

(3) Make certain that rudder is complete and in required configuration for balancing with all painting and rework accomplished. Dampers and push-rods must be installed. Tabs must not be installed.

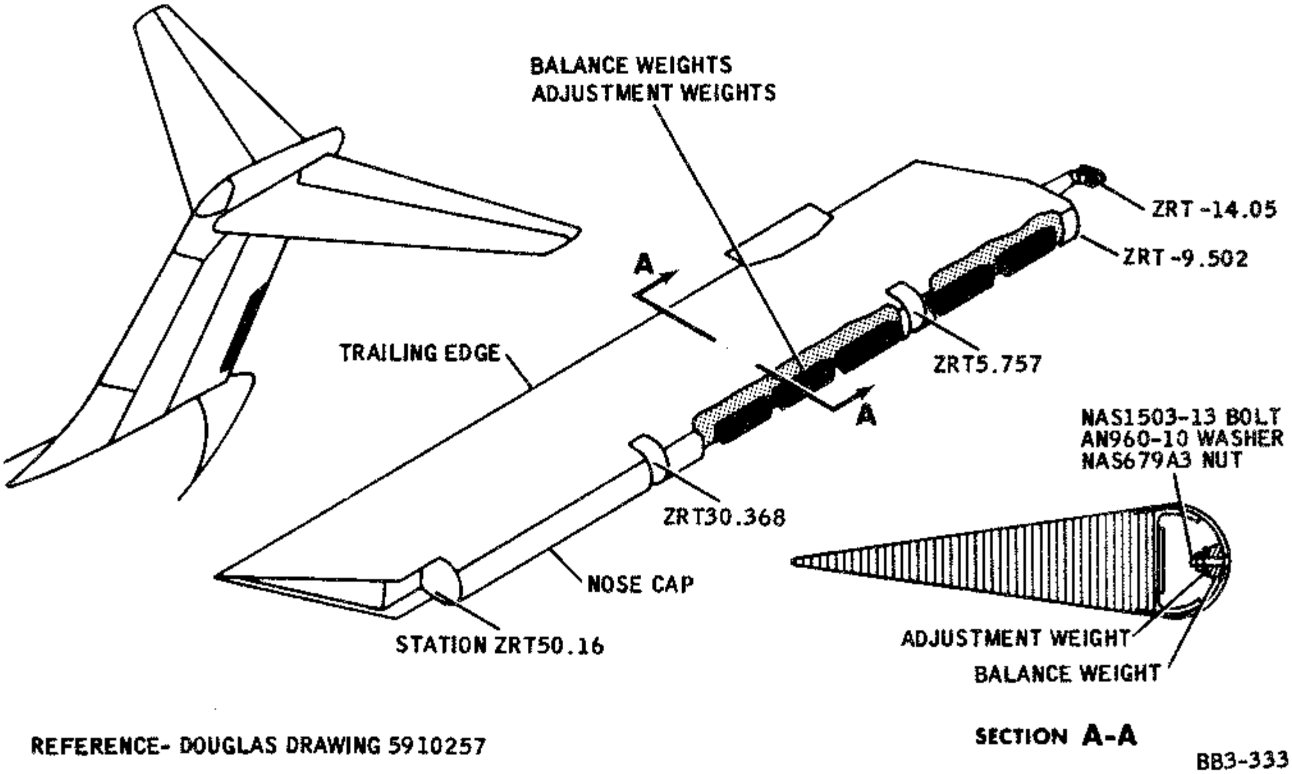
(4) Mount rudder on balance stands (see Figure 7). Use station ZR 43 and ZR 97.2 hinge locations. Use well-oiled, undersized hinge pins.

(5) Loosen damper access door screw (see Figure 7) and suspend standard 8.00 pound checkweight (see Figure 8) over leading edge with nylon cord or soft safety wire.

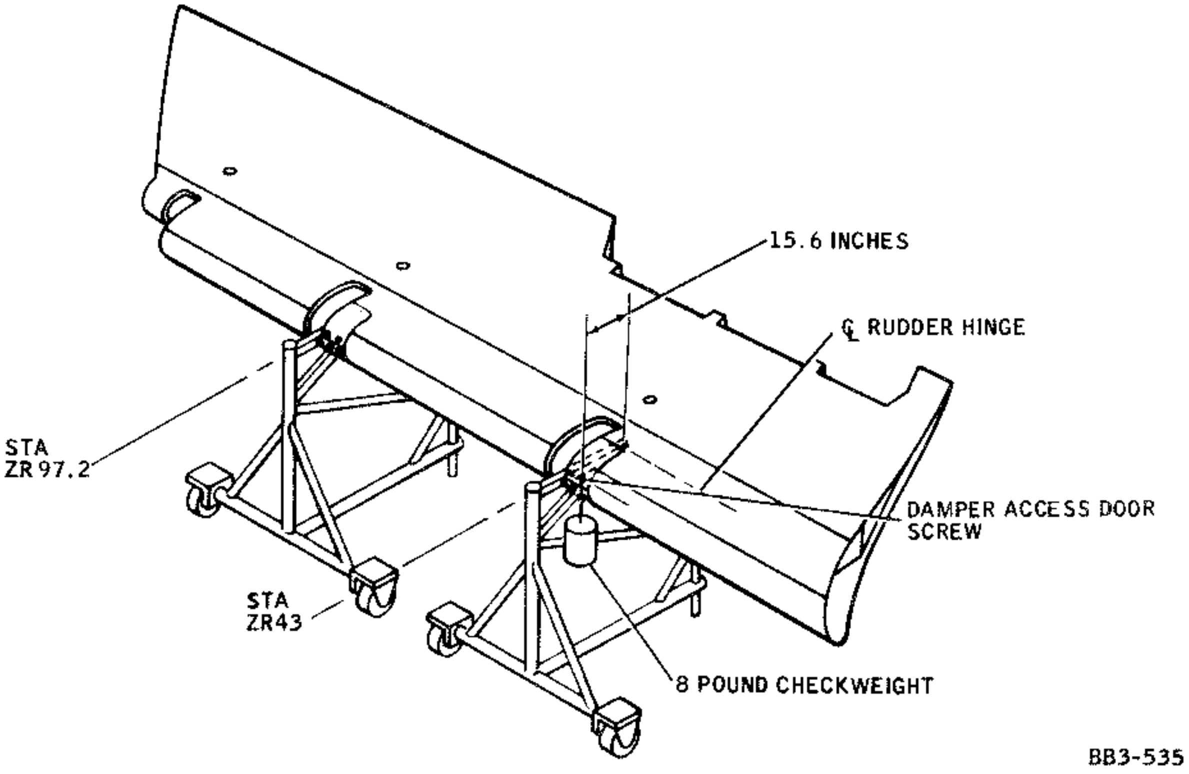
NOTE: Moment arm is 15.6 inches.

(6) Add checkweight (lead shot) to container until rudder assumes a horizontal attitude.

NOTE: The rudder is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points.



Rudder Tab Weight Location and Attachment
Figure 6



Rudder Balancing and Checkweight Suspension
Figure 7

(7) Weight total checkweights suspended.

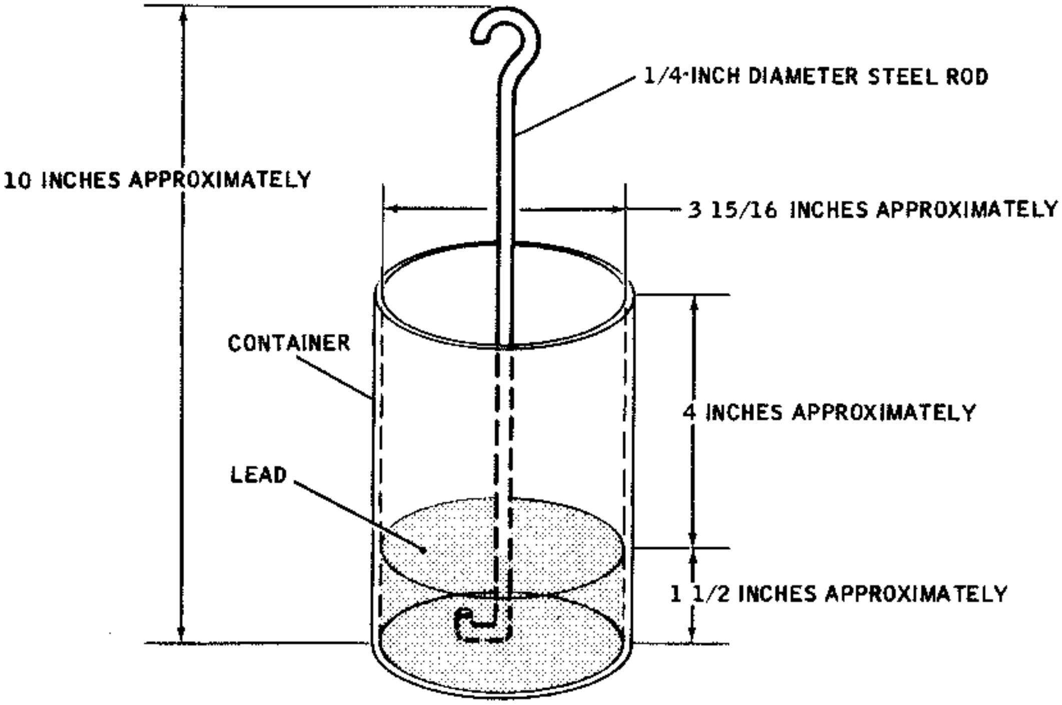
(8) Compare total checkweight value with the equivalent balance condition shown in Figure 9. The maximum trailing edge heavy moment is 145 inch-pounds. The total amount of checkweight required to equal maximum moment is 9.29 pounds.

NOTE: The rudder balance may vary from 60 inch-pounds nose heavy to 145 inch-pounds trailing edge heavy, dependent upon the amount of weight forward of hinge line. The maximum trailing edge heavy moment is established with certain flutter characteristics in mind.

(9) Add adjustment weights, as required. See Figure 1 for location and attachment.

(10) Recheck balance condition.

(11) Permanently record balance condition and weight on decal.



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 8.00 POUNDS.

BB3-432

Printed in U.S.A.

Eight Pound Standard Checkweight
Figure 8

Balance Condition		Suggested quantity of number 2914554 adjustment weights to add for indicated unbalance	Contribution of suggested number 2914554 adjustment weights	
Equivalent Checkweight above maximum weight of 9.29 pounds	Hinge Moment above maximum moment of 145 inch-pounds trailing edge heavy			
(Pounds)	(Inch-Pounds)		Weight (Pounds)	Moment (Inch-Pounds)
0 to 0.32	0 to 7	1	0.51	7.0
0.32 to 0.77	5 to 12	2	1.02	14.0
0.77 to 1.22	12 to 17	3	1.53	21.0
1.22 to 1.67	17 to 24	4	2.04	28.0
1.67 to 2.12	24 to 31	5	2.55	35.0
2.12 to 2.57	31 to 38	6	3.06	42.0
2.57 to 3.02	38 to 45	7	3.57	49.0

Rudder Balance Condition and Adjustment Weight Change Required
Figure 9

B. Check Rudder Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 21.30 pounds.

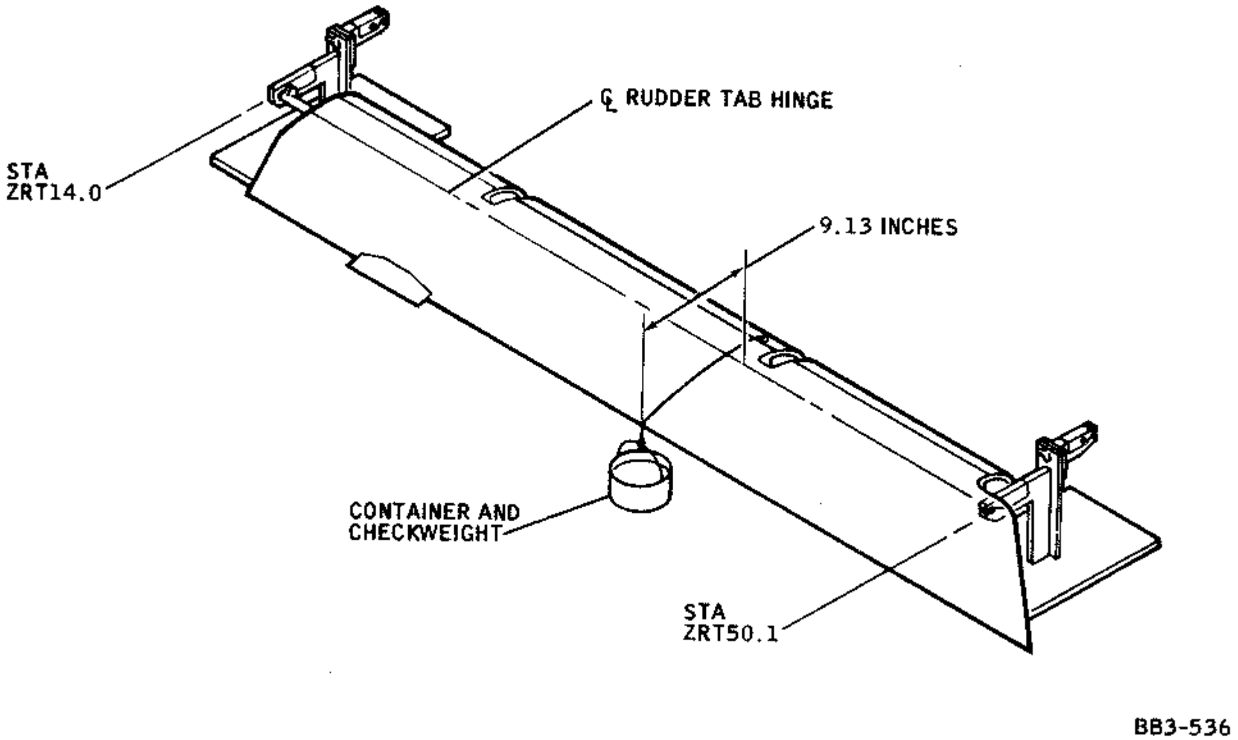
(2) Mount tab on balance stands (see Figure 10). Use station ZRT -14.05 and ZRT 50.16 hinge locations. Use well-oiled, undersized hinge pins.

(3) Loosen any nose cap attach screw.

(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.

(5) Suspend container over trailing edge.

NOTE: Moment arm is 9.13 inches.



Rudder Tab Balancing and Checkweight Suspension
Figure 10

(6) Add checkweight (lead shot) to container until tab assumes a horizontal attitude.

NOTE: Tab is in a horizontal attitude when centerline of trailing edge is the same distance from the floor (baseline) as the centerline of mount points.

(7) Weight container and checkweights.

(8) Compare weight with values specified in Figure 11.

(9) Add, or remove, adjustment weights (see Figure 6) for location and attachment) as required to maintain correct balance limits.

NOTE: Balance limits for the rudder tab are 9.5 inch-pounds minimum to 11.5 inch-pounds maximum nose heavy. Recommended balance is 10.5 inch-pounds nose heavy.

(10) Recheck balance condition.

(11) Weigh tab to ensure that the maximum allowable weight of 21.30 pounds is not exceeded.

(12) Permanently record balance condition and weight on decal.

TEMPORARY REVISION 55-13

FILING INSTRUCTIONS: Insert this Temporary Revision immediately preceding 55-40-1. Remove Temporary Revisions 55-10 and 55-11.

Retain this Temporary Revision until notified to remove it.

DESCRIPTION AND REASON: This Temporary Revision cancels and supersedes Temporary Revisions 55-10 and 55-11.

Provides new balance limits for rudder.

Provides information for balancing rudder by calculation method after repairs, provides information for balancing rudder and rudder tab by calculation after repainting, and provides information for calculating weight added by repaint.

EFFECTIVITY: ALL

Printed in U.S.A.

RUDDER AND RUDDER TAB BALANCING - DESCRIPTION AND OPERATION

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplane structure, the rudder tab must be balanced nose-heavy about its hinge line. The rudder is not a flutter-critical surface and is permitted a certain amount of trailing edge heavy moment.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes the minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the ability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever a surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs. The balance condition of the rudder may be checked by the calculation method after repairs or repainting. The balance condition, and weight, of the rudder tab may be checked by the calculation method after repainting; however, due to its close tolerances, the rudder tab must be removed from the airplane in order to check balance condition after repairs.

E. The weight of the rudder tab must be checked whenever repainted or reworked. The weight may be checked by calculation method after repainting (see paragraph 6). The weight condition must never exceed maximum allowable weight of 21.30 pounds.

F. Two methods of balancing the control surfaces while off the airplane are presented. One method utilizes a calibrated weight beam, with sliding weight, affixed to the control surface. The sliding weight is moved along the beam until the surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition. Either method may be used.

G. Both methods of balancing the surfaces while off the airplane utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing well-oiled undersized hinge pins through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms.

H. The balance condition, and weight if tab, is recorded on decal, or stencil, located on closing rib of surface. Any change to the recorded condition must be permamently recorded, so that a continual reference is available.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the rudder and rudder tab are control surfaces and are movable portions of the vertical tail which are used as yaw attitude controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) Rudder: The established maximum trailing edge heavy moment to maximum nose heavy moment are the required balance limits.

(2) Rudder tab: The established minimum to maximum nose-heavy moment is the required balance limits.

E. Minimum Balance Limit

(1) Rudder: No minimum trailing edge heavy moment is established. (The rudder trailing edge heavy moment may be less than maximum specified).

(2) Rudder tab: The established minimum nose-heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate moment established to provide an optimum point when rebalance is required is the recommended balance limit.

(a) The intermediate nose-heavy moment is the recommended balance limit for the rudder tab.

(b) There is no intermediate moment established for the rudder.

G. Maximum Balance Limit

(1) Rudder: The established maximum trailing edge heavy moment is the maximum balance limit.

(2) Rudder tab: The established maximum nose-heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to nose caps which constitute minor increments of balance moment. During balance checks, the amount of balance moment adjustment required is usually within the range of the adjustment weights.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in paragraphs A and B. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (hinge pins resting on knife edges) and that the hinge pins used be sufficiently undersize, and well-oiled, so as not to pick up any eyebolt bearing friction.

A. Calibrated Beam Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for rudder balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for rudder tab balancing
C	Beam Assembly	5916761-63		Direct reading scale for rudder balancing
D	Weight Assembly (5 pound)	5916761-71		Rudder balancing with beam
E	Beam Assembly	5916773-29		Direct reading scale for rudder tab balancing

Item	Name	Number	Manufacturer	Use
F	Weight Assembly (1 pound)	5916773-37		Rudder tab balancing with beam
G	Sensitive weighing scale	0 to 100 pounds with reliability to 0.01 pound	Trinner Scale and Manufacturing Co., Chicago, Ill.	Weigh rudder weights and tab

B. Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for rudder balancing
B	Control surface balance fixture (balance stand)	5916763		Mount for rudder tab balancing
C	Standard 8.00 pound checkweight (including container)		Local manufacturer	Standard of known weight and balance moment for balancing rudder
D	Lead shot of various sizes		Local supply	Checkweights of various values for balancing rudder and rudder tab
E	Metal container		Local supply	Suspension device to hold checkweights during balancing of rudder tab
F	Sensitive weighing scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	Weigh weights and tab

4. Balance Rudder and Rudder Tab Using Beam and Weight

A. Check Rudder Balance

(1) Weigh adjustment weights and balance weights installed, including retainers, support brackets, and attachments.

(2) To maintain surface at, or less than, maximum trailing edge heavy moment of 145 inch-pounds, add, or remove, adjustment weights, as required, to provide weight of 28 pounds. See Figure 1 for location and attachment.

NOTE: Increasing the weight above 28 pounds will decrease the trailing edge heavy moment.

(3) Make certain that rudder is complete and in required configuration for balancing with all painting and rework accomplished. Dampers and pushrods must be installed. Tab must not be installed.

(4) Mount rudder on balance stands (See Figure 2). Use well-oiled, undersized hinge pins.

(5) Mount the beam assembly and weight assembly (5 pounds) at location and as shown in Figure 2.

(6) Slide the 5 pound weight along the beam until the rudder assumes a horizontal attitude.

NOTE: The rudder is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

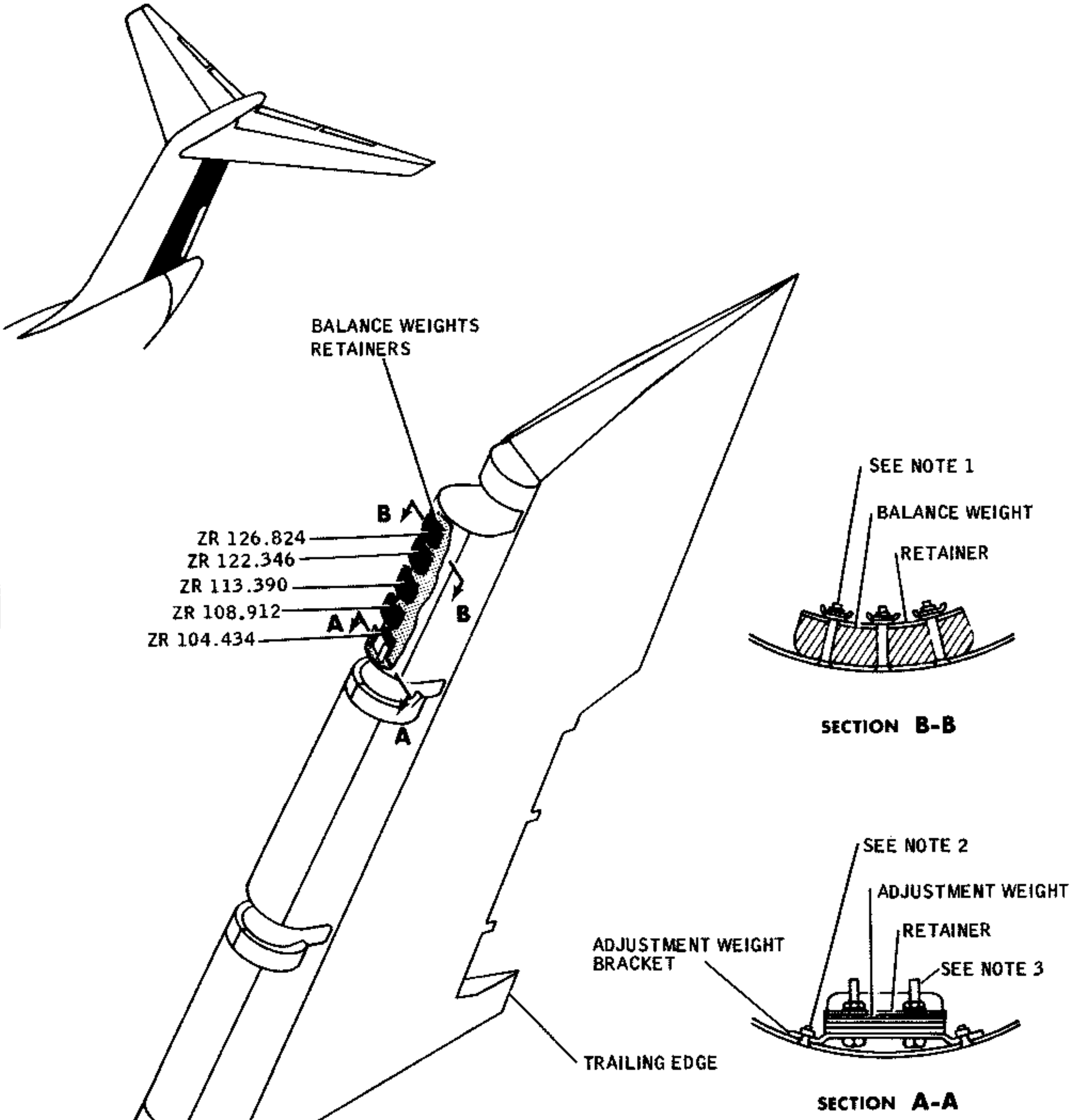
(7) Read the balance indication on the beam. The maximum trailing edge heavy mount permissible is 145 inch-pounds.

NOTE: The rudder balance may vary from 60 inch-pounds nose heavy to 145 inch-pounds trailing edge heavy, dependent upon the amount of weight forward of hinge line. If the rudder is in a nose heavy balance condition, the check-weight method of balancing is required instead of the beam method. The maximum trailing edge heavy moment is established with certain flutter characteristics in mind.

(8) If the rudder trailing edge heavy moment is above the maximum, add adjustment weights as required. See Figure 1 for location and attachment. See Figure 3 for suggested quantities to add if maximum trailing edge heavy moment exceeds 145 inch-pounds.

(9) Recheck balance condition.

(10) Permanently record balance condition on decal.

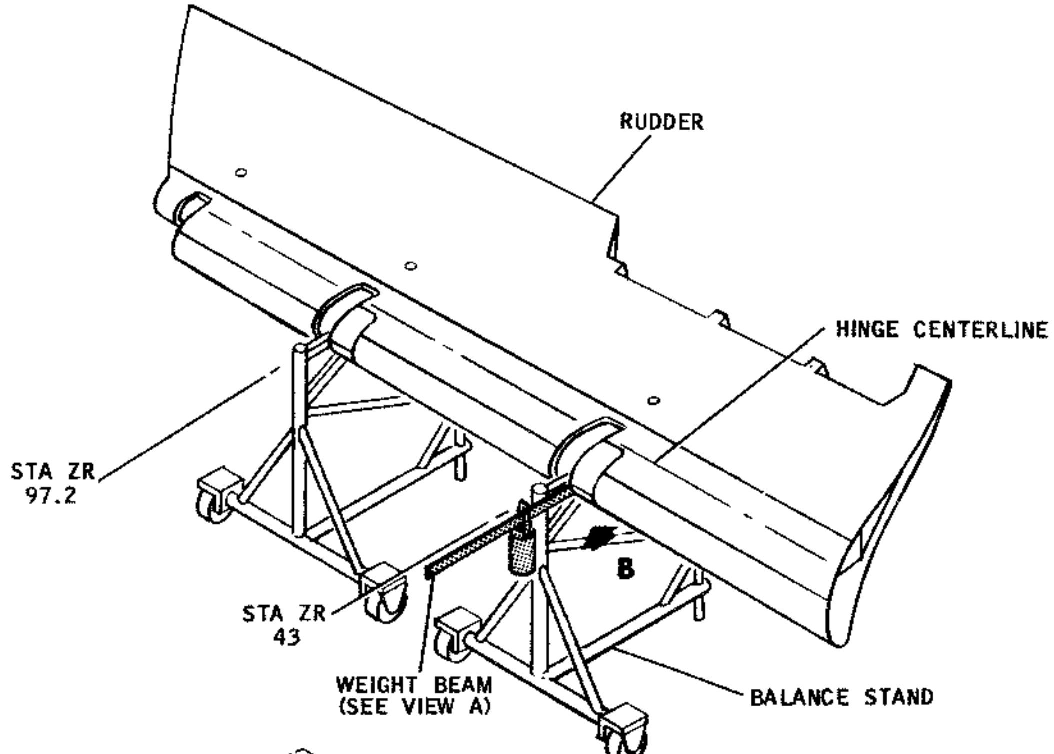


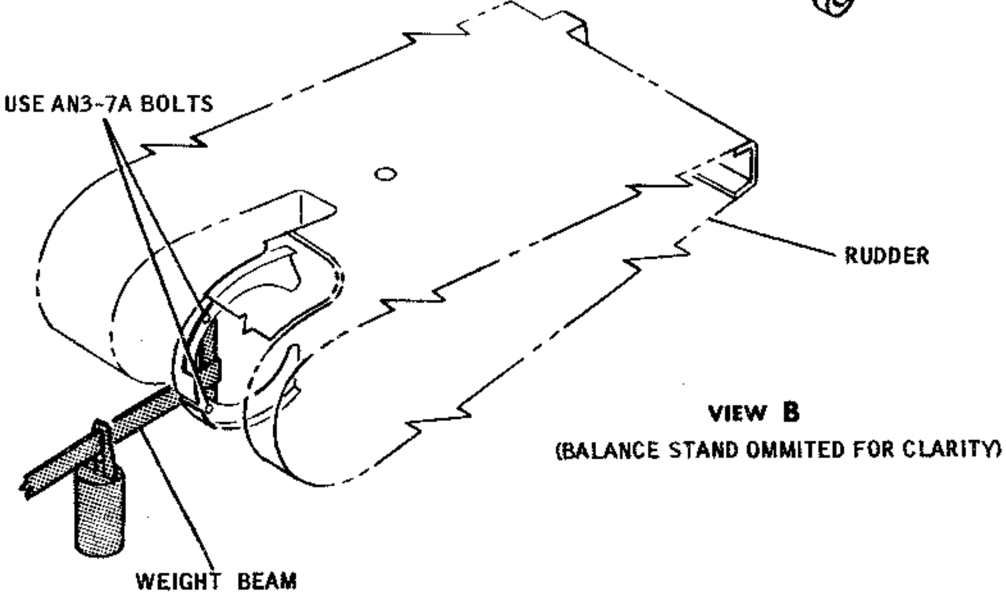
NOTES:

1. ALL BALANCE WEIGHTS ARE ATTACHED WITH NAS1504-SERIES BOLT, AN935 LOCKWASHERS, 124682-4-10-6 WASHERS, AND NAS690P8-SERIES GANG CHANNEL NUTS, AND RETAINERS.
2. ALL ADJUSTMENT WEIGHT BRACKETS ARE ATTACHED WITH NAS1504-4 BOLTS, AN960-416 WASHERS, AND NAS679A4 NUTS.
3. ALL ADJUSTMENT WEIGHTS ARE ATTACHED TO BRACKETS WITH NAS428K4-SERIES BOLTS, AN935-416 LOCKWASHERS, AND AN315-4R NUTS.
4. BALANCE WEIGHTS SHOWN TYPICAL FOR FACTORY INSTALLATION ON AIRPLANES 1-35. FACTORY INSTALLATION FOR AIRPLANES 35 AND SUBSEQUENT HAS 2 BALANCE WEIGHTS WHICH ARE LOCATED AT STATIONS 127.8 AND 120.8.
5. REFERENCE - DOUGLAS DRAWING 5957093.

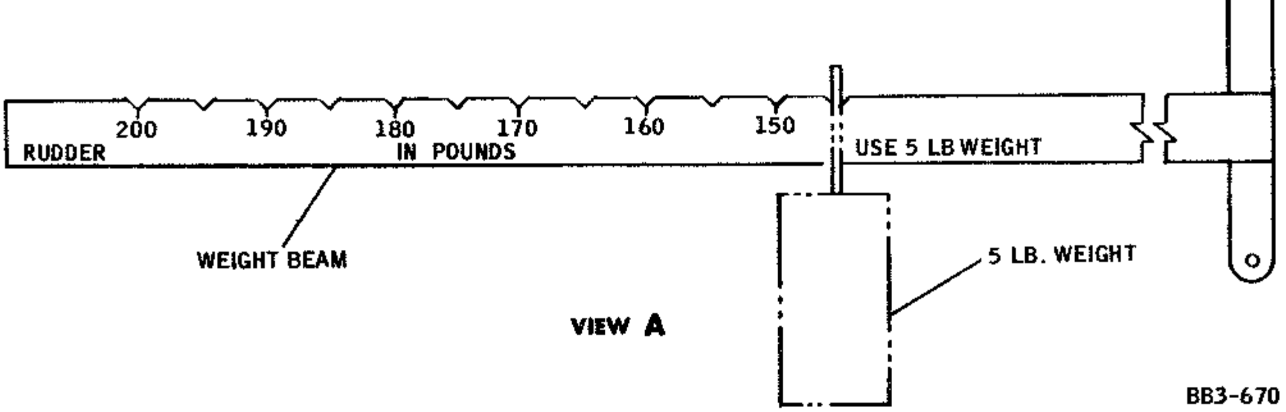
BB3-230A

Rudder Weight Location and Attachment
Figure 1





VIEW B
(BALANCE STAND OMMITED FOR CLARITY)



VIEW A

Rudder Balancing with Beam
Figure 2

B. Check Rudder Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing, with all painting and rework accomplished.

(2) Weigh tab. Total weight must not exceed 21.30 pounds.

(3) Mount the beam assembly and weight assembly (1 pound) on the tab horn fitting and the tab on the balance stands as shown in Figure 4.

Weight Beam Reading (Inch-pounds)	Suggested quantity of number 2914554 adjustment weights to add for indicated weight beam reading (see Figure 1 for location)	Weight and balance moment contribution of suggested quantity of number 2914554 weights	
		Weight (Pounds)	Moment (Inch-pounds)
145	WITHIN BALANCE LIMITS		
150	1	0.51	7.0
155	2	1.02	14.0
160	3	1.53	21.0
165	4	2.04	28.0
170	4	2.04	28.0
175	5	2.55	35.0

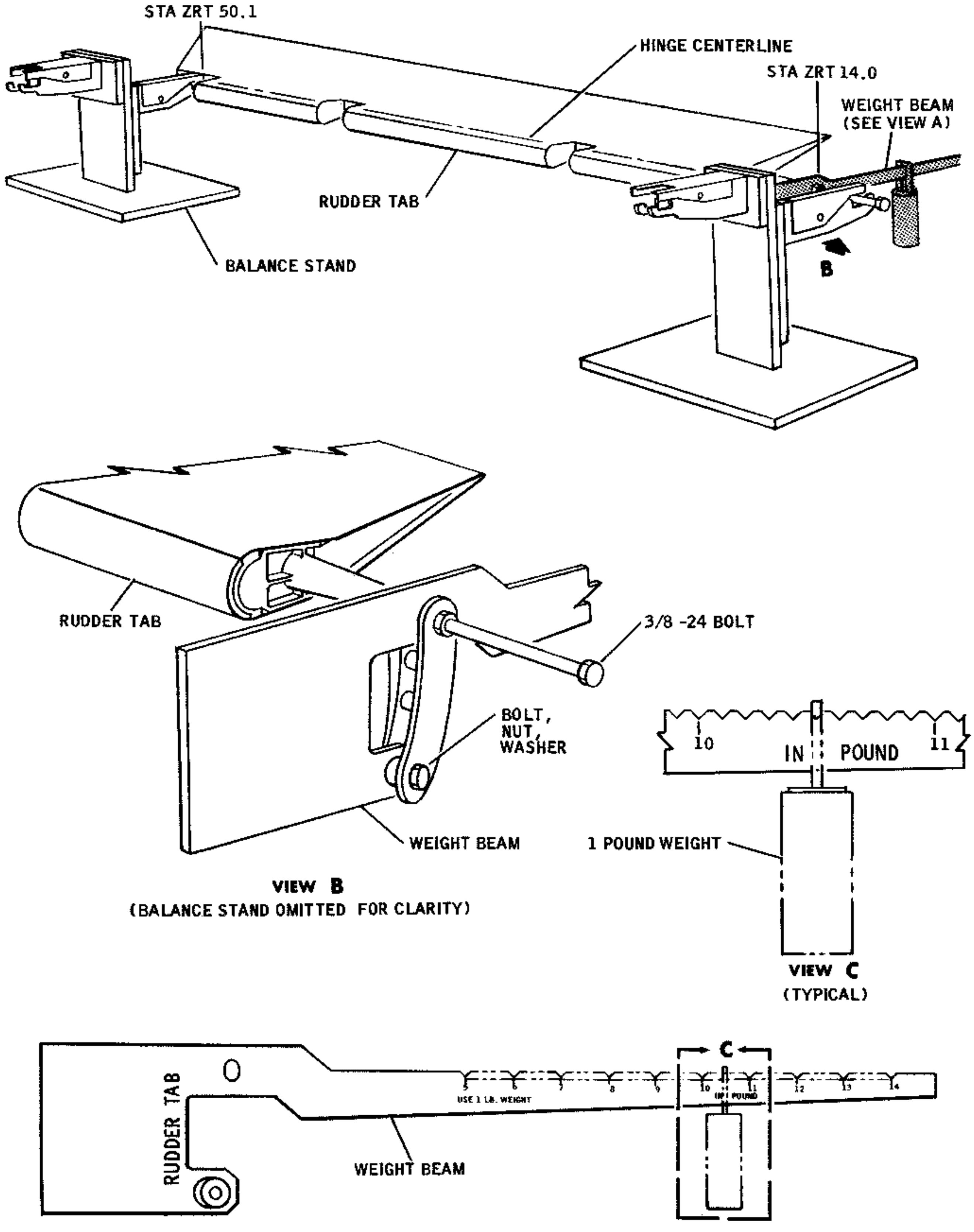
Rudder Balance Condition and Adjustment Weight Change Required
Figure 3

(4) Slide the 1 pound weight along the beam until the tab assumes a horizontal attitude.

NOTE: The tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points.

(5) Read the balance indication on the beam. Balance limits for the rudder tab are 9.5 inch-pounds minimum to 11.5 inch-pounds maximum nose heavy. Recommended balance is 10.5 inch-pounds nose heavy.

(6) If the balance indication is not within limits, add, or remove adjustment weights as necessary. See Figure 5 for adjustment weight number and contribution and Figure 6 for location and attachment.



VIEW B
(BALANCE STAND OMITTED FOR CLARITY)

VIEW C
(TYPICAL)

VIEW A

BB3-671

Rudder Tab Balancing with Beam
Figure 4

(7) Permanently record balance condition and weight on decal.

5. Balance Rudder and Rudder Tab Using Checkweight Method

A. Check Rudder Balances

(1) Weigh adjustment weights and balance weights installed, including retainers, support brackets, and attachments.

(2) To maintain surface at, or less than, maximum trailing edge heavy moment of 145 inch-pounds, add, or remove, adjustment weights, as required, to provide weight of 28 pounds. See Figure 1 for location and attachment.

NOTE: Increasing the weight above 28 pounds will decrease the trailing edge heavy moment.

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Contribution of Each Number 4917173 Adjustment Weight	
		Weight (Pounds)	Moment (Inch-pounds)
Minimum	9.5	0.08	0.2
Recommended	10.5		
Maximum	11.5		

Rudder Tab Balance Limits and Adjustment Weight Contribution
Figure 5

(3) Make certain that rudder is complete and in required configuration for balancing with all painting and rework accomplished. Dampers and pushrods must be installed. Tabs must not be installed.

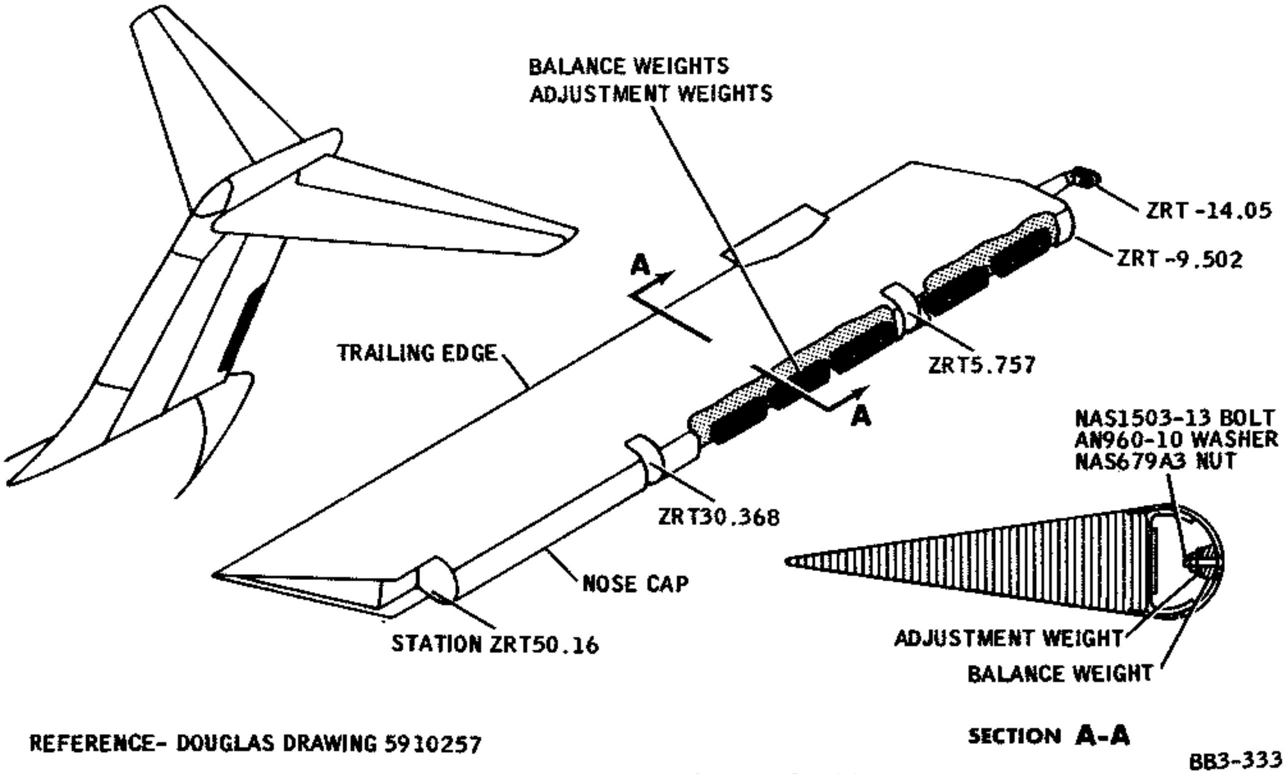
(4) Mount rudder on balance stands (see Figure 7). Use station ZR 43 and ZR 97.2 hinge locations. Use well-oiled, undersized hinge pins.

(5) Loosen damper access door screw (see Figure 7) and suspend standard 8.00 pound checkweight (see Figure 8) over leading edge with nylon cord or soft safety wire.

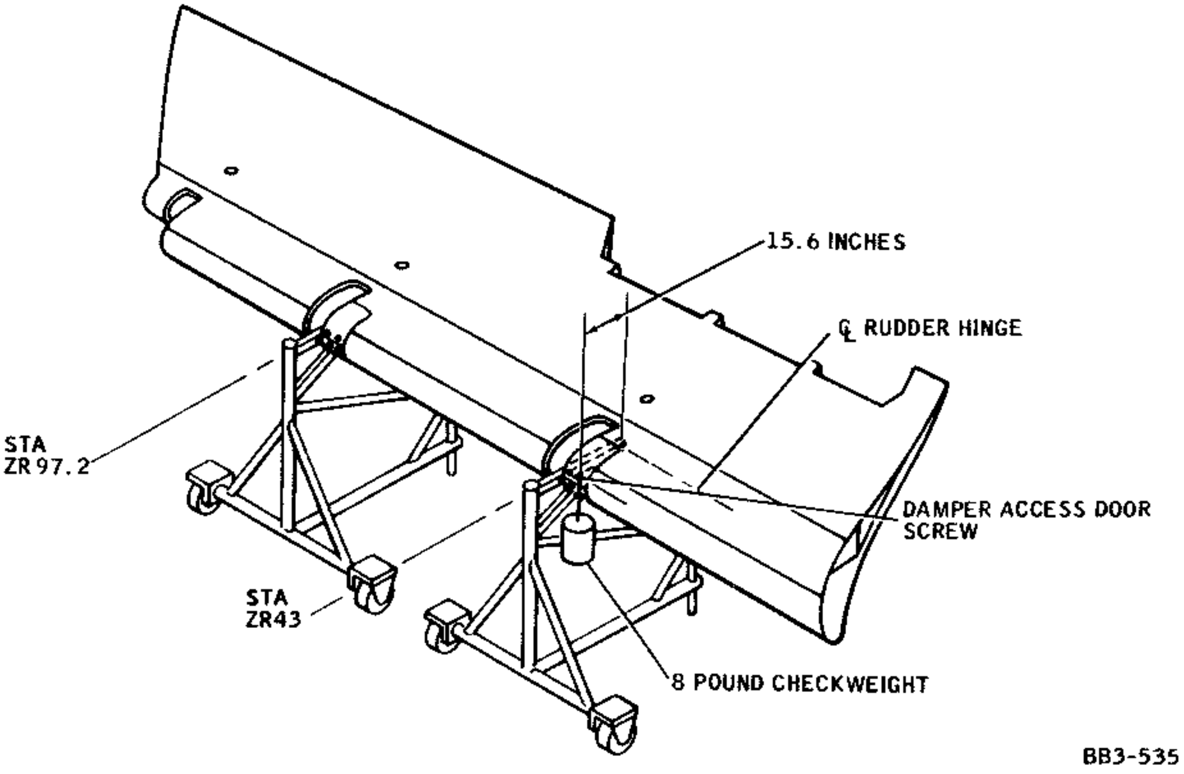
NOTE: Moment arm is 15.6 inches.

(6) Add checkweight (lead shot) to container until rudder assumes a horizontal attitude.

NOTE: The rudder is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points.



Rudder Tab Weight Location and Attachment
Figure 6



Rudder Balancing and Checkweight Suspension
Figure 7

(7) Weight total checkweights suspended.

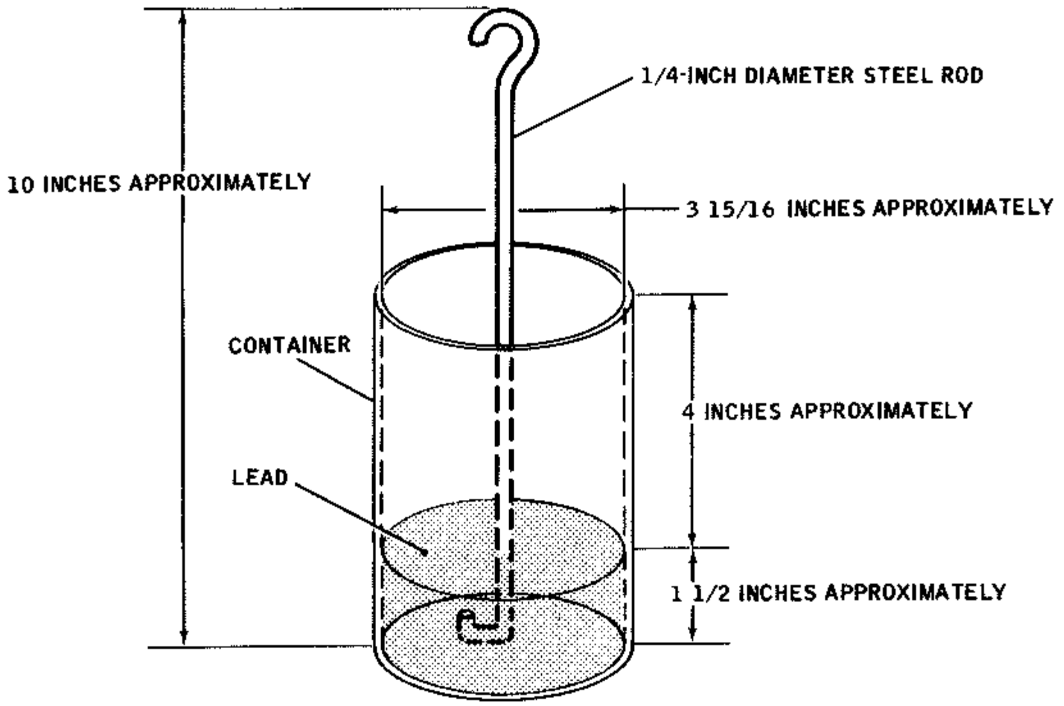
(8) Compare total checkweight value with the equivalent balance condition shown in Figure 9. The maximum trailing edge heavy moment is 145 inch-pounds. The total amount of checkweight required to equal maximum moment is 9.29 pounds.

NOTE: The rudder balance may vary from 60 inch-pounds nose heavy to 145 inch-pounds trailing edge heavy, dependent upon the amount of weight forward of hinge line. The maximum trailing edge heavy moment is established with certain flutter characteristics in mind.

(9) Add adjustment weights, as required. See Figure 1 for location and attachment.

(10) Recheck balance condition.

(11) Permanently record balance condition and weight on decal.



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 8.00 POUNDS.

BB3-432

Eight Pound Standard Checkweight
Figure 8

Balance Condition		Suggested quantity of number 2914554 adjustment weights to add for indicated unbalance	Contribution of suggested number 2914554 adjustment weights	
Equivalent Checkweight above maximum weight of 9.29 pounds	Hinge Moment above maximum moment of 145 inch-pounds trailing edge heavy		Weight	Moment
(Pounds)	(Inch-Pounds)		(Pounds)	(Inch-Pounds)
0 to 0.32	0 to 7	1	0.51	7.0
0.32 to 0.77	5 to 12	2	1.02	14.0
0.77 to 1.22	12 to 17	3	1.53	21.0
1.22 to 1.67	17 to 24	4	2.04	28.0
1.67 to 2.12	24 to 31	5	2.55	35.0
2.12 to 2.57	31 to 38	6	3.06	42.0
2.57 to 3.02	38 to 45	7	3.57	49.0

Rudder Balance Condition and Adjustment Weight Change Required
Figure 9

B. Check Rudder Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 21.30 pounds.

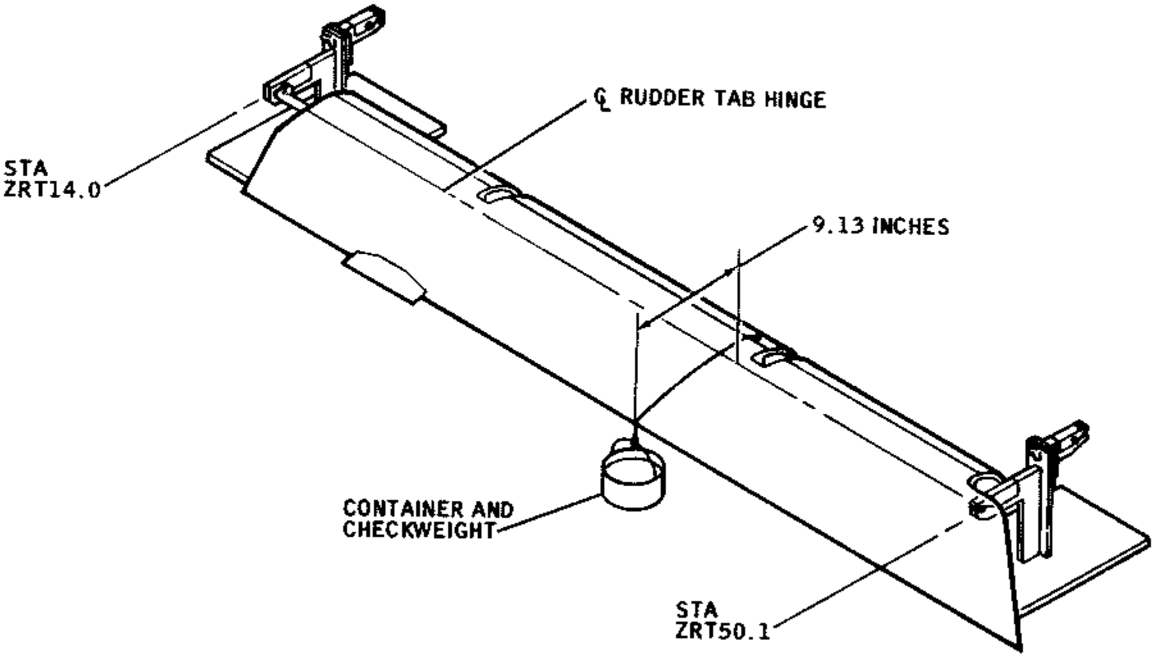
(2) Mount tab on balance stands (see Figure 10). Use station ZRT -14.05 and ZRT 50.16 hinge locations. Use well-oiled, undersized hinge pins.

(3) Loosen any nose cap attach screw.

(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.

(5) Suspend container over trailing edge.

<u>NOTE</u>: Moment arm is 9.13 inches.



BB3-536

Rudder Tab Balancing and Checkweight Suspension
Figure 10

(6) Add checkweight (lead shot) to container until tab assumes a horizontal attitude.

NOTE: Tab is in a horizontal attitude when centerline of trailing edge is the same distance from the floor (baseline) as the centerline of mount points.

(7) Weight container and checkweights.

(8) Compare weight with values specified in Figure 11.

(9) Add, or remove, adjustment weights (see Figure 6) for location and attachment) as required to maintain correct balance limits.

NOTE: Balance limits for the rudder tab are 9.5 inch-pounds minimum to 11.5 inch-pounds maximum nose heavy. Recommended balance is 10.5 inch-pounds nose heavy.

(10) Recheck balance condition.

(11) Weigh tab to ensure that the maximum allowable weight of 21.30 pounds is not exceeded.

(12) Permanently record balance condition and weight on decal.

Printed in U.S.A.

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Equivalent Checkweight (Pounds)	Contribution of Each Number 4917173 Adjustment Weight	
			Weight (Pounds)	Moment (Inch-Pounds)
Minimum	9.5	1.04	0.08	0.2
Recommended	10.5	1.15		
Maximum	11.5	1.26		

Rudder Tab Balance Limits and Adjustment Weight Contribution
Figure 11

6. Balance Rudder and Rudder Tab by Calculation Method

A. Calculation Method for Rudder to be Repaired

<u>CAUTION</u>: THE FOLLOWING PROCEDURE CHANGES BALANCE CONDITION OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS AND THE BALANCE CONDITION AFTER REPAIR MUST BE PERMANENTLY RECORDED ON DECAL, AFFIXED TO SURFACE.

(1) Weigh removed damaged material to nearest 0.01 pound.

(2) Weigh repair material to be added to nearest 0.01 pound.

(3) Subtract the removed material weight from the repair material weight. The remainder is the net weight.

Example 1:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.20 pound
Net weight change (0.20 - 0.10)	0.10 pound

Example 2:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.40 pound
Net weight change (0.40 - 0.10)	0.30 pound

(4) Attach cord to hinge centerline at each end of control surface and stretch cord taut across surface to establish hinge centerline across surface.

(5) Measure the distance in inches (to the nearest 0.1 inch) from the hinge centerline to centerline of the repair (see Figure 12).

<u>NOTE</u>: The example shown in Figure 12 shows repair aft of hinge line. If repair is forward of hinge line, measure distance forward of hinge line to center of repair.

(6) Multiply this dimension by the net weight change obtained in step (3). The product is the amount of moment added by repair. See examples below.

Example 3:

Net weight change (Example 1)	0.10 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added moment) (0.10 x 10)	1 inch-pound

Example 4:

Net weight change (Example 2)	0.30 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added moment) (0.30 x 10)	3 inch-pounds

<u>NOTE</u>: If repair is aft of hinge centerline, the moment added is to the trailing edge. If the repair is forward of the hinge line, the moment added is toward nose heavy condition.

(7) Note the recorded balance condition on the decal, or stencil, (generally located on inboard closing rib).

(8) If the recorded balance condition is trailing edge heavy and the repair is aft of the hinge centerline, add the trailing edge heavy moment added by repair to the recorded balance condition. The sum is the balance condition.

Example 5:

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pound
Sum (Trailing edge heavy balance)	144 inch-pounds

Example 6:

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
	146 inch-pounds

(a) If the balance condition is less that 145 inch-pounds trailing edge heavy (Example 5), and not more than 60 inch-pounds nose heavy, no further balance action is required. Permanently record balance condition on decal.

(b) If the balance condition is more than 145 inch-pounds trailing edge heavy (Example 6) balance moment must be added to nose cap.

Example 7:

Maximum rudder trailing edge balance limit	145 inch-pounds
Trailing edge balance condition after repair (Example 6)	146 inch-pounds
Minimum amount of balance moment to add in order to equal maximum trailing edge balance limit	1 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added to nose cap, select an amount of weight from Figure 3, Rudder Balance Condition and Adjustment Weight Change Required, and add to nose cap installation. Permanently record balance condition on decal.

NOTE: Assuming the condition shown in Example 7, adding one number 2914554 adjustment weight will provide 7 inch-pounds moment to nose. The 7 inch-pounds provides sufficient moment to counteract the trailing edge heavy moment added by repair and is within the 10 percent factor.

(9) If the recorded balance condition is trailing edge heavy and the repair is forward of the hinge centerline, subtract the moment added by the repair from the recorded balance condition. The remainder is the balance condition.

Example 9:

Recorded balance condition	143 inch-pounds
Nose heavy moment added by repair (Example 3)	1 inch-pound
Remainder (Trailing edge heavy balance condition)	142 inch-pounds

(a) Permanently record balance condition on decal.

(10) If the recorded balance condition is nose heavy and the repair is aft of the hinge centerline, subtract the moment added by repair from the recorded balance condition. The remainder is the nose heavy balance condition.

Example 10:

Recorded balance condition	58 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pound
Remainder (nose heavy balance)	59 inch-pounds

Example 11:

Recorded balance condition	58 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
Remainder (nose heavy balance)	55 inch-pounds

(a) Permanently record balance condition on decal.

(11) If the recorded balance condition is nose heavy and the repair is forward of hinge centerline, add the moment added by repair to the recorded balance condition. The sum is the balance condition.

Example 12:

Recorded balance condition	58 inch-pounds
Nose heavy moment added by repair (Example 3)	1 inch-pound
Sum (nose heavy balance)	59 inch-pounds

Example 13:

Recorded balance condition	58 inch-pounds
Nose heavy moment added by repair (Example 4)	3 inch-pounds
Sum (nose heavy balance)	61 inch-pounds

(a) If the sum is less than the maximum nose heavy balance limit of 60 inch-pounds, no further balance action is required. Permanently record balance condition on decal.

(b) If the sum (balance condition) is more than the maximum nose heavy balance limit of 60 inch-pounds, balance moment must be removed from the nose cap.

Example 14:

Maximum nose heavy balance limit	60 inch-pounds
Nose heavy balance condition after repair (Example 13)	61 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum nose heavy balance limit	1 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

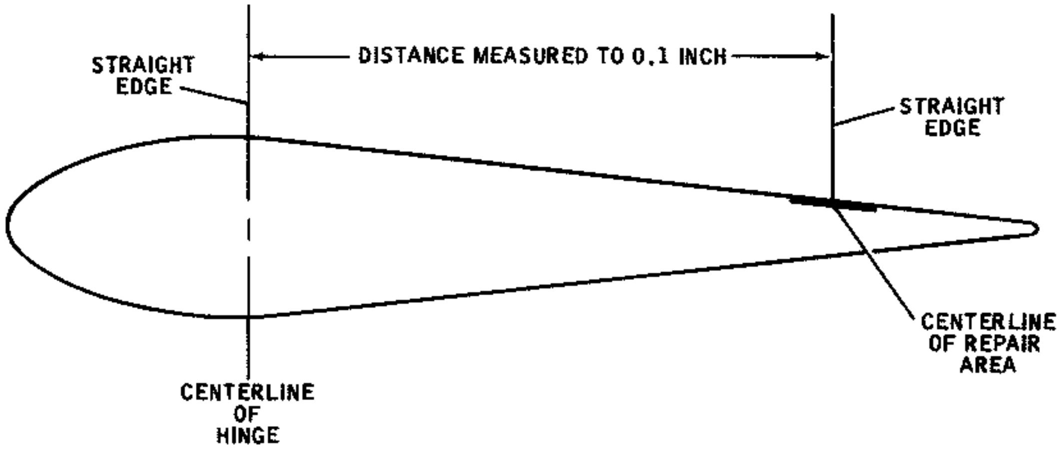
(c) If balance moment must be removed from nose cap, select an amount of weight from Figure 3 and remove from nose cap installation. Permanently record balance condition on decal.

NOTE: Assuming the condition shown in Example 14, removing one number 2914554 adjustment weight will remove 7 inch-pounds moment. The 7 inch-pounds moment removed is sufficient to counteract the moment added by repair and is within the 10 percent factor.

B. Calculation Method for Rudder and Rudder Tab to be Repainted

CAUTION: THE FOLLOWING PROCEDURES CHANGE BALANCE CONDITION, AND WEIGHT OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS AND IF SURFACE IS TAB, WITHIN MAXIMUM ALLOWABLE WEIGHT LIMIT. AFTER REPAINTING, THE BALANCE CONDITION, AND WEIGHT CONDITION IF TAB, MUST BE PERMANENTLY RECORDED ON DECAL AFFIXED TO SURFACE.

(1) Determine location (forward or aft of hinge centerline) of area to be repainted and distance from hinge centerline to center of area (see Figure 12).



TYPICAL MAIN CONTROL SURFACE

BB3-718

Determining Distance from Hinge Centerline to Repair Centerline
Figure 12

(2) Determine size of area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the rudder, including the tab, is 124.4 square feet. Of the 124.4 square feet, 33.2 square feet is forward of the hinge centerline and 79.26 square feet is aft of hinge centerline. The total surface area (both sides) of rudder tab is 11.94 square feet. Of the 11.94 square feet, 1.77 square feet is forward of hinge centerline, and 10.17 square feet is aft.

(3) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat applied. The product is the amount of weight added.

Example 15:

Area to be repainted	5 square feet
One coat primer and one top coat to be painted over area (0.015 x 2)	.03 pound/square foot
Product (weight added by repaint)	0.15 pound

(4) Multiply the weight added by repaint by the distance from hinge centerline to center of the repaint. The product is the amount of moment added.

Example 16:

Weight added by repaint (Example 15)	0.15 pound
Distance from hinge centerline to centerline of repaint area	10 inches
Product (moment added)	1.5 inch-pounds

NOTE: If the repaint is aft of the hinge centerline, the moment added is to the trailing edge. If the repaint is forward of the hinge centerline, the moment added is nose heavy.

(5) Note the recorded balance condition on decal, or stencil, (generally located on inboard closing rib).

(6) If the repaint is aft of the hinge centerline, and the surface is in a trailing edge heavy condition, add the moment added by repaint to the trailing edge heavy balance condition. The sum indicates balance condition of the surface.

Example 17 (Rudder in trailing edge heavy balance condition):

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repaint (Example 16)	1.5 inch-pounds
Sum (trailing edge heavy balance)	144.5 inch-pounds

(7) If the repaint is forward of hinge centerline; and the surface is in a trailing edge heavy condition, subtract the moment added by repaint from the trailing edge heavy balance condition. The remainder indicates balance condition of the surface.

Example 18 (Rudder in trailing edge heavy balance condition):

Recorded balance condition	143 inch-pounds
Nose heavy moment added by repaint (Example 16)	1.5 inch-pounds
Remainder (trailing edge heavy balance)	141.5 inch-pounds

(8) If the repaint is aft of the hinge centerline, and the surface is in a nose heavy balance condition, subtract the trailing edge heavy moment added by repaint from the recorded balance condition. The remainder indicates balance condition of surface.

Example 19 (Rudder tab):

Recorded balance condition	10.5 inch-pounds
Trailing edge heavy moment added by repaint (Example 16)	1.5 inch-pounds
Remainder (nose heavy balance)	9.0 inch-pounds

(9) If the repaint is forward of hinge centerline, and the surface is in a nose heavy condition, add the nose heavy moment added by repaint to the recorded balance condition. The sum indicates balance condition of surface.

Example 20 (Rudder tab):

Recorded balance condition	10.5 inch-pounds
Nose heavy moment added by repaint (Example 16)	1.5 inch-pounds
Sum (nose heavy balance)	12.0 inch-pounds

(10) If the balance condition after repaint is within the balance limits for surface involved, no further balance action is required. Permanently record balance condition, and weight if tab, on decal.

NOTE: Add the amount of weight added by repaint (Example 15) to the recorded weight. The sum indicates weight condition of tab.

(11) If the balance condition after repaint is not within the balance limits for the surface involved, the balance condition must be corrected.

(a) If the surface is rudder and the trailing edge heavy balance condition is more than the maximum limit of 145 inch-pounds, select weights from Figure 3 and add amount of moment (adjustment weight) to nose cap installation to counteract the excess trailing edge heavy condition by at least 10 percent. Permanently record balance condition on decal.

(b) If the surface is rudder and nose heavy balance condition is more than maximum limit of 60 inch-pounds, remove sufficient moment (adjustment weight) from nose cap installation to counteract the excess nose heavy condition by at least 10 percent. Permanently record balance condition on decal.

(c) If the surface is rudder tab, and nose heavy balance condition is less than minimum balance limit of 9.5 inch-pounds (Example 19), select weights from Figure 11, Rudder Tab Balance Limits and Adjustment Weight Contribution, and add to nose cap installation.

Example 21:

Minimum rudder tab balance limit	9.5 inch-pounds
Nose heavy balance condition after repaint (Example 19)	9.0 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	0.5 inch-pounds

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

Example 22:
Assuming the condition shown in Example 21, adding three number 4917173 adjustment weights to rudder tab nose cap installation will add 0.6 inch-pounds of moment (0.2 inch-pound x 3) to nose heavy condition. The 0.6 inch-pound of moment provides sufficient moment to equal the minimum limit and is within the 10 percent factor.

NOTE: When adding weight to the rudder tab nose cap installation, add the amount of weight added by repaint (Example 15) to the recorded weight condition and then add the amount of weight added by the adjustment weight. The sum indicates weight condition of surface. Adding three number 4917173 adjustment weights will add 0.24 pound of weight to surface (0.08 pound x 3). Maximum weight of surface must not exceed 21.30 pounds.

(d) If the surface is rudder tab, and nose heavy balance condition is more than maximum balance limit of 11.5 inch-pounds (Example 20) select weights from Figure 11 and remove from nose cap installation. Permanently record balance condition and weight on decal.

Example:

Maximum rudder tab balance limit	11.5 inch-pounds
Nose heavy balance limit after repaint (Example 20)	12.0 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit.	0.5 inch-pounds

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

Example 24:

Assuming the condition shown in Example 23, removing three number 4917173 adjustment weights from rudder tab nose cap will subtract 0.6 inch-pounds of moment (0.2 inch-pound x 3) from nose heavy condition. The 0.6 inch-pound of moment provides sufficient moment to equal the maximum limit and is within the 10 percent factor.

NOTE: When removing weight from the rudder tab nose cap installation, add the amount of weight added by repaint (Example 15) and then subtract the amount of weight removed by the adjustment weight change. The remainder indicates weight condition of surface. Removing three number 4917173 adjustment weights will remove 0.24 pounds from weight of surface (0.08 pound x 3).

Balance Limits (Nose-Heavy Balance Moment) (Inch-Pounds)		Equivalent Checkweight (Pounds)	Contribution of Each Number 4917173 Adjustment Weight	
			Weight (Pounds)	Moment (Inch-Pounds)
Minimum	9.5	1.04	0.08	0.2
Recommended	10.5	1.15		
Maximum	11.5	1.26		

Rudder Tab Balance Limits and Adjustment Weight Contribution
Figure 11

6. Balance Rudder and Rudder Tab by Calculation Method

A. Calculation Method for Rudder to be Repaired

CAUTION: THE FOLLOWING PROCEDURE CHANGES BALANCE CONDITION OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS AND THE BALANCE CONDITION AFTER REPAIR MUST BE PERMANENTLY RECORDED ON DECAL, AFFIXED TO SURFACE.

(1) Weigh removed damaged material to nearest 0.01 pound.

(2) Weigh repair material to be added to nearest 0.01 pound.

(3) Subtract the removed material weight from the repair material weight. The remainder is the net weight.

Example 1:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.20 pound
Net weight change (0.20 - 0.10)	0.10 pound

Example 2:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.40 pound
Net weight change (0.40 - 0.10)	0.30 pound

(4) Attach cord to hinge centerline at each end of control surface and stretch cord taut across surface to establish hinge centerline across surface.

Printed in U.S.A.

(5) Measure the distance in inches (to the nearest 0.1 inch) from the hinge centerline to centerline of the repair (see Figure 12).

NOTE: The example shown in Figure 12 shows repair aft of hinge line. If repair is forward of hinge line, measure distance forward of hinge line to center of repair.

(6) Multiply this dimension by the net weight change obtained in step (3). The product is the amount of moment added by repair. See examples below.

Example 3:

Net weight change (Example 1)	0.10 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added moment) (0.10 x 10)	1 inch-pound

Example 4:

Net weight change (Example 2)	0.30 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (Added moment) (0.30 x 10)	3 inch-pounds

NOTE: If repair is aft of hinge centerline, the moment added is to the trailing edge. If the repair is forward of the hinge line, the moment added is toward nose heavy condition.

(7) Note the recorded balance condition on the decal, or stencil, (generally located on inboard closing rib).

(8) If the recorded balance condition is trailing edge heavy and the repair is aft of the hinge centerline, add the trailing edge heavy moment added by repair to the recorded balance condition. The sum is the balance condition.

Example 5:

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pound
Sum (Trailing edge heavy balance)	144 inch-pounds

Example 6:

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
	146 inch-pounds

(a) If the balance condition is less that 145 inch-pounds trailing edge heavy (Example 5), and not more than 60 inch-pounds nose heavy, no further balance action is required. Permanently record balance condition on decal.

(b) If the balance condition is more than 145 inch-pounds trailing edge heavy (Example 6) balance moment must be added to nose cap.

Example 7:

Maximum rudder trailing edge balance limit	145 inch-pounds
Trailing edge balance condition after repair (Example 6)	146 inch-pounds
Minimum amount of balance moment to add in order to equal maximum trailing edge balance limit	1 inch-pound

<u>NOTE</u>: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

(c) If balance moment must be added to nose cap, select an amount of weight from Figure 3, Rudder Balance Condition and Adjustment Weight Change Required, and add to nose cap installation. Permanently record balance condition on decal.

<u>NOTE</u>: Assuming the condition shown in Example 7, adding one number 2914554 adjustment weight will provide 7 inch-pounds moment to nose. The 7 inch-pounds provides sufficient moment to counteract the trailing edge heavy moment added by repair and is within the 10 percent factor.

(9) If the recorded balance condition is trailing edge heavy and the repair is forward of the hinge centerline, subtract the moment added by the repair from the recorded balance condition. The remainder is the balance condition.

Example 9:

Recorded balance condition	143 inch-pounds
Nose heavy moment added by repair (Example 3)	1 inch-pound
Remainder (Trailing edge heavy balance condition)	142 inch-pounds

(a) Permanently record balance condition on decal.

(10) If the recorded balance condition is nose heavy and the repair is aft of the hinge centerline, subtract the moment added by repair from the recorded balance condition. The remainder is the nose heavy balance condition.

Example 10:

Recorded balance condition	58 inch-pounds
Trailing edge heavy moment added by repair (Example 3)	1 inch-pound
Remainder (nose heavy balance)	59 inch-pounds

Example 11:

Recorded balance condition	58 inch-pounds
Trailing edge heavy moment added by repair (Example 4)	3 inch-pounds
Remainder (nose heavy balance)	55 inch-pounds

(a) Permanently record balance condition on decal.

(11) If the recorded balance condition is nose heavy and the repair is forward of hinge centerline, add the moment added by repair to the recorded balance condition. The sum is the balance condition.

Example 12:

Recorded balance condition	58 inch-pounds
Nose heavy moment added by repair (Example 3)	1 inch-pound
Sum (nose heavy balance)	59 inch-pounds

Example 13:

Recorded balance condition	58 inch-pounds
Nose heavy moment added by repair (Example 4)	3 inch-pounds
Sum (nose heavy balance)	61 inch-pounds

(a) If the sum is less than the maximum nose heavy balance limit of 60 inch-pounds, no further balance action is required. Permanently record balance condition on decal.

(b) If the sum (balance condition) is more than the maximum nose heavy balance limit of 60 inch-pounds, balance moment must be removed from the nose cap.

Example 14:

Maximum nose heavy balance limit	60 inch-pounds
Nose heavy balance condition after repair (Example 13)	61 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum nose heavy balance limit	1 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

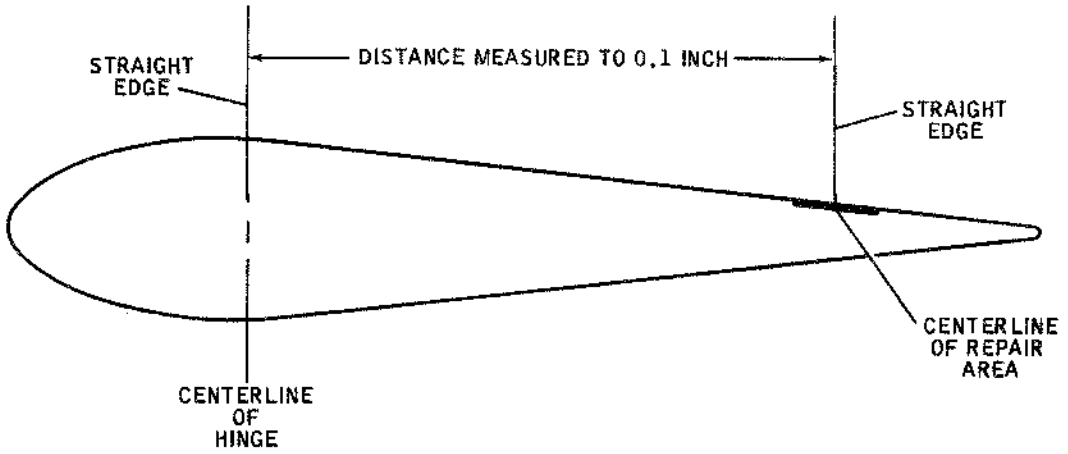
(c) If balance moment must be removed from nose cap, select an amount of weight from Figure 3 and remove from nose cap installation. Permanently record balance condition on decal.

NOTE: Assuming the condition shown in Example 14, removing one number 2914554 adjustment weight will remove 7 inch-pounds moment. The 7 inch-pounds moment removed is sufficient to counteract the moment added by repair and is within the 10 percent factor.

B. Calculation Method for Rudder and Rudder Tab to be Repainted

CAUTION: THE FOLLOWING PROCEDURES CHANGE BALANCE CONDITION, AND WEIGHT OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS AND IF SURFACE IS TAB, WITHIN MAXIMUM ALLOWABLE WEIGHT LIMIT. AFTER REPAINTING, THE BALANCE CONDITION, AND WEIGHT CONDITION IF TAB, MUST BE PERMANENTLY RECORDED ON DECAL AFFIXED TO SURFACE.

(1) Determine location (forward or aft of hinge centerline) of area to be repainted and distance from hinge centerline to center of area (see Figure 12).



TYPICAL MAIN CONTROL SURFACE

BB3-718

Determining Distance from Hinge Centerline to Repair Centerline
Figure 12

(2) Determine size of area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the rudder, including the tab, is 124.4 square feet. Of the 124.4 square feet, 33.2 square feet is forward of the hinge centerline and 79.26 square feet is aft of hinge centerline. The total surface area (both sides) of rudder tab is 11.94 square feet. Of the 11.94 square feet, 1.77 square feet is forward of hinge centerline, and 10.17 square feet is aft.

(3) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat applied. The product is the amount of weight added.

Example 15:

Area to be repainted	5 square feet
One coat primer and one top coat to be painted over area (0.015 x 2)	.03 pound/square foot
Product (weight added by repaint)	0.15 pound

(4) Multiply the weight added by repaint by the distance from hinge centerline to center of the repaint. The product is the amount of moment added.

Example 16:

Weight added by repaint (Example 15)	0.15 pound
Distance from hinge centerline to centerline of repaint area	10 inches
Product (moment added)	1.5 inch-pounds

NOTE: If the repaint is aft of the hinge centerline, the moment added is to the trailing edge. If the repaint is forward of the hinge centerline, the moment added is nose heavy.

(5) Note the recorded balance condition on decal, or stencil, (generally located on inboard closing rib).

(6) If the repaint is aft of the hinge centerline, and the surface is in a trailing edge heavy condition, add the moment added by repaint to the trailing edge heavy balance condition. The sum indicates balance condition of the surface.

Example 17 (Rudder in trailing edge heavy balance condition):

Recorded balance condition	143 inch-pounds
Trailing edge heavy moment added by repaint (Example 16)	1.5 inch-pounds
Sum (trailing edge heavy balance)	144.5 inch-pounds

(7) If the repaint is forward of hinge centerline; and the surface is in a trailing edge heavy condition, subtract the moment added by repaint from the trailing edge heavy balance condition. The remainder indicates balance condition of the surface.

Example 18 (Rudder in trailing edge heavy balance condition):

Recorded balance condition	143 inch-pounds
Nose heavy moment added by repaint (Example 16)	1.5 inch-pounds
Remainder (trailing edge heavy balance)	141.5 inch-pounds

(8) If the repaint is aft of the hinge centerline, and the surface is in a nose heavy balance condition, subtract the trailing edge heavy moment added by repaint from the recorded balance condition. The remainder indicates balance condition of surface.

Example 19 (Rudder tab):

Recorded balance condition	10.5 inch-pounds
Trailing edge heavy moment added by repaint (Example 16)	1.5 inch-pounds
Remainder (nose heavy balance)	9.0 inch-pounds

(9) If the repaint is forward of hinge centerline, and the surface is in a nose heavy condition, add the nose heavy moment added by repaint to the recorded balance condition. The sum indicates balance condition of surface.

Example 20 (Rudder tab):

Recorded balance condition	10.5 inch-pounds
Nose heavy moment added by repaint (Example 16)	1.5 inch-pounds
Sum (nose heavy balance)	12.0 inch-pounds

(10) If the balance condition after repaint is within the balance limits for surface involved, no further balance action is required. Permanently record balance condition, and weight if tab, on decal.

NOTE: Add the amount of weight added by repaint (Example 15) to the recorded weight. The sum indicates weight condition of tab.

(11) If the balance condition after repaint is not within the balance limits for the surface involved, the balance condition must be corrected.

(a) If the surface is rudder and the trailing edge heavy balance condition is more than the maximum limit of 145 inch-pounds, select weights from Figure 3 and add amount of moment (adjustment weight) to nose cap installation to counteract the excess trailing edge heavy condition by at least 10 percent. Permanently record balance condition on decal.

(b) If the surface is rudder and nose heavy balance condition is more than maximum limit of 60 inch-pounds, remove sufficient moment (adjustment weight) from nose cap installation to counteract the excess nose heavy condition by at least 10 percent. Permanently record balance condition on decal.

(c) If the surface is rudder tab, and nose heavy balance condition is less than minimum balance limit of 9.5 inch-pounds (Example 19), select weights from Figure 11, Rudder Tab Balance Limits and Adjustment Weight Contribution, and add to nose cap installation.

Example 21:

Minimum rudder tab balance limit	9.5 inch-pounds
Nose heavy balance condition after repaint (Example 19)	9.0 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	0.5 inch-pounds

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

Example 22:

Assuming the condition shown in Example 21, adding three number 4917173 adjustment weights to rudder tab nose cap installation will add 0.6 inch-pounds of moment (0.2 inch-pound x 3) to nose heavy condition. The 0.6 inch-pound of moment provides sufficient moment to equal the minimum limit and is within the 10 percent factor.

NOTE: When adding weight to the rudder tab nose cap installation, add the amount of weight added by repaint (Example 15) to the recorded weight condition and then add the amount of weight added by the adjustment weight. The sum indicates weight condition of surface. Adding three number 4917173 adjustment weights will add 0.24 pound of weight to surface (0.08 pound x 3). Maximum weight of surface must not exceed 21.30 pounds.

(d) If the surface is rudder tab, and nose heavy balance condition is more than maximum balance limit of 11.5 inch-pounds (Example 20) select weights from Figure 11 and remove from nose cap installation. Permanently record balance condition and weight on decal.

Example:

Maximum rudder tab balance limit	11.5 inch-pounds
Nose heavy balance limit after repaint (Example 20)	12.0 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit.	0.5 inch-pounds

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin.

Example 24:

Assuming the condition shown in Example 23, removing three number 4917173 adjustment weights from rudder tab nose cap will subtract 0.6 inch-pounds of moment (0.2 inch-pound x 3) from nose heavy condition. The 0.6 inch-pound of moment provides sufficient moment to equal the maximum limit and is within the 10 percent factor.

NOTE: When removing weight from the rudder tab nose cap installation, add the amount of weight added by repaint (Example 15) and then subtract the amount of weight removed by the adjustment weight change. The remainder indicates weight condition of surface. Removing three number 4917173 adjustment weights will remove 0.24 pounds from weight of surface (0.08 pound x 3).

CHAPTER 56

WINDOWS

Chapter 56

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
Title					
*56-Eff	1	Dec 1/66			
*56-Cont	1	Dec 1/66			
*56-Sect. App.	1	Dec 1/66			
56-00	1	Jun 1/66			
56-00	2	Dec 1/65			
56-10-0	1	Jun 1/66			
* 56-10-0	2	Dec 1/66			
* 56-10-0	3	Dec 1/66			
56-20-0	1	Jun 1/66			
*56-20-0	2	Dec 1/66			
56-30-0	1	Jun 1/66			
56-30-0	2	Sep 1/65			

*The asterisk indicates revised or added by the current revision.

Chapter 56

TABLE OF CONTENTS

Chapter 56

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
56-00	Yes	Yes
56-10-0	Yes	Yes
56-20-0	Yes	Yes
56-30-0	Yes	Yes

Chapter 56

WINDOWS

GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

   A. This chapter contains information concerning the windows of the airplane. Illustrations indicate the material used in the construction of the windows. For information regarding the supporting structure around the windows, see Chapter 53.

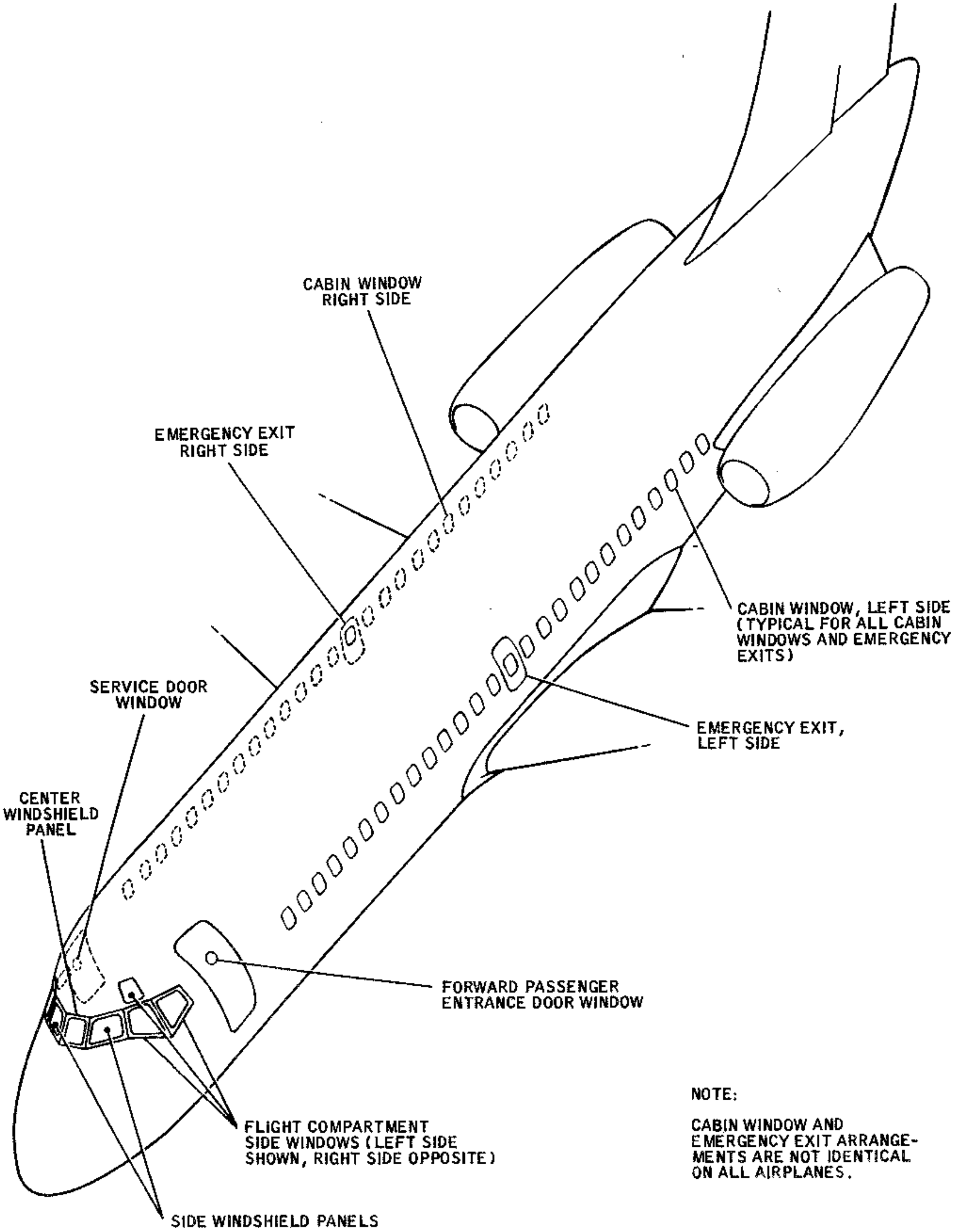
   B. For removal, installation, and maintenance of the windows, see Chapter 56, Maintenance Manual.

2. Repairs

   A. Repairs to windows and windshields are limited and are only applicable to specific windows as follows.

      (1) Repairs are not recommended for the windshields or side windows of the flight compartment. Repairs may be made, however, when specific engineering authorization is obtained.

      (2) Repair of inner or outer cabin windows is not a recommended procedure because rework does not extend the structural life of the window. However, it is permissible to remove crazing and small scratches from cabin window panes by polishing. Polishing should only be done when the operator desires to restore visual clarity to the window. The thickness of the cabin window outer pane must not be decreased below 0.352 inch. The thickness of the cabin window inner pane must not be decreased below 0.209 inch. Polishing must be done carefully by qualified personnel only.



NOTE:

CABIN WINDOW AND EMERGENCY EXIT ARRANGEMENTS ARE NOT IDENTICAL ON ALL AIRPLANES.

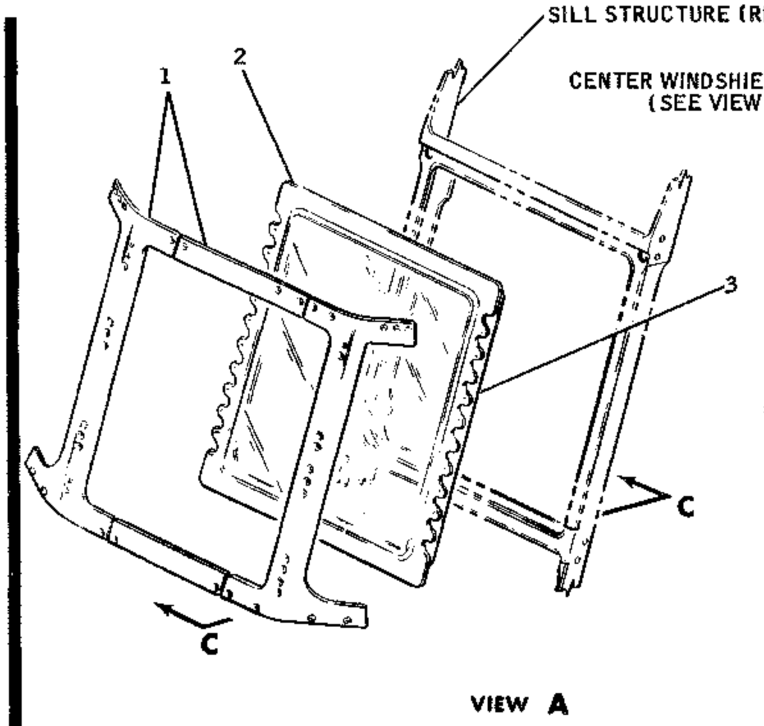
BB3-562

Window Index Illustration
Figure 1

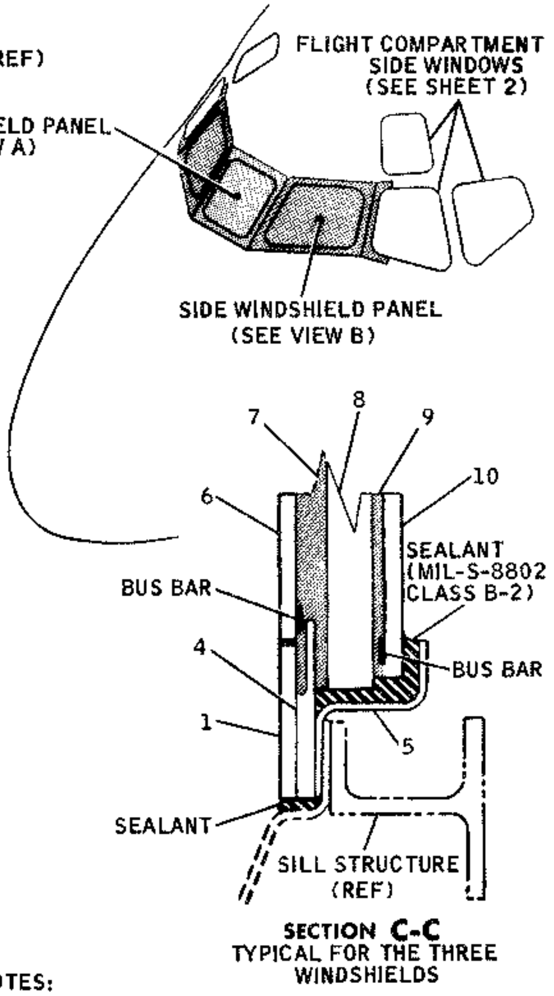
FLIGHT COMPARTMENT - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

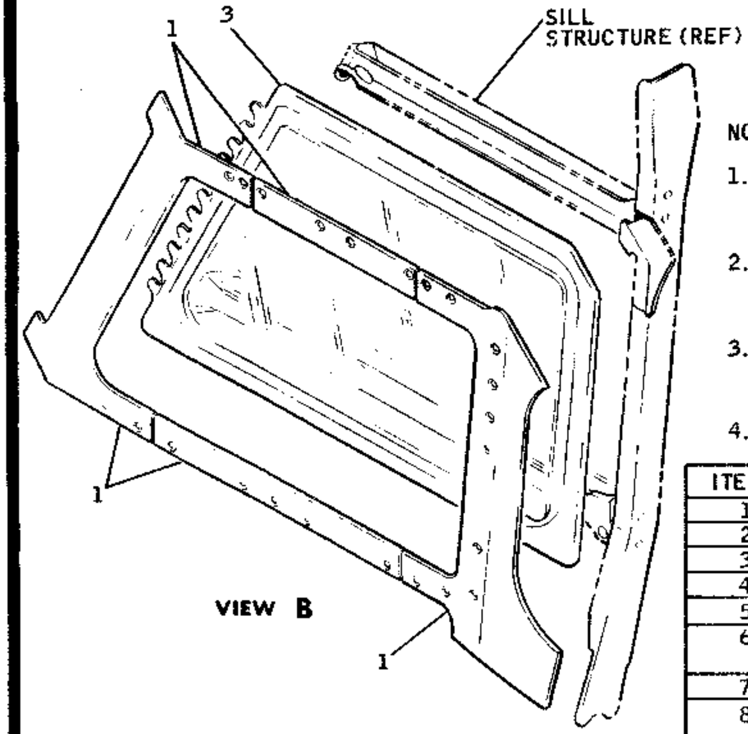
A. This section illustrates the windows in the flight compartment of the airplane. Types and gages of material used in construction of the window assemblies are identified within the illustrations.



VIEW A



SECTION C-C
TYPICAL FOR THE THREE WINDSHIELDS



VIEW B

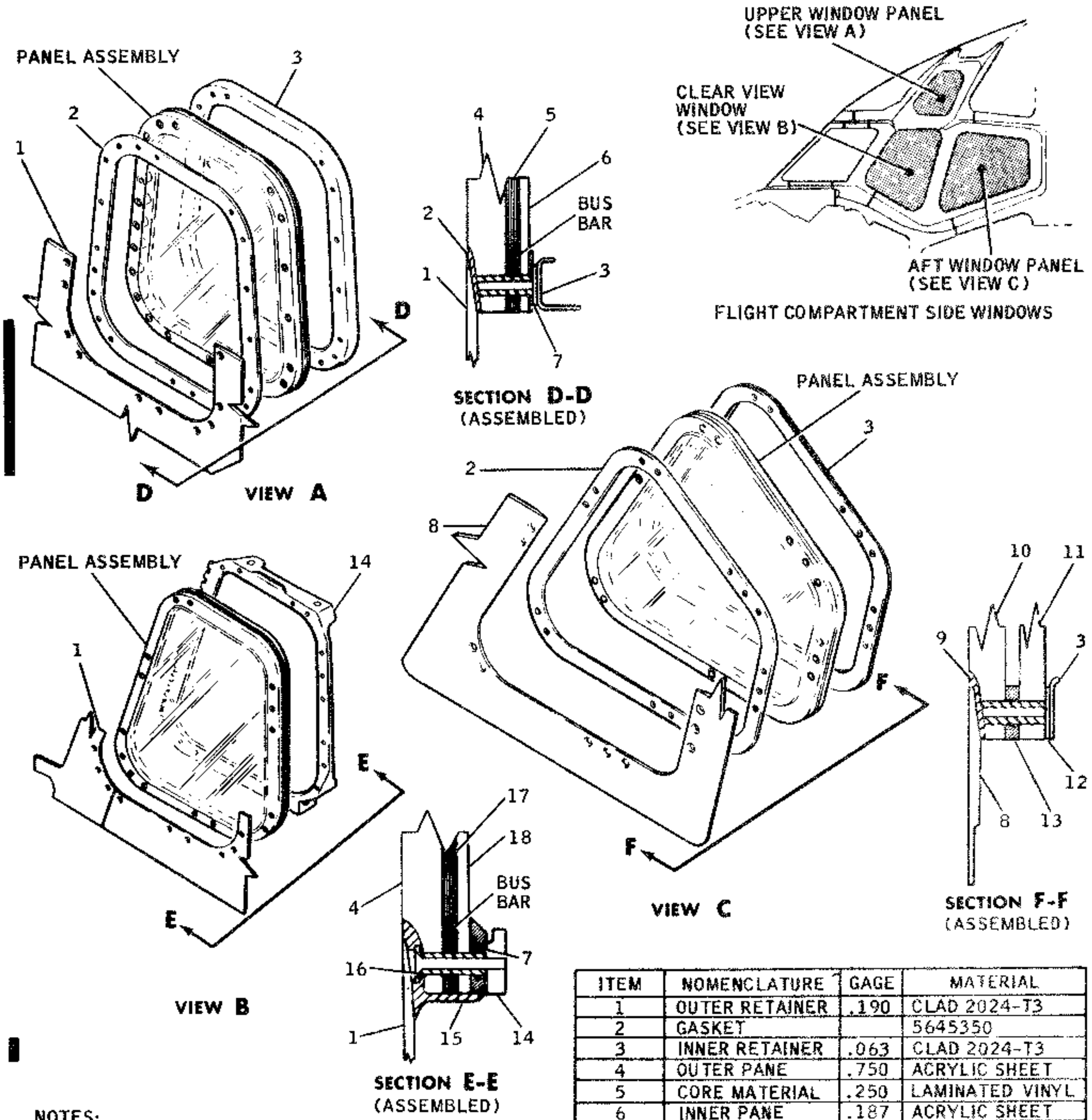
NOTES:

1. ITEMS 2 AND 3 ARE NON-REPAIRABLE WINDSHIELD ASSEMBLIES. SEE DC-9 ILLUSTRATED PARTS CATALOG FOR PART NUMBERS.
2. ITEMS 4 THRU 10 IDENTIFY MATERIALS USED IN THE WINDSHIELD ASSEMBLIES. THESE ARE PROVIDED FOR DESCRIPTIVE PURPOSES ONLY.
3. THE INTERIOR SURFACES OF PANES NUMBER 1 AND 3 ARE COATED WITH METALLIC OXIDE FOR ANTI-ICING AND DEFOGGING OF WINDSHIELDS.
4. REFERENCE - DOUGLAS DRAWING 5910076.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RETAINER	.190	CLAD 2024-T42
2	CTR WINDSHIELD	CONSISTS OF ITEMS 4 THROUGH 10	
3	SIDE WINDSHIELD		
4	INSERT		2024-T351
5	PAN	.080	CLAD 7075-T6
6	PANE NO. 1	.187	SEMI-TEMPERED GLASS
7	CORE MATERIAL	.375	LAMINATED VINYL
8	PANE NO. 2	.500	FULL-TEMPERED GLASS
9	CORE MATERIAL	.080	LAMINATED VINYL
10	PANE NO. 3	.187	SEMI-TEMPERED GLASS

BB3-159A

Flight Compartment Windows
Figure 1 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER RETAINER	.190	CLAD 2024-T3
2	GASKET		5645350
3	INNER RETAINER	.063	CLAD 2024-T3
4	OUTER PANE	.750	ACRYLIC SHEET
5	CORE MATERIAL	.250	LAMINATED VINYL
6	INNER PANE	.187	ACRYLIC SHEET
7	REINFORCEMENT		NYLON CLOTH
8	OUTER RETAINER	.190	CLAD 2024-T4
9	GASKET		5643531
10	OUTER PANE	.675	PLEXIGLASS 55
11	INNER PANE	.525	ACRYLIC SHEET
12	GASKET	.062	SYNTHETIC RUBBER AMS3240
13	SPACER	.250	SYNTHETIC RUBBER
14	FRAME		5613219
15	SEAL		5912880
16	SEAL RETAINER	.080	CLAD 2024-T42
17	CORE MATERIAL	.125	LAMINATED VINYL
18	INNER PANE	.375	ACRYLIC SHEET

BB3-160A

NOTES:

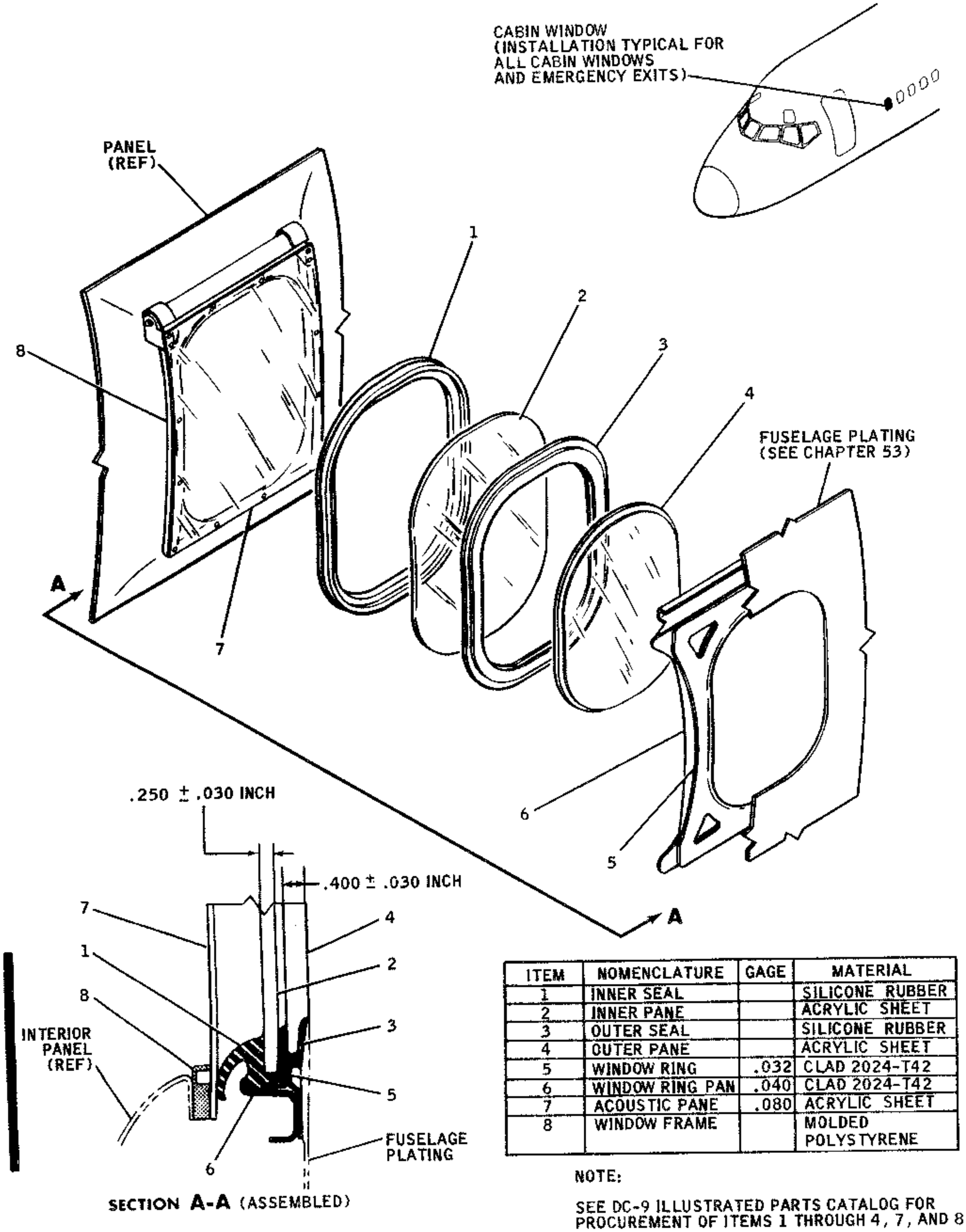
1. THE WINDOW PANEL ASSEMBLIES ARE NON-REPAIRABLE, SEE DC-9 ILLUSTRATED PARTS CATALOG FOR PART NUMBERS.
2. ITEMS 4 THRU 7, 10, 11, 13, AND 18 IDENTIFY MATERIALS USED IN THE WINDOW PANEL ASSEMBLIES. THESE ARE PROVIDED FOR DESCRIPTIVE PURPOSES ONLY.
3. THE INTERIOR SURFACES OF PANES, NUMBER 6 AND 18, ARE COATED WITH METALLIC OXIDE FOR DEFOGGING OF WINDOWS.
4. REFERENCE - DOUGLAS DRAWING 5910076.

Flight Compartment Windows
Figure 1 (Sheet 2)

CABIN - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates the windows in the cabin of the airplane. Types and gages of material used in construction of the window assemblies are identified within the illustration.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SEAL		SILICONE RUBBER
2	INNER PANE		ACRYLIC SHEET
3	OUTER SEAL		SILICONE RUBBER
4	OUTER PANE		ACRYLIC SHEET
5	WINDOW RING	.032	CLAD 2024-T42
6	WINDOW RING PAN	.040	CLAD 2024-T42
7	ACOUSTIC PANE	.080	ACRYLIC SHEET
8	WINDOW FRAME		MOLDED POLYSTYRENE

NOTE:

SEE DC-9 ILLUSTRATED PARTS CATALOG FOR PROCUREMENT OF ITEMS 1 THROUGH 4, 7, AND 8

REFERENCE - DOUGLAS DRAWING 5956095

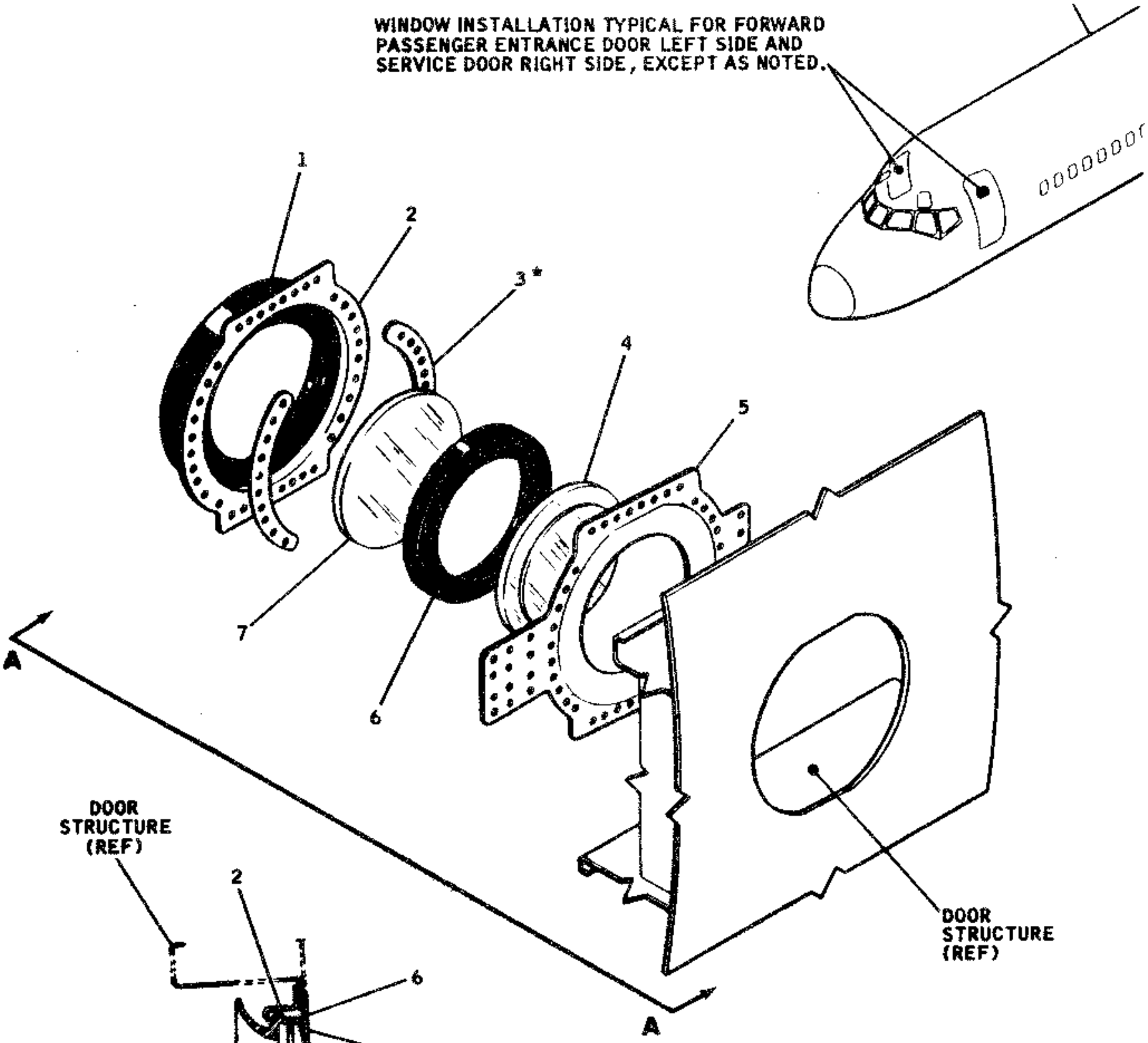
BB3-157B

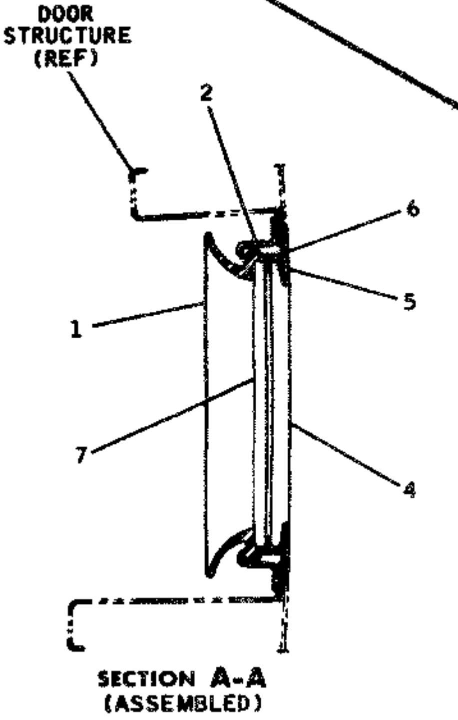
Cabin Windows
Figure 1

DOOR - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates the windows in the passenger forward entrance door and service door of the airplane. Types and gages of material used in construction of the windows are identified within the illustration.





ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INNER SEAL		MIL-R-3065
2	RETAINER	.040	CLAD 2024-T42
* 3	FILLER	.063	CLAD 2024-T3
4	OUTER PANE	.400	MIL-P-8184
5	DOUBLER	.160	CLAD 2014-T6
6	OUTER SEAL		MIL-R-3065
7	INNER PANE	.250	MIL-P-8184

NOTES:

1. DETAILS ARE EXPLODED FOR CLARITY ONLY. SEE DC-9 MAINTENANCE MANUAL FOR REMOVAL / INSTALLATION.
2. SEE DC-9 ILLUSTRATED PARTS CATALOG FOR PROCUREMENT OF ITEMS 1, 6, AND 7.
3.* PASSENGER ENTRANCE DOOR ONLY.

REFERENCE - DOUGLAS DRAWING 5956095

BB3-158

Entrance Door Windows
Figure 1

CHAPTER 57

WINGS

Chapter 57

LIST OF EFFECTIVE PAGES

Chapter Section Subject	Page	Date
Title		
*57-Eff.	1-4	Dec 1/66
*57-Cont.	1	Dec 1/66
57-Cont.	2	Jun 1/66
57-Cont.	3	Jun 1/66
57-Cont.	4	Jun 1/66
57-Cont.	5	Jun 1/66
*57-Sect. App.	1	Dec 1/66
57-Sect. App.	2	Sep 1/66
57-Sect. App.	3	Jun 1/66
*57-Typ Var	1	Dec 1/66
*57-Typ Var	2	Dec 1/66
57-00	1	Jun 1/66
57-00	2	Jun 1/66
*57-00	3	Dec 1/66
57-01	1	Jun 1/66
57-01	2	Dec 1/65
57-01	3	Mar 1/66
57-01	4	Dec 1/65
57-01	5	Mar 1/66
57-01	6	Mar 1/66
57-01	6A	Mar 1/66
57-01	7	Dec 1/65
57-01	8	Dec 1/65
57-01	9	Dec 1/65
57-01	10	Dec 1/65
57-01	11	Dec 1/65
57-01	12	Dec 1/65
57-01	13	Dec 1/65
57-01	14	Dec 1/65
57-01	15	Dec 1/65
57-01	16	Dec 1/65
57-01	17	Dec 1/65
57-01	18	Dec 1/65
57-01	19	Dec 1/65
57-01	20	Dec 1/65
57-01	21	Dec 1/65
57-02	1	Jun 1/66
57-02	2	Dec 1/65
57-03	1	Jun 1/66
57-03	2	Mar 1/66
57-03	3	Mar 1/66
57-03	4	Mar 1/66
57-03	4A	Mar 1/66
57-03	5	Dec 1/65
*57-03	6	Dec 1/66
57-03	7	Dec 1/65
57-03	8	Dec 1/65
*57-03	9	Dec 1/66
*57-03	10	Dec 1/66
*57-03	11	Dec 1/66
57-04	1	Jun 1/66
57-04	2	Dec 1/65
57-04	3	Dec 1/65
57-04	4	Dec 1/65
57-04	5	Dec 1/65
57-04	6	Dec 1/65
57-04	7	Dec 1/65
57-04	8	Dec 1/65
57-04	8A	Dec 1/65
57-04	9	Dec 1/65
57-04	10	Dec 1/65
57-04	11	Dec 1/65
57-04	12	Dec 1/65
57-04	13	Dec 1/65
57-04	14	Dec 1/65
57-04	15	Mar 1/66
57-04	16	Mar 1/66
57-04	16A	Mar 1/66
57-04	16B	Mar 1/66
57-04	17	Dec 1/65
57-04	18	Dec 1/65
57-04	19	Dec 1/65

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
57-04	20	Dec 1/65
57-04	21	Mar 1/66
57-04	22	Mar 1/66
57-04	23	Dec 1/65
57-04	24	Dec 1/65
57-05	1	Jun 1/66
57-06	1	Sep 1/66
57-06	2	Sep 1/66
57-06	3	Sep 1/66
57-06	4	Sep 1/66
57-06	5	Sep 1/66
57-06	6	Sep 1/66
57-06	7	Sep 1/66
*57-07	1	Dec 1/66
*57-07	2	Dec 1/66
*57-07	3	Dec 1/66
57-10-0	1	Jun 1/66
57-10-1	1	Jun 1/66
*57-10-1	2	Dec 1/66
*57-10-1	3	Dec 1/66
*57-10-1	4	Dec 1/66
*57-10-1	5	Dec 1/66
*57-10-1	6	Dec 1/66
57-10-2	1	Jun 1/66
*57-10-2	2	Dec 1/66
*57-10-2	3	Dec 1/66
*57-10-2	4	Dec 1/66
*57-10-2	5	Dec 1/66
57-10-3	1	Jun 1/66
57-10-3	2	Dec 1/65
57-10-3	3	Sep 1/65
57-10-3	4	Sep 1/65
57-10-3	5	Sep 1/65
57-11-0	1	Jun 1/66
57-11-1	1	Jun 1/66
57-11-1	2	Jun 1/66
57-11-1	3	Jun 1/66
57-11-1	4	Jun 1/66
57-11-1	5	Jun 1/66
*57-11-1	6	Dec 1/66
57-11-2	1	Jun 1/66
57-11-2	2	Jun 1/66
57-11-2	3	Jun 1/66
*57-11-2	4	Dec 1/66
*57-11-2	5	Dec 1/66
57-11-3	1	Jun 1/66
57-11-3	2	Sep 1/66
57-11-3	3	Jun 1/66
57-11-3	4	Jun 1/66
57-11-3	5	Jun 1/66
57-20-0	1	Jun 1/66
57-20-0	2	Dec 1/65
57-20-1	1	Jun 1/66
57-20-1	2	Mar 1/66
57-20-1	3	Mar 1/66
57-20-2	1	Jun 1/66
*57-20-2	2	Dec 1/66
57-20-3	1	Jun 1/66
57-20-3	2	Mar 1/66
57-20-3	3	Mar 1/66
57-20-3	4	Sep 1/66
57-21-0	1	Jun 1/66
57-21-0	2	Jun 1/66
57-21-1	1	Jun 1/66
57-21-1	2	Jun 1/66
57-21-1	3	Jun 1/66
57-21-1	4	Jun 1/66
57-21-2	1	Jun 1/66
57-21-2	2	Jun 1/66
57-21-3	1	Jun 1/66
57-21-3	2	Jun 1/66
57-21-3	3	Jun 1/66
57-21-3	4	Jun 1/66
57-30-0	1	Jun 1/66
57-30-1	1	Jun 1/66
*57-30-1	2	Dec 1/66
*57-30-1	3	Dec 1/66
57-30-2	1	Jun 1/66
*57-30-2	2	Dec 1/66
57-30-3	1	Jun 1/66
57-30-3	2	Mar 1/66
57-30-3	3	Mar 1/66
57-30-3	4	Mar 1/66
57-30-3	5	Mar 1/66
57-30-3	6	Mar 1/66
57-30-4	1	Jun 1/66
57-30-4	2	Mar 1/66
57-30-4	3	Mar 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date
57-30-4	4	Mar 1/66
57-30-4	5	Sep 1/65
57-30-4	6	Sep 1/65
57-30-4	7	Sep 1/65
57-30-4	8	Dec 1/65
57-30-4	9	Dec 1/65
57-30-4	10	Mar 1/66
57-30-4	11	Mar 1/66
57-30-5	1	Jun 1/66
57-30-5	2	Mar 1/66
57-31-0	1	Jun 1/66
57-31-1	1	Jun 1/66
57-31-1	2	Jun 1/66
57-31-1	3	Jun 1/66
57-31-1	4	Jun 1/66
57-31-1	5	Jun 1/66
57-31-2	1	Jun 1/66
57-31-2	2	Jun 1/66
57-31-3	1	Jun 1/66
57-31-3	2	Jun 1/66
57-31-3	3	Jun 1/66
57-31-3	4	Jun 1/66
57-31-3	5	Jun 1/66
57-31-3	6	Jun 1/66
57-31-4	1	Jun 1/66
57-31-4	2	Jun 1/66
57-31-4	3	Jun 1/66
57-31-4	4	Jun 1/66
57-31-4	5	Jun 1/66
57-31-4	6	Jun 1/66
57-40-0	1	Jun 1/66
57-40-1	1	Jun 1/66
57-40-1	2	Jun 1/66
57-41-0	1	Jun 1/66
57-41-1	1	Jun 1/66
57-41-1	2	Sep 1/66
57-50-0	1	Jun 1/66
57-50-1	1	Jun 1/66
57-50-1	2	Dec 1/65
57-50-1	3	Dec 1/65
57-50-1	4	Dec 1/65
57-50-1	5	Jun 1/66
57-50-1	6	Jun 1/66
57-50-1	7	Jun 1/66
57-50-1	8	Jun 1/66
57-50-1	9	Jun 1/66
57-50-1	10	Jun 1/66
57-50-1	11	Jun 1/66
57-50-1	12	Jun 1/66
57-50-1	13	Jun 1/66
57-50-1	14	Jun 1/66
57-50-1	15	Jun 1/66
57-50-1	16	Sep 1/66
57-50-1	17	Jun 1/66
57-50-1	18	Jun 1/66
57-50-1	19	Jun 1/66
57-50-2	1	Jun 1/66
*57-50-2	2	Dec 1/66
*57-50-2	3	Dec 1/66
*57-50-2	4	Dec 1/66
*57-50-2	5	Dec 1/66
*57-50-2	6	Dec 1/66
*57-50-2	7	Dec 1/66
*57-50-2	8	Dec 1/66
*57-50-2	9	Dec 1/66
57-50-3	1	Jun 1/66
*57-50-3	2	Dec 1/66
*57-50-3	3	Dec 1/66
*57-50-3	4	Dec 1/66
57-50-3	5	Sep 1/66
57-50-3	6	Sep 1/66
*57-50-3	6A	Dec 1/66
*57-50-3	7	Dec 1/66
57-50-3	8	Sep 1/66
57-50-3	9	Sep 1/65
57-50-3	10	Sep 1/66
57-50-3	11	Sep 1/66
57-50-3	12	Sep 1/65
57-50-3	13	Sep 1/65
57-50-3	14	Sep 1/65
57-50-4	1	Jun 1/66
57-50-4	2	Mar 1/66
57-50-4	3	Sep 1/65
57-50-5	1	Jun 1/66
57-50-5	2	Mar 1/66
57-50-5	3	Mar 1/66
57-50-6	1	Jun 1/66
57-50-6	2	Mar 1/66

*The asterisk indicates pages revised or added by the current revision.

Chapter Section Subject	Page	Date	Chapter Section Subject	Page	Date
57-50-7	1	Jun 1/66			
57-50-7	2	Mar 1/66			
57-50-8	1	Jun 1/66			
*57-50-8	2	Dec 1/66			
*57-50-8	3	Dec 1/66			
*57-50-8	4	Dec 1/66			
*57-50-8	5	Dec 1/66			
57-50-8	6	Jun 1/66			
57-50-9	1	Sep 1/66			
57-50-9	2	Jun 1/66			
*57-50-9	3	Dec 1/66			
*57-50-9	4	Dec 1/66			
57-50-9	5	Sep 1/66			
57-50-9	6	Sep 1/66			
*57-50-9	6A	Dec 1/66			
*57-50-9	7	Dec 1/66			
57-50-9	8	Sep 1/66			
57-50-9	9	Sep 1/66			
57-50-9	10	Sep 1/66			
57-50-9	11	Sep 1/66			
57-50-9	12	Sep 1/66			
57-50-9	13	Sep 1/66			
57-50-9	14	Sep 1/66			
57-50-10	1	Jun 1/66			
57-50-10	2	Jun 1/66			

*The asterisk indicates pages revised or added by the current revision.

Chapter 57

TABLE OF CONTENTS

Chapter 57

SECTION APPLICABILITY INDEX

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
57-00	YES	YES
57-01	YES	YES
57-02	YES	YES
57-03	YES	YES
57-04	YES	YES
57-05	YES	NO
57-06	YES	NO
57-07	YES	YES
57-10-0	YES	NO
57-10-1	YES	NO
57-10-2	YES	NO
57-10-3	YES	NO
57-11-0	NO	YES
57-11-1	NO	YES
57-11-2	NO	YES
57-11-3	NO	YES
57-20-0	YES	NO
57-20-1	YES	NO
57-20-2	YES	NO
57-20-3	YES	NO

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
57-21-0	NO	YES
57-21-1	NO	YES
57-21-2	NO	YES
57-21-3	NO	YES
57-30-0	YES	NO
57-30-1	YES	NO
57-30-2	YES	NO
57-30-3	YES	NO
57-30-4	YES	NO
57-30-5	YES	NO
57-31-0	NO	YES
57-31-1	NO	YES
57-31-2	NO	YES
57-31-3	NO	YES
57-31-4	NO	YES
57-40-0	YES	NO
57-40-1	YES	NO
57-41-0	NO	YES
57-41-1	NO	YES
57-50-0	YES	YES
57-50-1	YES	YES
57-50-2	YES	YES
57-50-3	YES	NO

Chapter 57

TYPE VARIATIONS

The illustrations listed below, in numerical sequence by chapter, section and subject, reflect structural differences in the wing. These differences are indicated as type variations. The effectivity of each type is indicated by fuselage serial numbers. Refer to the INTRODUCTION for a detailed explanation of type variations.

Figure	Title	Effectivity
	57-10-1	
1	Wing Main Frame Ribs and Bulkheads --Types I	All DC-9-10 airplanes except Type II and III listings
1	Wing Main Frame Ribs and Bulkheads --Type II	45731, 45732, 45785 - 45787.
1	Wing Main Frame Ribs and Bulkheads --Type III	45714 - 45716, 45735 - 45741, 45775 - 45784.
	57-10-2	
1	Wing Front Spar Structure -- Type I	All DC-9-10 airplanes except Type II and III listings.
1	Wing Front Spar Structure -- Type II	45731, 45732, 45785 - 45787.
1	Wing Front Spar Structure -- Type III	45714 - 45716, 45735 - 45741, 45775 - 45784.
	57-11-2	
2	Wing Rear Spar Structure -- Type A1	All DC-9-30 airplanes except Type A2.

TYPE VARIATIONS (Continued)

Figure	Title	Effectivity
	57-11-2 (Continued)	
2	Wing Rear Spar Structure -- Type A2	45710, 45827, 45845, 45846, 47019 - 47022, 47025 - 47028, 47037, 47038, 47076, 47077, 47094.

Chapter Section Subject	DC-9-10 Series	DC-9-30 Series
57-50-4	YES	YES
57-50-5	YES	NO
57-50-6	YES	NO
57-50-7	YES	NO
57-50-8	NO	YES
57-50-9	NO	YES
57-50-10	NO	YES

Chapter 57

WINGS

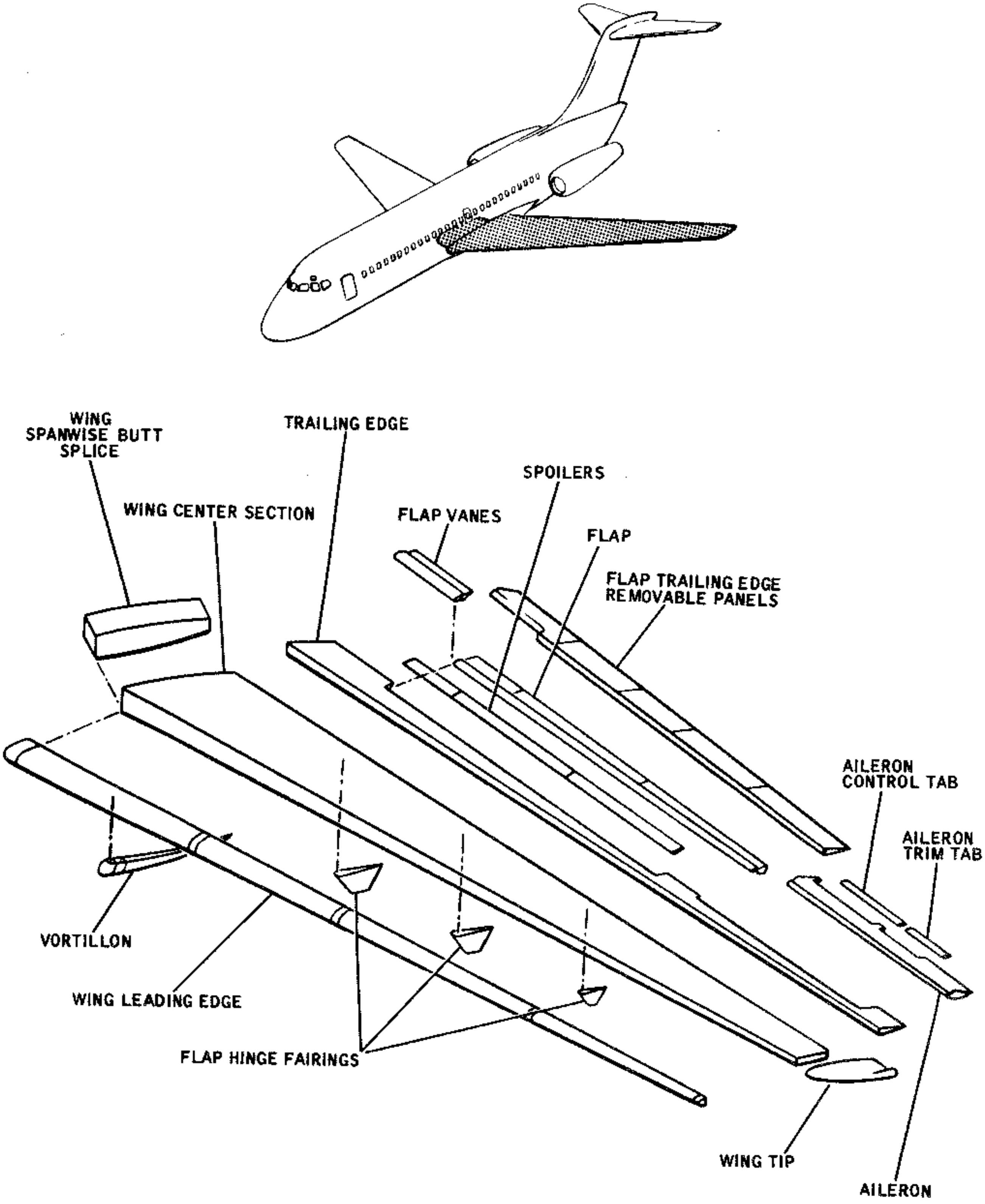
GENERAL - DESCRIPTION AND OPERATION (DC-9-ALL)

1. Description

A. Repair instructions for the wings are contained in this chapter. Material identification illustrations indicate the type of material and the gages of the reparable structural components of the wings. Repair instructions are presented for the most common types of damage encountered. For explanation of the classification of repairs and damage, see 51-00. For locations of wing components described in this chapter, refer to the index illustration, Figure 1. A repair index is presented with each section of components.

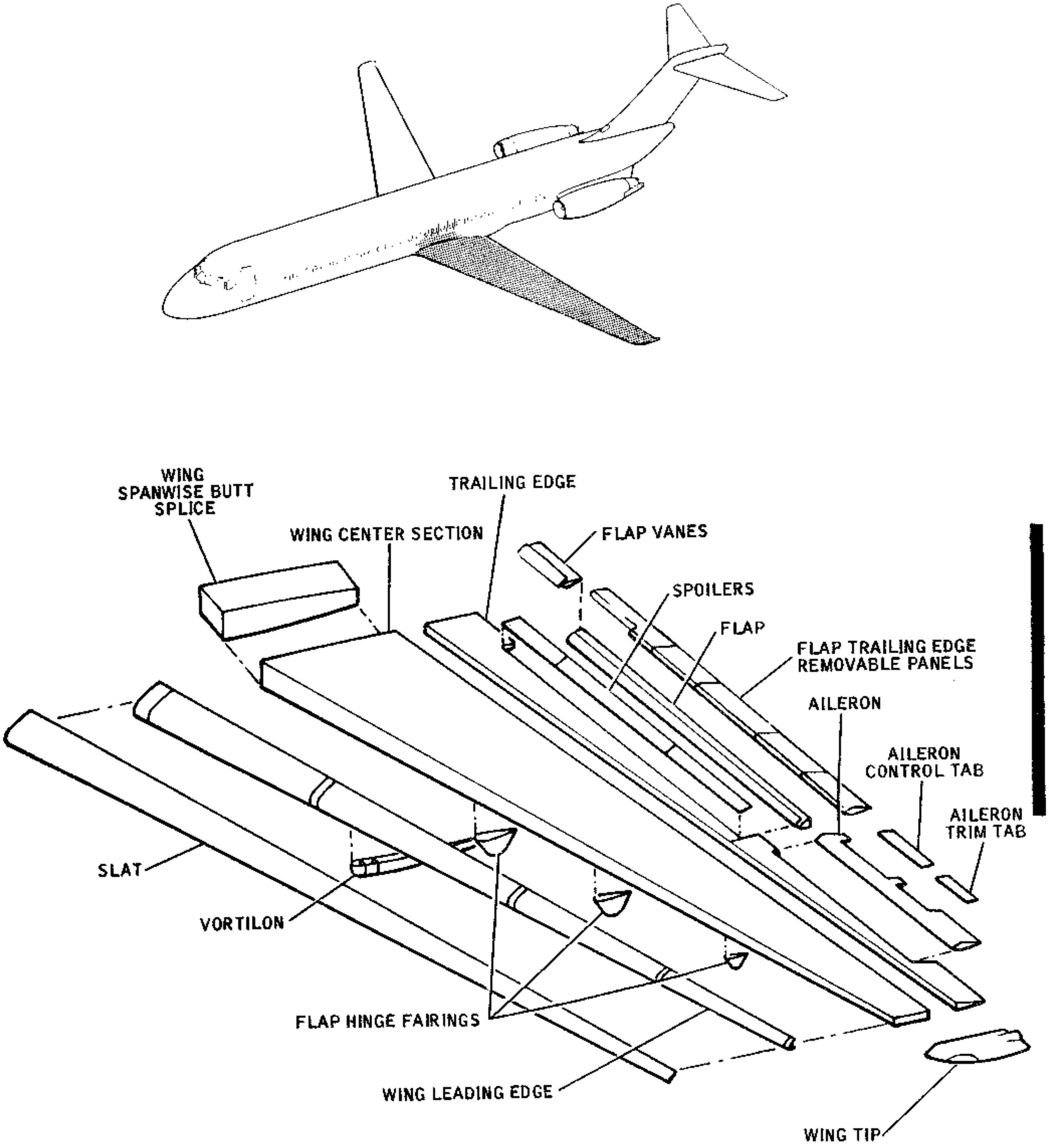
B. Also presented in this section are procedures for balancing of the control surfaces. Balancing procedures are contained in Section 57-50-1.

C. Whenever a repair is made to an aileron, an aileron control tab, or an aileron trim tab, the surface must be rebalanced. Whenever a repair is made to an aileron control or trim tab, the surface must also be weighed to ensure that the maximum allowable weight is not exceeded. The maximum allowable weights for the aileron control and trim tabs are given in the balancing procedure for the surface involved.



BB3-216

Wing Index Illustration (DC-9-10)
Figure 1



Wing Index Illustration (DC-9-30)
Figure 2

GENERAL REPAIR PROCEDURES AND PROCESSES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General Requirements

A. The following requirements are necessary to accomplish repairs described in this chapter and are in addition to specific repair requirements listed with individual repairs.

(1) Recommended edge distance for all attachments in repair areas is two diameters plus 1/16 inch, unless otherwise noted. The minimum edge distance is two diameters.

(2) All repair materials must be of the same material and heat treat condition as the part being repaired, unless otherwise noted. See Chapter 51 for recommended substitutions. If forming operations require repair material to be in the -O (soft) condition, the part must be heat treated to the appropriate -T condition after forming. The word CLAD is placed before aluminum alloy material designations in the manual to indicate material which has a thin protective layer of pure aluminum on its surface. Absence of the word CLAD preceding a material designation indicates that the material does not have this thin layer of aluminum.

(3) All metal parts must be cleaned and protected from corrosion in accordance with Chapter 51, unless otherwise noted in the individual repair.

(4) All repair parts must be free from cracks, burrs, dings, and sharp edges. This requirement also applies to parts to which repair parts are being attached.

(5) All attachment holes must be prepared in accordance with recommended fastener hole sizes specified in the applicable section of Chapter 51.

(6) The minimum attachment spacing in repair areas is four diameters, unless otherwise noted.

(7) All repairs within the pressure boundary of the fuselage require sealing as described in the Repair Sealing Section of Chapter 51.

(8) Where external doublers are to be tapered for aerodynamic reasons, a seal-type taper may be substituted. Refer to Repair Sealing Section of Chapter 51.

2. General Repairs

A. The repairs described in this section are of a general nature and may be used separately or in conjunction with specific repairs that are described in subsequent sections of the chapter. When applicable, specific repairs are preferred. Repairs involving more than one illustration must comply with the requirements of each illustration. The following repairs are outlined in this section.

ALLOWABLE CLEANUP OF SCRATCHES, NICKS, AND DINGS IN WING STRUCTURE

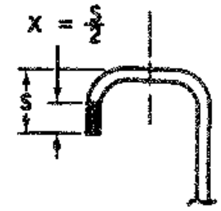
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE

NICKS IN EXTRUSIONS, ROLLED, AND FORMED SECTIONS.

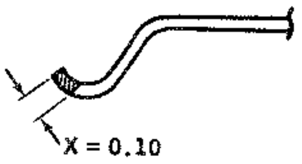
---

1. NICKS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. NICKS UP TO THE DEPTH SHOWN IN THE SKETCHES BELOW SHOULD BE ROUNDED OUT TO 1.00 INCH RADIUS.
3. NICKS DEEPER THAN THE LIMIT SHOWN IN THE SKETCHES BELOW MUST BE SPLICED OR REINFORCED AFTER THE NICK IS ROUNDED OUT.
4. NICKS IN A RADIUS AREA SHOULD BE REPAIRED AS A DING IN A RADIUS AREA AS DESCRIBED IN THE SKETCH ON SHEET 4, THE CRACKED MEMBER SPLICE REPAIR, THIS SECTION.

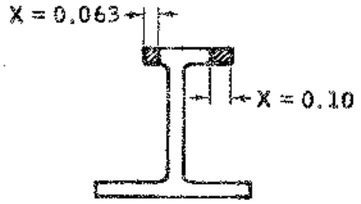


RETURN FLANGE
(ATTACHED AND UNATTACHED)

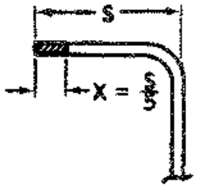
DETAIL OF NICK REMOVED
VIEW **A** (TYP)



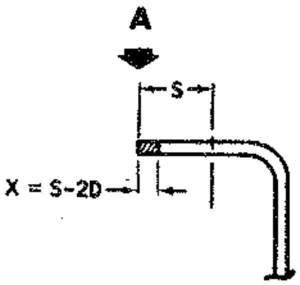
LIGHTENING HOLE



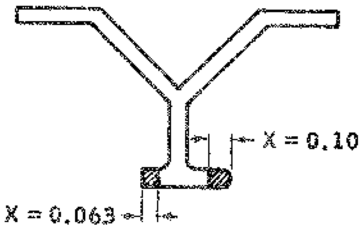
EXTRUDED UPPER STRINGER



STRAIGHT FLANGE
(UNATTACHED AND
BETWEEN ATTACHMENTS)



D = ATTACHMENT DIA
STRAIGHT FLANGE
(AT ATTACHMENTS)



EXTRUDED UPPER STRINGER

---

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEAN UP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

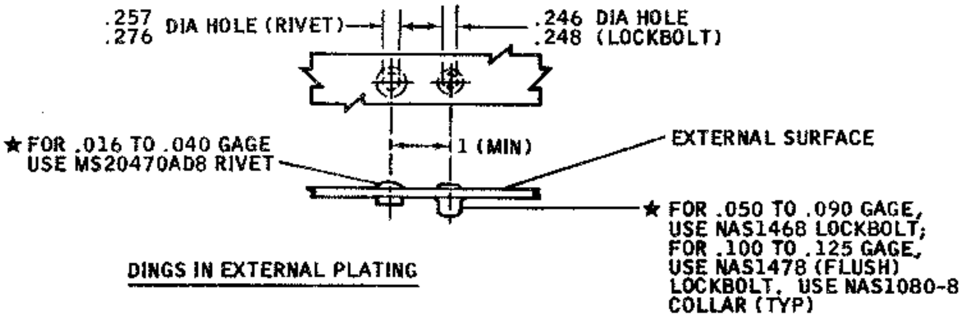
BB3-614A

Cleanup of Scratches, Gouges, Nicks and
Dings in Wing Structure
Figure 1 (Sheet 1)

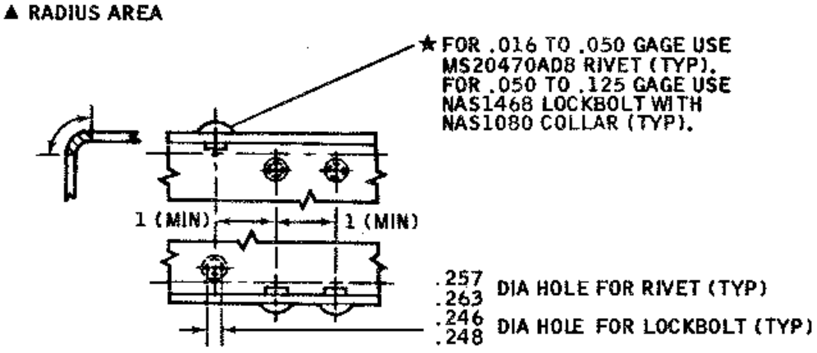
ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN WING STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
DINGS

1. DINGS THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.
2. DINGS THAT PENETRATE BEYOND THE CLAD AND ARE NOT LARGER THAN 0.250 INCH DIAMETER SHOULD BE REMOVED AND PLUGGED. SEE SKETCHES BELOW. SEE CHAPTER 51 FOR DING REPAIRS IN ALUMINUM HONEYCOMB PANELS.
3. DINGS LARGER THAN 0.250 INCH DIAMETER MUST BE REPAIRED. REPAIR IN SAME MANNER AS CRACKED MEMBERS, THIS SECTION.
4. THESE INSTRUCTIONS DO NOT APPLY TO THE VARIOUS SPAR CAPS, BULKHEAD CAPS, OR MACHINED FITTINGS IN THE WING.



DINGS IN EXTERNAL PLATING



DINGS IN INTERNAL STRUCTURE

★ MS20470AD8 RIVET MAY BE USED IN PLACE OF LOCKBOLT IF MORE CONVENIENT.

▲ DINGS IN A RADIUS AREA REQUIRE THE SECTION TO BE REPAIRED AFTER THE DING IS DRILLED OUT. SEE THE ALUMINUM ALLOY TO ALUMINUM ALLOY (CRACKED MEMBER) REPAIRS, THIS SECTION. (ONLY 3 ATTACHMENTS REQUIRED WHERE 5 ARE CALLED OUT). DO NOT INSTALL A FASTENER IN THE DING CLEANOUT HOLE.

1. ALL HOLES IN THE STRUCTURE OF THE AIRPLANE MUST BE PLUGGED OR REPAIRED UNLESS THEY HAVE BEEN DESIGNED AS DRAIN HOLES OR AIR FLOW PASSAGES. SEE CHAPTER 51, DC-9 MAINTENANCE MANUAL.
2. THE CROSS SECTIONAL AREA REMOVED, INCLUDING ALL EXISTING HOLES, MUST NOT EXCEED 10 PERCENT OF THE GROSS CROSS SECTIONAL AREA LOCALLY.
3. THE REQUIRED EDGE DISTANCE AND SPACING OF ATTACHMENTS MUST BE MAINTAINED.
4. CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL). SEE CHAPTER 51, CORROSION CONTROL AND PREVENTION SECTION.

BB3-615

Printed in U.S.A.

Cleanup of Scratches, Gouges, Nicks and
Dings in Wing Structure
Figure 1 (Sheet 2)

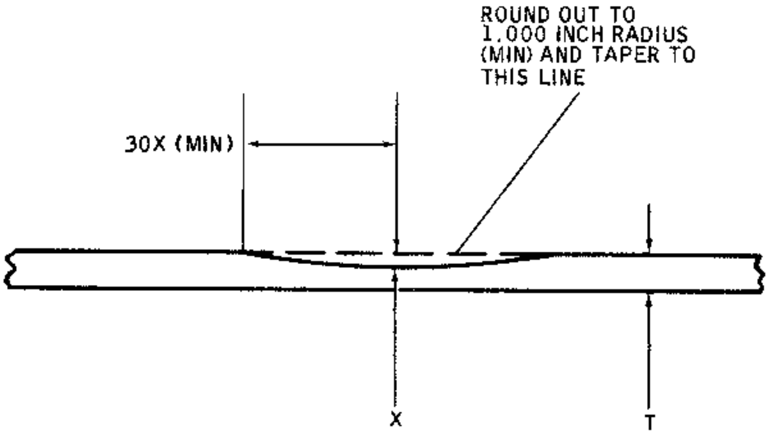
ALLOWABLE CLEANUP OF SCRATCHES, GOUGES, NICKS, AND DINGS IN WING STRUCTURE
(IF NOT SPECIFIED OTHERWISE IN AN INDIVIDUAL REPAIR)

TYPE OF DAMAGE
SCRATCHES AND GOUGES

1. SCRATCHES OR GOUGES THAT DO NOT PENETRATE BEYOND THE CLAD DO NOT REQUIRE REPAIR.

2. SCRATCHES OR GOUGES THAT PENETRATE BEYOND THE CLAD UP TO THE DEPTH SHOWN IN THE TABLE BELOW SHOULD BE ROUNDED OUT AND TAPERED. SEE SKETCH BELOW.

3. SCRATCHES OR GOUGES DEEPER THAN THE LIMIT SHOWN IN THE TABLE BELOW MUST BE REPAIRED. REPAIR IN THE SAME MANNER AS CRACKED MEMBER SPLICE REPAIRS, THIS SECTION.



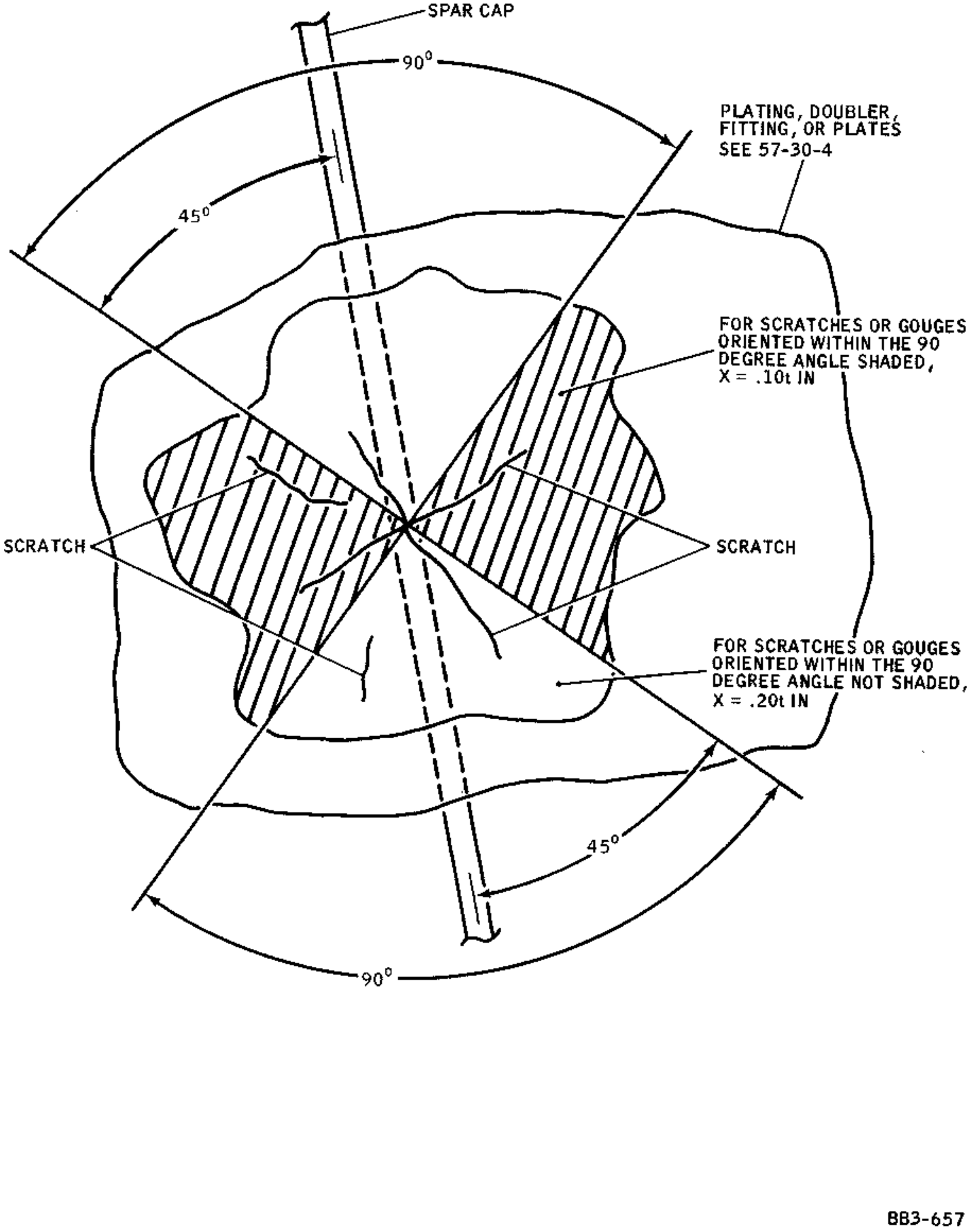
T = MATERIAL THICKNESS
X = ALLOWABLE DEPTH (SEE SCRATCH AND GOUGE ORIENTATION CHART FOR DEFINED LIMITS)

MAX DEPTH OF X NOT TO EXCEED 0.20T

NOTE: CLEANUP AREAS SHOULD BE FR PRIMED (INTERNAL) OR ALODINE TREATED (EXTERNAL)

BB3-616A

Cleanup of Scratches, Gouges, Nicks and Dings in Wing Structure
Figure 1 (Sheet 3)



BB3-657

Wing Scratch and Gouge Orientation Chart
Figure 1 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR

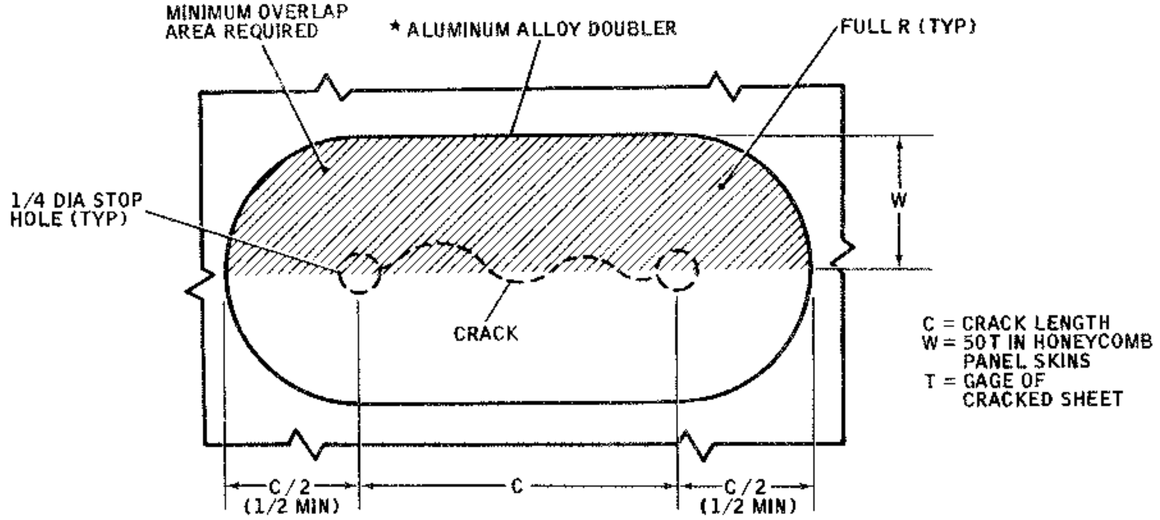
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF CRACKED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING AN ALUMINUM ALLOY DOUBLER BONDED PER 51-70-2. SEE EXAMPLE A BELOW.
2. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
4. CRACKS IN THE CONTROL SURFACE TAB SKINS, LONGER THAN ONE-FOURTH OF CHORD LENGTH IN THE CHORD DIRECTION OR 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.
5. CRACKS IN THE VANE SKINS, LONGER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION OR 18 INCHES IN LENGTH SPANWISE, REQUIRE SPECIFIC ENGINEERING INSTRUCTIONS.
6. IF CRACKS IN THE PANEL SKIN (OTHER THAN TABS OR VANES) ARE LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL IN THE SHORTEST DIRECTION, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.
7. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE, THIS SECTION, MAY ALSO BE USED IN CRACK REPAIRS. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.



EXAMPLE A

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F)
3. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

★ DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

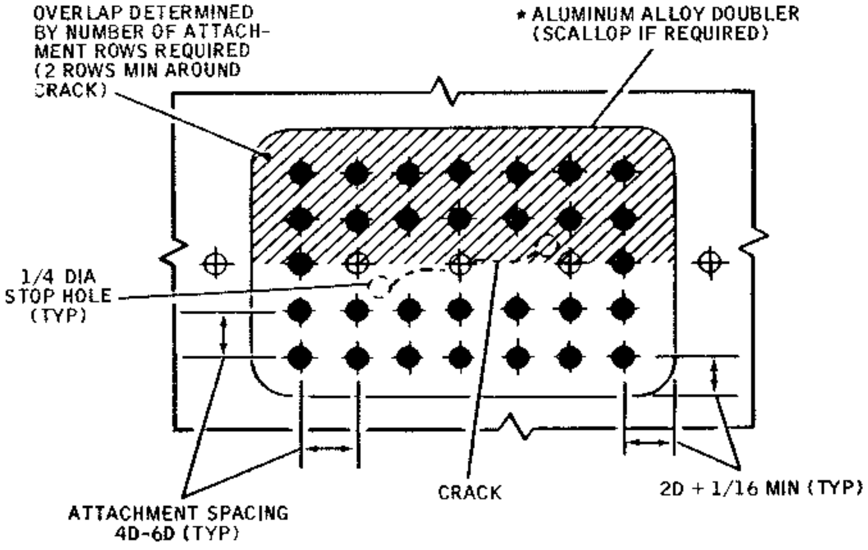
BB3-617

Aluminum Alloy to Aluminum Alloy
Repairs (Cracked Members)
Figure 2 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY SHEET
.016 TO .090 GAGE

1. REPAIR SHEET CRACKS, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. THE GLASS FIBER LAYUP DOUBLERS ILLUSTRATED ON ANOTHER FIGURE IN THIS SECTION MAY ALSO BE USED. HOWEVER, THE ALUMINUM ALLOY DOUBLER IS PREFERRED.
5. THESE INSTRUCTIONS ARE NOT APPLICABLE ON THE FUEL TANK PLATING.



EXAMPLE B

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
3. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

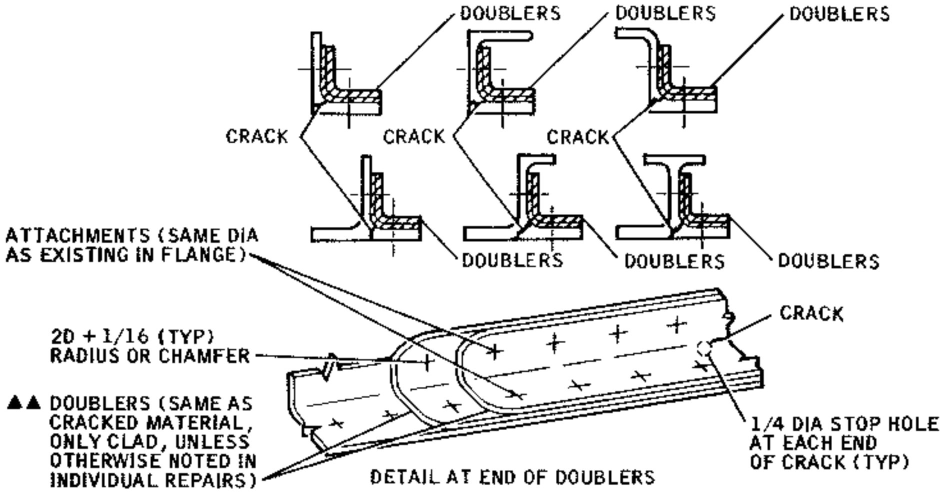
* DOUBLER MATERIAL SAME GAGE AND MATERIAL AS CRACKED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR.

BB3-618

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR

ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR
TYPE OF CRACKED MEMBER
ALUMINUM ALLOY EXTRUDED, FORMED AND ROLLED SECTIONS
.016 TO .125 GAGE

1. REPAIR CRACKS PARALLEL TO THE ATTACHED FLANGE RADIUS OF EXTRUDED, FORMED, OR ROLLED SECTIONS, USING FORMED DOUBLERS. INSTALL WITH ATTACHMENTS AND BOND PER 51-70-2. (SEE EXAMPLE C BELOW).
2. THE ADHESIVE WILL CAUSE THE DOUBLERS TO ACT AS A SINGLE DOUBLER, LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. PICK UP AT LEAST ONE ROW AT ATTACHMENTS EACH SIDE OF CRACK AND PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK IN EACH ROW AT EACH END AS SHOWN IN DETAIL BELOW.
4. THE DOUBLERS SHOULD BE EQUAL IN GAGE, IF POSSIBLE. THE THINNEST DOUBLER SHOULD BE INSTALLED NEXT TO CRACKED MEMBER.
5. IF THE CRACK IS PERPENDICULAR TO A FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED, OR ADDITIONAL DOUBLERS ADDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.
6. THESE INSTRUCTIONS ARE NOT APPLICABLE FOR THE WING STRINGERS, RIB CAPS, OR SPAR CAPS.



EXAMPLE C

1. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CRACKED MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
2. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
3. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY THE INDIVIDUAL REPAIR REQUIREMENTS.

▲▲ FOR FORMED AND ROLLED SECIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE EQUAL TO OR GREATER THAN THE CRACKED MEMBER GAGE, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR. FOR EXTRUSIONS, THE SUM OF THE DOUBLER GAGES SHOULD BE AT LEAST ONE GAGE HEAVIER THAN THE THICKEST LEG ADJACENT TO THE CRACK.

BB3-619

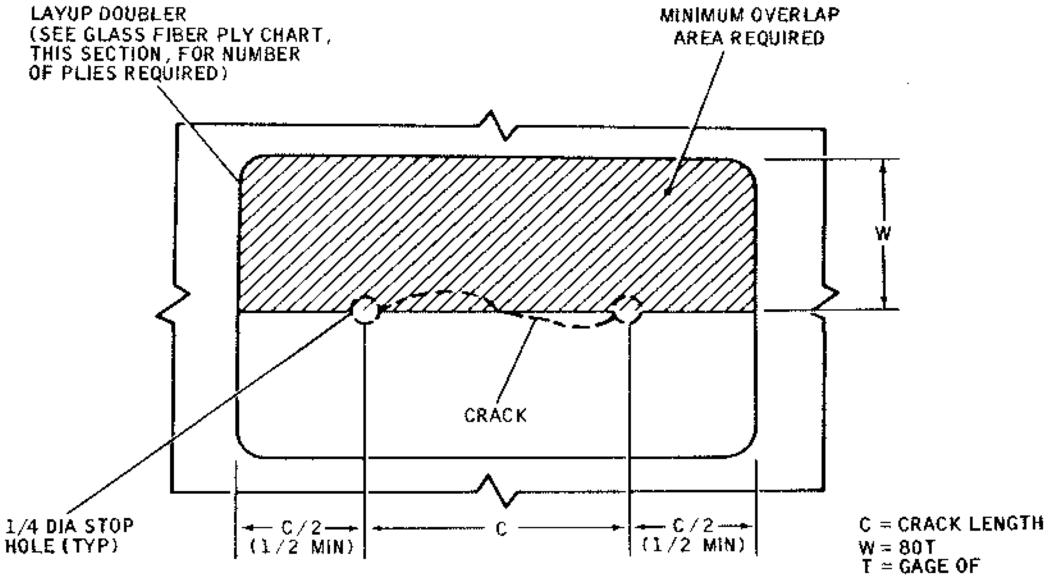
Aluminum Alloy to Aluminum Alloy
Repairs (Cracked Members)
Figure 2 (Sheet 3)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

1. REPAIR SKIN CRACKS, USING A GLASS FIBER LAYUP DOUBLER BONDED PER 51-70-3. SEE EXAMPLE A BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR ATTACHMENTS.
5. CRACKS IN THE CONTROL SURFACE TAB SKIN, LONGER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION OR 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.
6. CRACKS IN THE VANE SKINS, LONGER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION OR 18 INCHES IN LENGTH SPANWISE, REQUIRE SPECIFIC ENGINEERING INSTRUCTIONS.
7. IF THE CRACK IN THE PANEL SKIN (OTHER THAN TABS OR VANES) IS LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL IN THE SHORTEST DIRECTION, OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.



EXAMPLE A

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.
3. DO NOT USE GLASS FIBER REPAIRS IN INTEGRAL FUEL TANKS.

THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-620

Glass Fiber Layup to Aluminum Alloy
Repairs (Cracked Members)
Figure 3 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

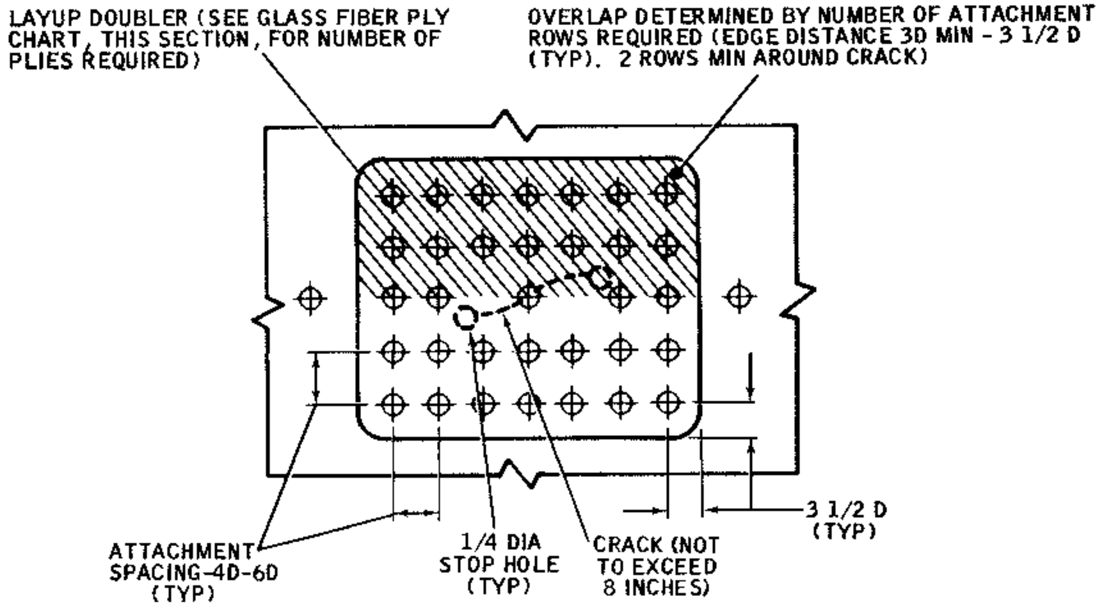
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER

ALUMINUM ALLOY SHEET

.016 TO .050 GAGE

1. REPAIR SHEET CRACKS, USING A GLASS FIBER LAYUP DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-3. SEE EXAMPLE B BELOW.
2. THE ADHESIVE SHOULD NOT BE CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND STOP HOLES, AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. IF THE LOAD IN THE SHEET CANNOT BE DETERMINED, REFER TO SECTION 51-30-0.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.



EXAMPLE B

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE IN REPAIRS IN FUEL TANKS.
3. DO NOT USE GLASS FIBER REPAIRS IN INTEGRAL FUEL TANKS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-621

Glass Fiber Layup to Aluminum Alloy
Repairs (Cracked Members)
Figure 3 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER

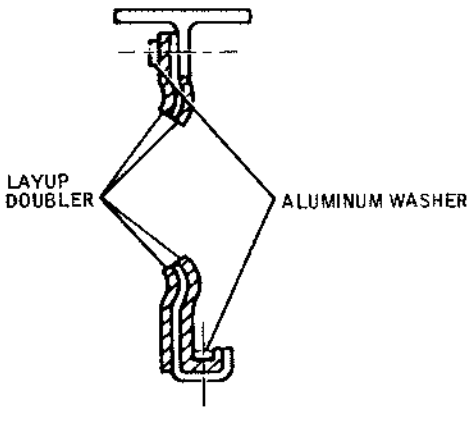
ALUMINUM ALLOY RIBS,
INTERCOSTALS, AND STIFFENERS

.016 TO .080 GAGE

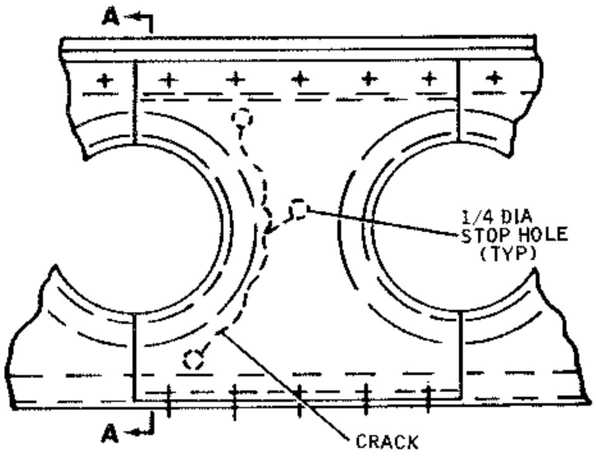
1. REPAIR LIGHTENING HOLE RADIUS CRACKS USING A LAYUP DOUBLER OVER BOTH SURFACES OF THE CRACKED MEMBER BONDED PER 51-70-3. SEE EXAMPLE C BELOW.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF THE MAIN CRACKS.
3. EXTEND THE DOUBLERS IN THE CRACK DIRECTION TO PICK UP ATTACHMENTS AS SHOWN. MAKE CERTAIN THAT ALUMINUM ALLOY WASHERS ARE INSTALLED ON THE GLASS FIBER SIDE OF THE REPAIR AT THE ATTACHMENTS.
4. EXTEND THE DOUBLERS ON BOTH SIDES OF THE CRACK TO THE APPROXIMATE CENTER OF THE LIGHTENING HOLE.
5. DO NOT USE GLASS FIBER LAYUP DOUBLERS ON WING TANK RIBS.

NOTE:

SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED IN DOUBLERS.



SECTION A-A



EXAMPLE C

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE IN REPAIRS IN FUEL TANKS.
3. DO NOT USE GLASS FIBER REPAIRS IN INTEGRAL FUEL TANKS

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-622

Glass Fiber Layup to Aluminum Alloy
Repairs (Cracked Members)
Figure 3 (Sheet 3)

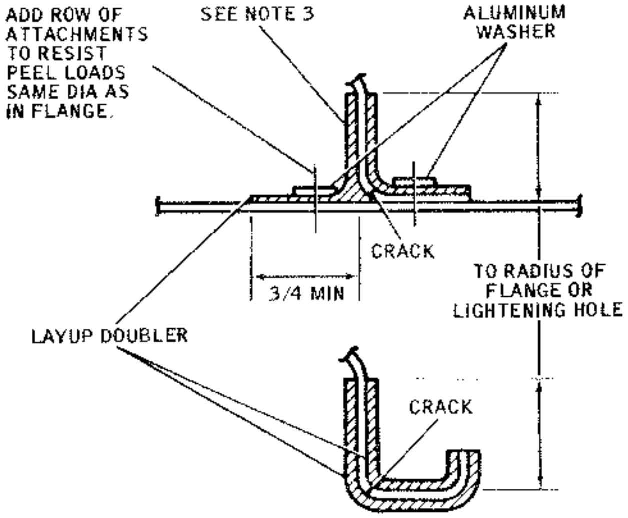
DESIGN REQUIREMENTS FOR REPAIR OF CRACKS IN ALUMINUM ALLOY WING MEMBERS WHEN THE CRACK IS LONGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF CRACKED MEMBER
ALUMINUM ALLOY FORMED AND ROLLED SECTIONS
.016 TO .080 GAGE

1. REPAIR CRACKS PARALLEL TO THE FLANGE RADIUS OF FORMED OR ROLLED SECTIONS USING LAYUP DOUBLERS BONDED PER 51-70-3. SEE EXAMPLE D BELOW.
2. IF THE CRACKED FLANGE IS ATTACHED, THEN PICK UP AT LEAST FIVE ATTACHMENTS BEYOND THE END OF THE CRACK AT EACH END, AND ADD A ROW OF ATTACHMENTS AS SHOWN. MAKE BOTH DOUBLERS THE SAME LENGTH. INSTALL ATTACHMENTS AFTER CURING.
3. IF THE FLANGE IS NOT ATTACHED, THEN OVERLAP THE DOUBLERS BEYOND THE ENDS OF THE CRACK BY AT LEAST THREE INCHES.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. IF THE CRACK IS PERPENDICULAR TO THE FLANGE RADIUS, THEN THE DOUBLERS SHOULD BE EXTENDED TO SPLICE THE TOTAL LOCAL CROSS-SECTIONAL AREA OF THE CRACKED MEMBER.



EXAMPLE D

NOTES:
1. SEE GLASS FIBER PLY CHART, THIS SECTION, FOR NUMBER OF PLIES REQUIRED.
2. DRILL 1/4 DIA STOP HOLES AT THE ENDS OF CRACK.
3. IN .071 AND .080 GAGES, ADD ROW OF ATTACHMENTS SAME DIA AS THOSE IN FLANGE.

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE FOR REPAIRS IN FUEL TANKS.
3. DO NOT USE GLASS FIBER REPAIRS IN INTEGRAL FUEL TANKS.

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-623

Glass Fiber Layup to Aluminum Alloy
Repairs (Cracked Members)
Figure 3 (Sheet 4)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY WING MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

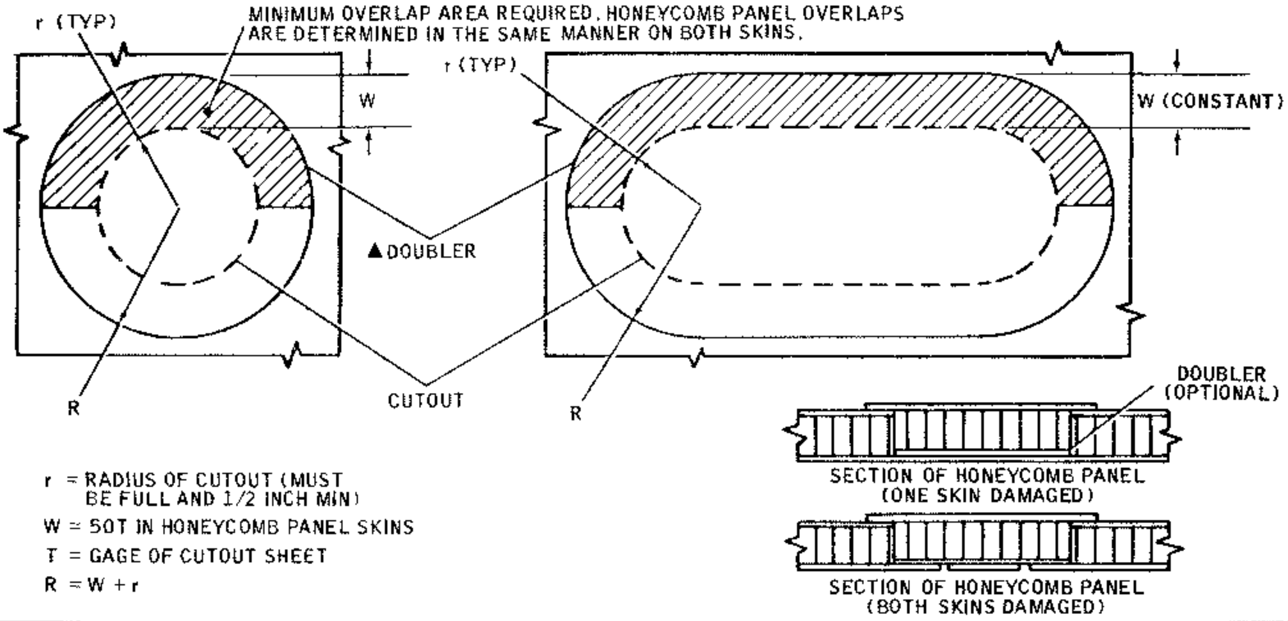
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM HONEYCOMB PANEL SKINS

.010 TO .040 GAGE

1. REPAIR SKIN CUTOUT DAMAGE USING A REPAIR PLUG MADE FROM A REPAIR PANEL OR ALUMINUM ALLOY DOUBLERS AND A REPAIR CORE BONDED PER 51-70-2. SEE SKETCHES BELOW.
2. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 500 PSI.
3. GLASS FIBER LAYUP SHOWN ON ANOTHER ILLUSTRATION, THIS SECTION, MAY BE USED AS A SUBSTITUTE FOR THE ALUMINUM ALLOY DOUBLERS. HOWEVER, ALUMINUM ALLOY DOUBLERS ARE PREFERRED.
4. DO NOT USE A BONDED ALUMINUM ALLOY DOUBLER (WITHOUT ATTACHMENTS), IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
5. DAMAGE TO THE CONTROL SURFACE TAB SKINS, GREATER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION OR GREATER THAN 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.
6. DAMAGE TO THE VANE SKINS, LARGER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION OR GREATER THAN 18 INCHES IN LENGTH SPANWISE, REQUIRES SPECIFIC ENGINEERING INSTRUCTION.
7. IF DAMAGE IN PANEL SKIN (OTHER THAN TABS OR VANES) IS LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL IN THE SHORTEST DIRECTION OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.



r = RADIUS OF CUTOUT (MUST BE FULL AND 1/2 INCH MIN)
W = 50T IN HONEYCOMB PANEL SKINS
T = GAGE OF CUTOUT SHEET
R = W + r

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
3. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ALSO APPLY TO DAMAGED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR, AND DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-624

Aluminum Alloy to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 4 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY WING MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ★

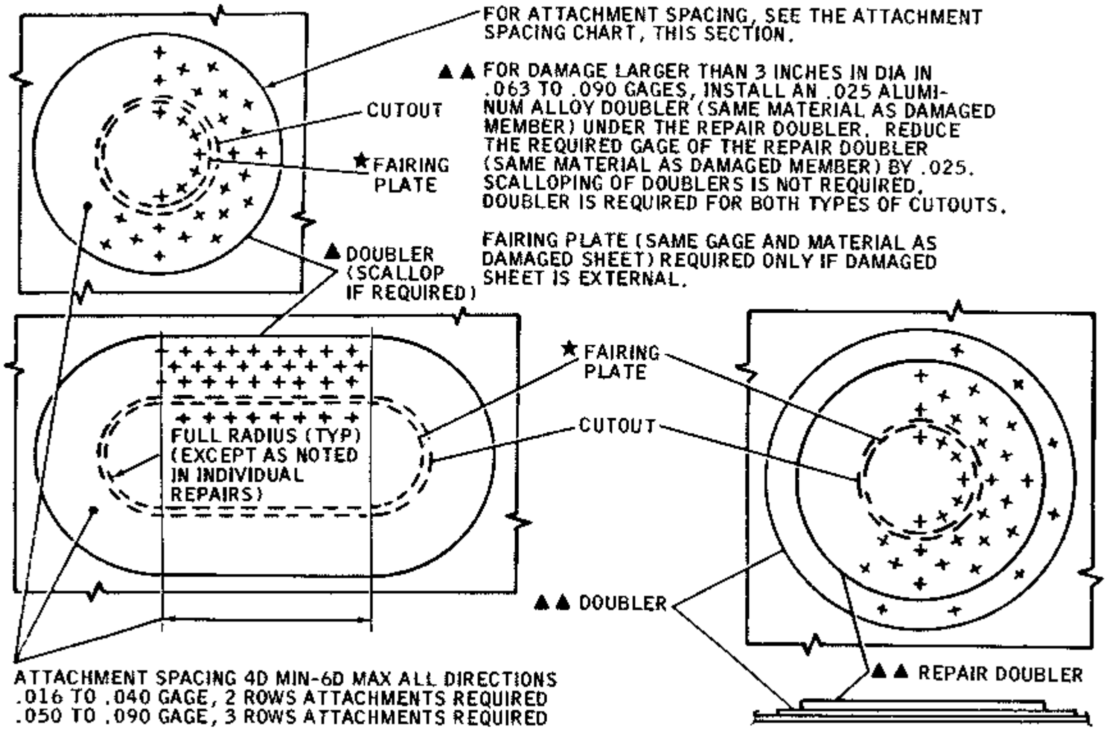
ALUMINUM ALLOY TO ALUMINUM ALLOY REPAIR

TYPE OF DAMAGED MEMBER

ALUMINUM ALLOY SHEET

.016 TO .090 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING AN ALUMINUM ALLOY DOUBLER. INSTALL DOUBLER WITH ATTACHMENTS AND BOND PER 51-70-2. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN STRENGTH CALCULATIONS EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED, AND CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAXIMUM CUTOUT DIAMETER ALLOWABLE IS SHOWN ON THE ATTACHMENT SPACING CHART, THIS SECTION. EXTENSIVE DAMAGE REQUIRES A PRODUCTION-TYPE SPLICING OF THE SHEET OR REPLACEMENT OF THE SHEET TO THE NEAREST PRODUCTION SPLICE.
4. GLASS FIBER LAYUP DOUBLERS MAY ALSO BE USED IN CUTOUT REPAIRS UP TO .040 GAGE AS ILLUSTRATED ON ANOTHER ILLUSTRATION, THIS SECTION. HOWEVER, AN ALUMINUM ALLOY DOUBLER IS PREFERRED.



FOR ATTACHMENT SPACING, SEE THE ATTACHMENT SPACING CHART, THIS SECTION.

▲▲ FOR DAMAGE LARGER THAN 3 INCHES IN DIA IN .063 TO .090 GAGES, INSTALL AN .025 ALUMINUM ALLOY DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) UNDER THE REPAIR DOUBLER. REDUCE THE REQUIRED GAGE OF THE REPAIR DOUBLER (SAME MATERIAL AS DAMAGED MEMBER) BY .025. SCALLOPING OF DOUBLERS IS NOT REQUIRED. DOUBLER IS REQUIRED FOR BOTH TYPES OF CUTOUTS.

FAIRING PLATE (SAME GAGE AND MATERIAL AS DAMAGED SHEET) REQUIRED ONLY IF DAMAGED SHEET IS EXTERNAL.

ATTACHMENT SPACING 4D MIN-6D MAX ALL DIRECTIONS
.016 TO .040 GAGE, 2 ROWS ATTACHMENTS REQUIRED
.050 TO .090 GAGE, 3 ROWS ATTACHMENTS REQUIRED

1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. GAPPING OR MISMATCH (BEFORE APPLYING ADHESIVE) MUST NOT EXCEED .032 INCH OVER THE FAYING SURFACE BETWEEN THE FORMED DOUBLER AND THE CUTOUT MEMBER. SEE THE GLASS FIBER LAYUP REPAIRS FOR REPAIRS IN DIFFICULT FORMING AREAS.
3. DO NOT USE ADHESIVE IN REPAIRS IN THE FUEL TANKS.

▲ ALUMINUM ALLOY DOUBLER OR REPAIR PLUG (SAME GAGE AND MATERIAL AS DAMAGED MEMBER, UNLESS OTHERWISE NOTED IN THE INDIVIDUAL REPAIR).

★ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-625

Aluminum Alloy to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 4 (Sheet 2)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY WING MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR
(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER
ALUMINUM HONEYCOMB PANEL SKINS
.010 TO .040 GAGE

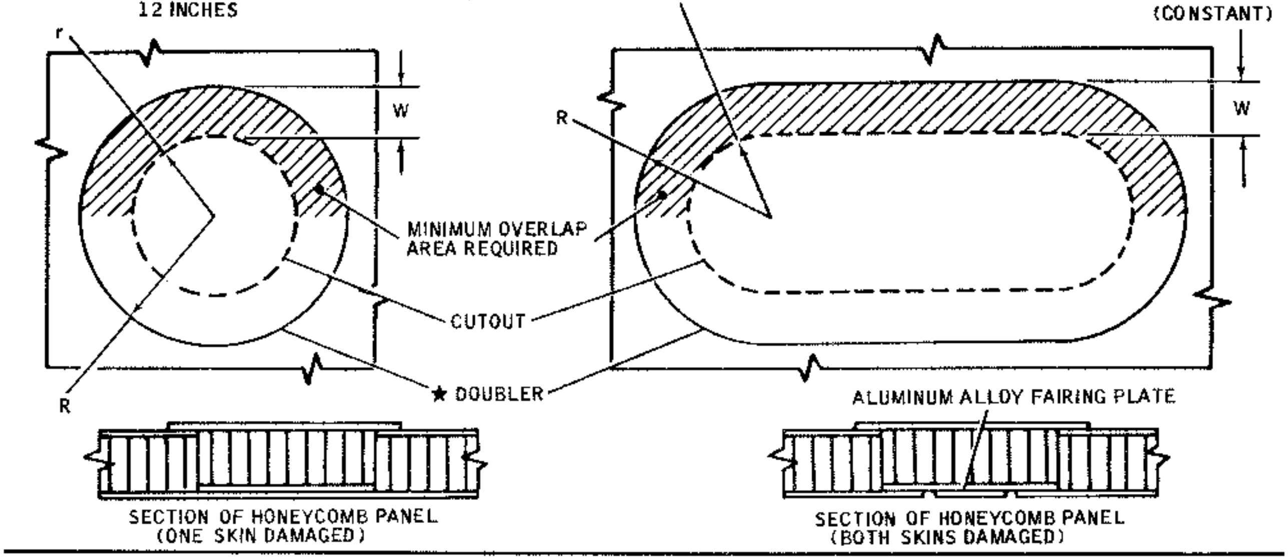
1. REPAIR SKIN CUTOUT DAMAGE, USING A REPAIR PLUG MADE WITH GLASS FIBER LAYUP DOUBLERS, AND REPAIR CORE BONDED PER 51-70-3. SEE SKETCHES BELOW.
2. DO NOT USE A LAYUP DOUBLER (WITHOUT ATTACHMENTS) IF THE ADHESIVE WILL BE LOADED IN TENSION OR PEEL.
3. IF THE MINIMUM OVERLAP CANNOT BE MAINTAINED, THEN ATTACHMENTS MUST BE ADDED (AFTER CURING) TO DEVELOP THE REQUIRED STRENGTH IN THE REPAIR. COMPUTE THE ULTIMATE SHEAR STRENGTH OF THE ADHESIVE EQUAL TO 250 PSI.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. DAMAGE TO THE CONTROL SURFACE TAB SKINS, GREATER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION, OR GREATER THAN 8 INCHES IN LENGTH SPANWISE, SHOULD NOT BE REPAIRED. REPLACE THE TAB.
6. DAMAGE TO THE VANE SKINS, LARGER THAN ONE-FOURTH OF THE CHORD LENGTH IN THE CHORD DIRECTION, OR GREATER THAN 18 INCHES IN LENGTH SPANWISE, REQUIRES SPECIFIC ENGINEERING INSTRUCTIONS.
7. IF DAMAGE IN PANEL SKIN (OTHER THAN TABS OR VANE) IS LONGER THAN ONE-FOURTH OF THE DISTANCE ACROSS THE PANEL IN THE SHORTEST DIRECTION OR IF THE REQUIRED REPAIR DOUBLER WOULD COVER MORE THAN 20 PERCENT OF THE PANEL, THEN THE PANEL SHOULD BE REPLACED.

NOTES:

1. HONEYCOMB PANEL OVERLAPS ARE DETERMINED IN THE SAME MANNER ON BOTH SKINS
2. RADIUS r NOT TO EXCEED 4 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 12 INCHES

r = RADIUS OF CUTOUT
W = 80T
T = GAGE OF CUTOUT SKIN
R = W + r

r MUST BE FULL RADIUS AND NOT LESS THAN 1/2 INCH



1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE IN REPAIRS IN FUEL TANKS.

★ GLASS FIBER LAYUP DOUBLER AND REPAIR CORE (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF DAMAGED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-626

Glass Fiber Layup to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 5 (Sheet 1)

DESIGN REQUIREMENTS FOR REPAIR OF CUTOUT DAMAGE IN ALUMINUM ALLOY WING MEMBERS WHEN THE DAMAGE IS LARGER THAN THE LIMIT SPECIFIED IN THE INDIVIDUAL REPAIR ▲

GLASS FIBER LAYUP TO ALUMINUM ALLOY REPAIR

(PRIMARILY FOR REPAIR REQUIRING DIFFICULT FORMING OPERATIONS TO THE DOUBLER)

TYPE OF DAMAGED MEMBER

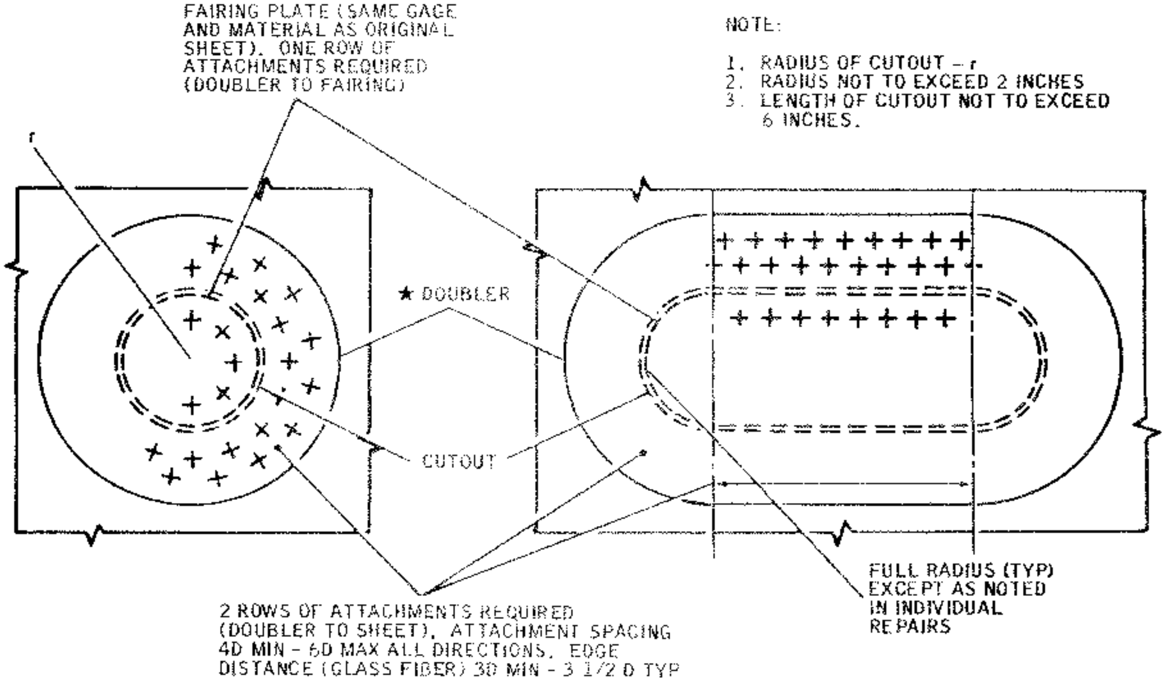
ALUMINUM ALLOY SHEET

.016 TO .040 GAGE

1. REPAIR SHEET CUTOUT DAMAGE, USING A GLASS FIBER LAYUP DOUBLER, INSTALL DOUBLER AND FAIRING PLATE WITH ATTACHMENTS AND BONDED PER 51-70-3. SEE SKETCHES BELOW.
2. THE ADHESIVE HAS NOT BEEN CONSIDERED IN THE STRENGTH CALCULATIONS, EVEN THOUGH IT WILL CARRY A PORTION OF THE LOAD. ATTACHMENTS MUST BE USED AND THEY MUST BE CALCULATED TO CARRY THE TOTAL LOAD. THE ADHESIVE WILL LOWER THE STRESS CONCENTRATION AROUND THE ATTACHMENT HOLES AND WILL ACT AS A SEALANT AT THE FAYING SURFACE.
3. MAKE CERTAIN THAT A FAIRING PLATE IS ATTACHED AND BONDED IN THE CUTOUT. THE FAIRING PLATE WILL STIFFEN THE GLASS FIBER AND WILL SERVE AS SURFACE FOR LAYUP. INSTALL ATTACHMENTS AFTER CURING.
4. ALWAYS INSTALL AN ALUMINUM ALLOY WASHER ON THE GLASS FIBER SIDE OF THE REPAIR AT ATTACHMENTS.
5. DO NOT USE GLASS FIBER REPAIRS IN THE FUEL TANKS.

NOTE:

1. RADIUS OF CUTOUT – r
2. RADIUS NOT TO EXCEED 2 INCHES
3. LENGTH OF CUTOUT NOT TO EXCEED 6 INCHES.



1. DO NOT USE ADHESIVE IN REPAIRS WHERE THE OPERATING TEMPERATURE IS HIGHER THAN 52°C (125°F).
2. DO NOT USE ADHESIVE IN REPAIRS IN FUEL TANKS.

★ GLASS FIBER LAYUP DOUBLER (SEE GLASS FIBER PLY CHART FOR NUMBER OF PLIES REQUIRED).

▲ THESE INSTRUCTIONS ARE ALSO APPLICABLE TO THE TYPES OF CRACKED WING MEMBERS LISTED IN THE ILLUSTRATION THAT ARE NOT COVERED BY AN INDIVIDUAL REPAIR. THESE INSTRUCTIONS DO NOT NULLIFY INDIVIDUAL REPAIR REQUIREMENTS.

BB3-627

Glass Fiber Layup to Aluminum Alloy Repairs
(Damage Requiring Cutouts)
Figure 5 (Sheet 2)

B. Determine the number of 181 bidirectional glass fiber cloth plies required for making glass cloth repairs as follows:

Damaged Aluminum Gage	Total Number of Plies
.016	3
.020	4
.025	5
.032	6
.040	7
.050	9
.063	11
.071	12
.080	14
.090	15

<u>NOTES</u>: 1. When applying the glass fiber cloth to both sides of the damaged aluminum alloy sheet, place half of the total plies on each side. If the total number of plies is an odd number, add one more ply.

2. For members with extreme curvature, it may be desirable to use the thinner bidirectional cloth Number 120. In this instance, double, the number of plies specified above.

3. Arrange the pattern of the glass cloth so that the threads are parallel to, and 90 degrees from, the direction of the crack.

4. This chart is for use only when specified in other repairs of this manual.

Glass Fiber Ply Chart
Figure 6

3. Attachment Spacing Chart

A. Determine the number of equal spaces required in the first row of attachments around a repaired hole from the following chart. The repair hole diameter must be no smaller than the minimum diameters given in the eight equal spaces column of the chart.

Plating Repair Cutout Diameter (Inches)						Attachment Diameter
1 to 1-1/4	1-1/4 to 2	2 to 3-1/4	3-1/4 to 5-1/4	5-1/4 to 7	7 to 11	1/8
1 to 1-3/4	1-3/4 to 3	3 to 4	4 to 6-1/2	6-1/2 to 9	9 to 13-3/4	5/32
1 to 2	2 to 3	3 to 5	5 to 8	8 to 11	11 to 16-1/2	3/16
1-1/2 to 2-3/4	2-3/4 to 4	4 to 6-1/2	6-1/2 to 10-1/2	10-1/2 to 14-1/2		1/4
8 Equal Spaces	12 Equal Spaces	16 Equal Spaces	24 Equal Spaces	36 Equal Spaces	48 Equal Spaces	

Attachment Spacing Chart
Figure 7

NOTE: Do not use chart (Figure 7) in making repairs unless it is specifically referenced for a particular repair.

4. Restricted Repair Areas

A. The repairs provided in this section are restricted in the areas outlined in Figure 8.

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 2 -- Aluminum Alloy to Aluminum Alloy Repairs (Cracked Members)	Bonded	Aluminum Honeycomb Panel Skin .010 to .040 Gage	None
	Bonded and Riveted	Aluminum Alloy Sheet .016 to .090 Gage	Aileron (Upper and Lower Surfaces) XA400 to XA405 XA463 to XA470 XA497 to XA501
		Aluminum Alloy Extruded, Formed, Rolled Sections .016 to .125 Gage	None

Restricted Repair Area Chart
Figure 8 (Sheet 1)

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 3 -- Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Member)	Bonded	Aluminum Honeycomb Panel Skin .010 to .040 Gage	Flap Vanes Movable ----------- XF 69, XF 112. Inboard Fixed XF 114, XF 143, XF 171 Center Fixed ------ XF 235, XF 267 Outboard Fixed ---- XF 315, XF 338
			Spoilers Ground ------------ XGS 113, XGS 137, XGS 161 Inboard Flight ---- XTE 162, XTE 206, XTE 251 Outboard Flight --- XTE 252, XTE 297, XTE 341
			Aileron Control Tab XA 386 to XA 396 XA 405 to XA 416
	Bonded and Riveted	Aluminum Alloy Sheet .016 to .050 Gage	Flaps See 57-03, (Flap Plating Crack Repair) Aileron XA 370 to XA 502

Restricted Repair Area Chart
Figure 8 (Sheet 2)

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 3 -- Glass Fiber Layup to Aluminum Alloy Repairs (Cracked Member)	Bonded Only or Riveted Also	Aluminum Alloy Formed, Rolled Sections .016 to .080 Gage	Trailing Edge Closing Channels Cracks Perpendicular to Fillet
	Bonded	Aluminum Alloy Ribs, Intercostals, and Stiffener .016 to .080 Gage	Flaps See 57-02 (Flap Intermediate Rib Repair) Ailerons See 57-02 (Aileron Intermediate Rib Repair) and Ribs at XW 352, XA 374, XA 377, XA 391, XA 400, XA 405, XA 411, XA 427, XA 436, XA 452, XA 463, XA 465, XA 470, XA 497, XA 501, XW 485
Figure 4 -- Aluminum Alloy to Aluminum Alloy Repairs (Damage Requiring Cutout)	Bonded	Aluminum Honeycomb Panel Skin .010 to .040 Gage	None
	Bonded and Riveted	Aluminum Alloy Sheet .016 to .090 Gage	Aileron XA 400 to XA 405 XA 463 to XA 470 XA 497 to XA 501
Figure 5 -- Glass Fiber Layup to Aluminum Alloy Repairs (Damage Requiring Cutouts)	Bonded	Aluminum Honeycomb Panel Skin .010 to .040 Gage	Flap Vanes Movable ----------- XF 69, XF 112 Inboard Fixed ----- XF 114, XF 143, XF 171

Restricted Repair Area Chart
Figure 8 (Sheet 3)

Repair	Type of Repair	Type of Damaged Member	Restricted Area
Figure 5 -- Glass Fiber Layup to Aluminum Alloy Repairs (Damage Requiring Cutouts)	Bonded	Aluminum Honeycomb Panel Skin .010 to .040 Gage	Flap Vanes (CONT) Center Fixed ------ XF 235, XF 267 Outboard Fixed ---- XF 315, XF 338
			Spoilers Ground ------------ XGS 113, XGS 137, XGS 161 Inboard Flight ---- XTE 162, XTE 206, XTE 251 Outboard Flight --- XTE 252, XTE 297, XTE 341
			Aileron Control Tab XA 386 to XA 396 XA 405 to XA 416
	Bonded and Riveted	Aluminum Alloy Sheet .016 to .040 Gage	Flaps See 57-03, (Flap Plating Crack Repair)
			Aileron XW 354 to XW 485 (Upper and Lower Surfaces)

Restricted Repair Area Chart
Figure 8 (Sheet 4)

WING RIBS AND INTERNAL STRUCTURE REPAIRS -

DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The repairs described in this section are applicable for the flap and aileron intermediate ribs.

2. Flap Intermediate Rib Repair - Class A (See Figure 1)

A. Repair damage of a crack nature occuring along the radius of a lightening hole, but not longer than half the distance across the rib web in the crack area, as follows:

(1) Drill 1/4-inch diameter stop holes at ends of crack or cracks.

(2) Apply adhesive and layup glass fiber doublers on each side of web in accordance with 51-70-3.

(3) Install the repair rivets, using AN960 aluminum washer on each glass fiber side.

3. Aileron Intermediate Rib Repair - Class A (See Figure 2)

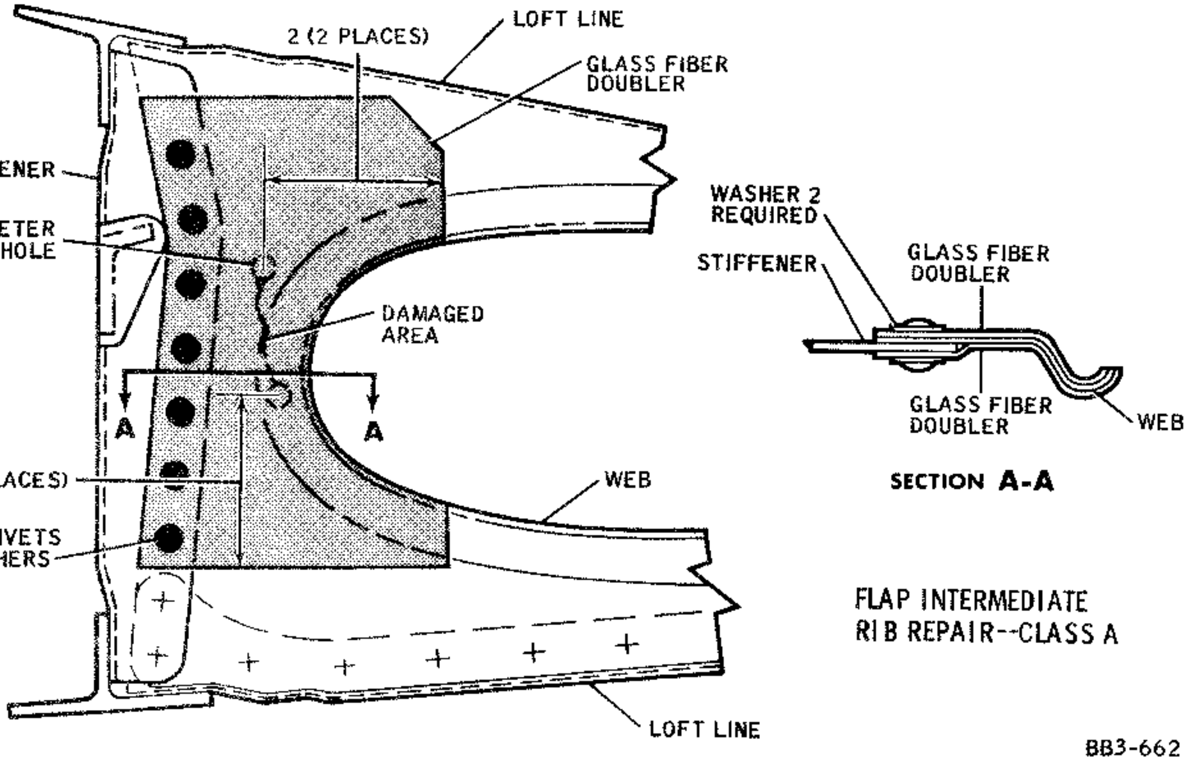
A. Repair damage of a crack nature occuring along the radius of a lightening hole, but not longer than half the distance across the rib web in the crack area, as follows:

(1) Drill 1/4-inch diameter stop holes at ends of crack or cracks.

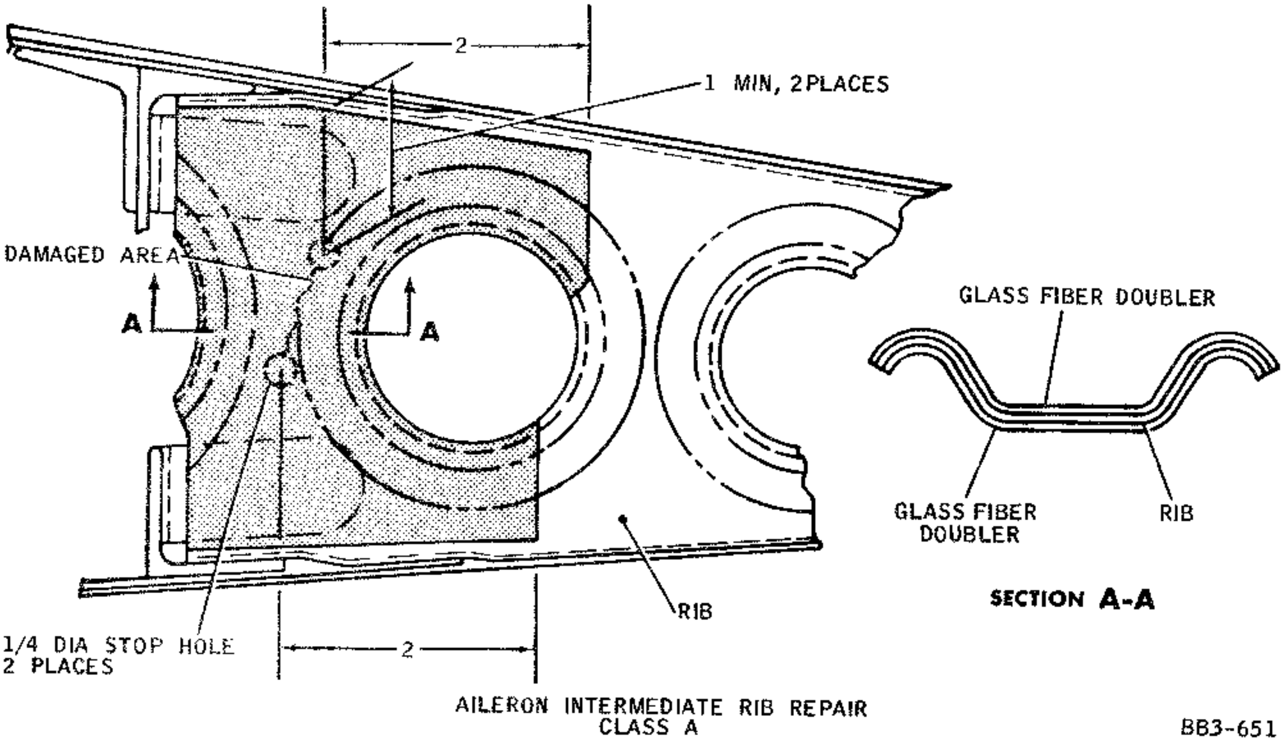
(2) Determine the proper number of plies of glass fiber plies from glass fibe ply chart of 57-01.

(3) Apply adhesive and layup glass fiber doubler in accordance with 51-70-3.

(4) Check balance condition of aileron in accordance with 57-50-1.



Flap Intermediate Rib Repair -- Class A
Figure 1



Aileron Intermediate Rib Repair -- Class A
Figure 2

WING PLATING REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The plating repairs described in this section are applicable for repair of the wingtip, flap, and aileron.

B. Information relative to the repair of the wing constant section plating is not presented here. Repair damage occuring to the plating in this area, by specific engineering instructions only.

2. Wingtip Scratch, Gouge, and Ding Repair -- Class B

A. Scratches, gouges, or dings that do not penetrate the clad do not require repair.

B. Repair scratches, or gouges, that penetrate the clad up to depth shown in Figure 1, example A, by rounding out and tapering.

C. Repair dents that are deeper than the limits shown in Figure 1, example A, by installing dent filler retainer rivets and filling dent with Pro-Seal 735 as shown in Figure 1, example B.

3. Wingtip Crack and Dent Repair -- Class A (See Figure 2.)

A. Accomplish Class A repair of dents that are cracked or deeper than 3/4 inch as follows:

(1) Remove the damage as shown in Figure 2.

(2) Prepare repair doubler and fairing of same gage and material as existing skin.

(3) Prepare repair splice of .050 Clad 2024-T3 as shown in Figure 2.

(4) Install doubler, fairing, and splice using rivets specified in Figure 2.

(5) Maintain rivet spacing as outlined in attachment spacing chart of 57-01.

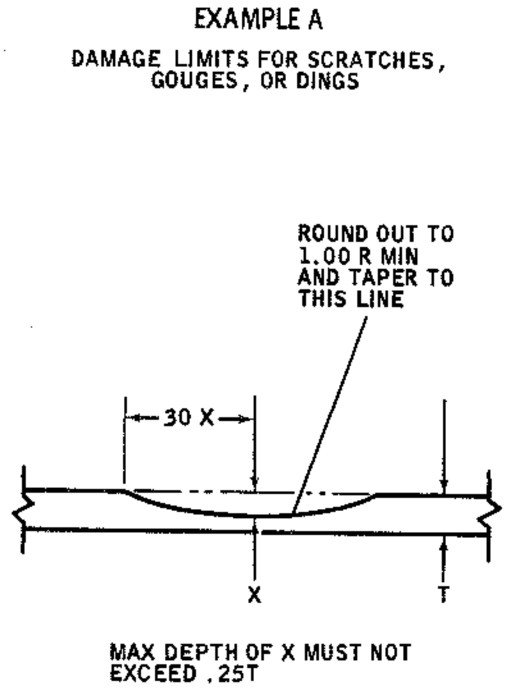
3A. Wingtip Crack and Dent Repair -- Class B (See Figure 2A.)

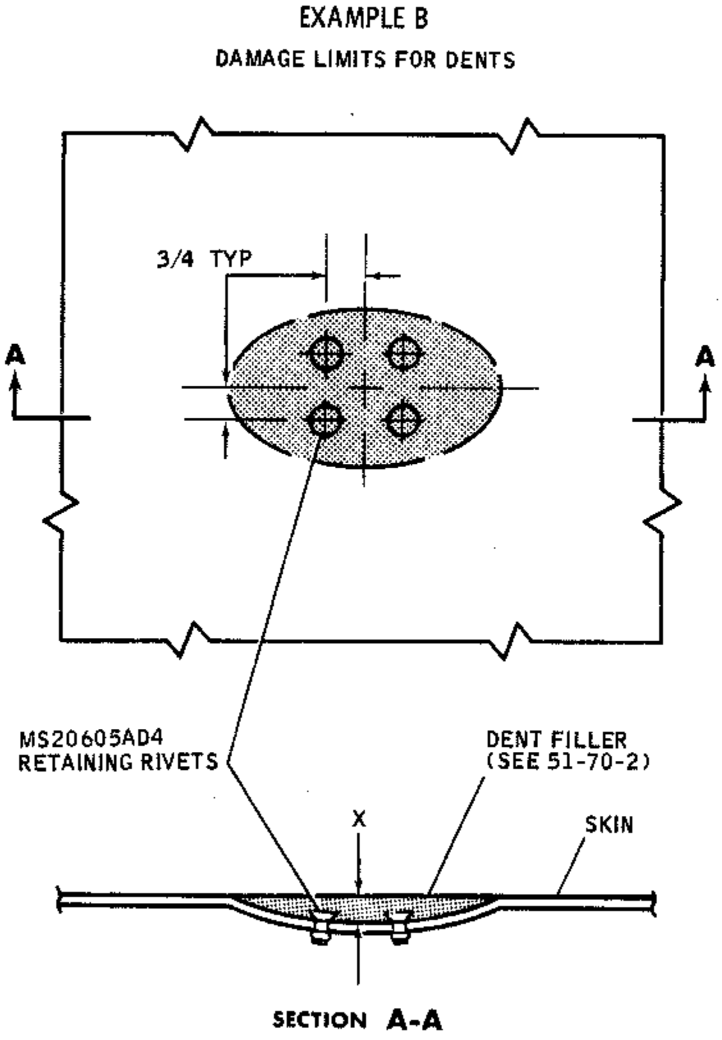
A. Accomplish Class B repair of dents that are cracked or deeper than 3/4 inch as follows:

(1) Remove damage as shown in Figure 2A.

(2) Prepare repair doubler using same gage and material as existing skin.

(3) Apply faying surface seal of PR-1422 (see 51-20-0) to doubler and skin.



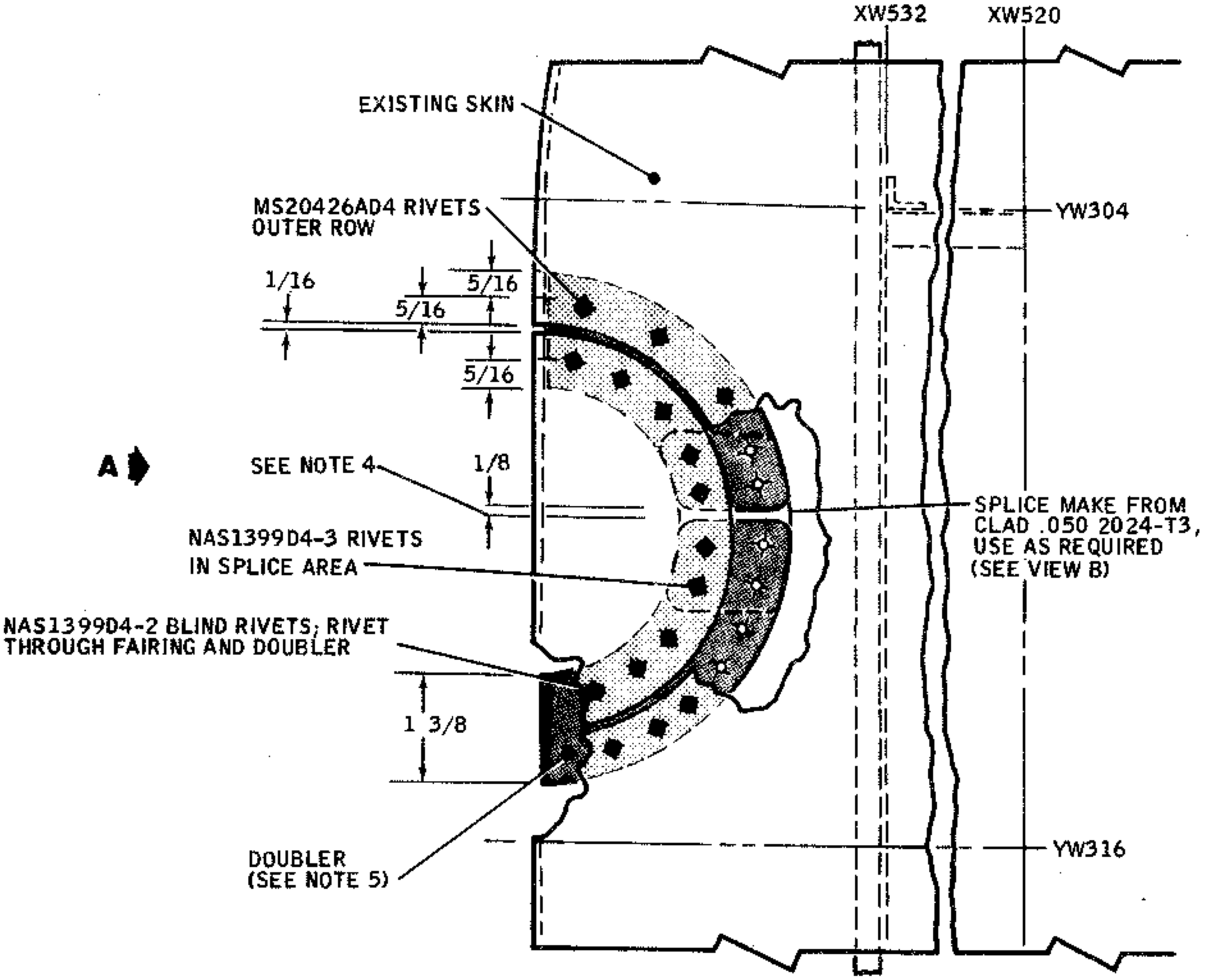


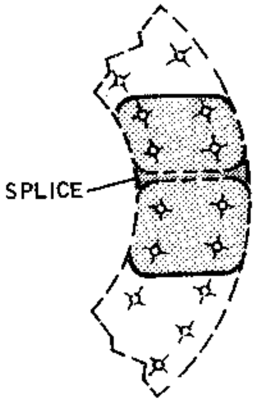
NOTES:

1. INSTALL MS20605AD4 DENT FILLER RETAINING RIVETS.
2. DO NOT COUNTERSINK RIVETS. THE HEAD ACTS AS A MECHANICAL RETAINING DEVICE FOR DENT FILLER.
3. FILL DENTS WITH PRO-SEAL 735. SEE 51-70-2.
4. MAX DEPTH OF X NOT TO EXCEED 3/4-INCH FOR DENTS.

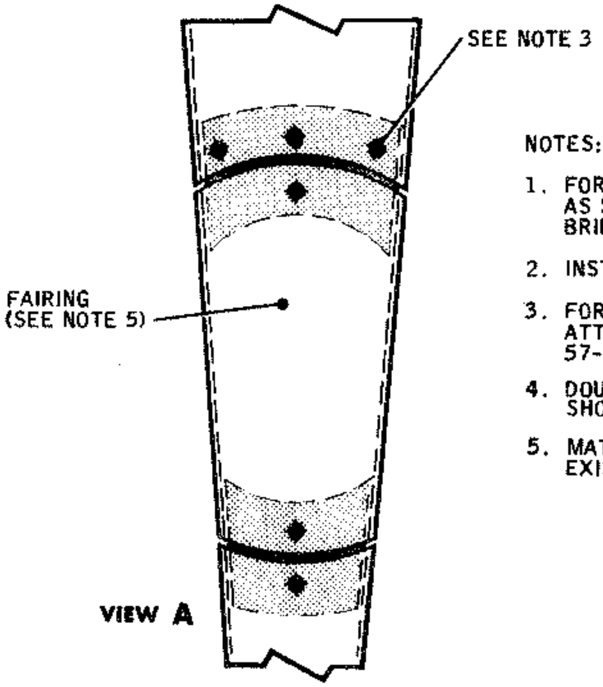
BB3-645A

Wingtip Damage Limits and Repair -- Class B
Figure 1





VIEW B
DETAIL OF SPLICE



VIEW A

NOTES:

1. FOR EVERY CUT IN DOUBLER, AS SHOWN, CUT MUST BE BRIDGED WITH A SPLICE.
2. INSTALL ATTACHMENTS AS SHOWN.
3. FOR SPACING OF RIVETS SEE ATTACHMENT SPACING CHART 57-01.
4. DOUBLER MAY BE INSTALLED AS SHOWN, OR IN TWO PIECES.
5. MATERIAL AND GAGE SAME AS EXISTING SKIN.

B83-649A

Wingtip Crack and Dent Repair -- Class A
Figure 2

Printed in U.S.A.

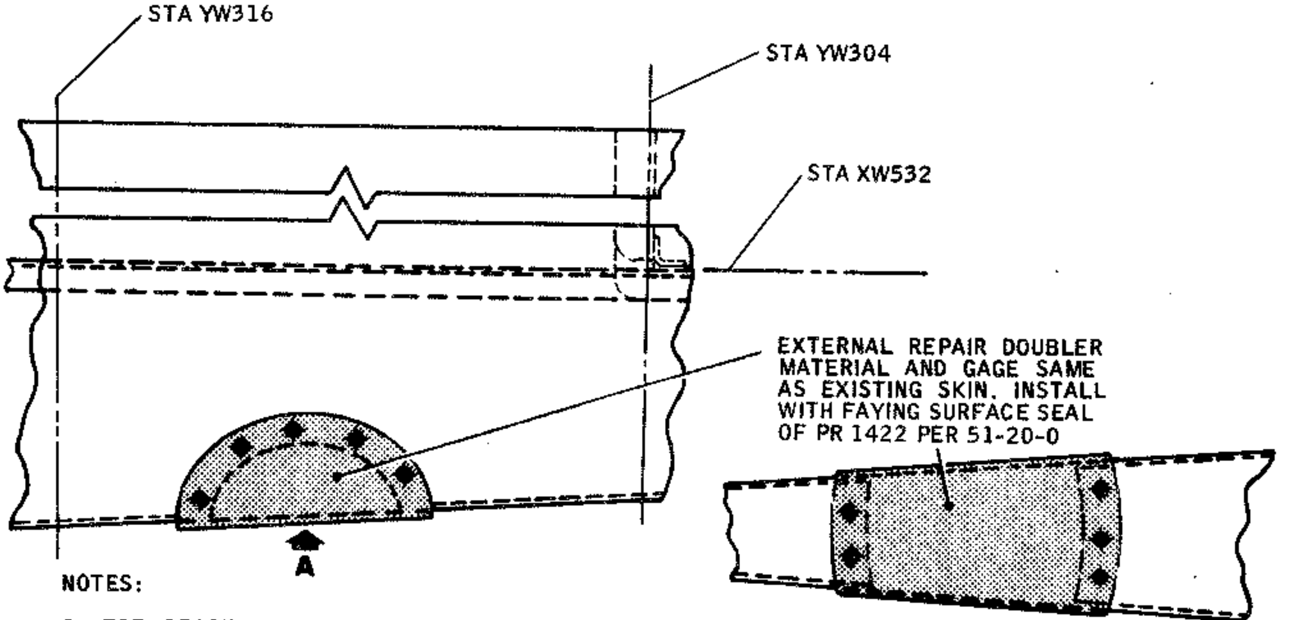
(4) Install doubler using NAS1399D4 rivets. Maintain rivet spacing as outlined in attachment spacing chart of 57-01.

NOTE: The adhesive does not require the temperature cure outlined in 51-20-0 if a strip of masking tape is installed around edge of doubler to protect the adhesive from fluids. The tape should remain in place at least 96 hours.

4. Flap Plating Crack Repair -- Class A (See Figure 3)

A. Repair damage of crack nature occurring to the plating, not over 4 inches in length and within areas outlined in Figure 4, as follows:

(1) Drill stop holes at ends of the crack, using a 1/4-inch diameter drill.

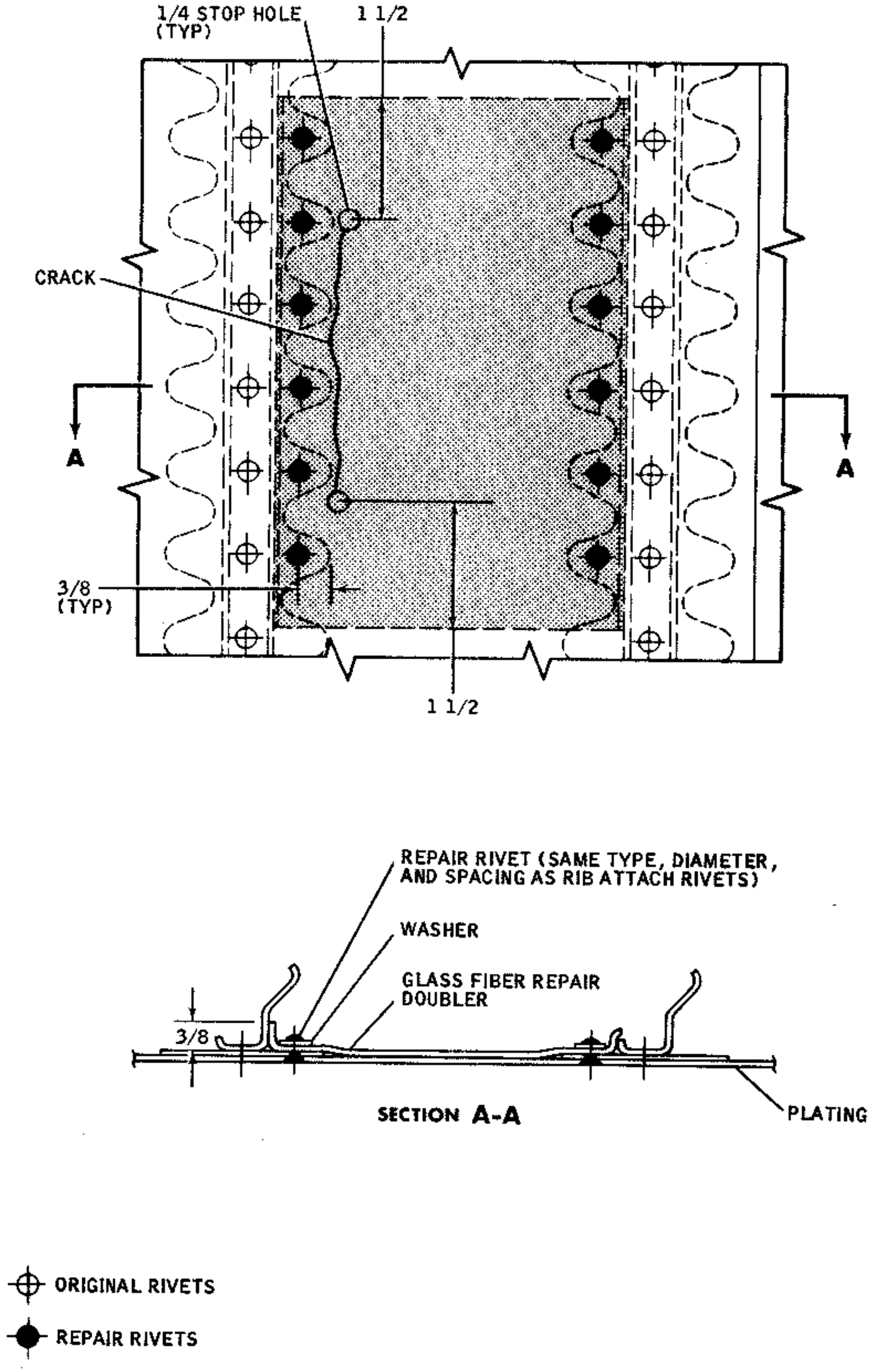


NOTES:

1. FOR SPACING OF RIVETS SEE ATTACHMENT SPACING CHART 57-01
2. ◆ NAS1399D4 RIVETS

BB3-650

Wingtip Repair (Damage Requiring Cutout) -- Class B
Figure 2A



BB3-655

Aileron and Flap Plating Crack Repair -- Class A
Figure 3

(2) Apply adhesive and layup the glass fiber doubler in accordance with 51-70-3. Determine required number of plies from glass fiber ply chart of 57-01.

(3) Install the repair rivets, using AN960 aluminum washers on the glass fiber side of the repair.

NOTE: The repair may be used between the stations outlined in Figure 4. See 57-50-3 for station locations.

5. <u>Aileron Plating Crack Repair -- Class A</u> (See Figure 3.)

A. Repair damage of a crack nature occuring to the plating, but not over 2 inches in length, as follows:

(1) Repair as outlined in paragraph 4.

NOTE: The repair may be used between the stations outlined in Figure 5. See 57-50-2 for station locations.

Flap Top Surface (Station)	Flap Bottom Surface (Station)
From XFLS 69 to XRS 164	From XF 114 to XRS 164
From XFLS 166 to XFLS 253	From XFLS 166 to XFLS 253
From XFLS 267 to XFLS 338	From XFLS 267 to XFLS 338
From XFLS 351 to XW351	From XFLS 351 to SW 351

Flap Plating Crack Repair Allowable Repair Locations
Figure 4

Both Surfaces (Station)
From XA 377 Canted to XA 400
From XA 405 to XA 463
From XA 470 to XA 497
From XA 501 to XW 485

Aileron Plating Crack Repair Allowable Repair Locations
Figure 5

6. Flap and Aileron Plating Repair -- Class A (See Figure 6)

A. Repair damage that is considered detrimental, but not over 2 inches in diameter, and does not extend into the bonded doubler, as follows:

(1) Remove the damaged plating, making a circular-shaped cutout.

(2) Apply adhesive and layup a glass fiber doubler in accordance with 51-70-3. Determine required number of plies from glass fiber ply chart of 57-01.

(3) Install the repair rivets, using AN960 aluminum washers on the glass fiber side of the repair.

7. Flap Plating Repair -- Class B (See Figure 7)

A. Repair small plating dings, nicks, and punctures not larger than 1-inch diameter as follows:

(1) Remove the damaged plating, making a circular-shaped cutout. The cutout should be just large enough to clear away the damage. Smoothen the edges of the cutout.

NOTE: When drilling through the flap plating and cutting away the damage, exercise care to prevent damage to internal structure.

(2) Prepare repair doubler as shown in Figure 7.

(3) Apply adhesive to the faying side of the doubler and bond as described in 51-70-2.

(4) Attach the doubler with four blind rivets, equally spaced.

8. Flap Trailing Edge Repairs - Class A (See Figures 8 and 9)

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge, as outlined in Figure 8 and as follows:

(1) See 57-01 for general requirements.

(2) Cut out damaged section as shown in Figure 8.

(3) Prepare Lefkoweld 109 in accordance with 51-70-2.

(4) Fill repair area solid with mixture of Lefkoweld 109 and glass fibers. Contour to shape desired.

(5) Lay up glass fiber doubler, or doubler of Scotch No. 853 tape, or equivalent, as shown in Figure 8.

(6) Bond glass fiber doubler in accordance with Section 51-70-2.

TEMPORARY REVISION 57-25

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 57-03, Page 5. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Changes part number of tape used in flap trailing edge repair.
EFFECTIVITY:	All

8. Flap Trailing Edge Repairs - Class A (See Figures 8 and 9)

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge as outlined in Figure 8 and as follows:

(1) See 57-01 for general requirements.

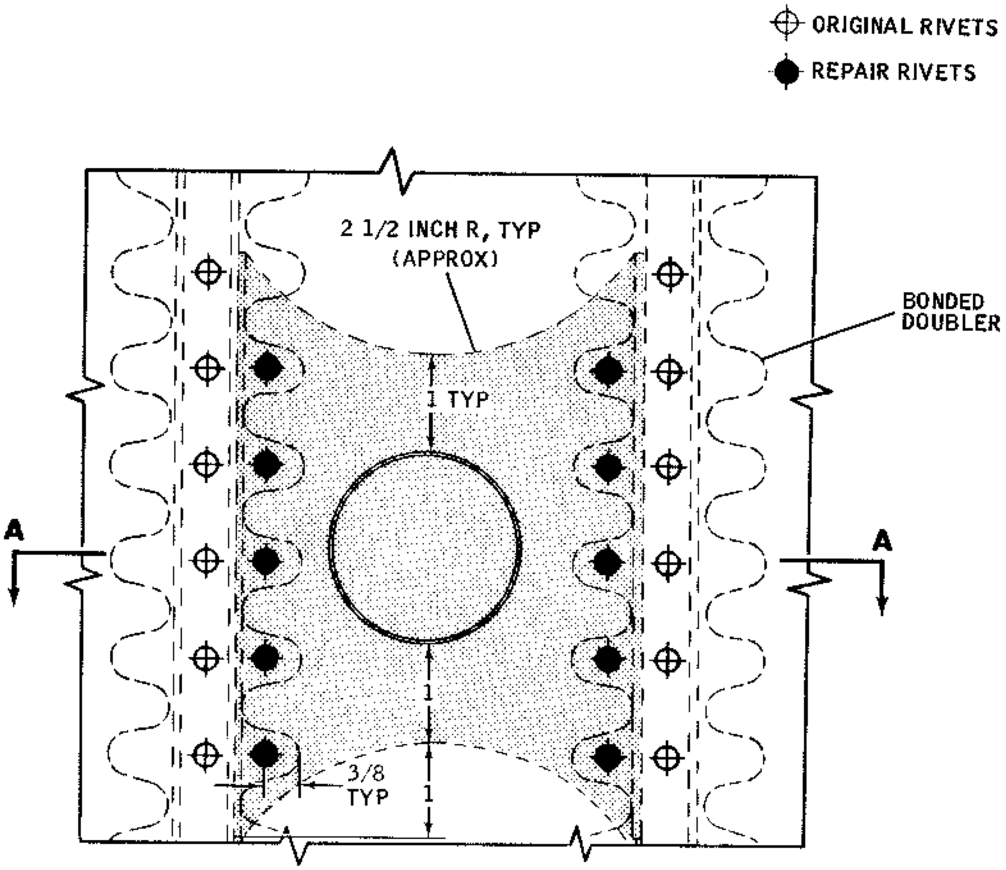
(2) Cut out damaged section as shown in Figure 8.

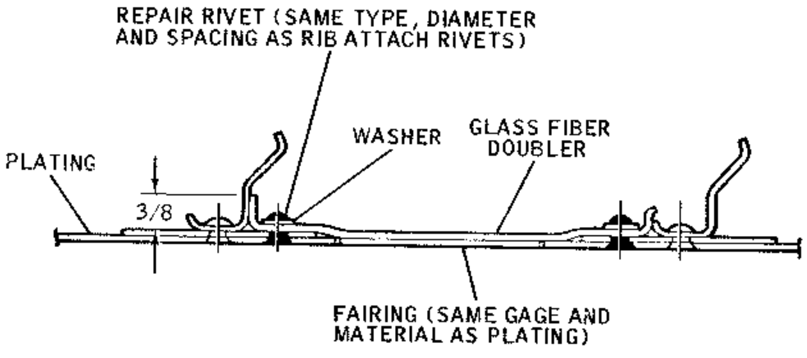
(3) Prepare Lefkoweld 109 in accordance with 51-70-2.

(4) Fill repair area solid with mixture of Lefkoweld 109 and glass fibers. Contour to shape desired.

(5) Lay up glass fiber doubler, or doubler of Scotch No. 853 tape, or equivalent, as shown in Figure 8.

(6) Bond glass fiber doubler in accordance with Section 51-70-2.

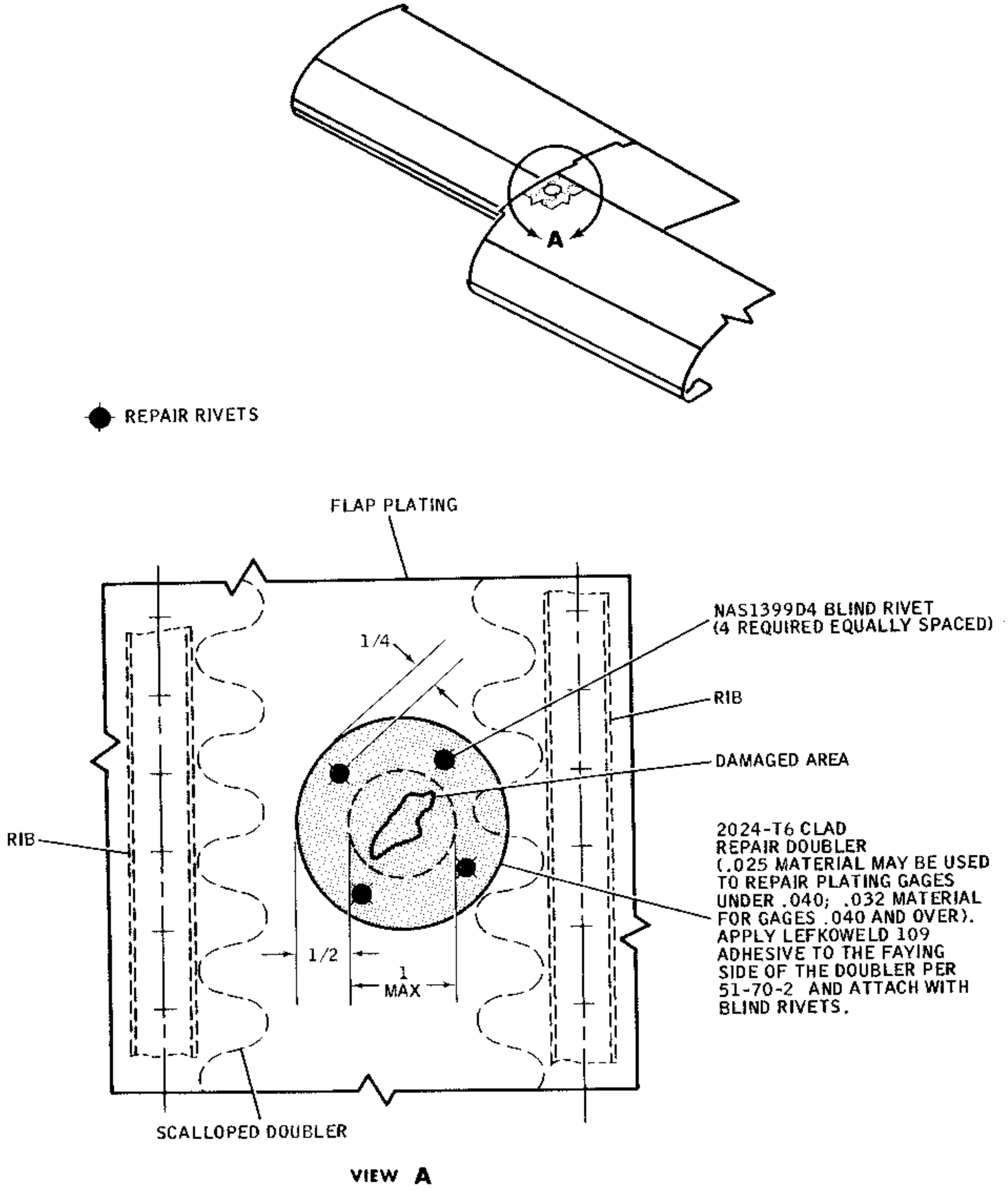




SECTION A-A

BB3-654

Aileron and Flap Plating Repair -- Class A
Figure 6



Flap Plating Repair -- Class B
Figure 7

TEMPORARY REVISION 57-26

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 57-03, Page 8. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Changes flap and aileron trailing edge repairs by adding requirement for zee, by changing type of repair rivets, and by changing part number of tape used in repair doubler.
EFFECTIVITY:	ALL

B. Repair extensive damage occurring to glass fiber trailing edge as outlined in Figure 9 and as follows:

(1) Cut out damaged section and remove existing rivets from structure in repair area.

(2) Prepare replacement section of trailing edge formed section to fit cutout.

(3) Fabricate zee as shown in Figure 9.

(4) Install zee and glass fiber section and install rivets as shown in Figure 9.

(5) Install doubler of Scotch No. 853 polyester tape, or equivalent, over both spliced ends as shown in Figure 9.

NOTE: If area is to be painted, it must be painted before applying tape.

9. Aileron Trailing Edge Repairs - Class A

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge as follows:

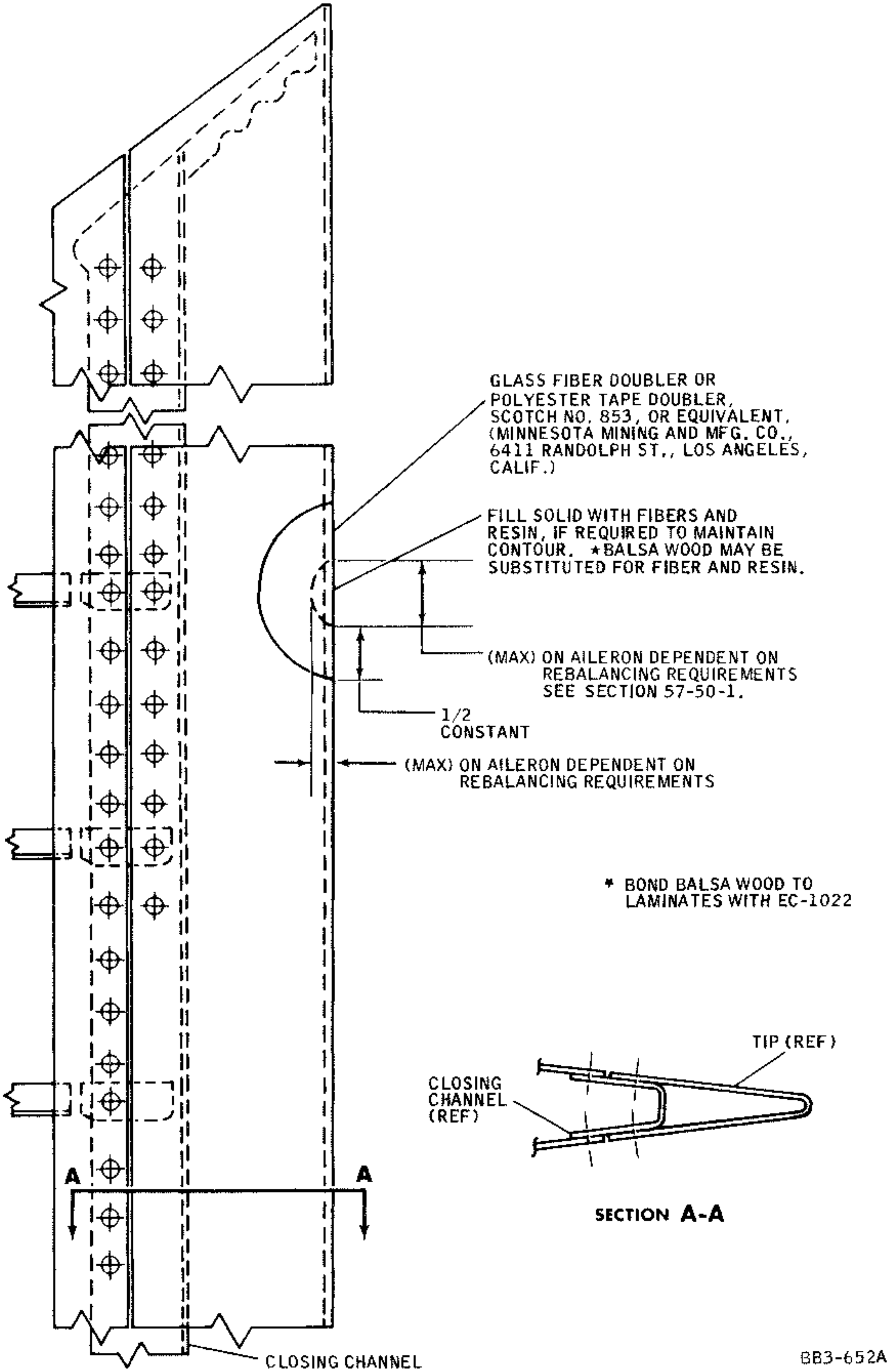
(1) Follow the procedure outlined in Paragraph 8, step A, except that, dependent upon balance requirements, balsa wood may be substituted in place of Lefkoweld 109 and glass fibers. If balsa wood is used, sand with number 80 grit sandpaper, clean with clean, dry cloth, and bond with EC-1022.

(2) Check balance condition of aileron in accordance with Section 57-50-1.

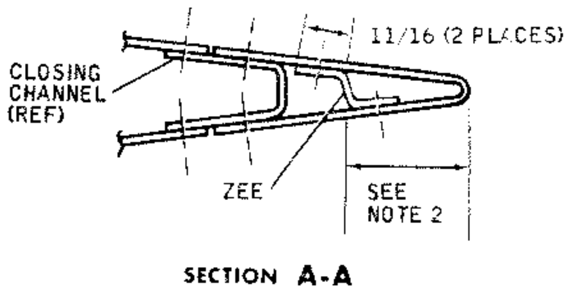
B. Repair extensive damage occurring to glass fiber trailing edge as follows:

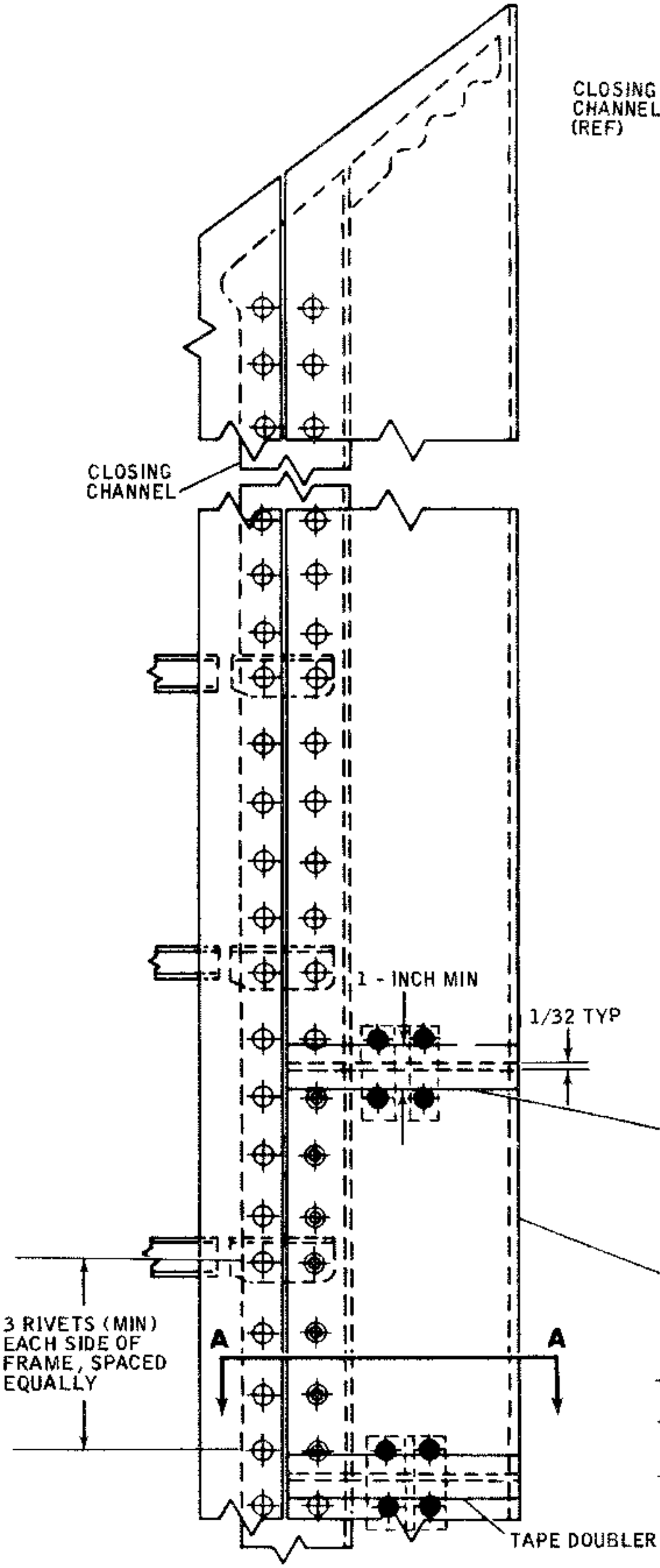
(1) Follow the procedure outlined in paragraph 8, step B.

(2) Check balance condition of aileron in accordance with Section 57-50-1.



Aileron and Flap Trailing Edge Gouge Repair - Class A
Figure 8





NOTES:

1. MAKE ZEE FROM .032 CLAD 2024-T3. MAINTAIN 1/8 BEND RADIUS.
2. OPTIMUM LOCATION IS MIDWAY BETWEEN CLOSING CHANNEL AND TRAILING EDGE. DETERMINE EXACT LOCATION BY CLEARANCE REQUIRED FOR BLIND FASTENER INSTALLATION.
3. USE CR2248-4-1 REPAIR RIVETS AND CR2249-4-1 REPAIR RIVETS TO FASTEN TIP. USE SAME TYPE HEAD IN REPAIR RIVET AS REPLACED RIVET. USE MS20470B4 REPAIR RIVETS TO FASTEN ZEE TO EXISTING SECTION OF TIP AND CR2249-4-1 REPAIR RIVETS TO FASTEN ZEE TO REPAIR SECTION OF TIP. MAINTAIN MINIMUM EDGE DISTANCES CALLED OUT IN ATTACHMENT SPACING CHART, SECTION 57-01.
4. IF SURFACE IS TO BE PAINTED, IT MUST BE PAINTED PRIOR TO INSTALLING TAPE.
5. REBALANCE AILERON AS OUTLINED IN SECTION 57-50-1.

⊕ ORIGINAL RIVETS

◈ ORIGINAL RIVET HOLES USED IN REPAIR

● REPAIR RIVETS

BB3-653A

Aileron and Flap Trailing Edge Spliced Section Repair - Class A

Figure 9

B. Repair extensive damage occurring to glass fiber trailing edge as outlined in Figure 9 and as follows:

(1) Cut out damaged section and remove existing rivets from structure in repair area.

(2) Prepare replacement section of trailing edge formed section to fit cutout.

(3) Fabricate zee as shown in Figure 9.

(4) Install zee and glass fiber section and install rivets as shown in Figure 9.

(5) Install doubler of Scotch No. 853 polyester tape, or equivalent, over both spliced ends as shown in Figure 9.

NOTE: If area is to be painted, it must be painted before applying tape.

9. Aileron Trailing Edge Repairs - Class A

A. Repair minor damage of gouge nature occurring to glass fiber trailing edge as follows:

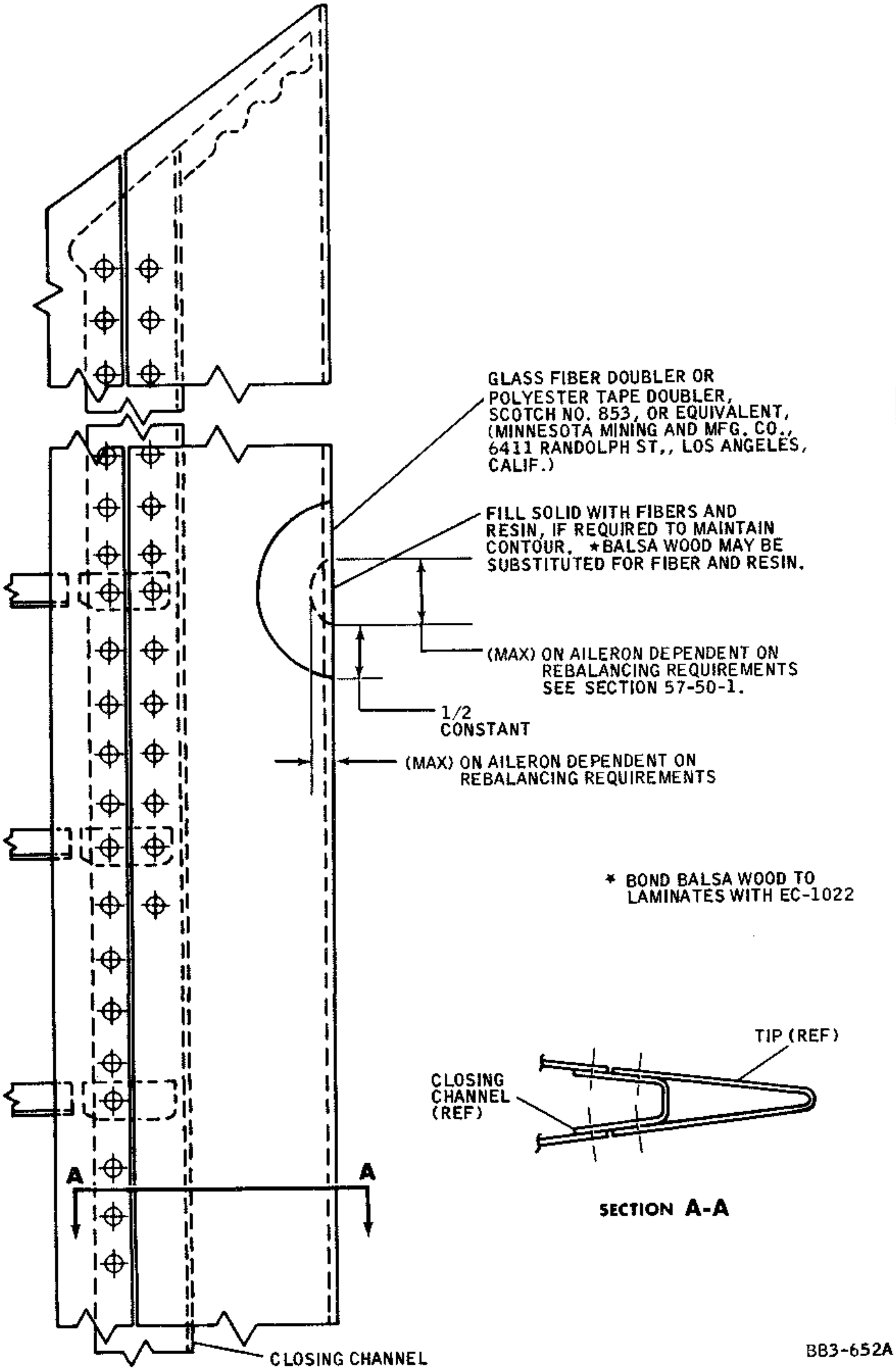
(1) Follow the procedure outlined in Paragraph 8, step A, except that, dependent upon balance requirements, balsa wood may be substituted in place of Lefkoweld 109 and glass fibers. If balsa wood is used, sand with number 80 grit sandpaper, clean with clean, dry cloth, and bond with EC-1022.

(2) Check balance condition of aileron in accordance with Section 57-50-1.

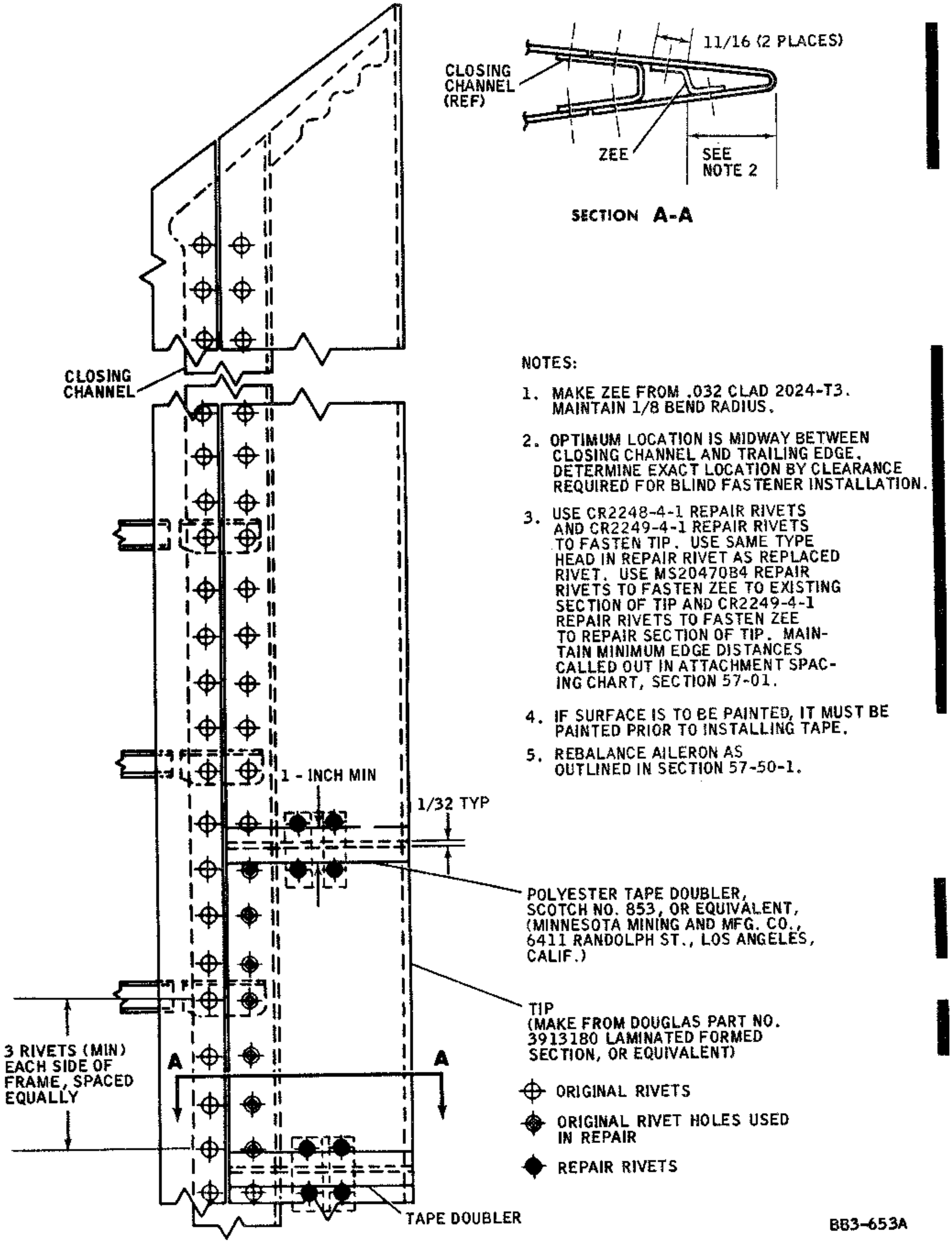
B. Repair extensive damage occurring to glass fiber trailing edge as follows:

(1) Follow the procedure outlined in paragraph 8, step B.

(2) Check balance condition of aileron in accordance with Section 57-50-1.



Aileron and Flap Trailing Edge Gouge Repair - Class A
Figure 8



NOTES:

1. MAKE ZEE FROM .032 CLAD 2024-T3. MAINTAIN 1/8 BEND RADIUS.
2. OPTIMUM LOCATION IS MIDWAY BETWEEN CLOSING CHANNEL AND TRAILING EDGE. DETERMINE EXACT LOCATION BY CLEARANCE REQUIRED FOR BLIND FASTENER INSTALLATION.
3. USE CR2248-4-1 REPAIR RIVETS AND CR2249-4-1 REPAIR RIVETS TO FASTEN TIP. USE SAME TYPE HEAD IN REPAIR RIVET AS REPLACED RIVET. USE MS20470B4 REPAIR RIVETS TO FASTEN ZEE TO EXISTING SECTION OF TIP AND CR2249-4-1 REPAIR RIVETS TO FASTEN ZEE TO REPAIR SECTION OF TIP. MAINTAIN MINIMUM EDGE DISTANCES CALLED OUT IN ATTACHMENT SPACING CHART, SECTION 57-01.
4. IF SURFACE IS TO BE PAINTED, IT MUST BE PAINTED PRIOR TO INSTALLING TAPE.
5. REBALANCE AILERON AS OUTLINED IN SECTION 57-50-1.

Aileron and Flap Trailing Edge Spliced Section Repair - Class A
Figure 9

WING HONEYCOMB REPAIRS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. The honeycomb repairs described in this section are applicable for repair of wing trailing edge, spoiler, tab, and flap honeycomb assemblies. Additional repairs for honeycomb, preparation and application of resins, and bonding repair techniques are described in 51-70-2.

B. Repairs in the entire flapwell area, including spoilers, and certain wing areas require mechanical attachments (see 51-70-2). If the repair is located in an area that requires mechanical attachments, prepare and install attachments (serrated rivets) in accordance with 51-70-2.

2. Wing Trailing Edge Honeycomb Panel (Flat and Tapered) and Spoiler Skin and Core Repair - Class A (See Figure 1.)

A. Repair damage occurring to the skin and core, if damage is located away from supporting structure and is not over 4 inches in diameter, as follows:

(1) Carefully inspect damage to determine extent of damage to both internal and external surfaces of honeycomb panel.

(2) Outline damaged area with a grease pencil.

(3) Hand-rout damaged area from panel. Make a circular-shaped cutout.

NOTE: On tapered panels, prepare tapered wooden plug and tapered wooden shim as shown in Figure 1, Sheet 3.

(4) Insert wooden plug into the panel hole. The plug must be same size as hole diameter and thickness of removed section of honeycomb.

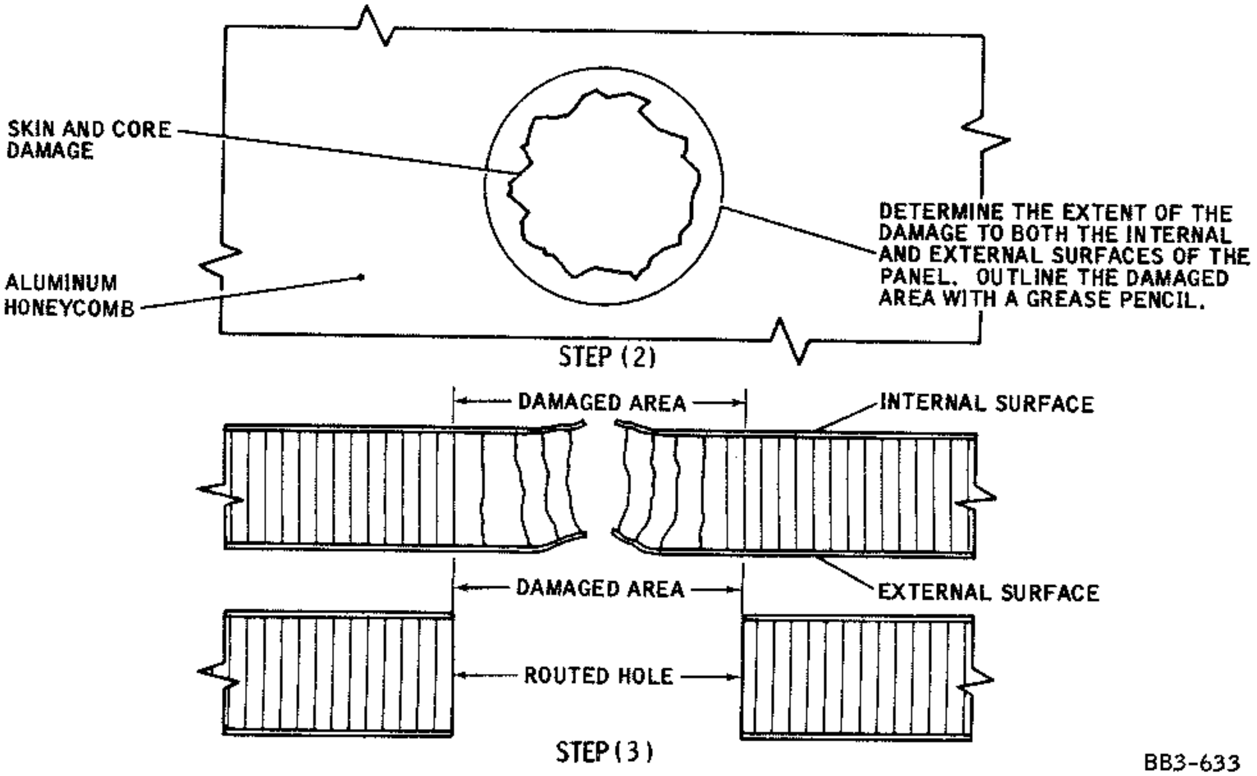
NOTE: On tapered panels, bolt the tapered wooden shim on top of router template as shown in Figure 1, Sheet 3.

(5) Bolt a router template to each side of the plug. The template attached to external surface must allow for routing a path 1/2-inch beyond edge of panel hole. The template attached to the internal surface must allow for routing a path 1/2-inch beyond path of external routed surface.

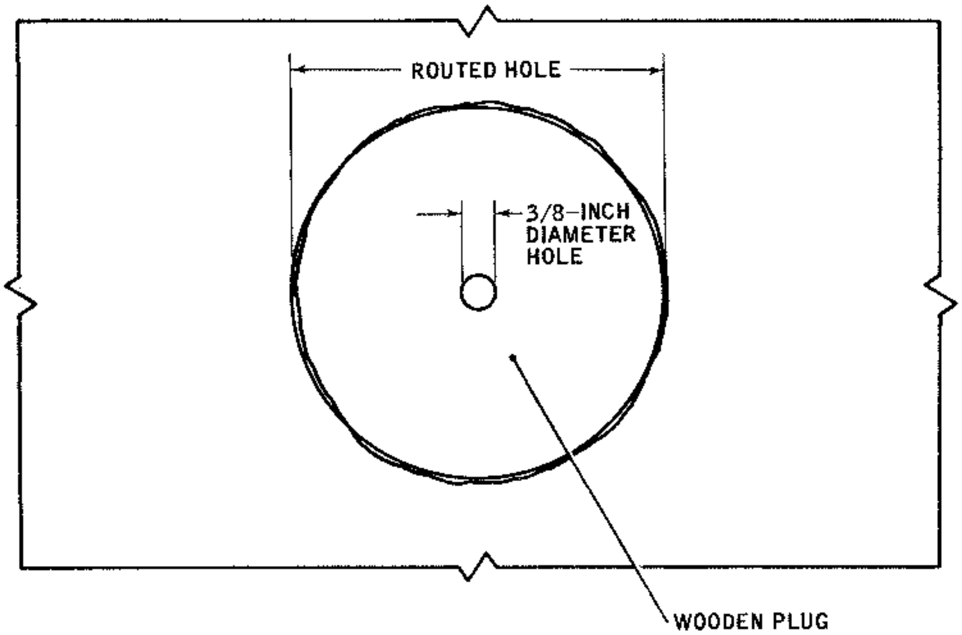
(6) Rout out paths located by templates. Remove templates, wooden plug, and wooden shim, if used, from panel.

(7) Peel damaged internal skin from honeycomb, thereby exposing the core. Do not apply leverage to the surrounding panel which could cause additional damage to adjacent honeycomb.

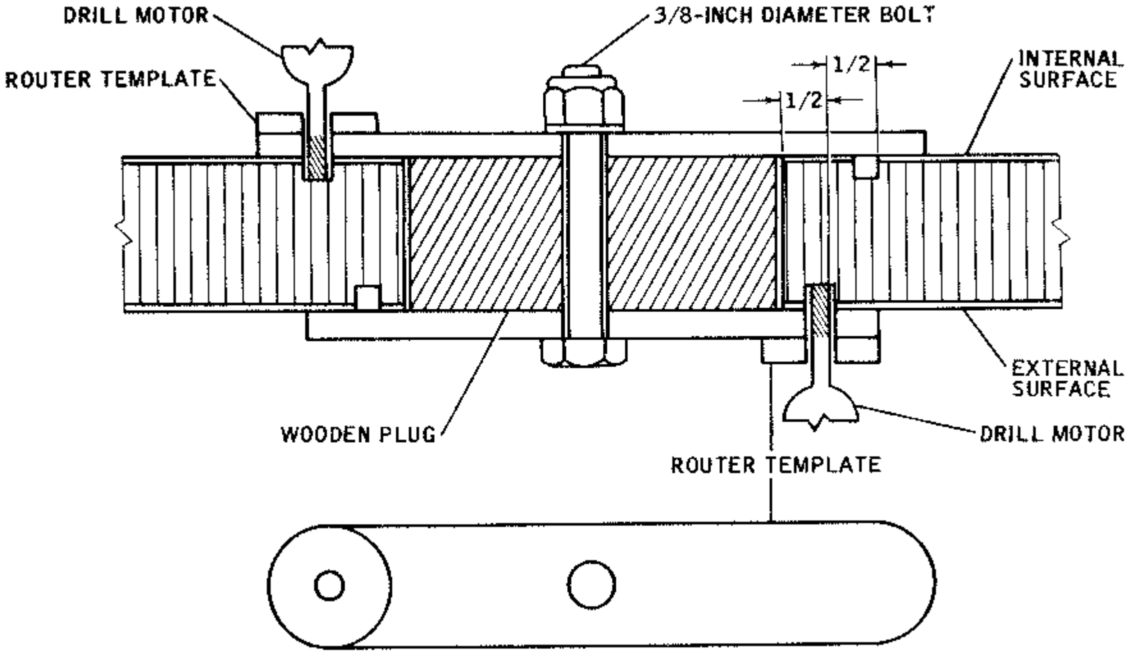
(8) Grind core down to bonding material at external skin surface. Surface should be smooth to touch. Some existing core material will still be imbedded in the external bonded surface and will be visible.



Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
and Spoiler Skin and Core Repair -- Class A
Figure 1 (Sheet 1)



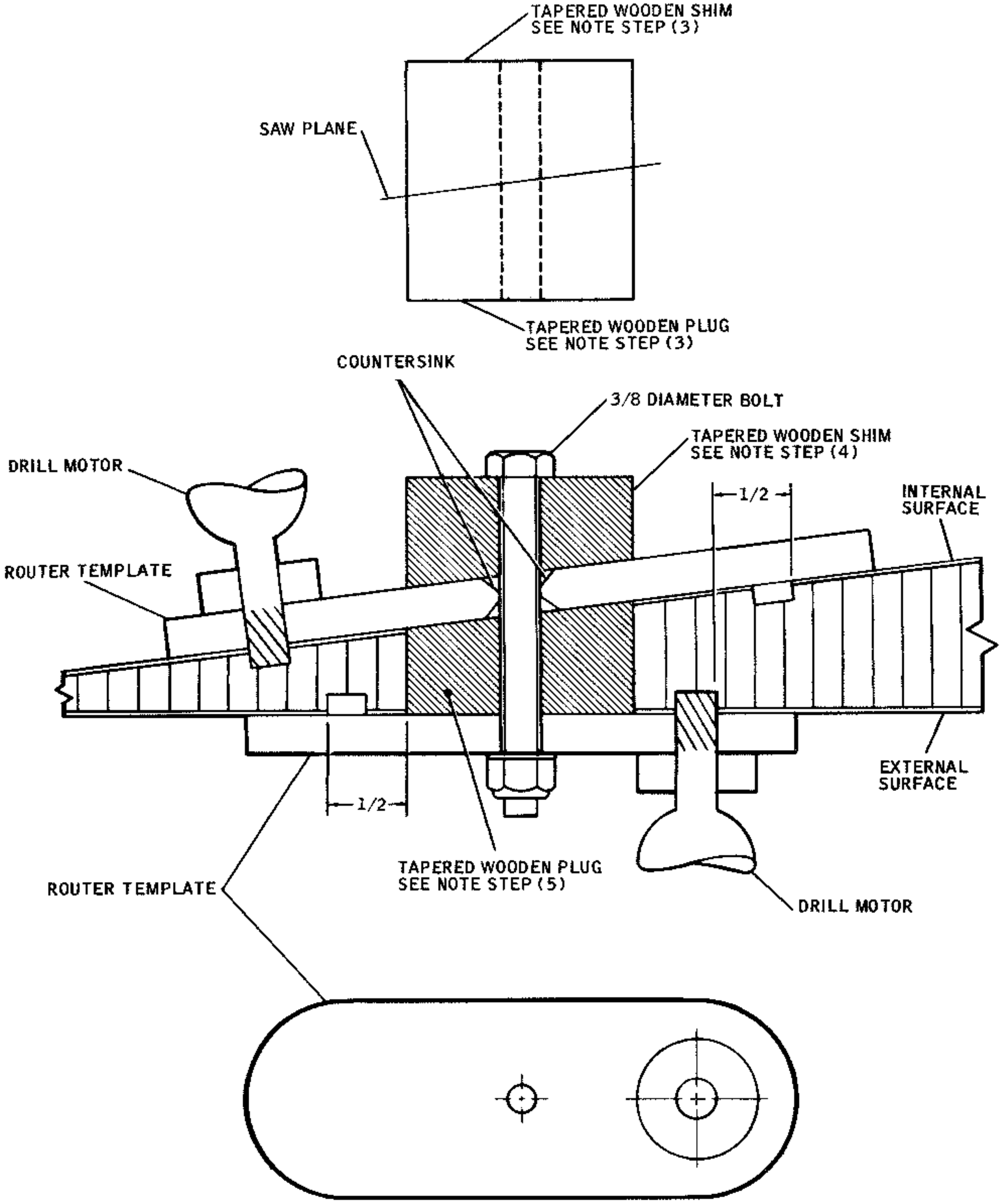
STEP (4)



STEP (5)

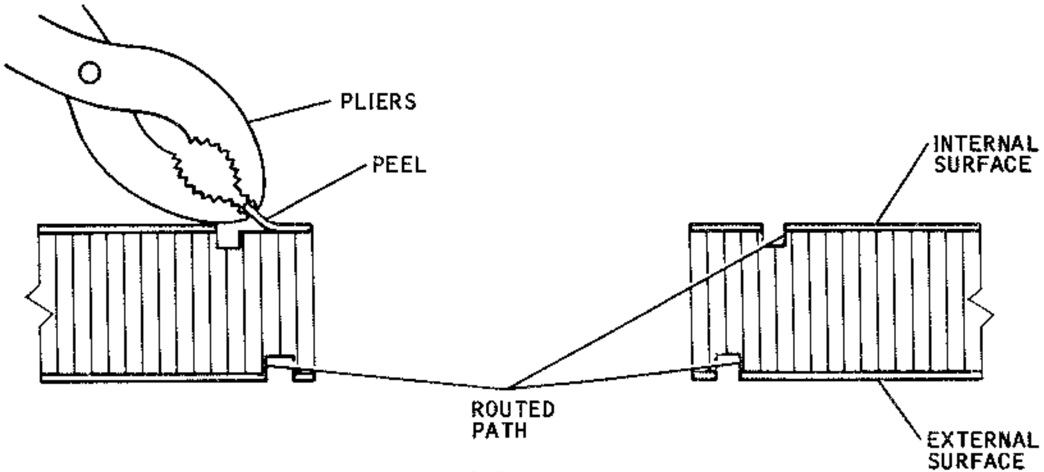
BB3-634

Wing Trailing Edge Honeycomb Panel (Flat) and Spoiler
Skin and Core Repair -- Class A
Figure 1 (Sheet 2)

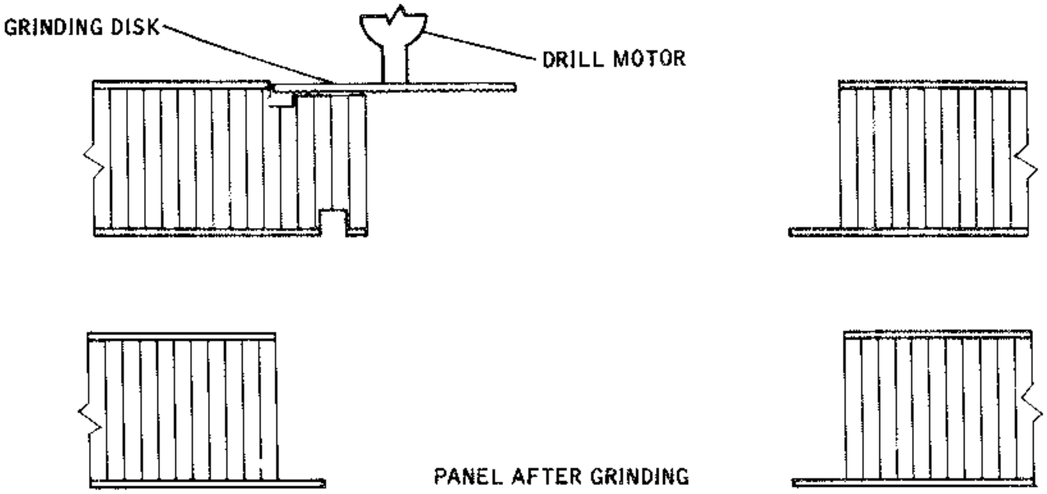


BB3-635

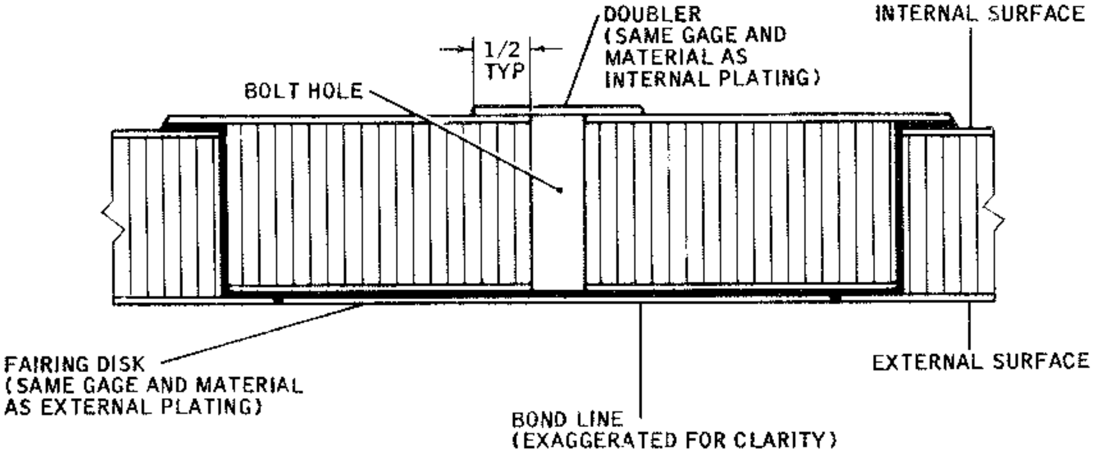
Wing Trailing Edge Honeycomb Panel (Tapered)
and Spoiler Skin and Core Repair -- Class A
Figure 1 (Sheet 3)



STEP (7)



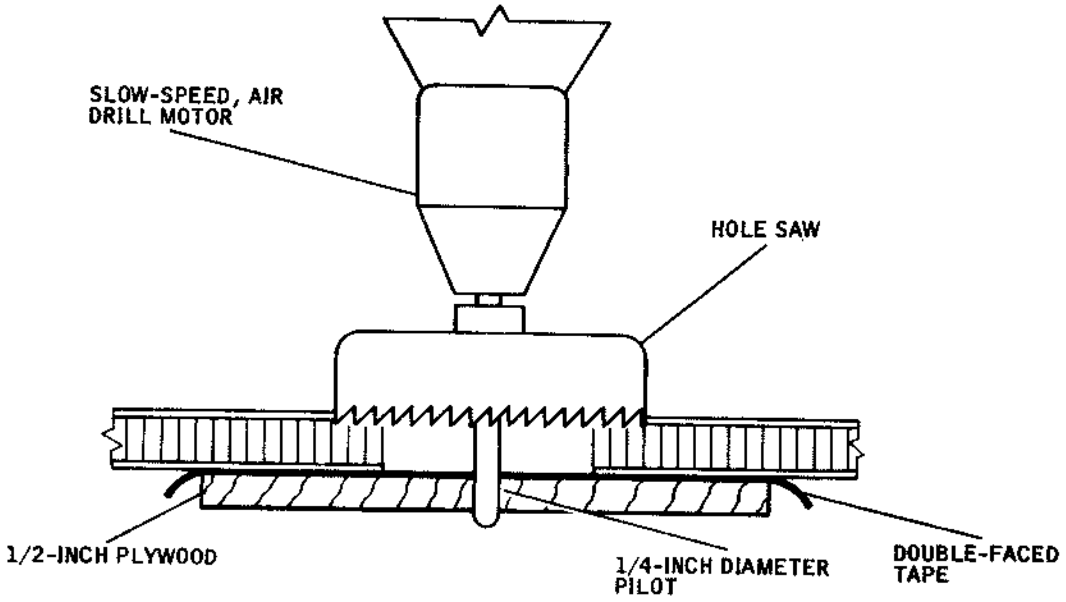
STEP (8)



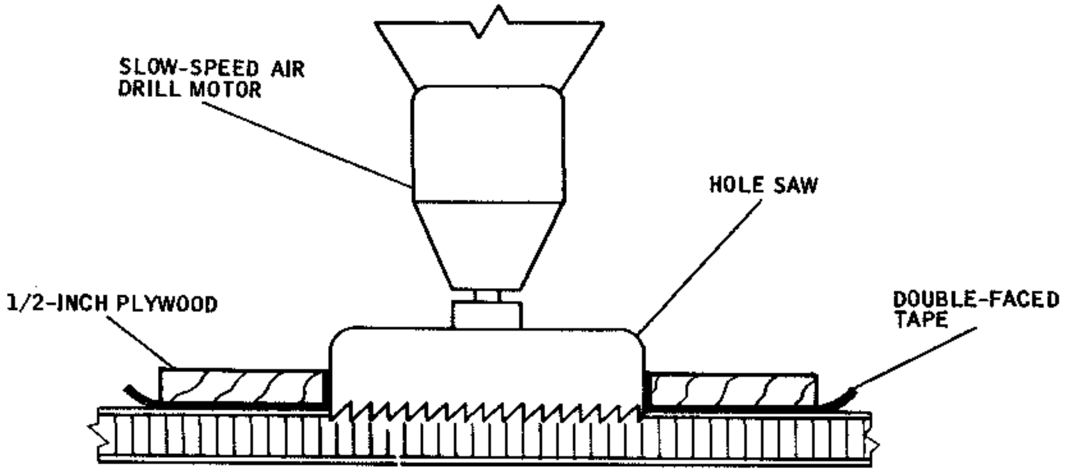
STEP (10)

BB3-636

Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
and Spoiler Skin and Core Repair -- Class A
Figure 1 (Sheet 4)



BOTH SURFACES DAMAGED



ONE SURFACE DAMAGED

BB3-637

Alternate Method of Removing Damaged Honeycomb
Figure 2

(9) Deburr skin edges.

(10) Prepare repair plug from section of repair panel material. A bolt hole may be drilled at center of section of honeycomb and a bolt installed to hold section of honeycomb while it is being rotated about its axis during routing. The prepared honeycomb plug should be fabricated to diameter of 1/16 inch less than hole in panel being repaired, except at internal surface. At internal surface, an additional 1-inch diameter of bonded skin should be left to allow for overlap as shown in Figure 1.

<u>NOTES</u>: 1. Bond fairing, repair plug, and doubler to panel as described in 51-70-2.

2. Repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.

3. An alternate method of removing damaged surfaces with a hole saw is illustrated in Figure 2.

4. Do not make any repair closer than 3 inches to the edge of another repair. Not more than one-sixth of the panel surface may contain repairs. Deviation from these requirements requires replacement of the panel, or specific engineering instructions.

3. Wing Trailing Edge Honeycomb Panel (Flat and Tapered) Skin Crack Repair - Class A (See Figure 3.)

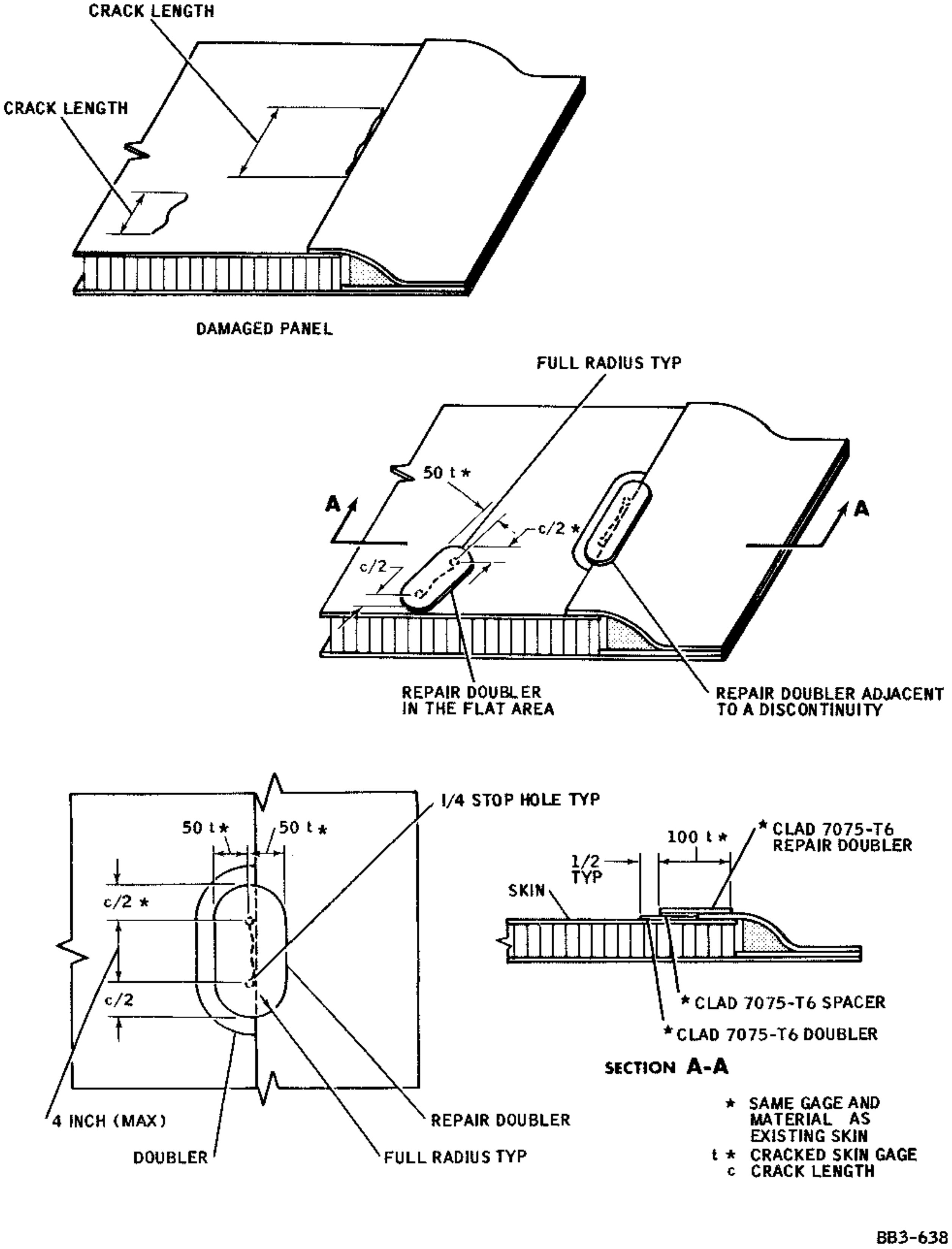
A. Repair cracks not exceeding 4 inches in length as follows:

(1) Drill 1/4-inch diameter stop holes at ends of crack.

(2) If crack is located in flat area of panel, bond a repair doubler over cracked portion of panel. Make repair doubler of same gage and material as cracked skin.

(3) If crack is located adjacent to a panel discontinuity, bond a doubler to the skin, a spacer to the doubler, and a repair doubler to the spacer and honeycomb discontinuity as illustrated in Figure 3.

NOTE: Refer to 51-70-2 for bonding instructions.



Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
Skin Crack Repair -- Class A
Figure 3

4. Wing Trailing Edge Honeycomb Panel (Flat and Tapered) and Spoiler Honeycomb Panel Unbonded Skin Repair - Class A (See Figure 4)

A. Repair panels that develop unbonded areas between the core and the external skin, if not larger than 4 inches in diameter, as follows:

(1) Mark the unbonded area with a grease pencil.

(2) Rout out the internal skin to a circular-shaped cutout opposite the marked unbonded area. If the unbonded area occurs between the core and the bonding material, remove the core only. Roughen the surface slightly with a sanding disk. If the unbonded area occurs between the skin and the bonding material, remove both the core and the unbonded bonding material. Use a sanding disk.

(3) Prepare a repair plug, and bond and cure in accordance with 51-70-2.

B. Repair panels that develop unbonded areas between the core and the internal skin, if not larger than 4 inches, as follows:

(1) Mark the unbonded area with a grease pencil.

(2) Rout out the internal skin (over the unbonded area) to a circular-shaped cutout.

(3) Grind the core down to the bonding material surface until smooth to the touch. Do not remove the bonding material. The core will still be imbedded in the bond and will be visible.

(4) Prepare a repair plug, and bond and cure in accordance with 51-70-2.

NOTES: (1) The skin may be removed and the repair plug prepared as described in paragraph 2.

(2) The repair plug may be made from two sheets of plating (same gage and material as original) and a piece of repair core.

(3) The edge of one repair must not be closer than 3 inches to the edge of another repair. Not more than one-sixth of the panel surface should contain repairs.

5. Wing Trailing Edge Honeycomb Panel (Flat and Tapered), Spoiler Honeycomb, and Flap Vane Honeycomb Dent Repair - Class A and B

A. Class A. Repair: Accomplish Class A repair of honeycomb dent by filling dent area with Pro-Seal 735 as described in 51-70-2.

NOTES: 1. Dents to be repaired must be at least 1 inch in diameter, but not more than 3 inches.

2. Dents must be less than 0.093 inch in depth.

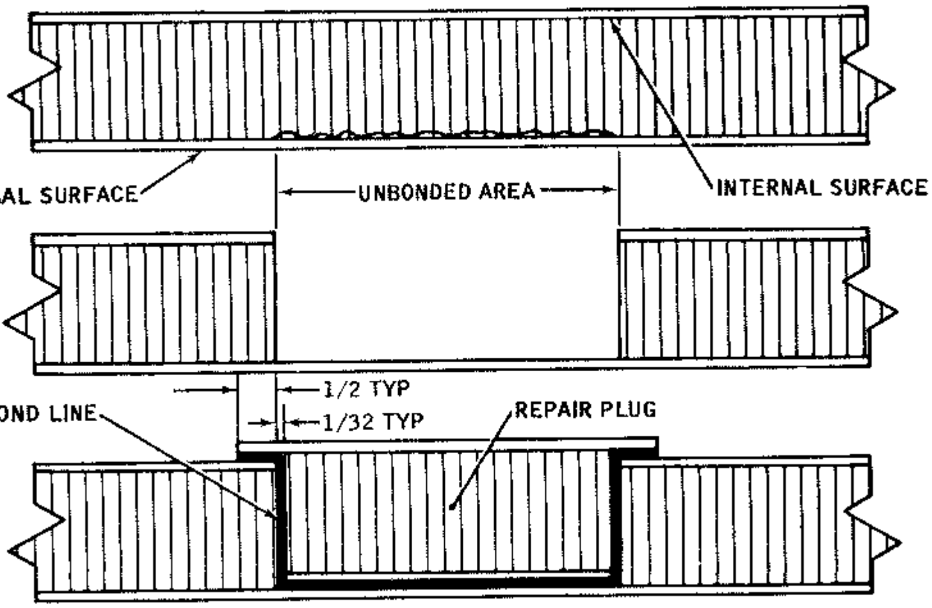
3. Dents must be smooth (single radius), with no evidence of punctures, cracks, or scratches which cannot be polished out.

4. Dents do not require repairing if they are less than 1 inch in diameter, less than 0.063 inch in depth, and are smooth, with no evidence of punctures, cracks, or scratches.

5. Not more than 3 dents, or dents totalling one-tenth of the panel surface, whichever is smaller, may be repaired on each wing trailing edge panel or each flap vane. Not more than 4 dents, or dents totalling one-sixth of the panel surface, whichever is smaller, may be repaired on each spoiler honeycomb panel.

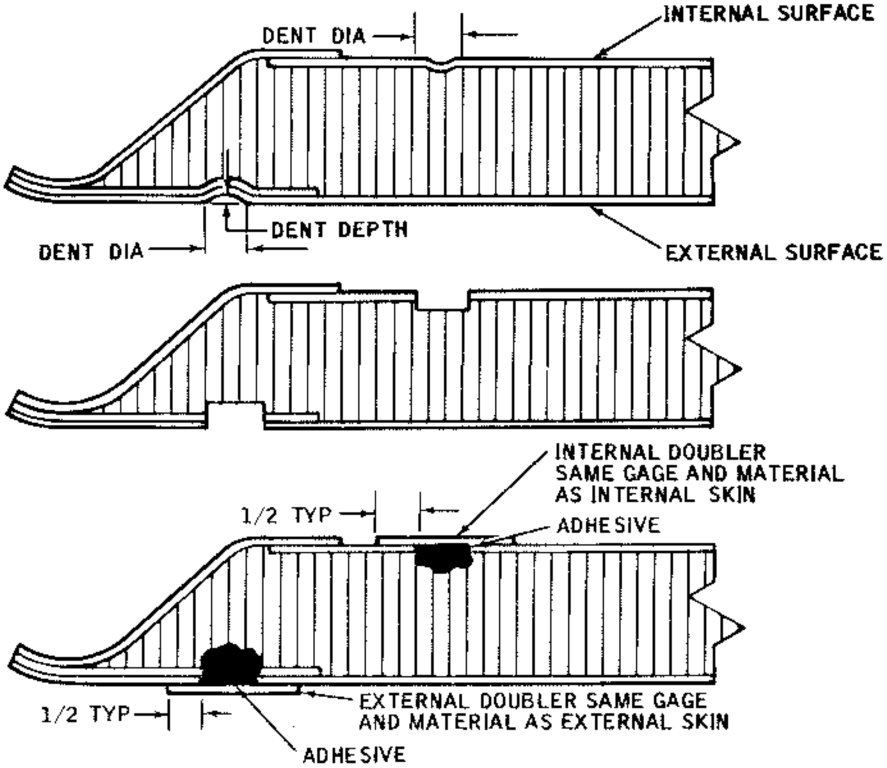
B. Class B Repair (see Figure 5). If dents are between 3/8- and 1 1/4-inch diameter, and not more than six core cells are damaged, and the dent is not smooth, or if punctures, cracks, or deep scratches exist, repair as follows:

(1) Remove damaged skin with hole saw. Leave circular hole. Be certain that not more than one-sixteenth of core is removed. See Figure 2 for the method of removing skin and core with a hole saw.



BB3-639

Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
and Spoiler Unbonded Skin Repair -- Class A
Figure 4



BB3-640

Wing Trailing Edge Honeycomb Panel (Flat and Tapered) and
Spoiler Honeycomb Panel Dent Repair -- Class B
Figure 5

(2) Bond a doubler to the panel dented area as described in 51-70-2. Apply just enough adhesive to core to make contact with doubler. Make certain doubler overlaps hole by 1/2 inch.

NOTES: 1. Not more than six dents or dents totalling one-tenth of the panel surface, whichever is smaller, may be repaired in this manner.

2. The edge of any repair must not be closer than 2 inches to the edge of another repair.

3. If dents are between 1 1/4 and 4 inches in diameter, and not more than six core cells damaged, and the dent is not smooth, or if punctures, cracks, or deep scratches exist, repair as described in paragraph 2.

4. Repair dents or dings that are smaller than 3/8-inch diameter, not smooth, or where skin is punctured, as described in 51-70-2.

6. Wing Trailing Edge Honeycomb Panel (Flat) Skin and Core Damage Repair - Class A (See Figure 6.)

A. If the damage is not longer than 6 inches, or wider than 3 inches, repair single directional tear damage occurring to skins and core as follows:

(1) Carefully inspect damage to determine extent of damage to panel.

(2) Outline damaged area with a grease pencil.

(3) Hand rout damaged area from panel. Make ends semicircular-shaped and the same radius.

(4) Clamp a router template to each side of panel. External surface template must locate routing path 1/2 inch beyond edge of panel hole. The internal surface template must locate routing path 1/2 inch beyond path of external surface template.

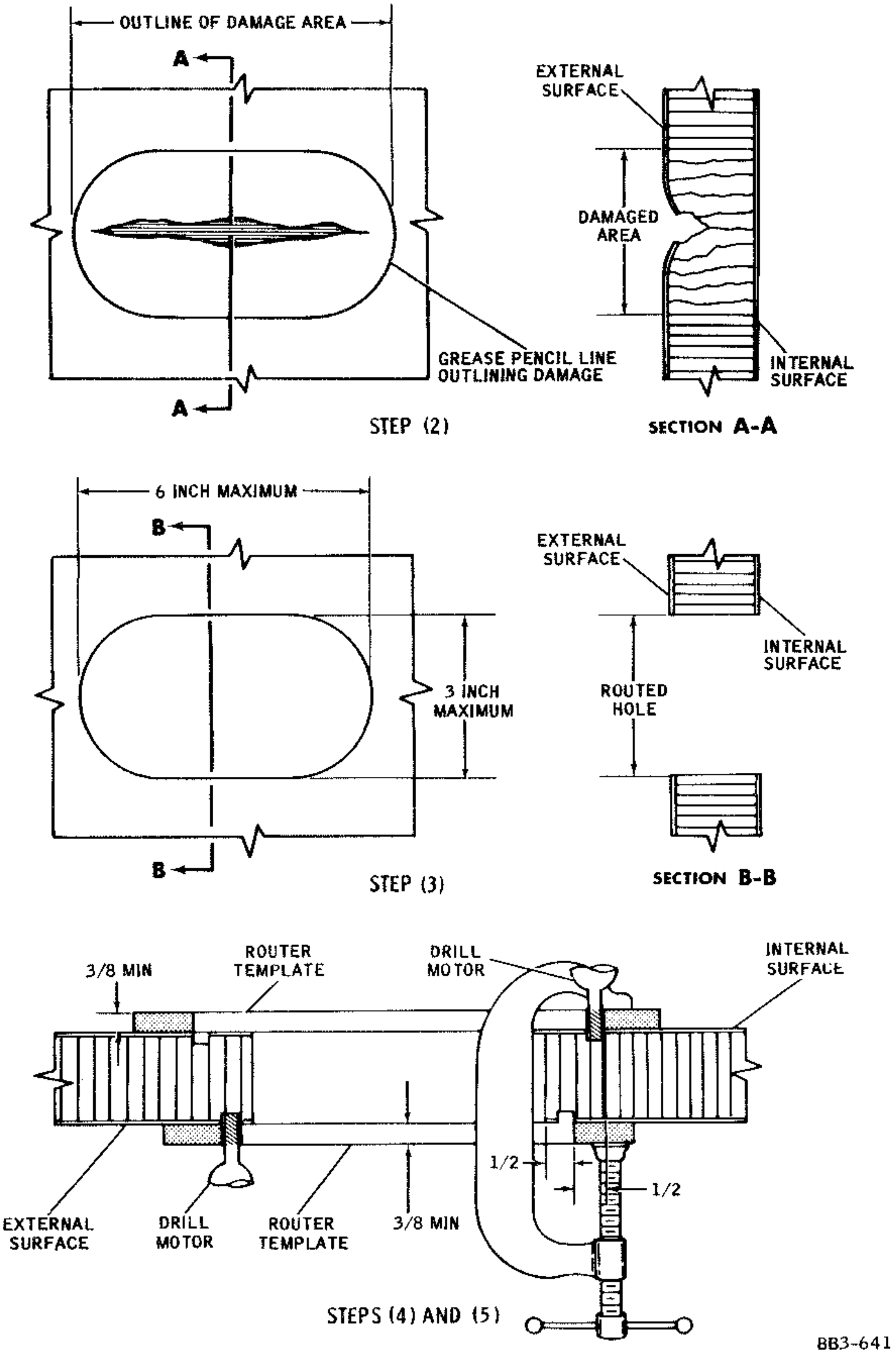
(5) Rout out paths located by templates. Remove templates from panel.

(6) Peel internal surface skin within routed area from honeycomb, exposing the core. Do not apply leverage to surrounding panel which could cause damage to adjacent honeycomb.

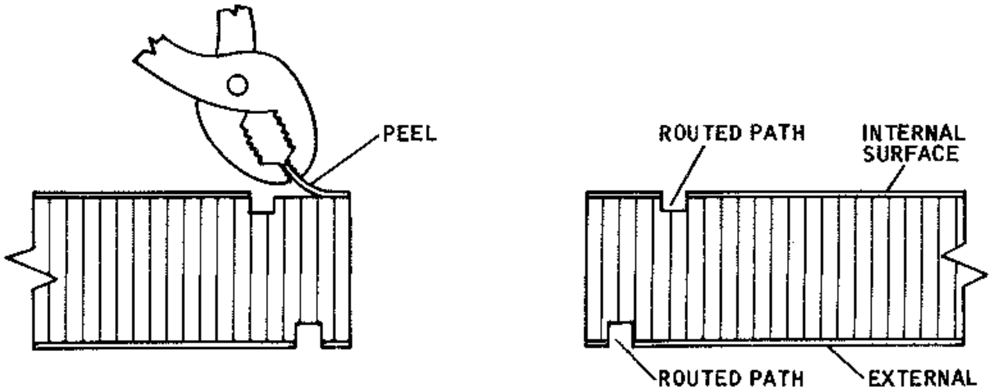
(7) Grind core down to bending material at external skin surface. Surface will be smooth to touch. Some existing core material will still be imbedded in external surface and will be visible.

(8) Deburr skin edges.

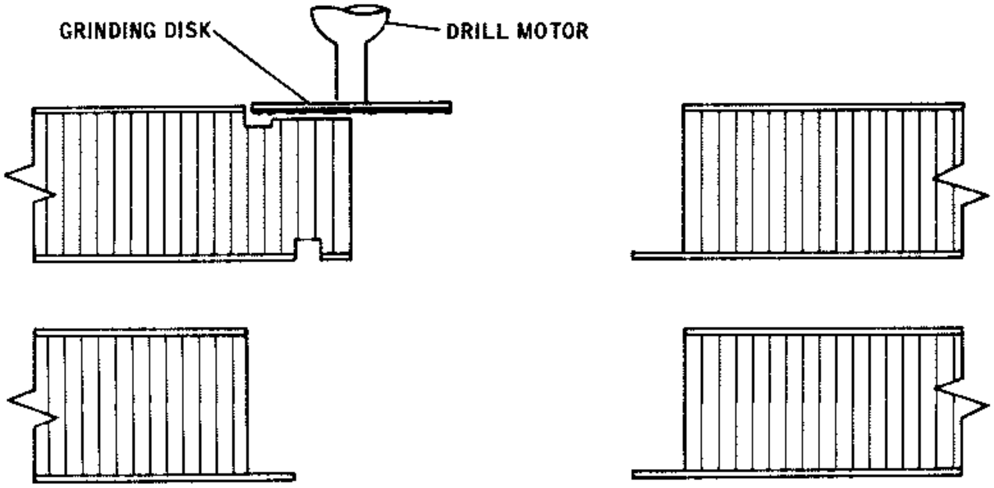
(9) Prepare fairing disk to fit external surface hole. Make fairing disk from same material and gage as external surface skin.



Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
Skin and Core Damage Repair -- Class A
Figure 6 (Sheet 1)

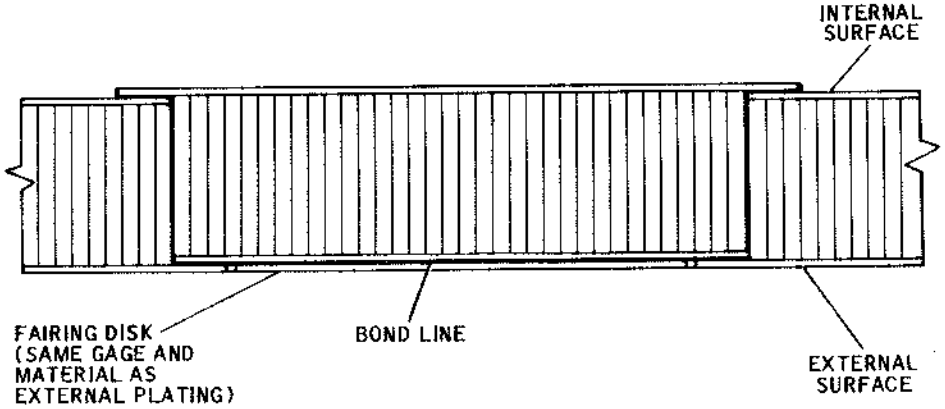


STEP (6)



PANEL AFTER GRINDING

STEP (7)



STEP (10)

BB3-642

Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
Skin and Core Damage Repair -- Class A
Figure 6 (Sheet 2)

(10) Prepare repair plug by routing a section of desired shape from repair panel. Repair plug should be fabricated to 1/16-inch diameter less than hole being repaired in panel, except at internal surface. At internal surface, an additional inch of bonded skin should be left to allow for an overlap as shown in Figure 6.

NOTES: 1. Bond the repair plug fairing disk to panel as described in 51-70-2.

2. Repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.

3. Do not make any repair closer than 3 inches to edge of another repair. Not more than one-sixth of the panel surface may contain repairs. Deviation from these requirements requires replacement of the panel, or specific engineering instructions.

7. Wing Trailing Edge Honeycomb Panel (Flat and Tapered) Edge Skin Repair - Class B (See Figure 7.)

A. Repair damage occurring to the skin and core at the panel edge not exceeding 4 inches in diameter, as follows:

(1) Carefully inspect honeycomb to determine extent of damage.

(2) Rout damaged skin from external surface of panel. Make a circular-shaped cutout.

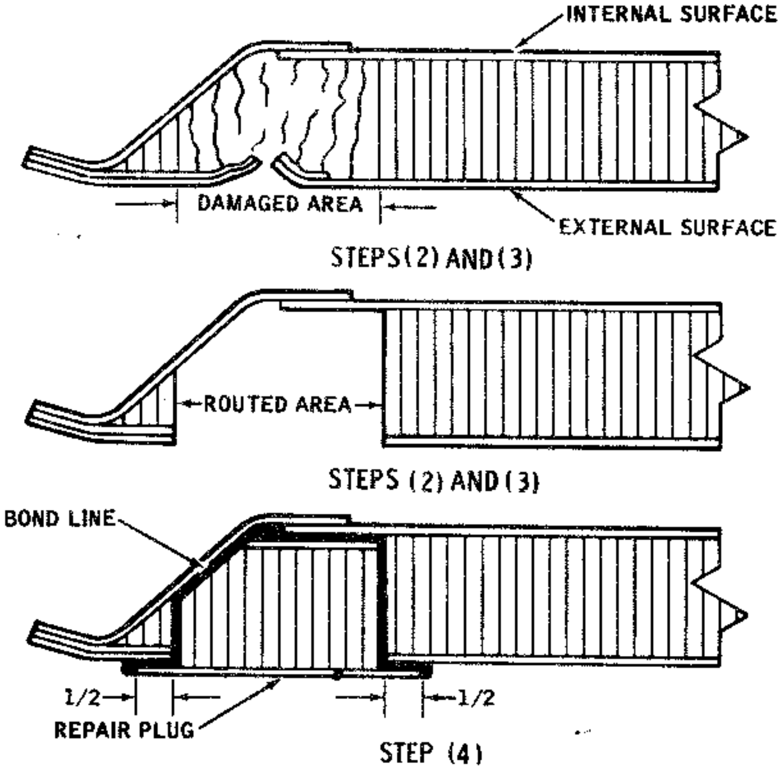
(3) Hand rout core from panel.

(4) Prepare a repair plug on drill press from a repair panel section. Make certain external surface of plug has an additional 1-inch of skin remaining to allow bonding overlap as illustrated. Saw a corner from repair plug as required to fit plug into panel.

NOTES: 1. The damaged skin may be removed as shown in Figure 2.

2. The repair plug may be made from two sheets of skin, same gage and material as original, and a piece of repair core, if a repair panel is not available. Previously prepared repair panel sections, however, will be easier to work and will greatly reduce time required to accomplish repair.

3. The edge of any repair must not be closer than 3 inches to the edge of another repair. Not more than three repairs of this type may be made on one panel.



BB3-643

Wing Trailing Edge Honeycomb Panel (Flat and Tapered)
Skin Repair -- Class B
Figure 7

8. Wing Trailing Edge Honeycomb Panel Flange Repair - Class A

A. If the attaching flange of the panel is damaged, it is not recommended that the panel be repaired. It is considered more economical to replace the panel.

B. If the free standing flange of the panel is dented or bent, remove the panel before attempting to accomplish straightening of the flange. Repair cracks or tears in the flange as follows:

(1) If the crack or tear is not over 3 inches long and is confined to the flange and does not extend into the filler or core, drill 1/4-inch diameter stop holes at the end, or ends, of crack.

(2) Apply adhesive and lay up a glass fiber doubler on the internal surface of the panel, maintaining 1-inch overlap from the crack and stop holes. Use 7-ply number 181 bidirectional cloth. Install as described in 51-70-3.

NOTE: If the tear cannot be straightened satisfactorily, or if the crack runs into the filler or core, repair as described in paragraph 8A.

8A. Wing Trailing Edge Honeycomb Panel Flange Repair (Damage Requiring Cutout) - Class B (See Figure 7A.)

A. Repair dents, bends, cracks or tears extending into the filler or core of free standing flanges as follows:

(1) Cut out damage as shown in Figure 7A.

(2) Fill exposed edges of honeycomb with Epocast H-1337-B-1 or Lefkoweld 109 adhesive mixed as outlined in 51-70-2.

(3) Fabricate pan doubler, filler, and repair doubler as shown in Figure 7A.

NOTE: Due to contour, nesting of pan doubler in certain areas may require repair part to be formed in soft condition followed by heat treatment to obtain final hardness.

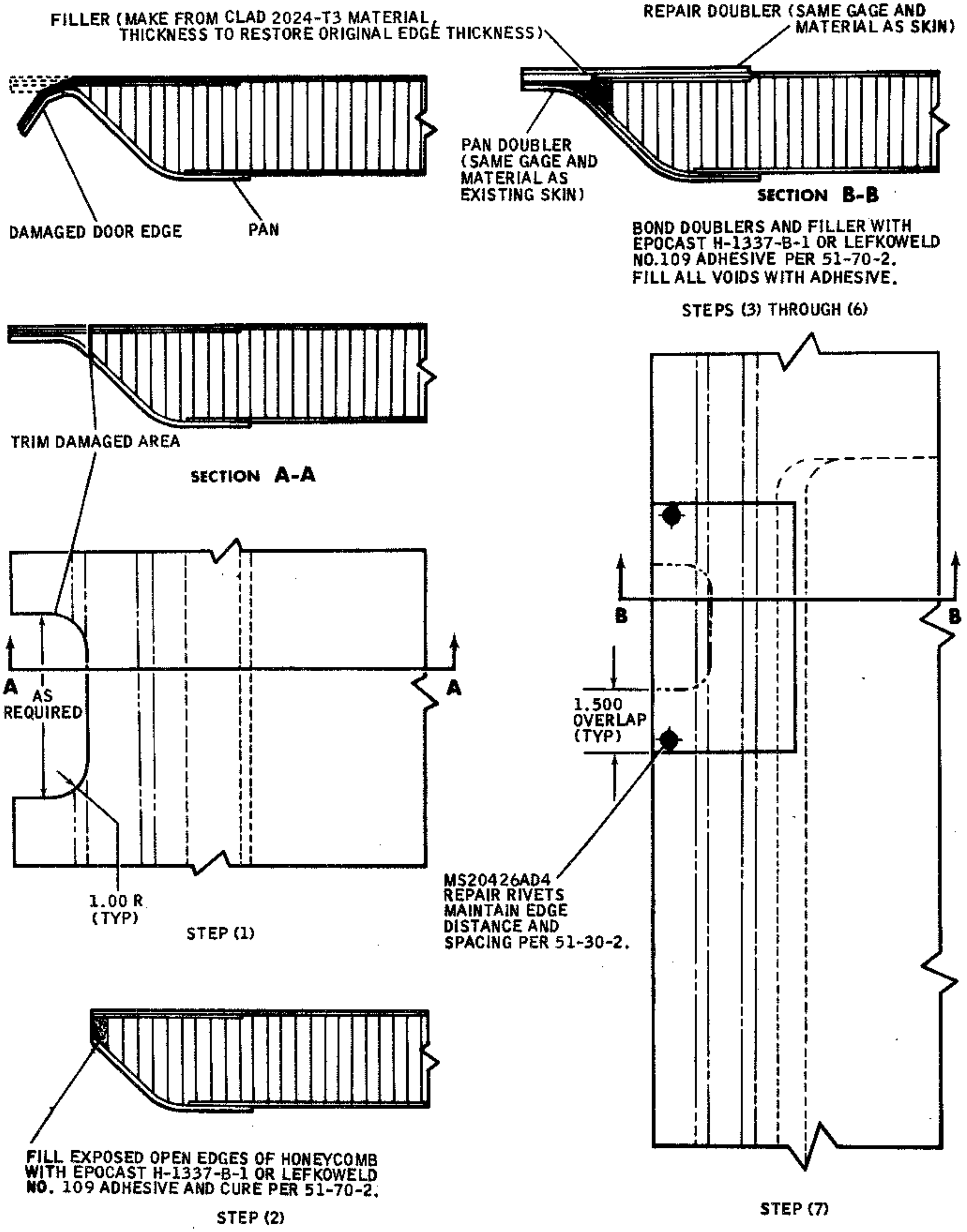
(4) Clean faying surfaces of repair parts and parts in repair area as outlined in 51-70-2.

(5) Apply Epocast H-1337-B-1 or Lefkoweld 109 adhesive to faying surfaces.

(6) Install repair parts, ensuring that all voids are filled with adhesive.

(7) Install repair rivets. Maintain edge distance and spacing as outlined in 51-30-2.

(8) Cure the adhesive as outlined in 51-70-2.



BOND DOUBLERS AND FILLER WITH EPOCAST H-1337-B-1 OR LEFKOWELD NO.109 ADHESIVE PER 51-70-2. FILL ALL VOIDS WITH ADHESIVE.

MS20426AD4 REPAIR RIVETS MAINTAIN EDGE DISTANCE AND SPACING PER 51-30-2.

FILL EXPOSED OPEN EDGES OF HONEYCOMB WITH EPOCAST H-1337-B-1 OR LEFKOWELD NO. 109 ADHESIVE AND CURE PER 51-70-2.

Printed in U.S.A.

BB3-632

Wing Trailing Edge Honeycomb Panel Flange Repair
(Damage Requiring Cutout) -- Class B
Figure 7A

9. Additional Wing Trailing Edge Honeycomb Repairs

A. Additional repairs as described in 51-70-0 thru 51-70-3 may also be used provided the general requirements and limitations of this chapter are followed.

10. Spoiler Honeycomb Skin Crack Repair - Class A (See Figure 3.)

A. Repair skin damage of a crack nature and not exceeding 4 inches in length as follows:

(1) Repair in accordance with paragraph 3.

11. Spoiler Honeycomb Trailing Edge Repair - Class B (See Figure 8.)

A. Repair damage occurring to the trailing edge, but not longer than 6 inches along the trailing edge nor deeper than 3 inches into the core, as follows:

(1) Rout out the damaged skin and core so that the exterior skin overlaps by 1 inch, as illustrated.

(2) Prepare a honeycomb plug from a repair panel section. Make the interior skin of the plug overlap the panel hole by 1 inch, as illustrated.

(3) Bond and rivet the repair plug to the panel and the fairing to the repair plug. See 51-70-2 for bonding procedures.

NOTES: 1. The repair plug may be made from two sheets of skin (same gage and material as original), a piece of repair core, and a wedge-shaped spacer of 7075-T6 CLAD aluminum.

2. The spoiler panels (5910053 and 5910055) may be repaired using a 1 3/4 X 3/16 X .001 NON-PERF 5052-H39 aluminum repair core (Hexcel Products, Inc., 2332 Fourth St., Berkley 10, Calif.).

3. The edge of one repair must not be closer than 3 inches to the edge of another repair.

12. Spoiler Honeycomb Core Damage Repair - Class B (See Figure 9.)

A. Repair core damage in spoiler honeycomb as follows:

(1) Remove damaged or loose skin.

(2) Check the core and remove damage within limits illustrated in Figure 9.

(3) Ensure that all moisture is removed from spoiler panel.

(4) Fit the replacement core. Use either aluminum or glass fiber honeycomb of the required thickness, with a layer of impregnated glass fiber cloth bonded to each side of the honeycomb core.

(5) Fit the replacement skins to cover the damaged area. Skins must extend to the leading edge to pick up the existing rivet pattern. On the ground spoiler use .020 7075-T6 CLAD skins. On the flight spoilers, use .032 7075-T6 CLAD skins.

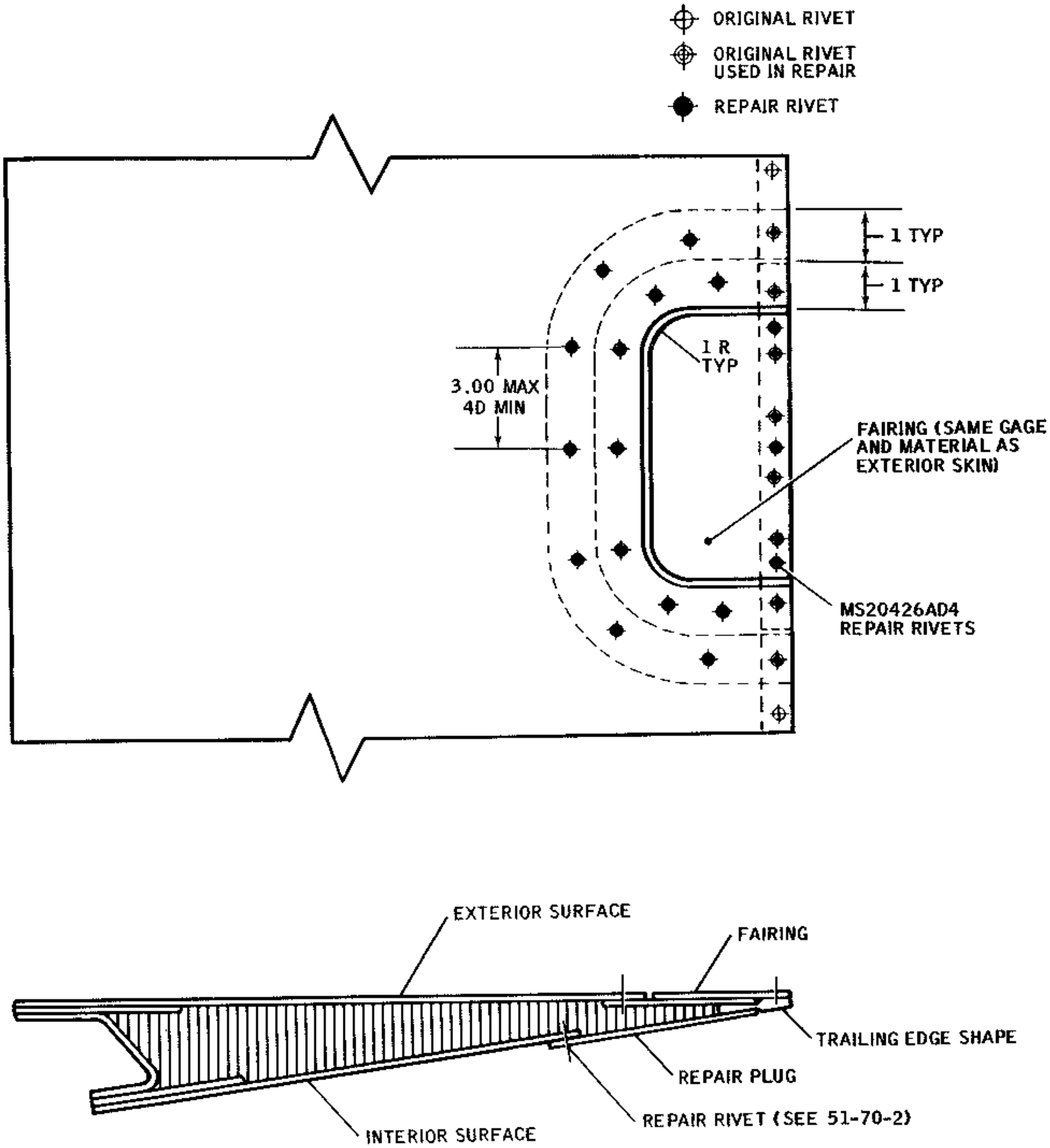
(6) Bond the repair core per 51-70-2. Add enough plies of glass fiber cloth to each side of the core until the repair section is flush with the original skin level.

(7) Bond the replacement skins over the repair as described in 51-70-2.

(8) Apply roller to replacement skins and roll until all air bubbles are evacuated. Glue line should be .010 or less.

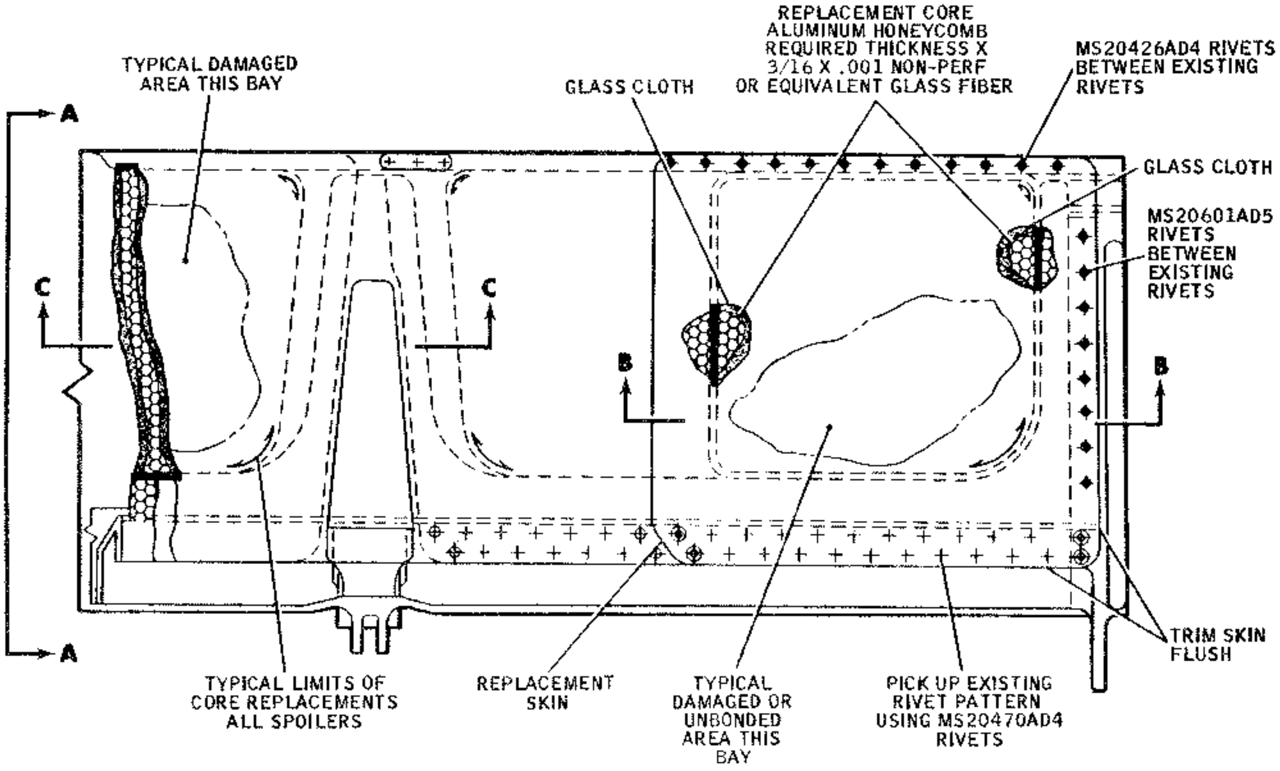
(9) Prepare rivet holes as required. Use existing rivet holes at leading edge and add rivets as illustrated. Drive the rivets wet with sealant (PR-1422) (Products Research Co., 2919 Empire Ave., Burbank, Calif.).

