

CGTO 1C-130-1

T.O. 1C-130(H)-1
PERFORMANCE DATA IS CONTAINED IN
T.O. 1C-130H-1-1.

FLIGHT MANUAL

C-130

USCG SERIES AIRCRAFT

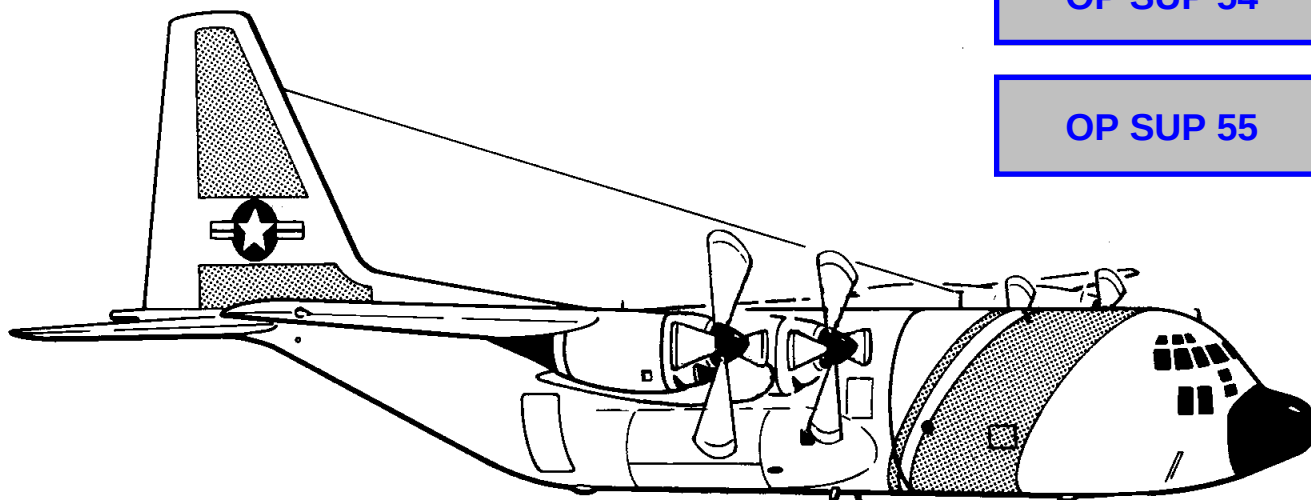
OP SUP 35

OP SUP 42

OP SUP 49

OP SUP 54

OP SUP 55



This change incorporates Operational Supplements C.G.T.O. 1C-130-1S-043, C.G.T.O. 1C-130-1S-052 and C.G.T.O. 1C-130-1S-053. Operational Supplements C.G.T.O. 1C-130-1S-035, C.G.T.O. 1C-130-1S-042, C.G.T.O. 1C-130-1S-054 and C.G.T.O. 1C-130-1S-055 are not incorporated in this change and shall remain supplements until they are rescinded or incorporated. C.G.T.O. 1C-130-1S-049 (Electrical System Upgrade) has been incorporated, but will remain an active supplement until all planes have been modified.

COMMANDING OFFICERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AFFECTED PERSONNEL.

PUBLISHED UNDER THE AUTHORITY OF THE COMMANDANT, USCG.

15 DECEMBER 2000
CHANGE 1 – 1 JULY 2001

CGTO 1C-130-1

C-130 FLIGHT MANUAL

To: Holders of CGTO 1C-130-1, C-130 Flight Manual.

Highlights: Change 1, dated 01 July 2001.

Comments regarding the contents of this manual, including those of an editorial nature, are encouraged and should be forwarded to the C-130 Standardization Team in Elizabeth City, NC. Changes to this manual should be accomplished via AF FORM 847.

REVISED PAGES

DESCRIPTION OF MATERIAL ADDED / REVISED

Highlights

Highlights pages describe the current changes made to an existing manual and very often contain information not repeated elsewhere in the manual. Highlights pages provide a historical record of the revisions to a manual and should be inserted directly behind the title page of the affected manual until superseded by the Highlights pages for the next change or revision.

Record of Revisions

The Record of Revisions page shall be inserted in sequence after the Highlights page. This page provides a readily available record of the status of the affected manual.

List of Effective Pages

Revised to reflect Change 1.

CGTO 1C-130-1 C-130 FLIGHT MANUAL	
PAGE	DESCRIPTION OF CHANGE
i	Revised General Table of Contents.
ii	Changed 1503 and 1504 to model year 73.
1-7	Added note 1 concerning panel configurations.
1-8	Changed mode selector panel.
1-9	Changed mode selector panel.
1-10	Added Pitot Heat Off light.
1-11	Added Pitot Heat Off light.
1-14	Added text for remote compensator.
1-15	Added digital controllers.
1-17	Added INS No. 2 Control Display Unit and Mode Selector Unit.
1-18	Removed Nose Radome Heat switch and light.
1-19	Removed Nose Radome Heat switch and light. Removed provision for No. 2 INS CDU.
1-25	Added box around pump assembly.
1-26	Added coloring to metering section line.
1-40	Blanked Master Trim panel.
1-41	Deleted Synchrophasor Trim Controls text. Caused text rollback on 1-42.
1-52	Added check valve between external tank and refueling manifold.
1-53	Added coloring to line between external tank and refueling manifold.
1-75	Added effectivity to title.
1-98	Deleted text for Radome Heat System and Urinal Drain Ejectors.
1-101	Removed radome heat valve and capped duct.
1-103	Removed radome heat valve and capped duct.
1-105	Removed radome heat valve and capped duct.

HIGHLIGHTS

PAGE 1

CGTO 1C-130-1

C-130 FLIGHT MANUAL

1-127	Added note 3 concerning nose wheel well heat.
1-128	Allowed text rollback to accomodate added text on page 1-129.
1-129	Changed/added text for Pitot Tube Anti-icing.
1-130	Changed text in Utility Hydraulic System paragraph.
1-131	Deleted note 4 and added flare launcher to list.
1-134	Changed text in Booster Hydraulic System paragraph.
1-146	Added picture of vertical torque shaft companion flange.
1-150	Replaced text missing from Nose Gear Emergency Release Handle paragraph.
1-154	Changed position of emergency brake selector valve.
1-163	Deleted text from figure title.
1-165	Changed item 4 of figure 1A-101 to VSI-TA/RA Display. Changed effectivity. Caused text rollover onto page 1-166.
1-167	Deleted ONS text, changed effectivity of Pitot-Static Instruments paragraph.
1-168	Replaced figure 1A-102 and changed effectivity.
1-169	Deleted ONS text.
1-170	Deleted free air temp indicator note, changed text for Rosemount paragraph.
1-171	Replaced figure 1A-103.
1-174	Moved APU/GTC Control circuit breaker text from 1-171 to 1-174. Changed text regarding fenwal setting in Overheat Warning paragraph.
1-175	Changed text regarding fenwal in Fire Detection and Warning paragraph.
1-178	Added number to figure 1A-108. Corrected labeling of landing lights circuit breaker.
1-184	Deleted note 1.
1-191	Moved oxygen regulator forward of right paratroop door.
1-203	Added Passenger Carrying Equipment paragraph. Caused rollover of text onto 1-204 and 1-205
1-206	Changed note for view A.
1-207	Changed reference in note.
1-209 thru 1-436	Replaced Avionics Section with abbreviated version. CGTO 1C-130-1-D contains expanded avionics information.
2-17	Deleted step 5.f. (afterbody strakes).
2-23	Changed BDI to BDHI (2 places) and added reference to note for BDHI comparison. Changed reference from Section IB to chapter 3 of CGTO 1C-130-1-D.
2-39	Changed effectivity in step 21.b.
2-44	Added text to note in FE's Lineup Checklist.
2-46	Added (LM) to Lineup Checks.
2-50	Deleted step 5.b. of FE's After Takeoff Checklist.
2-53	Deleted step 6. of FE's Before Landing Checklist.
2-60	Deleted steps 8.c. and 8.d. of FE's Operational Stop Checklist. Added effectivity to step 8.b.
2-61	Added note before step 9. of FE's Operational Stop Checklist.
2-75	Added caution to Rinse Procedure.

HIGHLIGHTS

CGTO 1C-130-1

C-130 FLIGHT MANUAL

2-79	Changed BDI to BDHI (2 places) and added reference to note for BDHI comparison. Added step and note for turning off ATM generator in FE's Before Starting and Push-back Checklist. Changed reference from Section IB to chapter 3 of CGTO 1C-130-1-D.
2-80	Changed note for timing of bleed air system pressure drop. Added step to turn ATM generator back on in FE's Before Starting and Push-back Checklist.
2-85	Changed text of warning in figure 2B-2.
2-87	Changed text of warning in figure 2B-4.
2-89	Changed text of warning in figure 2B-6.
2-91	Changed text of warning in figure 2B-8.
2-98	Changed step 21.a. to a note and added text.
2-99, 2-100	Changed text in DMB paragraph. Changed all instances of <i>ASRK-18</i> to <i>ASRK-2</i> , <i>LRU-20/A six place</i> to <i>POD-8 eight place</i> and <i>ADR-6</i> to <i>ADR-8</i> . Changed maximum weight limitation for ADS-Can. Added section for Authorized Drill Equipment.
2-103	Deleted text from warning in figure 2C-4.
2-105	Added text to "30 seconds standby" in figure 2C-6.
2-106	Added text to introduction of figure 2C-7.
2-107 thru 2-116	Incorporated CGTO 1C-130-1S-052 (alternate restraint procedure for ADDS pack).
3-1, 3-2	Updated table of contents.
3-39 thru 3-46	Added CASPER Emergency Power Off Procedure and Electrical Isolation Procedure. Generated pages 3-40a and 3-40b to minimize number of pages affected by text rollover. Added cleanup procedures for Fuselage Fire/Smoke and Fume Elimination. Deleted Nose Radome from Overheat paragraph. Deleted Nose Wheel Well section from Overheat Chart. Deleted Nose Wheel Well/Nose Radome section from Overheat Chart.
3-58	Added caution after step 8. concerning nose wheel steering.
3-63	Added picture of vertical torque shaft companion flange.
4-1, 4-2	Updated table of contents. Text rollback affected page 4-2.
4-3	Added step for EPOS in Loadmaster duties.
4-4	Added crew duties for Sensor System Operator and Tactical System Operator. Generated pages 4-4a and 4-4b to minimize number of pages affected by text rollover.
4-12	Added (LM) to line up checks.
4-18	Added step 33 (gunners belt) to LM/DM checklist.
4-22	Changed ARSK-18 to ARSK-24.
4-23	Changed ADR-6 to ADR-8.
4-29	Deleted step 13 (safety belt) and note from LM/DM Before Takeoff checklist.
4-30	Added note concerning fastening seatbelt. Added Line Up Checklist.
4-43	Added step to check FLIR/EO date and time. Added note concerning time-setting procedure.
4-45	Added (LM) to lineup checks.
4-48	Added (LM) to lineup checks.
5-2	Deleted -7 TIT indicator.

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5-3	Changed frequency tolerance to 20 Hz.
5-28	Deleted Airdrop Limitations and Strake Limitations.

CGTO 1C-130-1

FLIGHT MANUAL
C-130
USCG SERIES AIRCRAFT
RECORD OF REVISIONS

REV NO.	REV DATE	INSERT DATE	INSERT BY	REV NO.	REV DATE	INSERT DATE	INSERT BY
1	JUNE 1/00						

RECORD OF REVISIONS

CGTO 1C-130-1

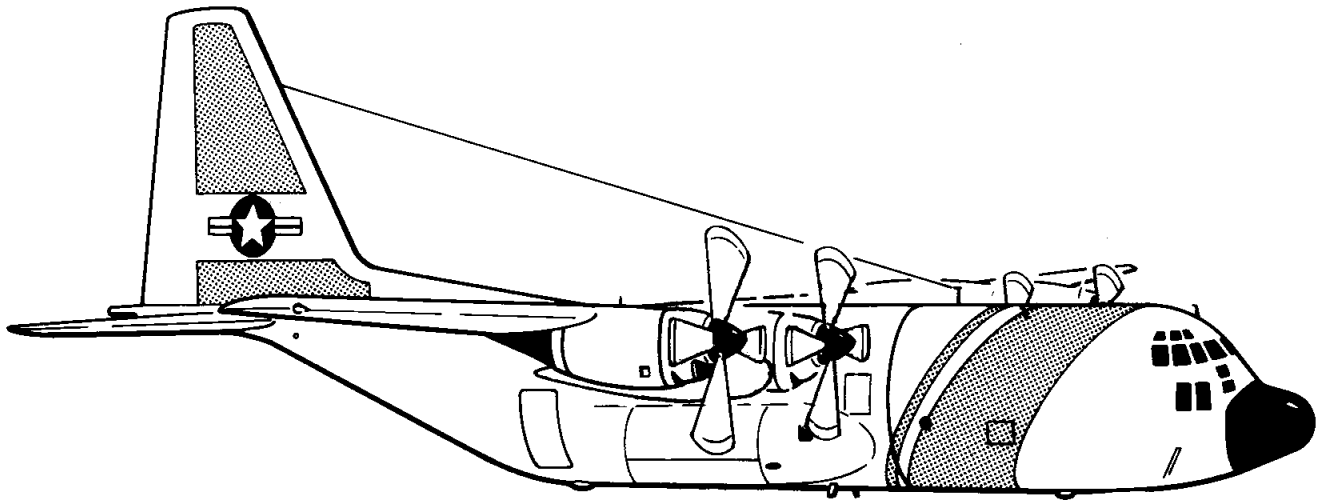
T.O. 1C-130(H)-1

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FLIGHT MANUAL

C-130

USCG SERIES AIRCRAFT



This change incorporates Operational Supplements C.G.T.O. 1C-130-1S-043, C.G.T.O. 1C-130-1S-052 and C.G.T.O. 1C-130-1S-053. Operational Supplements C.G.T.O. 1C-130-1S-035, C.G.T.O. 1C-130-1S-042, C.G.T.O. 1C-130-1S-054 and C.G.T.O. 1C-130-1S-055 are not incorporated in this change and shall remain supplements until they are rescinded or incorporated. C.G.T.O. 1C-130-1S-049 (Electrical System Upgrade) has been incorporated, but will remain an active supplement until all planes have been modified.

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PUBLISHED UNDER THE AUTHORITY OF THE COMMANDANT, USCG.

ERRATA

15 DECEMBER 2000

CHANGE 1 - 1 JULY 2001

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE The portion of the text affected by changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original 0 15 Dec 00

Change 1 1 01 Jul 01

Page No.	Change No. *	Page No.	Change No. *	Page No.	Change No. *
Title – D	1	1-172 – 1-173	0	2-92 – 2-97	0
i – ii	1	1-174	1	2-98 – 2-100	1
iii – viii blank	0	1-175 – 1-177	0	2-101 – 2-102	0
1-1 – 1-6	0	1-178	1	2-103	1
1-7 – 1-11	1	1-179 – 1-183	0	2-104	0
1-12 – 1-13	0	1-184	1	2-105 – 2-116	1
1-14 – 1-15	1	1-185 – 1-190	0	3-1 – 3-2	1
1-16	0	1-191	1	3-3 – 3-38	0
1-17 – 1-19	1	1-192 – 1-202	0	3-39 – 3-46	1
1-20 – 1-24	0	1-203 – 1-208 blank	1	3-47 – 3-57	0
1-25 – 1-26	1	1-209 – 1-238 blank	1	3-58	1
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1-40 – 1-42	1	2-17	1	3-63	1
1-43 – 1-51	0	2-18 – 2-22	0	3-64 – 3-96	0
1-52 – 1-53	1	2-23	1	4-1 – 4-4b	1
1-54 – 1-74	0	2-24 – 2-38	0	4-5 – 4-11	0
1-75	1	2-39	1	4-12	1
1-76 – 1-97	0	2-40 – 2-43	0	4-13 – 4-17	0
1-98	1	2-44	1	4-18	1
1-99 – 1-100	0	2-45	0	4-19 – 4-21	0
1-101	1	2-46	1	4-22 – 4-23	1
1-102	0	2-47 – 2-49	0	4-24 – 4-28	0
1-103	1	2-50	1	4-29 – 4-30	1
1-104	0	2-51 – 2-52	0	4-31 – 4-42	0
1-105	1	2-53	1	4-43	1
1-106 – 1-126	0	2-54 – 2-59	0	4-44	0
1-127 – 1-131	1	2-60 – 2-61	1	4-45	1
1-132 – 1-133	0	2-62 – 2-74	0	4-46 – 4-47	0
1-134	1	2-75	1	4-48	1
1-135 – 1-145	0	2-76 – 2-78	0	4-49 – 4-50	0
1-146	1	2-79 – 2-80	1	5-1	0
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1-151 – 1-153	0	2-86	0	5-28	1
1-154	1	2-87	1	5-29 – 5-34	0
1-155 – 1-162	0	2-88	0	6-1 – 6-12 blank	0
1-163	1	2-89	1	7-1 – 7-10 blank	0
1-164	0	2-90	0	Index 1 – Index 20	1
1-165 – 1-171	1	2-91	1		

*Zero in this column indicates an original page.

P 141813Z FEB 02

FM COMDT COGARD WASHINGTON DC//G-OCA/G-SEA//
TO COGARD AIRSTA BARBERS PT HI//OPS/ENG//
COGARD AIRSTA CLEARWATER FL//OPS/ENG//
COGARD AIRSTA ELIZABETH CITY NC//OPS/ENG/C130 STAN TEAM//
COGARD AIRSTA KODIAK AK//OPS/ENG//
COGARD AIRSTA SACRAMENTO CA//OPS/ENG//
COGARD ATC MOBILE AL//C130 STAN TEAM//
COGARD AR SC ELIZABETH CITY NC//C130 PLM//

BT

UNCLAS //N13221//

**SUBJ: INTERIM CHANGE 2 TO FLIGHT MANUAL C-130 USCG SERIES
AIRCRAFT**

A. FLIGHT MANUAL C-130 USCG SERIES AIRCRAFT, CGTO 1C-130-1

1. DUE TO A CHANGE 1 PRINTING ERROR, TWO STEPS WERE LEFT OFF OF THE FLIGHT ENGINEER'S PORTION OF THE OPERATIONAL STOP CHECKLIST.
2. MAKE THE FOLLOWING PEN AND INK CHANGES IN REF A.
A. ON PAGE 2-60, FLIGHT ENGINEER STEP 8, OPERATIONAL STOP CHECKLIST ADD STEPS "C. ENGINE ANTI-ICING - ON" AND "D. PROP ANTI/DEICING - ON".
3. COMMANDING OFFICERS SHALL MAKE A COPY OF THIS MESSAGE AVAILABLE TO ALL C-130 PILOTS AND AIRCREW. ENSURE THE CHANGE IS ENTERED IN ALL UNIT COPIES OF REF A. C-130 STAN TEAM POC IS LCDR JOHN BORIS (252) 335-6320.

BT

NNNN

P 142056Z FEB 02

FM COMDT COGARD WASHINGTON DC//G-OCA/G-SEA//
TO COGARD AIRSTA BARBERS PT HI//OPS/ENG//
COGARD AIRSTA CLEARWATER FL//OPS/ENG//
COGARD AIRSTA ELIZABETH CITY NC//OPS/ENG/C130 STAN TEAM//
COGARD AIRSTA KODIAK AK//OPS/ENG//
COGARD AIRSTA SACRAMENTO CA//OPS/ENG//
COGARD ATC MOBILE AL//C130 STAN TEAM//
COGARD AR SC ELIZABETH CITY NC//C130 PLM//

BT

UNCLAS //N13221//

**SUBJ: ADDENDUM TO INTERIM CHANGE 1 TO FLIGHT MANUAL C-130
USCG SERIES AIRCRAFT**

A. MY 282102Z JAN 02

B. FLIGHT MANUAL C-130 USCG SERIES AIRCRAFT, CGTO 1C-130-1

C. CHECKLIST C-130 USCG SERIES AIRCRAFT, CGTO 1C-130-1CL-1

1. REF A OUTLINED PROCEDURAL CHANGES TO REF B FOR AIRCRAFT
EQUIPPED WITH DUAL LN-100 INS UNITS. ASSOCIATED CHANGES TO REF C
ARE CONTAINED HEREIN.

2. MAKE THE FOLLOWING PEN AND INK CHANGES TO REF C.

A. ON PAGE N-27, STEP 17 (BEFORE STARTING AND PUSH-BACK CHECKLIST)
REPLACE "SET, STATE SETTING", WITH "OFF".

B. ON PAGE N-28, ADD STEP 36A, TO READ, "INS "SET, STATE SETTING"
N/E/CP.

3. COMMANDING OFFICERS SHALL MAKE A COPY OF THIS MESSAGE
AVAILABLE TO ALL C-130 PILOTS AND AIRCREW. ENSURE THE CHANGE IS
ENTERED IN ALL UNIT COPIES OF REF C. C-130 STAN TEAM POC IS LCDR
JOHN BORIS (252) 335-6320.

BT

NNNN

STATUS PAGE

This page provides a listing of the active Safety and Operational Supplements for the Flight Manual.

Safety supplements are numbered as follows: C.G.T.O. 1C-130-SS-1, C.G.T.O. 1C-130-SS-2, etc. Operational supplements continue in sequence and are numbered as follows: C.G.T.O. 1C-130-1S-1, C.G.T.O. 1C-130-1S-2, etc. Supplement numbers should follow in sequence and will never be used more than once. If your manual is missing any supplements listed on this page, see your Quality Assurance Department.

AIRCREW FLIGHT MANUAL	BASIC DATE	CHANGE NO. / DATE
1C-130-1	15 Dec 00	1/01 Jul 01

FLIGHT CREW CHECKLIST	BASIC DATE	CHANGE NO. / DATE
C.G.T.O. 1C-130-1CL-1	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-2	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-3	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-4	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-5	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-6	15 Dec 00	1/01 Jul 01
C.G.T.O. 1C-130-1CL-7	15 Dec 00	1/01 Jul 01

The supplements listed below were not incorporated into the latest Flight Manual change and shall remain supplements until they are rescinded or incorporated.

SAFETY AND OPERATIONAL SUPPLEMENTS	DATE	SHORT TITLE
C.G.T.O. 1C-130-1S-035	1 Apr 96	Garmin GPS 55 Global Positioning System
C.G.T.O. 1C-130-1S-042	1 Oct 99	Emergency Procedures for Aircraft with a Forward Escape Hatch Mounted MILSATCOM Antenna Installed
C.G.T.O. 1C-130-1S-048		Reserved
C.G.T.O. 1C-130-1S-049	1 Jan 01	Electrical System Upgrade (Incorporated, but remains active, with restricted distribution)
C.G.T.O. 1C-130-1S-054	1 Apr 01	Single LN-100 System
C.G.T.O. 1C-130-1S-055	1 May 01	Chip Detector System

INCORPORATED, RESCINDED, OR DELETED SUPPLEMENTS

C.G.T.O. 1C-130-1S-031	16 Jan 97	Control Display Navigation Unit (CDNU)
C.G.T.O. 1C-130-1S-036		RESCINDED
C.G.T.O. 1C-130-1S-040	30 Oct 98	406 MHz ELT
C.G.T.O. 1C-130-1S-041	1 Apr 99	Corrections to Critical and Emergency Procedures
C.G.T.O. 1C-130-1S-043	1 Jun 00	CASPER System
C.G.T.O. 1C-130-1S-044	15 Jan 00	Dual LN-100 Systems
C.G.T.O. 1C-130-1S-045	15 Jan 00	Single LN-100 with CNMS (Superseded)
C.G.T.O. 1C-130-1S-046	1 Aug 00	Single LN-100 without CNMS (Superseded)
C.G.T.O. 1C-130-1S-047	1 Oct 99	Standby Attitude Indicator (SAI)
C.G.T.O. 1C-130-1S-050	1 Mar 00	HC-130 Navigator and Radio Operator Syllabi

CGTO 1C-130-1

C.G.T.O. 1C-130-1S-051	1 Dec 00	Single LN-100 w/o CNMS/GPS (Superseded)
C.G.T.O. 1C-130-1S-052	1 Dec 00	Alternate Restraint Procedure for ADDS Pack
C.G.T.O. 1C-130-1S-053	1 Apr 01	Dual LN-100 Systems

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	Part C SAR Procedures	2-93
	Part D Aerial Dispersant Delivery System	2-107
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SECTION III	EMERGENCY PROCEDURES	3-1
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SCOPE

This manual contains the necessary information for safe and efficient operation of the C-130. These instructions provide you with a general knowledge of the airplane, its characteristics and specific normal and emergency operating procedures. Your flying experience is recognized; therefore, basic flight principles are avoided. When information in the manual pertains to a particular airplane, the following code symbols are used:

HC-130 COAST GUARD TO AIR FORCE TO LOCKHEED NUMBER CROSS REFERENCE

USCG	USAF	LOCKHEED	USCG	USAF	LOCKHEED
1500	72-01300	4501	1705	83-0007	4993
1501	72-01301	4507	1706	83-0505	4996
1502	72-01302	4513	1707	83-0506	4999
1503	73-00844	4528	1708	83-0507	5002
1504	73-00845	4529	1709	83-0508	5005
			1710	84-0479	5028
1601	77-0318	4760	1711	84-0480	5031
1602	77-0319	4762	1712	84-0481	5033
1603	77-0320	4764	1713	84-0482	5034
			1714	84-0051	5035
1790	81-0999	4931	1715	85-0052	5037
1700	82-0081	4947	1716	85-1360	5023
1701	82-0082	4958	1717	86-0420	5104
1702	82-0083	4966	1718	86-0421	5106
1703	82-0084	4967	1719	86-0422	5107
1704	82-0085	4969	1720	87-0156	5120

SOUND JUDGMENT

Instructions in this manual are for a crew inexperienced in the operation of this airplane. This manual provides the best possible operating instructions under most circumstances, but it is not a substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

PERMISSIBLE OPERATIONS

The Flight Manual takes a “positive approach” and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from the Commandant (G-OCA-2) before any questionable operation is attempted which is not specifically permitted in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA

Refer to COMDTINST M13005 series, its monthly supplement, and the latest safety or operational supplement flyleaf.

STANDARDIZATION AND ARRANGEMENT

Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into seven sections to simplify reading straight through or using it as a reference manual.

SAFETY SUPPLEMENTS

Information involving safety will be promptly forwarded to you by Safety Supplements. Supplements covering loss of life will get to you in 48 hours by message, and those concerning serious damage to equipment will arrive within 10 days by mail. The title page of the Flight Manual and the title block of each Safety Supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements – current supplements must be complied with, but there is no point in restricting your operation by complying with a replaced or rescinded supplement.

OPERATIONAL SUPPLEMENTS

Information involving operations will be promptly forwarded to you by Operational Supplements. Supplements covering urgent operational information will get to you in 48 hours by message and those concerning essential information, but of a less urgent nature, will get to you within 21 days by mail. The title page of the Flight Manual and the title block of each Operational Supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements – current supplements must be complied with, but there is no point in restricting your operation with a replaced or rescinded supplement.

CHECKLISTS

The Flight Manual contains amplified checklists. Abbreviated checklists have been issued as separate technical orders. Line items in the Flight Manual and checklists are identical with respect to arrangement and item numbers. Whenever a Safety Supplement affects the checklists, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page incorporating the supplement will be issued. This will keep handwritten entries of Safety Supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES

Each flight crew member is entitled to a personal copy of the Flight Manual, Safety Supplements, Operational Supplements and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your quality assurance personnel. It is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Publication Requirements Table (COMDTINST M13005 series). Make sure a system is established at your station to deliver these publications to the flight crew members immediately upon receipt.

FLIGHT MANUAL AND CHECKLIST BINDERS

Loose-leaf binders are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your checklist. These binders contain plastic envelopes into which individual checklist pages are inserted. They are available in two capacities and are obtained through quality assurance. Check with your quality assurance personnel for assistance in securing these items. Sectionalized tabs may be special ordered through quality assurance.

PERFORMANCE MANUALS

For aircraft equipped with T-56-A-15 use T.O. 1C-130H-1-1.

REFERENCE MANUALS

The following manuals are to be used for reference as applicable.

T.O. 1C-130A-9	AFJMAN 24-204
T.O. 1C-130-6CF-1	CFR 49, Parts 171, 172, 173, 175
T.O. 1C-130E-5	T.O. 1-1B-40
	T.O. 1-1B-50
	COMDTINST M3710.1 (series)

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to “Warnings,” “Cautions,” and “Notes” found throughout the manual:

WARNING	– Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.
CAUTION	– Operating procedures, techniques, etc., which will result in damage to equipment if not carefully followed.
NOTE	– Operating procedures, techniques, etc., which are considered essential to emphasize.

USE OF WORDS SHALL, WILL, AND MAY

The following definitions apply to words “shall,” “will,” and “may” found throughout the manual:

Shall and Will	– Used to indicate a mandatory requirement.
May	– Indicates an acceptable or suggested means of accomplishment.

USE OF CAPITAL LETTERS, QUOTATION MARKS, COMMAS AND VIRGULES, “IF INSTALLED,” “TYPICAL.”

1. In description information:

a. Placarded name of switches, controls, fuses, circuit breakers, illuminated annunciator lights, and illuminated pushbutton switch lights.	– CAPITALS
b. Marked or unmarked switch/control positions.	– CAPITALS IN QUOTATION MARKS
c. The phrase “if installed” is used where equipment/switch locations could not accurately be determined before publication of this manual. If used with a checklist challenge, it means all series aircraft do not or will not have this item installed. If used with a checklist response, it means the item’s location varies with different series airplanes.	

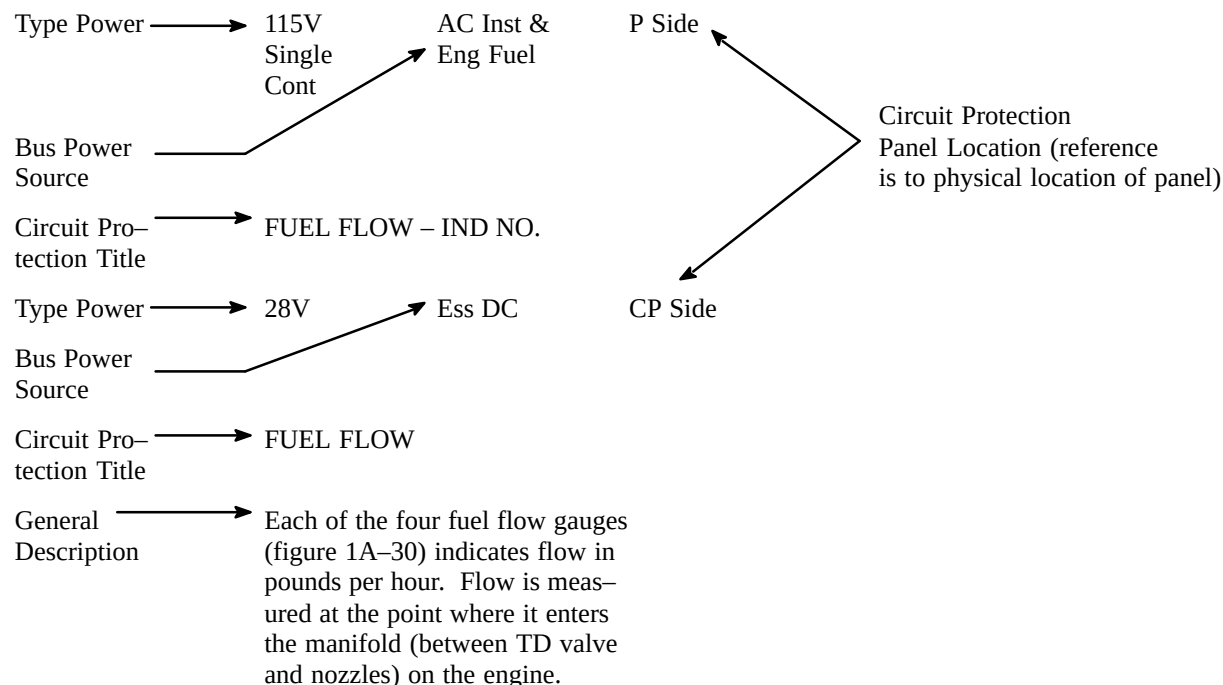
2. Checklist:

a. In checklist responses/actions, placarded names and unplacarded switch positions will be in capitals, and unplacarded names/actions will be in initial capitals. Challenges will be in initial capitals. Quotation marks are reserved for spoken responses.	
b. A comma between crew positions or responses indicates that both will be applicable. A virgule (/) between positions or responses indicates either one or the other will apply.	
c. Due to the varying configurations of aircraft the phrase “Typical” is used when a description or figure is representative of the majority of aircraft.	

GENERAL DESCRIPTION OF SYSTEM, POWER SOURCE, BUS, AND CIRCUIT BREAKER LOCATION.

All ac power is assumed to be three-phase unless otherwise stated. All circuit protection is assumed to be a circuit breaker unless otherwise specified, i.e., fuse or current limiter. Circuit protection information is presented in manual as follows:

(Paragraph Heading) → **FUEL FLOW GAUGES.**



YOUR RESPONSIBILITY – TO LET US KNOW

Every effort is made to keep the Flight Manual current. Flight Manual review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your C-130 Standardization Officer to Commanding Officer, USCG Air Station, Elizabeth City, NC 27909, ATTN: C-130 Standardization Unit.

RECOMMENDATION FOR CHANGE OF PUBLICATION (<i>FLIGHT PUBLICATIONS</i>)			DATE	UNIT NUMBER
PUBLICATION NUMBER (1)	BASIC DATE (2)	REVISION/CHANGE DATE (3)		(<i>Reserved</i>)
PAGE NUMBER (4)	MAJOR PARAGRAPH TITLE (5)			
SUB-PARAGRAPH TITLE (6)			ITEM NUMBER (7)	
(8) ☐ CHANGE ☐ DELETE SO MUCH OF ☐ PARAGRAPH ☐ ITEM ☐ FIGURE				
AS READS				
TO READ				
AFTER PRESENT (9) ☐ SENTENCE ☐ ITEM				
AS READS				
☐ ADD NEW (10) ☐ PARAGRAPH ☐ SENTENCE ☐ ITEM ☐ FIGURE				
TO READ				
REASON FOR RECOMMENDED CHANGE, ADDITION OR DELETION (<i>Include Adverse operational effects</i>) (11)				
ORGANIZATION				
TYPED NAME AND GRADE OF ORIGINATOR			SIGNATURE	

ACTION		
1ST ENDORSEMENT		
TO:		FROM:
☐ CONCUR	☐ DO NOT CONCUR	
REMARKS		
DATE	TYPED NAME, GRADE AND TITLE	SIGNATURE
2ND ENDORSEMENT		
TO:		FROM:
☐ CONCUR	☐ DO NOT CONCUR	
REMARKS		
DATE	TYPED NAME, GRADE AND TITLE	SIGNATURE
3RD ENDORSEMENT		
TO:		FROM:
☐ CONCUR	☐ DO NOT CONCUR	
REMARKS		
DATE	TYPED NAME, GRADE AND TITLE	SIGNATURE
4TH ENDORSEMENT		
TO:		FROM:
☐ CONCUR	☐ DO NOT CONCUR	
REMARKS		
DATE	TYPED NAME, GRADE AND TITLE	SIGNATURE

SECTION I

DESCRIPTION PART A – SYSTEMS

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THE AIRPLANE

The Lockheed C-130 is an all-metal, high-wing, long-range, land-based monoplane. The fuselage is divided into the cargo compartment and the flight station. It can be fully pressurized and air conditioned, both in flight and on the ground. The mission of the airplane is to provide rapid transportation of personnel or cargo for delivery by parachute or by landing. The

airplane can be used as a tactical transport carrying 86 ground troops or 58 paratroops and equipment, and can be readily converted for ambulance or aerial delivery missions. When used as an ambulance, the airplane can carry up to 66 litters. There are provisions for normal life raft storage to accommodate 80 persons for overwater flights. The C-130 can land and takeoff on short runways, and it can be used on landing strips such as those usually found in advance base operations.

Aircraft Dimensions (Typical)

NOTE

1. DIMENSIONS SHOWN AIRPLANE EQUIPPED AND EMPTY.

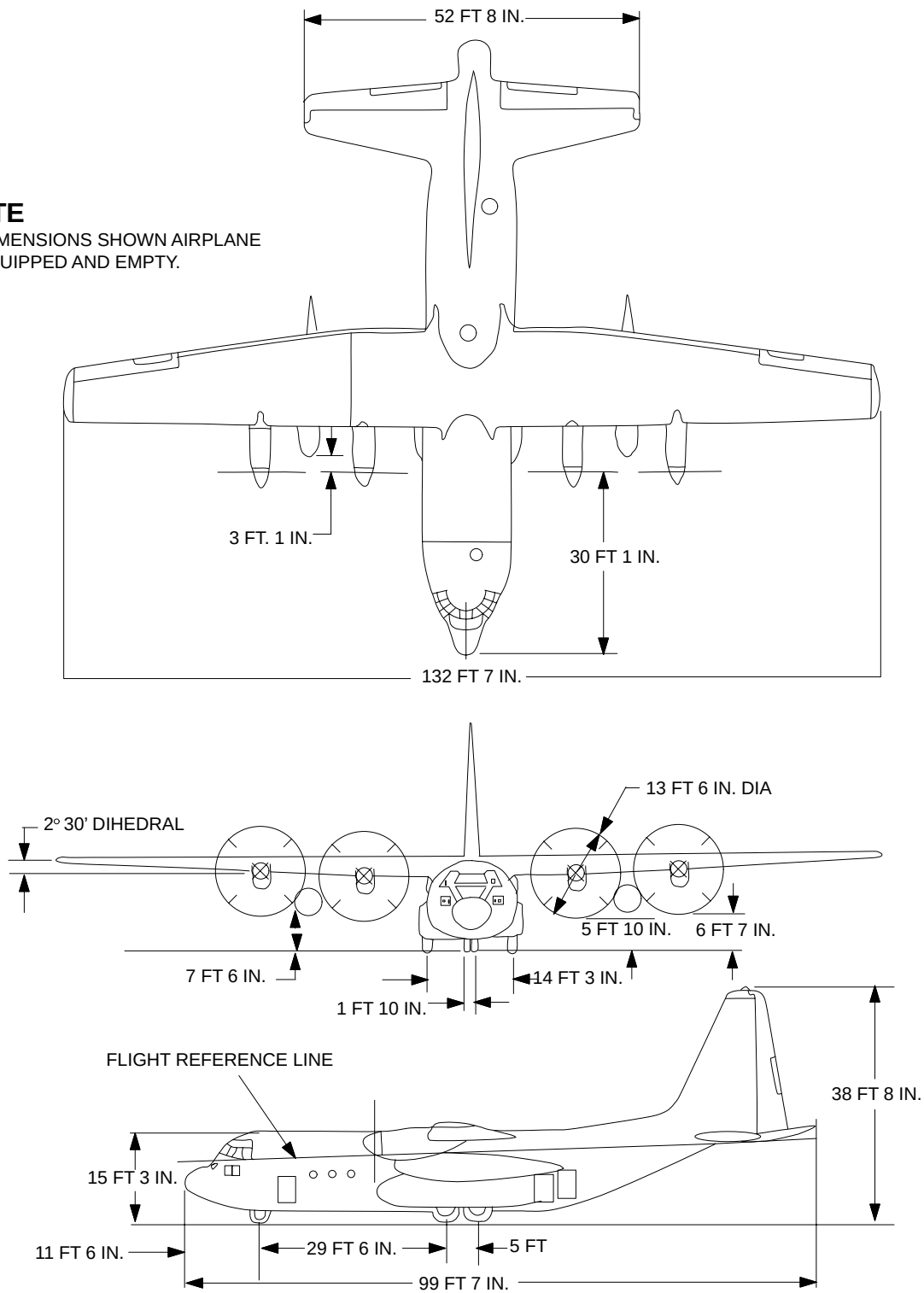
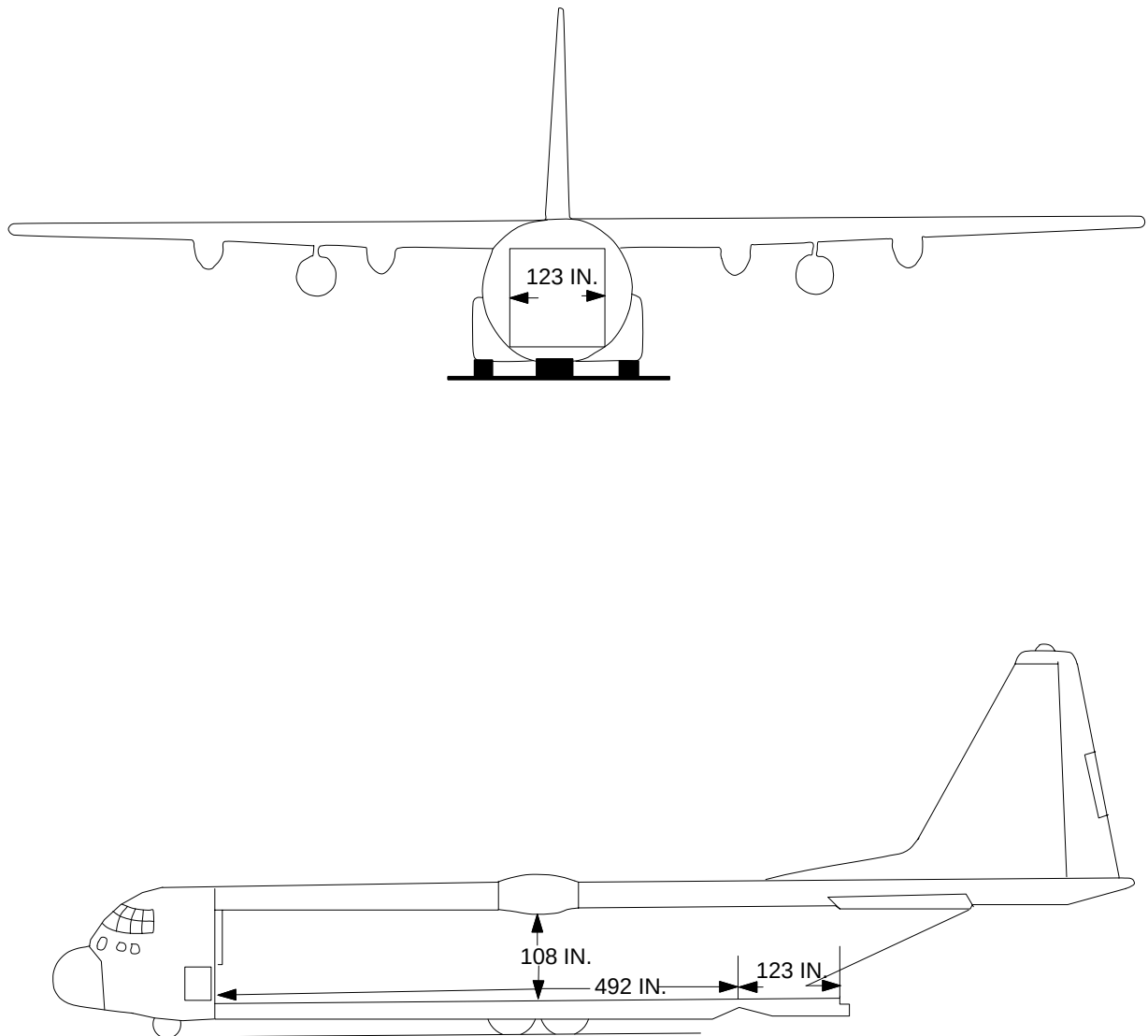


Figure 1A-1

Cargo Compartment Loading (Typical)**NOTE**

DO NOT USE FOR CARGO
LOADING INFORMATION.
FOR LOADING INFORMATION
USE T.O. 1C-130A-9

Figure 1A-2

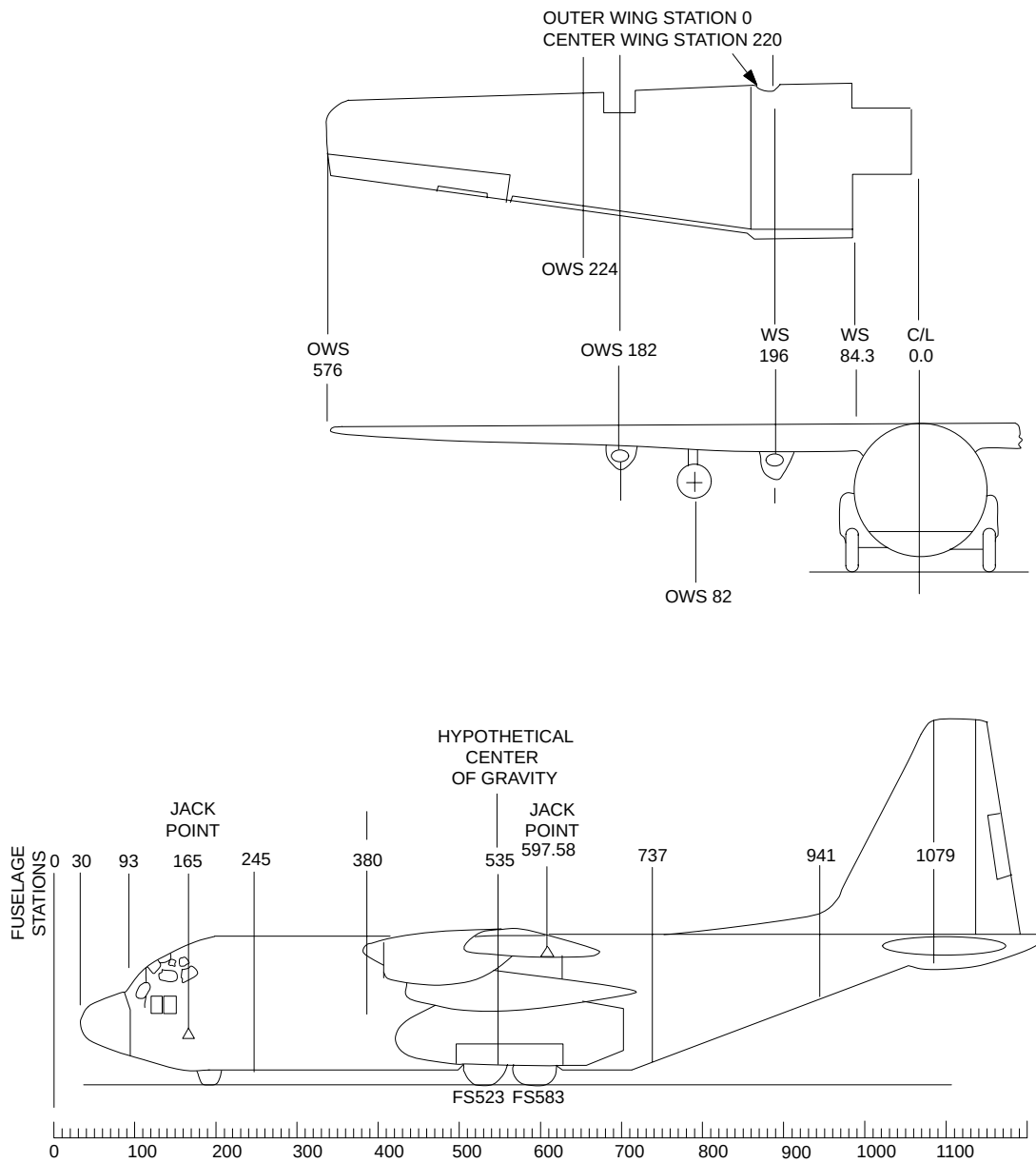
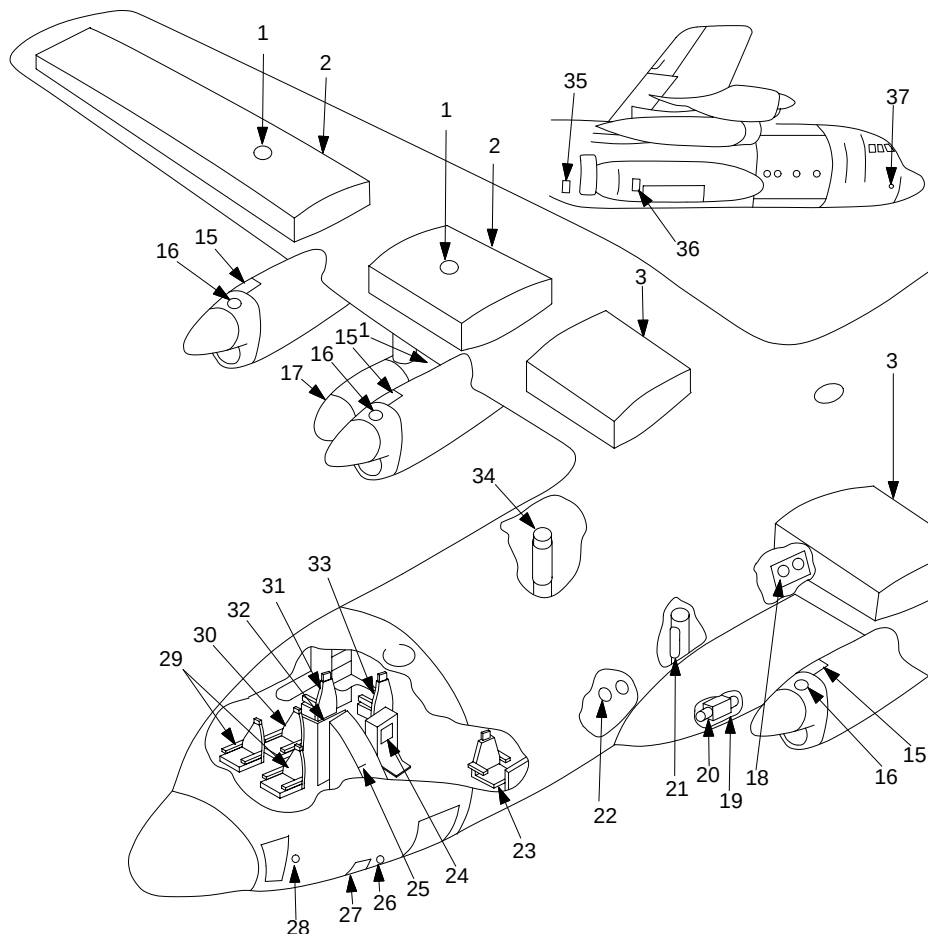


Figure 1A-3

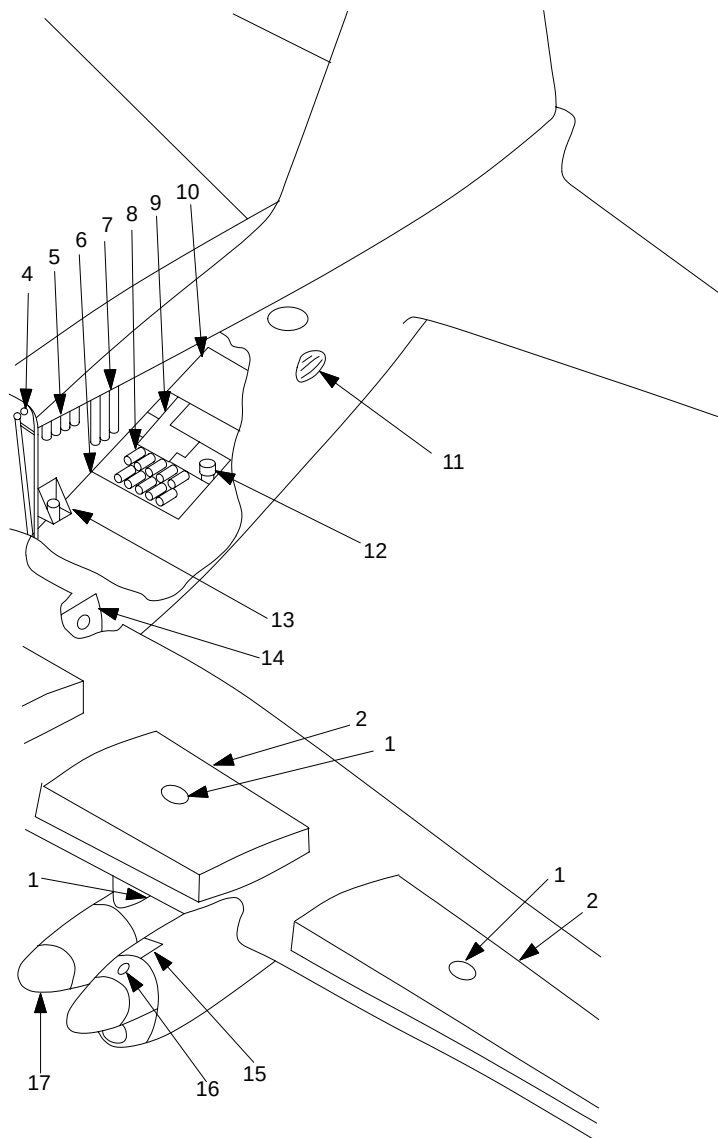
General Arrangement and Servicing Diagram



SPECIFICATIONS		NATO SYMBOL
RECOMMENDED FUEL	MIL-T-5624 JP-4	F-40
OIL	ENGINE MOBIL OIL 254 APU/GTC STARTER 	
HYDRAULIC FLUID	MIL-H-83282	H-537

SPECIFICATIONS		NATO SYMBOL
EXTINGUISHER FLUID	ENGINE AND APU ALTERNATE HAND EXTINGUISHERS MIL-D-4540 MIL-B-4394 HALON 1211	
OXYGEN	MIL-O-27210 TYPE II	
PROPELLER FLUID	MIL-H-83282	H-537

Figure 1A-4 (Sheet 1 of 2)



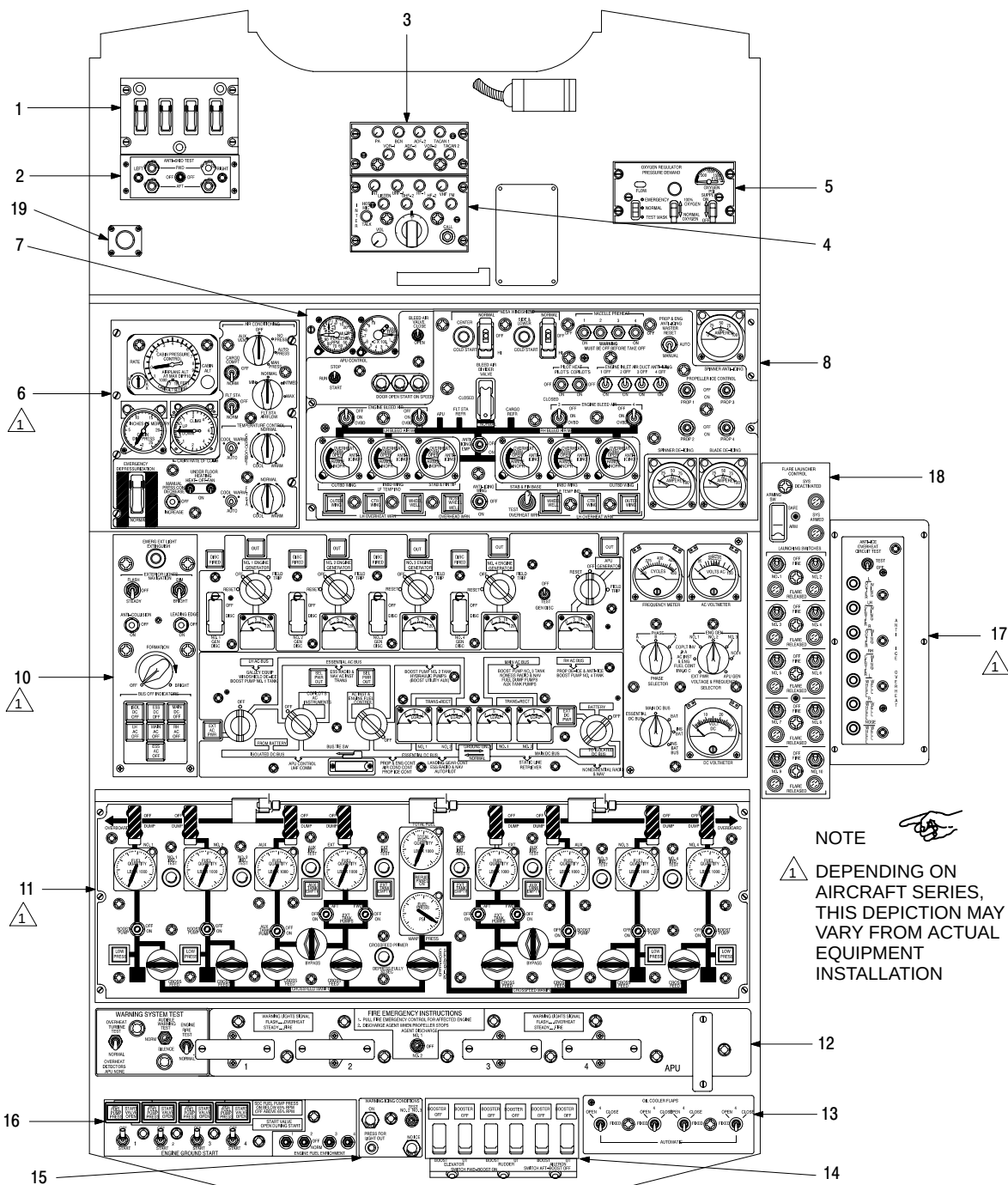
NOTE

⚠ BENDIX STARTERS ARE PERMANENTLY LUBRICATED

1. FUEL FILLER POINTS (6 PLACES)
2. MAIN FUEL TANKS (4 PLACES)
3. AUXILIARY FUEL TANKS (2 PLACES)
4. GROUND AIR CONDITIONING ADAPTERS
5. WATER BOTTLES (LH-5, RH-5)
6. RAMP
7. FLARE STOWAGE
8. FLARE LAUNCHER
9. FLARE STOWAGE COMPARTMENTS
10. CARGO DOOR
11. ENGINE TAILPIPE SHIELDS
12. AUXILIARY HYDRAULIC SYSTEM RESERVOIR
13. TOILET
14. PARATROOP DOORS (LH SHOWN – RH OPPOSITE)
15. ENGINE OIL AND STARTER OIL (4 PLACES)
16. PROPELLER OIL RESERVOIR
17. EXTERNAL FUEL TANKS (2 PLACES)(IF INSTALLED)
18. FIRE EXTINGUISHER AGENT BOTTLES
19. APU/GTC RESERVOIR
20. APU/GTC
21. UTILITY HYDRAULIC RESERVOIR
22. ENGINE AIR INTAKE SHIELDS
23. SCANNER'S SEAT (LH SHOWN – RH OPPOSITE)
24. STOWAGE CABINET
25. GALLEY
26. EXTERNAL ELECTRICAL POWER RECEPTACLE
27. BATTERY
28. EXTERNAL INTERPHONE CONNECTION
29. PILOT'S AND COPILOT'S SEATS
30. FLIGHT ENGINEER'S SEAT
31. NAVIGATOR'S SEAT
32. CURTAIN
33. RADIO OPERATOR'S SEAT
34. BOOSTER HYDRAULIC SYSTEM RESERVOIR
35. TOILET SERVICING ADAPTER
36. SINGLE POINT REFUELING ADAPTER
37. OXYGEN FILLER

Figure 1A-4 (Sheet 2 of 2)

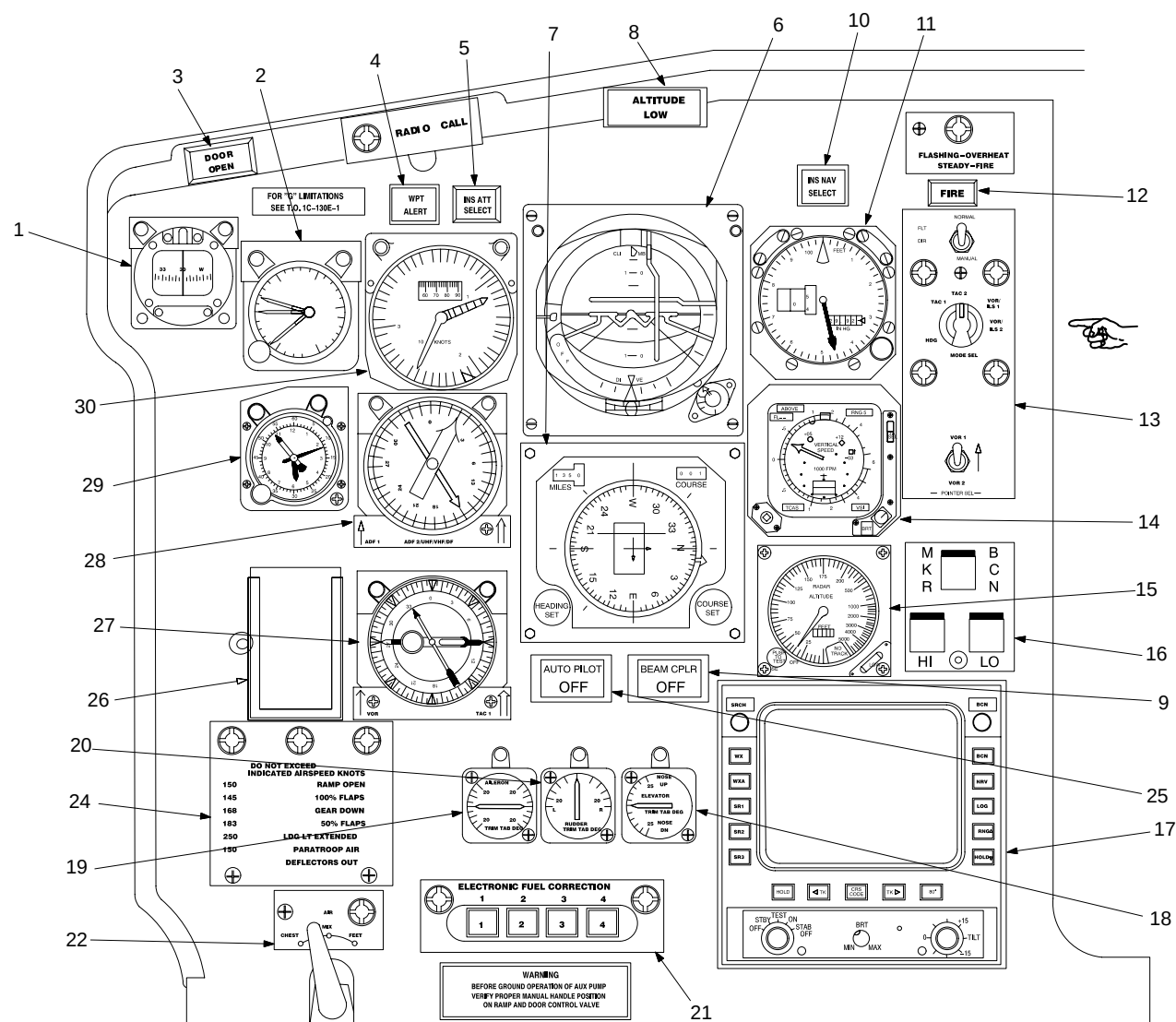
Overhead Control Panel (Typical)



1. FUEL GOVERNING CHECK PANEL	10. OVERHEAD ELECTRICAL CONTROL PANEL
2. ANTI-SKID PANEL	11. FUEL CONTROL PANEL
3. FLIGHT ENGINEER'S INTERCOM MONITOR PANEL	12. FIRE EMERGENCY CONTROL PANEL
4. FLIGHT ENGINEER'S INTERCOM CONTROL PANEL	13. OIL COOLER FLAP CONTROL PANEL
5. OXYGEN REGULATOR PANEL	14. CONTROL BOOST SWITCH PANEL
6. AIR CONDITIONING AND PRESSURIZATION CONTROL PANEL	15. ICE DETECTION PANEL
7. APU CONTROL PANEL	16. ENGINE STARTING CONTROL PANEL
8. ANTI-ICING SYSTEMS CONTROL PANEL	17. ANTI-ICE OVERHEAT PANEL (1500 SERIES)
9. DELETED	18. FLARE LAUNCH PANEL
	19. ICS CONNECTOR