NOTE: Forward facing edges of replacement skins in blind areas may be attached with NAS 1399MW-3 rivets of the proper grip, installed 1 inch on center. Fill the blind rivet holes with sealant (PR-1422).

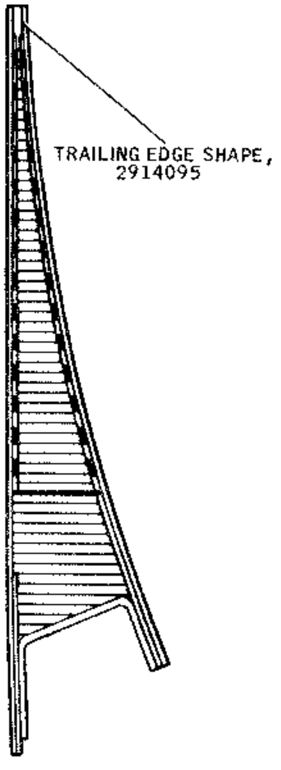


BB3-644

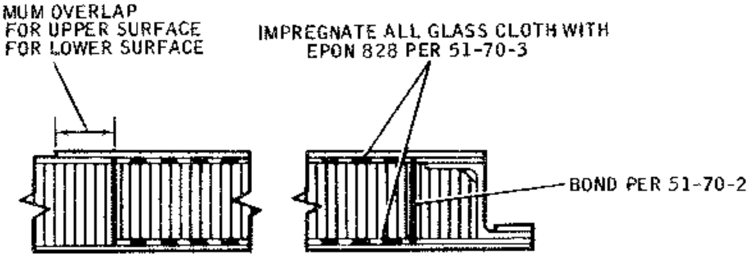
Spoiler Honeycomb Panel Trailing Edge Repair -- Class B
Figure 8



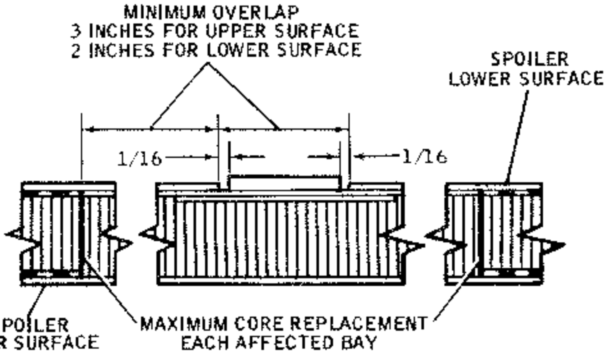
VIEW LOOKING AT LOWER SURFACE



SECTION **A-A**



SECTION **B-B**



SECTION **C-C**

BB3-647

Printed in U.S.A.

Spoiler Honeycomb Core Damage Repair -- Class B
Figure 9

(10) Cure the repair as described in 51-70-2.

(11) Fill all gaps and voids with sealant (PR-1422) and cover exposed sealant with two coats of Nycote 31A (Nycote Laboratories, 15002 Delano St., Van Nuys, Calif.).

(12) Test for leaks according to 51-20-0.

13. Vane Honeycomb Skin Crack Repair - Class B

A. Repair skin damage of a crack nature not exceeding 4 inches in length as follows:

(1) Follow the procedure outlined in paragraph 3, except step (3) is not applicable.

14. Vane Honeycomb Skin and Core Repair - Class A

A. Repair damage occurring to the skin and core, not larger than 4 inches in diameter, as follows:

(1) Follow the procedure outlined in 51-70-2 and install honeycomb core plug.

(2) The edge of one repair must not be closer than 3 inches to the edge of another repair.

15. Vane Honeycomb Unbonded Skin Repair - Class B

A. Repair panels that develop unbonded areas between skin and core, not larger than 4 inches in diameter, as follows:

(1) Follow the procedure outlined in 51-70-2 and install honeycomb core plug.

(2) The edge of one repair must not be closer than 3 inches to the edge of another repair.

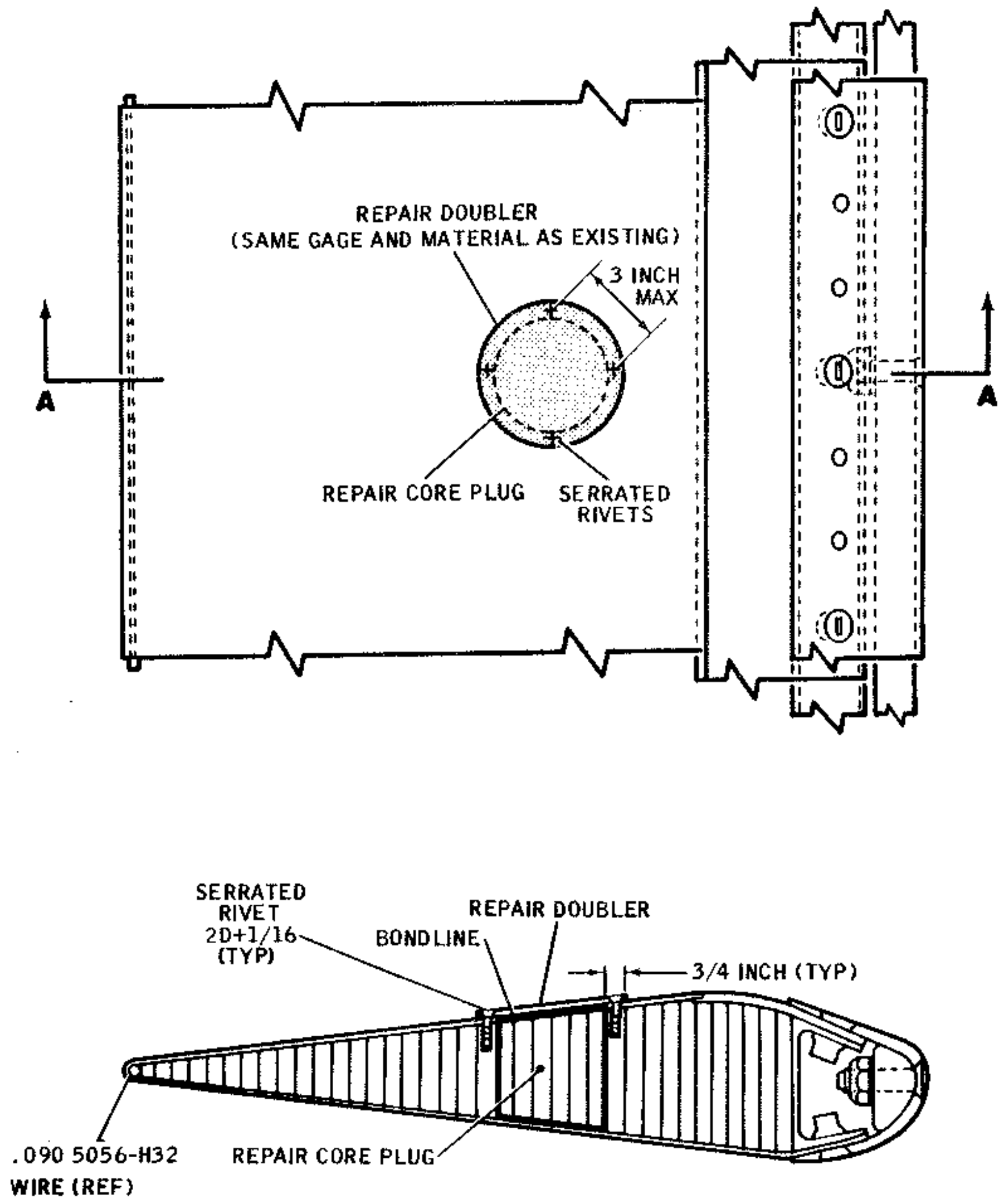
16. Aileron Tab Skin and Core Repair - Class B (See Figure 10.)

A. Repair damage occurring to the skin and core, but not exceeding 2 inches in diameter, in aileron control tab (5910047) and aileron trim tab (5910051) as follows:

(1) Rout out the damaged skin from the panel. Make a circular-shaped cutout.

(2) Hand rout the core from the panel with a sanding disk.

(3) Prepare repair core plug and repair doubler.



SECTION A-A

CONTROL TAB SHOWN
REPAIR TYPICAL FOR AILERON TABS

883-646A

Aileron Tab Skin and Core Repair--Class B
Figure 10

(4) Bond the repair core plug, doubler, and serrated rivets as outlined in 51-70-2.

NOTES: 1. The aileron tabs may be repaired using 1.6 X 3/16 X .001 NON-PERF 5052-H39 aluminum repair core (Hexcel Products, Inc., 2332 Fourth St., Berkley 10, Calif.) if repair panel is not available. The repair core may be machined to the proper taper as shown in 51-70-2.

2. The number of repairs allowed on a tab is dependent upon the ability to maintain the surface within its balance and maximum allowable weight limits. See 57-50-1.

3. The edge of one repair must not be closer than 2 inches to the edge of another repair.

17. Aileron Tab Dent Repair - Class A

A. Repair skin dents in the aileron control (5910047) and aileron trim tab (5910051) as follows:

(1) Apply Pro-Seal 735 plating dent filler as outlined in 51-70-2.

NOTES: 1. Dents must be between 1 and 3 inches in diameter.

2. Dents must be less than .093 inch in depth.

3. Dents must be smooth (single radius) with no evidence of punctures, cracks, or scratches that cannot be polished out.

4. The edge of one repair must not be closer than 2 inches to the edge of another repair.

5. The number of repairs allowed on a tab is dependent upon the ability to maintain the surface within its balance and maximum allowable weight limits. See 57-50-1.

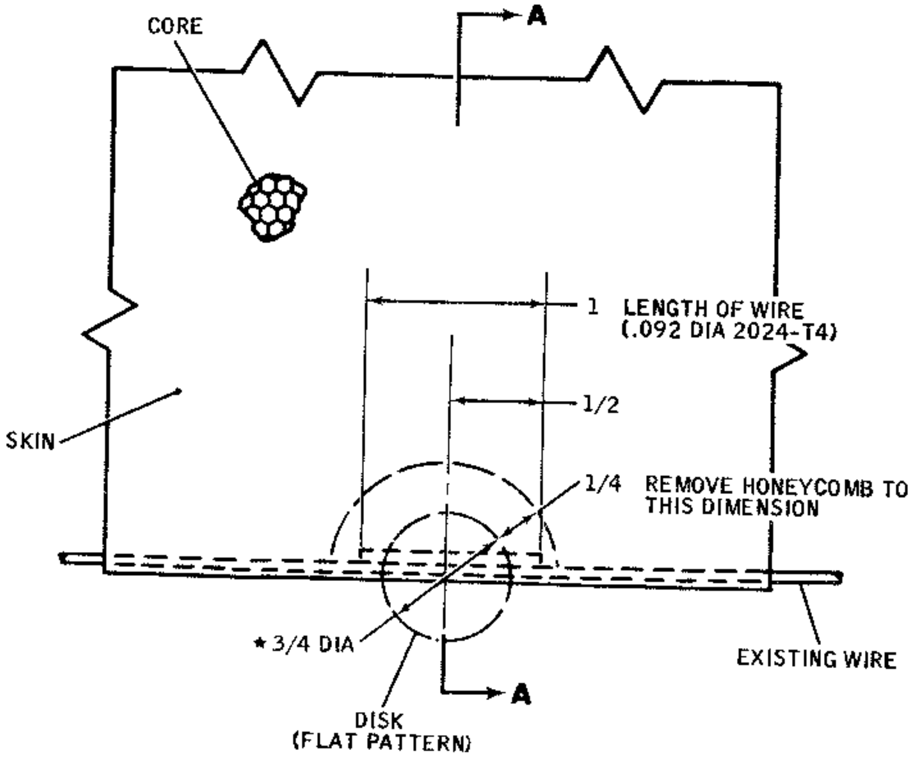
18. Aileron Tab Trailing Edge Honeycomb Repair - Class A (See Figure 11.)

A. Repair damage on the aileron control tab (5910047) and aileron trim tab (5910051) panels occurring to the trailing edge, but not longer than 3 inches along the trailing edge nor deeper than 3/4-inch into the core, as follows:

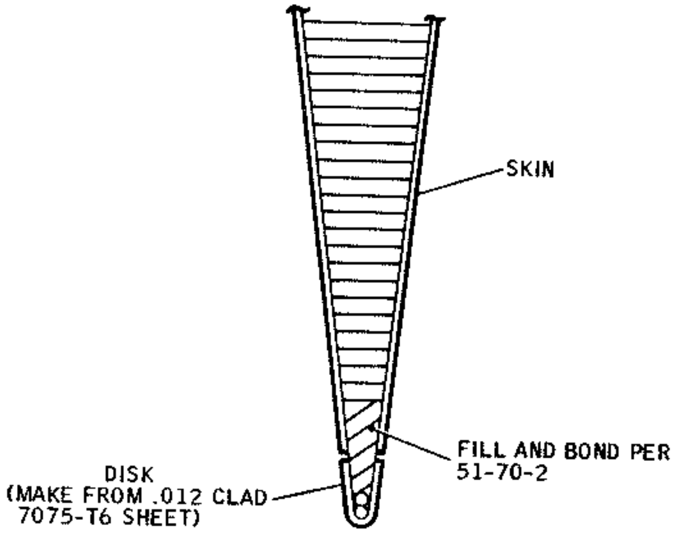
(1) Cutout damage and make bonded repair in accordance with 51-70-2. Maintain dimensions shown in Figure 11.

(2) Check tab balance and maximum allowable weight condition in accordance with 57-50-1.

NOTE: The number of repairs on tabs depends on the ability to maintain control surface within its balance and maximum allowable weight limits.



★ MAX REPAIR IS DEPENDENT
ON REBALANCING REQUIREMENTS



SECTION A-A

BB3-648

Aileron Tab Trailing Edge Repair -- Class A
Figure 11

19. Aileron Tab Dent Repair - Class B

A. Repair skin dents in the aileron control tab and aileron trim tab if dents are between 3/8 inch and 1 1/4 inch in diameter, not more than 6 core cells are damaged, and the dent is not smooth (more than one radius), or if punctures, cracks, or deep scratches exist, as follows:

(1) Make repairs in accordance with paragraph 5.

NOTES: 1. The number of repairs of this type should not exceed four.

2. Maintain balance and maximum allowable weight limits in accordance with 57-50-1.

20. Aileron Tab Honeycomb Panel Unbonded Repair - Class B

A. Repair unbonded areas not larger than 1 1/2 inches in diameter as outlined in paragraph 16. Maintain balance and maximum allowable weight limits in accordance with 57-50-1.

VORTEX GENERATOR REPAIRS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

   A. Vortex generators are installed on the upper surface of the wing inboard trailing edge, on the wing center panel landing gear support doubler, and on the flaps.

   B. A total of 28 vortex generators are installed on the airplane; four on each inboard trailing edge, three on each landing gear support doubler, and seven on each flap.

   C. Repairs to trailing edge and landing gear support doubler vortex generator installation are included with the material identification and location illustration in Section 57-30-5. Repairs to the flap vortex generator installation are included with the material identification and location illustration in Section 57-50-6.

WING LEADING EDGE REPAIRS - DESCRIPTION AND OPERATION (DC-9-10)

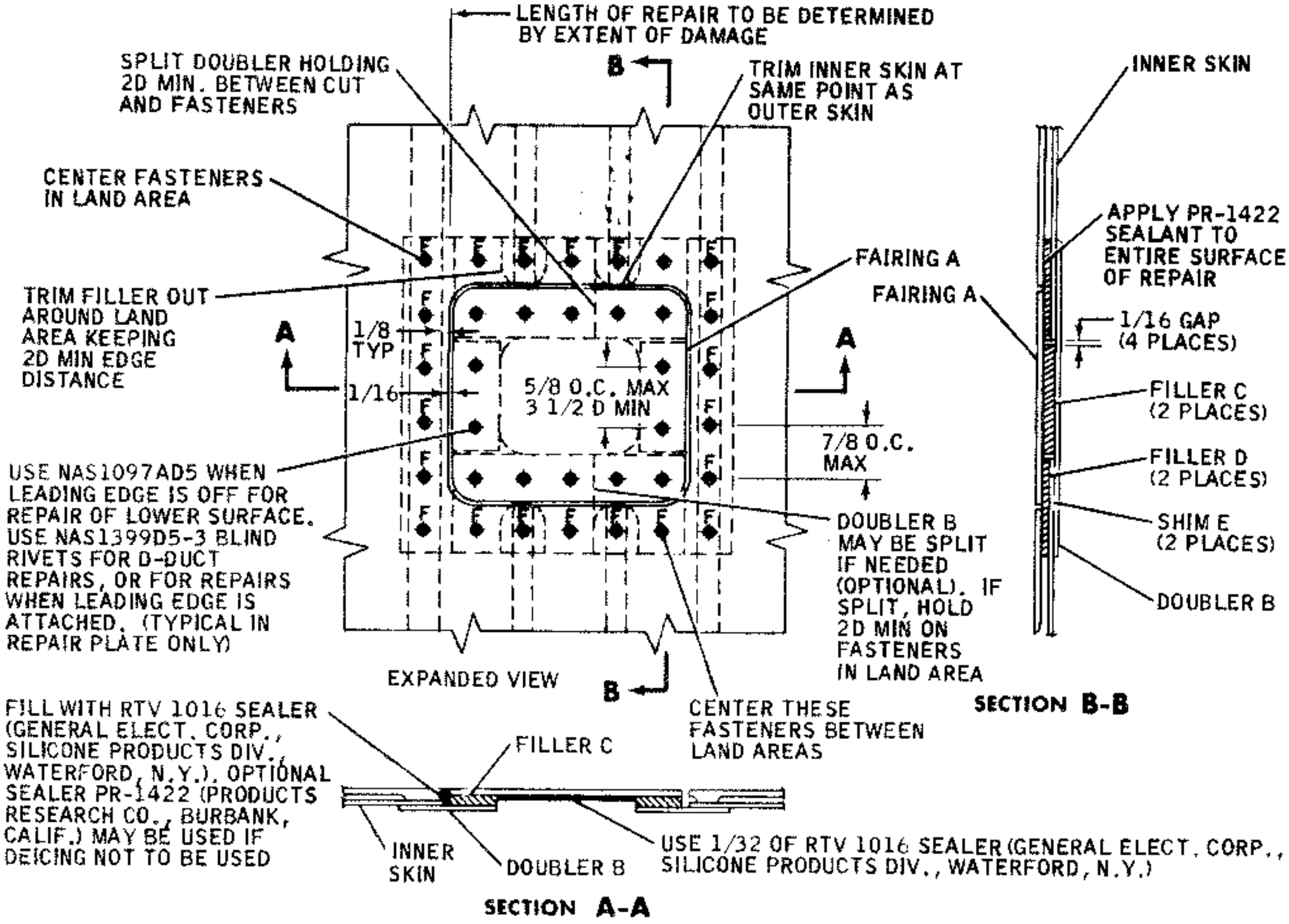
1. General

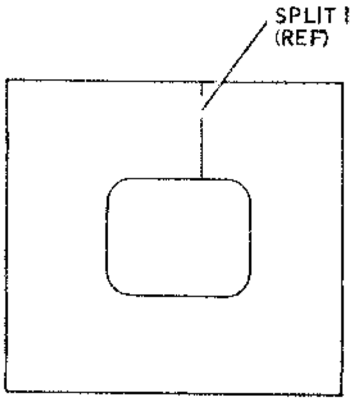
A. This section describes wing leading edge repairs for dents, cracks and holes.

2. Wing Leading Edge Repairs

A. The wing leading edge repairs listed below are provided for use as follows:

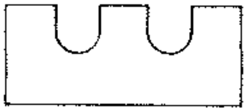
Wing Leading Edge Minor Repair - Class A	Figure 1
Wing Leading Edge Minor Repair - Class B	Figure 2
Wing Leading Edge Major Repair - Class A	Figure 3



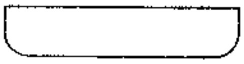


DETAIL DOUBLER B

DETAIL FILLER C



DETAIL FILLER D



DETAIL SHIM E

NOTES:

1. REPAIR TO BE USED FOR DINGS, CRACKS OR SMALL HOLES IN D-DUCT AND LOWER SURFACE.
2. WHEN REPAIRING LOWER SURFACE IN AREA OF A RIB, THE RIB MUST BE MOVED UP BY THICKNESS OF THE DOUBLER B, AND THEN SHIM RIB FORWARD AND AFT OF DOUBLER.
3. RADII OF 9/32 INCH ARE OPTIONAL FOR CORNER RADII.
4. HEAT TREAT PARTS MADE FROM 2014-0 TO 2014-T6 AFTER FORMING.

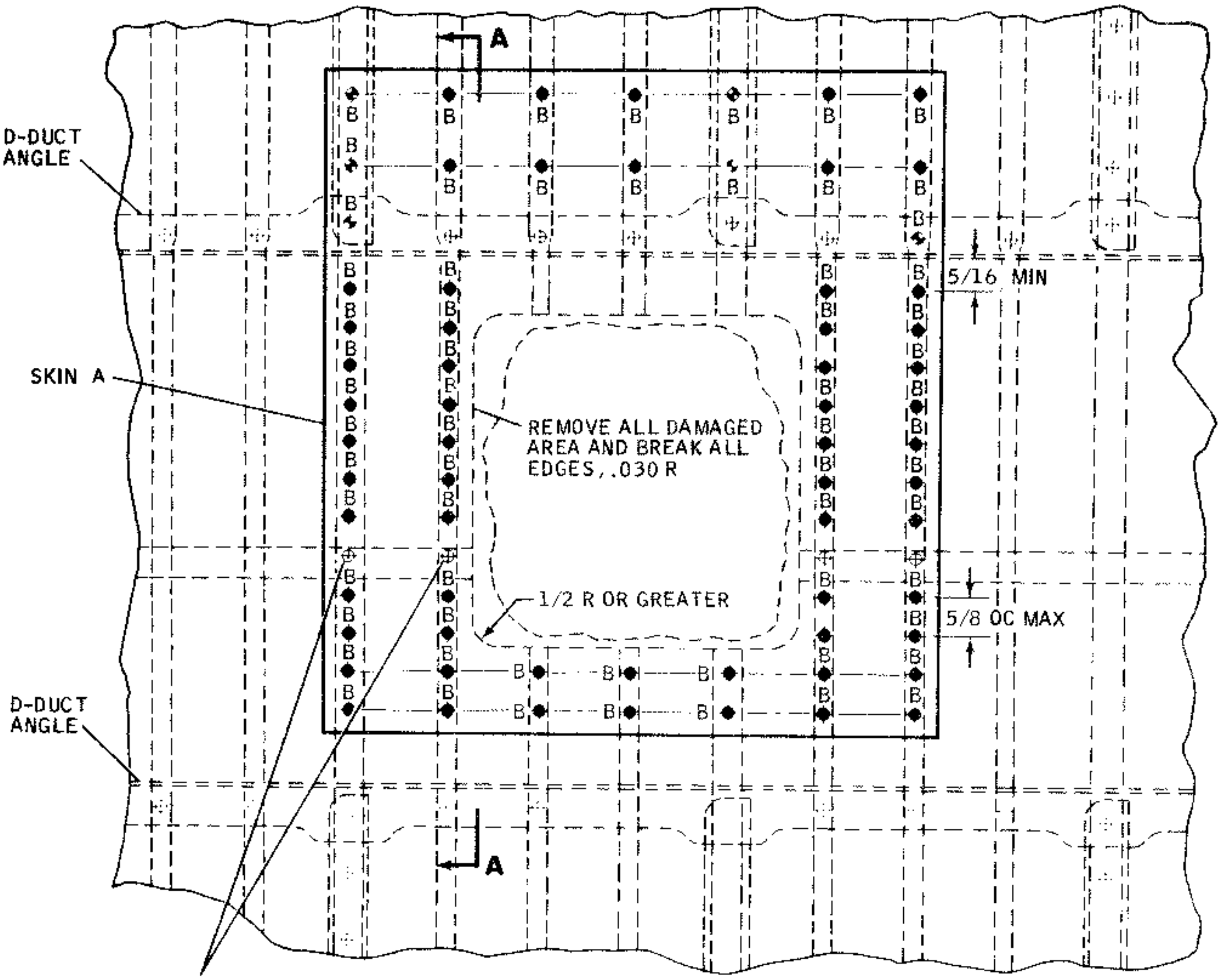
ITEM	NOMENCLATURE	GAGE	MATERIAL
A	FAIRING	.040	2014-0 CLAD
B	DOUBLER	.060	2014-0 CLAD
C	FILLER	.080	2014-0 CLAD
D	FILLER	.060	2014-0 CLAD
E	SHIM	.016	2014-0 CLAD

ITEM	TYPE OF FASTENER
F	NAS1097AD5 RIVET

◆ REPAIR RIVETS

BB3-889

Wing Leading Edge Minor Repair - Class A (DC-9-10)
Figure 1



IN AREA WHERE ROLLED EDGE OF INNER SKIN EXISTS, FASTENERS WILL NOT BE USED. HOWEVER, 2 ROWS OF FASTENER MUST ALWAYS EXIST BEYOND NOT USED FASTENERS.

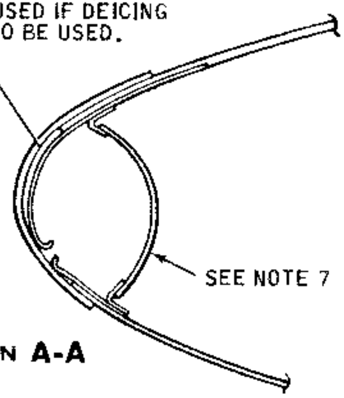
LEADING EDGE REPAIR
(LOOKING AFT)

⊕ ORIGINAL FASTENER
◆ REPAIR RIVET
◈ EXISTING RIVET LOCATION NEW RIVET CALLOUT

NOTES:

1. REPAIR MAY EXTEND PAST THE D-DUCT ANGLES (TOP OR BOTTOM), AND AFT AS LONG AS REPAIR DOES NOT INTERFERE WITH DOOR STRUCTURES OR ATTACH FASTENERS AT FRONT SPAR.
2. FASTENERS SHOULD BE PLACED IN CENTER OF LAND AREA.
3. NAS1398D4-2 RIVETS MAY BE USED AS OPTIONAL TO NAS1399D4-2 RIVETS. HOWEVER, THE NAS1399D4-2 RIVETS ARE PREFERABLE FOR LONGER SERVICE LIFE OF REPAIR.
4. IF REPAIR IS MADE BEHIND D-DUCT WEB, NAS1097AD-5 RIVETS MAY BE USED INSTEAD OF NAS1399D4 RIVETS.
5. HEAT TREAT PARTS MADE FROM 2014-0 TO 2014-T6 AFTER FORMING.
6. RADII OF 9/32 INCH ARE OPTIONAL FOR CORNER RADII OF REPAIR PARTS.
7. CONTACT DOUGLAS AIRCRAFT CO. BEFORE MAKING THIS REPAIR AND NOTIFY AS TO THE EXTENT OF DAMAGE TO THE SKIN, D-DUCT AND DEICING SYSTEM.

SEAL ENTIRE REPAIR SURFACE WITH RTV-1016 (GENERAL ELECT. CORP., SILICONE PRODUCTS DIV., WATERFORD, N.Y.).
OPTIONAL SEALER PR-1422 (PRODUCTS RESEARCH CO. BURBANK CALIF.) MAY BE USED IF DEICING SYSTEM IS NOT TO BE USED.



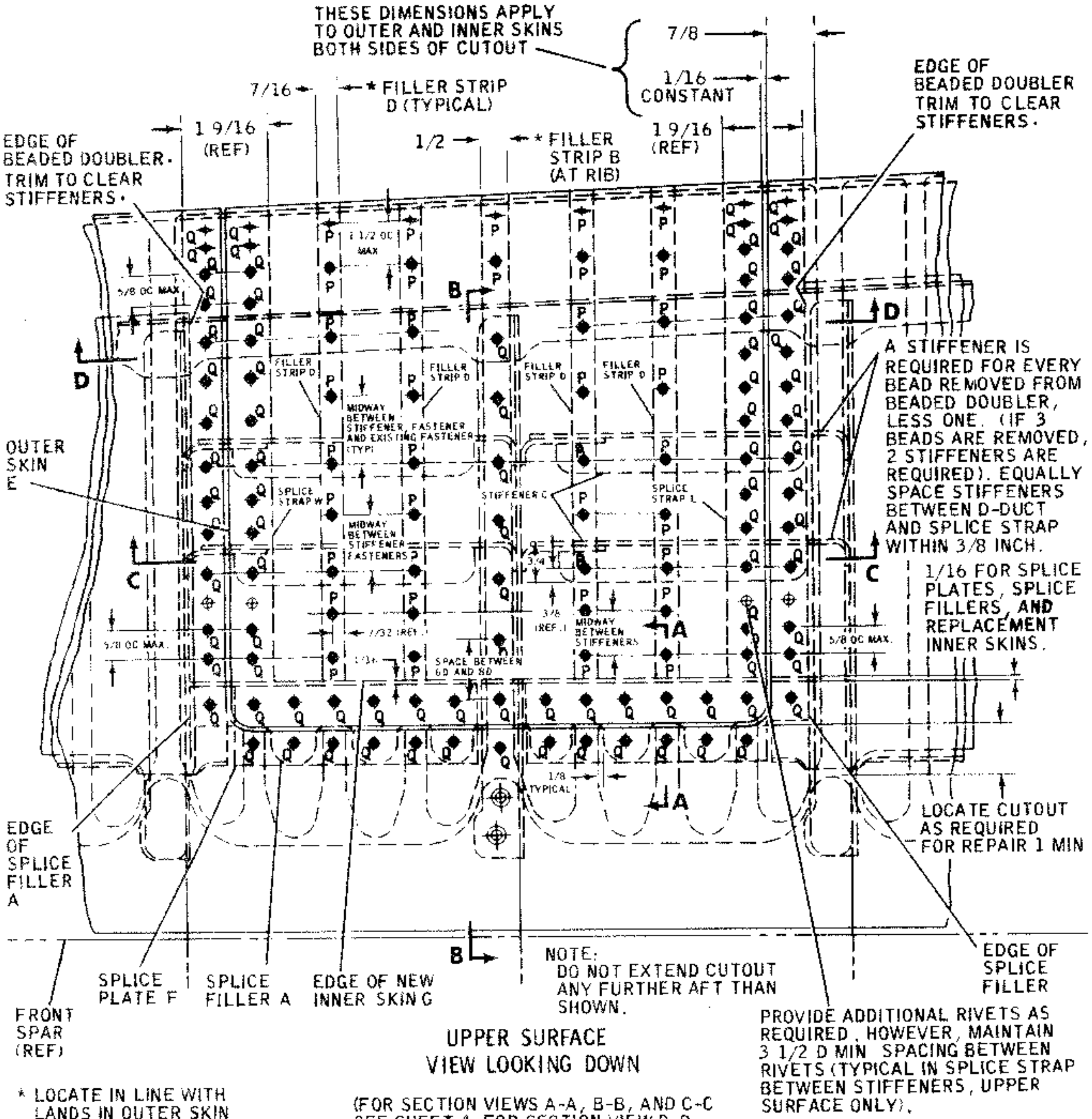
SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL
A	SKIN	.063	2014-0 CLAD

ITEM	TYPE OF FASTENER
B	NAS1399D4-2 RIVET

BB3-890

Wing Leading Edge Minor Repair - Class B (DC-9-10)
Figure 2



* LOCATE IN LINE WITH LANDS IN OUTER SKIN WITHIN ± 1/8.

(FOR SECTION VIEWS A-A, B-B, AND C-C SEE SHEET 4; FOR SECTION VIEW D-D, SEE SHEET 3)

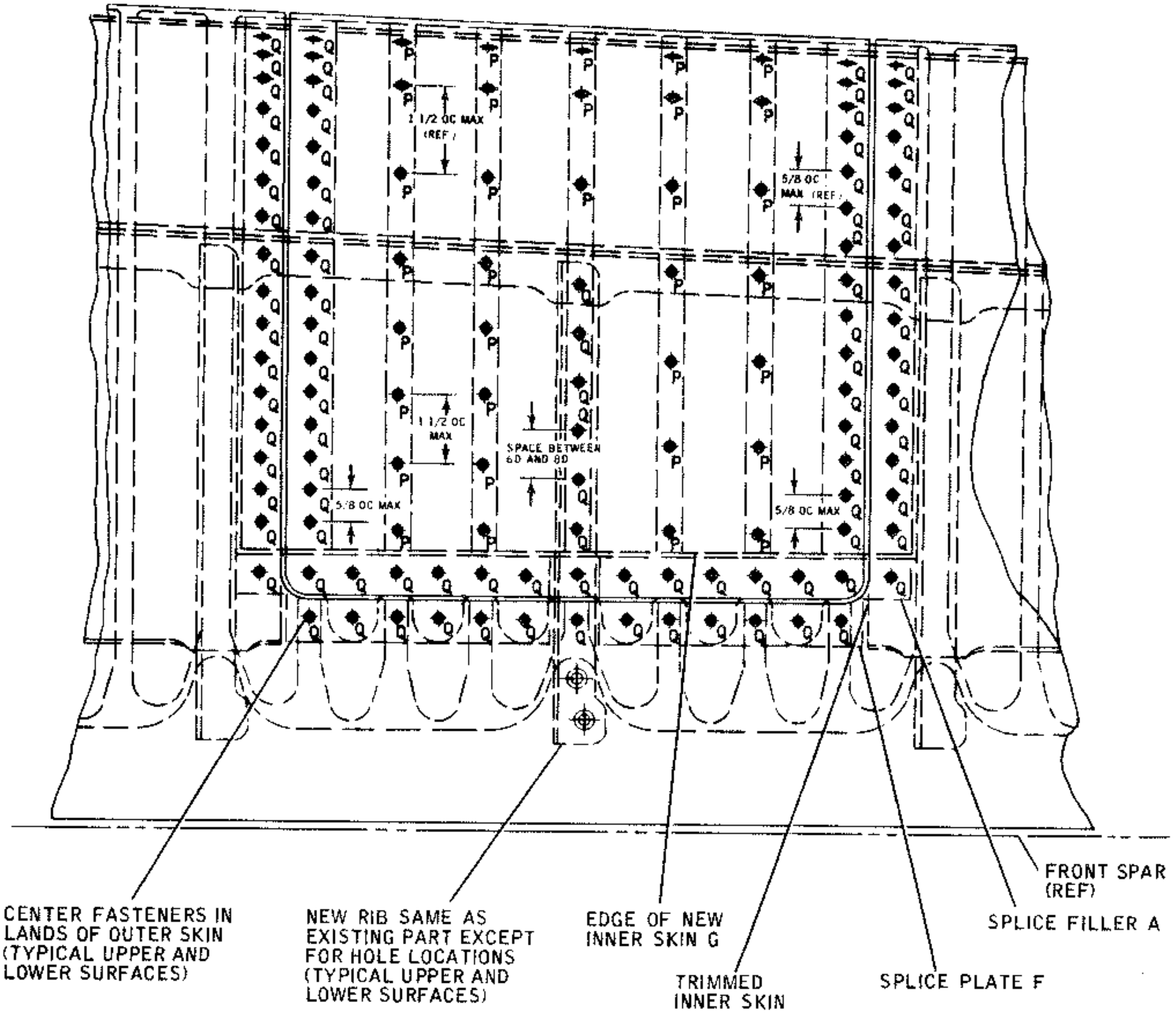
NOTES:

1. THIS REPAIR MUST NOT BE USED IF INTERFERENCE WITH DOUBLERS, STIFFENERS, DOORS OR ANY STRUCTURAL ITEM IN THE AREA OCCURS IN THE FOLLOWING AREAS (ALL STAS. ARE XFS): STAS. 83 TO 90, 108 TO 115, 152 TO 158, 183 TO 202, 214 TO 232, 239 TO 245, 263 TO 269, 275 TO 287, 299 TO 306, 343 TO 350, 387 TO 393, 431 TO 437, 481 TO 487, 525 TO 531, 556 TO 564.
2. REPAIR HAS NO DEFINITE LENGTH. FOR LONGER REPAIRS, THE RIBS UNDER OUTER SKIN, ITEM E, ARE ALL INSTALLED IN THE SAME MANNER AS THE ONE ILLUSTRATED.
3. STIFFENERS NOT USED OUTBOARD OF STA XFS 475.000 WHERE NO BEADED DOUBLER EXISTS.
4. REPAIR MUST MATCH EXISTING CONTOUR WITHIN ± .015.
5. RADII OF 9/32 INCH ARE OPTIONAL FOR CORNER EDGES OF REPAIR PARTS.
6. FOR MATERIAL IDENTIFICATION SEE SHEET 4.

✦ EXISTING RIVET LOCATION, NEW RIVET CALLOUT
✛ ORIGINAL FASTENER
⊕ ORIGINAL FASTENER USED IN REPAIR
◆ REPAIR RIVETS

BB3-891

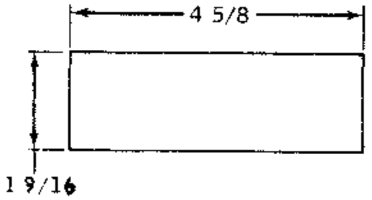
Wing Leading Edge Major Repair - Class A (DC-9-10)
Figure 3 (Sheet 1)



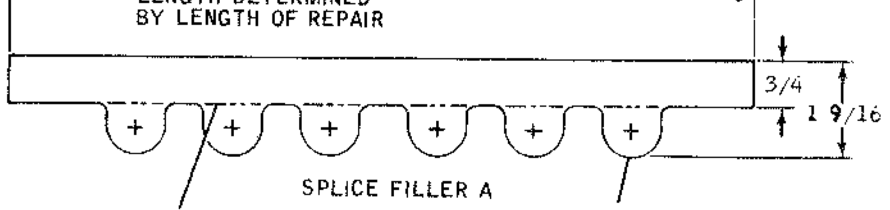
╪ ORIGINAL FASTENER USED IN REPAIR

◆ REPAIR RIVETS

LOWER SURFACE
VIEW LOOKING UP



SPLICE PLATE F



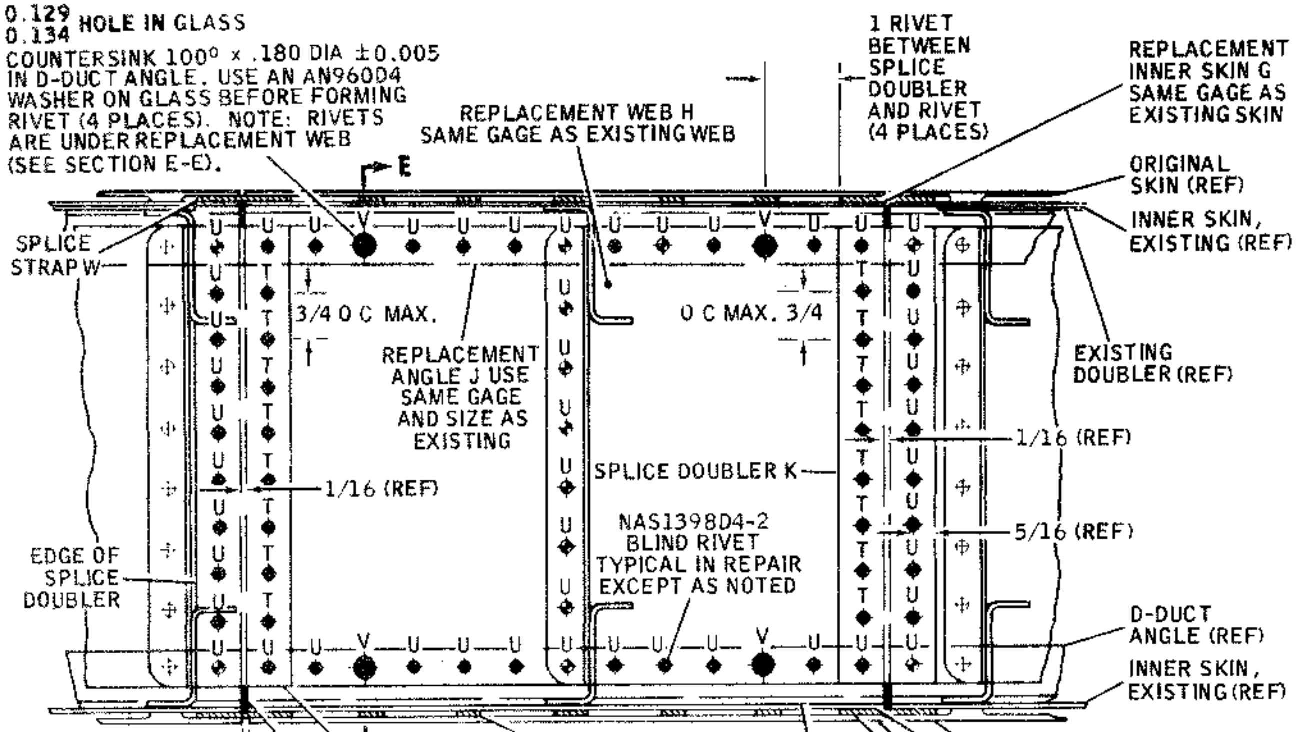
SPLICE FILLER A

OPTIONAL TRIMLINE. IF TRIMMED INSTALL AS SEPARATE PIECES. PART MAY BE TRIMMED AS LONG AS 2D EDGE DISTANCE IS HELD.

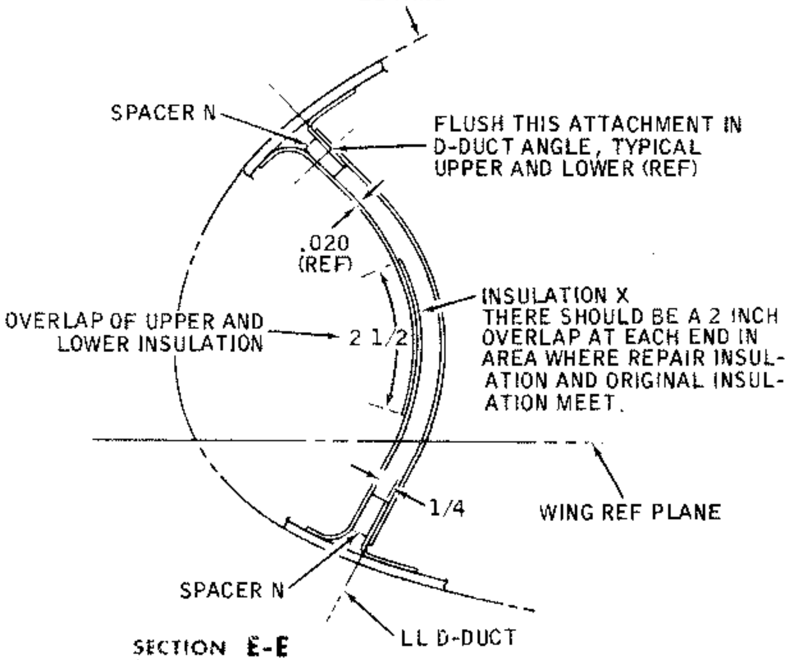
FULL RADIUS (TYPICAL)

BB3-892

Wing Leading Edge Major Repair - Class A (DC-9-10)
Figure 3 (Sheet 2)



SECTION D-D
EXPANDED VIEW
(FROM MAIN VIEW ON SHEET 1)



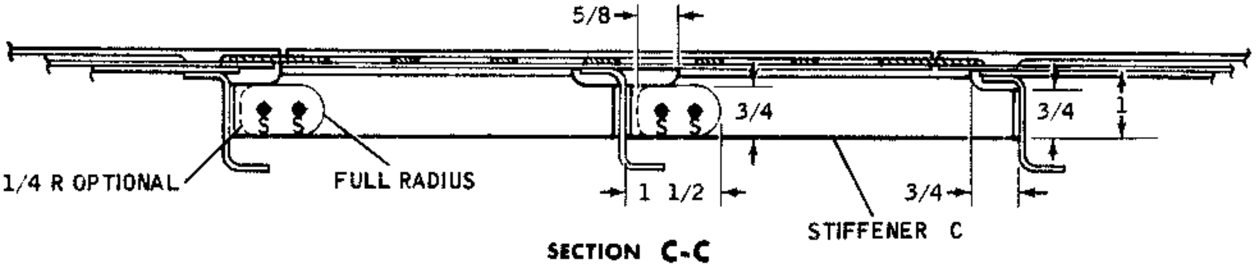
SECTION E-E
LOOKING INBOARD

NOTES:

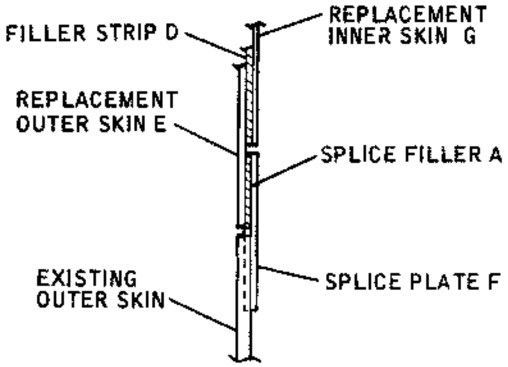
1. IF PICCOLO SUPPORT CLIP IS IN AREA, IT WILL HAVE TO BE RE-RIVETED, USING SAME LOCATION AND BLIND RIVETS.
2. IF ACCESS THROUGH D-DUCT WEB IS REQUIRED, USE WEB H, SPLICE DOUBLER K, ANGLE J, ANGLE M (ALWAYS SPLICE IN NEW ANGLES) AND INSULATION X AS SHOWN TO REPAIR WEB WHERE ACCESS HOLE WAS MADE.

BB3-893

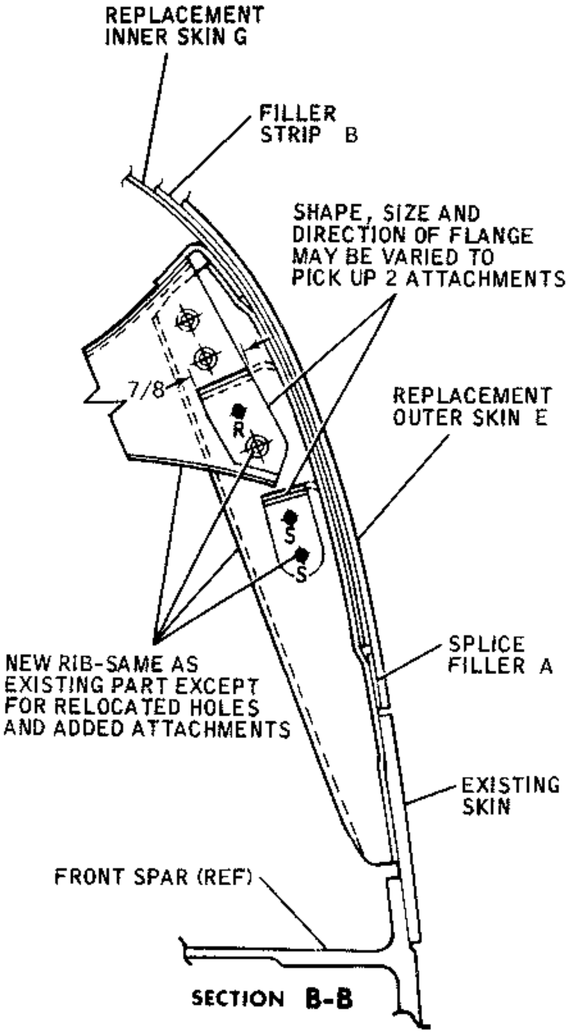
Wing Leading Edge Major Repair - Class A (DC-9-10)
Figure 3 (Sheet 3)



SECTION C-C
(SECTION VIEWS ON THIS SHEET
ORIGINATE ON SHEET 1)



SECTION A-A
(FASTENERS OMITTED FOR CLARITY)



SECTION B-B

ITEM	NOMENCLATURE	GAGE	MATERIAL
A	SPLICE FILLER	.060	2014-0 CLAD
B	FILLER STRIP	.060	2014-0 CLAD
C	STIFFENER	.050	2014-0 CLAD
D	FILLER STRIP	.060	2014-0 CLAD
E	OUTER SKIN	.040	2014-0 CLAD
F	SPLICE PLATE	.050	2014-0 CLAD
G	INNER SKIN	*	2014-0 CLAD
H	WEB	*	2014-T6 CLAD
J	ANGLE	*	2014-0 CLAD
K	SPLICE DOUBLER	.050	2014-T6 CLAD
L	SPLICE STRAP	.060	2014-0 CLAD
M	ANGLE	*	2014-0 CLAD
N	SPACER		SEE NOTE 2
W	SPLICE STRAP	.060	2014-0 CLAD
X	INSULATION		SEE NOTE 3

ITEM	TYPE OF FASTENER
P	NAS1097AD4 RIVET
Q	NAS1097AD5 RIVET
R	NAS1466-2 LOCKBOLT (2024-T4 COLLAR)
S	NS204070-AD5 RIVET
T	MS204070-AD4 RIVET
U	NS1398D4-2 RIVET
V	NAS1097AD4-7 RIVET

NOTES:

1. * MAKE FROM SAME GAGE AS EXISTING MATERIAL.
2. MAKE FROM B-STAGE PHENOLIC NO. 181 GLASS FIBER, 5/8 INCH SQUARE.
3. MAKE FROM DOUGLAS PART NOS. 5912474, 5912473, 5912472, 5912471, OR B-STAGE PHENOLIC, NO. 181 GLASS FABRIC.
4. HEAT TREAT PARTS MADE FROM 2014-0 TO 2014-T6 AFTER FORMING.

B83-895

Wing Leading Edge Major Repair - Class A (DC-9-10)
Figure 3 (Sheet 4)

TEMPORARY REVISION 57-27

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately preceding 57-10-0, Page 1. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Provides instructions for application of antichafe compound on flap expansion joint covers.
EFFECTIVITY:	ALL

Flap Expansion Joint Cover Repair - Description and Operation

1. General

A. Flap expansion joint covers may be repaired by application of antichafe compound, Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.), on the portion of cover surface not attached to the flap panels.

NOTE: For location of the covers, see the removable panel plating illustrations in Section 57-50-3 of the manual.

2. Prepare Surfaces

A. Unprimed Surfaces

(1) Clean the area by wiping with clean, lint-free cotton cloths dampened, not dripping, with methyl ethyl ketone, TT-M-261, until all traces of contaminants are removed. Change the cleaning cloths often enough to ensure that the contaminants are being removed and not just redeposited.

(2) Before the solvent has an opportunity to dry, wipe dry with clean, lint-free cotton cloths.

(3) Clean the area again by wiping with clean, lint-free cloths dampened with No. 901 cleaner (Tec Chemical Co., 524 South Monterey Pass Road, Monterey Park, Calif.). Dry with clean, lint-free cotton cloths before the solvent has started to dry.

(4) Again clean the area with methyl ethyl ketone dampened cloths and dry with clean, lint-free cotton cloths.

(5) Apply Alodine No. 1200 solution (see Paragraph 3).

B. FR Primed Surfaces

(1) Clean the area with clean, lint-free cotton cloths dampened with methyl ethyl ketone until all traces of contaminants are removed.

(2) Scuff sand the area with Scotchbrite Type A Aluminum Oxide Abrasive Nylon Wool Pads (Minnesota Mining and Manufacturing Co., 6023 Garfield Blvd., Los Angeles, Calif.), or equivalent.

(3) Repaint the area as required with FR primer, Koropon No. 515-006 with catalyst (DeSoto Chemical Co., Berkley, Calif.), by applying one wet cross coat.

3. Prepare and Apply Alodine No. 1200 Solution

A. Mix the following in a polyethylene bottle:

CAUTION: AVOID SKIN CONTACT WITH INGREDIENTS OR SOLUTION. WEAR RUBBER GLOVES AND PROTECTIVE FACE DEVICES WHEN MIXING OR APPLYING, IF INGREDIENTS OR SOLUTION CONTACT THE SKIN, FLUSH WITH WATER AND WASH THOROUGHLY WITH SOAP AND WATER.

Alodine No. 1200 powder (Amchem Products Inc., Box 390, St. Joseph, Mo.) ——— two ounces (by weight)

Nitric Acid (42°Baume), O-N-350 —— six cubic centimeters (by volume)

Kloramine D-100 wetting agent (A. Ramsey & Sons, International Paint Co., Vancouver, Canada) ——— 0.34 ounce (by weight)

B. Add tap water to make one gallon and agitate the solution thoroughly to ensure that the Alodine 1200 powder is dissolved.

C. Date the bottle to note when mixed.

CAUTION: DO NOT USE ALODINE SOLUTION MORE THAN 72 HOURS OLD. WHEN NOT IN USE, KEEP THE SOLUTION IN CLOSED POLYETHYLENE CONTAINERS.

D. Apply Alodine 1200 solution using clean, lint-free cotton cloths. Keep the solution wet and agitate the area by constant swabbing for five minutes. Do not permit the solution to puddle and dry.

E. Wash with clean, lint-free cotton cloths and tap water and then wipe dry using clean, lint-free cotton cloths. Change the cloths and wash water frequently.

CAUTION: ALODINE RESIDUE MAY PREVENT ADHESION. ALL RESIDUE MUST BE REMOVED.

4. Prepare Laminar X-500 Teflon Coating

A. Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.) is a three-part material consisting of a resin/pigment (component A), a hardener (component B), and a thinner/converter (component C).

B. Mix the material as follows:

(1) Before weighing, thoroughly mix the resin/pigment (component A) until pigments are uniformly dispersed.

(2) Add components B and C and thoroughly mix the materials using the following proportions:

Resin/pigment (Component A)	57.5 parts (by weight)
Hardener (Component B)	18.5 parts (by weight)
Thinner/converter (Component C)	24.0 parts (by weight)

(3) Permit catalyzed material to stand at least five minutes before using.

5. Apply Laminar X-500 Teflon Coating

A. Spray Application

(1) Mask around areas to prevent overspray.

(2) Apply five to six successive cross coats using an MBC spray gun (DeVilbiss Co., Box 913, 300 Phillips Ave., Toledo, Ohio) with a No. E needle and a No. 30 air cap, or an equivalent spray gun, needle, and air cap combination.

NOTE: Five to six successive cross coats of Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch. Immediately after use, thoroughly clean spray equipment using methyl ethyl ketone.

(3) Allow material to cure for 24 hours at 21.1°C (70°F).

B. Brush Application

(1) Mask around areas to prevent run-off onto adjacent parts.

(2) Using high quality bristle brushes, apply one uniform wet coat. Allow to air dry for two hours at ambient temperature.

(3) Apply a second uniform wet coat.

(4) Allow material to cure for 24 hours at 21.1°C (70°F).

NOTE: Two wet brush coats of the Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch.

Flap Expansion Joint Cover Repair - Description and Operation

1. General

A. Flap expansion joint covers may be repaired by application of antichafe compound, Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.), on the portion of cover surface not attached to the flap panels.

NOTE: For location of the covers, see the removable panel plating illustrations in Section 57-50-3 of the manual.

2. Prepare Surfaces

A. Unprimed Surfaces

(1) Clean the area by wiping with clean, lint-free cotton cloths dampened, not dripping, with methyl ethyl ketone, TT-M-261, until all traces of contaminants are removed. Change the cleaning cloths often enough to ensure that the contaminants are being removed and not just redeposited.

(2) Before the solvent has an opportunity to dry, wipe dry with clean, lint-free cotton cloths.

(3) Clean the area again by wiping with clean, lint-free cloths dampened with No. 901 cleaner (Tec Chemical Co., 524 South Monterey Pass Road, Monterey Park, Calif.). Dry with clean, lint-free cotton cloths before the solvent has started to dry.

(4) Again clean the area with methyl ethyl ketone dampened cloths and dry with clean, lint-free cotton cloths.

(5) Apply Alodine No. 1200 solution (see Paragraph 3).

B. FR Primed Surfaces

(1) Clean the area with clean, lint-free cotton cloths dampened with methyl ethyl ketone until all traces of contaminants are removed.

(2) Scuff sand the area with Scotchbrite Type A Aluminum Oxide Abrasive Nylon Wool Pads (Minnesota Mining and Manufacturing Co., 6023 Garfield Blvd., Los Angeles, Calif.), or equivalent.

(3) Repaint the area as required with FR primer, Koropon No. 515-006 with catalyst (DeSoto Chemical Co., Berkley, Calif.), by applying one wet cross coat.

3. Prepare and Apply Alodine No. 1200 Solution

A. Mix the following in a polyethylene bottle:

CAUTION: AVOID SKIN CONTACT WITH INGREDIENTS OR SOLUTION. WEAR RUBBER GLOVES AND PROTECTIVE FACE DEVICES WHEN MIXING OR APPLYING, IF INGREDIENTS OR SOLUTION CONTACT THE SKIN, FLUSH WITH WATER AND WASH THOROUGHLY WITH SOAP AND WATER.

Alodine No. 1200 powder (Amchem Products Inc., Box 390, St. Joseph, Mo.) ———— two ounces (by weight)

Nitric Acid (42°Baume), O-N-350 ———— six cubic centimeters (by volume)

Kloramine D-100 wetting agent (A. Ramsey & Sons, International Paint Co., Vancouver, Canada) ———— 0.34 ounce (by weight)

B. Add tap water to make one gallon and agitate the solution thoroughly to ensure that the Alodine 1200 powder is dissolved.

C. Date the bottle to note when mixed.

CAUTION: DO NOT USE ALODINE SOLUTION MORE THAN 72 HOURS OLD. WHEN NOT IN USE, KEEP THE SOLUTION IN CLOSED POLYETHYLENE CONTAINERS.

D. Apply Alodine 1200 solution using clean, lint-free cotton cloths. Keep the solution wet and agitate the area by constant swabbing for five minutes. Do not permit the solution to puddle and dry.

E. Wash with clean, lint-free cotton cloths and tap water and then wipe dry using clean, lint-free cotton cloths. Change the cloths and wash water frequently.

CAUTION: ALODINE RESIDUE MAY PREVENT ADHESION. ALL RESIDUE MUST BE REMOVED.

4. Prepare Laminar X-500 Teflon Coating

A. Laminar X-500 Teflon Coating (Magna Coatings and Chemical Corp., 1785 North Eastern Ave., Los Angeles, Calif.) is a three-part material consisting of a resin/pigment (component A), a hardener (component B), and a thinner/converter (component C).

B. Mix the material as follows:

(1) Before weighing, thoroughly mix the resin/pigment (component A) until pigments are uniformly dispersed.

(2) Add components B and C and thoroughly mix the materials using the following proportions:

Resin/pigment (Component A)	57.5 parts (by weight)
Hardener (Component B)	18.5 parts (by weight)
Thinner/converter (Component C)	24.0 parts (by weight)

(3) Permit catalyzed material to stand at least five minutes before using.

5. Apply Laminar X-500 Teflon Coating

A. Spray Application

(1) Mask around areas to prevent overspray.

(2) Apply five to six successive cross coats using an MBC spray gun (DeVilbiss Co., Box 913, 300 Phillips Ave., Toledo, Ohio) with a No. E needle and a No. 30 air cap, or an equivalent spray gun, needle, and air cap combination.

NOTE: Five to six successive cross coats of Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch. Immediately after use, thoroughly clean spray equipment using methyl ethyl ketone.

(3) Allow material to cure for 24 hours at 21.1°C (70°F).

B. Brush Application

(1) Mask around areas to prevent run-off onto adjacent parts.

(2) Using high quality bristle brushes, apply one uniform wet coat. Allow to air dry for two hours at ambient temperature.

(3) Apply a second uniform wet coat.

(4) Allow material to cure for 24 hours at 21.1°C (70°F).

NOTE: Two wet brush coats of the Laminar X-500 Teflon coating should result in a dry film thickness of 0.008 to 0.010 inch.

MAIN FRAME - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates components of wing main frame ribs and bulkheads. Types and gages of material used in construction of assemblies are identified within illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

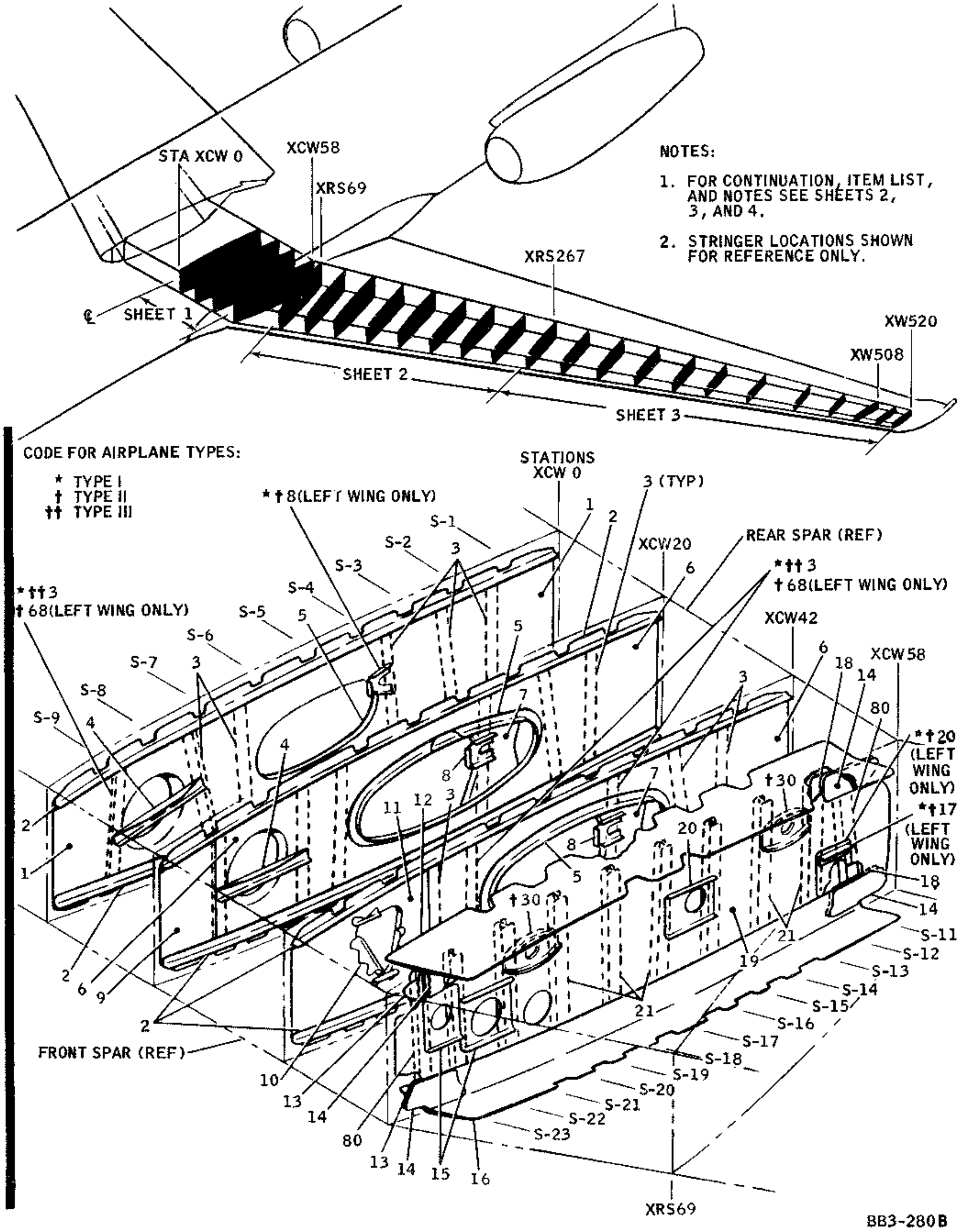
Structural Component	Approved Repairs
All	57-01, Figure 1
Stringers (Except in fuel tank areas)	57-01, Figure 2, Sheet 3
Frames, Formers, Bulkheads (Except in fuel tank areas)	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4 57-01, Figure 5, Sheet 2

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

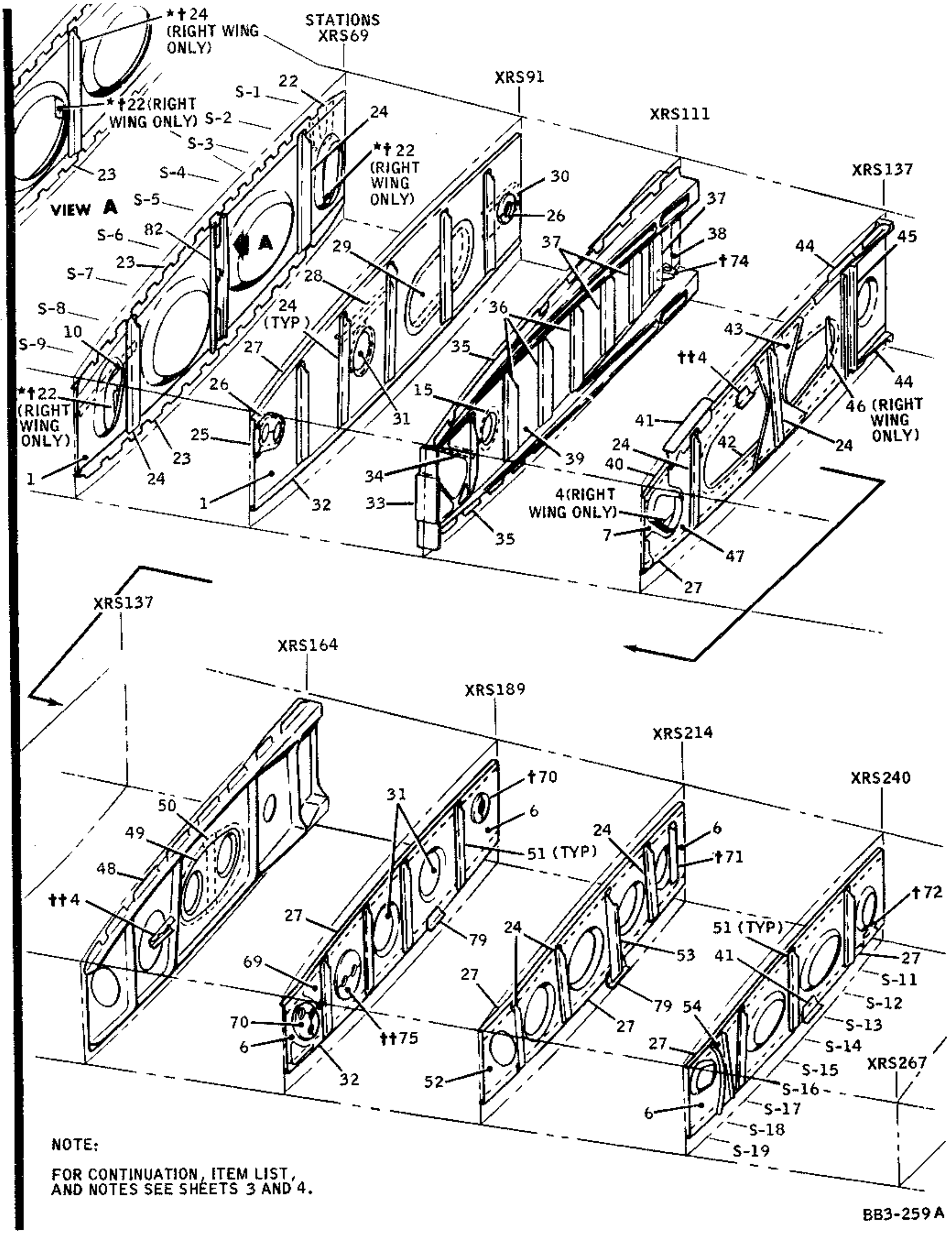
MAIN FRAME RIBS AND BULKHEADS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures in this section illustrate wing main frame rib and bulkhead materials. Materials are identified in material lists by item number callouts.



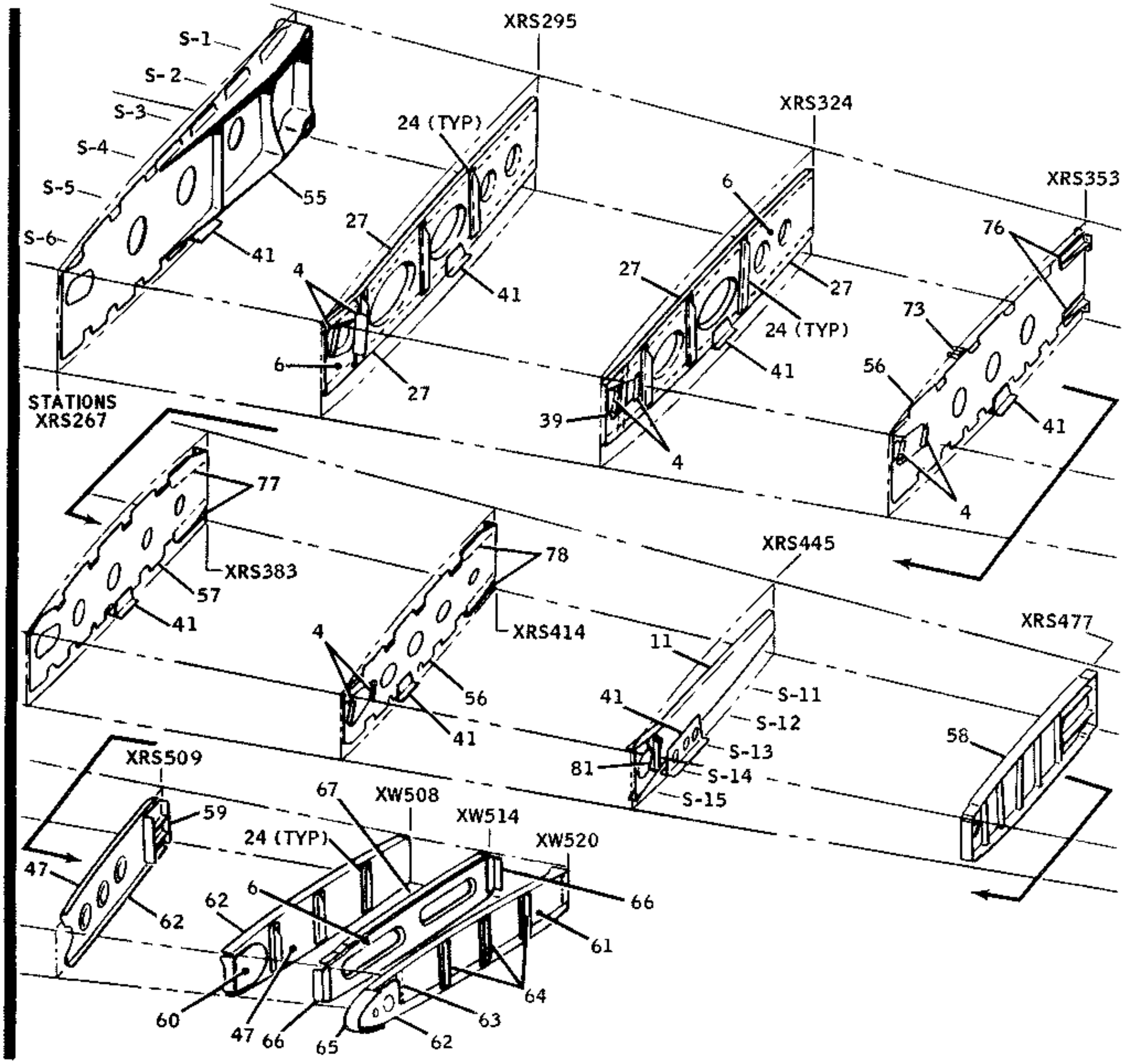
Wing Main Frame Ribs and Bulkheads -- Types I, II, and III
Figure 1 (Sheet 1)



NOTE:

FOR CONTINUATION, ITEM LIST, AND NOTES SEE SHEETS 3 AND 4.

Wing Main Frame Ribs and Bulkheads -- Types I, II, and III
Figure 1 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.063	CLAD 7075-T6	11	WEB	1.000	PLATE 7075-T651
2	CAP		1544604	12	CAP		4911243
3	STIFFENER		1093791	13	SPLICE	.160	CLAD 7075-T6
4	BRACKET	.063	CLAD 7075-T6	14	SPLICE	.250	CLAD 7075-T651
5	ANGLE		1415615	15	DOUBLER	.090	CLAD 7075-T6
6	WEB	.050	CLAD 7075-T6	16	CAP		4911242
7	DOUBLER	.071	CLAD 7075-T6	17	STIFFENER		1417984
8	BRACKET	.050	CLAD 7075-T6	18	SPLICE	.125	CLAD 7075-T6
9	WEB	.080	CLAD 7075-T6	19	WEB	.160	CLAD 7075-T6
10	ANGLE	.063	CLAD 2024-T42	20	DOUBLER	.100	CLAD 7075-T6

(FOR CONTINUATION OF LIST OF MATERIAL SEE SHEET 4)

BB3-446B

Wing Main Frame Ribs and Bulkheads -- Types I, II, and III
Figure 1 (Sheet 3)

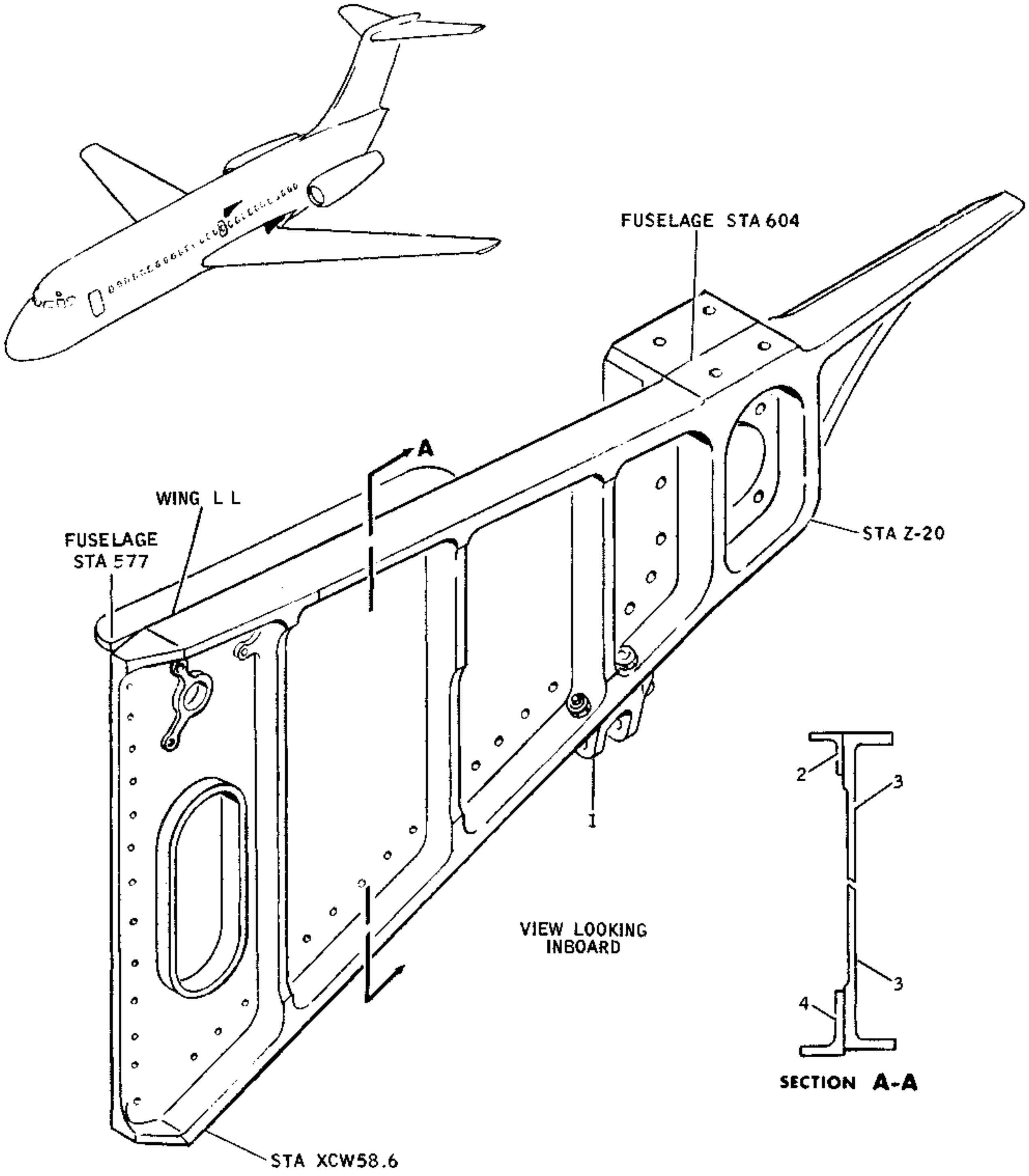
ITEM	NOMENCLATURE	GAGE	MATERIAL
21	STIFFENER		2912311
22	CLIP	.063	CLAD 2024-T42
23	CAP		1363992
24	STIFFENER		2912830
25	PLATE	.500	PLATE 7075-T651
26	SUPPORT		SEE NOTE 3
27	CAP		2777927
28	ANGLE		1464708
29	DOOR	.063	CLAD 7075-T6
30	DOUBLER	.063	CLAD 7075-T6
31	FLAPPER, 3911334		SEE NOTE 4
32	CAP		2912466
33	FITTING,9911788		PLATE 7075-T651
34	CLIP		1642726
35	CAP, 9911793		7075-T411 FORGING
36	STIFFENER		1532213
37	STIFFENER		1533937
38	SHIM	.032	CLAD 7075-T6
39	WEB	.190	CLAD 7075-T6
40	CAP		1418201
41	TEE		1418683
42	CAP		1291250
43	GUSSET	.080	CLAD 7075-T6
44	FITTING,3912408		BAR 7075-T651
45	STIFFENER	.063	CLAD 7075-T6
46	BRACKET		1249243
47	WEB	.071	CLAD 7075-T6
48	WEB, 5912070		2014-T6 FORGING
49	COVER	.050	CLAD 7075-T6
50	STIFFENER		1248529
51	STIFFENER		1475407
52	WEB	.250	CLAD 7075-T651
53	STIFFENER	.071	CLAD 7075-T6
54	STIFFENER	.070	CLAD 7075-T6
55	WEB, 5912284		7075-T73 FORGING
56	WEB	1.500	PLATE 7075-T651
57	WEB	.875	PLATE 7075-T651
58	RIB	1.500	PLATE 7075-T651
59	SUPPORT	1.250	PLATE 7075-T651
60	COVER	.063	CLAD 2014-T6
61	RIB	.071	CLAD 2024-T42
62	CAP	.071	CLAD 2024-T42
63	DOUBLER	1.125	PLATE 2024-T351
64	STIFFENER		1361666
65	DOUBLER	.080	CLAD 2014-T6
66	CLIP	.050	CLAD 2024-T42
67	ANGLE	.050	CLAD 2024-T42
68	STIFFENER		1418684
69	DOUBLER	.250	PLATE 7075-T651
70	PLATE	.250	SEE NOTE 5
71	SUPPORT	.063	CLAD 2024-T3
72	BRACKET	.063	CLAD 2024-T3
73	SUPPORT	.050	CLAD 2024-T3
74	BRACKET	.040	CLAD 2024-T3
75	PLATE	.1875	SEE NOTE 5
76	FITTING, 4911392		PLATE 7075-T651
77	FITTING, 4911453		PLATE 7075-T651
78	FITTING, 4911450		PLATE 7075-T651
79	ANGLE		1418990
80	STIFFENER		2614727
81	TEE		1414813
82	STIFFENER	.125	CLAD 7075-T6

NOTES: (CONTINUED FROM SHEET 1)

3. MADE FROM .250 GAGE SLAB POLYAMIDE, (NYLON), MIL-P-46060 NYLON 6-6.
4. MADE FROM MOLDED POLYAMIDE (NYLON), MIL-P-17091, TYPE 2.
5. MADE FROM SLAB POLYAMIDE (NYLON), MIL-P-17091, TYPE 1.
6. REFERENCE-DOUGLAS DRAWINGS 5910037, 7910004, 9911600 THRU 9911621, AND 5920872.

BB3-447B

Wing Main Frame Ribs and Bulkheads -- Types I, II, and III
Figure 1 (Sheet 4)



NOTES:

1. MADE FROM 2.500 IN. 7075-T651 BAR.
2. MADE FROM 2.125 IN. 7075-T651 PLATE.
3. MADE FROM 2.500 IN. 7075-T651 PLATE.
4. REFERENCE - DOUGLAS DRAWING 9910048

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BRACKET		SEE NOTE 1
2	ANGLE		1419314
3	PANEL		SEE NOTE 2
4	PANEL		SEE NOTE 3

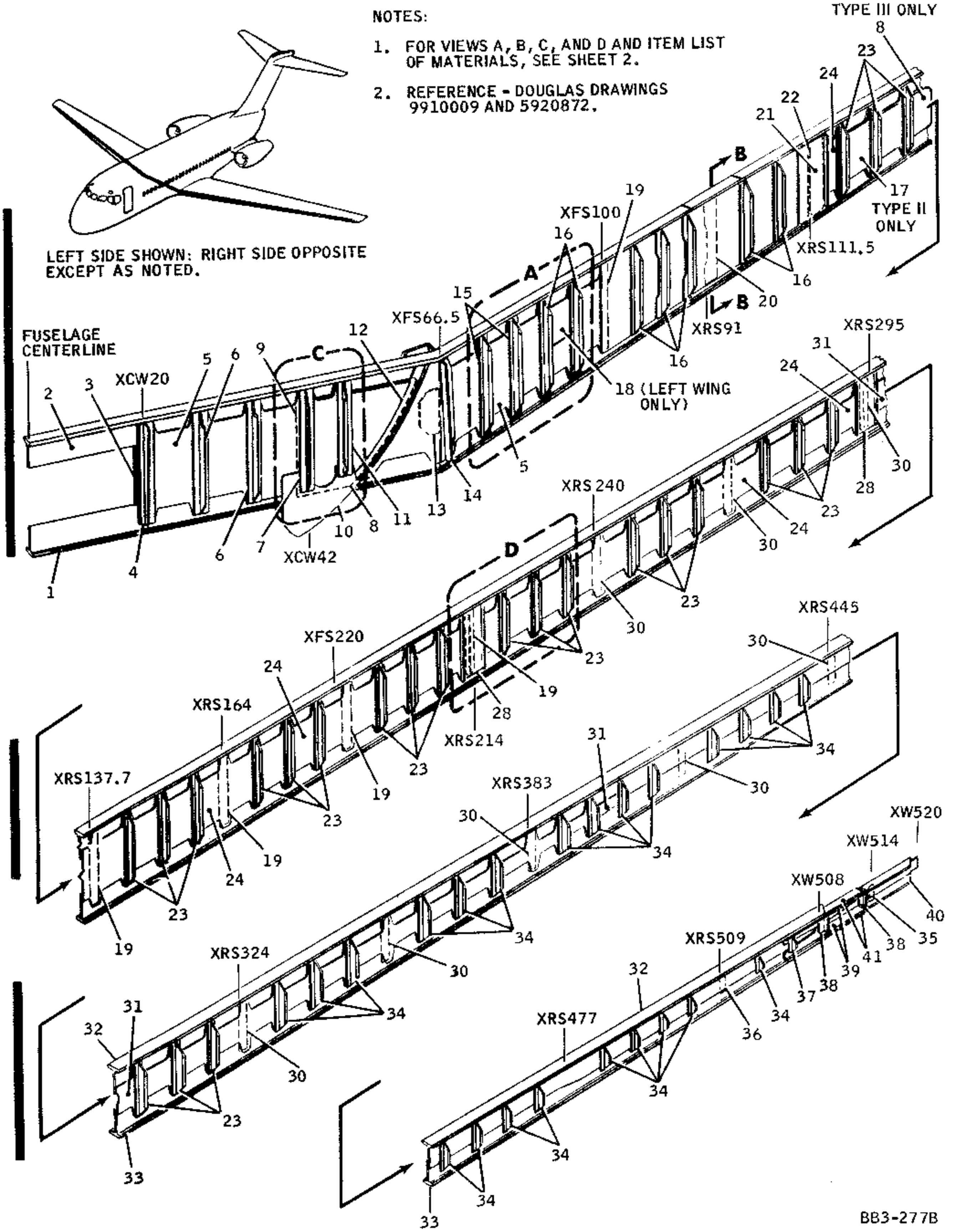
BB3-254A

Trapezoidal Panel Structure
Figure 2

MAIN FRAME SPARS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures in this section illustrate main frame spar materials. Materials are identified in material lists by item number callouts.



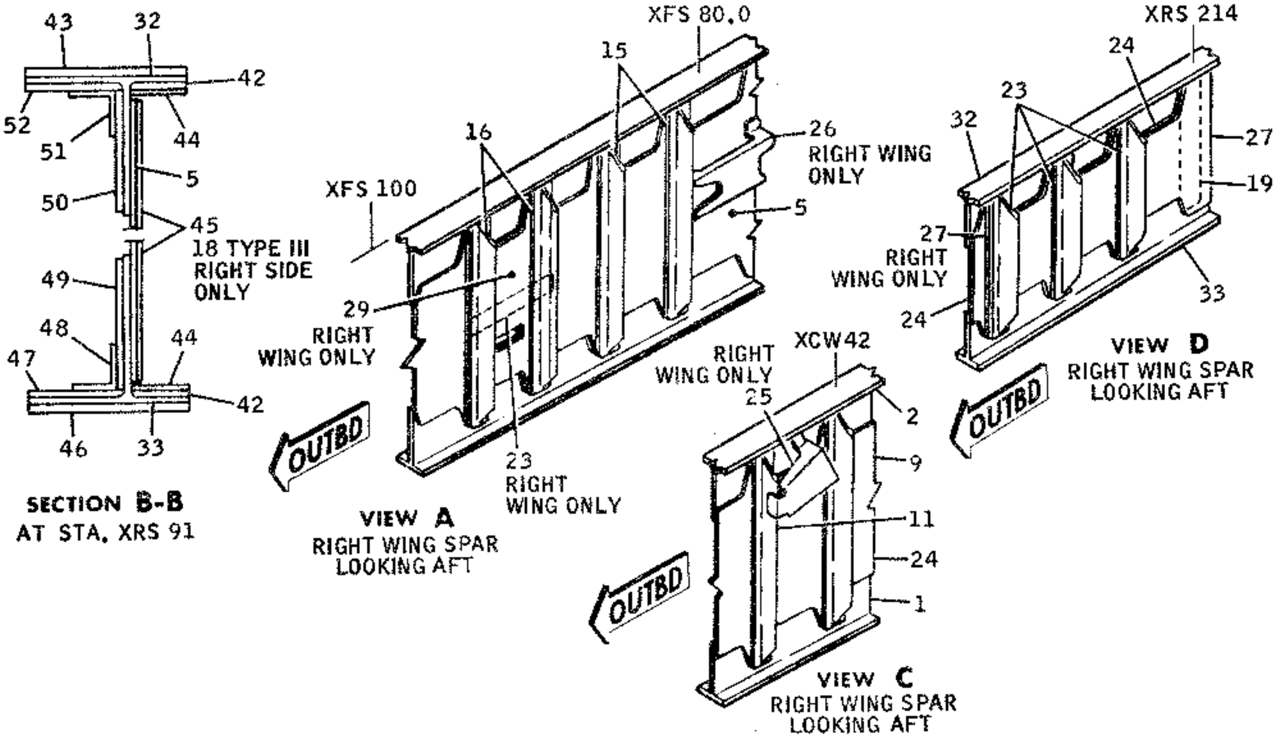
NOTES:

1. FOR VIEWS A, B, C, AND D AND ITEM LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWINGS 9910009 AND 5920872.

LEFT SIDE SHOWN: RIGHT SIDE OPPOSITE EXCEPT AS NOTED.

BB3-277B

Wing Front Spar Structure -- Types I, II, and III
Figure 1 (Sheet 1)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP, NO. 5911307		FORGING 2014-T411
2	CAP, NO. 5911306		FORGING 7075-T411
3	TEE		2640548
4	STIFFENER		1416793
5	WEB	.090	CLAD 7075-T6
6	STIFFENER		1532213
7	TEE		2620678
8	DOUBLER	.040	CLAD 7075-T6
9	STIFFENER		1528377
10	FITTING		FORGING 2014-T6
11	STIFFENER		2614737
12	ANGLE	.188	CLAD 7075-T6
13	ANGLE	.250	CLAD 7075-T6
14	ANGLE		1205311
15	STIFFENER		1419073
16	STIFFENER		1248529
17	DOUBLER	.125	CLAD 7075-T6
18	DOUBLER	.071	CLAD 7075-T6
19	TEE		2777974
20	TEE	3.000	BAR 7075-T651
21	ANGLE	.071	CLAD 7075-T6
22	SHIM	.020	CLAD 7075-T6
23	STIFFENER		2613680
24	WEB	.071	CLAD 7075-T6
25	BRACKET	.071	CLAD 7075-T6
26	BRACKET	.063	CLAD 7075-T6
27	DOUBLER	.063	CLAD 7075-T6
28	CHANNEL	.063	CLAD 7075-T6
29	DOUBLER	.090	CLAD 7075-T6
30	TEE		2777975
31	WEB	.063	CLAD 7075-T6
32	CAP		4912718
33	CAP		4911207
34	STIFFENER		2915844
35	CLIP	.050	2024-T42
36	ANGLE	.160	CLAD 7075-T6
37	ANGLE		1361666
38	ANGLE	.050	CLAD 2014-T6
39	SPLICE ANGLE	.080	CLAD 7075-T6
40	INTERCOSTAL	.080	CLAD 7075-T6
41	FILLER	.100	CLAD 2024-T3
42	SPLICE	.250	PLATE 7075-T651
43	WEDGE	.312	PLATE 7075-T651
44	STRAP	.063	CLAD 7075-T6
45	DOUBLER	.050	CLAD 7075-T6
46	SPLICE WEDGE	.375	PLATE 2024-T351
47	SPLICE PLATE	.500	PLATE 2024-T351
48	ANGLE		1105662
49	SPLICE PLATE	.375	PLATE 2024-T351
50	SPLICE PLATE	.375	PLATE 7075-T651
51	ANGLE		2464541
52	SPLICE PLATE	.500	PLATE 7075-T651

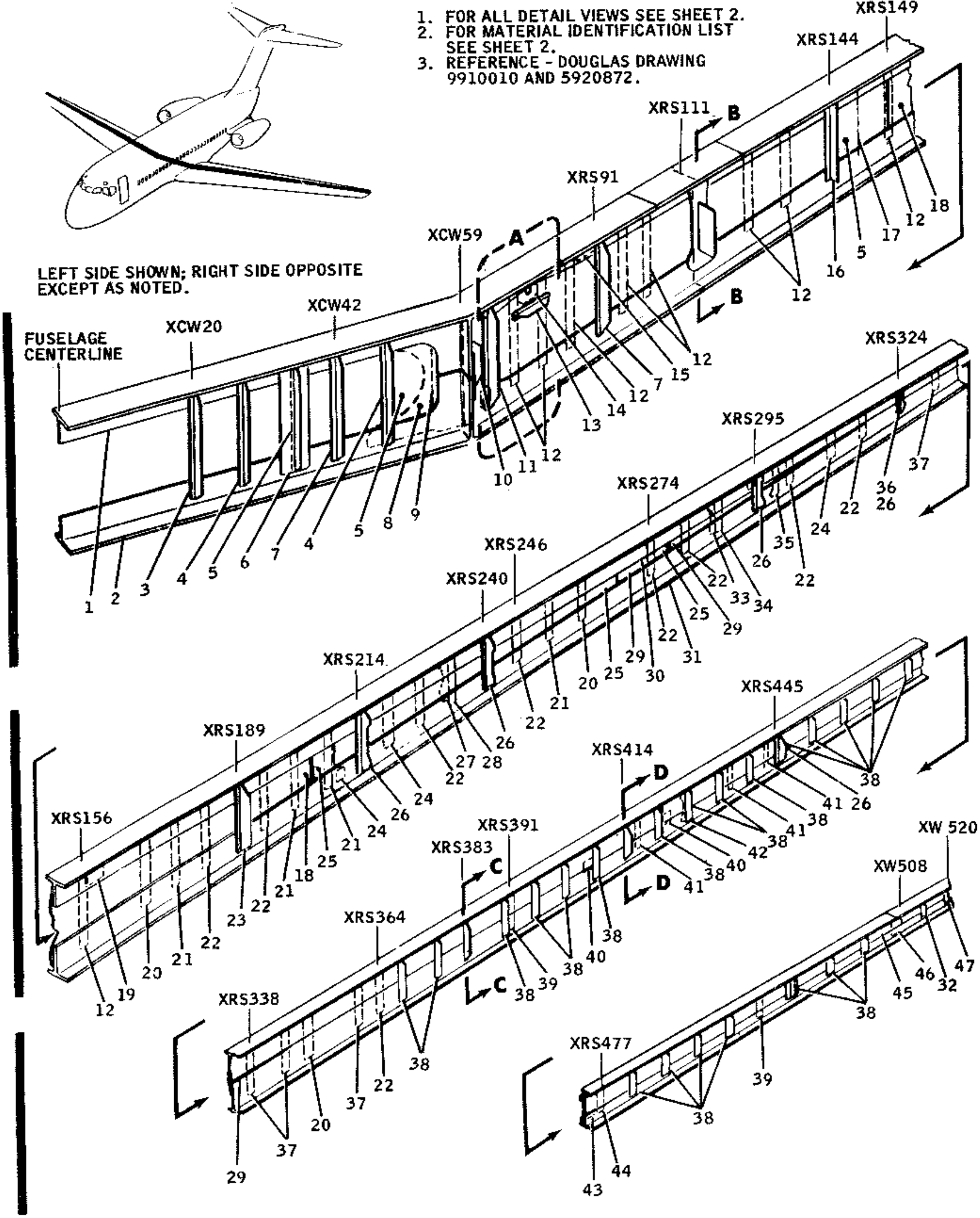
BB3-279B

Wing Front Spar Structure -- Types I, II and III
Figure 1 (Sheet 2)

NOTES:

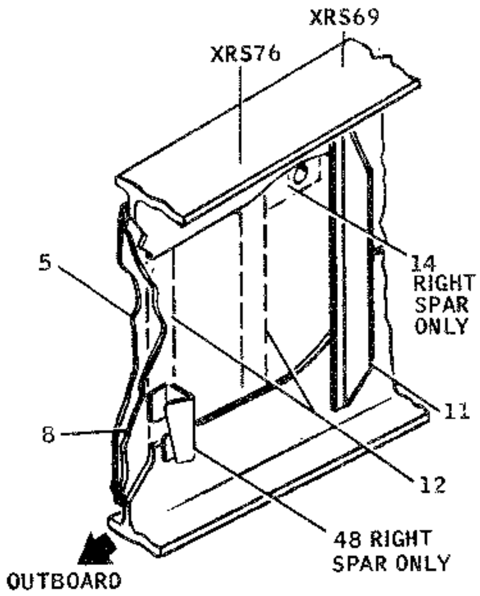
1. FOR ALL DETAIL VIEWS SEE SHEET 2.
2. FOR MATERIAL IDENTIFICATION LIST SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 9910010 AND 5920872.

LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE EXCEPT AS NOTED.

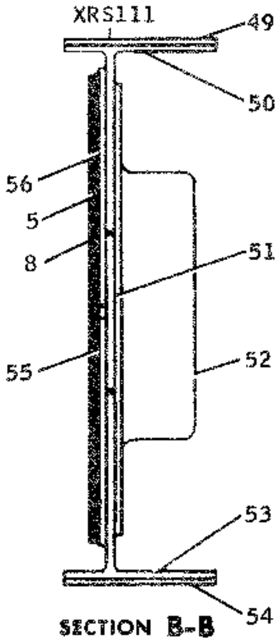


BB3-278B

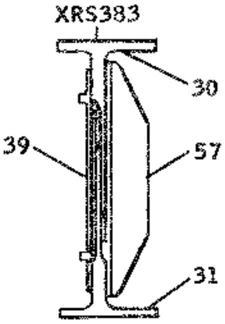
Wing Rear Spar Structure
Figure 2 (Sheet 1)



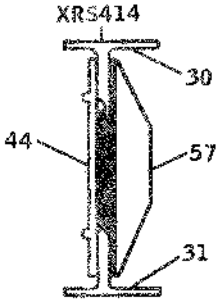
VIEW A
RIGHT WING SPAR
LOOKING AFT



SECTION B-B
AT STA XRS111



SECTION C-C
AT STA XRS383



SECTION D-D
AT STA XRS414

NOTES:

1. MADE FROM 7075 - T6511, SHAPE NO. 4911204.
2. MADE FROM 2024 - T3511, SHAPE NO. 4911205.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP, NO. 5911304		2014-T411 FORGING	30	CAP, NO. 5911301		SEE NOTE 1
2	CAP, NO. 5911305		2014-T411 FORGING	31	CAP, NO. 5911300		SEE NOTE 2
3	TEE		1362783	32	ANGLE	.063	CLAD 7075-T6
4	STIFFENER		2640729	33	SUPPORT	4.500	2014-T411 FORGING
5	WEB	.160	CLAD 7075-T6	34	ANGLE		1419056
6	TEE		2640547	35	TEE	2.000	PLATE 7075-T651
7	TEE		2620678	36	TEE		1298026
8	DOUBLER	.160	CLAD 7075-T6	37	STIFFENER		1419318
9	FITTING	2.500	BAR 7075-T651	38	STIFFENER		2915844
10	ANGLE		4616560	39	RETAINER	.375	PLATE 7075-T651
11	TEE		2644854	40	HAT	.063	CLAD 7075-T6
12	STIFFENER		2613679	41	FITTING	.625	PLATE 7075-T651
13	STIFFENER		1532213	42	FITTING	.625	PLATE 7075-T651
14	NIPPLE ASSY		BAR 6061-T51	43	FITTING	.875	PLATE 7075-T651
*15	BRACKET	.090	CLAD 7075-T6	44	RETAINER	.375	PLATE 7075-T651
*16	TEE		1642914	45	SPLICE	.080	CLAD 7075-T6
17	STIFFENER	.090	CLAD 2024-T42	46	INTERCOSTAL	.080	CLAD 7075-T6
18	WEB	.100	CLAD 7075-T6	47	ANGLE	.080	CLAD 2024-T42
19	CHANNEL	.100	CLAD 7075-T6	48	CLIP	.050	CLAD 2024-T3
20	STIFFENER		2506870	49	SPLICE PLATE	.312	PLATE 7075-T651
21	STIFFENER		2613680	50	TEE		SEE NOTE 1
22	STIFFENER		1248307	51	FILLER	.375	PLATE 7075-T651
*23	TEE		1642914	52	TEE		2644853
24	FITTING	2.000	PLATE 7075-T651	53	SPLICE TEE		SEE NOTE 2
25	WEB	.080	CLAD 7075-T6	54	SPLICE PLATE	.312	PLATE 2024-T351
26	TEE		2506195	55	SPLICE PLATE	.375	PLATE 2024-T351
27	ANGLE		1298097	56	SPLICE PLATE	.375	PLATE 7075-T6
28	SUPPORT	4.500	2014-T411 FORGING	57	TEE		1646170
29	WEB	.071	CLAD 7075-T6				

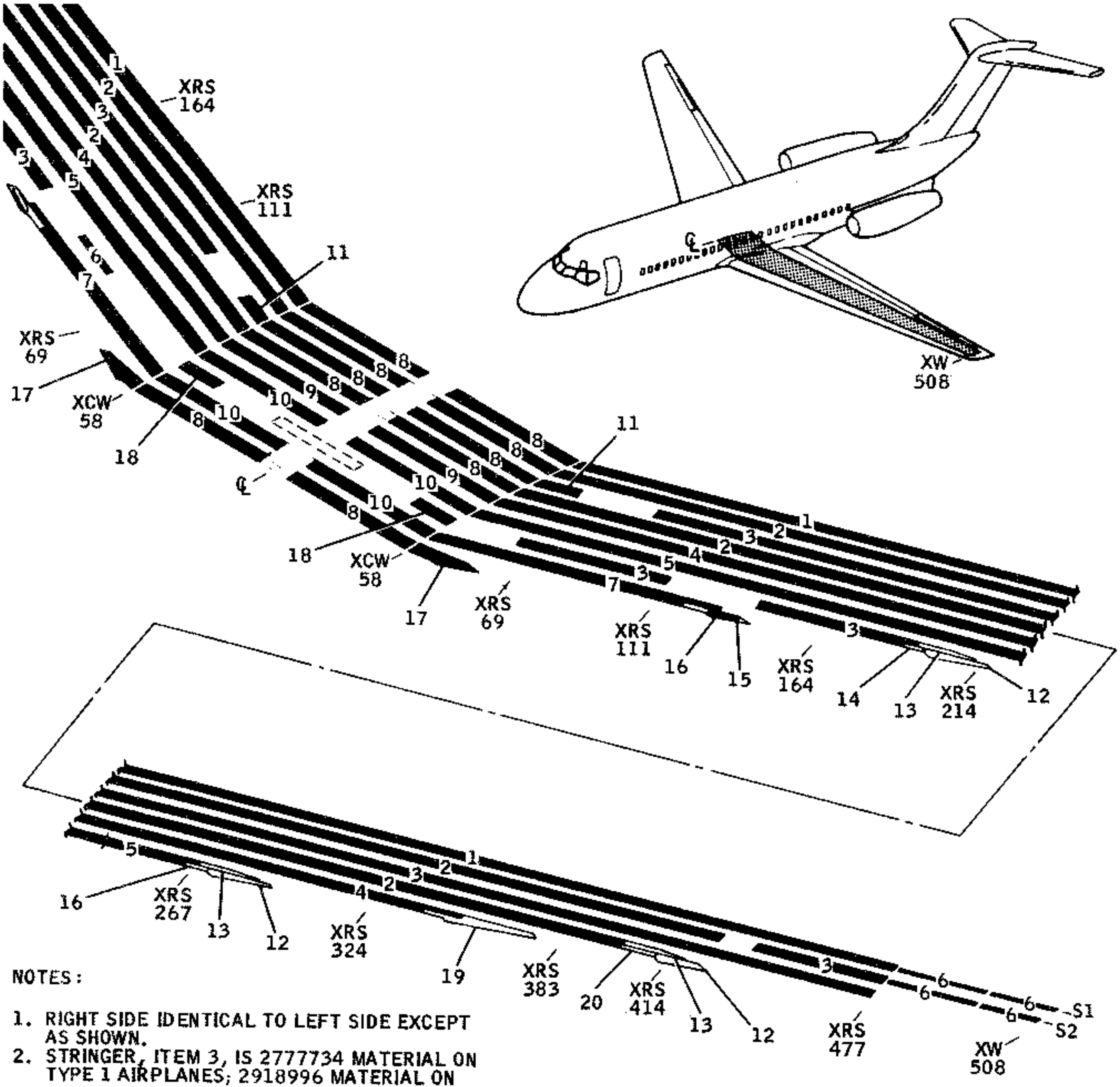
883-3598

Wing Rear Spar Structure
Figure 2 (Sheet 2)

MAIN FRAME STRINGERS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures in this section illustrate wing stringer materials. Materials are identified in material lists by item number callouts.



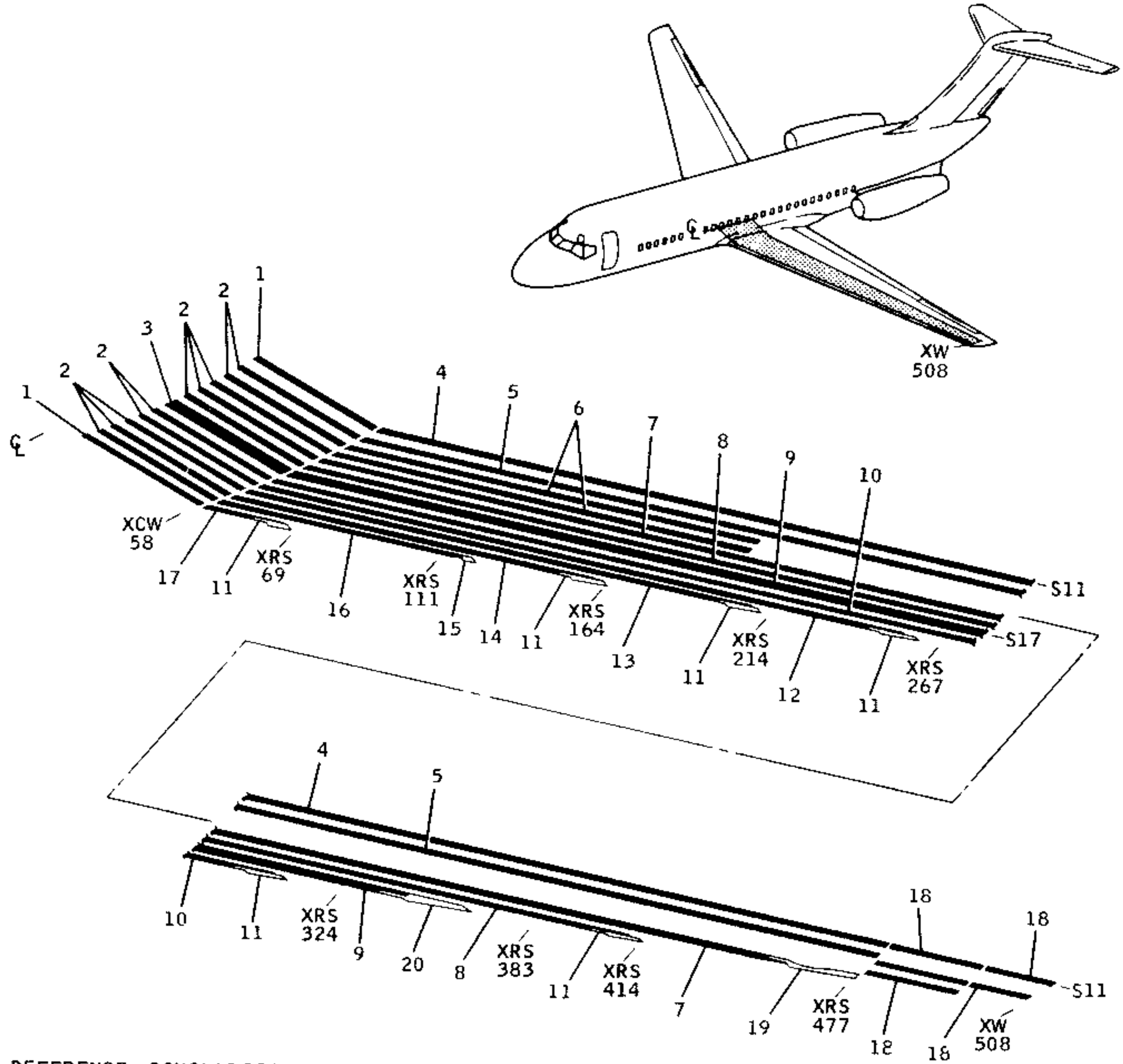
NOTES:

1. RIGHT SIDE IDENTICAL TO LEFT SIDE EXCEPT AS SHOWN.
2. STRINGER, ITEM 3, IS 2777734 MATERIAL ON TYPE I AIRPLANES; 2918996 MATERIAL ON TYPE II AIRPLANES. 3911232-50 MATERIAL USED ON SOME AIRPLANES IN PLACE OF 2818996.
3. REFERENCE - DOUGLAS DRAWING 5910005.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		3911230-505,-506	11	STRINGER	2.000	PLATE 7075-T651
2	STRINGER		3911232-505,-506	12	SPLICE	.100	CLAD 7075-T6
3	STRINGER		SEE NOTE 2	13	SPLICE	.080	CLAD 7075-T6
4	STRINGER		3911234-1,-2	14	SHIM	.100	CLAD 2024-T3
5	STRINGER		3911232-507,-508	15	SPLICE	.125	CLAD 7075-T6
6	STRINGER		2613001	16	SHIM	.080	CLAD 2024-T3
7	STRINGER		3911232-501,-502	17	STRINGER	2.500	BAR 7075-T651
8	STRINGER		3911230-1,-2	18	STRINGER		2645505
9	STRINGER		3911234-501,-502	19	SPLICE		2615114
10	STRINGER		3911232-1,-2	20	SHIM		CLAD 2024-T3

BB3-281A

Center Section Upper Panel Stringers
Figure 1

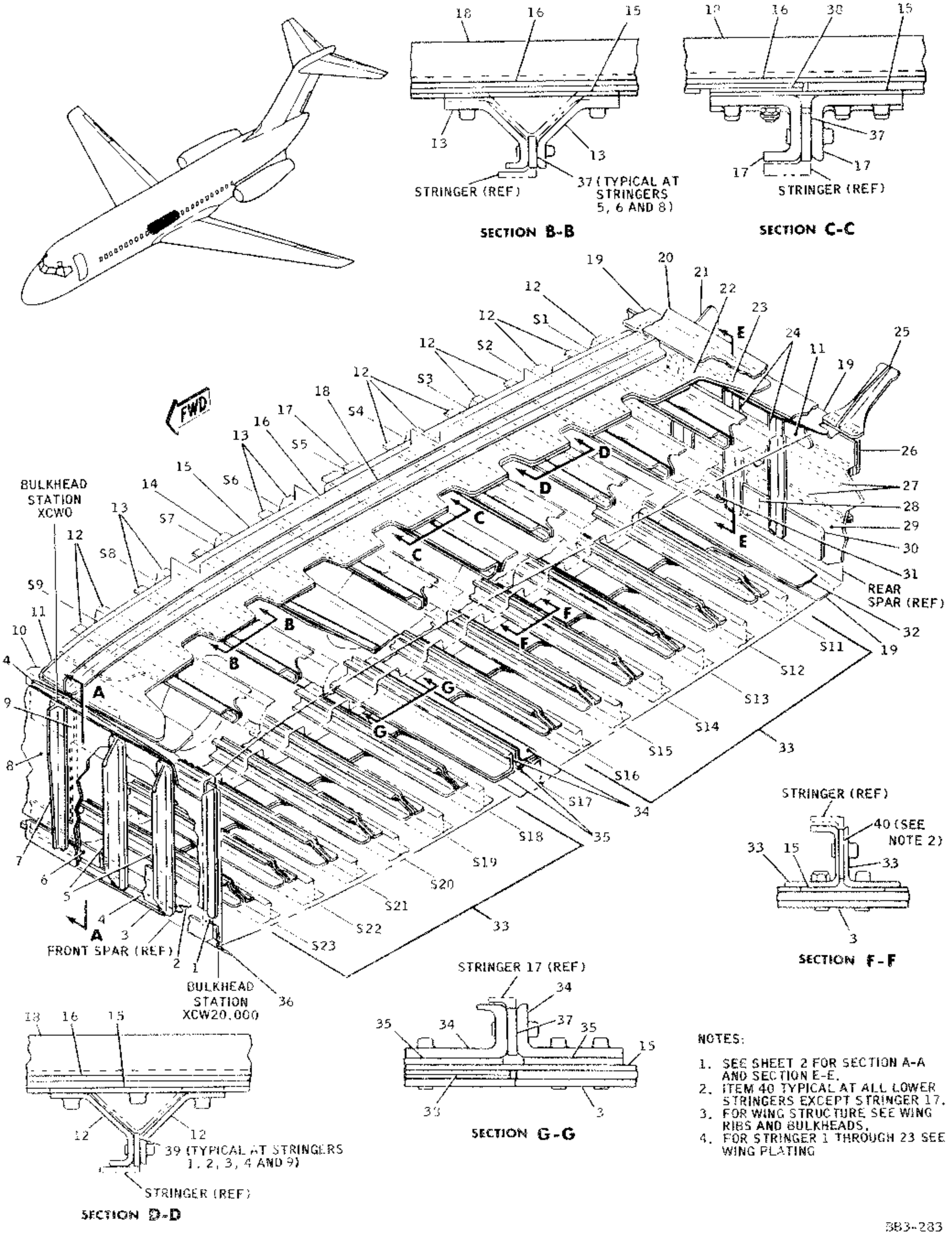


REFERENCE - DOUGLAS DRAWING 5910006

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		3911238-1,-2	11	SPLICE	.100	CLAD 2024-T42
2	STRINGER		3911238-1-2	12	STRINGER		3911238-509,-510
3	STRINGER		3911240-501,-502	13	STRINGER		3911238-507,-508
4	STRINGER		3911238-515,-516	14	STRINGER		3911238-505,-506
5	STRINGER		3911236-1,-2	15	SPLICE	2.000	PLATE 2024-T351
6	STRINGER		3911236-503,-504	16	STRINGER		3911238-503,-504
7	STRINGER		3911236-501,-502	17	STRINGER		3911238-501,-502
8	STRINGER		3911238-513,-514	18	STRINGER		2613001
9	STRINGER		3911240-1,-2	19	SPLICE	.090	CLAD 2024-T3
10	STRINGER		3911238-511,-512	20	SPLICE		2913226

BB3-282

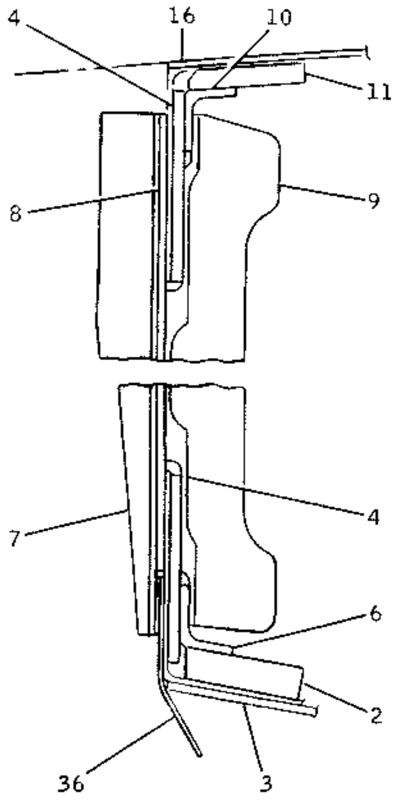
Center Section Lower Panel Stringers
Figure 2



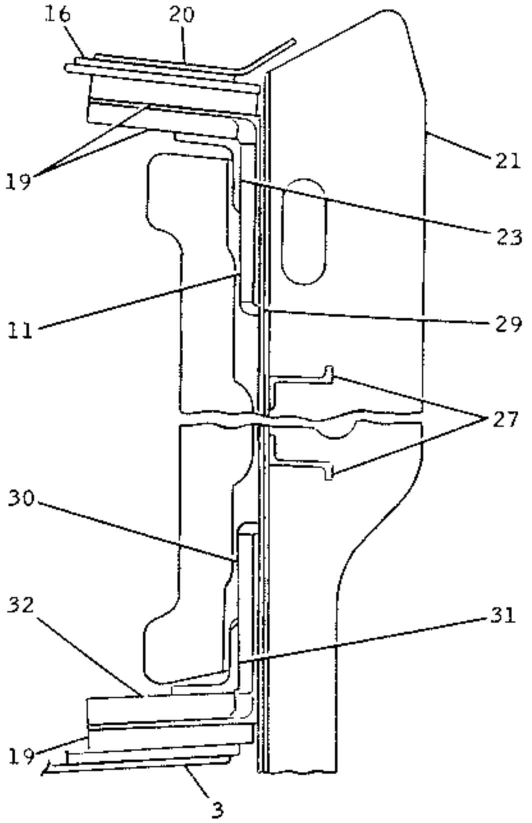
NOTES:

1. SEE SHEET 2 FOR SECTION A-A AND SECTION E-E.
2. ITEM 40 TYPICAL AT ALL LOWER STRINGERS EXCEPT STRINGER 17.
3. FOR WING STRUCTURE SEE WING RIBS AND BULKHEADS.
4. FOR STRINGER 1 THROUGH 23 SEE WING PLATING

Wing Spanwise Butt Joint Structure
Figure 3 (Sheet 1)



SECTION A-A



SECTION E-E

NOTES:

1. MADE FROM TITANIUM SHEET DMS1592.
2. REFERENCE - DOUGLAS DRAWING 5910037

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SHIM	.025	CLAD 7075-T6	21	TEE		1646170
2	SPLICE	.875	PLATE 2024-T351	22	TEE		2644854
3	DOUBLER	.312	CLAD 2024-T351	23	ANGLE		1448936
4	SPLICE	.375	PLATE 2024-T351	24	STIFFENER		2640547
5	TEE		1532213	25	FITTING,3916410-1,-2	1.000	CLAD 7075-T651
6	ANGLE		1105665	26	FITTING,4916534-1,-2	1.125	PLATE 7075-T651
7	STIFFENER		1325214	27	CHANNEL		1616528
8	WEB	.063	CLAD 7075-T6	28	FITTING,3913582-1,-2	2.000	PLATE 7075-T651
9	TEE		1242754	29	WEB	.090	CLAD 7075-T6
10	ANGLE		2464541	30	SPLICE	.500	PLATE 2024-T351
11	SPLICE	.500	PLATE 7075-T651	31	ANGLE	1.750	PLATE 2024-T351
12	SPLICE		2913088A	32	SPLICE	.750	PLATE 2024-T351
13	SPLICE		2913105A	33	SPLICE		2913237A
14	STRINGER, INBOARD		2777734	34	SPLICE		3917128
15	DOUBLER	.125	CLAD 2024-T3	35	SPLICE	.312	PLATE 2024-T351
16	DOUBLER	.160	CLAD 7075-T6	36	ANGLE	.040	SEE NOTE 1
17	SPLICE		2913513	37	SPACER	.250	PLATE 7075-T651
18	ANGLE		1329663	38	SPACER	.050	CLAD 7075-T6
19	SPLICE	.625	PLATE 7075-T651	39	SPACER	.160	CLAD 7075-T6
20	ANGLE	.125	CLAD 2024-T42	40	SPACER	.125	CLAD 2024-T3

BB3-476

Wing Spanwise Butt Joint Structure
Figure 3 (Sheet 2)

MAIN FRAME - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates components of wing main frame ribs and bulkheads. Types and gages of material used in construction of assemblies are identified within illustrations

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

Structural Component	Approved Repairs
All	57-01, Figure 1
Stringers (Except in fuel tank areas)	57-01, Figure 2, Sheet 3
Frames, Formers, Bulkheads (Except in fuel tank areas)	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4 57-01, Figure 5, Sheet 2

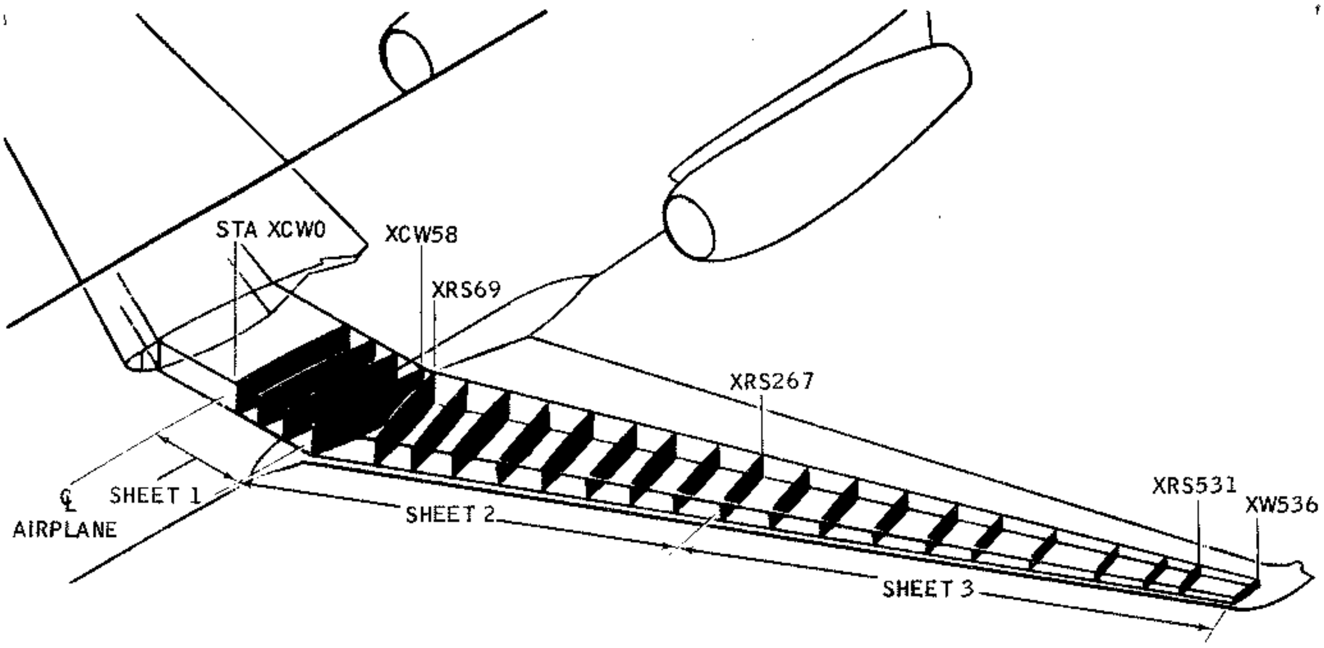
NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

Printed in U.S.A.

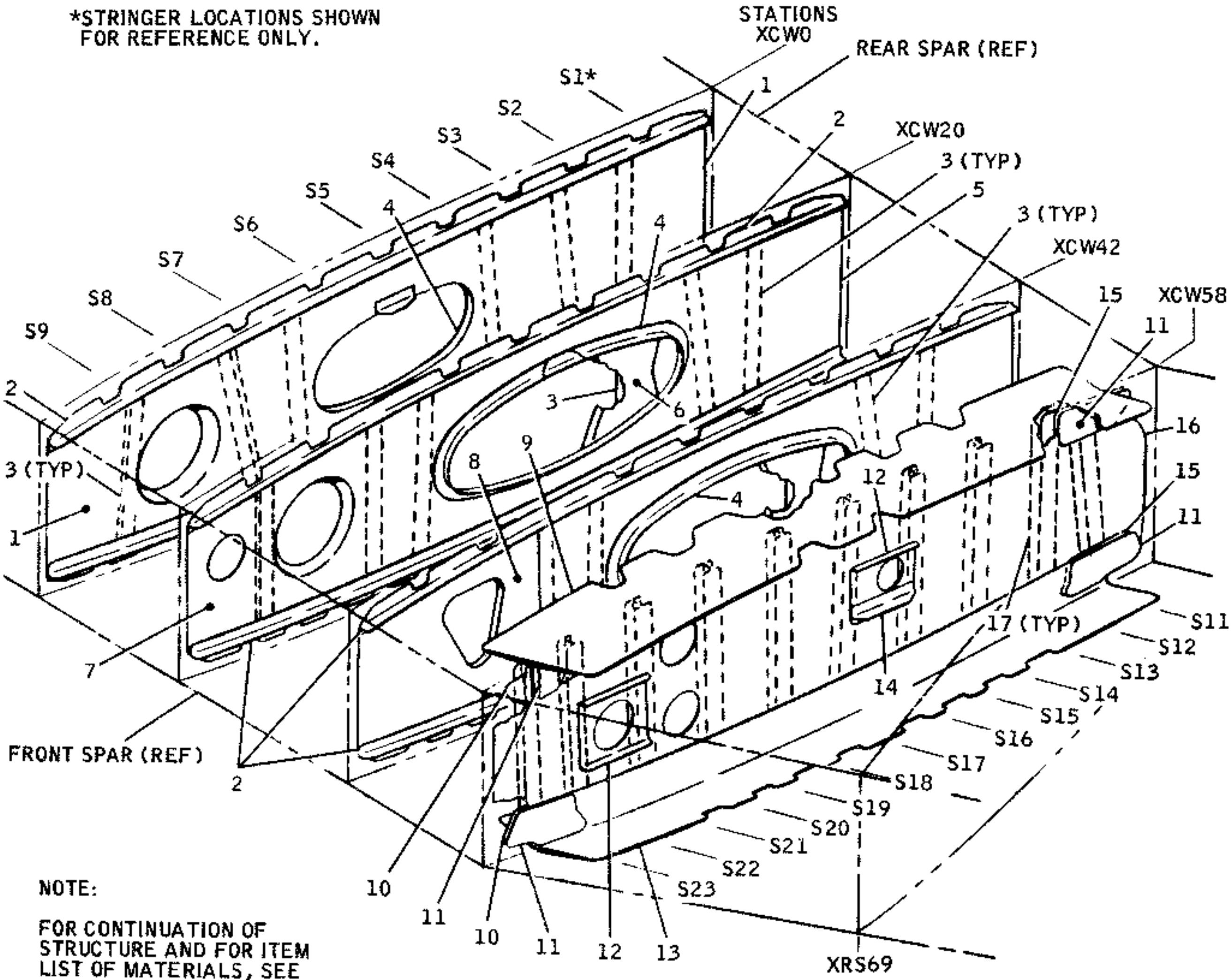
MAIN FRAME RIBS AND BULKHEADS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures in this section illustrate wing main frame rib and bulkhead materials. Materials are identified in material lists by item number callouts.



*STRINGER LOCATIONS SHOWN FOR REFERENCE ONLY.

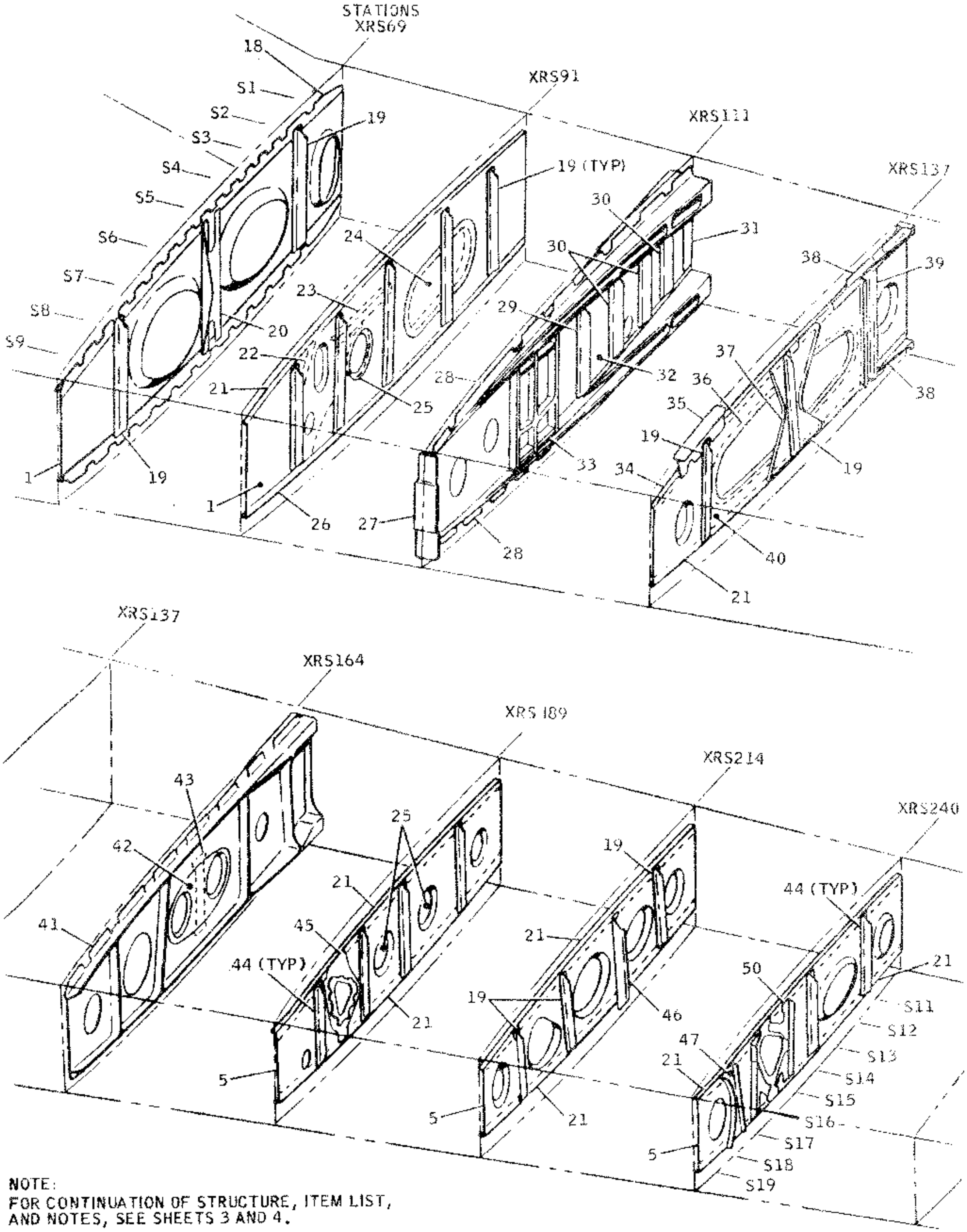


NOTE:

FOR CONTINUATION OF STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEETS 2, 3, AND 4.

BB3-734

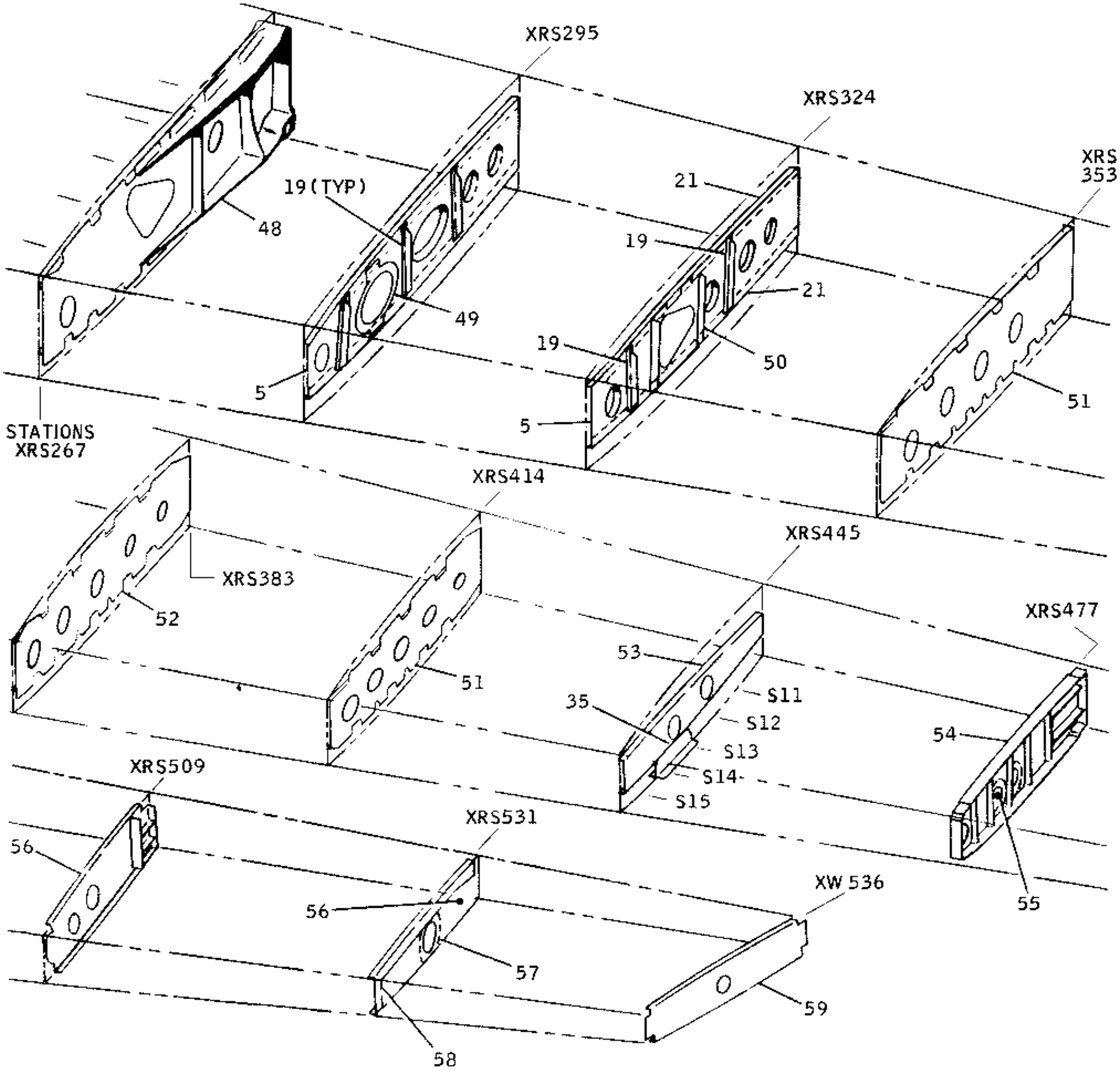
Wing Main Frame Ribs and Bulkheads -- Type A
Figure 1 (Sheet 1)



NOTE:
FOR CONTINUATION OF STRUCTURE, ITEM LIST, AND NOTES, SEE SHEETS 3 AND 4.

Wing Main Frame Ribs and Bulkheads -- Type A
Figure 1 (Sheet 2)

Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.063	CLAD 7075-T6	11	SPLICE	.250	CLAD 7075-T651
2	CAP		1544604	12	DOUBLER	.090	CLAD 7075-T6
3	STIFFENER		1093791	13	CAP		4911242
4	ANGLE		1415615	14	STIFFENER		1417984
5	WEB	.050	CLAD 7075-T6	15	SPLICE	.125	CLAD 7075-T6
6	DOUBLER	.071	CLAD 7075-T6	16	WEB	.160	CLAD 7075-T6
7	WEB	.080	CLAD 7075-T6	17	STIFFENER		2912311
8	WEB	1.000	PLATE 7075-T651	18	CAP		1363992
9	CAP		4911243	19	STIFFENER		2912830
10	SPLICE	.160	CLAD 7075-T6	20	STIFFENER	.125	CLAD 7075-T6

(FOR CONTINUATION OF LIST OF MATERIAL SEE SHEET 4)

BB3-736

Wing Main Frame Ribs and Bulkheads -- Type A
Figure 1 (Sheet 3)

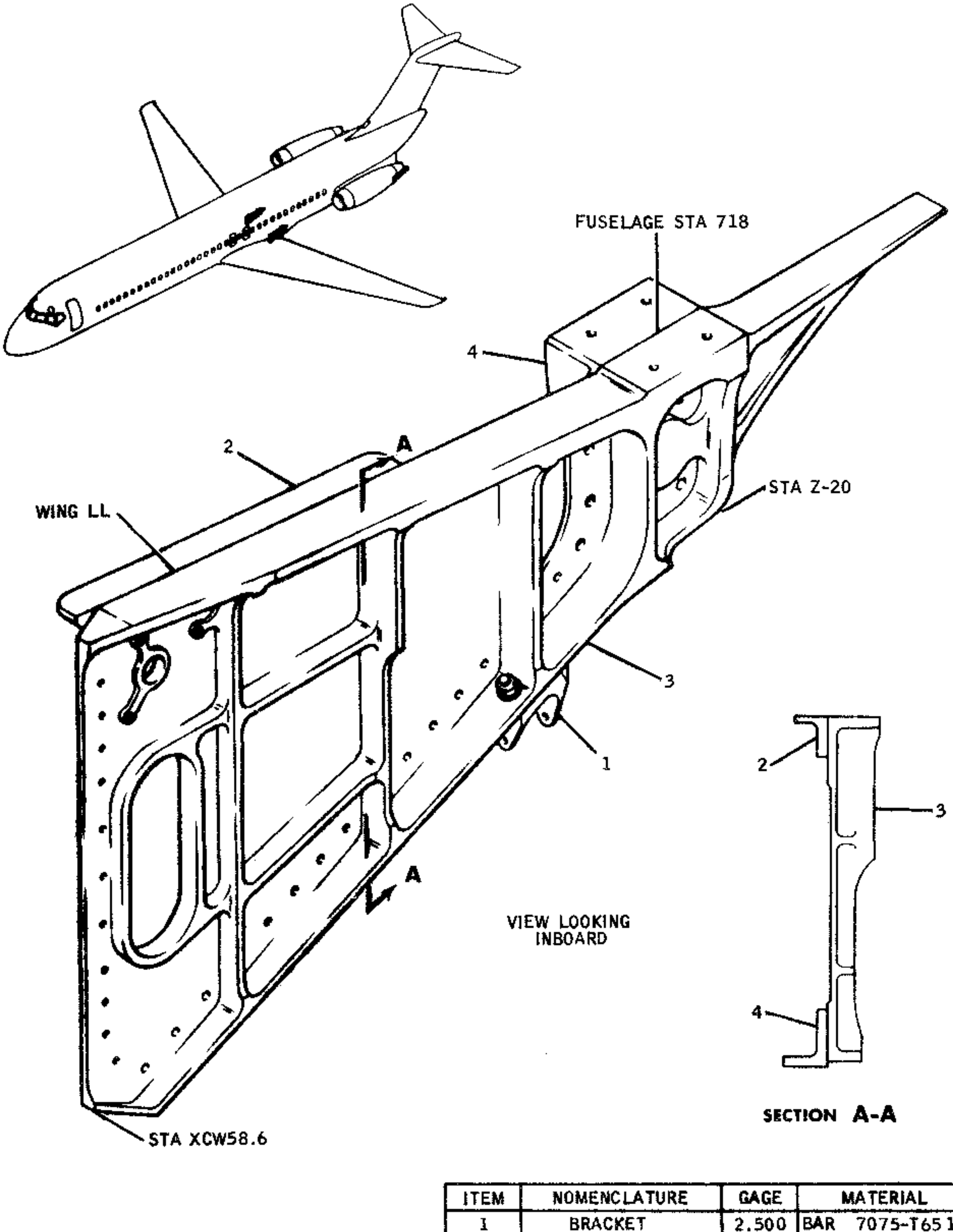
ITEM	NOMENCLATURE	GAGE	MATERIAL
21	CAP		2777927
22	DOUBLER	.063	CLAD 7075-T6
23	ANGLE		1464708
24	DOOR	.063	CLAD 7075-T6
25	FLAPPER		SEE NOTE 2
26	CAP		2912466
27	FITTING		PLATE 7075-T651
28	CAP		FORGING 7075-T411
29	STIFFENER		1532213
30	STIFFENER		1533927
31	SPACER	.032	CLAD 7075-T6
32	WEB	.190	CLAD 7075-T6
33	DOUBLER	1.125	PLATE 7075-T651
34	CAP		1418201
35	TEE		1418683
36	CAP		1291250
37	GUSSET	.080	CLAD 7075-T6
38	FITTING		BAR 7075-T651
39	STIFFENER	.063	CLAD 7075-T6
40	WEB	.071	CLAD 7075-T6
41	WEB		FORGING 7075-T73
42	COVER	.050	CLAD 7075-T6
43	STIFFENER		1248529
44	STIFFENER		1475407
45	DOUBLER	.250	PLATE 7075-T651
46	STIFFENER	.071	CLAD 7075-T6
47	STIFFENER	.070	CLAD 7075-T6
48	WEB		FORGING 7075-T73
49	DOUBLER	.375	CLAD 7075-T651
50	DOUBLER	1.000	PLATE 7075-T651
51	WEB	1.500	PLATE 7075-T651
52	WEB	.875	PLATE 7075-T651
53	WEB	1.125	CLAD 7075-T651
54	RIB	1.500	PLATE 7075-T651
55	COVER	.063	CLAD 7075-T6
56	RIB	1.250	PLATE 7075-T651
57	COVER	.071	CLAD 7075-T6
58	ANGLE	.071	CLAD 7075-T6
59	WEB	.125	CLAD 7075-T6

NOTES:

1. MADE FROM .250 GAGE SLAB POLYAMIDE (NYLON), MIL-P-17091, TYPE 1.
2. MADE FROM MOLDED POLYAMIDE, MIL-P-17091, TYPE 2.
3. REFERENCE - DOUGLAS DRAWING 7910471.

BB3-737

Wing Main Frame Ribs and Bulkheads -- Type A
Figure 1 (Sheet 4)



REFERENCE - DOUGLAS DRAWING 9910543.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BRACKET	2.500	BAR 7075-T651
2	ANGLE		1419314
3	PANEL	2.250	PLATE 7075-T651
4	SUPPORT	2.500	PLATE 7075-T651

BB3-738A

Trapezoidal Panel Structure
Figure 2

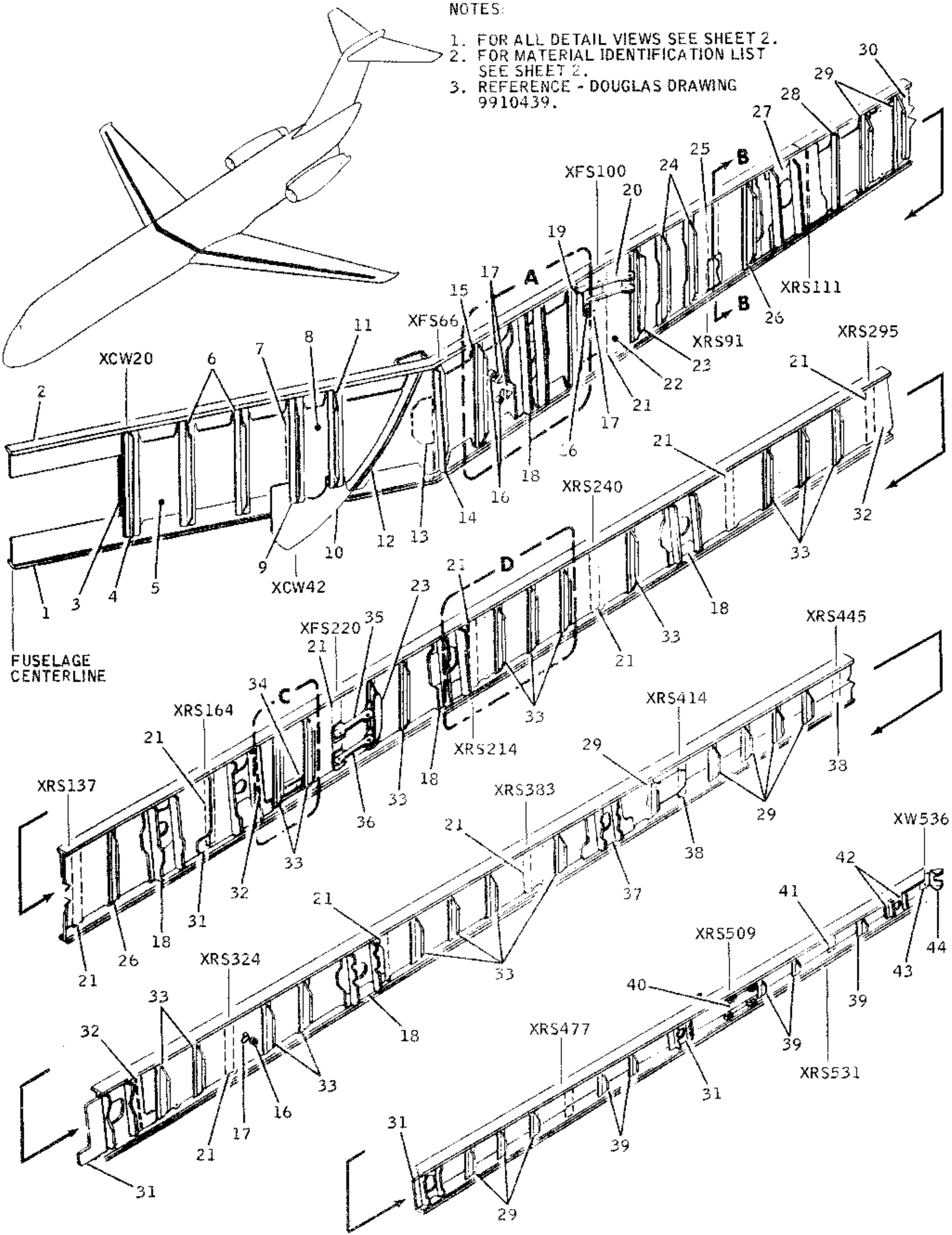
MAIN FRAME SPARS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures in this section illustrate main frame spar materials. Materials are identified in material lists by item number callouts.

NOTES:

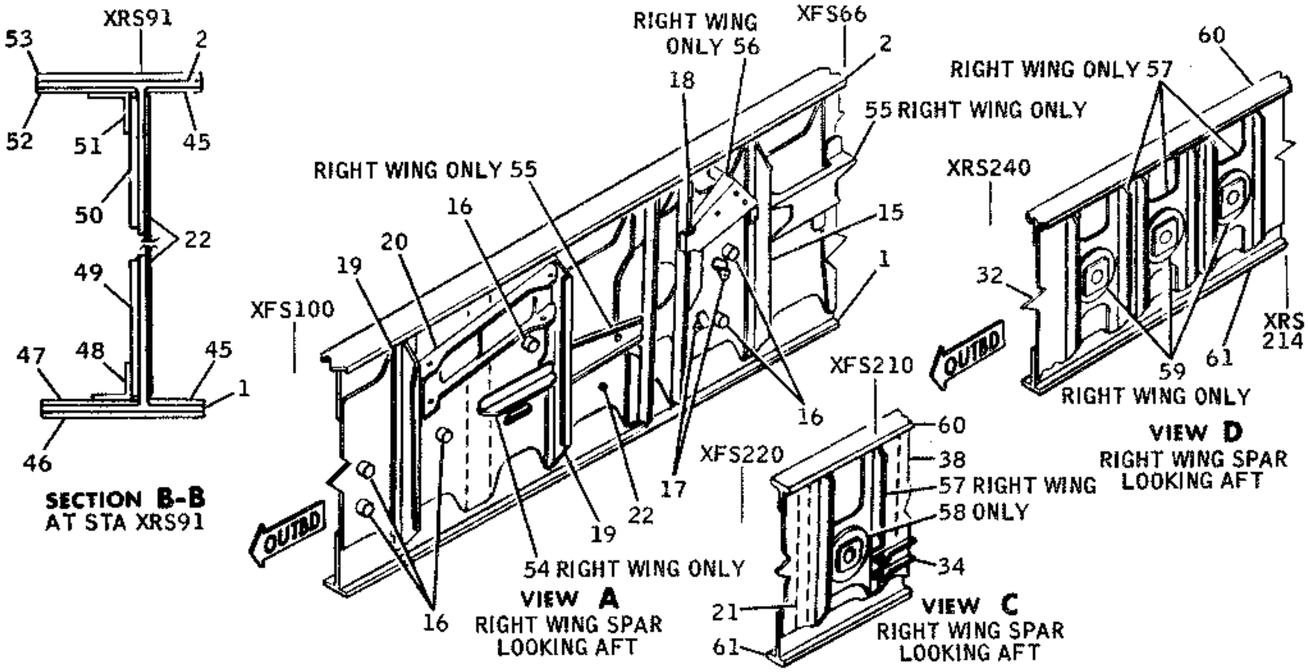
1. FOR ALL DETAIL VIEWS SEE SHEET 2.
2. FOR MATERIAL IDENTIFICATION LIST SEE SHEET 2.
3. REFERENCE - DOUGLAS DRAWING 9910439.



BB3-739

Wing Front Spar Structure -- Type A
Figure 1 (Sheet 1)

Printed in U.S.A.



ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP, 5911307-3		FORGING 7075-T411	32	WEB	.100	CLAD 7075-T6
2	CAP, 5911306-3		FORGING 7075-T411	33	STIFFENER		1641009
3	TEE		2640548	34	SUPPORT	1.50	PLATE 7075-T651
4	STIFFENER		1416793	35	SUPPORT		3920549
5	WEB	.090	CLAD 7075-T6	36	SUPPORT		1716225
6	STIFFENER		1532213	37	DOUBLER	1.50	PLATE 7075-T651
7	TEE		2620678	38	TEE		2777975
8	DOUBLER	.040	CLAD 7075-T6	39	STIFFENER		2915844
9	STIFFENER		1528377	40	ANGLE	.125	CLAD 7075-T6
10	FITTING		5912411	41	ANGLE	.063	CLAD 7075-T6
11	STIFFENER		2614737	42	ANGLE		1242933
12	ANGLE	.188	CLAD 7075-T6	43	CLIP	.050	CLAD 7075-T6
13	ANGLE	.250	CLAD 7075-T6	44	CLIP	.080	CLAD 7075-T6
14	ANGLE		1205311	45	SPLICE	.250	PLATE 7075-T651
15	STIFFENER		1419073	46	WEDGE		PLATE 2024-T351
16	FITTING		2014-T6	47	PLATE		1174055
17	ZEE CLIP	.040	CLAD 2024-T3	48	ANGLE		1105662
18	DOUBLER		2920515	49	PLATE	.375	2024-T351
19	STIFFENER		2614730	50	PLATE	.375	7075-T651
20	SUPPORT	1.75	PLATE 7075-T651	51	ANGLE		2464541
21	TEE		2777974	52	PLATE	.500	7075-T651
22	DOUBLER	.063	CLAD 7075-T6	53	WEDGE	.312	PLATE 7075-T651
23	STIFFENER		2272071	54	STIFFENER	.063	CLAD 7075-T6
24	STIFFENER		1248529	55	BRACKET	.063	CLAD 7075-T6
25	TEE		3912214	56	BRACKET	.071	CLAD 7075-T6
26	STIFFENER		1286227	57	STIFFENER	.090	CLAD 7075-T6
27	DOUBLER	2.00	PLATE 7075-T651	58	FITTING		BAR 6061-T651
28	ANGLE		1415741	59	FITTING		AL TUBE 6061-T4
29	STIFFENER		2919136	60	CAP		4912718
30	WEB	.090	CLAD 7075-T6	61	CAP		4911207
31	DOUBLER	1.25	PLATE 7075-T651				

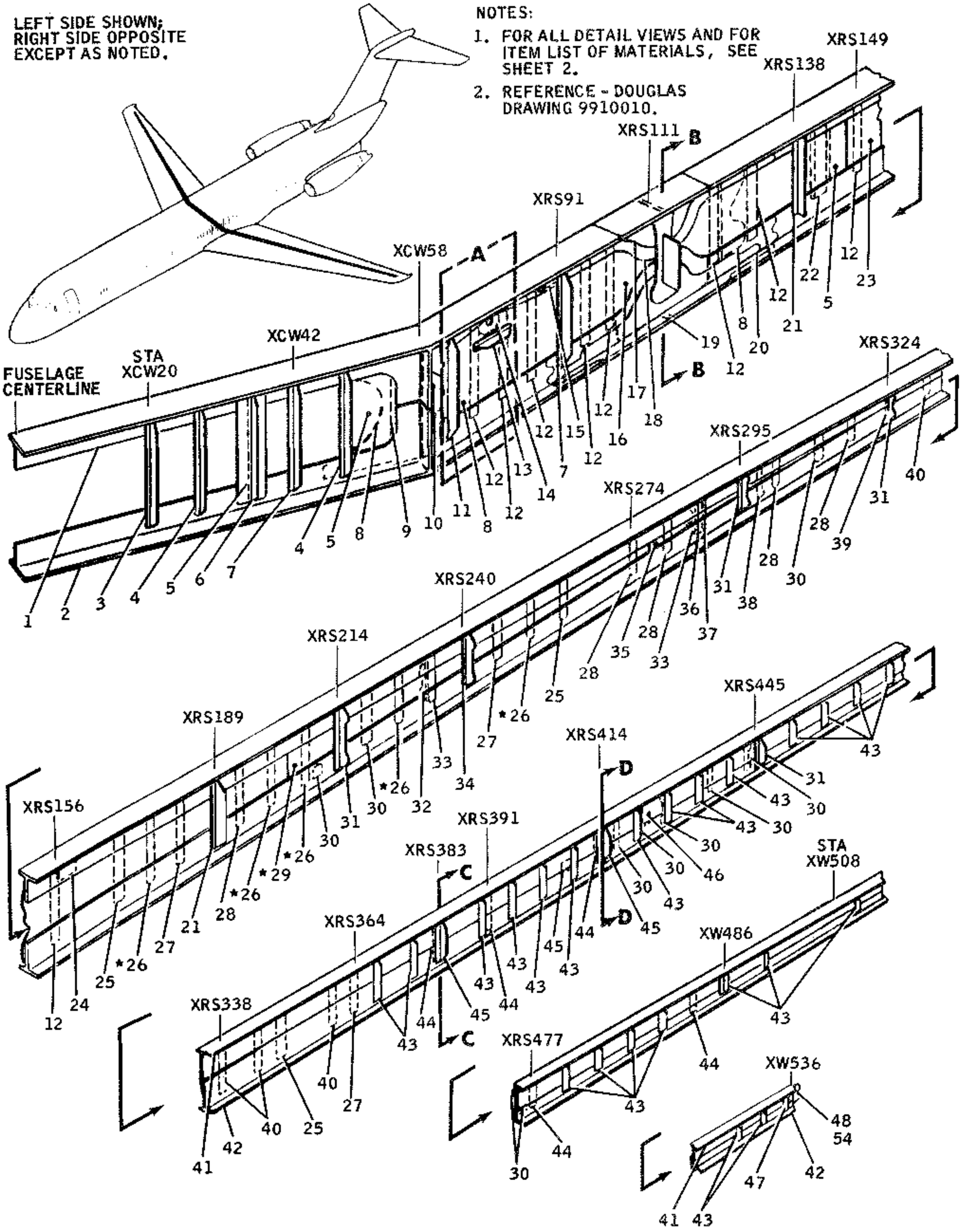
BB3-740

Wing Front Spar Structure -- Type A
Figure 1 (Sheet 2)

LEFT SIDE SHOWN; RIGHT SIDE OPPOSITE EXCEPT AS NOTED.

NOTES:

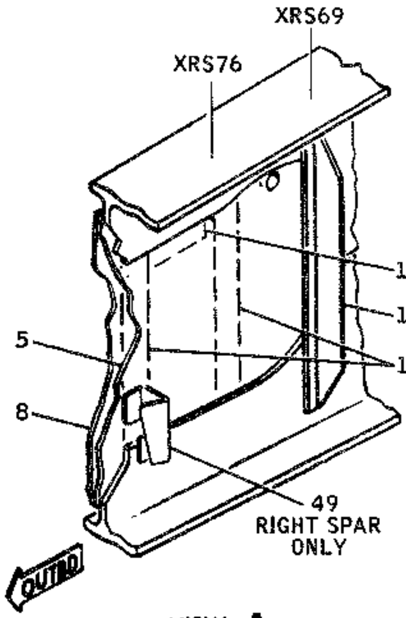
1. FOR ALL DETAIL VIEWS AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE - DOUGLAS DRAWING 9910010.



*SEE NOTES FOR TYPE A2 VARIATION.

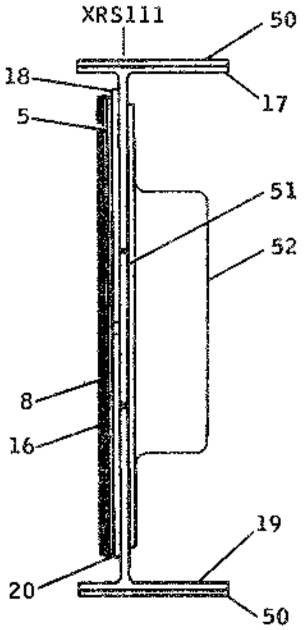
BB3-741A

Wing Rear Spar Structure -- Type A1 and A2
Figure 2 (Sheet 1)



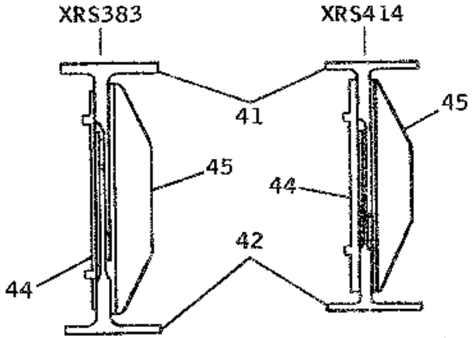
VIEW A

RIGHT WING SPAR
LOOKING AFT



SECTION B-B

AT STA XRS111



SECTION C-C

AT STA XRS383

SECTION D-D

AT STA XRS414

NOTES:

1. MADE FROM 2613680; TYPE A2 SAME, EXCEPT MADE FROM 1248307.
2. MADE FROM .080 CLAD 7075-T6; TYPE A2 SAME, EXCEPT GAGE IS .100.
3. REFERENCE DOUGLAS DRAWING 9910010.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP, 5911304		FORGING, 2014-T411	28	STIFFENER		1248307
2	CAP, 5911305		FORGING, 2014-T411	29	WEB		SEE NOTE 2
3	TEE		1362783	30	FITTING	2.000	PLATE 7075-T651
4	STIFFENER		2640729	31	TEE		2506195
5	WEB	.160	CLAD 7075-T6	32	SHIM	.020	7075-T6
6	TEE		2640547	33	SUPPORT	4.500	FORGING, 2014-T411
7	TEE		2620678	34	ANGLE		1248097
8	DOUBLER	.160	CLAD 7075-T6	35	WEB	.071	CLAD 7075-T6
9	FITTING	2.500	BAR 7075-T651	36	SHIM	.016	7075-T6
10	ANGLE		4616560	37	ANGLE		1419056
11	TEE		2644854	38	TEE	2.000	PLATE 7075-T651
12	STIFFENER		2613679	39	TEE		1298026
13	STIFFENER		1532213	40	STIFFENER		1419318
14	NIPPLE		6061-T4	41	CAP		4911204
15	BRACKET	.090	CLAD 7075-T6	42	CAP		4911205
16	DOUBLER	.063	CLAD 7075-T6	43	STIFFENER		2915844
17	TEE		4911204	44	RETAINER	.375	PLATE 7075-T651
18	SPLICE	.312	PLATE 7075-T651	45	TEE		1646170
19	TEE		4911205	46	HAT	.063	CLAD 7075-T6
20	SPLICE		PLATE 2024-T351	47	BRACKET		1514793
21	TEE		1642914	48	CLIP	.063	CLAD 2024-T3
22	STIFFENER	.090	CLAD 2024-T6	49	CLIP	.050	CLAD 2024-T3
23	WEB	.100	CLAD 7075-T6	50	PLATE	.312	2024-T351
24	CHANNEL	.100	CLAD 7075-T6	51	FILLER	.312	PLATE 7075-T651
25	STIFFENER		2506870	52	TEE		2644853
26	STIFFENER		SEE NOTE 1	53	DOUBLER	.063	CLAD 7075-T6
27	TEE		1248307	54	TEE		1418493

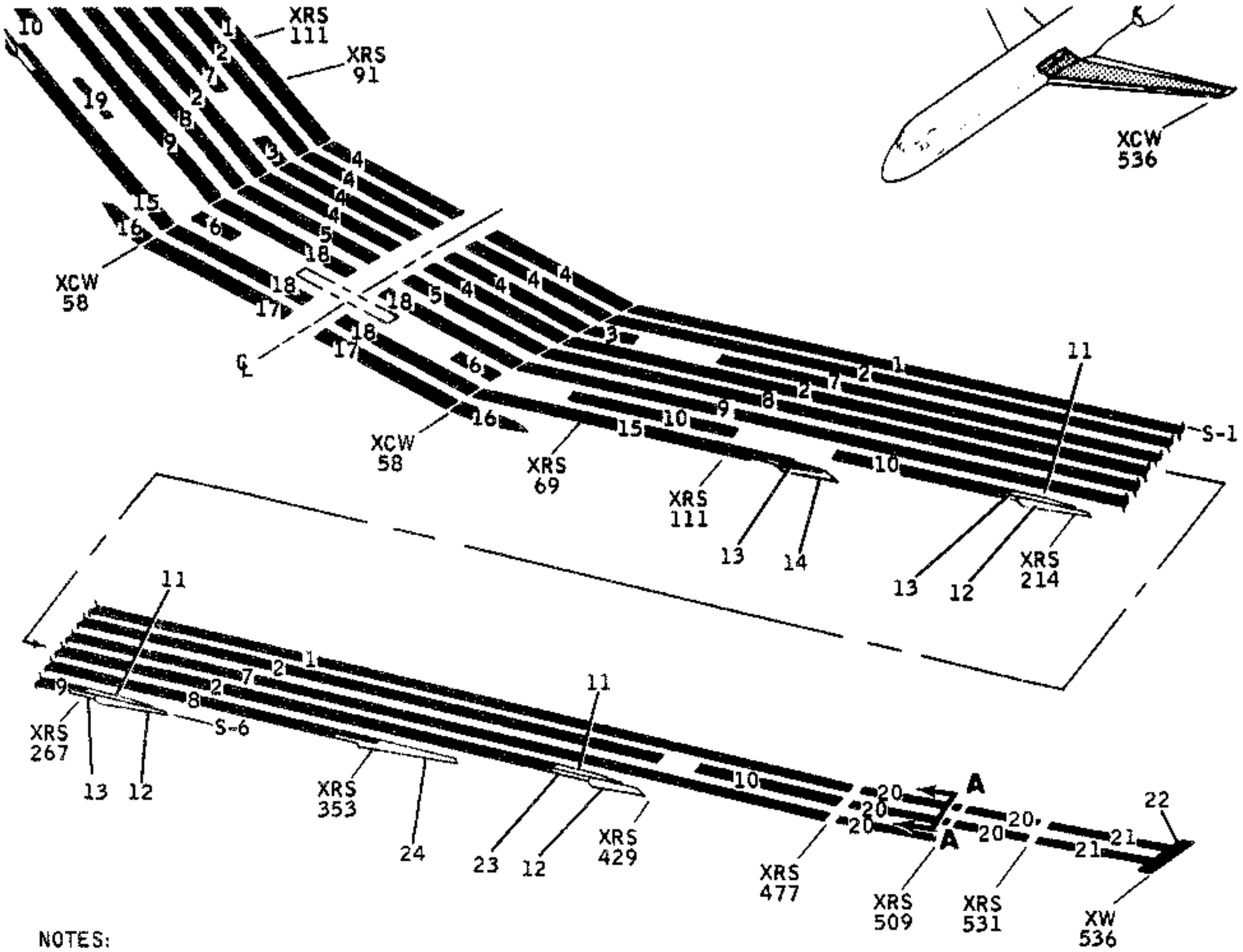
B83-742A

Wing Rear Spar Structure -- Type A1 and A2
Figure 2 (Sheet 2)

MAIN FRAME STRINGERS - DESCRIPTION AND OPERATION (DC-9-30)

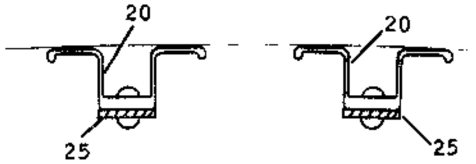
1. General

A. The following figures in this section illustrate wing stringer materials. Materials are identified in material lists by item number callouts.



NOTES:

1. RIGHT SIDE IDENTICAL TO LEFT SIDE EXCEPT AS SHOWN.
2. ITEM 25, DOUBLER, INSTALLED ONLY ON TWO STIFFENERS SHOWN IN SECTION A-A.
3. REFERENCE - DOUGLAS DRAWING 5910464.

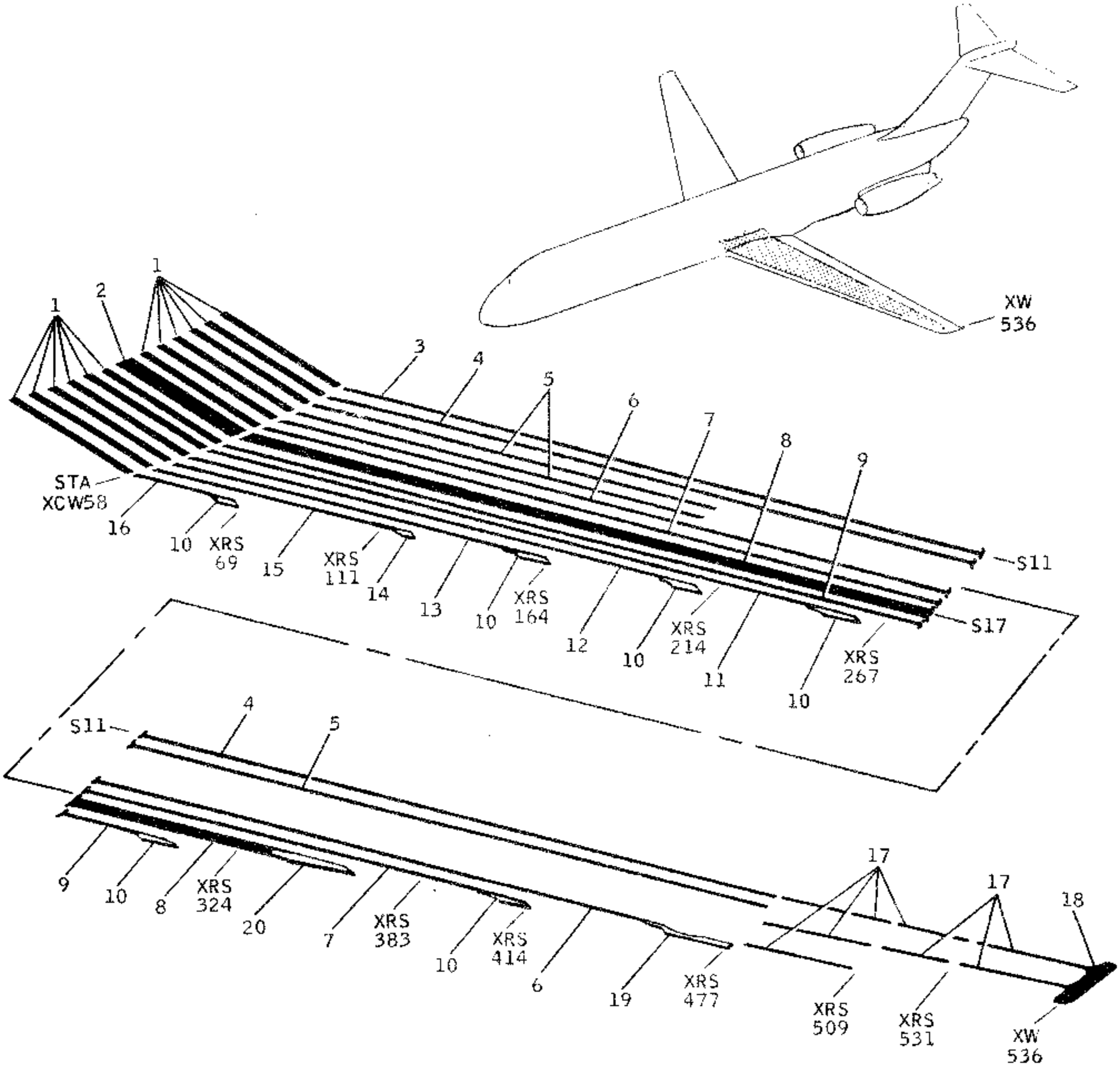


SECTION A-A

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		3919249-1, -2	14	SPLICE	.125	CLAD 7075-T6
2	STRINGER		3919248-1, -2	15	STRINGER		3911232-501, -502
3	STRINGER	2.000	PLATE 7075-T651	16	STRINGER		BAR 7075-T651
4	STRINGER		3919249-501, -502	17	STRINGER	2.000	3911230-1, -2
5	STRINGER		3911234-501, -502	18	STRINGER		3911232-1, -2
6	STRINGER		2645505-1	19	STRINGER		2613001
7	STRINGER		2918996	20	STIFFENER		2704736
8	STRINGER		3911234-1, -2	21	STIFFENER	.063	CLAD 7075-T6
9	STRINGER		3911323-507, -508	22	SPLICE	.090	CLAD 7075-T6
10	STRINGER		2777734	23	SHIM	.050	CLAD 2024-T3
11	SPLICE	.080	CLAD 7075-T6	24	SPLICE		2615114
12	SPLICE	.100	CLAD 7075-T6	25	DOUBLER	.125	CLAD 7075-T6
13	SHIM	.080	CLAD 2024-T3				

BB3-744A

Center Section Upper Panel Stringers -- Type A
Figure 1

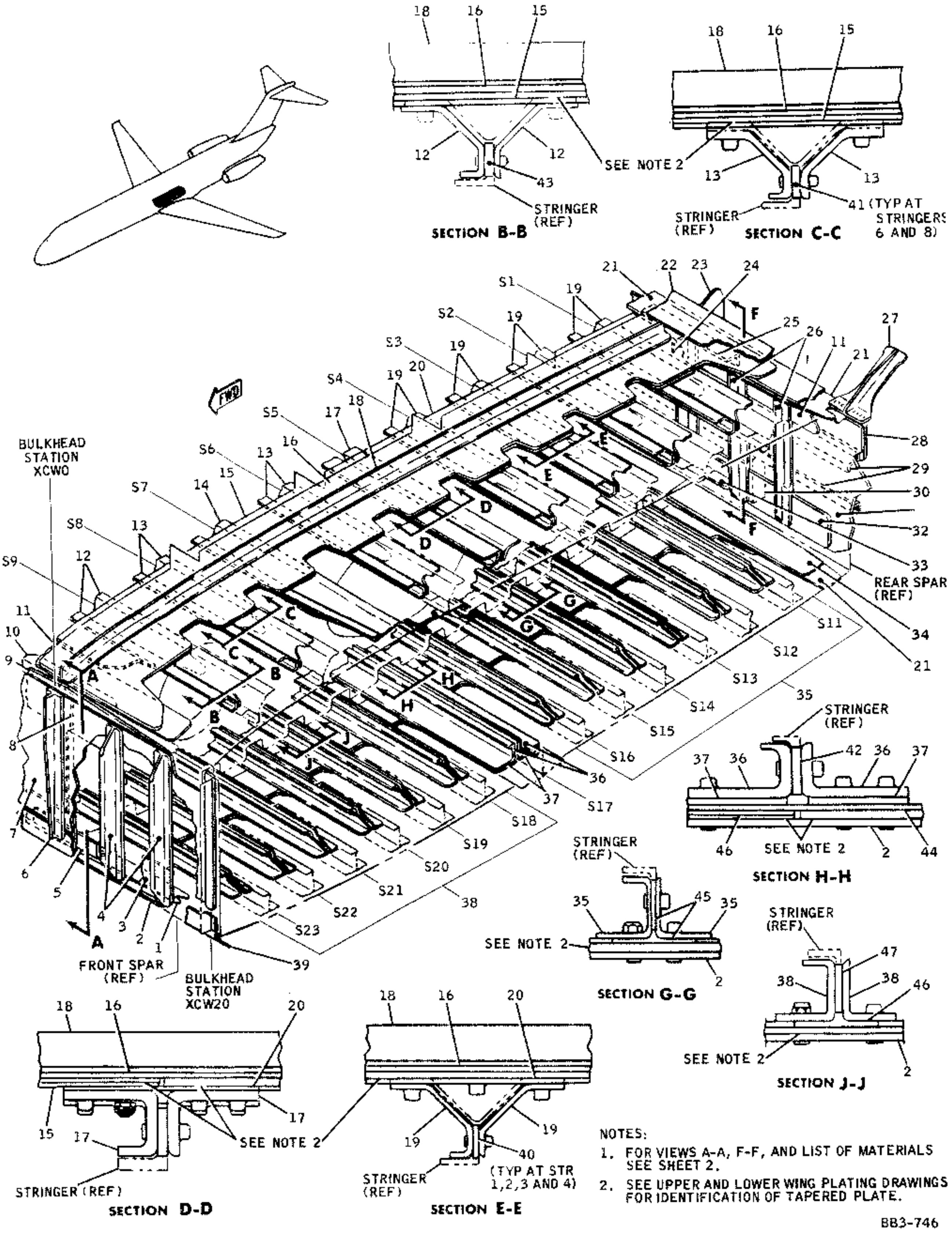


REFERENCE - DOUGLAS DRAWING 5910465

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		3911238-1, -2	11	STRINGER		3911238-509, -510
2	STRINGER		3911240-501, -502	12	STRINGER		3911238-507, -508
3	STRINGER		3911238-515, -516	13	STRINGER		3911238-505, -506
4	STRINGER		3911236 -1, -2	14	SPLICE	2.000	PLATE 2024-T351
5	STRINGER		3911236-503, -504	15	STRINGER		3911238-503,-504
6	STRINGER		3911236-501, -502	16	STRINGER		3911238-501, -502
7	STRINGER		3911238-513, -514	17	STIFFENER		1430858
8	STRINGER		3911240-503, -504	18	SPLICE	.100	CLAD 2024-T3
9	STRINGER		3911238-511, -512	19	SPLICE	.190	CLAD 2024-T3
10	SPLICE	.100	CLAD 2024-T42	20	SPLICE		2919261

BB3-745

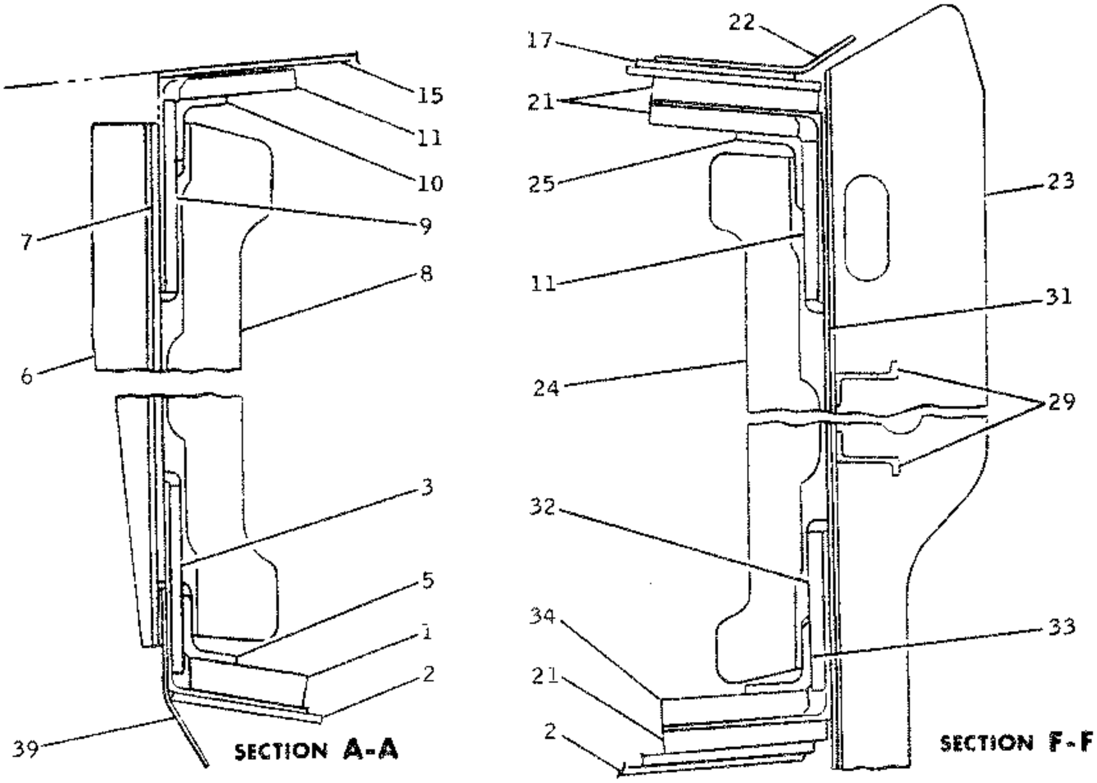
Center Section Lower Panel Stringers -- Type A
Figure 2



NOTES:

1. FOR VIEWS A-A, F-F, AND LIST OF MATERIALS SEE SHEET 2.
2. SEE UPPER AND LOWER WING PLATING DRAWINGS FOR IDENTIFICATION OF TAPERED PLATE.

Wing Spanwise Butt Joint Structure -- Type A
Figure 3 (Sheet 1)



NOTES:
1. MACHINE FROM .500 7075-T651 PLATE THICKNESS TAPERED FROM .468 TO .090 ± .005.
2. MACHINE FROM .750 2024-T351, TAPER FROM .625 TO .094.
3. MACHINE FROM .312 2024-T351 PLATE, THICKNESS TAPERED FROM .218 TO .153 ± .005.
4. MAKE FROM TITANIUM SHEET DMS1592.
5. REFERENCE - DOUGLAS DRAWING 5910481.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SPLICE	.875	PLATE 2024-T351	25	ANGLE		1448936
2	DOUBLER	.312	PLATE 2024-T351	26	STIFFENER		2640547
3	SPLICE	.375	PLATE 2024-T351	27	FITTING	1.00	CLAD 7075-T651
4	TEE		1532213	28	FITTING	1.125	PLATE 7075-T651
5	ANGLE		1105665	29	CHANNEL		1616528
6	STIFFENER		1325214	30	FITTING	2.00	PLATE 7075-T651
7	WEB	.063	CLAD 7075-T6	31	WEB	.090	CLAD 7075-T6
8	TEE		1242754	32	SPLICE	.500	PLATE 2024-T351
9	SPLICE	.375	PLATE 7075-T651	33	ANGLE	1.750	PLATE 2024-T351
10	ANGLE		2464541	34	SPLICE	.750	SEE NOTE 2
11	SPLICE	.500	SEE NOTE 1	35	SPLICE		2919253
12	SPLICE		2913088	36	SPLICE		3917128
13	SPLICE		2913105	37	SPLICE	.312	SEE NOTE 3
14	STRINGER, INBD		2777734	38	SPLICE	.125	CLAD 2024-T3
15	DOUBLER	.125	CLAD 7075-T6	39	ANGLE	.040	SEE NOTE 4
16	DOUBLER	.250	CLAD 7075-T6	40	SPACER	.160	CLAD 7075-T6
17	SPLICE		2913513	41	SPACER	.250	PLATE 7075-T651
18	ANGLE		1329663	42	SPACER	.250	PLATE 2024-T351
19	SPLICE		2919254	43	SPACER	.160	CLAD 7075-T6
20	DOUBLER	.160	CLAD 7075-T6	44	DOUBLER	.125	CLAD 2024-T3
21	SPLICE	.625	PLATE 7075-T651	45	SPACER	.190	CLAD 2024-T3
22	ANGLE	.125	CLAD 2024-T42	46	DOUBLER	.125	CLAD 2024-T3
23	TEE		1646170	47	SPACER	.125	CLAD 2024-T3
24	TEE		2644854				

BB3-747

Wing Spanwise Butt Joint Structure -- Type A
Figure 3 (Sheet 2)

AUXILIARY - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates components of wing auxiliary structure. Types and gages of material used in construction of assemblies are identified within illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

Structural Component	Approved Repairs
Leading Edge	
All	57-01, Figure 1
Ribs, Formers, Stiffeners, Webs	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 1 through 3
Wing Tip	
All	57-01, Figure 1
Ribs, Internal Structure	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 1 through 4 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2
Trailing Edge	
All	57-01, Figure 1
Ribs and Supports	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4
Stringers, Webs	57-01, Figure 2, Sheet 3

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

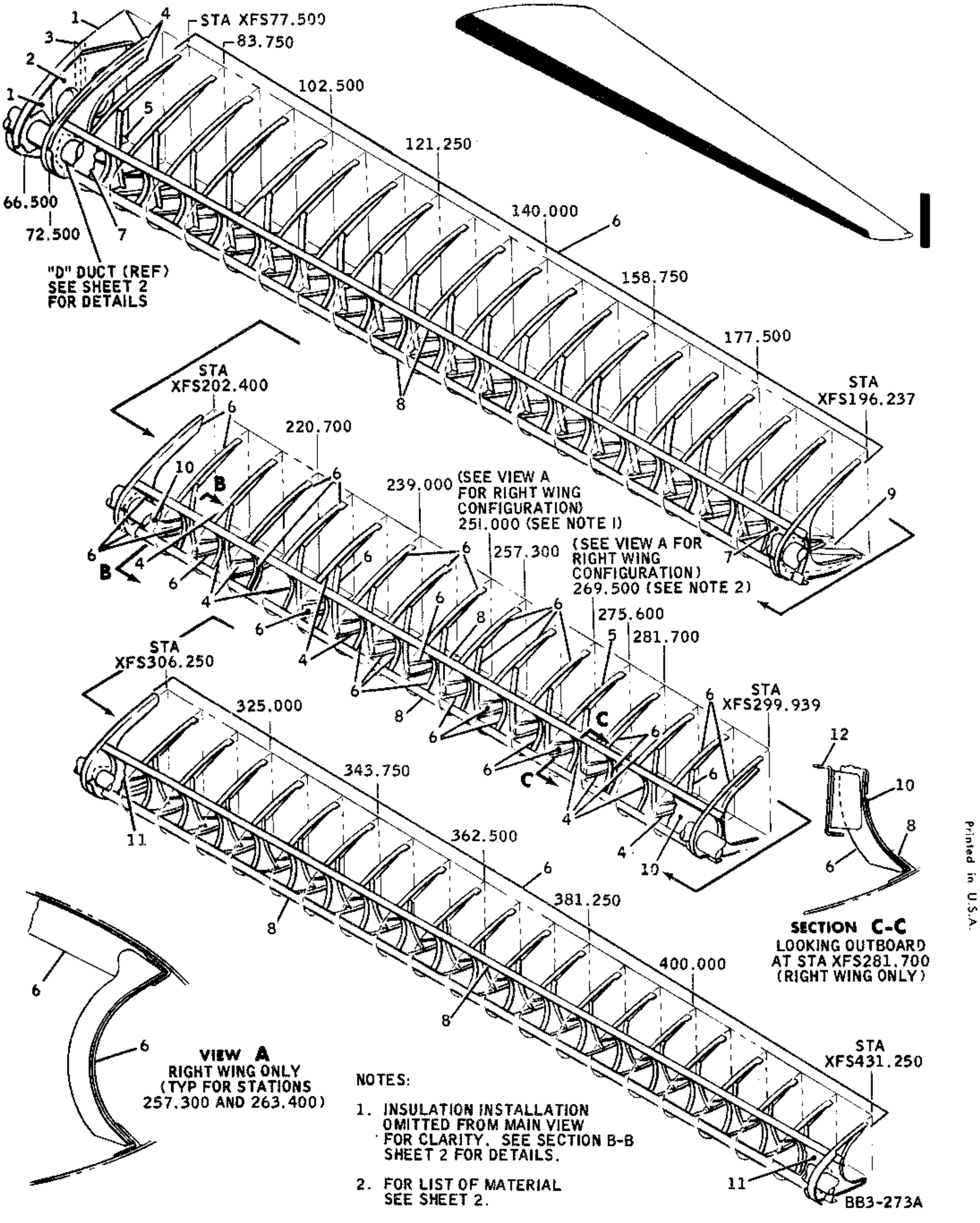
Structural Component	Approved Repairs
Stringers	57-01, Figure 2, Sheet 3
Webs	57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

AUXILIARY LEADING EDGE - DESCRIPTION AND OPERATION (DC-9-10)

1. General

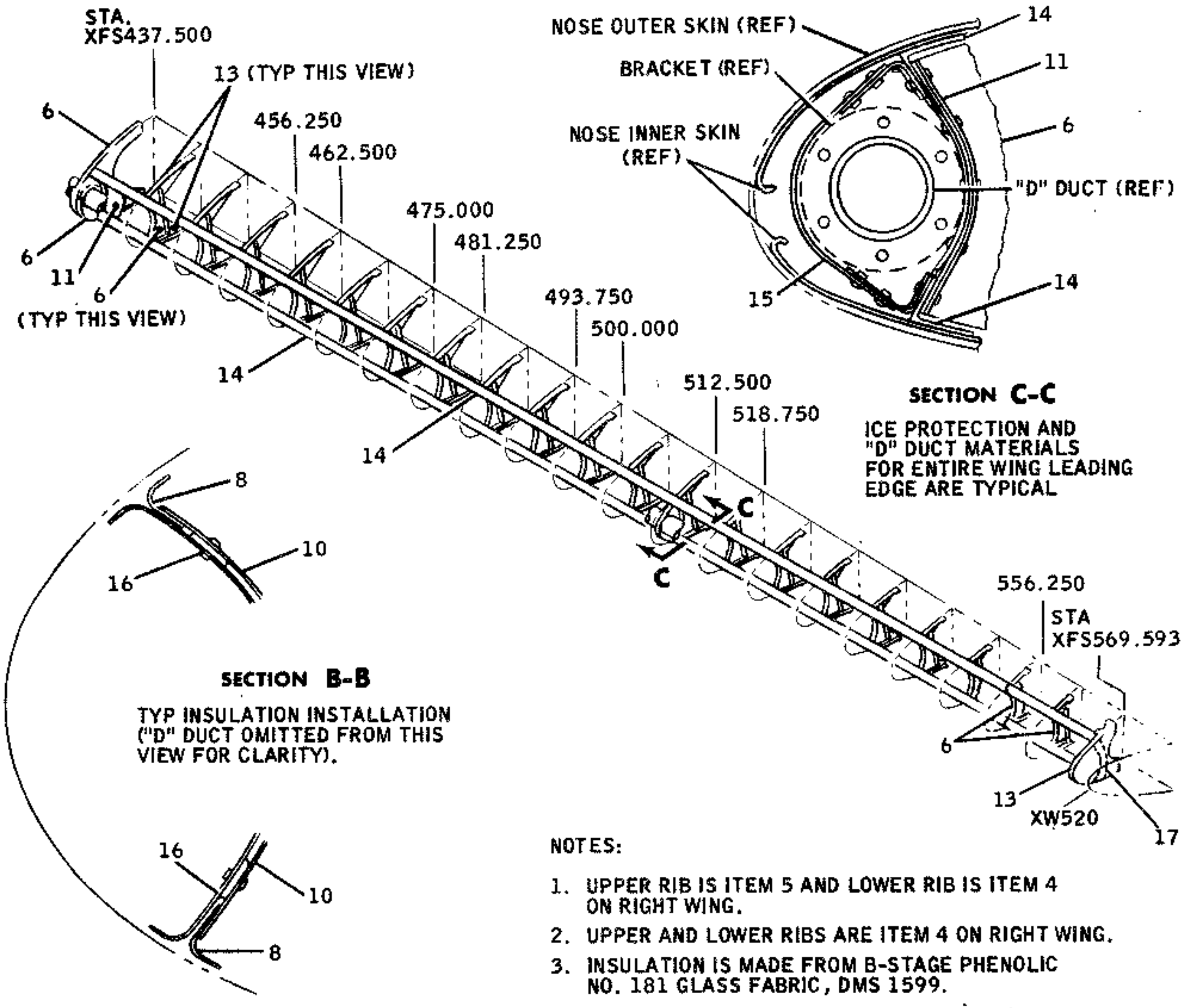
A. The following figures in this section illustrate wing leading edge structural materials, excluding plates/skins. Materials are identified in material lists by item number callouts.



NOTES:

1. INSULATION INSTALLATION OMITTED FROM MAIN VIEW FOR CLARITY. SEE SECTION B-B SHEET 2 FOR DETAILS.
2. FOR LIST OF MATERIAL SEE SHEET 2.

Wing Leading Edge Structure
Figure 1 (Sheet 1)



SECTION C-C

ICE PROTECTION AND "D" DUCT MATERIALS FOR ENTIRE WING LEADING EDGE ARE TYPICAL

SECTION B-B

TYP INSULATION INSTALLATION ("D" DUCT OMITTED FROM THIS VIEW FOR CLARITY).

NOTES:

1. UPPER RIB IS ITEM 5 AND LOWER RIB IS ITEM 4 ON RIGHT WING.
2. UPPER AND LOWER RIBS ARE ITEM 4 ON RIGHT WING.
3. INSULATION IS MADE FROM B-STAGE PHENOLIC NO. 181 GLASS FABRIC, DMS 1599.
4. REFERENCE - DOUGLAS DRAWING 5910003.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.090	CLAD 2014-T6	10	WEB (LEFT WING)	.025	CLAD 2014-T6
2	WEB	.050	CLAD 2014-T6		WEB (RIGHT WING)	.032	CLAD 2014-T6
3	STIFFENER		2612329	11	WEB	.016	CLAD 2014-T6
4	RIB	.063	CLAD 2014-T6	12	CHANNEL	.050	CLAD 2024-T3
5	RIB	.080	CLAD 2014-T6	13	RIB	.040	CLAD 2014-T6
6	RIB	.050	CLAD 2014-T6	14	ANGLE	.040	CLAD 2014-T6
7	WEB	.020	CLAD 2014-T6	15	BRACKET	.040	CLAD 2024-T42
8	ANGLE	.050	CLAD 2014-T6	16	INSULATION		SEE NOTE 3
9	FORMER	.063	CLAD 2014-T6	17	ANGLE	.040	CLAD 2024-T42

BB3-274A

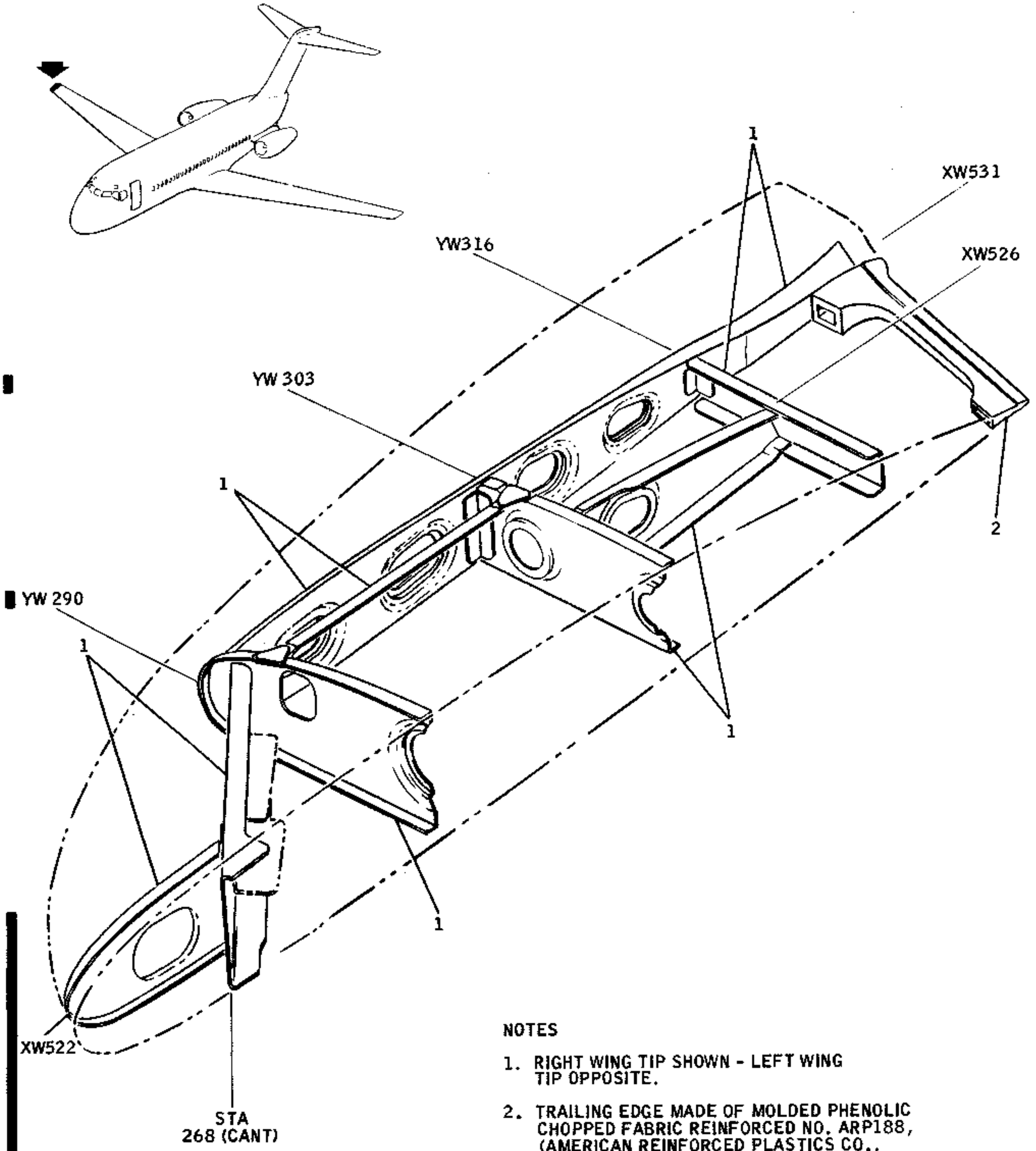
Wing Leading Edge Structure
Figure 1 (Sheet 2)

AUXILIARY WING TIP- DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures in this section illustrate wing tip structural materials, excluding plates/skins. Materials are identified in material lists by item number callouts.

Wing Tip Structure...Figure 1



NOTES

1. RIGHT WING TIP SHOWN - LEFT WING TIP OPPOSITE.
2. TRAILING EDGE MADE OF MOLDED PHENOLIC CHOPPED FABRIC REINFORCED NO. ARP188, (AMERICAN REINFORCED PLASTICS CO., 851 E. 60 ST., LOS ANGELES, CALIF.).

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.050	CLAD 2024-T42
2	TRAILING EDGE		3913531, SEE NOTE 2

REFERENCE - DOUGLAS DRAWING 5910014.

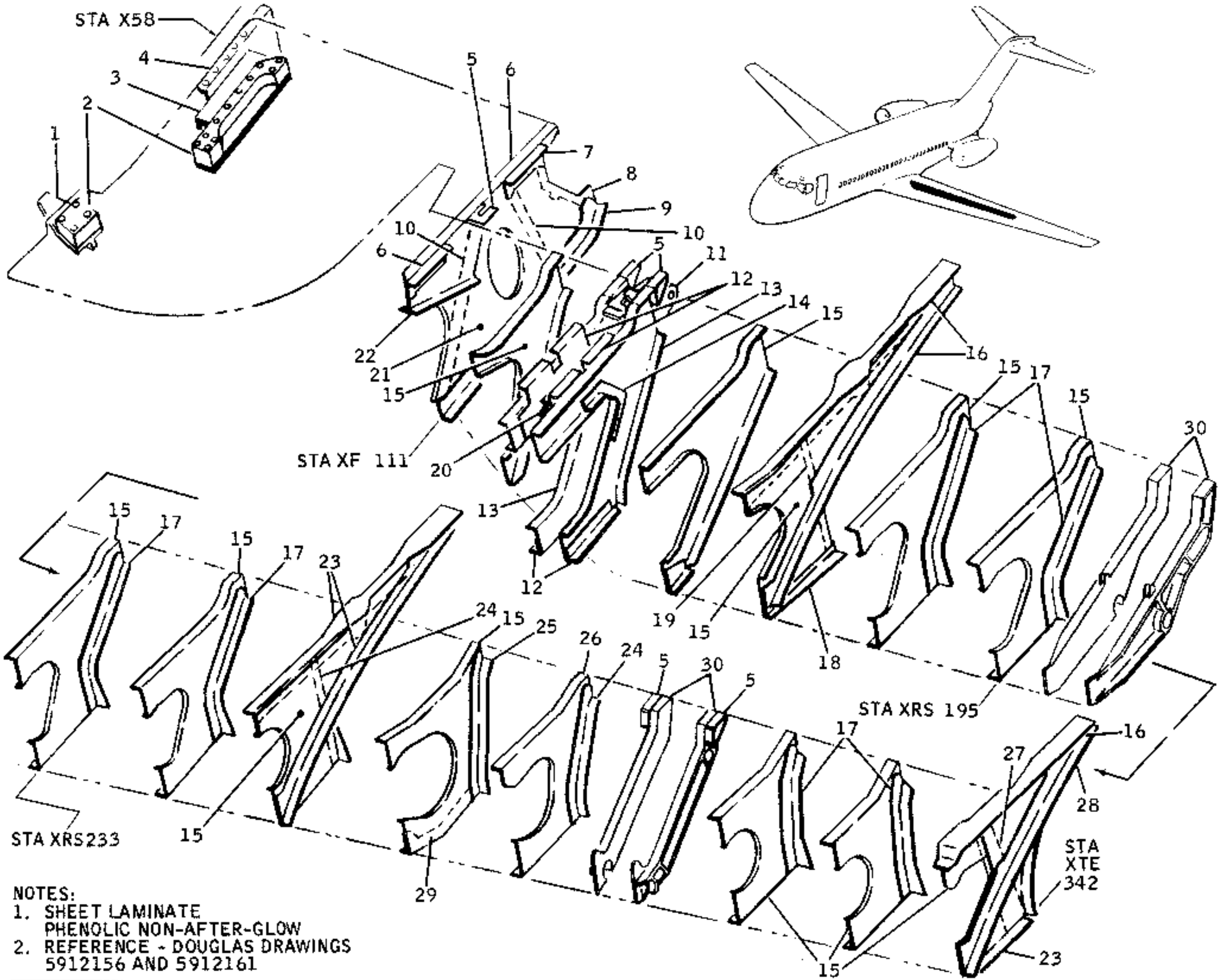
BB3-290B

Wingtip Structure
Figure 1

AXULIARY TRAILING EDGE - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. The following figures in this section illustrate wing trailing edge structural materials, excluding plates/skins. Since honeycomb structures form external covering of sections of trailing edge, they are considered with sections covering plates/skins throughout the manual. Materials are identified in material lists by item number callouts.



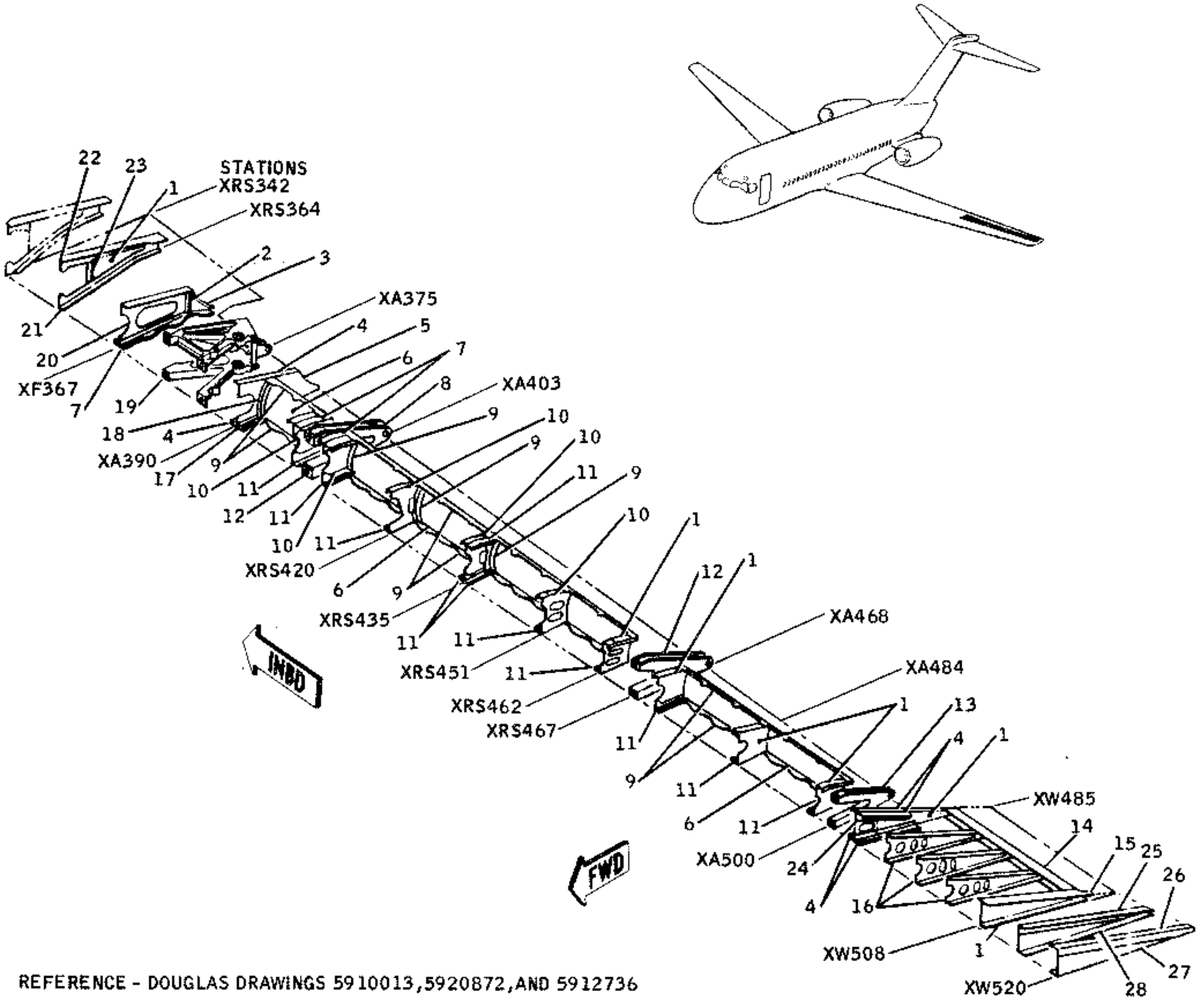
NOTES:
1. SHEET LAMINATE PHENOLIC NON-AFTER-GLOW
2. REFERENCE - DOUGLAS DRAWINGS 5912156 AND 5912161

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING 4914722		PLATE 7075-T651	16	TEE		2506195
2	BLOCK		SEE NOTE 1	17	TEE		1243286
3	FITTING 3914723		PLATE 7075-T651	18	ANGLE		1325737
4	FITTING 3912160		PLATE 2024-T351	19	ANGLE		1245072
5	FITTING 3913194		PLATE 7075-T73	20	FITTING, 3913543		PLATE 7075-T651
6	ANGLE		1109080	21	RIB	.050	CLAD 2024-T42
7	ANGLE		1287425	22	DOUBLER	.080	CLAD 2024-T42
8	FITTING, 3913223		PLATE 2024-T351	23	TEE		2615551
9	TEE		1329984	24	TEE		1243286
10	ANGLE	.063	CLAD 7075-T6	25	ANGLE		1119206
11	FITTING, 3913248		FORGING 2014-T6	26	RIB	.040	CLAD 2024-T42
12	BRACKET	.063	CLAD 7075-T6	27	CHANNEL	.050	CLAD 2024-T42
13	RIB	.063	CLAD 7075-T6	28	ANGLE		1328429
14	FLANGE	.312	CLAD 7075-T6	29	CLIP	.080	CLAD 2024-T42
15	RIB	.040	CLAD 2024-T42	30	SUPPORT	1.125	PLATE 7075-T651

Printed in U.S.A.

BB3-224A

Wing Trailing Edge Ribs and Supports
Figure 1 (Sheet 1)

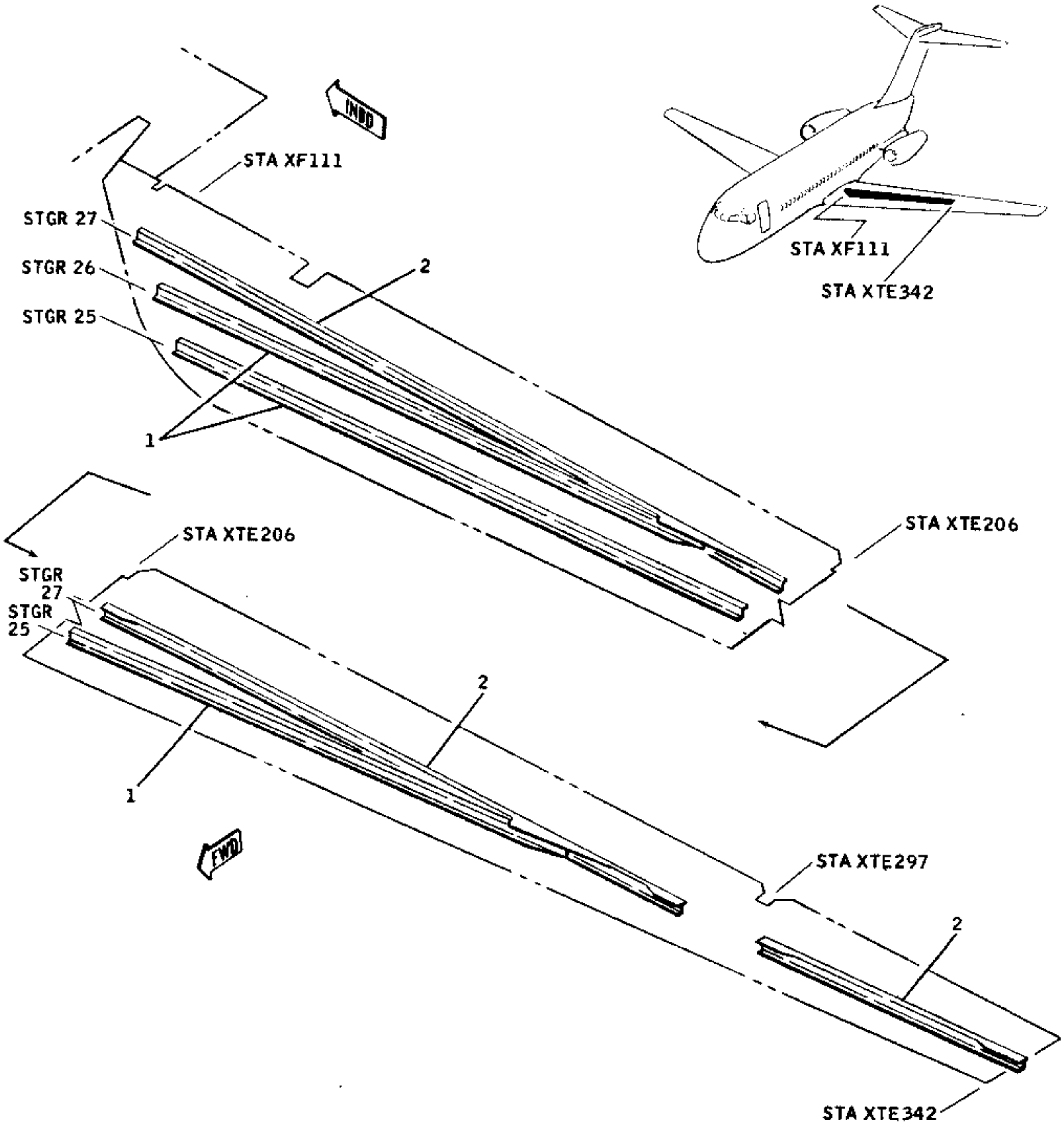


REFERENCE - DOUGLAS DRAWINGS 5910013,5920872,AND 5912736

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEB	.040	CLAD 2024-T3	15	EXTRUSION		2718854
2	ANGLE	.063	CLAD 2024-T42	16	WEB	.032	CLAD 2024-T42
3	CLIP	.063	CLAD 2024-T42	17	C-SECTION	.040	CLAD 2024-T42
4	C-SECTION	.050	CLAD 2024-T42	18	L-SECTION	.040	CLAD 2024-T42
5	DOUBLER	.050	CLAD 2024-T42	19	FITTING		5912447-1, -2
6	WEB	.020	CLAD 2024-T3	20	WEB	.050	CLAD 2024-T42
7	CHANNEL	.063	CLAD 2024-T42	21	ANGLE		1464575
8	BRACKET, 5912547-1, -2		PLATE 2014-T651	22	TEE		1329806
9	ANGLE	.040	CLAD 2024-T42	23	TEE		1430824
10	WEB	.063	CLAD 2024-T42	24	DOUBLER	.040	CLAD 2024-T3
11	CHANNEL	.040	CLAD 2024-T42	25	CAP	.040	CLAD 2024-T42
12	BRACKET, 5912516-1, -2		PLATE 2014-T651	26	CAP	.071	CLAD 2024-T42
13	BRACKET, 5912491		PLATE 2014-T651	27	RIB	.071	CLAD 2024-T42
14	CHANNEL	.025	CLAD 2024-T42	28	RIB	.040	CLAD 2024-T42

BB3-219A

Wing Trailing Edge Ribs and Supports
Figure 1 (Sheet 2)



REFERENCE - DOUGLAS DRAWING 5912156

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		1647068
2	STRINGER		1648361

Printed in U.S.A.

BB3-223

Wing Trailing Edge Stringers
Figure 2

AUXILIARY - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates components of wing auxiliary structure. Types and gages of material used in construction of assemblies are identified within illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

Structural Component	Approved Repairs
Leading Edge	
All	57-01, Figure 1
Ribs, Formers, Stiffeners, Webs	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheet 1 through 3
Wing Tip	
All	57-01, Figure 1
Ribs, Internal Structure	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 1 through 4 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2
Trailing Edge	
All	57-01, Figure 1
Ribs and Supports	57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4
Stringers, Webs	57-01, Figure 2, Sheet 3

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

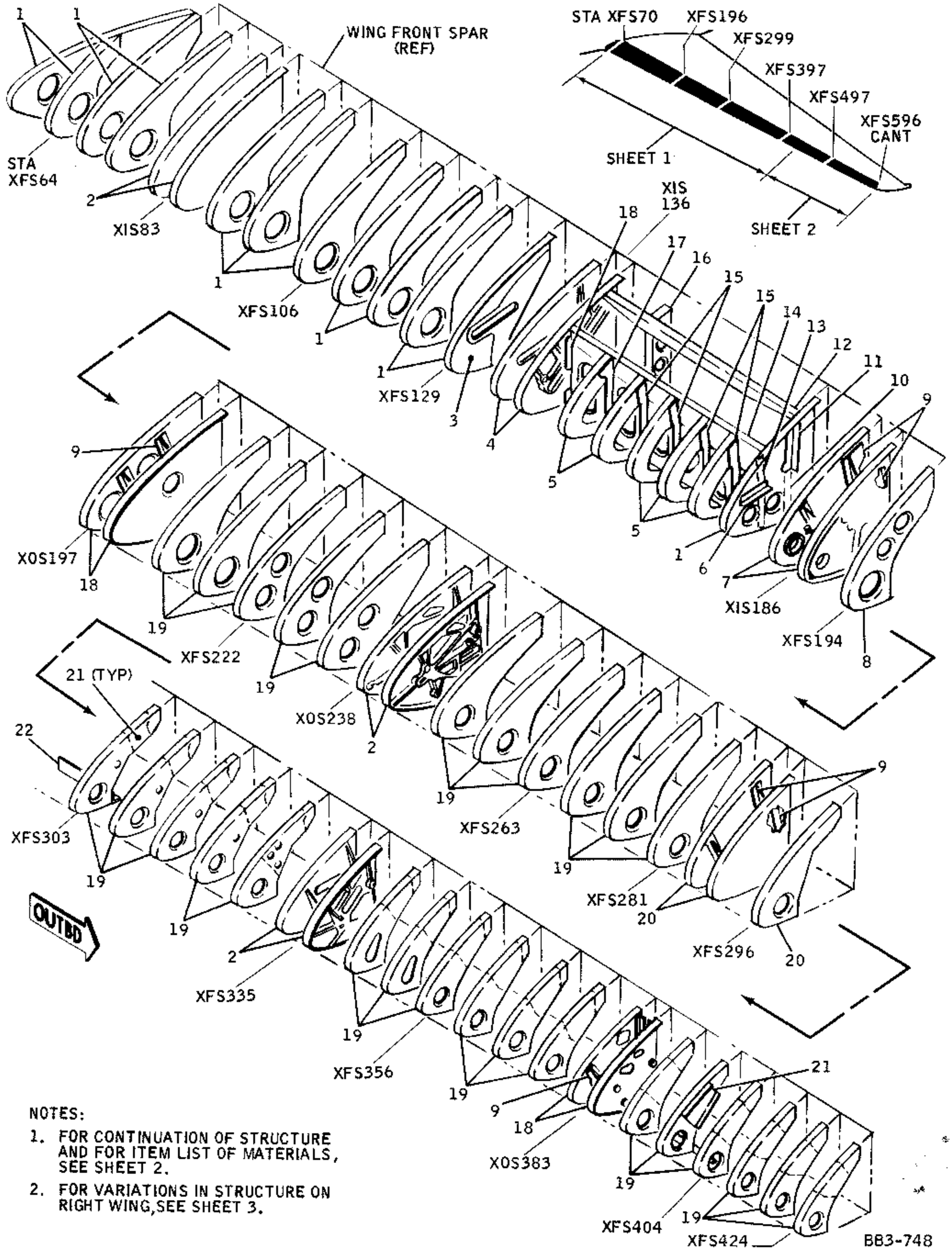
Structural Component	Approved Repairs
Stringers	57-01, Figure 2, Sheet 3
Webs	57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

AUXILIARY LEADING EDGE - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures in this section illustrate wing leading edge structural materials, excluding plates/skins. Materials are identified in material lists by item number callouts.

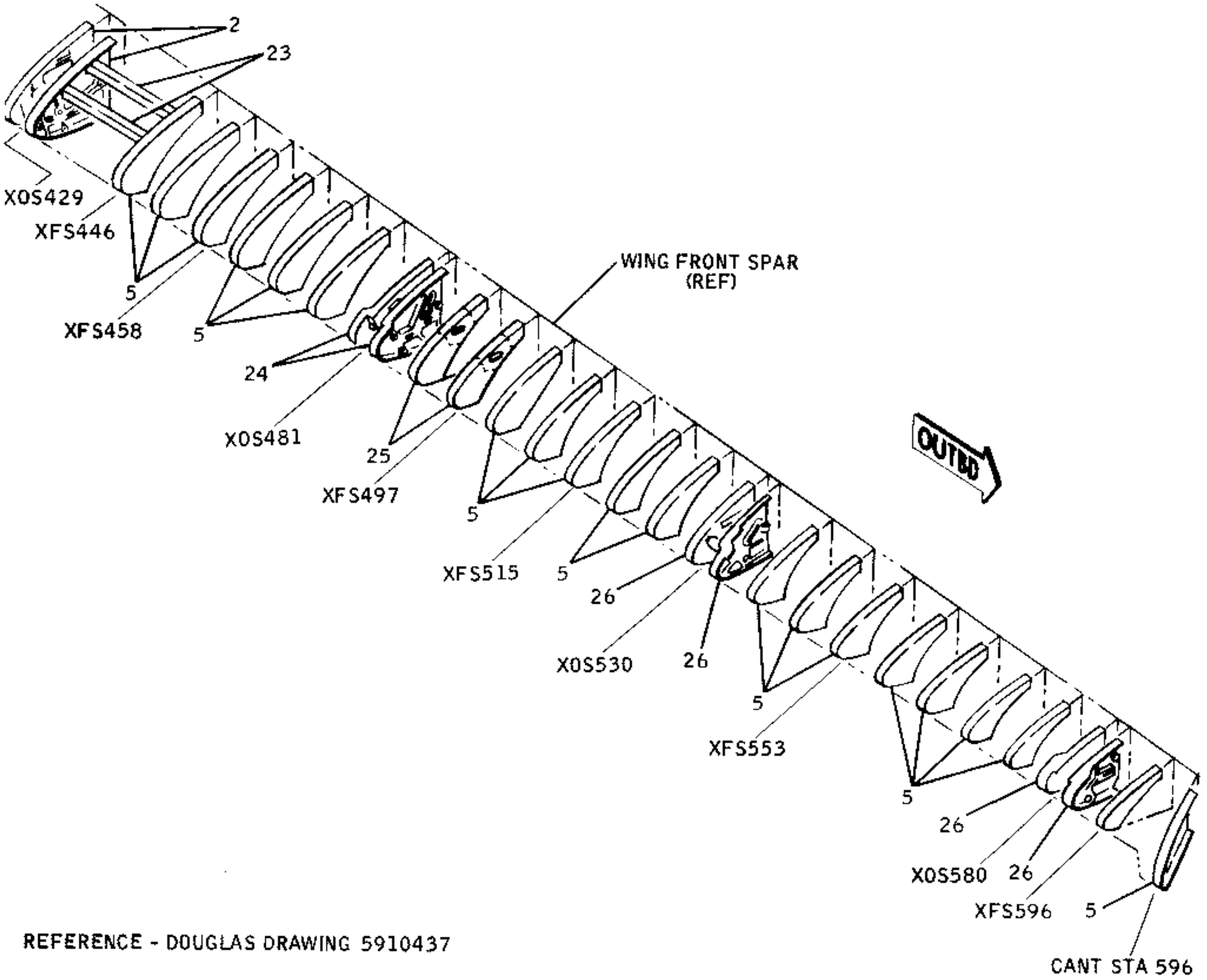


NOTES:

1. FOR CONTINUATION OF STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. FOR VARIATIONS IN STRUCTURE ON RIGHT WING, SEE SHEET 3.

Wing Leading Edge Structure -- Type A
Figure 1 (Sheet 1)

Printed in U.S.A.

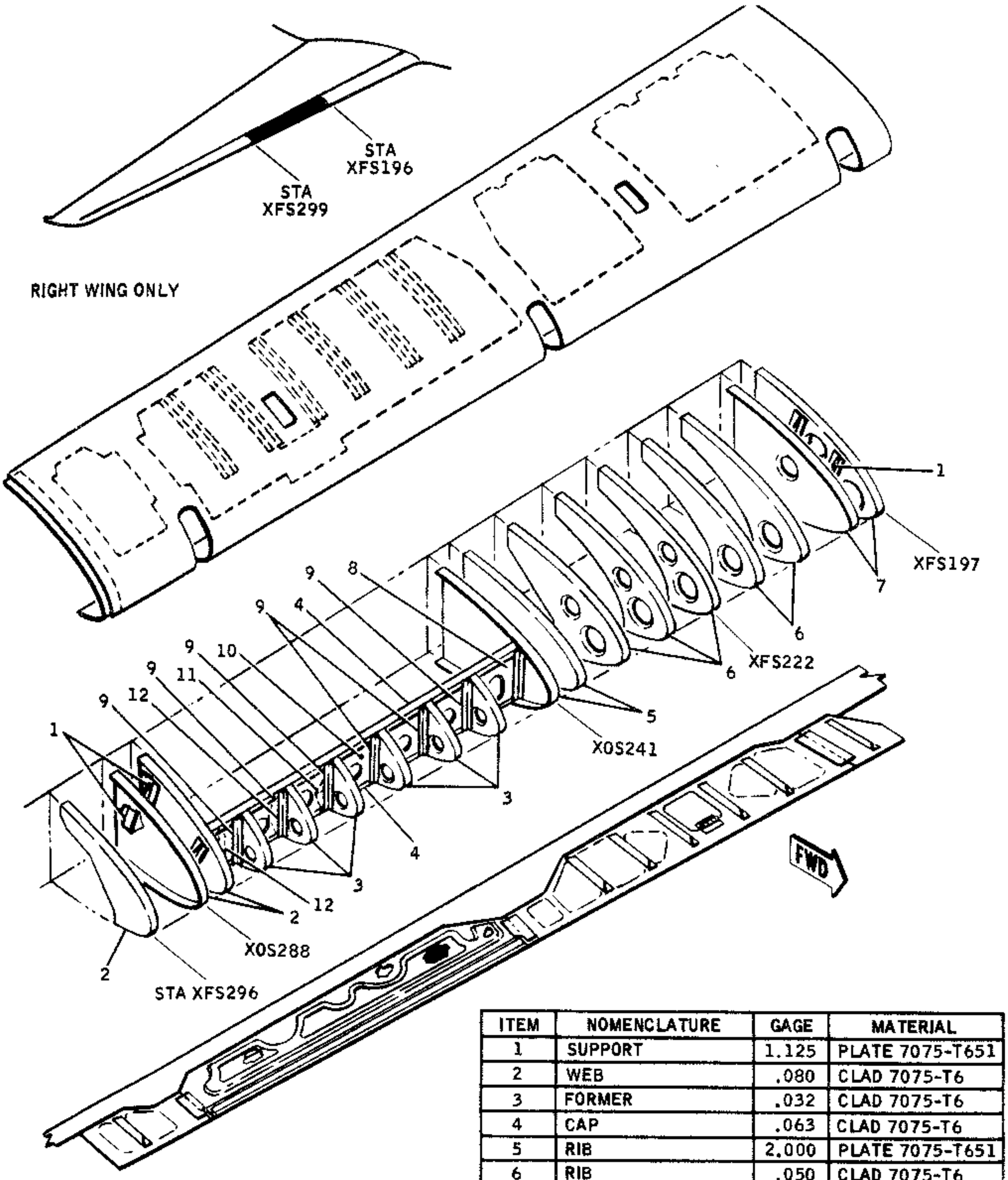


REFERENCE - DOUGLAS DRAWING 5910437

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.071	CLAD 7075-T6	15	ANGLE	.050	CLAD 2024-T42
2	RIB	2.000	PLATE 7075-T651	16	SUPPORT	1.000	PLATE 7075-T651
3	DOUBLER	.071	CLAD 7075-T6	17	ANGLE	.100	CLAD 2024-T42
4	RIB	1.750	PLATE 7075-T6	18	RIB	.071	CLAD 7075-T6
5	RIB	.040	CLAD 7075-T6	19	RIB	.050	CLAD 7075-T6
6	STIFFENER	.050	CLAD 2024-T42	20	WEB	.080	CLAD 7075-T6
7	RIB	1.250	CLAD 7075-T6	21	DOUBLER	.050	CLAD 7075-T6
8	RIB	.063	CLAD 7075-T6	22	CLIP	.063	CLAD 7075-T6
9	SUPPORT	1.125	PLATE 7075-T651	23	STIFFENER		1415595
10	STIFFENER		1419315	24	RIB	1.875	PLATE 7075-T651
11	STIFFENER		1242520	25	RIB	.051	CLAD 7075-T6
12	STIFFENER	.125	CLAD 7075-T6	26	RIB	2.500	PLATE 7075-T651
13	ANGLE	.063	CLAD 2024-T42	27	FORMER	.040	CLAD 2024-T42
14	INTERCOSTAL	.050	CLAD 2024-T42				

BB3-749

Wing Leading Edge Structure -- Type A
Figure 1 (Sheet 2)



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SUPPORT	1.125	PLATE 7075-T651
2	WEB	.080	CLAD 7075-T6
3	FORMER	.032	CLAD 7075-T6
4	CAP	.063	CLAD 7075-T6
5	RIB	2.000	PLATE 7075-T651
6	RIB	.050	CLAD 7075-T6
7	RIB	.071	CLAD 7075-T6
8	ANGLE	.100	CLAD 7075-T6
9	ANGLE	.050	CLAD 7075-T6
10	WEB	.050	CLAD 7075-T6
11	BRACKET	.063	CLAD 7075-T6
12	ANGLE	.063	CLAD 7075-T6

BB3-853

NOTES:

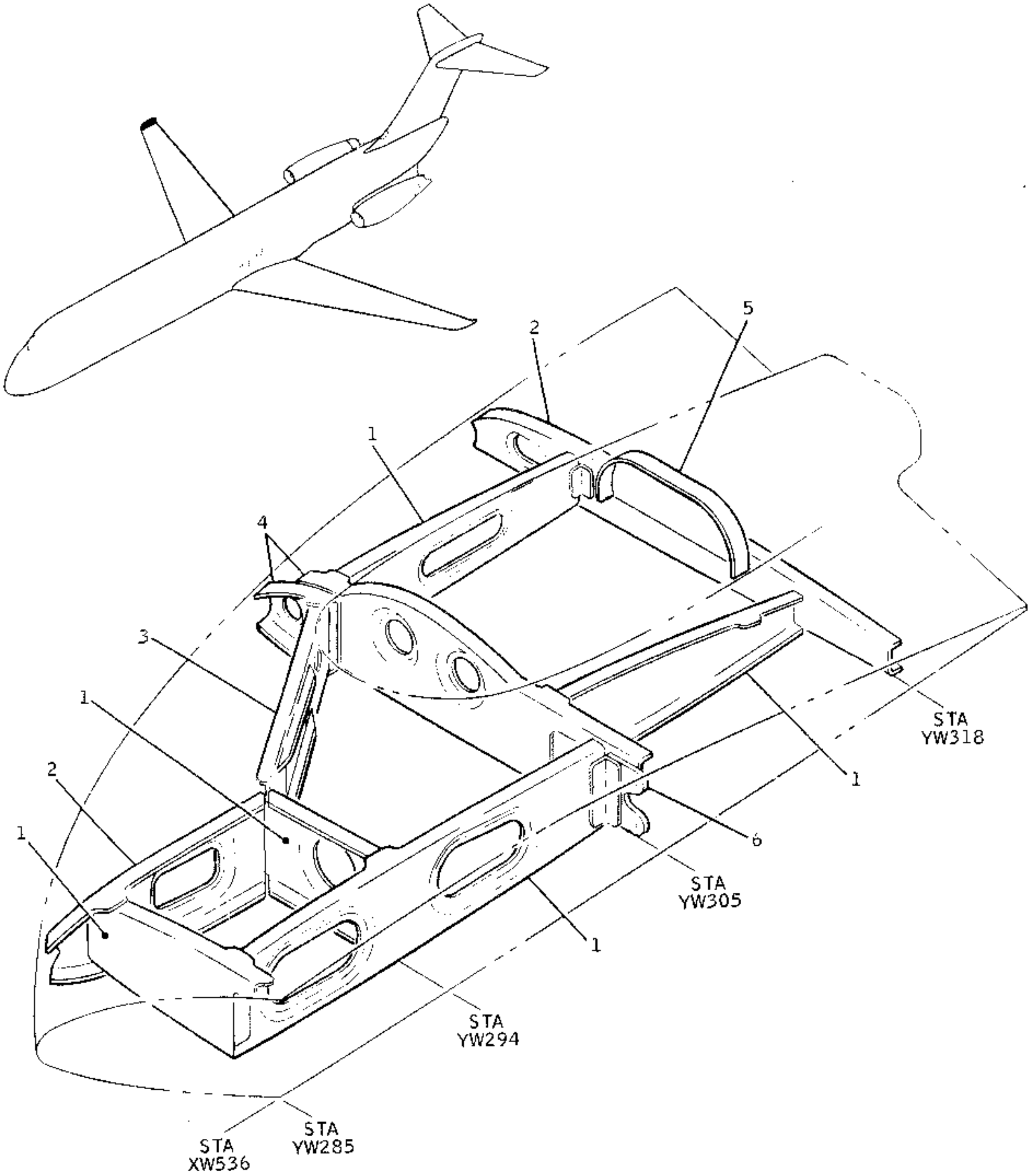
1. FOR PLATING MATERIAL IDENTIFICATION IN THIS AREA, SEE SECTION 57-31-1.
2. REFERENCE - DOUGLAS DRAWING 5919139

Wing Leading Edge Structure -- Type A
Figure 1 (Sheet 3)

AUXILIARY WING TIP - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures in this section illustrate wing tip structural materials, excluding plates/skins. Materials are identified in material lists by item number callouts.



NOTES:

1. RIGHT WING TIP SHOWN, LEFT WING TIP OPPOSITE.
2. REFERENCE - DOUGLAS DRAWING 5910472.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.040	CLAD 2024-T42
2	RIB	.040	CLAD 2024-T42
3	INTERCOSTAL	1.25	PLATE 7075-T651
4	RIB	.063	CLAD 7075-T6
5	FORMER	.040	CLAD 2024-T42
6	DOUBLER	.100	CLAD 7075-T6

BB3-743

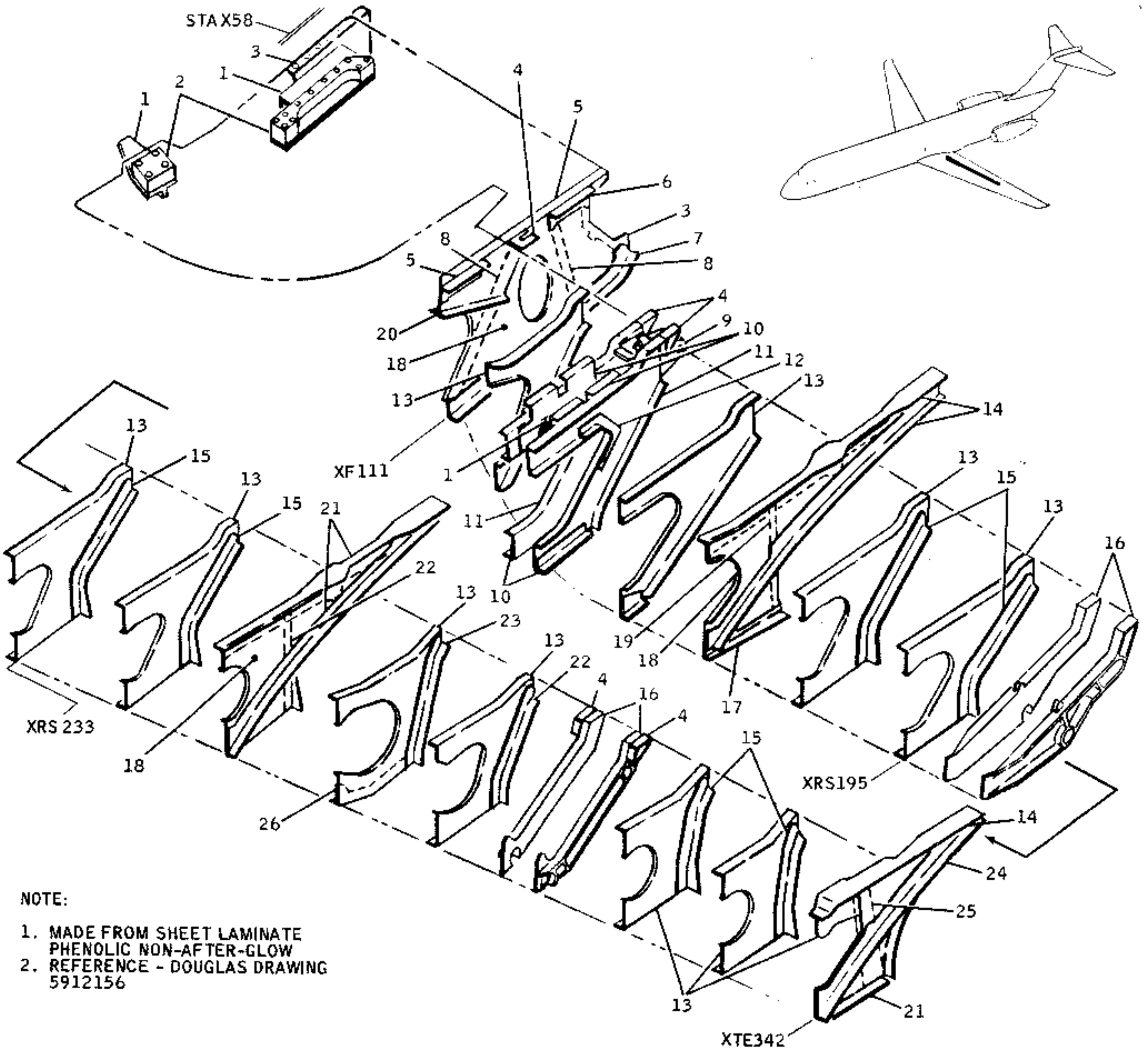
Wing Tip Structure -- Type A
Figure 1

AUXILIARY TRAILING EDGE - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. The following figures in this section illustrate wing trailing edge structural materials, excluding plates/skins. Since honeycomb structures form external covering of sections of trailing edge, they are considered with sections covering plates/skins throughout the manual. Materials are identified in material lists by item number callouts.

Printed in U.S.A.



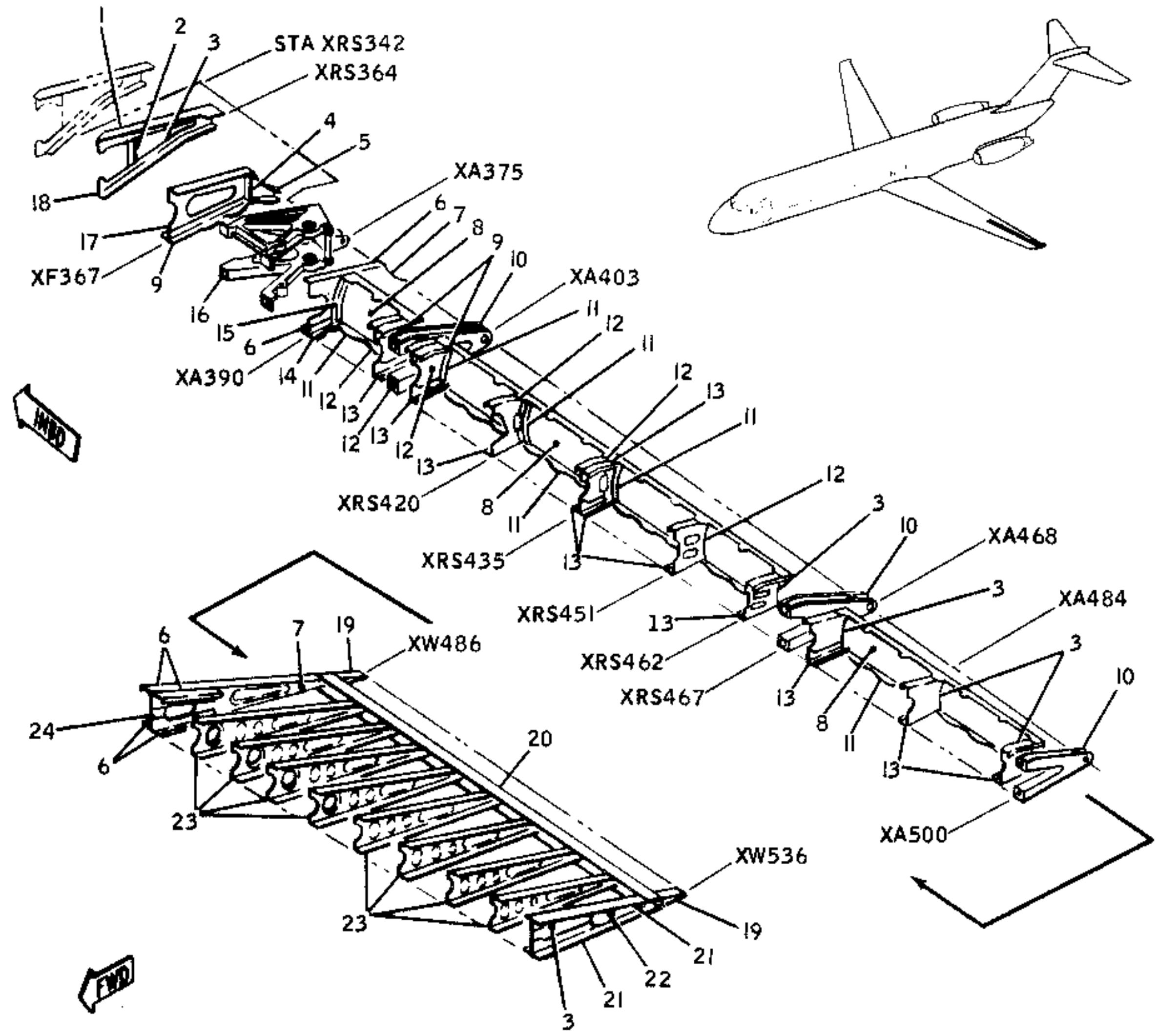
NOTE:

1. MADE FROM SHEET LAMINATE PHENOLIC NON-AFTER-GLOW
2. REFERENCE - DOUGLAS DRAWING 5912156

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		PLATE 7075-T651	14	TEE		2506195
2	BLOCK		SEE NOTE 1	15	TEE		1243286
3	FITTING		FORGING, 7075-T73	16	SUPPORT	1.125	PLATE 7075-T651
4	FITTING		PLATE 7075-T73	17	ANGLE		1325737
5	ANGLE		1109080	18	RIB	.050	CLAD 2024-T42
6	ANGLE		1287425	19	ANGLE		1245072
7	TEE		1329984	20	DOUBLER	.080	CLAD 2024-T42
8	ANGLE	.063	CLAD 7075-T6	21	TEE		1397588
9	FITTING		FORGING 2014-T6	22	TEE		1329806
10	BRACKET	.063	CLAD 7075-T6	23	ANGLE		1119206
11	RIB	.063	CLAD 7075-T6	24	ANGLE		2615551
12	FLANGE	.312	CLAD 7075-T651	25	CHANNEL	.050	CLAD 2024-T42
13	RIB	.040	CLAD 2024-T42	26	CLIP	.080	CLAD 2024-T42

BB3-750

Wing Trailing Edge Ribs and Supports -- Type A
Figure 1 (Sheet 1)

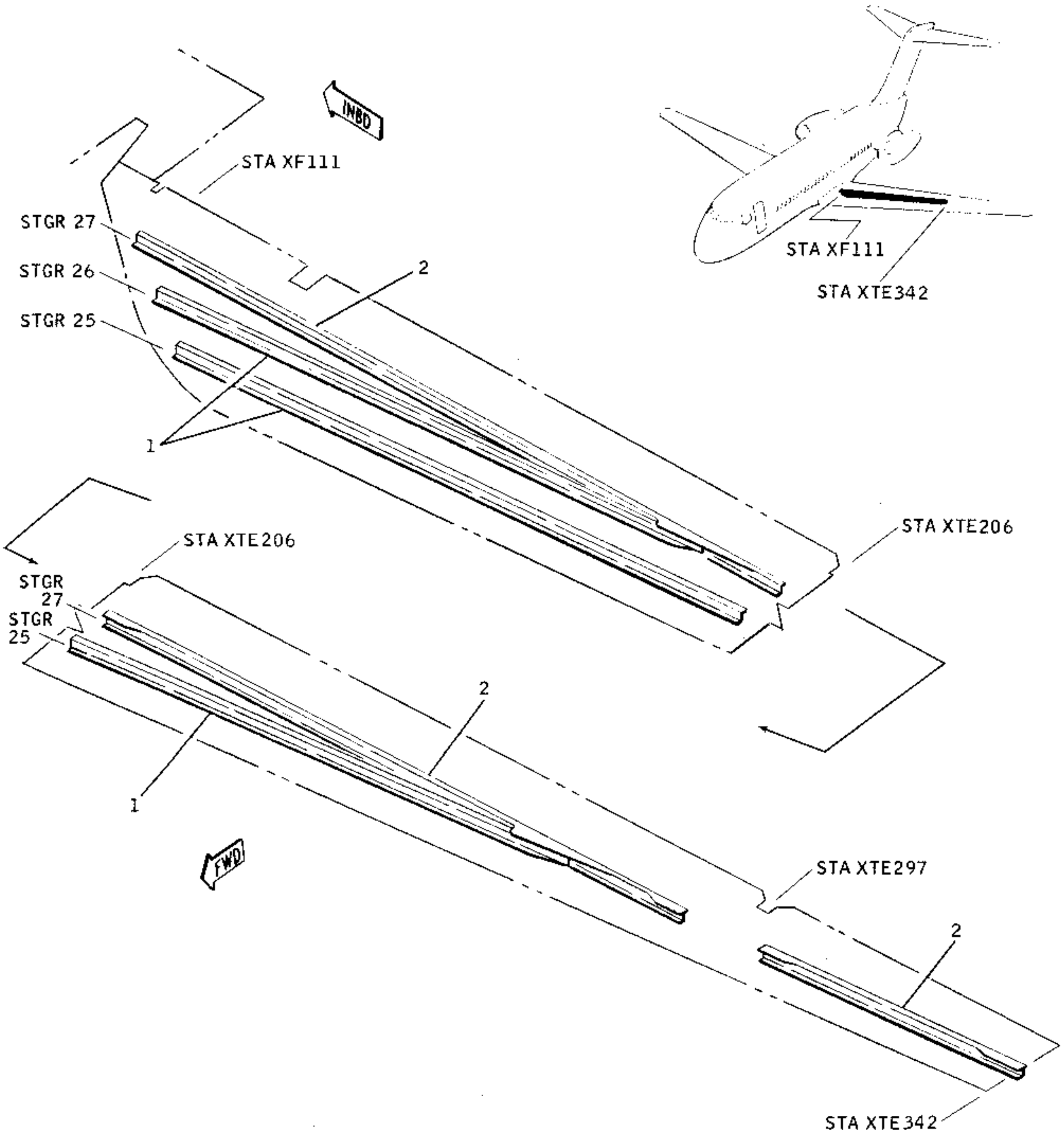


REFERENCE - DOUGLAS DRAWING 5910515

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TEE		1430824	13	CHANNEL	.040	CLAD 2024-T42
2	ANGLE	.050	CLAD 2024-T3	14	C-SECTION	.040	CLAD 2024-T42
3	WEB	.040	CLAD 2024-T3	15	L-SECTION	.040	CLAD 2024-T42
4	ANGLE	.063	CLAD 2024-T42	16	FITTING		FORGING 2014-T6
5	CLIP	.063	CLAD 2024-T42	17	WEB	.050	CLAD 2024-T42
6	C-SECTION	.050	CLAD 2024-T42	18	ANGLE		1464575
7	WEB	.040	CLAD 2024-T42	19	FORMER	.025	CLAD 2024-T42
8	WEB	.020	CLAD 2024-T3	20	CHANNEL	.025	CLAD 2024-T3
9	CHANNEL	.063	CLAD 2024-T42	21	FORMER		2718854
10	BRACKET		PLATE 2014-T651	22	FORMER	.063	CLAD 2024-T42
11	ANGLE	.040	CLAD 2024-T42	23	RIB	.032	CLAD 2024-T42
12	WEB	.063	CLAD 2024-T42	24	DOUBLER	.040	CLAD 2024-T42

BB3-751

Wing Trailing Edge Ribs and Supports -- Type A
Figure 1 (Sheet 2)



REFERENCE - DOUGLAS DRAWING 5912156

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STRINGER		1647068
2	STRINGER		1648361

BB3-223

Wing Trailing Edge Stringers -- Type A
Figure 2

PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates components of wing exterior covering. Types and gages of material used in construction of assemblies are identified within illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

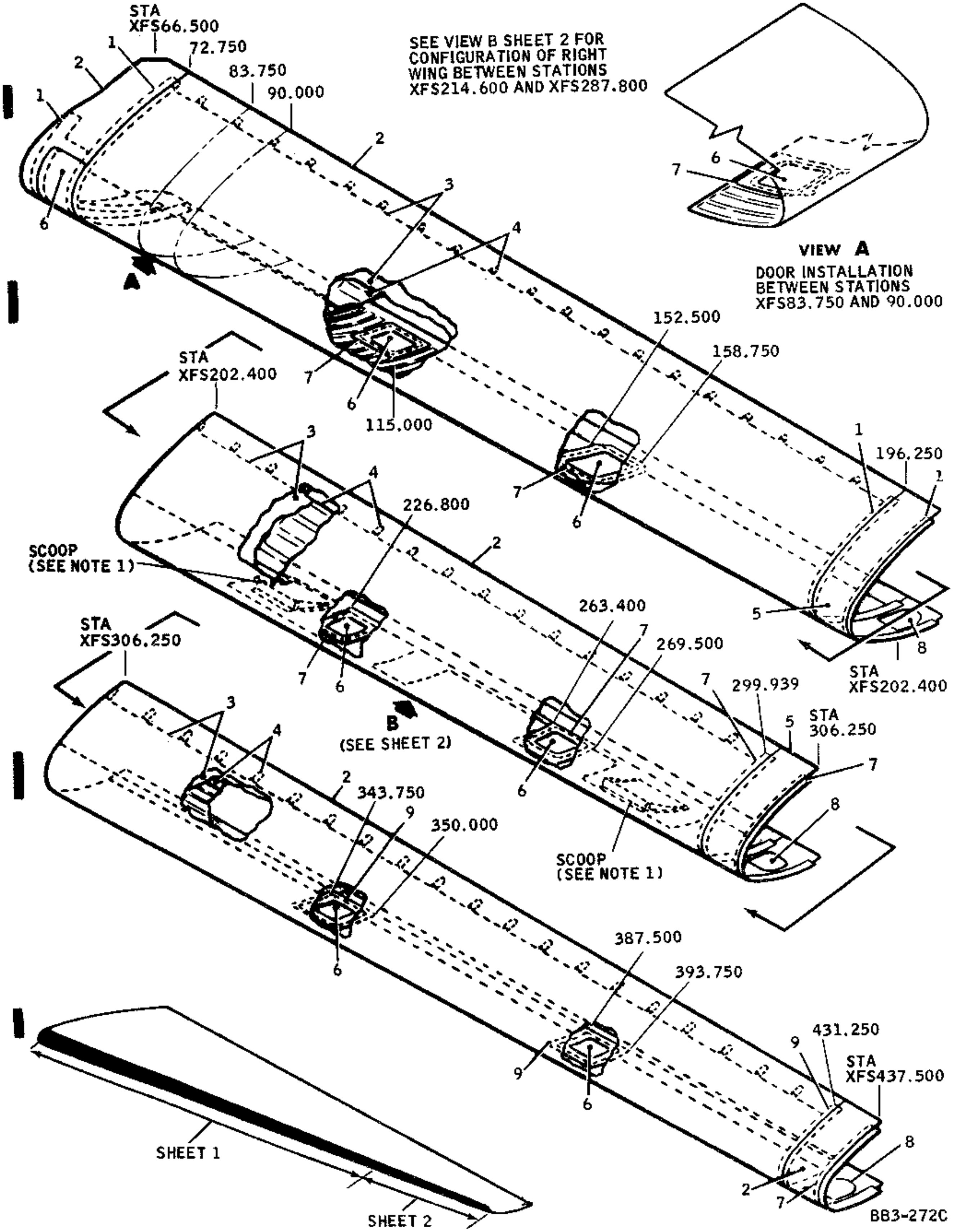
Structural Component	Approved Repairs
Center Section	
All	57-01, Figure 1, Sheet 3
Leading Edge	57-01, Figure 1, Sheet 3 51-70-2, Figure 10 (Dent Filler)
Wing Tip	57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2 51-70-2, Figure 10 (Dent Filler) 57-03, Figures 1 and 2
Trailing Edge	57-01, Figure 1 57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheets 1 and 2 57-01, Figure 5, Sheets 1 and 2 57-04, as applicable

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

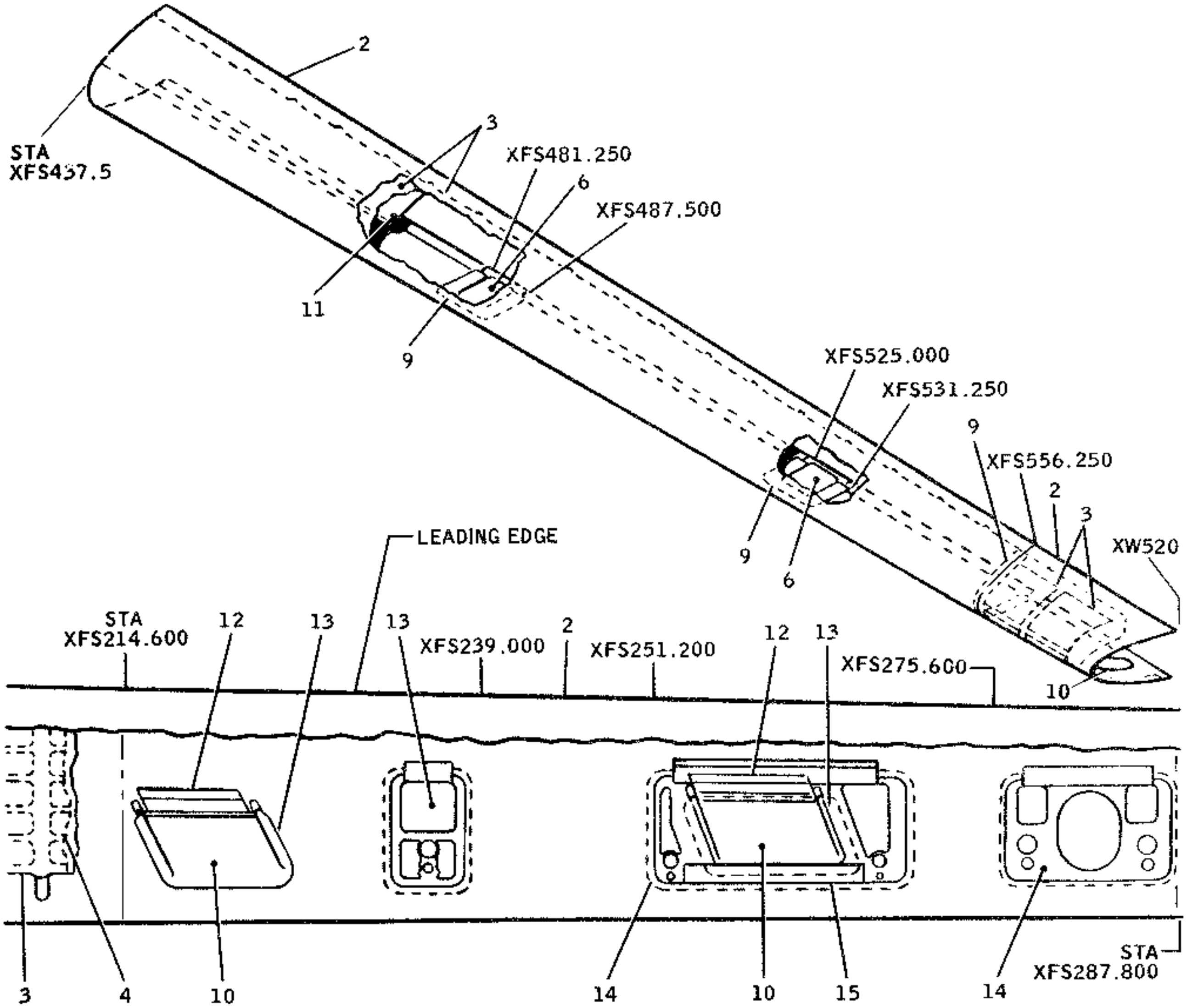
LEADING EDGE PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates wing leading edge plates/skins. Materials are identified in material lists by item number callouts.



Wing Leading Edge Plating
Figure 1 (Sheet 1)



VIEW B

LOOKING DOWN AT LOWER
SURFACE OF RIGHT WING
BETWEEN STATIONS XFS214.600
AND XF5287.800

NOTES:

1. SCOOPS TYPICAL LEFT AND RIGHT WING.
2. ITEMS 2, 5, 6 AND 13 CHEMICALLY MILLED FROM MATERIAL SPECIFIED.
3. REFERENCE - DOUGLAS DRAWING 5910003.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.071	CLAD 2014-T6	9	DOUBLER	.050	CLAD 2014-T6
2	SKIN	.125	CLAD 2014-T6	10	SCOOP	.050	CLAD 6061-T6
3	INNER SKIN	.016	CLAD 2014-T6	11	BEADED DOUBLER	.020	CLAD 2014-T6
4	BEADED DOUBLER	.025	CLAD 2014-T6	12	FLANGE	.050	CLAD 2014-T6
5	SKIN	.160	CLAD 2014-T42	13	DUCT SIDE	.050	SHEET 6061-T6
6	DOOR SKIN	.125	CLAD 2014-T6	14	DOOR SKIN	.100	CLAD 2014-T6
7	DOUBLER	.063	CLAD 2014-T6	15	CHANNEL	.040	CLAD 2024-T3
8	DOOR	.125	CLAD 2014-T6				

BB3-418B

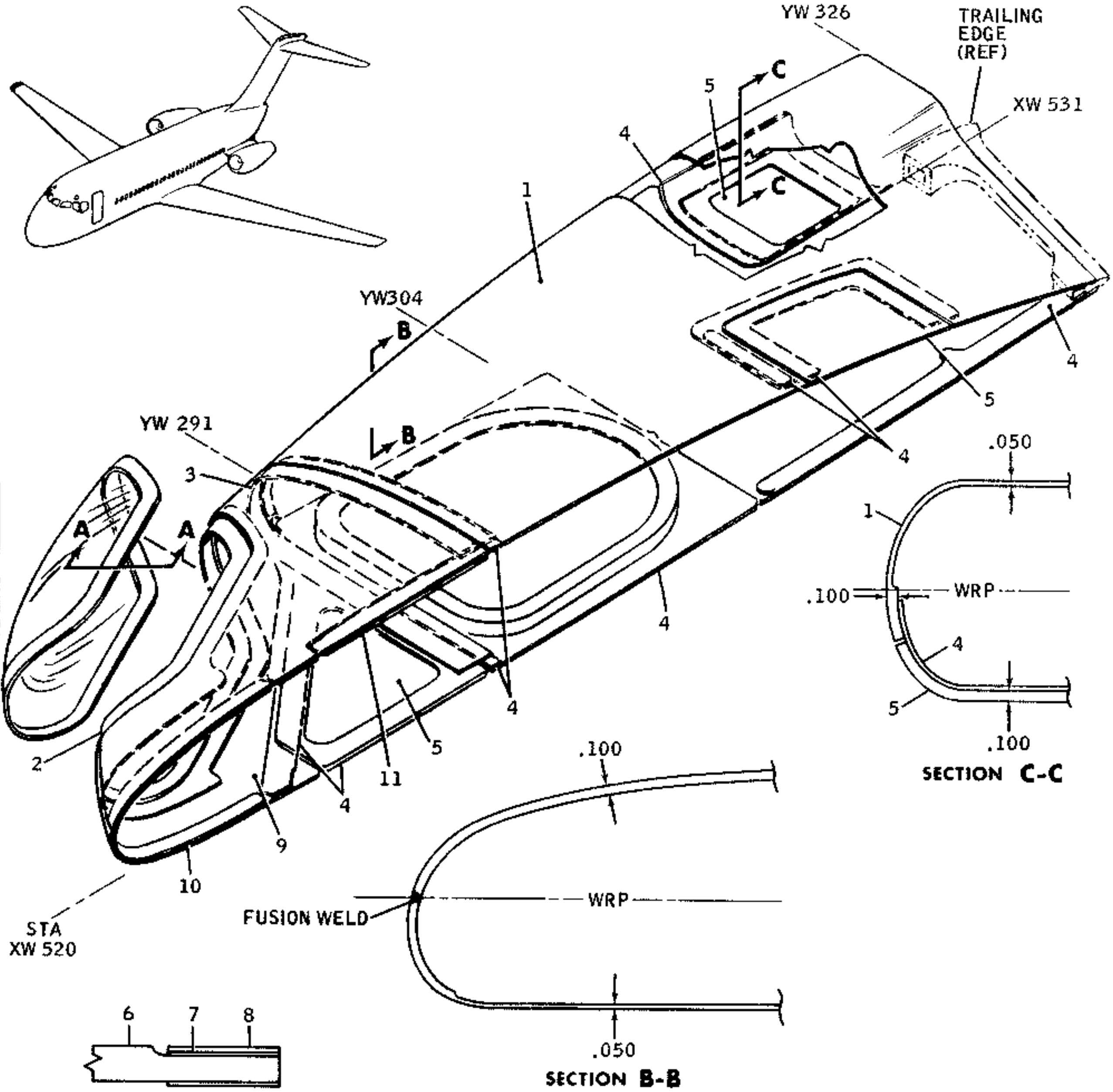
Printed in U.S.A.

Wing Leading Edge Plating
Figure 1 (Sheet 2)

WING TIP PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates wing tip plates/skins. Materials are identified in material lists by item number callouts.



	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	NOTED	CLAD 6061-T6X
2	DOUBLER	.063	CLAD 2024-T42
3	DOUBLER	.080	CLAD 2024-T42
4	DOUBLER	.050	CLAD 2024-T42
5	DOOR	.100	CLAD 2024-T42
6	LENS	.250	SEE NOTE 2
7	SEAL	.032	SEE NOTE 3
8	STRAP	.080	CLAD 2024-T3
9	SKIN	.050	CLAD 2024-T42
10	DOUBLER	.071	CLAD 2024-T42
11	DOUBLER	.025	CLAD 2024-T3

NOTES:

1. RIGHT WING TIP SHOWN, LEFT WING TIP OPPOSITE.
2. MADE FROM ACRYLIC, MIL-C-25050.
3. MADE FROM SILICONE MOLDED RUBBER MIL-R-5847, CLASS 2B, GRADE 50.
4. UPPER AND LOWER SKINS CHEMICALLY MILLED FROM .160 AND .100 STOCK TAPER VARIES FROM .100 TO .050.
5. REFERENCE - DOUGLAS DRAWING 5910014

BB3-289C

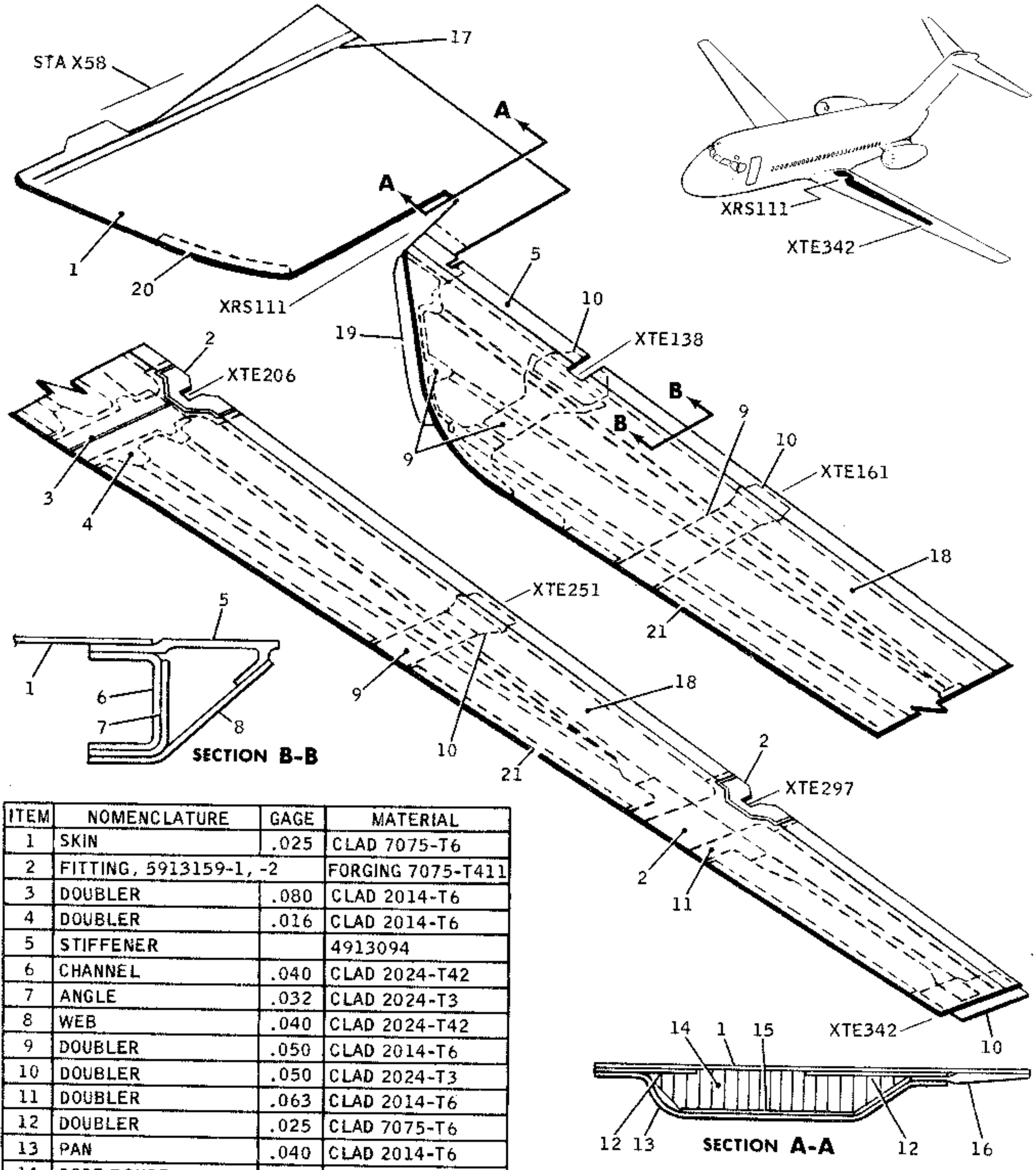
Wingtip Plating
Figure 1

TRAILING EDGE PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates wing trailing edge plates/skins, including honeycomb structures which comprise a portion of external covering. Materials are identified in material lists by item number callouts.

Printed in U.S.A.



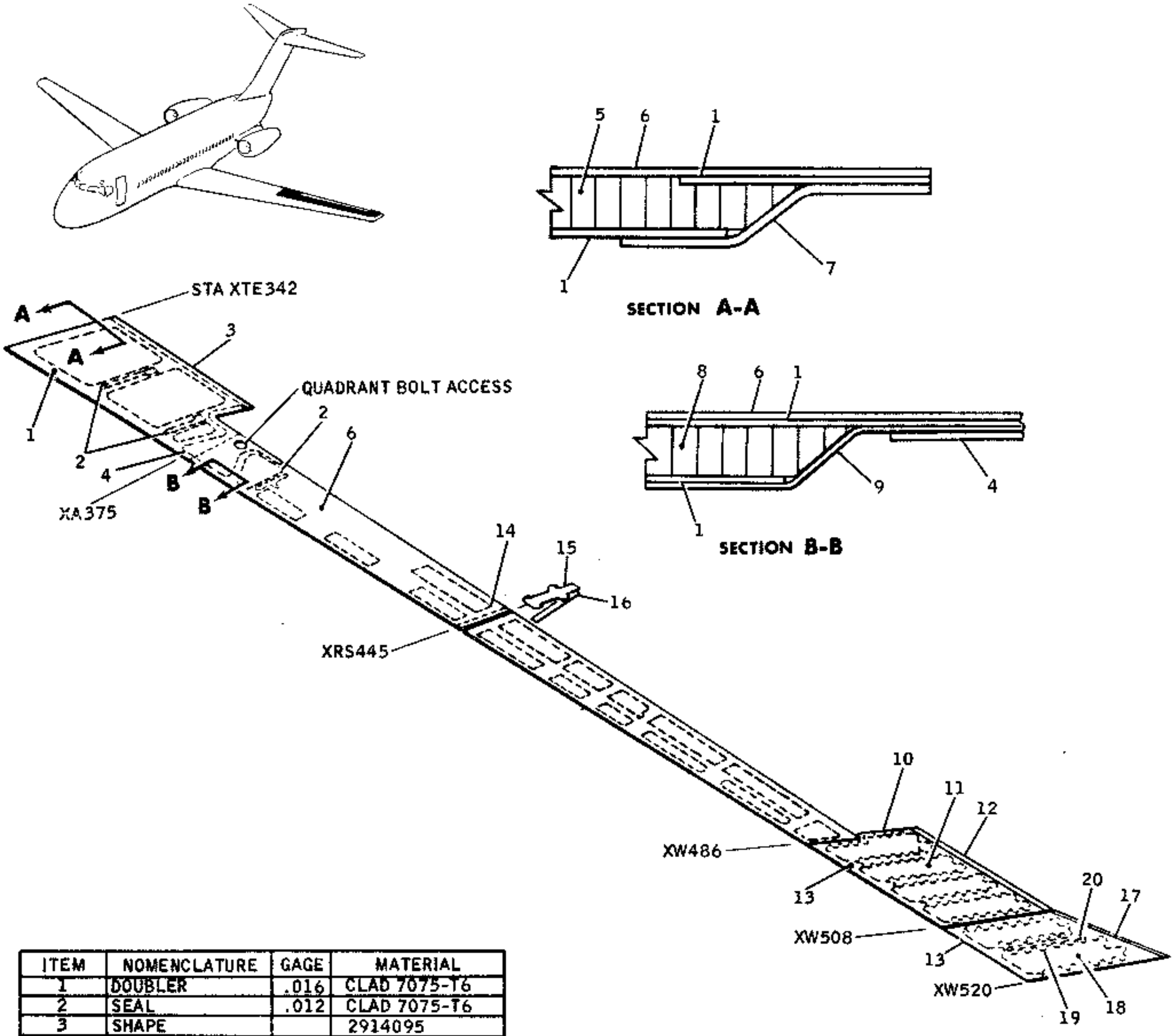
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.025	CLAD 7075-T6
2	FITTING, 5913159-1, -2		FORGING 7075-T411
3	DOUBLER	.080	CLAD 2014-T6
4	DOUBLER	.016	CLAD 2014-T6
5	STIFFENER		4913094
6	CHANNEL	.040	CLAD 2024-T42
7	ANGLE	.032	CLAD 2024-T3
8	WEB	.040	CLAD 2024-T42
9	DOUBLER	.050	CLAD 2014-T6
10	DOUBLER	.050	CLAD 2024-T3
11	DOUBLER	.063	CLAD 2014-T6
12	DOUBLER	.025	CLAD 7075-T6
13	PAN	.040	CLAD 2014-T6
14	CORE BONDED		SEE NOTE 1
15	INNER SKIN	.020	CLAD 7075-T6
16	EDGE		2914095
17	STRIP	.016	SEE NOTE 2
18	SKIN	.040	CLAD 2014-T6
19	DOUBLER	.090	CLAD 7075-T6
20	SHIM	SEE NOTE 3	
21	SHIM	.025	CLAD 2014-T6

NOTES:

1. ITEM 14, CORE, 1.000 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. CREW SHEET, MIL-S-5059, COND 1/4 H FINISH, NO. 28.
3. ITEM 20, SHIM, IS LAMINATED ALUMINUM, HALF SOLID, HALF LAMINATED (.003 INCH LAMINATIONS), AMS 4013.
4. REFERENCE - DOUGLAS DRAWINGS 5912156 AND 5912161.

BB3-222B

Wing Inboard Trailing Edge Upper Plating
Figure 1



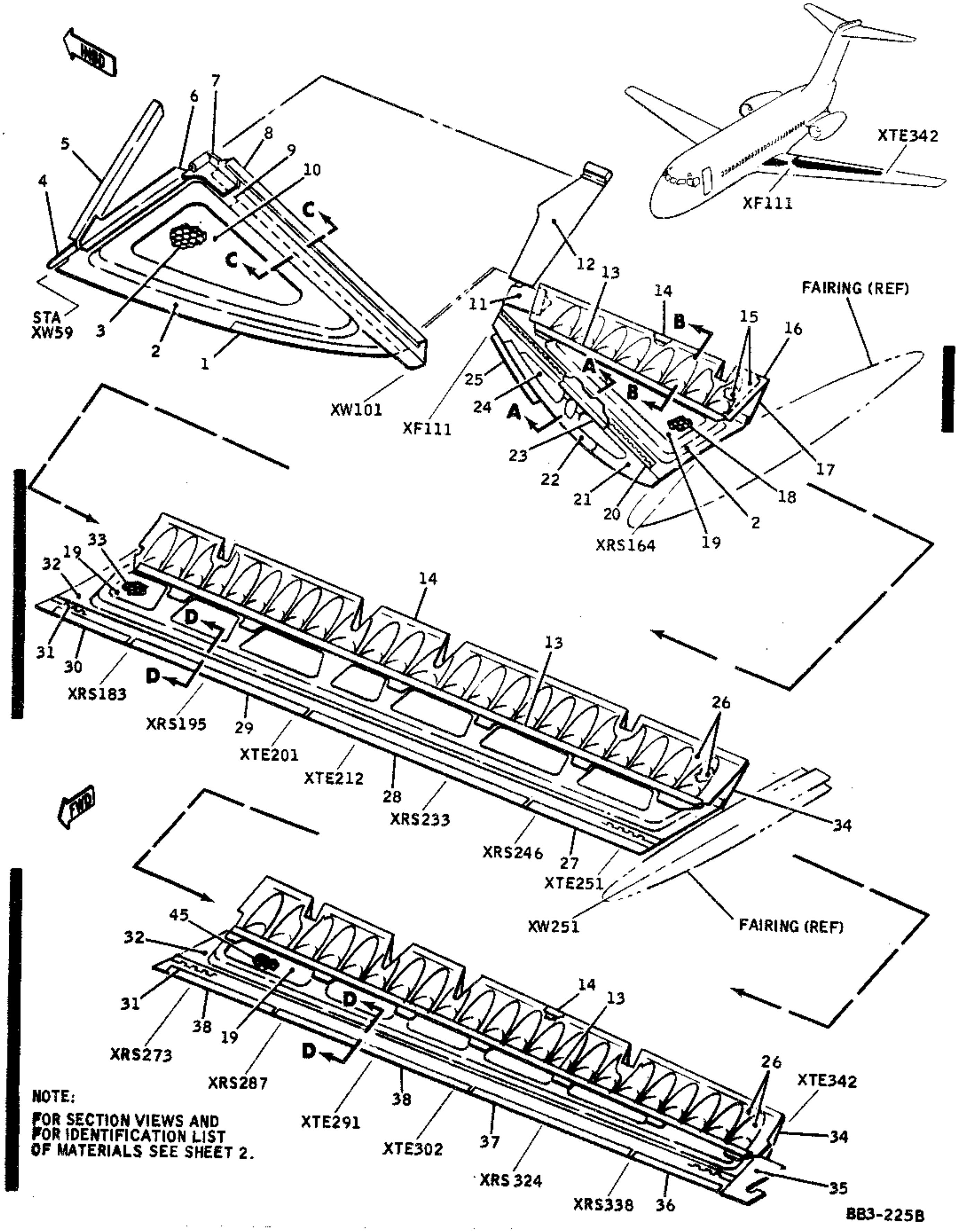
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.016	CLAD 7075-T6
2	SEAL	.012	CLAD 7075-T6
3	SHAPE		2914095
4	DOUBLER	.063	CLAD 7075-T6
5	CORE		SEE NOTE 1
6	SKIN	.016	CLAD 7075-T6
7	PAN	.032	CLAD 7075-T6
8	CORE		SEE NOTE 2
9	PAN	.025	CLAD 7075-T6
10	BONDED DOUBLER	.016	CLAD 7075-T6
11	SKIN	.020	CLAD 7075-T6
12	SHAPE		SEE NOTE 3
13	BONDED DOUBLER	.032	CLAD 7075-T6
14	SPACER		SEE NOTE 4
15	DOUBLER	.040	CLAD 2024-T3
16	SPLICE PLATE	.020	CRES SHEET
17	TIP	.625	PLATE 2024-T351
18	SKIN	.080	CLAD 7075-T6
19	BONDED DOUBLER	.020	CLAD 7075-T6
20	SHIM	.032	CLAD 2024-T4

NOTE:

1. CORE IS MADE FROM .687 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
2. CORE IS MADE FROM NON-EXPANDED 3.000 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
3. SHAPE NO. 3913181 IS MODE FROM NO. 124 AND 181 GLASS FIBER LAMINATE WITH FILLER OF GLASS FIBER ROVING DMS 159A, CLASS 3.
4. SPACER MADE OF SHEET LAMINATE PHENOLIC NON-AFTER GLOW.
5. REFERENCE - DOUGLAS DRAWINGS 5910013 AND 5920872

BB3-220A

Wing Outboard Trailing Edge Upper Plating
Figure 2

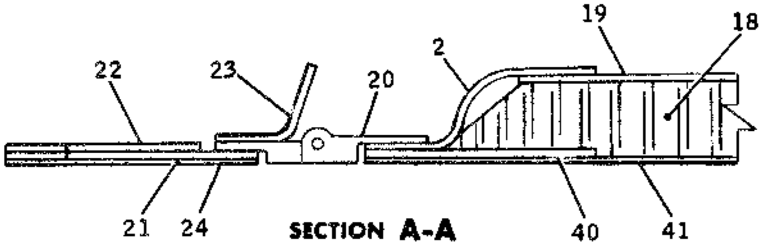


NOTE:
FOR SECTION VIEWS AND
FOR IDENTIFICATION LIST
OF MATERIALS SEE SHEET 2.

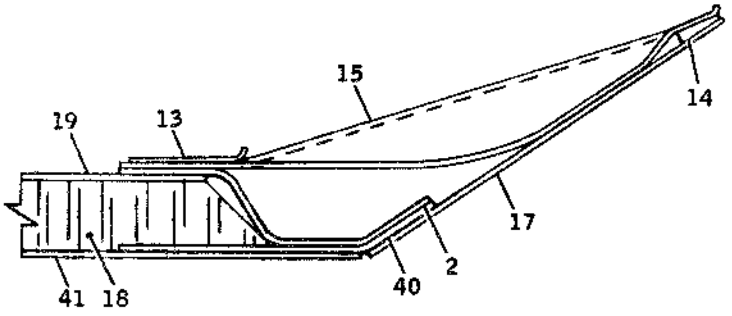
Wing Inboard Trailing Edge Lower Plating
Figure 3 (Sheet 1)

NOTES:

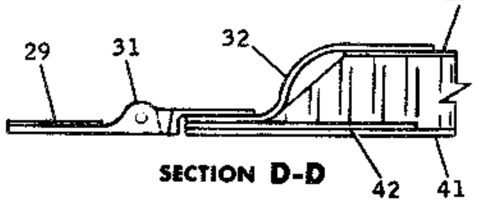
1. ITEM 3, CORE, MADE FROM .562 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 18, CORE, MADE FROM .687 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 33, CORE, MADE FROM .625 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 45, CORE, MADE FROM .500 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. SPACERS AND SHIMS MADE FROM SHEET LAMINATED GLASS CLOTH PHENOLIC.
3. SPACER, FILLER, AND RUB STRIP MADE FROM SHEET LAMINATED PHENOLIC SEMI-GLOSS, MIL-P-15035, TYPE FBE.
4. INBOARD AND OUTBOARD SEGMENTS OF HINGE HALVES MADE FROM .312 2024-T351 PLATE. CENTER SEGMENT AND AFT HINGE HALF MADE FROM 2913655 EXTRUSION.
5. FORWARD HINGE HALF MADE FROM 3913654. AFT HINGE MADE FROM 3913655.



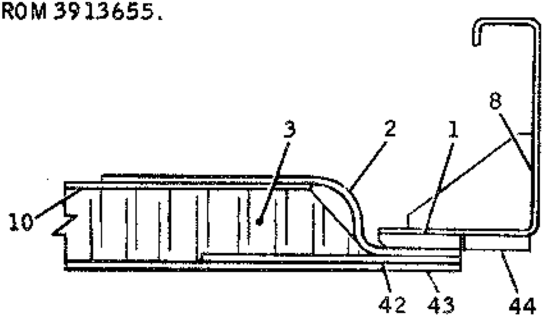
SECTION A-A



SECTION B-B



SECTION D-D



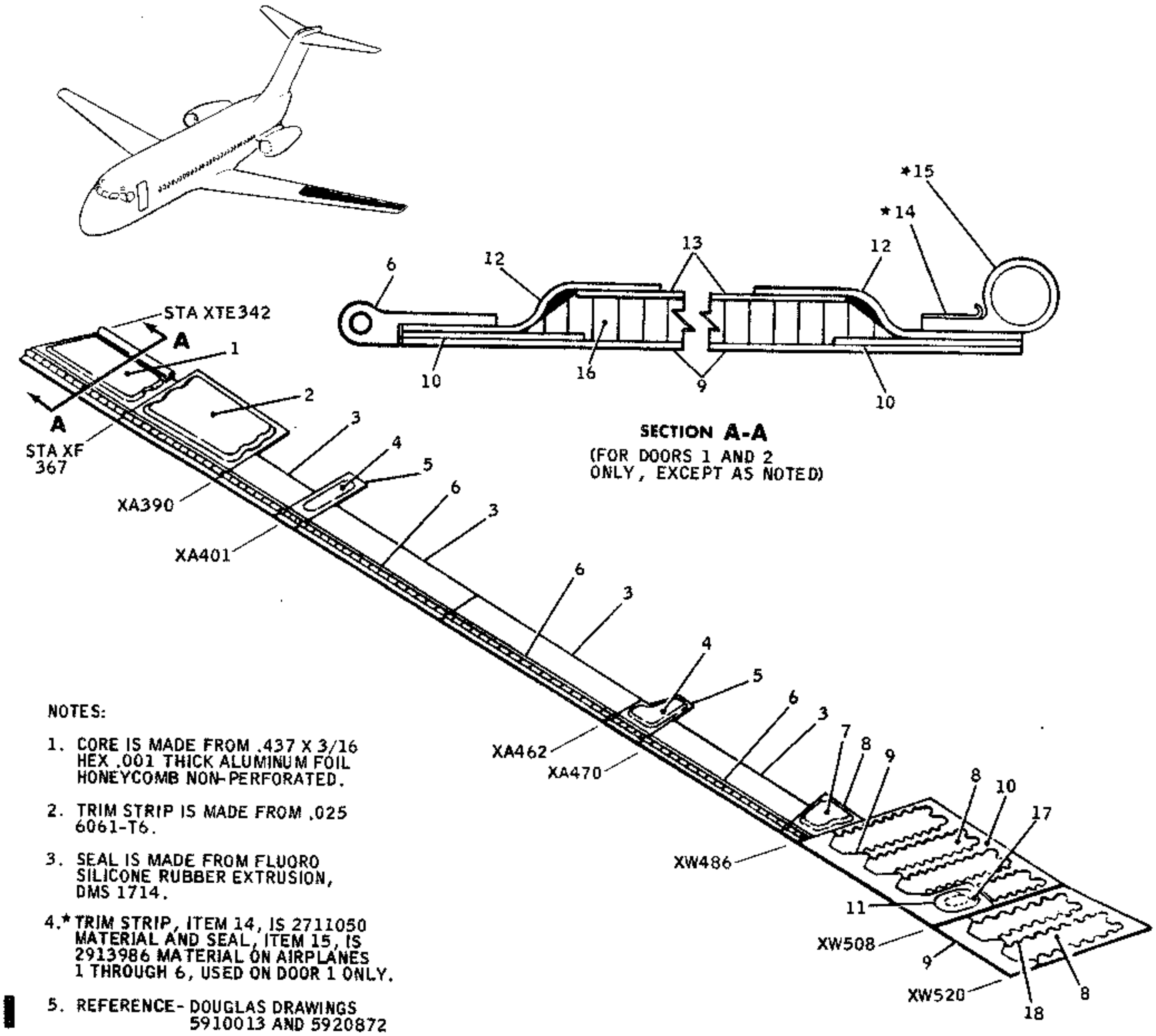
SECTION C-C

REFERENCE - DOUGLAS DRAWINGS 5910012, 5912144, 5912145, 5913438 AND 5913622.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FILLER	.156	SEE NOTE 3
2	PAN	.040	CLAD 7075-T6
3	CORE		SEE NOTE 1
4	WEB	.040	CLAD 7075-T6
5	ANGLE		1418203
6	ANGLE		1619970
7	FITTING, 3916379		AL BAR 7075-T651
8	JAMB	.063	CLAD 2024-T42
9	FILLER	.160	CLAD 2014-T6
10	INNER SKIN	.020	CLAD 7075-T6
11	BRACKET	.080	CLAD 7075-T6
12	AFT SKIN	.070	CLAD 7075-T6
13	DOUBLER	.032	CLAD 2024-T3
14	SPACER		1152325
15	SKIN	.025	CLAD 2024-T42
16	DOUBLER	.032	CLAD 2024-T3
17	SKIN	.032	CLAD 2024-T3
18	CORE		SEE NOTE 1
19	INNER SKIN	.016	CLAD 7075-T6
20	HINGE, 5914469		SEE NOTE 4
21	HINGE SPACER	.030	SEE NOTE 2
22	PANEL SPACER	.137	SEE NOTE 2
23	ANGLE	.090	CLAD 7075-T6
24	SKIN	.063	CLAD 7075-T6
25	TIE PLATE	.125	CLAD 7075-T6
26	SKIN	.040	CLAD 2024-T42
27	SHIM	.083	SEE NOTE 2
28	SHIM	.101	SEE NOTE 2
29	SHIM	.119	SEE NOTE 2
30	SHIM	.128	SEE NOTE 2
31	HINGE, 5913665		SEE NOTE 5
32	PAN	.025	CLAD 7075-T6
33	CORE		SEE NOTE 1
34	SKIN	.032	CLAD 7075-T6
35	PANEL	.190	CLAD 2024-T3
36	SHIM	.012	CLAD 2024-T3
37	SHIM	.040	SEE NOTE 2
38	SHIM	.057	SEE NOTE 2
39	SHIM	.065	SEE NOTE 2
40	DOUBLER	.040	CLAD 7075-T6
41	OUTER SKIN	.016	CLAD 7075-T6
42	DOUBLER	.032	CLAD 7075-T6
43	OUTER SKIN	.020	CLAD 7075-T6
44	RUB STRIP	.125	SEE NOTE 3
45	CORE		SEE NOTE 1

BB3-221B

Wing Inboard Trailing Edge Lower Plating
Figure 3 (Sheet 2)



NOTES:

1. CORE IS MADE FROM .437 X 3/16 HEX .001 THICK ALUMINUM FOIL HONEYCOMB NON-PERFORATED.
2. TRIM STRIP IS MADE FROM .025 6061-T6.
3. SEAL IS MADE FROM FLUORO SILICONE RUBBER EXTRUSION, DMS 1714.
4.* TRIM STRIP, ITEM 14, IS 2711050 MATERIAL AND SEAL, ITEM 15, IS 2913986 MATERIAL ON AIRPLANES 1 THROUGH 6, USED ON DOOR 1 ONLY.
5. REFERENCE- DOUGLAS DRAWINGS 5910013 AND 5920872

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOOR		SEE SECTION A-A	10	BONDED DOUBLER	.016	CLAD 7075-T6
2	DOOR		SEE SECTION A-A	11	COVER	.040	CLAD 2024-T3
3	DOOR	.040	CLAD 2024-T3	12	PAN	.032	CLAD 7075-T6
4	PAN	.020	CLAD 6061-T6	13	INNER SKIN	.016	CLAD 7075-T6
5	SKIN	.020	CLAD 6061-T6	*14	TRIM STRIP		CLAD 7075-T6
6	HINGE		5913038	*15	SEAL		2919037-12
7	PAN	.032	CLAD 7075-T6	16	HONEYCOMB CORE		SEE NOTE 1
8	OUTER SKIN	.020	CLAD 7075-T6	17	BONDED DOUBLER	.064	CLAD 7075-T6
9	BONDED DOUBLER	.032	CLAD 7075-T6	18	BONDED DOUBLER	.020	CLAD 7075-T6

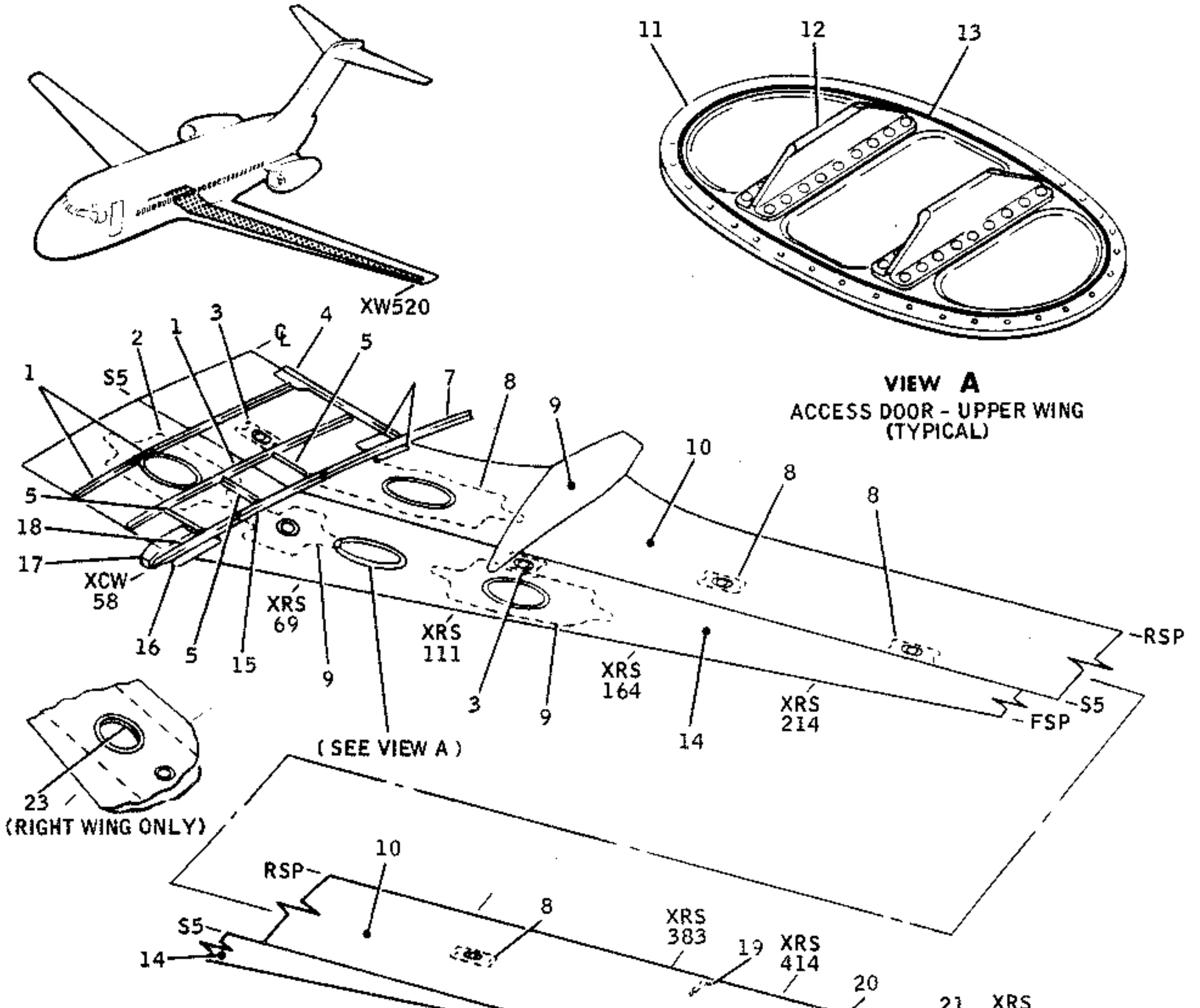
BB3-227B

Wing Outboard Trailing Edge Lower Door Plating
Figure 4

CENTER SECTION PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates wing center section plates/skins. Materials are identified in material lists by item number callouts. Tapered plating is identified by cross-section thicknesses as illustrated in tapered plating charts, Figure 3.



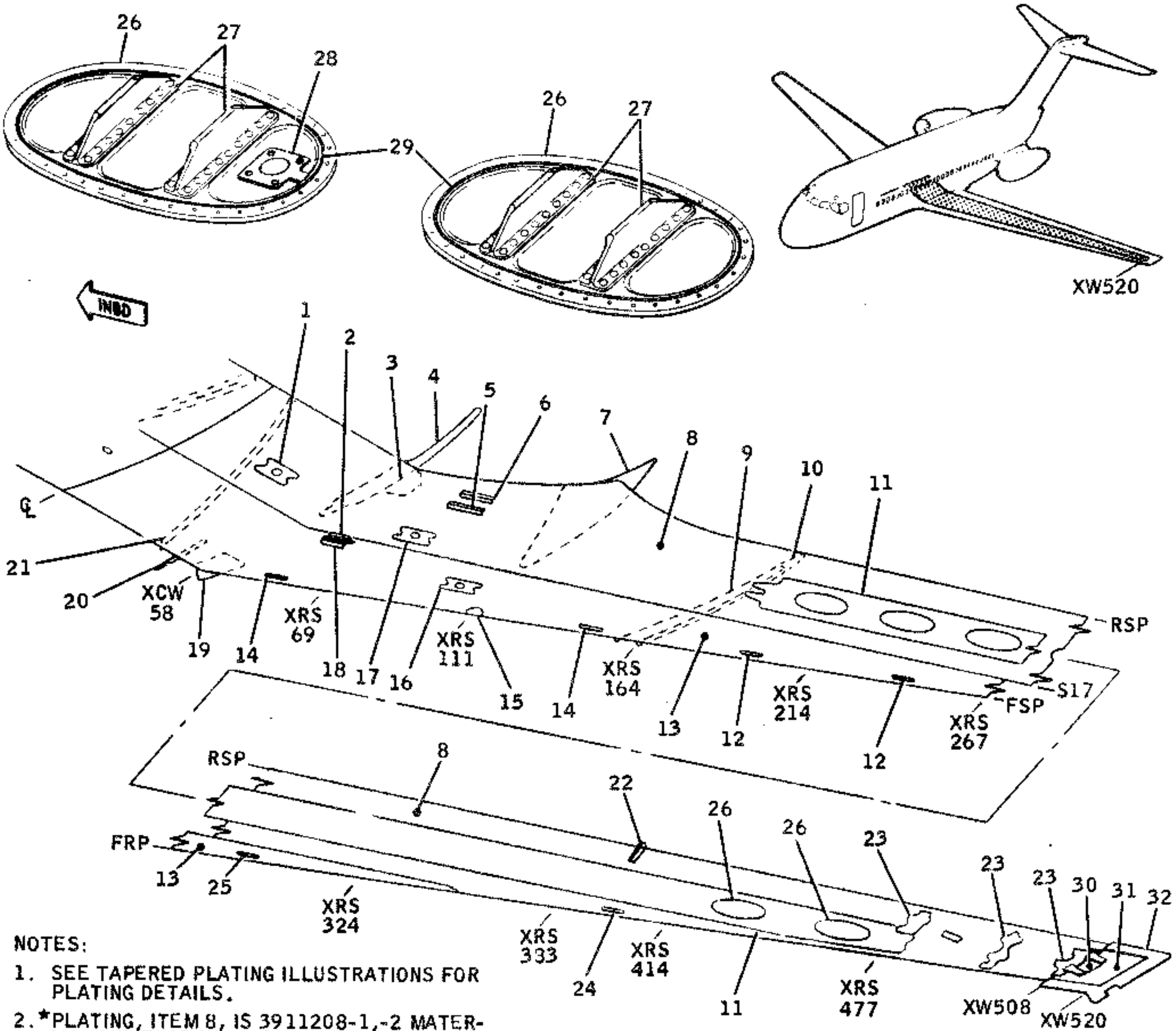
NOTES:

1. SEE TAPERED PLATING ILLUSTRATIONS FOR PLATING DETAILS.
2. *PLATING, ITEM 10, WAS 3911210-1, -2 AND PLATING, ITEM 14, WAS 3911211-1, -2 AND IS ACCEPTABLE AS ALTERNATE MATERIAL ON SOME AIRPLANES.
3. REFERENCE - DOUGLAS DRAWING 5910005 AND 5920872.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP		2913627
2	DOUBLER	.250	PLATE 7075-T651
3	DOUBLER	.625	PLATE 7075-T651
4	CAP	.125	CLAD 2024-T3
5	CAP	.080	CLAD 7075-T6
6	SPLICE	.190	CLAD 7075-T6
7	TEE		3912878-503
8	DOUBLER	.375	PLATE 7075-T651
9	DOUBLER	.312	PLATE 7075-T651
*10	PLATING		3917764-1,-2
11	DOOR	.250	CLAD 7075-T6
12	TEE		1286227
13	SEAL		SILICONE RUBBER
*14	PLATING		3917763-1,-2
15	TEE		3912878-501
16	FITTING	.312	PLATE 7075-T651
17	FITTING	2.500	PLATE 7075-T651
18	TEE		3912878-1
19	CLIP	1.500	PLATE 7075-T651
20	DOUBLER	1.250	PLATE 7075-T651
21	DOUBLER	.080	CLAD 2024-T3
22	COVER	.090	CLAD 7075-T6
23	SUPPORT	.071	SHEET 6061-T6
24	SHIM	.025	CLAD 2024-T3
25	PLATING	.080	CLAD 7075-T6
26	DOUBLER	.080	CLAD 7075-T6

BB3-275B

Wing Center Section Upper Panel Plating
Figure 1



NOTES:

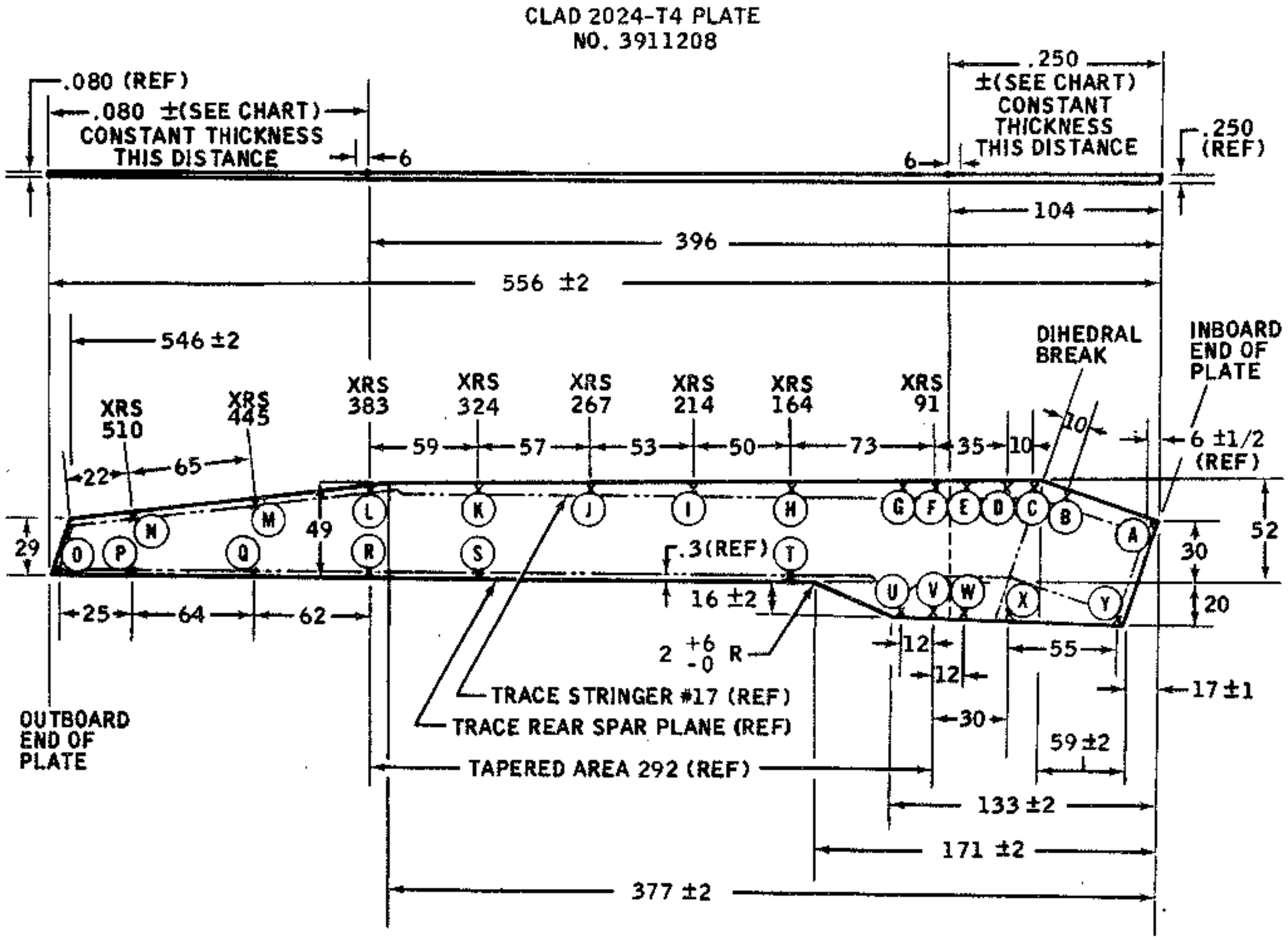
1. SEE TAPERED PLATING ILLUSTRATIONS FOR PLATING DETAILS.
2. *PLATING, ITEM 8, IS 3911208-1,-2 MATERIAL; AND PLATING, ITEM 13, IS 3911209-1, -2 MATERIAL ON EARLY AIRPLANES.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.160	CLAD 2024-T3
2	BRACKET	2.250	PLATE 2024-T351
3	PLATE	.375	PLATE 2024-T351
4	CAP	3.000	BAR 7075-T6
5	BRACKET		1453926
6	BRACKET	2.000	PLATE 2024-T351
7	DOUBLER	.500	PLATE 2024-T351
*8	PLATING		3917180-1, -2
9	CHANNEL	.063	CLAD 7075-T6
10	FAIRING	.100	CLAD 7075-T6
11	DOUBLER		4911352
12	SPACER	.125	CLAD 2024-T3
*13	PLATING		3917181-1, -2
14	SPACER	.160	CLAD 2024-T3
15	PLATE	.500	STEEL BAR 4130
16	DOUBLER	.190	CLAD 2024-T3
17	DOUBLER	.250	PLATE 2024-T351
18	BRACKET	1.625	PLATE 2024-T351
19	PLATE	.312	PLATE 2024-T351
20	ANGLE	.125	CLAD 7075-T6
21	ANGLE	.090	CLAD 2024-T6
22	CLIP	1.500	PLATE 7075-T6
23	DOUBLER	.080	CLAD 2024-T3
24	SPACER	.090	CLAD 2024-T3
25	SPACER	.190	CLAD 2024-T3
26	DOOR	.190	CLAD 2024-T3
27	TEE		1245828
28	SHIM	.190	CLAD 2024-T351
29	SEAL		SILICONE RUBBER
30	DOOR	.080	CLAD 7075-T6
31	PLATING	.160	CLAD 7075-T6
32	DOUBLER	.080	CLAD 7075-T6

REFERENCE - DOUGLAS DRAWING 5910006 AND 5920872.

BB3-276B

Wing Center Section Lower Panel Plating
Figure 2



MATERIAL THICKNESS CHART

LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.237	.264	Ⓝ	.071	.092
Ⓑ	.237	.264	Ⓞ	.071	.092
Ⓒ	.237	.264	Ⓟ	.071	.092
Ⓓ	.237	.264	Ⓠ	.071	.092
Ⓔ	.237	.264	Ⓡ	.076	.092
Ⓕ	.237	.264	Ⓢ	.108	.126
Ⓖ	.231	.257	Ⓣ	.198	.220
Ⓗ	.198	.220	Ⓤ	.231	.257
Ⓘ	.169	.190	Ⓥ	.237	.264
Ⓙ	.141	.160	Ⓦ	.237	.264
Ⓚ	.108	.126	Ⓧ	.237	.264
Ⓛ	.076	.092	Ⓨ	.237	.264
Ⓜ	.071	.092			

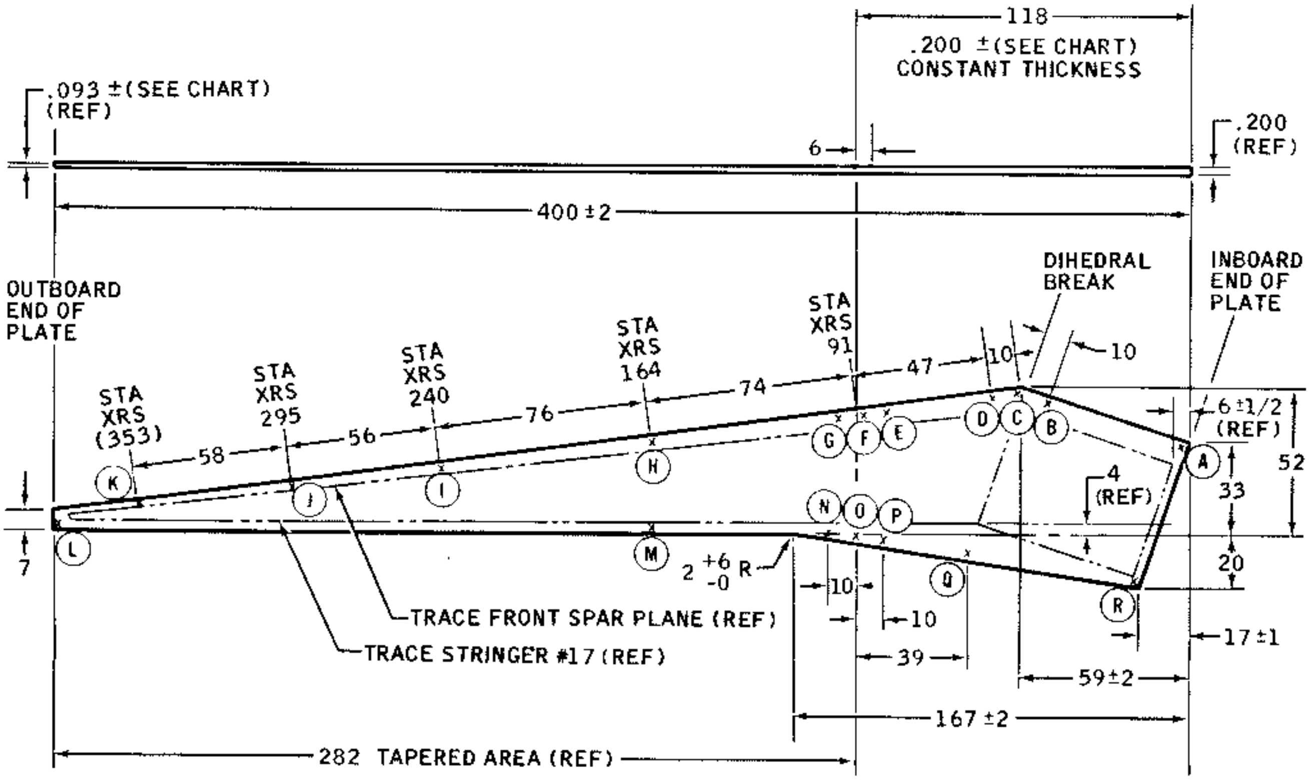
NOTE: ±3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE

BB3-288A

Printed in U.S.A.

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 1)

CLAD 2024-T4 PLATE
NO. 3911209



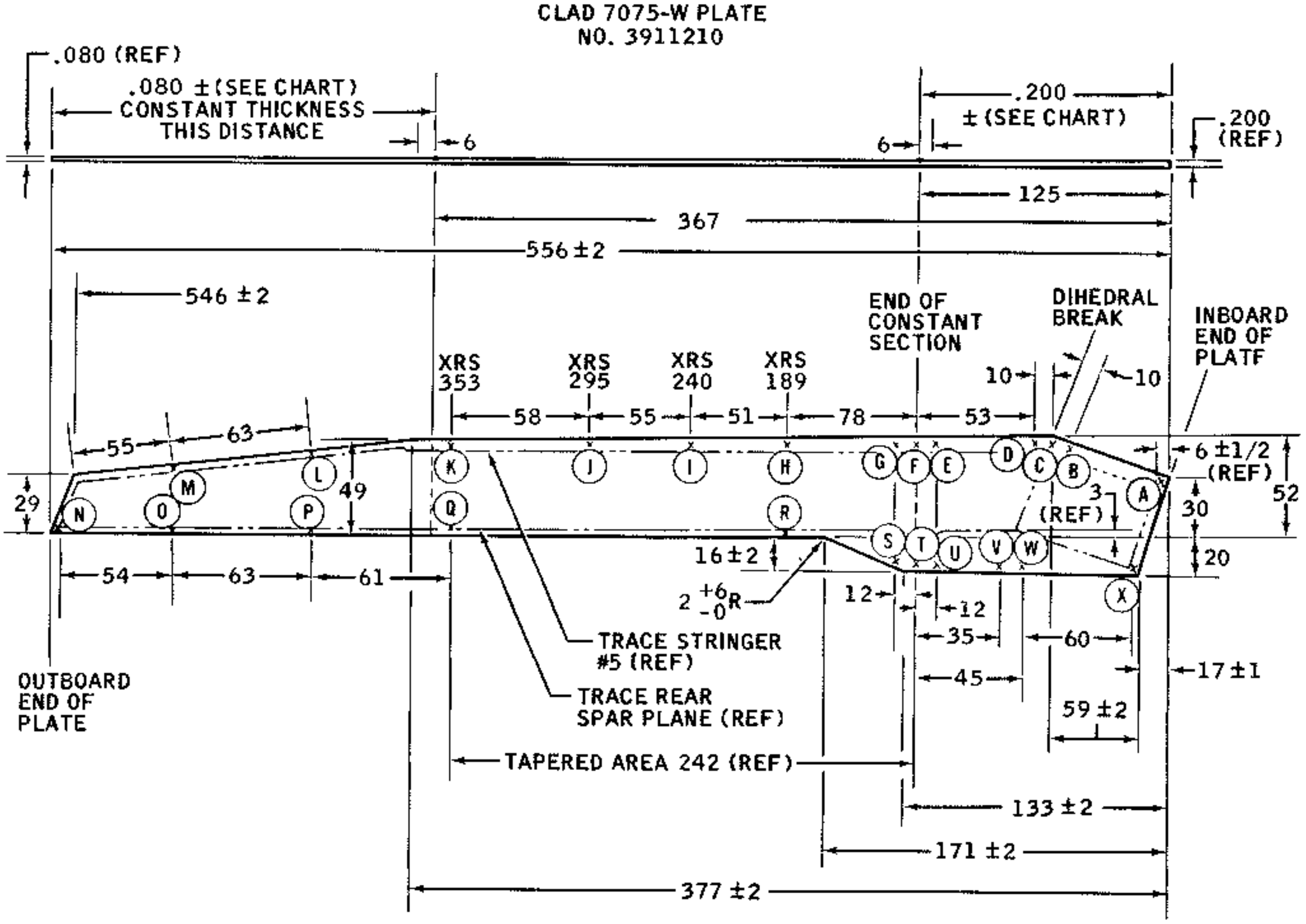
MATERIAL THICKNESS CHART

LOCATION	MIN	MAX
Ⓐ	.190	.212
Ⓑ	.190	.212
Ⓒ	.190	.212
Ⓓ	.190	.212
Ⓔ	.190	.212
Ⓕ	.190	.212
Ⓖ	.186	.208
Ⓗ	.163	.184
Ⓘ	.136	.155
Ⓙ	.116	.134
Ⓚ	.095	.112
Ⓛ	.088	.105
Ⓜ	.163	.184
Ⓝ	.186	.208
Ⓞ	.190	.212
Ⓟ	.190	.212
Ⓠ	.190	.212
Ⓡ	.190	.212

NOTE:
± 3 DEVIATIONS FROM INDICATED
LOCATIONS PERMISSIBLE

BB3-287

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 2)



MATERIAL THICKNESS CHART

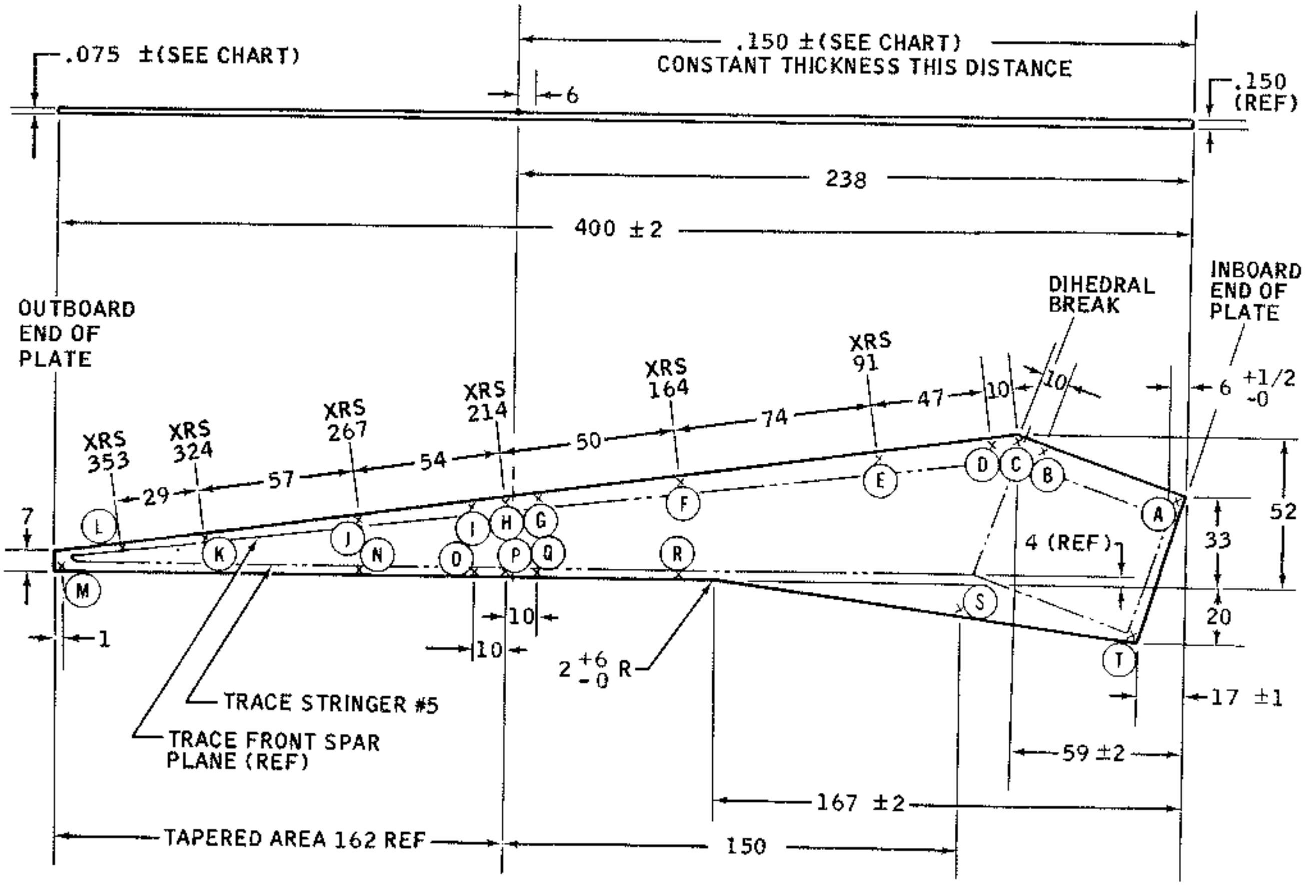
LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.190	.212	Ⓜ	.071	.092
Ⓑ	.190	.212	Ⓝ	.071	.092
Ⓒ	.190	.212	Ⓞ	.071	.092
Ⓓ	.190	.212	Ⓟ	.071	.092
Ⓔ	.190	.212	Ⓠ	.076	.092
Ⓕ	.190	.212	Ⓡ	.154	.174
Ⓖ	.184	.206	Ⓢ	.184	.206
Ⓗ	.154	.174	Ⓣ	.190	.212
Ⓘ	.129	.148	Ⓤ	.190	.212
Ⓙ	.104	.121	Ⓥ	.190	.212
Ⓚ	.076	.092	Ⓦ	.190	.212
Ⓛ	.071	.092	Ⓧ	.190	.212

NOTE: ±3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE

BB3-286

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 3)

CLAD 7075-W PLATE
NO. 3911211



MATERIAL THICKNESS CHART

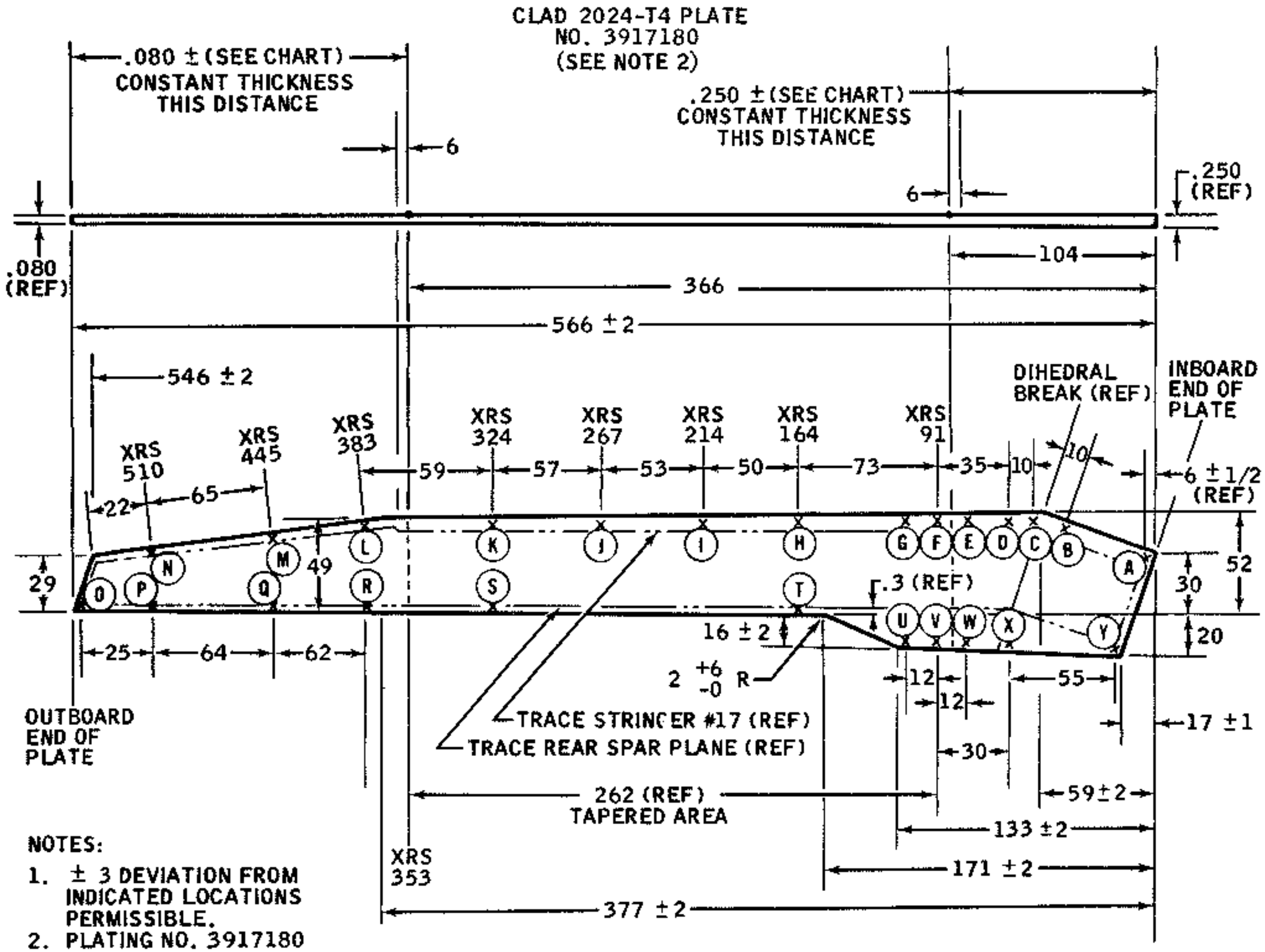
LOCATION	• MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.142	.162	Ⓚ	.094	.111
Ⓑ	.142	.162	Ⓛ	.082	.098
Ⓒ	.142	.162	Ⓜ	.072	.088
Ⓓ	.142	.162	Ⓝ	.119	.137
Ⓔ	.142	.162	Ⓞ	.138	.157
Ⓕ	.142	.162	Ⓟ	.142	.162
Ⓖ	.142	.162	Ⓠ	.142	.162
Ⓗ	.142	.162	Ⓡ	.142	.162
Ⓘ	.138	.157	Ⓢ	.142	.162
Ⓙ	.119	.137	Ⓣ	.142	.162

NOTE: ±3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE

BB3-285

Printed in U.S.A.