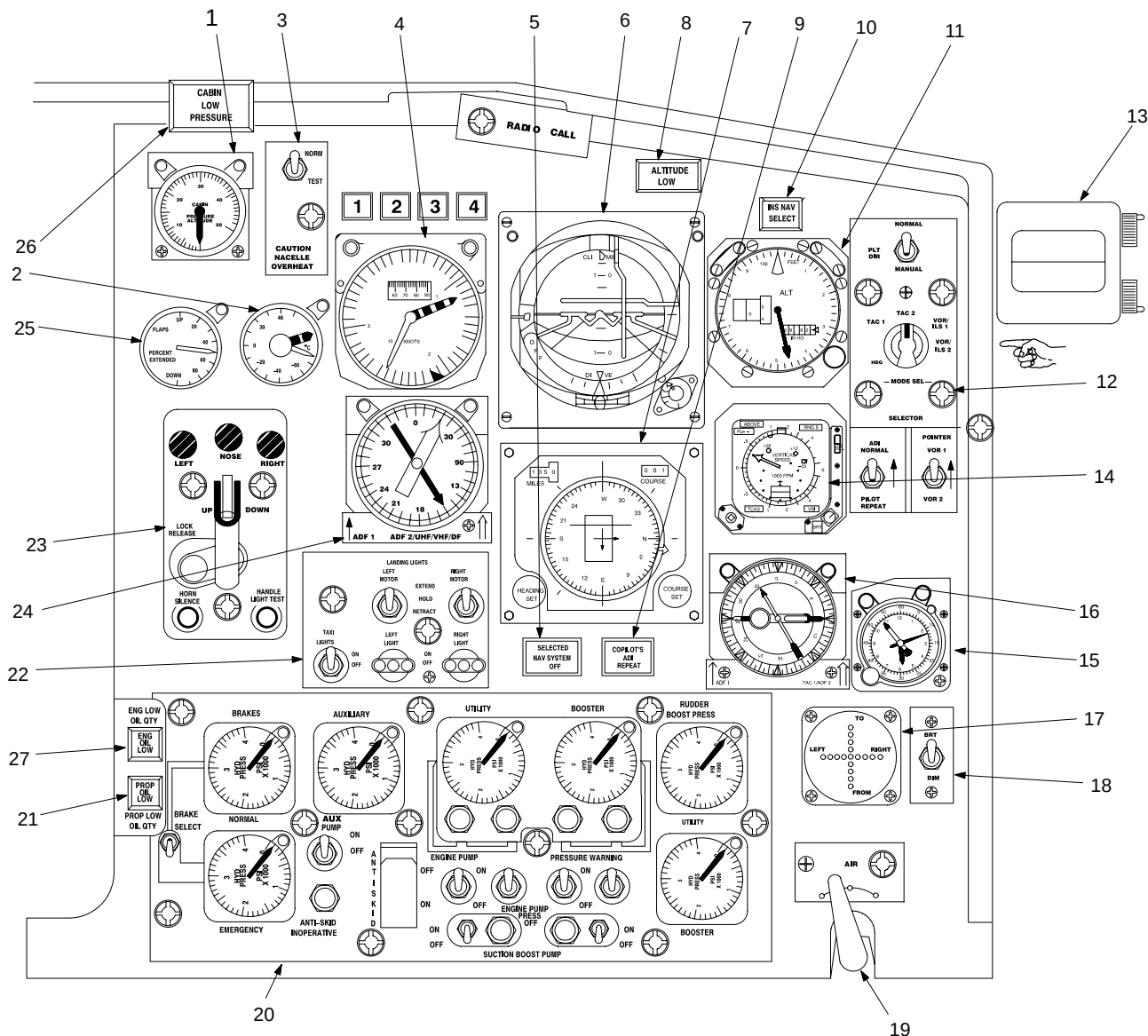
Figure 1A-5

Instrument Panel (CGNR 1503, 1504)



1. MAGNETIC COMPASS	16. MARKER BEACON CONTROL PANEL
2. ACCELEROMETER	17. WEATHER RADAR INDICATOR
3. DOOR OPEN WARNING LIGHT	18. ELEVATOR TAB POSITION INDICATOR
4. INS WAYPOINT ALERT INDICATOR	19. AILERON TAB POSITION INDICATOR
5. INS ATTITUDE SELECTOR SWITCH	20. RUDDER TAB POSITION INDICATOR
6. ATTITUDE DIRECTOR INDICATOR	21. ELECTRONIC FUEL CORRECTION PANEL
7. HORIZONTAL SITUATION INDICATOR	22. AIR DIVERTER HANDLE
8. ALTITUDE LOW WARNING LIGHT	23. DELETED
9. BEAM COUPLER OFF LIGHT	24. AIRSPEED LIMITATION PLACARD
10. INS NAV SELECT SWITCH	25. AUTOPILOT OFF LIGHT
11. ALTIMETER-ENCODER	26. MAGNETIC COMPASS CORRECTION CARD HOLDER
12. MASTER FIRE WARNING LIGHT	27. BEARING-DISTANCE-HEADING INDICATOR
13. NAVIGATION SELECTOR PANEL	28. RADIO MAGNETIC INDICATOR
14. VSI - TA/RA DISPLAY	29. CLOCK
15. RADAR ALTIMETER	30. AIRSPEED INDICATOR

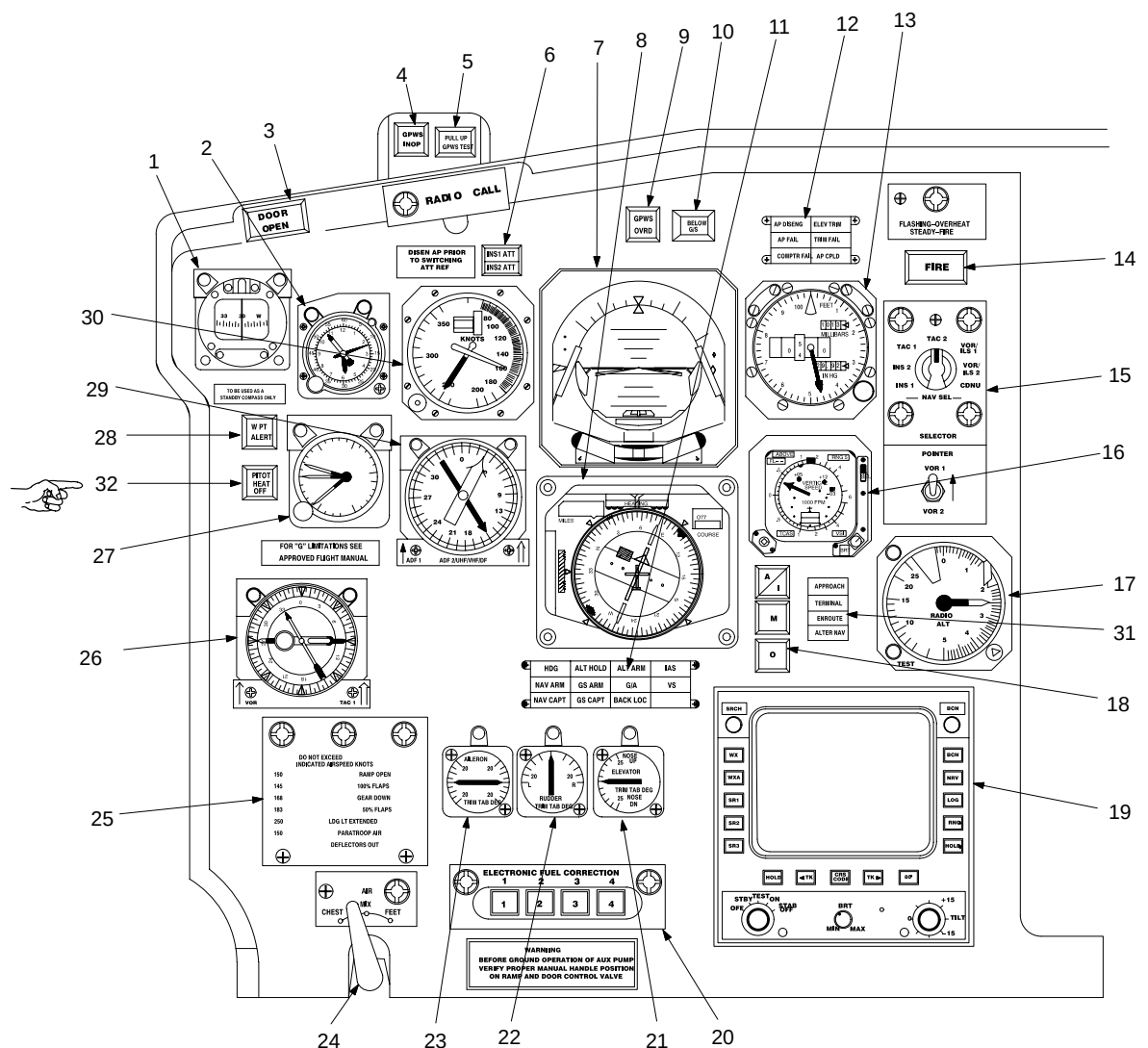
Figure 1A-6 (Sheet 1 of 2)



1. CABIN ALTIMETER	14. VSI-TA/RA DISPLAY
2. FREE AIR TEMPERATURE INDICATOR	15. CLOCK
3. NACELLE OVERHEAT WARNING	16. BEARING-DISTANCE-HEADING INDICATOR
4. AIRSPEED INDICATOR	17. HOMING SYSTEM SLAVE INDICATOR
5. SELECTED NAV SYSTEM OFF LIGHT	18. SLAVE INDICATOR BRIGHT/DIM SWITCH
6. ATTITUDE DIRECTOR INDICATOR	19. AIR DIVERTER HANDLE
7. HORIZONTAL SITUATION INDICATOR	20. HYDRAULIC CONTROL PANEL
8. ALTITUDE LOW WARNING LIGHT	21. PROP LOW OIL QUANTITY MASTER WARNING LIGHT
9. COPILOT'S ADI REPEAT LIGHT	22. LANDING AND TAXI LIGHTS CONTROL PANEL
10. INS NAV SELECT SWITCH	23. LANDING GEAR CONTROL PANEL
11. ALTIMETER	24. RADIO MAGNETIC INDICATOR
12. NAVIGATION SELECTOR PANEL	25. WING FLAP POSITION INDICATOR
13. SCROLL CHECKLIST	26. CABIN LOW PRESSURE WARNING LIGHT
	27. ENG LOW OIL QUANTITY MASTER WARNING LIGHT

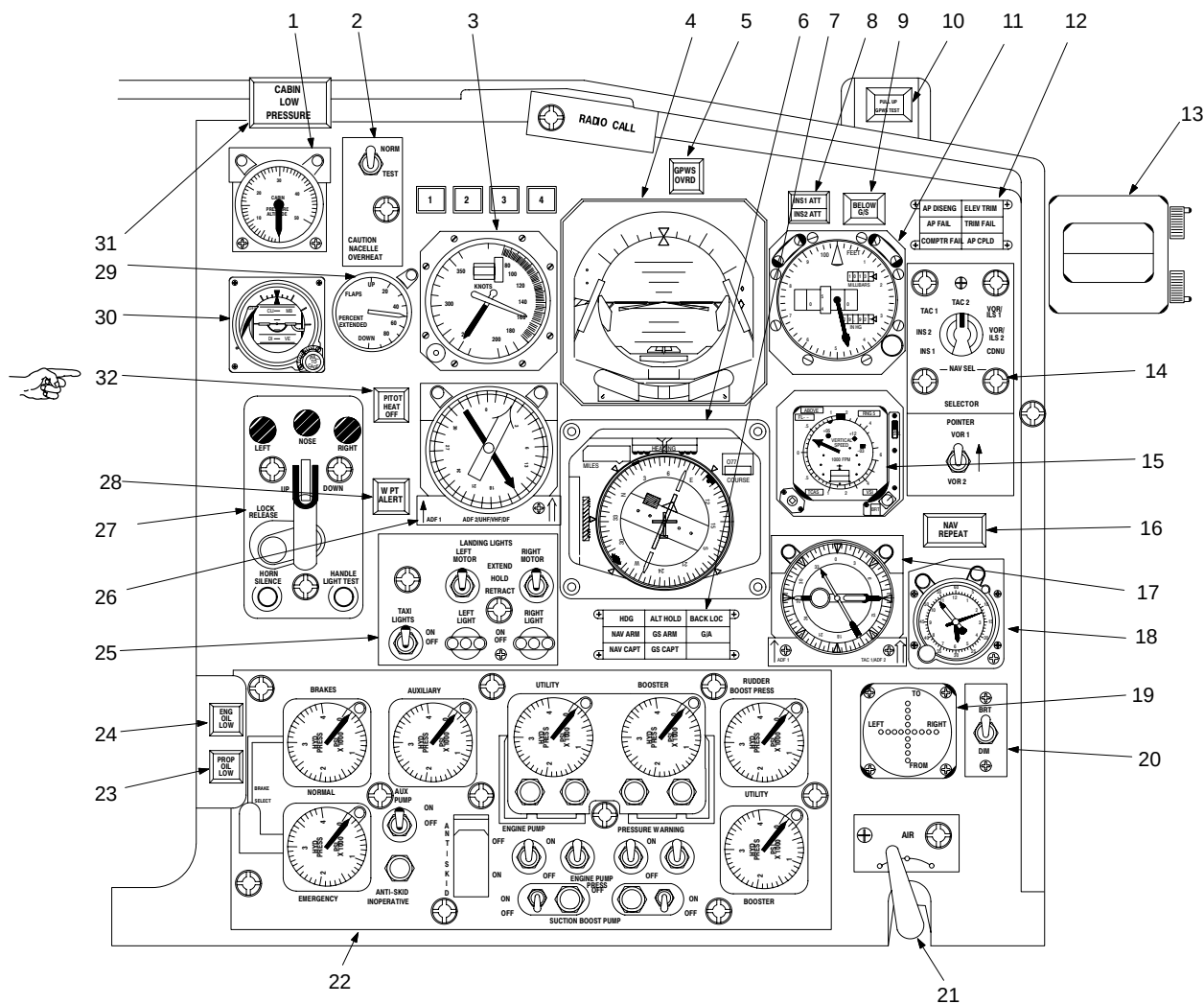
Figure 1A-6 (Sheet 2 of 2)

Instrument Panel (Typical)



1. MAGNETIC COMPASS	17. RADIO ALTIMETER
2. CLOCK	18. MARKER BEACON INDICATOR
3. DOOR OPEN WARN LIGHT	19. WEATHER RADAR INDICATOR
4. GPWS INOP ANN	20. ELECTRONIC FUEL CORRECTION PANEL
5. GPWS PULL UP ANN	21. ELEV TAB POSITION INDICATOR
6. ATT SEL SW AND IND LIGHT	22. RUD TAB POSITION INDICATOR
7. ATT DIRECTOR INDICATOR	23. AILERON TAB POSITION INDICATOR
8. HORIZONTAL SITUATION IND	24. AIR DIVERTER HANDLE
9. GPWS OVERRIDE ANN	25. AIRSPEED LIMITATION PLACARD
10. GPWS BELOW GS ANN	26. BEARING-DISTANCE-HEADING INDICATOR
11. FCS MODE ANN LIGHT PANEL	27. ACCELEROMETER
12. FCS WARN OR ADVISORY ANN LIGHT PANEL	28. WAY POINT ALERT INDICATOR
13. ALTIMETER-ENCODER	29. RADIO MAGNETIC INDICATOR
14. MASTER FIRE WARN LIGHT	30. AIRSPEED INDICATOR
15. NAV SEL CONTROL PANEL	31. GPS MODE ANNUNCIATOR PANEL
16. VERTICAL VELOCITY INDICATOR	32. PITOT HEAT OFF LIGHT (1717 AND UP)
- 

Figure 1A-7 (Sheet 1 of 2)



1. CABIN ALTIMETER	17. BEARING-DISTANCE-HEADING INDICATOR
2. NACELLE OVERHEAT WARN	18. CLOCK
3. AIRSPEED INDICATOR	19. HOMING SYSTEM SLAVE INDICATOR
4. ATT DIRECTOR INDICATOR	20. SLAVE INDICATOR BRIGHT/DIM SWITCH
5. GPWS OVERRIDE ANN	21. AIR DIVERTER HANDLE
6. HORIZONTAL SITUATION IND	22. HYDRAULIC CONTROL PANEL
7. FCS MODE ANN LIGHT PANEL	23. PROP LOW OIL QTY MASTER WARN LIGHT
8. ATT SEL SW AND IND LIGHT	24. ENG LOW OIL QTY WARN LIGHT
9. GPWS BELOW GS ANN	25. LANDING AND TAXI LIGHTS CONTROL PANEL
10. GPWS PULL UP ANN	26. RADIO MAGNETIC INDICATOR
11. ALTIMETER	27. LANDING GEAR CONTROL PANEL
12. FCS WARN OR ADVISORY ANN LIGHT PANEL	28. WAYPOINT ALERT INDICATOR
13. SCROLL CHECKLIST HOLDER	29. WING FLAP POSITION INDICATOR
14. NAV SEL CONTROL PANEL	30. STANDBY ATTITUDE INDICATOR
15. VERTICAL VELOCITY INDICATOR	31. CABIN LOW PRESSURE LIGHT
16. NAV REPEAT LIGHT	32. PITOT HEAT OFF LIGHT (1717 AND UP)

Figure 1A-7 (Sheet 2 of 2)

Flight Control Pedestal (1500 Series without CDNU Modification)

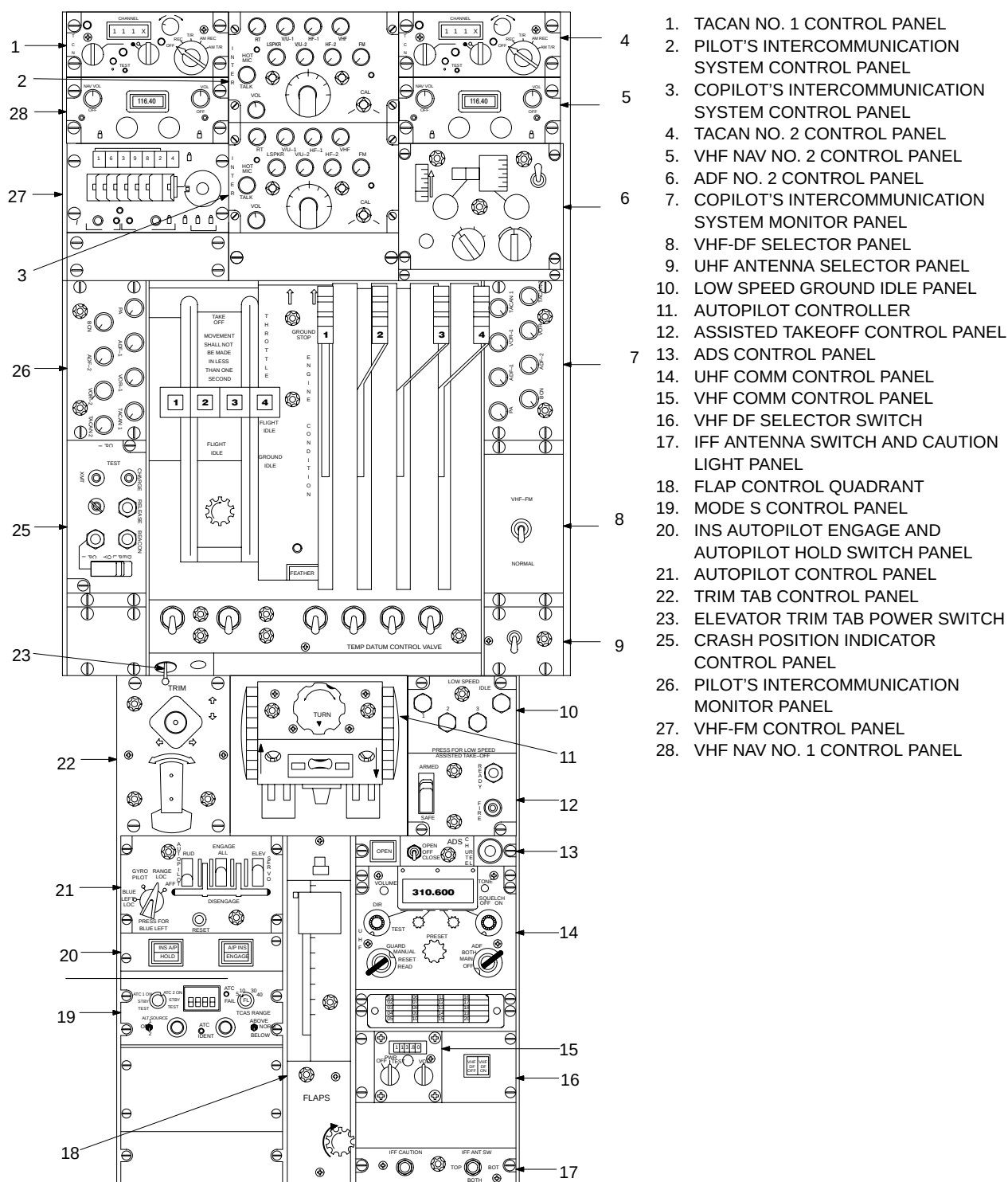
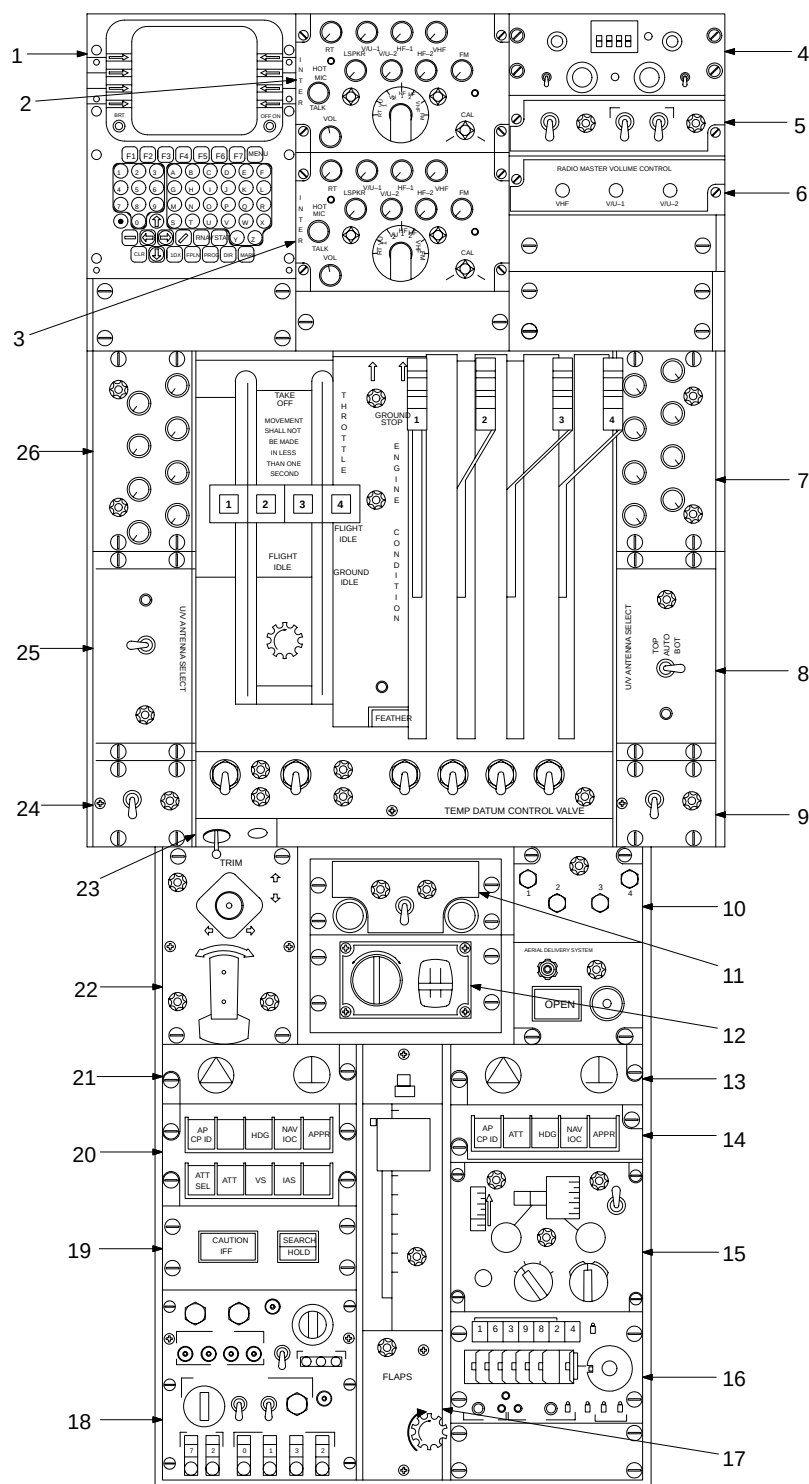


Figure 1A-8

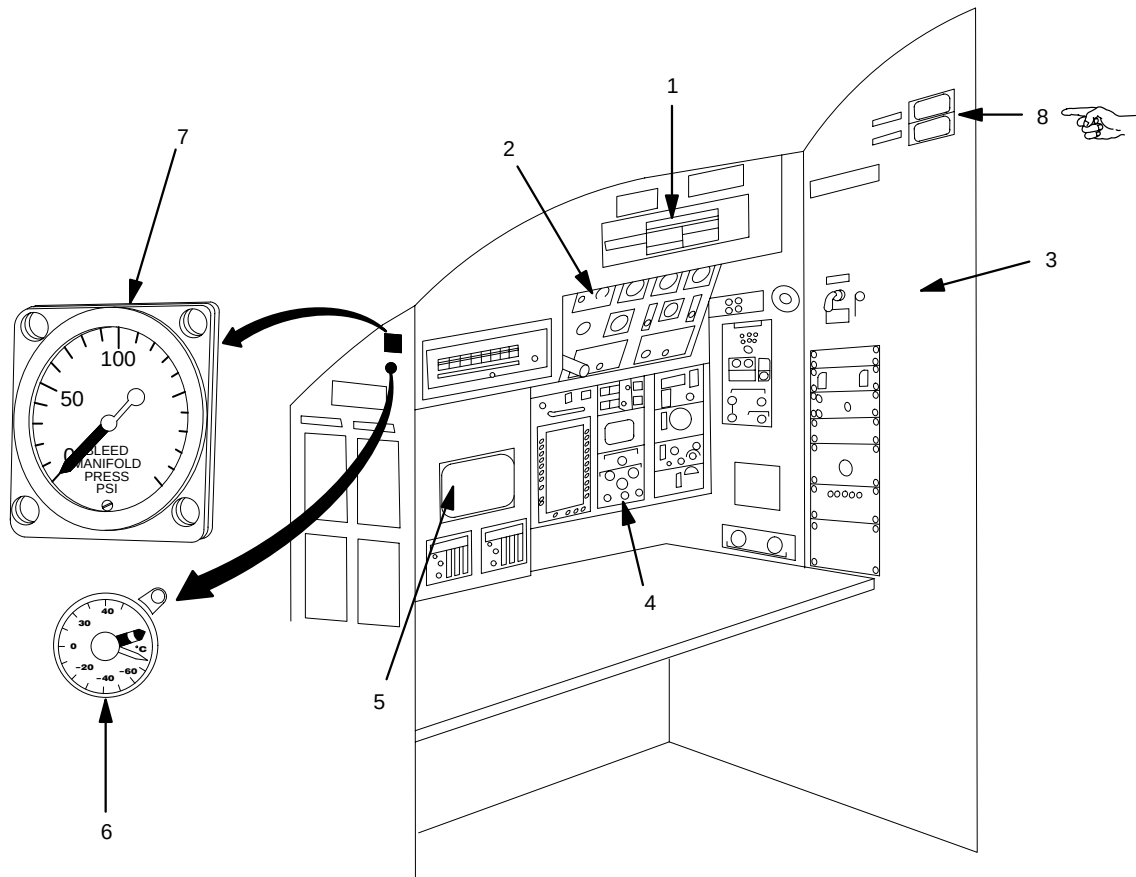
Flight Control Pedestal (Typical)



1. CONTROL DISPLAY NAVIGATION UNIT (CDNU) (PILOT'S)
2. PILOT'S INTERCOMMUNICATION CONTROL PANEL
3. COPILOT'S INTERCOMMUNICATION CONTROL PANEL
4. TCAS/MODE S CONTROL PANEL
5. EMERGENCY RADIO SELECT PANEL
6. RADIO MASTER VOLUME CONTROL PANEL
7. COPILOT'S INTERCOMMUNICATION MONITOR PANEL
8. NO. 2 U/V ANTENNA SELECT CONTROL PANEL
9. VHF/DF SELECTOR CONTROL PANEL
10. LOW SPEED GROUND IDLE AND ADS CONTROL PANEL
11. FCS ANNUNCIATOR LIGHTS CONTROL PANEL
12. AUTOPILOT CONTROLLER
13. FCS NO. 2 REMOTE HEADING AND COURSE SELECTOR
14. FCS NO. 2 MODE SELECTOR PANEL
15. ADF NO. 2 CONTROL PANEL
16. VHF-FM RADIO CONTROL PANEL
17. FLAP CONTROL QUADRANT
18. IFF TRANSPONDER CONTROL PANEL
19. INS SEARCH HOLD AND CAUTION IFF PANEL
20. FCS NO. 1 MODE SELECTOR PANEL
21. FCS NO. 1 REMOTE HEADING AND COURSE SELECTOR
22. TRIM TAB CONTROL PANEL
23. ELEVATOR TRIM TAB POWER SELECTOR PANEL
24. VHF/DF SELECTOR CONTROL PANEL
25. NO. 1 U/V ANTENNA SELECT CONTROL PANEL
26. PILOT'S INTERCOMMUNICATION MONITOR PANEL

Figure 1A-9

Navigator's Station (Typical)



1. ELECTRICAL SPARES STORAGE
2. INSTRUMENT PANEL
3. CONSOLE
4. CONTROL PANEL
5. RADAR INDICATOR
6. FREE AIR TEMPERATURE INDICATOR
7. BLEED AIR MANFOLD PRESSURE INDICATOR
8. REMOTE COMPENSATORS (SINGLE LN-100 ONLY)



Figure 1A-10

Navigator's Instrument Panel

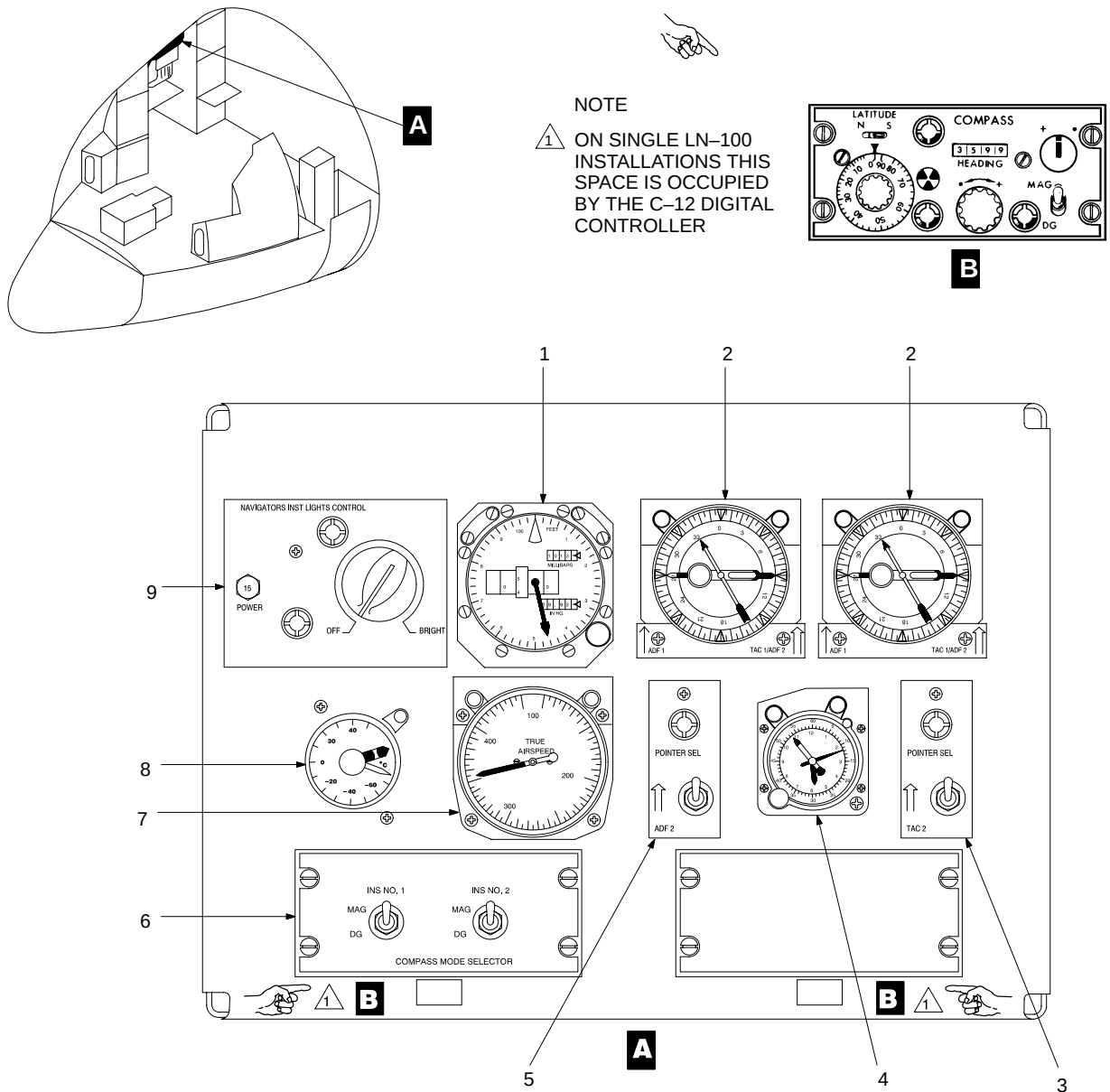
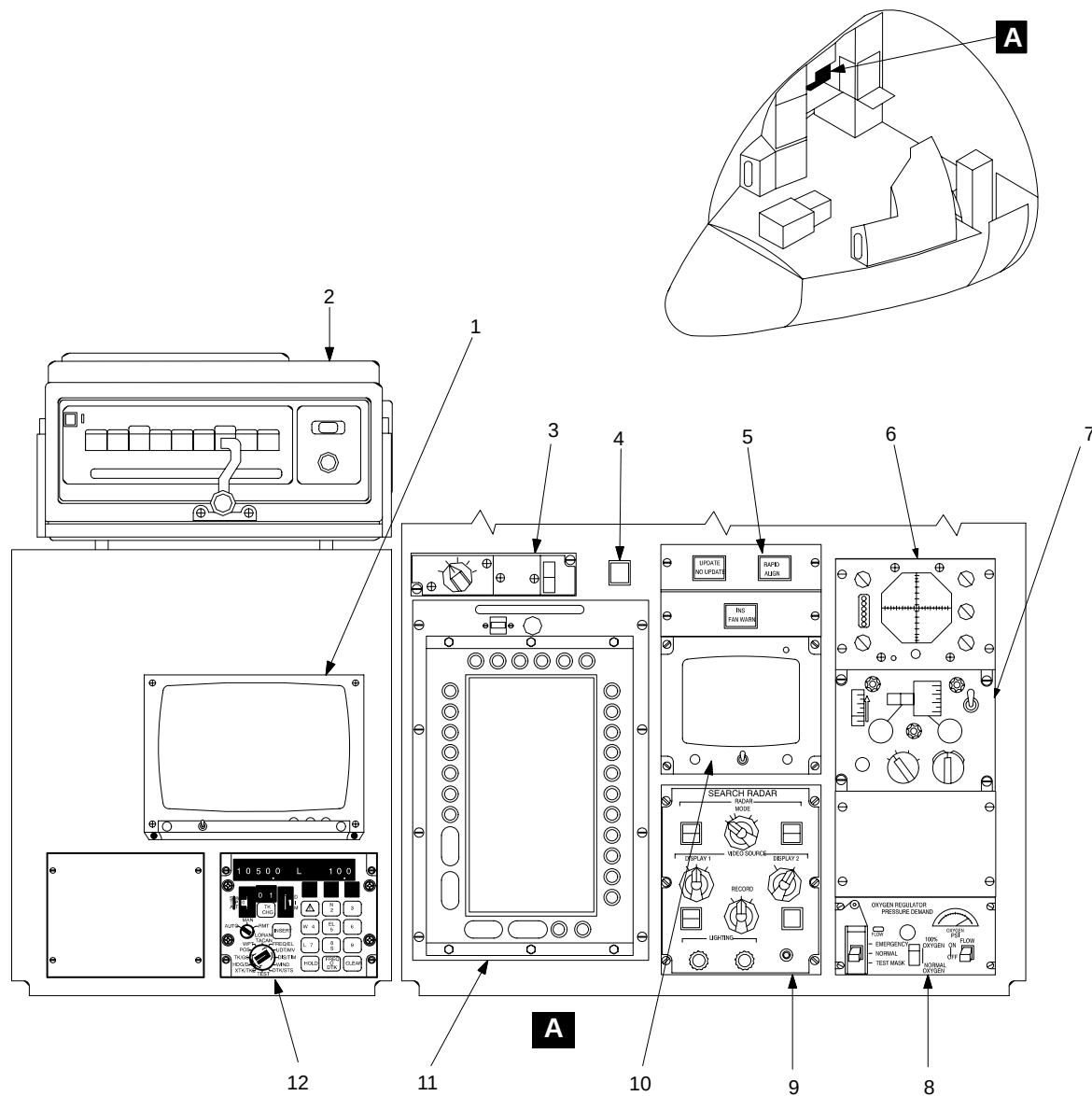


Figure 1A-11

Navigator's Control Panel (1500 Series without CDNU Modification)



1. SEA SEARCH RADAR (INDICATOR)	7. ADF NO. 1 CONTROL PANEL
2. AIRBORNE VIDEO CASSETTE TAPE RECORDER	8. OXYGEN REGULATOR
3. INS NO. 1 MODE SELECTOR UNIT	9. REMOTE SEA SEARCH RADAR CONTROL
4. RADAR FAN WARNING LIGHT	10. SEA SEARCH RADAR B-SCAN DISPLAY
5. INS RAPID/UPDATE/FAN WARNING PANEL	11. SEA SEARCH RADAR CONTROL INDICATOR
6. ANS-4 RECEIVER/CONTROL	12. INS NO. 1 CONTROL DISPLAY UNIT

Figure 1A-12

Navigator's Control Panel (Typical)

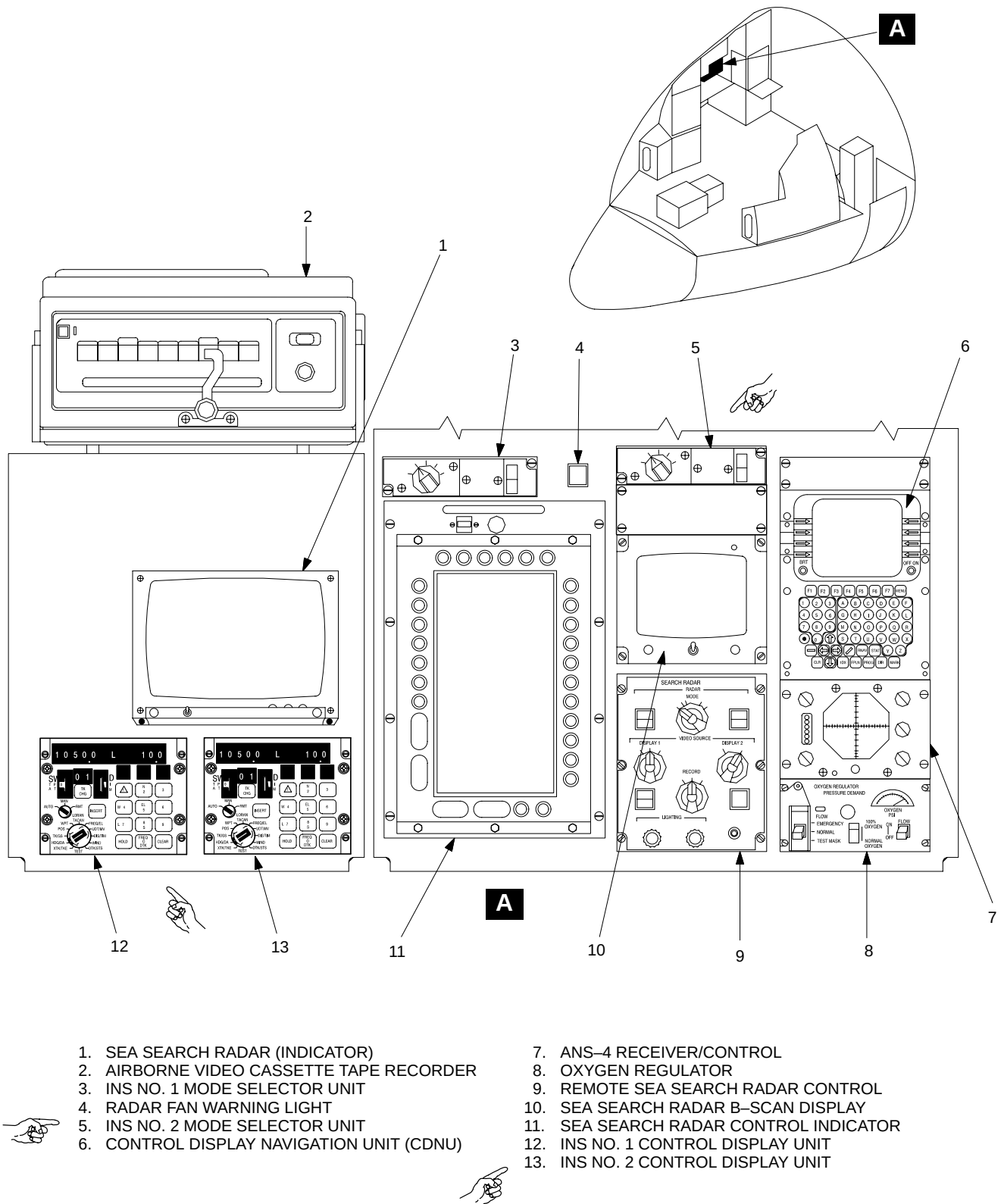


Figure 1A-13

Navigator's Console (CGNR 1503, 1504)

1. C-12 COMPASS NO. 1 REMOTE COMPENSATOR
2. C-12 COMPASS NO. 2 REMOTE COMPENSATOR
3. CFA OVERRIDE PANEL
4. SEA SEARCH RADAR COOLING FAN CONTROL PANEL
5. VHF WFS-210 RECEIVER CONTROL
6. NAVIGATOR'S ICS MONITOR PANEL
7. NAVIGATOR'S ICS CONTROL PANEL
8. PUBLIC ADDRESS SYSTEM CONTROL PANEL
9. NAVIGATOR'S LIGHTING CONTROL
10. ICS DISCONNECT RECEPTACLE
11. COMPASS CORRECTION CARD HOLDER
12. TEST EQUIPMENT CONNECTOR
13. SEA SEARCH RADAR VIDEO CONVERTER
14. NAVIGATOR'S FUNCTION CONTROL PANEL
15. BOTTOM STROBE LIGHT TEST SWITCH

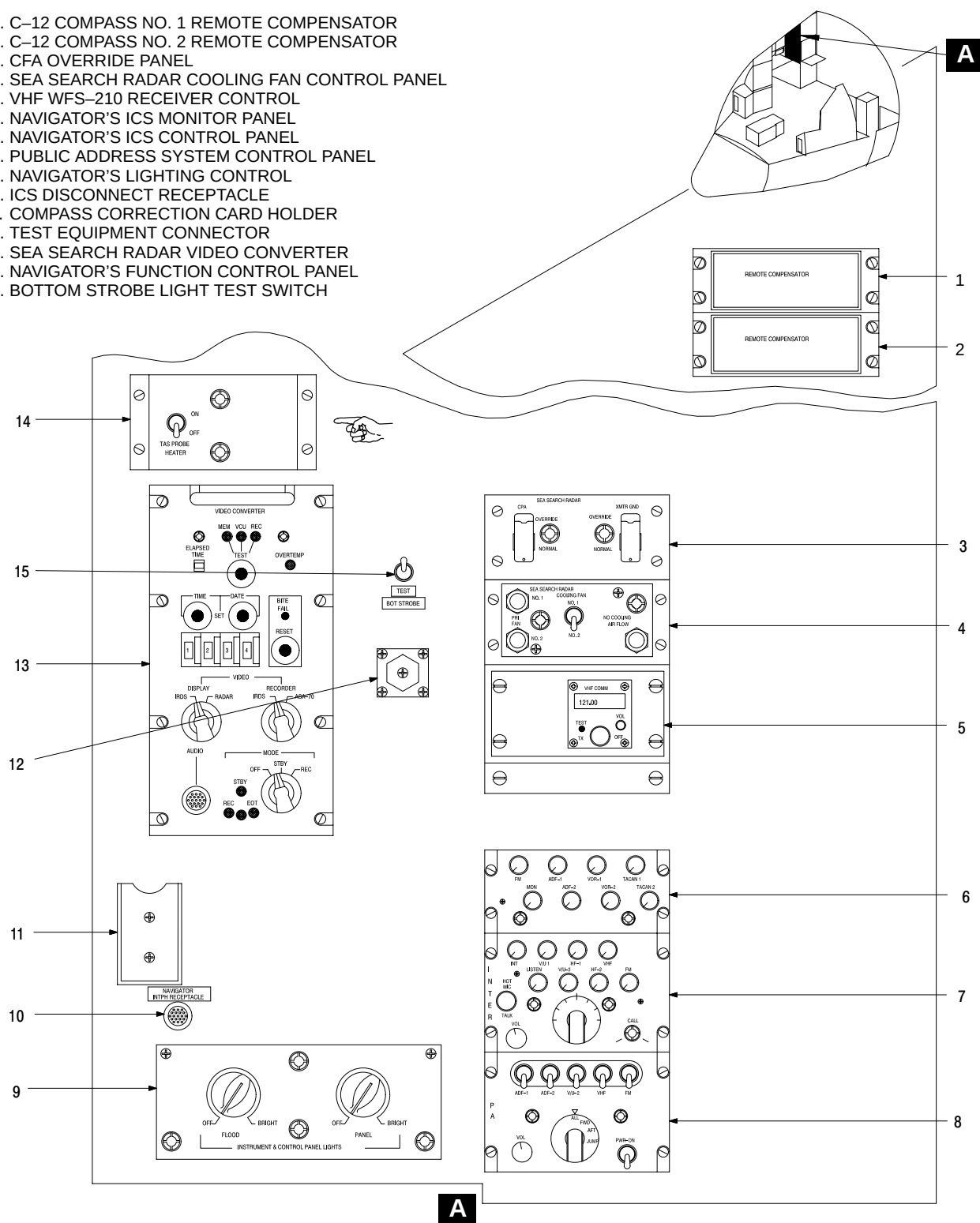


Figure 1A-14

Navigator's Console (Typical)

1. C-12 COMPASS NO. 1 REMOTE COMPENSATOR
2. C-12 COMPASS NO. 2 REMOTE COMPENSATOR
3. PUBLIC ADDRESS SYSTEM CONTROL PANEL
4. DIGITAL TRANSFER DEVICE
5. GPS FILL PANEL
6. SEA SEARCH RADAR COOLING FAN CONTROL PANEL
7. CFA OVERRIDE PANEL
8. NAVIGATOR'S ICS MONITOR PANEL
9. NAVIGATOR'S ICS CONTROL PANEL
10. ADF NO. 1 CONTROL PANEL
11. NAVIGATOR'S LIGHTING CONTROL
12. ICS DISCONNECT RECEPTACLE
13. COMPASS CORRECTION CARD HOLDER
14. TEST EQUIPMENT CONNECTOR
15. SEA SEARCH RADAR VIDEO CONVERTER
16. NAVIGATOR'S FUNCTION CONTROL PANEL
17. COCKPIT VOICE RECORDER CONTROL UNIT
18. COCKPIT VOICE RECORDER TEST SWITCH
19. BOTTOM STROBE LIGHT TEST SWITCH

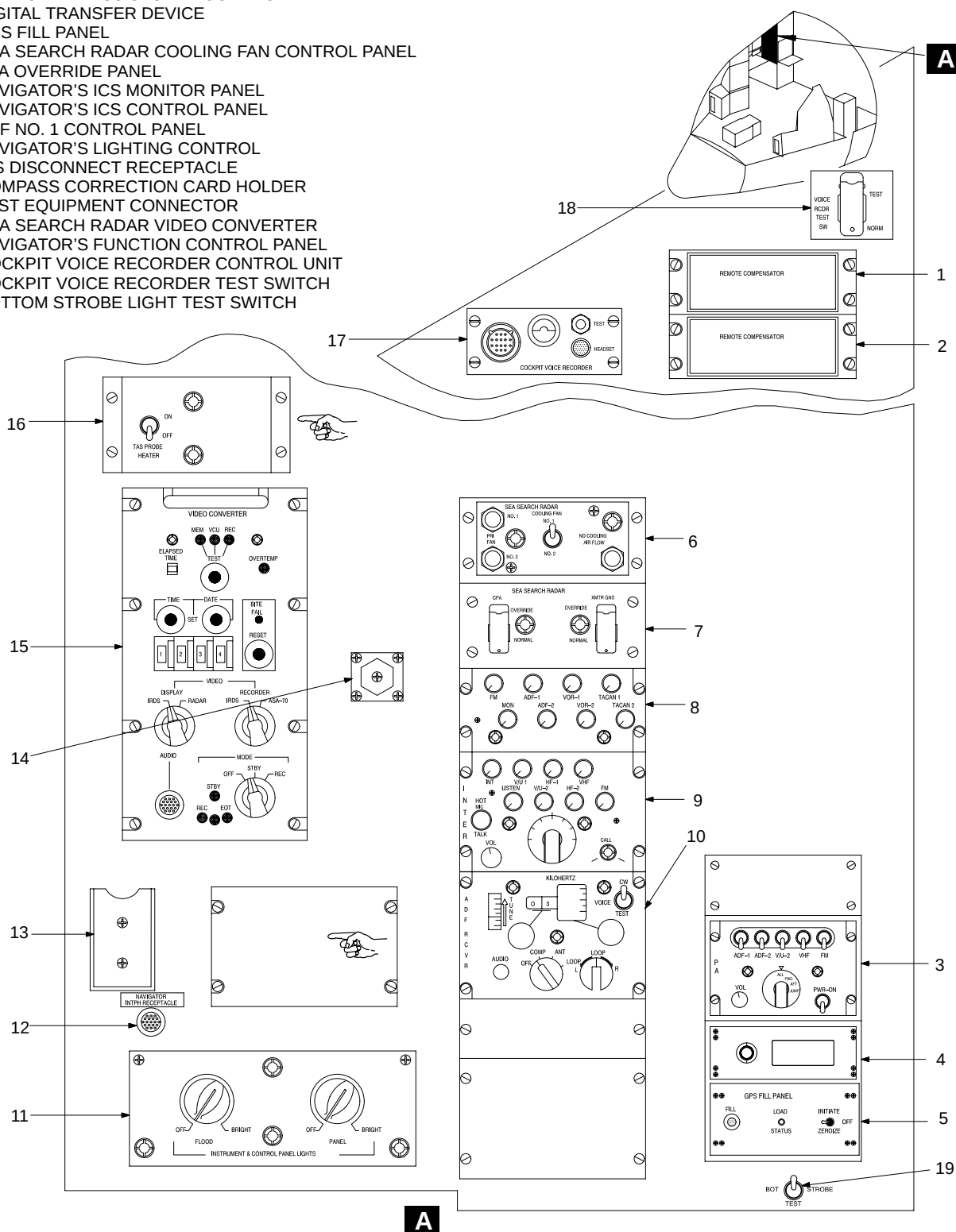
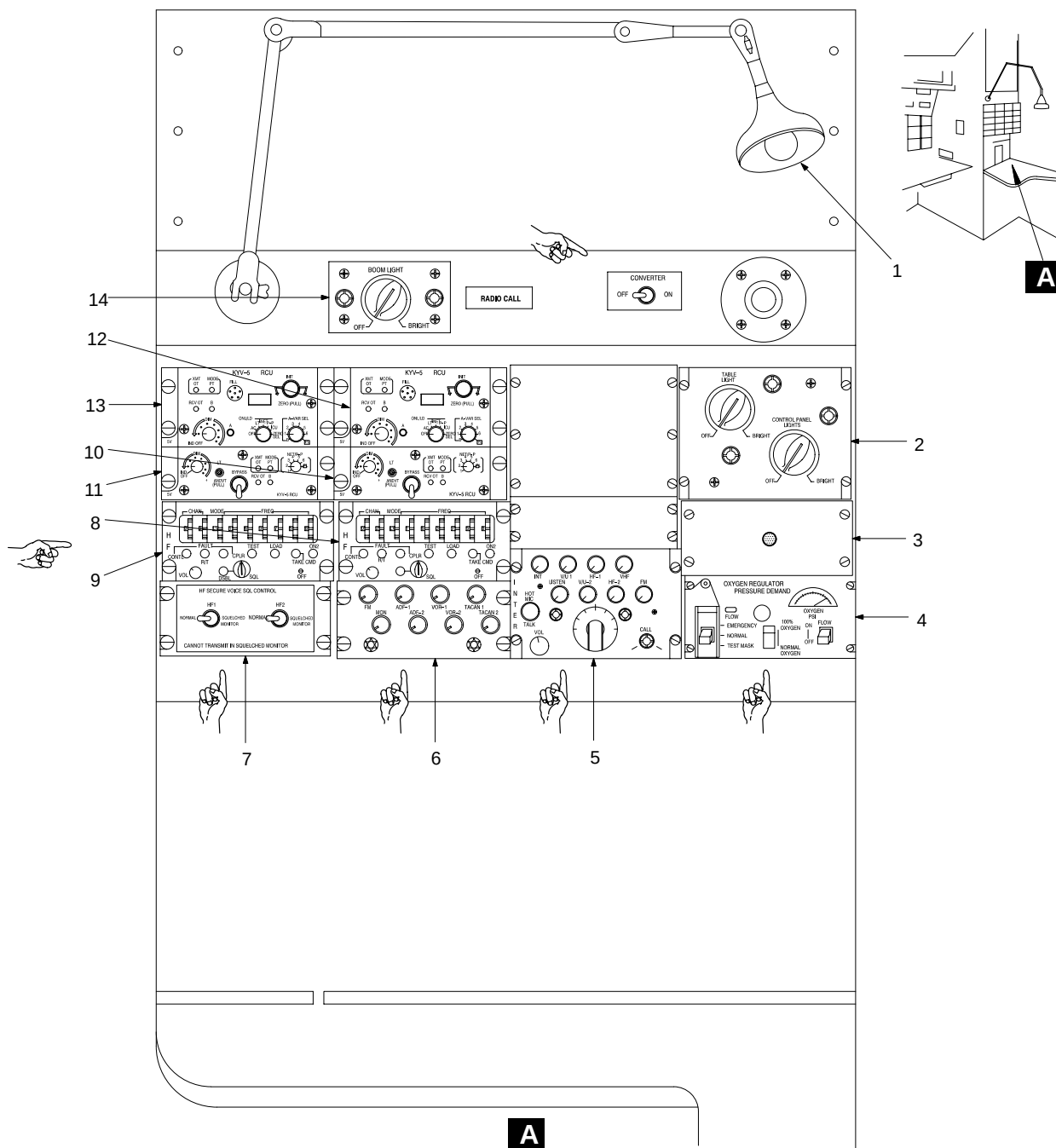


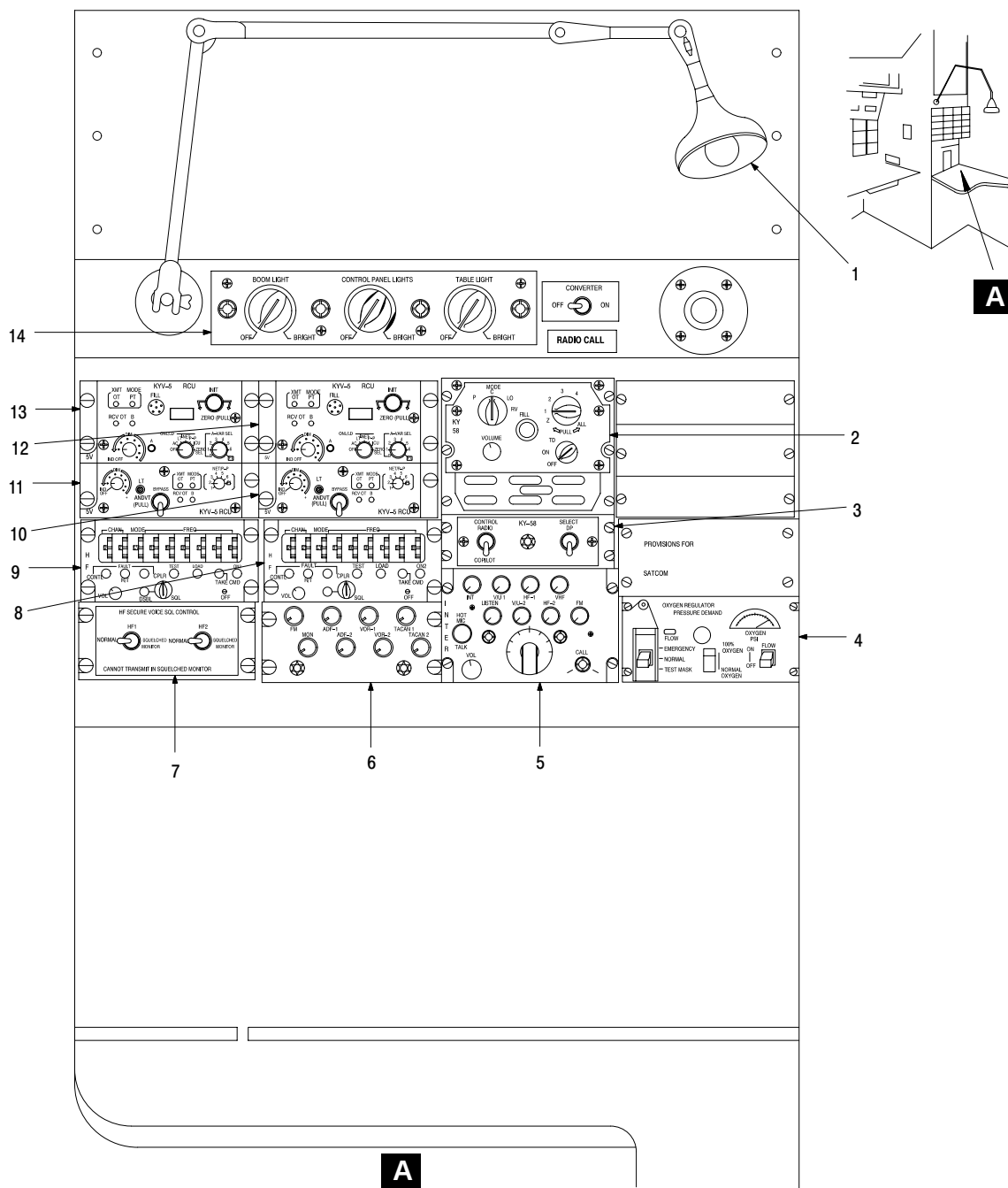
Figure 1A-15

Radio Operator's Station (1500 Series)



1. BOOM LIGHT	8. HF COMMUNICATION NO. 2 CONTROL PANEL
2. LIGHTING CONTROL PANEL	9. HF COMMUNICATION NO. 1 CONTROL PANEL
3. ICS DISCONNECT RECEPTACLE	10. SECURE VOICE NO. 2 REMOTE CONTROL UNIT IIB
4. OXYGEN REGULATOR	11. SECURE VOICE NO. 1 REMOTE CONTROL UNIT IIB
5. INTERCOMMUNICATION CONTROL PANEL	12. SECURE VOICE NO. 2 REMOTE CONTROL UNIT IIA
6. INTERCOMMUNICATION MONITOR PANEL	13. SECURE VOICE NO. 1 REMOTE CONTROL UNIT IIA
7. HF SECURE SQUELCH PANEL	14. BOOM LIGHT CONTROL

Figure 1A-16

Radio Operator's Station (Typical) 

1. BOOM LIGHT	8. HF COMMUNICATION NO. 2 CONTROL PANEL
2. KY-58 UHF PROCESSOR	9. HF COMMUNICATION NO. 1 CONTROL PANEL
3. KY-58 CONTROL AND DP-BB SELECT PANEL	10. SECURE VOICE NO. 2 REMOTE CONTROL UNIT IIB
4. OXYGEN REGULATOR	11. SECURE VOICE NO. 1 REMOTE CONTROL UNIT IIB
5. INTERCOMMUNICATION CONTROL PANEL	12. SECURE VOICE NO. 2 REMOTE CONTROL UNIT IIA
6. INTERCOMMUNICATION MONITOR PANEL	13. SECURE VOICE NO. 1 REMOTE CONTROL UNIT IIA
7. IIF SECURE VOICE SQUELCH CONTROL	14. LIGHTING CONTROL PANEL

Figure 1A-17

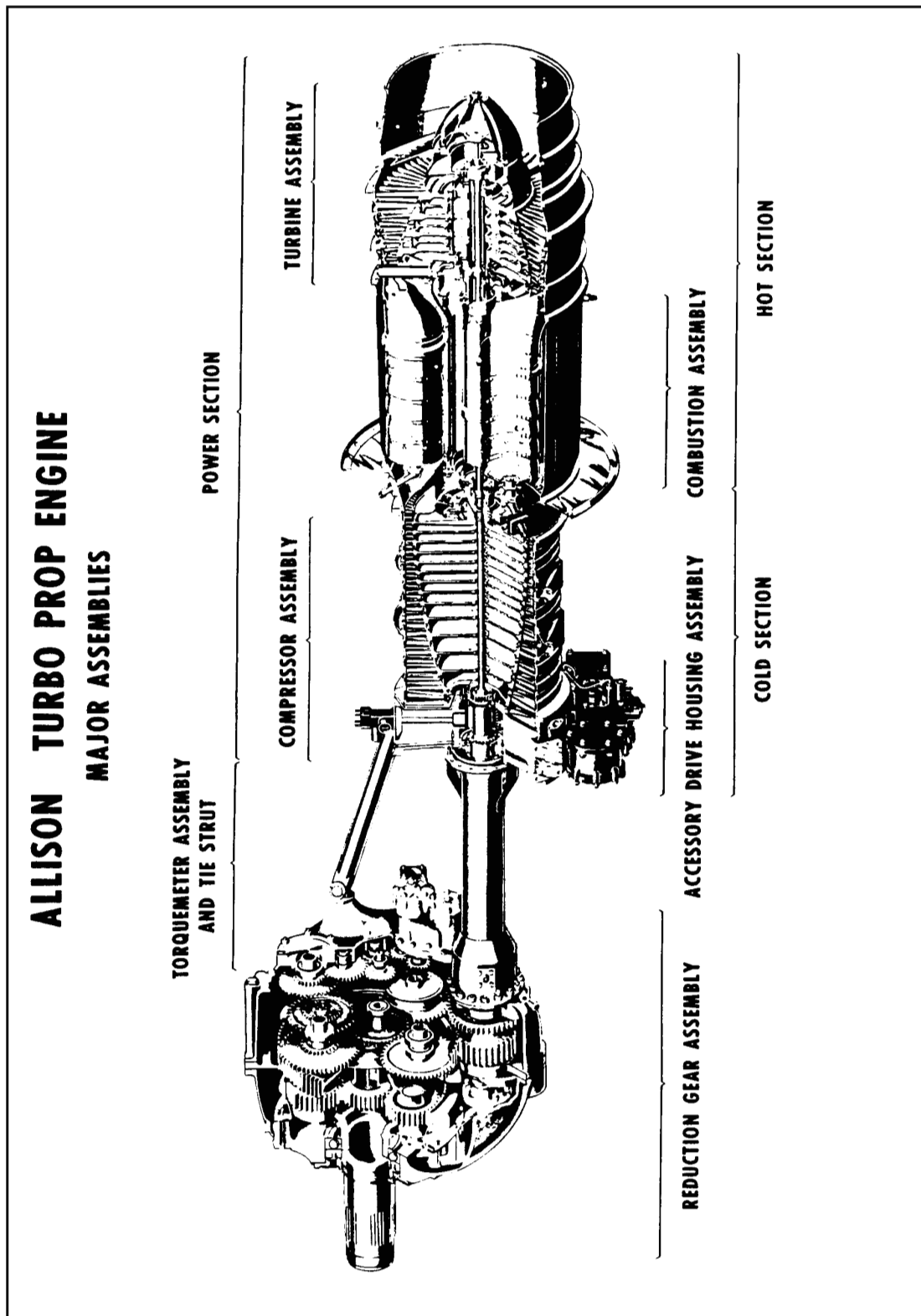


Figure 1A-18

ENGINES

The airplane is powered by four T56-A-15 engines. The static, standard day, sea level, takeoff rating of the engine at 100 percent rpm (13,820) is 4,910 propeller SHP for T56-A-15 engines. The maximum allowable torque meter indicated power is 19,600 inch-pounds. This is equivalent to 4,200 SHP plus 100 SHP allowance for gearbox accessory losses, or a total of 4,300 SHP.