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 4)



NOTES:

1. ± 3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE.
2. PLATING NO. 3917180 MAY BE USED IN PLACE OF PLATING NO. 3911208.

MATERIAL THICKNESS CHART

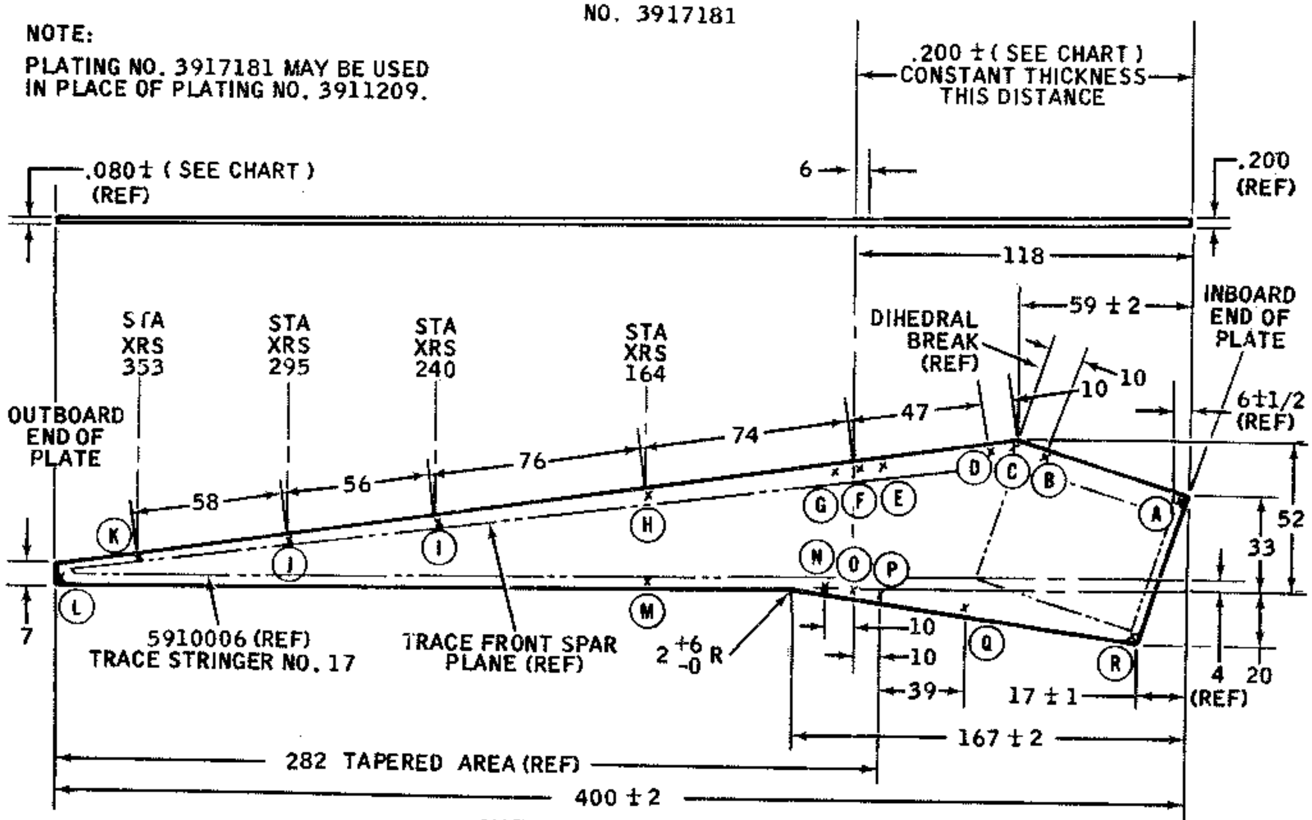
LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.237	.264	Ⓝ	.076	.092
Ⓑ	.237	.264	Ⓞ	.076	.092
Ⓒ	.237	.264	Ⓟ	.076	.092
Ⓓ	.237	.264	Ⓠ	.076	.092
Ⓔ	.237	.264	Ⓡ	.076	.092
Ⓕ	.237	.264	Ⓢ	.094	.111
Ⓖ	.230	.256	Ⓣ	.193	.216
Ⓗ	.193	.216	Ⓤ	.230	.256
Ⓘ	.161	.183	Ⓥ	.237	.264
Ⓙ	.129	.149	Ⓦ	.237	.264
Ⓚ	.094	.111	Ⓧ	.237	.264
Ⓛ	.076	.092	Ⓨ	.237	.264
Ⓜ	.076	.092			

BB3-628

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 5)

CLAD 2024-T4 PLATE
NO. 3917181

NOTE:
PLATING NO. 3917181 MAY BE USED IN PLACE OF PLATING NO. 3911209.

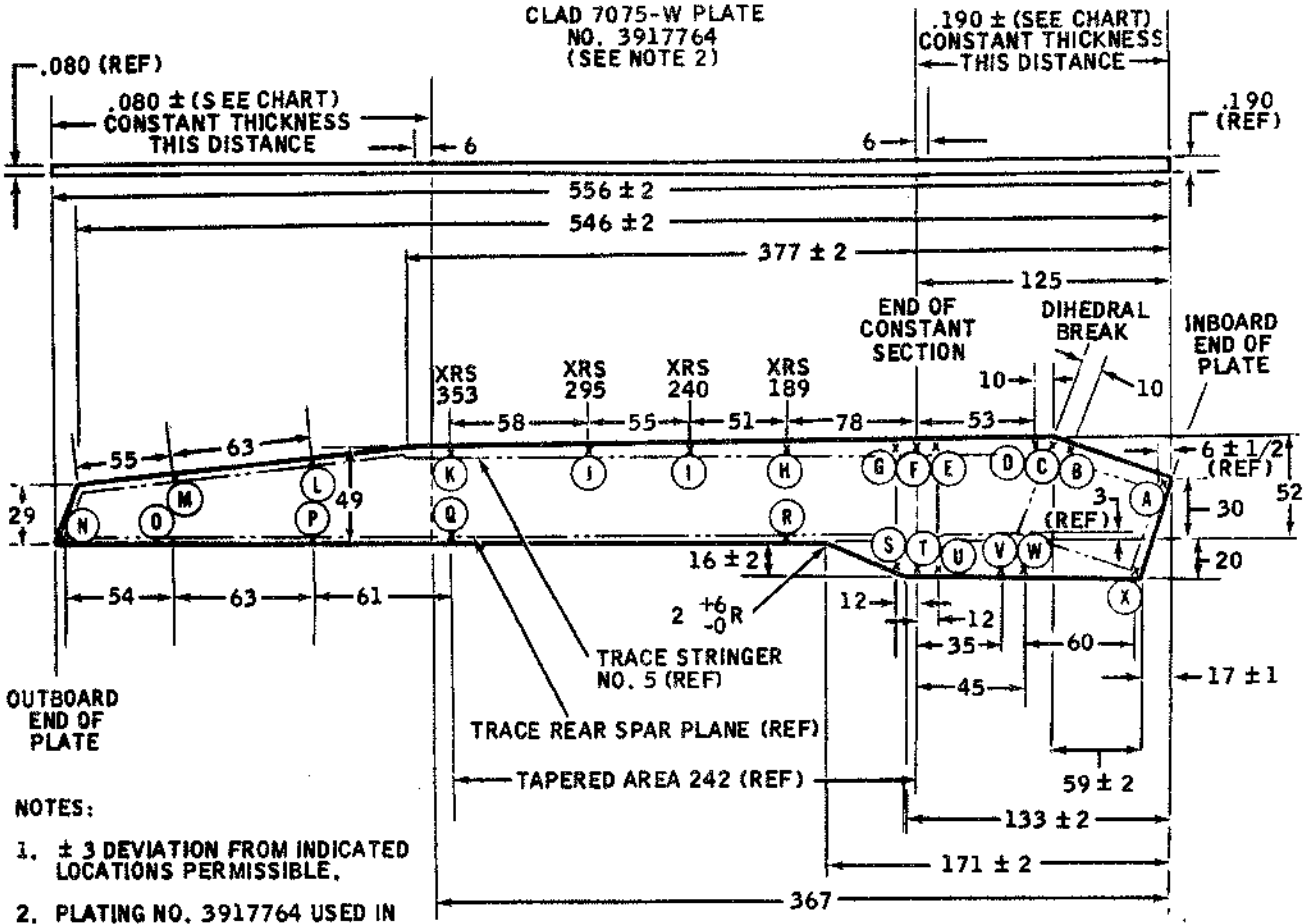


MATERIAL THICKNESS CHART

LOCATION	MIN	MAX
Ⓐ	.190	.212
Ⓑ	.190	.212
Ⓒ	.190	.212
Ⓓ	.190	.212
Ⓔ	.190	.212
Ⓕ	.190	.212
Ⓖ	.186	.208
Ⓗ	.160	.180
Ⓘ	.129	.148
Ⓙ	.106	.124
Ⓚ	.083	.099
Ⓛ	.076	.092
Ⓜ	.160	.180
Ⓝ	.186	.208
Ⓞ	.190	.212
Ⓟ	.190	.212
Ⓠ	.190	.212
Ⓡ	.190	.212

BB3-629

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 6)



NOTES:

1. ± 3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE.
2. PLATING NO. 3917764 USED IN PLACE OF PLATING NO. 3911210 ON AIRPLANES 39 AND SUBSEQUENT.

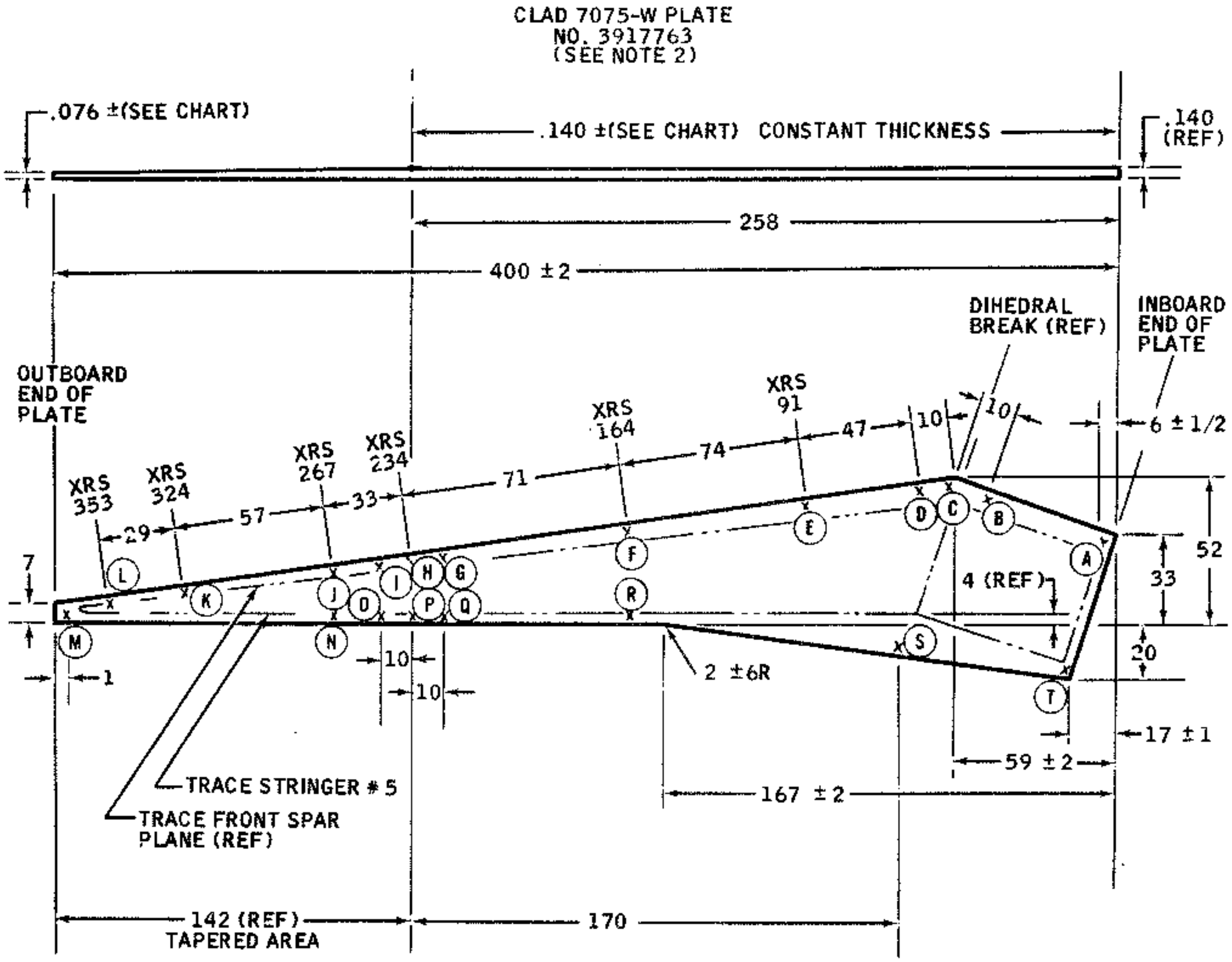
MATERIAL THICKNESS CHART

LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.181	.202	Ⓜ	.068	.092
Ⓑ	.181	.202	Ⓝ	.068	.092
Ⓒ	.181	.202	Ⓞ	.068	.092
Ⓓ	.181	.202	Ⓟ	.068	.092
Ⓔ	.181	.202	Ⓠ	.072	.092
Ⓕ	.181	.202	Ⓡ	.146	.166
Ⓖ	.175	.196	Ⓢ	.181	.202
Ⓗ	.146	.166	Ⓣ	.181	.202
Ⓘ	.124	.143	Ⓤ	.181	.202
Ⓙ	.101	.118	Ⓥ	.181	.202
Ⓚ	.072	.092	Ⓦ	.181	.202
Ⓛ	.068	.092	Ⓧ	.181	.202

Printed in U.S.A.

BB3-630A

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 7)



MATERIAL THICKNESS CHART

LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.133	.152	Ⓚ	.094	.111
Ⓑ	.133	.152	Ⓛ	.074	.098
Ⓒ	.133	.152	Ⓜ	.068	.088
Ⓓ	.133	.152	Ⓝ	.119	.137
Ⓔ	.133	.152	Ⓞ	.128	.147
Ⓕ	.133	.152	Ⓟ	.133	.152
Ⓖ	.133	.152	Ⓠ	.133	.152
Ⓗ	.133	.152	Ⓡ	.133	.152
Ⓘ	.128	.147	Ⓢ	.133	.152
Ⓙ	.119	.137	Ⓣ	.133	.152

NOTES:

1. ± 3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE.
2. PLATING NO. 3917763 USED IN PLACE OF PLATING NO. 3911211 ON AIRPLANES 39 AND SUBSEQUENT.

BB3-631A

Printed in U.S.A.

Wing Center Section Tapered Plating Charts
Figure 3 (Sheet 8)

WING VORTEX GENERATORS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. Four vortex generators are installed on the wing inboard trailing edge (see Figure 1) and three vortex generators are installed on the wing center panel main landing gear support doubler (see Figure 1). Vortex generators are also installed on the flaps (see 57-50-6).

B. Three of the vortex generators on the trailing edge are bonded and riveted to the trailing edge plating. One of the vortex generators on the trailing edge and the three vortex generators on the wing center panel landing gear support doubler are riveted to straps.

2. Repair Wing Trailing Edge Vortex Generator Installation

A. Repair Vortex Generators on Straps (See Figure 1.)

(1) Remove strap securing bolts.

(2) Insert nonmetallic device under end of strap and work end of strap loose from plating.

NOTE: Chilling strap with dry ice will ease removal.

(3) Peel strap from plating.

NOTE: If strap is damaged, fabricate new strap and duplicate attach holes, dimples, and countersinks. Replace vortex generators per steps (6) through (12).

(4) Remove old bonding material from plating and strap with nonmetallic scraper.

(5) Drill out vortex generator attaching rivets.

(6) Position and orient vortex generators on strap (see Figure 1).

(7) Attach vortex generators, using MS20426AD4 rivets. Maintain generator positioning and orientation.

(8) Clean bonding areas on strap and trailing edge plating with cloth dampened with methyl ethyl ketone (TT-M-261).

(9) Thoroughly dry both bonding areas.

(10) Apply thin coat (0.005 to 0.010) of Lefkoweld 109 or Epocast H-1337-B-1 adhesive to faying surfaces of strap and plating. Mix adhesive per 51-70-2.

(11) Install strap and strap securing attachments.

(12) Allow assembly to cure for 45 minutes at 88°C (190°F), or for 24 hours at 21°C (70°F).

B. Repair Vortex Generators in Area Without Straps

(1) Drill out vortex generator attaching rivets.

(2) Insert nonmetallic device under generator and strike a moderately hard blow to remove generator.

NOTE: Chilling the generator with dry ice will ease removal.

(3) Remove old bonding agent from trailing edge plating with nonmetallic scraper.

(4) Clean trailing edge plating and vortex generator with cloth dampened with methyl ethyl ketone (TT-M-261).

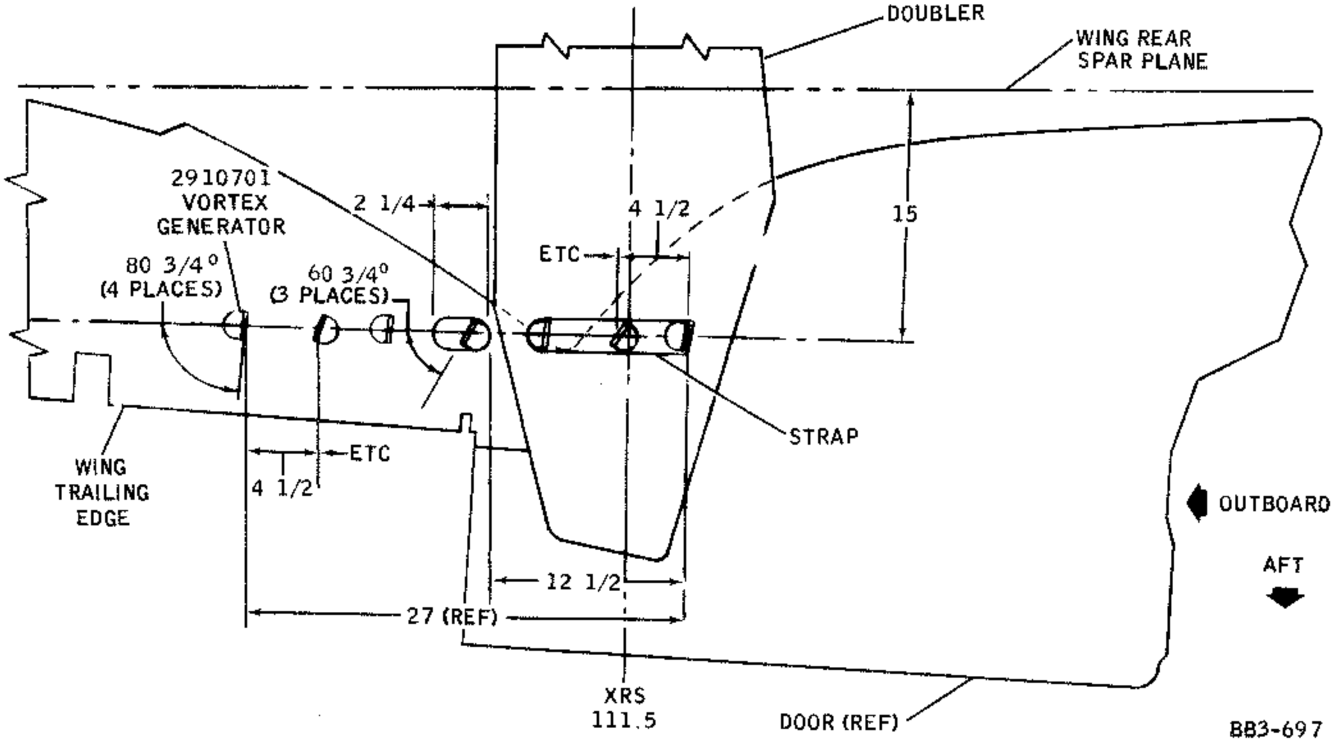
(5) Position and orient generators on trailing edge plating (see Figure 1). Mark locations.

(6) Thoroughly dry both bonding areas and maintain dry condition.

(7) Apply thin coat (0.005 to 0.010) of Lefkoweld 109 or Epocast H-1337-B-1 adhesive to faying surfaces of vortex generators and trailing edge plating. Mix adhesive per 51-70-2.

(8) Join faying surfaces and attach vortex generators, using MS20426AD4 rivets. Maintain generator positioning and orientation.

(9) Allow assembly to cure for 45 minutes at 88°C (190°F), or for 24 hours at 21°C (70°F).



Wing Trailing Edge Vortex Generator Installation
Figure 1

PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates components of wing exterior covering. Types and gages of material used in construction of assemblies are identified within illustrations.

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

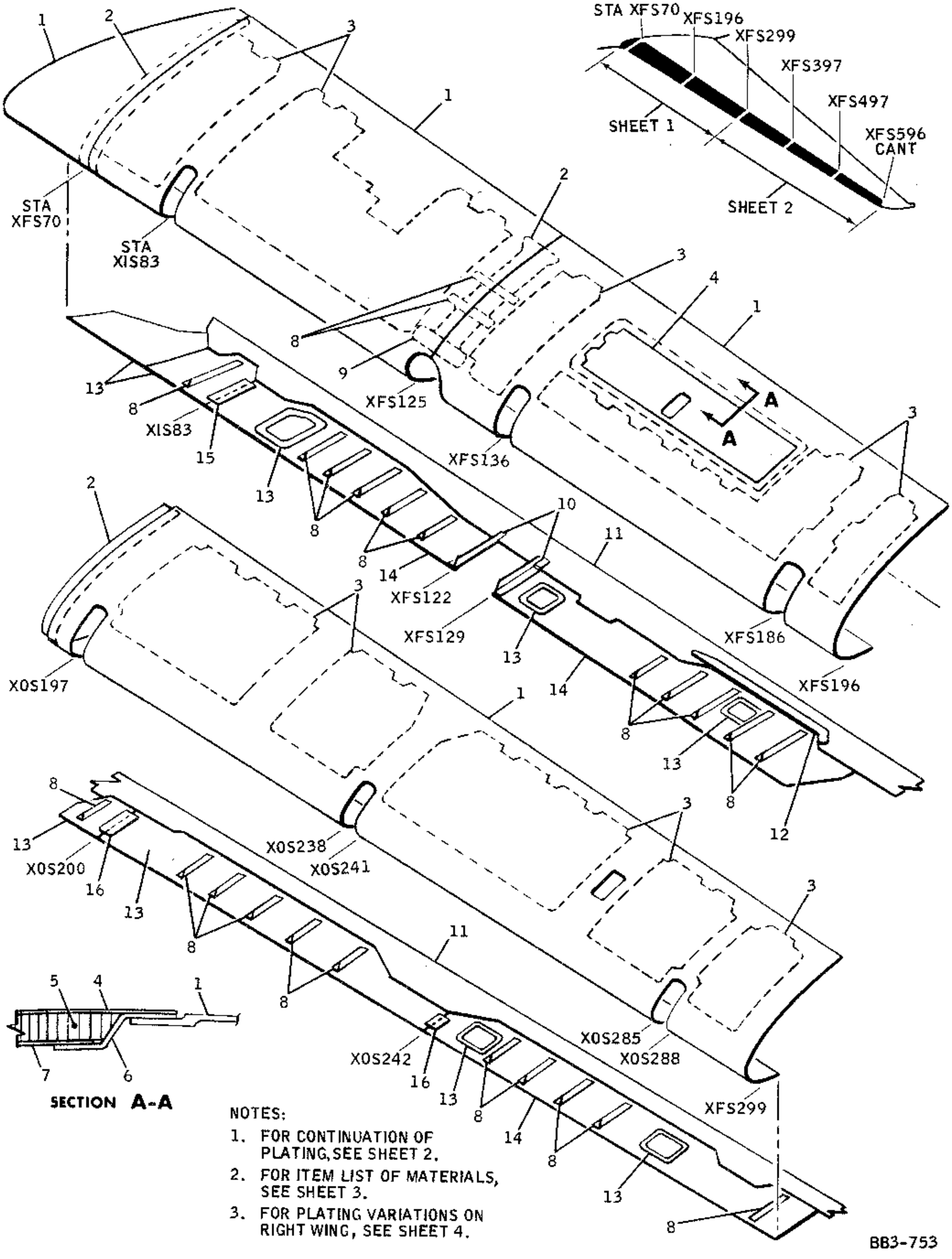
Structural Component	Approved Repairs
Center Section	
All	57-01, Figure 1, Sheet 3
Leading Edge	57-01, Figure 1, Sheet 3 57-70-2, Figure 10 (Dent Filler)
Wing Tip	57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheet 2 57-01, Figure 5, Sheet 2 51-70-2, Figure 10 (Dent Filler) 57-03, Figures 1 and 2
Trailing Edge	57-01, Figure 1 57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheets 1 and 2 57-01, Figure 3, Sheets 1 and 2 57-01, Figure 4, Sheets 1 and 2 57-01, Figure 5, Sheets 1 and 2 57-04, as applicable

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

LEADING EDGE PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates wing leading edge plates/skins. Materials are identified in material lists by item number callouts.

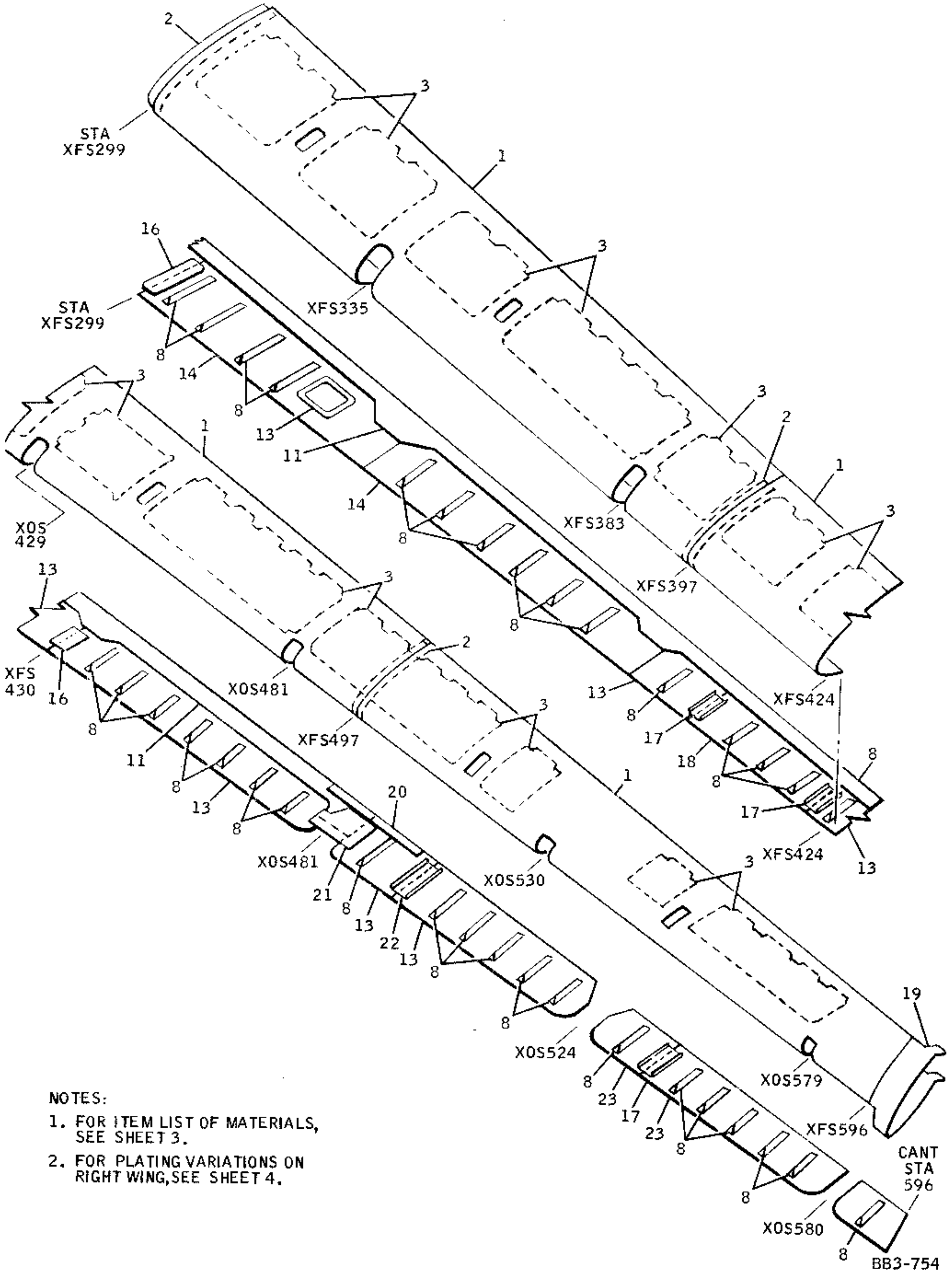


NOTES:

1. FOR CONTINUATION OF PLATING, SEE SHEET 2.
2. FOR ITEM LIST OF MATERIALS, SEE SHEET 3.
3. FOR PLATING VARIATIONS ON RIGHT WING, SEE SHEET 4.

Wing Leading Edge Plating -- Type A
Figure 1 (Sheet 1)

Printed in U.S.A.



NOTES:

1. FOR ITEM LIST OF MATERIALS, SEE SHEET 3.
2. FOR PLATING VARIATIONS ON RIGHT WING, SEE SHEET 4.

Wing Leading Edge Plating -- Type A
Figure 1 (Sheet 2)

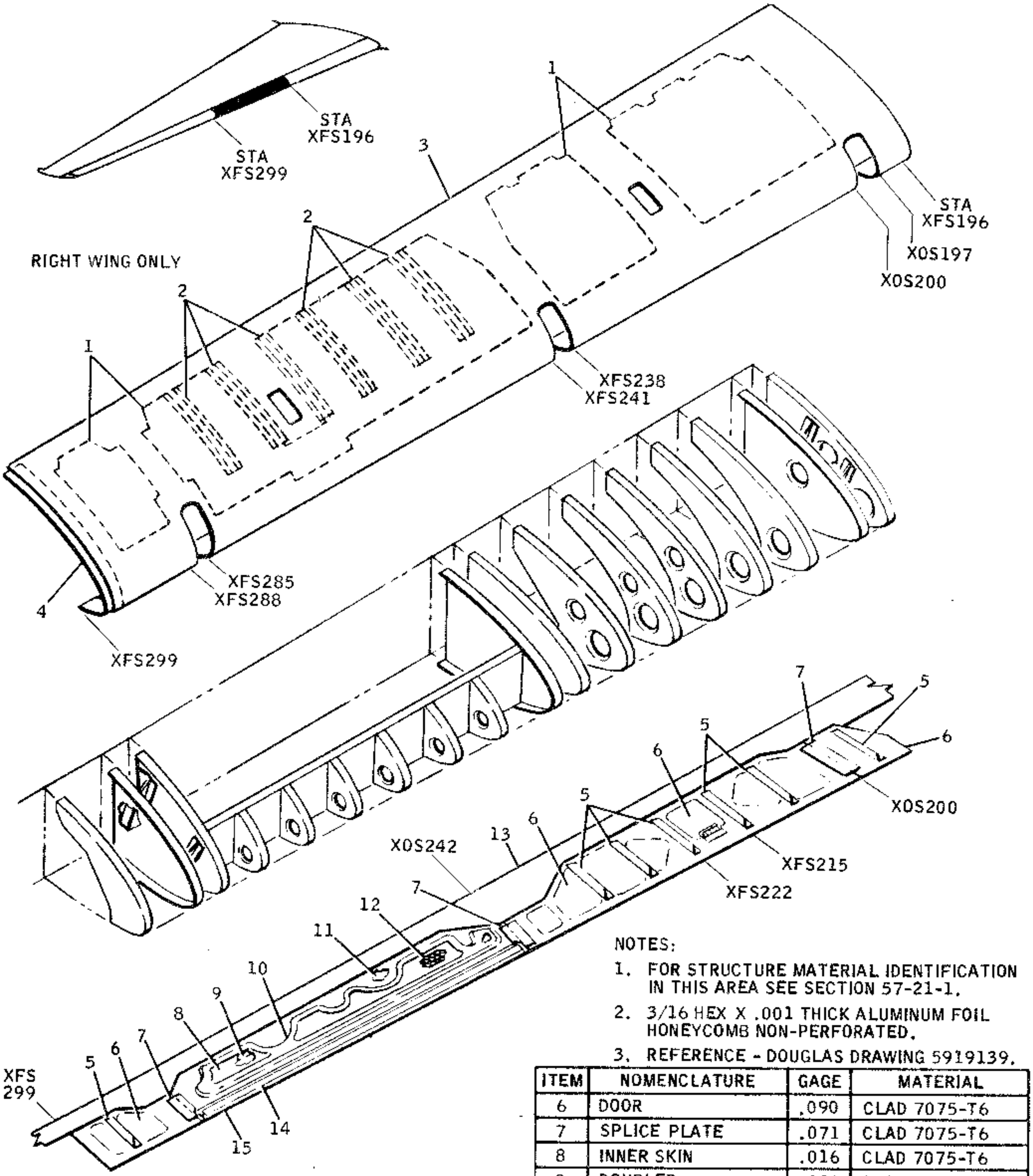
ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.190	CLAD 7075-T6	13	DOOR	.090	CLAD 7075-T6
2	SPLICE PLATE	.063	CLAD 7075-T6	14	DOOR	.190	CLAD 7075-T6
3	BEADED DOUBLER	.020	CLAD 7075-T6	15	SPLICE PLATE	.100	CLAD 7075-T6
4	SKIN	.063	CLAD 7075-T6	16	SPLICE PLATE	.071	CLAD 7075-T6
5	CORE	.500	SEE NOTE 1	17	CHANNEL	.071	CLAD 7075-T6
6	PAN	.032	CLAD 7075-T6	18	SKIN	.090	CLAD 7075-T6
7	INNER SKIN	.020	CLAD 7075-T6	19	SUPPORT	.160	SHEET 6061-T6X
8	STIFFENER		1418887	20	DOUBLER	.190	CLAD 7075-T6
9	TEE		1093791	21	SPLICE PLATE	.190	CLAD 7075-T6
10	STIFFENER	.090	CLAD 7075-T6	22	SUPPORT	.063	CLAD 7015-T6
11	DOUBLER	.250	AL PLATE 2024-T351	23	DOOR	.125	CLAD 7075-T6
12	STRAP	.190	CLAD 2024-T6				

NOTES:

1. MADE FROM 3/16 HEX X .001 THICK ALUMINUM FOIL HONEYCOMB NON-PERFORATED.
2. REFERENCE-DOUGLAS DRAWING 5910437

BB3-854

Wing Leading Edge Plating -- Type A
Figure 1 (Sheet 3)



NOTES:

1. FOR STRUCTURE MATERIAL IDENTIFICATION IN THIS AREA SEE SECTION 57-21-1.
2. 3/16 HEX X .001 THICK ALUMINUM FOIL HONEYCOMB NON-PERFORATED.
3. REFERENCE - DOUGLAS DRAWING 5919139.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.190	CLAD 7075-T6
2	STIFFENER	.071	CLAD 7075-T6
3	SKIN	.190	CLAD 7075-T6
4	SPLICE PLATE	.063	CLAD 7075-T6
5	STIFFENER		1418887

ITEM	NOMENCLATURE	GAGE	MATERIAL
6	DOOR	.090	CLAD 7075-T6
7	SPLICE PLATE	.071	CLAD 7075-T6
8	INNER SKIN	.016	CLAD 7075-T6
9	DOUBLER	.020	CLAD 7075-T6
10	PAN	.030	CLAD 7075-T6
11	OUTER SKIN	.016	CLAD 7075-T6
12	CORE	.375T	SEE NOTE 2
13	DOUBLER	.250	AL PLATE 2024-T351
14	HINGE		2546397
15	HINGE		2546396

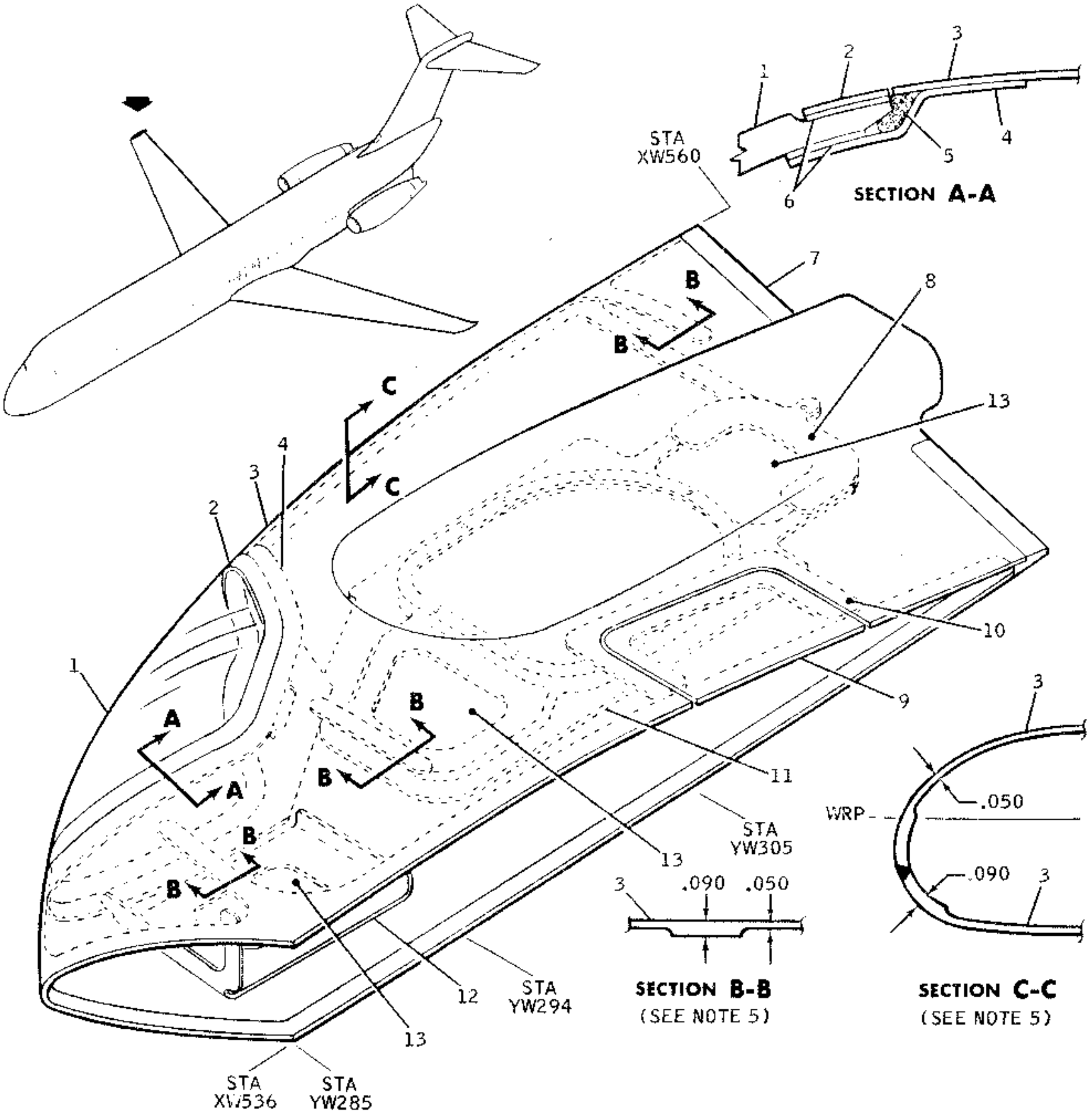
BB3-855

Wing Leading Edge Plating -- Type A
Figure 1 (Sheet 4)

WING TIP PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates wing tip plates/skins. Materials are identified in material lists by item number callouts.



Printed in U.S.A.

NOTES:

1. RIGHT WING TIP SHOWN, LEFT WING TIP OPPOSITE.
2. MADE FROM SHEET ACRYLIC 5425.
3. MADE FROM LASR-5361.
4. MADE FROM SHEET RUBBER AMS-3240N.
5. *PLATING CHEM-MILLED FROM .090 TO .050 THICKNESS BETWEEN LANDS.
6. REFERENCE - DOUGLAS DRAWING 5910472.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	LENS	.250	SEE NOTE 2
2	STRAP	.080	CLAD 2024-T42
3	SKIN	*.090	CLAD 6061-T6X
4	DOUBLER	.040	CLAD 2024-T42
5	SEAL		SEE NOTE 3
6	SEAL	.031	SEE NOTE 4
7	STRIP		2920914
8	DOUBLER	.040	CLAD 7075-T6
9	DOOR	*.090	2024-T3
10	DOUBLER	.050	CLAD 2024-T42
11	PAN	.050	CLAD 2024-T42
12	DOUBLER	.063	CLAD 2024-T42
13	DOOR	*.090	CLAD 7075-T6

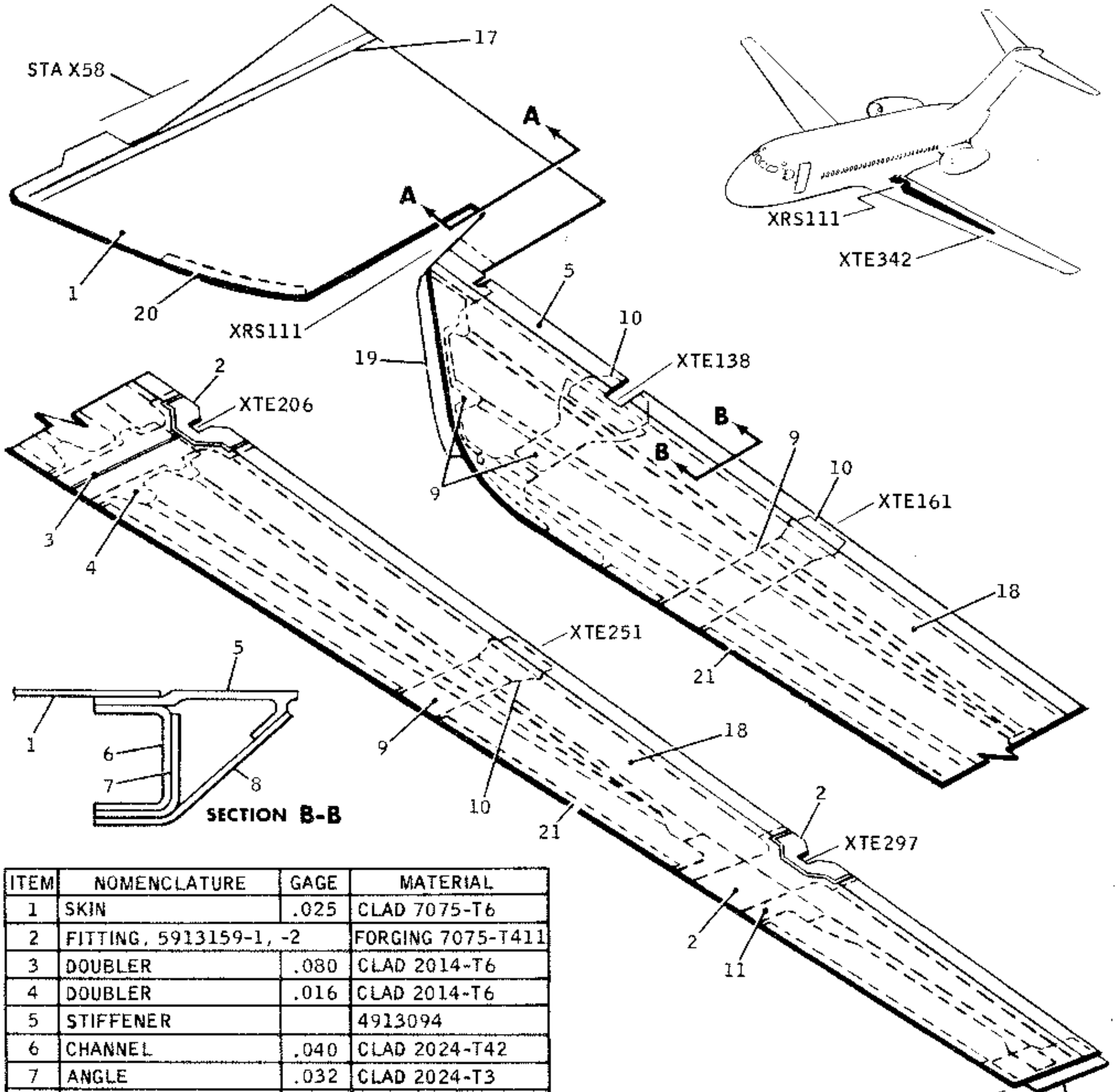
BB3-755

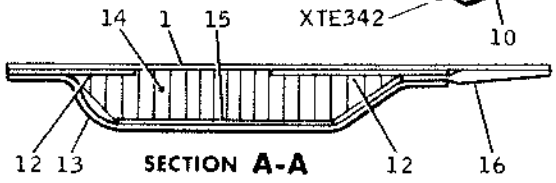
Wing Tip Plating -- Type A
Figure 1

TRAINING EDGE PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates wing trailing edge plates/skins, including honeycomb structures which comprise a portion of external covering. Materials are identified in material lists by item number callouts.





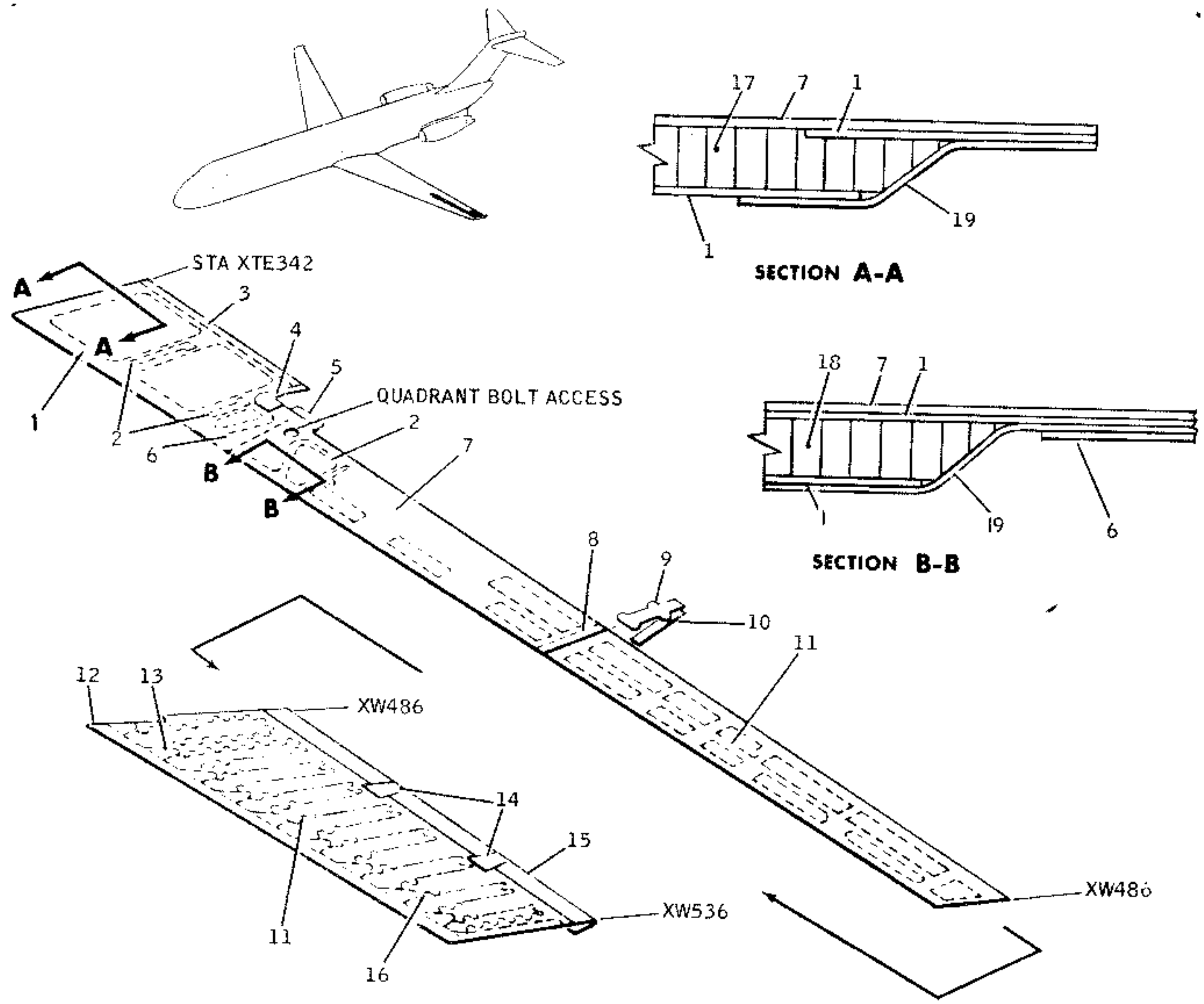
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.025	CLAD 7075-T6
2	FITTING, 5913159-1, -2		FORGING 7075-T411
3	DOUBLER	.080	CLAD 2014-T6
4	DOUBLER	.016	CLAD 2014-T6
5	STIFFENER		4913094
6	CHANNEL	.040	CLAD 2024-T42
7	ANGLE	.032	CLAD 2024-T3
8	WEB	.040	CLAD 2024-T42
9	DOUBLER	.050	CLAD 2014-T6
10	DOUBLER	.050	CLAD 2024-T3
11	DOUBLER	.063	CLAD 2014-T6
12	DOUBLER	.025	CLAD 7075-T6
13	PAN	.040	CLAD 2014-T6
14	CORE BONDED		SEE NOTE 1
15	INNER SKIN	.020	CLAD 7075-T6
16	EDGE		2914095
17	STRIP	.016	SEE NOTE 2
18	SKIN	.040	CLAD 2014-T6
19	DOUBLER	.090	CLAD 7075-T6
20	SHIM	SEE NOTE 3	
21	SHIM	.025	CLAD 2014-T6

NOTES:

1. ITEM 14, CORE, 1.000 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. CREW SHEET, MIL-S-5059, COND 1/4 H FINISH, NO. 28.
3. ITEM 20, SHIM, IS LAMINATED ALUMINUM, HALF SOLID, HALF LAMINATED (.003 INCH LAMINATIONS), AMS 4013.
4. REFERENCE - DOUGLAS DRAWINGS 5912156 AND 5912161.

BB3-222B

Wing Inboard Trailing Edge Upper Plating -- Type A
Figure 1



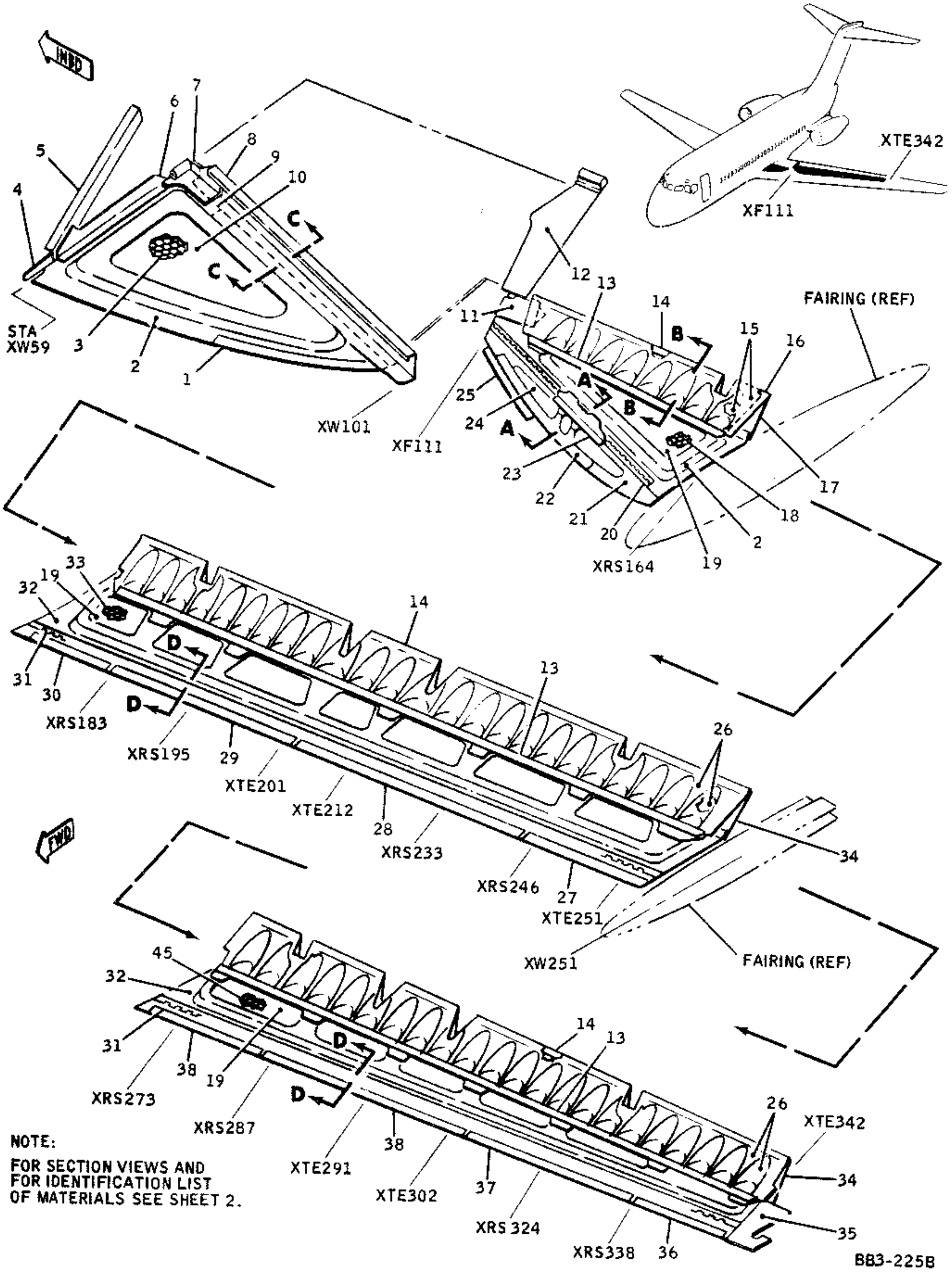
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.016	CLAD 7075-T6
2	SEAL	.012	CLAD 7075-T6
3	SHAPE		2914095
4	SEAL	.020	SEE NOTE 1
5	COVER	.012	SEE NOTE 1
6	DOUBLER	.063	CLAD 7075-T6
7	SKIN	.016	CLAD 7075-T6
8	SPACER		SEE NOTE 2
9	DOUBLER	.040	CLAD 2024-T3
10	SPLICE PLATE	.020	CRES SHEET
11	BONDED DOUBLER	.016	CLAD 7075-T6
12	FILLER	.032	CLAD 7075-T6
13	BONDED DOUBLER	.032	CLAD 7075-T6
14	DOUBLER	.020	CLAD 2024-T42
15	TIP		SEE NOTE 3
16	SKIN	.020	CLAD 7075-T6
17	CORE		SEE NOTE 4
18	CORE		SEE NOTE 5

NOTES:

1. MADE FROM CRES SHEET MIL-S-5059, 1/2 H, COMP 301 FINISH NO. 2B.
2. SPACER MADE FROM SHEET LAMINATE PHENOLIC NON-AFTER GLOW.
3. TIP NO. 3913181 IS MADE FROM NO. 124 AND 181 GLASS FIBER LAMINATE WITH FILLER OF GLASS FIBER ROVING DMS 159A CLASS 3.
4. CORE IS MADE FROM .687 x 3/16 HEX .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
5. CORE IS MADE FROM NON-EXPANDED 3.000 x 3/16 HEX x .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
6. REFERENCE - DOUGLAS DRAWING 5910515.

BB3-757

Wing Outboard Trailing Edge Upper Plating -- Type A
Figure 2

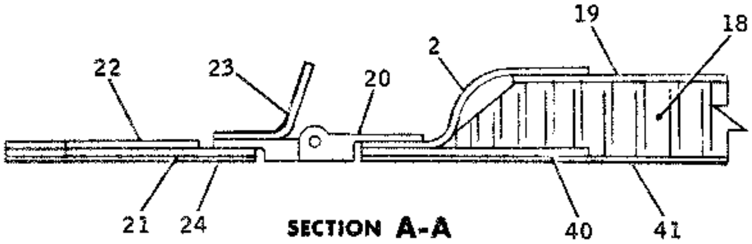


NOTE:
FOR SECTION VIEWS AND FOR IDENTIFICATION LIST OF MATERIALS SEE SHEET 2.

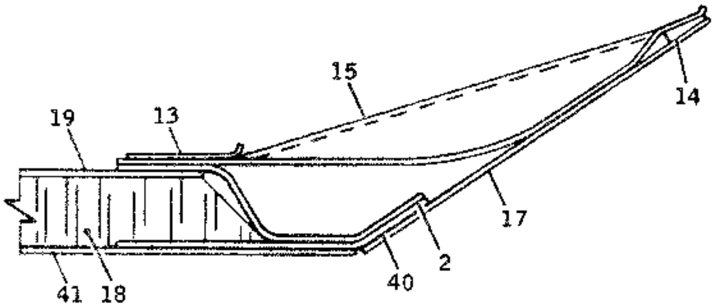
Wing Inboard Trailing Edge Lower Plating -- Type A
Figure 3 (Sheet 1)

NOTES:

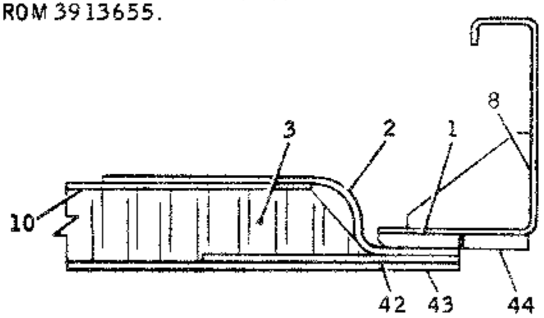
1. ITEM 3, CORE, MADE FROM .562 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 18, CORE, MADE FROM .687 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 33, CORE, MADE FROM .625 x 3/16 HEX x .001 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
   ITEM 45, CORE, MADE FROM .500 x 3/16 HEX x .001 THICH NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. SPACERS AND SHIMS MADE FROM SHEET LAMINATED GLASS CLOTH PHENOLIC.
3. SPACER, FILLER, AND RUB STRIP MADE FROM SHEET LAMINATED PHENOLIC SEMI-GLOSS, MIL-P-15035, TYPE FBE.
4. INBOARD AND OUTBOARD SEGMENTS OF HINGE HALVES MADE FROM .312 2024-T351 PLATE. CENTER SEGMENT AND AFT HINGE HALF MADE FROM 2913655 EXTRUSION.
5. FORWARD HINGE HALF MADE FROM 3913654. AFT HINGE MADE FROM 3913655.



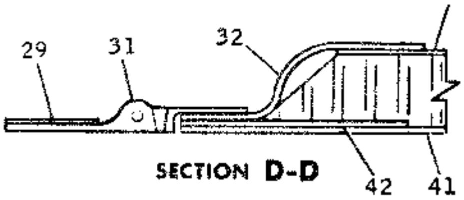
SECTION A-A



SECTION B-B



SECTION C-C



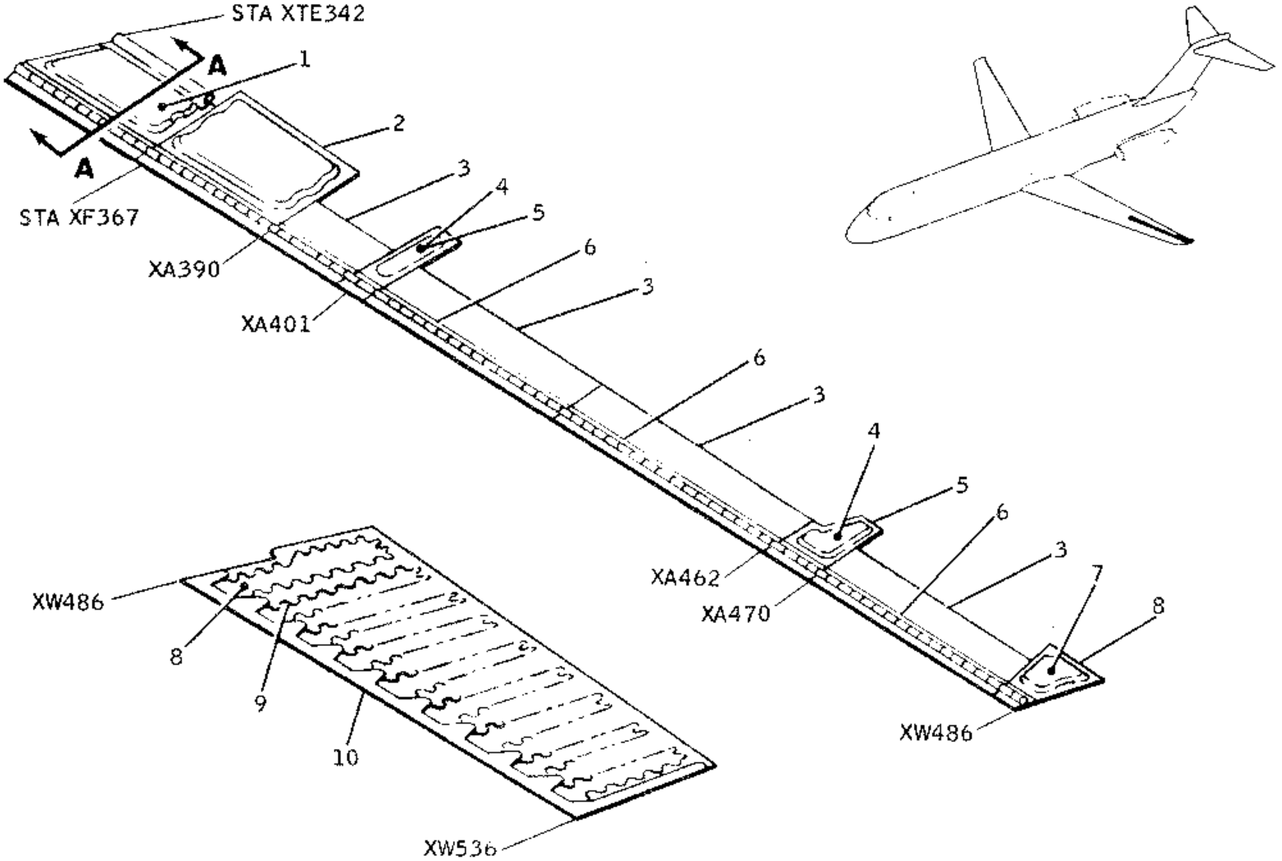
SECTION D-D

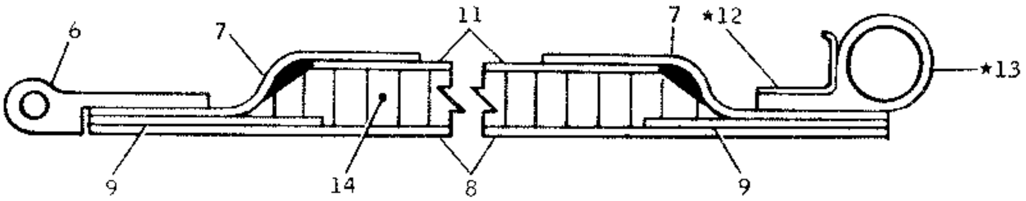
REFERENCE - DOUGLAS DRAWINGS 5910012, 5912144, 5912145, 5913438 AND 5913622.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FILLER	.156	SEE NOTE 3	23	ANGLE	.090	CLAD 7075-T6
2	PAN	.040	CLAD 7075-T6	24	SKIN	.063	CLAD 7075-T6
3	CORE		SEE NOTE 1	25	TIE PLATE	.125	CLAD 7075-T6
4	WEB	.040	CLAD 7075-T6	26	SKIN	.040	CLAD 2024-T42
5	ANGLE		1418203	27	SHIM	.083	SEE NOTE 2
6	ANGLE		1619970	28	SHIM	.101	SEE NOTE 2
7	FITTING, 3916379		AL BAR 7075-T651	29	SHIM	.119	SEE NOTE 2
8	JAMB	.063	CLAD 2024-T42	30	SHIM	.128	SEE NOTE 2
9	FILLER	.160	CLAD 2014-T6	31	HINGE, 5913665		SEE NOTE 5
10	INNER SKIN	.020	CLAD 7075-T6	32	PAN	.025	CLAD 7075-T6
11	BRACKET	.080	CLAD 7075-T6	33	CORE		SEE NOTE 1
12	AFT SKIN	.070	CLAD 7075-T6	34	SKIN	.032	CLAD 7075-T6
13	DOUBLER	.032	CLAD 2024-T3	35	PANEL	.190	CLAD 2024-T3
14	SPACER		1152325	36	SHIM	.012	CLAD 2024-T3
15	SKIN	.025	CLAD 2024-T42	37	SHIM	.040	SEE NOTE 2
16	DOUBLER	.032	CLAD 2024-T3	38	SHIM	.057	SEE NOTE 2
17	SKIN	.032	CLAD 2024-T3	39	SHIM	.065	SEE NOTE 2
18	CORE		SEE NOTE 1	40	DOUBLER	.040	CLAD 7075-T6
19	INNER SKIN	.016	CLAD 7075-T6	41	OUTER SKIN	.016	CLAD 7075-T6
20	HINGE, 5914469		SEE NOTE 4	42	DOUBLER	.032	CLAD 7075-T6
21	HINGE SPACER	.030	SEE NOTE 2	43	OUTER SKIN	.020	CLAD 7075-T6
22	PANEL SPACER	.137	SEE NOTE 2	44	RUB STRIP	.125	SEE NOTE 3
				45	CORE		SEE NOTE 1

BB3-221B

Wing Inboard Trailing Edge Lower Plating -- Type A
Figure 3 (Sheet 2)





SECTION A-A
(FOR DOORS 1 AND 2 ONLY, EXCEPT AS NOTED)

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOOR		SEE SECTION AA
2	DOOR		SEE SECTION AA
3	DOOR	.040	CLAD 2024-T3
4	PAN	.020	CLAD 6061-T6
5	SKIN	.020	CLAD 6061-T6
6	HINGE		5913038
7	PAN	.032	CLAD 7075-T6
8	OUTER SKIN	.020	CLAD 7075-T6
9	BONDED DOUBLER	.016	CLAD 7075-T6
10	BONDED DOUBLER	.032	CLAD 7075-T6
11	INNER SKIN	.016	CLAD 7075-T6
*12	TRIM STRIP	.032	CLAD 7075-T6
*13	SEAL		2919037-12
14	HONEYCOMB CORE		SEE NOTE 1

NOTES:

1. CORE IS MADE FROM .437 x 3/16 HEX .001 THICK ALUMINUM FOIL HONEYCOMB NON-PERFORATED.
2. *ITEMS 12 AND 13, TRIM STRIP AND SEAL, ON DOOR, ITEM 1, ONLY.
3. REFERENCE - DOUGLAS DRAWING 5910515.

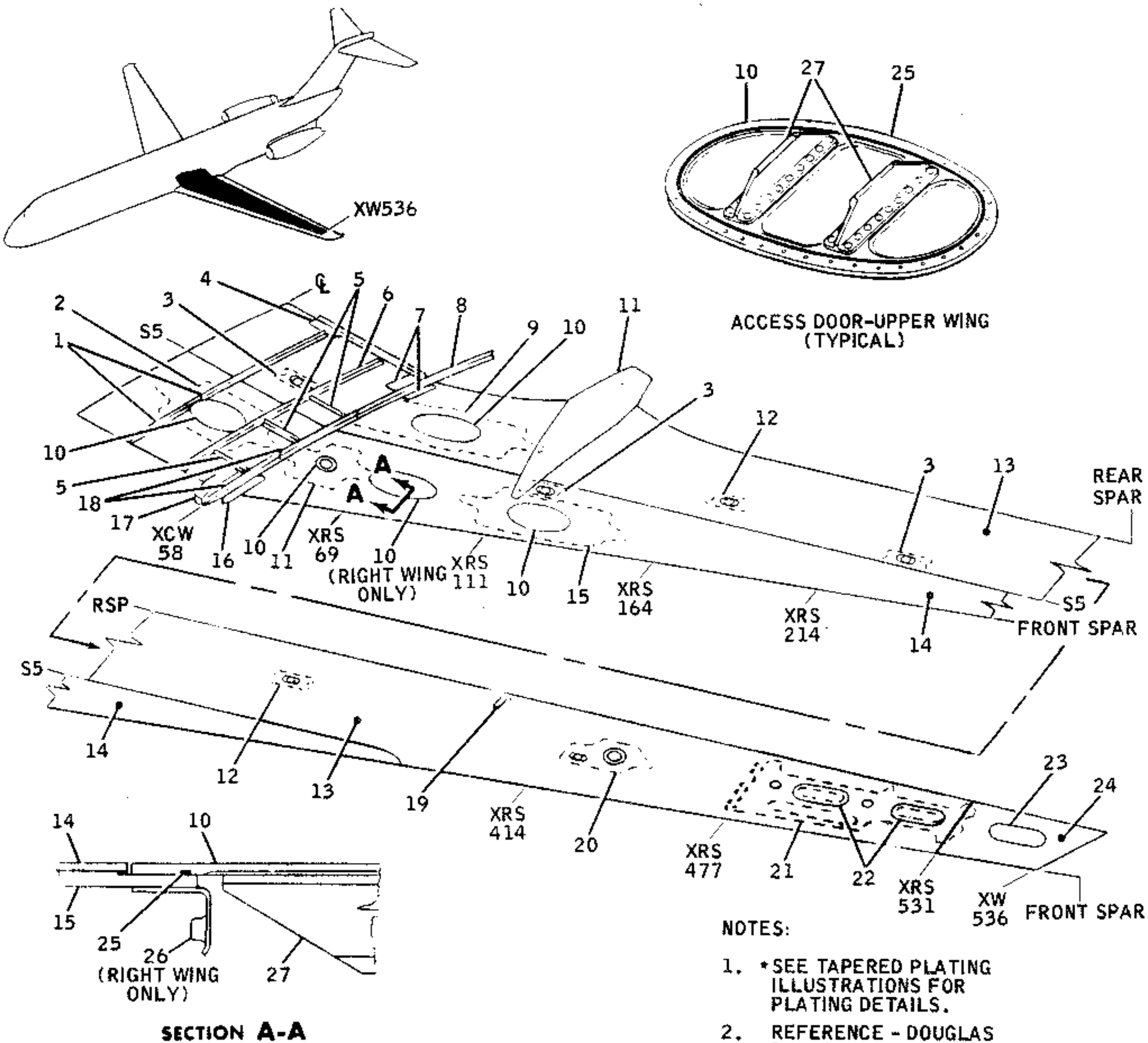
BB3-760

Wing Outboard Trailing Edge Lower Door Plating -- Type A
Figure 4

CENTER SECTION PLATES/SKINS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates wing center section plates/skins. Materials are identified in material lists by item number callouts. Tapered plating is identified by cross-section thicknesses as illustrated in tapered plating charts, Figure 3.



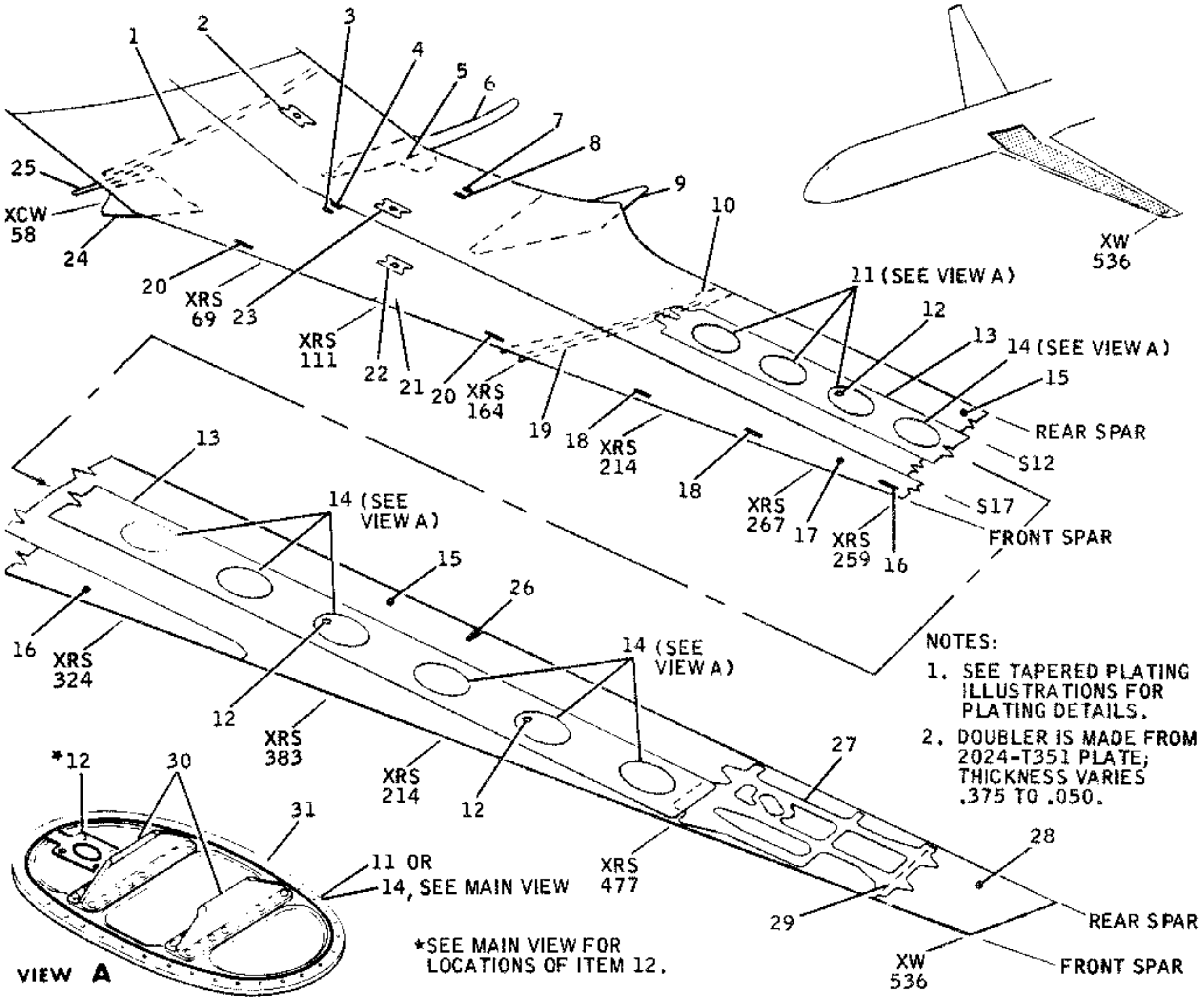
NOTES:

1. *SEE TAPERED PLATING ILLUSTRATIONS FOR PLATING DETAILS.
2. REFERENCE - DOUGLAS DRAWING 5910464

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP		2913627	15	DOUBLER	.3125	PLATE 7075-T651
2	DOUBLER	.250	PLATE 7075-T651	16	SPLICE	.150	CLAD 7075-T6
3	DOUBLER	.625	PLATE 7075-T651	17	FITTING	2.500	PLATE 7075-T651
4	CAP	.125	CLAD 2024-T3	18	TEE		3912878-1, -2
5	CAP	.080	CLAD 7075-T6	19	CLIP	1.500	PLATE 7075-T651
6	CAP		1419008	20	DOUBLER	1.250	PLATE 7075-T651
7	SPLICE	.190	CLAD 7075-T6	21	DOUBLER	.125	CLAD 7075-T6
8	TEE		3919229-501	22	COVER	.125	CLAD 7075-T6
9	DOUBLER	.475	PLATE 7075-T651	23	COVER	.090	CLAD 7075-T6
10	DOOR	.625	PLATE 7075-T651	24	PANEL	.125	CLAD 7075-T6
11	DOUBLER	.312	PLATE 7075-T651	25	SEAL		SILICONE RUBBER
12	DOUBLER	.500	PLATE 7075-T651	26	SUPPORT	.071	6061-T6
*13	SKIN		3919255-1, -2	27	TEE		1286227
*14	SKIN		3919200-1, -2				

BB3-761

Wing Center Section Upper Panel Plating -- Type A
Figure 1



NOTES:
1. SEE TAPERED PLATING ILLUSTRATIONS FOR PLATING DETAILS.
2. DOUBLER IS MADE FROM 2024-T351 PLATE; THICKNESS VARIES .375 TO .050.

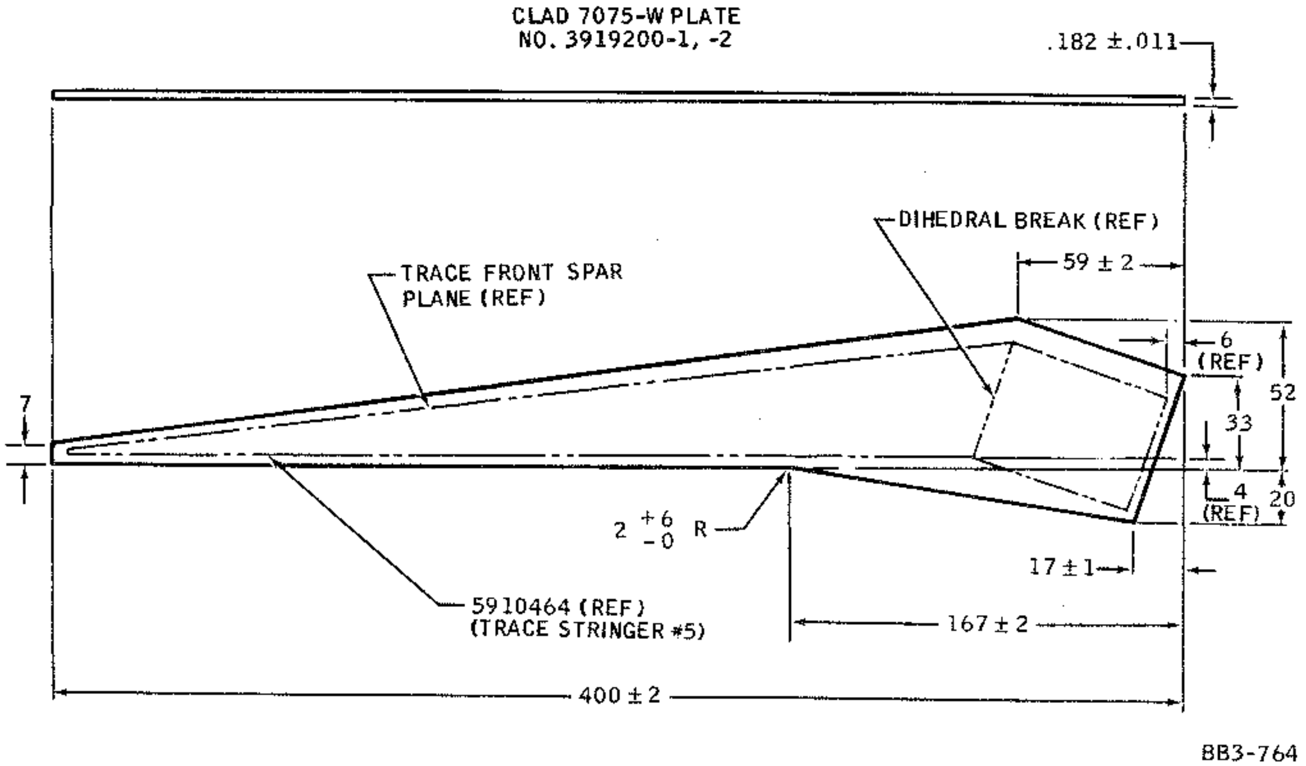
*SEE MAIN VIEW FOR LOCATIONS OF ITEM 12.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.090	CLAD 2024-T6	17	PLATING		3919093-1, -2
2	DOUBLER	.250	CLAD 2024-T351	18	SPACER	.125	CLAD 2024-T3
3	BRACKET	2.250	PLATE 2024-T351	19	CHANNEL	.063	CLAD 7075-T6
4	BRACKET	1.625	PLATE 2024-T351	20	SPACER	.160	CLAD 2024-T3
5	PLATE	.375	PLATE 2024-T351	21	PLATE		17-4PH, HT-180
6	CAP	3.000	BAR 7075-T6	22	DOUBLER	.190	CLAD 2024-T3
7	BRACKET	2.000	PLATE 2024-T351	23	DOUBLER	.500	PLATE 2024-T351
8	BRACKET		1453926	24	PLATE	.312	PLATE 2024-T351
9	DOUBLER	.500	PLATE 2024-T351	25	ANGLE	.125	CLAD 7075-T6
10	FAIRING	.100	CLAD 7075-T6	26	CLIP	1.500	PLATE 7075-T651
11	DOOR	.312	PLATE 2024-T351	27	DOUBLER	.090	CLAD 2024-T3
12	SHIM	.190	CLAD 2024-T351	28	SKIN	.050	CLAD 2024-T3
13	DOUBLER		SEE NOTE 2	29	SHIM	.020	CLAD 2024-T3
14	DOOR	.190	CLAD 2024-T3	30	TEE		1245828
15	PLATING		3919224-1, -2	31	SEAL		SILICONE RUBBER
16	SPACER	.190	CLAD 2024-T3				

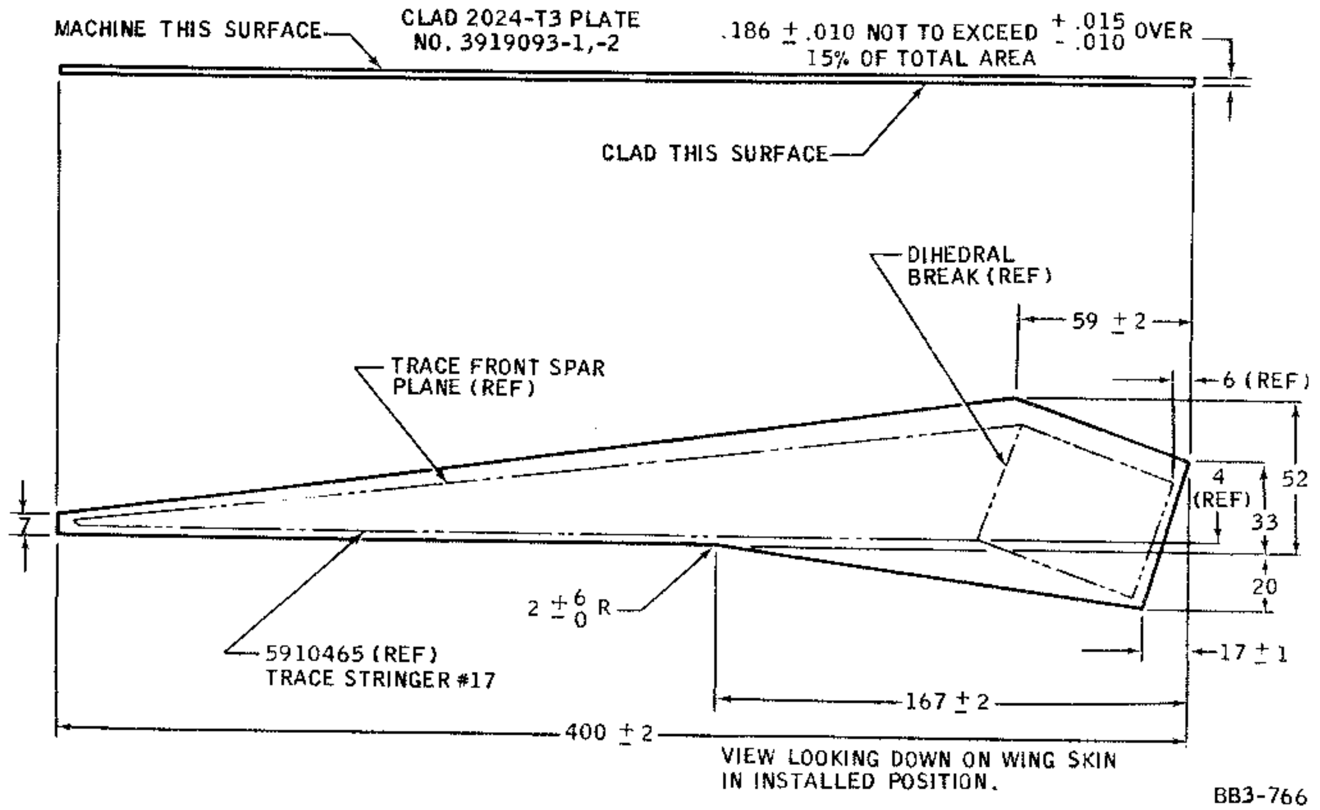
REFERENCE - DOUGLAS DRAWING 5910465

BB3-762

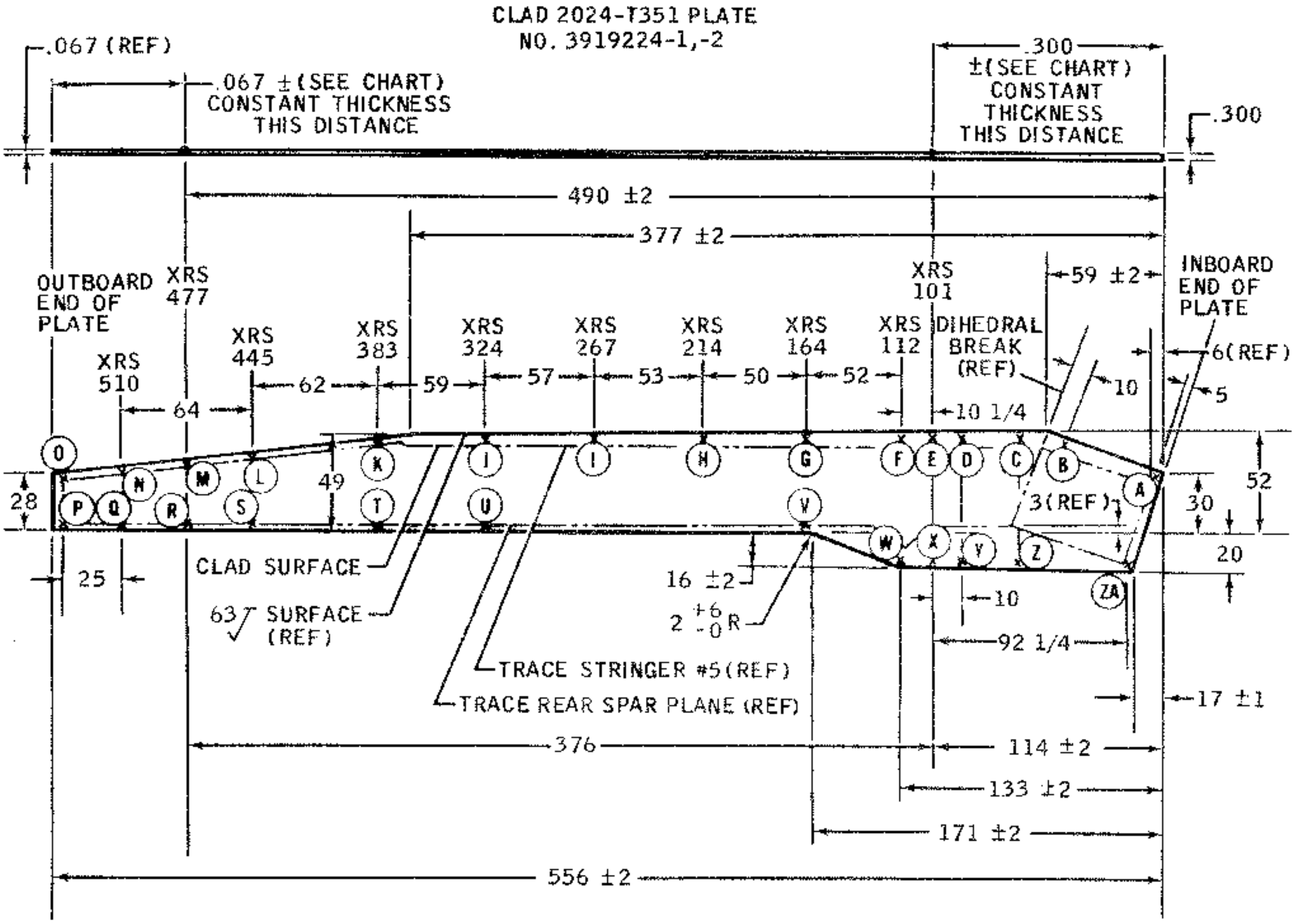
Wing Center Section Lower Panel Plating -- Type A
Figure 2



Wing Center Section Plating Charts -- Type A
Figure 3 (Sheet 1)



Wing Center Section Plating Charts -- Type A
Figure 3 (Sheet 2)



MATERIAL THICKNESS CHART

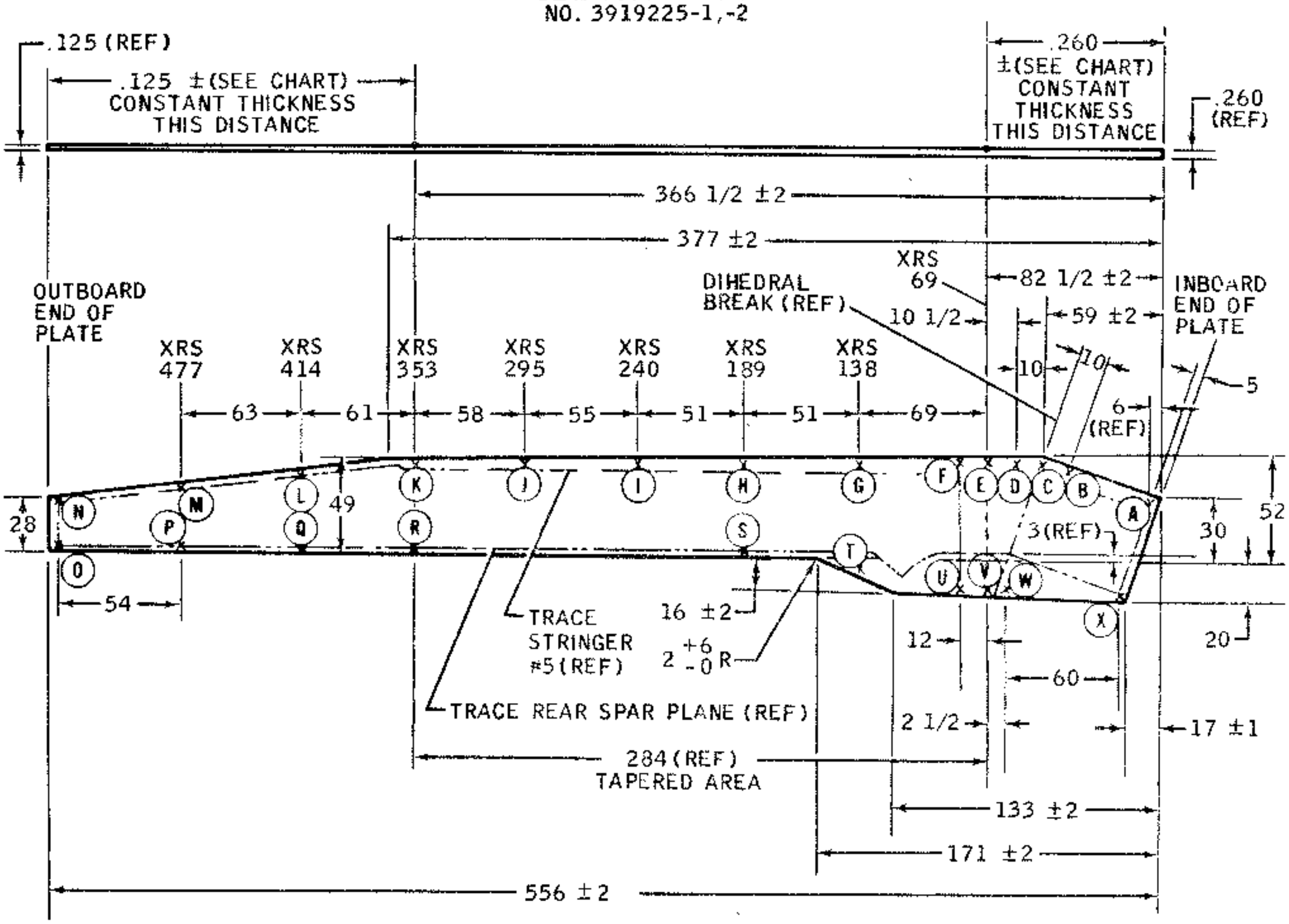
LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.290	.310	Ⓞ	.057	.077
Ⓑ	.290	.310	Ⓟ	.057	.077
Ⓒ	.290	.310	Ⓠ	.057	.077
Ⓓ	.290	.310	Ⓡ	.057	.077
Ⓔ	.290	.310	Ⓢ	.076	.096
Ⓕ	.284	.304	Ⓣ	.115	.135
Ⓖ	.251	.271	Ⓤ	.152	.172
Ⓗ	.220	.240	Ⓥ	.251	.271
Ⓘ	.187	.207	Ⓦ	.284	.304
Ⓙ	.152	.172	Ⓧ	.290	.310
Ⓚ	.115	.135	Ⓨ	.290	.310
Ⓛ	.076	.096	Ⓩ	.290	.310
Ⓜ	.057	.077	(ZA)	.290	.310
Ⓝ	.057	.077			

NOTE: ± 3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE

BB3-765

Wing Center Section Plating Charts -- Type A
Figure 3 (Sheet 3)

CLAD 7075-W PLATE
NO. 3919225-1,-2



MATERIAL THICKNESS CHART

LOCATION	MIN	MAX	LOCATION	MIN	MAX
Ⓐ	.246	.274	Ⓜ	.113	.137
Ⓑ	.246	.274	Ⓝ	.113	.137
Ⓒ	.246	.274	Ⓞ	.113	.137
Ⓓ	.246	.274	Ⓟ	.113	.137
Ⓔ	.246	.274	Ⓠ	.113	.137
Ⓕ	.240	.268	Ⓡ	.113	.137
Ⓖ	.213	.241	Ⓢ	.191	.216
Ⓗ	.191	.216	Ⓣ	.213	.241
Ⓘ	.167	.191	Ⓤ	.240	.268
Ⓙ	.143	.164	Ⓥ	.246	.274
Ⓚ	.113	.137	Ⓦ	.246	.274
Ⓛ	.113	.137	Ⓧ	.246	.274

NOTE: ±3 DEVIATION FROM INDICATED LOCATIONS PERMISSIBLE

BB3-763

Wing Center Section Plating Charts -- Type A
Figure 3 (Sheet 4)

ATTACH FITTINGS - DESCRIPTION AND OPERATION (DC-9-10)

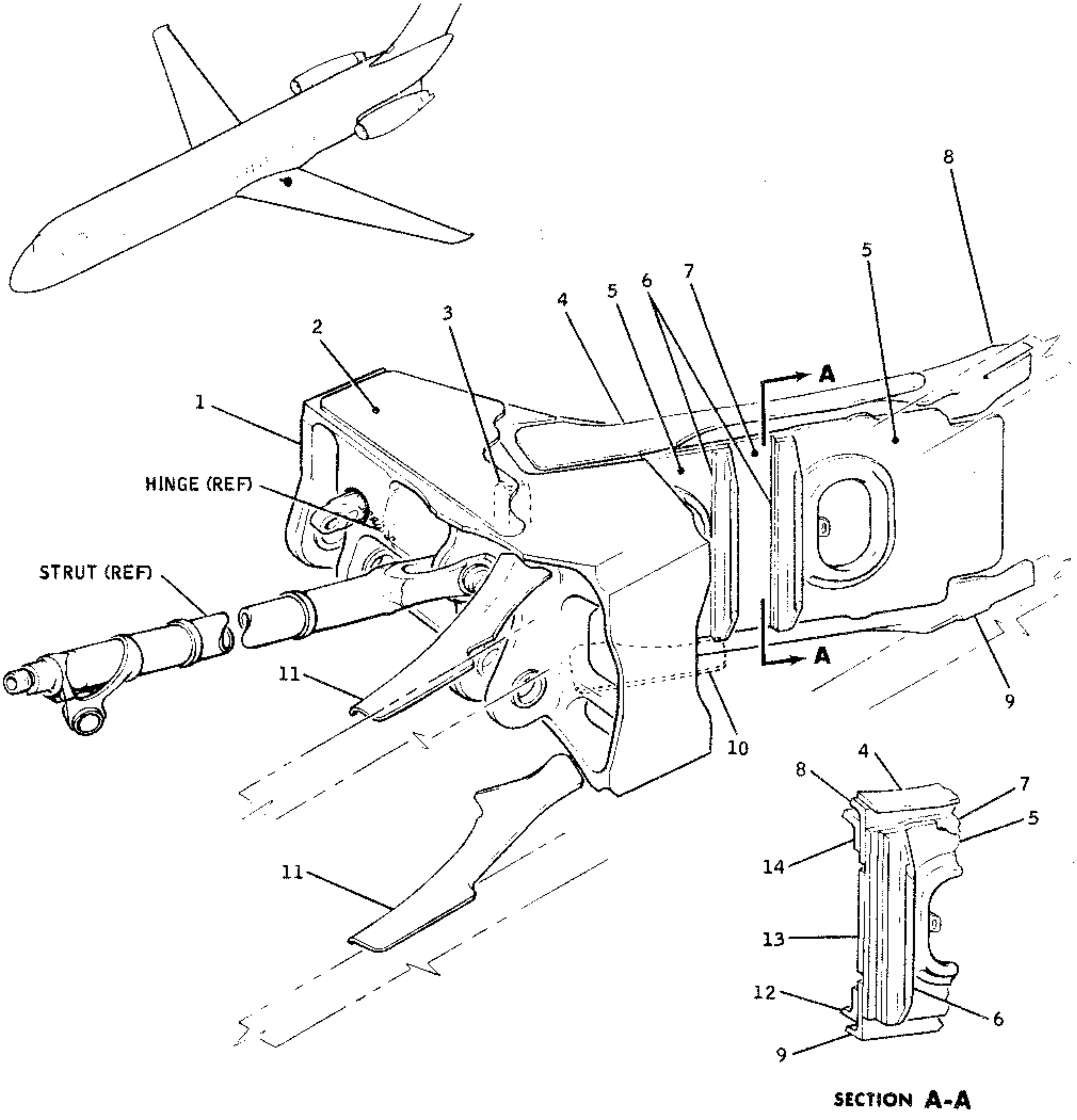
1. General

A. This section illustrates attach fittings. Types and gages of material used in construction of assemblies are identified within illustrations.

MAIN LANDING GEAR ATTACHMENT FITTINGS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates main landing gear attachment fittings. Materials are identified in material lists by item number callouts.



REFERENCE - DOUGLAS DRAWING 5910007

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		FORGING,7079-T411	8	CAP	3.500	BAR 7075-T651
2	FILLER	.190	CLAD 7075-T6	9	CAP	3.500	BAR 2014-T651
3	ANGLE	.125	CLAD 7075-T6	10	GUSSET	.190	STEEL SHEET 4130
4	GUSSET	.250	PLATE 4130	11	STIFFENER	.090	CLAD 2014-T6
5	WEB	.100	CLAD 7075-T6	12	CAP	1.750	PLATE 2014-T651
6	STIFFENER		1325309	13	ANGLE		1242526
7	DOUBLER	.100	CLAD 7075-T6	14	CAP	2.000	PLATE 7075-T651

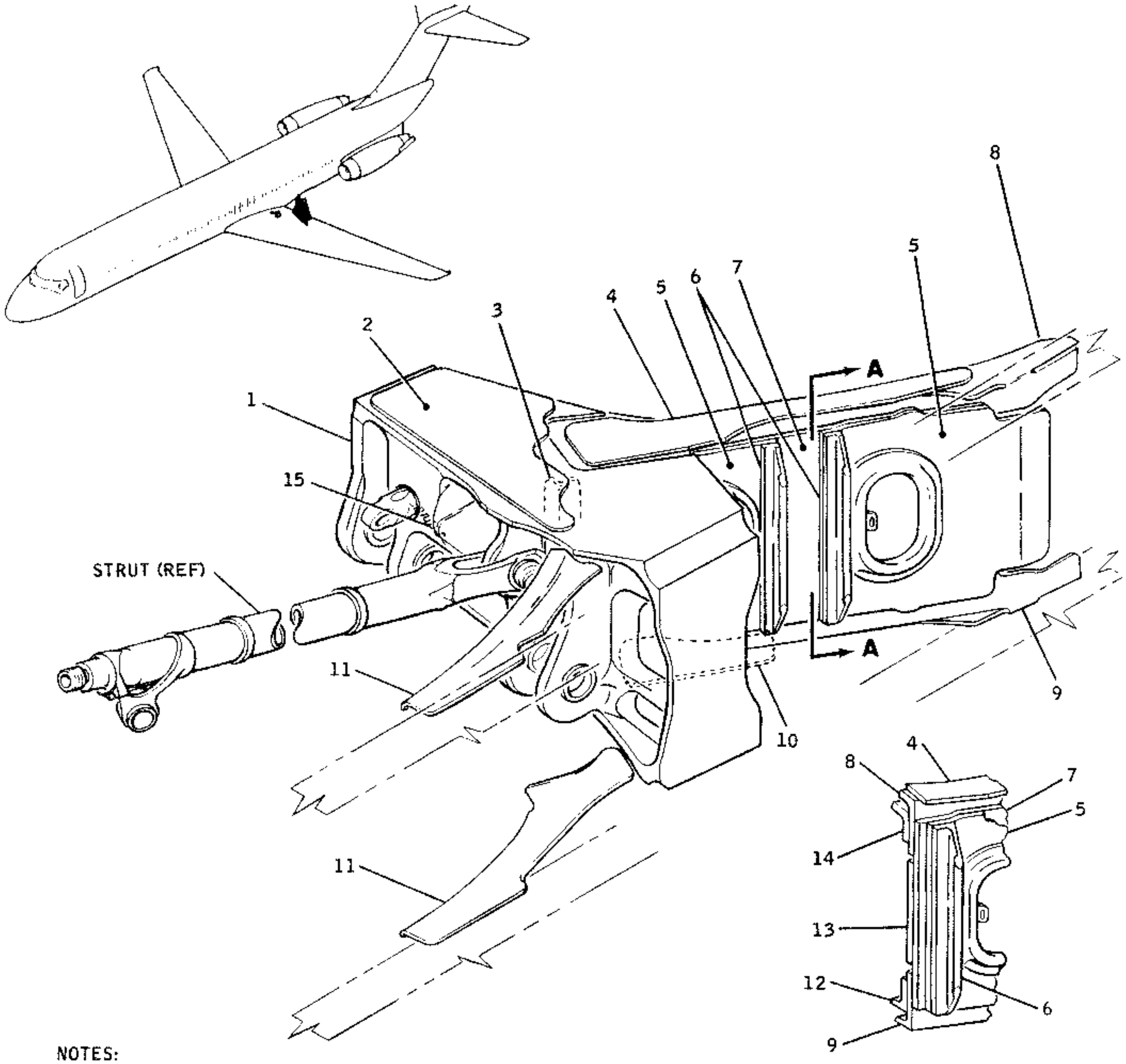
BB3-792

Main Landing Gear Support Structure
Figure 1

MAIN LANDING GEAR ATTACHMENT FITTINGS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates main landing gear attachment fittings. Materials are identified in material lists by item number callouts.



NOTES:

1. HINGE MADE FROM 2913436 EXTRUSION, AIRPLANES 1 THRU 160. USE HINGES MADE FROM 1583A FORGINGS, DOUGLAS PART NUMBER 3924290 ON AIRPLANES 161 AND SUBSEQUENT AND FOR REPLACEMENTS.
2. REFERENCE-DOUGLAS DRAWING 5910484.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		FORGING,7079-T411	8	CAP	3.500	BAR 7075-T651
2	FILLER	.312	CLAD 7075-T651	9	CAP	3.500	BAR 2014-T651
3	ANGLE	.125	CLAD 7075-T6	10	GUSSET	.190	STEEL SHEET 4130
4	GUSSET	.250	PLATE 4130	11	STIFFENER	.090	CLAD 2014-T6
5	WEB	.100	CLAD 7075-T6	12	CAP	1.750	PLATE 2014-T651
6	STIFFENER		1325309	13	ANGLE		1242526
7	DOUBLER	.100	CLAD 7075-T6	14	CAP	2.000	PLATE 7075-T651
				15	HINGE HALF		SEE NOTE 1

BB3-849

Main Landing Gear Support Structure -- Type A
Figure 1

MAIN LANDING GEAR ATTACHMENT FITTINGS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates main landing gear attachment fittings. Materials are identified in material lists by item number callouts.

TO BE ADDED WHEN AVAILABLE

Main Landing Gear Support Structure -- Type A
Figure 1

FLIGHT SURFACES - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates components of wing flight surfaces. Types and gages of material used in construction of assemblies are identified within illustrations.

B. This section also describes balancing procedures for aileron, aileron control tab, and aileron trim tab (see 57-50-1). Whenever repair or repainting is made to an aileron, aileron control tab, or aileron trim tab, the surface must be rebalanced. The aileron control tab and the aileron trim tab must also be weighed to ensure that its respective maximum allowable weight is not exceeded (see 57-50-1).

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

Structural Component	Approved Repairs
Internal Structure	57-01, Figure 1, Sheet 1 57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4
Internal Webs	57-01, Figure 2, Sheet 2 57-01, Figure 4, Sheet 2 57-02, Figures 1 and 2
Honeycomb	57-04, as applicable
Plating	57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheet 2 57-01, Figure 4, Sheet 2 57-03, Figure 3 57-03, Figures 6 through 9

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

AILERON AND AILERON TAB BALANCING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplane structure; the aileron, aileron control tab, and aileron trim tab must be balanced nose heavy about their hinge lines.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes the minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of nose overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the ability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever a surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs.

NOTE: Tabs supplied by Douglas Aircraft Company are interchangeable, provided the tabs have the same engineering drawing number configuration as the tabs being replaced. If repainted or reworked, the control tab and trim tab must also be weighed to ensure that its maximum allowable weight is not exceeded. Maximum allowable weight for the control tab is 9.90 pounds. Maximum allowable weight for the trim tab is 6.35 pounds.

E. Two methods of balancing the control surfaces are presented. One method utilizes a calibrated weight beam, with sliding weight, affixed to the control surface. The sliding weight is moved along the beam until the surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition.

F. Either method of balancing can be used; however, the direct reading beam is considered preferable because of its simplicity, speed, and direct reading capabilities.

G. Both methods of balancing utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing well-oiled, undersize hinge pins through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the aileron and aileron tabs are control surfaces and are movable portions of the wing airfoil and are used as lateral controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) The established minimum to maximum nose heavy moment is the required balance limits.

E. Minimum Balance Limit

(1) The established minimum nose heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate nose heavy moment established to provide an optimum point when rebalance is required is the recommended balance limit.

G. Maximum Balance Limit

(1) The established maximum nose heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to nose caps which constitute minor increments of balance moment. During balance checks, the amount of balance moment adjustment required is usually within the range of the adjustment weights.

TEMPORARY REVISION 57-31

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately following 57-50-0, Page 1. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Completely revises aileron and aileron tab balancing information. Provides instructions for repair of aileron weight installation and instructions for balancing by calculation method.
EFFECTIVITY:	ALL

AILERON AND AILERON TAB BALANCING - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. To prevent aerodynamic flutter, which can have serious effects on the airplane structure, the aileron, aileron control tab, and aileron trim tab must be balanced nose-heavy about their hinge lines.

CAUTION: TO ENSURE THAT REQUIRED BALANCE LIMITS ARE MAINTAINED, BALANCE CHECKS REQUIRE THAT THE SURFACE BE IN A SPECIFIC CONDITION. THE CONDITION OF THE SURFACES FOR BALANCING MUST BE AS OUTLINED IN SUBSEQUENT PARAGRAPHS FOR THE SURFACE INVOLVED. ALL EQUIPMENT MUST BE IN GOOD WORKING ORDER. SCALES USED MUST BE ACCURATE. BALANCE CHECKS MUST BE ACCOMPLISHED IN A WIND-FREE AREA AND ON A RELATIVELY LEVEL FLOOR. THE CONTROL SURFACE MUST BE FREE OF DIRT AND FOREIGN MATTER.

B. Balancing of control surfaces is affected and controlled by aerodynamic flutter prevention, which establishes minimum overbalance, and structural strength and weight control, which establishes the maximum overbalance.

C. Static balance of control surfaces is accomplished by the amount of nose overbalance established. Dynamic balance of control surfaces is accomplished by the specific spanwise distribution of weights. Balance weights must not be added beyond the capability of the nose section structure to support added weight. The uncontrolled addition of weight to any area of the airplane is not desirable.

D. The balance condition of control surfaces must be checked whenever a surface has been repainted, whenever parts not of identical weight are replaced, and whenever moment changes occur due to structural revisions and repairs. The balance condition of the aileron may be checked by the calculation method after repairs or repainting (see paragraph 21).

E. In addition to maintaining the correct balance condition, the weight of the aileron control tab and aileron trim tab must not exceed their respective maximum allowable weight; 9.90 pounds for aileron control tab, 6.35 pounds for aileron trim tab.

F. The balance condition of all control surfaces, and the weight of all tabs, is recorded on a weight and balance tag, generally located on inboard closing rib of respective surface. Any change must be recorded on the tag.

G. Two methods of balancing the control surfaces while off the airplane are presented. One method utilizes a calibrated weight beam, with sliding weight affixed to the control surface. The sliding weight is moved along the beam until the control surface assumes a horizontal attitude. The balance condition is directly readable on the beam. The other method utilizes standard and variable values of checkweights suspended from specified points on the control surface, weighing the checkweights, and comparing the weight value to the equivalent balance condition. Either method may be used.

H. Both methods of balancing the surfaces while off the airplane utilize the same type stands to support the control surfaces. The surfaces are supported at specified points by placing oiled, undersize hinge pins (bolts) through the eyebolt bearings and resting the hinge pins on the knife edges of the stand mounting arms.

I. The aileron weight installation may be repaired by replacing the existing Clad 2024-T42 aluminum door (located on bottom surface of aileron nose cap between stations XA390 and XA394) with No. 3924628-7 steel door and installing adjustment weights on the door. Repair of the door in this manner provides an easy access to adjustment weights without necessity of removing nose cap. The repair is outlined in paragraph 20.

2. Glossary of Terms

A. Control Surface

(1) Control surfaces are the movable surfaces which control the attitude of the airplane; for example, the aileron and aileron tabs are control surfaces and are movable portions of the wing airfoil and are used as lateral controls.

B. Balance Moment, or Moment

(1) Balance moment is the product of a weight, or force, times the distance to the control surface hinge line. The balance moment of a control surface is equal to the weight of the entire surface times the distance between the control surface's center-of-gravity and the hinge line.

C. Moment Arm

(1) The moment arm is the distance from the weight, or force, on the control surface to the control surface hinge line.

D. Required Balance Limits

(1) The established minimum to maximum nose-heavy moment is the required balance limits.

E. Minimum Balance Limit

(1) The established minimum nose-heavy moment is the minimum balance limit.

F. Recommended Balance Limit

(1) The intermediate nose-heavy moment established to provide an optimum point when rebalance is required is the recommended balance limit.

G. Maximum Balance Limit

(1) The established maximum nose-heavy moment is the maximum balance limit.

H. Balance Weights

(1) Balance weights are those weights attached to control surface nose caps which constitute the major increments of balance moment. Balance checks seldom require removal of balance weights.

I. Adjustment Weights

(1) Adjustment weights are those weights attached to control surface nose caps which constitute minor increments of balance moment. During balance checks, the amount of balance moment adjustment required is usually within the range of the adjustment weights.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in Figures 1 and 2; however, if the calibrated beam method is used, beam and weight assemblies must conform to Douglas drawings 5916761, C change or later, and 5916773, B change or later, and be calibrated to conform to Douglas drawing 5923792, B change or later, to ensure accurate balance indications. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (undersize hinge pins resting on knife edges). Hinge pins used should be lightly oiled.

A. Tools and Equipment Required for Calibrated Beam Method (see Figure 1)

Item	Name	Number	Manufacturer	Use
A	Two Each Control Surface Balance Stand Assemblies	5916761-3	Douglas Aircraft Co. Inc., Long Beach, Calif.	Stands to support aileron during balance checks
B	Two Each Control Surface Balance Stand Assemblies	5916773-79		Stands to support aileron tabs during balance checks

Tools and Equipment Required for Calibrated Beam Method
Figure 1 (Sheet 1)

Item	Name	Number	Manufacturer	Use
C	One Each Weight Assembly	5916761-69	Douglas Aircraft Co. Inc., Long Beach, Calif.	Standard of known weight and balance moment for checking aileron balance condition
D	Beam Assembly	5916761-61		Direct reading scale for checking aileron balance condition
E	Weight Assembly	5916761-67		Sliding weight for beam assembly (Item D)
F	Beam Assembly	5916773-25		Direct reading scale for checking aileron control tab balance condition
G	Weight Assembly	5916773-33		Sliding weight for beam assembly (Item F)
H	Beam Assembly	5916773-27		Direct reading scale for checking aileron trim tab balance condition
I	Weight Assembly	5916773-35		Sliding weight for beam assembly (Item H)
J	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	To weigh tabs

Tools and Equipment Required for Calibrated Beam Method
Figure 1 (Sheet 2)

B. Tools and Equipment Required for Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Two Each Control Surface Balance Stand Assemblies	5916761-3	Douglas Aircraft Co. Inc., Long Beach, Calif.	Stands to support aileron during balance checks
B	Two Each Control Surface Balance Stand Assemblies	5916773-79		Stands to support aileron tabs during balance checks
C	Standard 12.00 pound checkweight (including container)		Local manufacture	Standard of known weight and balance moment for checking aileron balance condition
D	Metal container			Suspension device to hold checkweights during balance check of tabs
E	Checkweights of various weight values			Checkweights of various values for checking aileron, aileron control tab, and aileron trim tab balance condition
F	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	To weigh checkweights and tabs

Tools and Equipment Required for Checkweight Method
Figure 2

4. Check Condition of Aileron Prior to Balance Check

A. Ensure that the aileron is complete and in required condition for balancing (see Figure 3). All painting and rework must be accomplished. Control tab and trim tab must not be installed. Surface must be free of dirt and foreign matter.

CAUTION: FOR BALANCE CHECKS THE AILERON MUST BE COMPLETE EXCEPT FOR THE ITEMS WHICH ARE NOT INSTALLED, INSTALLED, OR SPECIFICALLY POSITIONED AS SHOWN IN FIGURE 3.

B. Ensure that the No. LH-7461T-070 nuts securing the eyebolt bearings installed at stations XA 402.8 and XA 467.8 are tightened to a torque of 300 to 400 pounds-inch and that the eyebolt bearings are perpendicular to the aileron axis of rotation. Ensure that the NAS 1105-22 bolts (hinge pins) that are installed through the eyebolt bearings are lightly oiled and centered in the bearings.

CAUTION: THE TORQUE VALUES SPECIFIED ABOVE FOR THE EYEBOLT NUTS ARE FOR BALANCE CHECKS ONLY. FOR INSTALLATION OF AILERON ON THE AIRPLANE, EYEBOLTS ARE INSTALLED AND THE NUTS TIGHTENED AS OUTLINED IN CHAPTER 27, DC-9 MAINTENANCE MANUAL.

C. Ensure that the eyebolts and attaching parts installed at stations XAC -2.0 and XAT 33.3 are installed as shown in Figure 3.

D. Ensure that the tab hinge attach parts are installed as shown in Figure 3.

E. Ensure that the links of the damper assemblies and that the pushrods and attach parts are installed as shown in Figure 3 and taped down with the smallest piece of masking tape possible that will prohibit movement of the parts.

5. Aileron Balance Limits

A. Aileron balance limits are shown in Figure 4.

B. It is recommended that the aileron balance condition be maintained as near to maximum balance limit as is possible and preferably at or between recommended balance and maximum balance limit; however, any point between minimum balance limit and maximum balance limit is permissible.

NOTE: Maintaining the aileron balance condition at the upper end of the balance limits provides more available balance moment for any subsequent repairs aft of the aileron hinge line.

Minimum Balance Limit	250 Inch-Pounds (Nose-Heavy)
Recommended Balance	257.5 Inch-Pounds (Nose-Heavy)
Maximum Balance Limit	260 Inch-Pounds (Nose-Heavy)

Aileron Balance Limits
Figure 4

6. Aileron Balance Weights and Adjustment Weights

A. Aileron balance weights are those weights installed in the aileron nose cap which constitute major increments of balance moment. During balance checks, adjustment of balance weights is seldom necessary.

(1) Balance weight numbers, locations, and approximate weight values are shown in Figure 5.

(2) Balance weight locations and attachment are shown in Figure 7.

B. Aileron adjustment weights are those weights installed in the aileron nose cap which constitute minor increments of balance moment. The amount of balance moment adjustment required during balance checks is usually possible by addition or removal of adjustment weights. The nose-heavy moment contribution of the adjustment weights is a product of the weight value times the moment arm. By selection of the proper weight value and moment arm, various moment contribution is possible.

(1) Adjustment weight numbers, locations, weight, and moment contribution are shown in Figure 6.

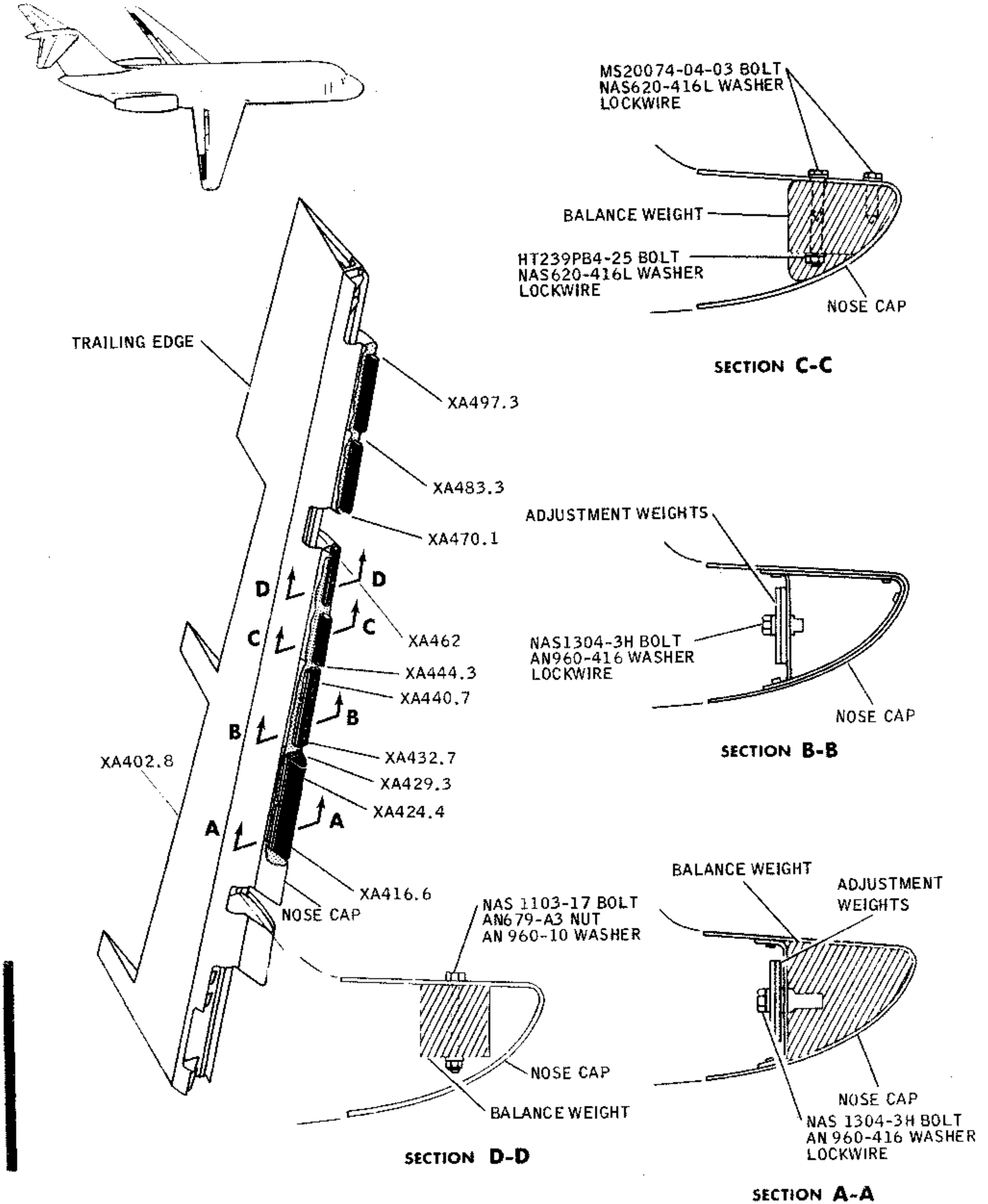
(2) Adjustment weight location and attachment are shown in Figure 7.

Number	Location (Aileron Station XA)	Approximate Weight (Pounds)
3915182-5	411.7	24
5955891-1	455	15.90
5955891-503	470	8.39
5955891-505	485	6.73
5913840-0013	453	4

Aileron Balance Weights
Figure 5

Adjustment Weight Number (NO. 4917170-)	-503	-1	-503	-505	-501	-505
Location (Aileron Station XA)	416.6	420.5	424.4	432.7	436.7	440.7
Moment Arm (Inches)	5.5	5.5	5.4	5.0	5.0	4.9
Weight Value Each (Pounds)	0.21	0.47	0.21	0.15	0.40	0.15
Nose-Heavy Moment Each (Inch-Pounds)	1.2	2.6	1.1	0.8	2.0	0.7

Aileron Adjustment Weights
Figure 6



REFERENCE - DOUGLAS DRAWING 5913840

BB3-328A

Aileron Weight Location and Attachment
Figure 7

7. Check Aileron Balance Condition Using Calibrated Beam Method

A. Ensure that aileron is in required condition for balancing (see paragraph 4).

B. Mount the aileron on balance stands (see Figures 1 and 8). Suspend the surface by resting the NAS 1105-22 bolts (installed through the eyebolt bearings at stations XA 402.8 and XA 467.8) across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

C. Suspend a No. 5916761-69 weight assembly from tab hinge locations XAC 34.4 (see Figures 1 and 8). Ensure that the weight does not interfere with movement of the surface.

D. Mount the No. 5916761-61 beam assembly and the No. 5916761-67 weight assembly on the aileron as shown in Figure 8 (Sheet 1).

E. Measure the distance from the floor (baseline) to the centerline of the bolts (hinge pins) installed through the eyebolt bearings at stations XA 402.8 and XA 467.8.

NOTE: An inspection type height gage as shown in Figure 8 is recommended for measurement so that it can easily be moved to the trailing edge and provide a visual reference.

F. Slide the weight assembly along the beam assembly until the aileron assumes a horizontal attitude.

NOTE: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points within a tolerance of ±0.10 inch.

G. Deflect the aileron three or four times and ensure that it returns to the horizontal position without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

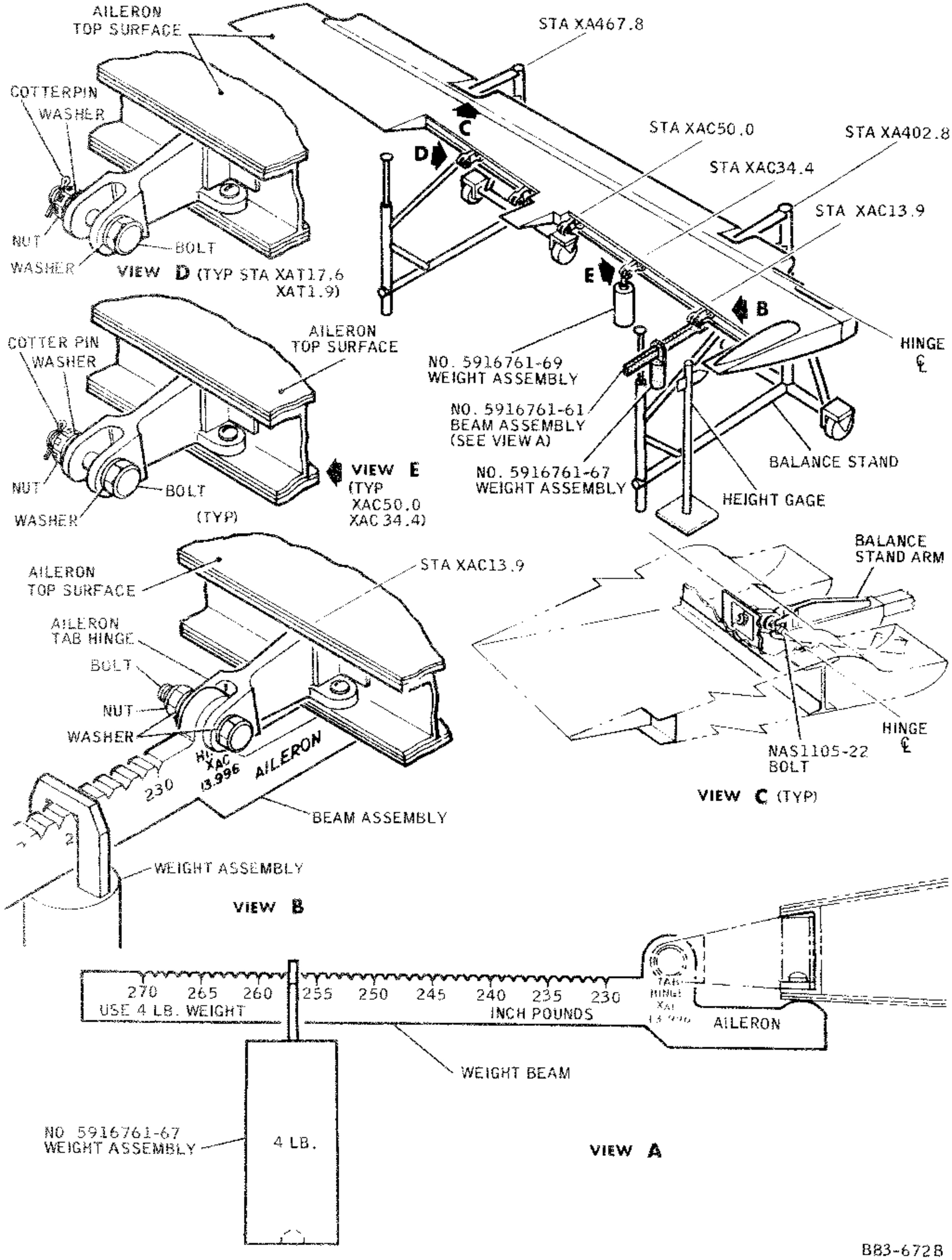
H. When the aileron is in a horizontal attitude, read the balance indication on the beam assembly.

I. If the balance indication is not within limits (see paragraph 5), make the necessary changes to the quantity of adjustment weights as shown in Figure 8, (Sheet 2).

NOTE: See Figures 6 and 7 for adjustment weight numbers and locations.

J. Repeat paragraphs E thru I until balance indication is correct.

K. Engrave balance condition on the weight and balance tag and enter the condition on any other records required.



Aileron Balancing Using Calibrated Beam Method
Figure 8 (Sheet 1)

Weight Beam Reading (Inch-Pounds)	Suggested Quantity of No. 4917170 (-) Adjustment Weights to Add/Remove Per Aileron Station (XA) For Indicated Beam Reading (see Figure 6 for weight and moment contribution of weights)						
	No. 4917170(-)	(-503)	(-1)	(-503)	(-505)	(-501)	(-505)
	Aileron Station	416.6	420.5	424.4	432.7	436.7	440.7
230		4	3	3	1	4	4
231		3	3	5	1	3	4
232		4	3	3	1	3	4
233		2	3	2	5	3	3
234		3	3	4	2	2	3
235		2	2	4	3	3	3
236		3	3	4	2	1	3
237 Add		1	2	3	5	2	4
238 Weights		2	2	2	2	3	3
239 For These		1	2	2	3	2	5
240 Readings		4	1	3	1	3	0
241		2	1	1	2	3	4
242		2	1	2	2	3	1
243		2	1	1	2	2	4
244		2	1	1	0	3	2
245		2	1	1	2	1	4
246		2	1	1	0	2	2
247		2	1	0	1	2	1
248		2	0	0	3	2	1
249		0	0	2	2	2	1
250 to 260	WITHIN BALANCE LIMITS						
261 Remove		0	0	0	1	0	1
262 Weights		1	0	1	1	0	2
263 For These		0	0	0	1	2	1
264 Readings		1	1	1	2	0	0
265		2	0	0	3	1	1

NOTE: Adding/removing the quantities of adjustment weights shown brings the aileron balance condition to approximately 257.5 inch-pounds nose-heavy. If a different balance condition is desired, refer to Figure 6 and select a quantity of adjustment weights which will provide sufficient moment to bring surface to desired balance condition. Always recheck balance condition after changing adjustment weights, and always maintain surface within balance limits.

Aileron Balancing Using Calibrated Beam Method
Figure 8 (Sheet 2)

8. Check Aileron Balance Condition Using Checkweight Method

A. Ensure that aileron is in required condition for balancing (see paragraph 4).

B. Mount the aileron on balance stands (see Figures 1 and 9). Suspend the surface by resting the NAS 1105-22 bolts (hinge pins) (installed thru the eyebolt bearings at stations XA 402.8 and XA 467.8) across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

C. Measure the distance from the floor (baseline) to the centerline of the bolts (hinge pins) installed through the eyebolt bearings at stations XA 402.8 and XA 467.8.

<u>NOTE</u>: An inspection type height gage as shown in Figure 9 is recommended for measurement so that it can easily be moved to the trailing edge and provide a visual reference.

D. Suspend 12.00 pound checkweight (see Figures 1 and 10) from the control tab hinge point at station XAC 13.9 (see Figure 9).

<u>NOTE</u>: The moment arm at this hinge point is 17.195 inches from the aileron hinge axis.

E. Add variable checkweights to the 12.00 pound checkweight container until the aileron assumes a horizontal attitude.

<u>NOTE</u>: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points (hinge pins) within a tolerance of ±0.10 inch.

F. Deflect the aileron three or four times and ensure that it returns to the horizontal attitude without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

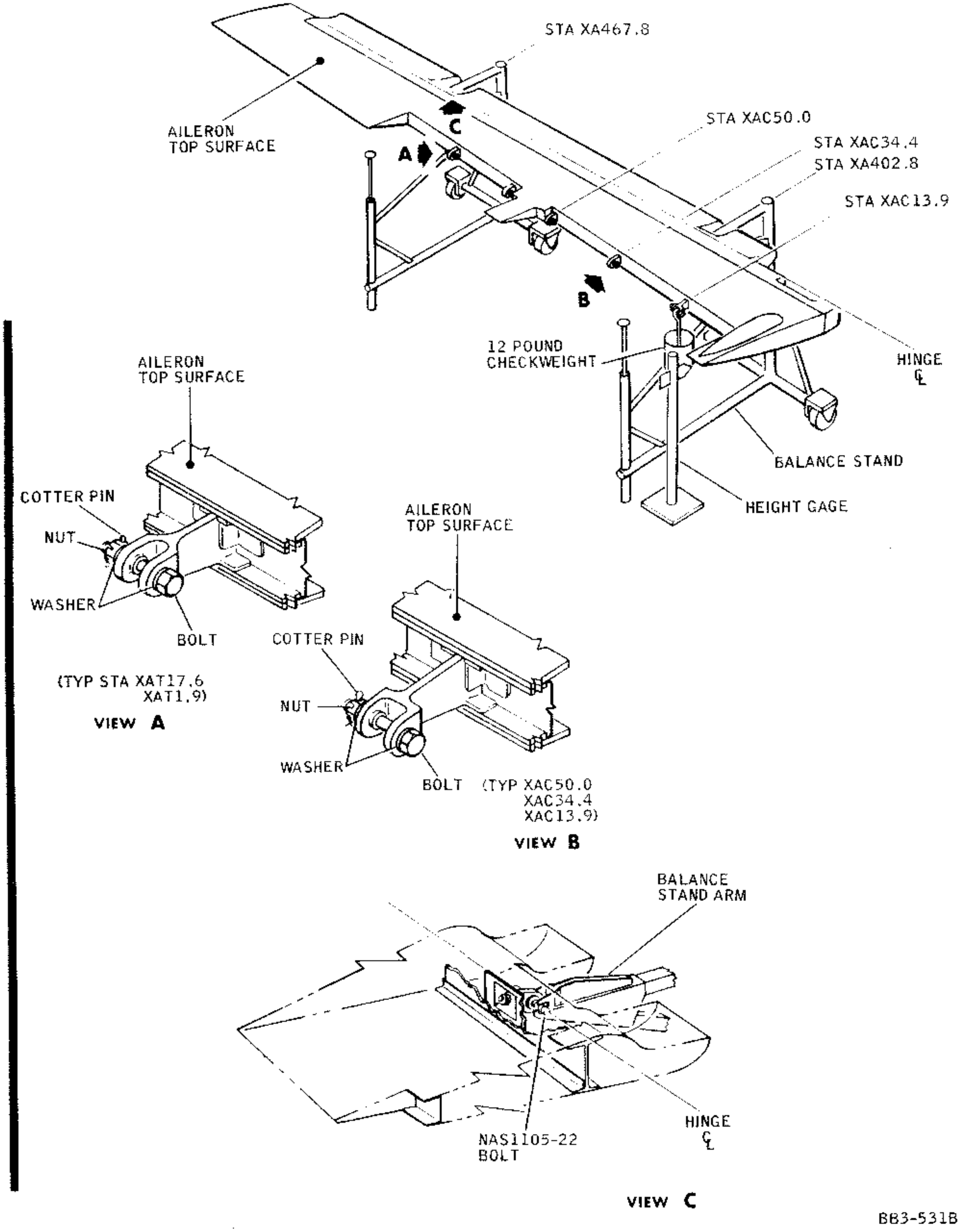
G. When the aileron is in a horizontal attitude, weigh (to the nearest hundreth pound) the total checkweights (including container) that are suspended from station XAC 13.9 hinge point.

H. Compare the weight value obtained in paragraph G, above, with the weight values shown in Figure 11. If balance condition is not correct, make the necessary changes to quantities of adjustment weights which will provide correct balance condition.

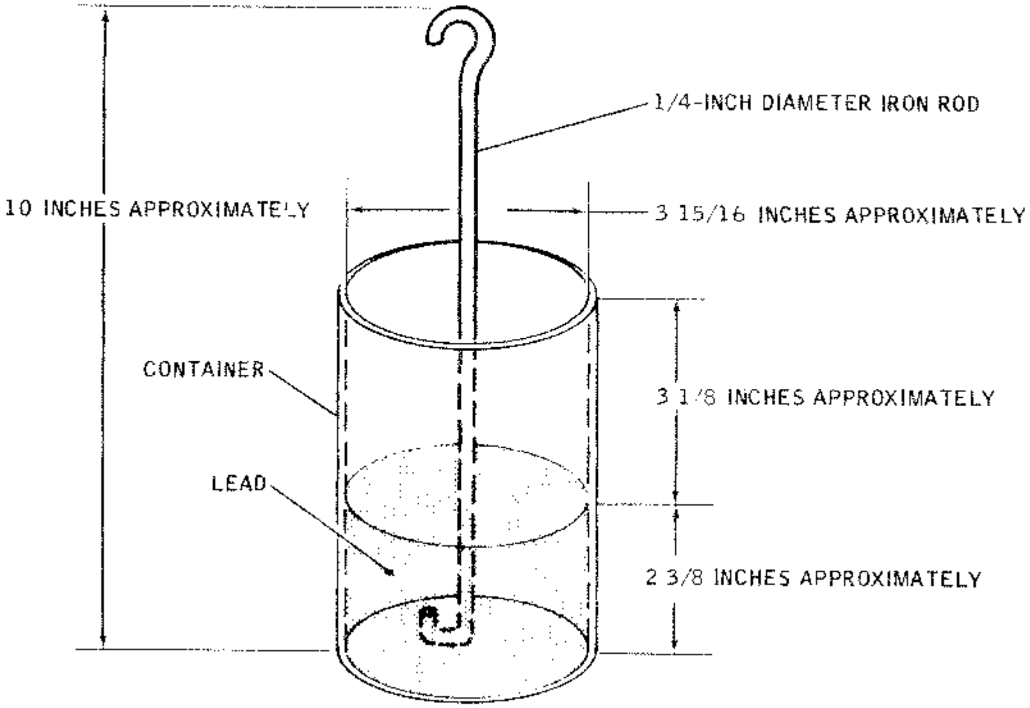
<u>NOTE</u>: See Figures 6 and 7 for adjustment weight numbers, locations, and contribution.

I. Repeat paragraphs C thru I until balance condition is correct.

J. Engrave balance condition on the weight and balance tag and on any other records required.



Aileron Balancing Using Checkweight Method
Figure 9



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 12.00 POUNDS.

BB3-431

Twelve Pound Standard Checkweight
Figure 10

Weight Value of Checkweights Suspended From Tab Hinge Point at Station XAC13.9	Equivalent Aileron Nose-Heavy Balance Condition (Inch-pounds)	
13.38 (and lower) to 14.53	Low. Add adjustment weights per Sheet 2	
14.54	250.01	↑
14.55	250.19	
14.56	250.35	
14.57	250.53	W
14.58	250.70	I
14.59	250.87	T
14.60	251.04	H
14.61	251.21	I
14.62	251.39	N
14.63	251.56	
14.64	251.73	B
14.65	251.90	A
14.66	252.07	L
14.67	252.25	A
14.68	252.42	N
14.69	252.59	C
14.70	252.76	E
14.71	252.93	
14.72	253.11	L
14.73	253.28	I
14.74	253.45	M
14.75	253.62	I
14.76	253.79	T
14.77	253.97	S
14.78	254.14	
14.79	254.31	
14.80	254.48	
14.81	254.65	
14.82	254.82	
14.83	255.00	↓

Weight Value of Checkweights Suspended From Tab Hinge Point at Station XAC13.9	Equivalent Aileron Nose-Heavy Balance Condition (Inch-pounds)	
14.84	255.17	↑
14.85	255.34	
14.86	255.51	
14.87	255.68	W
14.88	255.86	I
14.89	256.03	T
14.90	256.20	H
14.91	256.37	I
14.92	256.54	N
14.93	256.72	
14.94	256.89	B
14.95	257.06	A
14.96	257.23	L
14.97	257.40	A
14.98	257.58	N
14.99	257.75	C
15.00	257.92	E
15.01	258.09	
15.02	258.26	L
15.03	258.44	I
15.04	258.61	M
15.05	258.78	I
15.06	258.95	T
15.07	259.12	S
15.08	259.30	
15.09	259.47	
15.10	259.64	
15.11	259.81	
15.12	259.99	↓
15.13 to 15.54 (and higher)	High. Remove Adjustment weights per Sheet 3	

Aileron Checkweight Values and Adjustment Weight Change Required
Figure 11 (Sheet 1)

Weight Value of Check-weights Suspended From Tab Hinge Point at Station XAC 13.9 (Pounds)	Equivalent Balance Condition (Inch-Pounds)	Suggested Quantity of No. 4917170 (-) Adjustment weights (see Figure 6 for Weight Values and Moment contribution) to Add Per Aileron Station XA Indicated					
		(-503) 416.6	(-1) 420.5	(-503) 424.4	(-505) 432.7	(-501) 436.7	(-505) 440.7
13.38	230.06	4	3	3	1	4	4
13.44	231.10	4	3	2	1	4	4
13.50	232.13	3	3	2	3	4	2
13.56	233.16	4	3	0	3	4	2
13.61	234.02	3	3	4	2	2	3
13.67	235.05	2	2	4	3	3	3
13.73	236.08	3	3	4	2	1	3
13.77	236.77	2	3	2	2	3	1
13.79	237.11	2	2	3	1	4	1
13.84	237.97	2	2	2	3	3	2
13.89	238.83	2	2	2	1	3	3
13.90	239.01	1	2	2	3	2	5
13.95	239.87	2	2	2	3	2	2
13.96	240.04	4	1	3	1	3	0
14.01	240.90	2	2	1	4	2	1
14.02	241.07	2	1	1	2	3	4
14.07	241.93	2	2	2	3	1	2
14.08	242.10	2	1	2	1	3	2
14.13	242.96	2	1	1	2	2	4
14.19	244.00	2	1	1	0	3	2
14.25	245.02	2	1	1	2	1	4
14.31	246.06	2	1	1	0	2	2
14.37	247.09	2	1	0	1	2	1
14.42	247.95	1	1	1	0	2	1
14.43	248.12	2	0	0	3	2	1
14.48	248.98	1	1	0	1	2	0
14.49	249.15	1	1	0	0	2	1
14.50	249.32	2	1	1	1	0	2
14.51	249.49	2	0	3	2	0	1
14.52	249.67	2	0	3	0	0	3
14.53	249.84	2	1	1	2	0	0

NOTE: Adding the quantities of adjustment weights shown brings the aileron balance condition to approximately 257.5 inch-pounds nose-heavy. If a different balance condition is desired, refer to Figure 6 and select a quantity of adjustment weights which will provide sufficient moment to bring surface to desired balance condition. Always recheck balance condition after changing adjustment weights, and always maintain surface within balance limits.

Aileron Checkweight Values and
Adjustment Weight Change Required
Figure 11 (Sheet 2)

Weight Value of Check weights Suspended From Tab Hinge Point at Station XAC 13.9 (Pounds)	Equivalent Balance Condition (Inch-Pounds)	Suggested Quantity of No. 4917170 (-) Adjustment Weights (see Figure 6 for weight values and moment contribution) to Remove Per Aileron Station XA Indicated.					
		(-503) 416.6	(-1) 420.5	(-503) 424.4	(-505) 432.7	(-501) 436.7	(-505) 440.7
15.13	260.16	0	1	0	0	0	0
15.14	260.33	0	0	0	1	1	0
15.15	260.50	0	0	2	1	0	0
15.16	260.67	0	0	1	0	1	0
15.17	260.84	0	1	0	0	0	1
15.18	261.02	0	0	0	1	1	1
15.19	261.19	0	1	1	0	0	0
15.20	261.36	1	1	0	0	0	0
15.21	261.53	0	0	0	0	2	0
15.22	261.70	0	0	2	0	1	0
15.23	261.87	2	0	0	0	1	0
15.24	262.05	1	0	1	1	0	2
15.30	263.08	0	0	0	1	2	1
15.36	264.11	2	0	2	0	1	0
15.42	265.14	1	0	2	1	1	2
15.48	266.17	2	0	2	0	2	0
15.54	267.21	2	0	3	0	2	0

NOTE: Removing the quantities of adjustment weights shown brings the aileron balance condition to approximately 257.5 inch-pounds nose-heavy. If a different balance condition is desired, refer to Figure 6 and select a quantity of adjustment weights which will provide sufficient moment to bring surface to desired balance condition. Always recheck balance condition after changing adjustment weights, and always maintain surface within balance limits.

Aileron Checkweight Values and Adjustment Weight Change Required
Figure 11 (Sheet 3)

9. Check Condition of Aileron Control Tab for Weight and Balance Check

A. Ensure that aileron control tab is structurally complete. All painting and rework must be accomplished.

B. Ensure that surface is free of dirt and foreign matter.

10. Aileron Control Tab Weight and Balance Limits

A. Figure 12 shows aileron control tab weight limits.

Minimum Weight Limit (Pounds)	Maximum Weight Limit (Pounds)
None	9.90

Aileron Control Tab Weight Limits
Figure 12

B. Figure 13 shows aileron control tab balance limits.

Minimum Balance Limit ———— 2.5 Inch-Pounds (Nose-Heavy)

Maximum Balance Limit ———— 4.00 Inch-Pounds (Nose-Heavy)

Aileron Control Tab Balance Limits
Figure 13

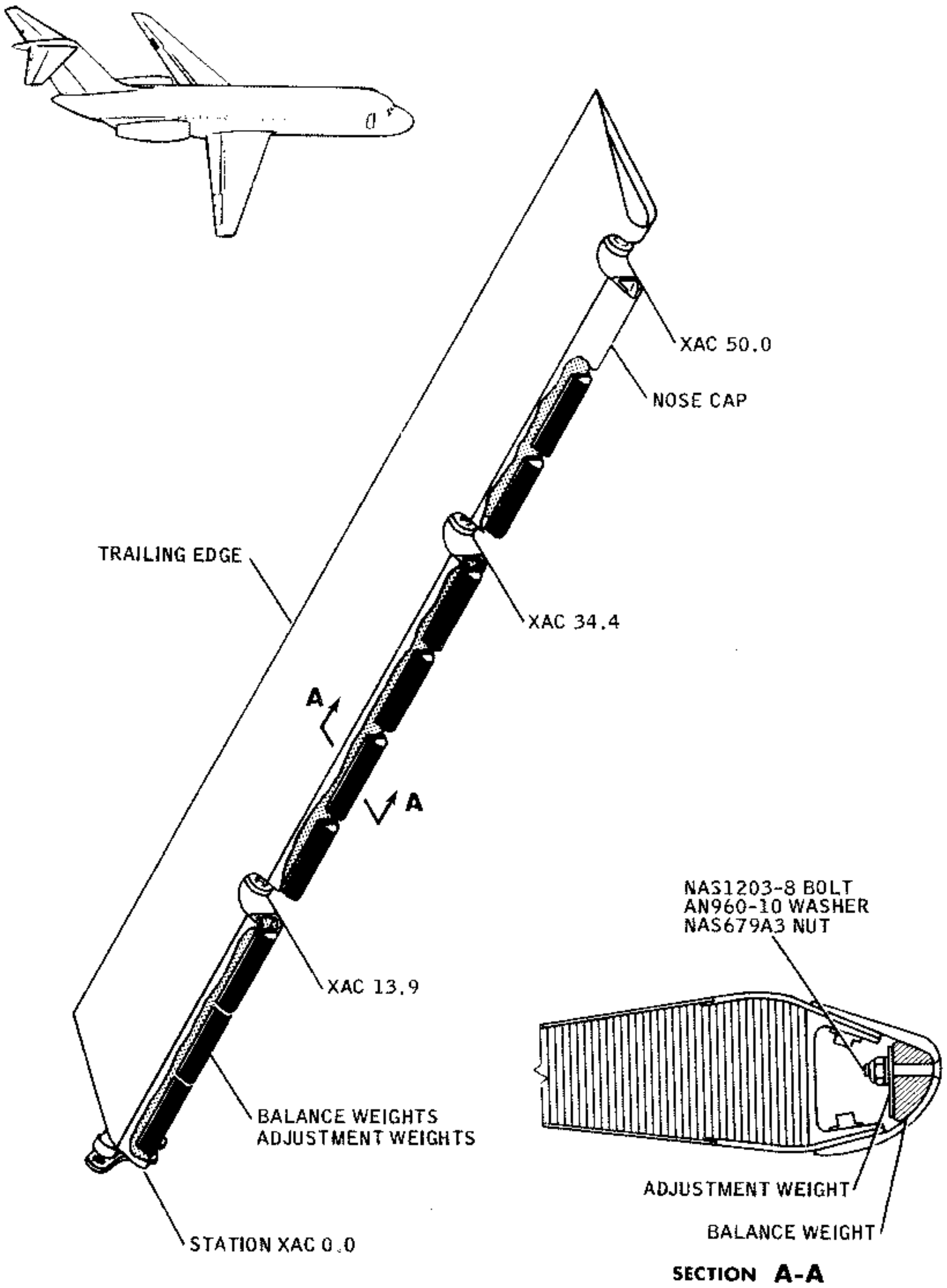
11. Aileron Control Tab Adjustment Weights

A. Figure 14 shows aileron control tab adjustment weight number, weight, and moment contribution.

Adjustment Weight No.	Weight (Each) (Pounds)	Moment Contribution (Each) (Inch-Pounds)
2917168	0.04	0.1

Aileron Control Tab Adjustment Weight Number, Weight, and Contribution
Figure 14

B. Figure 15 shows aileron control tab weight location and attachment.



REFERENCE - DOUGLAS DRAWING 5910047

BB3-329

Aileron Control Tab Weight Location and Attachment
Figure 15

12. Check Aileron Control Tab Balance Condition Using Calibrated Beam Method

A. Ensure that the aileron control tab is in required condition for balancing (see paragraph 9).

B. Install NAS 1103-17 bolts (hinge pins) through the eyebolt bearings at stations XAC 13.9 and XAC 50.0 (see Figure 16).

C. Mount the aileron control tab on balance stands (see Figures 1 and 16). Suspend the surface by resting the NAS 1103-17 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Mount the No. 5916773-25 beam assembly and No. 5916773-33 weight assembly on the aileron control tab as shown in Figure 16.

E. Measure the distance from the floor, or table (baseline), to the centerline of the bolts (hinge pins) installed through the eyebolt bearings at stations XAC 13.9 and XAC 50.0.

NOTE: An inspection-type height gage, as shown in Figure 16 is recommended so that it can easily be moved to the trailing edge and provide a visual reference.

F. Slide the weight assembly along the beam assembly until the control tab assumes a horizontal attitude.

NOTE: The control tab is in a horizontal attitude when the centerline of of the trailing edge is the same distance from the floor (baseline) as the centerline of the mount points (hinge pins) within a tolerance of ±0.10 inch.

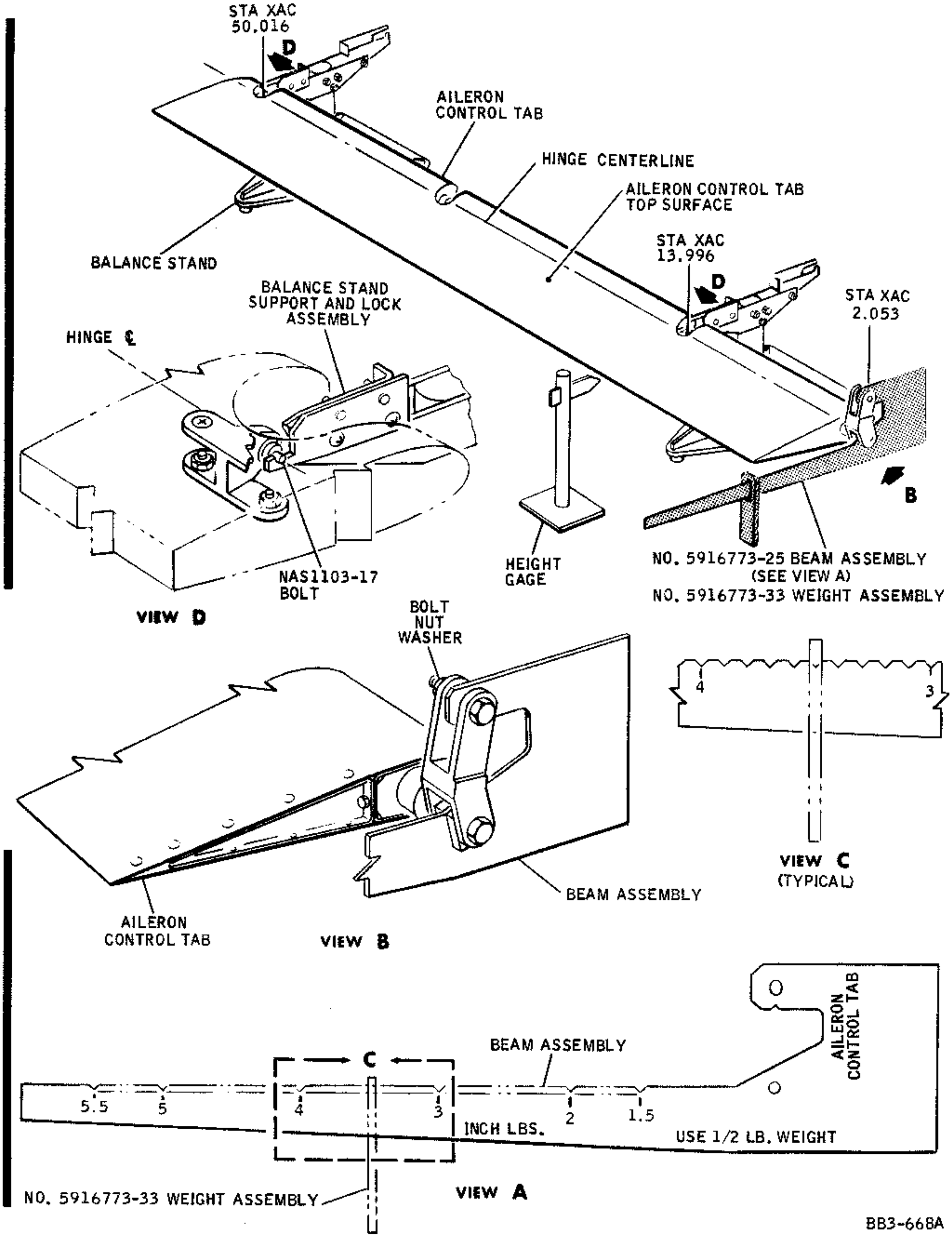
G. Deflect the control tab three or four times and ensure that it returns to the horizontal position without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

H. When the control tab is in a horizontal attitude, read the balance indication on the beam assembly.

I. If the balance indication is not within limits (see Figure 13), make the necessary changes to the quantity of adjustment weights as shown in Figure 17. Exercise care in adding weights so as not to exceed maximum weight limit.

NOTE: See Figure 14 for adjustment weight numbers, weight, and contribution.