POWER SECTION

The power section (figure 1A-18) of the engine has a single-entry, 14 stage axial flow compressor; a set of six combustion chambers of the through-flow type; and a four stage turbine. Mounted on the power section are an accessories drive assembly and components of the engine fuel, ignition, and control systems. Acceleration bleed valves are installed at the 5th and 10th compressor stages. A manifold at the diffuser bleeds air from the compressor for airplane pneumatic systems. Anti-icing systems prevent accumulation of ice in the engine inlet air duct and the oil cooler scoop. Inlet air enters the compressor and is progressively compressed through the 14 stages of the compressor. The compressed air (at approximately 125 psi, 315 °C (600 °F)) flows through a diffuser into the combustion section. Fuel flows into the combustion chambers and burns, increasing the temperature and thereby the energy of the gases. The gases pass through the turbine, causing it to rotate and drive the compressor, propeller, and accessories. The gases, after expanding through the turbine, flow out a tailpipe.

EXTENSION SHAFT ASSEMBLY

The extension shaft assembly consists of two concentric shafts and torque meter components. The inner shaft transmits power from the power section to the reduction gear. The outer shaft serves as a reference so the torsional deflection of the loaded inner shaft can be detected by the magnetic pickups of the torque indicating system.

REDUCTION GEAR ASSEMBLY

A reduction gear is used because the turning speed of the power unit is too high for use with a propeller. The reduction gear assembly contains a reduction gear train, a propeller brake, an engine negative torque control system, and a safety coupling. Mounted on the accessory drive pads are the engine starter, an ac generator, a hydraulic pump, an oil pump, and a tachometer generator (two pads). The reduction gear has an independent drysump oil system supplied from the engine oil tank. The reduction gear train is in two stages, providing an overall reduction of 13.54 to 1 between engine speed (13,820 rpm) and propeller shaft speed (1,021 rpm).

Propeller Brake

The cone-type propeller brake acts on the first stage of reduction gearing. During engine operation, it is held disengaged by gearbox oil pressure when rpm exceeds 23 percent, and is engaged below this speed. As engine speed is reduced and oil pressure drops, the braking surfaces are brought into contact by spring force to help slow the propeller to a stop. Helical splines are provided between the starter shaft and the starter gear on the outer brake member, causing the brake to disengage when starting torque is applied during starting. The brake also engages to stop reverse rotation of the propeller.

Safety Coupling

The safety coupling is provided to decouple the power section from the reduction gear if negative torque applied to the reduction gear exceeds approximately 6,000 inch-pounds, a value much higher than that required to operate the NTS system. Because of its higher setting, the safety coupling backs up the NTS system to reduce drag until the propeller can be feathered. The safety coupling connects the engine extension shaft to the pinion of the first stage of reduction gears. While disengaged, the two members are forced together by springs so that the teeth ratchet. The teeth can thus be damaged; therefore, the engine should not be continued in operation after a decoupling.

ENGINE FUEL AND CONTROL SYSTEM

In flight the engine operates at a constant speed which is maintained by the governing action of the propeller. Power changes are made by changing fuel flow and propeller blade angle rather than engine speed. An increase in fuel flow causes an increase in turbine inlet temperature and a corresponding increase in energy available at the turbine. The turbine absorbs more energy and transmits it to the propeller in the form of torque. The propeller, in order to maintain governing speed, increases blade angle to absorb the increased torque. Turbine inlet temperature is a very important factor in the control of the engine. It is directly related to fuel flow and consequently to power produced. It is also limited because of the strength and durability of the combustion and turbine section materials. The control system schedules fuel flow to produce specific turbine inlet temperatures and to limit those temperatures so that the temperature tolerances of combustion and turbine section materials are not exceeded. The fuel system (figures 1A-19, 1A-20) consists of fuel filters, a fuel pump, a hydromechanical fuel control in series with an electronic temperature datum control system, and six fuel nozzles. Operating with the fuel system is the ignition system, the starting fuel enrichment system, the bleed air system, and the propeller. Changes in power settings are effected by the throttle, which is connected to the fuel control, and the propeller through a mechanical coordinator. During ground operation,

changes in throttle position mechanically affect both the fuel flow and the propeller blade angle. In flight, changes in throttle position mechanically affect fuel flow and the propeller governor regulates blade angle, maintaining constant engine speed. The hydromechanical fuel control, which is part of the basic fuel system, senses engine inlet air temperature and pressure, rpm, and throttle position and varies fuel flow accordingly. The electronic temperature datum (TD) control system senses turbine inlet temperature and throttle position and makes any necessary changes in the fuel flow from the fuel control before it reaches the fuel nozzles. The TD system compensates for minor variables not sensed by the hydromechanical fuel control and for mechanical tolerances within the fuel control itself. By means of switches the TD system can be turned off or locked and the engine will operate on the basic hydromechanical system alone. With the TD system in AUTO, temperature protection is provided through the entire throttle range, and automatic temperature scheduling is provided when the throttle is in the range of 65 to 90 degrees. When the TD system is in NULL, the automatic functions of temperature limiting and temperature scheduling must be accomplished manually by adjustment of the throttle.

Throttle, Coordinator, and Propeller Control Linkage

The coordinator is a mechanical discriminating device which coordinates the throttle, the propeller, the fuel control, and the electronic temperature datum (TD) system. Movements of the throttle are transmitted to the coordinator by cables and, in turn, to the fuel control and the propeller by a series of levers and rods. A potentiometer in the coordinator provides signals to the TD system. Propeller blade angle is scheduled by throttle position from MAXIMUM REVERSE to FLIGHT IDLE (Beta). For throttle settings (figure 1A-21) between FLIGHT IDLE and TAKEOFF (Alpha), the propeller is governing. Throttle movement in this range serves primarily to change fuel flow.

Hydromechanical Fuel Control and Fuel Nozzles

28V	ISOL DC	P Side
TOUCHDOWN RELAY		
28V	ESS DC	CP Side
IGNITION CONTROL		

The engine speed function of the fuel control maintains engine speed in the taxi range and limits engine speed in the flight range if the propeller governor fails. Governor action is controlled by flyweights that respond to engine rpm. The control will start to reduce fuel to the engine at approximately 103.5 percent rpm. Fuel metered by the control is equal to engine requirements plus an additional 20 percent, which is for

the use of the temperature datum valve, a part of the TD system.

Electronic Temperature Datum Control System

28V	ESS DC	CP Side
ENG FUEL CONT		
115V	AC INST & ENG	P Side
SINGLE FUEL CONT		
FUEL AND TEMPERATURE CONTROL		

Engine Fuel Control

The temperature datum control, together with the coordinator potentiometer, temperature adjustment network, a turbine inlet temperature measurement system, and the temperature datum valve, make up the electronic temperature datum system. The system compensates for variations in fuel heat value and density, engines, and control system characteristics. The temperature datum control is furnished actual turbine inlet temperature signals from a set of thermocouples and desired turbine inlet temperature signals by the throttle through the coordinator potentiometer and the temperature adjustment network. The valve then reduces the fuel flow (up to 50 percent during starting, 20 percent above 94 percent rpm) to the nozzles by returning the excess to the fuel pump. When the turbine inlet temperature lowers to the desired level, the temperature datum control signals the valve to return to the null position.

Acceleration Bleed Air Valves

The bleed air valves on the fifth and tenth stages of the compressor are provided for compressor unloading during starting and while the engine is operating in the low-speed ground idle range. These bleed valves remain open only when engine speed is below 94 percent rpm. The fifth and tenth stage bleed air valves are automatic in operation and are actuated by 14th stage compressor air pressure through an engine-driven, speed-sensitive valve assembly.

Starting Fuel Enrichment System

28V	ESS DC	CP Side
IGNITION CONTROL		

The enrichment system consists of a bypass line in which is mounted a solenoid valve controlled by the speed-sensitive control and a pressure switch (50 psi). The valve is opened by the speed-sensitive control through the ignition relay when engine speed reaches 16 percent rpm during starting. While open, it allows pump discharge fuel to flow around the metering section of the fuel control to add to the metered flow from the fuel control. After fuel pressure in the manifold reaches approximately 50 psi, the manifold pressure switch opens to deenergize the valve, which then closes.

Engine Fuel Flow Engine Starting (Series Operation)

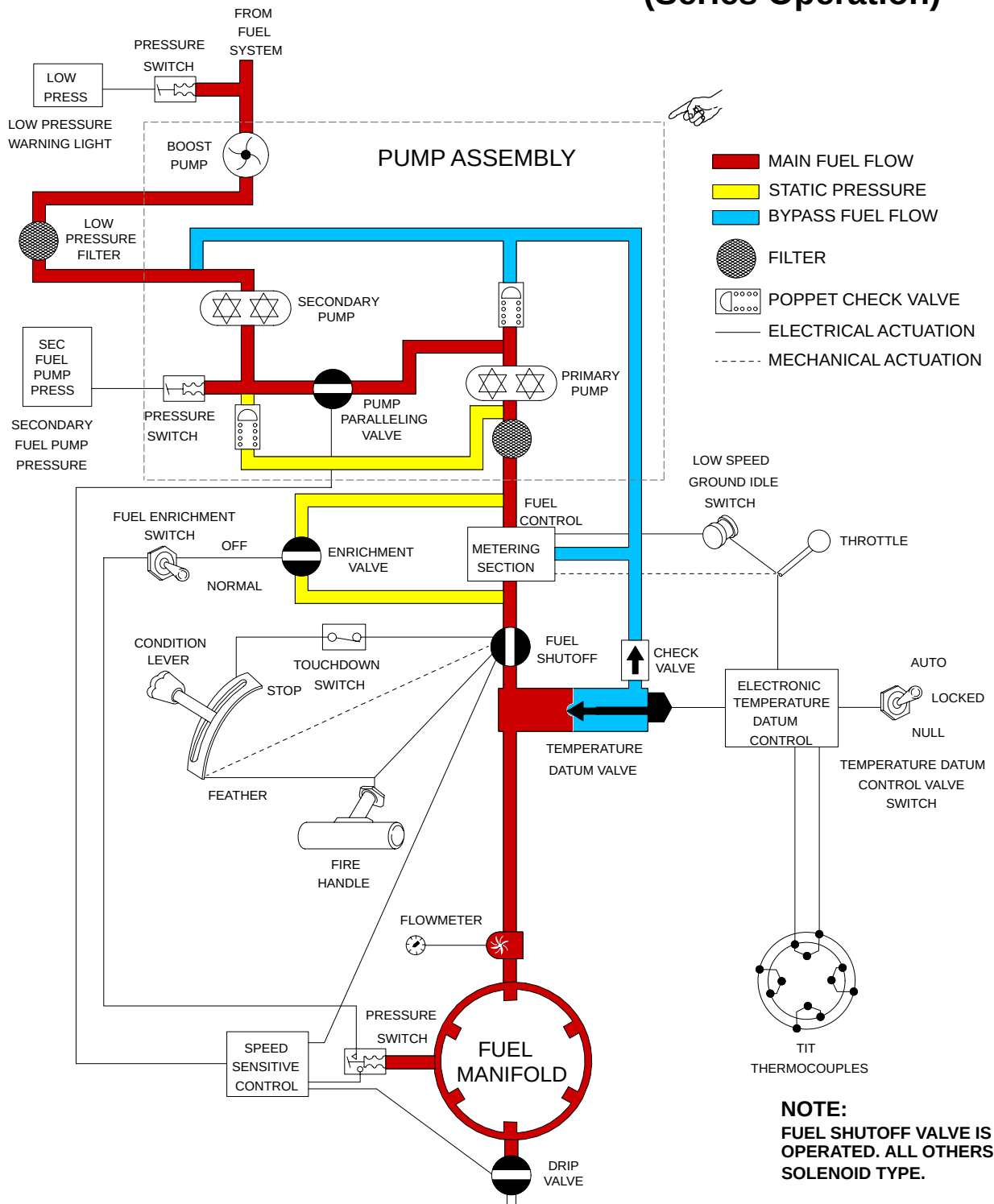


Figure 1A-19

Engine Fuel Flow Engine Starting (Parallel Operation)

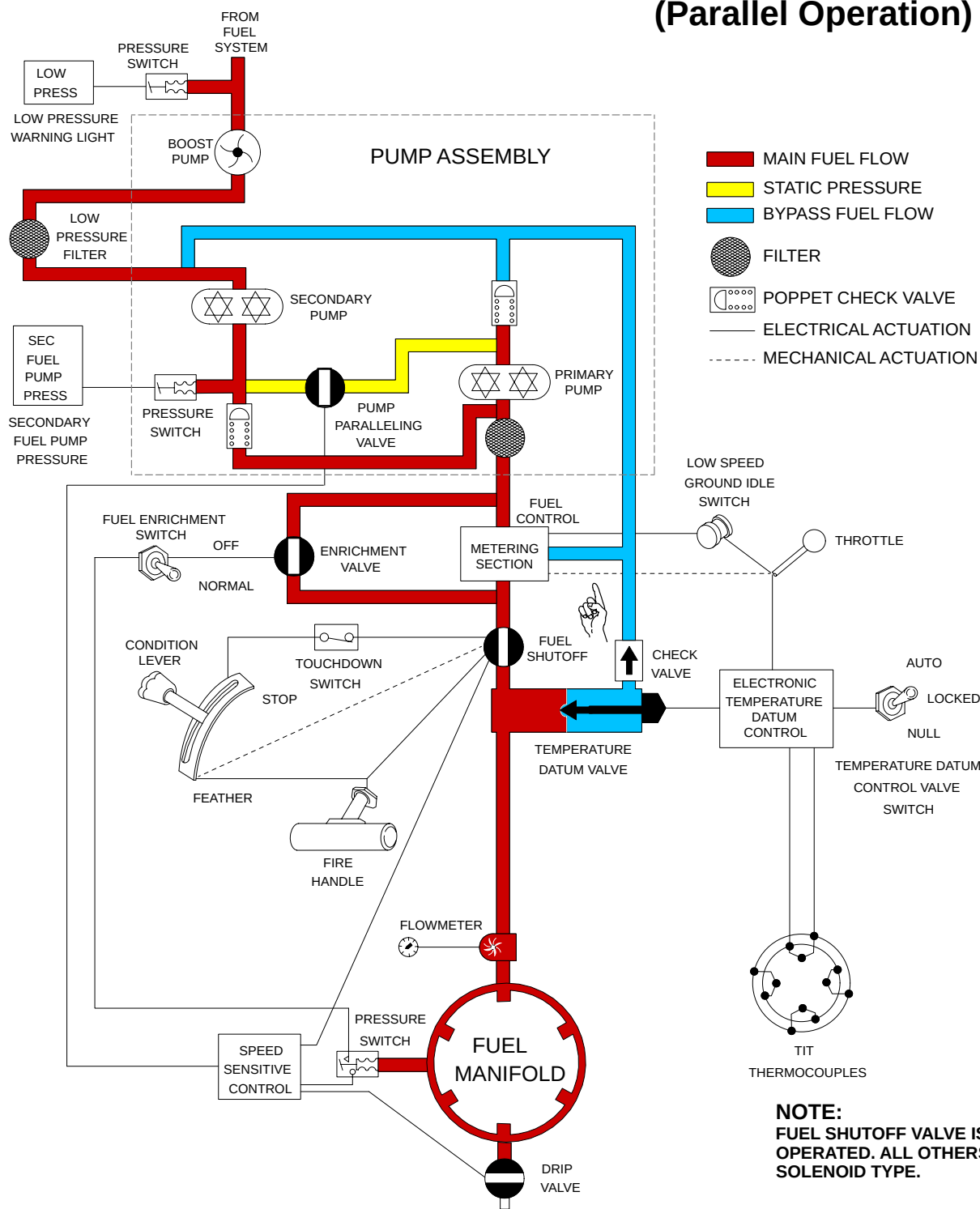


Figure 1A-20

Throttle Quadrant

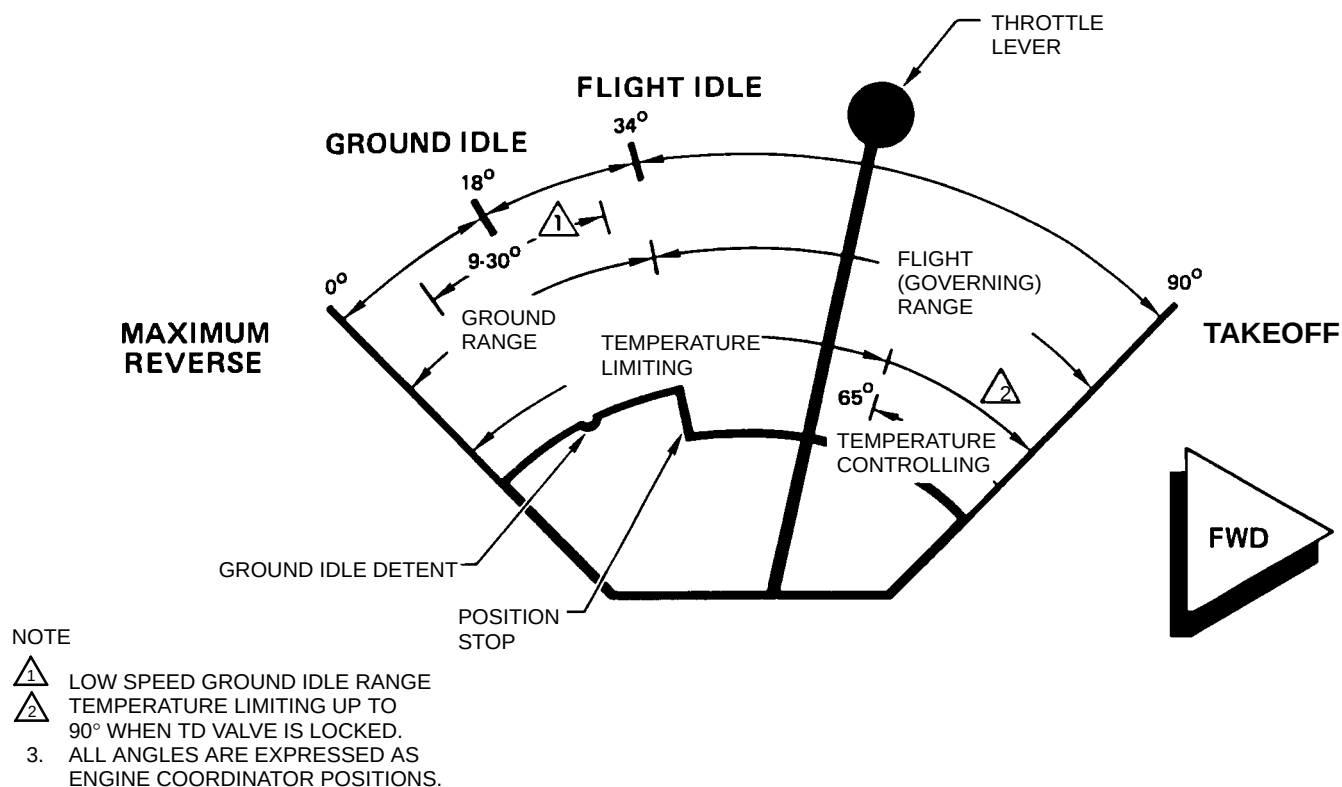


Figure 1A-21

The engine fuel enrichment switches (figure 1A-22 and 1A-23) are located on the engine starting panel. They are toggle switches with NORMAL and OFF positions. In NORMAL, each switch allows the engine fuel enrichment valve to be controlled by the speed-sensitive control and manifold pressure switch during starting. The OFF position is provided to permit deactivating the fuel enrichment system for any engine.

STARTER

28V ESS DC CP Side
OIL (SHUTOFF)
START CONTROL

An air turbine starter unit drives the engine for ground starts. This starter unit consists of an air-driven turbine section, a clutch, and a reduction gear section that is splined to the reduction gear section of the engine. Air for driving the starter can be supplied by the gas turbine compressor/auxiliary power unit, by an operating engine, or by an external air source. The air is routed through the bleed air system and the engine bleed air valves/regulators. When the respective bleed air valve/regulator is opened, air is supplied to the starter control valve. When the engine start switch is activated, the circuit is energized to allow the valve to modulate air to the starter at

approximately 34 psi. The starter control valve closes when its solenoid is deenergized. This closes off the air supply to the starter turbine and causes the clutch to disengage the starter from the engine reduction gearing. (Refer to Section V for starter limits.)

IGNITION SYSTEM

28V ESS DC CP Side
IGNITION CONTROL

The ignition system is a high-voltage, condenser-discharge type, consisting of an exciter, two igniters, and control components. The system is controlled by the speed-sensitive control through the ignition relay, which turns it on at 16 percent engine rpm and off at 65 percent engine rpm during starting.

ENGINE CONTROLS AND INDICATORS

Throttles

The throttles (figure 1A-21 and 1A-24) are quadrant-mounted on the flight control pedestal. Throttle movement controls engine operation by positioning the propeller controls and by positioning the controls to select the rate of engine fuel flow. Throttle movements are transmitted through mechanical linkage to an engine-mounted coordinator. The

**Engine Starting and Fuel
Enrichment Panel
(1500 and 1600 Series)**

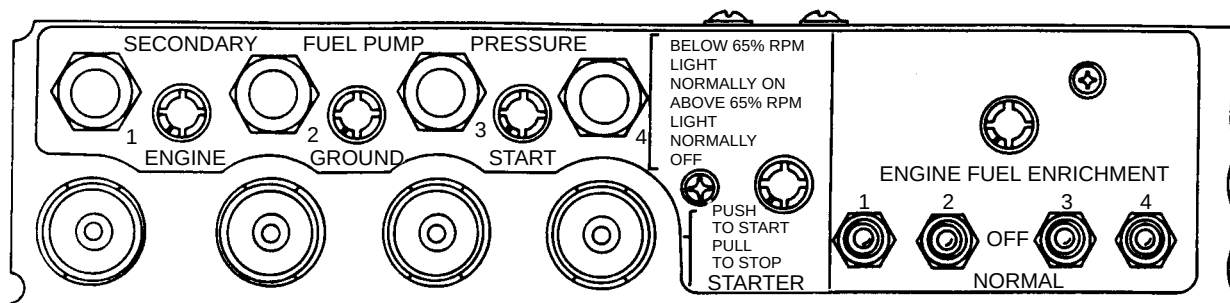
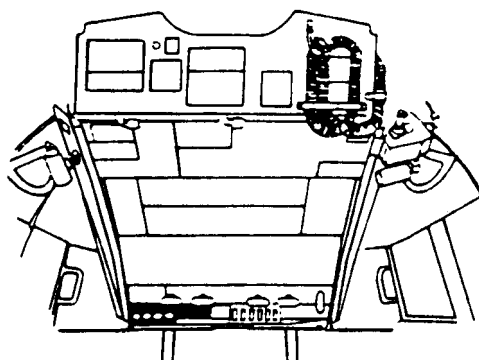


Figure 1A-22

**Engine Starting and Fuel
Enrichment Panel (CG
1790 and 1700 Series)**

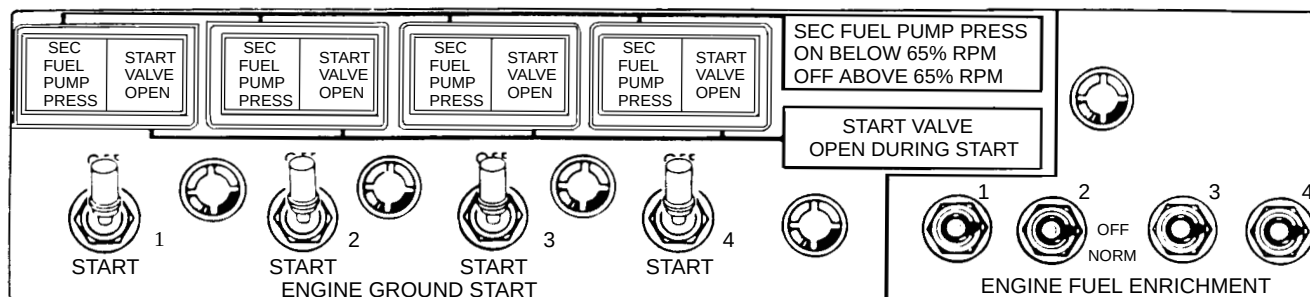
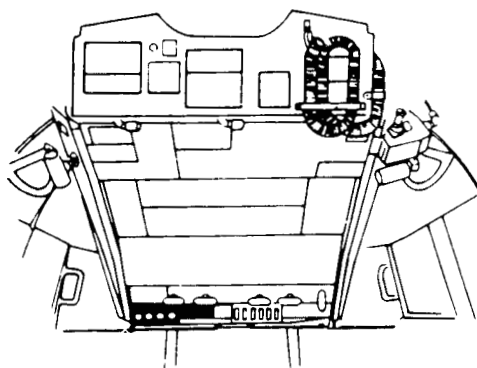


Figure 1A-23

coordinator transmits the movements through mechanical linkage to the propeller and to the engine fuel control, and it also actuates switches and a potentiometer which affect electronic temperature datum control system operation. Each throttle has two distinct ranges of movement, ground (Beta) and flight (Alpha), which are separated by a stop (see figure 1A-21). Both ranges are used for ground operation, but the ground range must not be used in flight. In the ground range, the throttle position selects a propeller blade angle (NTS linkage is cammed out) and a corresponding rate of fuel flow. In the flight (governing) range, throttle position selects a rate of fuel flow to produce a scheduled turbine inlet temperature; and the propeller governor controls propeller blade angle (throttle anticipation and speed stabilization). The throttles have the following four placarded positions (figure 1A-21):

MAXIMUM REVERSE – (0 degrees travel) gives maximum reverse thrust with engine power approximately 60 percent of maximum power at 100 KIAS or 30 percent of maximum power static.

GROUND IDLE – (Approximately 18 degrees travel) is a detent position. This is the ground starting position at which blade angle is set for minimum thrust.

FLIGHT IDLE – (34 degrees travel) is the transition point between the ground and flight (governing) ranges. A stop in the quadrant limits aft travel of the throttle at this position until the throttle is lifted.

TAKEOFF – (90 degrees travel) is the maximum power position.

The throttle quadrant is also divided into two unmarked ranges with respect to control of the electronic temperature datum control system. The crossover point is at 65 degrees throttle travel, at which point the switches in the coordinator are actuated. Below this point, the electronic temperature da-

tum control system can limit turbine inlet temperature. Above this point, it is controlling turbine inlet temperature.

Low-Speed Ground Idle Controls

28V ESS DC
LOW-SPEED GRD IDLE

CP Side

Four low-speed ground idle control buttons (figure 1A-24) located on the control pedestal may be pushed in to reduce engine rpm from 69 to 75.5 percent at any time the throttles are in the range between 9 degrees and 30 degrees. Moving the throttles out of this range will automatically disengage the low-speed ground idle buttons.

Throttle Friction Knob

A friction knob (see figures 1A-8 and 1A-9) on the throttle quadrant adjusts the amount of friction applied to the throttles to prevent creeping or accidental movement.

Engine Condition Levers

Four pedestal-mounted condition levers (figures 1A-8 and 1A-9) are the primary controls for engine starting and stopping and propeller feathering and unfeathering.

They actuate both mechanical linkages and switches which provide electrical control. Each lever has four placarded positions:

RUN is a detent position. At this position, the lever closes a switch which places engine fuel and ignition systems under control of the speed-sensitive control. For engines No. 2 and No. 3, the ice detection system is energized. When in this position, the condition lever has no control on the propeller.

AIR START is a position attained by holding the lever forward against spring tension. In this position, the lever closes

LOW SPEED GROUND IDLE BUTTONS

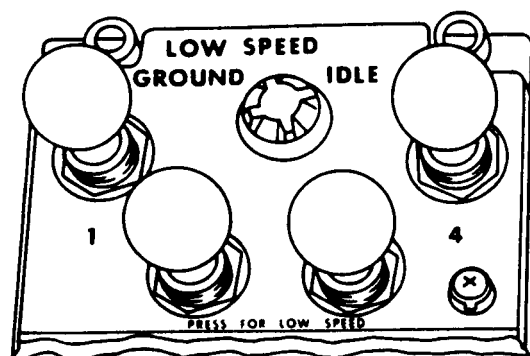
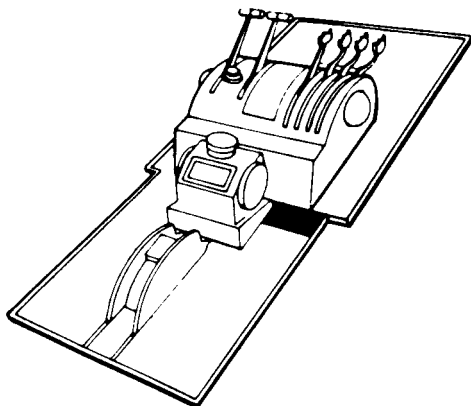


Figure 1A-24

the same switch closed by placing the lever at RUN, and in addition closes a switch which causes the propeller auxiliary pump to operate, thus providing pressure to unfeather the propeller.

GROUND STOP is a detent position. In this position, the lever actuates a switch which causes the electrical fuel shutoff valve on the engine fuel control to close, if the airplane is on the ground and the landing gear touchdown switches are closed. When in this position, the condition lever has no control on the propeller.

FEATHER is a detent position. When the lever is pulled toward this position, mechanical linkages transmit the motion to the engine-mounted coordinator and from the coordinator to the propeller and to the shutoff valve on the engine fuel control. Switches are also actuated by the lever as it is pulled aft. The results of moving the lever to FEATHER are the following:

The propeller receives a feather signal mechanically (pilot valve to increase and feather valve to feather) and electrically energizes the feather solenoid valve through the feather override button circuit.

The fuel shutoff valve on the engine fuel control is closed both mechanically and electrically.

The propeller auxiliary pump is turned on, providing pressure to feather the propeller.

Temp Datum Control Valve Switches

115V	AC INST & ENG	P Side
FUEL CONT		
FUEL & TEMPERATURE CONTROL		
28V	ESS DC	CP Side
ENG FUEL CONT		

Four temperature datum control valve switches (figure 1A-25) are mounted on a control panel at the aft end of the flight control pedestal. Each switch has AUTO, LOCKED, and NULL positions. The switch positions are used as follows:

The AUTO position permits normal operation of the electronic temperature datum control system.

The LOCKED position may be set when the throttles are in temperature-controlling range, to provide a fixed percentage correction on the metered fuel flow throughout the engine operating range to maintain a symmetrical shaft horsepower. If the TD control valve switch is then positioned at LOCKED, the TD valve is locked at whatever position it is in at the time. The TD valves remain locked and the fuel correction lights remain out through all throttle movements, unless an overtemperature condition is sensed by the amplifier. When the

Temperature Datum Control Valve Panel

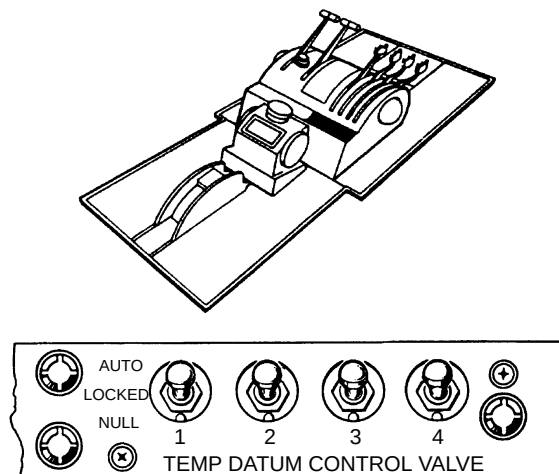


Figure 1A-25

switch is in the LOCKED position, the TD valve for an engine is unlocked and moves toward a "take" position if turbine inlet temperature for the engine exceeds normal temperature limiting. If a valve is unlocked by its control system to correct an overtemperature condition, the fuel correction light for that engine illuminates to indicate that the valve has unlocked to correct for the overtemperature. Overtemperature protection is still available. Resetting the system for locked operation will extinguish the light. If the switches have not been placed in the LOCKED position and the throttles are moved out of the temperature controlling range, the TD valves return to the NULL position.

NOTE

The switches lock a fuel correction only when they are positioned at LOCKED while the throttle is in temperature controlling range and the fuel correction light is out.

The NULL position removes ac power from the control system amplifier; and the TD valve, receiving no control signals, returns to its null position so that it does not correct the fuel flow according to turbine inlet temperature. The TD valve brake is released by 28-volt dc power. The NULL position of these switches is used to deactivate the electronic temperature datum control systems when erratic electronic fuel scheduling is suspected or when the engines are not operating.

Electronic Fuel Correction Lights

28V	ESS DC	CP Side
ENG FUEL CONT		

The electronic fuel correction amber lights (figure 1A-26) are located on the pilot's instrument panel. The lights are on while the throttles are in temperature-limiting range (below

65 degrees) and go out when the throttles are advanced to the temperature-controlling range (above 65 degrees).

Electronic Fuel Correction Lights

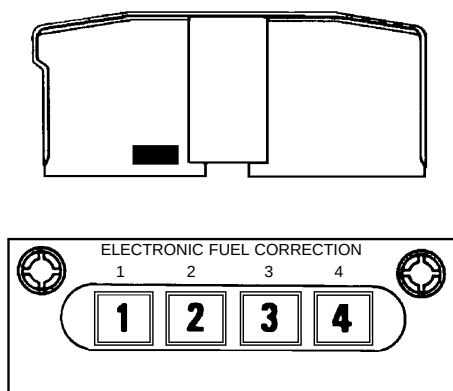


Figure 1A-26

Starting Control System

The starting control system automatically controls fuel flow and ignition during ground and air starts. The automatic control of the starting control system has a speed-sensitive control and a speed-sensitive valve, which are engine-driven. The speed-sensitive control performs the following functions:

On acceleration to 16 percent rpm – the fuel shutoff valve in the engine fuel control is opened, the ignition relay is energized, completing circuits to the ignition exciter, the engine fuel pump paralleling valve closes, the fuel enrichment valve opens, and the manifold drip valve closes.

On acceleration to 65 percent rpm – ignition system is deenergized, fuel pump paralleling valve is opened to return pumps to series operation, and manifold drip valve is deenergized (it is then held closed by pressure).

On acceleration to 94 percent rpm – electronic temperature datum control system is switched from start limiting to normal limiting, the TD valve take capability changes from 50 percent to 20 percent, and the speed-sensitive valve opens to allow 14th stage bleed air to force the 5th and 10th stage acceleration bleed valves closed.

Engine Ground Start Switches

28V ESS DC CP Side
START CONTROL
OIL (SHUTOFF)

The engine ground start switches (figures 1A-22 and 1A-23) are located on the engine starting panel on the overhead control panel. Each switch is used to open the starter air regulator

valve to permit operation of the starter. The engine start switch is actuated manually and held until starter out rpm (60%) is attained. The engine start switch can be released at any time to discontinue starter operation. Each engine starting circuit is electrically interlocked with the corresponding engine OIL FIRE SHUTOFF VALVE control circuit. This renders the starting circuit inoperative unless the fire handle is pushed in and the OIL FIRE SHUTOFF VALVE circuit breaker is engaged.

Start Valve Open Lights (CG 1790 and 1700 Series)

28V ESS DC CP Side
START CONTROL

Four press-to-test START VALVE OPEN lights are located on the overhead engine starting and fuel enrichment panel. Each light is controlled by a pressure switch connected to the respective engine starter and starter regulator valve pressure sensing line. The START VALVE OPEN light will illuminate when the starter regulator valve opens and pressure exceeds approximately 2 psi. The START VALVE OPEN light does not necessarily indicate starter engagement. The light will extinguish within 15 seconds after the ENGINE GROUND START switch is released to “OFF,” indicating that the starter regulator valve is closed.

Engine Bleed Air Valve Switches (1500 Series)

28V ESS DC CP Side
BLEED AIR (SHUTOFF)

The engine bleed air valve switches are located on the anti-icing systems control panel on the overhead panel. They are toggle switches with OPEN and CLOSED positions. Each switch controls a motor-driven bleed air valve in the aft section of the engine nacelle, just forward of the wing beam. The valve may be closed when necessary to prevent airflow from the engine to the bleed air system or from the bleed air system to the nacelle ducts. A check valve is provided to prevent backflow into the engine diffuser.

Engine Bleed Air Switches (1600 Series, CG 1790, and 1700 Series)

28V ESS DC CP Side
BLEED AIR (SHUTOFF)

The engine bleed air switches, located on the anti-icing and deicing control panel, are three-position (OFF, ON, OVRD) toggle switches. Each switch controls a pressure-actuated, dual solenoid-controlled pressure regulator. When the switch is in the OFF position, the regulator shuts off all airflow to or from the engine. When the switch is in the ON position the

regulator regulates airflow from the engine to the crosswing manifold to approximately 50 psi and prevents airflow into the engine nacelle if the manifold pressure is above approximately 50 psi. Low manifold pressure will allow airflow into an engine nacelle. When the switch is in OVRD, the regulator is fully open and permits airflow in either direction. It is necessary to use the OVRD (override) position during engine starting, and for engine inlet air scoop anti-icing with the engine not running. A check valve is provided to prevent backflow into the engine diffuser. The regulators go to the closed position when deenergized. A manual override, which allows the regulator to be controlled manually in the event of an electrical failure, is located on the regulator assembly in the aft nacelle. A latching mechanism holds the regulator in the open position when the manual override is used.

Secondary Fuel Pump Pressure Lights

28V

ESS DC

CP Side

FUEL MANAGEMENT

SEC PUMP IND LIGHT

Four secondary fuel pump pressure lights (figure 1A-22 and 1A-23) are located on the overhead engine starting control panel. Each light is controlled by a pressure switch (150 psi) on the engine fuel pump and filter assembly. The light is normally illuminated while the two gear pumps in the assembly are operating in parallel during engine starting (between 16 to 65 percent rpm). The light also illuminates at any other time if the pump paralleling valve is not open or if the primary gear pump fails. If the light does not illuminate during starting, it may indicate that either the pump paralleling valve has not closed or that the secondary pump has failed.

ENGINE INLET AIR DUCT ANTI-ICING SYSTEMS

28V

ESS DC

CP Side

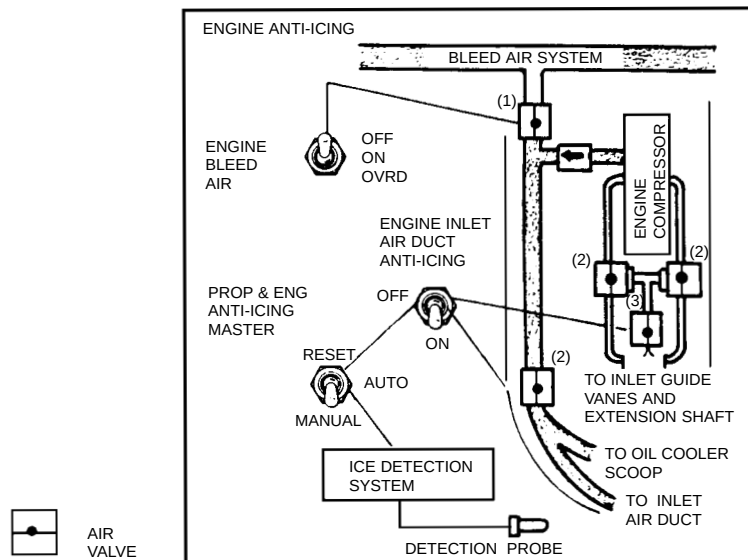
ENGINE ANTI-ICE SHUTOFF

Two systems are provided for engine inlet air duct anti-icing (figure 1A-27). One system routes bleed air from the bleed air system to passages in the engine inlet air scoop and oil cooler scoop to heat the scoops. The other system routes air from the compressor diffuser section of the engine to passages in the compressor inlet vanes. The scoop anti-icing airflow is shut off by a solenoid valve which is energized closed. The air flows when the valve is deenergized open; The vane anti-icing airflow is controlled by two pressure-actuated valves, which are controlled by a single solenoid valve. When the solenoid valve is energized, the pressure-actuated valves shut off the airflow, and when the solenoid valve is deenergized, the pressure actuated valves open. Both the scoop and vane anti-icing systems are termed fail-safe, meaning that anti-icing is provided when the system power supply is lost. The electrical control circuits are interconnected with the ice detection system so that the duct anti-icing can be turned on automatically when the detection system senses icing.

Engine Inlet Air Duct Anti-icing Switches

Four engine inlet air duct anti-icing switches are located on the anti-icing systems control panel (figure 1A-5). Each switch has ON and OFF positions. If a switch is in the ON position, the scoop and vane anti-icing systems for that engine are turned on if the prop and engine anti-icing master switch is in MANUAL. If the master switch is in the AUTO position, anti-icing is turned on when the ice detection (figure 1A-28) system detects ice. When an engine inlet air duct anti-icing switch is in the OFF position, both scoop and vane anti-icing valves for that engine close to shut off the anti-icing airflow.

Engine Anti-icing



- (1) (1500 SERIES) MOTOR-DRIVEN SHUTOFF VALVE (ON-OPEN; OFF-CLOSED) (1600 SERIES, CG 1790 AND 1700 SERIES) PRESSURE -ACTUATED DUAL SOLENOID-CONTROLLED PRESSURE REGULATOR (OPEN WHEN SOLENOID IS ENERGIZED) (ON-REGULATES PRESSURE TO APPROXIMATELY

- 50 PSI, OVRD VALVE FULLY OPEN, OFF VALVE CLOSED)
 (2) PRESSURE-ACTUATED, SOLENOID-CONTROLLED SHUTOFF VALVE (CLOSED WHEN SOLENOID IS ENERGIZED)
 (3) SOLENOID-OPERATED VALVE (CLOSED WHEN ENERGIZED)

Figure 1A-27

Ice Detection Panel

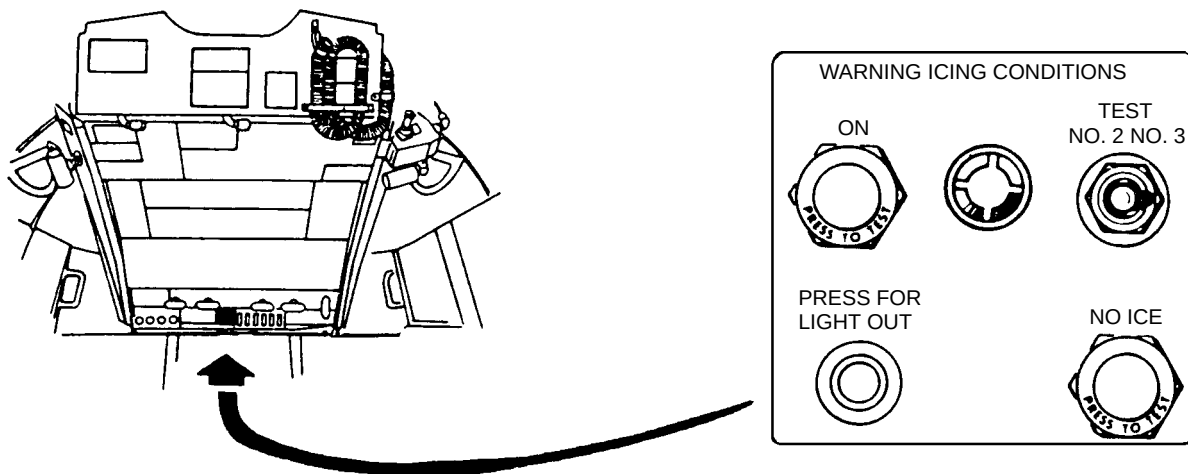


Figure 1A-28

NORMAL ENGINE STARTING SEQUENCE

During a normal start, the following actions take place automatically (provided Section II checklist procedures have been followed) as listed. An examination of the sequence will be helpful in understanding the overall operation of any start.

% ENGINE RPM (approximate)	ACTION	CONTROLLED BY
0-94%	Temperature Datum Control Normally Limits TIT to 830 °C During Start	Speed-Sensitive Switch
0-94%	5th and 10th Stage Compressor Bleeds Open	Speed-Sensitive Valve
—	Electronic Fuel Correction Light On	Throttle and Electronic Fuel Correction Switch
16%	Fuel Shutoff Opened	Speed-Sensitive Switch
16%	Fuel Enrichment On	Speed-Sensitive Switch and Fuel Enrichment Switch
16%	Fuel Pumps in Parallel Operation	Speed-Sensitive Switch
16% and UP	Drip Valve Closed	Speed-Sensitive Switch and Pressure
16%	Ignition On	Speed-Sensitive Switch
50 PSIG Fuel Manifold pressure	Fuel Enrichment Off	Manifold Pressure Switch
60%	Starter Disengaged	Engine Ground Start Switch (Released by Pilot)
65%	Fuel Pumps in Series Operation	Speed-Sensitive Switch
65%	Ignition Off	Speed-Sensitive Switch
94%	5th and 10th Stage Compressor Bleeds Closed	Speed-Sensitive Valve
94%	TIT Limited by Temperature Datum Control	Speed-Sensitive Switch
94%	TD Valve Take Capability Changes from 50 Percent to 20 Percent	Speed-Sensitive Switch

OIL SYSTEMS

28V ESS DC CP Side
OIL

Independent oil systems, one for each engine, supply lubrication to the engine gearboxes and power sections. An oil tank is located in each nacelle above the engine and has a 12 gallon oil capacity and a 7.5 gallon expansion space. The oil gravity feeds from the tank into the gearbox and power section of the engine, and is then pumped to the bearings for lubrication, where it is picked up by scavenge pumps and driven through a heat exchanger and oil cooler back into the oil tank. Hot oil passing through the heat exchanger heats the engine fuel and prevents ice from forming in the fuel filter. Air flowing through an oil cooler duct and over the coils of the oil cooler absorbs excess heat from the oil. A thermostatic element, located in the oil tank return line, controls the oil temperature by regulating the amount of air flowing through the oil cooler duct. Four motor-operated valves provide an emergency means of shutting off oil flow to the engines when the fire emergency control handles are pulled. Each valve control circuit is electrically interlocked with the corresponding engine starting circuit, so that the engine can be started only when the fire emergency handle has been pushed in and the oil valve shutoff circuit breaker has been closed.

OIL SYSTEM CONTROLS

Oil Cooler Flap Switches

28V ESS DC CP Side
OIL – COOLER FLAPS

Airflow through the oil cooler is governed by a controllable oil cooler flap which restricts the opening of the oil cooler air exit duct. Four, four-position (AUTOMATIC, OPEN, CLOSE, FIXED) toggle switches are located on the oil cooler flaps switch panel (figure 1A-29) of the flight control overhead panel.

These switches control the electrical circuits of the oil cooler flap actuators. When in the AUTOMATIC position, the position of the oil cooler flap is regulated by a thermostatic unit to cool the oil to approximately 80°C (176°F). In the OPEN or CLOSE positions (spring-loaded), the thermostat is excluded from the circuit, and the actuator is directly energized to open or close the oil cooler flap. When the switch is moved to the FIXED position, the flap actuator is deenergized and the flap will remain in the position it was in prior to moving the switch. Moving the switch to the AUTOMATIC position provides for all normal operations. OPEN, CLOSE, and FIXED positions

Oil Cooler Flap Control Panel

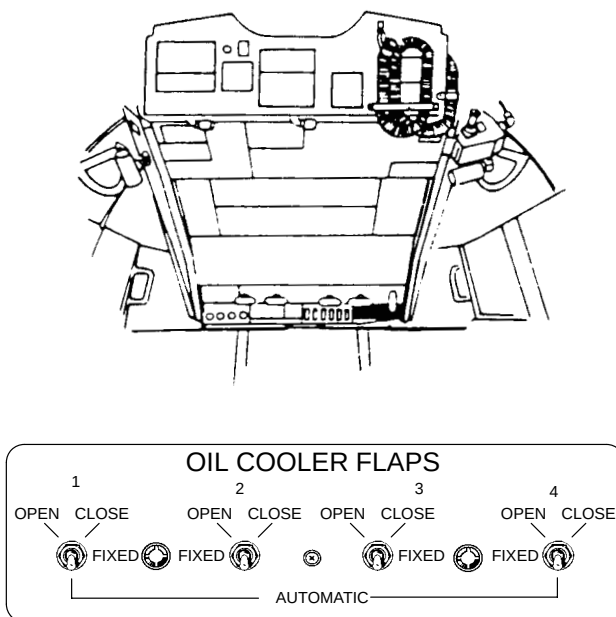


Figure 1A-29

are used to control the oil cooler flap actuator manually if the thermostatic control unit fails.

ENGINE INSTRUMENTS

TORQUEMETERS

115V AC Inst & P Side
Single Eng Fuel Cont
ENGINE TORQUEMETER – ENG NO.

Each of the four torqueometers (figure 1A-30) indicates torque in inch-pounds, and can indicate either positive or negative torque. When reading positive torque, the indicator hands are read together. When reading negative torque, the small indicator must be read in reverse. The difference between 1,000 and the small indicator hand reading is the indicated negative torque. (Example: with the large indicator hand showing -1,000 and the small indicator hand reading 800, the negative torque is -1,200.) The indicated torque is detected at the extension shaft between the engine power section and reduction gear assembly.

TACHOMETERS

SELF-POWERED AC

Each of the four tachometers (figure 1A-30) indicates engine speed in percent of normal engine rpm. Normal rpm (100 percent) equals 13,820 engine rpm, and 1,021 propeller rpm. A vernier dial on each indicator makes it possible to read to the

nearest percent. The tachometer system has a separate engine-driven tachometer generator mounted on each engine (on accessory section of gearbox) that is not dependent upon the airplane's electrical system for operation.

TURBINE INLET TEMPERATURE INDICATORS

115V	AC Inst &	P Side
Single	Eng Fuel Cont	

TURBINE INLET TEMPERATURE – ENG NO.

Each of the turbine inlet temperature indicators (figure 1A-30) indicates temperature sensed by thermocouples in the engine turbine inlet casing. Each indicator registers temperature in degrees Centigrade and contains a vernier scale graduated in 10-degree increments.

FUEL FLOW GAUGES

115V	AC Inst &	P Side
Single	Eng Fuel Cont	

FUEL FLOW – IND NO.

28V	ESS DC	CP Side

FUEL FLOW

Each of the four fuel flow gauges (figure 1A-30) indicates flow in pounds per hour. Flow is measured at the point where it enters the manifold (between the TD valve and the fuel nozzles) on the engine.

OIL TEMPERATURE GAUGES

28V	ESS DC	CP Side

ENGINE OIL – TEMP INDICATOR

The four oil temperature gauges (figure 1A-30) indicate oil temperature in the engine oil inlet lines. They are electrical-resistance-type indicators. Oil temperature is taken as oil leaves the oil tank.

OIL QUANTITY GAUGES

28V	ESS DC	CP Side

QUANTITY INDICATOR – OIL

Four oil quantity gauges (figure 1A-30), one for each engine oil system, are located on the engine instrument panel. Each instrument is calibrated from 0 (empty) to F (full) in increments of two quarts and numbered in gallons. The float-type oil quantity transmitter located in the oil tank is interchangeable with the solid-state unit, which incorporates a built-in test circuit that verifies operation of the transmitter electronics, drive circuits, sense wire, indicator, low oil quantity warn-

ing light, and the presence of oil. When dc power is first applied, the test circuit will cause the quantity indicator to drive to full scale, extinguishing the oil quantity warning light; then to empty, illuminating the oil quantity warning light; and then to a value indicating the correct oil quantity.

NOTE

The solid-state transmitter tests the engine oil quantity indicating system continuously during any power-on condition. Should a fault develop in the probe, the low oil light will blink; should the transmitter detect a fault in its own circuits, the low oil light will illuminate steadily and the indicator pointer will drive to off-scale full. If a self-test is interrupted for any reason, or power is removed from the system during normal operation, a 30 second wait is required before the transmitter's microprocessor will reset. After this interval, power may be reapplied for a normal power-on self-test.

OIL PRESSURE GAUGES

26V	AC Inst & Eng	P Side
	Fuel Cont	
	Inst	Fuse
	Transformer	

IND ENGINE OIL PRESSURE – ENG. NO.

Four dual oil pressure gauges (figure 1A-30) register oil pressure for both the engine power sections and reduction gears. The rear needle marked G on each indicator shows reduction gear oil pressure; and the front needle marked E indicates power section oil pressure.

LOW OIL QUANTITY WARNING LIGHTS

28V	ESS DC	CP Side

QUANTITY LIGHT – ENGINE OIL

A low oil quantity warning light (figure 1A-30) is located on the engine instrument panel. The light is electrically connected to each oil quantity indicator transmitter, and illuminates when an oil tank quantity level drops to approximately 4.0 gallons. The light will be energized only on the first engine to have a low oil quantity.

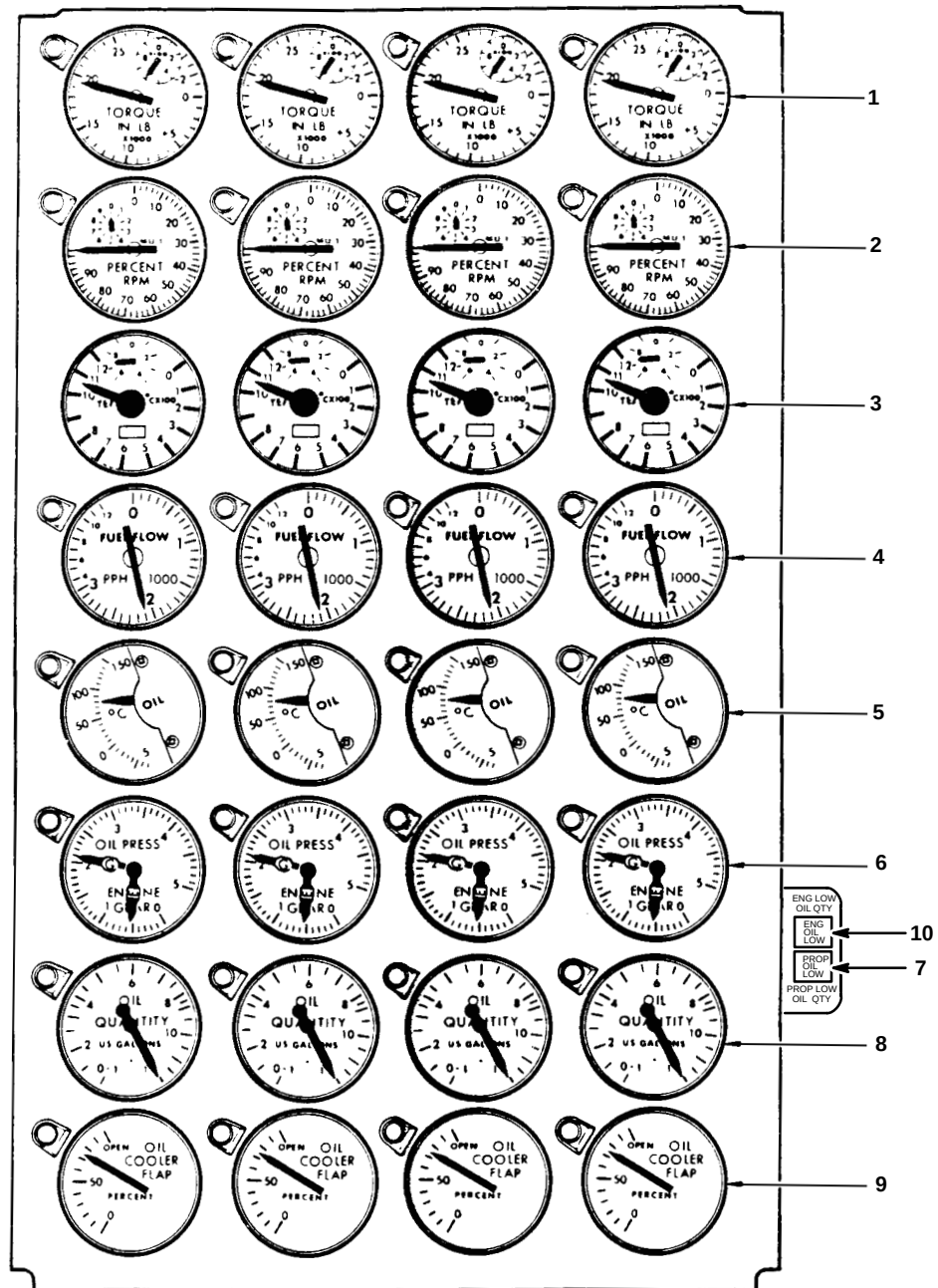
OIL COOLER FLAP POSITION INDICATORS

28V	ESS DC	CP Side

COOLER FLAPS – OIL

Four oil cooler flap position indicators (figure 1A-30), one for each engine oil system, are located on the engine instrument panel. The indicators are electrically connected to position transmitters that are geared to the oil cooler flap actuators.

Engine Instrument Panel



1. TORQUEMETER	6. OIL PRESSURE
2. TACHOMETER	7. PROP LOW OIL QUANTITY MASTER WARNING LIGHT
3. TURBINE INLET TEMPERATURE	8. OIL QUANTITY
4. FUEL FLOW	9. OIL COOLER FLAP POSITION
5. OIL TEMPERATURE	10. ENGINE LOW OIL QUANTITY WARNING LIGHT

Figure 1A-30

The indicator dials, calibrated from 0 to OPEN in increments of 10 percent, indicate the percent of opening of cooler flap doors.

PROPELLERS

Each engine is equipped with a Hamilton Standard, four-bladed, electro-hydraulic, full-feathering, reversible-pitch propeller (54H60-117). The propeller operates as a controllable-pitch propeller for throttle settings below FLIGHT IDLE (Beta) and as a constant-speed propeller for throttle setting of FLIGHT IDLE (Alpha) or above. The major components of the propeller system are the propeller assembly, the synchrophasing system, the control system, and the anti-icing and deicing systems. The oil capacity of the pressurized sump is 6.5 quarts. The capacity of the complete system fully serviced, including the pressurized sump, is 26 quarts. The propeller blades are solid aluminum alloy with shanks which are partially hollow for weight reduction.

DOME ASSEMBLY

The dome assembly is mounted on the forward section of the barrel assembly. It contains the pitch changing mechanism and the low pitch stop assembly. The pitch changing mechanism converts hydraulic pressure into mechanical torque. Its main parts are a piston assembly, a stationary cam, a rotating cam, and the dome shell. The piston is a double walled assembly which fits over the two cams and inside the dome shell. The piston is held in place by rollers which ride in the cam tracks of both cams. The rear of the rotating cam is connected to the propeller blades by beveled gears. As hydraulic pressure is applied to the piston, causing it to move, the rollers riding in the cam tracks turn the rotating cam, changing the blade angle. The low pitch stop is located in the dome and mechanically stops the piston from decreasing blade angle below approximately 23 degrees in flight. The low pitch stop is retracted to allow lower blade angles during ground operation.

PITCH LOCK ASSEMBLY

The pitch lock regulator assembly is located within the barrel assembly. Components of the pitch lock mechanism are a stationary pitch lock ratchet which is splined to the barrel, and a rotating pitch lock ratchet which is splined to the rotating cam within the dome assembly. The pitch lock mechanism prevents the blades from decreasing pitch if overspeeding of approximately 103 percent rpm occurs or if hydraulic pressure is lost. The stationary and rotating pitch lock ratchet rings are held disengaged by propeller oil pressure under control of the pitch lock regulator; they are spring-loaded to engage when the pressure is lost. However, when the ratchet rings are engaged, the propeller can still increase pitch to allow feathering. When an overspeed condition is sensed by the

flyweight within the pitch lock regulator assembly, oil pressure is removed to allow the pitch lock ratchets to engage and prevent a decrease in blade angle. To release the pitch lock, the overspeed must be corrected to restore oil pressure, and the blade angle must increase a few degrees to disengage the ratchets. In order to ensure that pitch lock action will not interfere with normal reversing of the propeller, the pitch lock ratchet rings are mechanically held apart by cam action throughout a blade angle range of a few degrees above the low pitch stop to full reverse. The loss of hydraulic pressure for propeller control (or in the pitch lock regulator) will result in the propeller pitch locking. For the propeller to pitch-lock, the blade angle must decrease (approximately 1.8° blade angle) to engage the pitch lock ratchet, normally resulting in an rpm increase and causing an audible beat. The pitch lock is cammed out except for 25° to 55° blade angle. However, a propeller which has pitch-locked cannot be reversed, as its blade angle cannot be reduced.

CONTROL ASSEMBLY

The propeller control assembly is mounted in the aft extension of the propeller barrel but does not rotate. It contains the oil reservoir, pumps, valves, and control components which supply the pitch changing mechanism with hydraulic pressure of the proper magnitude and direction to vary the propeller blade angle as required for the selected operating condition. The main components contained within the valve housing assembly section of the control assembly are the flyweight speed sensing pilot valve, feather valve, feather solenoid valve, and feather actuating valve. The pump housing assembly contains a scavenge, main, standby, and an electrically driven double element auxiliary pump. The flow of fluid from these pumps is controlled by the valves in the valve housing assembly to accomplish the desired propeller operation. All mechanical and electrical connections necessary for propeller operation are made through the control assembly. The mechanical connections are linkages from the engine control system and the NTS (negative torque signal) system. The electrical connections are for oil level indication, pulse generator coil, auxiliary pump motor, synchrophasing system, NTS and feather switches, anti-icing and deicing systems, and the electric feathering system.

SPINNER ASSEMBLY

The spinner assembly improves the aerodynamic characteristics of the propeller assembly. It encloses the dome, barrel, and control assemblies. It consists of a front section, rear section, and a non rotating afterbody assembly. Cooling air is admitted through an air inlet at the front of the spinner and passes over the dome assembly, barrel assembly, and control assembly fins and exhausts through vents in the engine nacelle.

PROPELLER LOW OIL WARNING LIGHTS

28V ESS DC CP Side
PROP LOW OIL LEVEL

A propeller low oil warning light for each propeller is located on the copilot's side shelf (figure 1A-31); a prop low oil quantity light, which acts as a master warning light, is located on the engine instrument panel (figure 1A-30). The propeller low oil warning system is controlled by a float actuated switch in each propeller control assembly. When the oil quantity for any propeller drops approximately two quarts below normal in the pressurized sump, the float actuated switch closes and illuminates the propeller low oil warning light for that engine and the prop low oil quantity light. If another propeller experiences a low oil quantity, the only indication will be from the propeller low oil warning light for that engine. For leakage limits refer to T.O. 1C-130H-2-11.

PROPELLER SPEED CONTROL SYSTEM

The speed of the propeller is controlled by the propeller governing system within the Flight Range of the throttle lever so as to maintain a constant rpm. Within the Ground Range, the propeller blade angle is a function of throttle lever position. The propeller does not govern the rpm within the ground range.

Propeller Governing System

The principal function of the propeller governing system is to maintain a constant engine operating rpm. Propeller governing is accomplished by the action of the flyweight speed sensing pilot valve. This valve is controlled by the mechanical action of the flyweights opposing the force of the speeder spring. When the propeller is in an on speed condition, the pilot valve meters sufficient fluid to the increase pitch or forward side of the dome assembly piston to overcome the centrifugal twisting moment and maintain the required blade angle. When an overspeed condition occurs, the flyweight force overcomes the speeder spring force, and the pilot valve moves to increase the flow to the increase pitch side of the piston to increase blade angle and cause the propeller to slow down. If the propeller slows below governed speed, the force of the speeder spring overcomes the force exerted by the flyweights, and the pilot valve meters fluid to the aft side of the dome assembly piston to decrease blade angle and allow the propeller to increase speed. The low pitch stop prevents the propellers from decreasing blade angle below approximately 23 degrees while the throttles are in the Flight Range.

Electronic Propeller Governing

The synchrophaser electronic unit provides circuits for the following governing functions: speed stabilization (deriva-

tive), throttle anticipation, and synchrophasing. The propeller mechanical governor will hold a constant speed in the flight range, but throttle changes will cause the governor to overspeed or underspeed while trying to compensate for the change in power. A stabilization circuit stabilizes the mechanical governor during these changes when the propeller governor control switch is in the NORMAL position by sending a signal to the speed bias servo control motor to change the speeder spring compression. The throttle anticipation circuit stabilizes the propeller speed during rapid movement of the throttle when the propeller governor control switch is in the NORMAL position. The synchrophasing system acts to keep all the propellers turning at the same speed, and it maintains a constant rotational position relationship between the blades to decrease vibration and to lower the noise level. The system uses either No. 2 or No. 3 engine as the master engine, and it relates the blade position of the other three engines to the master. The blade position of a slave engine is changed by moving the pilot valve to increase or decrease the speed of that engine. The synchrophasing circuit determines blade position by comparing an electrical pulse generated by each slave propeller to a modified pulse from the master propeller. If propeller operation is erratic, see PROPELLER MALFUNCTIONS in Section III.

NTS (NEGATIVE TORQUE SIGNAL) SYSTEM

The NTS (negative torque signal) system provides a mechanical signal to limit negative torque. Negative torque is encountered when the propeller attempts to drive the engine. If not relieved, this condition creates a great amount of drag, causing the airplane to yaw. The NTS system consists of an actuating mechanism housed partly within the reduction gear assembly and partly in a signal assembly in the propeller valve housing. It operates when negative torque applied to the reduction gear exceeds a predetermined value of -1260 ± 600 inch-pounds. A ring gear is then moved forward against springs as a result of a torque reaction generated through helical splines. In moving forward, the ring gear pushes a plunger through the nose of the gearbox. The plunger pushes against a cam in the signal assembly to actuate control linkage connected to the propeller valve housing. When a negative torque signal is transmitted to the propeller, the propeller increases blade angle to relieve the condition, except when the throttles are below the FLIGHT IDLE position. When the throttles are below FLIGHT IDLE, a cam moves the actuator away from the NTS plunger and renders the system inoperative. This is necessary to prevent a propeller from receiving a possible negative torque signal at high landing speeds when the throttles are moved toward reverse. If the negative torque is sufficiently reduced, the signal mechanism returns to normal by springs acting on the ring gear.

Propeller Controls

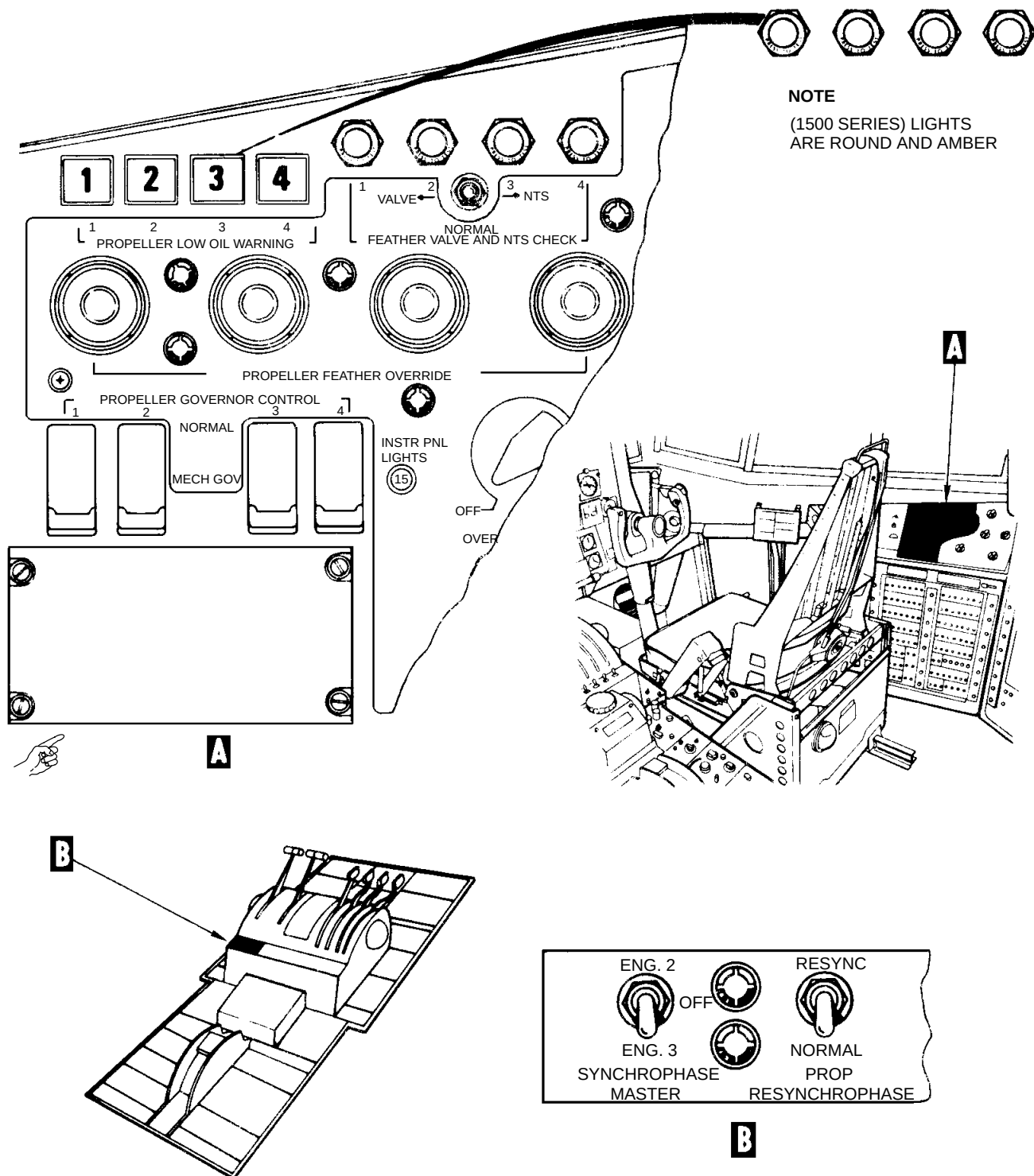


Figure 1A-31

NOTE

Normal operation of the NTS system does not commit the propeller to feather. However, a malfunctioning NTS system may completely feather the propeller or cause engine to stall/ flame out.

PROPELLER CONTROLS

Propeller controls include the throttles, condition levers, fire emergency control handles, synchrophase master switch, prop resynchrophase switch, synchrophaser trim controls, propeller governor control switches, fuel governor check switches, feather override buttons, and feather valve and NTS check switch.

Synchrophase Master Switch

28V ESS DC CP Side
SYNCHROPHASER

115V ESS AC P Side
PROP SYNCHROPHASER

The synchrophase master switch (figure 1A-31) is located on the flight control pedestal. This three-position (ENG 2, OFF, ENG 3) toggle switch controls the operation of the synchrophasing system and selects the engine to be used as the master. When the switch is in the ENG 2 position, the number 2 engine is selected as the master and the other propeller rotational speeds and blade phase angles are referenced to this engine. When the switch is in the OFF position, there is no synchrophasing and the propellers operate in normal governing. When the switch is in the ENG 3 position, the No. 3 engine is the master and the other propellers are referenced to this engine.

Propeller Resynchrophase Switch

28V ESS DC CP Side
SYNCHROPHASER

The propeller resynchrophase switch (figure 1A-31) is a two-position (NORMAL, RESYNC) toggle switch located on the flight control pedestal. The switch is spring-loaded to the NORMAL position. When the switch is placed in the RESYNC position, the speed bias servo motors of the slave propellers are repositioned to the midpoint of their travel range, and speeds of the propellers remain the same until the switch is released to the NORMAL position. Each time the switch is placed in RESYNC and released, the speed of the slave propellers can change approximately 2 percent to a maximum of approximately ± 5 percent from the optimum 100 percent. When the switch is held in the RESYNC position for 1 to 2 seconds and then released to NORMAL, it takes the synchrophasing system as long as 1 minute to correct the phase angle and speed of the propellers. On airplanes equipped with a

solid-state synchrophaser, the prop resynchrophase switch shall not be positioned to RESYNC except when performing the propeller reindexing procedure. The resync switch should be used only for correcting an out-of-sync or off-speed condition by performing the complete reindexing procedure. Airplanes equipped with a solid-state synchrophaser will have a decal installed above the prop resynchrophase switch on the flight control pedestal stating "SOLID-STATE SYNCHROPHASER INSTALLED. REFER TO APPROVED FLIGHT MANUAL FOR OPERATION."

Propeller Governor Control Switches

28V ESS DC CP Side
SYNCHROPHASER

115V ESS AC P Side
PROP SYNCHROPHASER

The four propeller governor control switches are two-position (NORMAL, MECH GOV) guarded toggle switches located on the copilot's side shelf (figure 1A-31). When the switches are in the NORMAL position the throttle anticipation and speed stabilization (derivative) circuits are operative, and if the synchrophaser master switch is positioned to either master engine, the blade rotational position of the slave engines is related to the master by the synchrophasing system. Placing a switch in the MECH GOV position disconnects the electrical speed control to that propeller, and the speed of the propeller is controlled by basic mechanical governing.

Feather Valve and Negative Torque Signal (NTS) Test Switch and Lights

28V ESS DC CP Side
NTS CHECK

The feather valve and negative torque signal check system (figure 1A-31) consists of a feather valve and NTS check switch, four indicator lights (one for each engine), four NTS check relays (one for each engine), and a feather valve switch and an NTS switch in each propeller control assembly. When the feather valve and NTS check switch are in the VALVE position, it completes the light circuits from the essential dc bus through the lights and contacts of each NTS check relay to the feather valve switch in each propeller control assembly. If the feather valve is positioned for feathering the propeller, it completes a circuit to ground for the corresponding indicator light. The light will come on to indicate that the feather valve is in position to feather the propeller. When the feather valve and NTS check switch are in the NTS position, it completes two circuits. One circuit is completed from the essential dc bus through each indicator light to a set of contacts in each NTS check relay. The other circuit is completed from the essential dc bus through the coil of each NTS check relay to the NTS check switch in the propeller control assembly. When a negative torque condition exists, the engine NTS plunger actuates

a linkage which closes the NTS switch. The NTS switch completes a circuit to ground for the NTS check relay coil and energizes the relay. The relay actuates to provide a ground path for the light circuit and the relay coil. The relay will remain energized, and the indicator light will glow as long as the feather valve and NTS check switch are in the NTS position.

Fuel Governing Check Switches

The four fuel governing check switches (figure 1A-5) located on the aft end of the overhead control panel are for maintenance purposes only. The switches are safe-tied and will not be used in flight. They reset the speeder spring to approximately 105.5% rpm.

Feather Override Buttons

28V ESS DC CP Side
FEATHER & AIRSTART – EMER FEATHER

Four feather override buttons are located on the copilot’s side shelf (figure 1A-31). They provide a means for manually stopping the auxiliary pump at completion of the feather cycle. When the condition lever is moved to FEATHER or the fire emergency control handle is pulled, a circuit is completed to a holding coil of the propeller feather override button. The propeller feather override button pulls in and completes circuits to energize the auxiliary pump and feather solenoid. Normally, a pressure switch at the propeller opens the holding solenoid circuit when the blades reach feather and the button pops out. If the button fails to pop out after the feather cycle is completed, the button should be pulled out manually to turn off the auxiliary pump.

PROPELLER ANTI-ICING AND DEICING SYSTEMS



Spinner anti-ice, blade deice and spinner deice circuit breakers shall not be reset until proper inspection and repairs have been made unless a greater emergency exists. Resetting these circuit breakers may cause damage to the propeller control assembly.

The propeller spinner and blades are equipped with heating elements for anti-icing and deicing (figure 1A-32).

Propeller Anti-icing System

28V ESS DC CP Side
PROPELLER DEICING TIMER

115V RH AC P Side
PROPELLER ICE CONTROL – SPINNER
ANTI-ICING

The forward section of the spinner and the propeller after-body are covered by electrical resistance-type heating elements to provide anti-icing. Phase A primary ac power is applied to the heating elements to warm the surface of the spinner and prevent the formation of ice. The ac power is protected by the spinner anti-icing circuit breakers on the pilot’s upper circuit breaker panel and is applied by relays which are controlled by dc control circuits. The control circuits are interconnected with the ice detection systems so that the propeller anti-icing can be turned on automatically when the detection system senses icing. The propeller anti-icing is a continuous-heating-type system.

Propeller Deicing System

28V ESS DC CP Side
PROPELLER DEICING TIMER

115V RH AC P Side
PROPELLER ICE CONTROL ENG NO. Main AC
BLADE DEICING ENG NO. (245)
SPINNER DEICING ENG NO.

The aft portion of the front spinner section, the rear rotating spinner section, the spinner plateaus, and the leading edges and fairing of the propeller blades contain heating elements for deicing the surfaces. The control circuits for the propeller deicing, like the control circuits for the propeller anti-icing system, are connected to the ice detection system so that they may be turned on automatically. The application of spinner and blade deicing power to the heating elements is controlled by the deicing timer. The timer applies power to the heating elements of only one propeller at a time, the elements of each

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Propeller Anti-icing and Deicing System

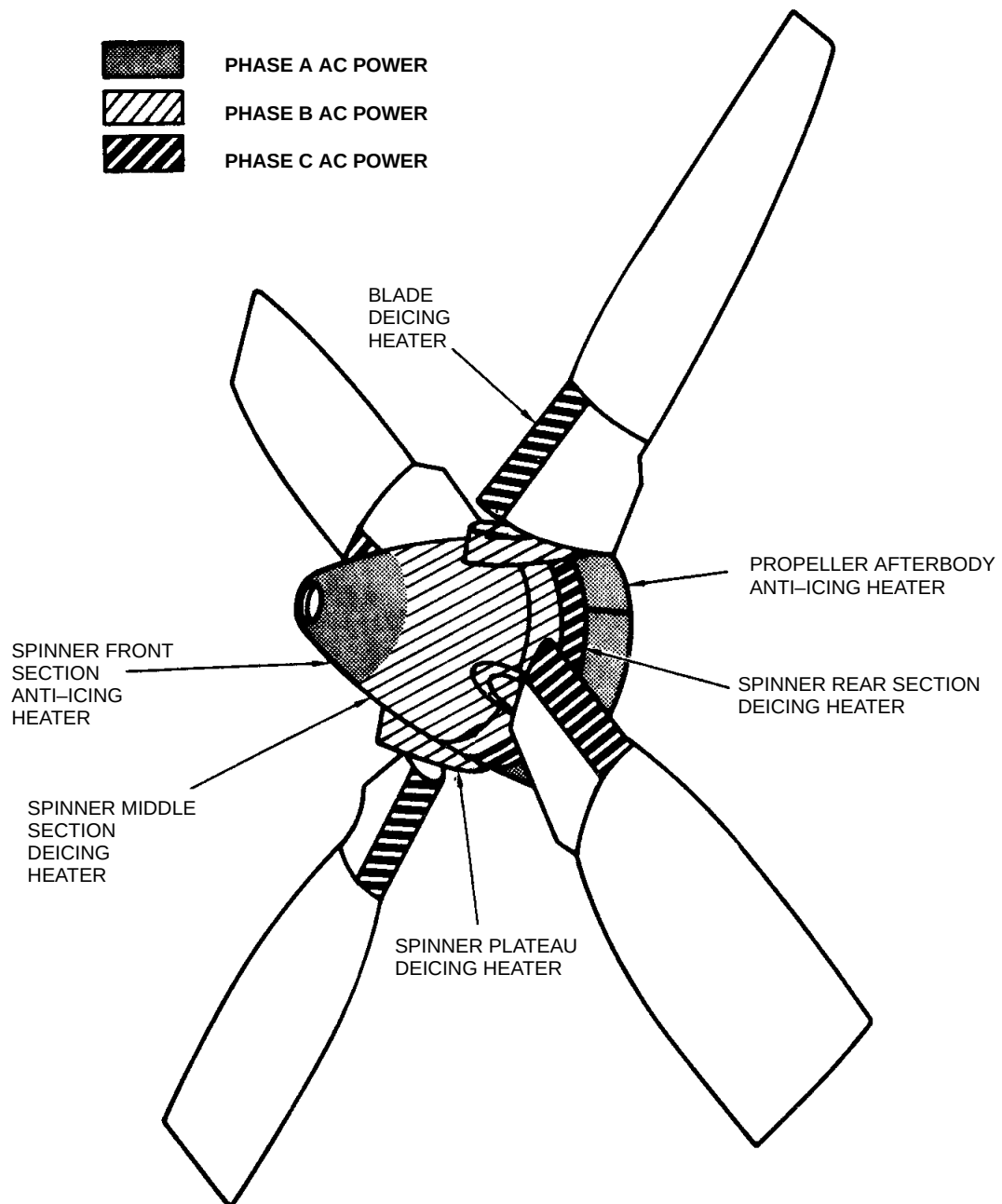


Figure 1A-32

propeller are energized 15 seconds during each 1-minute cycle.

The aft portion of the front spinner section, along with the forward part of the rear rotating spinner section and the spinner plateaus, use Phase B primary ac power. The aft portion of the rear rotating spinner section and the leading edges and fairing of the propeller blades use Phase C primary ac power.

Propeller Ice Control Switches

Four propeller ice control switches are located on the anti-icing systems control panel (figure 1A-5). These two-position (ON, OFF) toggle switches control the propeller anti-icing and deicing systems. When a switch is placed in the ON position and the propeller and engine anti-icing master switch is in the MANUAL position, the anti-icing and deicing systems for the corresponding propeller are energized. If a switch is positioned to ON while the propeller and engine anti-icing master switch is in the AUTO position, the anti-icing and deicing systems are energized only when the ice detection system detects icing. When a switch is placed in the OFF position, the anti-icing and deicing systems for the corresponding propeller are deenergized.

Anti-icing and Deicing Ammeters

Three ammeters located on the anti-icing systems control panel indicate the amperage of the various phases of primary ac power drawn for the propeller anti-icing and deicing systems. The spinner anti-icing ammeter indicates the amperage of Phase A power drawn for anti-icing; the spinner deicing ammeter indicates the amperage of Phase B power drawn for deicing; and the blade deicing ammeter indicates the amperage of Phase C power drawn for deicing. (Refer to Section V for limits.)

ICE DETECTION SYSTEM

28V ESS DC CP Side
ICE DETECTOR – LH OR RH

The ice detection system (figure 1A-28) is used as an automatic control for turning on the radome anti-icing, engine inlet air duct anti-icing, and propeller anti-icing and deicing systems. The detection system consists of a propeller and engine anti-icing master switch, two sets of detector units, indicator lights, a test switch, and control relays. Each set of detection units has a detector and an interpreter. Each detector includes a probe; one is mounted in the No. 2 engine inlet air duct, and the other is in the No. 3 engine duct. The detection units are energized by essential dc power applied through the engine starting circuits, and they are operative when the No. 2 or No. 3 engine is running and the propeller and engine anti-

icing master switch is at AUTO. If either probe becomes iced over while the engine in which it is installed is running, and if the propeller and engine anti-icing master switch is at AUTO position at that time, the detection units trigger a control relay. This relay turns on the anti-icing and deicing systems if the switches for those systems are at ON or AUTO positions. The relay also turns on an indicator light. The ice detection system does not turn off the anti-icing and deicing systems automatically when icing conditions no longer exist, but the master switch can be held at the RESET position to turn them all off simultaneously. A timer in the ice detection system operates after the No. 2 and No. 3 engines are shut down and disarms the detection system. If any of the anti-icing or deicing systems have been left in the automatic operation, they are turned off upon disarming of the detection system at engine shutdown.

Propeller and Engine Anti-icing Master Switch

The propeller and engine anti-icing master switch is located on the anti-icing systems control panel (figure 1A-5). The switch has three positions: AUTO, MANUAL, and RESET. When in the AUTO position, it permits control of the radome anti-icing, engine inlet air duct anti-icing, and propeller anti-icing and deicing systems by the ice detection system. The AUTO position is also used to permit testing of the ice detection system. When in the MANUAL position, the switch permits control of the anti-icing and deicing systems by the individual control switches for the systems. The RESET position is a momentary position used to turn off the anti-icing and deicing systems when icing conditions no longer exist. When the switch is positioned at RESET and allowed to return to AUTO, the ice detection system remains armed; therefore, it will automatically turn on the anti-icing and deicing systems again if it senses icing.

Test Switch

The test switch is located on the ice detection panel (figure 1A-28). It has No. 2 and No. 3 momentary positions and a center OFF position. It is used to test operation of the two sets of ice detector interpreter units by simulating detection of icing. If it is held at No. 2 position while the No. 2 engine is running and the propeller and engine anti-icing master switch is at AUTO, the ON indicator light on the ice detection panel comes on to indicate that the ice detection system has triggered the control relay, which turns on the anti-icing and deicing systems. The No. 3 position of the switch is used in the same manner to test operation of the other set of detector interpreter units. After the test switch is operated to either position, the propeller and engine anti-icing master switch must be held at RESET momentarily to unlock the control relay and rearm the detection system.

On-Light and Press-For-Light-Out Switch

The on-light and the press-for-light-out switch is located on the ice detection panel (figure 1A-28). The indicator light is turned on by the ice detection system whenever it detects ice while the prop and engine anti-icing master switch is in the AUTO position. When lighted, it indicates that icing has been detected by probes in the engine inlet air scoops and that anti-icing and deicing systems have been turned on automatically if the individual system switches are at ON. It also lights when the test switch is operated and then indicates that the detection units are functioning. The momentary light out switch can be operated to turn the light out. If the propeller and engine anti-icing master switch is held in the RESET position to turn off the anti-icing and deicing systems, the light remains off if icing no longer exists.

No-Ice Light

The no-ice light is on the ice detection panel (figure 1A-28). It is turned on when the probes of the detection system are no longer icing for 90 seconds and indicates that the anti-icing and deicing systems can be turned off. If the propeller and engine anti-icing master switch is held in the RESET position to turn the anti-icing and deicing systems off, the light is also extinguished.

GTC (GAS TURBINE COMPRESSOR) (1500 SERIES)

28V ISOL DC P Side
GTC CONTROL

The GTC (figure 1A-33), located forward in the left wheel well, supplies air for ground operation of the air turbine motor, engine starting, and air conditioning system. The unit is composed of a compressor assembly, power turbine assembly, and an accessory assembly.

COMPRESSOR ASSEMBLY

The GTC uses a two-stage, centrifugal-type compressor. When the compressor is operating at full speed, part of the compressed air is discharged into the power turbine to support combustion, and the remainder is available as pneumatic power.

POWER TURBINE ASSEMBLY

The power turbine assembly drives the compressor and the GTC accessories. The assembly consists of a turbine section and a combustor. Fuel is injected into the combustion chamber, mixed with air, and burned. The combustion gases are directed against the turbine wheel, which supplies rotary power

to drive the compressor and accessory assemblies. After being used to turn the turbine wheel, the combustion gases pass out through the exhaust.

ACCESSORY ASSEMBLY

The accessory assembly of the GTC consists of a starter motor, oil and fuel pumps, an oil cooler fan, and a governor. The accessory group, with the exception of the starter motor, is powered through a reduction gear train directly coupled to the compressor drive shaft. The starter motor is coupled to the reduction gear train through a spring-loaded clutch. The starter clutch is disengaged by centrifugal force when the unit reaches approximately 35 percent of its nominal governed speed.

GTC OIL SYSTEM

The GTC oil circulation system provides lubrication for all gears and shaft bearings. Oil from a fuselage-mounted reservoir (3 quart capacity) is delivered by a gear-type pump through an oil filter to the various lubrication points. A relief valve in the system maintains the desired pressure. Oil is removed from the unit by a dual scavenge pump and returned to the reservoir, either through the oil cooler or, if oil temperature is below 27 °C (81 °F), through the oil cooler bypass valve. An oil drain line is connected to the accessory section to eliminate the possibility of oil accumulation after the gas turbine compressor is stopped. Oil used in this unit must conform to the specification and grade listed in the general arrangement and servicing diagram (see figure 1A-4).

GTC FUEL SYSTEM

Fuel for operation of the GTC may be supplied from any fuel tank through the crossfeed manifold. A pressure regulator limits the inlet pressure to the GTC gear-driven fuel pump to approximately 15 psi. A fuel strainer is located in the supply line between the pressure regulator and the combustion chamber. In addition to filtering the fuel, the strainer removes water from the incoming fuel and collects it in a sump. A valve is provided for sump drainage. During the starting cycle, when the oil pressure in the GTC oil system reaches approximately 3 psi, the fuel and ignition circuits are energized through a switch actuated by oil pressure. The fuel supply to the GTC is shut off by moving the GTC control switch to OFF or by pulling the GTC fire emergency handle.

GTC CONTROL SYSTEM

The operation of the GTC is governor-controlled to maintain a nearly constant speed of approximately 100% (42,100 rpm) rpm under varying load conditions. The speed-sensing governor, powered by the accessory gear train, controls the unit by regulating fuel flow into the combustion chamber. An overspeed switch closes the fuel shutoff valve to prevent overspeeding. The GTC can be operated on the ground only through the touchdown circuit.

Gas Turbine Compressor

1. HOURMETER
2. EXTERNAL PRESSURE CONNECTION
3. GTC COMPARTMENT COOLING EXHAUST
4. EXHAUST
5. INLET
6. GTC PRIMER BUTTON
7. ACCELERATION LIMITER ORIFICE

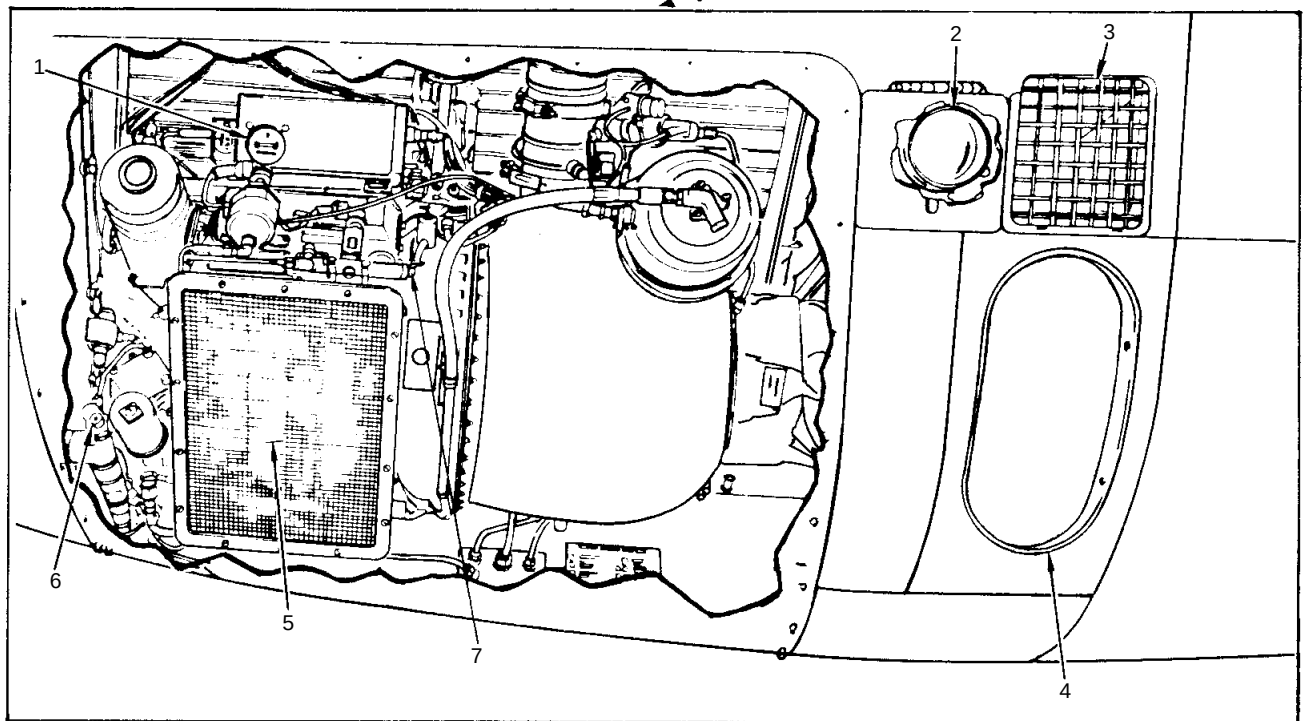
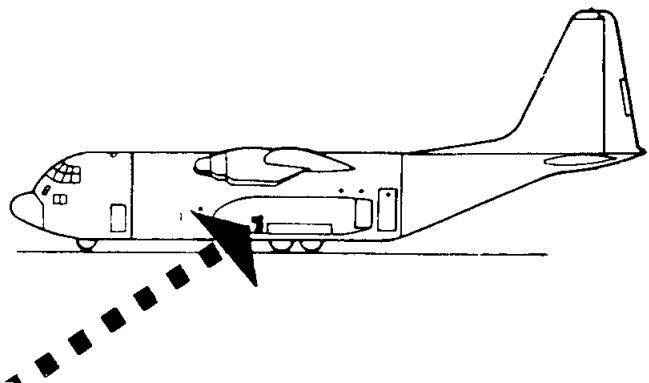


Figure 1A-33

Gas Turbine Compressor Control Panel

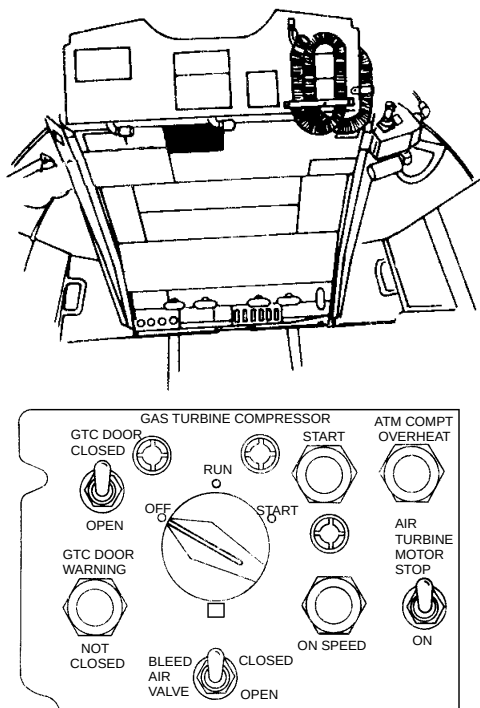


Figure 1A-34

GTC CONTROLS

28V ISOL DC P Side
GTC CONTROL

All GTC controls are located on the GTC control panel (figure 1A-34), on the overhead control panel.

GTC Control Switch

28V ISOL DC P Side
Current Limiter

A selector switch for the GTC is located on the GTC control panel (figure 1A-34). This three-position (OFF, RUN, START) rotary switch controls the operation of the GTC. Holding the selector switch in the spring-loaded START position energizes the self-holding GTC starter relay. This relay will remain closed until the circuit is broken by the 35-percent speed switch or by moving the selector switch to the OFF position. When the switch is released, it moves to the RUN position. In this position, all GTC circuits are energized to the various automatic controls. These oil-pressure and speed-sensitive switches control their respective circuits to accomplish starting and running of the GTC. In the OFF position, all circuits are deenergized.

GTC Door Switch

28V ISOL DC P Side
GTC CONTROL

28V MAIN DC CP Side
DOOR WARNING LIGHT

A two-position (OPEN, CLOSED), toggle switch on the GTC control panel (figure 1A-34) controls the opening and closing of the GTC intake door. A limit switch in the GTC door actuator and a GTC DOOR control switch are connected in the gas turbine compressor control circuit. When the GTC DOOR control switch is placed in the OPEN position, it completes a circuit from the GTC CONTROL circuit breaker through contacts of a GTC fire emergency handle switch and the auxiliary touchdown relay to the open field of the GTC door actuator motor. When the doors are open, two limit switches close their contacts. One switch is the door limit switch on the wheel well fairing which completes a circuit to energize a GTC DOOR WARNING light on the GTC control panel. The other switch is in the GTC door actuator and is connected in the gas turbine compressor control circuit. The gas turbine compressor cannot be started until the doors are open. If the doors are not fully open while the gas turbine compressor is operating, the control circuit will be opened and the gas turbine compressor will stop. The GTC door upper switch permits the GTC to be operated if the actuator should fail in the closed position. The door is separated from the actuator by removing the attaching screws, and the GTC upper door switch closes to bypass the switch built into the actuator.

Bleed Air Valve Switch

28V ISOL DC P Side
GTC CONTROL

A bleed air valve switch is located on the GTC control panel (figure 1A-34). After the compressor reaches operating speed, this two-position (OPEN, CLOSED) toggle switch controls the normally closed, solenoid-operated bleed air valve. With the valve closed, air is supplied to the power turbine combustion chamber only. With the valve open, air is supplied to both the combustion chamber and the bleed air system of the airplane. Applying a bleed air load to the compressor before it reaches operating speed is prevented by the 95-percent speed switch, which completes the circuit to the bleed air valve switch only after operating speed is reached.

Fire Emergency Control Handle

28V ISOL DC P Side
GTC CONTROL

28V BATT DC P Side
FIRE EXTINGUISHER

The GTC fire emergency handle on the overhead control panel provides for emergency shutdown of the GTC. This

CGTO 1C-130-1

handle, when pulled, energizes the motor-operated oil shutoff valve closed, and deenergizes power to the GTC door and control switch. When the circuit to the control switch is broken, the motor-operated fuel valve is energized closed. The solenoid-operated fuel and bleed air valves are also deenergized to the closed position.

GTC INDICATORS

The indicators for the GTC are located on the GTC control panel (figure 1A-34), which is part of the overhead control panel.

Start Light

A start light is located on the GTC control panel. This press-to-test light glows to indicate that the starter motor is energized. The light stays on until the compressor reaches approximately 35 percent rpm, at which time a centrifugal switch deenergizes the starter and the start light.

On-Speed Light

An on-speed light is located on the GTC control panel. This press-to-test light is energized through the 95-percent speed switch, and it indicates that the compressor has reached or is maintaining operating speed.

ATM (AIR TURBINE MOTOR) (1500 SERIES)

28V ISOL DC P Side
ATM CONTROL

The ATM, located in the left wheel well above and aft of the GTC, is a single-stage, axial-flow turbine used to drive a 20-kVA, ac generator to supply 115/ 200-volt, three-phase, ac power. With the airplane on the ground and at an ambient temperature of 40 ° C (104 ° F) or less, the ATM-driven ac generator is rated at 30-kVA (1.0 reading on loadmeter). Compressed air for ground operation of the ATM is furnished by the GTC, engines, or an external source. Compressed air for in-flight operation of the ATM is supplied by bleed air from the engines. The speed of the unit is controlled by a speed-sensing butterfly valve in the turbine inlet which meters the amount of air supplied to the turbine and provides automatic shutdown in case of overspeed and must be manually reset in the ATM compartment. A cooling fan for the ac generator, energized by generator output, is included in the unit. A plug assembly for the ATM cooling fan intake is supplied with the airplane and stowed in the miscellaneous stowage box.

The ATM generator can be operated with the fan failed as follows:

During Flight	Full load No time limit
Ground Operation	20 kVA (66% load 0.66) No time limit

ATM CONTROL SWITCH

28V ISOL DC P Side
ATM CONTROL

The ATM control switch is located on the GTC control panel (figure 1A-34). This two-position (ON, STOP) toggle switch controls a shutoff valve in the ATM inlet line. When the switch is moved to the ON position, the shutoff valve is opened, and compressed air is admitted to drive the ATM.

APU (AUXILIARY POWER UNIT) (1600 SERIES, CG 1790, AND 1700 SERIES)

28V ISOL DC P Side
APU CONTROL

The APU (figure 1A-35), located forward in the left wheel well, supplies air for ground operation of the air conditioning systems and engine starters. It also provides shaft power to drive a 40 kVA ac generator on the ground or in flight. The unit is composed of a compressor assembly, power turbine assembly, and an accessory assembly.

COMPRESSOR ASSEMBLY

The APU uses a two-stage, centrifugal type compressor. When the compressor is operating at full speed, part of the compressed air is discharged into the power turbine to support combustion, and the remainder is available as pneumatic power.

POWER TURBINE ASSEMBLY

The power turbine assembly drives the compressor and the APU accessories. The assembly consists of a turbine section and a combustor. Fuel is injected into the combustion chamber, mixed with air, and burned. The combustion gases are directed against the turbine wheel, which supplies rotary power to drive the compressor and accessory assemblies. After being used to turn the turbine wheel, the combustion gases pass out through the exhaust.

Auxiliary Power Unit

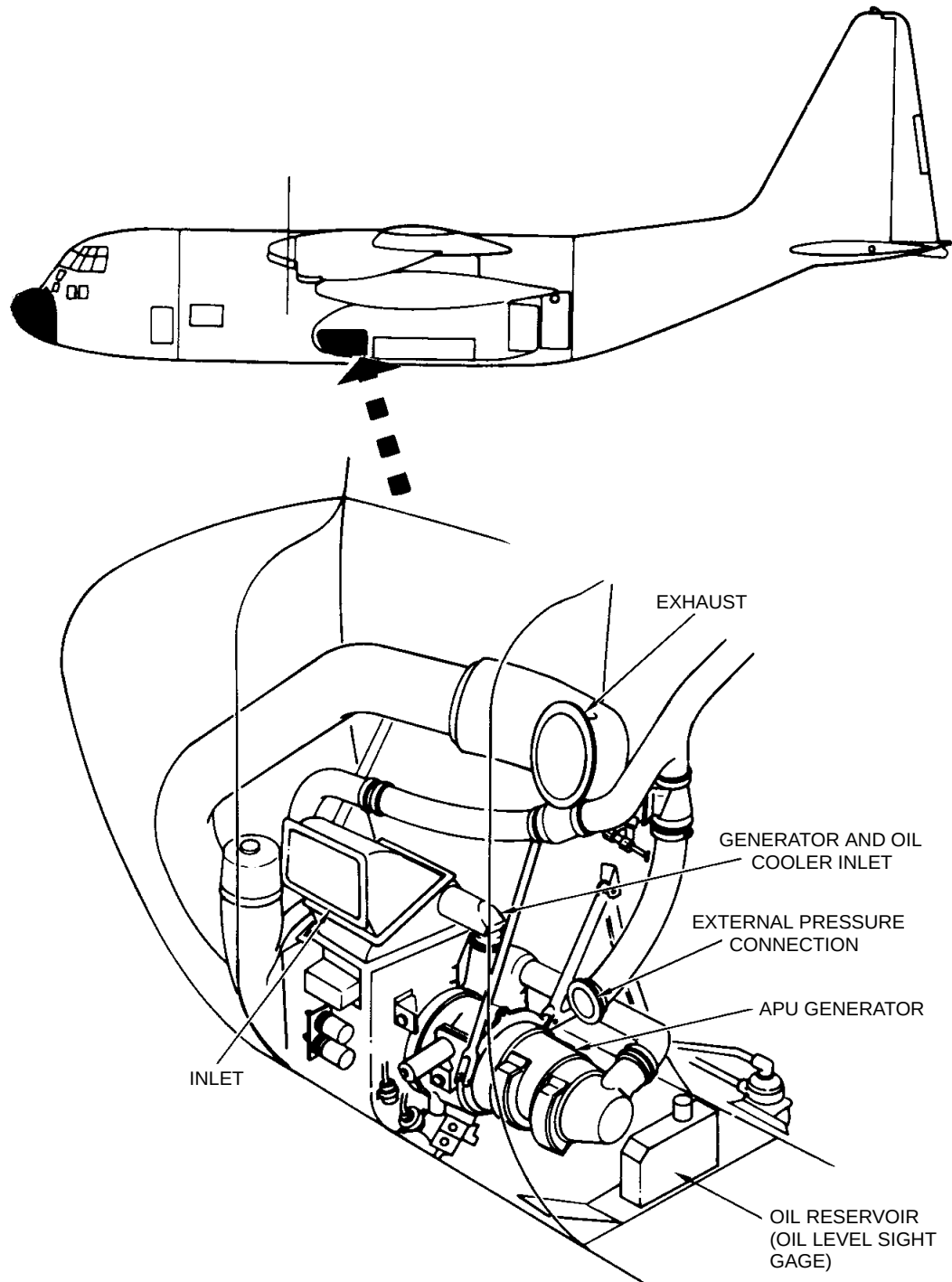


Figure 1A-35

ACCESSORY ASSEMBLY

The accessory assembly of the APU consists of a starter motor, oil and fuel pumps, an oil cooler fan, tachometer generator, mounting pad for shaft powered accessory (APU generator) and a governor. The accessory group, with the exception of the starter motor, is powered through a reduction gear train directly coupled to the compressor drive shaft. The starter motor is coupled to the reduction gear train through a spring-loaded clutch.

APU OIL SYSTEM

The APU oil circulation system provides lubrication for all gears and shaft bearings. Oil from a reservoir (4 qts capacity) mounted in the APU compartment is delivered by a gear-type pump through an oil filter to the various lubrication points. A relief valve in the system maintains the desired pressure. Oil is removed from the unit by a dual scavenge pump and returned to the reservoir, either through the oil cooler or, if oil temperature is below 27 °C (81 ° F), through the oil cooler bypass valve. An oil drain line is connected to the accessory section to eliminate the possibility of oil accumulation after the APU is stopped. Oil used in this unit must conform to the specification and grade listed in the general arrangement and servicing diagram (MIL-L-23699).

APU FUEL SYSTEM

Fuel is gravity-fed from No. 2 main fuel tank through a motor-operated shutoff valve outside the tank boundary in No. 2 dry bay. The valve opens when the APU control switch is in the START position and remains open when the switch is released to RUN. The valve is closed when the switch is in the STOP position or when the APU fire emergency control handle is pulled. A fuel strainer is located in the line behind the APU compartment. During the starting cycle, when the oil pressure in the APU oil system reaches approximately 4 psi, the fuel and ignition circuits are energized through a switch actuated by oil pressure.

APU CONTROL SYSTEM

The operation of the APU is governor-controlled to maintain a nearly constant speed of approximately 100 percent rpm (42,000 rpm) under varying load conditions. The speed-sensing governor, powered by the accessory gear train, controls the unit by regulating fuel flow into the combustion chamber. An overspeed switch deenergizes the control circuit which shuts the unit down.

APU CONTROLS

28V ISOL DC P Side
APU CONTROL

All APU controls are located on the APU control panel (figure 1A-36), on the overhead control panel.

APU Control Switch

A three-position (STOP, RUN, START) toggle switch controls the operation of the APU. When the APU control switch is placed to RUN or START, power is supplied to open the APU inlet door. The inlet door is powered through contacts of the auxiliary touchdown relay. The door opens approximately 35 degrees on the ground and 15 degrees in flight. Holding the APU control switch in the spring-loaded START position energizes the start and holding relays, which opens the wing tank APU fuel shutoff valve and energizes the starter. The start relay remains energized until the circuit is broken by the 35-percent speed switch or by moving the control switch to the STOP position. When the switch is released, it moves to the RUN position. In this position, all APU circuits are energized to the various automatic controls. These oil-pressure and speed-sensitive switches control their respective circuits to accomplish starting and running of the APU. In the STOP position, all circuits are deenergized. When the APU control switch is placed in STOP, the overspeed test solenoid breaks the contacts on the 110 percent speed switch and shuts down the APU. If the 110 percent switch is inoperative, the APU will not shut down and the fire emergency control handle must be pulled to deenergize the holding circuit and to close the APU fuel shutoff valve. When the APU control switch is placed in STOP or the fire handle is pulled, the APU inlet door is energized to close after the APU speed has decreased to approximately 18 percent rpm. This action is provided by an oil pressure switch which actuates at approximately 20 psi and is to prevent collapsing the inlet duct due to negative pressure when the door closes.

Auxiliary Power Unit Control Panel

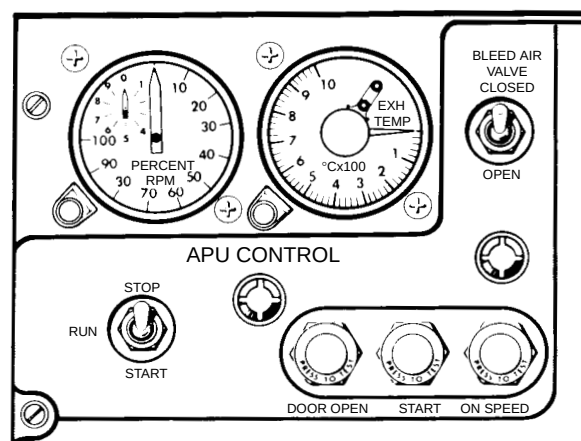


Figure 1A-36

WARNING

Ensure that the APU CONTROL circuit breaker on the pilot's side circuit breaker panel is open before working around the APU air intake door. Failure to comply could result in serious injury to personnel due to the action of the APU door.

NOTE

The APU door can be opened on the ground to run the APU, when the door actuator has failed, by removing the retaining bolt on the actuator, sliding the actuator forward to open the door, and replacing the bolt to retain the door in the open position. To bypass the actuator limit switch, disconnect the actuator limit switch, disconnect the actuator connector plug and attach it to the dummy receptacle adjacent to the actuator.

Bleed Air Valve Switch

A bleed air valve switch is located on the APU control panel (figure 1A-36). After the compressor reaches 95 percent rpm, this two-position (OPEN, CLOSE) toggle switch controls the normally closed, solenoid-operated bleed air valve. With the valve closed, air is supplied to the power turbine combustion chamber only. With the valve open, air is supplied to both the combustion chamber and the bleed air system of the airplane. Applying a bleed air load to the compressor before it reaches operating speed is prevented by the 95-percent speed switch, which completes the circuit to the bleed air valve switch only after operating speed is reached.

Fire Handle

28V	ISOL DC	P Side
APU CONTROL		
28V	BATT DC	P Side
FIRE EXTINGUISHER		

The APU fire handle (figure 1A-5) on the overhead control panel provides for emergency shutdown of the APU. This handle, when pulled, energizes the motor-operated fuel shut-off valve closed, and energizes the APU door closed after APU speed has decreased to approximately 18 percent rpm. It also interrupts control power to the APU, causing it to shut down.

APU INDICATORS

The indicators for the APU are located on the APU control panel (figure 1A-36), which is part of the overhead control panel.

Start Light

A start light is located on the APU control panel. This press-to-test light glows to indicate that the starter circuit is energized. The light stays on until the APU reaches approximately 35 percent rpm, at which time a centrifugal switch deenergizes the starter and the start light.

On Speed Light

An on speed light is located on the APU control panel. This press-to-test light is energized through the 95-percent speed switch, and it indicates that the APU has reached or is maintaining operating speed.

APU Door Open Light

An APU door open light is located on the APU control panel (figure 1A-36). This press-to-test light illuminates when the APU intake door is not closed.

APU Tachometer

The tachometer located on the APU control panel (figure 1A-36) indicates APU speed in percent of normal APU rpm. Normal rpm (100 percent) equals 42,000 rpm. A vernier dial on each indicator makes it possible to read to the nearest percent. The tachometer system has an APU-driven tachometer generator and is not dependent upon the airplane electrical system for operation.

APU Exhaust Gas Temperature (EGT) Indicator

The EGT indicator is located on the APU control panel (figure 1A-36). The indicator is graduated from 0 to 1,000 degrees Centigrade with 20° increments. The EGT system is a thermocouple thermometer that is not dependent upon the airplane electrical system for operation. See Section V for operating limits.

FUEL SYSTEM

The fuel system is a modified manifold-flow type, incorporating a fuel crossfeed system, a single point refueling and defueling system, and a fuel dump system. The system provides fuel supply for the four engines and the gas turbine compressor/auxiliary power unit. It is adaptable to a number of flow arrangements (figure 1A-37). Fuel specifications and grades are listed in the servicing diagram (figure 1A-4) at the beginning of this section. Nominal values for fully serviced and total usable capacities of the fuel tanks are shown in figure 1A-38. Airplane limitations resulting from use of alternate fuel are discussed in Section V.

Fuel System

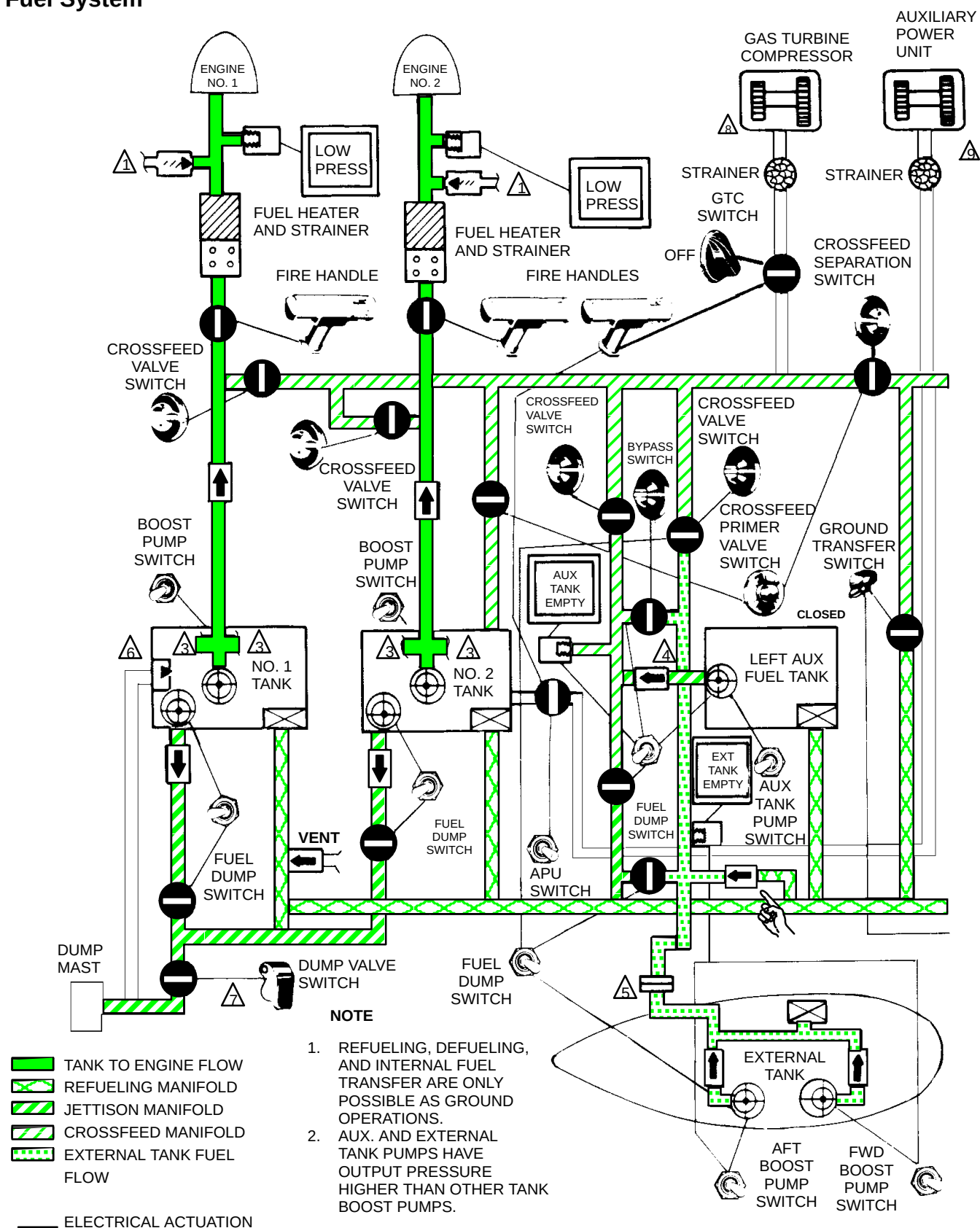


Figure 1A-37 (Sheet 1 of 2)

NOTES

1	OVERBOARD DRAIN LINE	8	GTC (1500 SERIES)
2	SURGE SUPPRESSOR	9	APU (1600, 1790, 1700 SERIES)
3	WATER REMOVAL SYSTEM		
4	FIXED OPEN WHEN EXTERNAL TANKS ARE NOT INSTALLED		
5	LINES CAPPED WHEN EXTERNAL TANKS ARE NOT INSTALLED		
6	1500 SERIES, CG 1705 AND UP		
7	VALVES ACTUATED BY TOUCH-DOWN SWITCH (CLOSED ON GROUND OPEN IN FLIGHT) (1500 SERIES)		

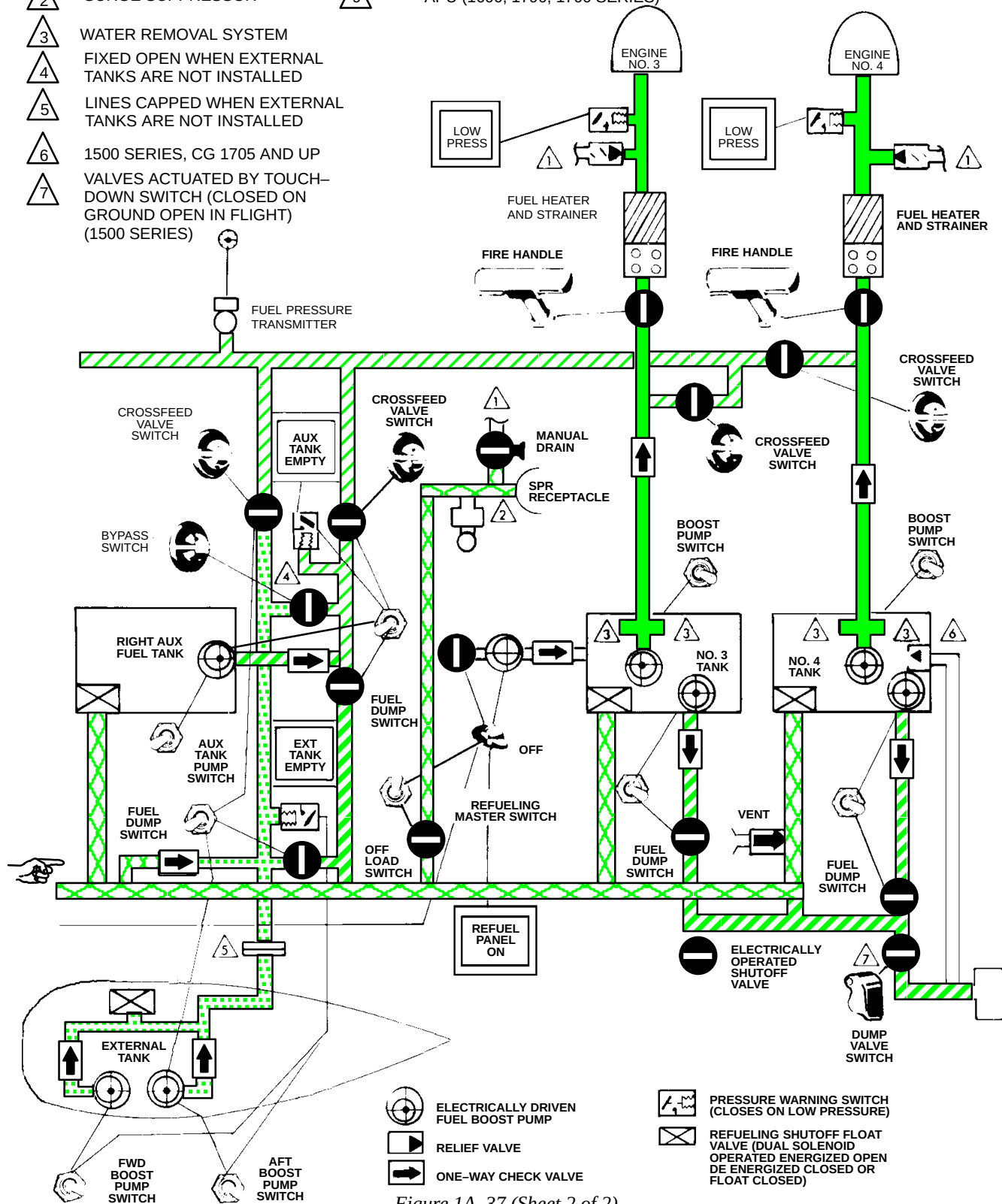


Figure 1A-37 (Sheet 2 of 2)

FUEL FLOW

Each engine may be supplied fuel either directly from the main respective fuel tank or through the crossfeed manifold system from any tank. Fuel for the GTC is supplied through the crossfeed manifold system also, and may come from any tank. Fuel for the APU is routed directly from the No. 2 fuel tank.

REFUELING AND DEFUELING

All fuel tanks may be refueled or defueled from a single point ground refueling and defueling receptacle located in the right aft landing gear fairing. Fuel is routed from the single point receptacle through the refueling manifold. Each tank has a separate supply line from the manifold and each supply line has a float type shutoff valve. Refueling is controlled at the single point refueling control panel, located above the refueling receptacle. As an alternate method, tanks may be fueled separately through a filler opening in the top of each tank. The auxiliary fuel tanks do not have filler openings in the top of the wing. Refer to Refueling and Defueling in the appropriate T.O.

INTERNAL TANKS

There are six fuel tanks located within the wing. The number one, two, three, and four tanks are integral and use sealed wing structure for tank walls. The left and right auxiliary fuel tanks are each comprised of units of three bladder type cells. The three cells are interconnected to form one assembly and are laced within the center wing section. Each of the six tanks has a three phase, ac-powered boost pump to assure fuel flow.

Fuel level around the boost pump is maintained in each main tank by the water removal system. An additional pump is located in each main tank for fuel dumping.

Water Removal System

The water removal system provides continual water removal from the tank low points during boost pump operation. The system consists of two ejectors, a check valve, a strainer and associated plumbing in each tank. The ejectors are connected by plumbing to the boost pump discharge line and a part of the boost pump fuel flow is routed through each ejector housing and discharged through its nozzle. This fuel flow through the ejectors causes a differential pressure and additional fuel is drawn from between the lower wing panel risers and is ejected into the surge box. Any time the fuel boost pump is operating, the fuel will be continually stirred, preventing water from settling in the bottom of the tank.

VENT SYSTEM

All of the fuel tanks are vented to the atmosphere to equalize pressure at all times. Tanks No. 2 and No. 3 and the left and right auxiliary have wrap-around vent systems. The wrap-around system permits venting for the above tanks even though the airplane is not in a wing-level attitude. Vent air leaving the tank passes through a vent tank on its way overboard. Any fuel entering the vent lines because of a change of attitude of the airplane collects in the vent tank and is returned to the tank continuously by a jet eductor pump operated by fuel flow taken from the boost pump discharge line. Boost pump pressure is necessary for the vent eductor system to operate. The extreme outboard tanks, No. 1 and No. 4, are vented by float controlled valves to prevent fuel loss overboard on the ground when the airplane is not in a wing-level attitude and in flight when the wings deflect upward. The external tanks are vented through the spaces at the tops of the bulkheads separating the tank compartments, and through the fuel vent line. The vent line runs from the forward compartment of the tank through the pylon, and up into the wing trailing edge where it vents to the atmosphere. Fuel will not fill the vent line because the tank is separated by compartments, and the line is at the top of the tank and runs upward to the wing.

Servicing Capacities

USABLE FUEL

BOOST PUMPS ON									BOOST PUMPS OFF									
JP-4				JP-5			JP-8			JP-4			JP-5			JP-8		
TANK	GAL.	LBS.	<1>	GAL.	LBS.	<1>	GAL.	LBS.	<1>	GAL.	LBS.	<1>	GAL.	LBS.	<1>	GAL.	LBS.	<1>
NO. 1	1288	8372	0	1288	8758	0	1288	8630	0	1065	6923	1450	1065	7242	1516	1065	7136	1494
NO. 2	1186	7709	0	1186	8065	0	1186	7946	0	1055	6858	852	1055	7174	891	1055	7069	878
NO. 3	1186	7709	0	1186	8065	0	1186	7946	0	1055	6858	852	1055	7174	891	1055	7069	878
NO. 4	1288	8372	0	1288	8758	0	1288	8630	0	1065	6923	1450	1065	7242	1516	1065	7136	1494
L AUX	901	5856		901	6127		901	6037										
R AUX	901	5856		901	6127		901	6037										
L EXT	1379	8963		1379	9377		1379	9239										
R EXT	1379	8963		1379	9377		1379	9239										
TOTAL	9508	61800		9508	64654		9508	63704		4240	27562	4604	4240	28832	4814	4240	28410	4744

TOTAL FUEL (GROUND FUELING)

TANK	U.S. GALS.	JP-4 LBS.	JP-5 LBS.	JP-8 LBS.
NO. 1	1300	8450	8840	8710
NO. 2	1200	7800	8160	8040
NO. 3	1200	7800	8160	8040
NO. 4	1300	8450	8840	8710
L AUX	910	5915	6188	6097
R AUX	910	5915	6188	6097
L EXT	1400	9100	9520	9380
R EXT	1400	9100	9520	9380
TOTAL	9620	62530	65416	64454

NOTES:

- <1> Gauge reading when only unusable fuel remains.
- Fuel quantities are the same whether tanks are filled by single point method or over the wing.
- JP-4 6.5 lbs. per gal., ICAO standard day.
JP-5 6.8 lbs. per gal., ICAO standard day.
JP-8 6.7 lbs. per gal., ICAO standard day.
- JP-4 18,730 BTU per lb.
JP-5 18,580 BTU per lb.
JP-8 18,400 BTU per lb.
- Never service the airplane with fuel containing TRI-CRESYLPHOSPHATE (TCP).

Figure 1A-38

Pressure Relief Valve (1500 Series, CG 1705 and up)

Pressure relief valves are installed in the No. 1 and No. 4 main tanks. Each relief valve is connected to the dump manifold and is completely open at an internal tank pressure of 3.5 psi and will completely close and reseal at 2.5 psi.

EXTERNAL TANKS

Two all-metal external fuel tanks are mounted under the wings on pylons between the inboard and outboard engines. The tanks are partially compartmented for center of gravity control. All fuel flows into the center compartment through check valves. A surge box in the tank center compartment contains a forward and an aft boost pump, providing dual reliability and an increased fuel dumping rate if both pumps are operated during fuel dumping. Both pumps have overriding output pressures which, under normal operation, assure depletion of fuel from the external tank before the main tanks are affected.

FUEL STRAINER AND HEATER UNIT

A combination fuel filter and heater is located in the right side of each nacelle. Heat is transferred from engine oil to the fuel in the heater unit, and the temperature is thermostatically controlled.

CROSSFEED PRIMER SYSTEM

28V ESS DC CP Side
FUEL MANAGEMENT – ENGINE CROSSFEED
VALVES – PRIME

A press-to-actuate crossfeed fuel primer valve switch is located on the fuel control panel. This switch, when depressed, moves the motor-operated crossfeed fuel primer valve to the open position and opens the motor driven crossfeed separation valve. This allows fuel to flow through the manifold into the No. 2 fuel tank to remove any trapped air. Normally, fuel from the No. 4 tank is used to prime the manifold. This requires that the No. 4 tank crossfeed valve be open and that the No. 4 tank boost pump be on. Releasing the switch actuates the primer valve to the closed position and closes the crossfeed separation valve.