J. Repeat paragraphs C thru I until balance indication is correct.



Aileron Control Tab Balancing Using Calibrated Beam Method
Figure 16

Existing Balance Condition (Weight Beam Reading Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pounds moment. See Figures 12 thru 14. Quantity Weights/Approximate New Balance Condition (Inch-Pounds)								
1.9							+6/2.5	+7/2.6	+8/2.7	+9/2.8
2.0						+5/2.5	+6/2.6	+7/2.7	+8/2.8	+9/2.9
2.1					+4/2.5	+5/2.6	+6/2.7	+7/2.8	+8/2.9	+9/3.0
2.2				+3/2.5	+4/2.6	+5/2.7	+6/2.8	+7/2.9	+8/3.0	+9/3.1
2.3			+2/2.5	+3/2.6	+4/2.7	+5/2.8	+6/2.9	+7/3.0	+8/3.1	+9/3.2
2.4		+1/2.5	+2/2.6	+3/2.7	+4/2.8	+5/2.9	+6/3.0	+7/3.1	+8/3.2	+9/3.3
2.5	WITHIN BALANCE LIMITS	+1/2.6	+2/2.7	+3/2.8	+4/2.9	+5/3.0	+6/3.1	+7/3.2	+8/3.3	+9/3.4
2.6		+1/2.7	+2/2.8	+3/2.9	+4/3.0	+5/3.1	+6/3.2	+7/3.3	+8/3.4	+9/3.5
2.6		-1/2.5								
2.7		+1/2.8	+2/2.9	+3/3.0	+4/3.1	+5/3.2	+6/3.3	+7/3.4	+8/3.5	+9/3.6
2.7		-1/2.6	-2/2.5							
2.8		+1/2.9	+2/3.0	+3/3.1	+4/3.2	+5/3.3	+6/3.4	+7/3.5	+8/3.6	+9/3.7
2.8		-1/2.7	-2/2.6	-3/2.5						
2.9		+1/3.0	+2/3.1	+3/3.2	+4/3.3	+5/3.4	+6/3.5	+7/3.6	+8/3.7	+9/3.8
2.9		-1/2.8	-2/2.7	-3/2.6	-4/2.5					
3.0		+1/3.1	+2/3.2	+3/3.3	+4/3.4	+5/3.5	+6/3.6	+7/3.7	+8/3.8	+9/3.9
3.0		-1/2.9	-2/2.8	-3/2.7	-4/2.6	-5/2.5				
3.1		+1/3.2	+2/3.3	+3/3.4	+4/3.5	+5/3.6	+6/3.7	+7/3.8	+8/3.9	+9/4.0
3.1		-1/3.0	-2/2.9	-3/2.8	-4/2.7	-5/2.6	-6/2.5			
3.2		+1/3.3	+2/3.4	+3/3.5	+4/3.6	+5/3.7	+6/3.8	+7/3.9	+8/4.0	
3.2		-1/3.1	-2/3.0	-3/2.9	-4/2.8	-5/2.7	-6/2.6	-7/2.5		

Aileron Control Tab Balance Condition and
Adjustment Weight Change Required
Figure 17 (Sheet 1)

Existing Balance Condition (Weight Beam Reading Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 9.90 pounds) and balance limits (2.5 to 4.5 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pounds moment. See Figures 12 thru 14. Quantity Weights/Approximate New Balance Condition (Inch-Pounds)								
3.3	WITHIN BALANCE LIMITS	+1/3.4	+2/3.5	+3/3.6	+4/3.7	+5/3.8	+6/3.9	+7/4.0		
3.3		-1/3.2	-2/3.1	-3/3.0	-4/2.9	-5/2.8	-6/2.7	-7/2.6	-8/2.5	
3.4		+1/3.5	+2/3.6	+3/3.7	+4/3.8	+5/3.9	+6/4.0			
3.4		-1/3.3	-2/3.2	-3/3.1	-4/3.0	-5/2.9	-6/2.8	-7/2.7	-8/2.6	-9/2.5
3.5		+1/3.6	+2/3.7	+3/3.8	+4/3.9	+5/4.0				
3.5		-1/3.4	-2/3.3	-3/3.2	-4/3.1	-5/3.0	-6/2.9	-7/2.8	-8/2.7	-9/2.6
3.6		+1/3.7	+2/3.8	+3/3.9	+4/4.0					
3.6		-1/3.5	-2/3.4	-3/3.3	-4/3.2	-5/3.1	-6/3.0	-7/2.9	-8/2.8	-9/2.7
3.7		+1/3.8	+2/3.9	+3/4.0						
3.7		-1/3.6	-2/3.5	-3/3.4	-4/3.3	-5/3.2	-6/3.1	-7/3.0	-8/2.9	-9/2.8
3.8		+1/3.9	+2/4.0							
3.8		-1/3.7	-2/3.6	-3/3.5	-4/3.4	-5/3.3	-6/3.2	-7/3.1	-8/3.0	-9/2.9
3.9		+1/4.0								
3.9		-1/3.8	-2/3.7	-3/3.6	-4/3.5	-5/3.4	-6/3.3	-7/3.2	-8/3.1	-9/3.0
4.0		-	-	-	-	-	-	-	-	-
4.0		-1/3.9	-2/3.8	-3/3.7	-4/3.6	-5/3.5	-6/3.4	-7/3.3	-8/3.2	-9/3.1
4.1		-1/4.0	-2/3.9	-3/3.8	-4/3.7	-5/3.6	-6/3.5	-7/3.4	-8/3.3	-9/3.2
4.2			-2/4.0	-3/3.9	-4/3.8	-5/3.7	-6/3.6	-7/3.5	-8/3.4	-9/3.3
4.3				-3/4.0	-4/3.9	-5/3.8	-6/3.7	-7/3.6	-8/3.5	-9/3.4
4.4					-4/4.0	-5/3.9	-6/3.8	-7/3.7	-8/3.6	-9/3.5
4.5						-5/4.0	-6/3.9	-7/3.8	-8/3.7	-9/3.6

Aileron Control Tab Balance Condition and
Adjustment Weight Change Required
Figure 17 (Sheet 2)

K. Engrave the balance condition on the weight and balance tag and enter the condition on any other records required.

L. Weigh the control tab as outlined in paragraph 19, engrave the weight condition (to the nearest hundredth pound) on the weight and balance tag, and enter the condition on any other records required.

13. Check Aileron Control Tab Balance Using Checkweight Method

A. Ensure that control tab is in required condition for balancing (see paragraph 9).

B. Install NAS 1103-17 bolts (hinge pins) through the eyebolt bearings at stations XAC 13.9 and XAC 50.0 (see Figure 18). Lightly oil each bolt.

C. Mount the surface on balance stands (see Figures 1 and 18). Suspend the surface by resting the NAS 1103-17 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Measure the distance from the floor, or table (baseline), to the centerline of the bolts (hinge pins) installed through the eyebolt bearings at stations XAC 13.9 and XAC 50.0.

NOTE: An inspection-type height gage, as shown in Figure 18 is recommended for measurement so that it can easily be moved to the trailing edge and provide a visual reference.

E. Loosen any nosecap attach screw.

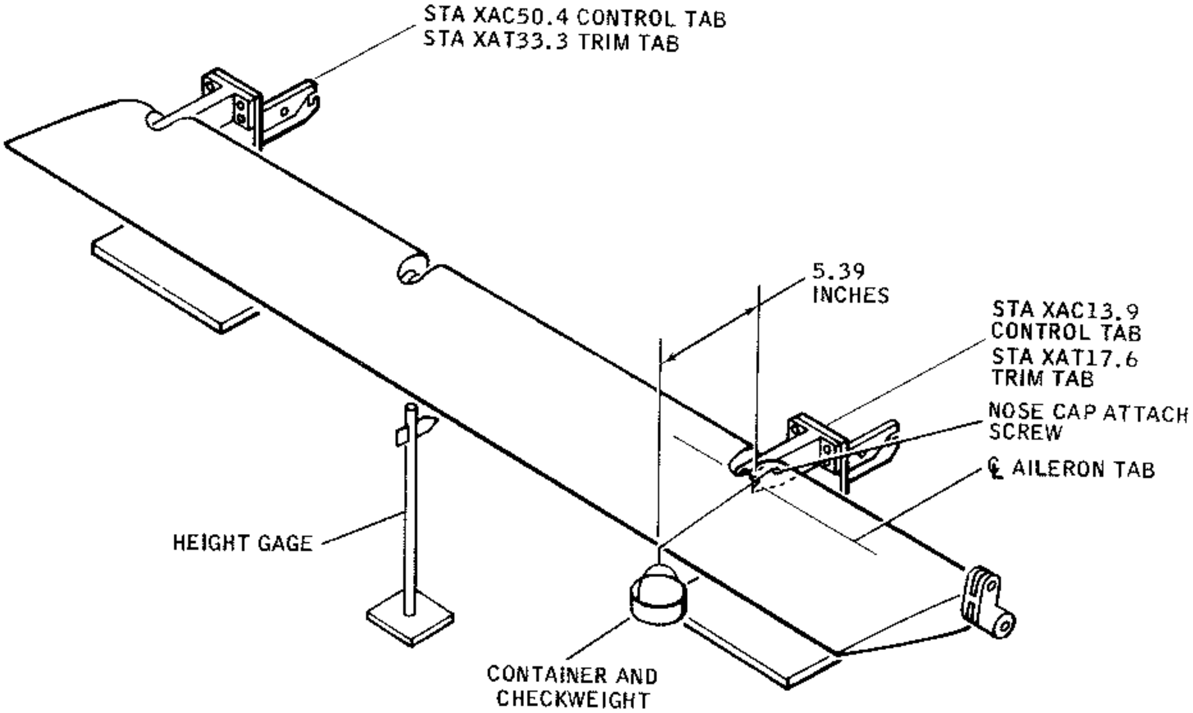
F. Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.

G. Attach one end of the cord to the nosecap attach screw and the other end to a container (see Figure 18).

H. Suspend container over the trailing edge in location directly aft of the nosecap attach screw. Ensure that container does not contact surface or any other object.

I. Add variable checkweights to the container until the control tab assumes a horizontal attitude.

NOTE: The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor, or table (baseline), as the centerline of the mount bolts (hinge pins) within a tolerance of ±0.10 inch. The moment arm at the trailing edge is 5.39 inches from the control tab hinge axis.



Aileron Tab Balancing Using Checkweight Method
Figure 18

J. Deflect the control tab three or four times and ensure that it returns to the horizontal attitude without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

K. When the surface is in a horizontal attitude, weigh (to the nearest hundredth pound) the variable checkweights (including container or other suspension device) that are suspended over the trailing edge.

L. Compare the weight value (obtained in paragraph K, above) with the weight values shown in Figure 19.

M. If the balance condition is not within limits (see Figure 13), make the necessary changes to the quantity of adjustment weights as shown in Figure 19. Exercise care in adding weights so as not to exceed maximum weight limit.

N. Repeat paragraphs D thru M until balance condition is correct.

O. Engrave balance condition on weight and balance tag and enter the condition on any other records required.

P. Weigh the control tab as outlined in paragraph 19 engrave the weight condition (to the nearest hundredth pound) on the weight and balance tag and enter the weight on any other records required.

14. Check Condition of Aileron Trim Tab for Weight and Balance Check

A. Ensure that aileron trim tab is structurally complete. All painting and rework must be accomplished.

B. Ensure that the No. 4914999 eyebolt at station XAT 33.3 is not installed.

C. Ensure that surface is free of dirt and foreign matter.

15. Aileron Control Tab Weight and Balance Limits

A. Figure 20 shows aileron trim tab weight limits:

Minimum Weight (Pounds)	Maximum Weight (Pounds)
None	6.35

Aileron Trim Tab Weight Limits
Figure 20

B. Figure 21 shows aileron trim tab balance limits:

Minimum Balance Limit (Inch-Pounds, Nose-Heavy)	Maximum Balance Limit (Inch-Pounds, Nose-Heavy)
0.5	2.00

Aileron Trim Tab Balance Limits
Figure 21

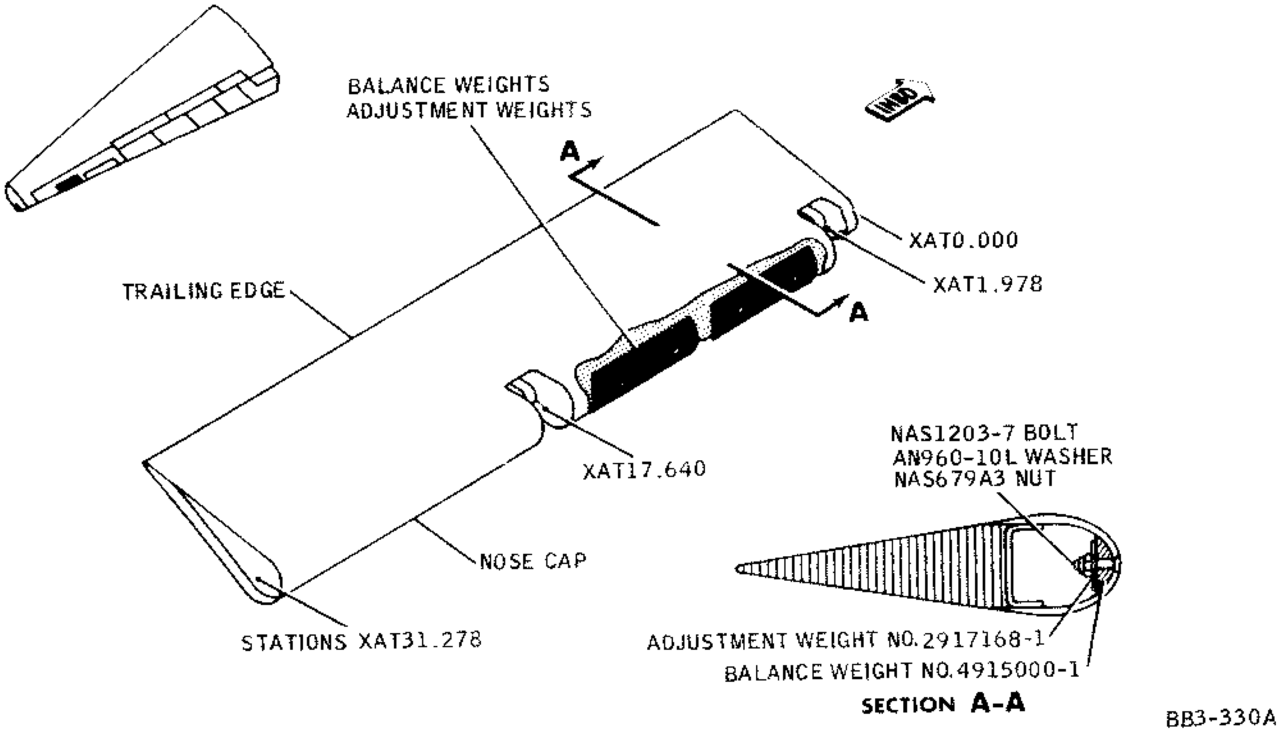
16. Aileron Trim Tab Adjustment Weights

A. Aileron trim tab adjustment weight number, weight, and moment contribution is shown in Figure 22:

Adjustment Weight No.	Weight (Each) (Pounds)	Moment Contribution (Each) (Pounds)
2917168	0.04	0.1

Aileron Trim Tab Adjustment Weight
Moment Contribution
Figure 22

B. Aileron trim tab adjustment weight location and attachment is shown in Figure 23.



Aileron Trim Tab Weight Location and Attachment
Figure 23

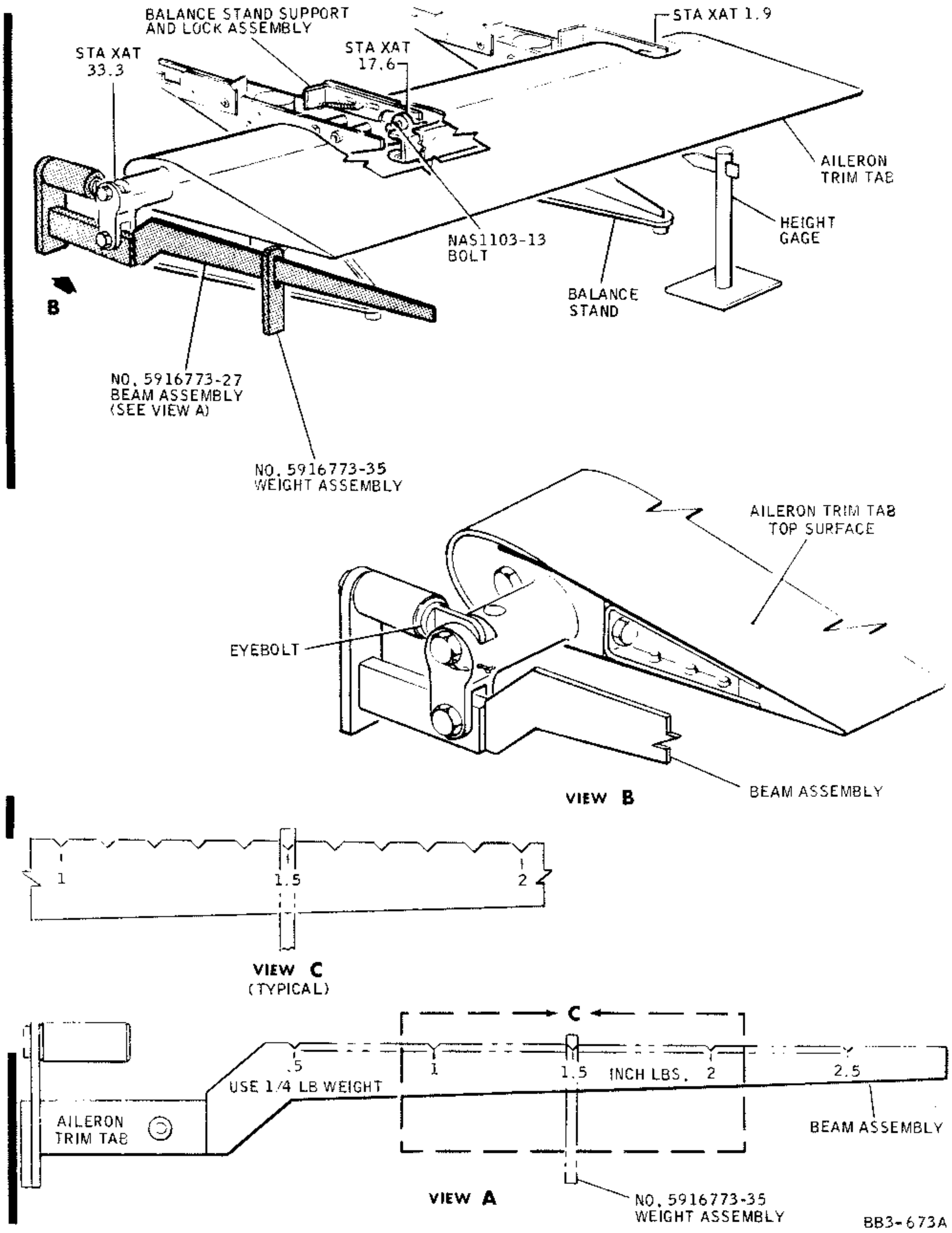
17. <u>Check Aileron Trim Tab Balance Condition Using Calibrated Beam Method</u>

A. Ensure that the trim tab is in required condition for balancing (see paragraph 14).

B. Install NAS 1103-13 bolts (hinge pins) through the eyebolt bearings at stations XAT 1.9 and XAT 17.6 (see Figure 24). Lightly oil each bolt.

C. Mount the surface on balance stands (see Figures 1 and 24). Suspend the surface by resting the NAS 1103-13 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Mount the No. 5916773-27 beam assembly and the No. 5916773-35 weight assembly on the trim tab as shown in Figure 24.



Aileron Trim Tab Balancing Using
Calibrated Beam Method
Figure 24

Existing Balance Condition (Weight Beam Reading Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limit (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pounds moment. See Figures 20 thru 22. Quantity Weights/Approximate New Balance Condition (Inch-Pounds)								
1.4	↑ WITHIN BALANCE LIMITS ↓	+1/1.5	+2/1.6	+3/1.7	+4/1.8	+5/1.9	+6/2.0			
1.4		-1/1.3	-2/1.2	-3/1.1	-4/1.0	-5/0.9	-6/0.8	-7/0.7	-8/0.6	-9/0.5
1.5		+1/1.6	+2/1.7	+3/1.8	+4/1.9	+5/2.0				
1.5		-1/1.4	-2/1.3	-3/1.2	-4/1.1	-5/1.0	-6/0.9	-7/0.8	-8/0.7	-9/0.6
1.6		+1/1.7	+2/1.8	+3/1.9	+4/2.0					
1.6		-1/1.5	-2/1.4	-3/1.3	-4/1.2	-5/1.1	-6/1.0	-7/0.9	-8/0.8	-9/0.7
1.7		+1/1.8	+2/1.9	+3/2.0						
1.7		-1/1.6	-2/1.5	-3/1.4	-4/1.3	-5/1.2	-6/1.1	-7/1.0	-8/0.9	-9/0.8
1.8		+1/1.9	+2/2.0							
1.8		-1/1.7	-2/1.6	-3/1.5	-4/1.4	-5/1.3	-6/1.2	-7/1.1	-8/1.0	-9/0.9
1.9		+1/2.0								
1.9		-1/1.8	-2/1.7	-3/1.6	-4/1.5	-5/1.4	-6/1.3	-7/1.2	-8/1.1	-9/1.0
2.0		-	-	-	-	-	-	-	-	-
2.0		-1/1.9	-2/1.8	-3/1.7	-4/1.6	-5/1.5	-6/1.4	-7/1.3	-8/1.2	-9/1.1
2.1		-1/2.0	-2/1.9	-3/1.8	-4/1.7	-5/1.6	-6/1.5	-7/1.4	-8/1.3	-9/1.2
2.2			-2/2.0	-3/1.9	-4/1.8	-5/1.7	-6/1.6	-7/1.5	-8/1.4	-9/1.3
2.3				-3/2.0	-4/1.9	-5/1.8	-6/1.7	-7/1.6	-8/1.5	-9/1.4
2.4					-4/2.0	-5/1.9	-6/1.8	-7/1.7	-8/1.6	-9/1.5
2.5						-5/2.0	-6/1.9	-7/1.8	-8/1.7	-9/1.6
2.6							-6/2.0	-7/1.9	-8/1.8	-9/1.7
2.7								-7/2.0	-8/1.9	-9/1.8
2.8									-8/2.0	-9/1.9
2.9										-9/2.0

Aileron Trim Tab Balance Condition and
Adjustment Weight Change Required
Figure 25 (Sheet 2)

C. Mount the surface on balance stands (see Figures 1 and 18). Suspend the surface by resting the NAS 1103-13 bolts across the knife edges of the stand mounting arms. Position the surface so that it is free to rotate about its hinge axis.

D. Measure the distance from the floor, or table (baseline), to the centerline of the bolts (hinge pins) installed through the eyebolt bearings at stations XAT 1.9 and XAT 17.6.

NOTE: An inspection-type height gage, as shown in Figure 18 is recommended so that it can easily be moved to the trailing edge and provide a visual reference.

E. Loosen any nosecap attach screw.

F. Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.

G. Attach one end of the cord to the nosecap attach screw and the other end to a container (see Figure 18).

H. Suspend container over the trailing edge in location directly aft of the nosecap attach screw. Ensure that container does not contact surface or any other object.

I. Add variable checkweights to the container until the trim tab assumes a horizontal attitude.

NOTE: The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor, or table (baseline), as the centerline of the mount points (hinge pins) within a tolerance of ±0.10 inch.

J. Deflect the trim tab three or four times and ensure that it returns to the horizontal position without sticking or binding. If the surface is not rotating freely, check the points of rotation and correct as necessary.

K. When the surface is in a horizontal attitude, weigh (to the nearest hundredth pound) the variable checkweights (including container) that are suspended over the trailing edge.

L. Compare the weight values (obtained in paragraph K, above) with the weight values shown in Figure 26.

M. If the balance indication is not within limits (see Figure 21), make the necessary changes to the quantity of adjustment weights as shown in Figure 26. Exercise care in adding weights so as not to exceed maximum weight limits.

N. Repeat paragraphs C thru M until balance condition is correct.

O. Engrave balance condition on weight and balance tag and on any other records required.

P. Weigh the trim tab as outlined in paragraph 19, engrave the weight condition (to the nearest hundredth pound) on the weight and balance tag, and enter the condition on any other records required.

19. Aileron Tab Weight Determination

A. Ensure that weight scale (see Figure 1) is in properly calibrated condition and in good working order.

B. With no load on the scale, ensure that the weight indicating mechanism reads zero weight. Adjust as required.

C. Carefully place the tab on the scale.

CAUTION: EXERCISE EXTREME CARE TO AVOID DAMAGE TO THE TAB.

D. Read the exact weight (to the nearest hundredth pound).

E. Engrave the exact weight (to the nearest hundredth pound) on the weight and balance tag and enter information on any other records required.

20. Repair of Aileron Weight Installation (See Figure 27.)

A. The aileron weight installation may be repaired by replacing the existing 2024-T42 door, located on bottom surface of aileron nosecap between stations XA 390 and XA 394, with a No. 3924628-7 steel door (see Figure 27) and installing No. 3924628-3 and -5 repair weights on the steel door.

NOTE: Parts may be obtained from the Douglas Aircraft Co., Inc., 3855 Lakewood Blvd., Long Beach, Calif.

B. Repair as follows and as shown in Figure 27.

(1) Remove existing 2024-T42 door and retain for use as template in drilling repair door attach holes and drain hole.

(2) Drill attach holes, weight attach holes, and drain holes in repair door. Maintain dimensions shown in Figure 27.

(3) Install No. 3924628-3 repair weight on repair door as shown in Figure 27. Bond weight to door using PR-1422 sealant (see 51-20-0).

(4) Install No. 3924628-5 repair weights as required to maintain desired balance condition. Tighten attaching parts.

(5) Install assembly on aileron nosecap.

(6) Note recorded balance condition of aileron and calculate new balance condition by adding the amount of moment contribution added by the repair door, weights, and attachments to the recorded balance condition. The sum is the new balance condition.

NOTE: Weight values and moment contribution are shown in Figure 27. The moment arm is 6.4 inches from the aileron hinge axis.

21. Balance Aileron by Calculation Method

A. Calculation Method for Aileron to be Repaired

CAUTION: THE FOLLOWING PROCEDURE CHANGES BALANCE CONDITION OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN ITS BALANCE LIMITS, AND THE BALANCE CONDITION AFTER REPAIR MUST BE PERMANENTLY RECORDED ON WEIGHT AND BALANCE TAG AND ENTERED ON ANY OTHER RECORDS REQUIRED.

(1) Weigh removed damaged material to nearest 0.01 pound.

(2) Weigh repair material to be added to the nearest 0.01 pound.

(3) Subtract the removed material weight from the repair material weight. The remainder is the net weight change.

Example 1:

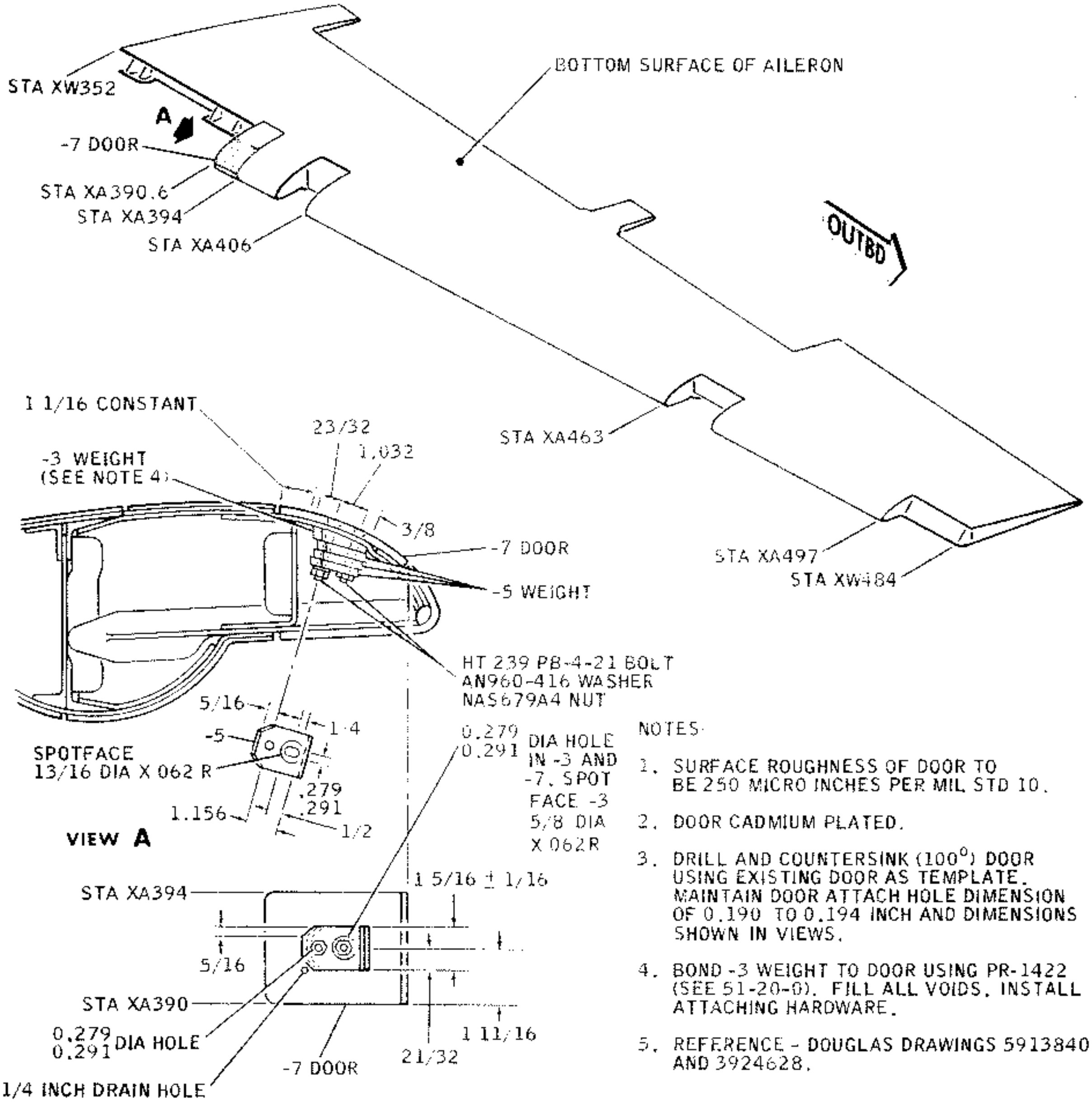
Weight of removed damaged material	0.10 pound
Weight of repair material	0.20 pound
Net weight change (0.20 - 0.10)	0.10 pound

Example 2:

Weight of removed damaged material	0.10 pound
Weight of repair material	0.40 pound
Net weight change (0.40 - 0.10)	0.30 pound

(4) Measure the distance in inches (to the nearest hundredth inch) from the hinge centerline of the repair (see Figure 28).

NOTE: The example given in Figure 28 shows repair aft of the hinge line. If repair is forward of hinge line, measure distance forward of hinge line to center of repair.



NOTES:

1. SURFACE ROUGHNESS OF DOOR TO BE 250 MICRO INCHES PER MIL STD 10.
2. DOOR CADMIUM PLATED.
3. DRILL AND COUNTERSINK (100°) DOOR USING EXISTING DOOR AS TEMPLATE. MAINTAIN DOOR ATTACH HOLE DIMENSION OF 0.190 TO 0.194 INCH AND DIMENSIONS SHOWN IN VIEWS.
4. BOND -3 WEIGHT TO DOOR USING PR-1422 (SEE 51-20-0). FILL ALL VOIDS. INSTALL ATTACHING HARDWARE.
5. REFERENCE - DOUGLAS DRAWINGS 5913840, AND 3924628.

NAME	MATERIAL	WEIGHT (LB)	MOMENT CONTRIBUTION (INCH-POUNDS)
3924628-3 WEIGHT	BAR, TUNGSTEN, HIGH DENSITY 2	1.1±0.10	7.0
3924628-5 WEIGHT	BAR, TUNGSTEN, HIGH DENSITY 2	0.34±0.05	2.2(EACH)
3924628-7 DOOR	0.090 INCH LOW CARBON STEEL	0.24(INCREASE)	1.5
ATTACHING HARDWARE		0.03	0.2

BB3-873A

Aileron Weight Installation Repair
Figure 27

(5) Multiply this dimension by the net weight change obtained in step (3). This product is the amount of moment added by repair. See examples:

Example 3:

Net weight change from step (3), Example 1 =	0.10 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (added moment) (0.10 lb x 10 in.)	1 inch-pound

Example 4:

Net weight change from step (3), Example 2 =	0.30 pound
Distance from hinge centerline to centerline of repair	10 inches
Product (added moment) (0.30 lb x 10 in.)	3 inch-pounds

NOTE: If the repair is aft of the hinge line, the moment added is to the trailing edge. If the repair is forward of the hinge line, the moment added is to the nose-heavy condition.

(6) Note the recorded balance condition on the weight and balance tag. If the surface is the control or trim tab, also note the recorded weight condition on the weight and balance tag.

(7) If the repair is aft of the hinge centerline, subtract the trailing edge heavy moment added by the repair from the recorded balance condition. The remainder indicates nose-heavy balance condition of the surface.

Example 5:

Recorded balance condition	255 inch-pounds
Trailing edge-heavy moment added by repair (Example 3)	1 inch-pounds
Remainder (nose-heavy balance condition)	254 inch-pounds

Example 6:

Recorded balance condition	252 inch-pounds
Trailing edge-heavy moment added by repair (Example 4)	3 inch-pounds
Remainder (nose-heavy balance condition)	249 inch-pounds

(a) If the remainder is within the aileron balance limits of 250 inch-pounds to 260 inch-pounds nose-heavy (see paragraph 5), no further balance action is required. Engrave the balance condition on the weight and balance tag.

(b) If the remainder is less than the minimum aileron balance limit of 250 inch-pounds (Example 6), balance moment (weight) must be added to nosecap.

Example 7:

Minimum aileron balance limit	250 inch-pounds
Nose-heavy balance condition after repair (Example 6)	249 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	1 inch-pound

<u>NOTE</u>: The minimum amount should always be increased by 10 percent to provide a working margin.

(c) If balance moment must be added, select sufficient number of repair weights (see paragraph 20) and add to aileron repair door (paragraph 20).

Example 8: Assuming the condition shown in Example 7, the addition of one No. 3924628-5 repair weight to repair door will provide 2.18 inch-pounds of moment to nose-heavy balance condition. The 2.18 inch-pounds provides sufficient balance moment to counteract the trailing edge-heavy moment added by repair and is within the 10 percent factor. Engrave the balance condition on the weight and balance tag.

(8) If the repair is forward of the hinge centerline, add the nose-heavy moment added by the repair to the recorded balance condition. The sum indicates nose-heavy balance condition of surface.

Example 9:

Recorded balance condition	255 inch-pounds
Nose-heavy moment added by repair (Example 3)	1 inch-pound
Sum (nose-heavy balance condition)	256 inch-pounds

Example 10:

Recorded balance condition	255 inch-pounds
Nose-heavy moment added by repair (Example 4)	3 inch-pounds
Sum (nose-heavy balance condition)	258 inch-pounds

(a) If the sum is within the aileron balance limits of 250 inch-pounds to 260 inch-pounds nose-heavy, no further balance action is required. Engrave the balance condition on the weight and balance tag.

(b) If the sum is more than the maximum aileron balance limit of 260 inch-pounds nose-heavy, balance moment must be removed from the nosecap.

Example 11:

Maximum aileron balance limit	260.0 inch-pounds
Nose-heavy balance condition after repair	261.5 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	1.5 inch-pounds

NOTE: The maximum amount should always be increased by a factor of 10 percent so as to provide a working margin.

(c) If balance moment must be removed, select sufficient number of repair weights (see paragraph 20) and remove from repair door (paragraph 20).

Example 12: Assuming the condition shown in Example 11, removing one No. 3924628-5 repair weight from repair door will provide 2.18 inch-pounds of moment. Removing the 2.18 inch-pounds of moment is sufficient to counteract the excessive nose-heavy moment added by repair and is within the 10 percent factor. Engrave the balance condition on the weight and balance tag.

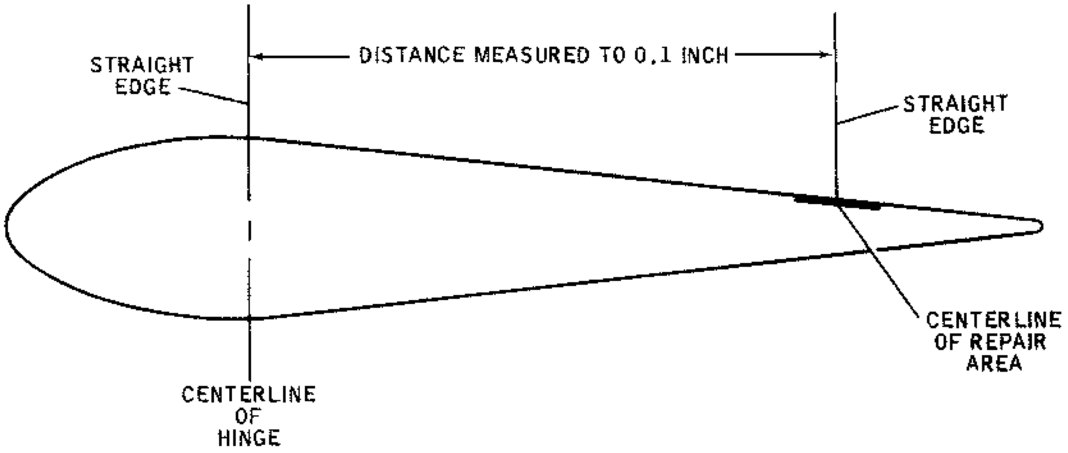
B. Calculation Method for Aileron to be Repainted

CAUTION: THE FOLLOWING PROCEDURES CHANGE THE BALANCE CONDITION AND WEIGHT OF SURFACE. THE SURFACE MUST BE MAINTAINED WITHIN THE BALANCE LIMITS, AND MAXIMUM ALLOWABLE WEIGHT, IF THE SURFACE IS A TAB. THE BALANCE CONDITION AND WEIGHT, IF THE SURFACE IS A TAB, MUST BE PERMANENTLY RECORDED ON THE WEIGHT AND BALANCE TAG AND ENTERED ON ANY OTHER RECORDS REQUIRED.

(1) Determine location (forward or aft of hinge centerline) or area to be repainted and distance from hinge centerline to center of area (see Figure 28).

(2) Determine size of area (in square feet) to be repainted.

NOTE: The total surface area (both sides) of the aileron, exclusive of tabs, is 53.1 square feet. Of the 53.1 square feet, 37.9 square feet are aft of the hinge centerline and 15.2 square feet are forward of the hinge centerline.



TYPICAL MAIN CONTROL SURFACE

BB3-718

Determining Distance From Hinge Centerline to Repair Centerline
Figure 28

(3) Multiply the area (square feet) by 0.015 pound/square foot for each cross coat of primer or top coat applied. The product is the amount of weight added.

Example 13:

Area to be repainted	5 square feet
1 coat primer and 1 top coat to be painted over area (0.015 X 2)	<u>0.03</u> pound/square foot
Product (Weight added by repainting)	0.15 pound

(4) Multiply the weight added by repainting by the distance from the hinge centerline to the center of the repainted area. The product is the amount of the moment added.

Example 14:

Weight added by repainting (Example 13)	0.15 pound
Distance from hinge centerline to centerline of repainted area	10 inches
Product (weight added by repainting)	1.5 inch-pounds

NOTE: If the repainting is aft of the hinge centerline, the moment added is to the trailing edge. If the repainting is forward of the hinge centerline, the moment added is nose-heavy.

(5) Note the recorded balance condition on the weight and balance tag.

(6) If the repainting is aft of the hinge centerline, subtract the trailing edge moment added by repainting from the recorded balance condition. The remainder indicates nose-heavy balance condition of the surface.

Example 15:

Recorded balance condition	255 inch-pounds
Trailing edge moment added by repainting (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	253.5 inch-pounds

Example 16:

Recorded balance condition	250.5 inch-pounds
Trailing edge moment added by repainting (Example 14)	1.5 inch-pounds
Remainder (nose-heavy balance)	249.0 inch-pounds

(a) If the remainder is within the balance limits for aileron (250 to 260 inch-pounds nose-heavy), no further balance action is required. Permanently record balance condition on weight and balance tag.

(b) If the remainder is less than the minimum nose-heavy balance limit, balance moment must be added to the nosecap installation.

Example 17:

Minimum aileron balance limit	250 inch-pounds
Nose-heavy balance condition after repainting (Example 16)	249 inch-pounds
Minimum amount of balance moment to add in order to equal minimum balance limit	1 inch-pound

NOTE: The minimum amount should always be increased by a factor of 10 percent to provide a working margin. Engrave the balance condition on the weight and balance tag.

(c) If balance moment must be added, select sufficient number of repair weights (see paragraph 20) and add to repair door (paragraph 20).

Example 18: Assuming the condition shown in Example 17, adding one No. 3924628-5 repair weight to repair door will provide 2.18 inch-pounds of moment to nose-heavy balance condition. The 2.18 inch-pounds provides sufficient balance moment to counteract the trailing edge-heavy moment added by repair and is within the 10 percent factor. Engrave the balance condition on the weight and balance tag.

(7) If the repainting is forward of the hinge centerline, add the nose-heavy moment added by repainting to the recorded balance condition. The sum indicates the nose-heavy balance condition.

Example 19:

Recorded balance condition	255.0 inch-pounds
Nose-heavy moment added by repainting (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	256.5 inch-pounds

Example 20:

Recorded balance condition	259.0 inch-pounds
Nose-heavy moment added by repainting (Example 14)	1.5 inch-pounds
Sum (nose-heavy balance)	260.5 inch-pounds

(a) If the sum is within balance limits for aileron (250 to 260 inch-pounds nose-heavy), no further balance action is required. Engrave balance condition on weight and balance tag.

(b) If the sum is more than the maximum aileron balance limit (260 inch-pounds), balance moment must be removed from the nosecap.

Example 21:

Aileron maximum balance limit	260.0 inch-pounds
Nose-heavy balance condition after repainting (Example 20)	260.5 inch-pounds
Minimum amount of balance moment to remove in order to equal maximum balance limit	0.5 inch-pound

(c) If balance moment must be removed, select sufficient number of repair weight (see paragraph 20) and remove from aileron repair door (paragraph 20).

Example 22: Assuming the condition shown in Example 21, removing one No. 3924628-5 weight will subtract 2.18 inch-pounds of moment.

(d) Engrave balance condition on weight and balance tag.

3. Tools and Equipment Required

NOTE: Equivalent substitutes may be used for the items listed in paragraphs A and B. It is recommended that the method of supporting the surfaces in the balance stands be the same as in the stands listed below (hinge pins resting on knife edges) and that the hinge pins used be sufficiently undersize, and well-oiled, so as not to pick up any eyebolt bearing friction.

A. Calibrated Beam Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916761	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for aileron balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for control tab and trim tab balancing
C	Weight Assembly (9 pound)	5916761-69		Standards of known weight and balance moment for balancing aileron
D	Beam	5916761-61		Direct reading scale for balancing aileron
E	Weight Assembly (4 pound)	5916761-67		Aileron balancing with beam
F	Beam	5916773-25		Direct reading scale for balancing control tab
G	Weight Assembly (1/2 pound)	5916773-33		Aileron control tab balancing with beam
H	Beam Assembly	5916773-27		Direct reading scale for balancing trim tab

Item	Name	Number	Manufacturer	Use
I	Weight Assembly (1/4 pound)	5916773-35	Douglas Aircraft Co., Inc., Long Beach, Calif.	Aileron trim tab balancing with beam
J	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pound	Triner Scale and Manufacturing Co., Chicago, Ill.	Weigh tabs

B. Checkweight Method

Item	Name	Number	Manufacturer	Use
A	Control surface balance fixture (balance stand)	5916771	Douglas Aircraft Co., Inc., Long Beach, Calif.	Mount for aileron balancing
B	Control surface balance fixture (balance stand)	5916773		Mount for control tab and and trim tab balancing
C	Standard 12.00 pound checkweight (including container)		Local manufacturer	Standard of known weight and balance moment for balancing aileron
D	Metal container		Local supply	Suspension device to hold checkweights during balancing of tabs
E	Lead shot of various sizes			Checkweights of various values for balancing aileron and tabs
F	Sensitive Weighing Scale	0 to 100 pounds with readability to 0.01 pounds	Triner Scale and Manufacturing Co., Chicago, Ill.	Weigh checkweights and tabs

TEMPORARY REVISION 57-19

FILING INSTRUCTIONS:	Insert this Temporary Revision immediately preceding 57-50-1, Page 5. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON:	Provides new balance limits for Aileron and Aileron Tabs.
EFFECTIVITY:	ALL

4. Balance Aileron, Aileron Control Tab, and Aileron Trim Tab Using Beam and Weight

A. Check Aileron Balance

(1) Make certain that aileron is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and trim tab must not be installed.

(2) Mount aileron on balance stands (see Figure 1). Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Suspend a 9 pound weight assembly from station XAC 34.4 hinge location and a 9 pound weight from station XAC 50 hinge location (see Figure 1).

(4) Mount the beam and 4 pound weight assembly at station XAC 13.9 hinge location as shown in Figure 1.

(5) Slide the 4 pound weight along the beam until the aileron assumes a horizontal attitude.

NOTE: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

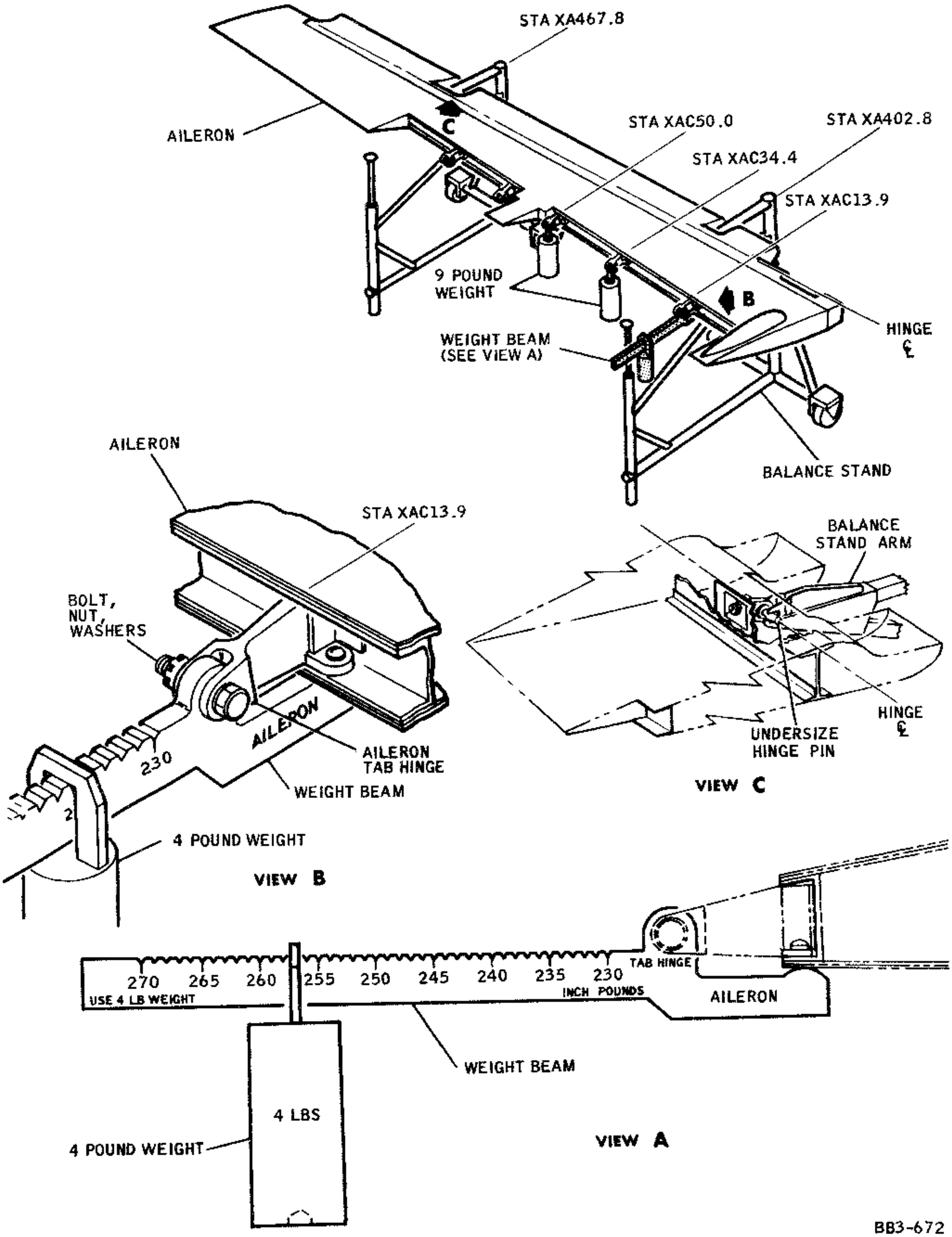
(6) Read the balance indication on the beam. Balance limits for the aileron are 255 inch-pounds minimum to 250 inch-pounds maximum nose heavy. Recommended balance is 257.5 inch-pounds nose heavy.

(7) If the balance indication is not within limits, compare the indication with the balance conditions shown in Figure 2.

(8) Add, or remove, adjustment weights as necessary. See Figures 2, 3, and 4 for location, quantity, and attachment. See Figure 5 for location of balance weights.

NOTE: A beam reading below minimum limit requires addition of adjustment weights. A beam reading above maximum limit requires removal of adjustment weights.

(9) Recheck balance condition.



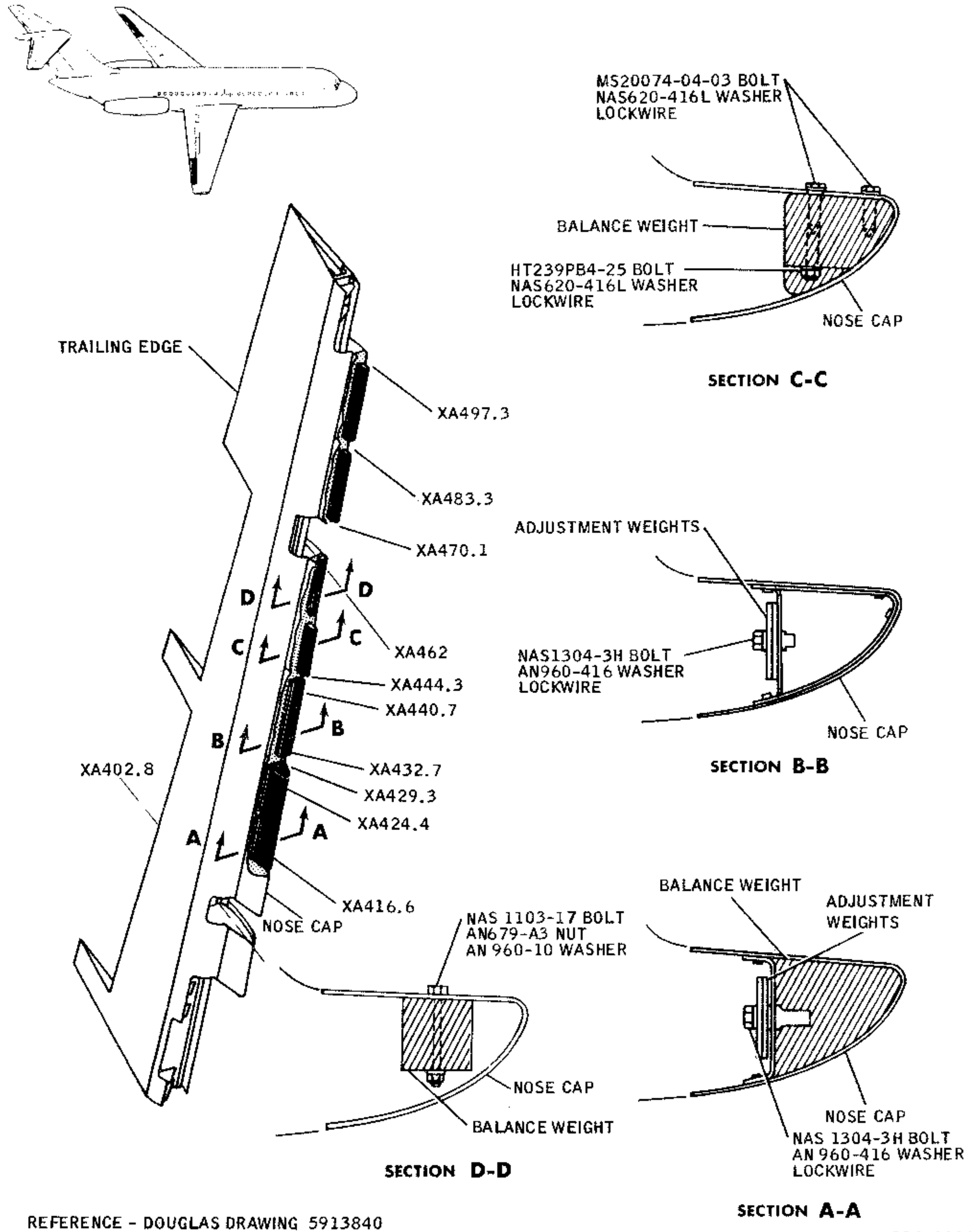
Aileron Balancing with Beam
Figure 1

Weight Beam Reading	Suggested quantity of adjustment weights to add/remove per station for indicated beam reading (see Figure 3 for adjustment weight numbers					
Inch-Pounds	Aileron Station (XA)					
	416.6	420.5	424.4	432.7	436.7	440.7
230	5	3	3	3	4	2
235	3	3	3	2	1	4
240	3	1	3	1	3	2
245	1	2	1		2	3
250	2		2		1	
250-260	WITHIN BALANCE LIMITS					
265	2	1	1		1	
270	1	2	1	2	2	1

Aileron Balance Condition and Adjustment Weight Change Required
Figure 2

Adjustment Weights number (see Figure 2 for suggested quantities)	Location (Aileron Station) XA	Moment Arm	Nose Heavy Moment (each)	Weight (each)
			Inch-Pounds	Pounds
4917170-503	416.6	5.5	1.1	0.21
-1	420.5	5.5	2.6	0.47
-503	424.4	5.4	2.0	0.21
-505	432.7	5.0	0.8	0.15
-501	436.7	5.0	1.1	0.40
-505	440.7	4.9	0.7	0.15

Aileron Adjustment Weight Numbers and Locations
Figure 3



REFERENCE - DOUGLAS DRAWING 5913840

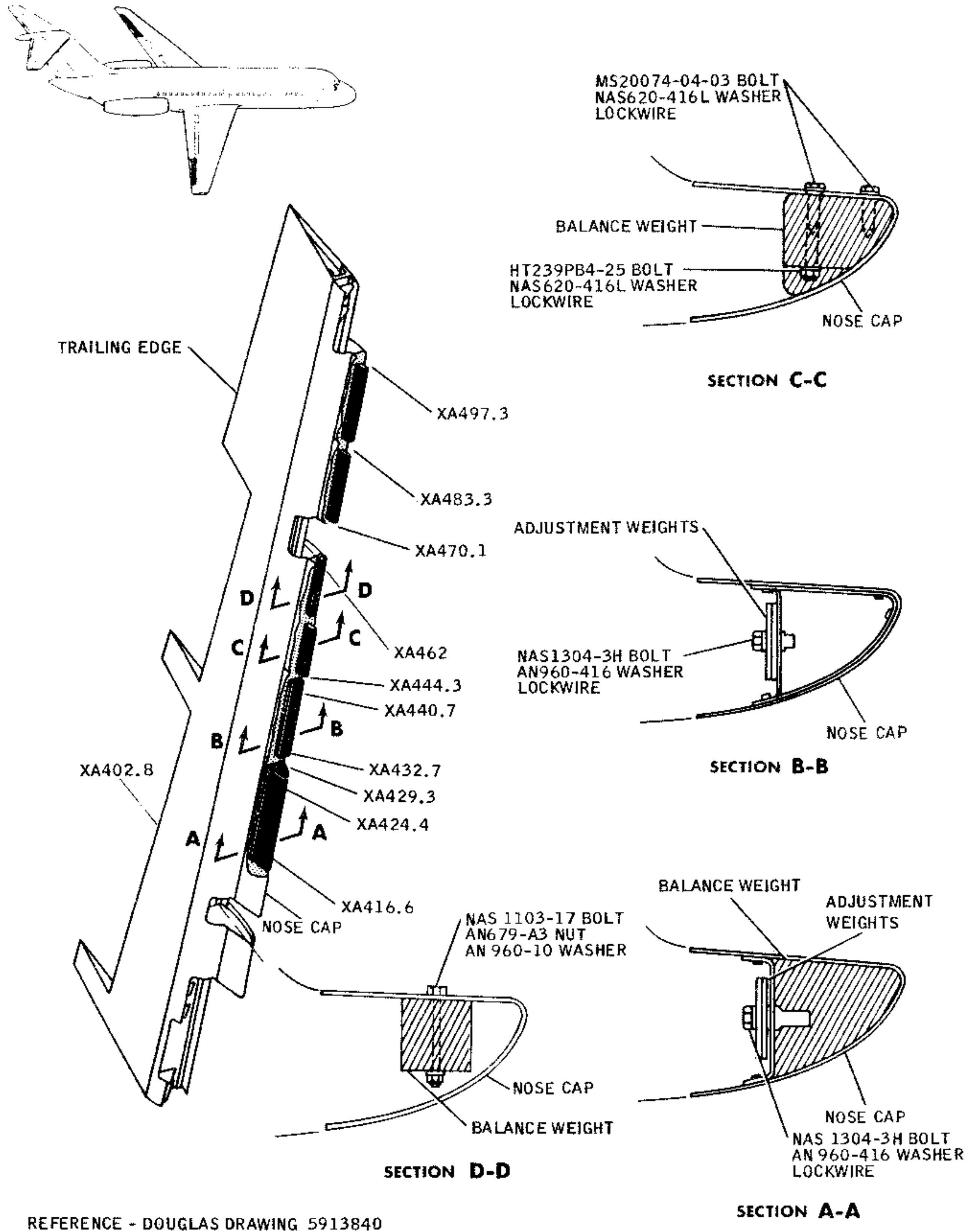
Aileron Weight Location and Attachment
Figure 4

Weight Beam Reading	Suggested quantity of adjustment weights to add/remove per station for indicated beam reading (see Figure 3 for adjustment weight numbers					
	Aileron Station (XA)					
Inch-Pounds	416.6	420.5	424.4	432.7	436.7	440.7
230	5	3	3	3	4	2
235	3	3	3	2	1	4
240	3	1	3	1	3	2
245	1	2	1		2	3
250	2		2		1	
250-260	WITHIN BALANCE LIMITS					
265	2	1	1		1	
270	1	2	1	2	2	1

Aileron Balance Condition and Adjustment Weight Change Required
Figure 2

Adjustment Weights number (see Figure 2 for suggested quantities)	Location (Aileron Station) XA	Moment Arm	Nose Heavy Moment (each)	Weight (each)
			Inch-Pounds	Pounds
4917170-503	416.6	5.5	1.1	0.21
-1	420.5	5.5	2.6	0.47
-503	424.4	5.4	2.0	0.21
-505	432.7	5.0	0.8	0.15
-501	436.7	5.0	1.1	0.40
-505	440.7	4.9	0.7	0.15

Aileron Adjustment Weight Numbers and Locations
Figure 3



REFERENCE - DOUGLAS DRAWING 5913840

BB3-328A

Aileron Weight Location and Attachment
Figure 4

Printed in U.S.A.

Number	Location	Approximate Weight
	Aileron Station (XA)	Pounds
5915182-5	411.7	24
5955891-1	455	15.90
5955891-505	470	8.39
5955891-505	485	6.73
5913840-0013	453	4

Aileron Balance Weight Locations
Figure 5

B. Check Aileron Control Tab Balance

(1) Make certain control tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over [illegible] pounds.

(2) Mount control tab on balance stands (see Figure [illegible]). Use station XA [illegible] and XA [illegible] hinge locations. Use well-oiled, undamaged hinge pins. Make certain balance stand is level.

(3) Mount the beam and 1/2 pound weight assembly on the control tab [illegible] assembly at station XA [illegible] (see Figure [illegible]).

(4) Slide the 1/2 pound weight along the beam until the control tab assumes a horizontal attitude.

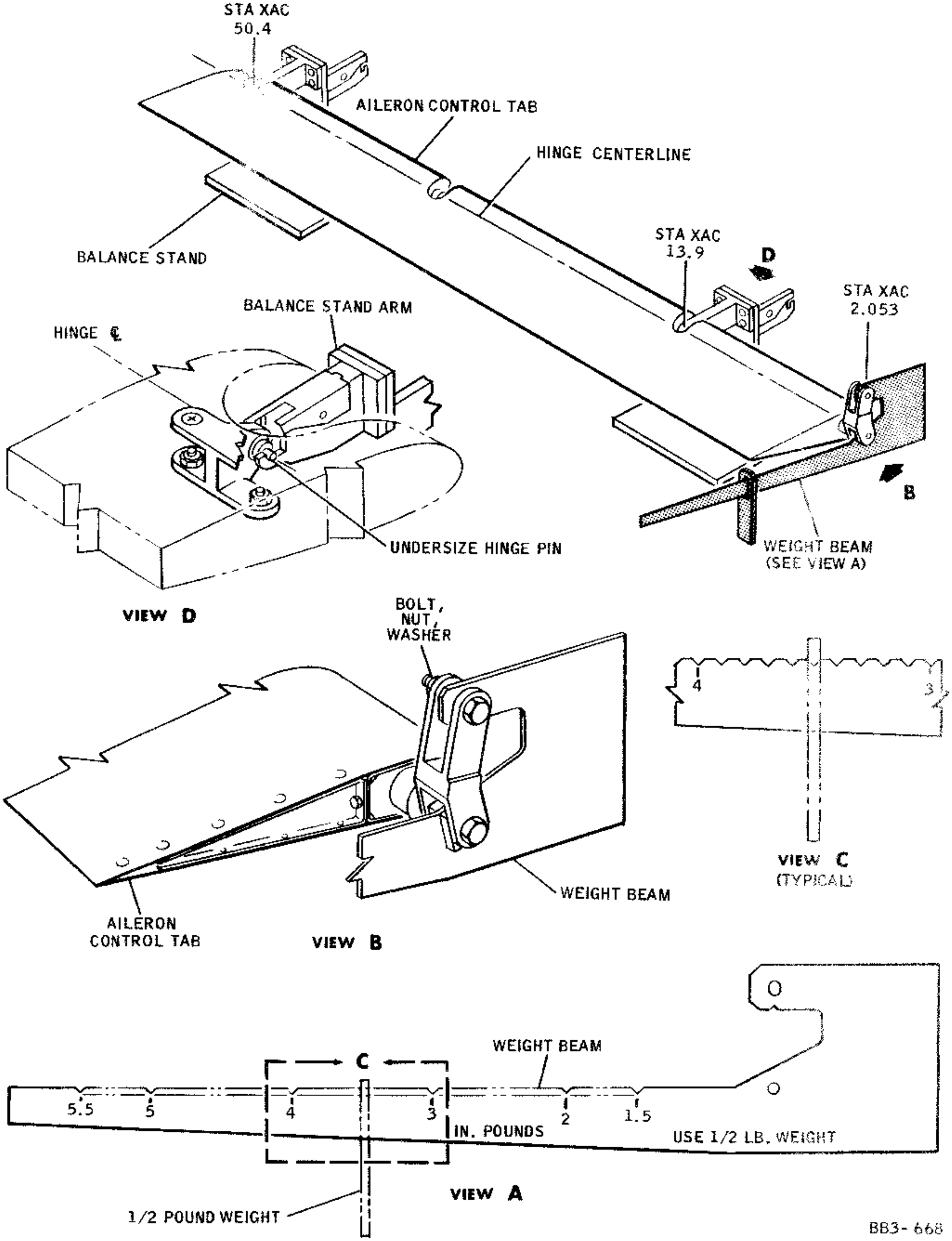
NOTE: The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (same line) as the centerline of the hinge points.

(5) Read the balance indication on the beam. Balance limits for the control tab are 2.5 inch-pounds minimum to 4 inch-pounds maximum nose heavy.

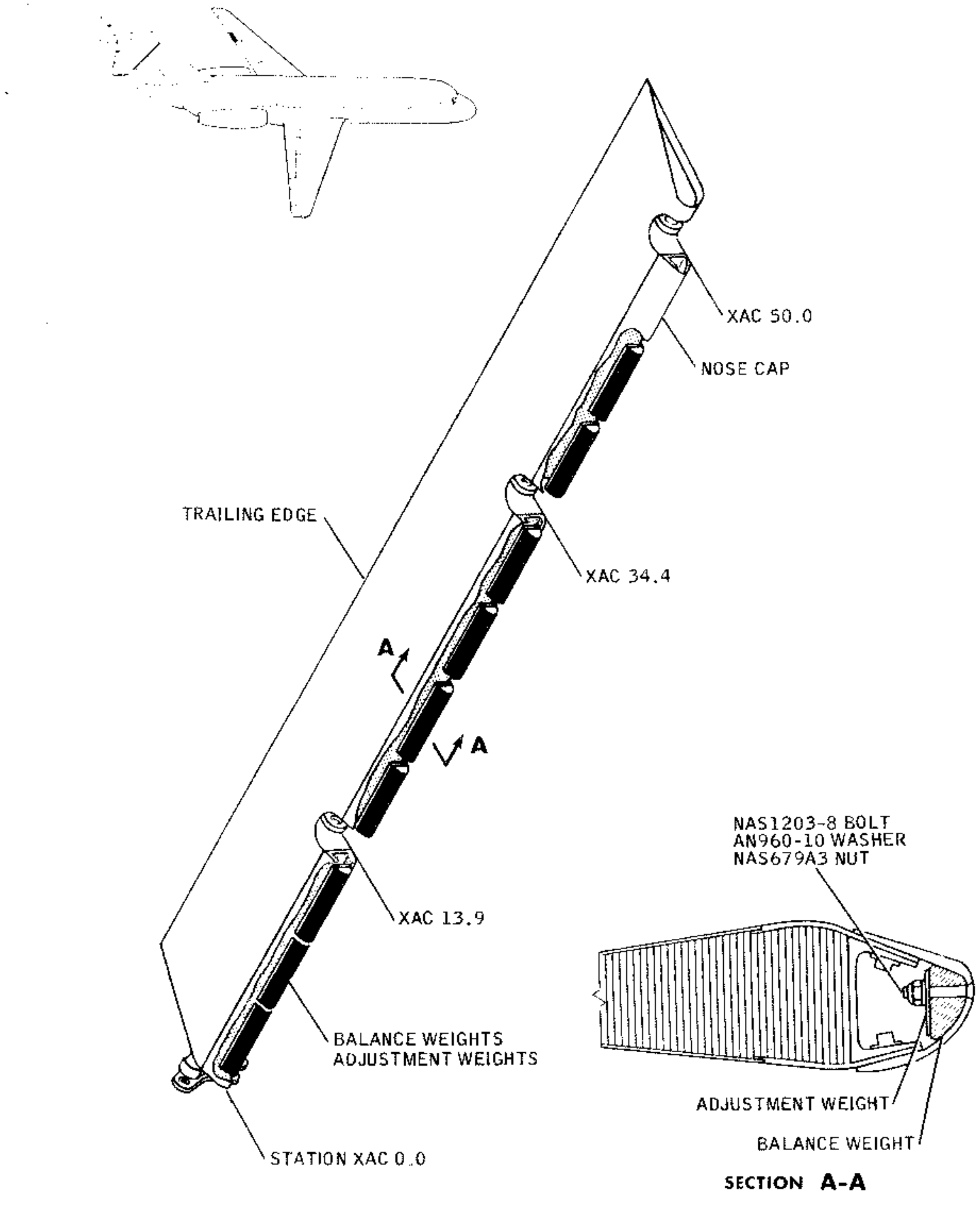
(6) If the balance indication is not within limits, add, or remove, adjustment weights as necessary. See Figure [illegible] for location and attachment and Figure 8 for adjustment weight number and contribution.

NOTE: A beam reading above balance limits requires removal of adjustment weights and a beam reading below balance limits requires addition of adjustment weights.

(7) Recheck balance condition.



Aileron Control Tab Balancing with Beam
Figure 6



REFERENCE - DOUGLAS DRAWING 5910047

BB3-329

Aileron Control Tab Weight Location and Attachment
Figure 7

(8) Weigh control tab to ensure that maximum allowable weight of 9.90 pounds is not exceeded.

Balance Limits (Nose Heavy Balance Moment)		Contribution of Each Number 2917168 Adjustment Weight	
(Inch-Pounds)		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	2.5	0.04	0.1
Maximum	4		

Aileron Control Tab Balance Limits and Adjustment Weight Contribution
Figure 8

J. Check Aileron Trim Tab Balance

(1) Make certain that trim tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 6.35 pounds.

(2) Mount trim tab on balance stands (see Figure 9). Use station XAT 1.9 and XAT 17.6 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Mount the beam assembly and 1/4 pound weight assembly on the trim tab fitting at station XAT 33.3 (see Figure 9).

(4) Slide the 1/4 pound weight along the beam until the trim tab assumes a horizontal attitude.

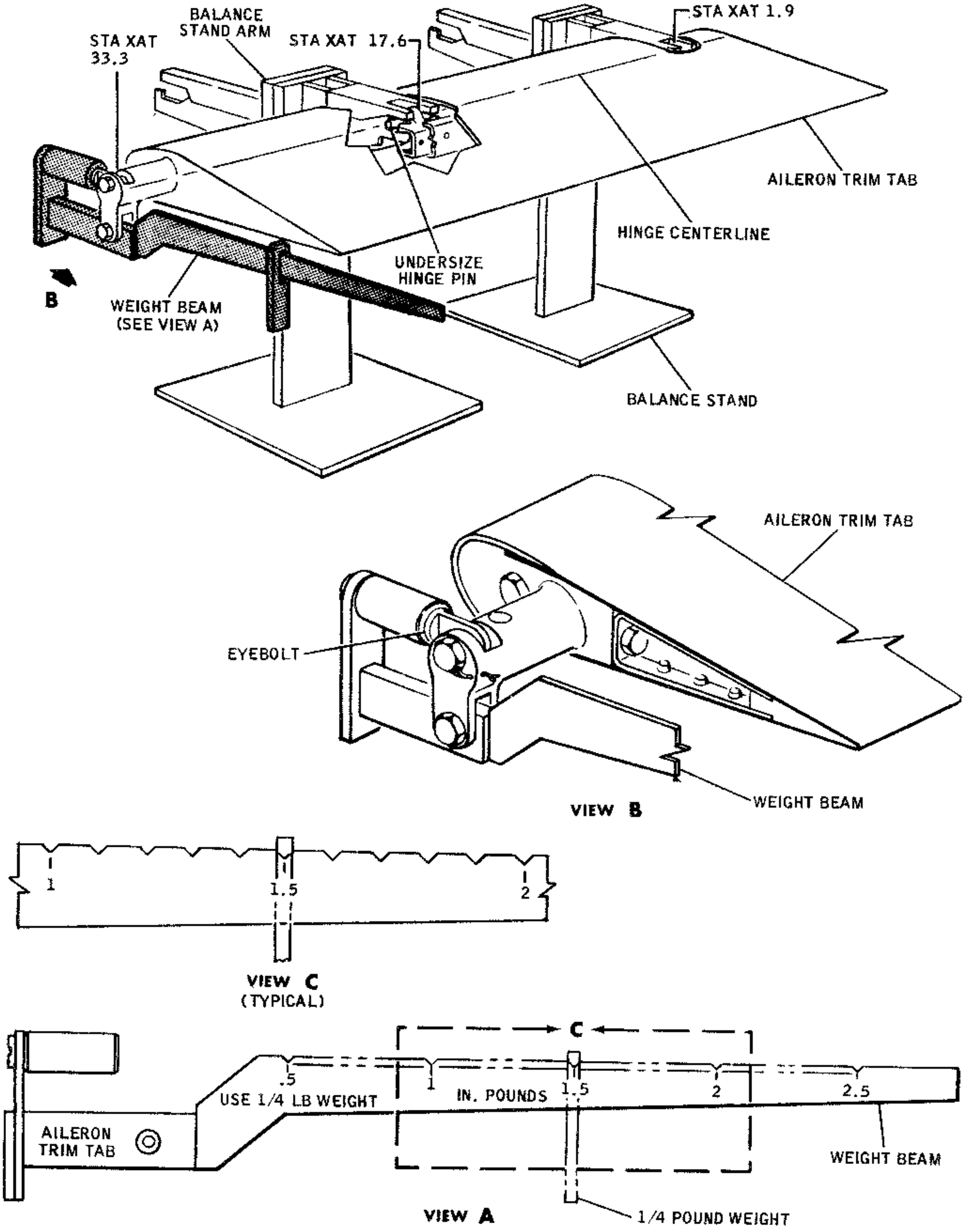
<u>NOTE</u>: The trim tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(5) Read the balance indication on the beam. Balance limits for the aileron trim tab are 0.5 inch-pound minimum to 2 inch-pounds maximum nose heavy.

(6) If the balance indication is not within limits, add, or remove, adjustment weights as necessary. See Figure 10 for adjustment weight number and contribution and Figure 11 for attachment.

(7) Recheck balance condition.

(8) Weigh trim tab to ensure that maximum allowable weight of 6.35 pounds is not exceeded.



BB3-673

Aileron Trim Tab Balancing with Beam
Figure 9

Balance Limits (Nose Heavy Balance Moment)		Contribution of Each Number 2917168 Adjustment Weight	
Inch-Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	0.5	0.04	0.1
Maximum	2		

Aileron Trim Tab Balance Limits and Adjustment Weight Contribution
Figure 10

5. Balance Aileron, Aileron Control Tab, and Aileron Trim Tab using Checkweight Method

A. Check Aileron Balance

(1) Make certain that aileron is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and trim tab must not be installed.

(2) Mount aileron on balance stands (see Figure 12). Use station XA 402.8 and XA 467.8 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Suspend 12.00 pound checkweight (see Figure 13) from hinge point at station XAC 13.9.

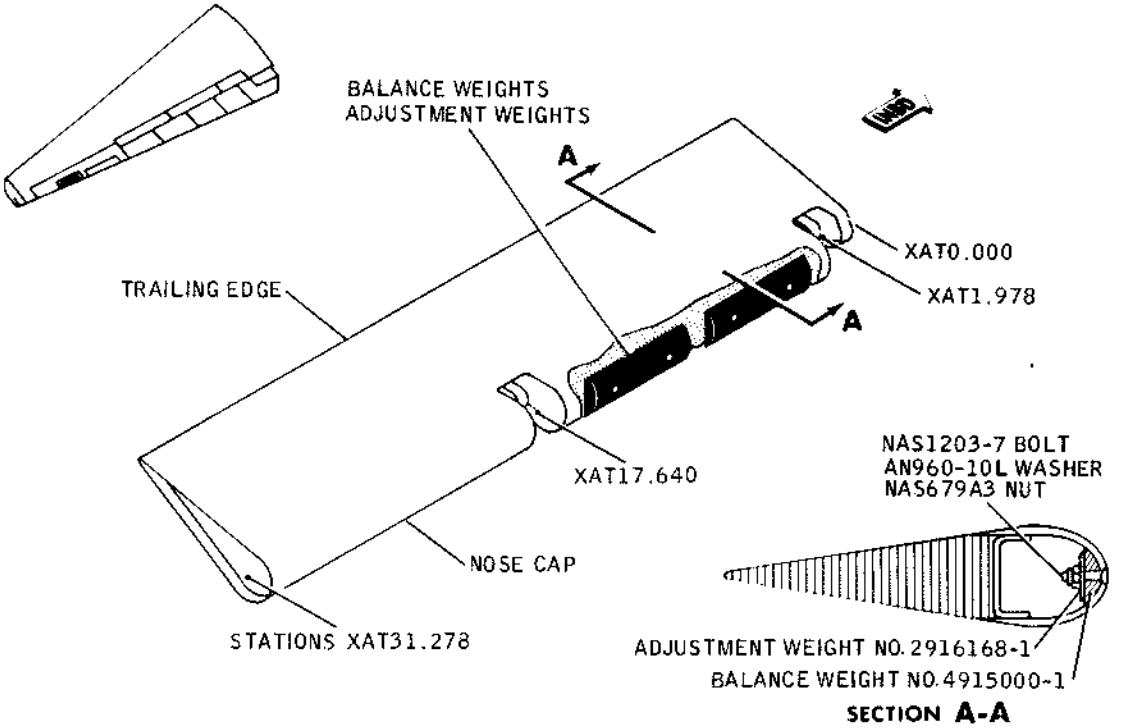
NOTE: Moment arm is 17.195 inches.

(4) Add checkweight (lead shot) to checkweight container until aileron assumes a horizontal attitude.

NOTE: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

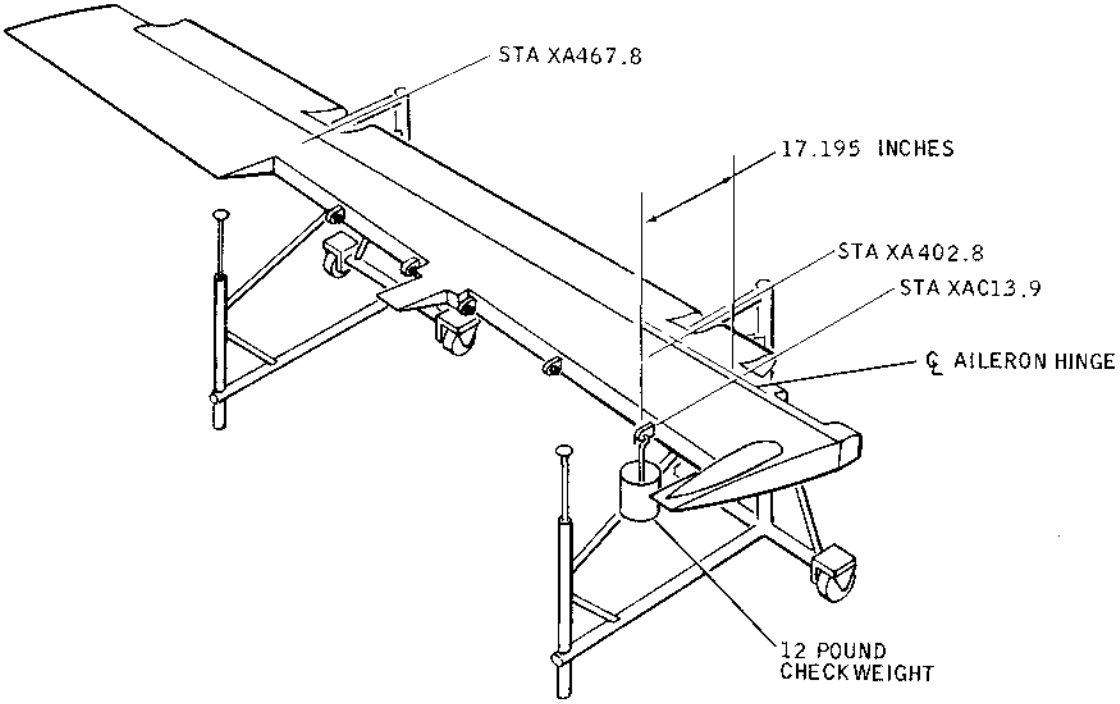
(5) Weigh total checkweights suspended from station XAC 13.9.

(6) Compare total weight of checkweights with the equivalent balance condition shown in Figure 14.



BB3-330

Aileron Trim Tab Weight Location and Attachment
Figure 11



BB3-531

Aileron Balancing and Checkweight Suspension
Figure 12

(7) Add, or remove, adjustment weights as required. See Figure 3 for adjustment weight numbers and locations. See Figure 4 for location and attachment. See Figure 5 for balance weight locations.

NOTE: Balance limits for the aileron are 250 inch-pounds minimum to 260 inch-pounds maximum nose heavy. Recommended balance is 257.5 inch-pounds nose heavy. The total amount of checkweights required to equal recommended balance is 14.97 pounds suspended from station XAC 13.9.

(8) Recheck balance condition.

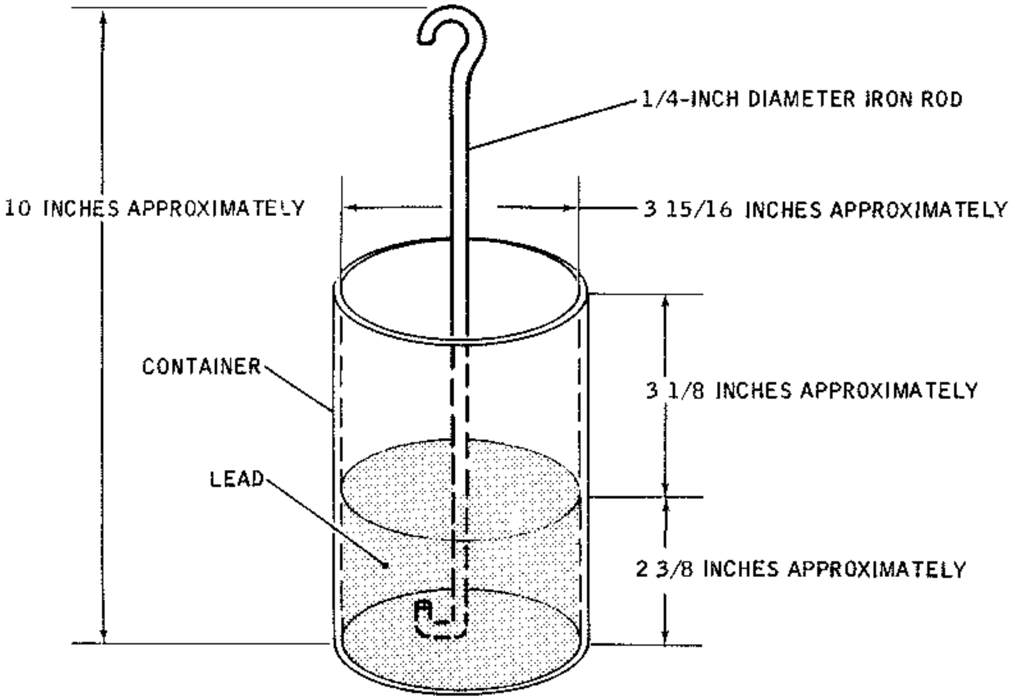
B. Check Aileron Control Tab and Aileron Trim Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 9.90 pounds for control tab and not over 6.35 pounds for trim tab.

(2) Mount tab on balance stand (see Figure 15). For control tab use station XAC 13.9 and XAC 50 hinge locations. For trim tab use station XAT 17.6 and XAT 33.3 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Loosen any nose cap attach screw.

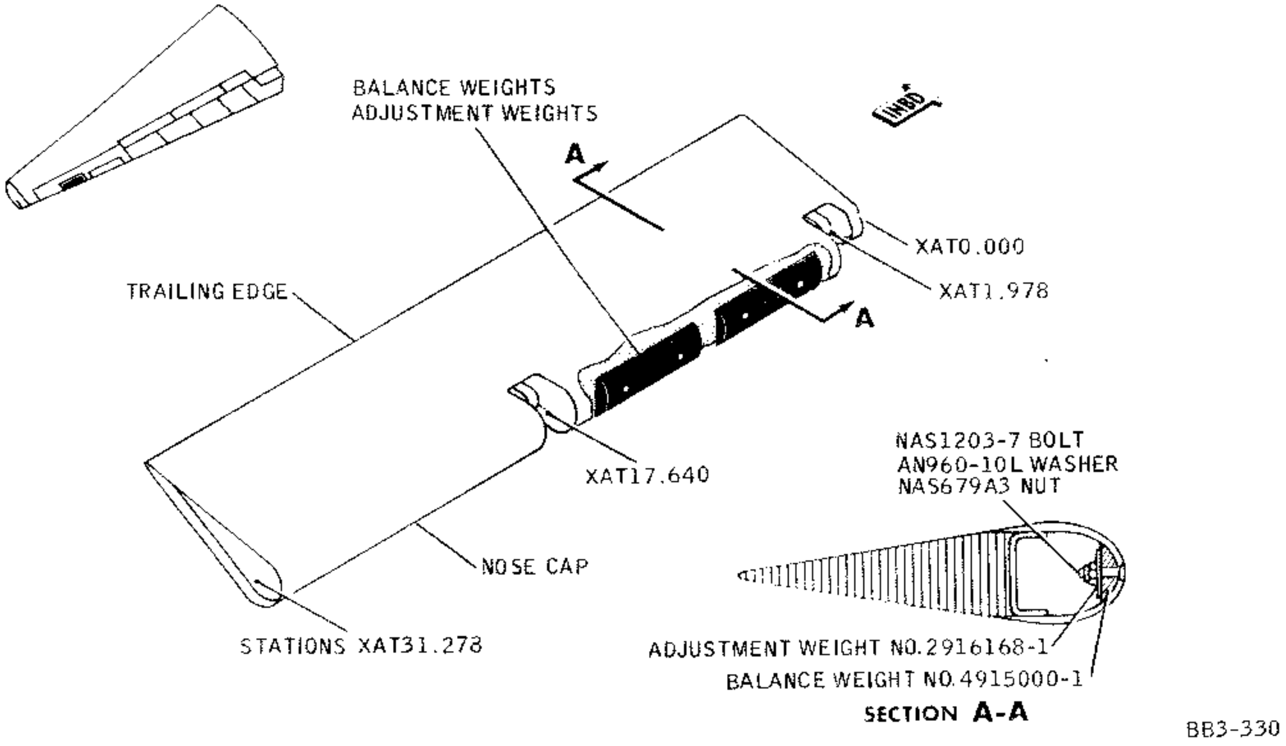
(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.



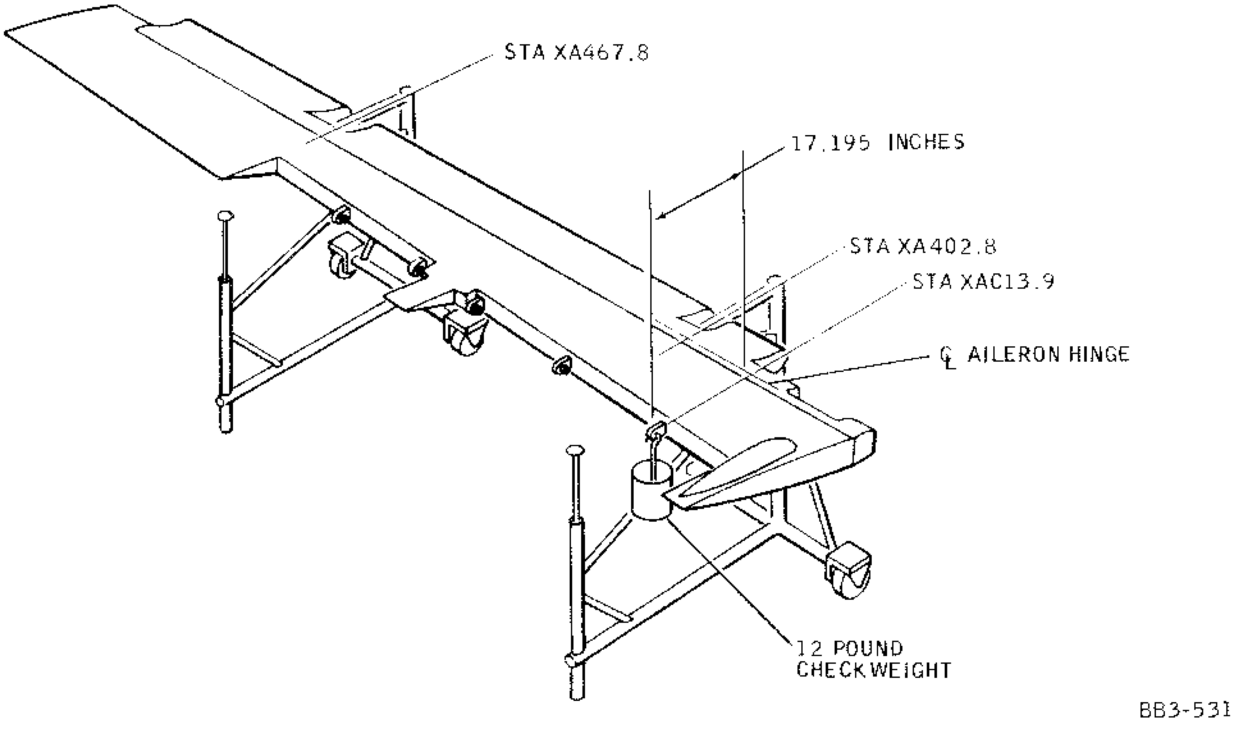
NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 12.00 POUNDS.

BB3-431

Twelve Pound Standard Checkweight
Figure 13



Aileron Trim Tab Weight Location and Attachment
Figure 11



Aileron Balancing and Checkweight Suspension
Figure 12

(7) Add, or remove, adjustment weights as required. See Figure 3 for adjustment weight numbers and locations. See Figure 4 for location and attachment. See Figure 5 for balance weight locations.

NOTE: Balance limits for the aileron are 255 inch-pounds minimum to 260 inch-pounds maximum nose heavy. Recommended balance is 257.[illegible] inch-pounds nose heavy. The total amount of checkweights required to equal recommended balance is 14.97 pounds suspended from station XAC 13.9.

(8) Recheck balance condition.

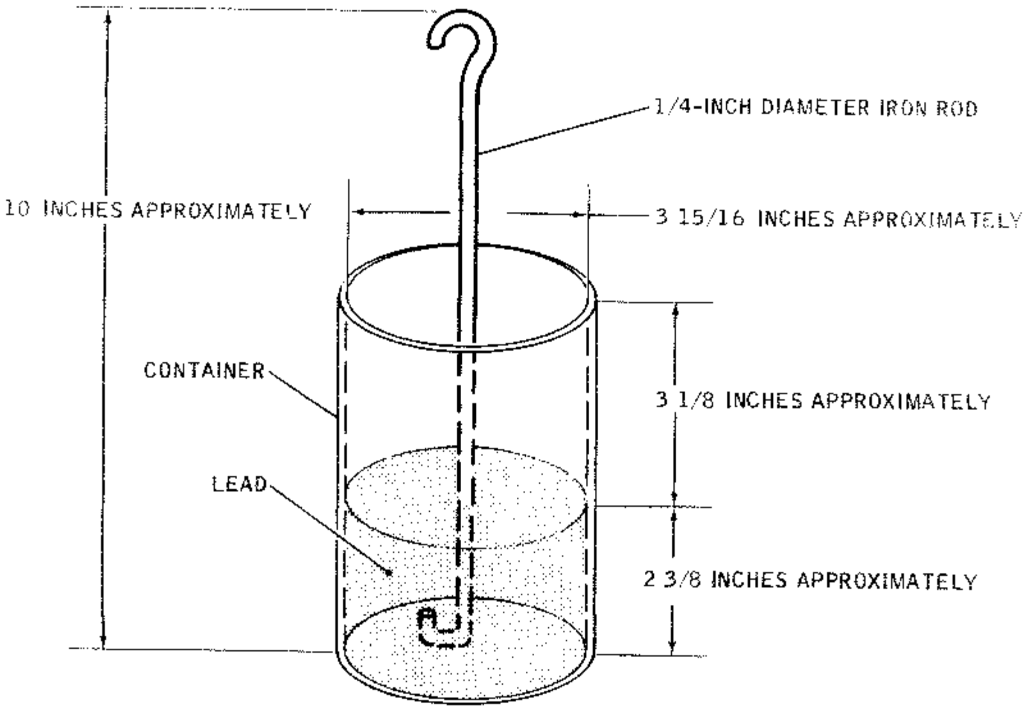
B. Check Aileron Control Tab and Aileron Trim Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 9.90 pounds for control tab and not over 6.35 pounds for trim tab.

(2) Mount tab on balance stand (see Figure 15). For control tab use station XAC 13.9 and XAC 50 hinge locations. For trim tab use station XAT 17.[illegible] and XAT 33.3 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Loosen any nose cap attach screw.

(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.



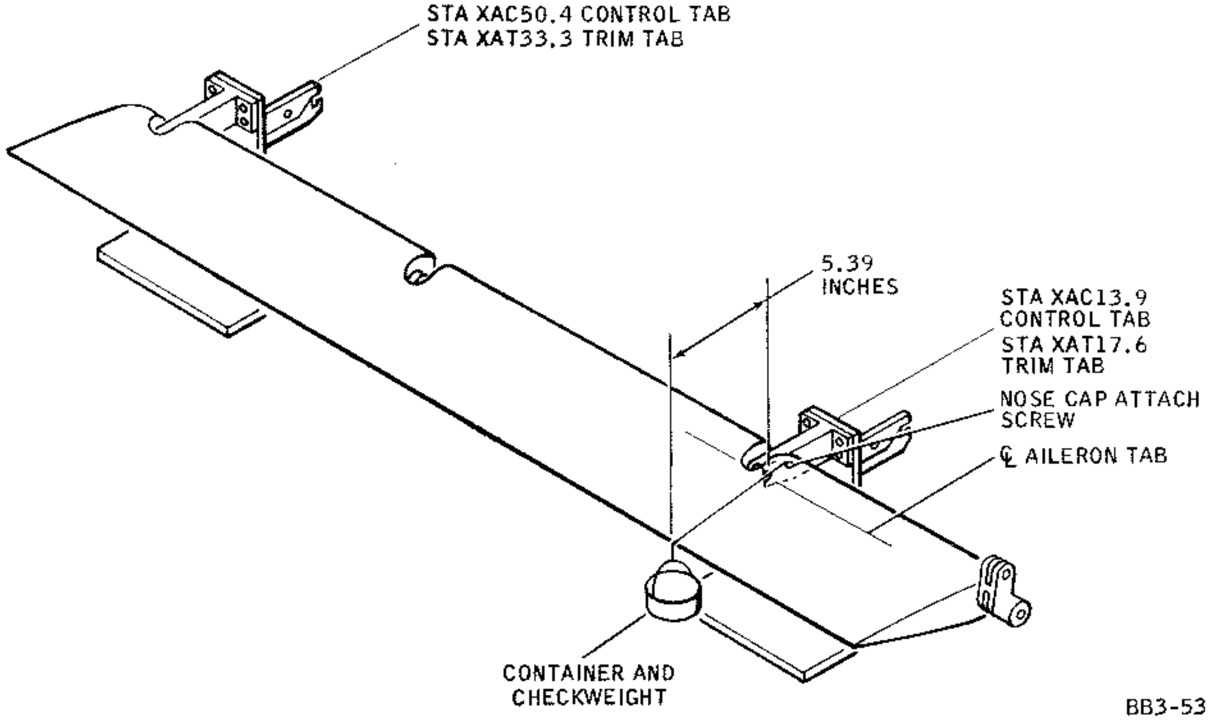
NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 12.00 POUNDS.

BB3-431

Twelve Pound Standard Checkweight
Figure 13

Balance Condition		Suggested quantity of adjustment weights to add/remove per station for indicated balance condition (see Figure 3 for adjustment weight numbers)					
Hinge moment above or below recommended moment of 257.5	Checkweight above or below recommended weight of 14.97 pounds at station XAC 13.9	Aileron Station (XA)					
Inch-Pounds	Pounds	416.6	420.5	424.4	432.7	436.7	440.7
0 to 2.5 7.5 (below) to 2.5 (above)	0 to 0.15 0.47 (below) to 0.15 (above)	WITHIN BALANCE LIMITS					
2.5 to 7.5	0.15 to 0.44	2		2		1	
7.5 to 12.5	0.44 to 0.73	1	1	1	1	2	2
12.5 to 17.5	0.73 to 1.02	3	1	3	1	3	2
17.5 to 22.5	1.02 to 1.31	3	2	3	2	3	2
22.5 to 27.5	1.31 to 1.60	3	3	3	3	3	2
27.5 to 32.5	1.60 to 1.89	4	3	4	4	4	3

Aileron Balance Condition and Adjustment Weight Change Required
Figure 14



Aileron Tab Balancing and Checkweight Suspension
Figure 15

(5) Attach one end of the cord to screw and other end to a container.

(6) Suspend container over trailing edge.

NOTE: Moment arm is 5.39 inches.

(7) Add checkweights (lead shot) to the container until tab assumes a horizontal attitude.

NOTE: The tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(8) Weight container and checkweights.

(9) Compare total weight of checkweights with equivalent balance condition shown in Figure 16 for control tab, or Figure 17 for trim tab.

(10) Add, or remove, adjustment weights as required to maintain nose heavy balance moment specified for the particular surface (see Figure 16 for control tab or Figure 17 for trim tab). See Figure 7 for control tab weight location and attachment or Figure 11 for trim tab weight location and attachment.

(11) Recheck balance condition.

(12) Weigh tab to ensure that maximum allowable weight of 9.90 pounds for control tab and 6.35 pounds for trim tab is not exceeded.

Balance Limits (Nose Heavy Balance Moment)		Equivalent Checkweight		Contribution (each) number 2917168 adjustment weight	
Inch-Pounds		Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	Maximum	Minimum	Maximum		
2.5	4	0.47	0.74	0.04	0.1

Aileron Control Tab Balance Limits and Adjustment Weight Contribution
Figure 16

Balance Limits (Nose Heavy Balance Moment)		Equivalent Checkweight		Contribution (each) number 2917168 adjustment weight	
Inch-Pounds		Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	Maximum	Minimum	Maximum		
0.5	2	0.10	0.37	0.04	0.1

Aileron Trim Tab Balance Limits and Adjustment Weight Contribution
Figure 17

4. Balance Aileron, Aileron Control Tab, and Aileron Trim Tab Using Beam and Weight

A. Check Aileron Balance

(1) Make certain that aileron is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and trim tab must not be installed.

(2) Mount aileron on balance stands (see Figure 1). Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Suspend a 9 pound weight assembly from station XAC 34.4 hinge location and a 9 pound weight from station XAC 50 hinge location (see Figure 1).

(4) Mount the beam and 4 pound weight assembly at station XAC 13.9 hinge location as shown in Figure 1.

(5) Slide the 4 pound weight along the beam until the aileron assumes a horizontal attitude.

NOTE: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

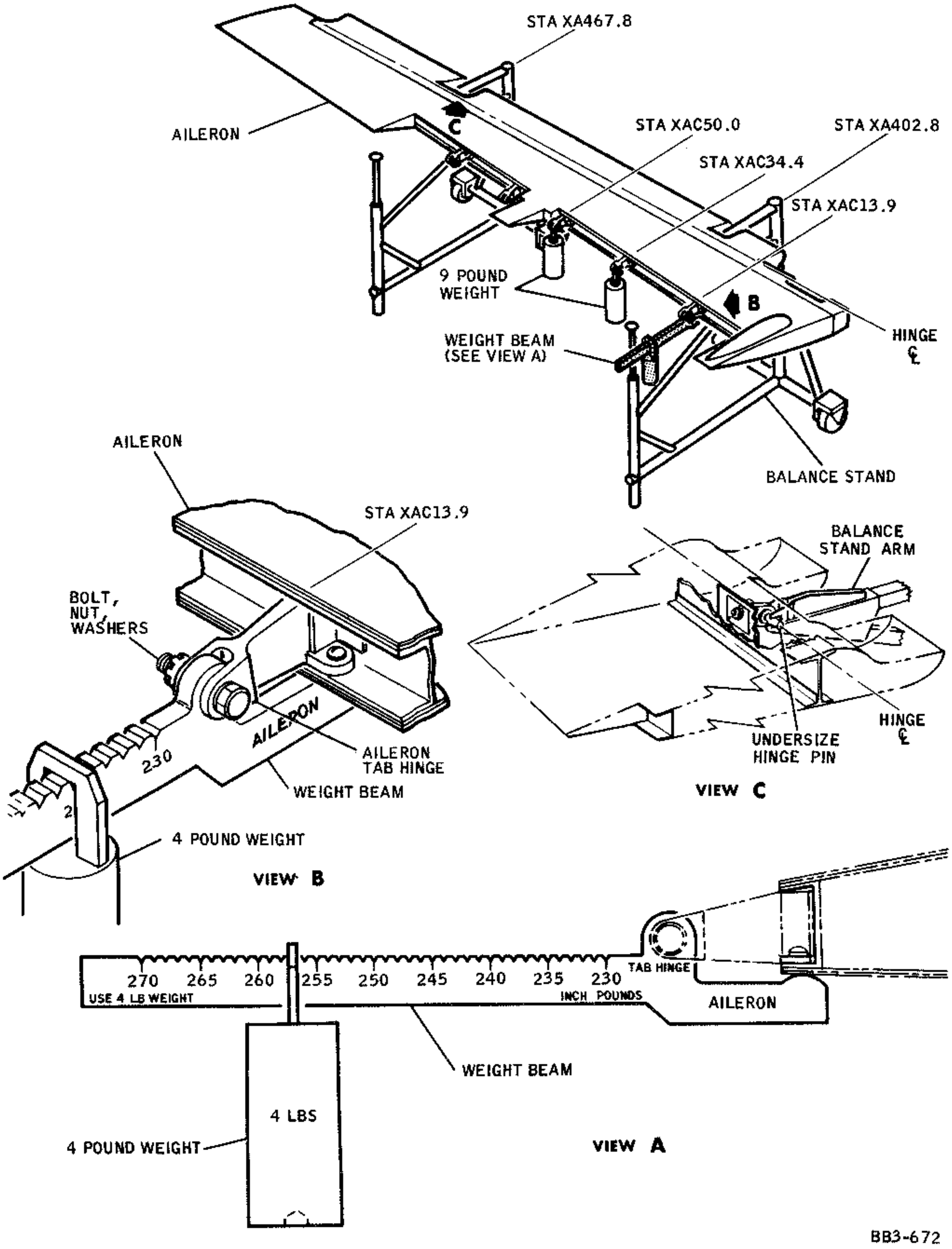
(6) Read the balance indication on the beam. Balance limits for the aileron are 250 inch-pounds minimum to 260 inch-pounds maximum nose heavy. Recommended balance is 257.5 inch-pounds nose heavy.

(7) If the balance indication is not within limits, compare the indication with the balance conditions shown in Figure 2.

(8) Add, or remove, adjustment weights as necessary. See Figures 2, 3, and 4 for location, quantity, and attachment. See Figure 5 for location of balance weights.

NOTE: A beam reading below minimum limit requires addition of adjustment weights. A beam reading above maximum limit requires removal of adjustment weights.

(9) Recheck balance condition.



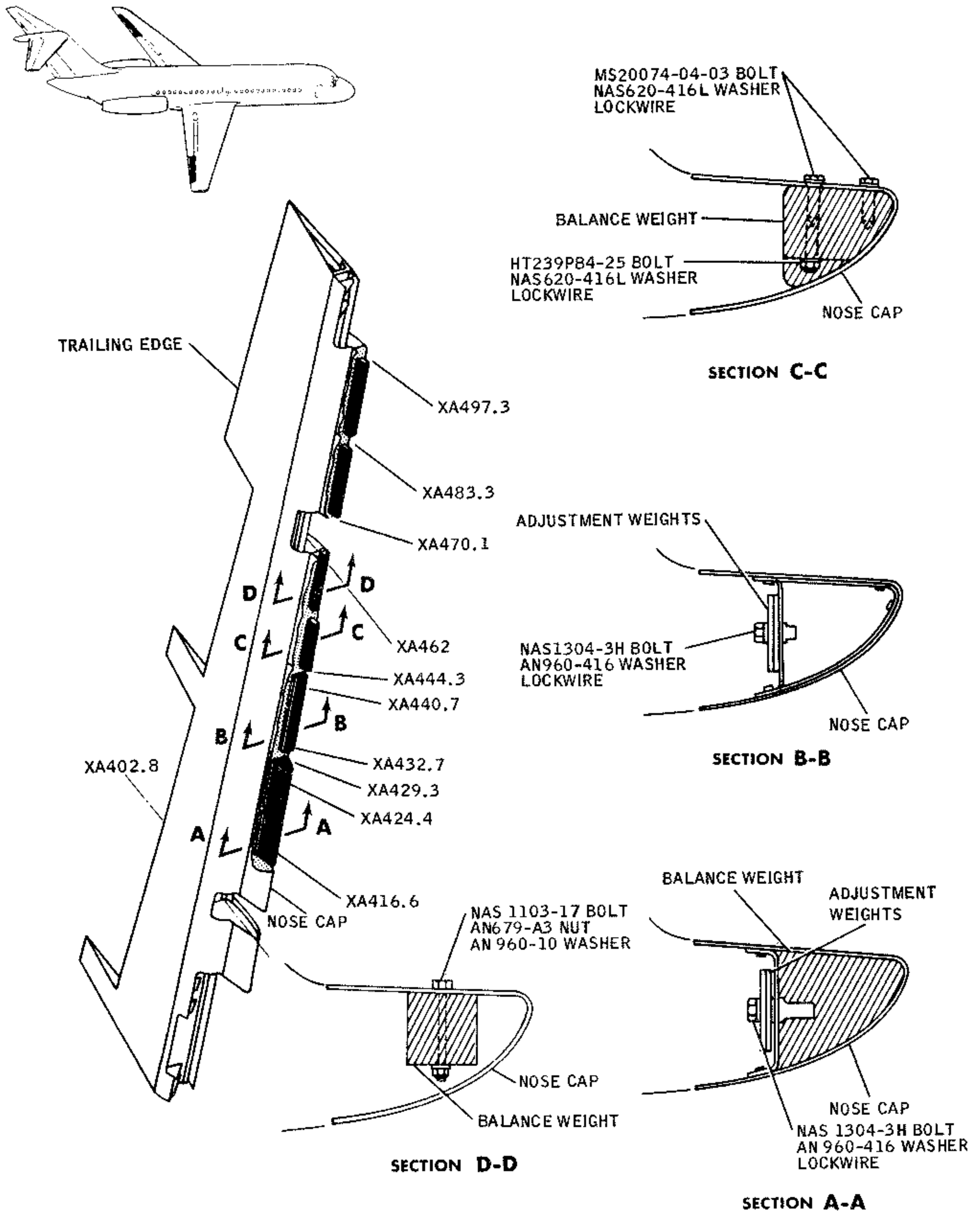
Aileron Balancing with Beam
Figure 1

Weight Beam Reading	Suggested quantity of adjustment weights to add/remove per station for indicated beam reading (see Figure 3 for adjustment weight numbers					
	Aileron Station (XA)					
Inch-Pounds	416.6	420.5	424.4	432.7	436.7	440.7
230	5	3	3	3	4	2
235	3	3	3	2	1	4
240	3	1	3	1	3	2
245	1	2	1		2	3
250	2		2		1	
250-260	WITHIN BALANCE LIMITS					
265	2	1	1		1	
270	1	2	1	2	2	1

Aileron Balance Condition and Adjustment Weight Change Required
Figure 2

Adjustment Weights number (see Figure 2 for suggested quantities)	Location (Aileron Station) XA	Moment Arm	Nose Heavy Moment (each)	Weight (each)
			Inch-Pounds	Pounds
4917170-503	416.6	5.5	1.1	0.21
-1	420.5	5.5	2.6	0.47
-503	424.4	5.4	2.0	0.21
-505	432.7	5.0	0.8	0.15
-501	436.7	5.0	1.1	0.40
-505	440.7	4.9	0.7	0.15

Aileron Adjustment Weight Numbers and Locations
Figure 3



REFERENCE - DOUGLAS DRAWING 5913840

BB3-328A

Aileron Weight Location and Attachment
Figure 4

Number	Location	Approximate Weight
	Aileron Station (XA)	Pounds
3915182-5	411.7	24
5955891-1	455	15.90
5955891-503	470	8.39
5955891-505	485	6.73
5913840-0013	453	4

Aileron Balance Weight Locations
Figure 5

B. Check Aileron Control Tab Balance

(1) Make certain control tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 9.90 pounds.

(2) Mount control tab on balance stands (see Figure 6). Use station XAC 13.9 and XAC 50.4 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Mount the beam and 1/2 pound weight assembly on the control tab fitting assembly at station XAC 2 (see Figure 6).

(4) Slide the 1/2 pound weight along the beam until the control tab assumes a horizontal attitude.

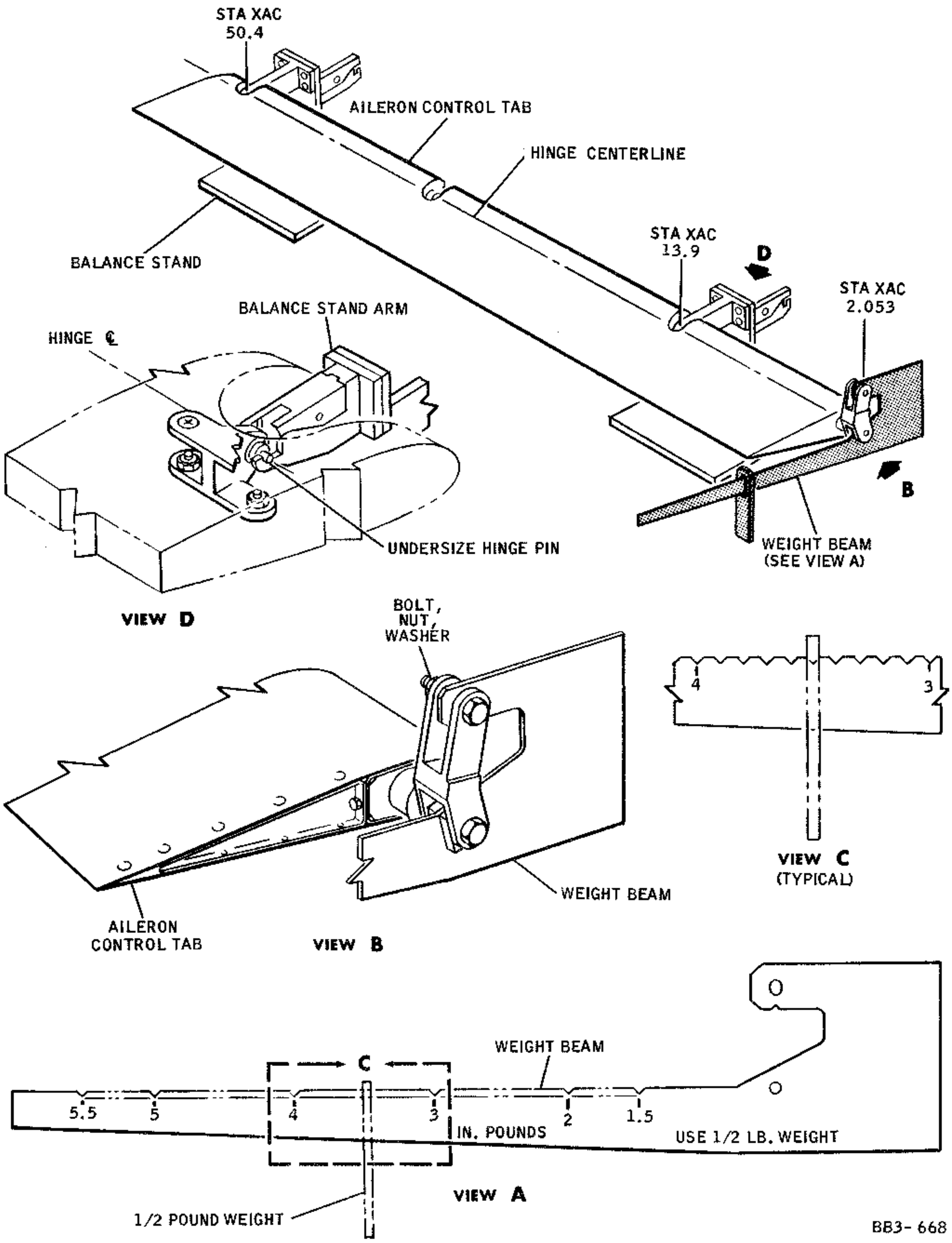
<u>NOTE:</u> The control tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(5) Read the balance indication on the beam. Balance limits for the control tab are 2.5 inch-pounds minimum to 4 inch-pounds maximum nose heavy.

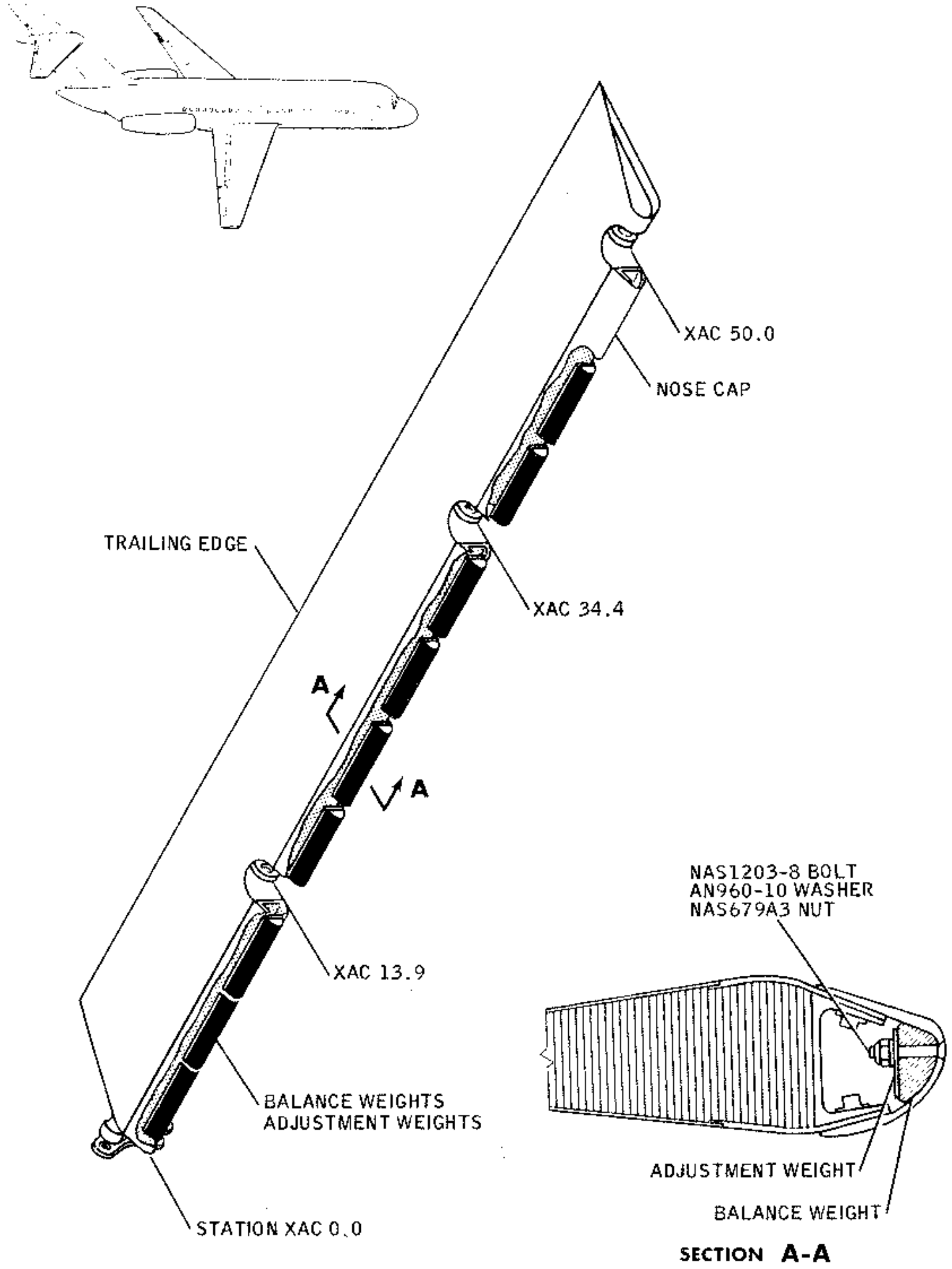
(6) If the balance indication is not within limits, add, or remove, adjustment weights as necessary. See Figure 7 for location and attachment and Figure 8 for adjustment weight number and contribution.

<u>NOTE:</u> A beam reading above balance limits requires removal of adjustment weights and a beam reading below balance limits requires addition of adjustment weights.

(7) Recheck balance condition.



Aileron Control Tab Balancing with Beam
Figure 6



REFERENCE - DOUGLAS DRAWING 5910047

BB3-329

Aileron Control Tab Weight Location and Attachment
Figure 7

(8) Weigh control tab to ensure that maximum allowable weight of 9.90 pounds is not exceeded.

Balance Limits (Nose Heavy Balance Moment)		Contribution of Each Number 2917168 Adjustment Weight	
(Inch-Pounds)		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	2.5	0.04	0.1
Maximum	4		

Aileron Control Tab Balance Limits and Adjustment Weight Contribution
Figure 8

C. Check Aileron Trim Tab Balance

(1) Make certain that trim tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 6.35 pounds.

(2) Mount trim tab on balance stands (see Figure 9). Use station XAT 1.9 and XAT 17.6 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Mount the beam assembly and 1/4 pound weight assembly on the trim tab fitting at station XAT 33.3 (see Figure 9).

(4) Slide the 1/4 pound weight along the beam until the trim tab assumes a horizontal attitude.

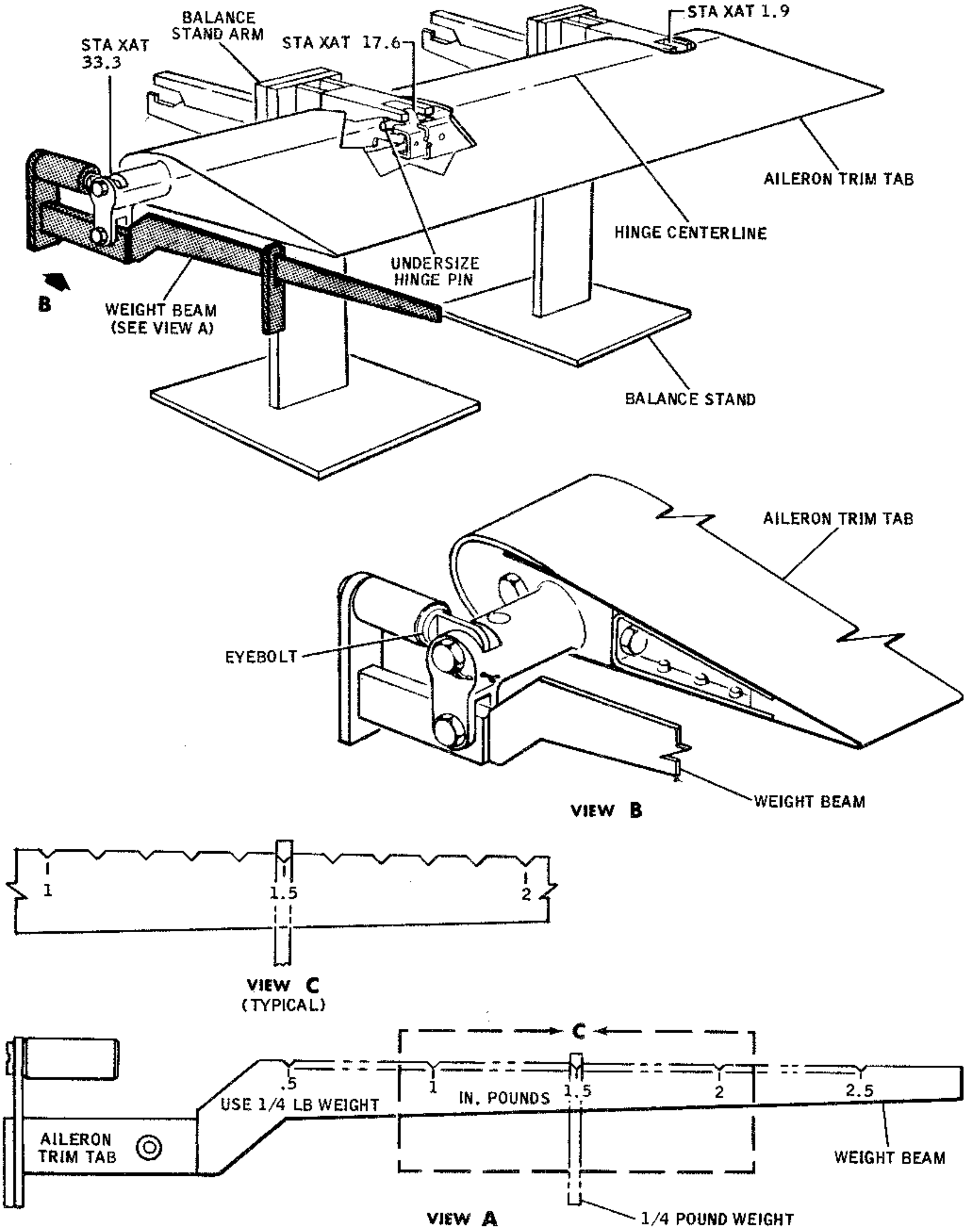
NOTE: The trim tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(5) Read the balance indication on the beam. Balance limits for the aileron trim tab are 0.5 inch-pound minimum to 2 inch-pounds maximum nose heavy.

(6) If the balance indication is not within limits, add, or remove, adjustment weights as necessary. See Figure 10 for adjustment weight number and contribution and Figure 11 for attachment.

(7) Recheck balance condition.

(8) Weigh trim tab to ensure that maximum allowable weight of 6.35 pounds is not exceeded.



Aileron Trim Tab Balancing with Beam
Figure 9

Balance Limits (Nose Heavy Balance Moment)		Contribution of Each Number 2917168 Adjustment Weight	
Inch-Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	0.5	0.04	0.1
Maximum	2		

Aileron Trim Tab Balance Limits and Adjustment Weight Contribution
Figure 10

5. Balance Aileron, Aileron Control Tab, and Aileron Trim Tab using Checkweight Method

A. Check Aileron Balance

(1) Make certain that aileron is complete and in required configuration for balancing with all painting and rework accomplished. Dampers, pushrods, and tab hinge bolts must be installed. Static dischargers must be installed. Control tab and trim tab must not be installed.

(2) Mount aileron on balance stands (see Figure 12). Use station XA 402.8 and XA 467.8 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Suspend 12.00 pound checkweight (see Figure 13) from hinge point at station XAC 13.9.

NOTE: Moment arm is 17.195 inches.

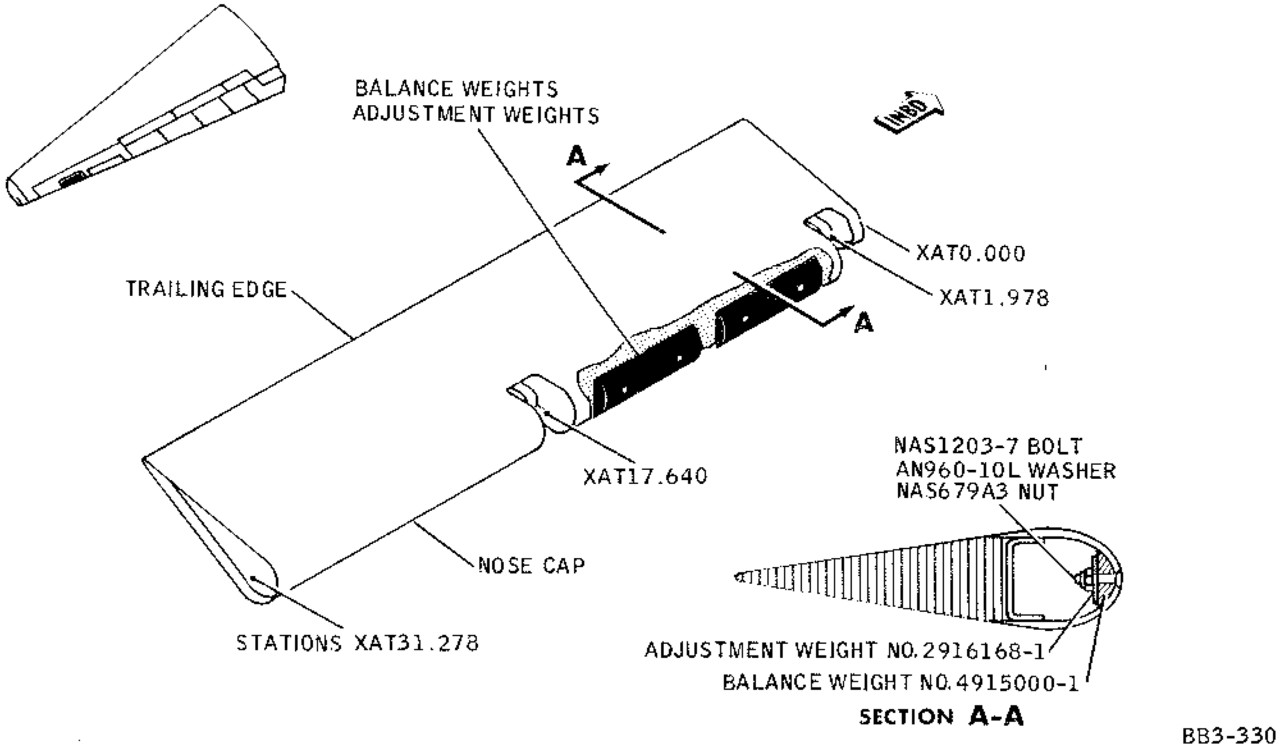
(4) Add checkweight (lead shot) to checkweight container until aileron assumes a horizontal attitude.

NOTE: The aileron is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

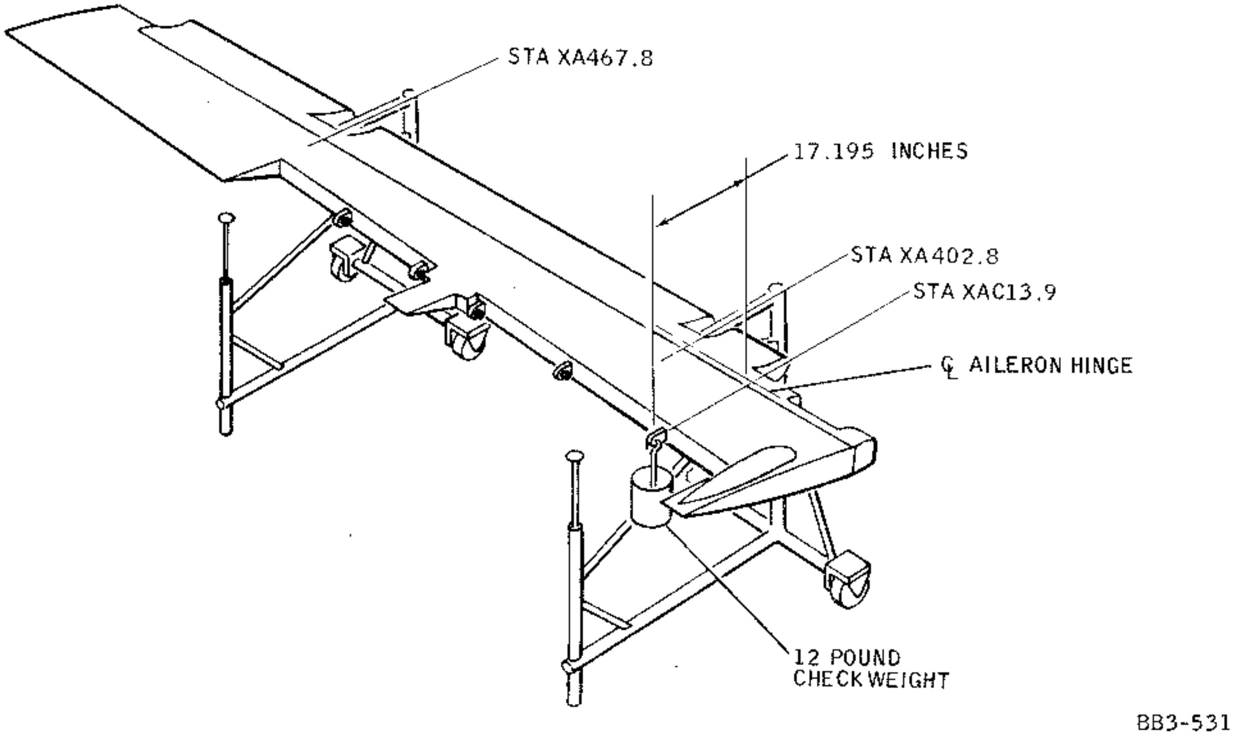
(5) Weigh total checkweights suspended from station XAC 13.9.

(6) Compare total weight of checkweights with the equivalent balance condition shown in Figure 14.

Printed in U.S.A.



Aileron Trim Tab Weight Location and Attachment
Figure 11



Aileron Balancing and Checkweight Suspension
Figure 12

(7) Add, or remove, adjustment weights as required. See Figure 3 for adjustment weight numbers and locations. See Figure 4 for location and attachment. See Figure 5 for balance weight locations.

NOTE: Balance limits for the aileron are 255 inch-pounds minimum to 260 inch-pounds maximum nose heavy. Recommended balance is 257.5 inch-pounds nose heavy. The total amount of checkweights required to equal recommended balance is 14.97 pounds suspended from station XAC 13.9.

(8) Recheck balance condition.

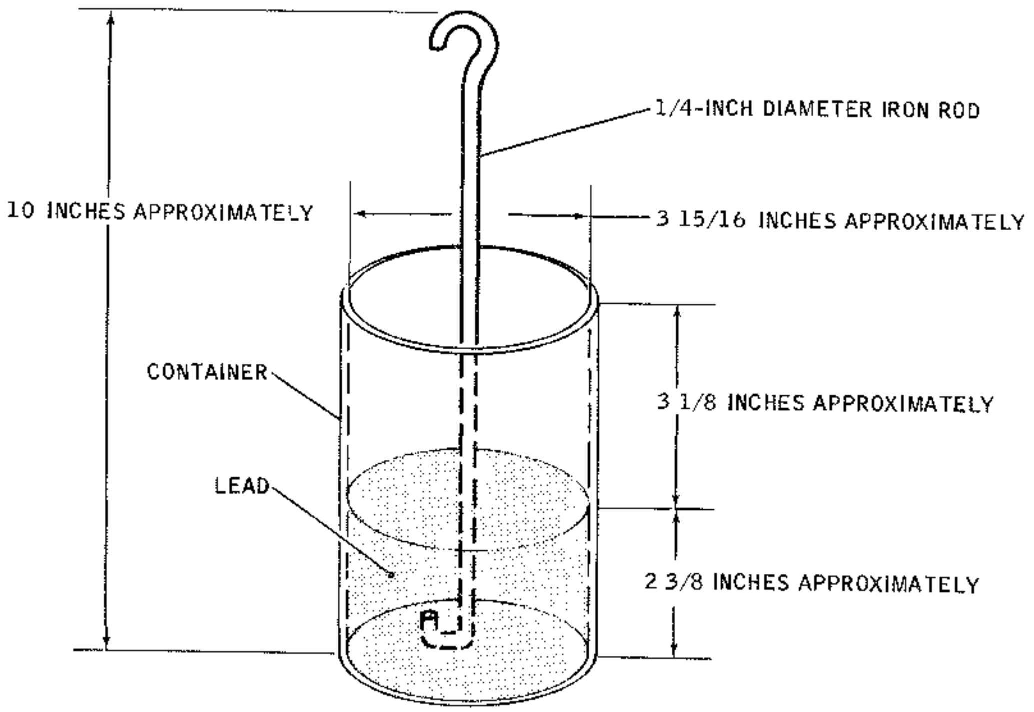
B. Check Aileron Control Tab and Aileron Trim Tab Balance

(1) Make certain that tab is complete and in required configuration for balancing with all painting and rework accomplished and total weight not over 9.90 pounds for control tab and not over 6.35 pounds for trim tab.

(2) Mount tab on balance stand (see Figure 15). For control tab use station XAC 13.9 and XAC 50 hinge locations. For trim tab use station XAT 17.6 and XAT 33.3 hinge locations. Use well-oiled, undersize hinge pins. Make certain balance stand is level.

(3) Loosen any nose cap attach screw.

(4) Select a length of nylon cord or soft safety wire of sufficient length to attach to screw and suspend over trailing edge.



NOTE: TRIM ASSEMBLY TO TOTAL WEIGHT OF 12.00 POUNDS.

BB3-431

Twelve Pound Standard Checkweight
Figure 13

TEMPORARY REVISION 57-24

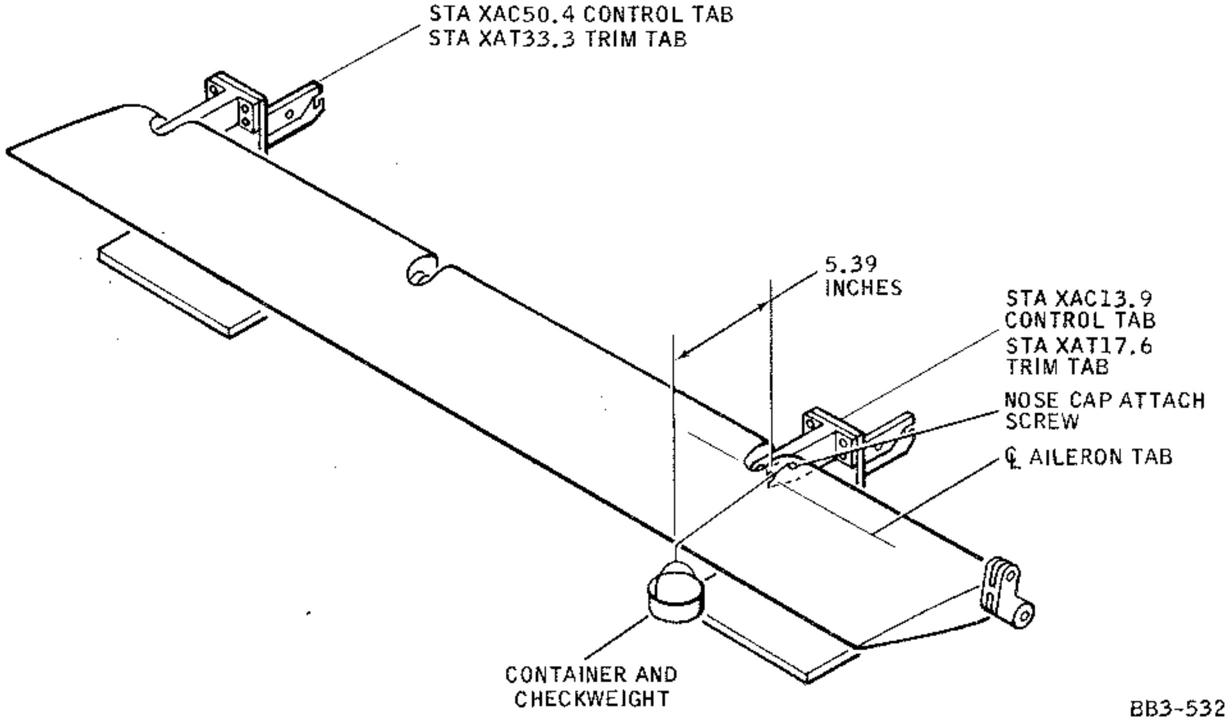
FILING INSTRUCTIONS:	This Temporary Revision is being issued to correct filing instruction - remove Temporary Revision 57-23 and replace with 57-24. Insert this Temporary Revision immediately following 57-50-1, Page 16. Retain this Temporary Revision until notified to remove it.
DESCRIPTION AND REASON	Corrects Aileron Minimum Balance Limit.
EFFECTIVITY:	ALL

Changes NOTE at top of Page 16 to read as follows:

NOTE: Balance limits for the aileron are 250 inch-pounds minimum to 260 inch-pounds maximum nose heavy. Recommended balance is 257.5 inch-pounds nose heavy. The total amount of checkweights required to equal recommended balance is 14.97 pounds suspended from station XAC 13.9.

Balance Condition		Suggested quantity of adjustment weights to add/remove per station for indicated balance condition (see Figure 3 for adjustment weight numbers)					
Hinge moment above or below recommended moment of 257.5	Checkweight above or below recommended weight of 14.97 pounds at station XAC 13.9	Aileron Station (XA)					
Inch-Pounds	Pounds	416.6	420.5	424.4	432.7	436.7	440.7
0 to 2.5 7.5 (below) to 2.5 (above)	0 to 0.15 0.47 (below) to 0.15 (above)	WITHIN BALANCE LIMITS					
2.5 to 7.5	0.15 to 0.44	2		2		1	
7.5 to 12.5	0.44 to 0.73	1	1	1	1	2	2
12.5 to 17.5	0.73 to 1.02	3	1	3	1	3	2
17.5 to 22.5	1.02 to 1.31	3	2	3	2	3	2
22.5 to 27.5	1.31 to 1.60	3	3	3	3	3	2
27.5 to 32.5	1.60 to 1.89	4	3	4	4	4	3

Aileron Balance Condition and Adjustment Weight Change Required
Figure 14



Aileron Tab Balancing and Checkweight Suspension
Figure 15

(5) Attach one end of the cord to screw and other end to a container.

(6) Suspend container over trailing edge.

<u>NOTE</u>: Moment arm is 5.39 inches.

(7) Add checkweights (lead shot) to the container until tab assumes a horizontal attitude.

<u>NOTE</u>: The tab is in a horizontal attitude when the centerline of the trailing edge is the same distance from the floor (base line) as the centerline of the mount points.

(8) Weight container and checkweights.

(9) Compare total weight of checkweights with equivalent balance condition shown in Figure 16 for control tab, or Figure 17 for trim tab.

(10) Add, or remove, adjustment weights as required to maintain nose heavy balance moment specified for the particular surface (see Figure 16 for control tab or Figure 17 for trim tab). See Figure 7 for control tab weight location and attachment or Figure 11 for trim tab weight location and attachment.

(11) Recheck balance condition.

(12) Weigh tab to ensure that maximum allowable weight of 9.90 pounds for control tab and 6.35 pounds for trim tab is not exceeded.

Balance Limits (Nose Heavy Balance Moment)		Equivalent Checkweight		Contribution (each) number 2917168 adjustment weight	
Inch-Pounds		Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	Maximum	Minimum	Maximum		
2.5	4	0.47	0.74	0.04	0.1

Aileron Control Tab Balance Limits and Adjustment Weight Contribution
Figure 16

Balance Limits (Nose Heavy Balance Moment)		Equivalent Checkweight		Contribution (each) number 2917168 adjustment weight	
Inch-Pounds		Pounds		Weight (Pounds)	Moment (Inch-Pounds)
Minimum	Maximum	Minimum	Maximum		
0.5	2	0.10	0.37	0.04	0.1

Aileron Trim Tab Balance Limits and Adjustment Weight Contribution
Figure 17

TEMPORARY REVISION 57-14

FILING INSTRUCTIONS:	Insert this Temporary Revision adjacent to 57-50-0, Page 1. Retain this Temporary Revision until the Mar 1/66 revision to the Structural Repair Manual incorporates this information.
DESCRIPTION AND REASON:	Provides revised Repair Index for wing flight surfaces.
EFFECTIVITY:	ALL

FLIGHT SURFACES - DESCRIPTION AND OPERATION

1. General

A. This section illustrates components of wing flight surfaces. Types and gages of material used in construction of assemblies are identified within illustrations.

B. This section also describes balancing procedures for aileron, aileron control tab, and aileron trim tab (see 57-50-1). Whenever repair or repainting is made to an aileron, aileron control tab, or aileron trim tab, the surface must be rebalanced. The aileron control tab and the aileron trim tab must also be weighed to ensure that its respective maximum allowable weight is not exceeded (see 57-50-1).

2. Repair Index

A. A list of structural components and applicable repairs which may be used to restore structural integrity and appearance is presented below.

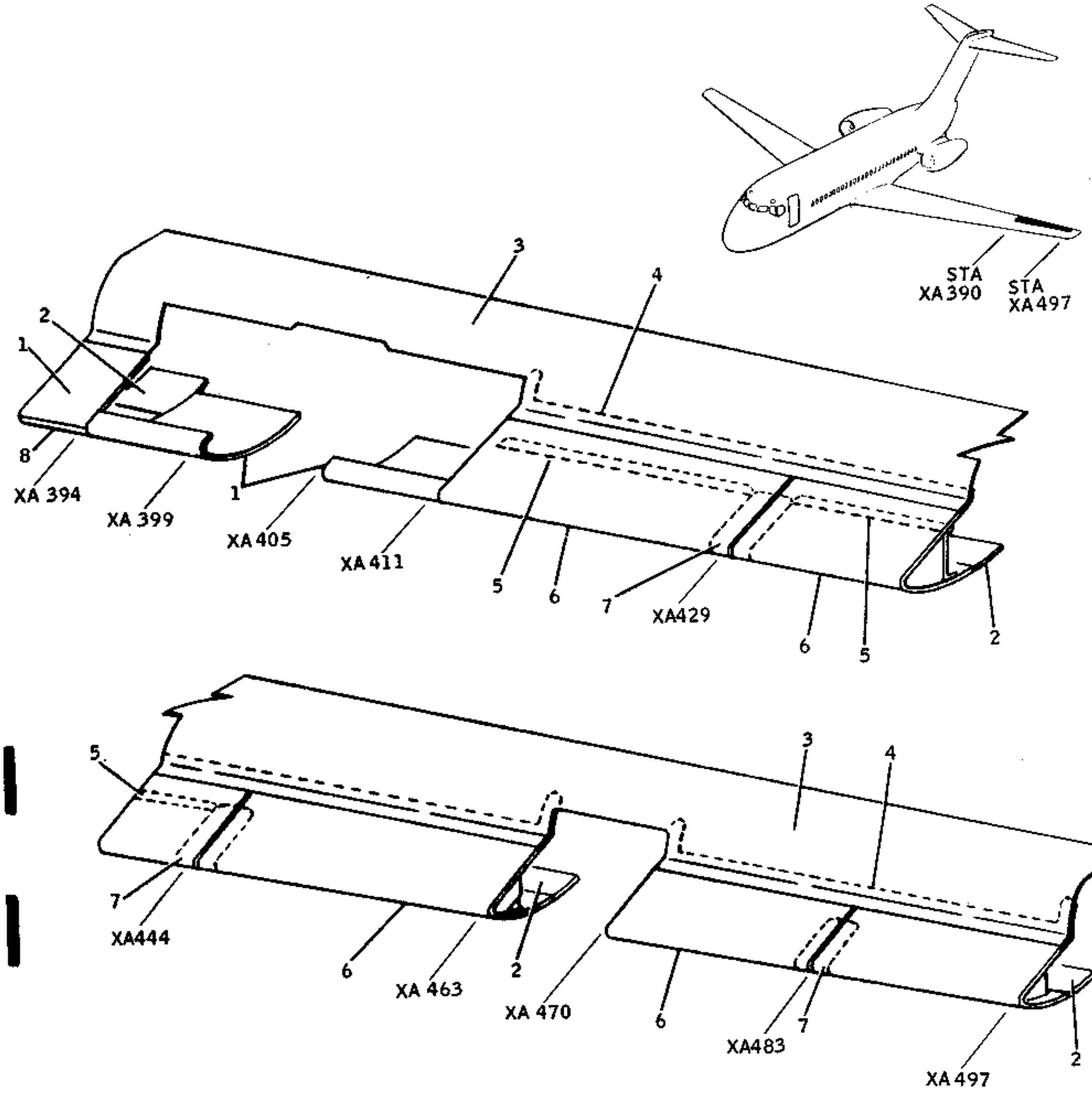
Structural Component	Approved Repairs
Internal Structure	57-01, Figure 1, Sheet 1 57-01, Figure 2, Sheet 3 57-01, Figure 3, Sheets 3 and 4
Internal Webs	57-01, Figure 2, Sheet 2 57-01, Figure 4, Sheet 2 57-02, Figures 1 and 2
Honeycomb	57-04, as applicable
Plating	57-01, Figure 1, Sheet 3 57-01, Figure 2, Sheet 2 57-01, Figure 4, Sheet 2 57-03, Figure 3 57-03, Figures 6 through 9

NOTE: The above repairs are applicable except as restricted on individual repair sketch or as shown in 57-01, Figure 8.

AILERON AND AILERON TABS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates the aileron, aileron trim tab, and aileron control tab structural materials. Materials are identified in material lists by item number callouts.



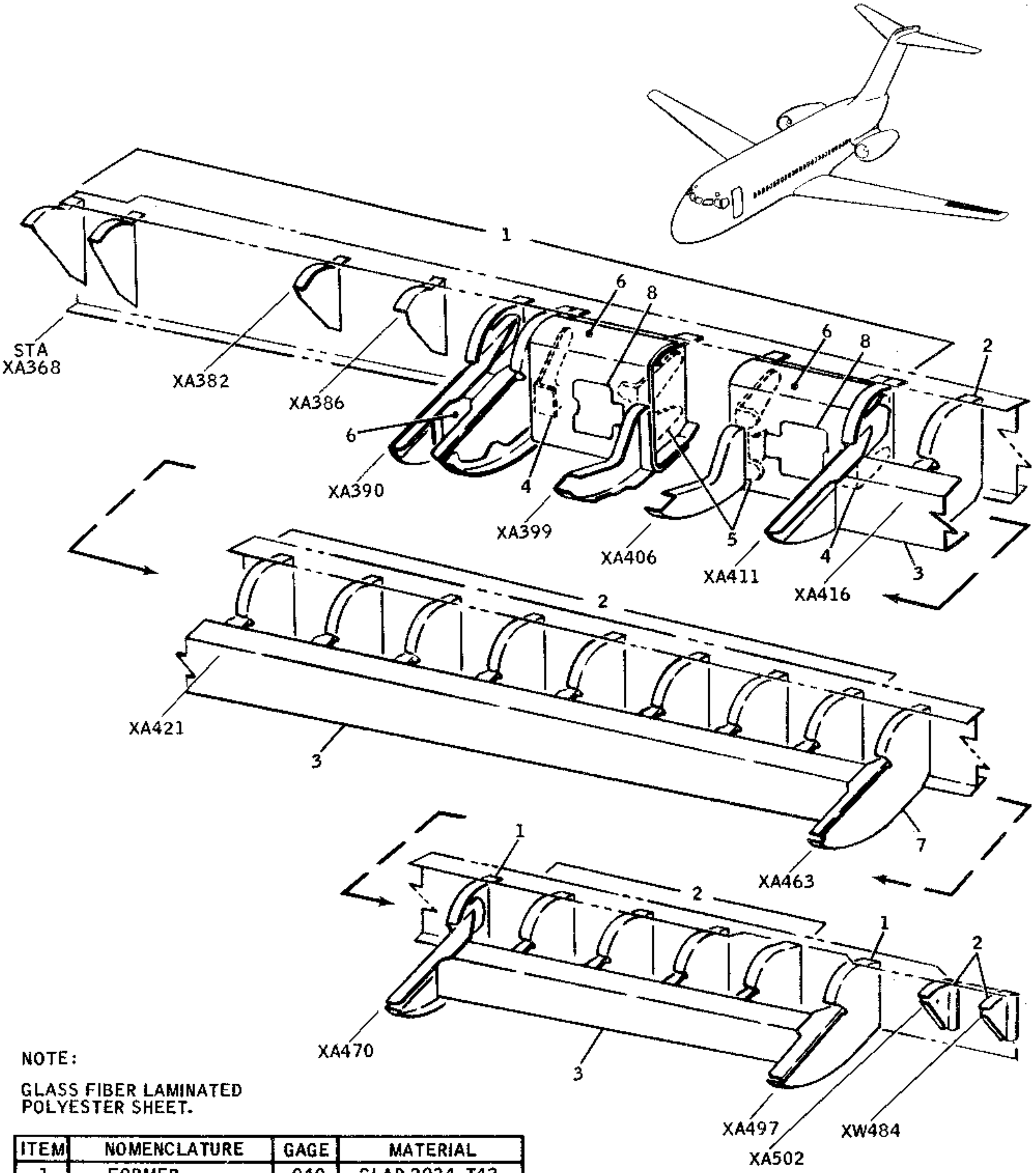
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CAP	.090	CLAD 2024-T42
2	DOOR	.040	CLAD 7075-T6
3	SKIN	.040	CLAD 2024-T3
4	DOUBLER	.040	CLAD 7075-T6
5	CHANNEL	.063	SEE NOTE 1
6	NOSE CAP	.090	SEE NOTE 1
7	SEAL	.063	SEE NOTE 1
8	DOOR	.090	CLAD 2024-T42

NOTES:

1. ITEMS 5, 6, AND 7 MADE FROM LOW CARBON STEEL SHEET, MIL-S-7952.
2. REFERENCE - DOUGLAS DRAWINGS 5910046, 5913840, 9955802, 3915183.

BB3-256A

Aileron Nose Plating
Figure 1



NOTE:

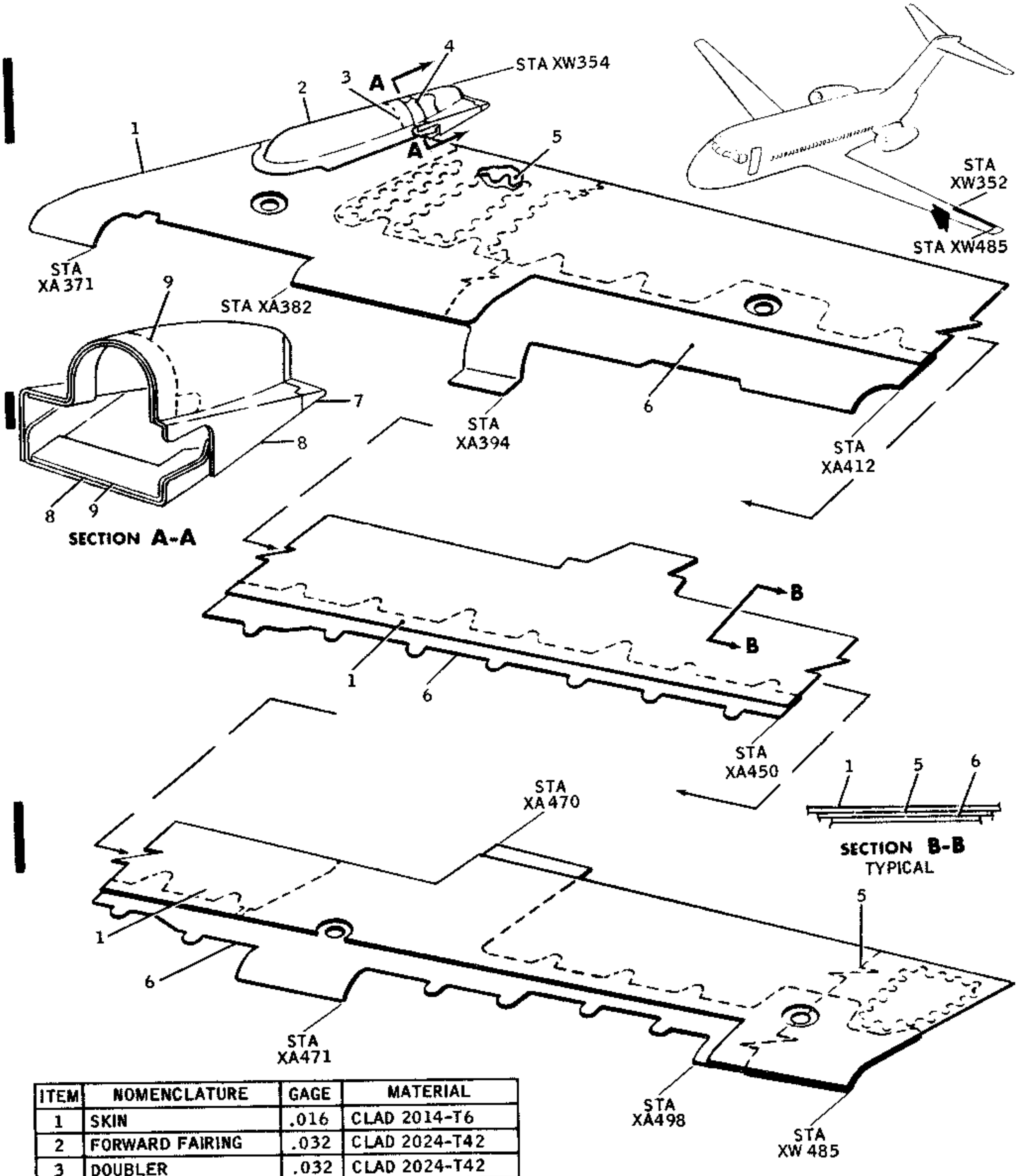
GLASS FIBER LAMINATED POLYESTER SHEET.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FORMER	.040	CLAD 2024-T42
2	FORMER	.032	CLAD 2024-T42
3	CHANNEL	.063	CLAD 2024-T42
4	ANGLE		1329984
5	TEE		1329984
6	CHANNEL	.040	CLAD 2024-T42
7	WEB	.040	CLAD 2024-T42
8	SEAL	.016	SEE NOTE

REFERENCE-DOUGLAS DRAWING 5913840

BB3-257B

Aileron Nose Structure
Figure 2



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.016	CLAD 2014-T6
2	FORWARD FAIRING	.032	CLAD 2024-T42
3	DOUBLER	.032	CLAD 2024-T42
4	FLANGE	.040	CLAD 2024-T42
5	BONDED DOUBLER	.016	CLAD 2014-T6
6	BONDED DOUBLER	.050	CLAD 2014-T6
7	FILLER, 3915702		SEE NOTE 1
8	AFT FAIRING	.032	CLAD 6061-T6
9	BONDED DOUBLER	.032	CLAD 6061-T6

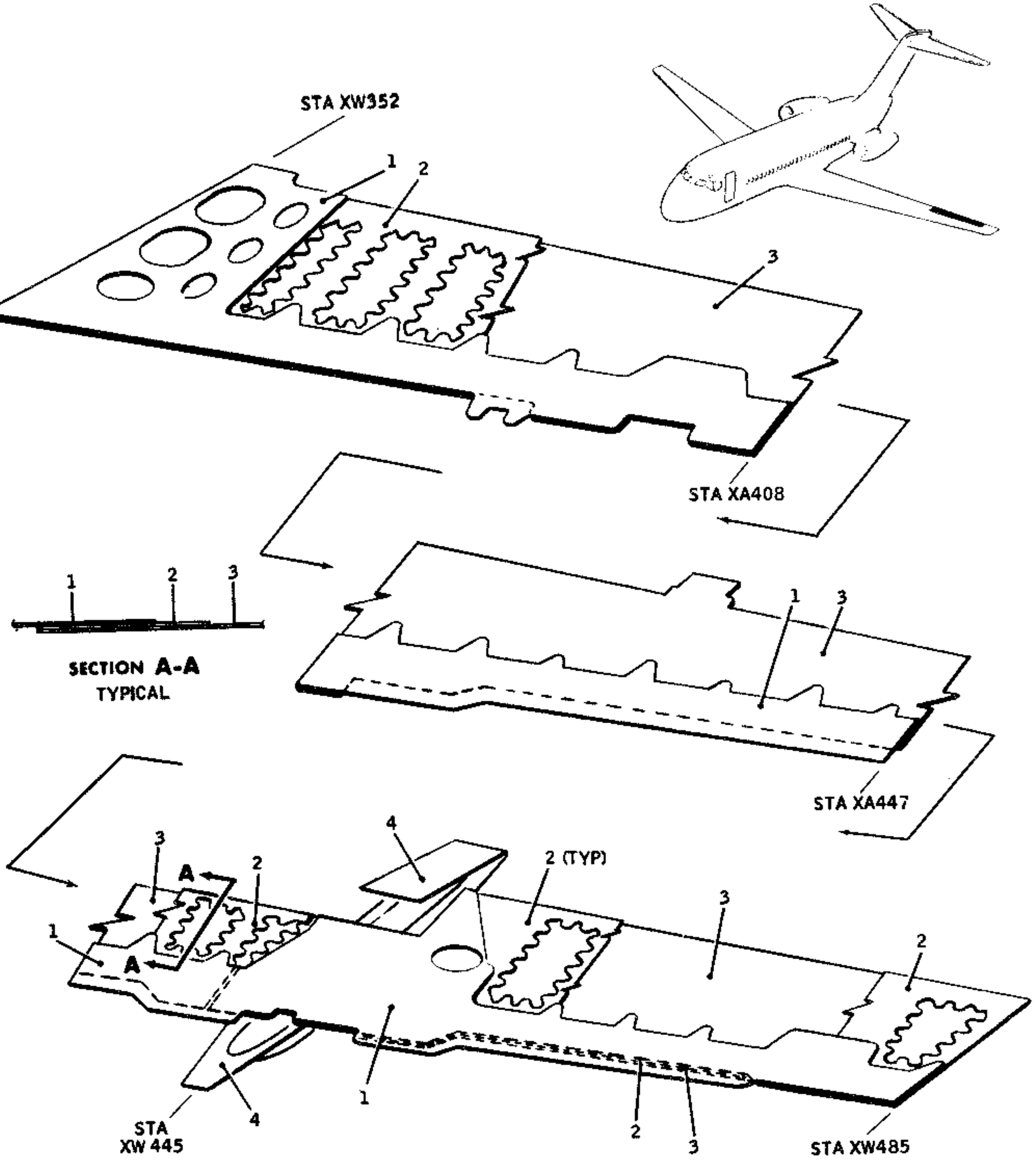
NOTES:

1. MADE FROM .375 SHEET LAMINATED GLASS CLOTH PHENOLIC.
2. REFERENCE - DOUGLAS DRAWINGS 5910046, 5955889, 5955890, AND 9957570.

BB3-250B

Aileron Main Section Plating
Figure 3 (Sheet 1)

Printed in U.S.A.