FUEL DUMPING SYSTEM

28V ESS DC CP Side
FUEL MANAGEMENT – FUEL DUMP VALVES

115V MAIN AC CP Side
DUMP PUMPS – TANK NO.
AUXILIARY TANK – EXT TANK PUMP

A fuel dump system is provided to enable all fuel, except approximately 2,100 pounds in each outboard tank, 1,800 pounds in each inboard tank and approximately 65 pounds in the external tanks, to be dumped overboard. Eight two-position (OFF, DUMP) toggle switches are located on the fuel control panel (figure 1A-39). For dumping rates, refer to the dumping chart in Section III. Actuation of any switch will initiate the dumping overboard of the fuel in its respective tank. The No. 1, No. 2, and the left auxiliary and external tanks feed into a common dumping manifold in the wings which has its outlet in the left wing tip. The right auxiliary and external tanks, No. 3 tank, and No. 4 tank feed into a manifold in the wings which has its outlet in the right wing tip. Check valves at each tank dump outlet prevent any reverse flow. The No. 1, No. 2, No. 3, and No. 4 tanks have individual integral pumps specifically for dumping. The left auxiliary tank and right auxiliary tank use the same pump for dumping and normal boost pumping. The aft boost pump in the external tanks is used for normal dumping, and the forward boost pump can be switched on manually to increase the dumping rate. Actuation of a dump switch will open the 28-volt dc motor-operated jettison valve and simultaneously turn on the pump for the selected tank. The respective crossfeed valve will close when the dump switch for the auxiliary or external tanks is placed in the DUMP position.

Dump Mast Shutoff Valves (1500 Series)

28V ESS DC CP Side
FUEL DUMP VALVES

A fuel dump shutoff valve is located in the line going to each of the two dump masts. The plumbing on these airplanes has been modified so that the refueling manifold and dump lines are connected together to permit rapid off-loading of fuel through the SPR receptacle using the dump pumps. The dump mast shutoff valves prevent fuel from coming out of the dump mast during ground defueling operation. The valves are actuated by the touchdown switch to close on the ground and open in flight.

Dump Valve Switches (1600 Series, CG 1790, and 1700 Series)

28V ESS DC CP Side
DUMP VALVES RH AND LH

Two two-position (NORM, OPEN) guarded dump valve switches on the main fuel control panel (figure 1A-40) are provided to open and close the dump mast shutoff valves. When the switches are placed in the OPEN position, the dump mast shutoff valves open to allow fuel to dump overboard when the dump pump switches are actuated. The NORM position closes the dump mast shutoff valves.

Fuel Control Panel (1500 Series)

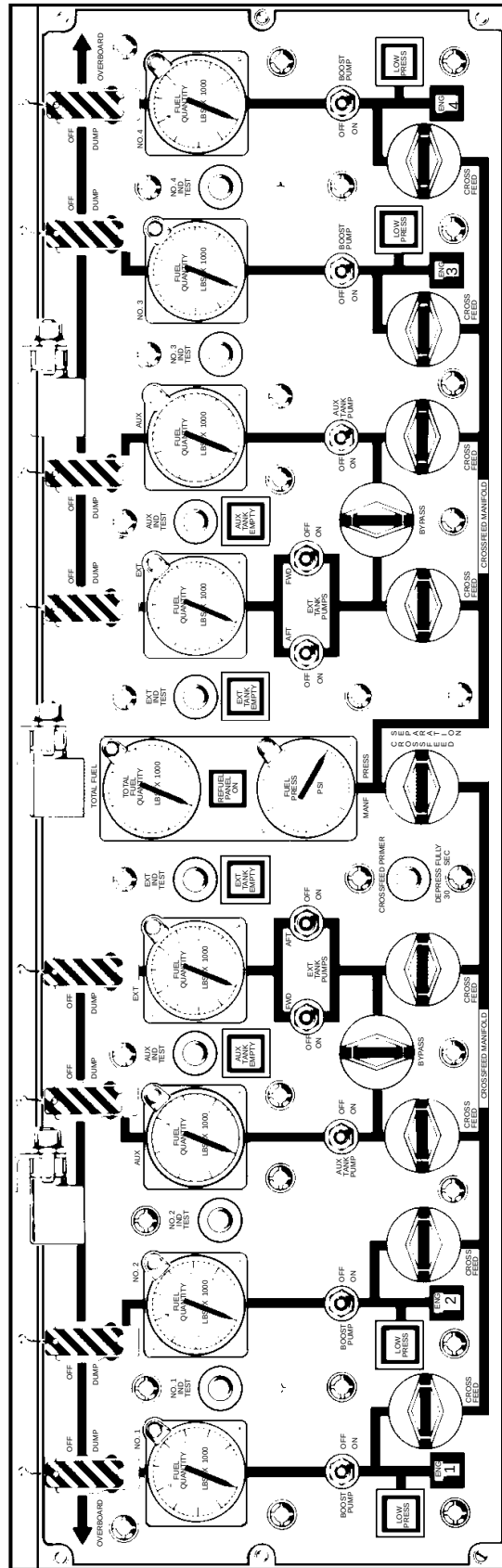
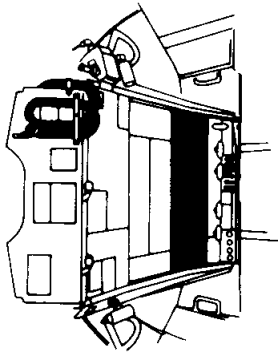


Figure 1A-39

Fuel Control Panel (1600 Series CG 1790 and 1700 Series)

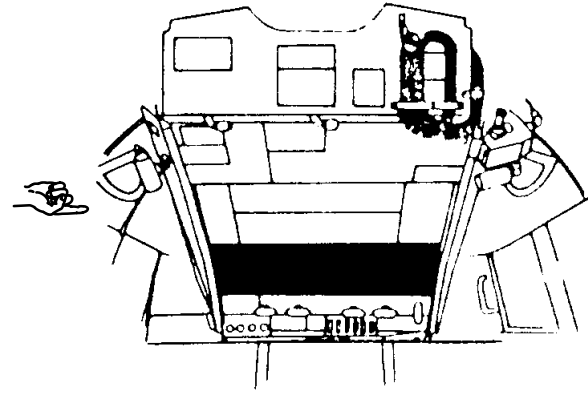
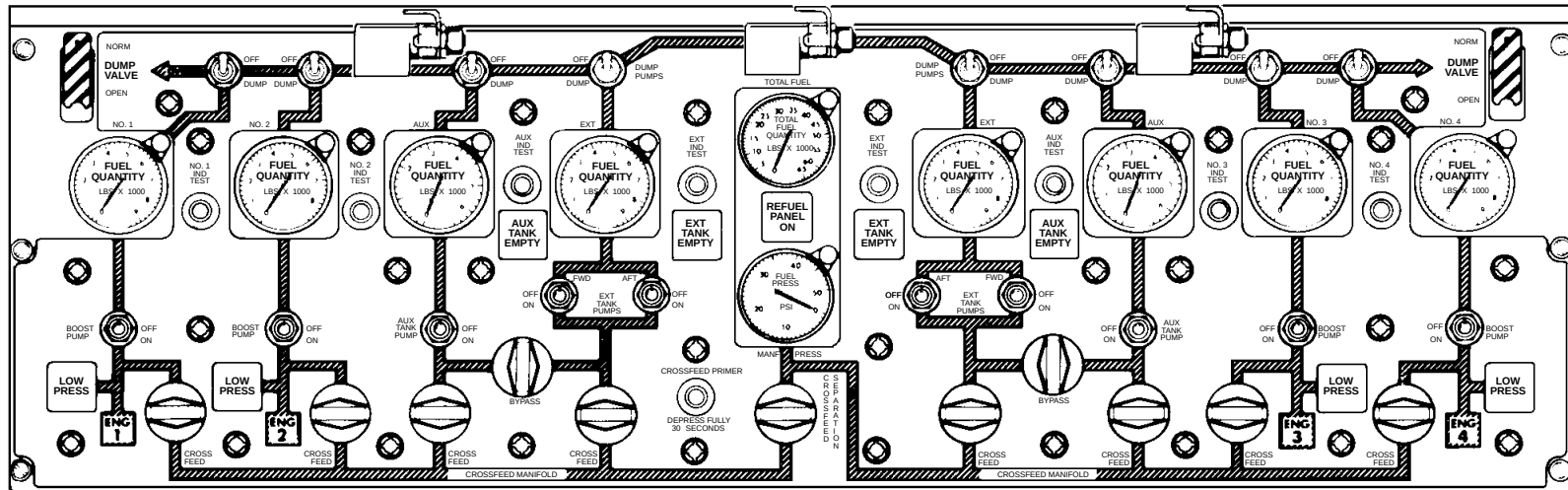


Figure 1A-40



FUEL SYSTEM CONTROLS

All controls for in-flight management of the fuel system are located on the fuel control panel.

Boost Pump Switches

115V	LH AC (NO. 1) ESS AC (NO. 2) MAIN AC (NO. 3 and AUXS) RH AC (NO. 4) RH AC (Forward Pump RH EXT) LH AC (Forward Pump LH EXT) MAIN AC (Aft Pumps EXT)	P & CP Side

Ten boost pump switches are located on the fuel control panel. The No. 1, 2, 3, and 4 fuel tank boost pump switches control the internal boost pumps for their respective tanks. The left and right auxiliary fuel tank pump switches control the pump in each of the auxiliary tanks. The two pump switches for each external tank control the forward and aft boost pumps in the external tanks.

Crossfeed Valve Switches

28V	ESS DC	CP Side
FUEL MANAGEMENT – ENGINE CROSSFEED VALVES		

Crossfeed valve switches are located on the fuel control panel. These are two-position rotary switches. When the switches are placed in the crossfeed position (switch markings aligned with the fuel control panel markings), the motors are energized to open the valves. When the switches are placed in the OFF position (switch markings at right angles to the panel markings), the valve motors are energized to close the valves. In case of power failure, the valves hold the last energized position.

Bypass Valve Switches

28V	ESS DC	CP Side
FUEL MANAGEMENT – ENGINE CROSSFEED VALVES – 1 & 4 or 2 & 3		

Two bypass valve switches are located on the fuel control panel to permit an alternate path for fuel from the left and right auxiliary and external fuel tanks if crossfeed valves fail to open. These are two-position rotary switches. When switches are placed in bypass position (switch markings aligned with fuel control panel markings), valve motors are energized to open the valves and allow external tank fuel to be crossfed or jettisoned through the auxiliary tank crossfeed or jettison valves, and vice versa. The bypass valves may be used to jettison main tank fuel in the event of main tank dump valve failure. When switches are placed in the OFF position

(switch markings at right angles to panel markings), valve motors are energized to close the valves. In case of power failure, the valves hold the last energized position.

Crossfeed Separation Valve Switch

28V	ESS DC	CP Side
FUEL MANAGEMENT – ENGINE CROSSFEED VALVES – PRIME		

The crossfeed separation switch is located on the fuel control panel. The crossfeed separation valve is provided in the crossfeed manifold system to permit additional control on fuel routing. The crossfeed separation valve provides for directing fuel from tanks located in the left section of the wing to engines No. 1 and No. 2 while engines No. 3 and No. 4 operate on fuel from the tanks located in the right section of the wing. This procedure ensures a more even fuel consumption when operating from the auxiliary or external tanks through the crossfeed manifold. Since there may be a slight variation in boost pump pressure, and if both pumps were supplying the manifold, the pump operating at the highest pressure would feed the manifold if not prevented by the separation valve when the crossfeed separation switch is placed in the open (vertical) position.

Fire Handles

Five fire handles, one for each engine and one for the gas turbine compressor/auxiliary power unit, are mounted on the fire emergency control panel. These fire handles route 28-volt dc power to the motor-operated, engine fire wall fuel shutoff valves and to the motor-operated, gas turbine compressor/auxiliary power unit fuel supply shutoff valve. In case of power failure, valves hold the last energized position. Circuit protection and other functions of the fire handles are described under FIRE EXTINGUISHING SYSTEM in this section.

FUEL SYSTEM INDICATORS

Quantity gauges and warning lights are located on the fuel control panel to give the crew a continuous, visual indication of the status of the fuel system. For additional information on the fuel indicators, see ENGINE INSTRUMENTS in this section.

WARNING

Fuel quantity indicators will not be removed or changed in flight. Fuel quantity circuit breakers will not be reset until proper inspection and repairs have been made.

Total Fuel Quantity

115V AC Inst & Eng P Side
Single Fuel Cont
FUEL QUANTITY – TOTALIZER

A total fuel quantity indicator is located in the center of the fuel control panel. The indicator is electronically connected to each of the fuel tank quantity gauges, through a ratio assembly and power unit, and continuously shows the total fuel quantity (in pounds) in the fuel tanks, when the single point refueling master switch is in the OFF position. When the master switch is in any position other than OFF, the total fuel quantity is deenergized.

Fuel Quantity Indicators and Test Switches

115V AC Inst & Eng P Side
Single Fuel Cont
FUEL QUANTITY – TANK NO.

Fuel quantity indicators are located on the fuel control panel. Each tank indicator is connected to capacitance probes in one of the respective fuel tanks, and gives a continuous visual indication of the pounds of fuel contained in that tank. Quantity indicator test switches are provided to test the quantity indicating system. When depressed, a press-to-test switch provides a ground and the indicator pointer moves toward zero. Failure of any pointer to move toward (but not necessarily to) zero indicates a malfunction in that quantity indicator. If a power failure is encountered, the indicators will remain at the last indication before power failure. If a power failure is encountered on one indicator, the individual indicator will remain at the last indication before power failure and the total fuel quantity indicator will subtract the amount of fuel indicated on the inoperative indicator.

Auxiliary Fuel Tank Magnetic Sight Gauge

An auxiliary fuel tank magnetic sight gauge is located on the underside of the wing center section for each auxiliary fuel tank. The magnetic sight gauge consists of three components: a mounting base and outer tube, a float, and a gauge stick. The mounting base is attached to the lower surface of the auxiliary fuel tank with the outer tube secured to the mounting base. The float rides to the outside of the tube and has magnets in its inner diameter. The gauge stick is contained within the outer tube, has magnets on its upper end, markings to indicate fuel quantity, and latches on the lower end into the mounting base. For flight the slot must be aligned with the two holes. The gauge stick markings indicate fuel quantity and are marked from 5 to 59 in 500-pound increments.

Aux/External Tank Empty Lights

28V ESS DC CP Side
AUX/EXTERNAL DUMP VALVE

Two auxiliary tank empty lights and two external tank empty lights are located on the fuel control panel in the flight station. If the boost pump switch associated with a given auxiliary or external tank is positioned at ON and the crossfeed separation valve is closed, the associated tank empty light will be illuminated whenever output flow pressure is approximately 23 psi. Illumination of the tank light indicates either depleted tank quantity or an inoperative boost pump or (in the case of external tanks only) failure of the fuel level control valve in the open position.

Refueling Panel on Light

28V MAIN DC CP Side
REFUELING PANEL – GROUND TRANSFER VALVE

A refueling panel on light is located on the fuel control panel. The circuit to this light is completed when the single point refueling master switch is not in the OFF position.

Fuel Pressure Indicator

26V AC Inst & P Side
Single Fuel Cont Fuse
#1 Inst Trans
FUEL PRESS INDICATOR

A fuel pressure indicator located on the fuel control panel is used to check out the fuel boost pumps before flight. This indicator is electrically connected to a fuel pressure transmitter. The transmitter measures the pressures of the crossfeed manifold. Thus, when the fuel boost pumps are turned on individually, the pressure supplied to the crossfeed system by any pump is measured by the transmitter and shown by the indicator.

NOTE

The markings on this instrument are for preflight reference only. In-flight low-pressure warning is supplied by the pressure warning lights on the fuel control panel. However, boost pump pressure may be checked with this instrument at any time.

Fuel Low-Pressure Warning Lights

28V ESS DC CP Side
FUEL MANAGEMENT – LOW-PRESSURE LIGHTS

Four fuel low-pressure warning lights are located on the fuel control panel. Each light is turned on when fuel supply pressure at the point where fuel entering the engine pump falls below approximately 8.5 psi. When illuminated, a light indicates a possible booster pump failure, valve failure, fuel line failure, or a malfunctioning pressure switch.

ELECTRICAL POWER SUPPLY SYSTEM

WARNING

Never use circuit breakers as switches. Circuit breakers should be pulled only during emergencies or maintenance. Any open circuit breaker system will be checked unless recorded in CG 5181.

All internal electrical power for airplane use comes basically from five ac generators or the battery. Each engine drives one 40-kVA ac generator. (1500 series) The air turbine motor drives one 20-kVA ac generator. (However, because the air turbine motor fan provides sufficient cooling air, the generator is rated in this installation at 30 kVA for continuous operation.) (1600 series, CG 1790, and 1700 series.) A 40-kVA generator is driven by the auxiliary power unit (APU). The APU-driven generator is the same type as the engine-driven generators. (All series) Power from these ac generators is used to provide electrical power for airplane use: 28-volt dc; 200/115-volt, 400-cycle, three-phase primary ac; and 115 volt, 400-cycle, single-phase, secondary and primary ac. The four engine-driven ac generators are connected through a series of relays to four ac buses; the left-hand ac bus, essential ac bus, main ac bus, and the right-hand ac bus (figures 1A-46 through 1A-50). The relay system operates in such a manner that any combination of two or more of the engine-driven ac generators will power all four of the buses. If only one generator is operating, it will power only the essential ac bus and the main ac bus. Placing the ATM/APU generator control switch in the ATM/APU GENERATOR position energizes the ATM/APU generator contactor relay, which connects the ATM/APU generator to the essential ac bus. The air turbine motor-driven/auxiliary power unit-driven ac generator will power only the essential ac bus at any time. The ATM generator under-frequency control circuit (which normally has a 5-second delay) is deactivated during engine start. This is necessary to prevent the ATM generator from dropping off the line due to an under-frequency condition caused by slowing of the ATM during engine starting. The APU generator, voltage regulator, and generator control are the same as the engine-driven generator voltage regulator, and generator control. (See this section for additional information on the ATM/APU.) Combinations of operating generators and buses which they power are shown on the AC Bus Power Sources chart (figure 1A-44). All in-flight controls for operation of the electrical control panel are on the overhead panel in the flight station.

NOTE

Any one engine-driven ac generator operating will power both the essential ac bus and the main ac bus, and provide normal dc power. (1500 and 1600 series) The ATM/APU driven generator will power the essential ac bus only, but will power the main dc bus through the reverse current relay connected to the essential dc bus if the airplane is on the ground. (CG 1790 and CG 1700 through 1709) The APU driven generator will power both the essential ac bus and the main ac bus, and provide normal dc power when the ground transfer switch on the refueling panel is placed in the open position. (CG 1710 and up) Placing the ac bus tie switch on the overhead electrical control panel to the open position will perform the same function. This function is for ground use only.

ELECTRICAL SYSTEM UPGRADE (ESU)

115V	MAIN AC	FS 245 AFT
ESS AVI PRI PWR		LWR MAIN
		DIST PNL
115V	RH AC	FS 245 AFT
ESS AVI SEC PWR		LWR MAIN
		DIST PNL
115V	MAIN AC	FS 245 AFT
MAIN AVI PRI PWR		LWR MAIN
		DIST PNL
115V	LH AC	FS 245 AFT
MAIN AVI SEC PWR		LWR MAIN
		DIST PNL
115V	ESS AC	P Upper
ESS AVI AC BUS POWER		
115V	MAIN AVI	CP Upper
MAIN AVI AC BUS PWR		
28V	ISOL DC	P Side
ESS BYPASS ON CONTROL		
MAIN BYPASS ON CONTROL		
28V	ISOL DC	P Side
ESS AC BUS OFF IND		
28V	ISOL DC	P Side
ESS & MAIN BUS OFF IND		

28V	ISOL DC	P Side
AC BUS OFF IND		
28V	ISOL DC	P Side
AC EXT PWR SW SOL		
115V	ESS AC	P Upper
ESS AC BUS PWR		

NOTE

The circuit breakers associated with the Essential Avionics Bus are color-coded blue for easy recognition.

NOTE

The circuit breakers associated with the Main Avionics Bus are color-coded grey for easy recognition.

The Electrical System Upgrade (ESU) provides existing C-130 aircraft with an electrical power system that is both reliable and easy to maintain. Quality power meeting MIL-STD-704 is automatically distributed to the electrical buses and subsystems. This is accomplished through the addition of dedicated avionics buses, a modified overhead electrical control panel (OECF), a solid-state 2500 VA AC Instrument and Engine Fuel Control Inverter (ECU-125A), a solid state 250 VA Copilot Instrument Inverter, two ECU-129/A Power Supplies (each consisting of a ECU-127/A Power Supply, ECU-128/A Static Power Inverter, and MTU-11A Electrical Equipment Mounting Base), built-in-test (BIT) circuitry, a fault bypass circuit, and electrical cabling, wiring and connectors. Installation of this kit includes modification of existing circuit breaker panels, the underdeck electrical equipment rack, and FS 245 bulkhead electrical panels.

SYSTEM COMPONENTS**Bus Switching System (BSS) (ECU-129/A Power Supply)**

The bus switching systems (BSS) provide continuous regulated ac power for sensitive avionics components through two additional (essential and main) avionics ac buses. Each BSS consists of a rectifier control unit (RCU), 10 kVA inverter, and a mounting base assembly. The essential avionics bus switching system (BSS 1) controls the essential avionics ac bus and draws primary power from generator No. 2 line contactor. In the event generator No. 2 should fail, the power supply picks up power (uninterrupted) from generator No. 4 and resumes normal operation. In the event BSS 1 should fail, a fail-safe bypass contactor (FBC) switches the power for essential avionics ac directly to the essential ac bus. The main avionics bus switching system (BSS 2) controls the main avionics ac

bus and draws primary power from generator No. 3 line contactor. In the event generator No. 3 should fail, the power supply picks up power (uninterrupted) from generator No. 1 and resumes normal operation. In the event BSS 2 should fail, a fail-safe bypass contactor (FBC) switches the power supply for the main avionics ac bus directly to the main ac bus.

Rectifier Control Unit (RCU) (ECU-127/A Power Supply).

The RCU provides primary 340 VDC and secondary 270 VDC to the 10 kVA inverter. Primary and secondary input power to the RCU is aircraft 115/200 volt, 400 Hz, three-phase ac power. The RCU contains a primary and secondary ac/dc converter. After conversion, dc power is fed to a dc/dc booster which increases the output to the 10 kVA inverter to 340 VDC. If the aircraft power should experience dropouts, spikes, switchover anomalies, or the dc/dc booster is not able to provide output to the 10 kVA inverter at 340 VDC, the secondary ac/dc converter will provide 270 VDC. The RCU will automatically resume operation from the dc/dc booster when aircraft primary input problems have ceased. If the problem is with the primary ac/dc converter or dc/dc booster, the secondary ac/dc converter will continue to supply 270 VDC to the inverter. If either the primary or secondary side of the power supply are not able to maintain output (above 220 VDC) to the inverter, the power storage bank (8 capacitors), located in the mounting base assembly, will maintain specified power output to the 10 kVA inverter.

10 kVA Inverter (ECU-128/A). The 10 kVA inverter inverts the 340 VDC, supplied by the RCU or mounting base assembly capacitive storage bank, into regulated 115V, 400 Hz ac power, which is then applied to the avionics bus. The inverter will maintain 115V, 400 (+/-7) Hz ac power output to the avionics bus even if the input from the RCU drops as low as 220 VDC. If the input power drops below 200 VDC, the inverter output voltage will drop to 0 volts preventing damage to avionics equipment. Additionally, the inverter will shut down and reset the RCU circuits and open the contacts that provide a ground for the FBC. When dc voltage from the RCU increases to a minimum of 220 VDC the inverter will restart and provide regulated ac power to the avionics bus.

Mounting Base Assembly (MTU-111/A). The mounting base assembly provides side-by-side mounting for the RCU and 10 kVA inverter, and houses the capacitive discharge bank. Two fans on the rear of the mounting base provide cooling for the RCU and 10 kVA inverter. The fans are independently powered from existing airplane buses. Each fan is capable of providing sufficient cooling if the other should fail. The capacitive discharge bank, located in the bottom portion of the mounting base, contains eight capacitors for energy storage. The capacitive power storage of the unit can maintain required dc power output to the 10 kVA inverter for a minimum of 60 milliseconds. This ensures that avionics equipment will

not be subjected to ac power system or generator switchover anomalies.

Fail-Safe Bypass Contactor (FBC)

The FBC eliminates single-point-failures in the BSS by ensuring that the avionics equipment will continue to be powered in the event of a complete BSS failure. There is one FBC for each BSS. The 10 kVA inverter controls the ground for the FBC. When the inverter output drops to 0 VAC, the ground for the FBC holding relay is removed allowing the FBC to deenergize. When the FBC deenergizes, input power to the avionics ac bus is switched from the BSS to the primary aircraft bus. When the power supply or inverter output voltage returns to normal, the ground is reestablished allowing the FBC to close, switching input power for the avionics ac bus back to the BSS. Holding power for each FBC is 28 VDC from the isolated bus through to circuit breakers (ESS and MAIN BYPASS ON CONTROL) located on the pilot's side circuit breaker panel (figure 1A-51).

Generator Switches

NOTE

On ESU equipped airplanes the generator voltage and frequency cannot be verified with the generator switch in the OFF/RESET position.

The engine generator switches, located on the overhead electrical control panel, consist of four two-position rotary-type switches. When a switch is in the ON position, a relay closes contacts to connect the generator to the buses if the generator is working normally. The distribution of generator power to the various buses under all conditions of generator operations is shown in figure 1A-45. All engine generators are off-line when the low speed ground idle buttons are engaged.

Generator Control Units (GCU)

The generator control units are mounted on the electrical control and supply rack. The GCUs are solid-state units that provide automated aircraft generator control and regulation. The GCUs replace the voltage regulators, generator control panels, and frequency-sensitive relays. The GCUs have the capability of identifying and regulating either Bendix or Leland generators, eliminating the requirement to match generator and GCU. Each GCU provides systems monitoring of the generator output and controls the contactors that tie the generators to the airplane buses. The GCUs provide overvoltage, undervoltage, overfrequency, and feeder fault protection. If any of the monitored parameters of a generator are outside the specified limits, the generator contactor is deenergized. In some cases (overvoltage, undervoltage, or feeder fault) the

generator is also deenergized. An LED fault indication panel is provided on the front of the unit.

The GCUs have a built-in-test (BIT) capability which is used to verify that the monitoring circuits are performing properly. The BIT is initiated by means of a pushbutton switch on the front of each unit. This test can be done at any time that the isolated dc bus is powered, whether the generators are on-line or not. When the button is pushed and the associated generator switch is in the ON position, four LED indicators on the front of the GCU illuminate for approximately 10 seconds and then go out if the GCU passes all of the internal tests. If a test fails, one or more of the LEDs remain illuminated to indicate the nature of the failure. An LED truth table on the front of the GCUs indicates the faulty system component.

The four LED indicators are used to indicate the nature of a system failure during BIT and normal operation. If a GCU trips during normal use, the LEDs will illuminate in a pattern to indicate what caused the system to trip. This provides more complete information about the nature of any problems that may exist. In most cases the GCU may be reset by placing the generator control switch to the OFF position and back to ON again.

There are certain codes resulting from the detection of a feeder fault, previous feeder fault or previous BIT failure that represent potentially serious generator system problems. Resetting the generator control switch or cycling the dc power to the GCU cannot clear these codes. The codes activate a latching circuit that prevents the system from powering up until corrective action has been taken. The GCUs receive 28 VDC power from the Isolated DC Bus through circuit breakers (GENERATOR CONTROL NO.1 through NO.4) located on the pilot's side circuit breaker panel (figure 1A-51).

On aircraft modified with the Electrical Service Upgrade, the light will illuminate when the Generator Control switch is in the ON position and one or more of the following conditions exist:

- the generator is not developing sufficient voltage (approximately 95 volts)
- the generator output is below approximately 368 CPS
- the generator output voltage is too high (exceeds approximately 130 VAC)
- a fault exists in the generator output circuit.

Bus Switching System Advisory Lights

NOTE

Illumination of the ESU BIT light may be an indication of primary or secondary power failure to either BSS.

These advisory lights indicate ESU BIT, ESS or MAIN avionics bus loss of regulated power from the respective BSS. The ESU BIT light is operated by a relay internal to the BSS which supplies dc power to the light when there is a detected fault in either the ESS or MAIN BSS. If a fault is sufficient to cause a BSS to shut down, the ESU BIT and ESS and/or MAIN lights illuminate. The ESS or MAIN bus light is operated by its respective relay which supplies dc power to the light when regulated power is not available to the avionics buses.

EXTERNAL POWER PROVISIONS

NOTE

The 200/115-volt, 3-phase, 400-Hertz ac external source should have a capacity of 40 kVA; its phase rotation must be A-B-C. The 28-volt dc external source should have a capacity of 400 amperes.

Both dc and ac external power receptacles are located on the left side of the fuselage just aft of the battery compartment (figure 1A-4). Dc power from the external source is supplied through two current limiters to the main dc bus. Any dc electrically operated equipment on the airplane, except equipment connected to the battery bus, can be supplied from an external dc power source. The battery is disconnected from all dc buses except the battery bus when external dc power is being used. When an external ac power source is connected to the airplane, power is supplied to all ac buses, to the dc buses through transformer-rectifier units, and to the battery bus to charge the battery if the dc power switch is in the BATTERY position.

NOTE

The ATM/APU generator switch must be in the OFF position before external ac power can be fed into the airplane system.

PRIMARY AC SYSTEM (NON-ESU-EQUIPPED AIRCRAFT)

Primary AC System Controls

The ac system controls, with the exception of a manual reset lever on each generator control panel, are located on the overhead electrical control panel in the flight station. The generator control panels are located in racks under the flight station and are accessible from the cargo compartment.

28V	ISOL DC	P Side
GEN CONTROL		

28V	ISOL DC	P Side
APU GEN CONTROL		

28V	ISOL DC	P Side
ATM GEN CONTROL		

GENERATOR SWITCHES

The generator switches consist of five 4-position rotary-type switches located on the overhead electrical control panel (figures 1A-41, 1A-42 and 1A-43) in the flight station. When a switch is in the ON position (knob stripe aligned with panel strip), a relay closes contacts to connect the generator to the buses if the generator is operating normally. The distribution of generated power to the various buses under all conditions of generator operation is shown in figure 1A-44. All engine generators are off the line when the low-speed ground idle buttons are engaged; therefore, the ATM/APU generator must be used to provide power to the essential ac bus which is the only bus it supplies. When the switch is placed in the OFF position, the relay disconnects the generator from the system. If the switch is turned to FIELD TRIP, the field circuit of the generator is opened by field relay to remove generator excitation. No voltage is then produced by the generator. The RESET position of the switch is used to operate the field relay to its reset position after it has been tripped. The relay then closes the generator field circuit to allow the generator to build up voltage. The RESET position of the generator switch knob is spring-loaded. The generator switch knob must be pulled out to move it to the FIELD TRIP position.

AC EXTERNAL POWER SWITCH

28V	BATT DC	P Side
AC EXT POWER	SW SOLENOID	
28V	POWER CART	BATT
EXT AC POWER	CONTROL	COMPT

A two-position, ac external power switch is located immediately below the LH ac bus loadmeter on the overhead electrical control panel (figures 1A-41 and 1A-42). The OFF position of the switch disconnects external power from the ac distribution system. The external power position (stripe on knob aligned with stripe on panel) connects external power to the ac distribution system.

NOTE

An override solenoid in the system is powered from the battery and will turn the switch off if the ATM/APU generator control switch is on, if the ac power is not in the correct phase sequence, if any engine generator is on the line, or if the external power plug is not in the receptacle.

Overhead Electrical Control Panel (1500 Series)

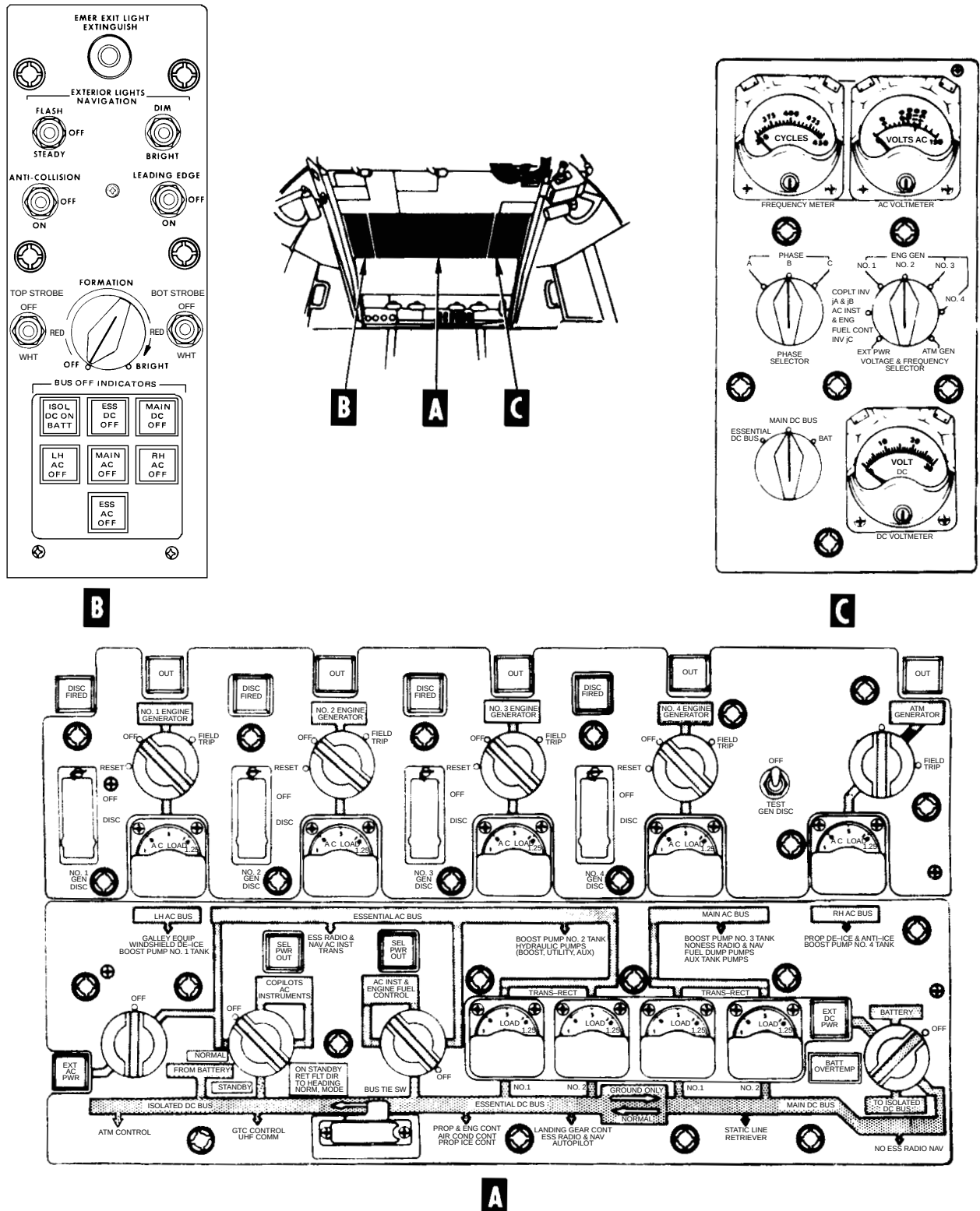
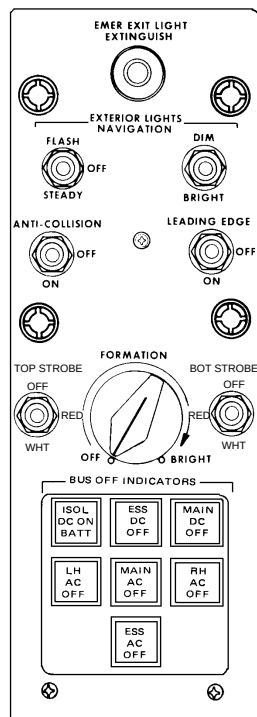
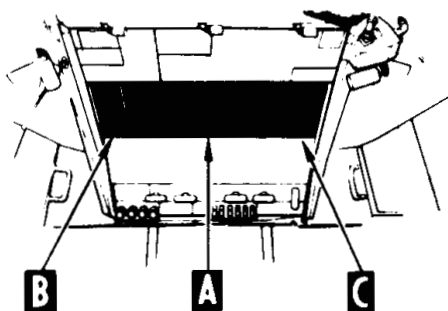


Figure 1A-41

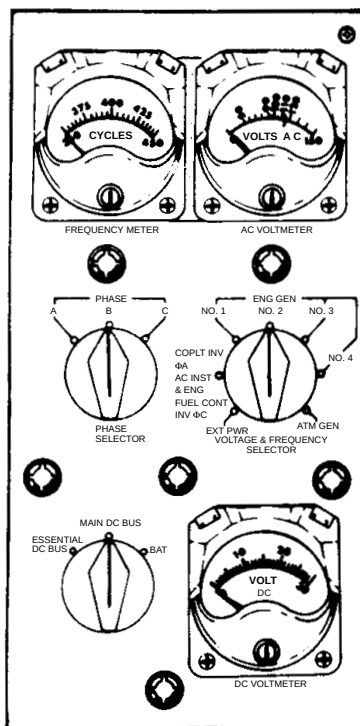
Overhead Electrical Control Panel (1600, CG 1790 and 1700 Series)



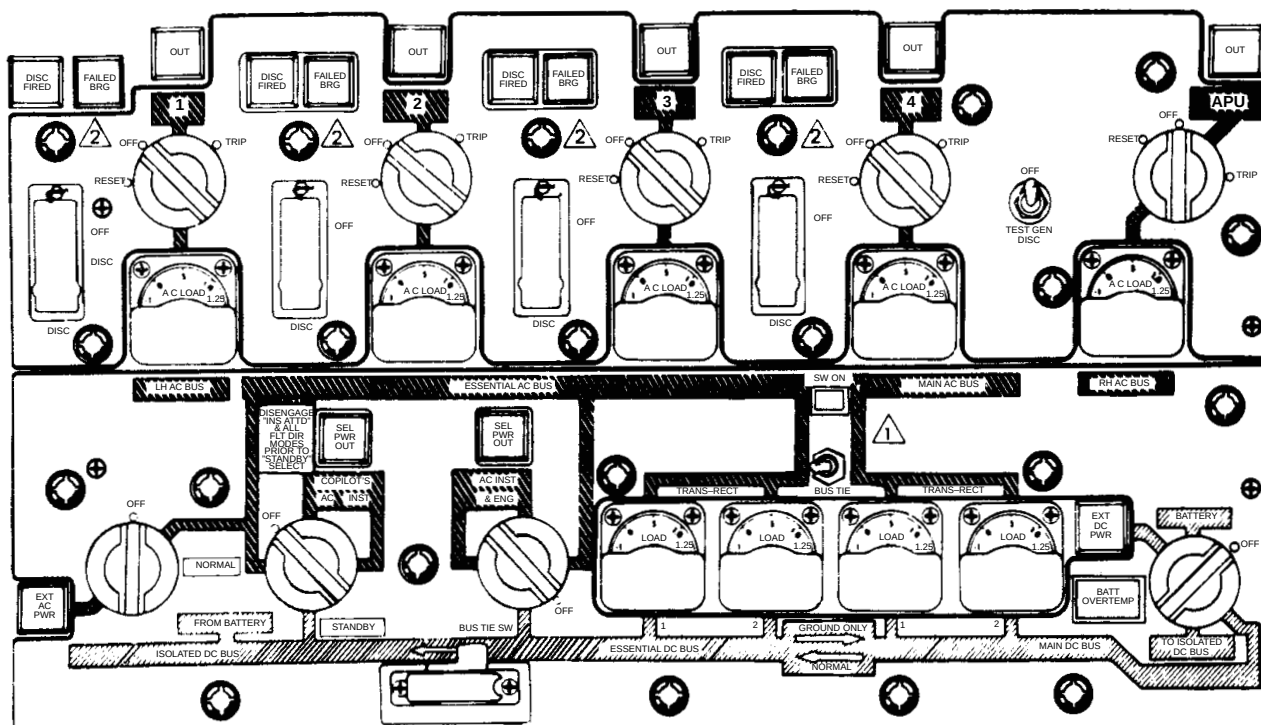
B



A



C



NOTE

- 1 CG 1710 AND UP
- 2 CG 1790, 1700 SERIES

Overhead Electrical Control Panel (Typical) (Airplanes Equipped with ESU)

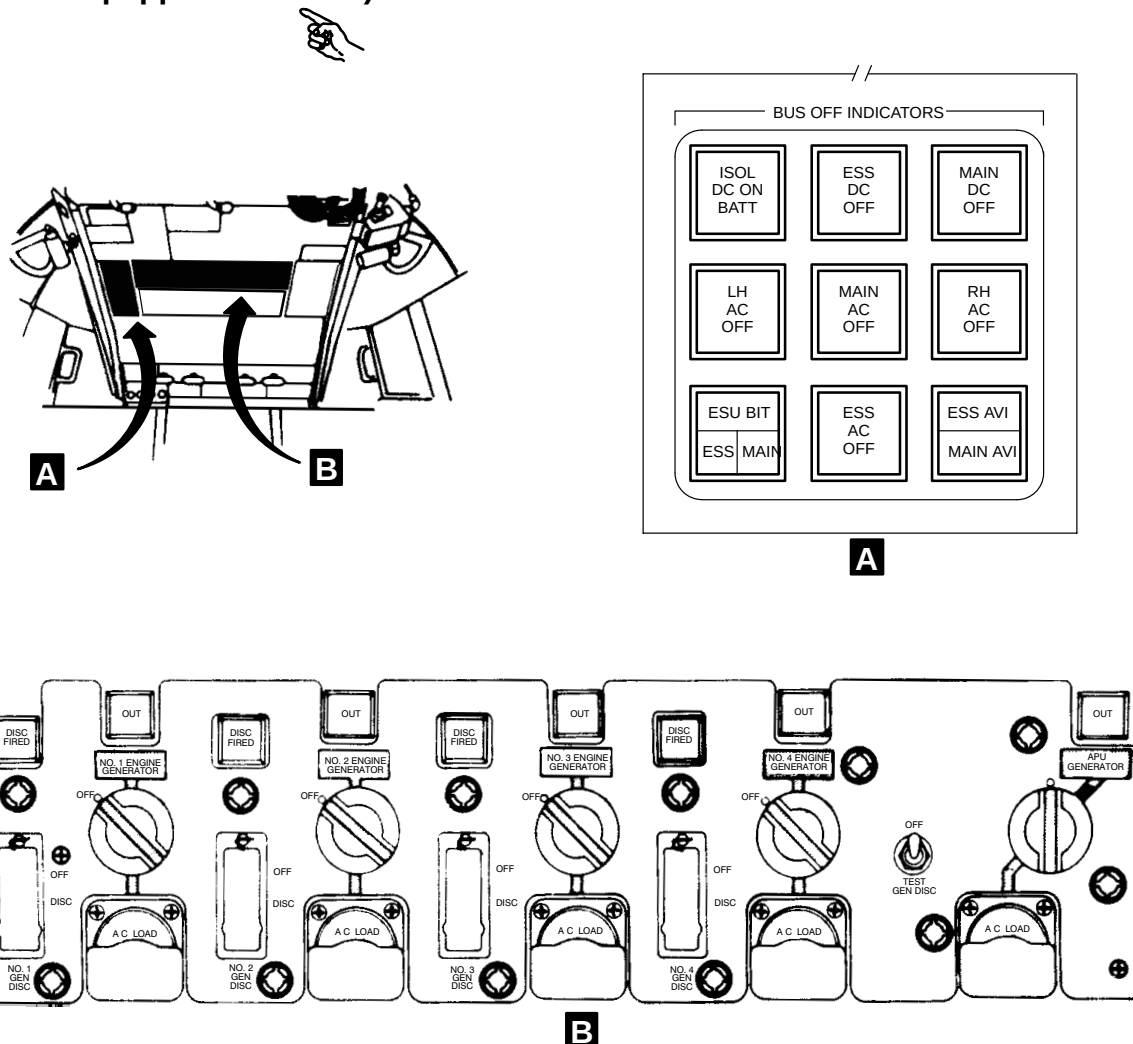


Figure 1A-43

AC VOLTMETER, FREQUENCY METER PHASE SELECTOR, AND FREQUENCY AND VOLTAGE SELECTOR SWITCH

An ac voltmeter and frequency meter indicate voltage and frequency of the source selected by the voltage and frequency selector switch (figure 1A-41 and 1A-42). The phase selector switch works in conjunction with the voltage and frequency selector switch and selects the phase of power for indication.

GENERATOR DISCONNECT SWITCHES

28V ESS DC CP Side
GEN DISCONNECT

Each engine-driven generator is provided with a two-position (OFF, DISC) guarded switch. When the switch (figures 1A-41 and 1A-42) is held in the DISC position (approximate-

AC Bus Power Sources

ENGINE DRIVEN GENERATORS				AC GENERATOR POWER SOURCE			
NO. 1	NO. 2	NO. 3	NO. 4	LH AC BUS	ESS AC BUS	MAIN AC BUS	RH AC BUS
				1	2	3	4
				2	2	3	4
				1	1	3	4
				1	2	4	4
				1	2	3	3
				4	3	3	4
				1	1	4	4
				1	2	2	1
				2	2	3	3
				2	2	4	4
				1	1	3	3
					4	4	
					3	3	
					2	2	
					1	1	
					ATM GEN ¹ APU GEN ²	APU GEN ³ APU GEN ⁴	

GENERATOR OUT

GENERATOR ON

EXAMPLE: NO. 2 AND NO. 3 ENGINE DRIVEN GENERATORS OUT.
 LH AC BUS SUPPLIED BY NO. 1 GENERATOR.
 ESSENTIAL AC BUS SUPPLIED BY NO. 1 GENERATOR.
 MAIN AC BUS SUPPLIED BY NO. 4 GENERATOR.
 RH AC BUS SUPPLIED BY NO. 4 GENERATOR.

NOTES

- ¹ 1500 SERIES
- ² 1600 SERIES, CG 1790, AND 1700 SERIES
- ³ CG 1790 AND CG 1700 THRU 1709
 THE APU GENERATOR WILL POWER THE MAIN AC BUS WHEN THE SINGLE-POINT REFUELING GROUND TRANSFER SWITCH IS PLACED IN THE OPEN POSITION. THIS FUNCTION IS FOR GROUND CHECKS ONLY.
- ⁴ CG 1710 AND UP
 THE APU GENERATOR WILL POWER THE MAIN AC BUS WHEN THE AC BUS TIE SWITCH IS PLACED TO ON. THIS FUNCTION IS FOR GROUND CHECKS ONLY.

Figure 1A-44

AC Bus Power Sources

(AIRPLANES EQUIPPED WITH ESU) 

ENGINE DRIVEN GENERATOR				AC GENERATOR POWER SOURCE				AC BUS POWER SOURCE ^{△4}			
NO. 1	NO. 2	NO. 3	NO. 4	LH AC BUS	ESS AC BUS	MAIN AC BUS	RH AC BUS	ESSENTIAL AVIONICS BUS		MAIN AVIONICS BUS	
								PRI	SEC	PRI	SEC
				1	2	3	4	2	4	3	1
				2	2	3	4	2	4	3	2
				1	1	3	4	1	4	3	1
				1	2	4	4	2	4	4	1
				1	2	3	3	2	3	3	1
				4	3	3	4	3	4	3	4
				1	1	4	4	1	4	4	1
				1	2	2	1	2	1	2	1
				2	2	3	3	2	3	3	2
				2	2	4	4	2	4	4	2
				1	1	3	3	1	3	3	1
					4	4		4	NONE	4	NONE
					3	3		3	NONE	3	NONE
					2	2		2	NONE	2	NONE
					1	1		1	NONE	1	NONE
					ATM GEN ^{△1} APU GEN ^{△2}	APU GEN ^{△3} APU GEN ^{△4}		APU GEN	NONE	APU GEN ^{△4}	NONE
				EXT	EXT	EXT	EXT	EXT	EXT	EXT	EXT

 GENERATOR OFF

 GENERATOR ON

EXAMPLE: NO. 2 AND NO. 3 ENGINE DRIVEN GENERATORS OUT.
LH AC BUS SUPPLIED BY NO. 1 GENERATOR.
ESSENTIAL AC BUS SUPPLIED BY NO. 1 GENERATOR.
MAIN AC BUS SUPPLIED BY NO. 4 GENERATOR.
RH AC BUS SUPPLIED BY NO. 4 GENERATOR.

NOTES

^{△1} 1500 SERIES

^{△2} 1600 SERIES, CG 1790, AND 1700 SERIES

^{△3} CG 1790 AND CG 1700 THRU 1709
THE APU GENERATOR WILL POWER THE MAIN AC BUS WHEN THE SINGLE-POINT REFUELING GROUND TRANSFER SWITCH IS PLACED IN THE OPEN POSITION. THIS FUNCTION IS FOR GROUND USE ONLY.

^{△4} CG 1710 AND UP
THE APU GENERATOR WILL POWER THE MAIN AC BUS WHEN THE AC BUS TIE SWITCH IS PLACED TO ON. THIS FUNCTION IS FOR GROUND CHECKS ONLY.

Figure 1A-45

AC Power Distribution (1500 Series)

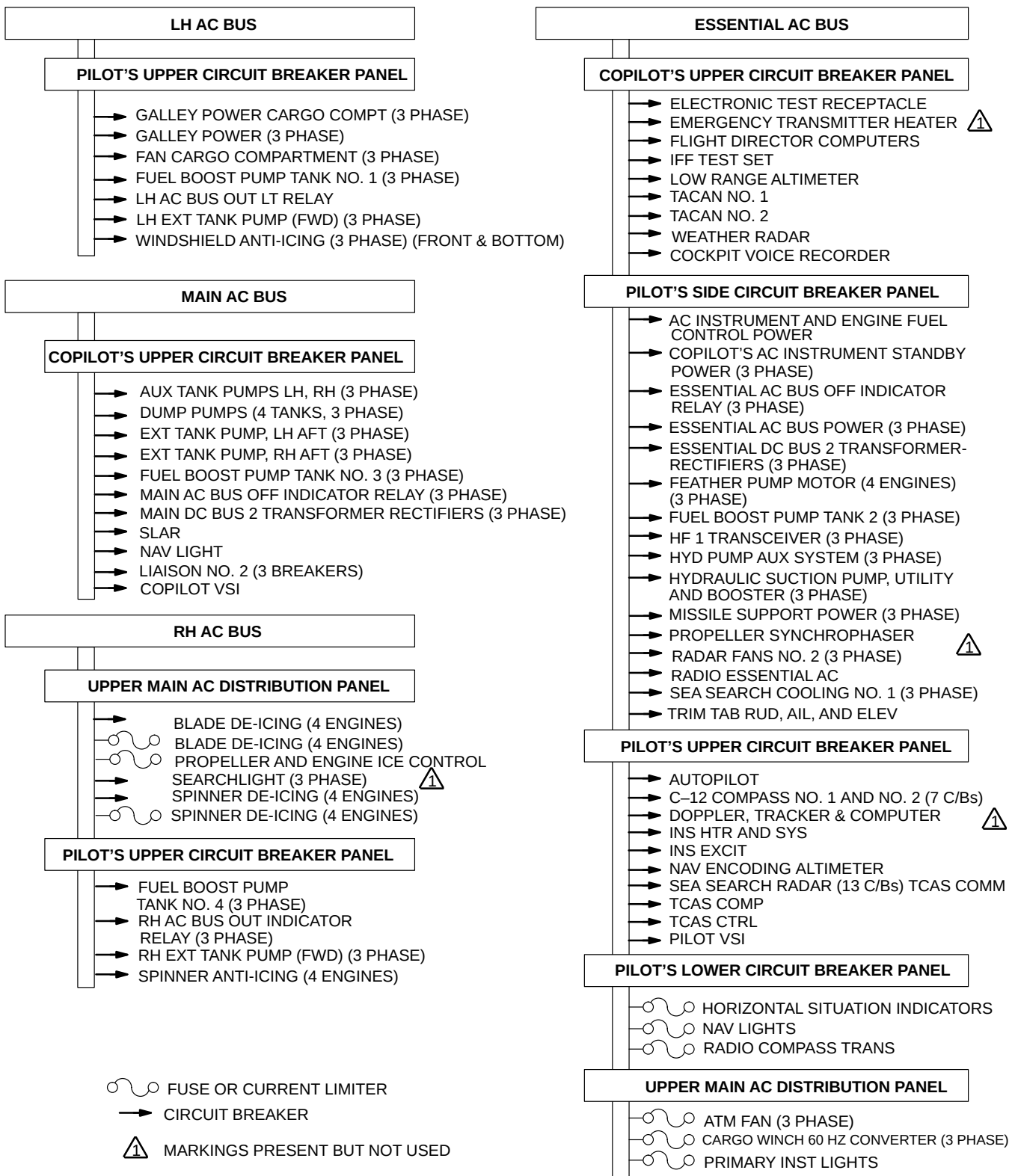


Figure 1A-46

AC Power Distribution (1600 Series)

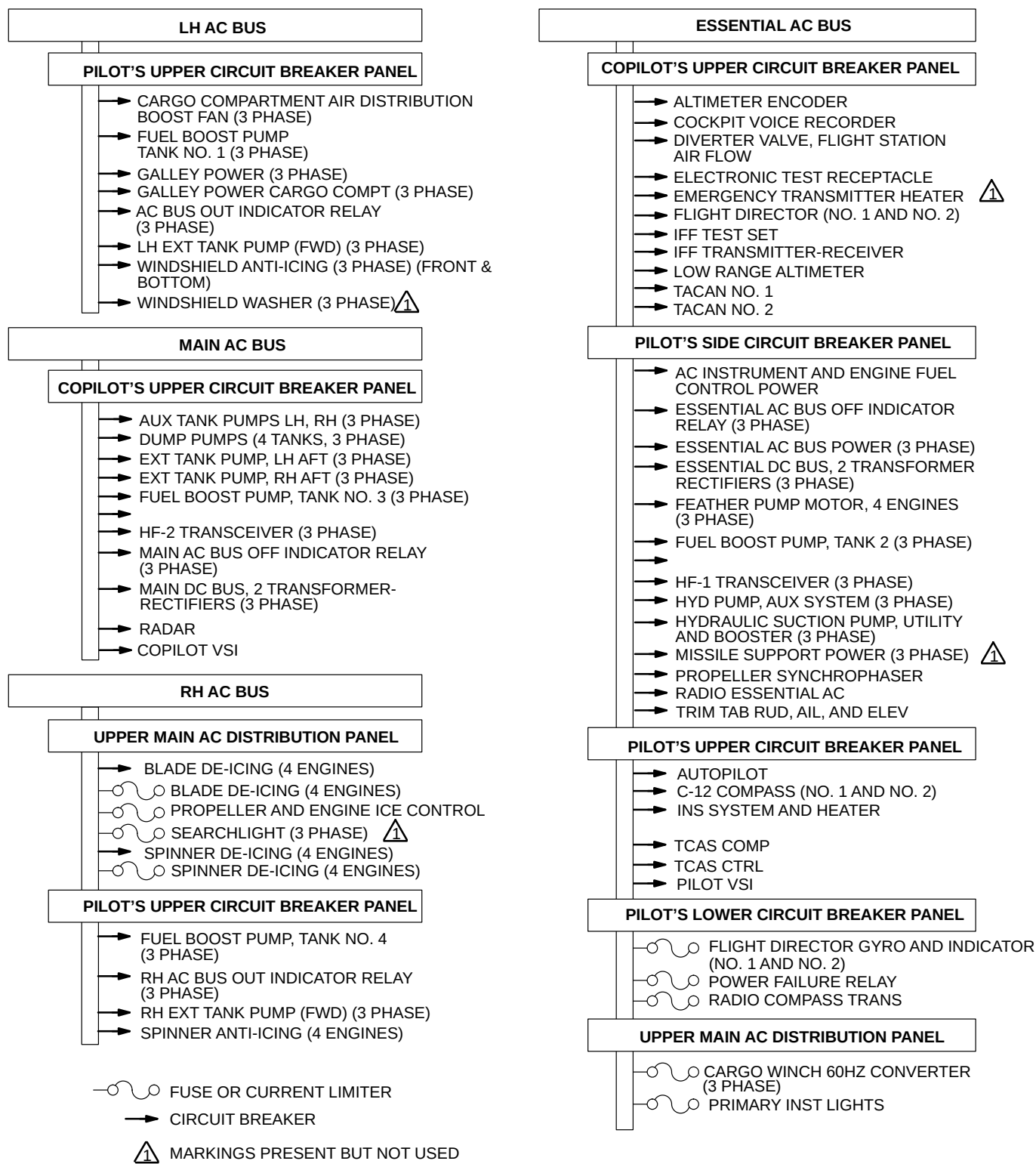


Figure 1A-47

AC Power Distribution (CG 1790 and 1700 through 1704)

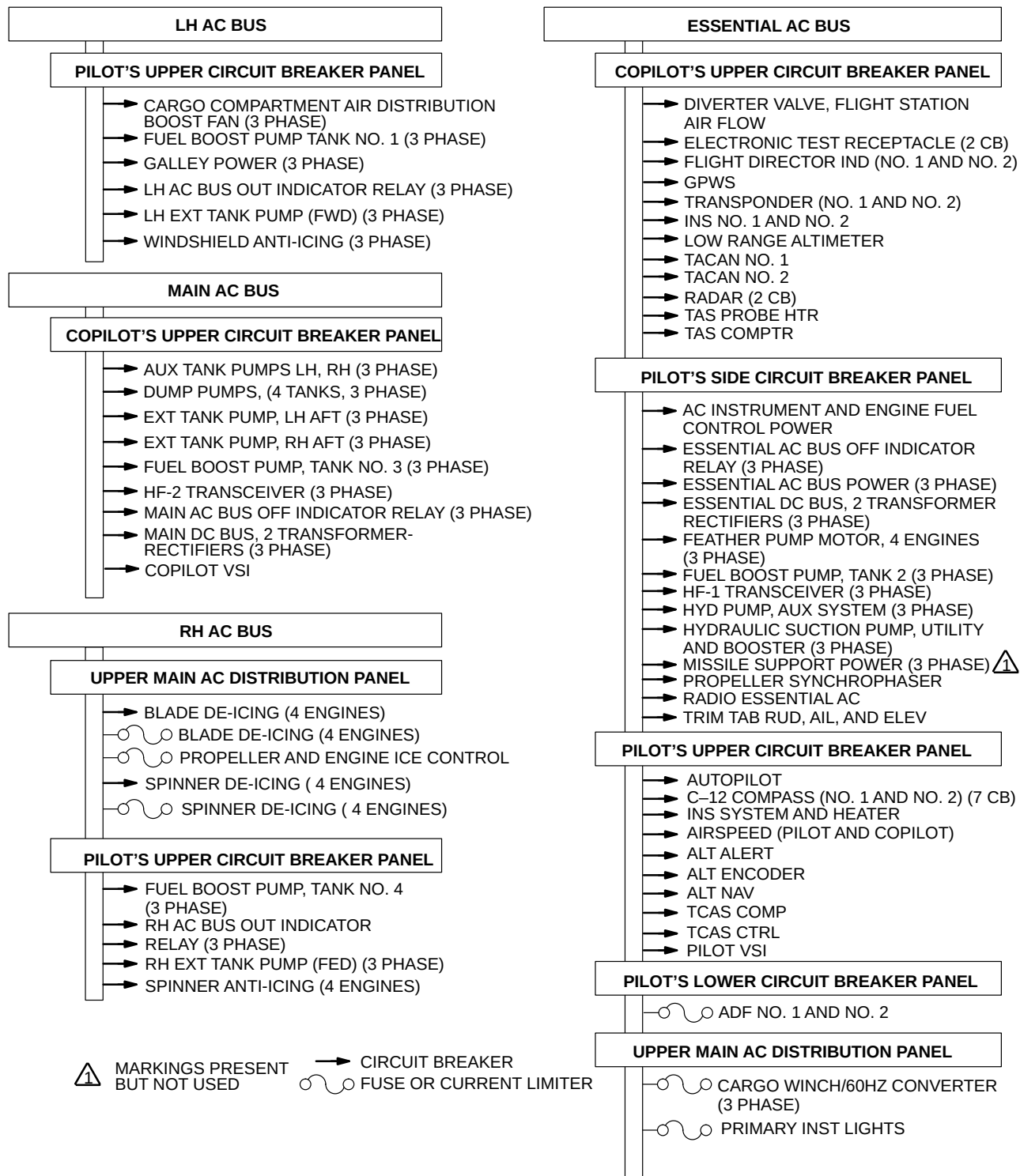


Figure 1A-48

AC Power Distribution (CG 1705 and Up)

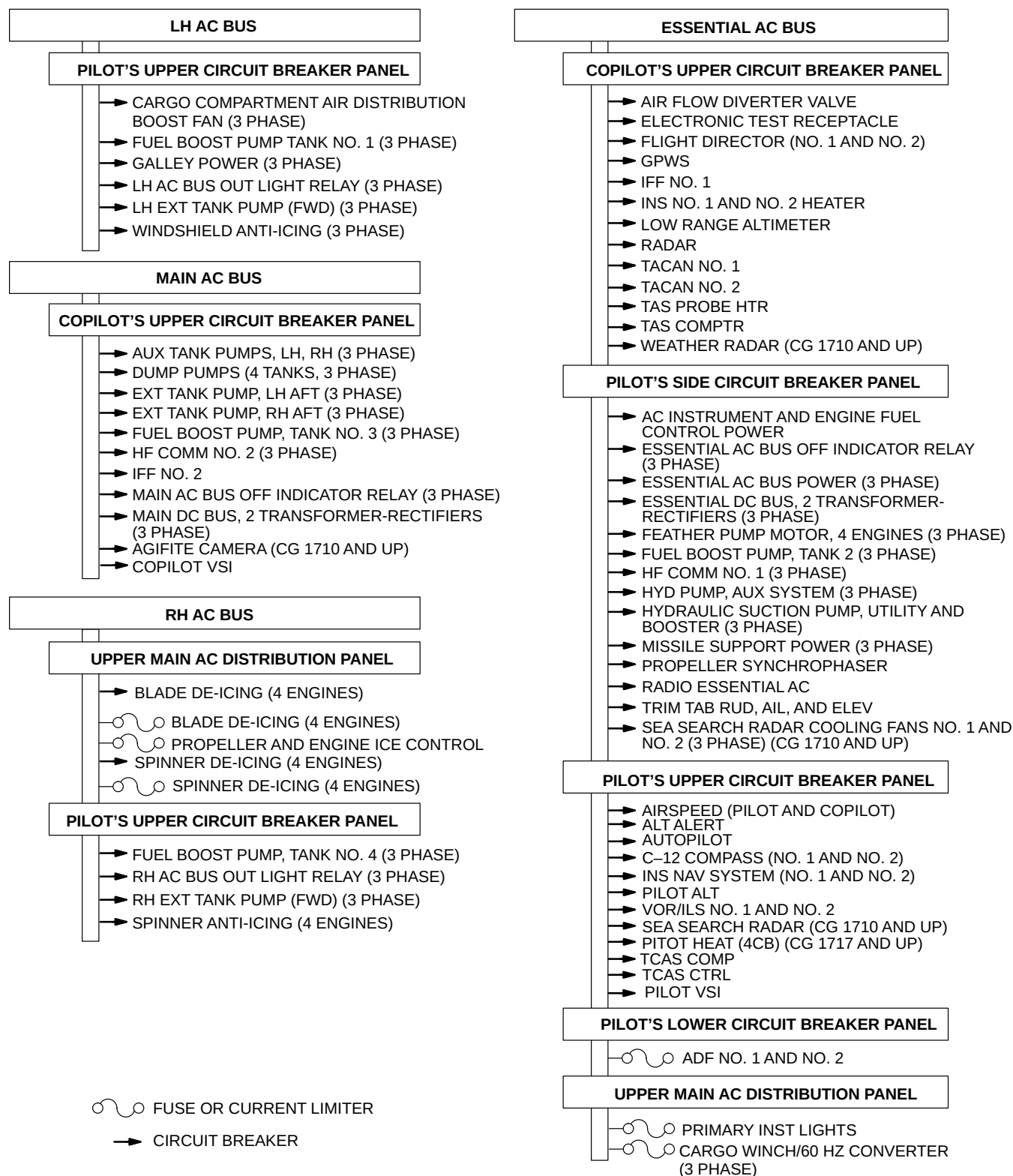


Figure 1A-49

AC Power Distribution (Typical) (Airplanes Equipped with ESU)

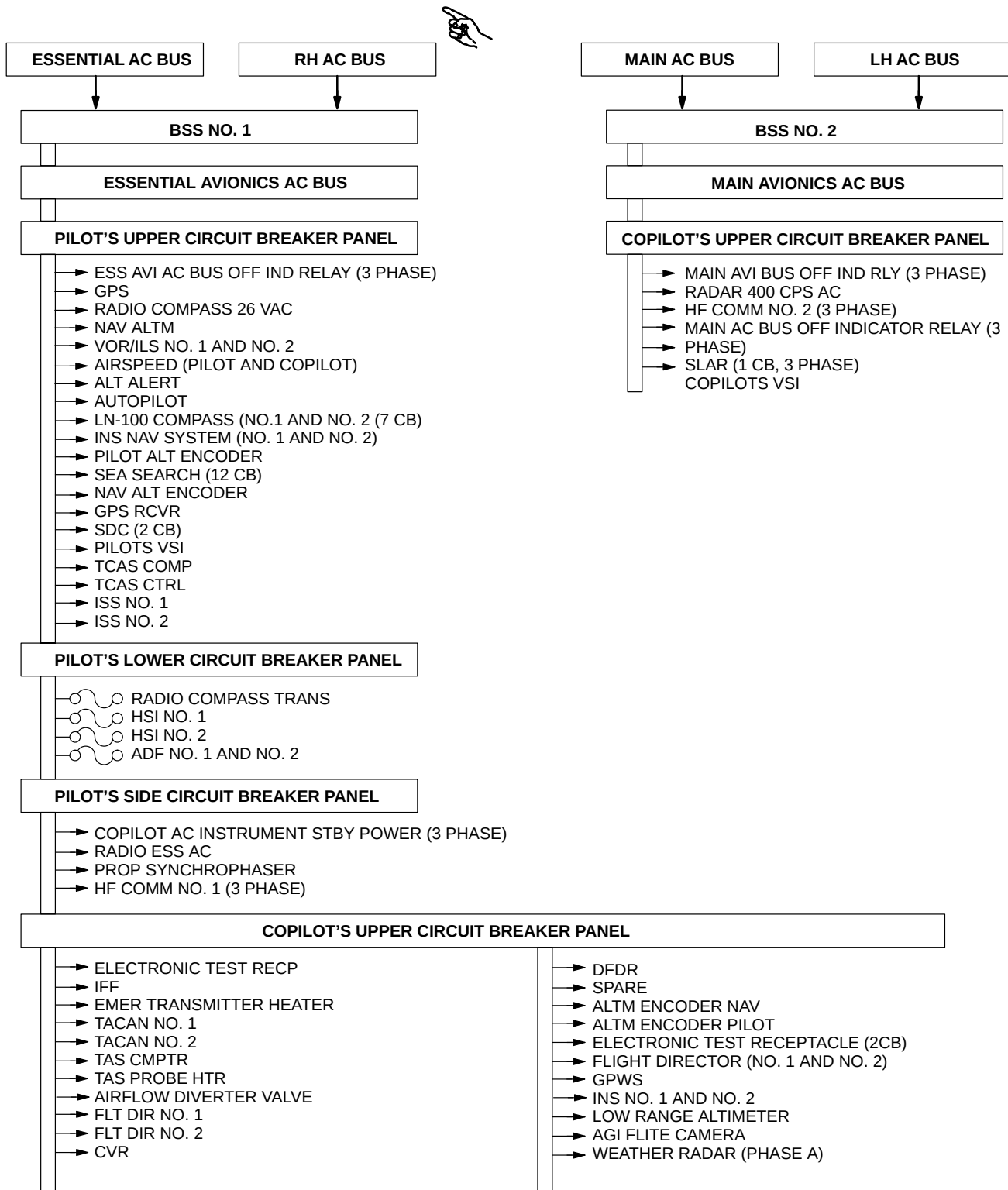
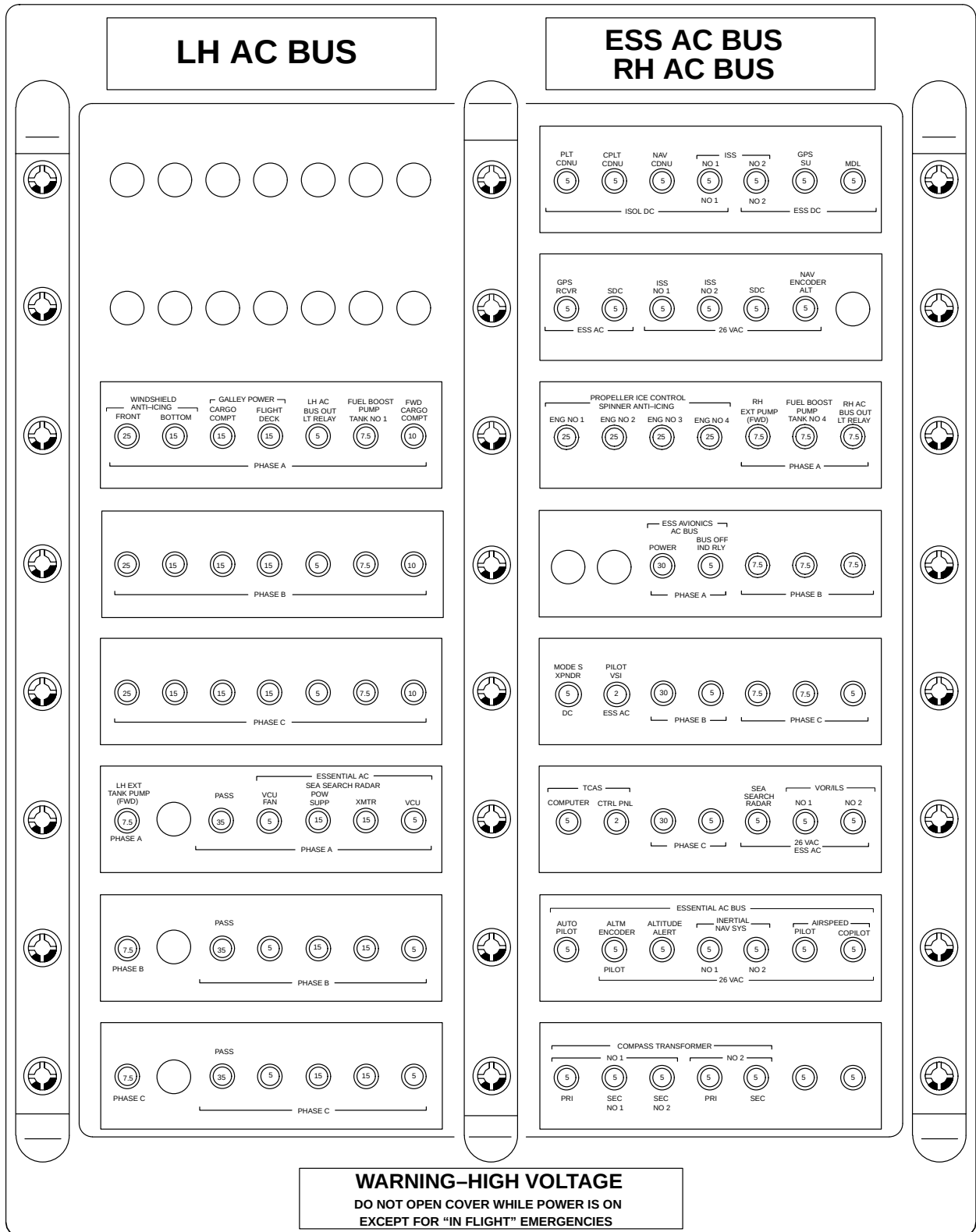
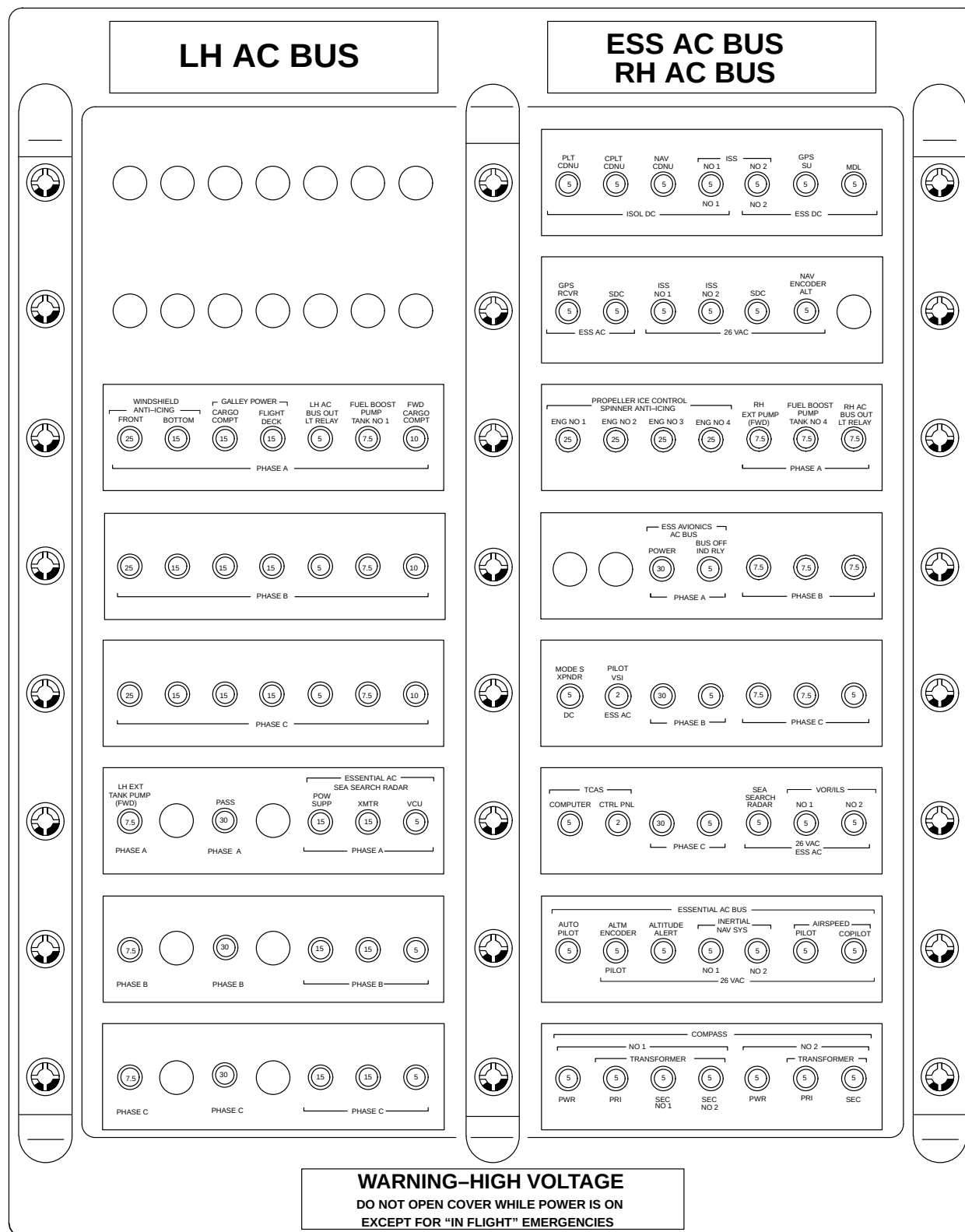


Figure 1A-50



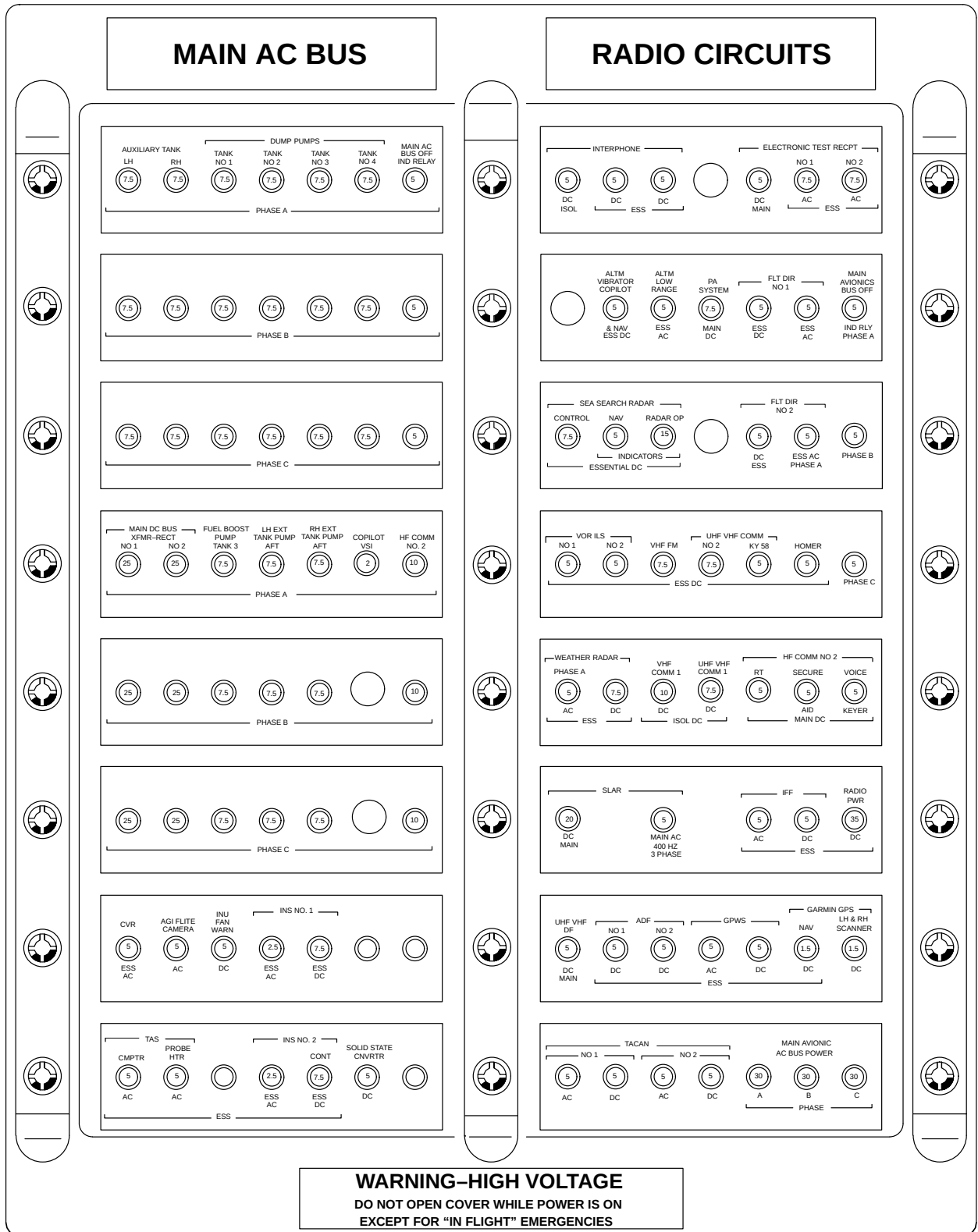
PILOT'S UPPER CIRCUIT BREAKER PANEL (1500-1715 AND 1790)
(Airplanes modified by ESU)

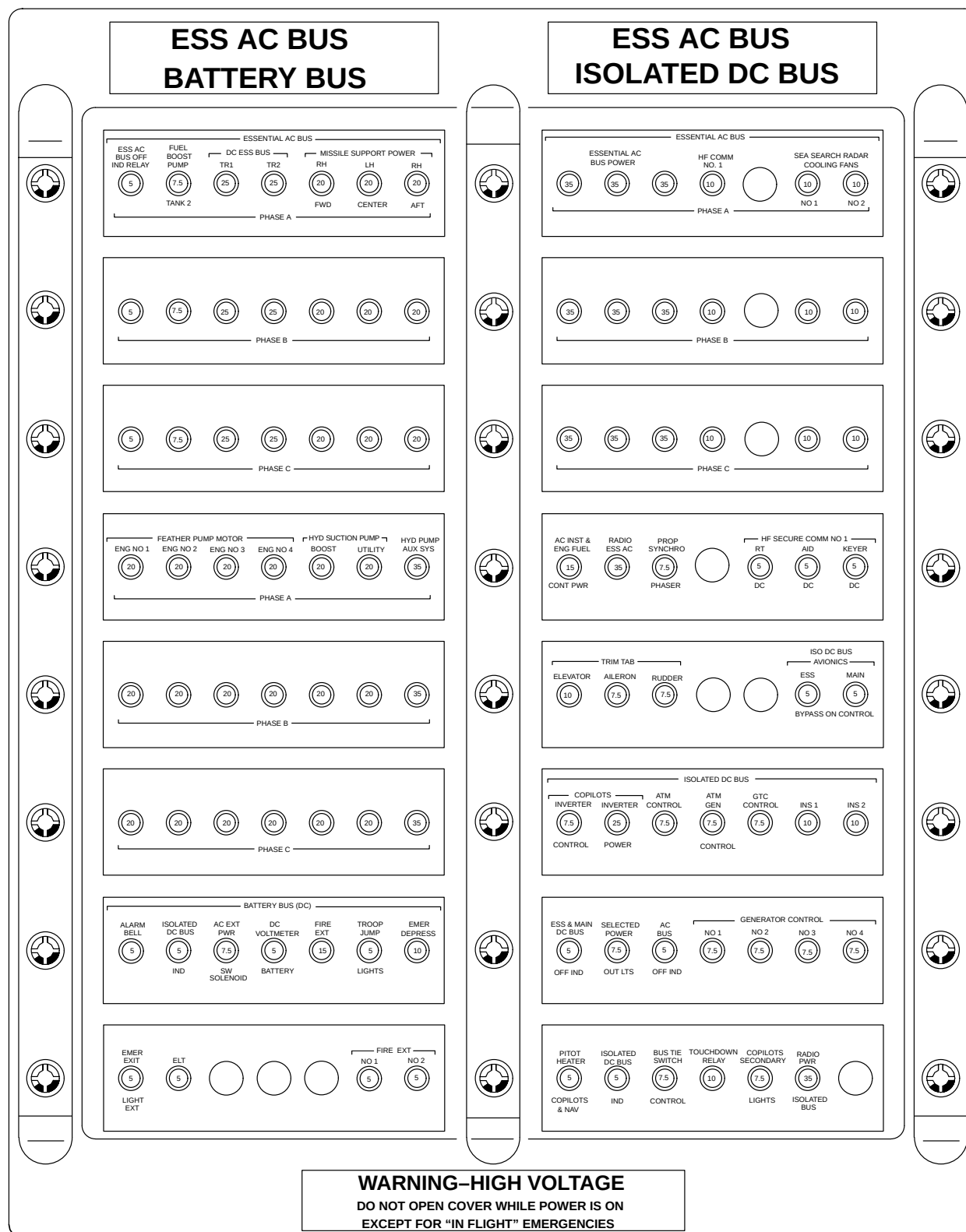
Figure 1A-51 (Sheet 1 of 4)



PILOT'S UPPER CIRCUIT BREAKER PANEL (1716-1720)
(Airplanes modified by ESU)

Figure 1A-51 (Sheet 2 of 4)





PILOT'S SIDE CIRCUIT BREAKER PANEL (Airplanes modified by ESU)

Figure 1A-51 (Sheet 4 of 4)

Upper Main AC Distribution Panel (1500 Series)

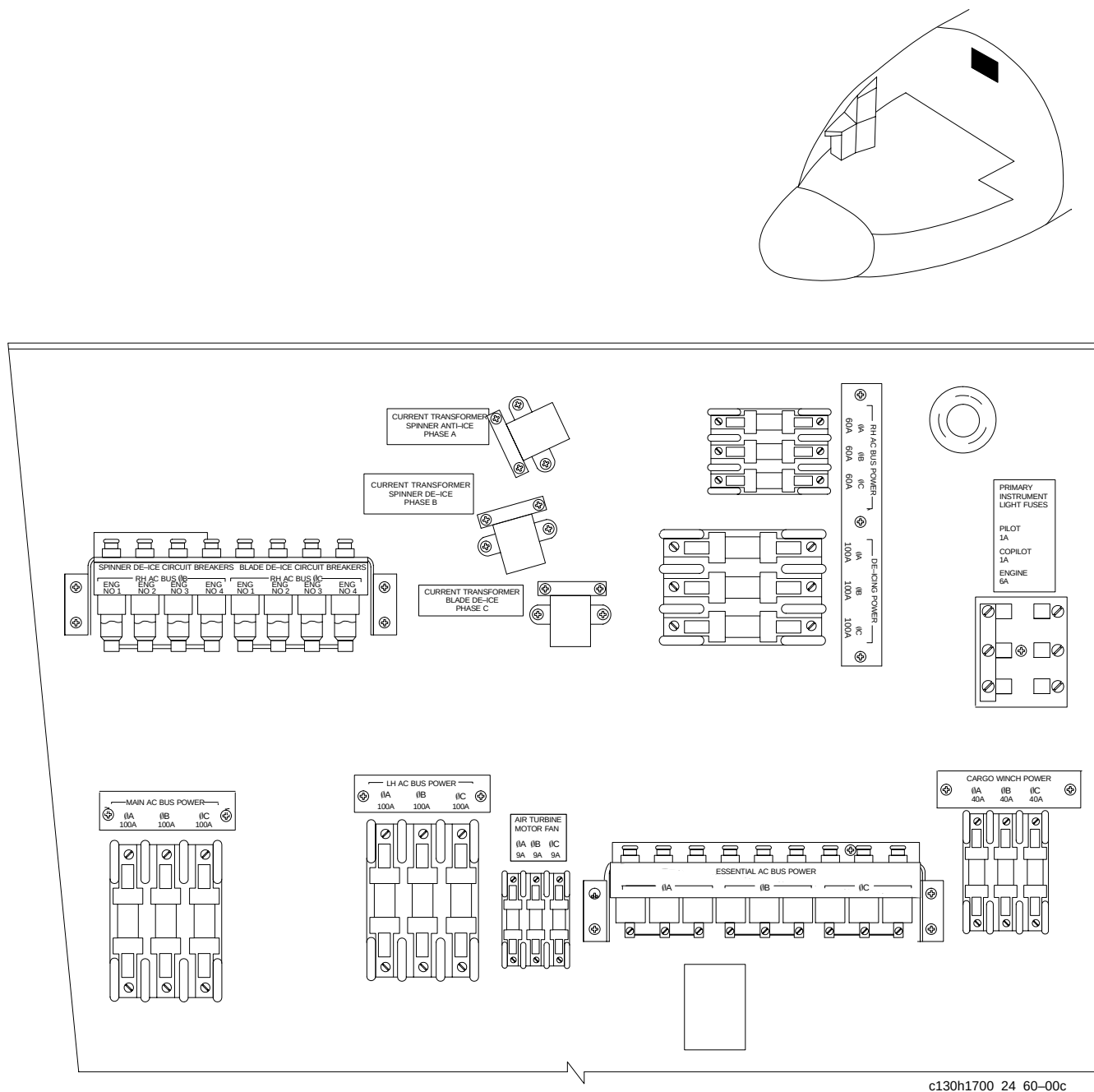
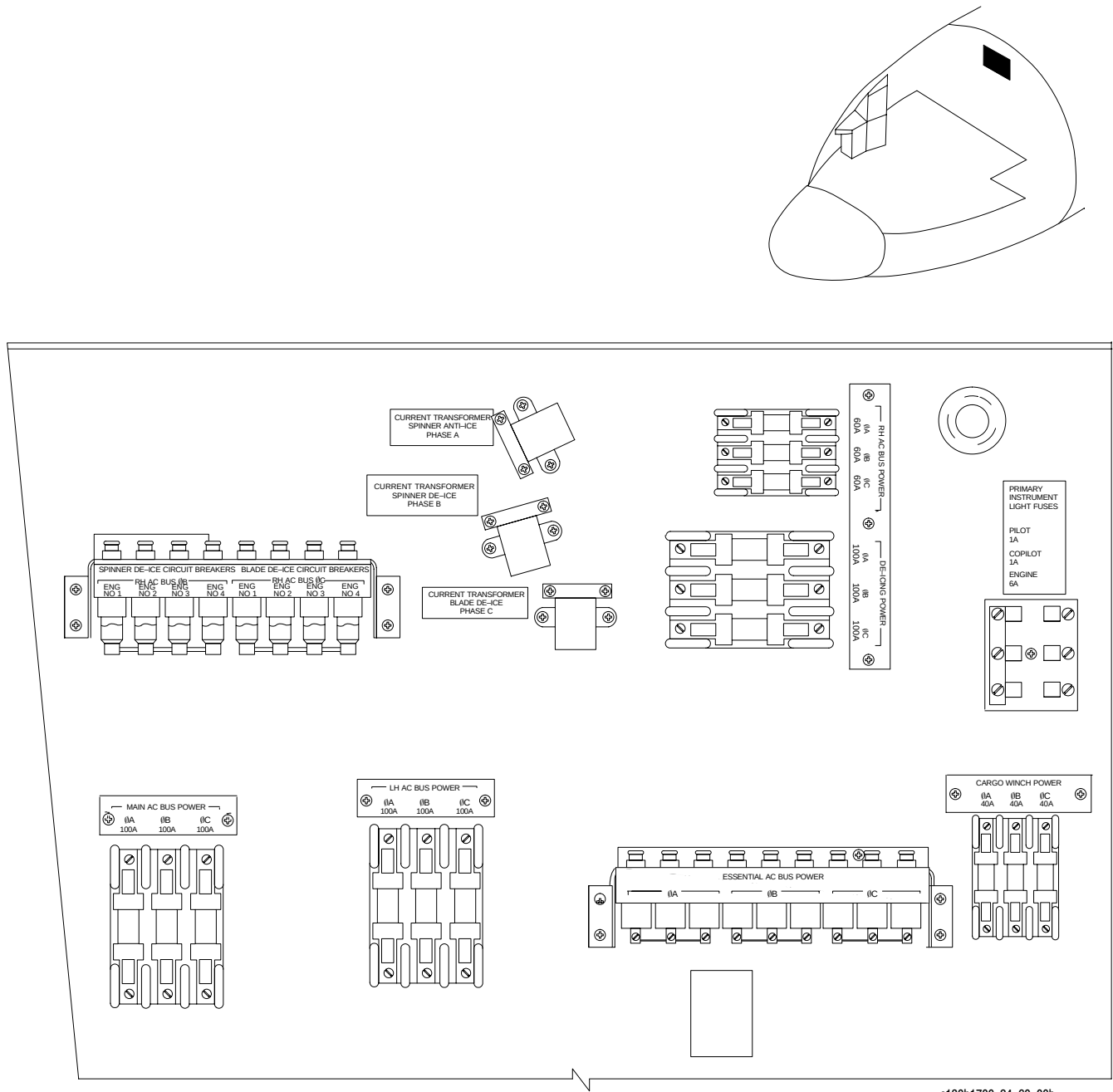


Figure 1A-52

Upper Main AC Distribution Panel (1600 Series)



c130h1700_24_60-00b

Figure 1A-53

Upper Main AC Distribution Panel (1700 Series and 1790)

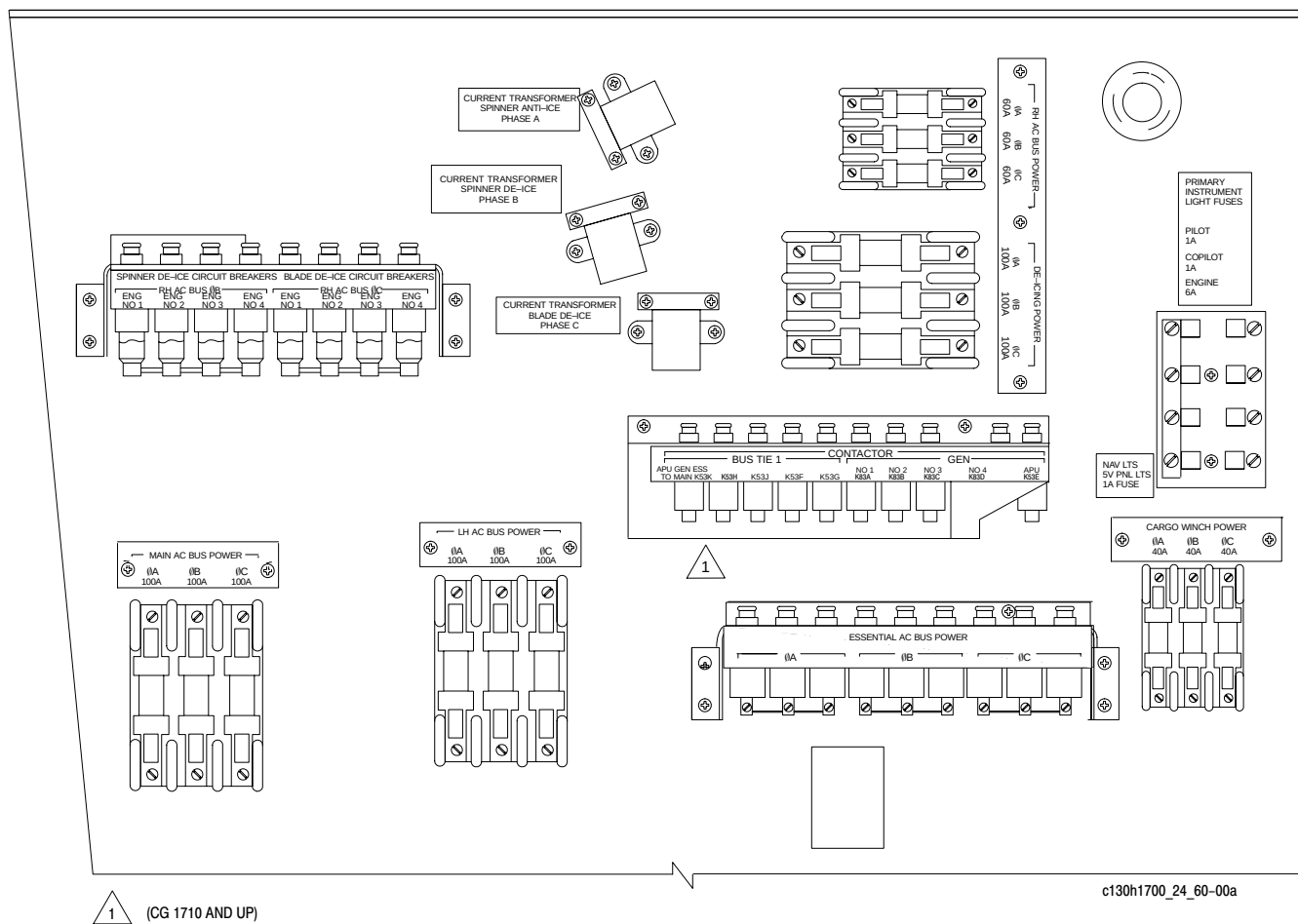
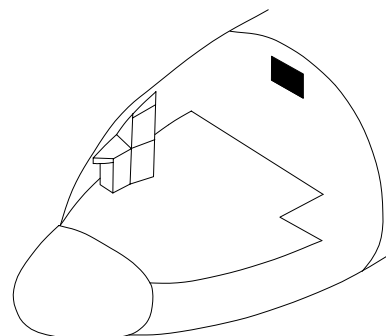


Figure 1A-54

ly 2 seconds), a direct short in the firing mechanism causes the fused portion of the plunger to burn through and be actuated by spring tension. Plunger movement actuates a generator disconnect fired switch, the generator disconnect fired light will illuminate, indicating the firing mechanism has been fired. The plunger then engages a wing on the generator stub shaft, causing it to shear. The generator cannot be reconnected in flight since a new stub shaft must be installed.

GENERATOR DISCONNECT TEST SWITCH

28V ESS DC CP Side
GEN DISCONNECT

A two-position (OFF, TEST GEN DISC) switch (figures 1A-41 and 1A-42) is provided to check the continuity of the firing mechanism. If the continuity check is good, the generator disconnect fired lights (4) will illuminate.

AC BUS TIE SWITCH (CG 1710 and Up)

28V ISOL DC UPPER MAIN AC
BUS TIE DISTRIBUTION
PANEL

A two-position “OFF,” “ON” AC BUS TIE switch on the overhead electrical control panel provides a means for powering the main ac bus from the APU generator during ground operation with no engine-driven generators supplying power.

CAUTION

Before placing the AC BUS TIE switch to “ON,” ensure that all operating engines are in low speed or that no engine driven generators are supplying power. Ensure that the AC BUS TIE switch is placed to “OFF” before bringing any engine to normal ground idle or placing any engine-driven generator switch to “ON.”

Primary AC System Indicators

Indicators for the primary ac power system are located in the overhead electrical control panel in the flight station.

AC BUS TIE SWITCH ON LIGHT (CG 1710 and Up)

28V	ESS DC	CP Side
GEN OUT	LIGHT APU	

An amber SW ON light located adjacent to the AC BUS TIE switch illuminates when the AC BUS TIE switch is in the “ON” position.

GENERATOR-OUT INDICATOR LIGHTS

28V ESS DC CP Side
GEN OUT LIGHTS – No. 1 & 2

No. 3 & 4 – ATM/APU

Each generator is provided with a GENERATOR-OUT indicator light on the overhead electrical control panel (figures 1A-41 and 1A-42). This light will illuminate when the generator control switch is in the ON position and one or more of the following conditions exist: the generator is not developing sufficient voltage (any phase 70 volts), the generator output is below approximately 368 cps (engine rpm is too low), or the field-trip relay has opened the field circuit of the generator. The field relay will trip when the generator switch is turned to the FIELD TRIP position, the generator output voltage is too high, or a fault exists in the generator output circuit.

GENERATOR DISCONNECT FIRED INDICATOR LIGHTS

28V ESS DC CP Side
GEN DISCONNECT

Each generator is provided with a generator disconnect fired (DISC FIRED) indicator light that will illuminate when one of the following conditions exist: a generator disconnect switch is held in the DISC position and the firing mechanism is fired, or when the generator disconnect test switch is held in the TEST GEN DISC position.

GENERATOR BEARING FAILURE INDICATOR LIGHTS (CG 1790 AND 1700 SERIES)

28V ESS DC CP Side
GEN BRG FAILURE

Each engine-driven generator is provided with a generator bearing failure (FAILED BRG) warning indicator light. Each generator stator contains a soft wire winding which grounds out the stator when contact is made with the rotor. When this occurs, a circuit is completed for illumination of the generator bearing failure indicator light. Once the indicator light is illuminated, it will remain illuminated until dc power to the circuit is removed.

AC LOADMETERS

Five ac loadmeters, one for each generator, are located on the overhead electrical control panel (figures 1A-41 and 1A-42) and give a continuous indication of the percent of rated current flow from their respective generators.

BUS OFF INDICATORS

28V ISOL DC P Side
AC BUS OFF IND

Four warning lights, one for each ac bus, are located on the overhead electrical control panel (figures 1A-41 and 1A-42). The lights are operated by a relay supplying dc power to the lights when the respective ac bus is not energized.

AC VOLTMETER

An ac voltmeter, mounted on the overhead electrical control panel (figures 1A-41 and 1A-42), can be used to measure the output voltage of that generator or inverter which has been selected with the voltage and frequency selector switch. Each of the three phases of generator output, or the appropriate phase of inverter output, can be measured by selectively positioning the phase selector switch.

FREQUENCY METER

A frequency meter mounted on the overhead electrical control panel (figures 1A-41 and 1A-42) permits measuring the frequency of the output power of that generator selected with the voltage and frequency selector switch. Each of the three phases of the generator output power can be measured by selecting the appropriate position on the phase selector switch.

NOTE

A & M frequency meters (identified by the word HERTZ on the face) are only accurate in the engine operating range above 90 percent rpm. Disregard any up-scale reading at low-speed ground idle.

AC EXTERNAL POWER ON INDICATOR LIGHT

An ac external power on (EXT AC PWR) indicator light is mounted next to the ac external power switch on the overhead electrical control panel (figures 1A-41 and 1A-42). The light is energized by dc power through small pins in the ac external power receptacle and through the closed contacts of a phase sequence relay on the lower main ac distribution panel when the relay is energized. The phase sequence relay is energized when three-phase external ac power with correct phase sequence and no open phases are connected to the airplane.

SECONDARY AC SYSTEM

The secondary ac power is comprised of two systems: the copilot's ac instrument system and the ac instrument and engine fuel control system (figures 1A-55 and 1A-56). Circuit breakers for distribution of the system are located on the pilot's lower and copilot's upper circuit breaker panels.

Copilot's AC Instrument Power System

A single 250-volt-ampere inverter supplies 115-volt, 400-cycle, three-phase power (1600 series, CG 1790, and 1700 series are single phase). The inverter draws dc power from the isolated bus; therefore, it can be operated from the battery during emergency conditions of flight. During normal operation, power is supplied from the essential ac bus through a power transformer which converts three-phase

200/115-volt, 400 cycle power to three-phase 115-volt, 400 cycle power to operate the pilot's and copilot's ac instruments.

AC Instruments and Engine Fuel Control System

The ac instruments and engine fuel control system is powered by a 115-volt, 400-cycle, single-phase, ac bus. One source of power is a 2500-volt-ampere, single-phase inverter powered from the essential dc bus through a current limiter located in the right-hand distribution box. Inverter control power is provided through the AC INST & ENG FUEL CONT INVERTER circuit breaker on the copilot's lower circuit breaker panel from the essential dc bus. Normal power is supplied from phase A of the essential ac bus through the AC INST & ENG FUEL CONT PWR circuit breaker. Two instrument transformers are powered from the 115-volt, 400-cycle, single-phase bus, and provide 26-volt, single-phase ac power for instrument use.

Secondary AC System Controls

Controls for the secondary ac power system are located on the overhead electrical control panel in the flight station. The controls consist of four rotary-type switches, two of which act as inverter controls and power source selectors, with the remaining two serving to permit measuring the frequency and voltage of the output power of the inverters.

COPILOT'S AC INSTRUMENT SWITCH

28V	ISOL DC	P SIDE
INVERTER CONTROL		
COPILOT'S INVERTER POWER		
28V	ESS DC	CP SIDE
COPILOT'S INST STANDBY CONTROL		

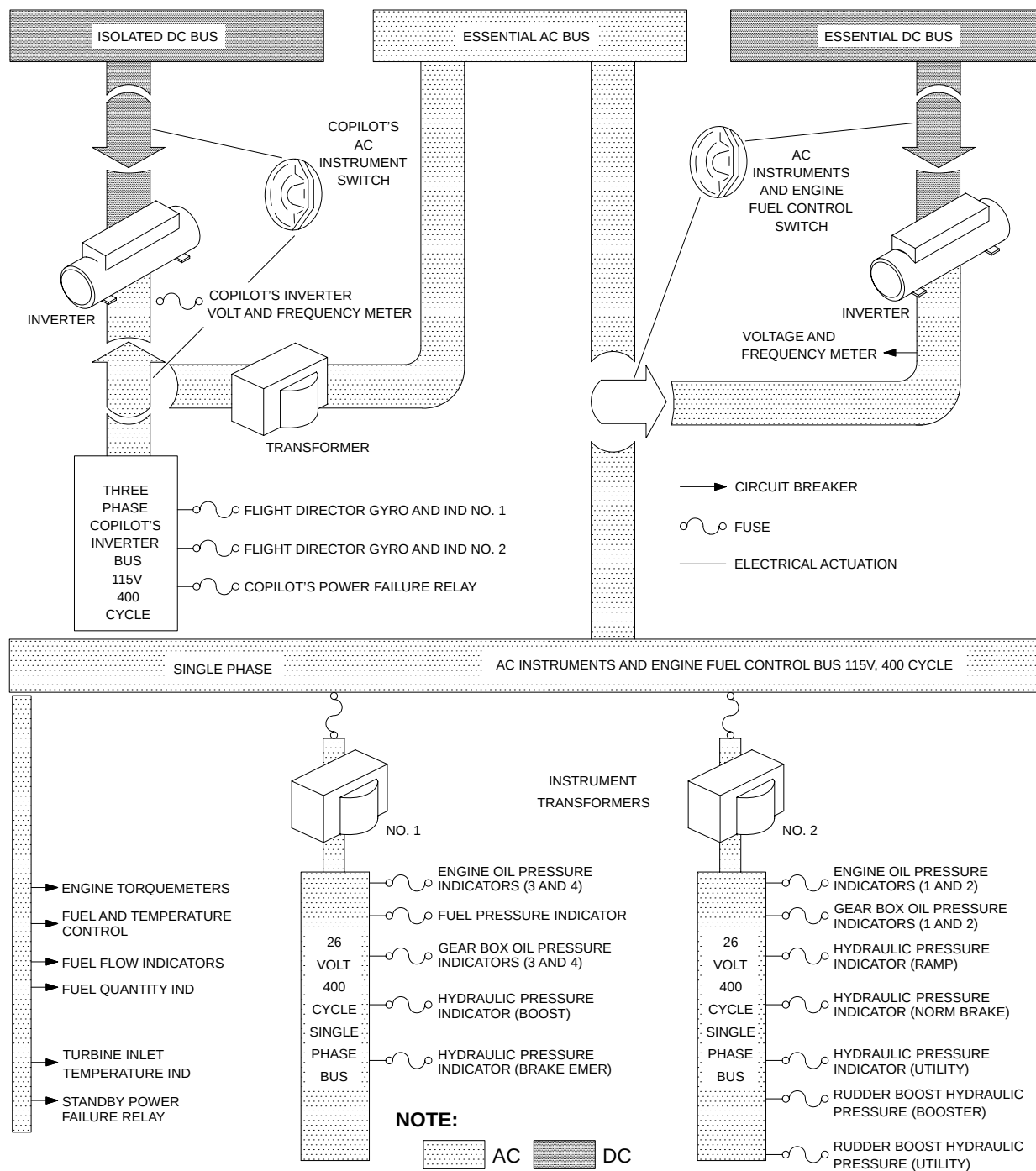
The copilot's ac instrument switch is a three-position (STANDBY, OFF, NORMAL) rotary switch. In the STANDBY position, power is routed from the isolated dc bus to operate the copilot's instrument inverter for the copilot's instrument power supply system. In the OFF position, no power is supplied to the system. (1500 series) In the NORMAL position, the inverter is turned off, and power for the copilot's instrument power system is taken from the essential ac bus through a transformer. (1600 series, CG 1790 and 1700 series). In the NORMAL position, the inverter is turned off, and power for the copilot's instrument power supply system is taken from the essential ac bus through the FLT DIR NO. 1 and NO. 2 ac circuit breakers on the copilot's upper circuit breaker panel.

AC INSTRUMENT AND ENGINE FUEL CONTROL SWITCH

28V	ESS DC	CP Side
AC INST & ENG FUEL CONT INVERTER		

AC Secondary Power System (1500 Series)

FUSES AND CIRCUIT BREAKERS LISTED BELOW ARE LOCATED ON THE PILOT'S LOWER CIRCUIT BREAKER PANEL.



c130h17002420001a

Figure 1A-55

AC Secondary Power System (1600 Series, CG 1790, and 1700 Series)

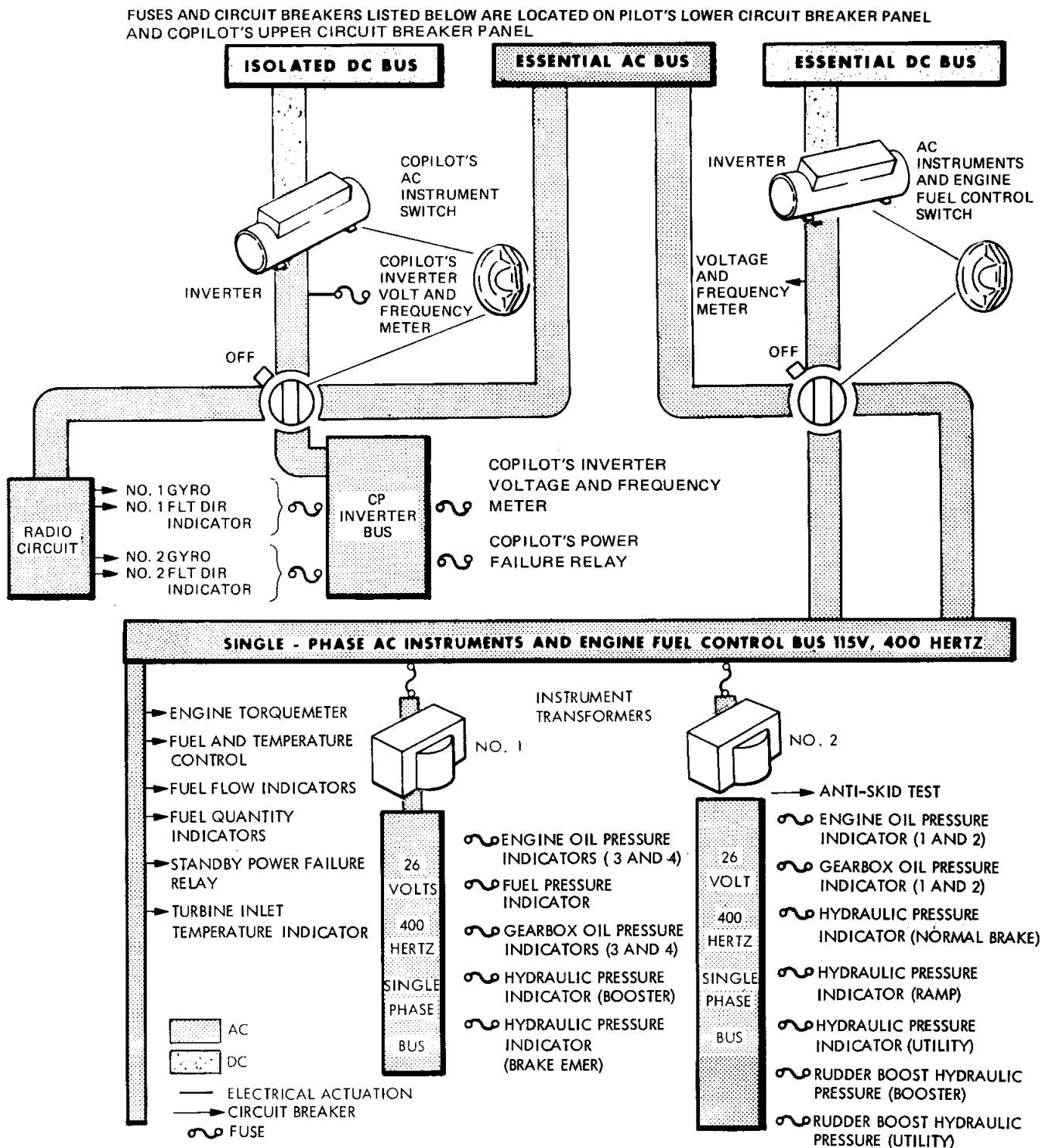


Figure 1A-56

The ac instrument and engine fuel control switch is a three-position (ESSENTIAL AC BUS, OFF, ESSENTIAL DC BUS) rotary switch. In the ESSENTIAL AC BUS position power is supplied to the 115-volt, 400-cycle, single-phase bus from phase A of the essential ac bus. In the ESSENTIAL DC BUS position power is supplied to the ac instruments and engine fuel control inverter which will then power the system. If the inverter voltage is insufficient, the power supply is automatically switched from the essential dc bus to the essential ac bus. This occurs when the inverter output voltage drops to 25 (± 20) volts. In the OFF position no power is supplied to the system.

VOLTAGE AND FREQUENCY SELECTOR SWITCH (1500 Series)

The VOLTAGE & FREQUENCY SELECTOR switch has seven positions for measuring the output voltage and frequency of the ac power supply sources. Placing the switch in the COPLT INV ØA and ØB AC INST & ENG FUEL CONT INV ØC position, while simultaneously placing the PHASE SELECTOR switch in the PHASE A or PHASE B position, provides an indication of the frequency and voltage of the copilot's inverter on the FREQUENCY METER and the AC VOLTMETER respectively. Positioning the PHASE SELECTOR switch to PHASE C provides an indication of the circuit frequency and voltage of the ac instrument and engine fuel control inverter. If the switch is at the COPLT INV ØA and ØB AC INST & ENG FUEL CONT INV ØC position and essential ac power is being used in place of the inverter, the FREQUENCY METER and the AC VOLTMETER will not indicate.

VOLTAGE AND FREQUENCY SELECTOR SWITCH (1600 Series, CG 1790, and 1700 Series)

The VOLTAGE & FREQUENCY SELECTOR switch has seven positions for measuring the output voltage and frequency of the ac power supply sources. Placing the switch in the COPLT INV ØA AC INST & ENG FUEL CONT INV ØC position, while simultaneously placing the PHASE SELECTOR switch in the PHASE A position, provides an indication of the frequency and voltage of the copilot's inverter on the FREQUENCY METER and the AC VOLTMETER respectively. Positioning the PHASE SELECTOR switch to PHASE C provides an indication of the ac instrument and engine fuel control inverter. If the switch is at the COPLT INV ØA AC INST & ENG FUEL CONT INV ØC position and essential ac power is being used in place of the inverter, the FREQUENCY METER and the AC VOLTMETER will not indicate.

PHASE SELECTOR SWITCH

A three-position phase selector switch, located on the overhead electrical control panel (figures 1A-41 and 1A-42), permits selection of the appropriate phase of electrical power when measuring the output voltage and frequency of either of the inverters.

Secondary AC System Indicators

Indicators for the secondary ac power system are a voltmeter, a frequency meter, and selected power out lights located on the overhead electrical control panel in the flight station.

VOLTMETER AND FREQUENCY METER

A voltmeter, a frequency meter and selector switch (figures 1A-41 and 1A-42), provide for reading the voltage and frequency of power supplied by any of the ac power sources. The meters are connected to the selected ac power source by the switch. If the switch is at an inverter position and a bus source of power is being used in place of the inverter, the meters will not indicate.

SELECTED POWER OUT LIGHTS

28V ISOL DC P Side

SELECTED POWER OUT LTS

Two selected power out lights (figures 1A-41 and 1A-42) are located on the electrical control panel. If the copilot's instrument selected power out light comes on, it indicates that no power is being supplied to the copilot's ac instrument bus. When the ac inst and engine fuel control switch is in the ESSENTIAL DC BUS position and its SEL PWR OUT light glows, an inverter has failed; however, the 115-volt ac instrument and engine fuel control bus is then automatically connected to the essential ac bus. A light does not glow when the corresponding selector switch is set to OFF.

NOTE

(1600 series, CG 1790, and 1700 series) The copilot's selected power out light will illuminate when the copilot's ac instrument switch is in the normal (essential ac bus) position and the No. 2 ac flight director circuit breaker (copilot's upper circuit breaker panel) is pulled. This is a false warning; power from the essential ac bus is still powering the copilot's secondary ac system.

115 VAC 60HZ CONVERTER

A converter has been installed on the deck under the clothes closet (FUS STA 228-245) to provide 115 VAC 60 Hz power to the PROS pallet. This 60Hz power is used by the two APS-137 indicators installed on the PROS pallet. Electrical outlets for the 115 VAC 60 Hz are installed on the aft side of the 245 bulkhead and on the side of the PROS pallet. Input power for the converter is provided from the UPPER MAIN AC DISTRIBUTION PANEL. The converter can be controlled from the radioman's position or from the PROS pallet.

DC POWER SYSTEM

Power from the essential ac bus and the main ac bus operates four transformer-rectifier units (two from each ac bus) to provide dc power for the airplane (figure 1A-57). The four transformer-rectifier units, mounted on the electronic control and supply rack, convert the power from the ac buses to 28-volt dc. Both the essential ac bus and the main ac bus may be powered by any of the engine-driven generators (refer to the ac Bus Power Sources chart). The essential ac bus is powered from the air turbine motor/auxiliary power unit generator also, so it may be used as a source of dc power for ground operation. The transformer-rectifier units feed current through reverse current relays to the main dc bus and the essential dc bus.

DC System Buses

There are four buses in the dc power system: the main bus, the essential bus, the isolated bus, and the battery bus (figures 1A-58 through 1A-61). The main and essential buses are connected through a reverse-current relay, which in flight allows current to flow from the main bus to the essential bus, but prevents current flow in the opposite direction. When the airplane is on the ground, a touchdown switch is actuated to complete a circuit which overrides the current preventing features of the reverse-current relay and permits current flow in either direction between the main and essential buses. The essential and isolated buses are similarly connected through another reverse-current relay which prevents current flow from the isolated bus to the essential bus in flight. When the airplane is on the ground, the touchdown switch completes a circuit so that manual positioning of the dc bus tie switch overrides the current preventing features of the reverse-current relay and permits current flow in either direction between the isolated and essential buses.

NOTE

The dc bus tie switch is only effective if the touchdown switch is actuated by the airplane being on the ground.

The isolated bus is connected to the battery bus by the dc power switch. During ground operation with no engines operating, all of the dc buses may be connected and powered through either the battery, or the essential dc bus, which can utilize air turbine motor/auxiliary power unit ac generator output to the essential ac bus as a power supply. External dc power is fed through the main dc bus and will supply all dc buses, except the battery, when the dc power switch is in the EXT DC PWR position.

Battery

WARNING

Do not operate the airplane without a serviceable battery. Power would not be available to operate the fire extinguisher system, alarm bells, or emergency depressurization.

The 24-volt, 34-ampere-hour NICAD/lead acid battery is located in a fuselage compartment forward of the crew entrance door. The battery supplies power to the battery bus and to the isolated dc bus. A reverse current relay is connected between the isolated dc bus and the essential and main dc buses. This relay normally prevents the battery from powering equipment connected to the essential and main dc buses and permits power from the essential and main dc buses to be used to power equipment connected to the isolated bus and to charge the battery. During GTC/APU starting, the battery powers the GTC/APU starter and control circuits.

THERMAL RUNAWAY (NICAD BATTERIES)

This phenomenon is sometimes observed during the overcharging phase of a constant potential charge, especially at elevated temperatures. It occurs just as the charge current would normally reach and remain at some minimal value. At this point, a rise in battery temperature will produce a slight decrease in the battery's resistance and voltage. These changes effect a reversal in the downward trend of the charge current, causing it to rise and produce a further increase in battery temperature with a consequent further drop in its voltage and resistance.

Recurring cycles of temperature rise and battery voltage drop progressively increase the charge current until sufficient heat is generated to destroy the separator in one or more cells. The current and temperature then rapidly rise until the battery is destroyed.

The initial battery temperature rise can be caused externally, by a rise in the ambient temperature, or internally as when a cell's cellophane separator has been damaged or degraded and permits the oxygen evolved at the positive plates to migrate to the negative plates where it recombines with cadmium and generates heat. In either case the resultant temperature rise may initiate the thermal runaway.