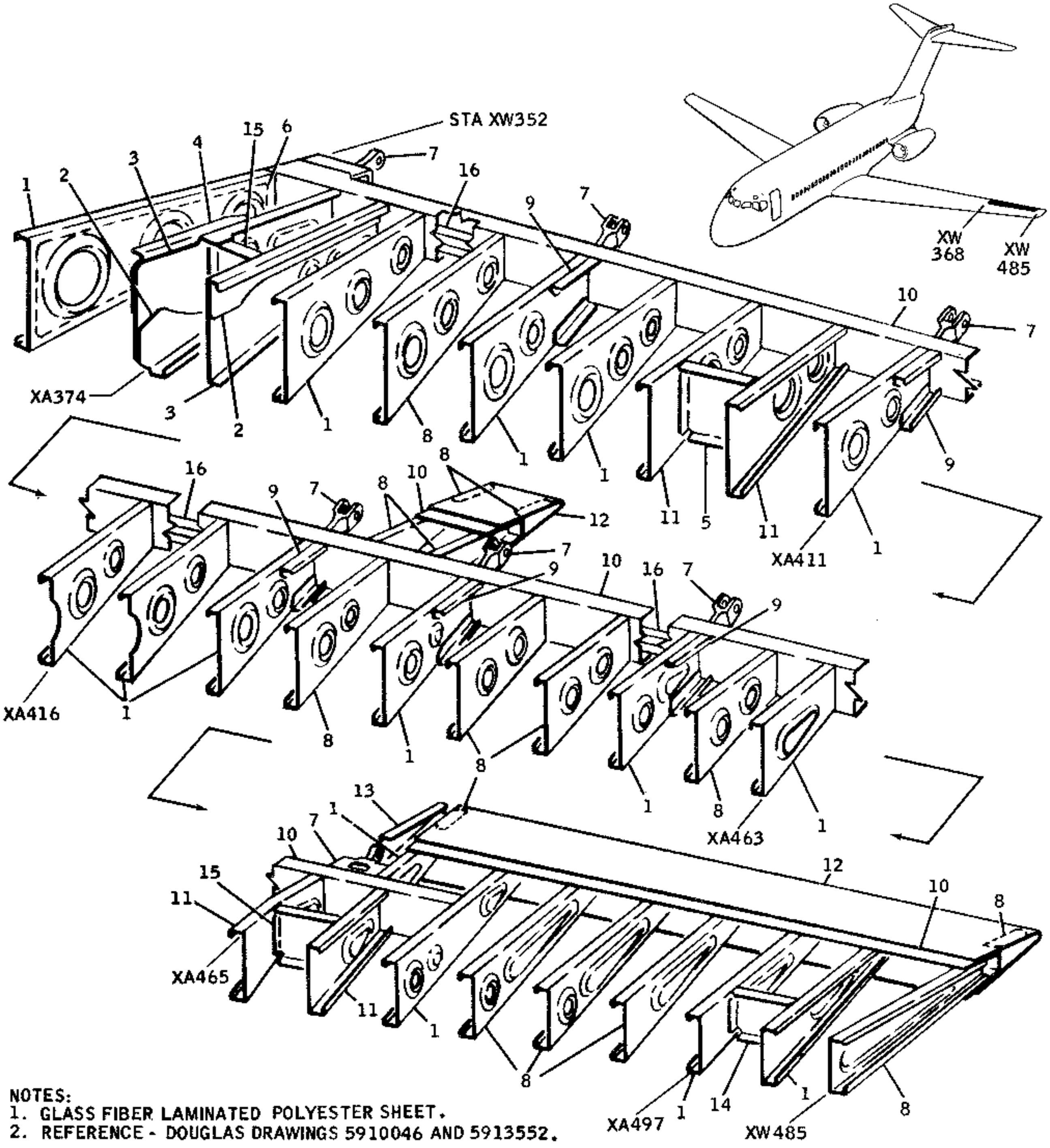


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.050	CLAD 2014 - T6
2	BONDED DOUBLER	.016	CLAD 2014 - T6
3	SKIN	.016	CLAD 2014 - T6
4	FAIRING	.032	CLAD. 6061 - T6

REFERENCE - DOUGLAS DRAWINGS 5910046,
5955888, AND 9957570.

BB3-341B

Aileron Main Section Plating
Figure 3 (Sheet 2)

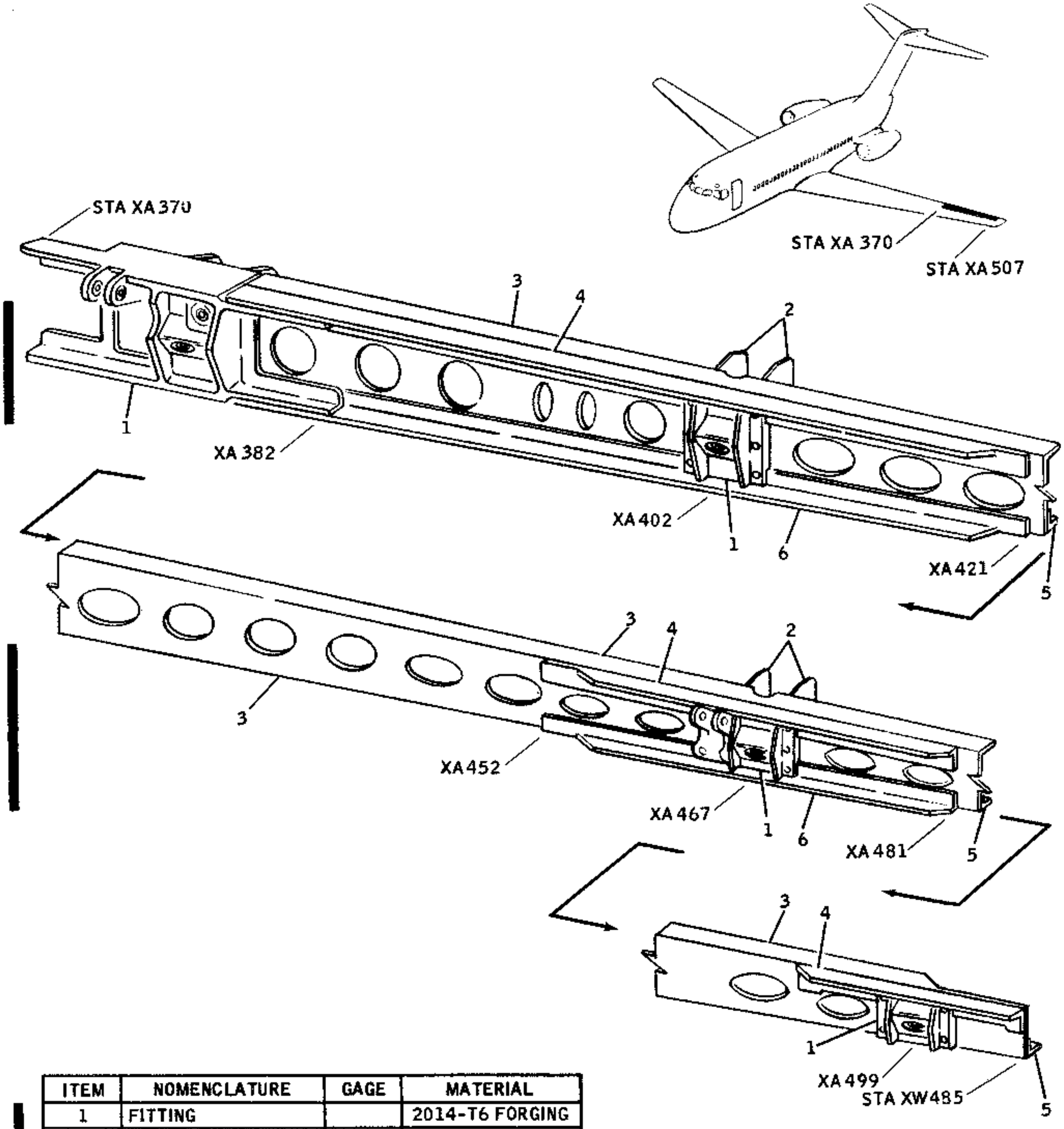


NOTES:
1. GLASS FIBER LAMINATED POLYESTER SHEET.
2. REFERENCE - DOUGLAS DRAWINGS 5910046 AND 5913552.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.032	CLAD 2024-T42	9	ANGLE	.032	CLAD 2024-T42
2	STIFFENER	.063	CLAD 2024-T42	10	CHANNEL	.025	CLAD 2024-T3
3	RIB	.063	CLAD 2024-T42	11	RIB	.040	CLAD 2024-T42
4	ANGLE	.063	CLAD 2024-T42	12	SHAPE		3913180
5	INTERCOSTAL	.040	CLAD 2024-T3	13	RIB	.040	SHEET 6061-T6
6	SEAL	.016	SEE NOTE 1	14	INTERCOSTAL	.032	CLAD 2024-T42
7	FITTING	2.000	PLATE 2014-T651	15	INTERCOSTAL	.040	CLAD 2024-T42
8	RIB	.025	CLAD 2024-T42	16	SEAL	.012	CLAD 2024-T3

BB3-251A

Aileron Main Section Structure
Figure 4 (Sheet 1)

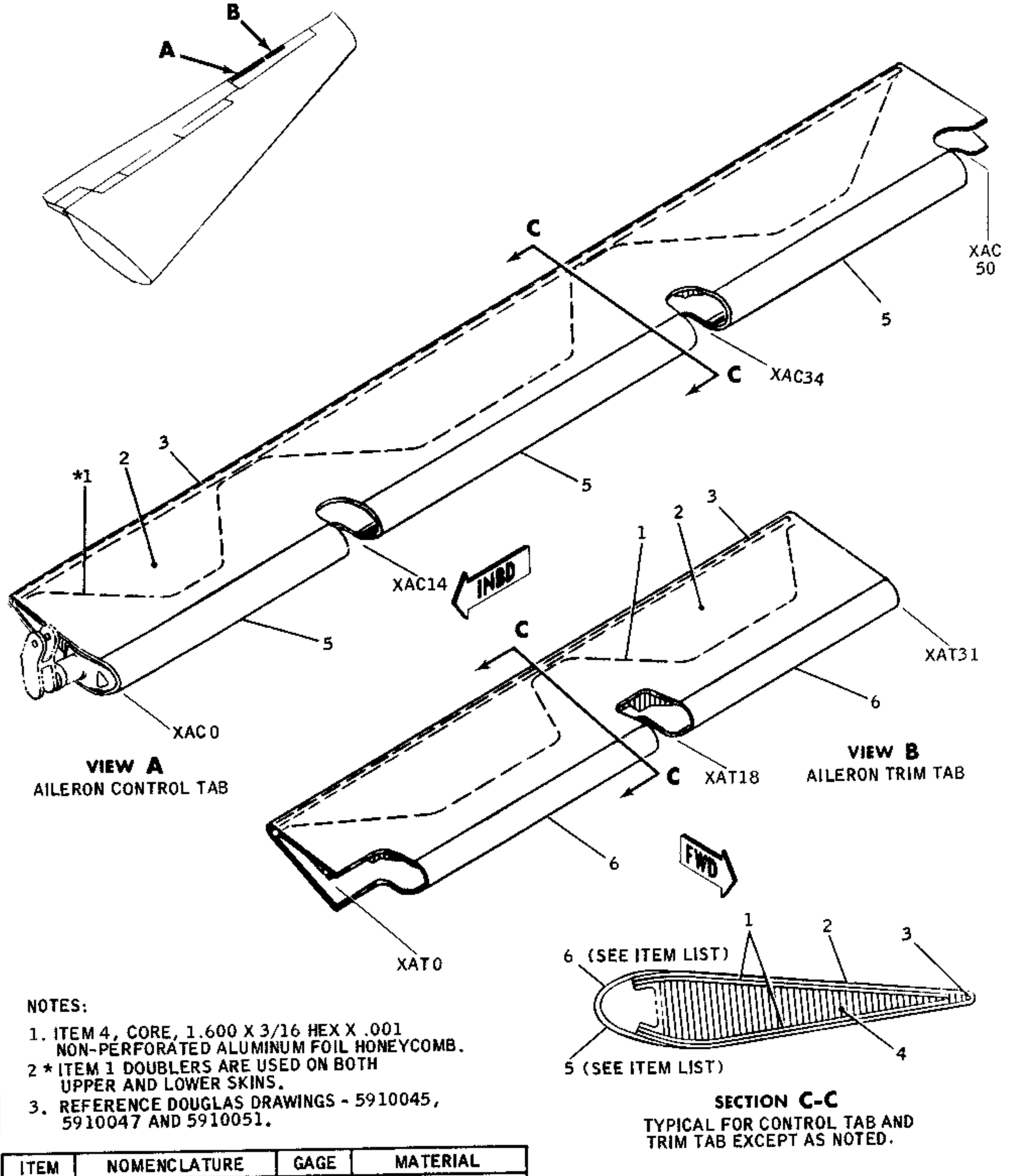


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		2014-T6 FORGING
2	FITTING	1.000	PLATE 2014-T651
3	CAP		2912064
4	CAP		2912063
5	CAP		2912066
6	CAP		2912065

REFERENCE - DOUGLAS
DRAWING 9911703

BB3-252 A

Aileron Main Section Structure
Figure 4 (Sheet 2)



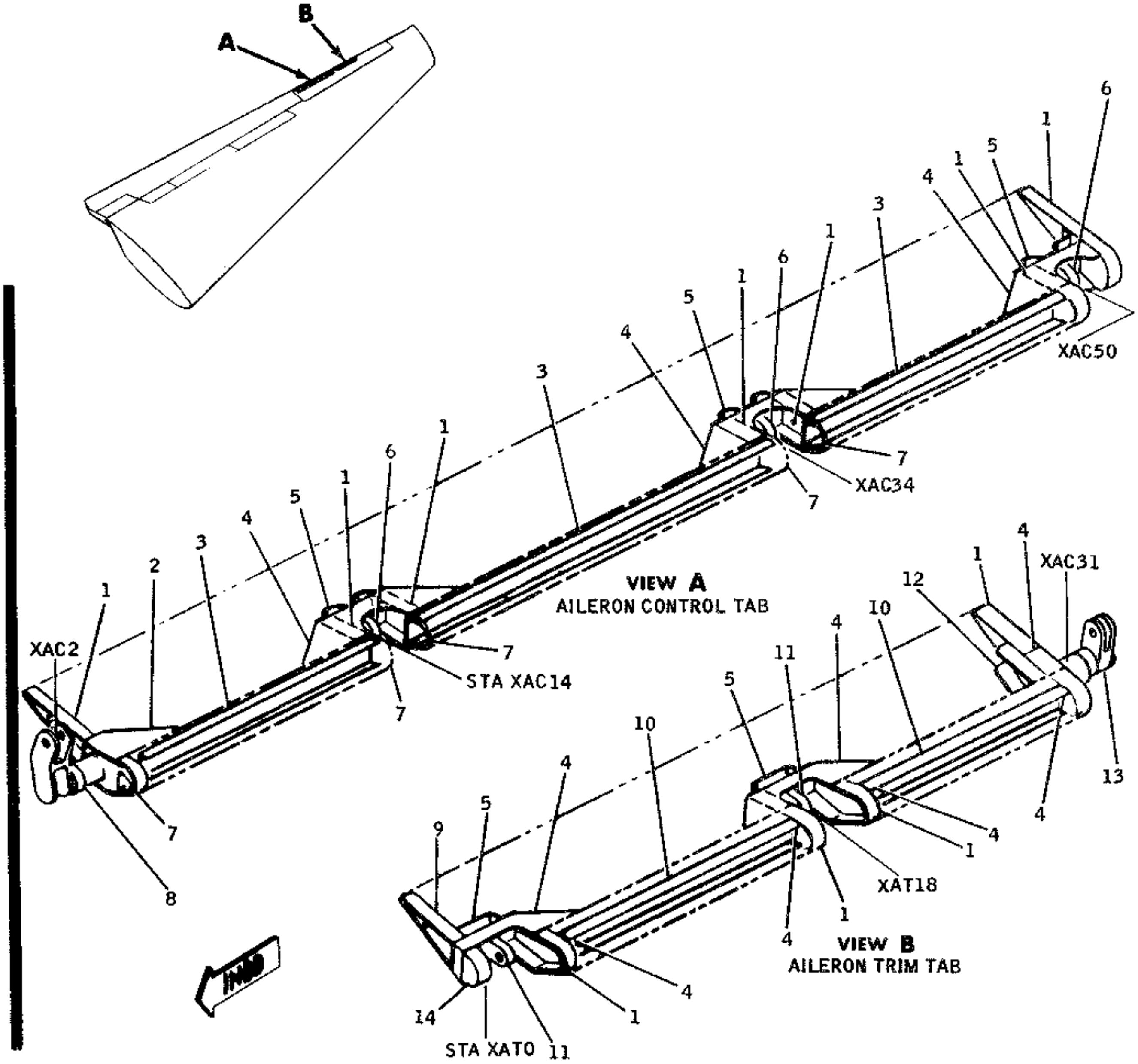
NOTES:

1. ITEM 4, CORE, 1.600 X 3/16 HEX X .001 NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. * ITEM 1 DOUBLERS ARE USED ON BOTH UPPER AND LOWER SKINS.
3. REFERENCE DOUGLAS DRAWINGS - 5910045, 5910047 AND 5910051.

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.020	CLAD 7075-T6
2	SKIN	.012	CLAD 7075-T6
3	WIRE	.090	5056-H32
4	CORE		SEE NOTE 1
5	NOSE CAP, CONTROL TAB		4914837
6	NOSE CAP, TRIM TAB		2914793

BB3-253A

Aileron Control Tab and Trim Tab Plating
Figure 5



REFERENCE - DOUGLAS DRAWINGS
5910047 AND 5910051

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.040	CLAD 7075-T6	8	FITTING		BAR 7075-T7351
2	BOX	.063	CLAD 7075 - T6	9	RIB	.032	CLAD 7075-T6
3	SPAR		2914765	10	SPAR CHANNEL	.040	CLAD 7075-T6
4	BOX	.040	CLAD 7075-T6	11	FITTING	1.500	PLATE 7075-T651
5	COVER	.032	CLAD 7075-T6	12	RIB	.050	CLAD 7075-T6
6	FITTING	1.250	7075-T651	13	FITTING	3.000	PLATE 7075-T7351
7	COVER	.025	CLAD 2024-T3	14	NOSE PIECE		CLAD 7075-T6

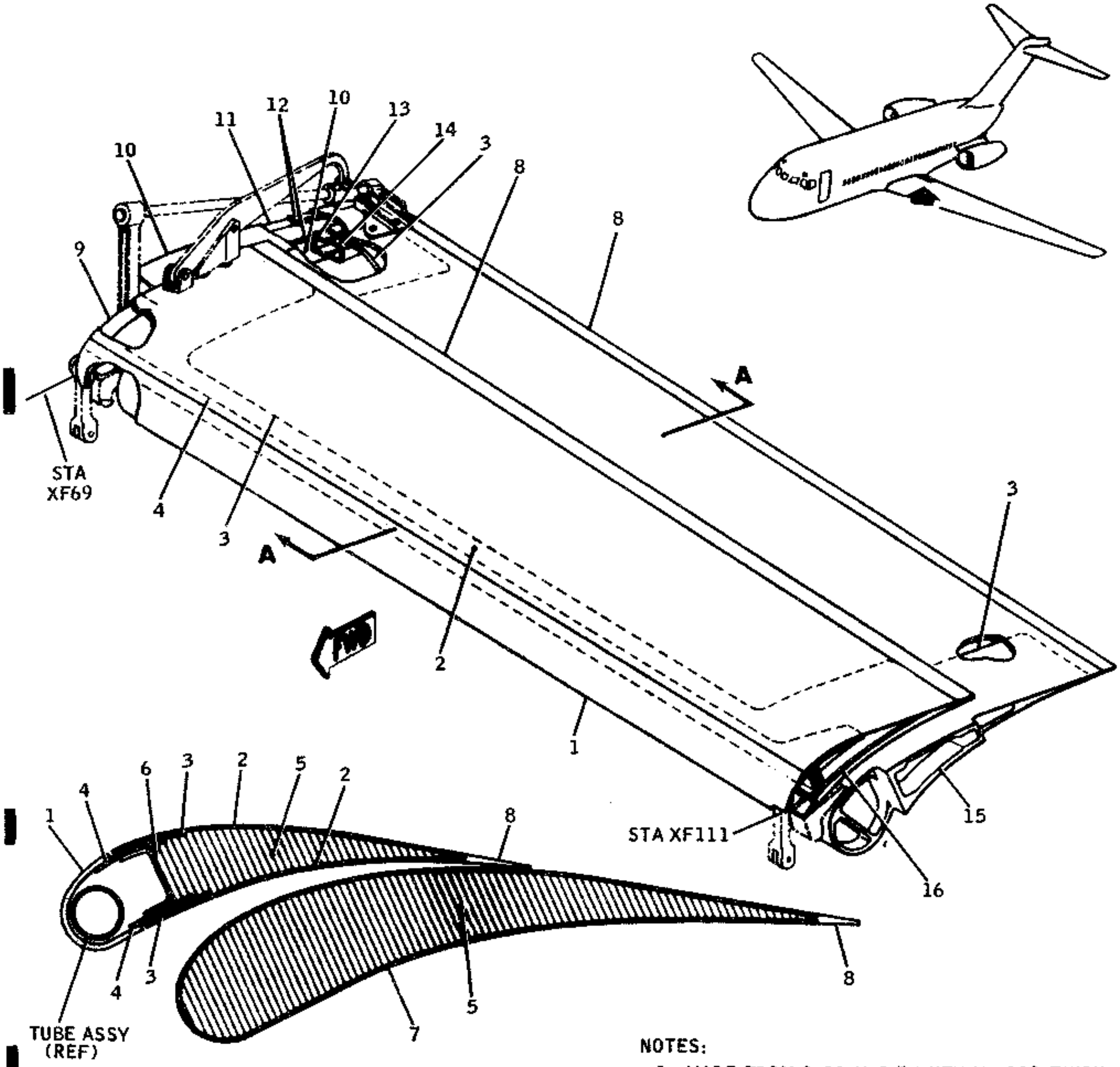
BB3-258A

Aileron Control Tab and Trim Tab Structure
Figure 6

FLAPS AND VANES - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section illustrates wing flaps and wing flap vanes. Materials for these components are identified in material lists by item number callouts.



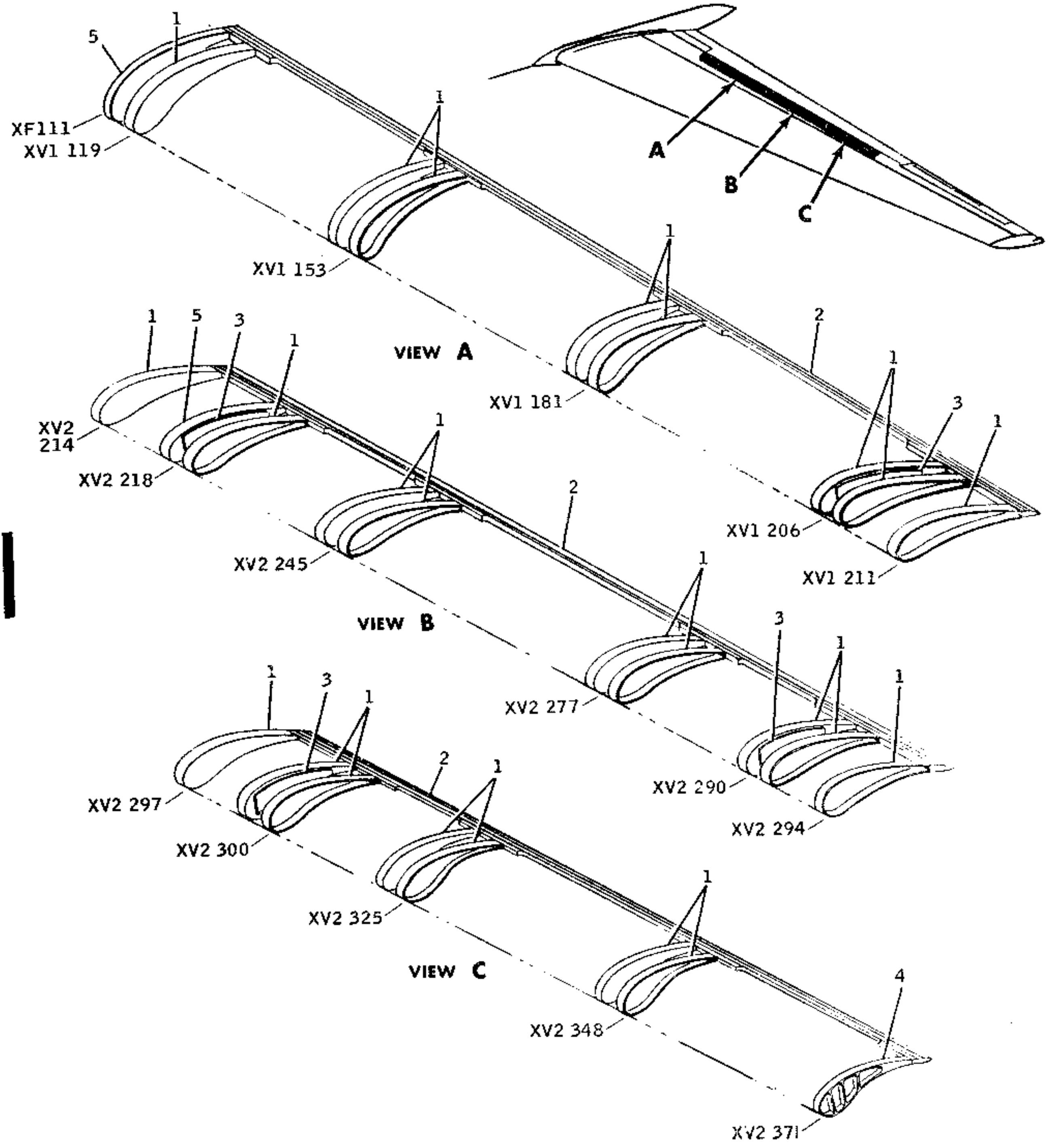
NOTES:

1. MADE FROM 0.80 X 3/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
2. REFERENCE - DOUGLAS DRAWINGS 5910040, 5912168.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	CLAD 2024-T42	9	RIB	1.750	PLATE 7075-T651
2	SKIN	.016	CLAD 7075-T6	10	FAIRING SKIN	.016	CLAD 2014-T6
3	DOUBLER	.032	CLAD 7075-T6	11	ZEE	.032	CLAD 2024-T3
4	DOUBLER	.063	CLAD 7075-T6	12	DOUBLER	.016	CLAD 2014-T6
5	CORE		SEE NOTE 1	13	CHANNEL	.032	CLAD 2024-T42
6	CHANNEL	.063	CLAD 7075-T6	14	RIB	3.000	PLATE 7075-T6
7	SKIN	.016	CLAD 7075-T6	15	RIB	2.000	PLATE 7075-T6
8	TRAILING EDGE		2912306	16	RIB	1.125	PLATE 7075-T6

BB3-268A

Forward and Aft Movable Flap Vanes Plating
Figure 1

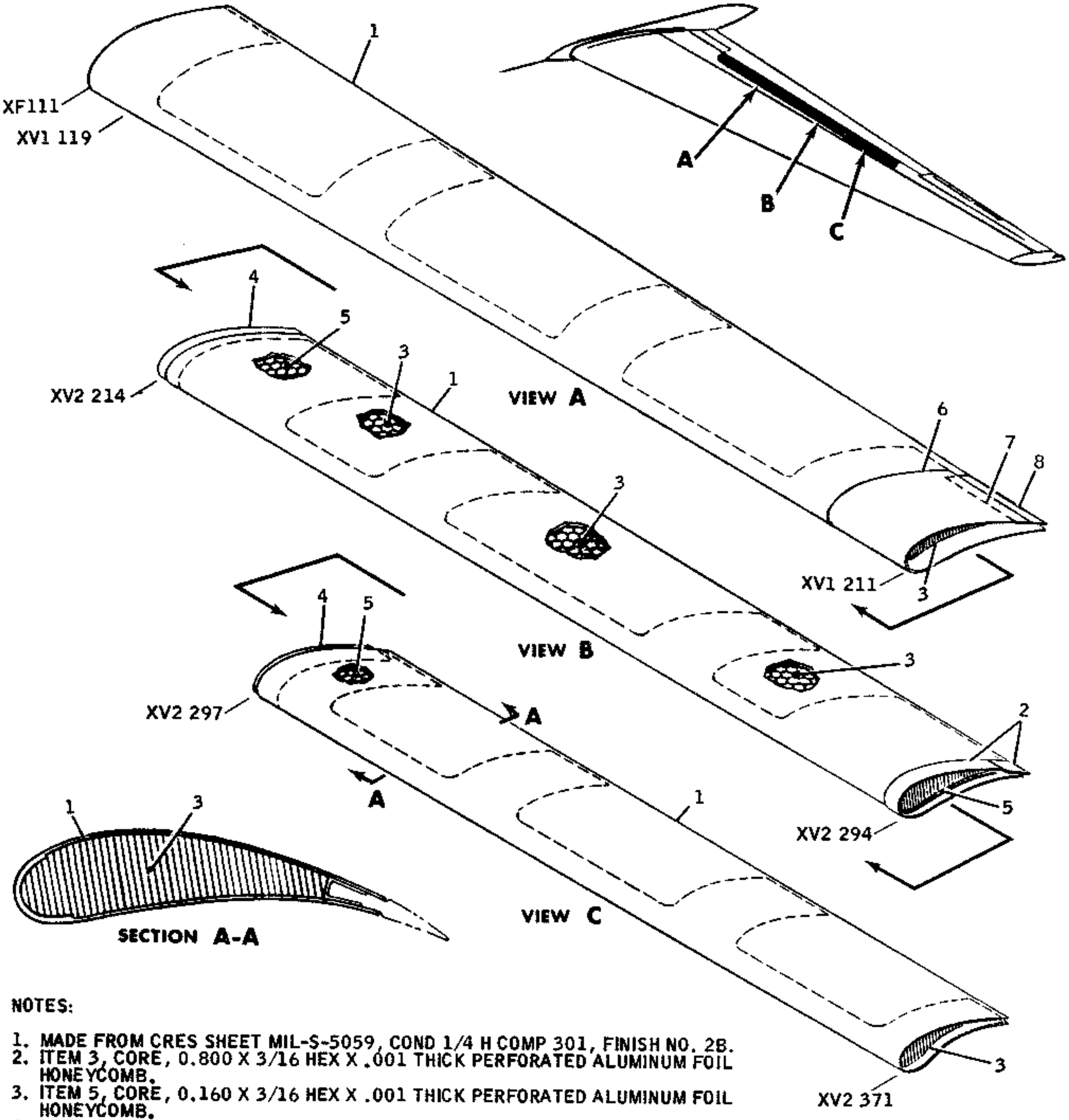


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.063	CLAD 7075-T6
2	TRAILING EDGE		1704438
3	FITTING	1.000	PLATE 7075-T651
4	RIB	1.125	PLATE 7075-T651
5	RIB	.040	CLAD 7075-T6

REFERENCE - DOUGLAS DRAWINGS
5910041, 5910042 AND 5910043

BB3-269B

Inboard, Center, and Outboard Fixed Flap Vanes Plating
Figure 2 (Sheet 1)



NOTES:

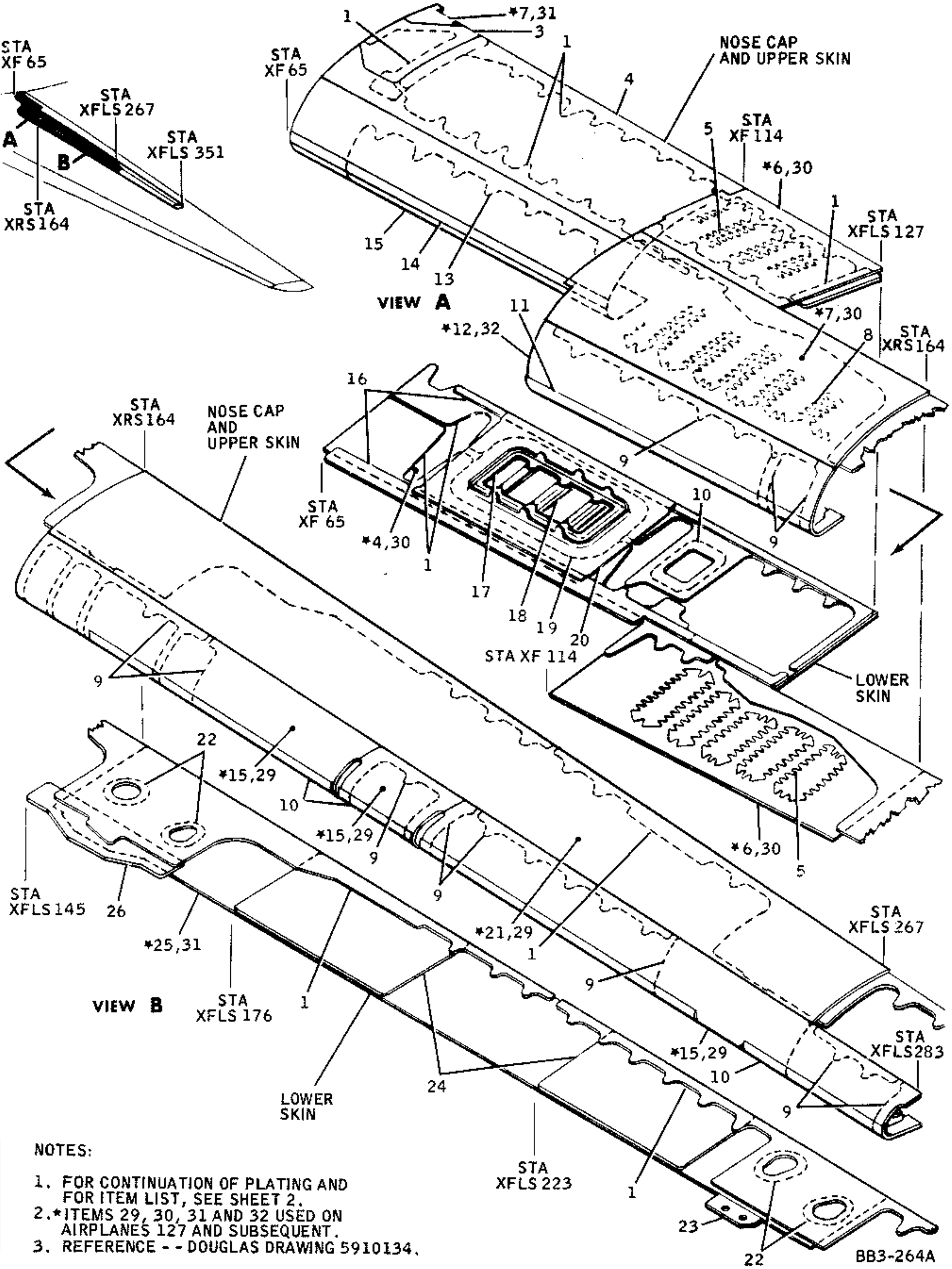
1. MADE FROM CRES SHEET MIL-S-5059, COND 1/4 H COMP 301, FINISH NO. 2B.
2. ITEM 3, CORE, 0.800 X 3/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
3. ITEM 5, CORE, 0.160 X 3/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
4. REFERENCE - DOUGLAS DRAWINGS 5910041, 5910042, 5910043.

ITEM	NOMENCLATURE	GAGE	MATERIAL
*1	SKIN	.063	CLAD 7075-T6
2	SEAL	.016	SEE NOTE 1
3	CORE		SEE NOTE 2
4	RUB STRIP	.016	SEE NOTE 1
5	CORE		SEE NOTE 3
6	SKIN	.032	CLAD 7075-T6
7	FILLER	.016	CLAD 7075-T6
8	DOUBLER	.032	CLAD 7075-T6

* ITEM 1, SKIN IS .050 ON AIRPLANES 33 AND SUBSEQUENT, CHEMICALLY MILLED TO .016 IN AREAS INDICATED BY BROKEN LINES; OR .016 CLAD 7075-T6 SKINS WITH .032 CLAD 7075-T6 DOUBLERS.

BB3-537B

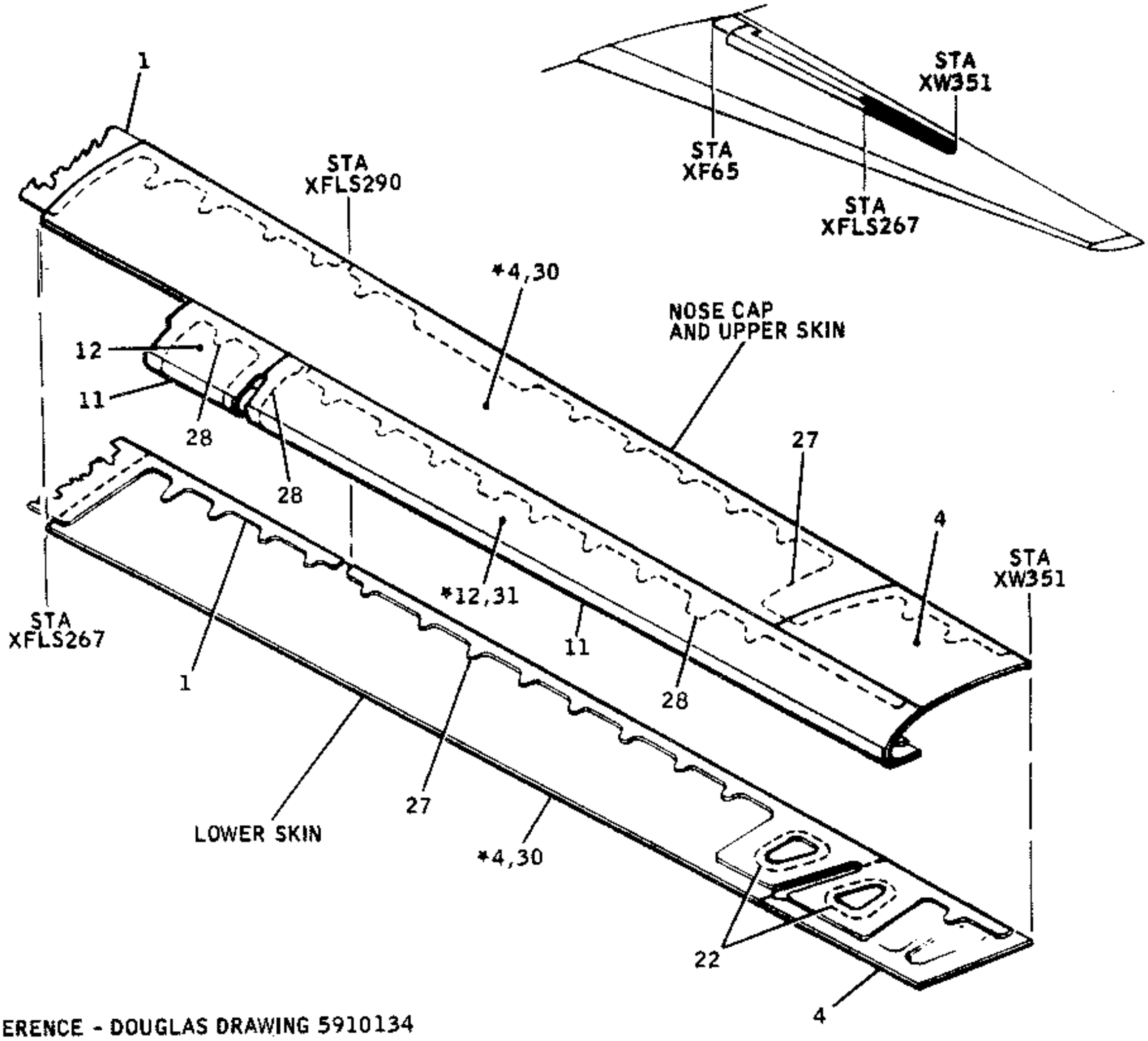
Inboard, Center, and Outboard Fixed Flap Vanes Plating -- Type A
Figure 2 (Sheet 2)



NOTES:

1. FOR CONTINUATION OF PLATING AND FOR ITEM LIST, SEE SHEET 2.
2. *ITEMS 29, 30, 31 AND 32 USED ON AIRPLANES 127 AND SUBSEQUENT.
3. REFERENCE - - DOUGLAS DRAWING 5910134.

Flap Plating
Figure 3 (Sheet 1)

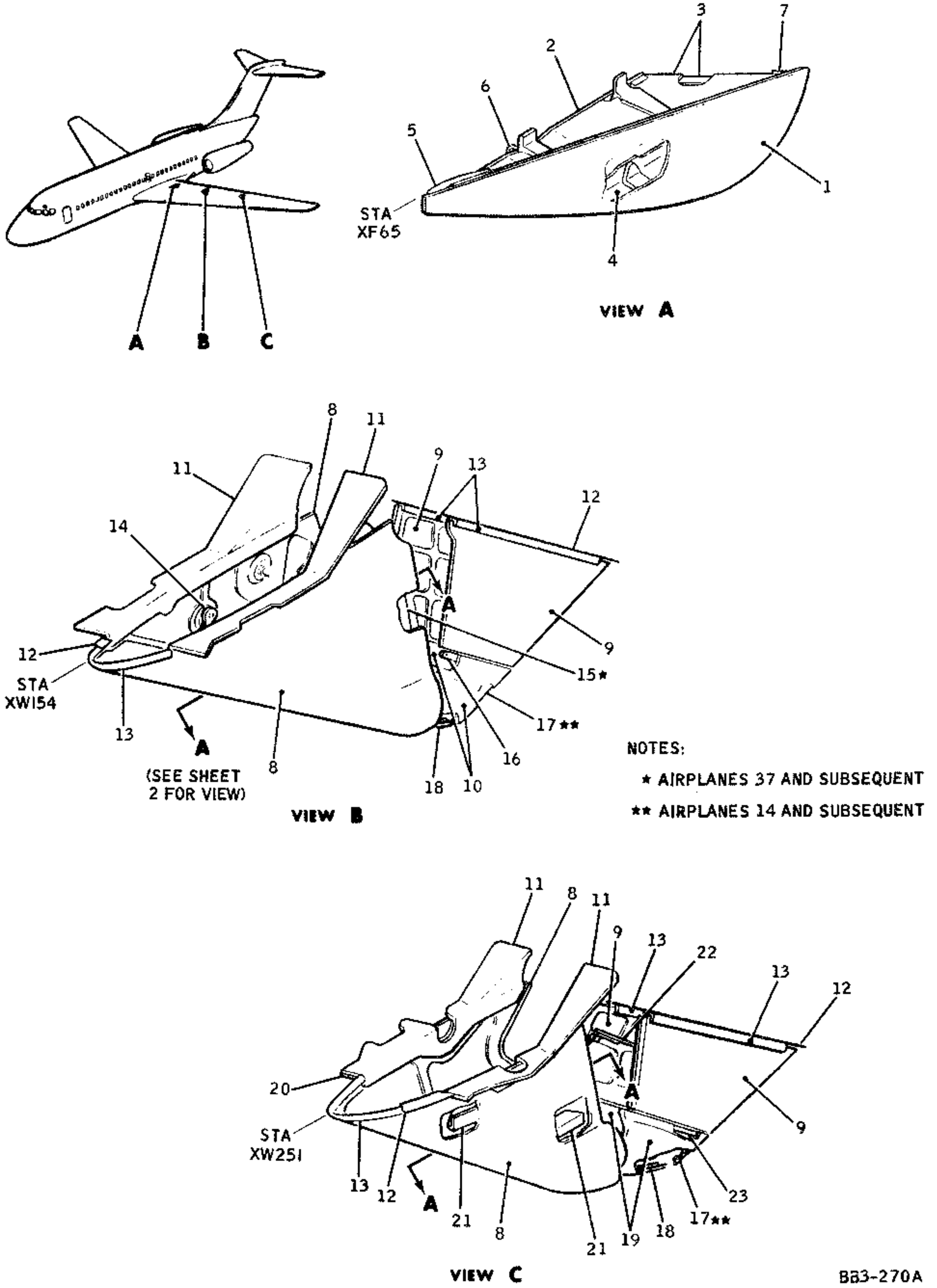


REFERENCE - DOUGLAS DRAWING 5910134

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 2024-T3	17	PAN	.063	CLAD 2014-T6
2	COVER	.063	CLAD 2024-T3	18	STIFFENER	.063	CLAD 2014-T6
3	DOOR	.125	CLAD 2024-T3	19	SKIN	.050	CLAD 2014-T6
4	SKIN	.050	CLAD 2024-T3	20	DOUBLER	.080	CLAD 2024-T42
5	BONDED DOUBLER	.020	CLAD 2014-T6	21	SKIN	.071	CLAD 2024-T3
6	SKIN	.032	CLAD 2014-T6	22	DOOR	.063	CLAD 2024-T3
7	SKIN	.063	CLAD 2024-T42	23	SKIN	.100	CLAD 2024-T3
8	DOUBLER	.020	CLAD 2014-T6	24	DOUBLER	.020	CLAD 2024-T3
9	BONDED DOUBLER	.025	CLAD 2014-T6	25	SKIN	.063	CLAD 2024-T3
10	DOOR	.090	CLAD 2024-T42	26	PLATE 39150184-1		PLATE 7075-T651
11	RUBSTRIP	.032	SHEET 6061-T6	27	DOUBLER	.071	CLAD 2024-T3
12	SKIN	.063	CLAD 2014-T6	28	BONDED DOUBLER	.020	CLAD 2024-T6
13	BONDED DOUBLER	.032	CLAD 2014-T6	29	SKIN	.071	CLAD 7075-T6
14	RUBSTRIP	.032	CLAD 7075-T6	30	SKIN	.050	CLAD 7075-T6
15	NOSE SKIN	.071	CLAD 2014-T6	31	SKIN	.063	CLAD 7075-T6
16	SHIM	.016	CLAD 2024-T3	32	SKIN	.040	CLAD 7075-T6

BB3-265B

Flap Plating
Figure 3 (Sheet 2)

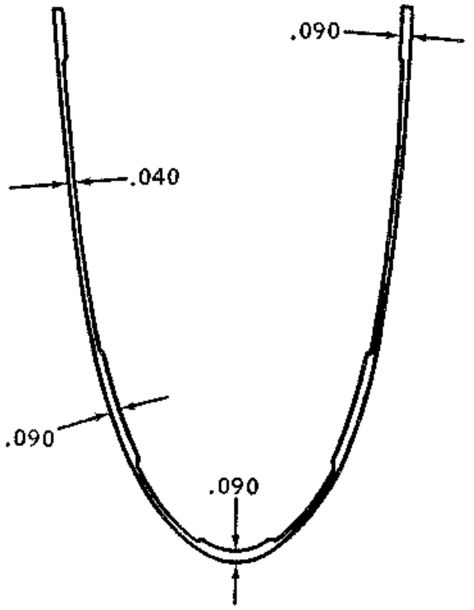


NOTES:

* AIRPLANES 37 AND SUBSEQUENT

** AIRPLANES 14 AND SUBSEQUENT

Flap Hinge Fairings Plating and Structure
Figure 4 (Sheet 1)



SECTION A-A

(CHEMICALLY MILLED FROM .090. STOCK. TAPER VARIES TO .040.)

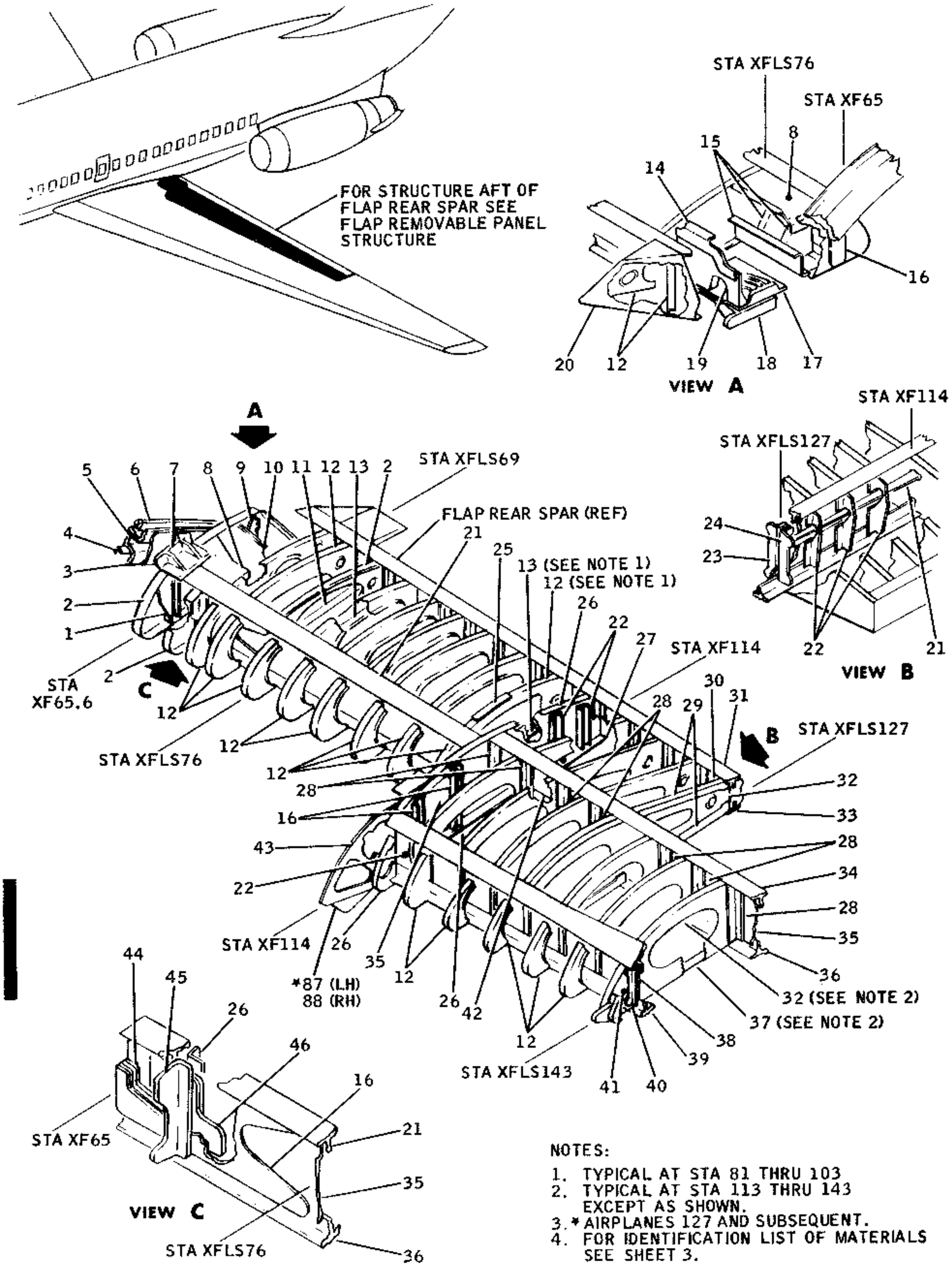
NOTES:

1. MADE FROM .025 CRES MIL-S-5059, ANLD, COMP 302, FINISH NO. 2D.
2. REFERENCE - DOUGLAS DRAWINGS 5912169, 5912171, 5912172, 5912174 AND 5915706.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.040	CLAD 2024-T3	13	SEAL		2916009
2	SKIN	.040	CLAD 2024-T42	14	CLIP	.080	CLAD 2024-T42
3	PANEL	.063	CLAD 2024-T42	15	STRIP		SEE NOTE 1
4	INTERCOSTAL	.050	CLAD 2024-T42	16	SPACER	.040	CLAD 2024-T3
5	FORMER	.050	CLAD 2024-T42	17	FILLER	.750	CSTG PM356-T6
6	STIFFENER	.040	CLAD 2024-T42	18	SPLICE PLATE	.050	CLAD 2024-T42
7	ANGLE	.050	CLAD 7075-T6	19	SKIN	.050	CLAD 2024-T42
8	FAIRING	.090	SHEET 6061-T6	20	FILLER	.100	CLAD 2024-T3
9	PLATE	.190	CLAD 2024-T3	21	BRACKET	.071	CLAD 2024-T42
10	FAIRING	.050	CLAD 2024-T42	22	SUPPORT	.080	CLAD 2024-T3
11	ANGLE	.090	CLAD 2024-T42	23	SHIM	.040	CLAD 2024-T3
12	RUB STRIP	.016	SHEET 6061-T6				

BB3-976

Flap Hinge Fairings Plating and Structure
Figure 4 (Sheet 2)



NOTES:

1. TYPICAL AT STA 81 THRU 103
2. TYPICAL AT STA 113 THRU 143 EXCEPT AS SHOWN.
3. * AIRPLANES 127 AND SUBSEQUENT.
4. FOR IDENTIFICATION LIST OF MATERIALS SEE SHEET 3.

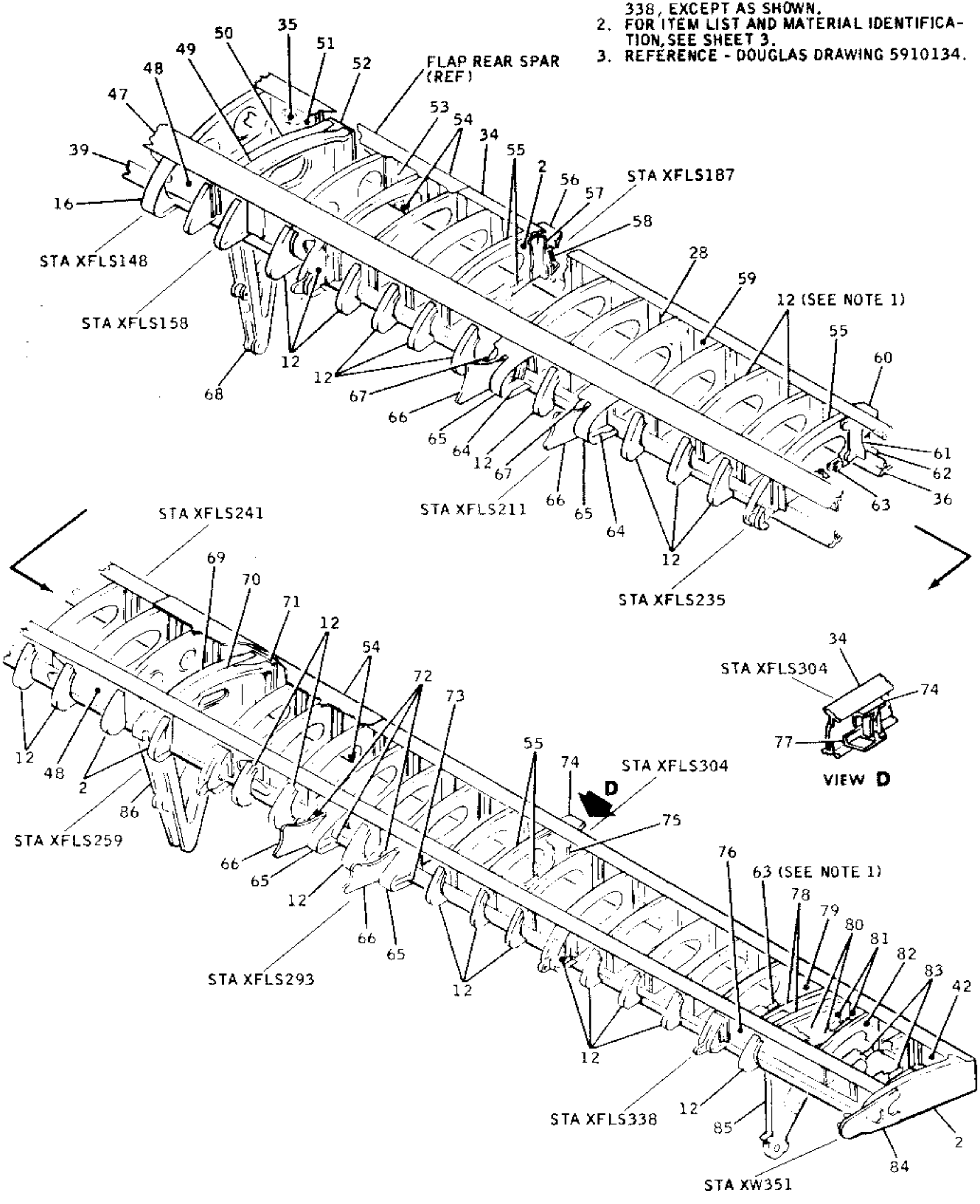
REFERENCE - DOUGLAS DRAWING 5910134

BB3-266A

Flap Structure
Figure 5 (Sheet 1)

NOTES:

1. TYPICAL AT STATIONS XFLS148 THROUGH 338, EXCEPT AS SHOWN.
2. FOR ITEM LIST AND MATERIAL IDENTIFICATION, SEE SHEET 3.
3. REFERENCE - DOUGLAS DRAWING 5910134.



Flap Structure
Figure 5 (Sheet 2)

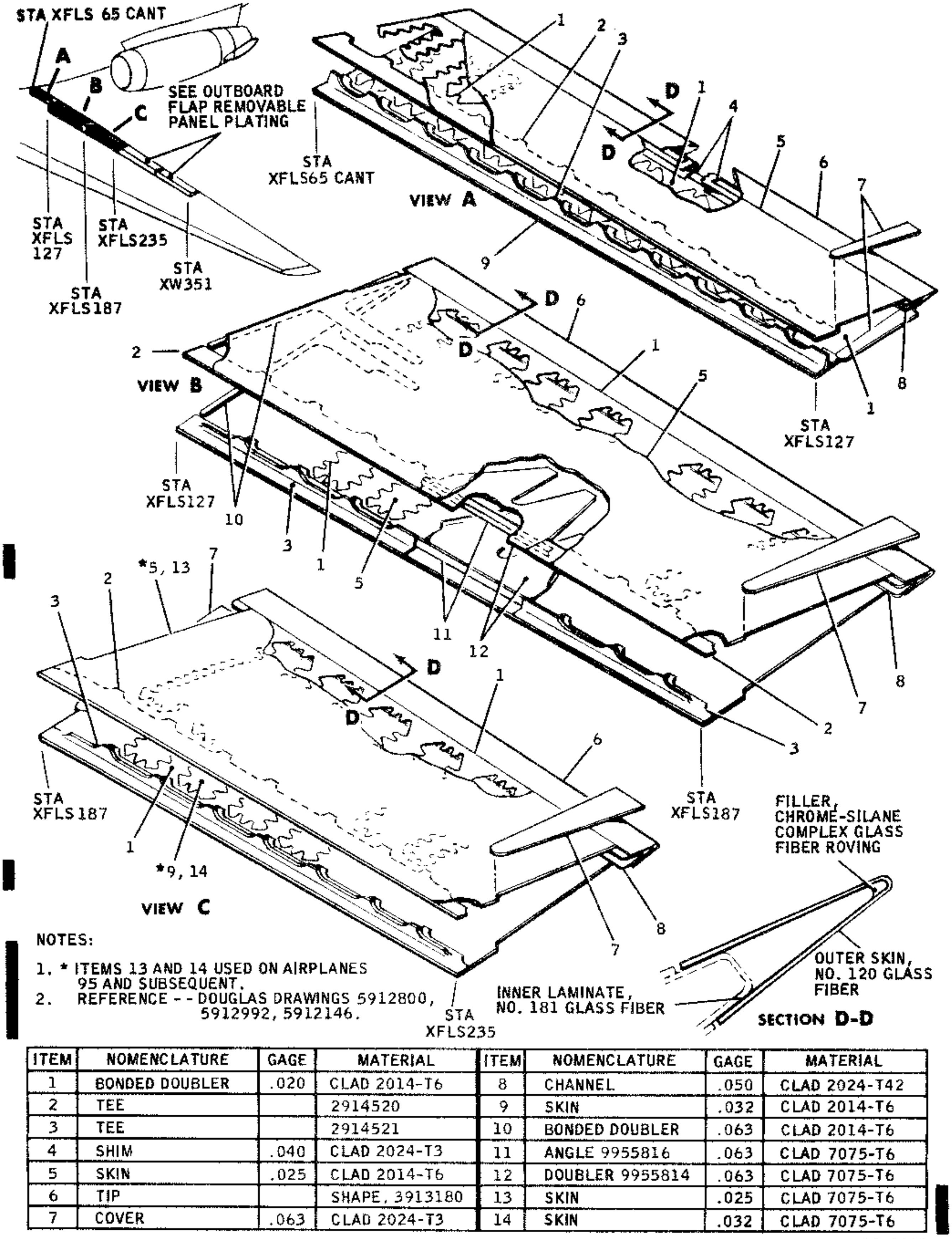
NOTES:

1. SEE SHEETS 1 AND 2 FOR DETAIL VIEWS.
2. MADE FROM TITANIUM SHEET DMS 1592.
3. MADE FROM TITANIUM FORGING DMS 1583.
4. REFERENCE - DOUGLAS DRAWING 5910134.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		PLATE 2024-T351	45	ANGLE		1419316
2	RIB	.063	CLAD 2024-T42	46	FILLER	.125	CLAD 2024-T3
3	BACKPLATE	.125	SEE NOTE 2	47	UPPER STRINGER		2912308
4	RUBSTRIP	.063	4130 STEEL	48	WEB	.080	CLAD 7075-T6
5	CHANNEL		SEE NOTE 3	49	FITTING		FORGING 7075-T411
6	TRACK		2914976	50	FITTING		FORGING 7075-T411
7	FITTING		PLATE 2024-T351	51	DOUBLER	.025	CLAD 7075-T6
8	FITTING		PLATE 2024-T351	52	FITTING		4140 STEEL
9	DOUBLER	.063	CLAD 2024-T3	53	TEE		137058
10	DOUBLER	.080	CLAD 2024-T42	54	SPLICE	.125	CLAD 7075-T6
11	TEE		1414813	55	ANGLE		1858549
12	RIB	.050	CLAD 2024-T42	56	FITTING		BAR 7075-T651
13	CHANNEL	.063	CLAD 2024-T42	57	TEE		1419385
14	CAP		PLATE 2024-T351	58	FITTING		BAR 7075-T651
15	INTERCOSTAL	.063	CLAD 2024-T42	59	WEB	.040	CLAD 7075-T6
16	DOUBLER	.063	CLAD 2024-T3	60	FITTING		BAR 7075-T651
17	FITTING		PLATE 2024-T351	61	TEE		1419385
18	FITTING		PLATE 2024-T351	62	FITTING		BAR 7075-T651
19	FITTING		PLATE 2024-T351	63	CHANNEL	.050	CLAD 2024-T42
20	FAIRING	.050	CLAD 7075-T6	64	RIB	.071	CLAD 7075-T6
21	SPAR		2912428	65	DOUBLER	.090	CLAD 7075-T6
22	STIFFENER	.063	CLAD 2024-T42	66	SUPPORT	.190	CLAD 7075-T6
23	STIFFENER		1419316	67	ANGLE	.071	CLAD 7075-T6
24	STIFFENER		1418915	68	BRACKET		FORGING 2014-T6
25	SPACER	.063	CLAD 2024-T3	69	FITTING		FORGING 7075-T411
26	ANGLE	.063	CLAD 2024-T42	70	FITTING		FORGING 7075-T411
27	TEE		1652272	71	FITTING		4140 STEEL
28	ANGLE		1245072	72	ANGLE	.063	CLAD 7075-T6
29	ANGLE		1109080	73	RIB	.063	CLAD 7075-T6
30	WEB	.050	CLAD 2024-T3	74	FITTING		PLATE 7075-T651
31	UPPER SPAR CAP		2912429	75	TEE		1419385
32	RIB	.040	CLAD 2024-T42	76	WEB	.063	CLAD 7075-T6
33	LOWER SPAR CAP		2912427	77	FITTING		PLATE 7075-T651
34	CAP		4912121	78	FORMER	.050	CLAD 7075-T6
35	WEB	.050	CLAD 7075-T6	79	DOUBLER	.032	CLAD 7075-T6
36	CAP		4912121	80	ANGLE		2602999
37	CHANNEL	.040	CLAD 2024-T42	81	CLIP	.050	CLAD 7075-T6
38	STIFFENER		1242526	82	RIB	.032	CLAD 2024-T42
39	LOWER STRINGER		2912310	83	CHANNEL	.032	CLAD 2024-T42
40	STIFFENER	.050	CLAD 2024-T42	84	FITTING		CLAD 2024-T3
41	WEB	.063	CLAD 2024-T42	85	BRACKET		FORGING 2014-T6
42	WEB	.032	CLAD 7075-T6	86	BRACKET		FORGING 2014-T6
43	FITTING		PLATE 2024-T351	87	CAM LH	.375	PLATE 7075-T651
44	DOUBLER	.125	CLAD 2024-T3	88	CAM RH	.412	PLATE 7075-T651

BB3-430B

Flap Structure
Figure 5 (Sheet 3)



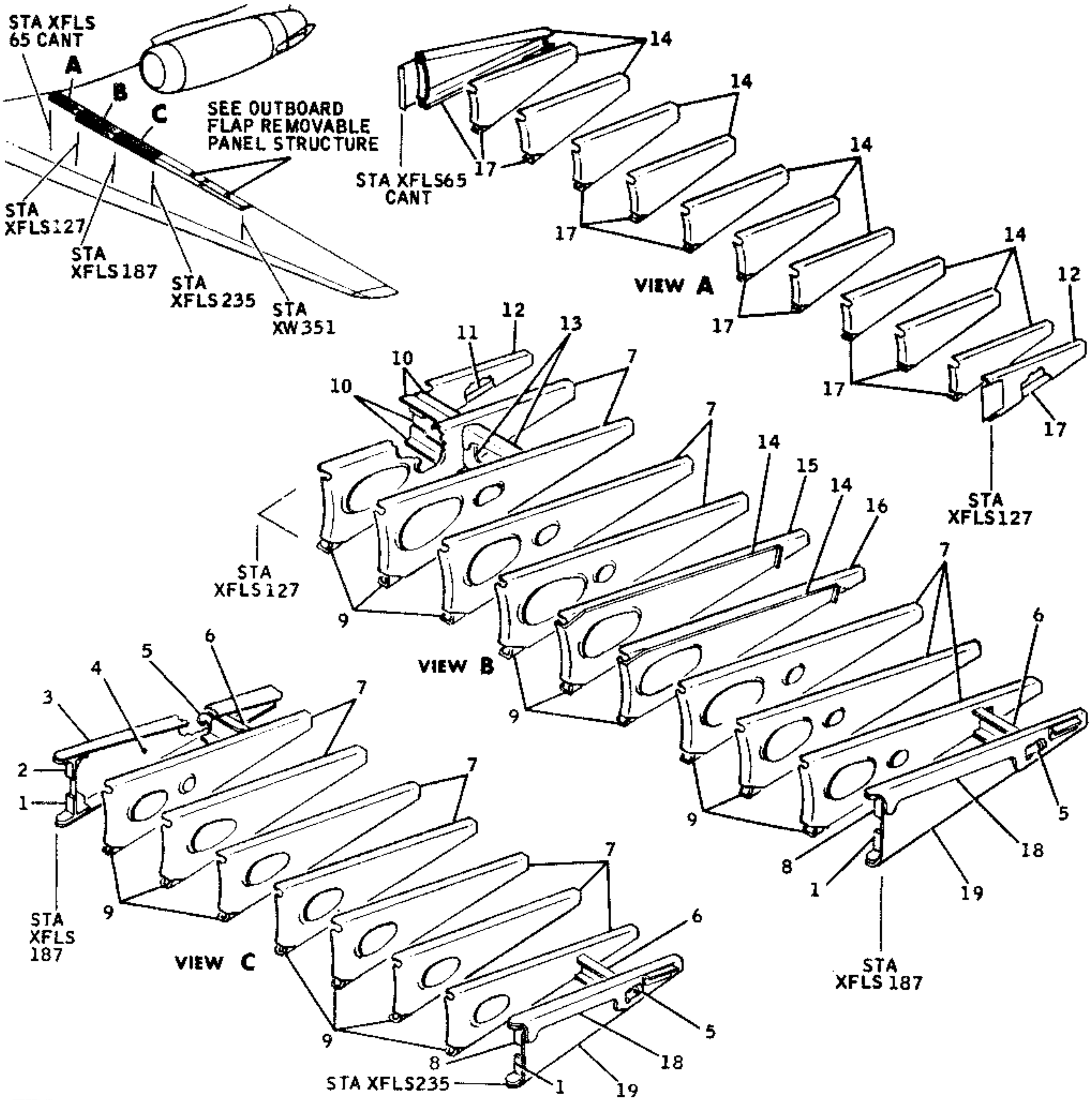
NOTES:

1. * ITEMS 13 AND 14 USED ON AIRPLANES 95 AND SUBSEQUENT.
2. REFERENCE - - DOUGLAS DRAWINGS 5912800, 5912992, 5912146.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.020	CLAD 2014-T6	8	CHANNEL	.050	CLAD 2024-T42
2	TEE		2914520	9	SKIN	.032	CLAD 2014-T6
3	TEE		2914521	10	BONDED DOUBLER	.063	CLAD 2014-T6
4	SHIM	.040	CLAD 2024-T3	11	ANGLE 9955816	.063	CLAD 7075-T6
5	SKIN	.025	CLAD 2014-T6	12	DOUBLER 9955814	.063	CLAD 7075-T6
6	TIP		SHAPE, 3913180	13	SKIN	.025	CLAD 7075-T6
7	COVER	.063	CLAD 2024-T3	14	SKIN	.032	CLAD 7075-T6

BB3-260A

Flap Inboard Section Removable Panels Plating
Figure 6



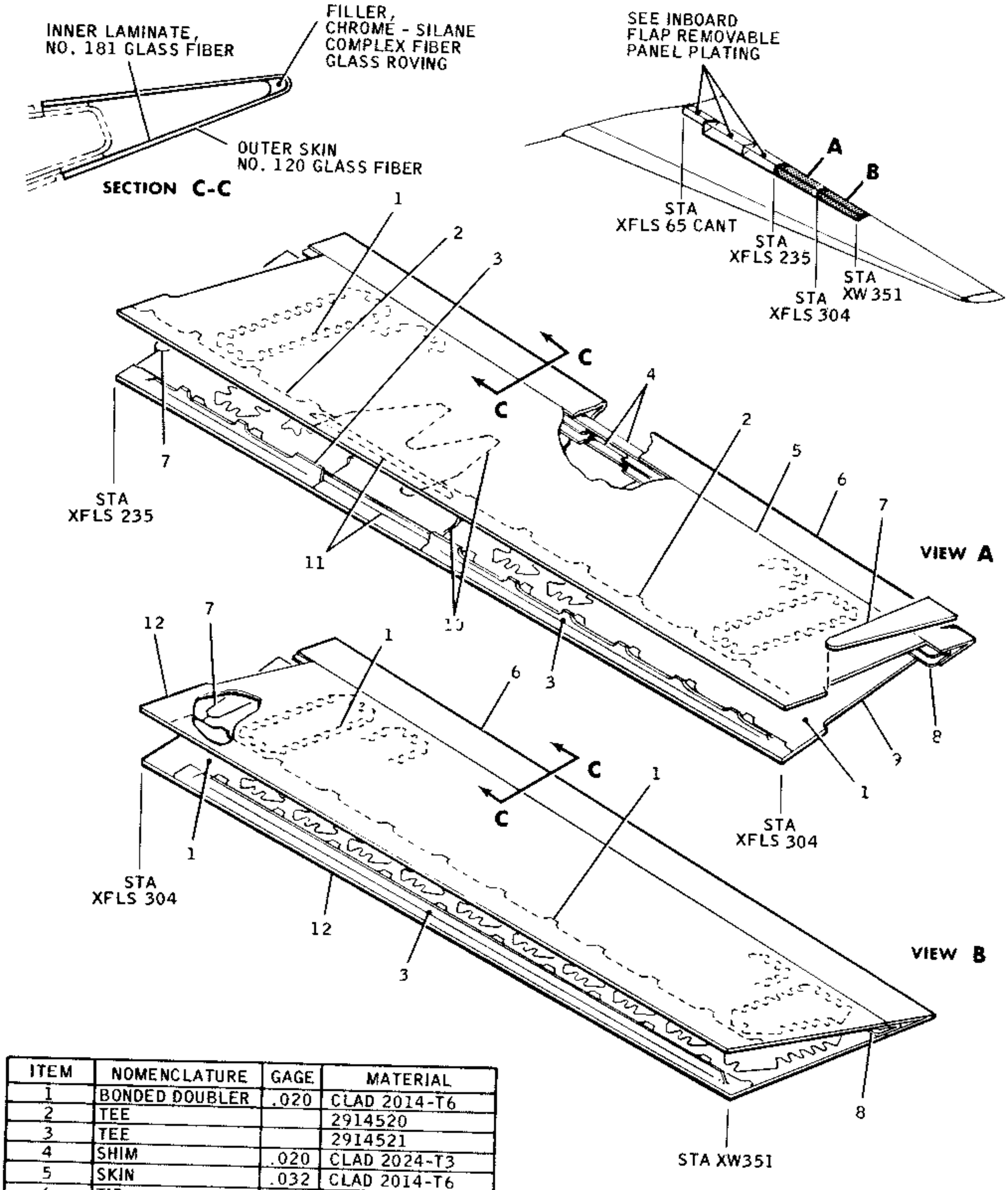
Printed in U.S.A.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING 3912973-1,-2		PLATE 7075-T651	11	CHANNEL	.050	CLAD 2024-T42
2	FITTING 3912972-1,-2		PLATE 7075-T651	12	WEB	.040	CLAD 2024-T42
3	CAP	.063	CLAD 2024-T42	13	BRACKET	.040	CLAD 2024-T42
4	WEB	.063	CLAD 2024-T42	14	RIB	.040	CLAD 2024-T42
5	SUPPORT 4913290-3		STEEL 4130	15	CHANNEL	.063	CLAD 2024-T42
6	INTERCOSTAL	.080	CLAD 7075-T6	16	CHANNEL	.063	CLAD 7075-T6
7	RIB	.032	CLAD 2024-T42	17	CHANNEL	.040	CLAD 2024-T42
8	FITTING 3912970-1,-2		PLATE 7075-T651	18	CAP	.063	CLAD 7075-T6
9	CHANNEL	.032	CLAD 2024-T42	19	WEB	.063	CLAD 7075-T6
10	BRACKET	.050	CLAD 2024-T42				

REFERENCE - DOUGLAS DRAWING 5912800, 5912992, 5912146

BB3-262

Flap Inboard Section Removable Panels Ribs
and Intercostals
Figure 7

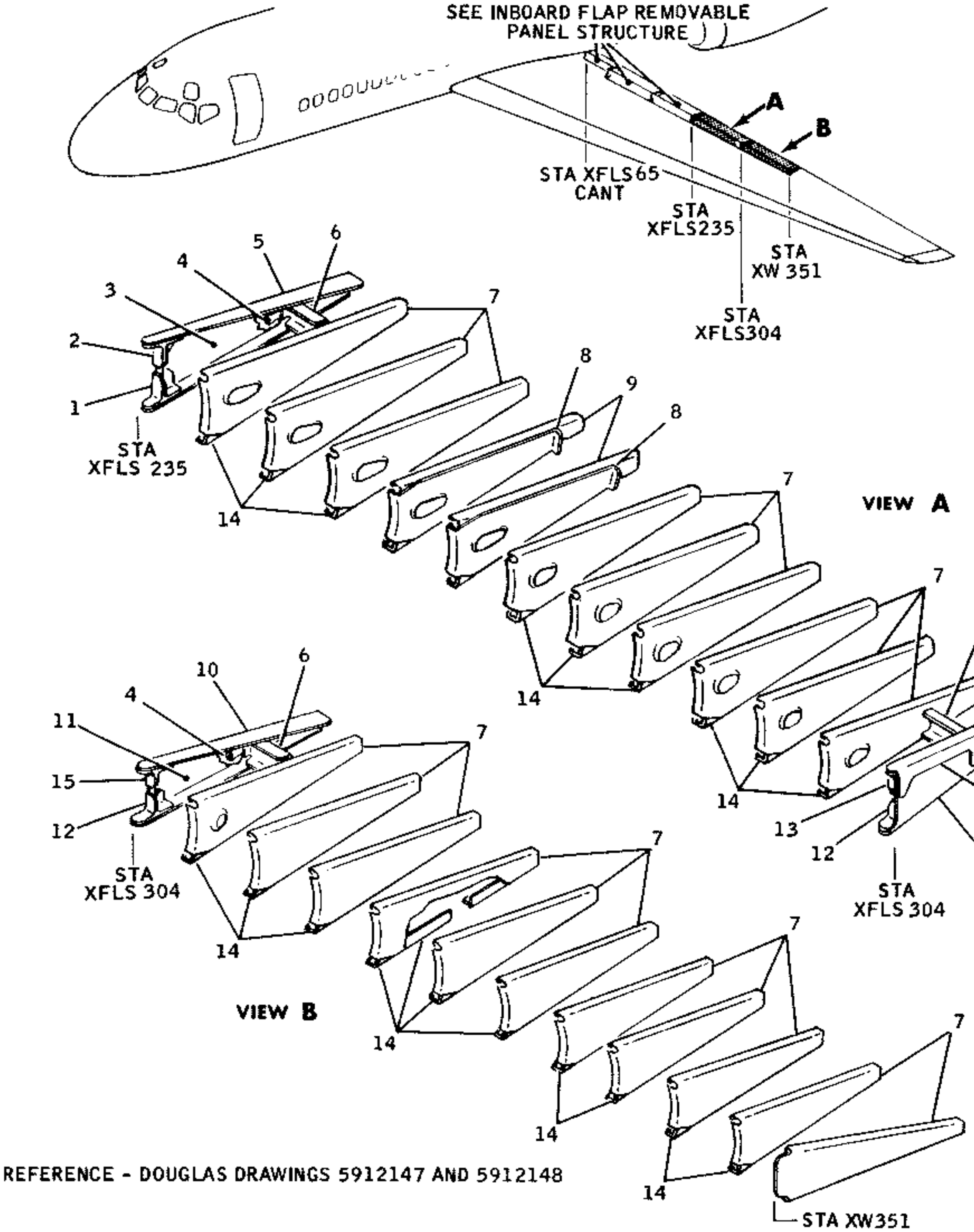


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.020	CLAD 2014-T6
2	TEE		2914520
3	TEE		2914521
4	SHIM	.020	CLAD 2024-T3
5	SKIN	.032	CLAD 2014-T6
6	TIP		SHAPE, 3913180
7	COVER	.063	CLAD 2024-T3
8	CHANNEL	.050	CLAD 2024-T42
9	SKIN	.040	CLAD 2014-T6
10	DOUBLER 9955814	.063	CLAD 7075-T6
11	SPLICE 9955816	.063	CLAD 7075-T6
12	SKIN	.025	CLAD 2024-T6

REFERENCE - DOUGLAS DRAWINGS 5912147 AND 5912148

B83-261

Flap Outboard Section Removable Panels Plating
Figure 8



REFERENCE - DOUGLAS DRAWINGS 5912147 AND 5912148

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING 3912973-1,-2		PLATE 7075-T651	9	CHANNEL	.063	CLAD 2024-T42
2	FITTING 3912972-1,-2		PLATE 7075-T651	10	CAP	.050	CLAD 7075-T6
3	WEB	.063	CLAD 2024-T42	11	WEB	.050	CLAD 7075-T6
4	SUPPORT 4913290-3		STEEL 4130	12	FITTING 4913711-1,-2		PLATE 7075-T651
5	CAP	.063	CLAD 2024-T42	13	FITTING 4913712-1,-2		PLATE 7075-T651
6	INTERCOSTAL	.080	CLAD 7075-T6	14	CHANNEL	.032	CLAD 2024-T42
7	RIB	.032	CLAD 2024-T42	15	FITTING 4913713-1,-2		PLATE 7075-T651
8	RIB	.040	CLAD 2024-T42				

BB3-263

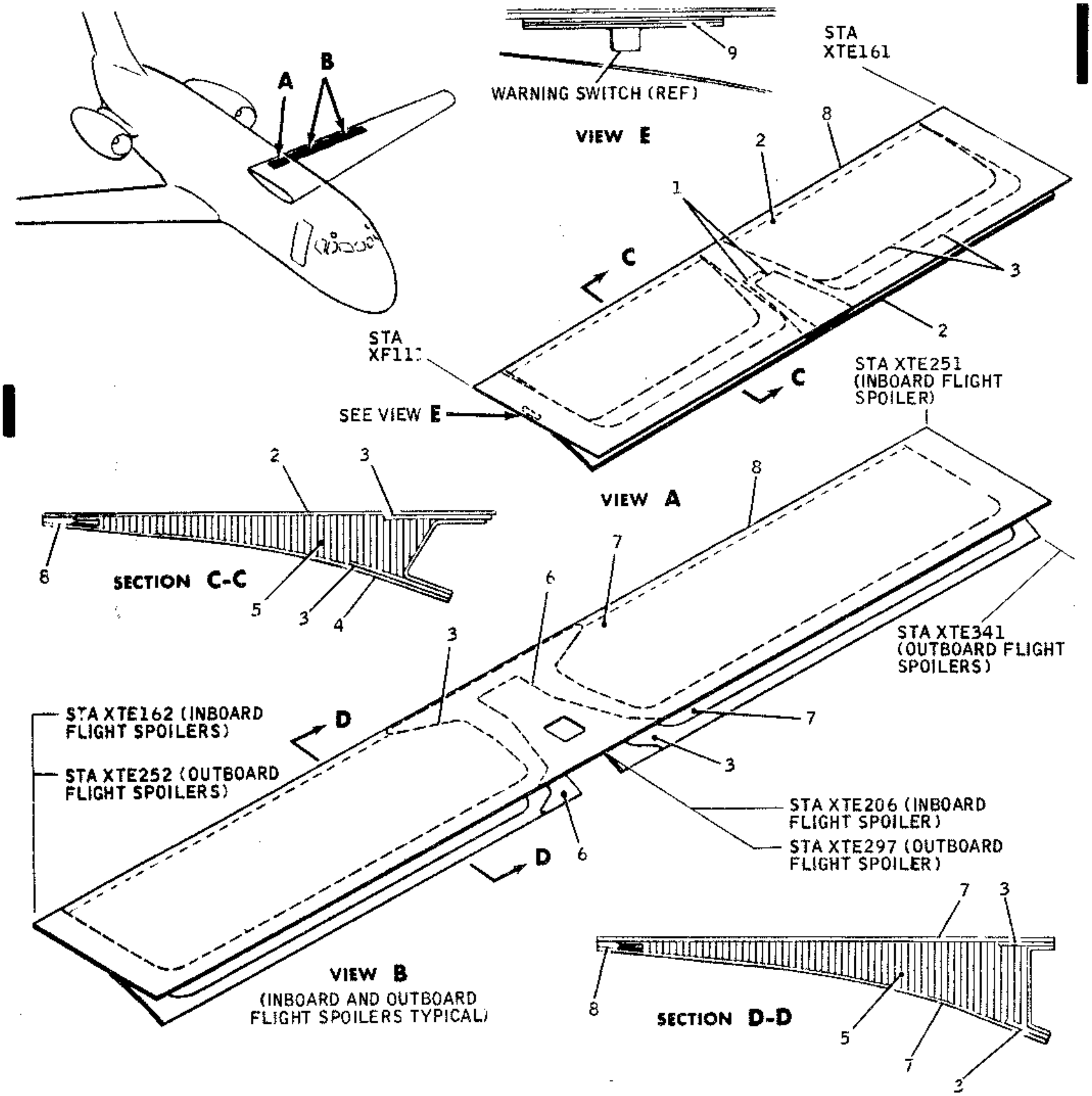
Flap Outboard Section Removable Panels Ribs and Intercostals
Figure 9

Printed in U.S.A.

FLIGHT AND GROUND SPOILERS - DESCRIPTION AND OPERATION (DC-9-ALL)

1. General

A. This section illustrates flight and ground spoilers. Materials used in construction are identified in material lists by item number callouts.



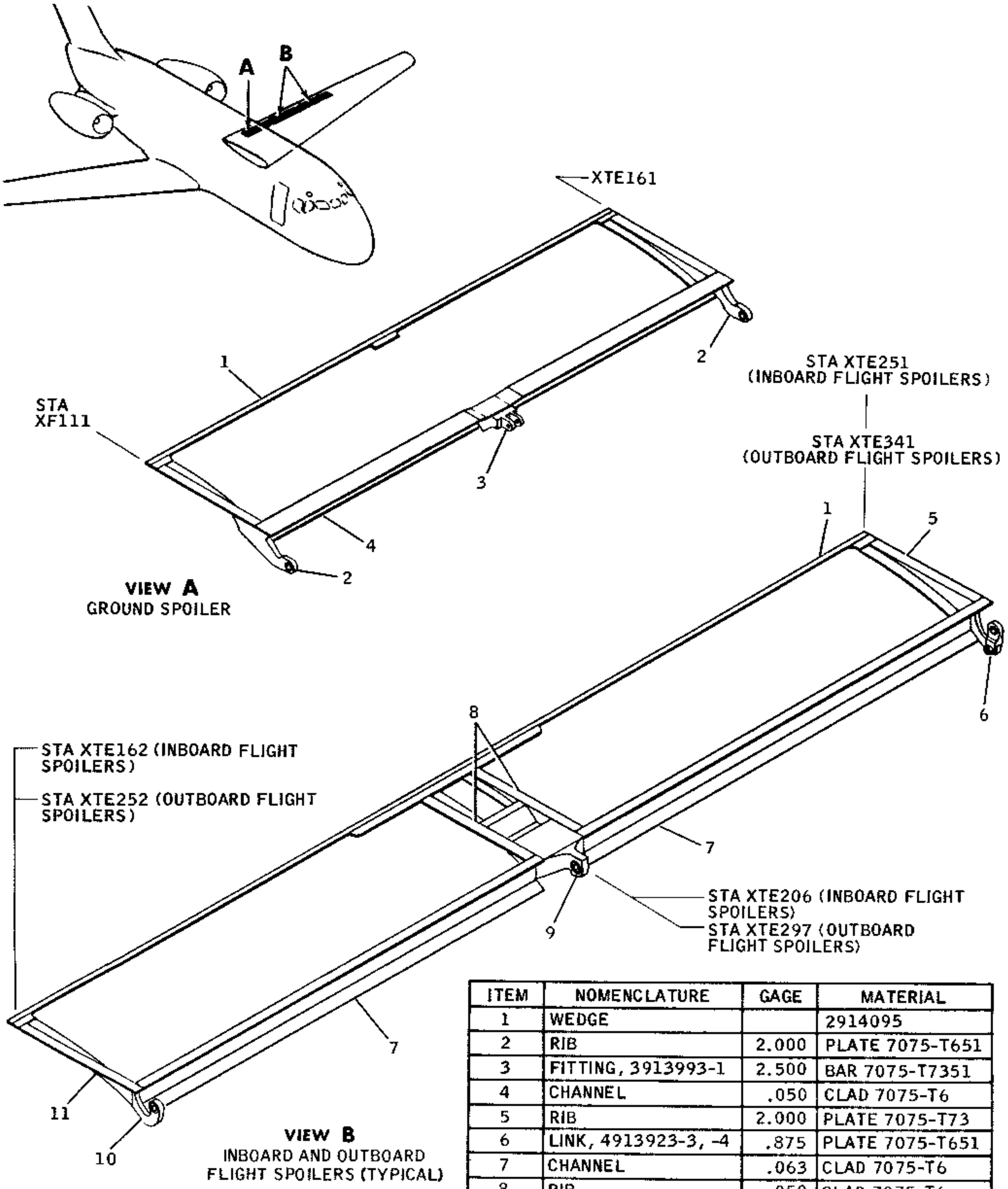
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.125	CLAD 7075-T6
2	SKIN	.020	CLAD 7075-T6
3	DOUBLER	.020	CLAD 7075-T6
4	SKIN	.016	CLAD 7075-T6
5	CORE		SEE NOTE 1
6	DOUBLER	.071	CLAD 7075-T6
7	SKIN	.032	CLAD 7075-T6
8	T.E. SHAPE		2914095
9	SHIM	.016	6061-T6

NOTES:

1. 1.600 X 3/16 HEX X .001 THICK NON PERFORATED ALUMINUM FOIL HONEYCOMB.
2. REFERENCE DOUGLAS DRAWINGS 5910052, 5910053 AND 5910055.

BB3-228B

Flight and Ground Spoilers Plating
Figure 1



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	WEDGE		2914095
2	RIB	2.000	PLATE 7075-T651
3	FITTING, 3913993-1	2.500	BAR 7075-T7351
4	CHANNEL	.050	CLAD 7075-T6
5	RIB	2.000	PLATE 7075-T73
6	LINK, 4913923-3, -4	.875	PLATE 7075-T651
7	CHANNEL	.063	CLAD 7075-T6
8	RIB	.050	CLAD 7075-T6
9	FITTING		3914042
10	LINK, 4913924-3, -4	1.000	STEEL BAR 4130
11	RIB	2.000	PLATE 7075-T7351

REFERENCE -'DOUGLAS DRAWING 5910052, 5910053, 5910055.

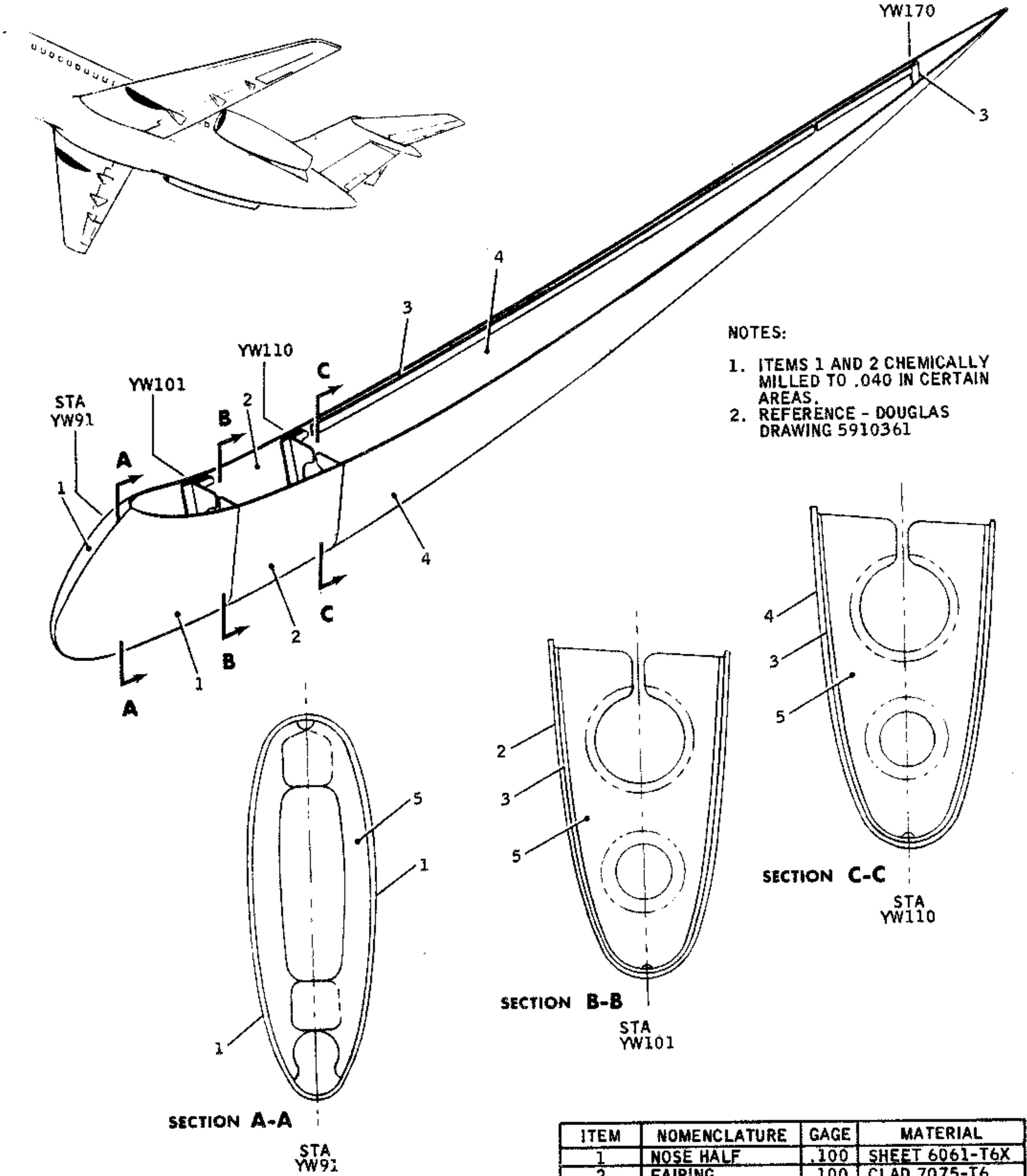
BB3-229

Flight and Ground Spoilers Ribs and Supports
Figure 2

VORTILON - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. This section identifies vortilon structural materials. Materials are identified in material lists by item number callouts.



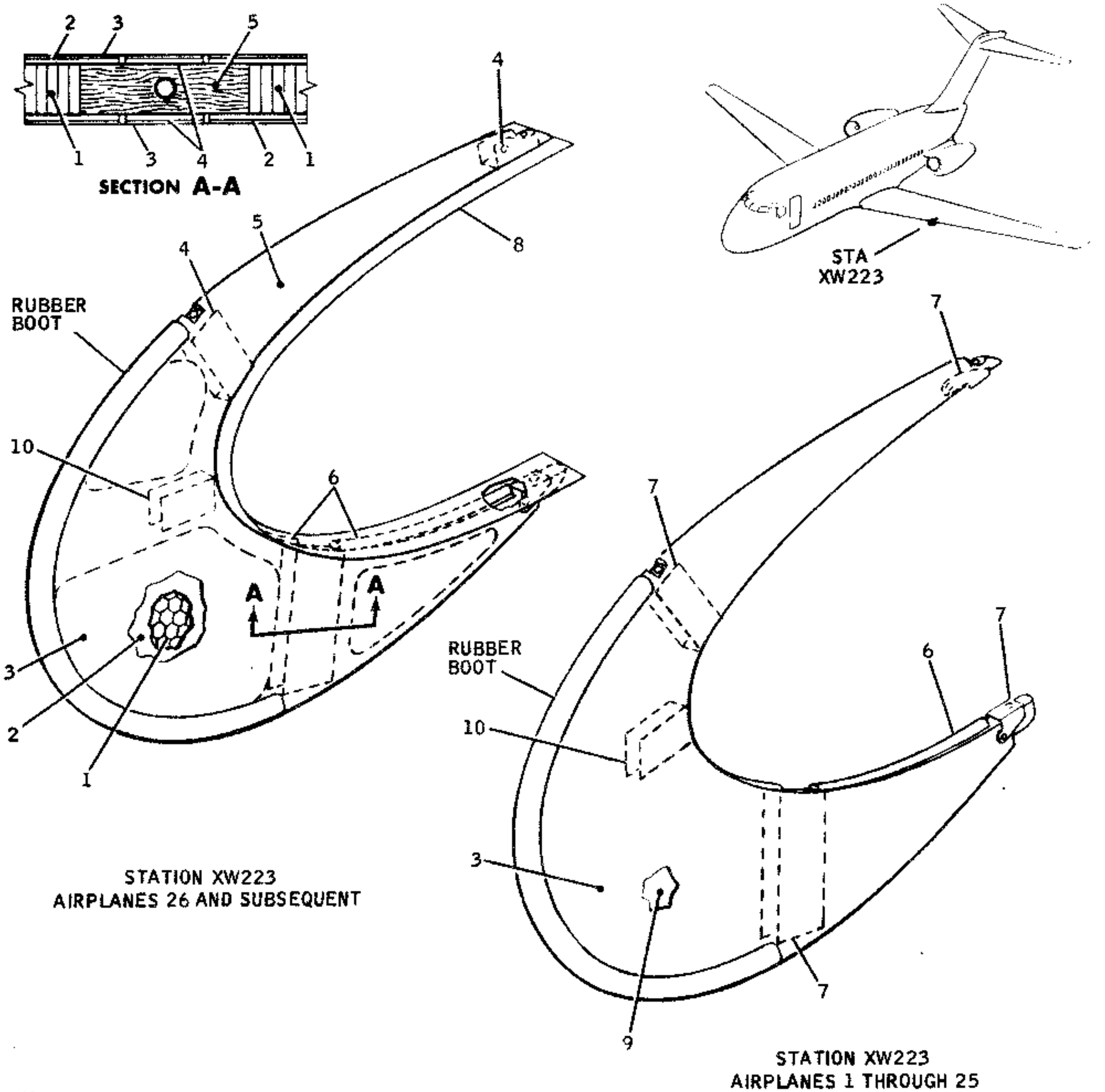
NOTES:

1. ITEMS 1 AND 2 CHEMICALLY MILLED TO .040 IN CERTAIN AREAS.
2. REFERENCE - DOUGLAS DRAWING 5910361

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	NOSE HALF	.100	SHEET 6061-T6X
2	FAIRING	.100	CLAD 7075-T6
3	BONDED DOUBLER	.050	CLAD 7075-T6
4	FAIRING	.040	CLAD 7075-T6
5	FORMER	.040	CLAD 2024-T3

BB3-284A

Vortilon Plating and Structure
Figure 1



NOTES:

1. ITEM 1, CORE, MADE FROM 3/16 HEX X .001 THICK ALUMINUM FOIL HONEYCOMB, NON-PERFORATED.
2. ITEM 2, PANEL, MADE FROM 3 PLY MAHOGANY FACE PLYWOOD, POPLAR CORE.
3. ITEM 3, EXTERIOR, MADE FROM NO. 1 GLASS FIBER CLOTH, VOLAN FINISH, MIL-C-9084, TYPE 8.
4. ITEM 4, CORE, MADE FROM NO. 1 GRADE, KILN DRIED, ROUGH BASS WOOD, MM-L-736.
5. ITEM 6, SEAL, MADE FROM SYNTHETIC RUBBER TUBE, MIL-R-6855, CLASS 2, GRADE 60.
6. ITEM 9, CORE, MADE FROM 5 PLY DOUGLAS FIR PLYWOOD,, NN-P-530, EXTERIOR GRADE A-B PER CS 45.
7. ITEM 10, CHANNEL, MADE FROM CRES SHEET 321T1, MIL-S-6721, COMP T1, ANNEALED.
8. REFERENCE - DOUGLAS DRAWINGS 5920229 AND 5920739.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CORE	.670	SEE NOTE 1	6	SEAL		SEE NOTE 5
2	PANEL	.060	SEE NOTE 2	7	STIFFENER	.063	CLAD 7075-T6
3	EXTERIOR		SEE NOTE 3	8	STRIP	.005	SHEET MYLAR
4	CHANNEL	.063	CLAD 2024-T42	9	CORE	.750	SEE NOTE 6
5	CORE, INNER		SEE NOTE 4	10	CHANNEL	.050	SEE NOTE 7

BB3-688

Station XW223 Vortilon Structure
Figure 2

FLAP VORTEX GENERATORS - DESCRIPTION AND OPERATION (DC-9-10)

1. General

A. Vortex generators are installed on the upper surface of the flap plating outboard of Station XF 114. The vortex generators are riveted to the flap plating with MS20426AD3 rivets.

B. To assure proper function, the vortex generators are precisely placed and oriented. Repairs to the installation requires the same placement and orientation as the original installation.

C. The flap vortex generator installation may be repaired at earliest convenience; however, consideration should be given to sharp or unsightly areas and care exercised not to leave hazardous objects on the structure.

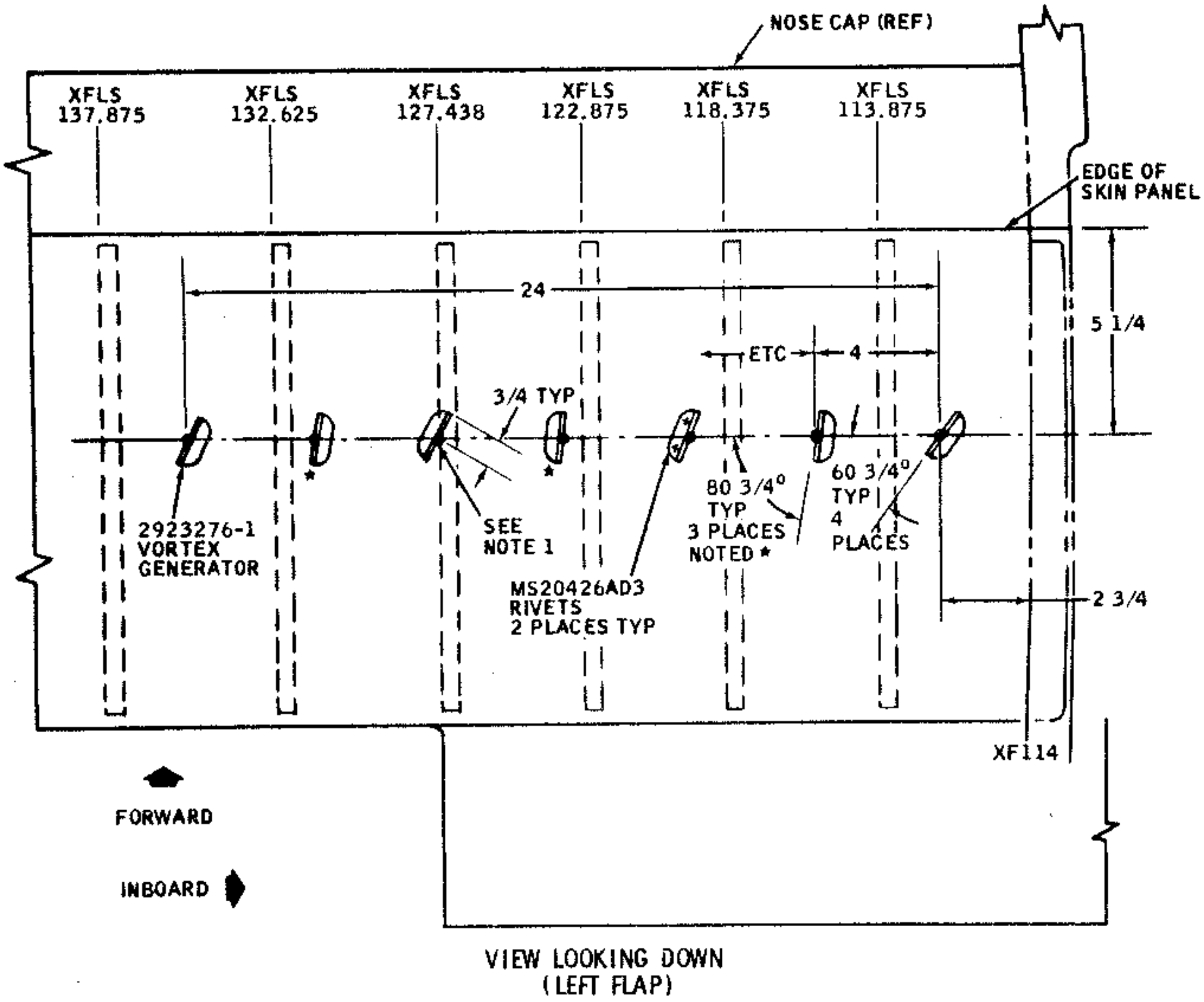
2. Repair Flap Vortex Generator Installation

A. Repair damaged or missing vortex generators as follows:

(1) Drill out vortex generator attaching rivets.

(2) Position and orient new generator on flap plating (see Figure 1).

(3) Install MS20426AD3 attaching rivets.



NOTES:

1. INTERSECTION OF VORTEX GENERATOR HEEL LINE AND 5 1/4 REFERENCE LINE, TYP 7 PLACES.
2. REFERENCE - DOUGLAS DRAWING 5910134.

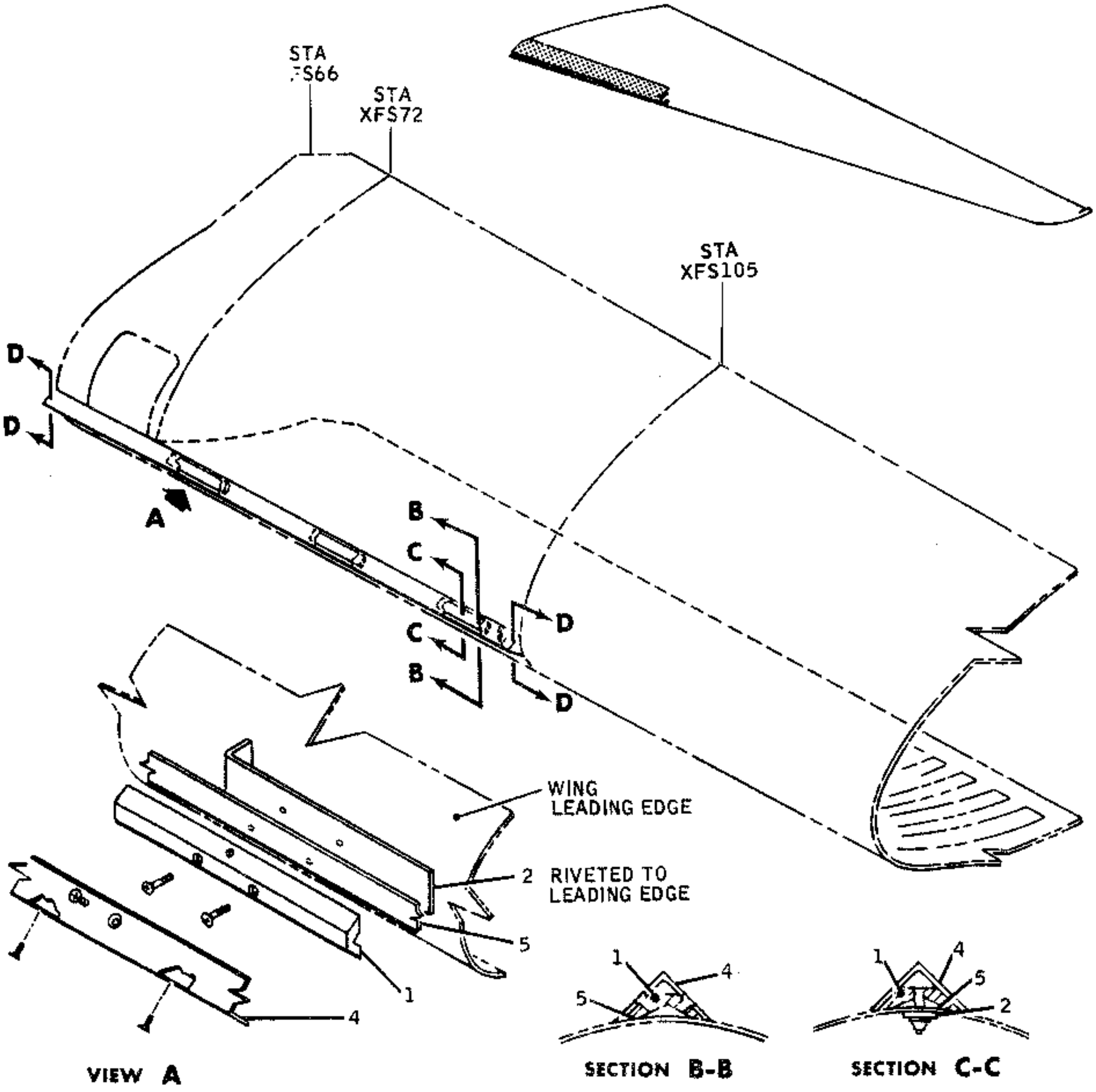
BB3-700

Flap Vortex Generator Installation
Figure 1

STALL STRIP - DESCRIPTION AND OPERATION (DC-9-10)

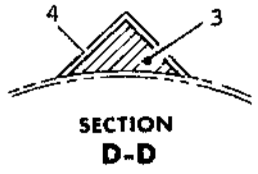
1. General

A. This section identifies stall strip structural materials. Materials are identified in material lists by item number callouts.



NOTES:

1. ITEM 1, BLOCK, MADE FROM CRES PLATE, TYPE 321, MIL-S-6721, COMP T1, ANNEALED.
2. ITEM 3, PLUG, MADE FROM SHEET LAMINATED PHENOLIC, SEMI-GLOSS, MIL-P-3115, TYPE PBG.
3. ITEM 5, RUB STRIP, MADE FROM CRES SHEET, MIL-S-5059.
4. REFERENCE- DOUGLAS DRAWING 5920551.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BLOCK	.375	SEE NOTE 1
2	STRIP	.090	CLAD 7075-T6
3	PLUG		SEE NOTE 2
4	LEADING EDGE		1325737
5	RUB STRIP	.012	SEE NOTE 3

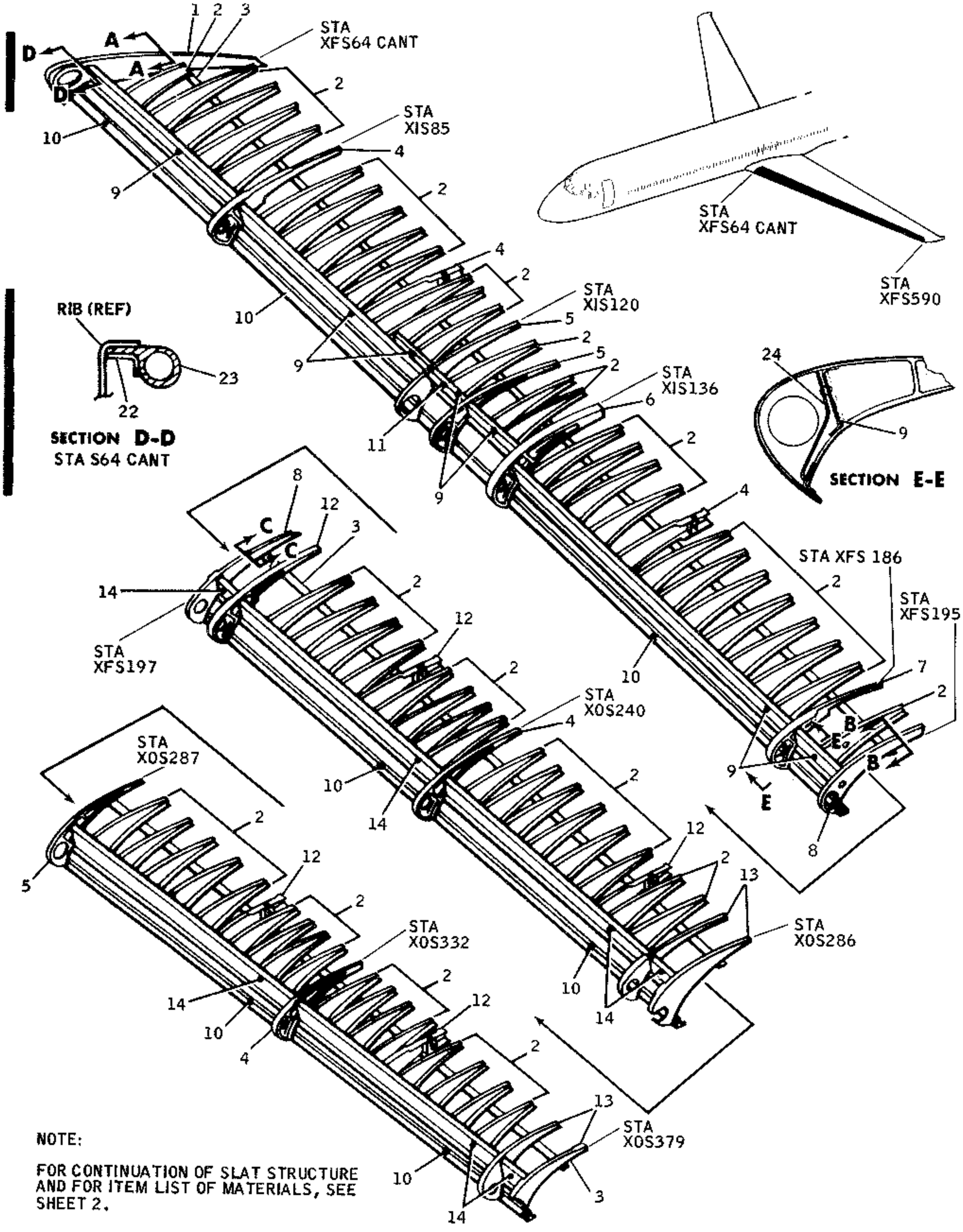
BB3-692

Wing Leading Edge Stall Strip
Figure 3

LEADING EDGE SLATS - DESCRIPTION AND OPERATION (DC-9-30)

1. General

A. This section illustrates leading edge slats. Materials are identified in material lists by item number callouts.

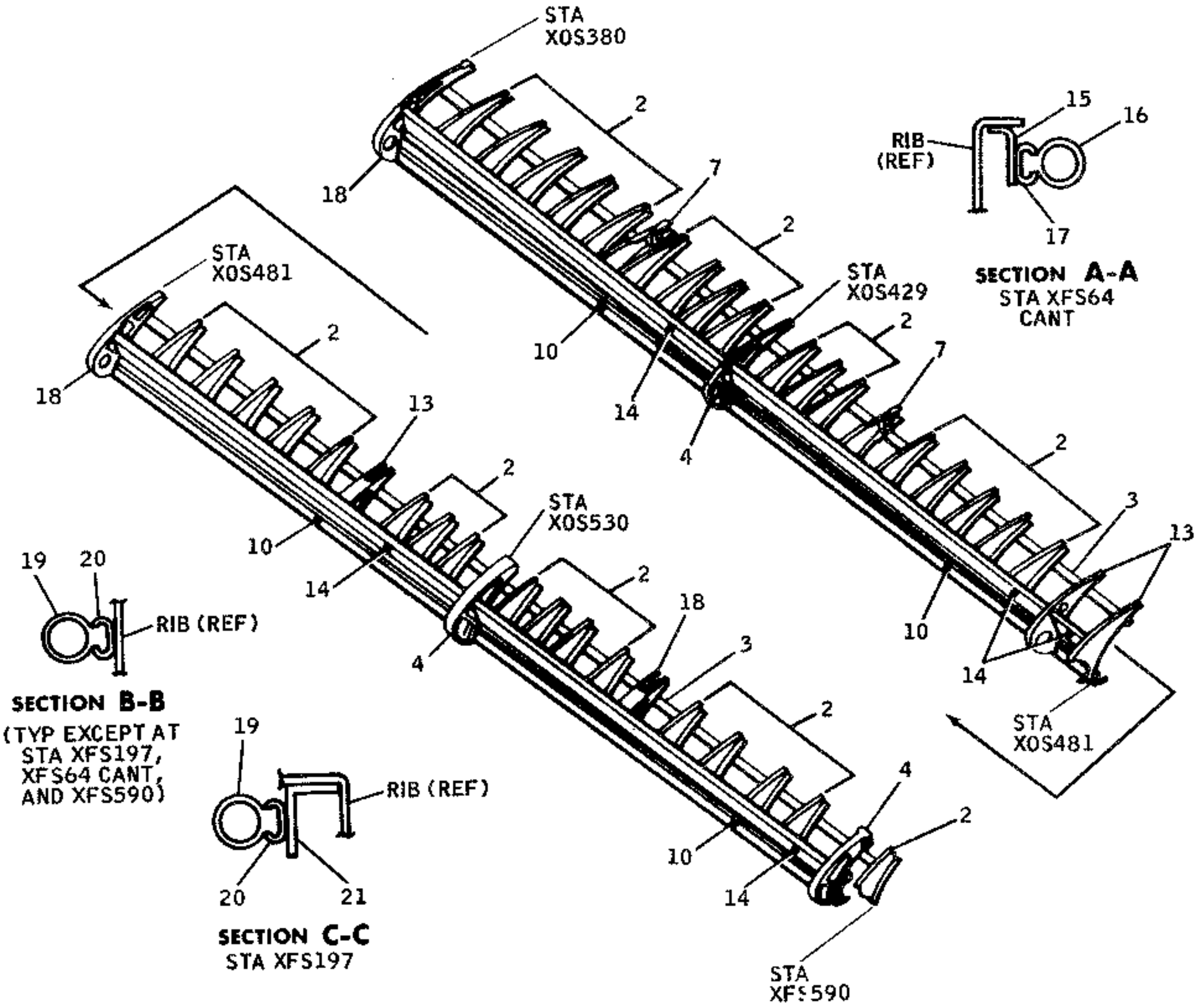


NOTE:

FOR CONTINUATION OF SLAT STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.

BB3-768A

Slat Structure -- Type A
Figure 1 (Sheet 1)



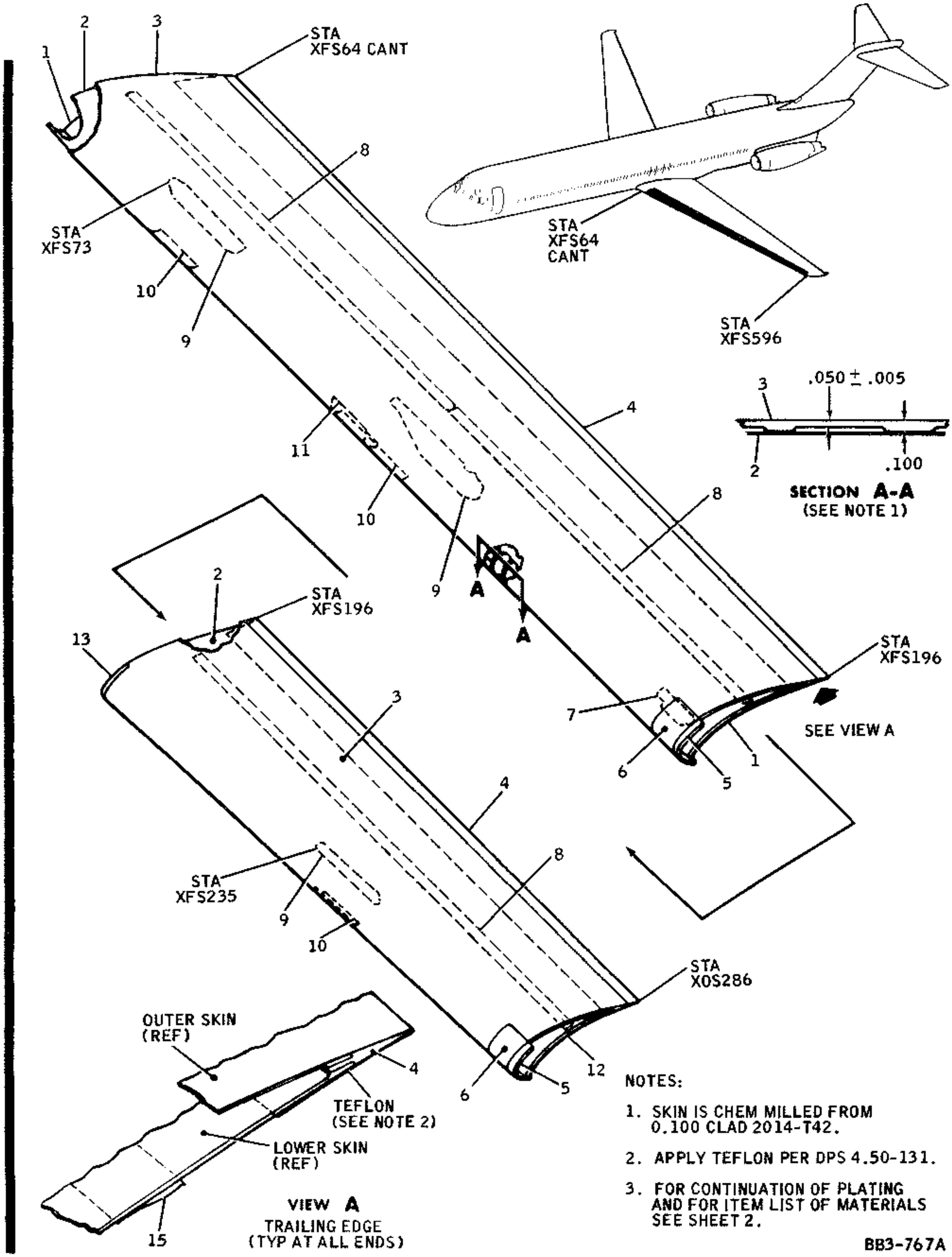
NOTES:

1. ITEM 24 MADE FROM B-STAGE PHENOLIC, NO. 181 GLASS FABRIC.
2. REFERENCE - DOUGLAS DRAWING 5922500

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.040	CLAD 2014-T6	13	RIB	2.00	PLATE 2014-T651
2	RIB	.025	CLAD 2014-T6	14	SPAR	.040	CLAD 2014-T6
3	SEAL		2923724	15	ANGLE	.050	CLAD 2014-T6
4	RIB	3.00	PLATE 2014-T651	16	SEAL		2924716
5	RIB	1.50	PLATE 2014-T651	17	RETAINER		1176093
6	RIB	2.875	BAR 2014-T651	18	RIB	1.750	PLATE 2014-T651
7	RIB	2.50	PLATE 2014-T651	19	SEAL		2923584
8	RIB	.063	CLAD 2014-T6	20	RETAINER		2923536
9	SPAR	.063	CLAD 2014-T6	21	SUPPORT		1640517
10	ANGLE	.063	CLAD 2219-T81	22	RETAINER	.050	CLAD 2014-T6
11	ANGLE	.063	CLAD 2014-T6	23	SEAL		2924698
12	RIB	2.75	PLATE 2014-T651	24	PANEL		SEE NOTE 1

BB3-846A

Slat Structure -- Type A
Figure 1 (Sheet 2)

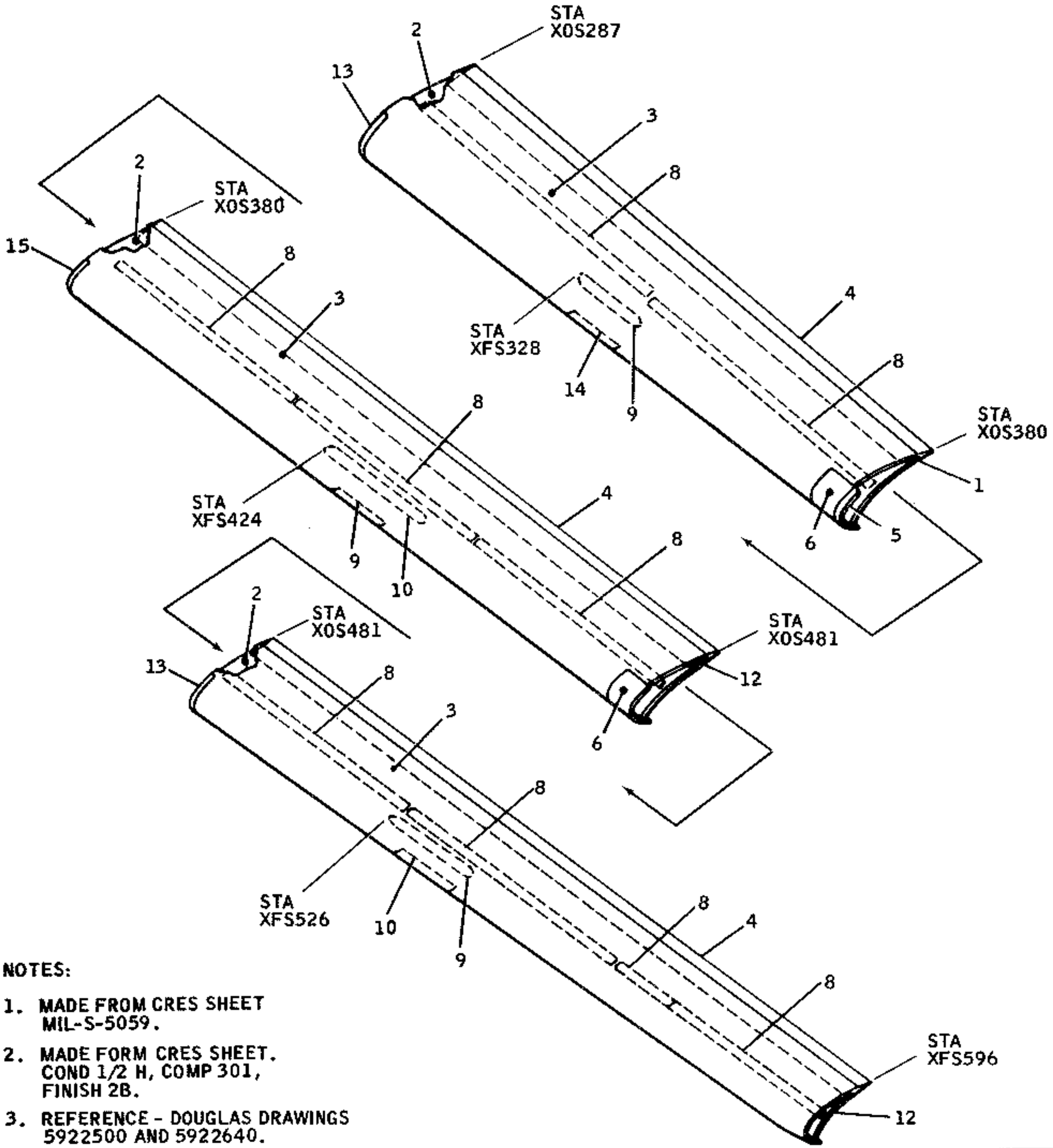


NOTES:

1. SKIN IS CHEM MILLED FROM 0.100 CLAD 2014-T42.
2. APPLY TEFLON PER DPS 4.50-131.
3. FOR CONTINUATION OF PLATING AND FOR ITEM LIST OF MATERIALS SEE SHEET 2.

BB3-767A

Slat Plating -- Type A
Figure 2 (Sheet 1)



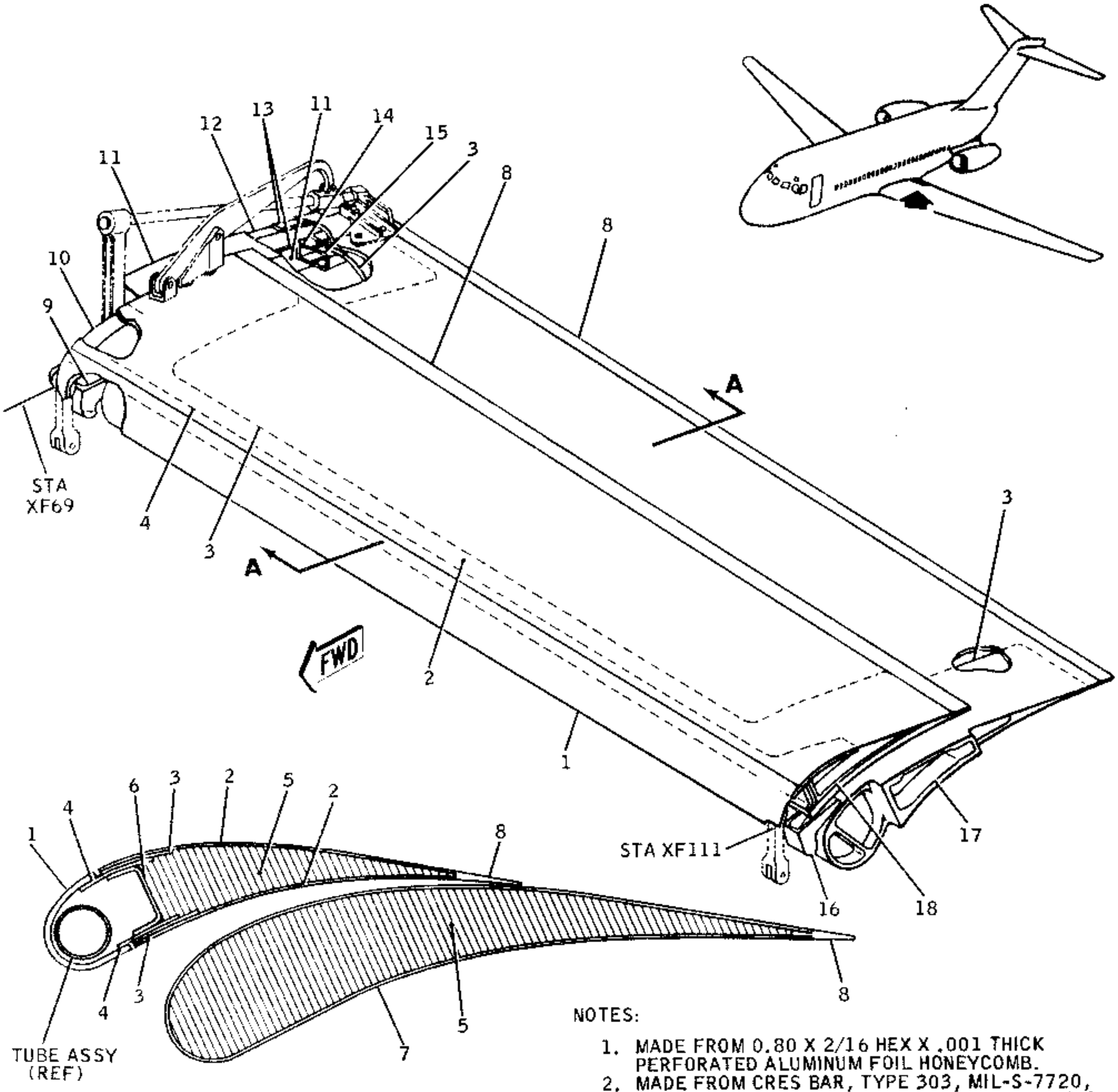
NOTES:

1. MADE FROM CRES SHEET MIL-S-5059.
2. MADE FORM CRES SHEET. COND 1/2 H, COMP 301, FINISH 2B.
3. REFERENCE - DOUGLAS DRAWINGS 5922500 AND 5922640.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.090	CLAD 2014-T6	9	DOUBLER	.063	CLAD 2014-T6
2	SKIN	.016	CLAD 2014-T6	10	DOUBLER	.080	CLAD 2219-T81
3	SKIN	.100	CLAD 2014-T6	11	BAFFLE	.032	CLAD 2014-T6
4	CAP		2920249	12	SKIN	.063	CLAD 2014-T6
5	SEAL	.016	SEE NOTE 1	13	RUBSTRIP	.016	SEE NOTE 2
6	DOOR	.100	CLAD 2014-T6	14	SPLICE	.080	CLAD 2219-T81
7	DOUBLER	.050	CLAD 2014-T6	15	RUBSTRIP	.020	SEE NOTE 2
8	SEAL	.010	SEE NOTE 1				

BB3-841A

Slat Plating -- Type A
Figure 2 (Sheet 2)



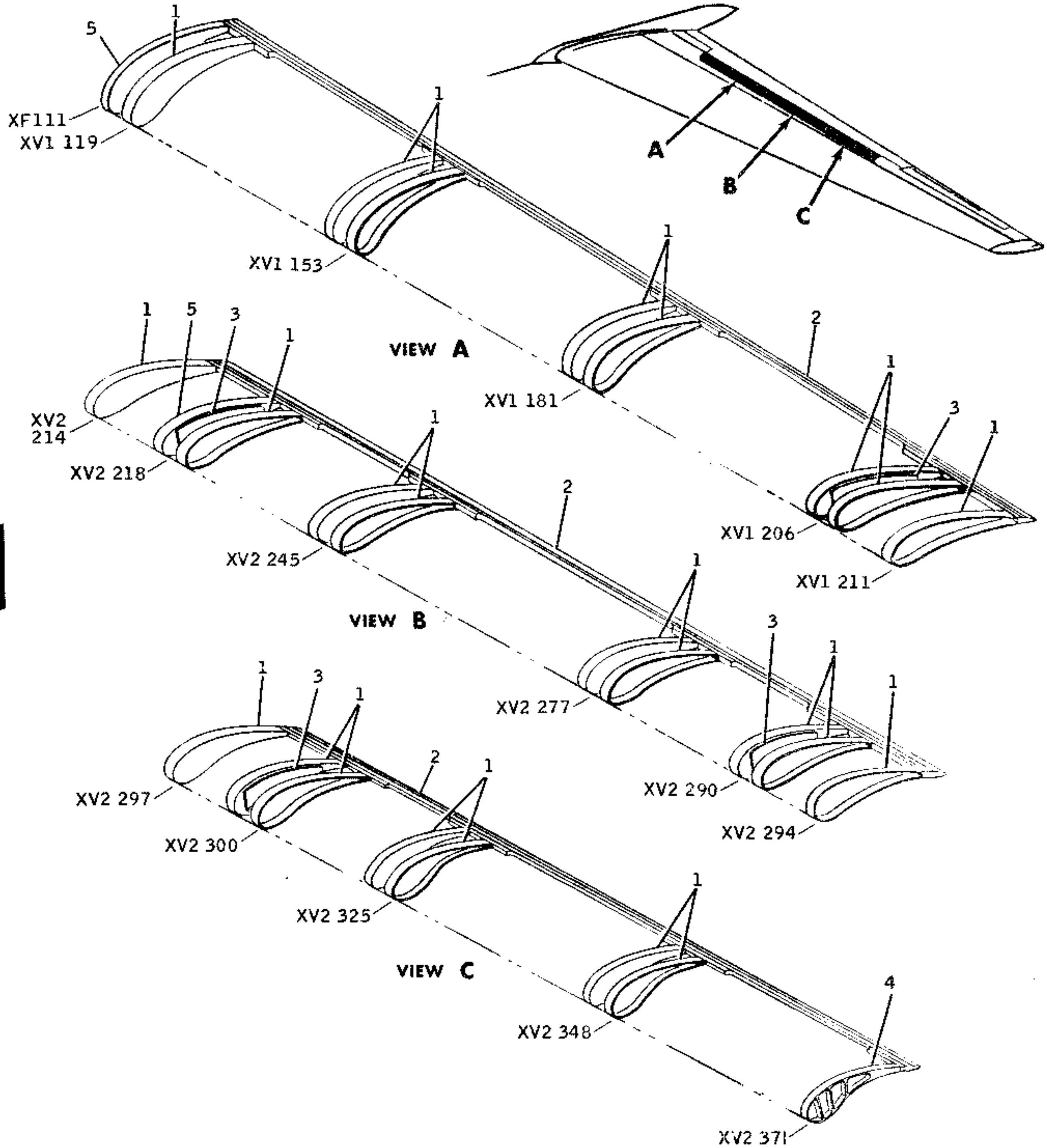
NOTES:

1. MADE FROM 0.80 X 2/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
2. MADE FROM CRES BAR, TYPE 303, MIL-S-7720, COMP 303 SE, COND B-C FOR ITEM 16, COND A-C ITEM 9.
3. REFERENCE - DOUGLAS DRAWINGS 5910040, 5912168

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	SKIN	.063	CLAD 2024-T3	10	RIB	1.750	PLATE 7075-T651
2	SKIN	.016	CLAD 7075-T6	11	FAIRING SKIN	.016	CLAD 2014-T6
3	DOUBLER	.032	CLAD 7075-T6	12	ZEE	.032	CLAD 2024-T3
4	DOUBLER	.063	CLAD 7075-T6	13	DOUBLER	.016	CLAD 2014-T6
5	CORE		SEE NOTE 1	14	CHANNEL	.032	2024-T42
6	CHANNEL	.063	CLAD 7075-T6	15	RIB	3.000	PLATE 7075-T6
7	SKIN	.016	CLAD 7075-T6	16	BUMPER	1.250	SEE NOTE 2
8	TRAILING EDGE		2912306	17	RIB	2.000	PLATE 7075-T6
9	BUMPER	1.500	SEE NOTE 2	18	RIB	1.125	PLATE 7075-T6

BB3-268

Forward and Aft Movable Flap Vanes Plating -- Type A
Figure 1

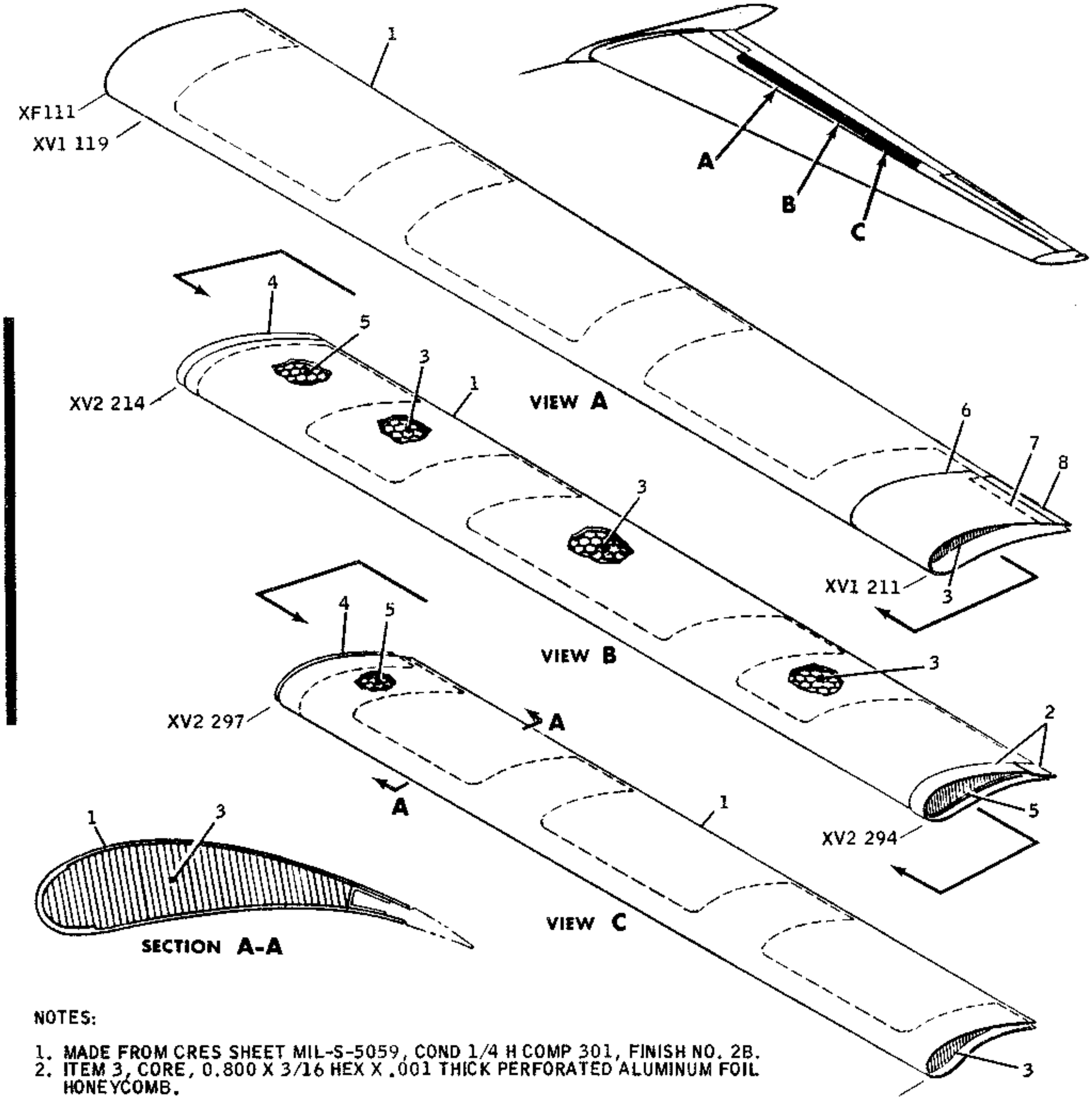


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.063	CLAD 7075-T6
2	TRAILING EDGE		1704438
3	FITTING	1.000	PLATE 7075-T651
4	RIB	1.125	PLATE 7075-T651
5	RIB	.040	CLAD 7075-T6

REFERENCE - DOUGLAS DRAWINGS
5910041, 5910042 AND 5910043

BB3-269B

Inboard, Center, and Outboard Fixed Flap Vanes Plating -- Type A
Figure 2 (Sheet 1)



NOTES:

1. MADE FROM CRES SHEET MIL-S-5059, COND 1/4 H COMP 301, FINISH NO. 2B.
2. ITEM 3, CORE, 0.800 X 3/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
3. ITEM 5, CORE, 0.160 X 3/16 HEX X .001 THICK PERFORATED ALUMINUM FOIL HONEYCOMB.
4. REFERENCE - DOUGLAS DRAWINGS 5910041, 5910042, 5910043.

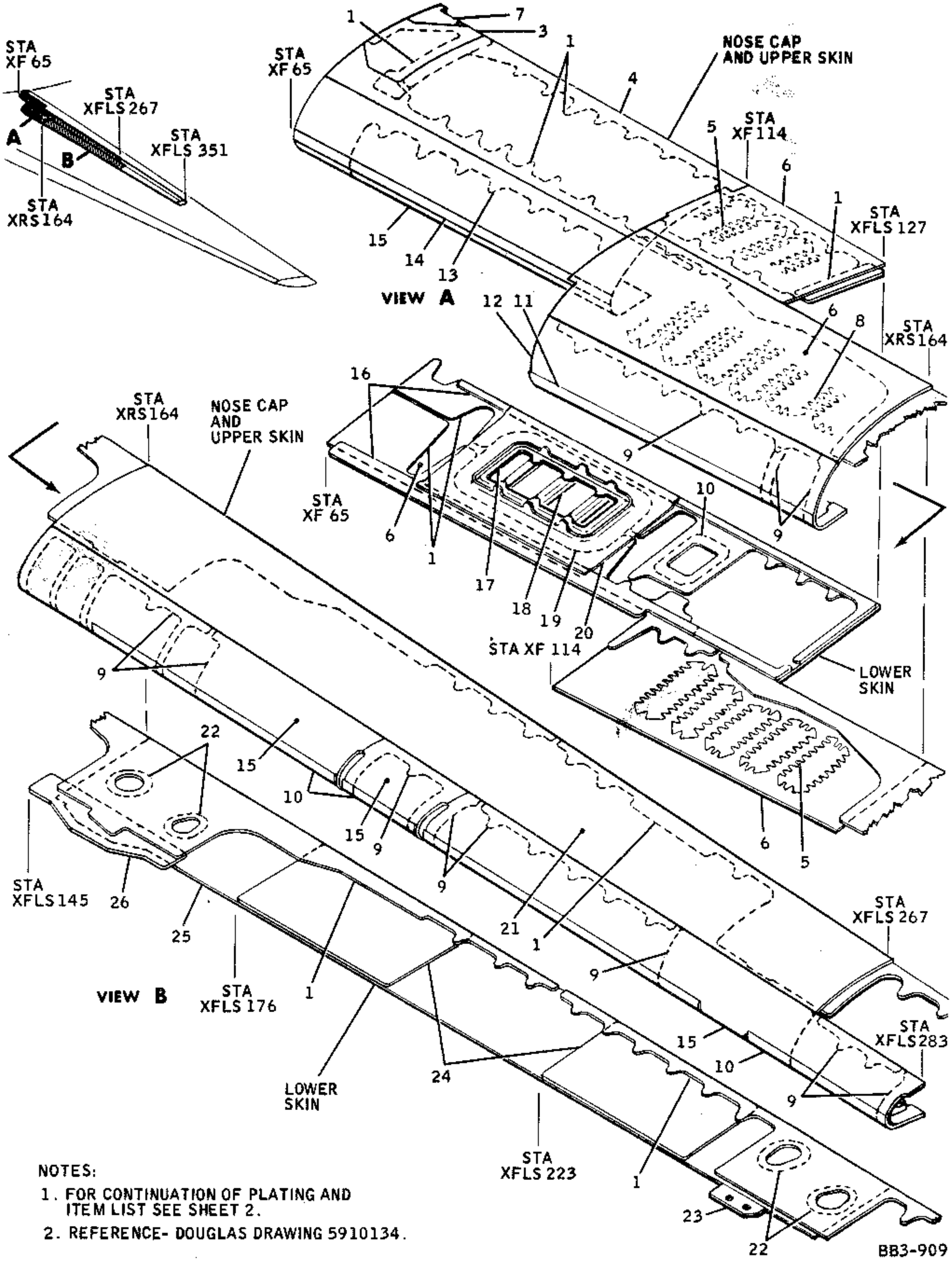
ITEM	NOMENCLATURE	GAGE	MATERIAL
*1	SKIN	.063	CLAD 7075-T6
2	SEAL	.016	SEE NOTE 1
3	CORE		SEE NOTE 2
4	RUB STRIP	.016	SEE NOTE 1
5	CORE		SEE NOTE 3
6	SKIN	.032	CLAD 7075-T6
7	FILLER	.016	CLAD 7075-T6
8	DOUBLER	.032	CLAD 7075-T6

* ITEM 1, SKIN IS .050 ON AIRPLANES 33 AND SUBSEQUENT, CHEMICALLY MILLED TO .016 IN AREAS INDICATED BY BROKEN LINES; OR .016 CLAD 7075-T6 SKINS WITH .032 CLAD 7075-T6 DOUBLERS.

BB3-537B

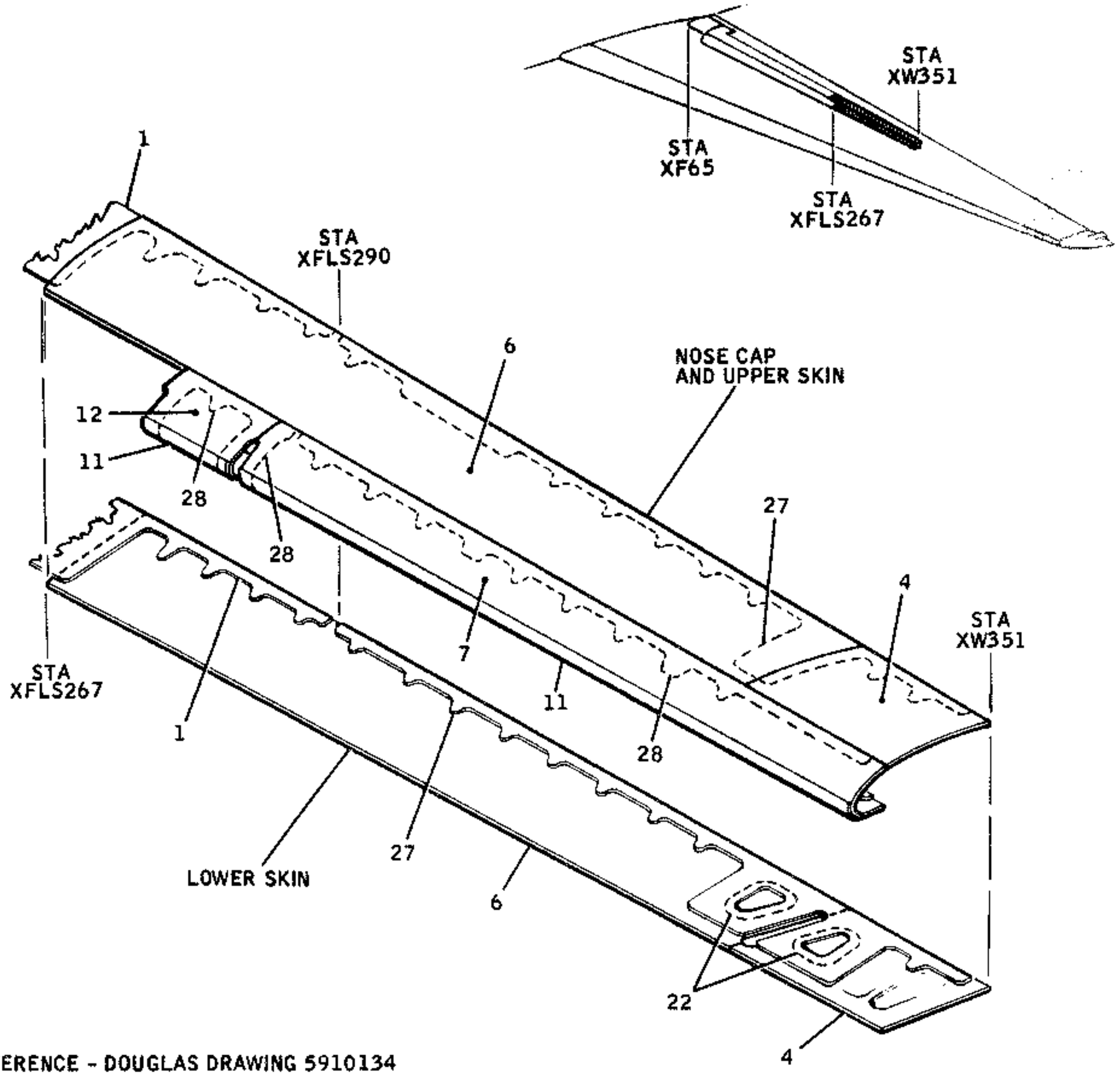
Printed in U.S.A.

Inboard, Center, and Outboard Fixed Flap Vanes Plating -- Type A
Figure 2 (Sheet 2)



NOTES:
1. FOR CONTINUATION OF PLATING AND ITEM LIST SEE SHEET 2.
2. REFERENCE- DOUGLAS DRAWING 5910134.

Flap Plating -- Type A
Figure 3 (Sheet 1)

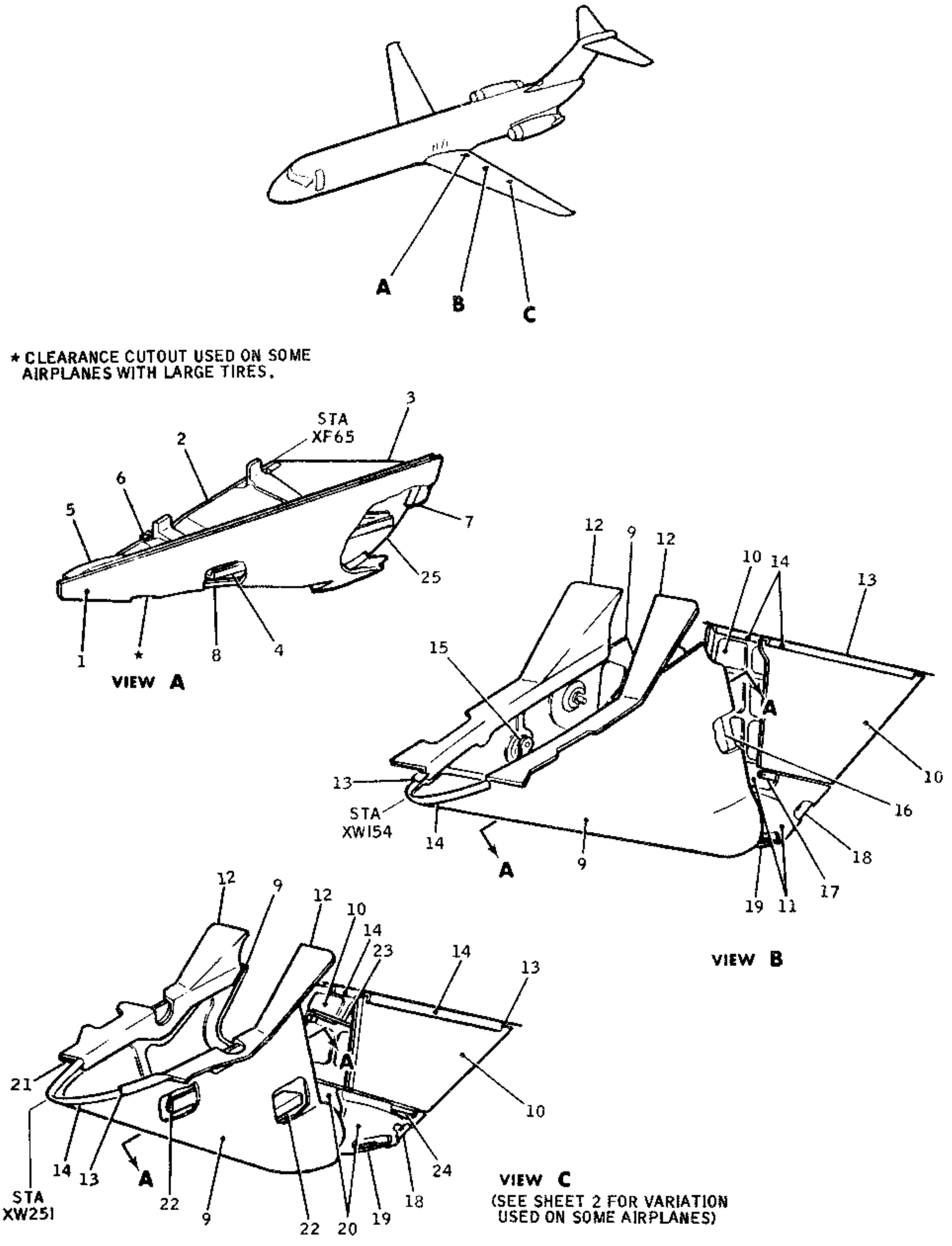


REFERENCE - DOUGLAS DRAWING 5910134

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	DOUBLER	.063	CLAD 2024-T3	15	NOSE SKIN	.071	CLAD 7075-T6
2	COVER	.063	CLAD 2024-T3	16	SHIM	.016	CLAD 2024-T3
3	DOOR	.125	CLAD 2024-T3	17	PAN	.063	CLAD 2014-T6
4	SKIN	.050	CLAD 2024-T3	18	STIFFENER	.063	CLAD 2014-T6
5	BONDED DOUBLER	.020	CLAD 2014-T6	19	SKIN	.050	CLAD 2014-T6
6	SKIN	.050	CLAD 7075-T6	20	DOUBLER	.080	CLAD 2024-T42
7	SKIN	.063	CLAD 7075-T6	21	SKIN	.071	CLAD 7075-T6
8	DOUBLER	.020	CLAD 2014-T6	22	DOOR	.063	CLAD 2024-T3
9	BONDED DOUBLER	.025	CLAD 2014-T6	23	SKIN	.100	CLAD 2024-T3
10	DOOR	.090	CLAD 2024-T42	24	DOUBLER	.020	CLAD 2024-T3
11	RUBSTRIP	.032	SHEET 6061-T6	25	SKIN	.063	CLAD 7075-T6
12	SKIN	.040	CLAD 7075-T6	26	PLATE 39150184-1		PLATE 7075-T651
13	BONDED DOUBLER	.032	CLAD 2014-T6	27	DOUBLER	.071	CLAD 2024-T3
14	RUBSTRIP	.032	CLAD 7075-T6	28	BONDED DOUBLER	.020	CLAD 2024-T6
				29	SKIN	.050	CLAD 7075-T6

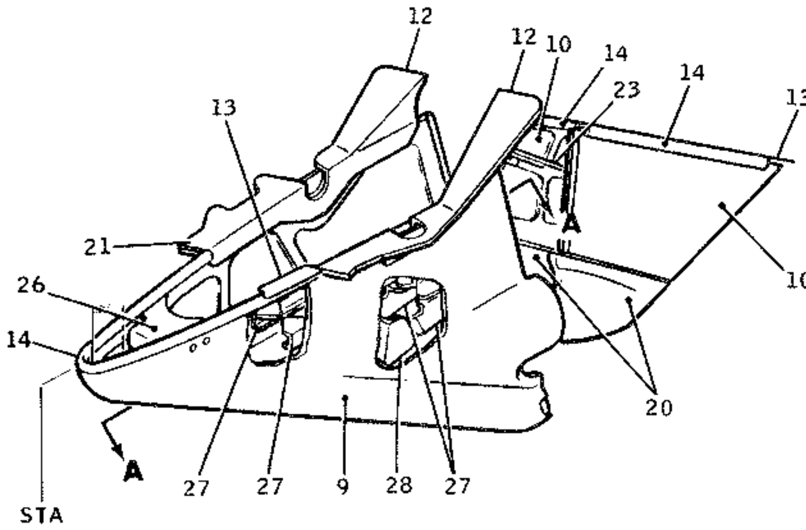
BB3-910

Flap Plating -- Type A
Figure 3 (Sheet 2)



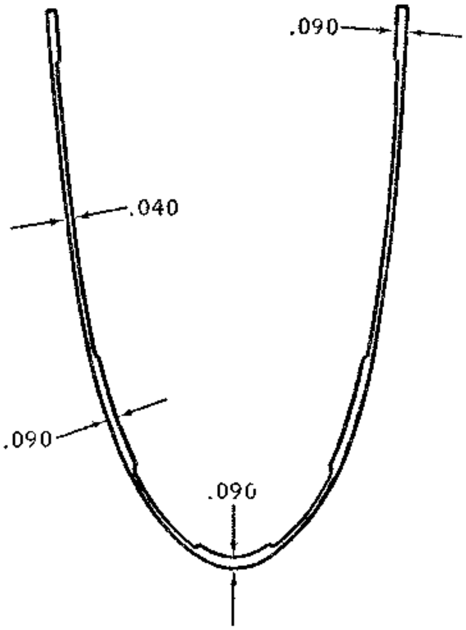
BB3-977

Flap Hinge Fairings and Plating Structure -- Type A
Figure 4



VIEW C

FUEL DUMP PROVISIONS USED
ON SOME AIRPLANES



SECTION A-A
(CHEMICALLY MILLED FROM .090 STOCK.
TAPER VARIES TO .040.)

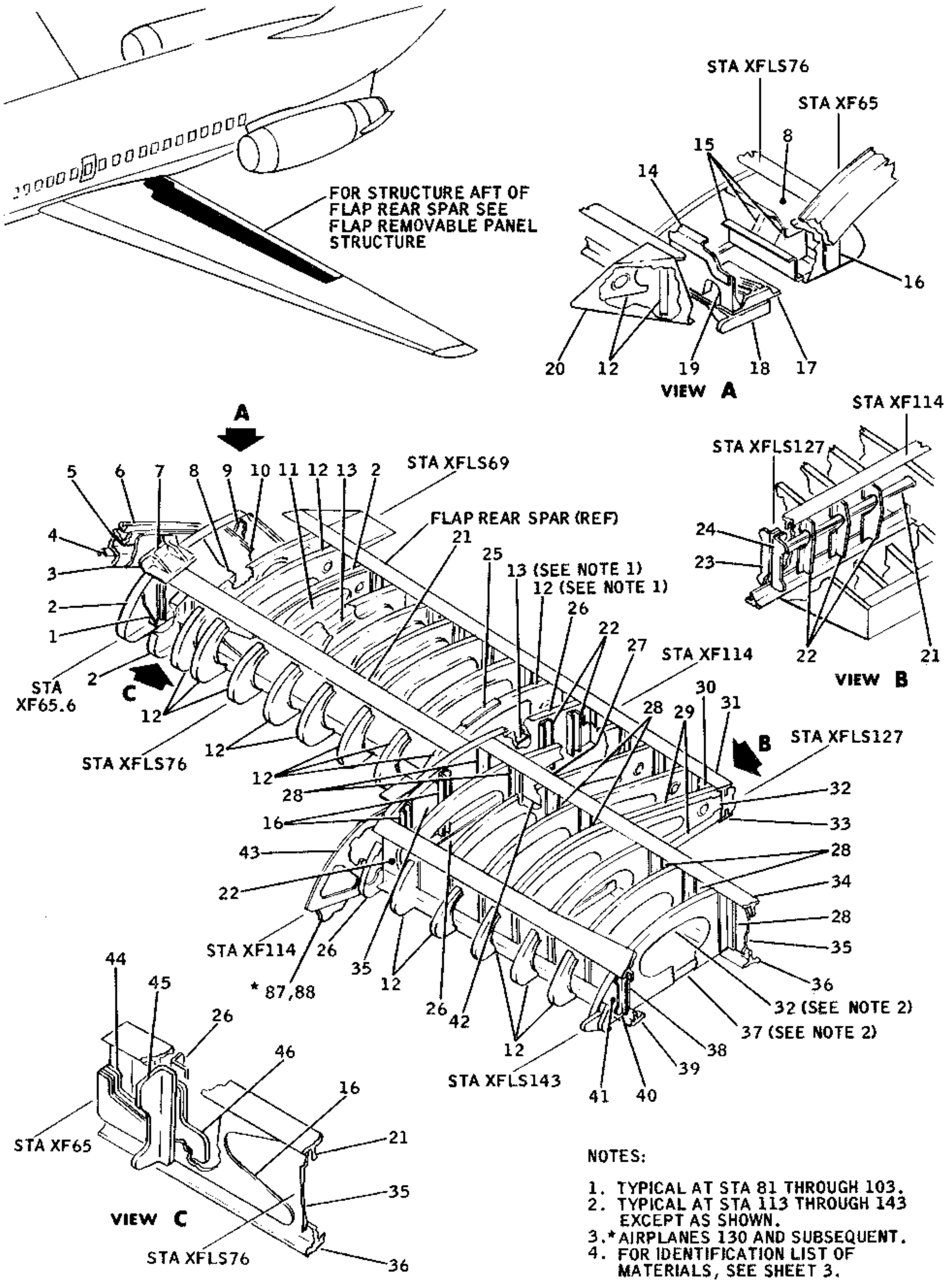
NOTES:

1. MADE FROM CRES MIL-S-5059, ANNEALED, COMP 302, FINISH NO. 2D.
2. REFERENCE - DOUGLAS DRAWINGS 5912169, 5912171, 5912172, 5912174, 5915706, AND 5917354.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	OUTER SKIN	.040	CLAD 2024-T3	16	STRIP		SEE NOTE 1
2	INNER SKIN	.040	CLAD 2024-T42	17	SPACER	.040	CLAD 2024-T3
3	UPPER PANEL	.063	CLAD 2024-T42	18	FILLER	.750	CSTG PM356-T6
4	INTERCOSTAL	.050	CLAD 2024-T42	19	SPLICE	.050	CLAD 2024-T42
5	NOSE FORMER	.050	CLAD 2024-T42	20	SKIN	.050	CLAD 2024-T42
6	STIFFENER	.040	CLAD 2024-T42	21	FILLER	.100	CLAD 2024-T3
7	ANGLE	.050	CLAD 7075-T6	22	BRACKET	.071	CLAD 2024-T42
8	ANGLE	.040	CLAD 2024-T42	23	SUPPORT	.080	CLAD 2024-T3
9	FAIRING	.090	SHEET 6061-T6	24	SHIM	.040	CLAD 2024-T3
10	PLATE	.190	CLAD 2024-T3	25	AFT PANEL	.040	CLAD 2024-T42
11	FAIRING	.050	CLAD 2024-T42	26	BRACKET	.063	CLAD 2024-T42
12	ANGLE	.090	CLAD 2024-T42	27	FORMER	.063	CLAD 2024-T42
13	RUB STRIP	.016	SHEET 6061-T6	28	CHANNEL	.063	CLAD 2024-T42
14	SEAL		2916009				
15	CLIP	.080	CLAD 2024-T42				

BB3-978

Flap Hinge Fairings Plating and Structure -- Type A
Figure 4 (Sheet 2)



NOTES:

1. TYPICAL AT STA 81 THROUGH 103.
2. TYPICAL AT STA 113 THROUGH 143 EXCEPT AS SHOWN.
3. *AIRPLANES 130 AND SUBSEQUENT.
4. FOR IDENTIFICATION LIST OF MATERIALS, SEE SHEET 3.

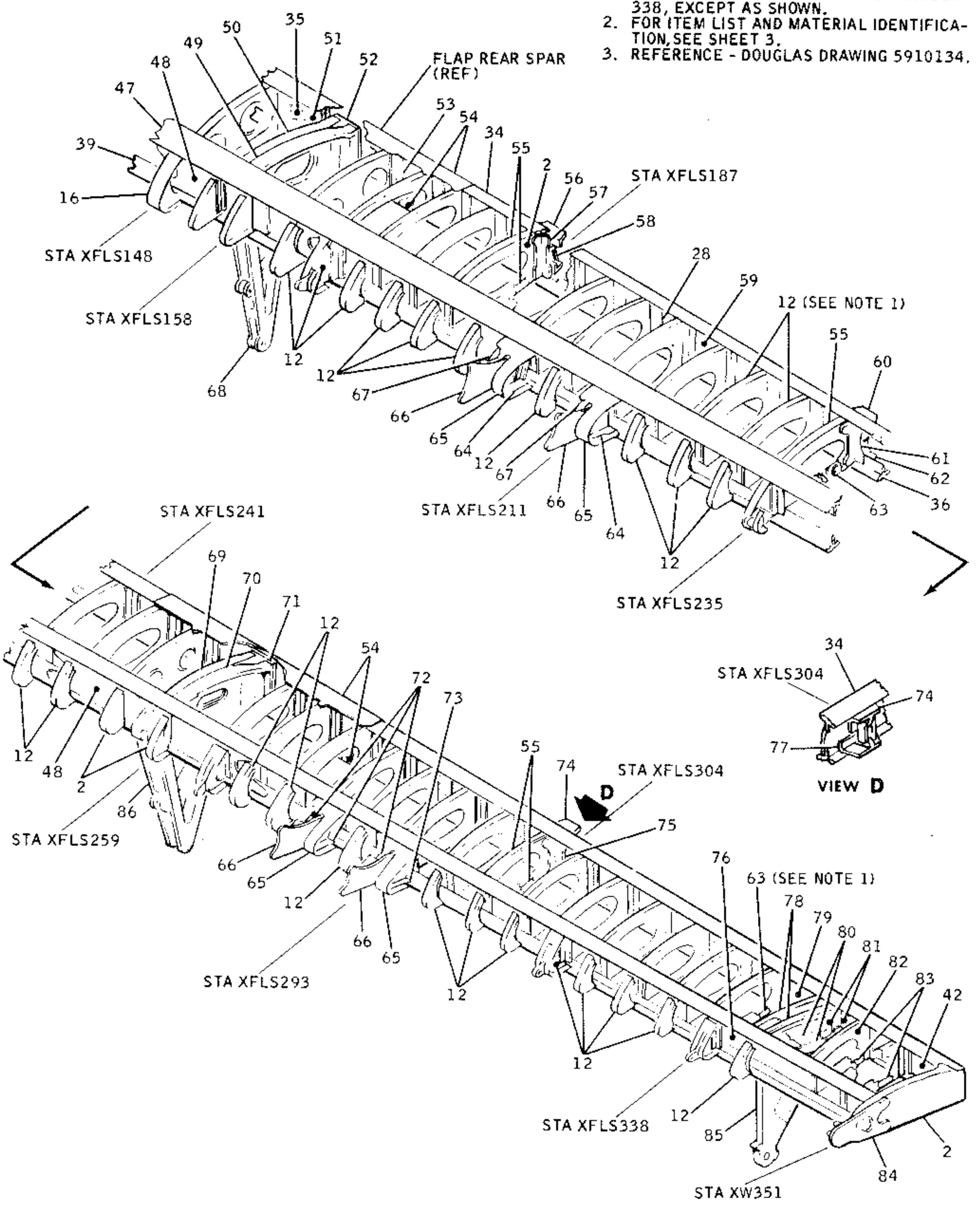
REFERENCE - DOUGLAS DRAWING 5910134

BB3-911

Flap Structure -- Type A
Figure 5 (Sheet 1)

NOTES:

1. TYPICAL AT STATIONS XFLS148 THROUGH 338, EXCEPT AS SHOWN.
2. FOR ITEM LIST AND MATERIAL IDENTIFICATION, SEE SHEET 3.
3. REFERENCE - DOUGLAS DRAWING 5910134.



Flap Structure -- Type A
Figure 5 (Sheet 2)

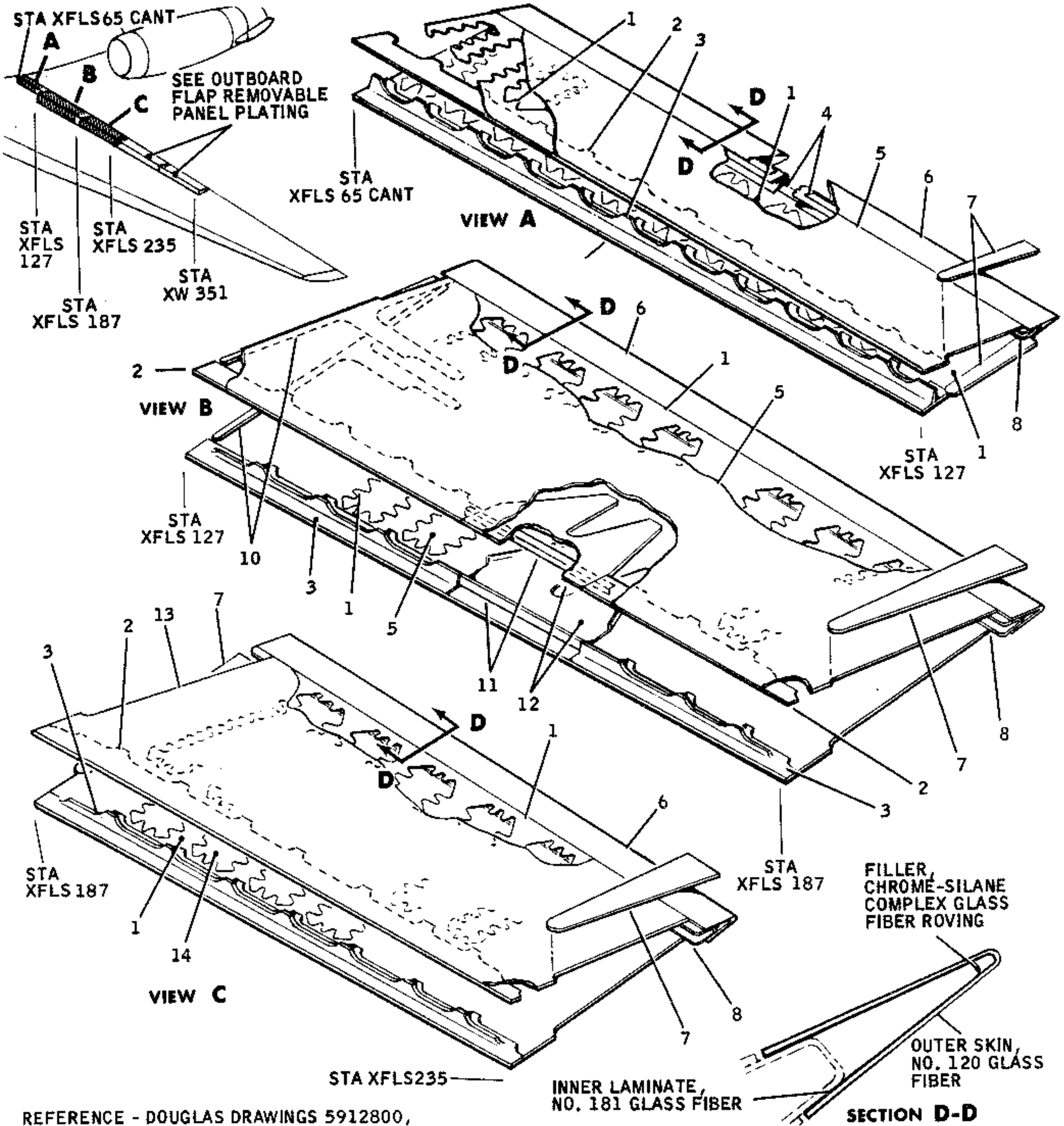
NOTES:

1. SEE SHEETS 1 AND 2 FOR DETAIL VIEWS.
2. MADE FROM TITANIUM SHEET DMS 1592.
3. MADE FROM TITANIUM FORGING DMS 1583.
4. REFERENCE - DOUGLAS DRAWING 5910134.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING		PLATE 2024-T351	45	ANGLE		1419316
2	RIB	.063	CLAD 2024-T42	46	FILLER	.125	CLAD 2024-T3
3	BACKPLATE	.125	SEE NOTE 2	47	UPPER STRINGER		2912308
4	RUBSTRIP	.063	4130 STEEL	48	WEB	.080	CLAD 7075-T6
5	CHANNEL		SEE NOTE 3	49	FITTING		FORGING 7075-T411
6	TRACK		2914976	50	FITTING		FORGING 7075-T411
7	FITTING		PLATE 2024-T351	51	DOUBLER	.025	CLAD 7075-T6
8	FITTING		PLATE 2024-T351	52	FITTING		4140 STEEL
9	DOUBLER	.063	CLAD 2024-T3	53	TEE		137058
10	DOUBLER	.080	CLAD 2024-T42	54	SPLICE	.125	CLAD 7075-T6
11	TEE		1414813	55	ANGLE		1858549
12	RIB	.050	CLAD 2024-T42	56	FITTING		BAR 7075-T651
13	CHANNEL	.063	CLAD 2024-T42	57	TEE		1419385
14	CAP		PLATE 2024-T351	58	FITTING		BAR 7075-T651
15	INTERCOSTAL	.063	CLAD 2024-T42	59	WEB	.040	CLAD 7075-T6
16	DOUBLER	.063	CLAD 2024-T3	60	FITTING		BAR 7075-T651
17	FITTING		PLATE 2024-T351	61	TEE		1419385
18	FITTING		PLATE 2024-T351	62	FITTING		BAR 7075-T651
19	FITTING		PLATE 2024-T351	63	CHANNEL	.050	CLAD 2024-T42
20	FAIRING	.050	CLAD 7075-T6	64	RIB	.071	CLAD 7075-T6
21	SPAR		2912428	65	DOUBLER	.090	CLAD 7075-T6
22	STIFFENER	.063	CLAD 2024-T42	66	SUPPORT	.190	CLAD 7075-T6
23	STIFFENER		1419316	67	ANGLE	.071	CLAD 7075-T6
24	STIFFENER		1418915	68	BRACKET		FORGING 2014-T6
25	SPACER	.063	CLAD 2024-T3	69	FITTING		FORGING 7075-T411
26	ANGLE	.063	CLAD 2024-T42	70	FITTING		FORGING 7075-T411
27	TEE		1652272	71	FITTING		4140 STEEL
28	ANGLE		1245072	72	ANGLE	.063	CLAD 7075-T6
29	ANGLE		1109080	73	RIB	.063	CLAD 7075-T6
30	WEB	.050	CLAD 2024-T3	74	FITTING		PLATE 7075-T651
31	UPPER SPAR CAP		2912429	75	TEE		1419385
32	RIB	.040	CLAD 2024-T42	76	WEB	.063	CLAD 7075-T6
33	LOWER SPAR CAP		2912427	77	FITTING		PLATE 7075-T651
34	CAP		4912121	78	FORMER	.050	CLAD 7075-T6
35	WEB	.050	CLAD 7075-T6	79	DOUBLER	.032	CLAD 7075-T6
36	CAP		4912121	80	ANGLE		2602999
37	CHANNEL	.040	CLAD 2024-T42	81	CLIP	.050	CLAD 7075-T6
38	STIFFENER		1242526	82	RIB	.032	CLAD 2024-T42
39	LOWER STRINGER		2912310	83	CHANNEL	.032	CLAD 2024-T42
40	STIFFENER	.050	CLAD 2024-T42	84	FITTING		CLAD 2024-T3
41	WEB	.063	CLAD 2024-T42	85	BRACKET		FORGING 2014-T6
42	WEB	.032	CLAD 7075-T6	86	BRACKET		FORGING 2014-T6
43	FITTING		PLATE 2024-T351	87	CAM LH	.375	PLATE 7075-T651
44	DOUBLER	.125	CLAD 2024-T3	88	CAM RH	.412	PLATE 7075-T651

BB3-912

Flap Structure -- Type A
Figure 5 (Sheet 3)

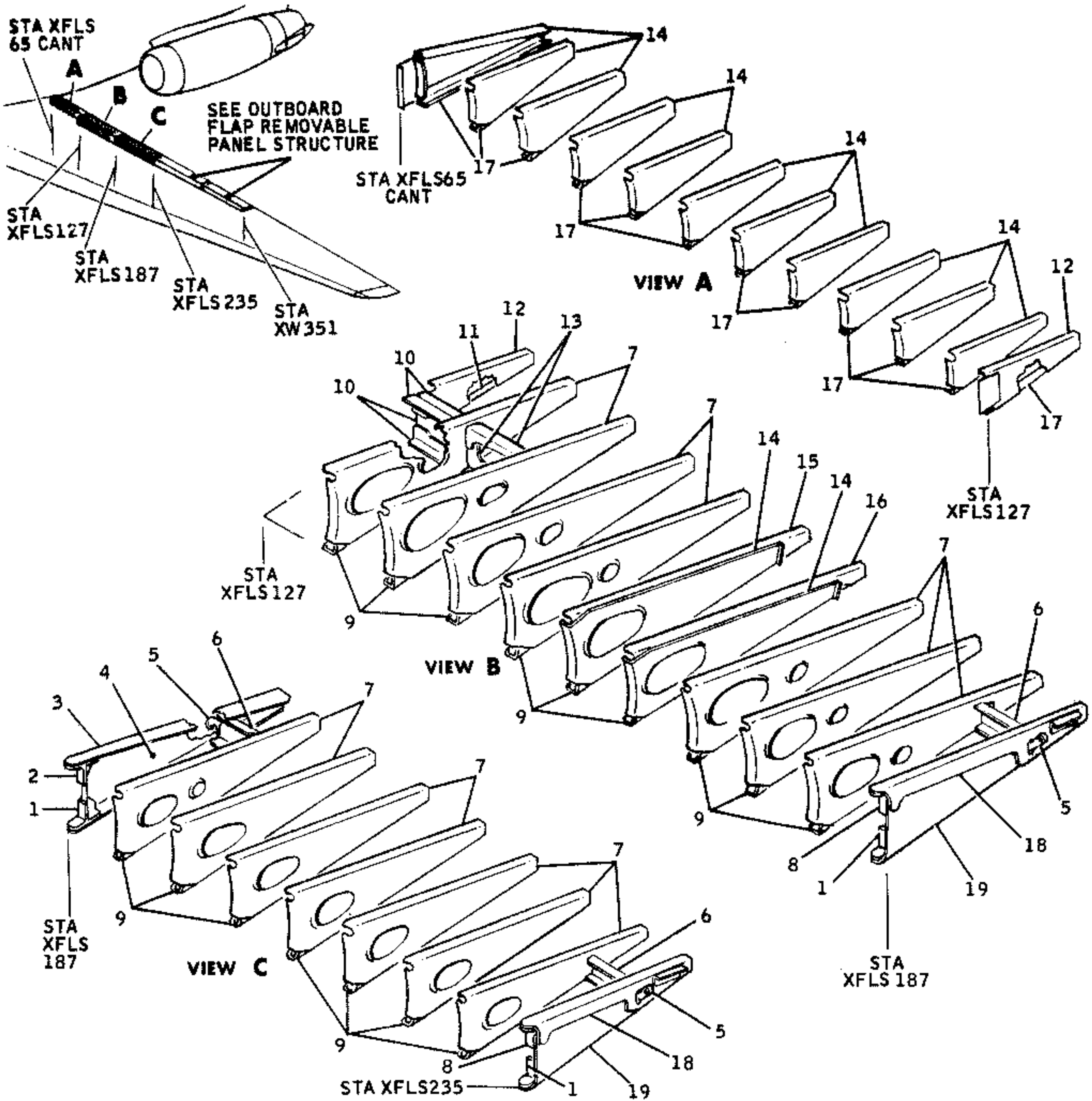


REFERENCE - DOUGLAS DRAWINGS 5912800,
5912992, 5912146

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.020	CLAD 2014-T6	8	CHANNEL	.050	CLAD 2024-T42
2	TEE		2914520	9	SKIN	.032	CLAD 2014-T6
3	TEE		2914521	10	BONDED DOUBLER	.063	CLAD 2014-T6
4	SHIM	.040	CLAD 2024-T3	11	ANGLE 9955816	.063	CLAD 2014-T6
5	SKIN	.025	CLAD 2014-T6	12	DOUBLER 9955814	.063	CLAD 7075-T6
6	TIP		SHAPE, 3913180	13	SKIN	.025	CLAD 7075-T6
	COVER	.063	CLAD 2024-T3	14	SKIN	.032	CLAD 7075-T6

BB3-913

Flap Inboard Section Removable Panels Plating -- Type A
Figure 6

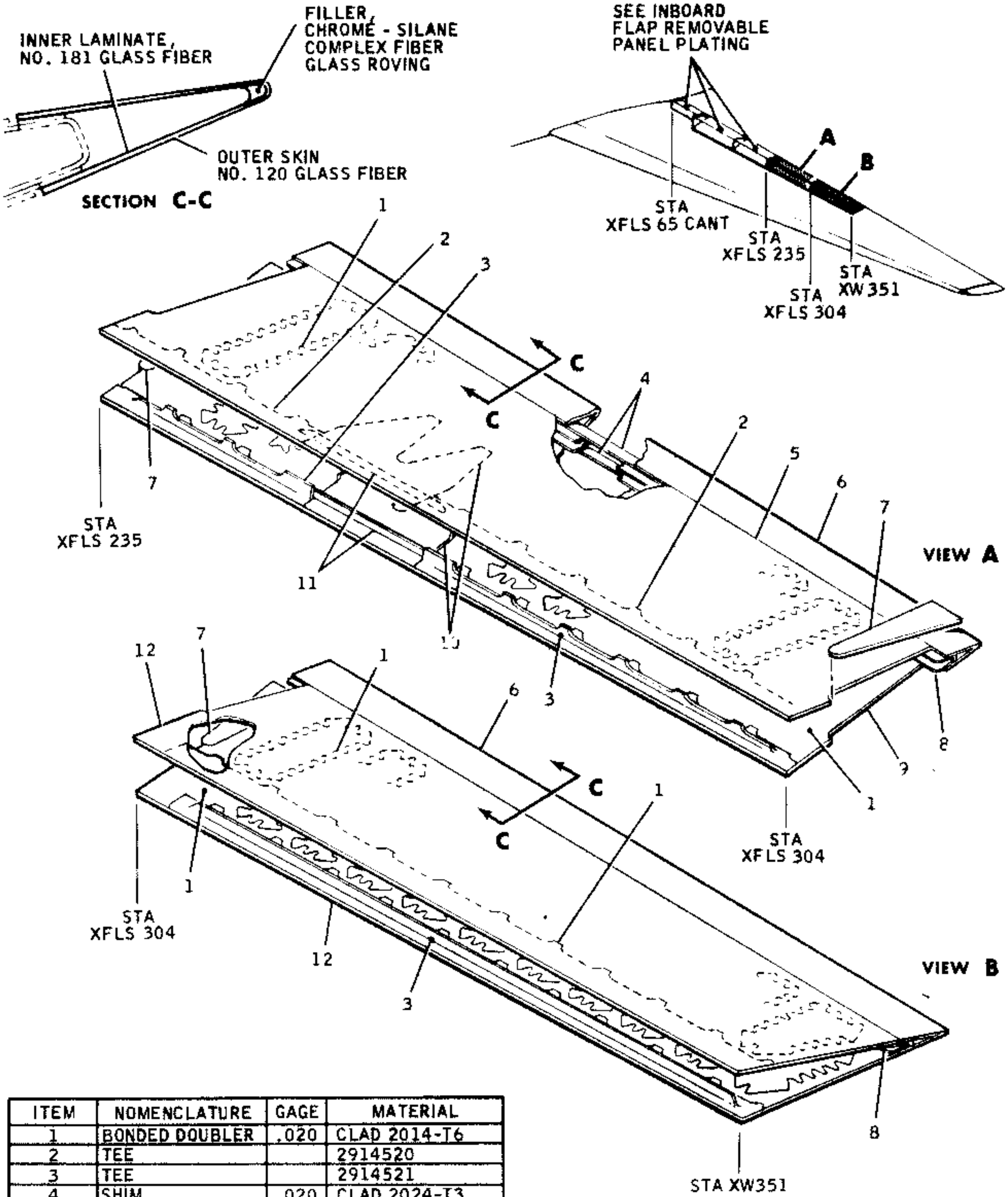


ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING 3912973-1,-2		PLATE 7075-T651	11	CHANNEL	.050	CLAD 2024-T42
2	FITTING 3912972-1,-2		PLATE 7075-T651	12	WEB	.040	CLAD 2024-T42
3	CAP	.063	CLAD 2024-T42	13	BRACKET	.040	CLAD 2024-T42
4	WEB	.063	CLAD 2024-T42	14	RIB	.040	CLAD 2024-T42
5	SUPPORT 4913290-3		STEEL 4130	15	CHANNEL	.063	CLAD 2024-T42
6	INTERCOSTAL	.080	CLAD 7075-T6	16	CHANNEL	.063	CLAD 7075-T6
7	RIB	.032	CLAD 2024-T42	17	CHANNEL	.040	CLAD 2024-T42
8	FITTING 3912970-1,-2		PLATE 7075-T651	18	CAP	.063	CLAD 7075-T6
9	CHANNEL	.032	CLAD 2024-T42	19	WEB	.063	CLAD 7075-T6
10	BRACKET	.050	CLAD 2024-T42				

REFERENCE - DOUGLAS DRAWING 5912800, 5912992, 5912146

BB3-262

Flap Inboard Section Removable Panels Ribs
and Intercostals -- Type A
Figure 7

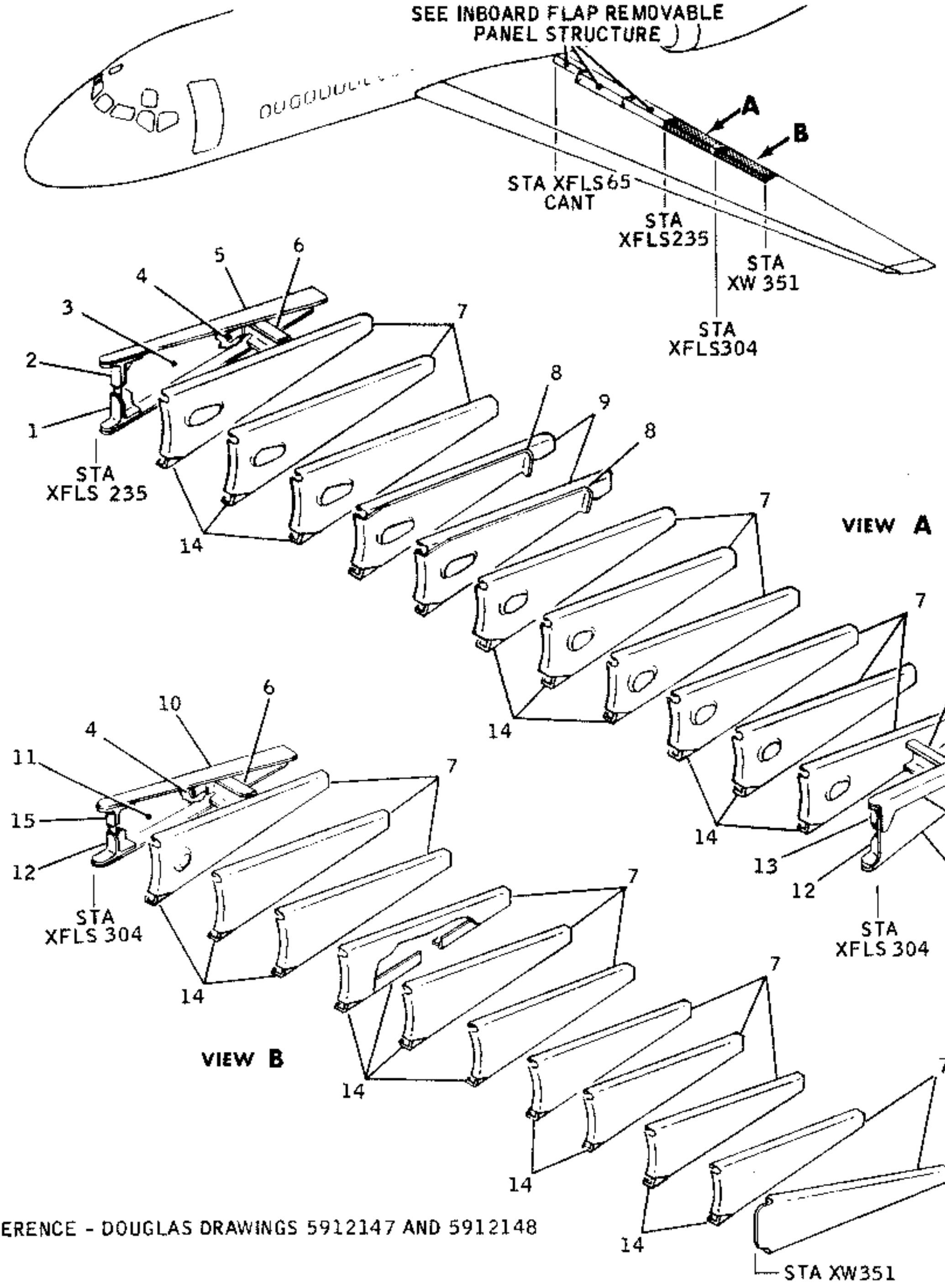


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	BONDED DOUBLER	.020	CLAD 2014-T6
2	TEE		2914520
3	TEE		2914521
4	SHIM	.020	CLAD 2024-T3
5	SKIN	.032	CLAD 2014-T6
6	TIP		SHAPE, 3913180
7	COVER	.063	CLAD 2024-T3
8	CHANNEL	.050	CLAD 2024-T42
9	SKIN	.040	CLAD 2014-T6
10	DOUBLER 9955814	.063	CLAD 7075-T6
11	SPLICE 9955816	.063	CLAD 7075-T6
12	SKIN	.025	CLAD 2024-T6

REFERENCE - DOUGLAS DRAWINGS 5912147 AND 5912148

B23-261

Flap Outboard Section Removable Panels Plating -- Type A
Figure 8

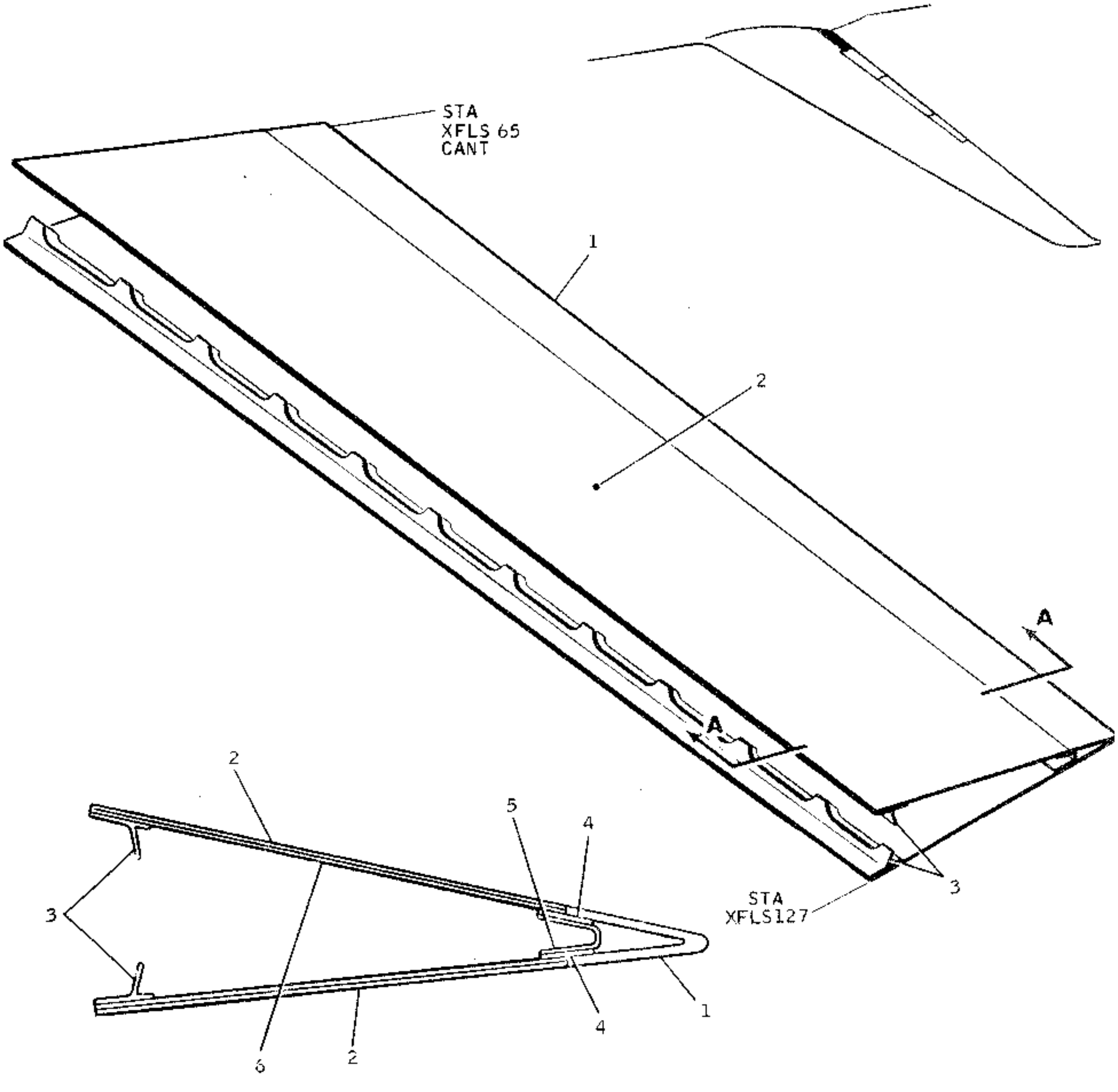


REFERENCE - DOUGLAS DRAWINGS 5912147 AND 5912148

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	FITTING 3912973-1,-2		PLATE 7075-T651
2	FITTING 3912972-1,-2		PLATE 7075-T651
3	WEB	.063	CLAD 2024-T42
4	SUPPORT 4913290-3		STEEL 4130
5	CAP	.063	CLAD 2024-T42
6	INTERCOSTAL	.080	CLAD 7075-T6
7	RIB	.032	CLAD 2024-T42
8	RIB	.040	CLAD 2024-T42
9	CHANNEL	.063	CLAD 2024-T42
10	CAP	.050	CLAD 7075-T6
11	WEB	.050	CLAD 7075-T6
12	FITTING 4913711-1,-2		PLATE 7075-T651
13	FITTING 4913712-1,-2		PLATE 7075-T651
14	CHANNEL	.032	CLAD 2024-T42
15	FITTING 4913713-1,-2		PLATE 7075-T651

BB3-263

Flap Outboard Section Removable Panels Ribs and Intercostals
Figure 9

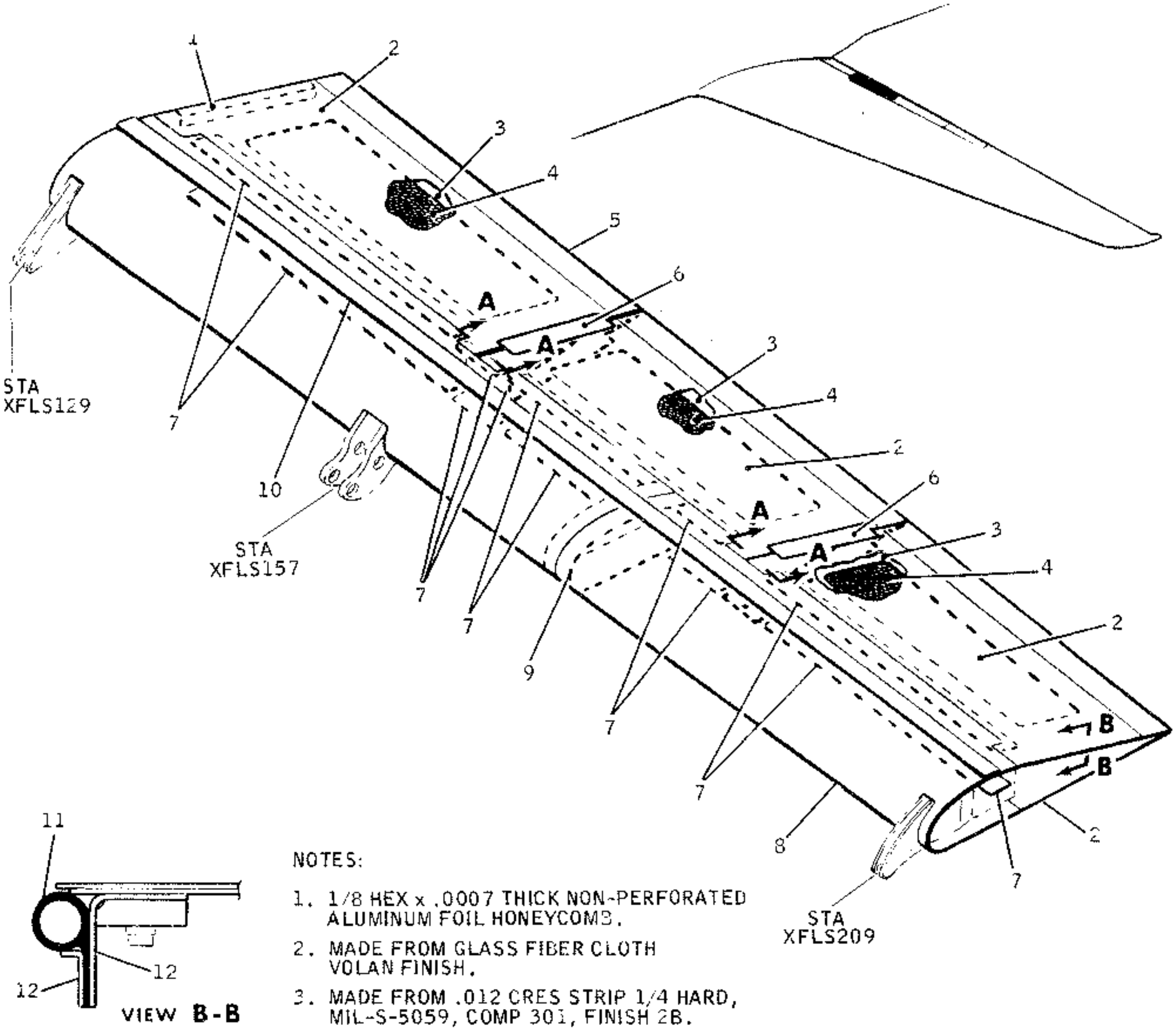


ITEM	NOMENCLATURE	GAGE	MATERIAL
1	TIP		SHAPE, 3913180
2	SKIN	.032	CLAD 2014-T6
3	TEE		2914520
4	SHIM	.025	CLAD 2024-T3
5	CHANNEL	.050	CLAD 2024-T42
6	DOUBLER	.020	CLAD 2014-T6

REFERENCE - DOUGLAS DRAWING 5921211

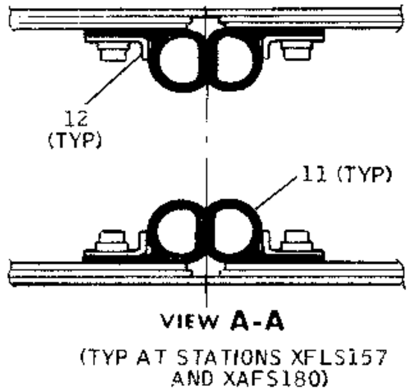
BB3-726

Inboard Auxiliary Flap Plating and Removable
Panel Plating -- Type A
Figure 8 (Sheet 1)



NOTES:

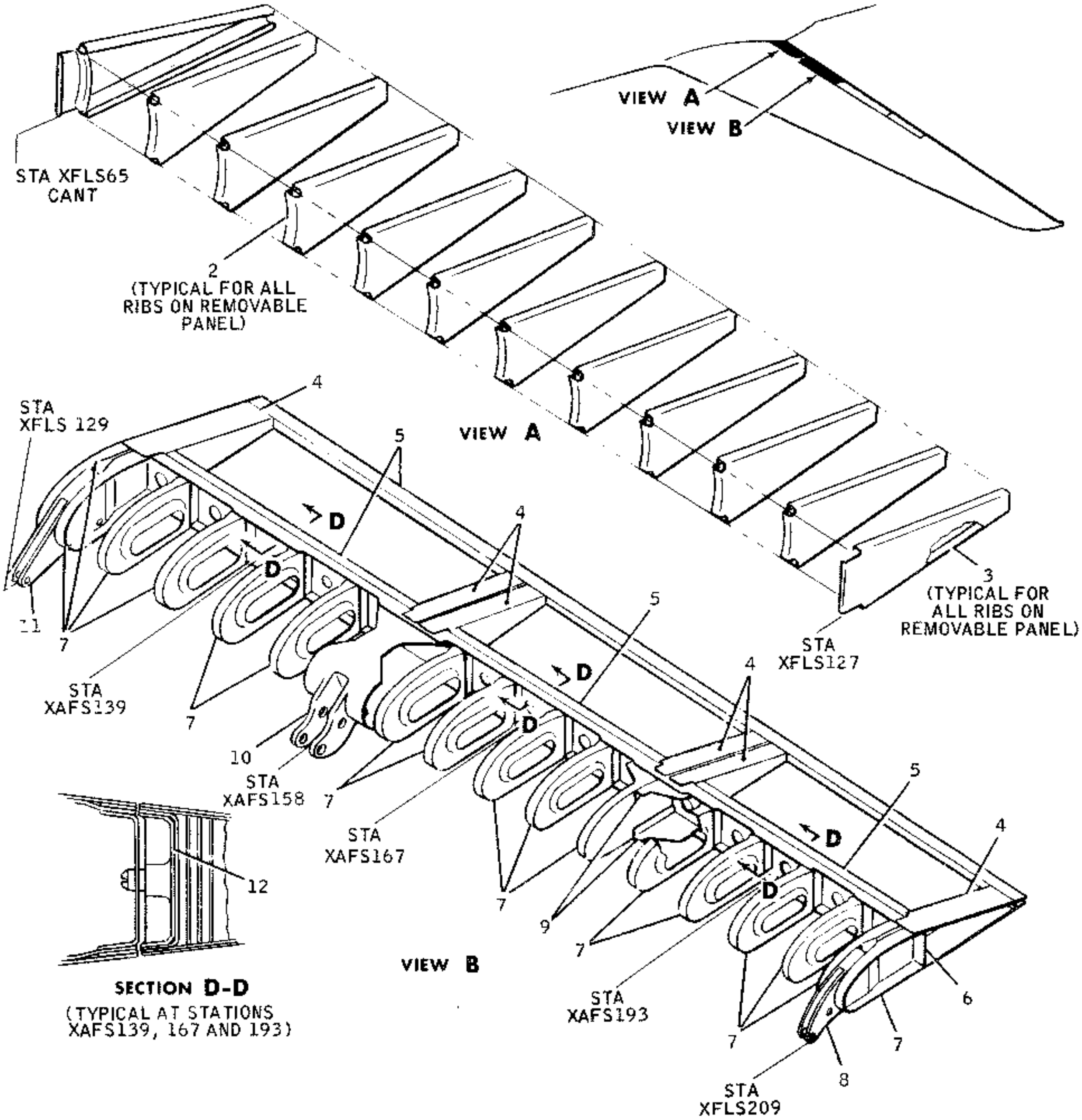
1. 1/8 HEX x .0007 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
2. MADE FROM GLASS FIBER CLOTH VOLAN FINISH.
3. MADE FROM .012 CRES STRIP 1/4 HARD, MIL-S-5059, COMP 301, FINISH 2B.
4. REFERENCE - DOUGLAS DRAWING 5910434.



ITEM	NOMENCLATURE	GAGE	MATERIAL
1	STIFFENER	.032	CLAD 2024-T3
2	SKIN	.016	CLAD 7075-T6
3	DOUBLER	.020	CLAD 7075-T6
4	CORE		SEE NOTE 1
5	CLOSURE		SEE NOTE 2
6	SEAL PLATE	.063	CLAD 7075-T6
7	SHIM	.012	CLAD 2024-T3
8	SKIN	.063	CLAD 2014-T6
9	SPLICE	.063	CLAD 2014-T6
10	RUB STRIP		SEE NOTE 3
11	SEAL		1417054
12	SUPPORT	.032	CLAD 2024-T42

BB3-801

Inboard Auxiliary Flap Plating and Removable Panel Plating -- Type A
Figure 8 (Sheet 2)



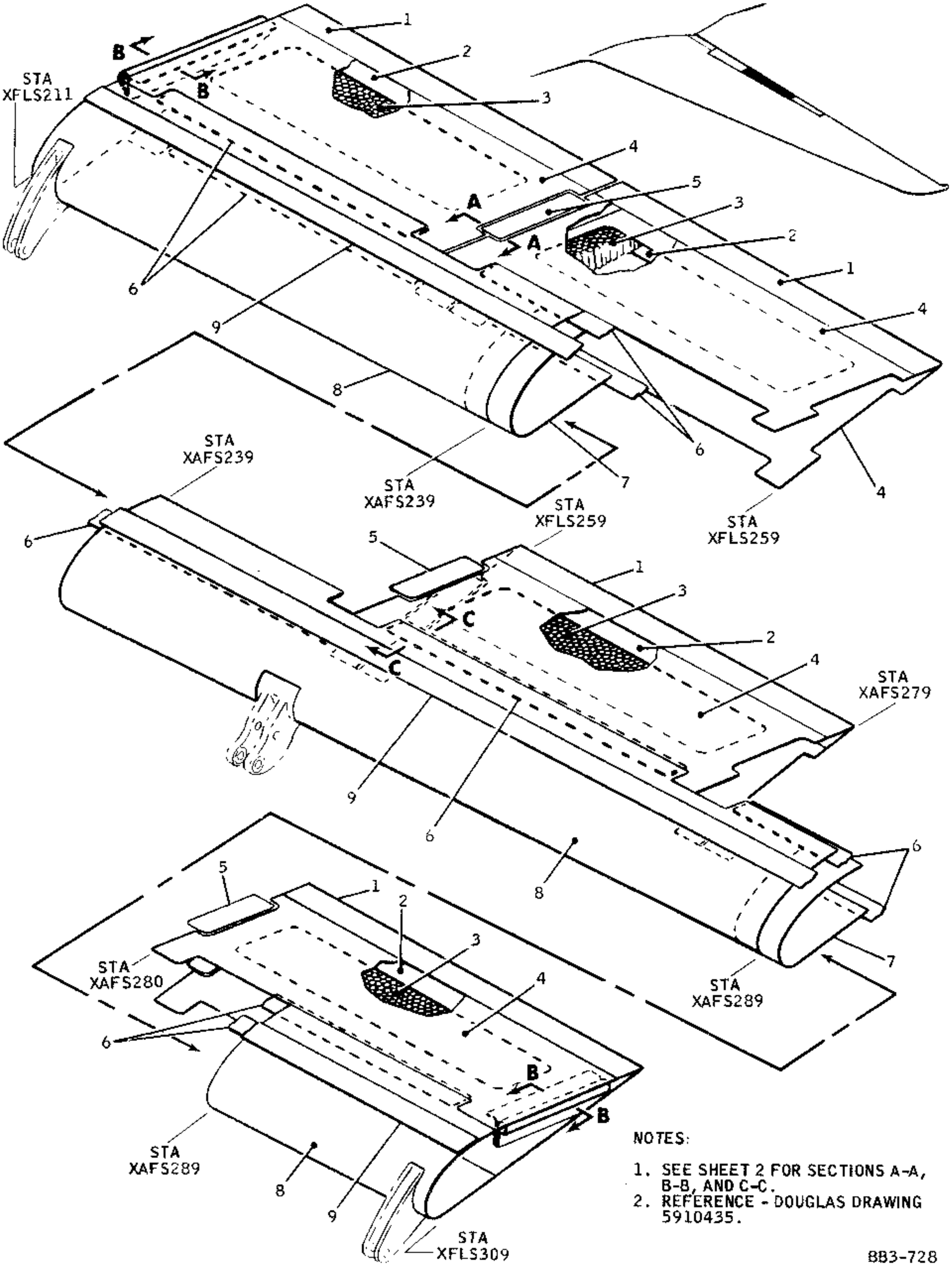
REFERENCE - DOUGLAS DRAWINGS 5910434 AND 5911211.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	ANGLE	.040	CLAD 2024-T42	7	RIB	.040	CLAD 7075-T6
2	RIB	.040	CLAD 2024-T42	8	FITTING	.125	PLATE 7075-T7351
3	CHANNEL	.040	CLAD 2024-T42	9	ANGLE	.040	CLAD 7075-T6
4	RIB	.032	CLAD 7075-T6	10	FITTING		FORGING 7075-T73
5	SPAR	.032	CLAD 7075-T6	11	FITTING	1.000	PLATE 7075-T7351
6	SPAR	1.500	PLATE 7075-T6	12	FITTING	2.000	PLATE 7075-T651

8B3-727

Inboard Auxiliary Flap Structure and Removable Panel Structure -- Type A
Figure 9

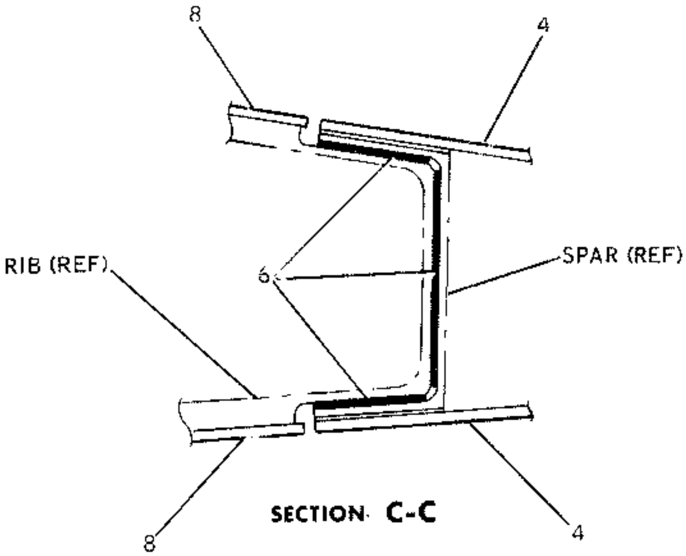
Printed in U.S.A.



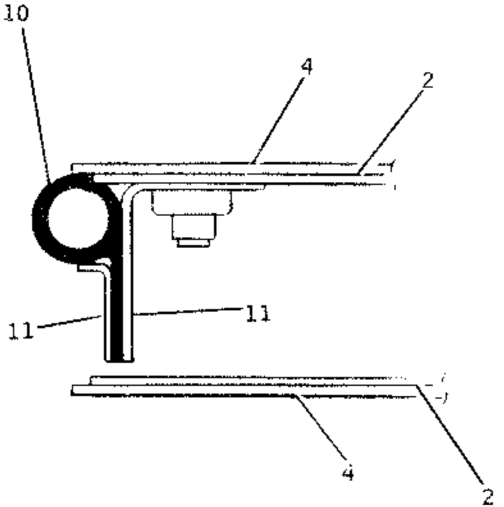
NOTES:

1. SEE SHEET 2 FOR SECTIONS A-A, B-B, AND C-C.
2. REFERENCE - DOUGLAS DRAWING 5910435.

Center Auxiliary Flap Plating -- Type A
Figure 10 (Sheet 1)

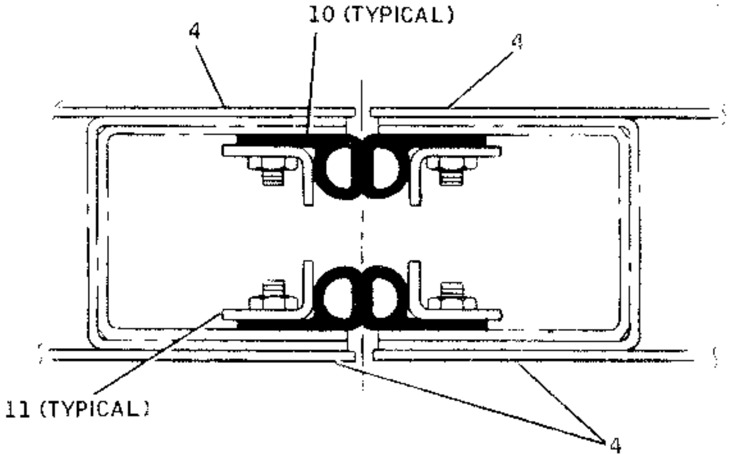


SECTION C-C



SECTION B-B

(TYPICAL AT STATIONS XFLS211 AND XFLS309)



SECTION A-A

(TYPICAL AT STATIONS XAFS230, XFLS259 AND XAFS279)

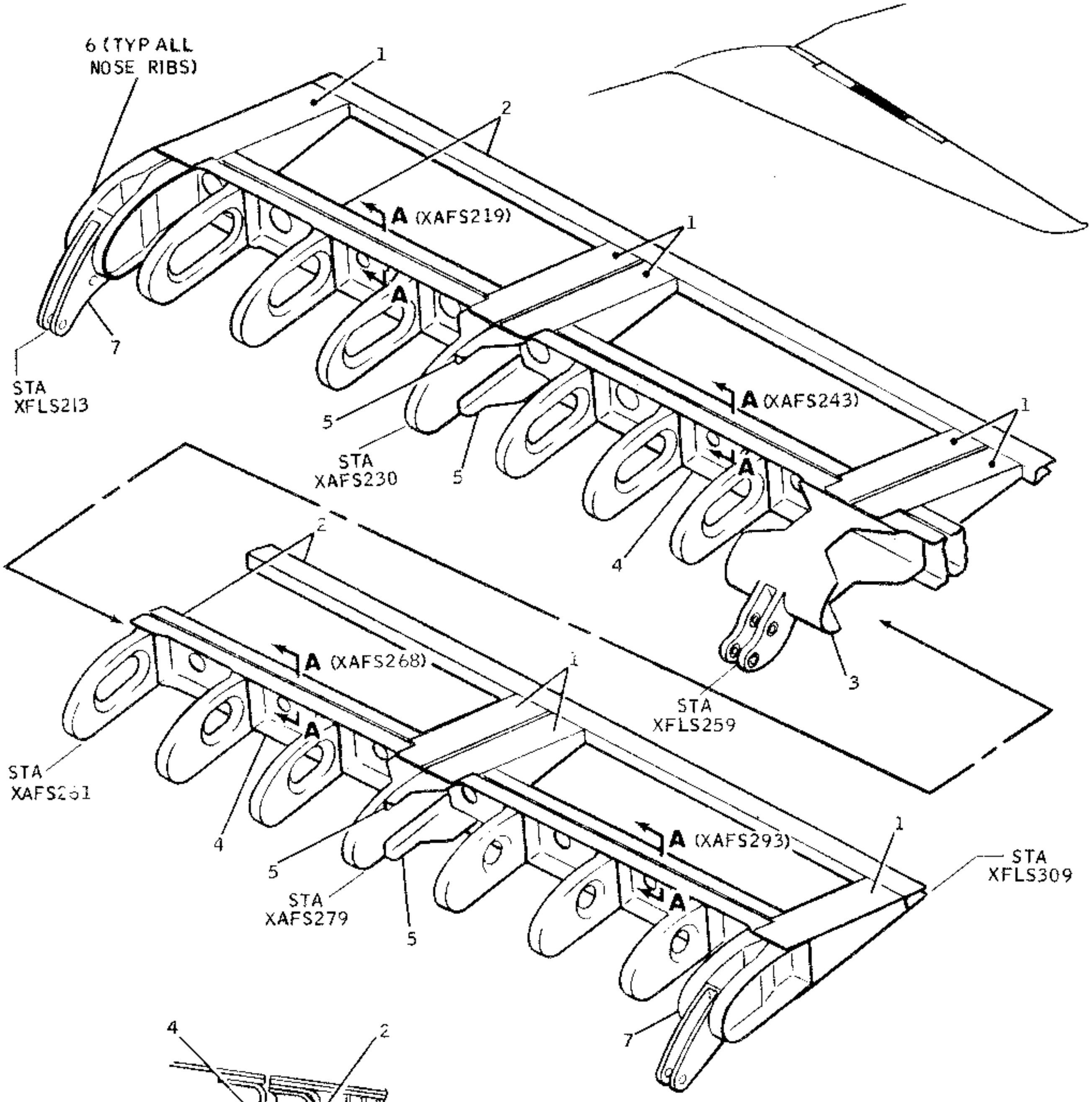
ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLOSURE		SEE NOTE 1
2	DOUBLER	.020	CLAD 7075-T6
3	CORE		SEE NOTE 2
4	SKIN	.016	CLAD 7075-T6
5	SEAL PLATE	.063	CLAD 7075-T6
6	SHIM	.012	CLAD 2024-T3
7	SPLICE	.063	CLAD 2014-T6
8	SKIN	.063	CLAD 2014-T6
9	RUB STRIP		SEE NOTE 3
10	SEAL		1417054
11	SUPPORT	.032	CLAD 2024-T42

NOTES:

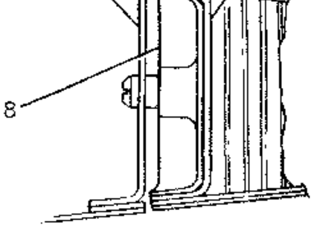
1. MADE FROM GLASS FIBER CLOTH VOLAN FINISH.
2. MADE FROM 1/8 HEX x .0007 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
3. MADE FROM .012 CRES STRIP 1/4 HARD, MIL-S-5059, COMP 301, FINISH 2B.
4. REFERENCE - DOUGLAS DRAWING 5910435.

BB3-826

Center Auxiliary Flap Plating -- Type A
Figure 10 (Sheet 2)



REFERENCE - DOUGLAS DRAWING 5910435

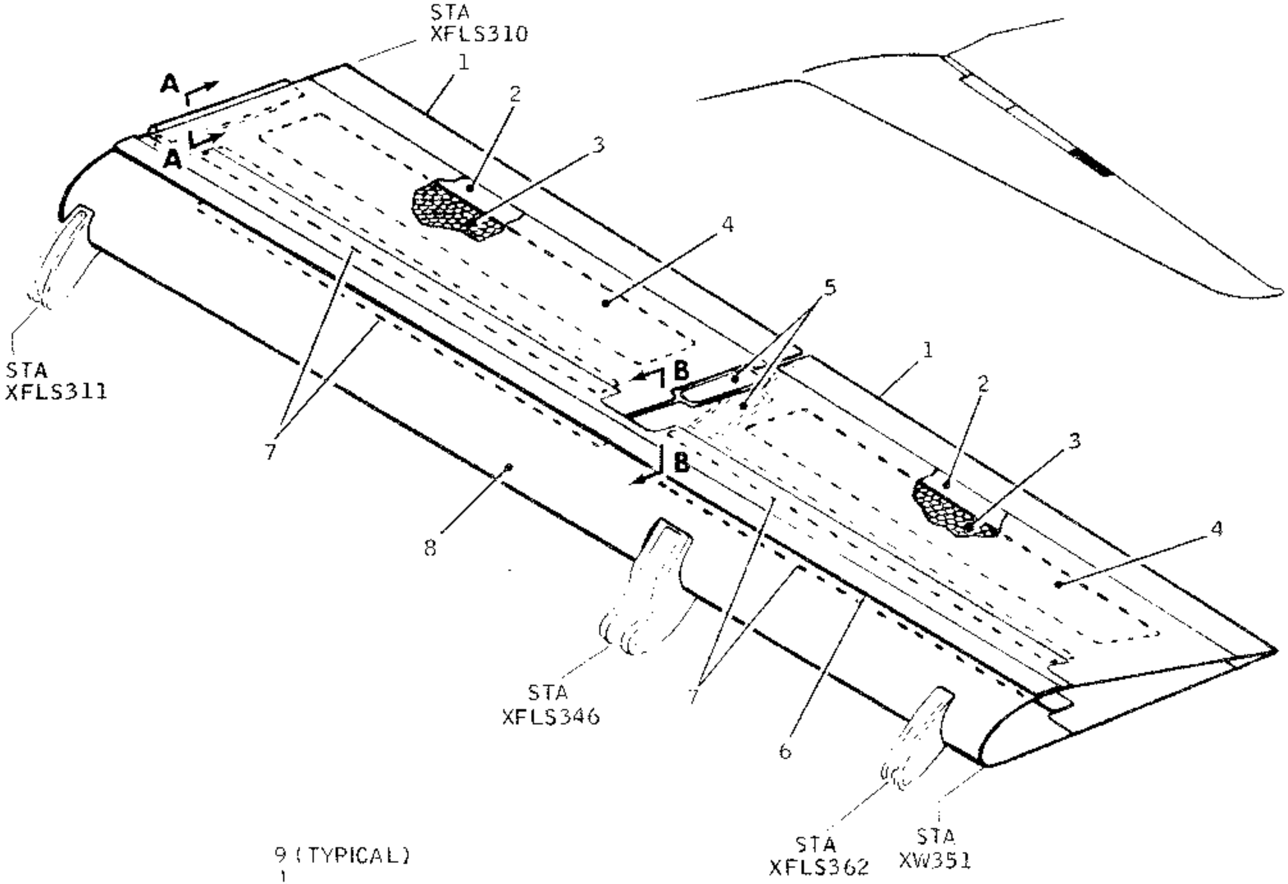


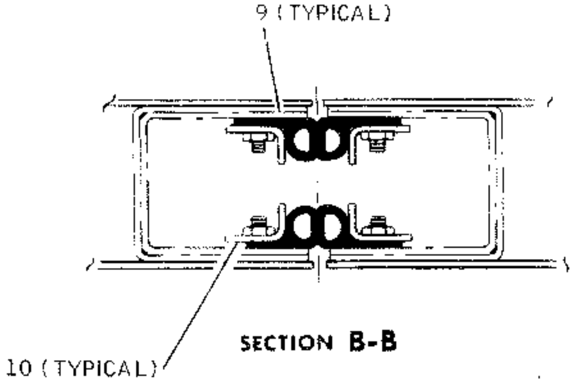
SECTION A-A
(TYPICAL AT STATIONS XAFS219, 243, 268 AND 293

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.032	CLAD 7075-T6
2	SPAR	.032	CLAD 7075-T6
3	FITTING	FORGING	7075-T411
4	SPAR	1.500	PLATE 7075-T651
5	ANGLE	.040	CLAD 7075-T6
6	RIB	.040	CLAD 7075-T6
7	FITTING	1.125	PLATE 7075-T7351
8	FITTING	2.000	PLATE 7075-T651

BB3-729

Center Auxiliary Flap Structure -- Type A
Figure 11

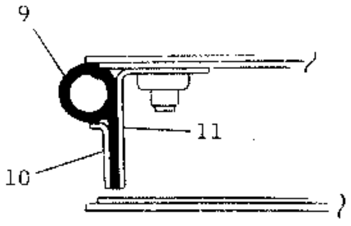




SECTION **B-B**

NOTES:

1. MADE FROM GLASS FIBER CLOTH VOLAN FINISH.
2. MADE FROM 1/8 HEX x .0007 THICK NON-PERFORATED ALUMINUM FOIL HONEYCOMB.
3. MADE FROM .012 CRES STRIP 1/4 HARD, MIL-S-5059, COMP 301, FINISH 2B.
4. REFERENCE - DOUGLAS DRAWING 5910436.

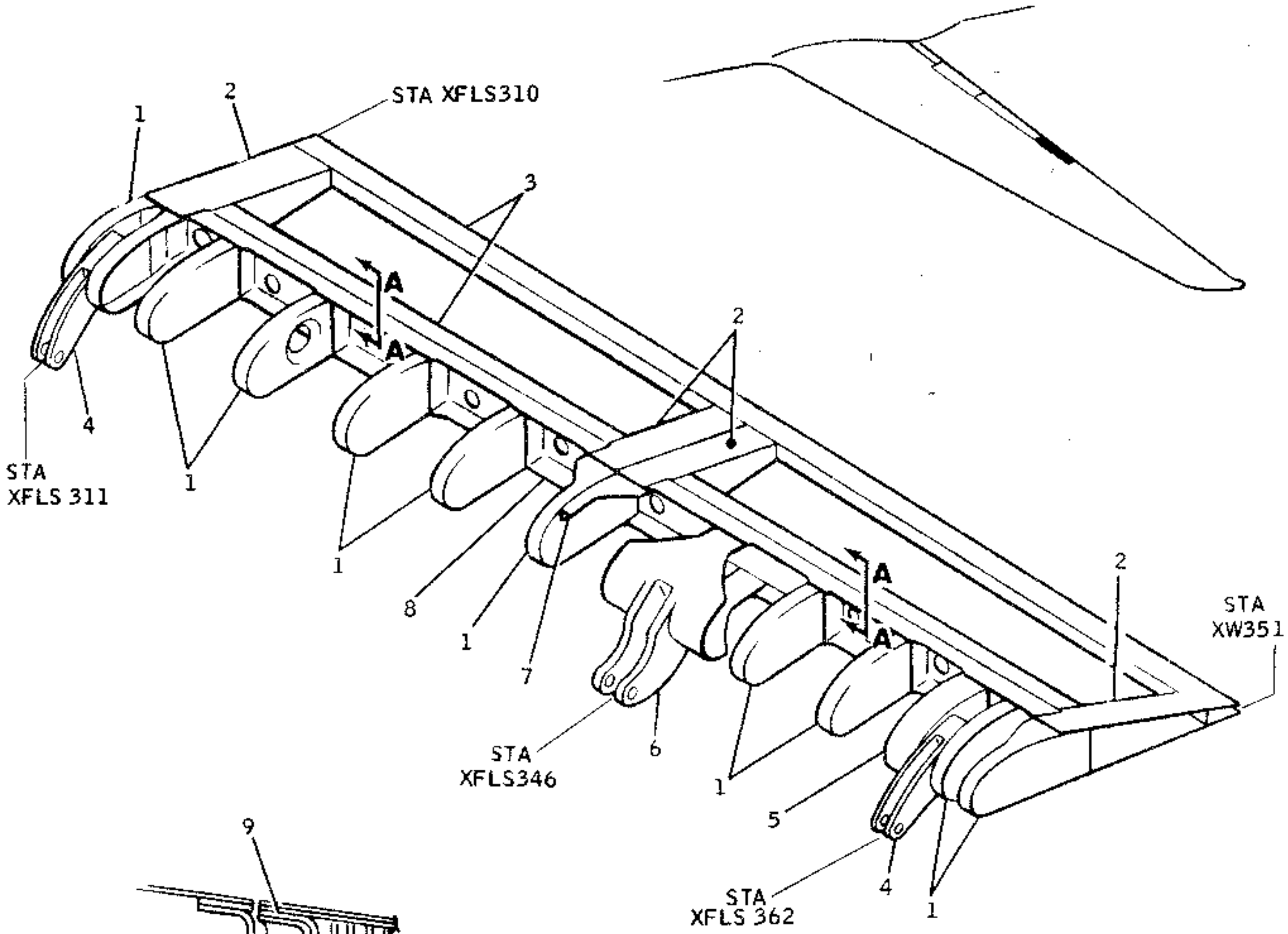


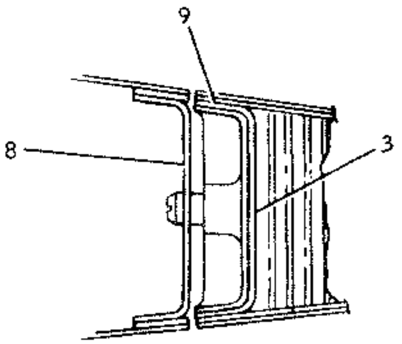
SECTION **A-A**

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	CLOSURE		SEE NOTE 1
2	DOUBLER	.020	CLAD 7075-T6
3	CORE		SEE NOTE 2
4	SKIN	.016	CLAD 7075-T6
5	SEAL PLATE	.063	CLAD 7075-T6
6	RUB STRIP		SEE NOTE 3
7	SHIM	.012	CLAD 2024-T3
8	SKIN	.063	CLAD 2014-T6
9	SEAL		1417054
10	RETAINER	.032	CLAD 2024-T42
11	SUPPORT	.032	CLAD 2024-T3

BB3-730

Outboard Auxiliary Flap Plating -- Type A
Figure 12





SECTION A-A

(TYPICAL AT STATIONS XAFS319
AND XAFS348)

ITEM	NOMENCLATURE	GAGE	MATERIAL
1	RIB	.042	CLAD 7075-T6
2	RIB	.032	CLAD 7075-T6
3	SPAR	.032	CLAD 7075-T6
4	FITTING	1.125	PLATE 7075-T7351
5	RIB	.063	CLAD 7075-T6
6	FITTING		FORGING 7075-T411
7	ANGLE	.040	CLAD 7075-T6
8	SPAR	1.500	PLATE 7075-T651
9	FITTING	2.000	PLATE 7075-T651

REFERENCE - DOUGLAS DRAWING 5910436

BB3-731

Outboard Auxiliary Flap Structure -- Type A
Figure 13

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22.								
(Pounds)	(Inch-Pounds)		Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.32	1.72	WITHIN BALANCE LIMITS	-1/1.62	-2/1.52	-3/1.42	-4/1.32	-5/1.22	-6/1.12	-7/1.02	-8/0.92	-9/0.82
0.33	1.78		+1/1.88	+2/1.98							
0.33	1.78		-1/1.68	-2/1.58	-3/1.48	-4/1.38	-5/1.28	-6/1.18	-7/1.08	-8/0.98	-9/0.88
0.34	1.83		+1/1.93								
0.34	1.83		-1/1.73	-2/1.63	-3/1.53	-4/1.43	-5/1.33	-6/1.23	-7/1.13	-8/1.03	-9/0.93
0.35	1.89		+1/1.99								
0.35	1.89		-1/1.79	-2/1.69	-3/1.59	-4/1.49	-5/1.39	-6/1.29	-7/1.19	-8/1.09	-9/0.99
0.36	1.94		-1/1.84	-2/1.74	-3/1.64	-4/1.54	-5/1.44	-6/1.34	-7/1.24	-8/1.14	-9/1.04
0.37	2.00		-1/1.90	-2/1.80	-3/1.70	-4/1.60	-5/1.50	-6/1.40	-7/1.30	-8/1.20	-9/1.10
0.38	2.05		-1/1.95	-2/1.85	-3/1.75	-4/1.65	-5/1.55	-6/1.45	-7/1.35	-8/1.25	-9/1.15
0.39	2.10		-1/2.00	-2/1.90	-3/1.80	-4/1.70	-5/1.60	-6/1.50	-7/1.40	-8/1.30	-9/1.20
0.40	2.16			-2/1.96	-3/1.86	-4/1.76	-5/1.66	-6/1.56	-7/1.46	-8/1.36	-9/1.26
0.41	2.21				-3/1.91	-4/1.81	-5/1.71	-6/1.61	-7/1.51	-8/1.41	-9/1.31
0.42	2.26				-3/1.96	-4/1.86	-5/1.76	-6/1.66	-7/1.56	-8/1.46	-9/1.36
0.43	2.32					-4/1.92	-5/1.82	-6/1.72	-7/1.62	-8/1.52	-9/1.42
0.44	2.37					-4/1.97	-5/1.87	-6/1.77	-7/1.67	-8/1.57	-9/1.47
0.45	2.43						-5/1.93	-6/1.83	-7/1.73	-8/1.63	-9/1.53
0.46	2.48						-5/1.98	-6/1.88	-7/1.78	-8/1.68	-9/1.58
0.47	2.53							-6/1.93	-7/1.83	-8/1.73	-9/1.63
0.48	2.59							-6/1.99	-7/1.89	-8/1.79	-9/1.69
0.49	2.64								-7/1.94	-8/1.84	-9/1.74
0.50	2.70								-7/2.00	-8/1.90	-9/1.80
0.51	2.75									-8/1.95	-9/1.85
0.52	2.80									-8/2.00	-9/1.90
0.53	2.86										-9/1.96

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 3)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.20	1.08		-1/0.98	-2/0.88	-3/0.78	-4/0.68	-5/0.58				
0.21	1.13		+1/1.23	+2/1.33	+3/1.43	+4/1.53	+5/1.63	+6/1.73	+7/1.83	+8/1.93	
0.21	1.13	↑ WITHIN BALANCE LIMITS ↓	-1/1.03	-2/0.93	-3/0.83	-4/0.73	-5/0.63	-6/0.53			
0.22	1.19		+1/1.29	+2/1.39	+3/1.49	+4/1.59	+5/1.69	+6/1.79	+7/1.89	+8/1.99	
0.22	1.19		-1/1.09	-2/0.99	-3/0.89	-4/0.79	-5/0.69	-6/0.59			
0.23	1.24		+1/1.34	+2/1.44	+3/1.54	+4/1.64	+5/1.74	+6/1.84	+7/1.94		
0.23	1.24		-1/1.14	-2/1.04	-3/0.94	-4/0.84	-5/0.74	-6/0.64	-7/0.54		
0.24	1.29		+1/1.39	+2/1.49	+3/1.59	+4/1.69	+5/1.79	+6/1.89	+7/1.99		
0.24	1.29		-1/1.19	-2/1.09	-3/0.99	-4/0.89	-5/0.79	-6/0.69	-7/0.59		
0.25	1.35		+1/1.45	+2/1.55	+3/1.65	+4.1.75	+5/1.85	+6/1.95			
0.25	1.35		-1/1.25	-2/1.15	-3/1.05	-4/0.95	-5/0.85	-6/0.75	-7/0.65	-8/0.55	
0.26	1.40		+1/1.50	+2/1.60	+3/1.70	+4/1.80	+5/1.90	+6/2.00			
0.26	1.40		-1/1.30	-2/1.20	-3/1.10	-4/1.00	-5/0.90	-6/0.80	-7/0.70	-8/0.60	-9/0.50
0.27	1.45		+1/1.55	+2/1.65	+3/1.75	+4/1.85	+5/1.95				
0.27	1.45		-1/1.35	-2/1.25	-3/1.15	-4/1.05	-5/0.95	-6/0.85	-7/0.75	-8/0.65	-9/0.55
0.28	1.51		+1/1.61	+2/1.71	+3/1.81	+4/1.91					
0.28	1.51		-1/1.41	-2/1.31	-3/1.21	-4/1.11	-5/1.01	-6/0.91	-7/0.81	-8/0.71	-9/0.61
0.29	1.56		+1/1.76	+2/1.86	+3/1.96						
0.29	1.56		-1/1.46	-2/1.36	-3/1.26	-4/1.16	-5/1.06	-6/0.96	-7/0.86	-8/0.76	-9/0.66
0.30	1.62		+1/1.72	+2/1.82	+3/1.92						
0.30	1.62		-1/1.52	-2/1.42	-3/1.32	-4/1.22	-5/1.12	-6/1.02	-7/0.92	-8/0.82	-9/0.72
0.31	1.67		+1/1.77	+2/1.87	+3/1.97						
0.31	1.67		-1/1.57	-2/1.47	-3/1.37	-4/1.27	-5/1.17	-6/1.07	-7/0.97	-8/0.87	-9/0.77
0.32	1.72		+1/1.82	+2/1.92							

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 2)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.07	0.38			+2/0.58	+3/0.68	+4/0.78	+5/0.88	+6/0.98	+7/1.08	+8/1.18	+9/1.28
0.08	0.43		+1/0.53	+2/0.63	+3/0.73	+4/0.83	+5/0.93	+6/1.03	+7/1.13	+8/1.23	+9/1.33
0.09	0.49		+1/0.59	+2/0.69	+3/0.79	+4/0.89	+5/0.99	+6/1.09	+7/1.19	+8/1.29	+9/1.39
0.10	0.54	WITHIN BALANCE LIMITS	+1/0.64	+2/0.74	+3/0.84	+4/0.94	+5/1.04	+6/1.14	+7/1.24	+8/1.34	+9/1.44
0.11	0.59		+1/0.69	+2/0.79	+3/0.89	+4/0.99	+5/1.09	+6/1.19	+7/1.29	+8/1.39	+9/1.49
0.12	0.65		+1/0.75	+2/0.85	+3/0.95	+4/1.05	+5/1.15	+6/1.25	+7/1.35	+8/1.45	+9/1.55
0.12	0.65		-1/0.55								
0.13	0.70		+1/0.80	+2/0.90	+3/1.00	+4/1.10	+5/1.20	+6/1.30	+7/1.40	+8/1.50	+9/1.60
0.13	0.70		-1/0.60	-2/0.50							
0.14	0.75		+1/0.85	+2/0.95	+3/1.05	+4/1.15	+5/1.25	+6/1.35	+7/1.45	+8/1.55	+9/1.65
0.14	0.75		-1/0.65	-2/0.55							
0.15	0.81		+1/0.91	+2/1.01	+3/1.11	+4/1.21	+5/1.31	+6/1.41	+7/1.51	+8/1.61	+9/1.71
0.15	0.81		-1/0.71	-2/0.61	-3/0.51						
0.16	0.86		+1/0.96	+2/1.06	+3/1.16	+4/1.26	+5/1.36	+6/1.46	+7/1.56	+8/1.66	+9/1.76
0.16	0.86		-1/0.76	-2/0.66	-3/0.56						
0.17	0.92		+1/1.02	+2/1.12	+3/1.22	+4/1.32	+5/1.42	+6/1.52	+7/1.62	+8/1.72	+9/1.82
0.17	0.92		-1/0.82	-2/0.72	-3/0.62	-4/0.52					
0.18	0.97		+1/1.07	+2/1.17	+3/1.27	+4/1.37	+5/1.47	+6/1.57	+7/1.67	+8/1.77	+9/1.87
0.18	0.97		-1/0.87	-2/0.77	-3/0.67	-4/0.57					
0.19	1.02		+1/1.12	+2/1.22	+3/1.32	+4/1.42	+5/1.52	+6/1.62	+7/1.72	+8/1.82	+9/1.92
0.19	1.02		-1/0.92	-2/0.82	-3/0.72	-4/0.62	-5/0.52				
0.20	1.08		+1/1.18	+2/1.28	+3/1.38	+4/1.48	+5/1.58	+6/1.88	+7/1.78	+8/1.88	+9/1.98

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 1)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)	Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.75	4.04	-1/3.94	-2/3.84	-3/3.74	-4/3.64	-5/3.54	-6/3.44	-7/3.34	-8/3.24	-9/3.14
0.76	4.10	-1/4.00	-2/3.90	-3/3.80	-4/3.70	-5/3.60	-6/3.50	-7/3.40	-8/3.30	-9/3.20
0.77	4.15		-2/3.95	-3/3.85	-4/3.75	-5/3.65	-6/3.55	-7/3.45	-8/3.35	-9/3.25
0.78	4.20		-2/4.00	-3/3.90	-4/3.80	-5/3.70	-6/3.60	-7/3.50	-8/3.40	-9/3.30
0.79	4.26			-3/3.96	-4/3.86	-5/3.76	-6/3.66	-7/3.56	-8/3.46	-9/3.36
0.80	4.31				-4/3.91	-5/3.81	-6/3.71	-7/3.61	-8/3.51	-9/3.41
0.81	4.37				-4/3.97	-5/3.87	-6/3.77	-7/3.67	-8/3.57	-9/3.47
0.82	4.42					-5/3.92	-6/3.82	-7/3.72	-8/3.62	-9/3.52
0.83	4.47					-5/3.97	-6/3.87	-7/3.77	-8/3.67	-9/3.57
0.84	4.53						-6/3.93	-7/3.83	-8/3.73	-9/3.63
0.85	4.58						-6/3.98	-7/3.88	-8/3.78	-9/3.68
0.86	4.64							-7/3.94	-8/3.84	-9/3.74

Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 4)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0) inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.64	3.45	WITHIN BALANCE LIMITS	+1/3.55	+2/3.65	+3/3.75	+4/3.85	+5/3.95				
0.64	3.45		-1/3.35	-2/3.25	-3/3.15	-4/3.05	-5/2.95	-6/2.85	-7/2.75	-8/2.65	-9/2.55
0.65	3.50		+1/3.60	+2/3.70	+3/3.80	+4/3.90	+5/4.00				
0.65	3.50		-1/3.40	-2/3.30	-3/3.20	-4/3.10	-5/3.00	-6/2.90	-7/2.80	-8/2.70	-9/2.60
0.66	3.56		+1/3.66	+2/3.76	+3/3.86	+4/3.96					
0.66	3.56		-1/3.46	-2/3.36	-3/3.26	-4/3.16	-5/3.06	-6/2.96	-7/2.86	-8/2.76	-9/2.66
0.67	3.61		+1/3.71	+2/3.81	+3/3.91						
0.67	3.61		-1/3.51	-2/3.41	-3/3.31	-4/3.21	-5/3.11	-6/3.01	-7/2.91	-8/2.81	-9/2.71
0.68	3.67		+1/3.77	+2/3.87	+3/3.97						
0.68	3.67		-1/3.57	-2/3.47	-3/3.37	-4/3.27	-5/3.17	-6/3.07	-7/2.97	-8/2.87	-9/2.77
0.69	3.72		+1/3.82	+2/3.92							
0.69	3.72		-1/3.62	-2/3.52	-3/3.42	-4/3.32	-5/3.22	-6/3.12	-7/3.02	-8/2.92	-9/2.82
0.70	3.77		+1/3.87	+2/3.97							
0.70	3.77		-1/3.67	-2/3.57	-3/3.47	-4/3.37	-5/3.27	-6/3.17	-7/3.07	-8/2.97	-9/2.87
0.71	3.82		+1/3.92								
0.71	3.82		-1/3.72	-2/3.62	-3/3.52	-4/3.42	-5/3.32	-6/3.22	-7/3.12	-8/3.02	-9/2.92
0.72	3.88		+1/3.98								
0.72	3.88		-1/3.78	-2/3.68	-3/3.58	-4/3.48	-5/3.38	-6/3.28	-7/3.18	-8/3.08	-9/2.98
0.73	3.93										
0.73	3.93		-1/3.83	-2/3.73	-3/3.63	-4/3.53	-5/3.43	-6/3.33	-7/3.23	-8/3.13	-9/3.03
0.74	3.99										
0.74	3.99		-1/3.89	-2/3.79	-3/3.69	-4/3.59	-5/3.49	-6/3.39	-7/3.29	-8/3.19	-9/3.09
0.743	4.00		-1/3.90	-2/3.80	-3/3.70	-4/3.60	-5/3.50	-6/3.40	-7/3.30	-8/3.20	-9/3.10

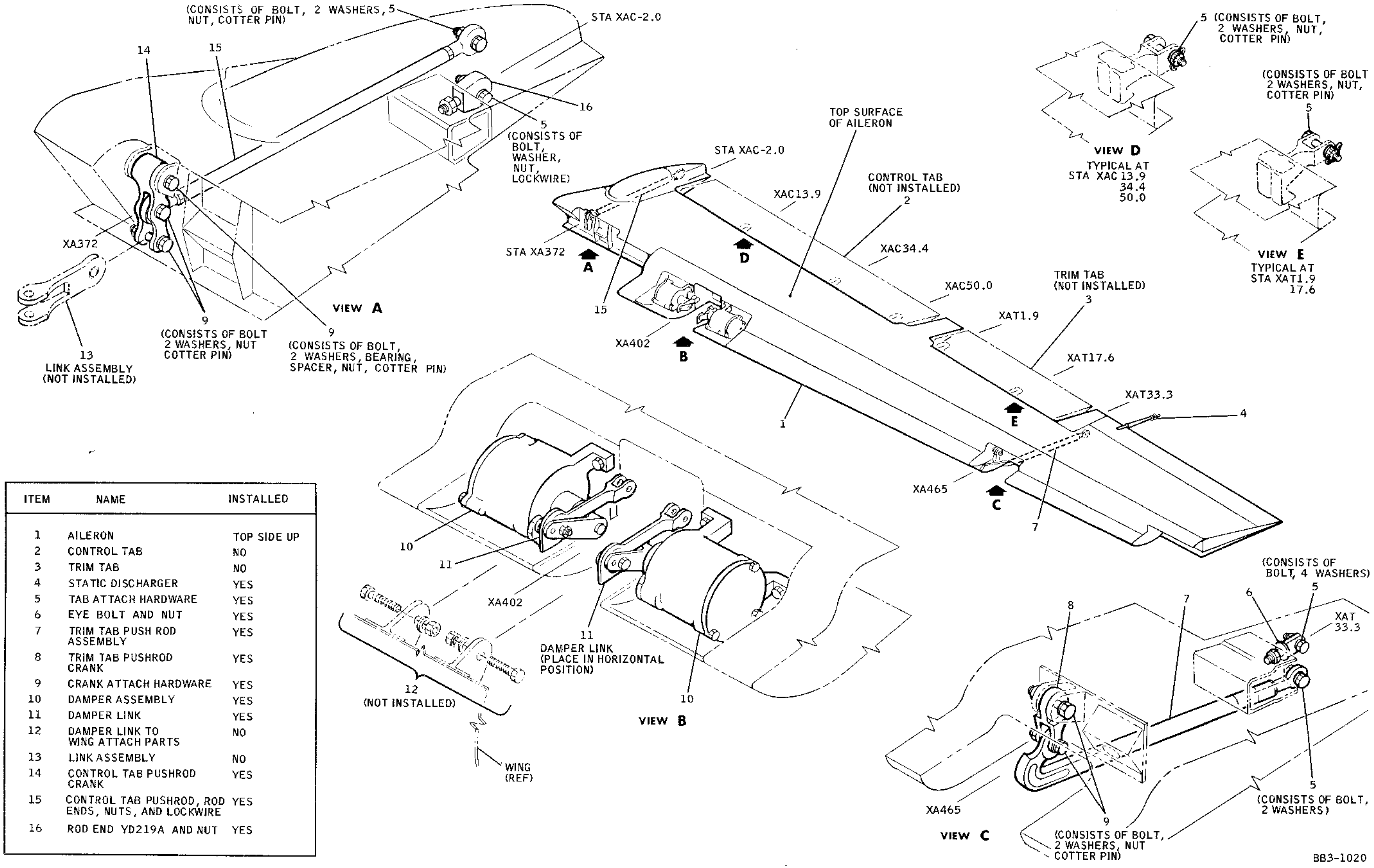
Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 3)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14.								
(Pounds)	(Inch-Pounds)		Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.53	2.86	WITHIN BALANCE LIMITS	+1/2.96	+2/3.06	+3/3.16	+4/3.26	+5/3.36	+6/3.46	+7/3.56	+8/3.66	+9/3.76
0.53	2.86		-1/2.76	-2/2.66	-3/2.56						
0.54	2.91		+1/3.01	+2/3.11	+3/3.21	+4/3.31	+5/3.41	+6/3.51	+7/3.61	+8/3.71	+9/3.81
0.54	2.91		-1/2.81	-2/2.71	-3/2.61	-4/2.51					
0.55	2.96		+1/3.06	+2/3.16	+3/3.26	+4/3.36	+5/3.46	+6/3.56	+7/3.66	+8/3.76	+9/3.86
0.55	2.96		-1/2.86	-2/2.76	-3/2.66	-4/2.56					
0.56	3.01		+1/3.11	+2/3.21	+3/3.31	+4/3.41	+5/3.51	+6/3.61	+7/3.71	+8/3.81	+9/3.91
0.56	3.01		-1/2.91	-2/2.81	-3/2.71	-4/2.61	-5/2.51				
0.57	3.07		+1/3.17	+2/3.27	+3/3.37	+4/3.47	+5/3.57	+6/3.67	+7/3.77	+8/3.87	+9/3.97
0.57	3.07		-1/2.97	-2/2.87	-3/2.77	-4/2.67	-5/2.57				
0.58	3.13		+1/3.23	+2/3.33	+3/3.43	+4/3.53	+5/3.63	+6/3.73	+7/3.83	+8/3.93	
0.58	3.13		-1/3.03	-2/2.93	-3/2.83	-4/2.73	-5/2.63	-6/2.53			
0.59	3.18		+1/3.28	+2/3.38	+3/3.48	+4/3.58	+5/3.68	+6/3.78	+7/3.88	+8/3.98	
0.59	3.18		-1/3.08	-2/2.98	-3/2.88	-4/2.78	-5/2.68	-6/2.58			
0.60	3.23		+1/3.33	+2/3.43	+3/3.53	+4/3.63	+5/3.73	+6/3.83	+7/3.93		
0.60	3.23		-1/3.13	-2/3.03	-3/2.93	-4/2.83	-5/2.73	-6/2.63	-7/2.53		
0.61	3.29		+1/3.39	+2/3.49	+3/3.59	+4/3.69	+5/3.79	+6/3.89	+7/3.99		
0.61	3.29		-1/3.19	-2/3.09	-3/2.99	-4/2.89	-5/2.79	-6/2.69	-7/2.69		
0.62	3.34		+1/3.44	+2/3.54	+3/3.64	+4/3.74	+5/3.84	+6/3.94			
0.62	3.34		-1/3.24	-2/3.14	-3/3.04	-4/2.94	-5/2.84	-6/2.74	-7/2.64	-8/2.54	
0.63	3.40		+1/3.50	+2/3.60	+3/3.70	+4/3.80	+5/3.90	+6/4.00			
0.63	3.40		-1/3.30	-2/3.20	-3/3.10	-4/3.00	-5/2.90	-6/2.80	-7/2.70	-8/2.60	-9/2.50

Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 2)

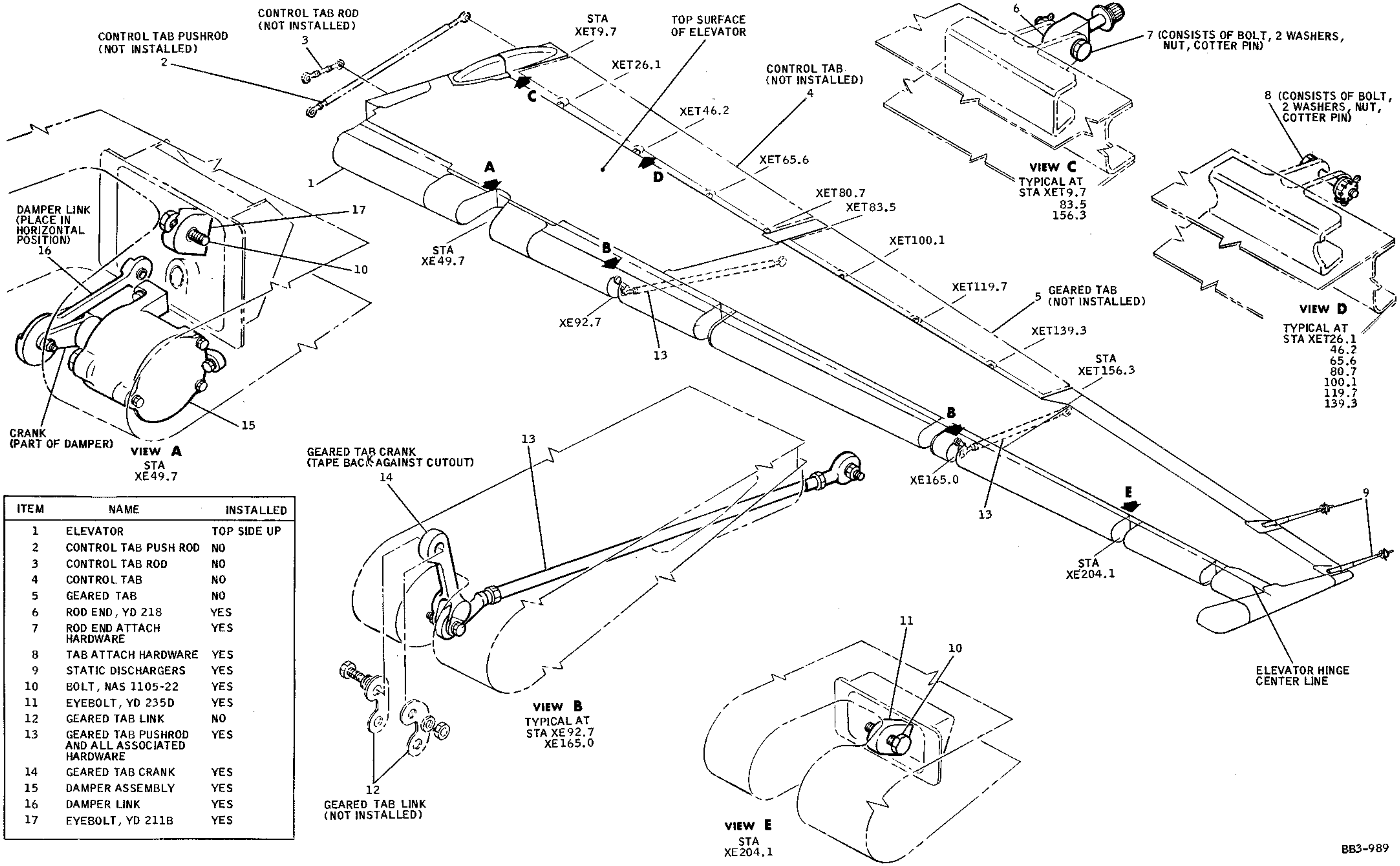
Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14. Quantity Weights/Approximate New Balance Condition (Inch-Pounds)								
0.35	1.88								+7/2.58	+8/2.68	+9/2.78
0.36	1.94							+6/2.54	+7/2.64	+8/2.74	+9/2.84
0.37	1.99							+6/2.59	+7/2.69	+8/2.79	+9/2.89
0.38	2.05						+5/2.55	+6/2.65	+7/2.75	+8/2.85	+9/2.95
0.39	2.10					+4/2.50	+5/2.60	+6/2.70	+7/2.80	+8/2.90	+9/3.00
0.40	2.15					+4/2.56	+5/2.66	+6/2.76	+7/2.86	+8/2.96	+9/3.06
0.41	2.21				+3/2.51	+4/2.61	+5/2.71	+6/2.81	+7/2.91	+8/3.01	+9/3.11
0.42	2.26				+3/2.56	+4/2.66	+5/2.76	+6/2.86	+7/2.96	+8/3.06	+9/3.16
0.43	2.32			+2/2.52	+3/2.62	+4/2.72	+5/2.82	+6/2.92	+7/3.02	+8/3.12	+9/3.22
0.44	2.37			+2/2.57	+3/2.67	+4/2.77	+5/2.87	+6/2.97	+7/3.07	+8/3.17	+9/3.27
0.45	2.42		+1/2.52	+2/2.62	+3/2.72	+4/2.82	+5/2.92	+6/3.02	+7/3.12	+8/3.22	+9/3.32
0.46	2.48		+1/2.58	+2/2.68	+3/2.78	+4/2.88	+5/2.98	+6/3.08	+7/3.18	+8/3.28	+9/3.38
0.47	2.53	WITHIN BALANCE LIMITS	+1/2.63	+2/2.73	+3/2.83	+4/2.93	+5/3.03	+6/3.13	+7/3.23	+8/3.33	+9/3.43
0.48	2.59		+1/2.69	+2/2.79	+3/2.89	+4/2.99	+5/3.09	+6/3.19	+7/3.29	+8/3.39	+9/3.49
0.49	2.64		+1/2.74	+2/2.84	+3/2.94	+4/3.04	+5/3.14	+6/3.24	+7/3.34	+8/3.44	+9/3.54
0/49	2.64		-1/2.54								
0.50	2.69		+1/2.79	+2/2.89	+3/2.99	+4/3.09	+5/3.19	+6/3.29	+7/3.39	+8/3.49	+9/3.59
0.50	2.69		-1/2.59								
0.51	2.75		+1/2.85	+2/2.95	+3/3.05	+4/3.15	+5/3.25	+6/3.35	+7/3.45	+8/3.55	+9/3.65
0.51	2.75		-1/2.65	-2/2.55							
0.52	2.80		+1/2.90	+2/3.00	+3/3.10	+4/3.20	+5/3.30	+6/3.40	+7/3.50	+8/3.60	+9/3.70
0.52	2.80		-1/2.70	-2/2.60	-3/2.50						

Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 1)



ITEM	NAME	INSTALLED
1	AILERON	TOP SIDE UP
2	CONTROL TAB	NO
3	TRIM TAB	NO
4	STATIC DISCHARGER	YES
5	TAB ATTACH HARDWARE	YES
6	EYE BOLT AND NUT	YES
7	TRIM TAB PUSH ROD ASSEMBLY	YES
8	TRIM TAB PUSHROD CRANK	YES
9	CRANK ATTACH HARDWARE	YES
10	DAMPER ASSEMBLY	YES
11	DAMPER LINK	YES
12	DAMPER LINK TO WING ATTACH PARTS	NO
13	LINK ASSEMBLY	NO
14	CONTROL TAB PUSHROD CRANK	YES
15	CONTROL TAB PUSHROD, ROD ENDS, NUTS, AND LOCKWIRE	YES
16	ROD END YD219A AND NUT	YES

Required Condition of Aileron for Balancing
Figure 3



ITEM	NAME	INSTALLED
1	ELEVATOR	TOP SIDE UP
2	CONTROL TAB PUSH ROD	NO
3	CONTROL TAB ROD	NO
4	CONTROL TAB	NO
5	GEARED TAB	NO
6	ROD END, YD 218	YES
7	ROD END ATTACH HARDWARE	YES
8	TAB ATTACH HARDWARE	YES
9	STATIC DISCHARGERS	YES
10	BOLT, NAS 1105-22	YES
11	EYEBOLT, YD 235D	YES
12	GEARED TAB LINK	NO
13	GEARED TAB PUSHROD AND ALL ASSOCIATED HARDWARE	YES
14	GEARED TAB CRANK	YES
15	DAMPER ASSEMBLY	YES
16	DAMPER LINK	YES
17	EYEBOLT, YD 211B	YES

Required Condition of Elevator For Balancing
Figure 3

MATERIAL SUBSTITUTION CHART

THE MATERIAL SUBSTITUTION FACTORS LISTED ARE BASED UPON THE ULTIMATE TENSILE STRENGTH FOR THE ALUMINUM ALLOYS AND UPON THE TENSILE YIELD FOR THE STAINLESS STEELS AND TITANIUMS.

DETERMINE THE SUBSTITUTE MATERIAL THICKNESS REQUIRED AS FOLLOWS:

1. MULTIPLY THE THICKNESS OF THE MATERIAL REQUIRING A SUBSTITUTION BY THE FACTOR SHOWN AT THE INTERSECTION OF THE "MATERIAL REQUIRING A SUBSTITUTION" COLUMN AND THE SELECTED "SUBSTITUTE MATERIAL" COLUMN TO OBTAIN THE MINIMUM THICKNESS REQUIRED.
2. EXAMPLE A - MATERIAL REQUIRING A SUBSTITUTION - .050 CLAD 7075-T6 SHEET (SEE NOTE 1, BELOW)
   SELECTED SUBSTITUTE MATERIAL = CLAD 2024-T3 SHEET
   MINIMUM THICKNESS REQUIRED = .050 X 1.19 = .060; USE .063 CLAD 2024-T3 SHEET
3. EXAMPLE B - MATERIAL REQUIRING A SUBSTITUTION = .063 7075-T6 EXTRUSION
   SELECTED SUBSTITUTE MATERIAL = CLAD 7075-T6 SHEET
   MINIMUM THICKNESS REQUIRED = .063 X 1.37 = .086; USE .090 CLAD 7075-T6 SHEET

	MATERIAL REQUIRING A SUBSTITUTION	SUBSTITUTE MATERIAL																			
		SHEET						EXTRUSION						SHEET							
		2024			2014		7075	2014			2024		7075	STAINLESS STEEL					TITANIUM		
		CLAD -T4	CLAD -T3	CLAD -T81	CLAD -T3	CLAD -T6	CLAD -T6	-T4511	-T6511	-T62	-T3511	-T42	-T6511	321 ANLD	ANLD 302	1/4H 301	1/2H 301	17 - 7PH HT - 170	AMS 4901	AMS 4908	AMS 4911
ALUMINUM ALLOY SHEET	CLAD 6061-T6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								
	CLAD 2024-T4		1.00	1.00	1.00	1.00	*	1.16	1.00	1.04	1.16	1.16	1.00								
	CLAD 2024-T3	1.02		1.00	1.08	1.00	*	1.20	1.00	1.06	1.18	1.18	1.02								
	CLAD 2014-T3	1.00	1.00	1.00		1.00	*	1.18	1.00	1.00	1.10	1.10	1.00								
	CLAD 2014-T6	1.10	1.07	1.02	1.15		*	1.28	1.13	1.13	1.26	1.26	1.09								
	CLAD 7075-T6	1.25	1.19	1.13	1.28	1.12		1.40	1.25	1.25	1.40	1.40	1.21								
ALUMINUM ALLOY EXTRUSION	6061-T6511	1.25	1.25	1.25	1.25	1.25	1.25	1.00	1.00	1.00	1.00	1.00	1.00								
	2014-T4511	1.25	1.25	1.25	1.25	1.25	1.25		1.00	1.00	1.00	1.00	1.00								
	2014-T6511	1.25	1.25	1.25	1.33	1.25	1.25	1.12		1.00	1.12	1.12	1.00								
	2024-T3511	1.27	1.25	1.25	1.27	1.25	1.25	1.00	1.00	1.00		1.00	1.00								
	7075-T6511	1.65	1.55	1.55	1.65	1.47	1.37	1.50	1.34	1.34	1.50	1.50									
STAINLESS STEEL SHEET	TYPE 321, ANLD													1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	COMP 302, ANLD													1.00		1.00	1.00	1.00	1.00	1.00	1.00
	COMP 301, 1/4 HARD																1.00	1.00	1.08	1.00	1.00
	COMP 301, 1/2 HARD																	1.00		1.00	1.00
	17 - 7 PH, HT - 170; HT-150																1.37			1.37	1.25
TITANIUM SHEET	DMS1536 (AMS4901)															1.00	1.00	1.00		1.00	1.00
	DMS1592 (AMS4911)																1.10	1.00		1.10	

NOTE:

1. THE WORD CLAD PLACED BEFORE AN ALUMINUM ALLOY CALLOUT INDICATES THE MATERIAL HAS A THIN OUTER LAYER OF PURE ALUMINUM. THE ABSENCE OF A SYMBOL INDICATES NON-CLAD MATERIAL.
2. USE STAINLESS STEEL AS A SUBSTITUTE FOR ALUMINUM ALLOYS ONLY IF CALLED OUT IN THE INDIVIDUAL REPAIR.
3. USE CLAD 7075-T6 (INDICATED WITH *) AS A SUBSTITUTION FOR 2024 AND 2014 ONLY IF CALLED OUT AS A SUBSTITUTION IN THE INDIVIDUAL REPAIR.
4. DISSIMILAR METAL PROTECTION MUST BE PROVIDED WHERE APPLICABLE.
5. FABRICATION OF SUBSTITUTE MATERIAL MUST BE IN ACCORDANCE WITH MANUAL REQUIREMENTS.
6. NO SPOTFACING OF MATERIAL RADII FOR ATTACHMENTS IS PERMISSIBLE EXCEPT AS ON ORIGINAL PART.

BB3-332

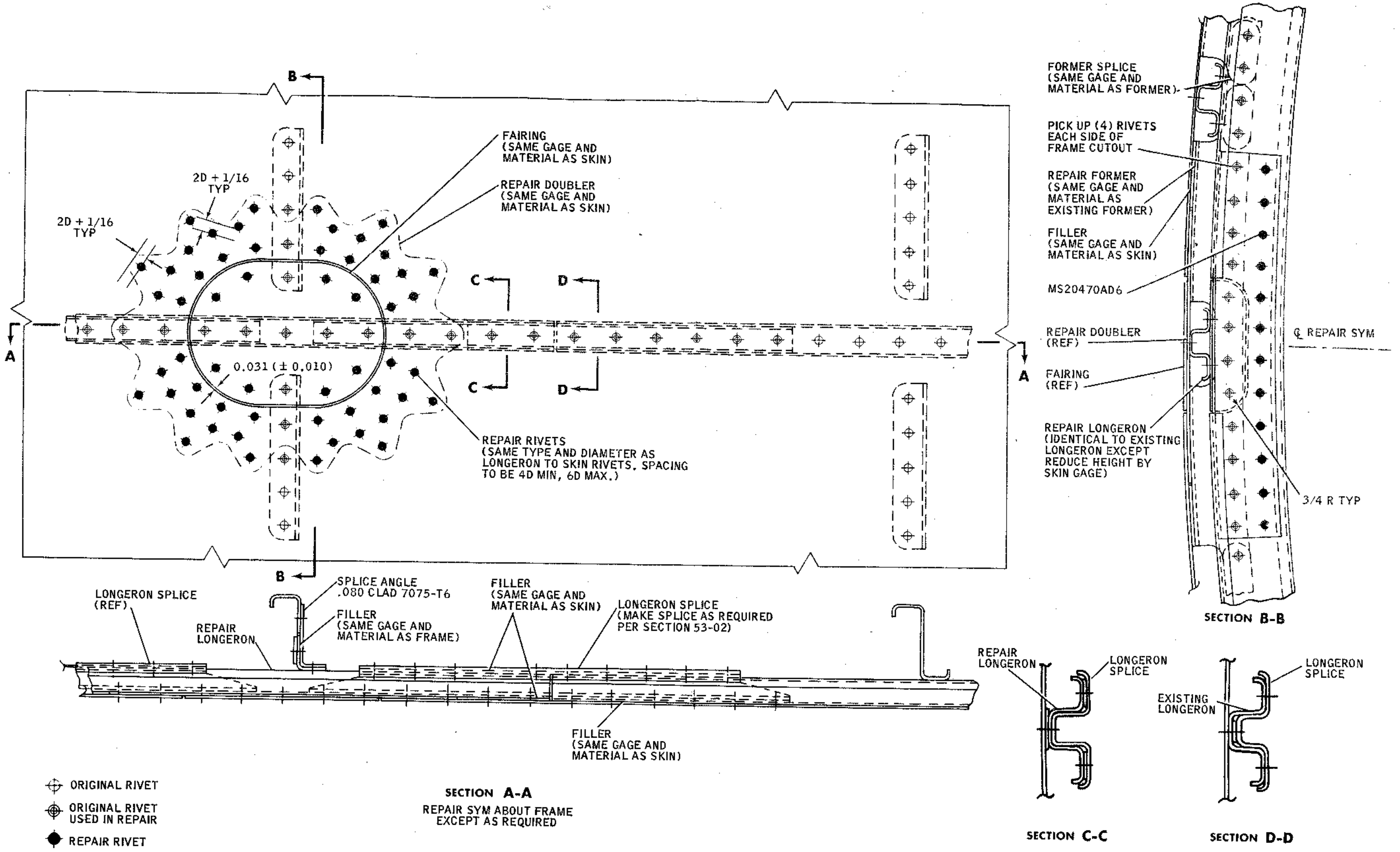
Material Interchangeability
Figure 1

PROCESS MATERIAL SUBSTITUTION CHART

	MATERIAL REQUIRING A SUBSTITUTION	MANUFACTURER	SUBSTITUTE RESTRICTED USAGE	SUBSTITUTE MATERIAL	MANUFACTURER
SEALANTS	RTV-1016	GENERAL ELEC. CORP., SILICONE PRODUCTS DIV. WATERFORD, N. Y.	STRUCTURAL REPAIR SEALANT	RTV-90	GENERAL ELECTRIC CORP.
			AIR DUCT FAYING SURFACE SEALANT	PR-1940	PRODUCTS RESEARCH CO.
			GENERAL HIGH-TEMPERATURE SEALANT AND SKYDROL AREA SEALANT	CS-3804	CHEM SEAL CORP., 12910 PANAMA ST., LOS ANGELES 66, CALIF.
	PR-1422	PRODUCTS RESEARCH CO., 2919 EMPIRE AVE., BURBANK, CALIF.	FUEL TANK SEALANT	PR-1435	PRODUCTS RESEARCH CO.
				PRO-SEAL 890	COAST PRO-SEAL MFG. CO., 2235 BEVERLY BLVD., LOS ANGELES 57, CALIF.
	PR-1422		FUSELAGE SEALANT	PRO-SEAL 757	
				PR-1223D	PRODUCTS RESEARCH CO.
				3C-401M	CHURCHILL CHEMICAL CORP., 3137 E. 26TH ST., LOS ANGELES 23, CALIF.
SEALANT OVERCOATS	NYCOTE 31Y	NYCOTE LABORATORIES, 15002 DELANO ST., VAN NUYS, CALIF	SEALANT OVERCOAT (YELLOW)	CHEMON 7707 (YELLOW)	CHEM SEAL CORP.
	NYCOTE 31A		SEALANT OVERCOAT (ALUMINUM)	CHEMON 7707 (ALUMINUM)	
	POLYURETHANE DV-1180	FINCH PAINT & CHEMICAL CO., 1536 W. 228TH ST., TORRANCE, CALIF.	TRANSPARENT FUEL TANK SUMP COATING	M80-50CX (SPENKEL)	SPENCER KELLOGG & SONS, INC., BUFFALO, NEW YORK
ADHESIVES	EPOXY H-1337-B-1 ADHESIVE WITH 9615A RESIN HARDENER	FURANE PLASTICS CO., 4516 BRAZIL ST., LOS ANGELES 39, CALIF.	BONDING REPAIR MATERIAL	LEFKOWELD 109	LEFFINGWELL CHEMICAL CO., P.O. BOX 1016, PERRY ANNEX, WHITTIER, CALIF.
	SILASTIC NO. 140	DOW CORNING CORP. 3033 W. MISSION ROAD, ALHAMBRA, CALIF.	DOOR SEALS	Q-3-0121	DOW CORNING CORP.
FIBERGLAS AND RADOME MATERIALS	CELLOPHANE SHEET 600PT (CLEAR) OR 600PC (RED)	E.I. DU PONT DE NEMOURS, INC., WILMINGTON, DELAWARE	GLASS FIBER REPAIRS	POLYVINYL ALCOHOL SHEET (PVA)	REYNOLDS METAL CO., 3540 WILSHIRE BLVD., LOS ANGELES 5, CALIF.
	HARDENER HN-951	FURANE PLASTICS CO.	CATALYST FOR EPOCAST H-991 IN RADOME REPAIRS	HARDENER HN-23	FURANE PLASTICS CO.
	HARDENER APCO 320	APPLIED PLASTICS CO., 130 PENN ST., EL SEGUNDO, CALIF.	CATALYST FOR EPON 828 RADOME RESIN	HARDENER RP-7	CHEMICAL PROCESS CO., 901 SPRING ST., REDWOOD CITY, CALIF.
ALUMINUM HONEYCOMB MATERIALS	EPON 828 WITH APCO 310 HARDENER	SHELL CHEMICAL CO. 9901 PARAMOUNT BLVD., DOWNEY, CALIF.	GLASS FIBER IMPREGNATOR FOR ALUMINUM HONEYCOMB REPAIRS	FENWAL PACK 80055-31	FENWAL, INC., ASHLAND, MASS.
	5052-H39 ALUMINUM HONEYCOMB CORE	HEXCEL PRODUCTS, 2332 FOURTH ST., BERKELEY 10, CALIF.	ALUMINUM HONEYCOMB PANEL REPAIRS	NP-3/16-112-6.0 FIBERGLAS HONEYCOMB CORE	HEXCEL PRODUCTS
FR PRIMER COATINGS	KOROPON 515-006 (WITH CATALYST)	DE SOTO CHEMICAL COATINGS, BERKELEY, CALIF.	CORROSION PROTECTION	162-G9 (WITH CATALYST)	W. P. FULLER CO., 222 N. AVE. 23, LOS ANGELES, CALIF.

BB3-559A

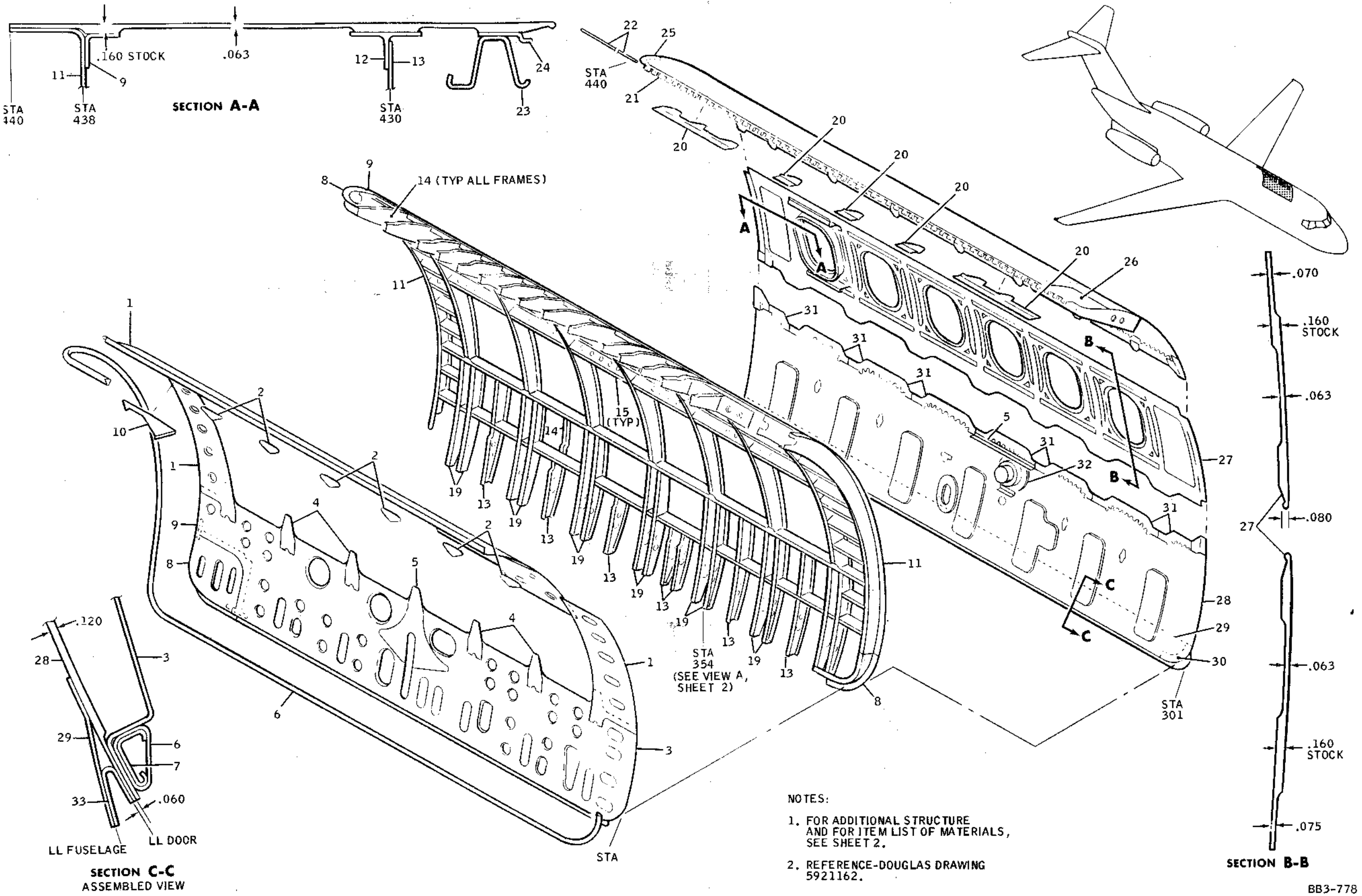
Process Material Substitution Data
Figure 2



NOTE: MAINTAIN 2D ($^{+1/16}_{-0.00}$) EDGE DISTANCE ON ALL FASTENERS

BB3-698

Combination Repair - Plating, Longeron, Former, and Frame
Figure 1

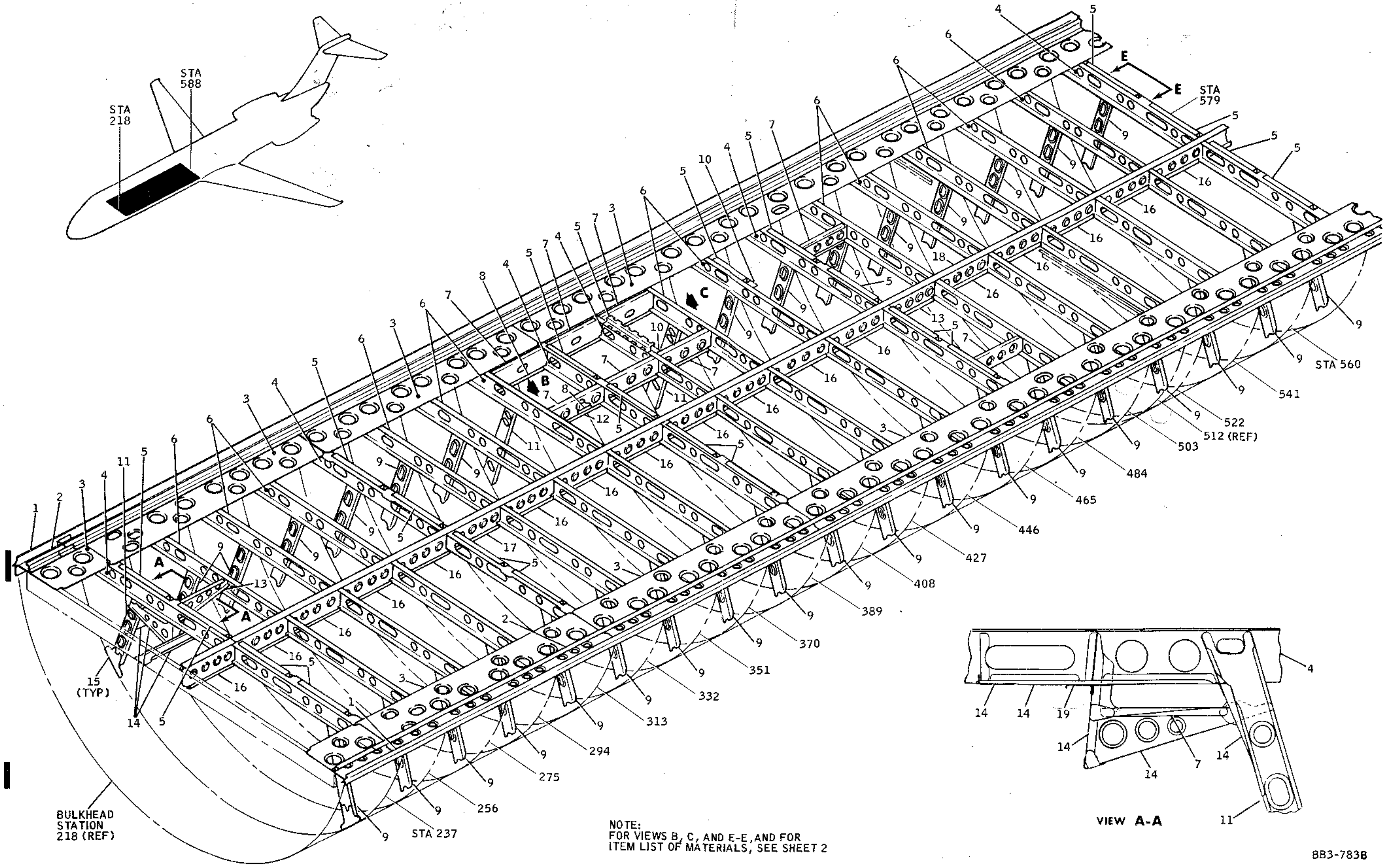


NOTES:

1. FOR ADDITIONAL STRUCTURE AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2.
2. REFERENCE-DOUGLAS DRAWING 5921162.

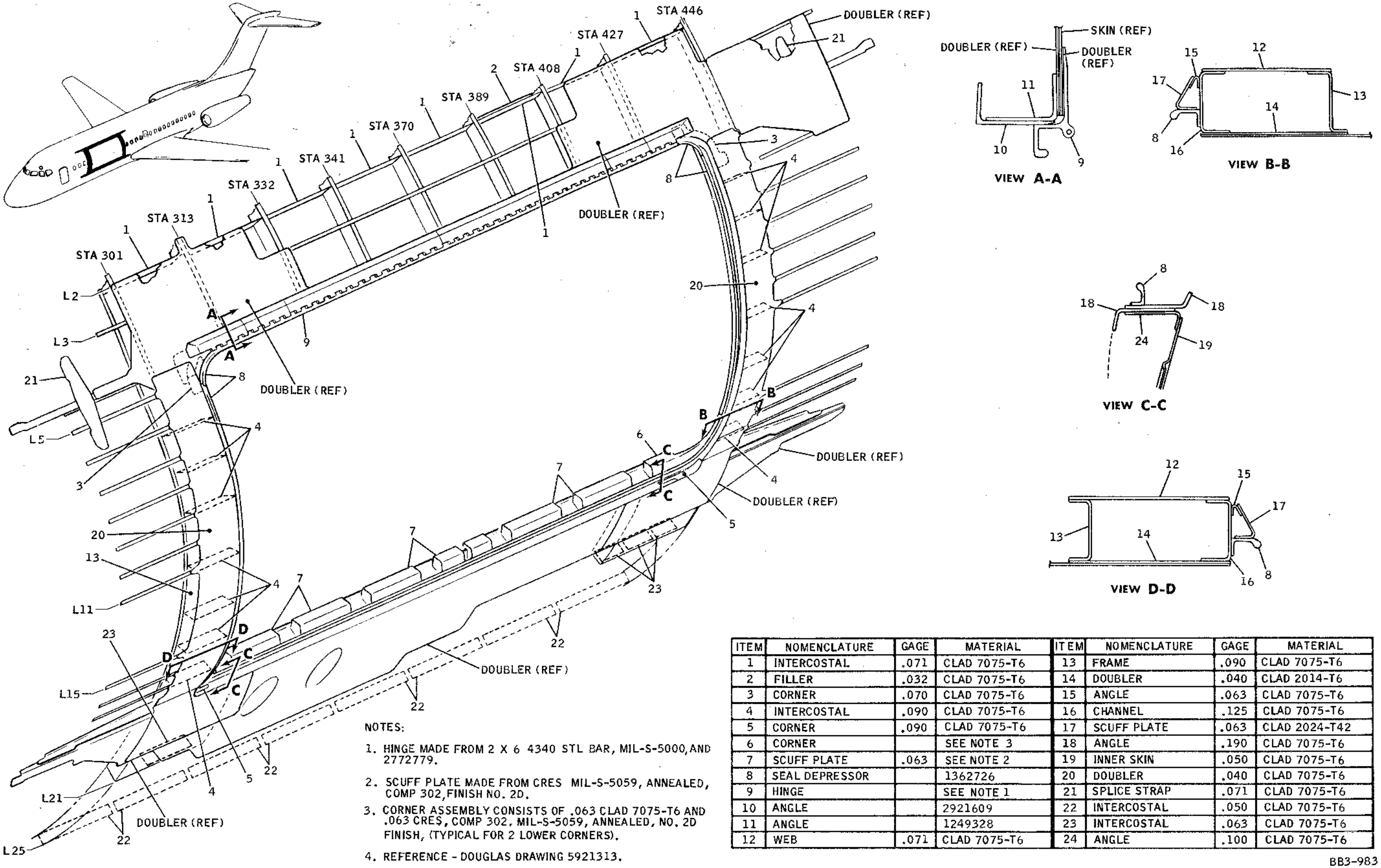
Printed in U.S.A.

Upper Cargo Door Structure
Figure 3 (Sheet 1)



NOTE:
FOR VIEWS B, C, AND E-E, AND FOR ITEM LIST OF MATERIALS, SEE SHEET 2

Floor Structure, Station 218 to 588 -- Type A
Figure 4 (Sheet 1)



NOTES:

1. HINGE MADE FROM 2 X 6 4340 STL BAR, MIL-S-5000, AND 2772779.
2. SCUFF PLATE MADE FROM CRES MIL-S-5059, ANNEALED, COMP 302, FINISH NO. 2D.
3. CORNER ASSEMBLY CONSISTS OF .063 CLAD 7075-T6 AND .063 CRES, COMP 302, MIL-S-5059, ANNEALED, NO. 2D FINISH, (TYPICAL FOR 2 LOWER CORNERS).
4. REFERENCE - DOUGLAS DRAWING 5921313.

ITEM	NOMENCLATURE	GAGE	MATERIAL	ITEM	NOMENCLATURE	GAGE	MATERIAL
1	INTERCOSTAL	.071	CLAD 7075-T6	13	FRAME	.090	CLAD 7075-T6
2	FILLER	.032	CLAD 7075-T6	14	DOUBLER	.040	CLAD 2014-T6
3	CORNER	.070	CLAD 7075-T6	15	ANGLE	.063	CLAD 7075-T6
4	INTERCOSTAL	.090	CLAD 7075-T6	16	CHANNEL	.125	CLAD 7075-T6
5	CORNER	.090	CLAD 7075-T6	17	SCUFF PLATE	.063	CLAD 2024-T42
6	CORNER		SEE NOTE 3	18	ANGLE	.190	CLAD 7075-T6
7	SCUFF PLATE	.063	SEE NOTE 2	19	INNER SKIN	.050	CLAD 7075-T6
8	SEAL DEPRESSOR		1362726	20	DOUBLER	.040	CLAD 7075-T6
9	HINGE		SEE NOTE 1	21	SPLICE STRAP	.071	CLAD 7075-T6
10	ANGLE		2921609	22	INTERCOSTAL	.050	CLAD 7075-T6
11	ANGLE		1249328	23	INTERCOSTAL	.063	CLAD 7075-T6
12	WEB	.071	CLAD 7075-T6	24	ANGLE	.100	CLAD 7075-T6

BB3-983

Frames and Intercostals, Station, 229 to 474, Upper Section -- Type II
Figure 1A (Sheet 3)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22.								
(Pounds)	(Inch-Pounds)		Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.32	1.72	WITHIN BALANCE LIMITS	-1/1.62	-2/1.52	-3/1.42	-4/1.32	-5/1.22	-6/1.12	-7/1.02	-8/0.92	-9/0.82
0.33	1.78		+1/1.88	+2/1.98							
0.33	1.78		-1/1.68	-2/1.58	-3/1.48	-4/1.38	-5/1.28	-6/1.18	-7/1.08	-8/0.98	-9/0.88
0.34	1.83		+1/1.93								
0.34	1.83		-1/1.73	-2/1.63	-3/1.53	-4/1.43	-5/1.33	-6/1.23	-7/1.13	-8/1.03	-9/0.93
0.35	1.89		+1/1.99								
0.35	1.89		-1/1.79	-2/1.69	-3/1.59	-4/1.49	-5/1.39	-6/1.29	-7/1.19	-8/1.09	-9/0.99
0.36	1.94		-1/1.84	-2/1.74	-3/1.64	-4/1.54	-5/1.44	-6/1.34	-7/1.24	-8/1.14	-9/1.04
0.37	2.00		-1/1.90	-2/1.80	-3/1.70	-4/1.60	-5/1.50	-6/1.40	-7/1.30	-8/1.20	-9/1.10
0.38	2.05		-1/1.95	-2/1.85	-3/1.75	-4/1.65	-5/1.55	-6/1.45	-7/1.35	-8/1.25	-9/1.15
0.39	2.10		-1/2.00	-2/1.90	-3/1.80	-4/1.70	-5/1.60	-6/1.50	-7/1.40	-8/1.30	-9/1.20
0.40	2.16			-2/1.96	-3/1.86	-4/1.76	-5/1.66	-6/1.56	-7/1.46	-8/1.36	-9/1.26
0.41	2.21				-3/1.91	-4/1.81	-5/1.71	-6/1.61	-7/1.51	-8/1.41	-9/1.31
0.42	2.26				-3/1.96	-4/1.86	-5/1.76	-6/1.66	-7/1.56	-8/1.46	-9/1.36
0.43	2.32					-4/1.92	-5/1.82	-6/1.72	-7/1.62	-8/1.52	-9/1.42
0.44	2.37					-4/1.97	-5/1.87	-6/1.77	-7/1.67	-8/1.57	-9/1.47
0.45	2.43						-5/1.93	-6/1.83	-7/1.73	-8/1.63	-9/1.53
0.46	2.48						-5/1.98	-6/1.88	-7/1.78	-8/1.68	-9/1.58
0.47	2.53							-6/1.93	-7/1.83	-8/1.73	-9/1.63
0.48	2.59							-6/1.99	-7/1.89	-8/1.79	-9/1.69
0.49	2.64								-7/1.94	-8/1.84	-9/1.74
0.50	2.70								-7/2.00	-8/1.90	-9/1.80
0.51	2.75									-8/1.95	-9/1.85
0.52	2.80									-8/2.00	-9/1.90
0.53	2.86										-9/1.96

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 3)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22.								
(Pounds)	(Inch-Pounds)		Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.20	1.08		-1/0.98	-2/0.88	-3/0.78	-4/0.68	-5/0.58				
0.21	1.13		+1/1.23	+2/1.33	+3/1.43	+4/1.53	+5/1.63	+6/1.73	+7/1.83	+8/1.93	
0.21	1.13	↑ WITHIN BALANCE LIMITS ↓	-1/1.03	-2/0.93	-3/0.83	-4/0.73	-5/0.63	-6/0.53			
0.22	1.19		+1/1.29	+2/1.39	+3/1.49	+4/1.59	+5/1.69	+6/1.79	+7/1.89	+8/1.99	
0.22	1.19		-1/1.09	-2/0.99	-3/0.89	-4/0.79	-5/0.69	-6/0.59			
0.23	1.24		+1/1.34	+2/1.44	+3/1.54	+4/1.64	+5/1.74	+6/1.84	+7/1.94		
0.23	1.24		-1/1.14	-2/1.04	-3/0.94	-4/0.84	-5/0.74	-6/0.64	-7/0.54		
0.24	1.29		+1/1.39	+2/1.49	+3/1.59	+4/1.69	+5/1.79	+6/1.89	+7/1.99		
0.24	1.29		-1/1.19	-2/1.09	-3/0.99	-4/0.89	-5/0.79	-6/0.69	-7/0.59		
0.25	1.35		+1/1.45	+2/1.55	+3/1.65	+4.1.75	+5/1.85	+6/1.95			
0.25	1.35		-1/1.25	-2/1.15	-3/1.05	-4/0.95	-5/0.85	-6/0.75	-7/0.65	-8/0.55	
0.26	1.40		+1/1.50	+2/1.60	+3/1.70	+4/1.80	+5/1.90	+6/2.00			
0.26	1.40		-1/1.30	-2/1.20	-3/1.10	-4/1.00	-5/0.90	-6/0.80	-7/0.70	-8/0.60	-9/0.50
0.27	1.45		+1/1.55	+2/1.65	+3/1.75	+4/1.85	+5/1.95				
0.27	1.45		-1/1.35	-2/1.25	-3/1.15	-4/1.05	-5/0.95	-6/0.85	-7/0.75	-8/0.65	-9/0.55
0.28	1.51		+1/1.61	+2/1.71	+3/1.81	+4/1.91					
0.28	1.51		-1/1.41	-2/1.31	-3/1.21	-4/1.11	-5/1.01	-6/0.91	-7/0.81	-8/0.71	-9/0.61
0.29	1.56		+1/1.76	+2/1.86	+3/1.96						
0.29	1.56		-1/1.46	-2/1.36	-3/1.26	-4/1.16	-5/1.06	-6/0.96	-7/0.86	-8/0.76	-9/0.66
0.30	1.62		+1/1.72	+2/1.82	+3/1.92						
0.30	1.62		-1/1.52	-2/1.42	-3/1.32	-4/1.22	-5/1.12	-6/1.02	-7/0.92	-8/0.82	-9/0.72
0.31	1.67		+1/1.77	+2/1.87	+3/1.97						
0.31	1.67		-1/1.57	-2/1.47	-3/1.37	-4/1.27	-5/1.17	-6/1.07	-7/0.97	-8/0.87	-9/0.77
0.32	1.72		+1/1.82	+2/1.92							

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 2)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 6.35 pounds) and balance limits (0.5 to 2.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 20 thru 22. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.07	0.38			+2/0.58	+3/0.68	+4/0.78	+5/0.88	+6/0.98	+7/1.08	+8/1.18	+9/1.28
0.08	0.43		+1/0.53	+2/0.63	+3/0.73	+4/0.83	+5/0.93	+6/1.03	+7/1.13	+8/1.23	+9/1.33
0.09	0.49		+1/0.59	+2/0.69	+3/0.79	+4/0.89	+5/0.99	+6/1.09	+7/1.19	+8/1.29	+9/1.39
0.10	0.54	WITHIN BALANCE LIMITS	+1/0.64	+2/0.74	+3/0.84	+4/0.94	+5/1.04	+6/1.14	+7/1.24	+8/1.34	+9/1.44
0.11	0.59		+1/0.69	+2/0.79	+3/0.89	+4/0.99	+5/1.09	+6/1.19	+7/1.29	+8/1.39	+9/1.49
0.12	0.65		+1/0.75	+2/0.85	+3/0.95	+4/1.05	+5/1.15	+6/1.25	+7/1.35	+8/1.45	+9/1.55
0.12	0.65		-1/0.55								
0.13	0.70		+1/0.80	+2/0.90	+3/1.00	+4/1.10	+5/1.20	+6/1.30	+7/1.40	+8/1.50	+9/1.60
0.13	0.70		-1/0.60	-2/0.50							
0.14	0.75		+1/0.85	+2/0.95	+3/1.05	+4/1.15	+5/1.25	+6/1.35	+7/1.45	+8/1.55	+9/1.65
0.14	0.75		-1/0.65	-2/0.55							
0.15	0.81		+1/0.91	+2/1.01	+3/1.11	+4/1.21	+5/1.31	+6/1.41	+7/1.51	+8/1.61	+9/1.71
0.15	0.81		-1/0.71	-2/0.61	-3/0.51						
0.16	0.86		+1/0.96	+2/1.06	+3/1.16	+4/1.26	+5/1.36	+6/1.46	+7/1.56	+8/1.66	+9/1.76
0.16	0.86		-1/0.76	-2/0.66	-3/0.56						
0.17	0.92		+1/1.02	+2/1.12	+3/1.22	+4/1.32	+5/1.42	+6/1.52	+7/1.62	+8/1.72	+9/1.82
0.17	0.92		-1/0.82	-2/0.72	-3/0.62	-4/0.52					
0.18	0.97		+1/1.07	+2/1.17	+3/1.27	+4/1.37	+5/1.47	+6/1.57	+7/1.67	+8/1.77	+9/1.87
0.18	0.97		-1/0.87	-2/0.77	-3/0.67	-4/0.57					
0.19	1.02		+1/1.12	+2/1.22	+3/1.32	+4/1.42	+5/1.52	+6/1.62	+7/1.72	+8/1.82	+9/1.92
0.19	1.02		-1/0.92	-2/0.82	-3/0.72	-4/0.62	-5/0.52				
0.20	1.08		+1/1.18	+2/1.28	+3/1.38	+4/1.48	+5/1.58	+6/1.88	+7/1.78	+8/1.88	+9/1.98

Aileron Trim Tab Checkweight Values and
Adjustment Weight Changes Required
Figure 26 (Sheet 1)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)	Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.75	4.04	-1/3.94	-2/3.84	-3/3.74	-4/3.64	-5/3.54	-6/3.44	-7/3.34	-8/3.24	-9/3.14
0.76	4.10	-1/4.00	-2/3.90	-3/3.80	-4/3.70	-5/3.60	-6/3.50	-7/3.40	-8/3.30	-9/3.20
0.77	4.15		-2/3.95	-3/3.85	-4/3.75	-5/3.65	-6/3.55	-7/3.45	-8/3.35	-9/3.25
0.78	4.20		-2/4.00	-3/3.90	-4/3.80	-5/3.70	-6/3.60	-7/3.50	-8/3.40	-9/3.30
0.79	4.26			-3/3.96	-4/3.86	-5/3.76	-6/3.66	-7/3.56	-8/3.46	-9/3.36
0.80	4.31				-4/3.91	-5/3.81	-6/3.71	-7/3.61	-8/3.51	-9/3.41
0.81	4.37				-4/3.97	-5/3.87	-6/3.77	-7/3.67	-8/3.57	-9/3.47
0.82	4.42					-5/3.92	-6/3.82	-7/3.72	-8/3.62	-9/3.52
0.83	4.47					-5/3.97	-6/3.87	-7/3.77	-8/3.67	-9/3.57
0.84	4.53						-6/3.93	-7/3.83	-8/3.73	-9/3.63
0.85	4.58						-6/3.98	-7/3.88	-8/3.78	-9/3.68
0.86	4.64							-7/3.94	-8/3.84	-9/3.74

Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 4)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge) (Pounds)	Equivalent Balance Condition (existing Balance Condition) (Inch-Pounds)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0) inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14. Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.64	3.45	WITHIN BALANCE LIMITS	+1/3.55	+2/3.65	+3/3.75	+4/3.85	+5/3.95				
0.64	3.45		-1/3.35	-2/3.25	-3/3.15	-4/3.05	-5/2.95	-6/2.85	-7/2.75	-8/2.65	-9/2.55
0.65	3.50		+1/3.60	+2/3.70	+3/3.80	+4/3.90	+5/4.00				
0.65	3.50		-1/3.40	-2/3.30	-3/3.20	-4/3.10	-5/3.00	-6/2.90	-7/2.80	-8/2.70	-9/2.60
0.66	3.56		+1/3.66	+2/3.76	+3/3.86	+4/3.96					
0.66	3.56		-1/3.46	-2/3.36	-3/3.26	-4/3.16	-5/3.06	-6/2.96	-7/2.86	-8/2.76	-9/2.66
0.67	3.61		+1/3.71	+2/3.81	+3/3.91						
0.67	3.61		-1/3.51	-2/3.41	-3/3.31	-4/3.21	-5/3.11	-6/3.01	-7/2.91	-8/2.81	-9/2.71
0.68	3.67		+1/3.77	+2/3.87	+3/3.97						
0.68	3.67		-1/3.57	-2/3.47	-3/3.37	-4/3.27	-5/3.17	-6/3.07	-7/2.97	-8/2.87	-9/2.77
0.69	3.72		+1/3.82	+2/3.92							
0.69	3.72		-1/3.62	-2/3.52	-3/3.42	-4/3.32	-5/3.22	-6/3.12	-7/3.02	-8/2.92	-9/2.82
0.70	3.77		+1/3.87	+2/3.97							
0.70	3.77		-1/3.67	-2/3.57	-3/3.47	-4/3.37	-5/3.27	-6/3.17	-7/3.07	-8/2.97	-9/2.87
0.71	3.82		+1/3.92								
0.71	3.82		-1/3.72	-2/3.62	-3/3.52	-4/3.42	-5/3.32	-6/3.22	-7/3.12	-8/3.02	-9/2.92
0.72	3.88		+1/3.98								
0.72	3.88		-1/3.78	-2/3.68	-3/3.58	-4/3.48	-5/3.38	-6/3.28	-7/3.18	-8/3.08	-9/2.98
0.73	3.93										
0.73	3.93		-1/3.83	-2/3.73	-3/3.63	-4/3.53	-5/3.43	-6/3.33	-7/3.23	-8/3.13	-9/3.03
0.74	3.99										
0.74	3.99		-1/3.89	-2/3.79	-3/3.69	-4/3.59	-5/3.49	-6/3.39	-7/3.29	-8/3.19	-9/3.09
0.743	4.00		-1/3.90	-2/3.80	-3/3.70	-4/3.60	-5/3.50	-6/3.40	-7/3.30	-8/3.20	-9/3.10

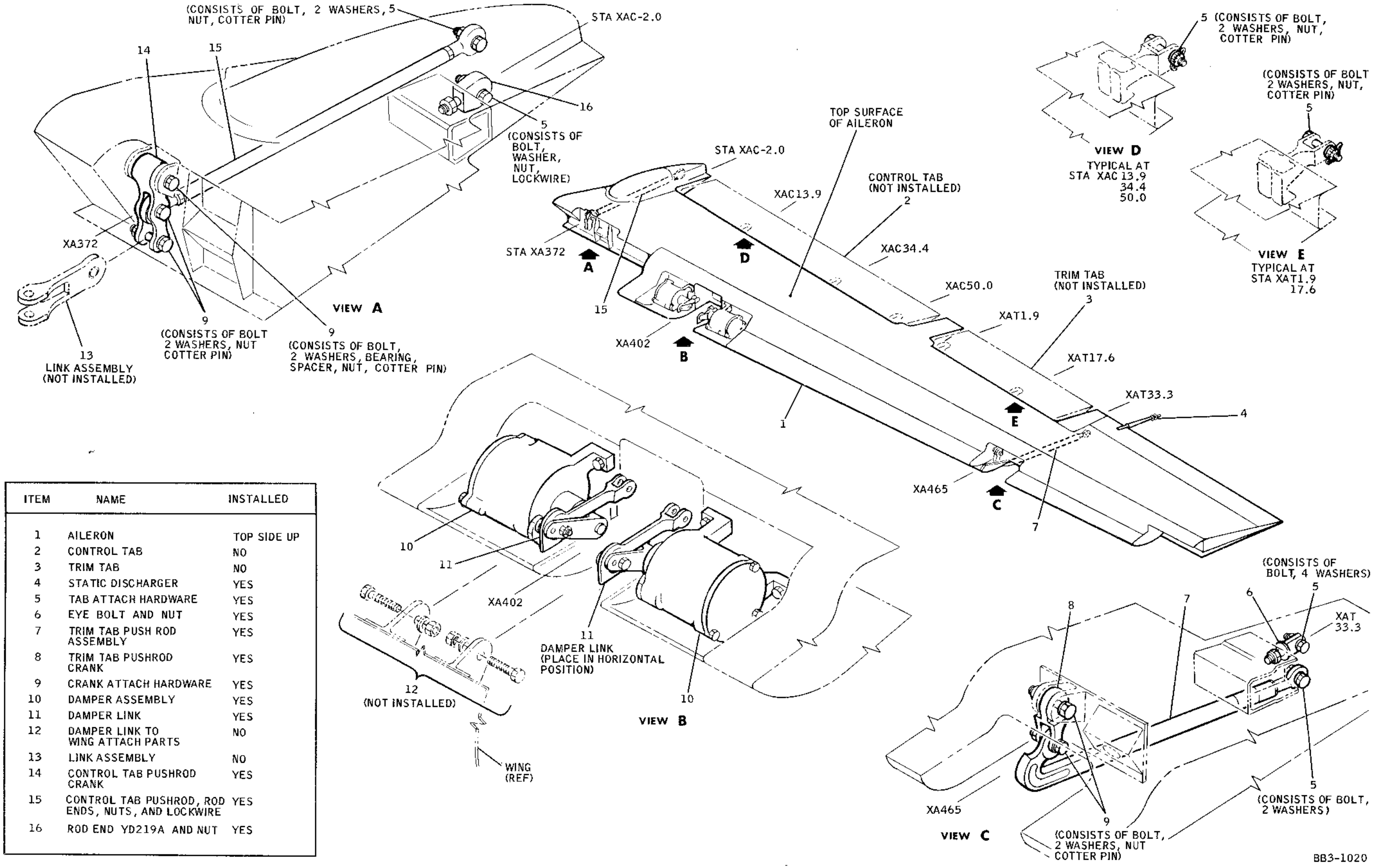
Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 3)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limits (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14.								
(Pounds)	(Inch-Pounds)		Quantity Weight/Approximate New Balance Condition (Inch-Pounds)								
0.53	2.86	WITHIN BALANCE LIMITS	+1/2.96	+2/3.06	+3/3.16	+4/3.26	+5/3.36	+6/3.46	+7/3.56	+8/3.66	+9/3.76
0.53	2.86		-1/2.76	-2/2.66	-3/2.56						
0.54	2.91		+1/3.01	+2/3.11	+3/3.21	+4/3.31	+5/3.41	+6/3.51	+7/3.61	+8/3.71	+9/3.81
0.54	2.91		-1/2.81	-2/2.71	-3/2.61	-4/2.51					
0.55	2.96		+1/3.06	+2/3.16	+3/3.26	+4/3.36	+5/3.46	+6/3.56	+7/3.66	+8/3.76	+9/3.86
0.55	2.96		-1/2.86	-2/2.76	-3/2.66	-4/2.56					
0.56	3.01		+1/3.11	+2/3.21	+3/3.31	+4/3.41	+5/3.51	+6/3.61	+7/3.71	+8/3.81	+9/3.91
0.56	3.01		-1/2.91	-2/2.81	-3/2.71	-4/2.61	-5/2.51				
0.57	3.07		+1/3.17	+2/3.27	+3/3.37	+4/3.47	+5/3.57	+6/3.67	+7/3.77	+8/3.87	+9/3.97
0.57	3.07		-1/2.97	-2/2.87	-3/2.77	-4/2.67	-5/2.57				
0.58	3.13		+1/3.23	+2/3.33	+3/3.43	+4/3.53	+5/3.63	+6/3.73	+7/3.83	+8/3.93	
0.58	3.13		-1/3.03	-2/2.93	-3/2.83	-4/2.73	-5/2.63	-6/2.53			
0.59	3.18		+1/3.28	+2/3.38	+3/3.48	+4/3.58	+5/3.68	+6/3.78	+7/3.88	+8/3.98	
0.59	3.18		-1/3.08	-2/2.98	-3/2.88	-4/2.78	-5/2.68	-6/2.58			
0.60	3.23		+1/3.33	+2/3.43	+3/3.53	+4/3.63	+5/3.73	+6/3.83	+7/3.93		
0.60	3.23		-1/3.13	-2/3.03	-3/2.93	-4/2.83	-5/2.73	-6/2.63	-7/2.53		
0.61	3.29		+1/3.39	+2/3.49	+3/3.59	+4/3.69	+5/3.79	+6/3.89	+7/3.99		
0.61	3.29		-1/3.19	-2/3.09	-3/2.99	-4/2.89	-5/2.79	-6/2.69	-7/2.69		
0.62	3.34		+1/3.44	+2/3.54	+3/3.64	+4/3.74	+5/3.84	+6/3.94			
0.62	3.34		-1/3.24	-2/3.14	-3/3.04	-4/2.94	-5/2.84	-6/2.74	-7/2.64	-8/2.54	
0.63	3.40		+1/3.50	+2/3.60	+3/3.70	+4/3.80	+5/3.90	+6/4.00			
0.63	3.40		-1/3.30	-2/3.20	-3/3.10	-4/3.00	-5/2.90	-6/2.80	-7/2.70	-8/2.60	-9/2.50

Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 2)

Weight Value of Variable Checkweights (including Container Suspended over Trailing Edge)	Equivalent Balance Condition (existing Balance Condition)		Suggested Quantity of Adjustment Weights (No. 2917168) to Add (+) or Remove (-) to Achieve New Balance Condition Shown. NOTE: Always maintain surface within weight limit (maximum 9.90 pounds) and balance limits (2.5 to 4.0 inch-pounds nose-heavy). Each adjustment weight contributes approximately 0.04 pounds weight and approximately 0.1 inch-pound moment. See Figures 12 thru 14.								
(Pounds)	(Inch-Pounds)		Quantity Weights/Approximate New Balance Condition (Inch-Pounds)								
0.35	1.88								+7/2.58	+8/2.68	+9/2.78
0.36	1.94							+6/2.54	+7/2.64	+8/2.74	+9/2.84
0.37	1.99							+6/2.59	+7/2.69	+8/2.79	+9/2.89
0.38	2.05						+5/2.55	+6/2.65	+7/2.75	+8/2.85	+9/2.95
0.39	2.10					+4/2.50	+5/2.60	+6/2.70	+7/2.80	+8/2.90	+9/3.00
0.40	2.15					+4/2.56	+5/2.66	+6/2.76	+7/2.86	+8/2.96	+9/3.06
0.41	2.21				+3/2.51	+4/2.61	+5/2.71	+6/2.81	+7/2.91	+8/3.01	+9/3.11
0.42	2.26				+3/2.56	+4/2.66	+5/2.76	+6/2.86	+7/2.96	+8/3.06	+9/3.16
0.43	2.32			+2/2.52	+3/2.62	+4/2.72	+5/2.82	+6/2.92	+7/3.02	+8/3.12	+9/3.22
0.44	2.37			+2/2.57	+3/2.67	+4/2.77	+5/2.87	+6/2.97	+7/3.07	+8/3.17	+9/3.27
0.45	2.42		+1/2.52	+2/2.62	+3/2.72	+4/2.82	+5/2.92	+6/3.02	+7/3.12	+8/3.22	+9/3.32
0.46	2.48		+1/2.58	+2/2.68	+3/2.78	+4/2.88	+5/2.98	+6/3.08	+7/3.18	+8/3.28	+9/3.38
0.47	2.53	WITHIN BALANCE LIMITS	+1/2.63	+2/2.73	+3/2.83	+4/2.93	+5/3.03	+6/3.13	+7/3.23	+8/3.33	+9/3.43
0.48	2.59		+1/2.69	+2/2.79	+3/2.89	+4/2.99	+5/3.09	+6/3.19	+7/3.29	+8/3.39	+9/3.49
0.49	2.64		+1/2.74	+2/2.84	+3/2.94	+4/3.04	+5/3.14	+6/3.24	+7/3.34	+8/3.44	+9/3.54
0/49	2.64		-1/2.54								
0.50	2.69		+1/2.79	+2/2.89	+3/2.99	+4/3.09	+5/3.19	+6/3.29	+7/3.39	+8/3.49	+9/3.59
0.50	2.69		-1/2.59								
0.51	2.75		+1/2.85	+2/2.95	+3/3.05	+4/3.15	+5/3.25	+6/3.35	+7/3.45	+8/3.55	+9/3.65
0.51	2.75		-1/2.65	-2/2.55							
0.52	2.80		+1/2.90	+2/3.00	+3/3.10	+4/3.20	+5/3.30	+6/3.40	+7/3.50	+8/3.60	+9/3.70
0.52	2.80		-1/2.70	-2/2.60	-3/2.50						

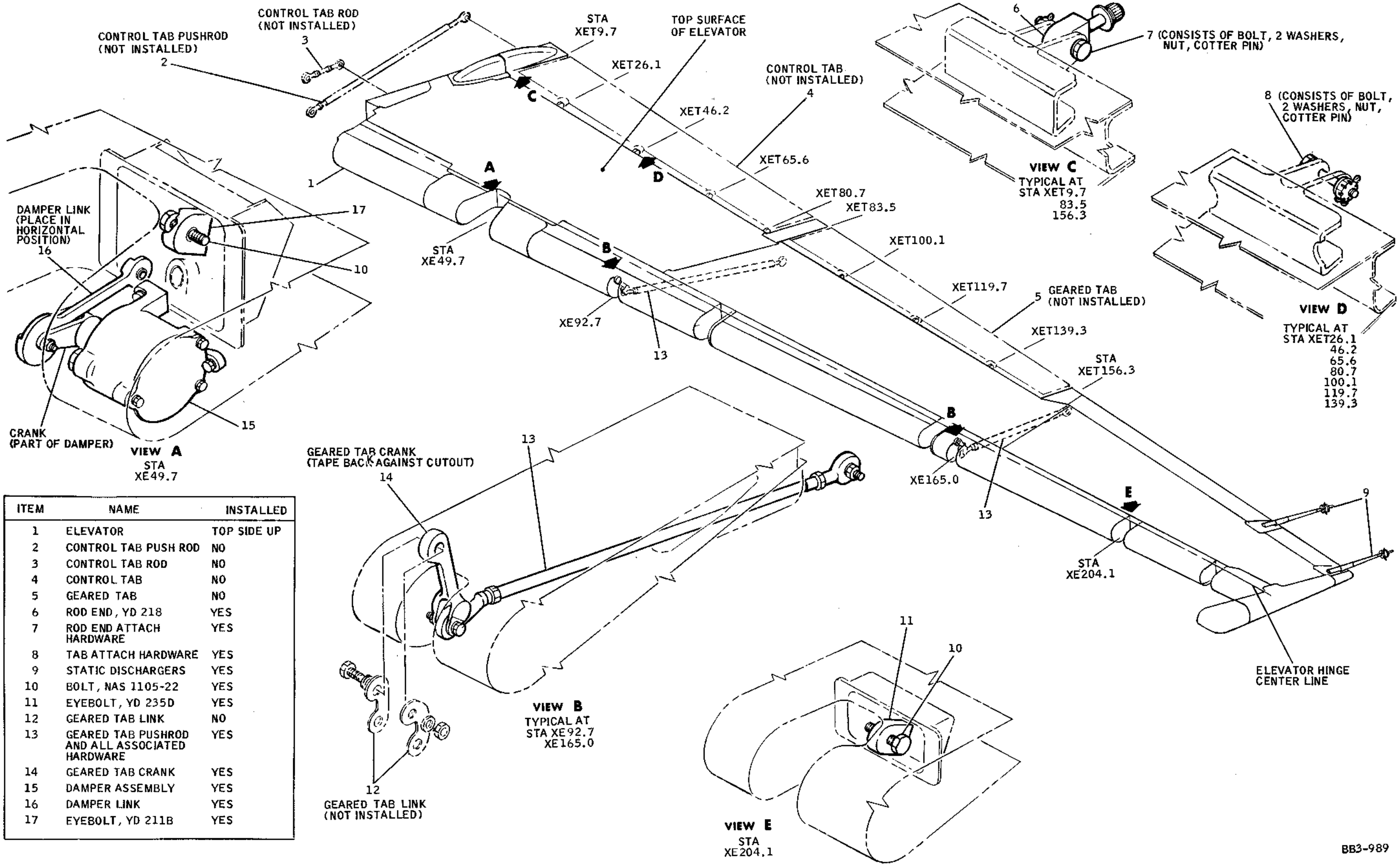
Aileron Control Tab Checkweight Values and
Adjustment Weight Change Required
Figure 19 (Sheet 1)



ITEM	NAME	INSTALLED
1	AILERON	TOP SIDE UP
2	CONTROL TAB	NO
3	TRIM TAB	NO
4	STATIC DISCHARGER	YES
5	TAB ATTACH HARDWARE	YES
6	EYE BOLT AND NUT	YES
7	TRIM TAB PUSH ROD ASSEMBLY	YES
8	TRIM TAB PUSHROD CRANK	YES
9	CRANK ATTACH HARDWARE	YES
10	DAMPER ASSEMBLY	YES
11	DAMPER LINK	YES
12	DAMPER LINK TO WING ATTACH PARTS	NO
13	LINK ASSEMBLY	NO
14	CONTROL TAB PUSHROD CRANK	YES
15	CONTROL TAB PUSHROD, ROD ENDS, NUTS, AND LOCKWIRE	YES
16	ROD END YD219A AND NUT	YES

Required Condition of Aileron for Balancing
Figure 3

(104)



ITEM	NAME	INSTALLED
1	ELEVATOR	TOP SIDE UP
2	CONTROL TAB PUSH ROD	NO
3	CONTROL TAB ROD	NO
4	CONTROL TAB	NO
5	GEARED TAB	NO
6	ROD END, YD 218	YES
7	ROD END ATTACH HARDWARE	YES
8	TAB ATTACH HARDWARE	YES
9	STATIC DISCHARGERS	YES
10	BOLT, NAS 1105-22	YES
11	EYEBOLT, YD 235D	YES
12	GEARED TAB LINK	NO
13	GEARED TAB PUSHROD AND ALL ASSOCIATED HARDWARE	YES
14	GEARED TAB CRANK	YES
15	DAMPER ASSEMBLY	YES
16	DAMPER LINK	YES
17	EYEBOLT, YD 211B	YES

Required Condition of Elevator For Balancing
Figure 3