DC System Controls

The dc electrical system is powered directly by the ac electrical system; therefore, only two dc system controls are neces-

DC Power Supply

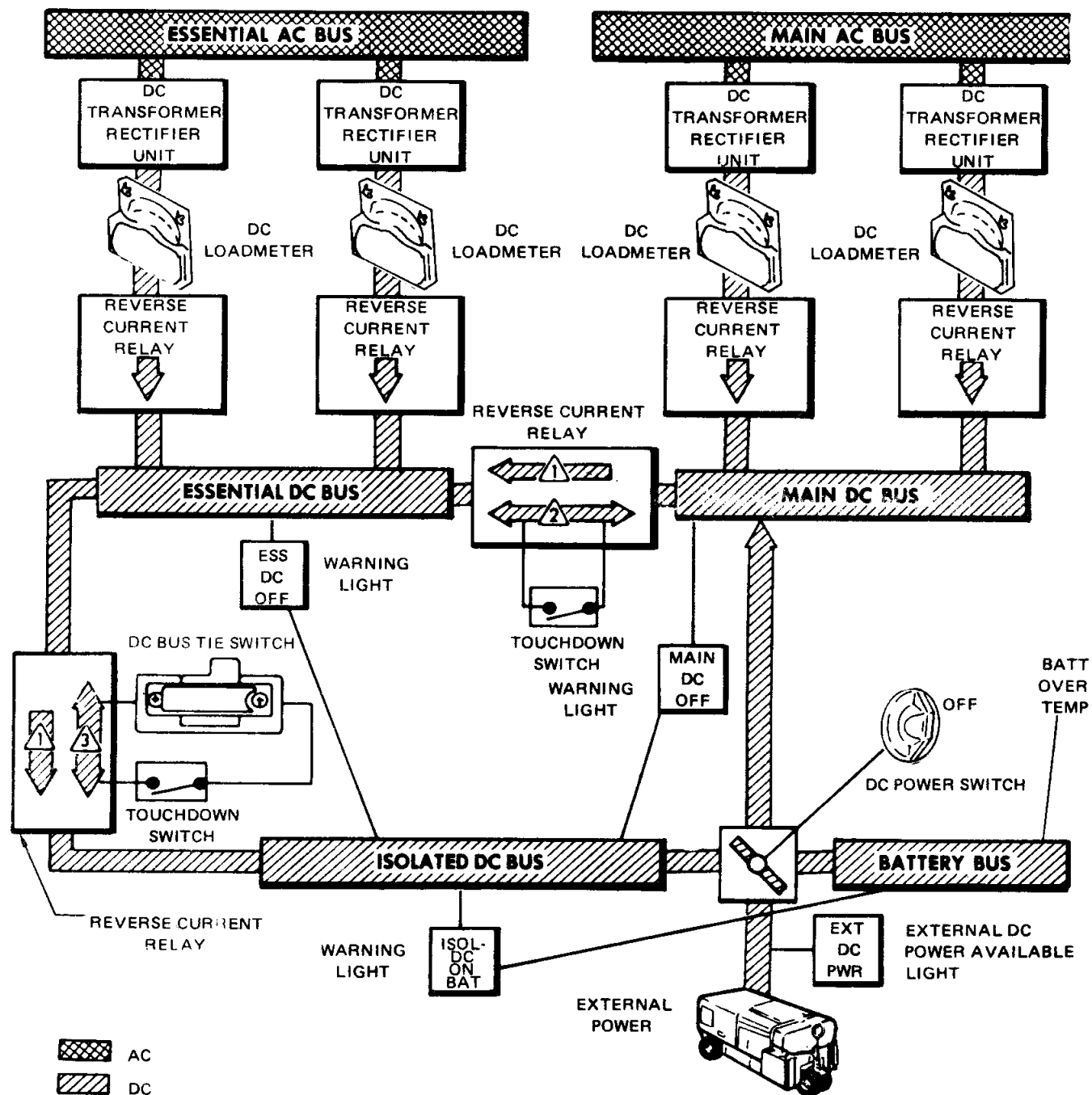


Figure 1A-57

DC Power Distribution (1500 Series)

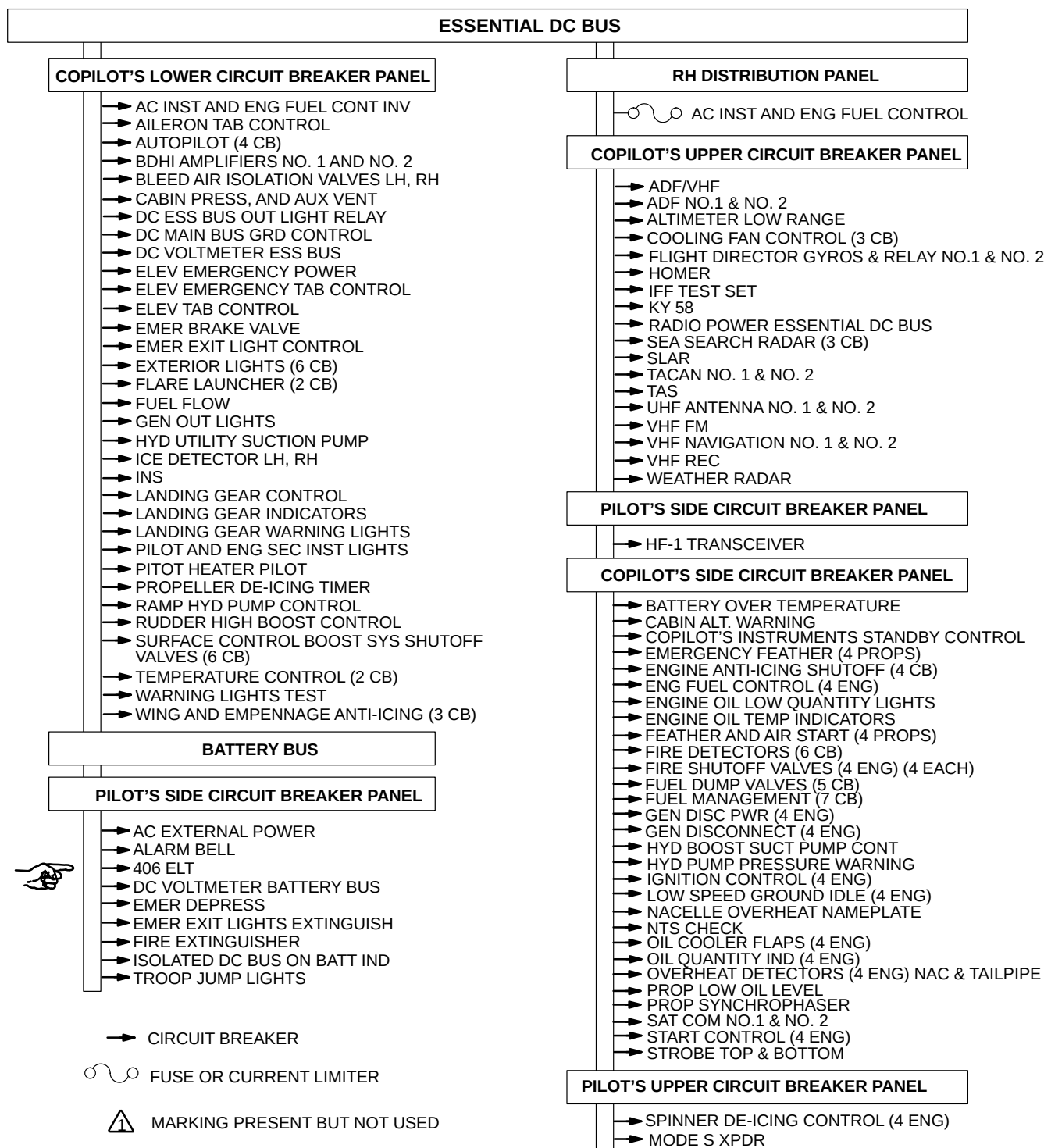


Figure 1A-58 (Sheet 1 of 2)

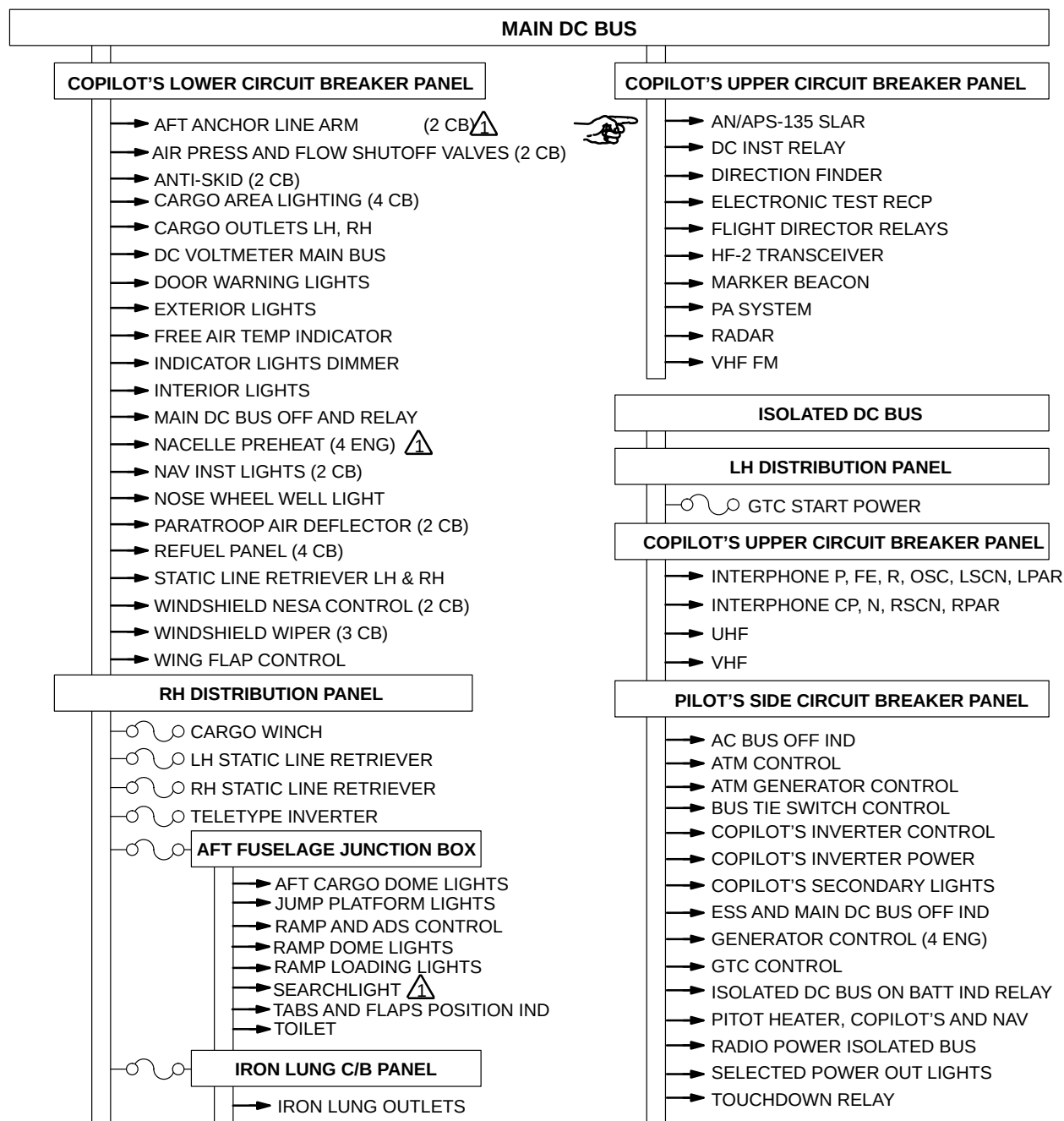


Figure 1A-58 (Sheet 2 of 2)

DC Power Distribution (1600 Series)

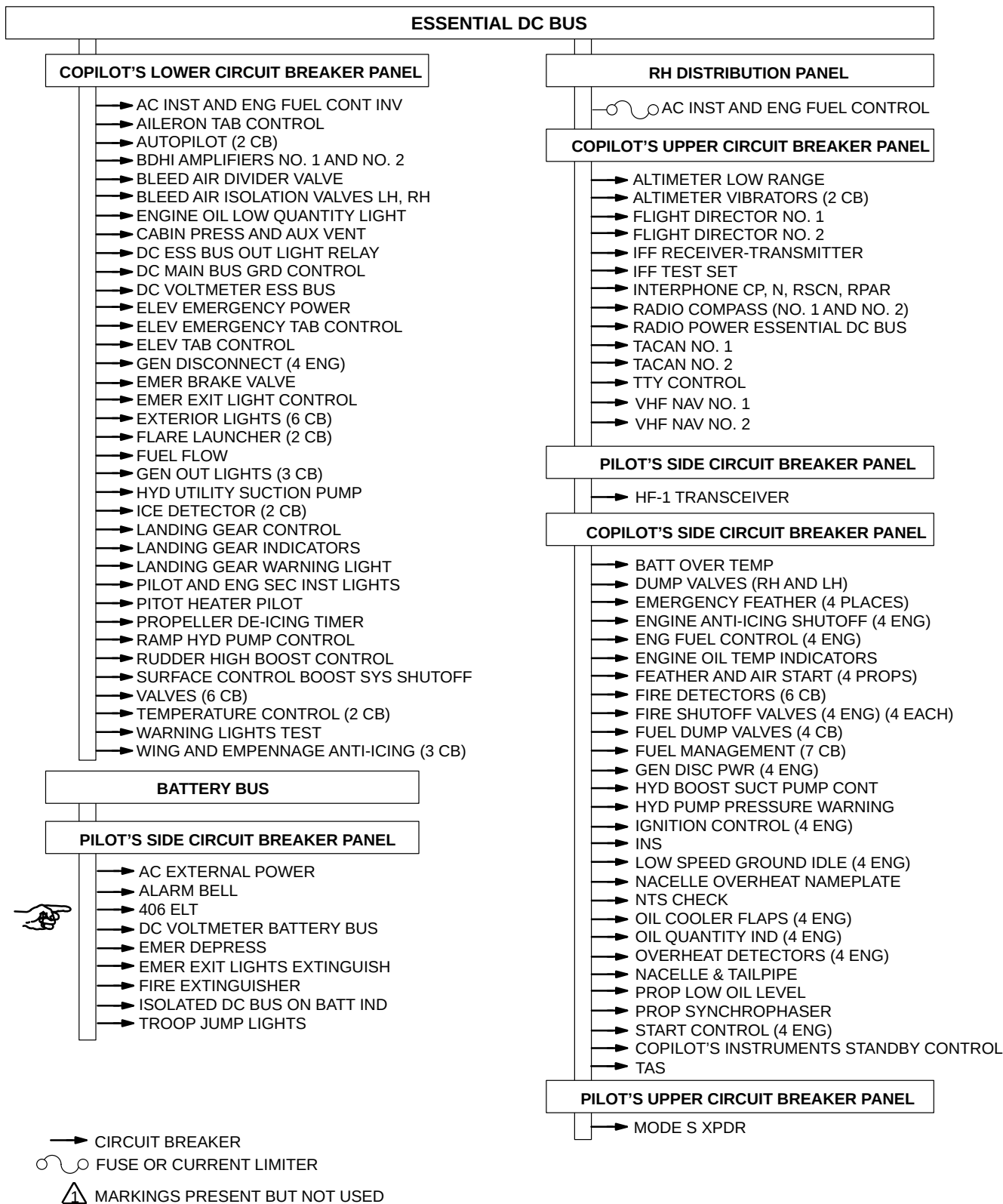


Figure 1A-59 (Sheet 1 of 2)

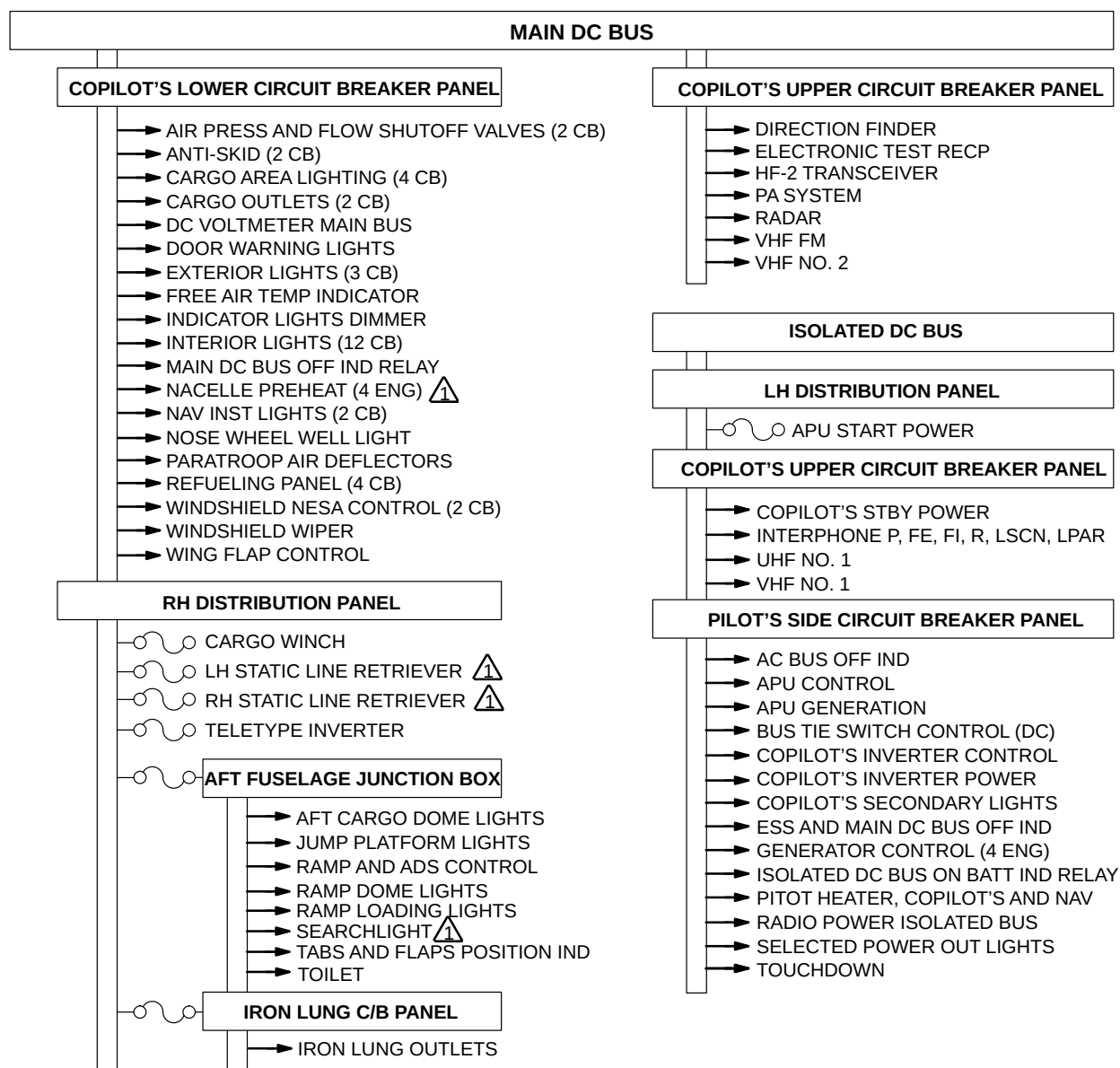


Figure 1A-59 (Sheet 2 of 2)

DC Power Distribution (CG 1790 and CG 1700 through 1704)

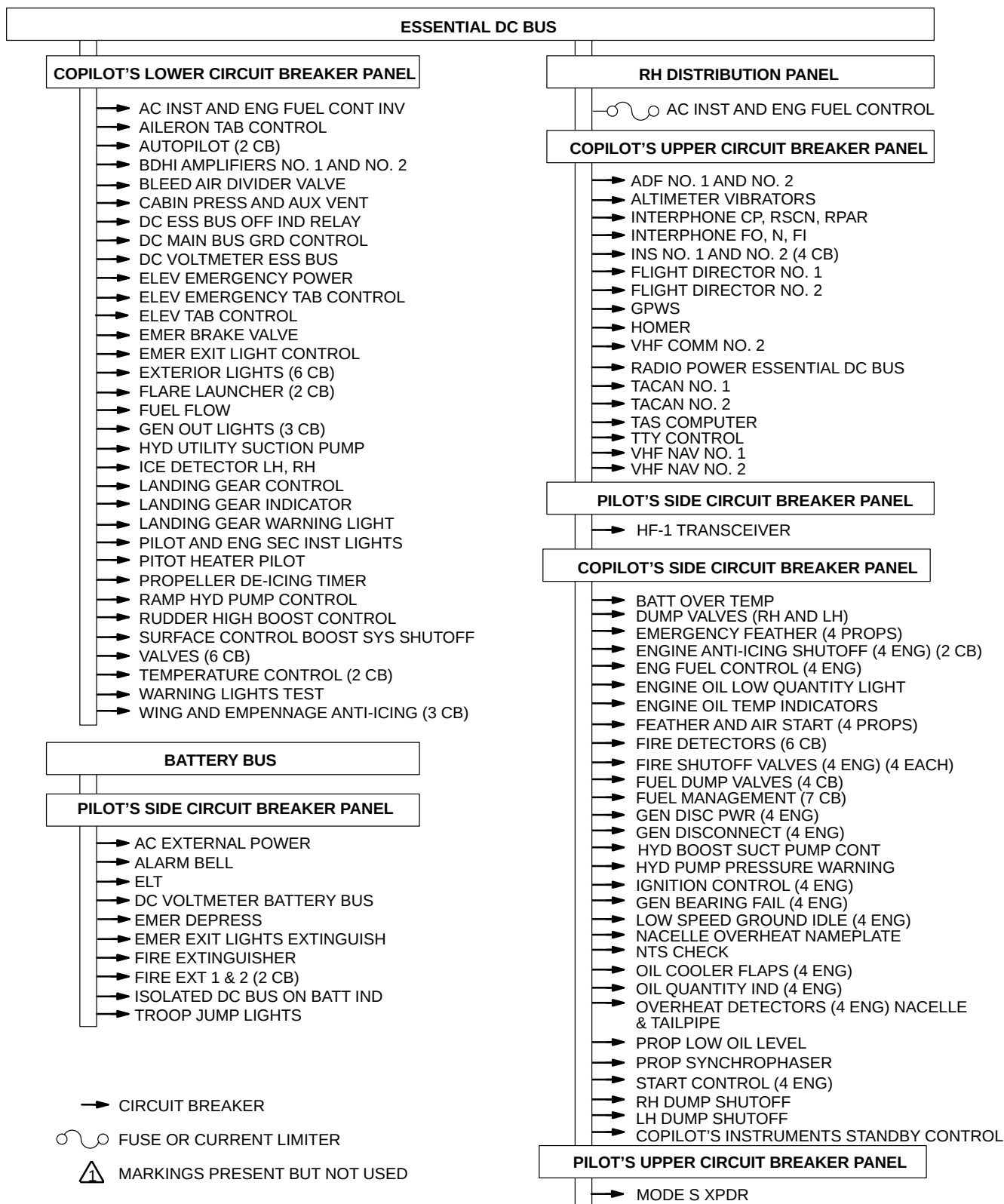


Figure 1A-60 (Sheet 1 of 2)

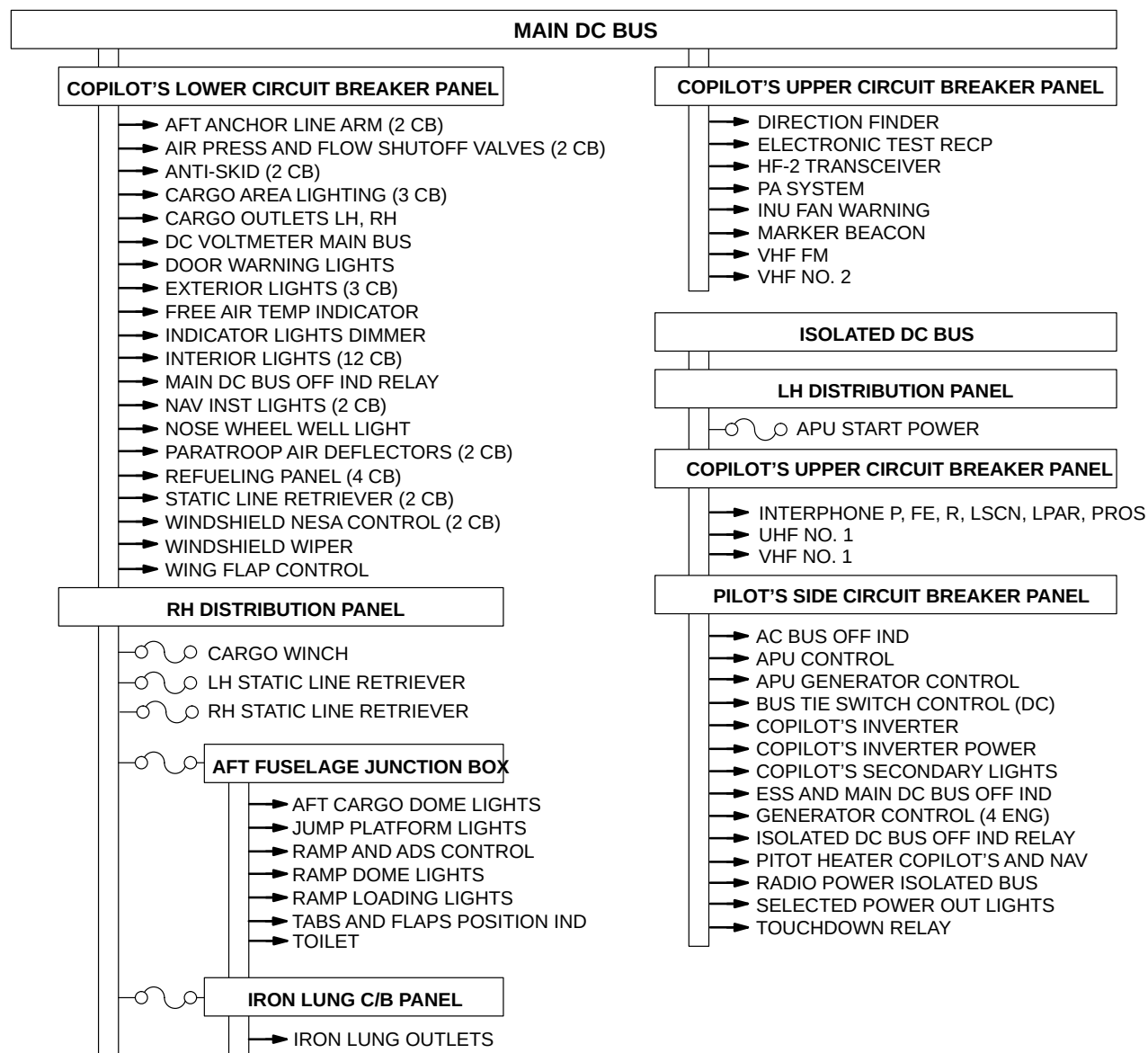


Figure 1A-60 (Sheet 2 of 2)

DC Power Distribution (CG 1705 and Up)

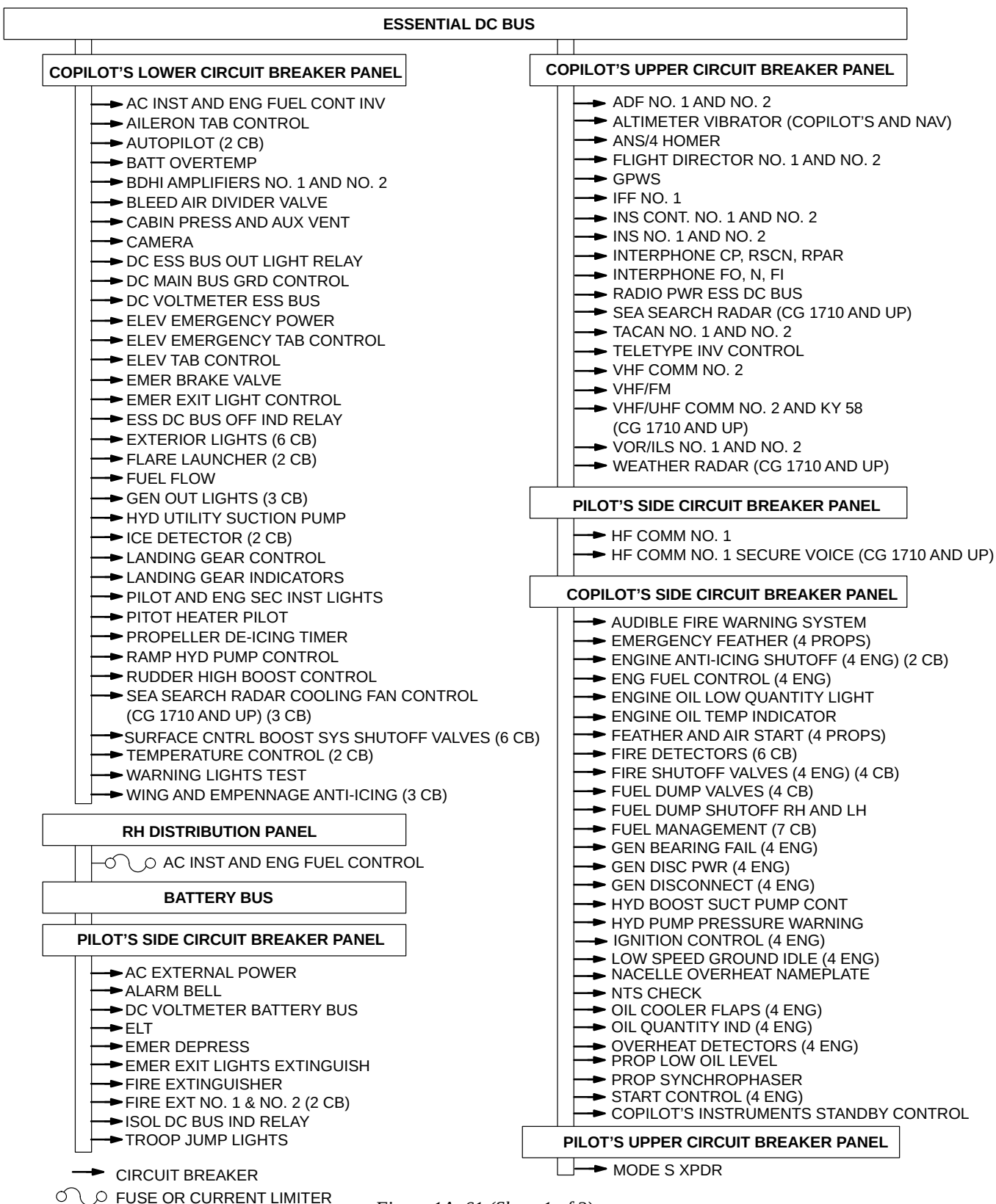


Figure 1A-61 (Sheet 1 of 2)

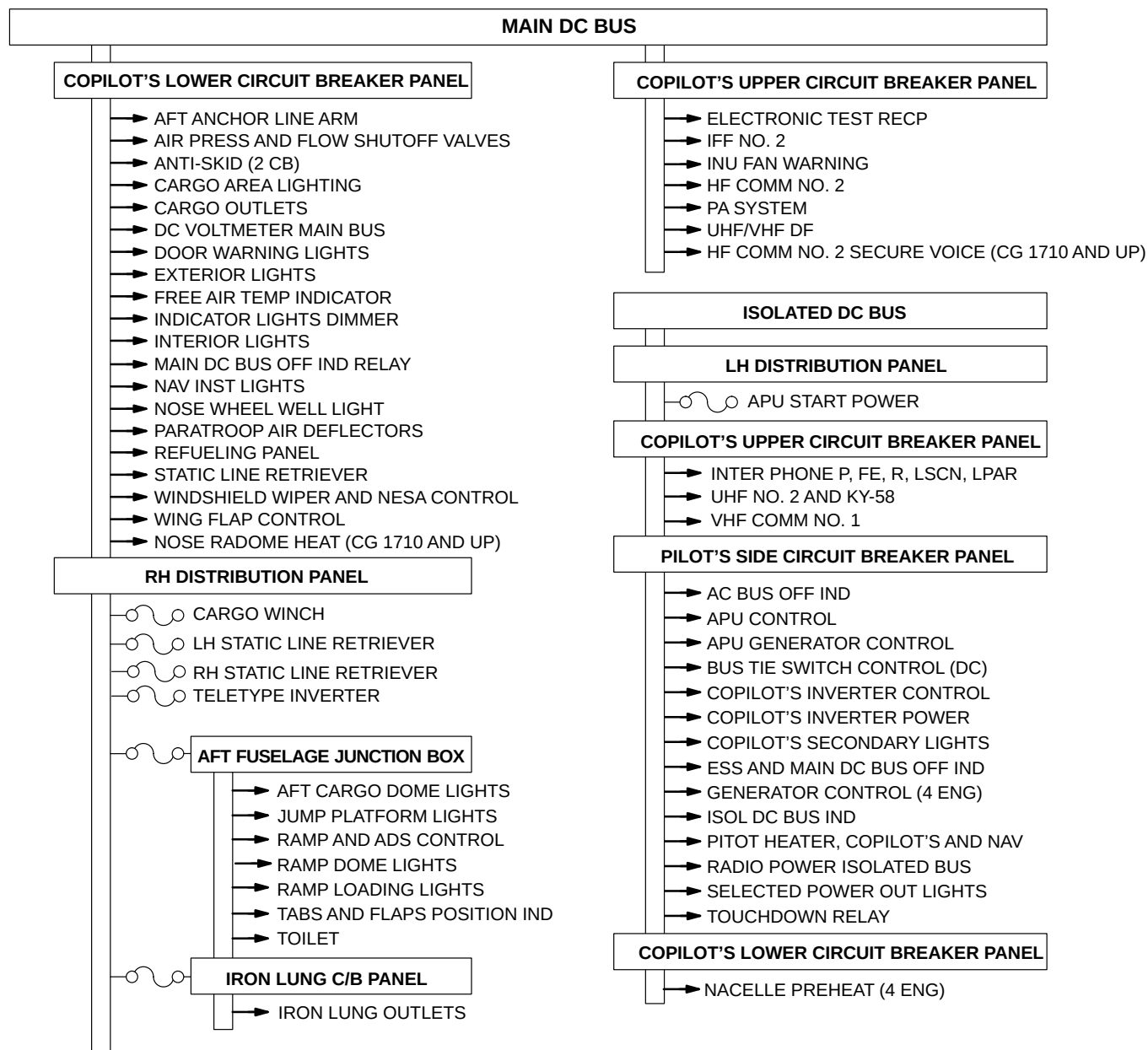


Figure 1A-61 (Sheet 2 of 2)

sary to operate the system. They are the dc bus tie switch and the dc power switch. They are both located on the electrical control panel on the overhead control panel in the flight station.

DC BUS TIE SWITCH

28V ISOL DC P Side
BUS TIE SWITCH CONTROL

The dc bus tie switch (figures 1A-41 and 1A-42) is a two-position (NORMAL, TIED) guarded toggle switch which functions in conjunction with the touchdown switch. When the airplane is on the ground the dc bus tie switch can connect the isolated dc bus and the essential dc bus for current flow in either direction. This allows battery power to feed all dc buses and circuits when the dc power switch is in the BATTERY position.

DC POWER SWITCH

28V POWER CART BATT
EXT DC PWR CONTROL COMPT

The dc power switch is a three position, rotary type switch located on the overhead electrical control panel (figures 1A-41 and 1A-42). When the switch is in the EXT DC PWR position, the external power relays will close when external power is applied in the correct polarity to connect the external power receptacle to the main dc bus. When the switch is in the BATTERY position, the battery relay is closed and the battery is connected to the isolated bus. This position of the switch permits power to flow through the reverse current relay to the isolated bus to charge the battery. When the switch is in the OFF position, the external power relay is open, the external power receptacle is disconnected from the main dc bus, and the battery is disconnected from the isolated bus.

DC System Indicators

The dc system indicators are all located on the electrical control panel on the overhead control panel in the flight station and include four load meters, two bus off indicators, an isolated dc bus on battery indicator, an external dc power available light, and a voltmeter with a bus selector switch.

LOADMETERS

Four loadmeters, one for each transformer rectifier unit, indicate percent of rated current load flowing from each unit.

BUS OFF INDICATOR LIGHTS

28V ISOL DC P Side
ESS & MAIN DC BUS OFF IND

Two bus off indicator lights, one each for the main dc bus and essential dc bus, give a visual indication of power off condition of the buses.

ISOLATED DC BUS ON BATTERY INDICATOR LIGHT

28V BATT DC P Side
ISOLATED DC BUS ON BATT IND

The isolated bus on battery light, marked ISOL DC ON BAT, gives a visual indication that the bus has become disconnected from the essential dc bus and is being powered by the battery only. The isolated bus on battery light is powered from the battery bus and controlled by the indicator circuit of the reverse current relay which connects the isolated dc bus to the essential dc bus.

NOTE

Turning the auxiliary hydraulic pump on may cause the isolated dc bus on battery indicator light to illuminate momentarily. This is normal.

VOLTMETER AND BUS SELECTOR SWITCH

28V BATT DC P Side
DC VOLTMETER BATTERY

28V ESS DC CP Side
DC VOLTMETER ESS BUS

28V MAIN DC CP Side
DC VOLTMETER MAIN BUS

The voltmeter is located on the overhead electrical control panel (figures 1A-41 and 1A-42) and is connected to the main dc bus, essential dc bus, or battery by means of the voltmeter selector switch adjacent to the voltmeter. Selected bus voltage will be indicated on the voltmeter.

EXTERNAL DC POWER INDICATOR LIGHT

The external dc power available light will be illuminated whenever external dc power is connected to the external dc power receptacle in correct polarity.

NICAD BATTERY OVERTEMPERATURE WARNING SYSTEM

28V ESS DC CP Side
BATT OVERTEMP

The NICAD battery has been modified with a battery intercell connector to sense the internal temperature of the battery. If the battery exceeds this temperature, the switch closes and illuminates the BATT OVERTEMP (figures 1A-41 and 1A-42) warning light in the cockpit overhead electrical panel. Placing the battery switch in the OFF position removes the charging source, reducing further temperature increase and the possibility of thermal runaway. The overtemperature

warning light will remain on until the battery cools below the thermal switch setting.

The BATT OVERTEMP warning light (figures 1A-41 and 1A-42) is located on the flight engineer's overhead electrical control panel adjacent to the EXT DC PWR light.

BLEED AIR SYSTEM

The bleed air system (figures 1A-62, 1A-63, and 1A-64) consists of high-pressure, stainless steel ducts and air shutoff valves which direct compressed air to pneumatically operated systems of the airplane. The entire system of ducts serve as a plenum from which air is distributed to other systems. The pneumatic systems served by the bleed air system are as follows:

Air Conditioning Systems

Radome Heat System (inoperative)

Leading Edge Anti-Icing System

Air Turbine Motor (1500 series)

Cabin Pressurization System

Engine Starting System

Windshield Defogging System

Engine Air Inlet Scoop Anti-Icing Systems and Oil Cooler Inlet Scoop Anti-Icing

Compressed air is supplied to the bleed air system from the engines when they are running, or compressed air is supplied from either the gas turbine compressor/auxiliary power unit or from an external pressure source when the airplane is on the ground and the engines are not running. The normal procedure is to supply air from the gas turbine compressor/auxiliary power unit or from an external source until the first engine is started; then, engine bleed air is used. The main bleed air manifold extends across the leading edge of the wing. Air enters the main manifold through six ports: four from the engines and one from the gas turbine compressor/auxiliary power unit or from an external source. Branch ducts connected to the main manifold distribute air for operating the following:

Air Conditioning Systems

Leading Edge Anti-Icing System

Air Turbine Motor (1500 series)

Each engine bleed air manifold is connected to the main manifold just aft of the fire wall by an engine bleed air shutoff valve (1500 series) and bleed air pressure regulators (1600 series, CG 1790, and 1700 series). Branch ducts connected to the engine manifold forward of the fire wall distribute air for operating the following:

Engine Starting System

Engine Air Inlet and Oil Cooler Scoop Anti-Icing

Check valves installed in each engine bleed air manifold, the gas turbine compressor/auxiliary power unit supply duct, and the external pressure supply duct prevent reverse flow when any of these sources of supply is inoperative.

ENGINE BLEED AIR CONTROLS (1500 SERIES)

28V	ESS DC	CP Side
FIRE SHUTOFF VALVES – BLEED AIR		

Four engine bleed air valve switches on the anti-icing systems control panel (figure 1A-65) control the opening and closing of the engine bleed air valves. The control circuit for each valve is connected through a switch actuated by the fire emergency control handle. When the fire emergency handle is pulled, the engine bleed air valve is closed and the normal switch control is rendered inoperative.

ENGINE BLEED AIR CONTROLS (1600 SERIES, CG 1790, AND 1700 SERIES)

28V	ESS DC	CP Side
FIRE SHUTOFF VALVES – BLEED AIR		

Four engine bleed air switches on the anti-icing systems control panel (figure 1A-65) control the opening, closing, and regulating (50 psi) of the engine bleed air pressure regulators. The control circuit for each regulator is connected through a switch actuated by the fire emergency control handle. When the fire emergency handle is pulled, the engine bleed air regulator is closed and the normal switch control is rendered inoperative.

BLEED AIR PRESSURE GAUGE

A direct-reading pressure gauge (figure 1A-66) located on the right-hand circuit breaker box above the copilot's upper circuit breaker panel indicates main bleed air manifold pressure in pounds per square inch. The gauge is used to check the pressure of the bleed air supply and the operation of the pneumatic systems.

NOTE

When the flight station air conditioning system is on, the bleed air pressure gauge may read 6 psi lower than the actual pressure in the bleed air manifold.

WING BLEED AIR ISOLATION VALVES (1500 AND 1600 SERIES)

28V ESS DC CP Side
BLEED AIR – ISOLATION VALVES –
LH OR RH WING

Two wing isolation valves are installed in the bleed air manifold near the inboard section of the wing. These valves are electrically closed by the wing isolation valve switches on the anti-icing control panel (figure 1A-65) and manually opened by two handles mounted in the top of the cargo compartment (figures 1A-62 and 1A-63) forward of the left and right wheel well wall.

BLEED AIR DIVIDER VALVE SWITCH (1600 SERIES, CG 1790, AND 1700 SERIES)

28V ESS DC CP Side
BLEED AIR – DIVIDER VALVE

The bleed air divider valve switch (figure 1A-65) is a guarded two-position (CLOSED, NORMAL) switch located on the anti-icing and deicing control panel. The switch controls a shutoff valve located in the bleed air duct between the outlets going to the flight deck and cargo compartment air conditioning units. The valve is normally in the open position. The valve is powered open and closed. Closing the valve isolates the bleed air supply so that one air conditioning unit can continue to operate in case of a bleed air duct failure.

AIR CONDITIONING SYSTEMS

The airplane is equipped with two independent operating air conditioning systems (figures 1A-67 and 1A-68), one for the flight deck and the other for the cargo compartment. Both are operated by bleed air supplied from the engine compressor, or they may be operated on the ground by air supplied from the gas turbine compressor/auxiliary power unit or by the attachment of an external ground compressor unit. Each system keeps the air at a required temperature and removes excess moisture from it before sending it through a system of ducts into the crew and cargo compartments. The principal components of each system comprise a venturi-type airflow regulator, an electrical temperature control system, a water separator, a refrigerating unit, auxiliary vent valve and controls, and

distribution ducts. The flight deck system includes a windshield defogging system and controls; the cargo compartment system includes a heating system for the cargo compartment floor. (1500 series) The systems are similar except for flow capacity. The higher capacity system serves the cargo compartment, and the lower capacity system is used for the flight deck. (1600 series, CG 1790, and 1700 series) The systems are the same except for the distribution duct arrangement. (All series) Electrical power for the air conditioning system control components is supplied through circuit breakers on the copilot's lower circuit breaker panel. Ground air conditioning can be accomplished by connecting an external unit to the cooling air scoops with air scoop adapters and using the airplane ducting.

AIRFLOW REGULATION

28V ESS DC CP Side
CABIN PRESS & AUX VENT

The amount of air flowing through each air conditioning system is controlled by the venturi-type airflow regulator in the system. Each regulator is set by the position of the air conditioning master switch on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70), for three operating conditions: during flight, on the ground with the GTC/APU supplying bleed air, and the shutoff condition when neither air conditioning nor pressurization is required.

(1500 series) The flight deck airflow regulator maintains a constant airflow of 30 pounds per minute when the air conditioning master switch is in either the AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS position, and 15 pounds per minute when in the AIR COND GTC position. The cargo compartment airflow regulator maintains a constant airflow of 70 pounds per minute when the air conditioning master switch is in either the AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS position. When the switch is in the AIR COND GTC position, the airflow regulator maintains a minimum pressure upstream of the valve at 27 psi, regardless of flow through the cargo compartment air conditioning system, to ensure air turbine motor operation and to allow airflow through the flight deck air conditioning system. These airflow regulators also act as shutoff valves to stop the bleed airflow through the air conditioning systems. They are pneumatically actuated and electrically controlled through solenoid valves to select the normal airflow, reduced airflow, or shutoff condition.

(1600 series, CG 1790, and 1700 series) The flight deck and cargo compartment airflow regulators compensate for altitude. The standard day sea level airflow from each regulator is 70 pounds per minute, and at 35,000 feet the airflow is 33 pounds per minute. The underfloor heat system provides an additional 34 pounds per minute airflow at 35,000 feet. The

Bleed Air System (1500 Series)

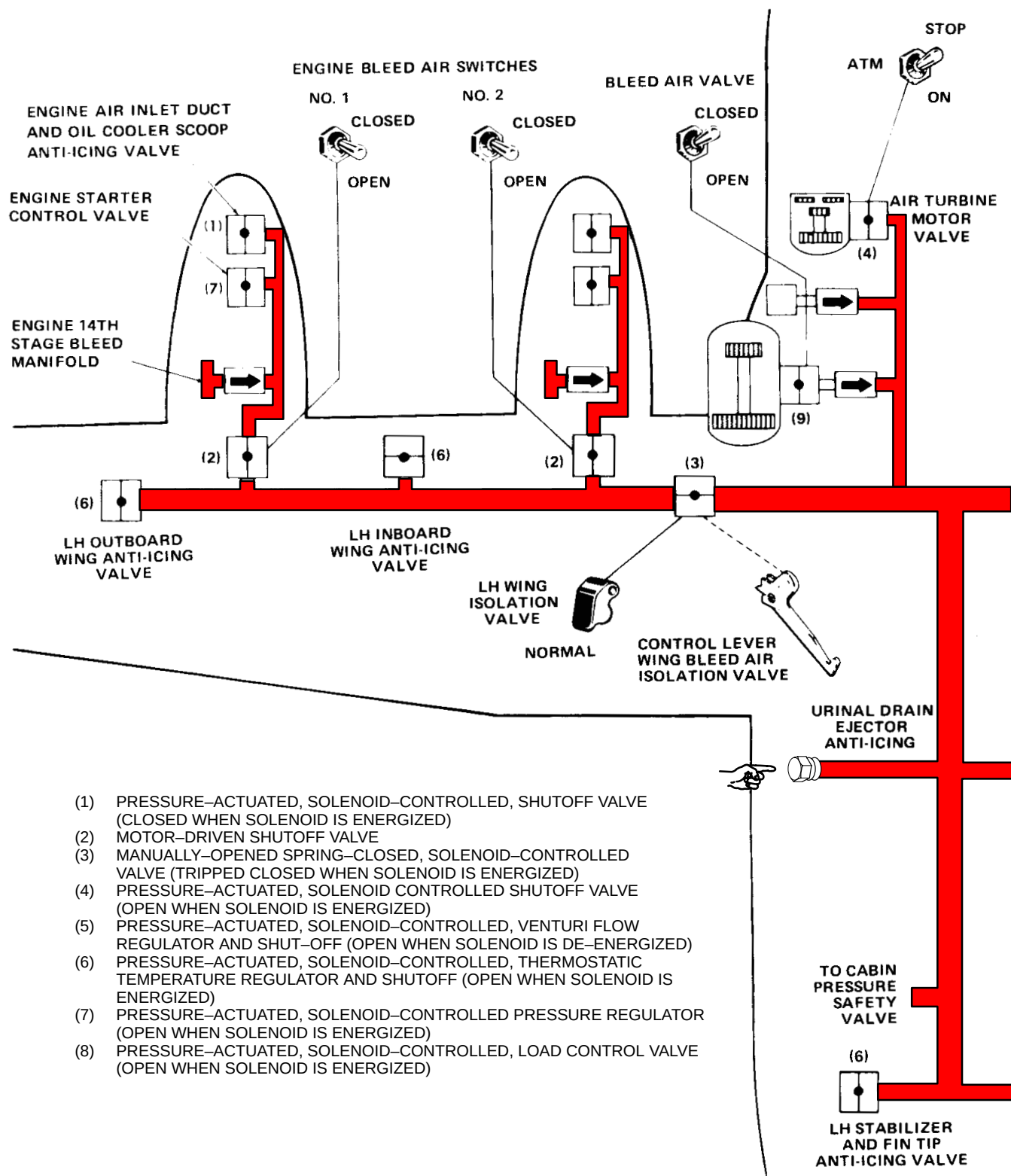


Figure 1A-62 (Sheet 1 of 2)

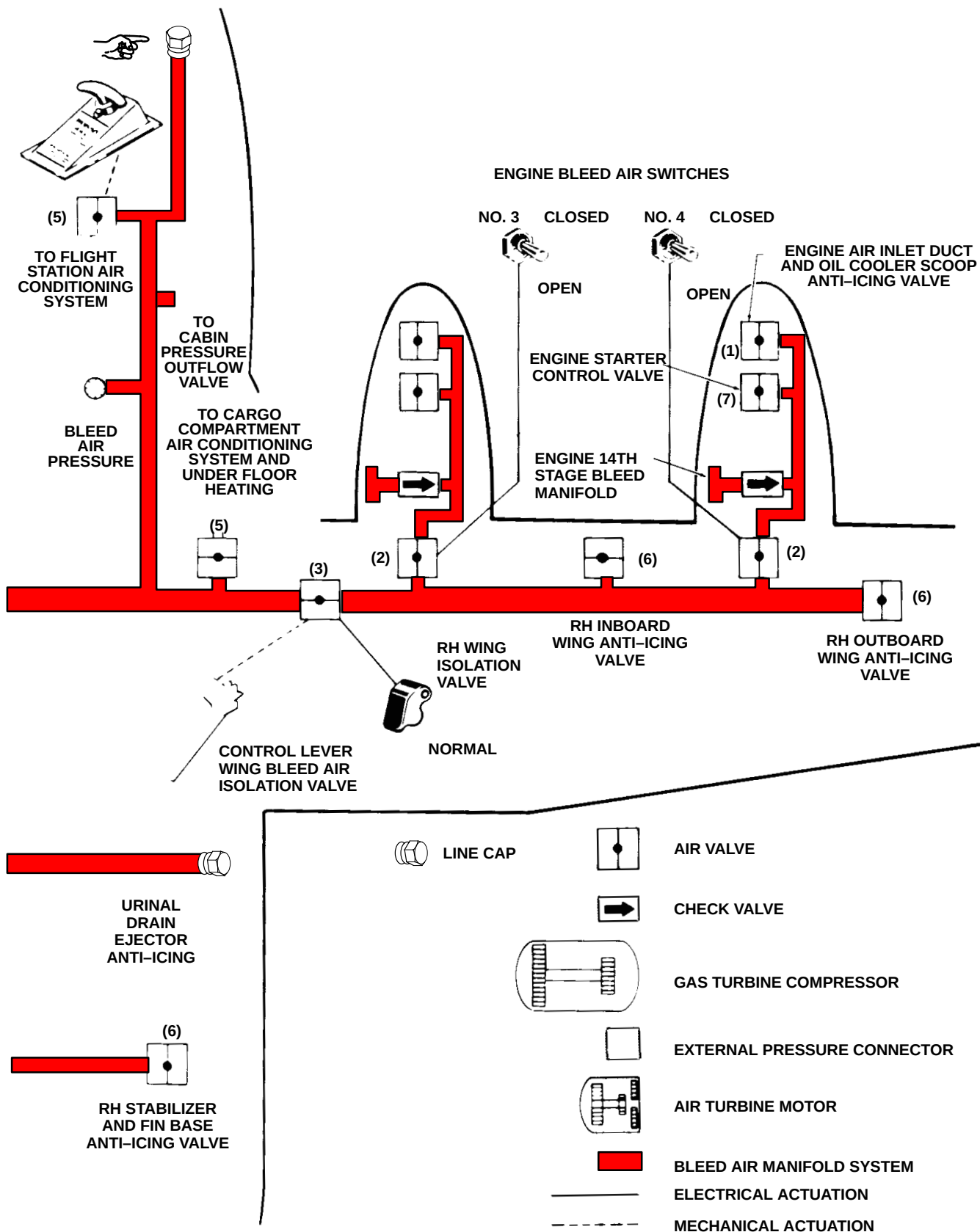


Figure 1A-62 (Sheet 2 of 2)

Bleed Air System (1600 Series)

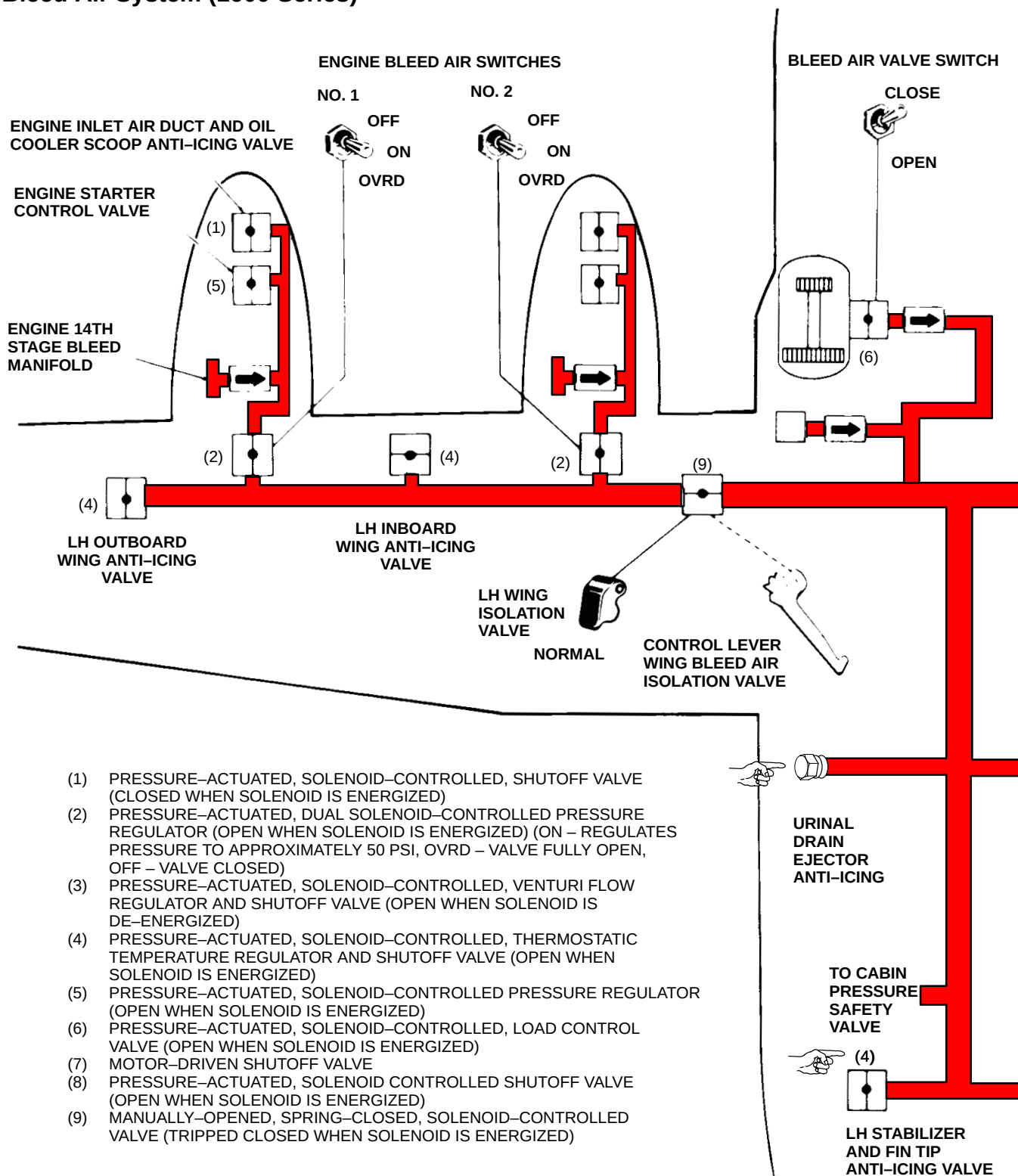


Figure 1A-63 (Sheet 1 of 2)

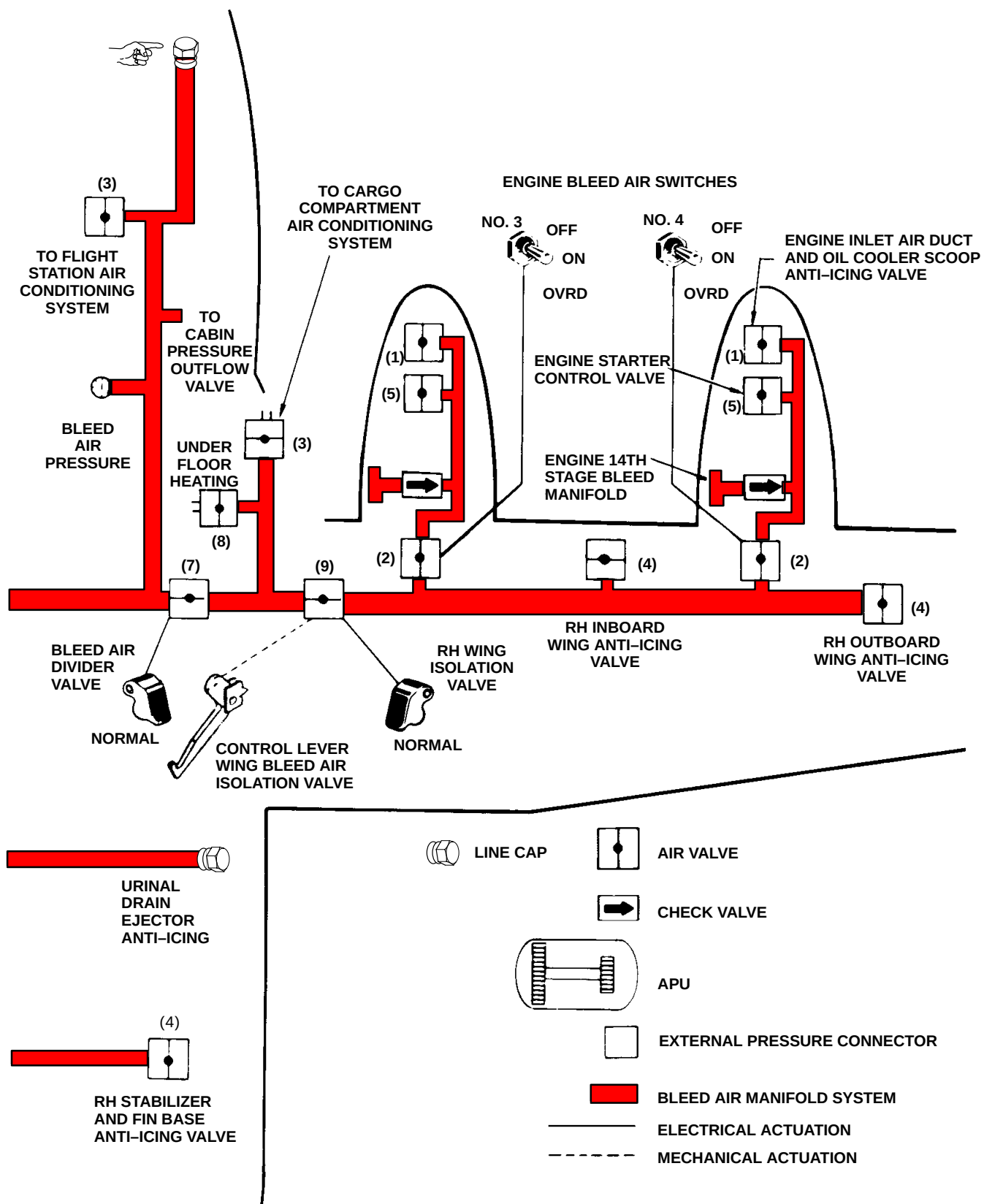


Figure 1A-63 (Sheet 2 of 2)

Bleed Air System (CG 1790 and 1700 Series)

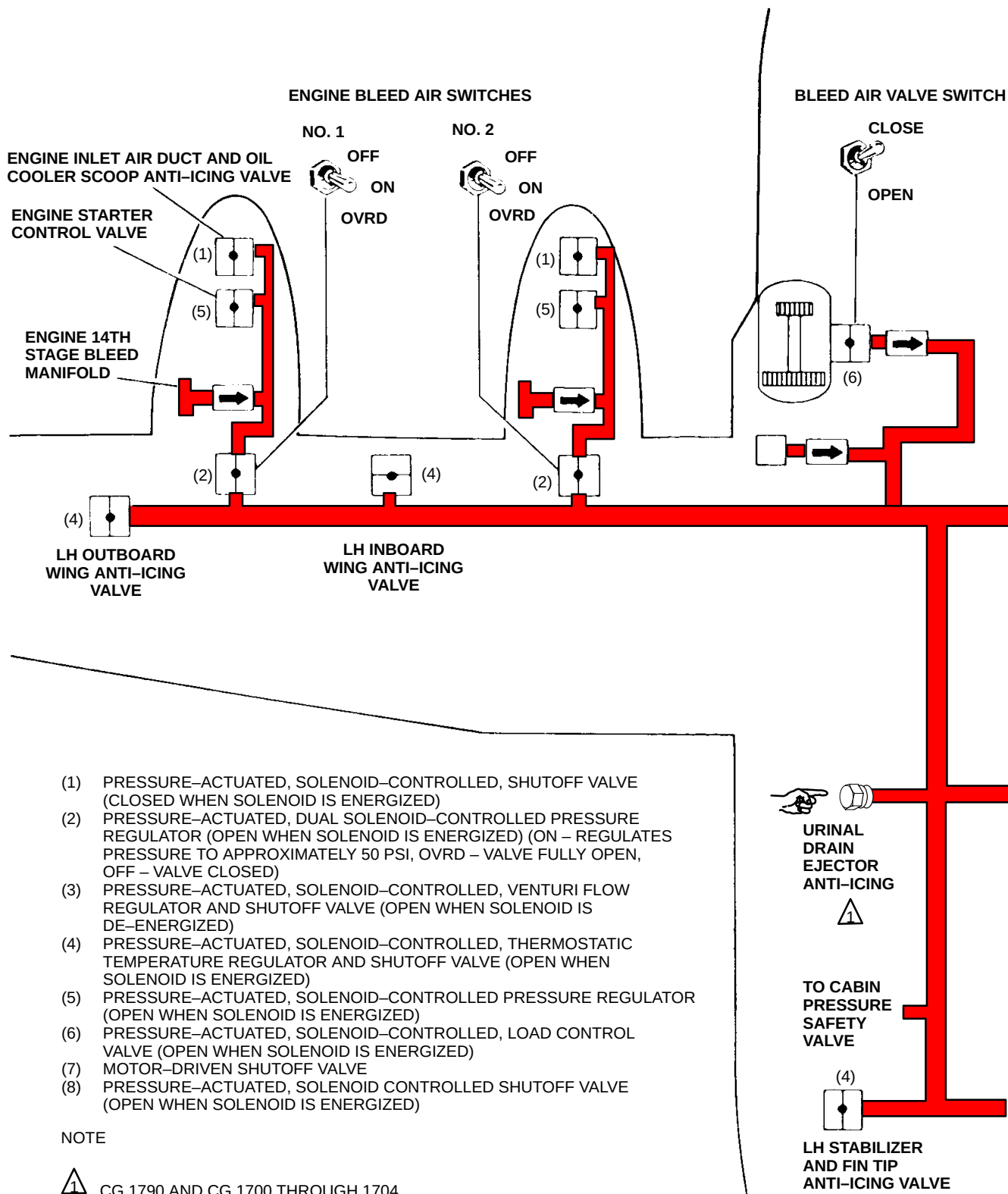


Figure 1A-64 (Sheet 1 of 2)

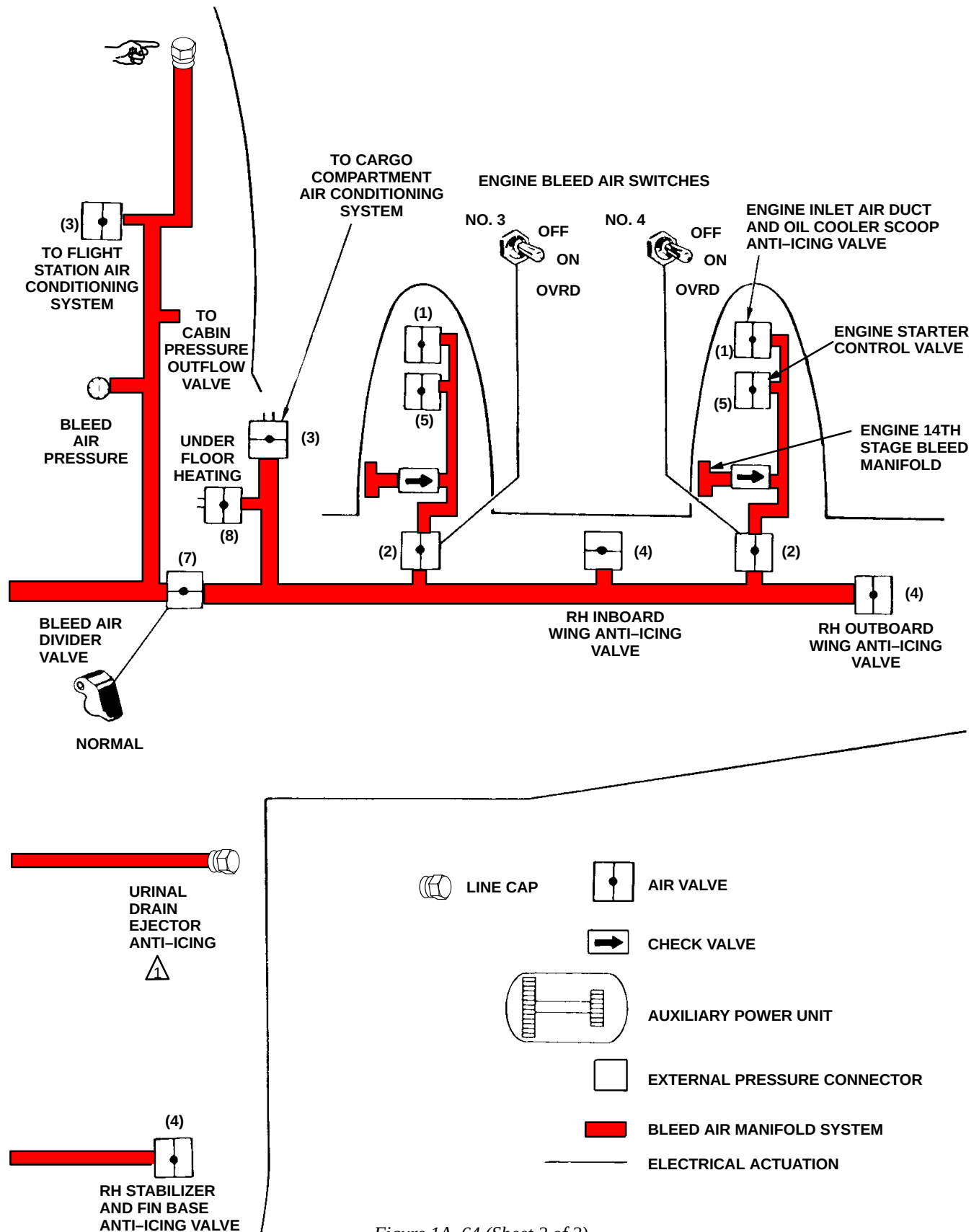


Figure 1A-64 (Sheet 2 of 2)

regulators operate when the air conditioning switch is in NO PRESS, AUTO PRESS or MAN PRESS. They are utilized as shutoff valves when the air conditioning master switch is in OFF or AUX VENT and when the emergency depressurization switch is placed to EMERGENCY DEPRESSURIZATION.

AIR TEMPERATURE CONTROL

28V ESS DC CP Side
TEMP CONTROL-FLIGHT DECK OR CARGO
COMPT

(1500 series) The dual temperature control valve in each air conditioning system opens or closes two bypass ports to establish flow routes for bleed air entering the system. Conditioned air is the combined flow of bypassed bleed air, heat exchanger cooled air, and air cooled by the turbine unit. (1600 series, CG 1790, and 1700 series) The temperature control system for each air conditioning system utilizes a single valve to bypass hot bleed air from downstream of the airflow regulator to a point downstream of the water separator, thus bypassing the refrigeration unit.

The temperature control valves are electrically operated by either automatic or manual control. During automatic operation, a desired temperature is selected, and the system positions the valve intermittently until the selected temperature is sensed by a thermostat. Approximately 5 minutes are required for the valve to travel from one extreme position to the other during automatic operation. A high-limit thermostat (1500 series) or sensor (1600 series, CG 1790, and 1700 series) prevents excessively high output air temperature during automatic operation of the temperature control valve. When the valve is controlled manually, it will travel from full cold to full hot in approximately 4 minutes; and from full hot to full cold in approximately 35 seconds.

REFRIGERATION

Part or all of the bleed air flowing to each air conditioning system flows through the heat exchanger and turbine. The first stage of cooling is provided by heat transfer in the air-to-air heat exchanger. During flight, ambient air under ram pressure passes through the heat exchanger and provides the cooling medium to initially reduce the bleed air temperature. (1700 series) Some of this partly cooled bleed air is routed from downstream of the heat exchanger back into the refrigeration unit through an aspirator type nozzle. Under humid conditions, drain water from the water separator flows into the nozzle and is sprayed on the heat exchanger to obtain maximum cooling. (All series) Air which enters the turbine after

being partly cooled in the heat exchanger is cooled further by expending its energy to drive the turbine, the fan also augments the cooling airflow through the heat exchanger.

During ground operation, with no ram air provided, the fan will draw air through the heat exchanger whenever the turbine is rotating to assure first-stage cooling of the bleed air. (1500 series) The conditioning system incorporates a jet pump in series with the cooling fan to assure augmented cooling airflow over the entire area of the heat exchanger. (1600 series, CG 1790, and 1700 series) The cargo compartment air conditioning unit draws supplemental ambient air from the air conditioning equipment compartment through a check valve into the cooling air plenum. (All series) The temperature of the output air depends on what portion of the total airflow is routed through the heat exchanger and turbine.

WATER SEPARATION

Each water separator will remove approximately 80 percent of the moisture which condenses when air is refrigerated. Moisture remaining in the air maintains a comfortable humidity level in the compartments. The water separator contains a cone-shaped bag and a drain. The bag causes fog in the air to form into water droplets which are swirled and thrown against the shell of the separator; then they collect and run down to the drain. If the bag in the water separator becomes clogged, a pressure-sensitive relief valve at the tip of the bag opens to bypass the airflow. Icing of the water separator is prevented by an ice control screen at the turbine outlet which keeps the turbine outlet air temperature above freezing. The ice control screen is removed from the flight deck system. (1500 series) Icing of the flight deck separator is prevented by addition of an anti-icing control box and two thermostats that eliminate temperatures below 2 °C (35 °F) in the water separator. (1600 series, CG 1790, and 1700 series) A low limit control valve, sensor and control box maintain water separator exit temperature at 3 °C (37 °F).

NOTE

Water separators do not remove all moisture from conditioned air. When cargo compt temp and/or flight deck temp selectors on the air conditioning control panel (figures 1A-69 and 1A-70) are moved all the way over to cool, a considerable amount of fog may enter the compartments from diffusers. Evaporation of fog increases the cooling effect of air, and moisture provides a comfortable humidity level in the compartments. Output of fog normally decreases as selectors are moved toward WARM.

CARGO COMPARTMENT UNDERFLOOR HEATING

The cargo compartment underfloor heating is controlled by the underfloor heating switch on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70) on the overhead control panel. This two-position (ON, OFF) toggle switch energizes the shutoff and the flow diverter (underfloor heat control valve 1600 series, CG 1790, and 1700 series) valves to the underfloor heating ducts. Placing the switch in the ON position opens the shutoff valve, and the cargo floor thermostat modulates the diverter/underfloor heat control valve to maintain an underfloor temperature of approximately 27 °C (80 °F). The bleed air to the underfloor ducts passes through a double jet pump to ensure circulation of the warm air. An overhead duct auxiliary fan operates whenever the underfloor heating is turned on. This fan ensures proper circulation of the air entering the cargo compartment from the overhead ducts.

AUXILIARY VENTILATION

The auxiliary ventilation provision in each system consists of a valve connecting the heat exchanger cooling air inlet duct to the conditioned air distribution ducts. When the valve is opened, most of the air entering the cooling air scoop flows directly into the distribution ducts. In flight, the air thus admitted to the airplane is ambient air under ram pressure. On the ground, adapters can be attached to the cooling air scoops so that air from an external air conditioner can be supplied for ventilation. To prevent collapsing the air conditioning low-pressure ducts when AUX VENT is selected, a differential pressure switch prevents the auxiliary vent valves from opening until the differential pressure is reduced to approximately (0.28 psi) 0.6 HG. (1600 series, CG 1790, and 1700 series) The ducts have been rearranged and a check valve has been installed.

AIR CONDITIONING SYSTEMS CONTROLS

The main controls for the two air conditioning systems are located on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70). These comprise a rotary master switch, a temperature control switch and rheostat, an underfloor heating control switch, and (1600 series, CG 1790, and 1700 series) a recirculating fan switch and flight station airflow rotary switch. Associated controls on the panel include a manual pressurization control switch and a guarded two-position emergency depressurization switch. Other air conditioning controls in the flight deck include air delivery diverter levers on the main instrument panel, windshield defogging outlet valve control on the pilot's side shelves, and (1500 series) flight deck refrigeration shutoff valve override handle at the navigator's station. (1600 series,

CG 1790, and 1700 through 1704) A cargo compartment refrigerator overheat warning light is located on the anti-icing systems control panel (figure 1A-65). (All series) A manual emergency depressurization handle, which operates a quick-opening door in the center escape hatch, is located directly above the pilot's seat.

Air Conditioning Master Switch

28V ESS DC CP Side
CABIN PRESS AND AUX VENT

The air conditioning master switch, located on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70), is a six-position (1500 series) (AIR COND GTC, AUX VENT, OFF, AIR COND AUTO PRESS, AIR COND MAN PRESS, AIR COND NO PRESS) five-position (1600 series, CG 1790, and 1700 series) (AUX VENT, OFF, NO PRESS, AUTO PRESS, MAN PRESS) rotary switch which selects the type of air conditioning and pressurization desired. The control functions of the master switch are shown in figure 1A-71.

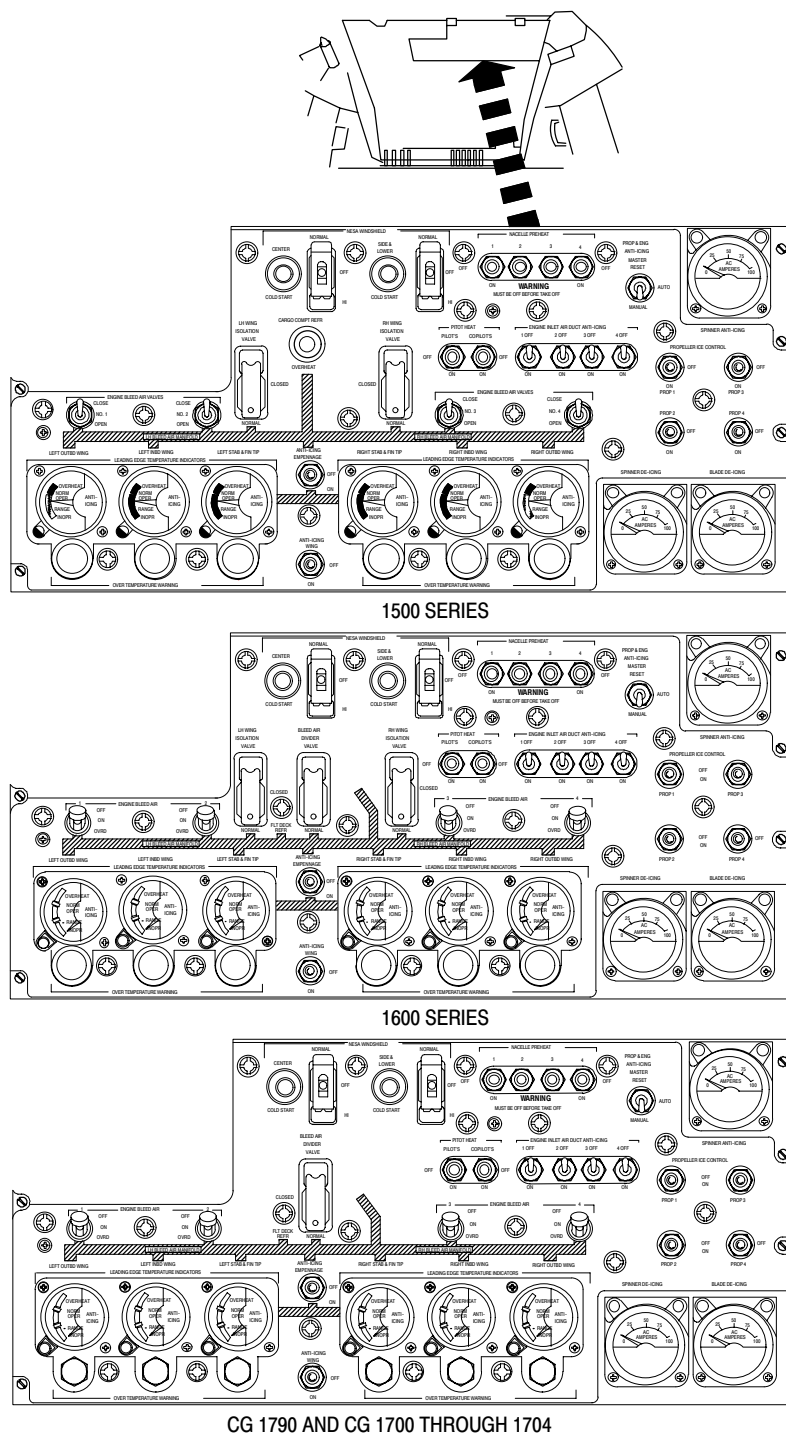
Flight Deck and Cargo Compartment Temperature Controls

28V ESS DC CP Side
TEMP CONTROL-FLIGHT DECK OR CARGO COMPT

The flight deck and cargo compartment temperature controls consist of two toggle switches and two rheostats on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70). One switch and one rheostat are used to control temperature conditions within the flight deck, and the second switch and rheostat control temperature within the cargo compartment.

The toggle-type temperature control switches are used to select warm, cool, or automatically controlled temperature conditions, but they function only when the air conditioning master switch is set to one of the AIR COND positions. Each switch may be moved from the center (off) position upward to COOL or WARM or downward to auto. With the temperature control switch set to AUTO, the temperature control valve is controlled automatically to maintain the compartment temperature selected on the temperature rheostats. When the switch is moved to the COOL position, the temperature control valve moves toward the extreme cold setting; the switch must be held for approximately 35 seconds for the valve to move from the extreme hot position to the extreme cold setting. With the switch at WARM, the valve turns to the extreme hot setting, with complete movement of the valve from the extreme cold setting to the extreme hot position taking approximately 4 minutes. The switch may be released at any time from either the WARM or COOL positions and is spring-loaded to return to the center (off) position; the temperature control valve will remain at the setting achieved

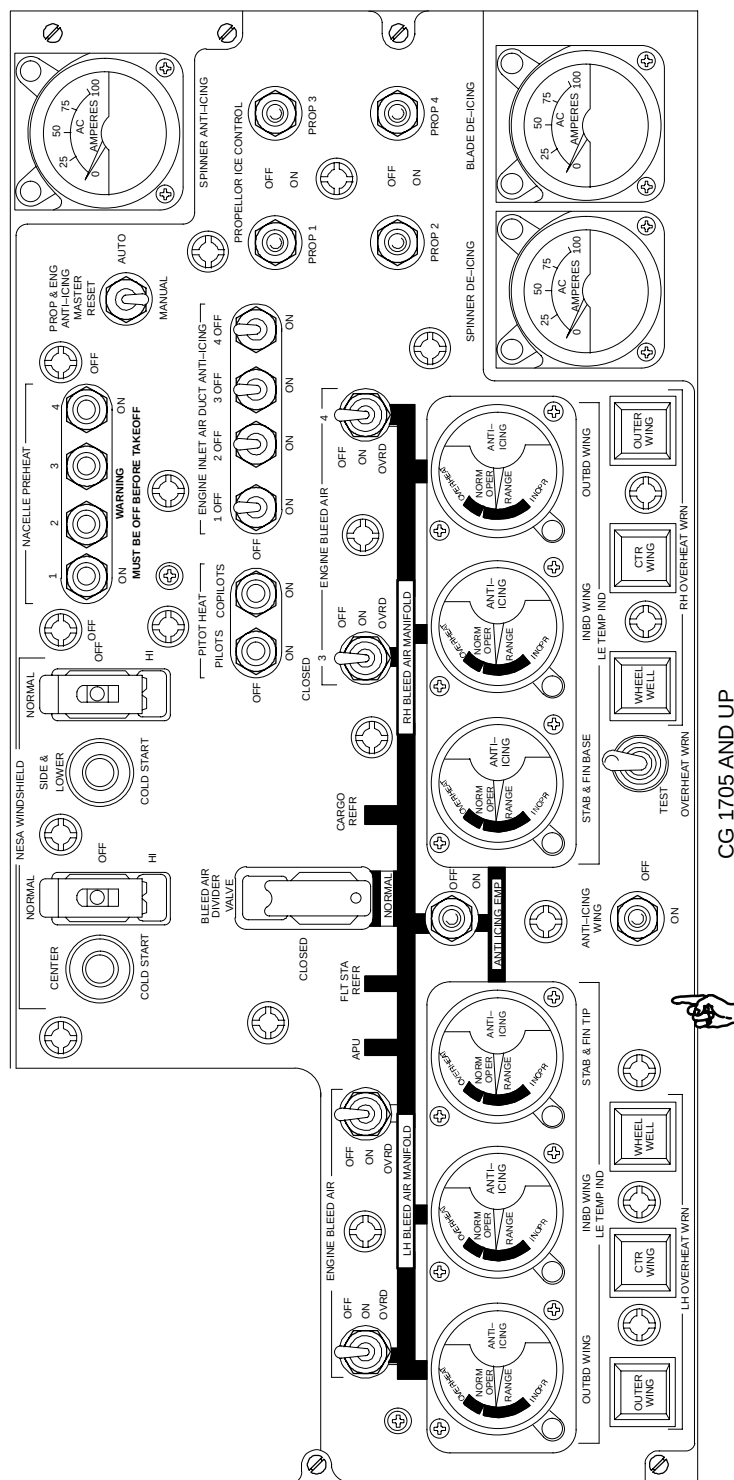
Bleed Air and Anti-Icing Systems Control Panels



c130h17003000001a

Figure 1A-65 (Sheet 1 of 2)

Bleed Air and Anti-Icing Systems Control Panels



CG 1705 AND UP

Figure 1A-65 (Sheet 2 of 2)

Bleed Air Pressure Gauge

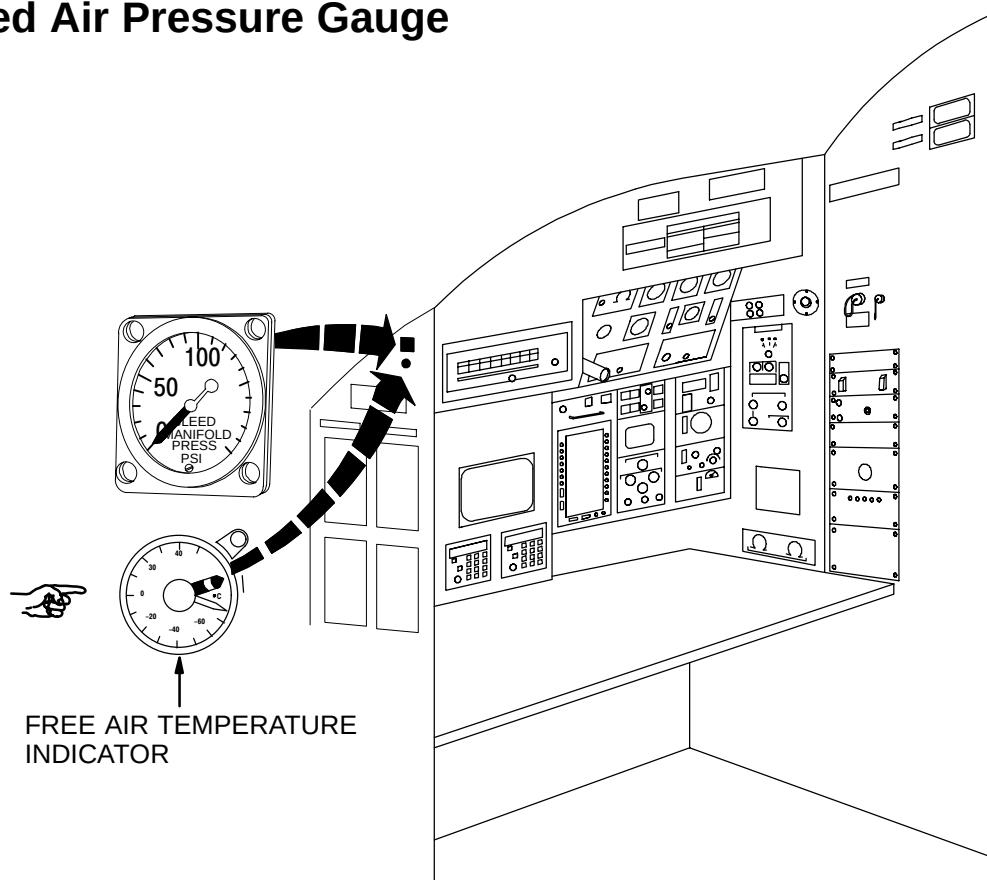


Figure 1A-66

when the switch is released. The system thermostat (1500 series) or sensor (1600 series, CG 1790, and 1700 series) blowers are activated whenever the air conditioning master switch is at one of the four (1500 series) or three (1600 series, CG 1790, and 1700 series) AIR COND positions.

The two temperature rheostats, located next to their respective temperature control switches, are used to select the temperature conditions desired within the flight deck and cargo compartment during automatic temperature control. The settings of each rheostat cover a temperature range from COOL through NORMAL to WARM.

CAUTION

(1600 series, CG 1790, and 1700 series) Do not open the temp control circuit breakers on the copilot's lower circuit breaker panel during operation of the air conditioning systems. Opening these circuit breakers will disable the automatic shutoff circuit and may result in damage to the air conditioning equipment.

Air Conditioning System (1500 Series)

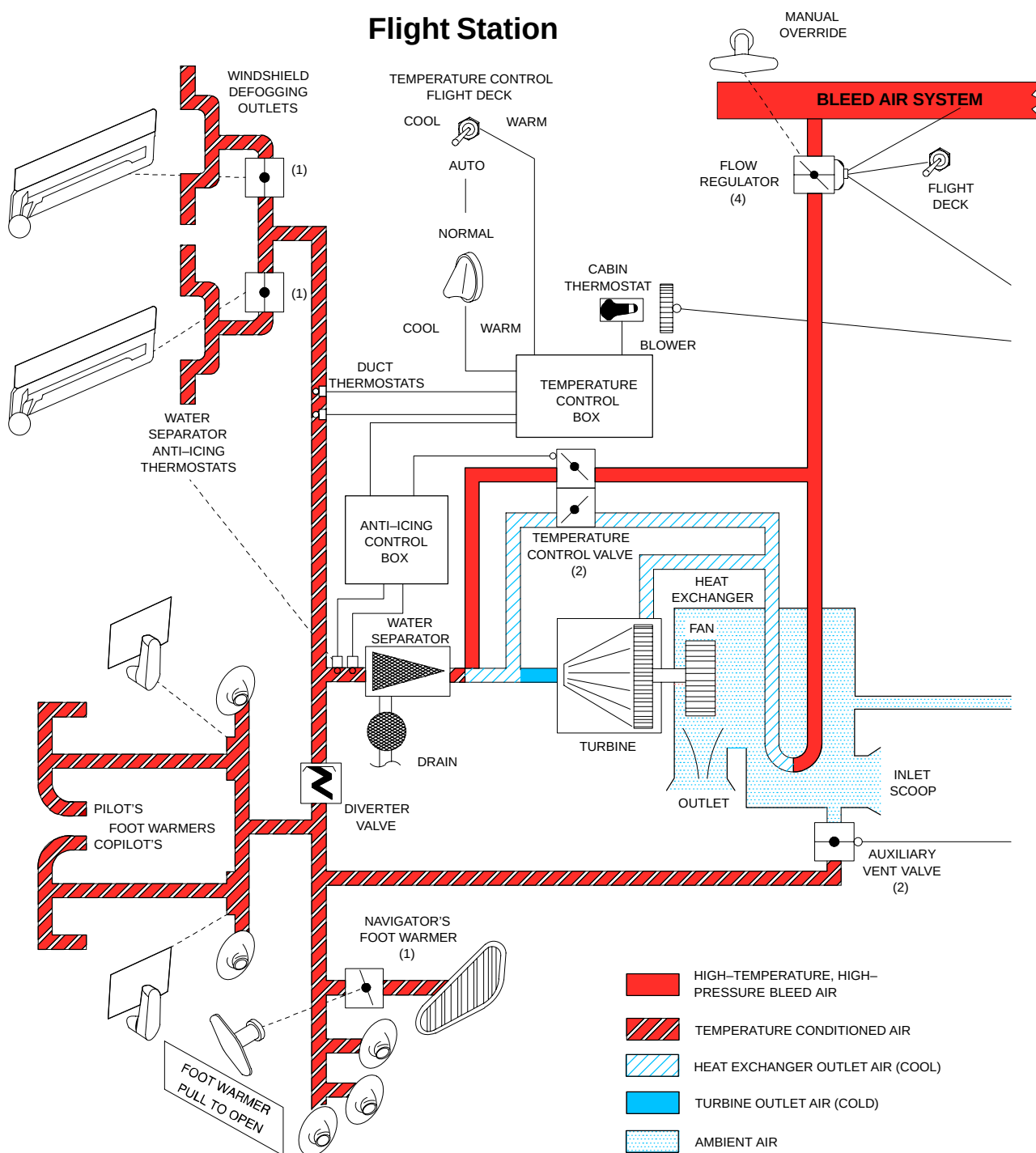
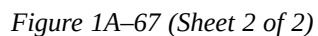


Figure 1A-67 (Sheet 1 of 2)



Air Conditioning Systems (1600 and 1700 Series)

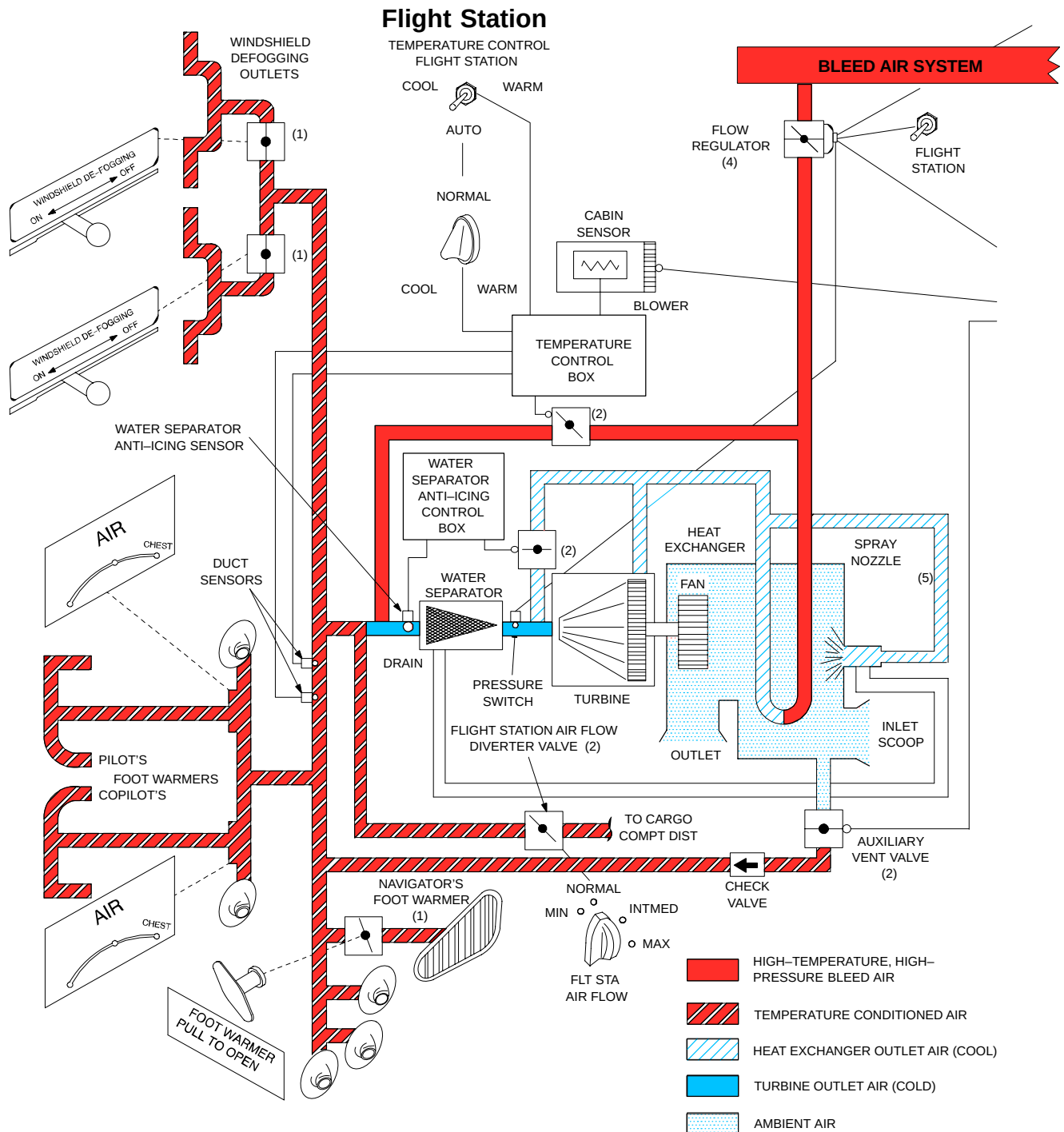


Figure 1A-68 (Sheet 1 of 2)

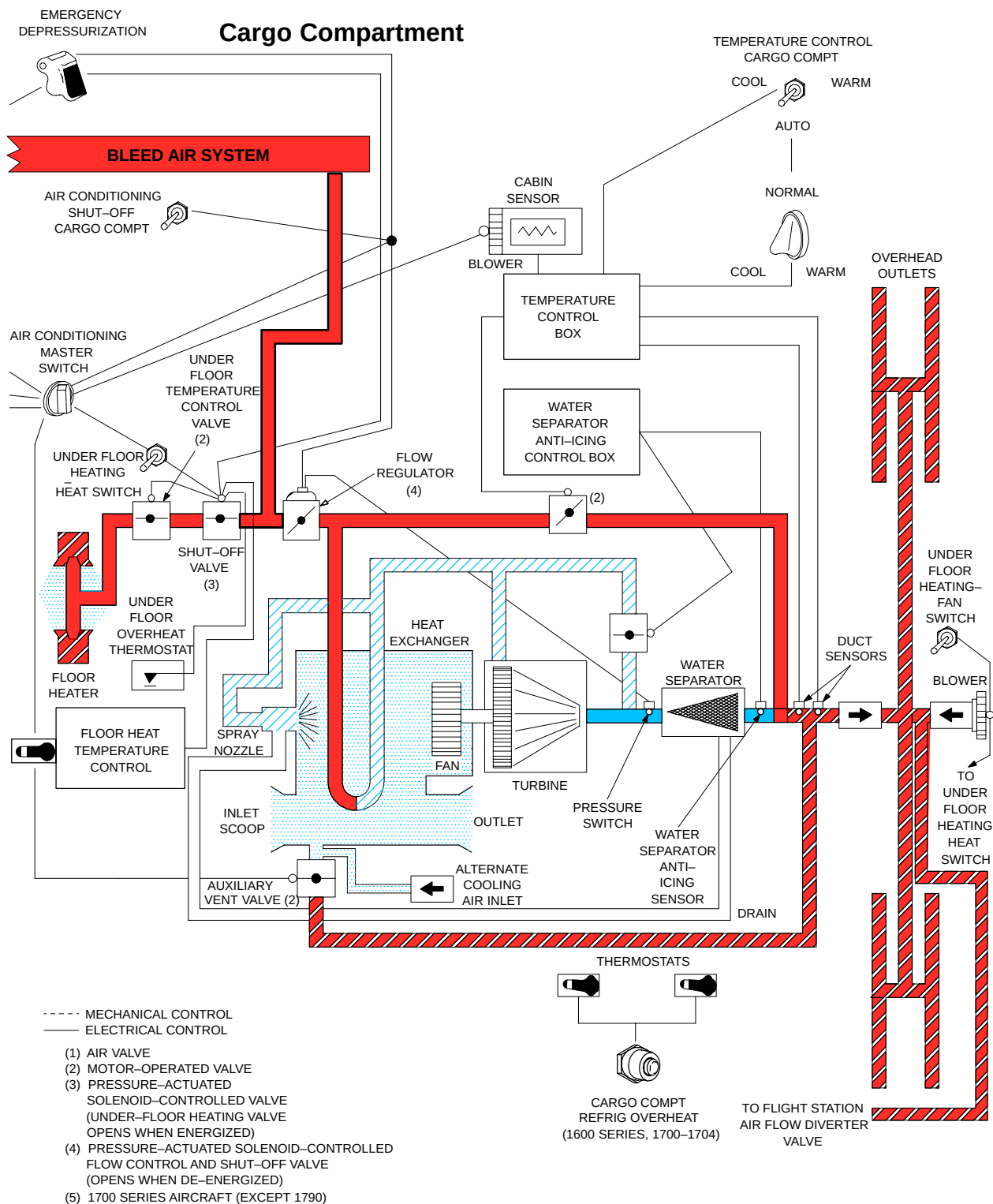


Figure 1A-68 (Sheet 2 of 2)

Recirculating Fan Switch (1600 Series, CG 1790, and 1700 Series)

28V ESS DC CP Side
TEMP CONTROL-FLIGHT DECK OR CARGO COMPT

115V LH AC P Side
FAN CARGO COMPT

The recirculating fan switch (figure 1A-70) is a two-position (ON, OFF) toggle switch located on the air conditioning and pressurization control panel. The switch provides control of the cargo compartment recirculating fan without operating the underfloor heating. The air conditioning master switch must be in a position other than OFF or AUX VENT and the underfloor heating switch must be in the OFF position before the recirculating fan switch will operate the fan. The recirculating fan will operate when underfloor heat switch is ON, regardless of fan switch position.

Flight Station Airflow Switch (1600 Series, CG 1790, and 1700 Series)

115V Single ESS AC CP Side
AIR FLOW DIVERTER VALVE

The flight station airflow switch (figure 1A-70) is a four-position (MIN, NORMAL, INTMED, MAX) rotary switch which controls the flight station airflow diverter valve. With both air conditioning systems operating, the FLT STA airflow switch provides the following distribution from the flight station system:

- MIN – Diverter valve full open, 70 percent to cargo compartment, 30 percent to flight station.
- NORMAL – Diverter valve partially open, 40 percent to cargo compartment, 60 percent to flight station.
- INTMED – Diverter valve partially open, 20 percent to cargo compartment, 80 percent to flight station.
- MAX – Diverter valve closed, 100 percent flow to the flight station.

The flight station airflow switch may be used to provide airflow from the cargo compartment system to the flight station when the flight station unit is not operating.

Air Diverter Controls

A lever at each side of the main instrument panel controls a valve through which the conditioned airflow may be directed, by way of a louver, toward each pilot's chest or through floor-level outlets toward each pilot's feet; a central

position for the lever, marked MIX, divides the available airflow between the upper and lower outlets. At the rear of the flight deck, a similar valve arrangement controlled by a handle on the right-hand edge of the navigator's table, directs the conditioned airflow through a footwarming louver below the navigator's table or through three directable louvers disposed about the aft flight deck. The handle is pulled to open the foot-warming louver and admit temperature conditioned air to the navigator's station, or it is pushed in to close the louver. The three individual louvers in the rear of the flight deck and similar louvers at the pilot's stations may be moved manually to change the direction of the airflow.

Windshield Defogging Levers

A windshield defogging lever on each pilot's side shelf controls a valve connecting the temperature-conditioned air duct to the windshield defogging outlets on that side of the flight deck. With the lever moved to ON, the valve is opened and the available airflow is directed by a diverter valve to the windshield defogging outlets and away from the flight deck air distribution louvers and outlets.

NOTE

(1600 series, CG 1790, and 1700 series) If the windshield defogging lever is in an intermediate position with flight station airflow switch in INTMED or MAX, a loud noise may be heard in the defogging system.

Air Conditioning Shutoff Switches

Two shutoff switches, on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70), override the air conditioning master switch and enable either air conditioning system to be shut down individually. Each switch may be set to either OFF or NORMAL. If the flight deck switch is set to OFF, the airflow regulator for the flight deck air conditioning system halts the flow of bleed air regardless of the setting of the air conditioning system master switch. Similarly, if the cargo compt switch is placed to OFF, the airflow regulator closes off the supply of bleed air to the cargo compartment air conditioning system and (1500 series) the underfloor heating system (on 1600 series, CG 1790, and 1700 series the underfloor heat is not controlled by cargo compt shutoff). With either switch set to NORMAL, the associated air flow regulator maintains the normal flow of air to the air conditioning system. (1500 series) In an emergency, the flight deck system airflow regulator may be closed, to halt the entry of bleed air, by pulling the OVERRIDE FLT DECK REFRIG SHUTOFF VALVE handle on the floor of the navigator's station.

NOTE

(1600 series, CG 1790, and 1700 series) Either of the airflow regulators will be closed automatically

to stop the entry of bleed air if an overpressure condition occurs in the water separator inlet duct. In the event that either air conditioning unit is shut down automatically, select a warmer temperature with two temperature control switch/knobs for the affected system. After 3 minutes or longer, place the air conditioning master switch to OFF and then back to the original position. After the air conditioning unit operation stabilizes, select temperature as desired.

Flight Deck Refrigeration Shutoff Valve Override (1500 Series)

A manual override, which allows the flight deck system air-flow regulator to be controlled manually, is located on the floor below the navigator's table. When the handle is pulled, the flow regulator will close whether the system is pressurized or not. When the handle is pushed in, the regulator will open only if the system is pressurized. During normal operation of the air conditioning system, the handle must remain in the neutral position.

Cargo Compartment Refrigeration Overheat Warning Light (1600 Series, CG 1790, and CG 1700 through 1704)

28V ESS DC CP Side
WING & EMPENNAGE OVERHEAT LIGHTS

A red press-to-test light (figure 1A-65) located on the anti-icing control panel is provided to warn of an overheat condition in the cargo compartment refrigerator area. Two overheat detectors are located in the refrigerator area of the wheel well. When an overheat condition of 93 ° C (200 ° F) exists, the warning light will illuminate and the overheat condition must be corrected to extinguish the light.

CABIN PRESSURIZATION SYSTEM

Pressurization (figure 1A-72) of the flight deck and cargo compartment for high-altitude flight is achieved by air supplied from the bleed air system and ducted through the air conditioning system. The pressurization system basically consists of an outflow valve, pressure controller, differential pressure gauge, cabin rate-of-climb indicator, cabin altimeter, safety valve, and a manually operated emergency depressurization door. The outflow valve, which opens to relieve excess pressure, is used with the pressure controller to maintain cabin pressure automatically at a constant level or to limit the cabin-to-atmosphere differential pressure. The safety valve gives excess pressure relief if the combination of the pressure controller and outflow valve fails to regulate the cabin pressure properly. The pressure controller differential pressure gauge, and cabin rate-of-climb indicator are

mounted on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70). Two knobs on the pressure controller permit presetting of the cabin rate of climb and cabin pressure. The differential pressure gauge indicates the difference between cabin and atmospheric pressure, and the rate-of-climb indicator shows the rate at which the cabin pressure is changing. The airplane is pressurized when pressure within the flight deck and cargo compartment exceeds atmospheric pressure. This may be accomplished by automatic control of the pressurization system or by manual operation, depending upon the setting of the air conditioning master switch.

OUTFLOW VALVE

28V BATT BUS P Side
EMER DEPRESS

28V ESS DC CP Side
CABIN PRESS & AUX VENT

The outflow valve is located on the right side of the airplane at the aft end of the flight station. It exhausts cabin air to the atmosphere through a louver in the skin. The valve consists of a butterfly valve, a main actuating diaphragm, a relay valve, an air jet pump, a solenoid dump valve, and an electrical actuator. During automatic pressurization, the butterfly valve is pneumatically positioned by differential pressure across the main actuating diaphragm. The relay valve and air jet pump control the differential pressure in accordance with the cabin altitude selected on the pressure controller. The solenoid dump valve opens the butterfly valve for depressurization and for any nonpressure operation. The electrical actuator is controlled by a switch to position the butterfly valve during manual operation of the system.

CABIN PRESSURE CONTROLLER

Electrical power for manual operation of the outflow valve is supplied from the ESS DC Bus through the CABIN PRESSURE & AUX VENT circuit breaker. The cabin pressure controller, on the air conditioning and pressurization control panel (figures 1A-69 and 1A-70), is divided into three chambers, each providing a separate cabin pressure control system: a constant pressure or isobaric control, a differential control system, and a rate-of-climb control.

The isobaric control system positions the outflow valve to maintain a constant cabin pressure. Any desired cabin altitude, from -1,000 feet to 10,000 feet, can be selected on the controller, and during automatic pressurization the cabin altitude will be held constant upon reaching the selected cabin altitude. The differential control system positions the outflow valve to vary the cabin pressure altitude when the maximum differential pressure is reached. The cabin altitude will change in order to maintain a constant differential pressure.

Air Conditioning and Pressurization Control Panel (1500 Series)

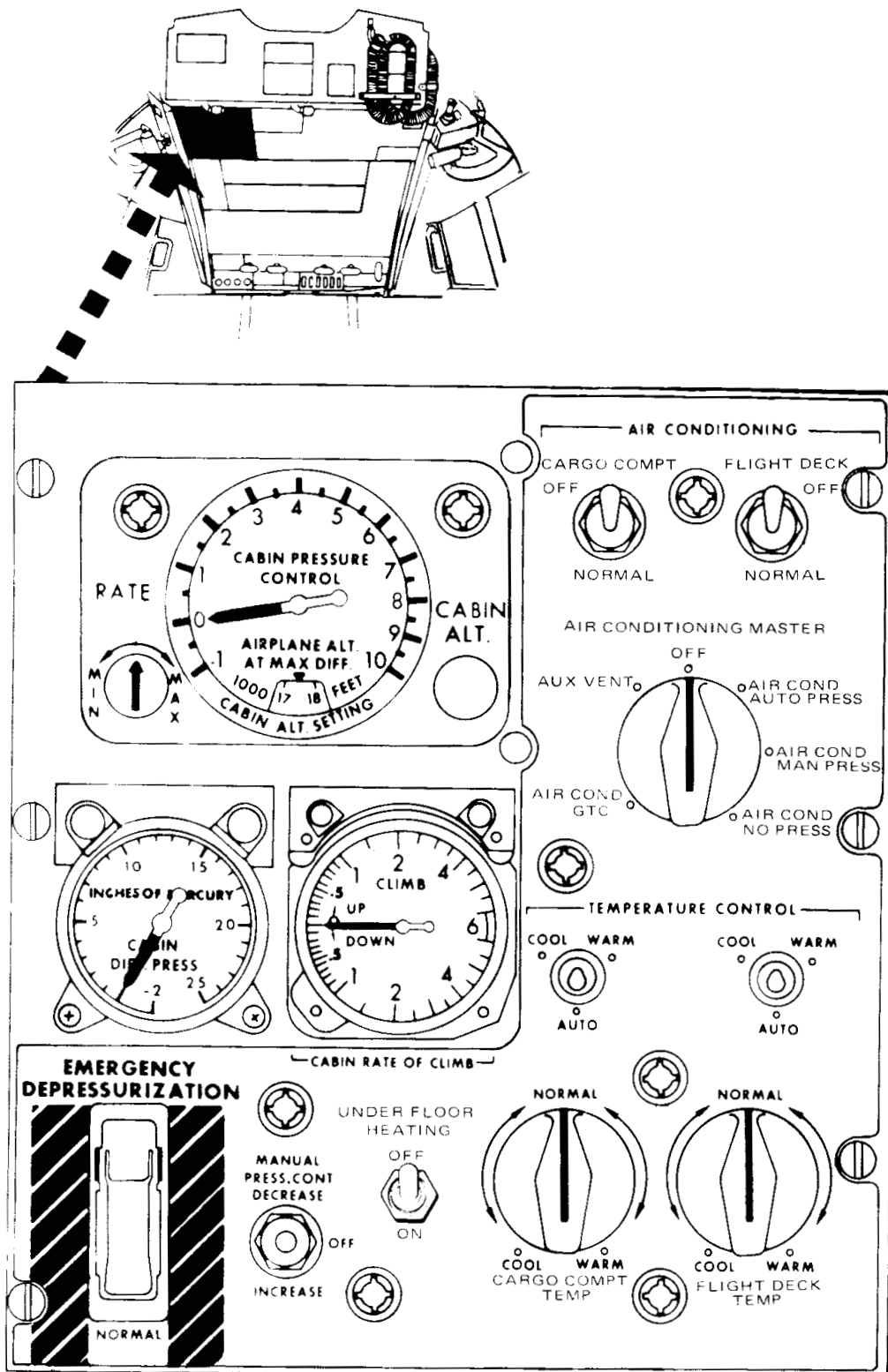


Figure 1A-69

Air Conditioning and Pressurization Control Panels (1600 Series, CG 1790, and 1700 Series)

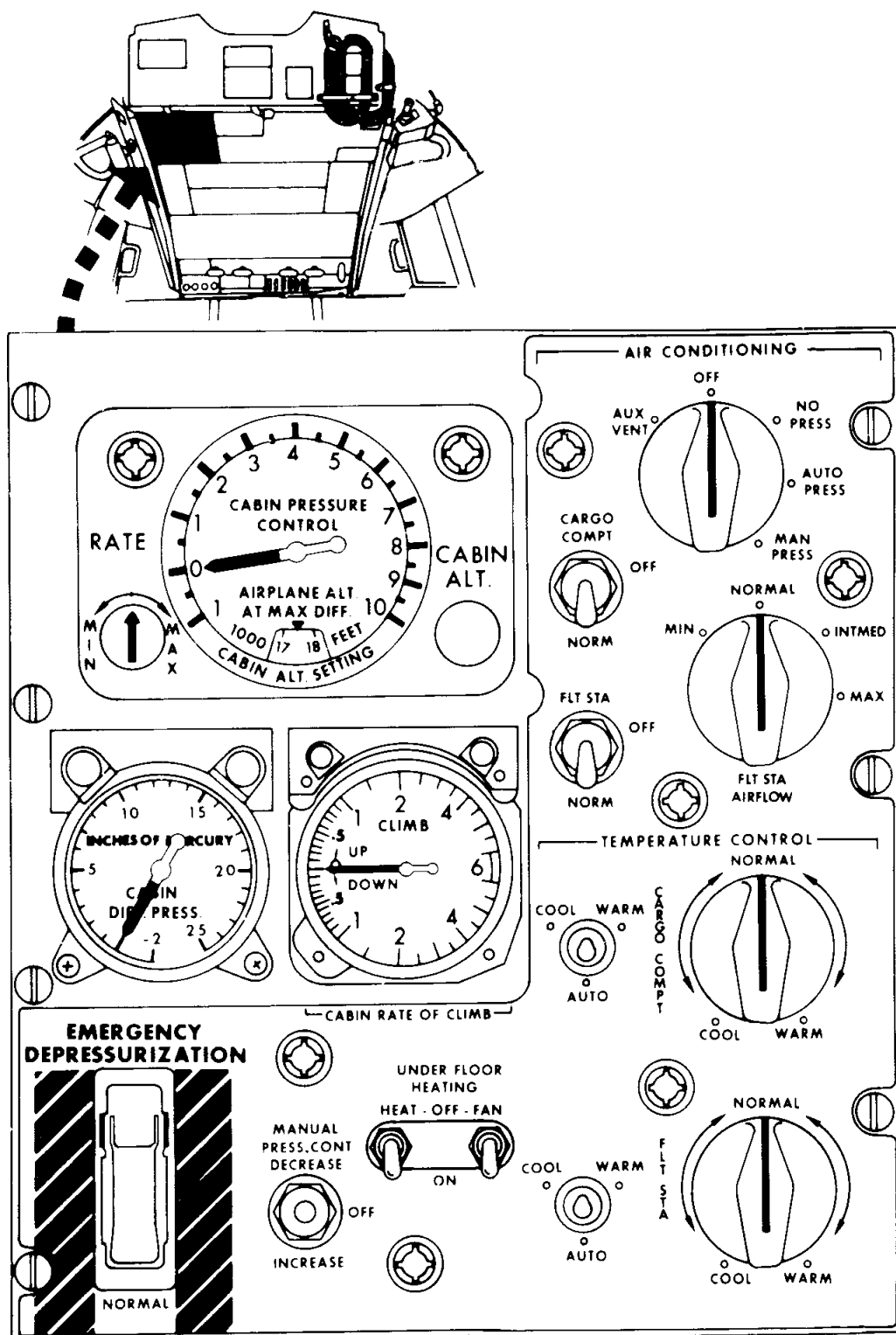


Figure 1A-70

Air Conditioning Control Functions

AIR CONDITIONING MASTER SWITCH	AIR COND GTC 	AUX VENT	OFF	AUTO PRESS	MAN PRESS	NO PRESS
AIR FLOW REGULATORS	OPEN	CLOSED	CLOSED	OPEN	OPEN	OPEN
AUX VENT	CLOSED	OPEN	CLOSED 	CLOSED	CLOSED	CLOSED
OUTFLOW VALVE	OPEN	OPEN	OPEN	PNEUMATIC MODULATION	MANUALLY MODULATED 	OPEN
SAFETY VALVE	OPEN	OPEN	CLOSED	CLOSED	CLOSED	OPEN
TEMP CONTROLS	POWER ON	POWER OFF	POWER OFF	POWER ON	POWER ON	POWER ON
UNDERFLOOR HEAT	AS SELECTED	OFF	OFF	AS SELECTED	AS SELECTED	AS SELECTED
 OPEN, 1500 SERIES  ELECTRIC ACTUATOR ENERGIZED BY USE OF MANUAL PRESSURE CONTROL SWITCH  1500 SERIES						

Figure 1A-71

This system protects the airplane structure from excessive pressures by overriding the isobaric control system (figure 1A-73). (Refer to Section V for differential pressure limitations.) The rate control system positions the outflow valve to maintain a constant rate of cabin pressure change up to the isobaric altitude selected. Any desired rate of cabin pressure change, from MIN (30 to 200 feet per minute), to max (1,600 to 2,900 feet per minute) can be selected on the controller. During automatic pressurization, the cabin pressure will change at the selected rate until the cabin pressure altitude reaches the isobaric altitude selected on the controller.

SAFETY VALVE

28V BATT BUS P Side
EMER DEPRESS

The differential pressure safety valve is located on the aft cargo door. It is electrically controlled and pneumatically opened in a nonpressure condition or for emergency depressurization. The valve is normally closed during any pressurized operation. It will open to relieve cabin pressure if the positive differential pressure reaches 15.9" hg or if the negative differential pressure reaches 0.76" hg. When either emergency depressurization or nonpressure operation is se-

lected, the valve is opened. Electrical power to energize the safety valve solenoid is supplied from the Battery Bus through the EMER DEPRESS circuit breaker.

CHECK VALVE

To prevent rapid loss of cabin pressure in the event of failure in the air recirculating duct system, a check valve is installed in the cargo compartment air conditioning and pressurization system. The valve basically consists of a hinged flap which normally assumes an open position under pressure of the inward-flowing air, but will close if inward air pressure is lost.

EMERGENCY DEPRESSURIZATION DOOR

An emergency depressurization door, located in the center emergency escape hatch, is released by pulling the emergency depressurization handle (figure 1A-74) on the overhead control panel directly above the pilot. The handle is connected by a cable to the release mechanism of the door which is restrained from consequential loss by two shock cords. After depressurization is accomplished, the door can be replaced and the release mechanism reset manually.

CABIN PRESSURIZATION CONTROLS

Controls for the cabin pressurization system consist of the air conditioning master switch, a pressure controller, a manual pressure control switch, and an emergency depressurization switch. All controls are located on the air conditioning and pressurization control panel. A manually operated emergency depressurization system is also provided.

Air Conditioning Master Switch

28V ESS DC CP Side
CABIN PRESS & AUX VENT

The air conditioning master switch on the air conditioning and pressurization control panel (figures 1A-69, 1A-70, 1A-72) is used to select the type of operation of the air conditioning and pressurization systems. It controls operation of the outflow and safety valve under conditions of pressurized and nonpressurized operation. For functions of the switch positions, refer to AIR CONDITIONING SYSTEMS CONTROLS.

Cabin Pressure Controller

The cabin pressure controller on the air conditioning and pressurization control panel (figures 1A-69, 1A-70, 1A-72) includes the cabin differential pressure gauge, a rate-of-climb indicator, a cabin altitude selector knob, a rate selector knob, and an altitude selector indicator. The cabin altitude selector on the pressure controller consists of a cabin altitude knob and an indicator. When the knob is turned, it positions the large pointer and small rotating dial of the indicator and also mechanically opens and closes the metering valve which sets selected cabin altitude into the isobaric system of the controller. When the knob is set as required, the large pointer indicates the cabin altitude selected and the small rotating dial indicates the maximum airplane altitude at which the isobaric control system can maintain control of the outflow valve.



Do not force the cabin alt. knob below a setting of -1,000 feet or above 10,000 feet. To do so may damage the pressure controller.

The rate selector knob is used to determine the rate of cabin pressure change until the cabin altitude, as shown by the pointer, is reached. The knob is turned from MIN (30 to 200 feet per minute) clockwise to MAX (1,600 to 2,900 feet per minute).

Manual Pressure Control Switch

28V ESS DC CP Side
CABIN PRESS & AUX VENT

The manual pressure control switch is a three-position (INCREASE, OFF, DECREASE) toggle switch, located on the air conditioning and pressurization control panel (figures 1A-69, 1A-70 and 1A-72). It has a center spring-loaded OFF position and momentary INCREASE and DECREASE positions. The switch controls the electric actuator of the outflow valve when the air conditioning master switch is in the AIR COND MAN PRESS position. When the switch is held in the INCREASE position, the actuator turns the outflow valve toward its closed position. When the switch is held in the DECREASE position, the actuator turns the butterfly valve toward its open position. When operating the system manually, the cabin vertical velocity indicator will give the first indication of pressurization.



Deliberate operation of the manual pressure control switch in a manner that will drive the outflow valve to the closed position, resulting in the safety valve opening, is prohibited.

NOTE

After switching from automatic to manual pressure control, the manual pressure control switch must be held in the INCREASE or DECREASE position for approximately 40 seconds to gain control of the outflow valve.

Cabin Pressurization System

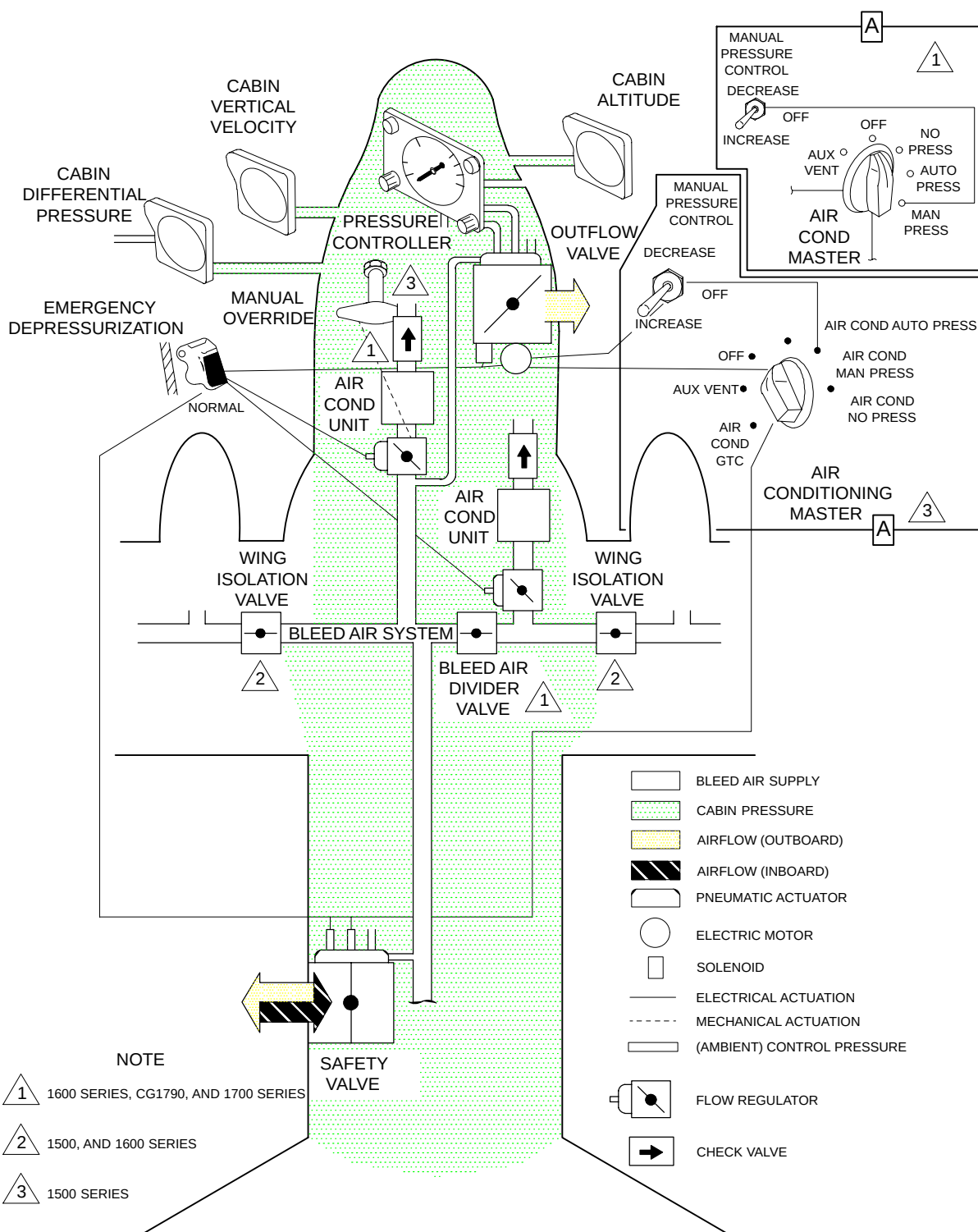


Figure 1A-72

Cabin Pressurization Chart

● ICAO STANDARD ATMOSPHERE

SAMPLE PROBLEM

GIVEN:
LONG RANGE MISSION WITH PASSENGERS ON BOARD.
CABIN PRESSURE LIMITED TO 8,000 FEET.

FIND:
MAXIMUM PERMISSIBLE AIRPLANE ALTITUDE WITH NOMINAL
DIFFERENTIAL PRESSURE LIMITED BY PRESSURE CONTROLLER.

SOLUTION:
ENTER THE CHART AT CABIN ALTITUDE OF 8,000 FEET. MOVE
HORIZONTALLY TO THE 15.16 IN. HG DIFFERENTIAL PRESSURE
LINE AND THEN DOWN TO THE AIRPLANE ALTITUDE SCALE.
READ 35,000 FEET MAXIMUM PERMISSIBLE AIRPLANE ALTITUDE.

NOTE

FOR MAXIMUM DIFFERENTIAL CABIN RANGE
OF PRESSURE, READ CABIN ALTITUDE AT
JUNCTION OF AIRPLANE ALTITUDE AND
MAXIMUM DIFFERENTIAL PRESSURE LINE.
REFER TO SECTION V FOR LIMITS.

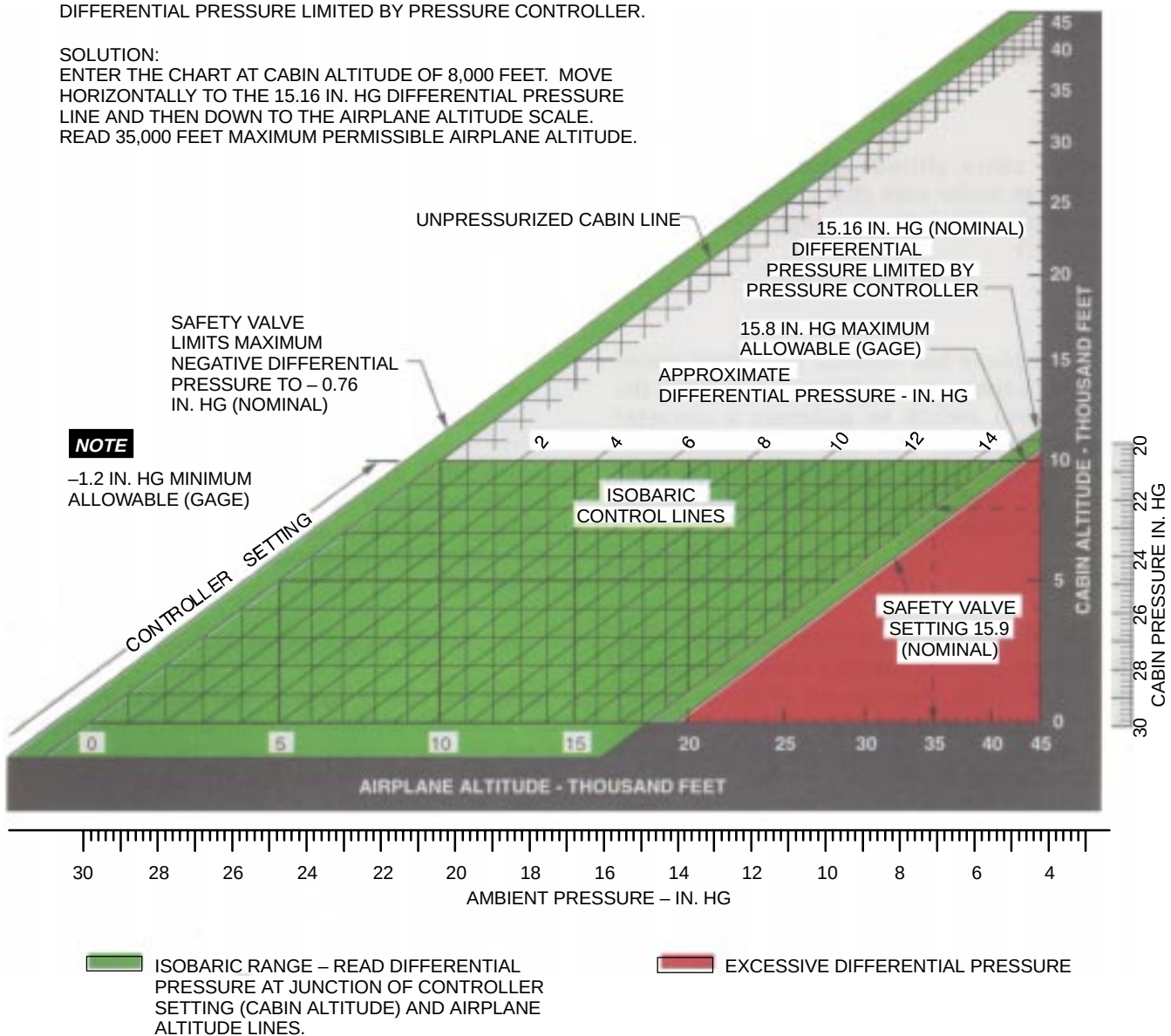


Figure 1A-73

Emergency Depressurization Switch

28V BATT BUS P Side
EMER DEPRESS

The emergency depressurization switch is a guarded, two-position (NORMAL, EMERGENCY DEPRESSURIZATION) toggle switch located on the air conditioning and pressurization control panel (figures 1A-69, 1A-70). Positioning the switch from NORMAL to EMERGENCY DEPRESSURIZATION will override the normal control circuit, opening the outflow and safety valves; closing both air conditioning shutoff valves (1600 series, CG 1790, and 1700 series) the underfloor heat shutoff valve is closed. (1500 series) If the flight deck air conditioner is being operated by the manual override handle, the emergency depressurization switch will not close the flow regulator. It must be closed by use of the manual override.

Pressurization Test Valves

An isobaric and an atmospheric test valve, labeled No. 1 and No. 2 respectively, are located on the left side of the overhead control panel. These valves, wired in the open position, are intended only for ground use.

CABIN PRESSURIZATION SYSTEM INDICATORS

The cabin pressurization system indicators are a differential pressure gauge, a cabin rate-of-climb indicator, a cabin altimeter, and a low cabin air pressure warning light.

Differential Pressure Gauge

The differential pressure gauge, located on the air conditioning and pressurization control panel (figures 1A-69, 1A-70 and 1A-72), senses both cabin and atmospheric pressures and indicates the pressure differential in inches of mercury.



The normal differential pressure operating limits specified in Section V should never be exceeded.

Cabin Rate-of-Climb Indicator

The cabin rate-of-climb indicator, which shows the rate of change of cabin altitude in feet per minute, is mounted on the air conditioning and pressurization control panel.

Cabin Altimeter

The cabin altimeter (figure 1A-72) indicates cabin air pressure within the range 0 to 50,000 feet. It is installed on the copilot's instrument panel.

Low Cabin Air Pressure Warning Light

28V ESS DC CP Side
CABIN LOW PRESSURE WARNING

A low cabin air pressure warning light on the copilot's instrument panel will illuminate if the cabin altitude exceeds 10,000 feet (figures 1A-6 and 1A-7).

ANTI-ICING AND DEICING SYSTEMS

Anti-icing systems (figures 1A-75, 1A-76, and 1A-77) that can be used to prevent the formation of ice on critical areas of the airplane, and deicing systems, which will remove ice after it is formed, are installed on the airplane. Heat for the systems is obtained either by the use of electrical heating elements or by heated air drawn from the compressor of each engine.

Anti-icing systems using heated air from the bleed air system serve the wing and empennage leading edges, the nose radome, and the engine inlet air and oil cooler scoops. Anti-icing of the engine compressor inlet vanes also is accomplished by heated air, but this is supplied directly from the engine compressor and not through the bleed air system.

Anti-icing systems using heat from electrical sources are installed for the windshields, pitot tubes and the forward section and afterbody of the propeller spinner. Deicing of the propeller blades and rear section of the propeller spinner is also accomplished electrically.

An ice detection system may be used to achieve automatic operation of the following anti-icing and deicing systems:

- Engine inlet air scoop anti-icing
- Compressor inlet vane anti-icing
- Propeller spinner forward section and after body anti-icing
- Propeller blade deicing
- Propeller spinner middle and rear section deicing
- Propeller spinner plateaus deicing

WING AND EMPENNAGE LEADING EDGES ANTI-ICING SYSTEM

The leading edge anti-icing system (figures 1A-75, 1A-76 and 1A-77) is divided into six sections, each consisting of a shutoff valve, ejectors, and control components. The shutoff valve controls the flow of air from the bleed air system to the ejectors, where it is ejected through small nozzles into mixing chambers. The hot bleed air at approximately 315 °C (600 °F) is mixed with ambient air drawn into the mixing chambers. The resultant mixed air at approximately 177 °C (350 °F) flows through passages next to the leading edge skin. Since some of the air leaving the passages is drawn back in for recirculation, a lower percentage of bleed air is required for continuous anti-icing. Each of the six shutoff valves is pneumatically actuated and electrically controlled.

Each shutoff valve acts to stop anti-icing and to control air-flow when anti-icing is required. When a solenoid on the valve is energized, the valve permits flow of bleed air to the leading edge area. The differential pressure assures a flow of air through the leading edge passages. Thermostats connected to the control solenoid of the shutoff valve cause the valve to close and shut off the flow of bleed air when the temperature in the leading edge reaches approximately 82 °C (180 °F). When the temperature drops to 70 °C (158 °F), the valve opens and hot bleed air enters the leading edge. An overheat warning system is installed in the leading edge area. When the temperature reaches approximately 102 °C (215 °F) in any area, the overheat warning sensor(s) will complete the electrical circuit and the light for that area will illuminate.

Wing and Empennage Anti-icing Switches

28V ESS DC CP Side
WING & EMPENNAGE ICE CONTROL

The wing and empennage anti-icing switches are two-position (ON, OFF) toggle switches located on the anti-icing system control panel (figure 1A-65). When the switches are placed in the ON position, solenoids on the anti-icing shutoff valves are energized and the valves control a flow of bleed

air to the leading edge air ejectors. When the switches are in the OFF position, the anti-icing regulators shut off the flow of bleed air to the anti-icing ejectors.

Leading Edge Temperature Indicators

28V ESS DC CP Side
WING & EMPENNAGE – TEMP INDICATOR

Six leading edge temperature indicators, one for each section of the anti-icing system, are located on the anti-icing system control panel (figure 1A-65). Each indicator is connected to a resistance bulb located in the leading edge area. The resistance bulbs are placed so that they sense temperature of the air in the area aft of the leading edge skin, not the hot air passed next to the skin. Each indicator is marked in ranges as follows:

INOPERATIVE – Approximately 24 °C
(75 °F) and below (blue)

NORM OPER RANGE – Between approximately
24 °C (75 °F) and
102 °C (215 °F) (green)

OVERHEAT – Approximately 102 °C
(215 °F) and above (red)

Leading Edge and Wheel Well Overtemperature Warning Lights (1500 Series)

28V ESS DC CP Side
WING & EMPENNAGE – OVERHEAT LIGHTS

The anti-ice overheat panel is installed on the right outboard edge of the overhead control panel (figure 1A-78). Seven overtemperature warning lights, labeled L OUTER WING, L CENTER WING, R OUTER WING, R CENTER WING, L WHEEL WELL, and R WHEEL WELL, and NOSE WHEEL WELL (not used) are located on the panel. A two-position, spring loaded to OFF, anti-ice overheat circuit test switch is located on the panel above the warning lights. Overheat warning for the ATM compartment has been combined with the left wheel well area and overheat warning for the cargo compartment refrigeration unit has been combined with the right wheel well area. The warning light circuits for the empennage stabilizer and fin have been eliminated; consequently the STAB and FIN temperature indicators are the only means of overheat detection. Sensors for the left outboard and left inboard temperature indicators are located in the left outer wing area and, therefore, correspond to the left outer wing overheat light only. Sensors for the right outboard and right inboard temperature indicators are located in the right outer wing area and, therefore, correspond to the right outer wing overheat light only. No temperature indicators are provided for the left or right center wing lights, left or right wheel well lights, or the nose wheel well light. The left

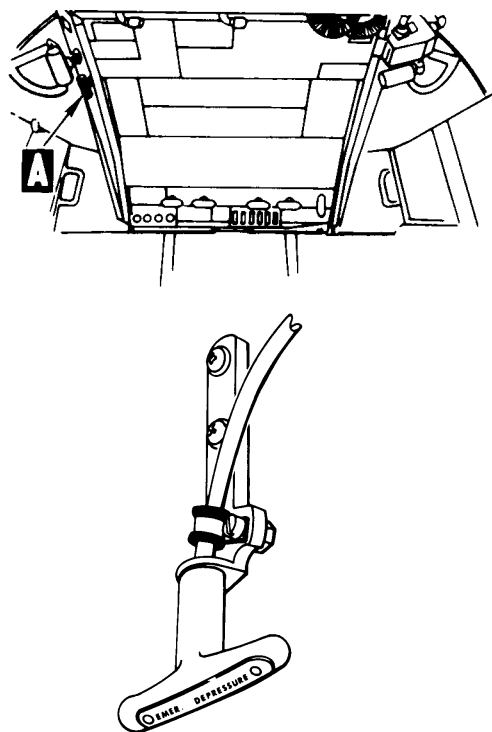


Figure 1A-74

Leading Edge Anti-icing System (1500 Series)

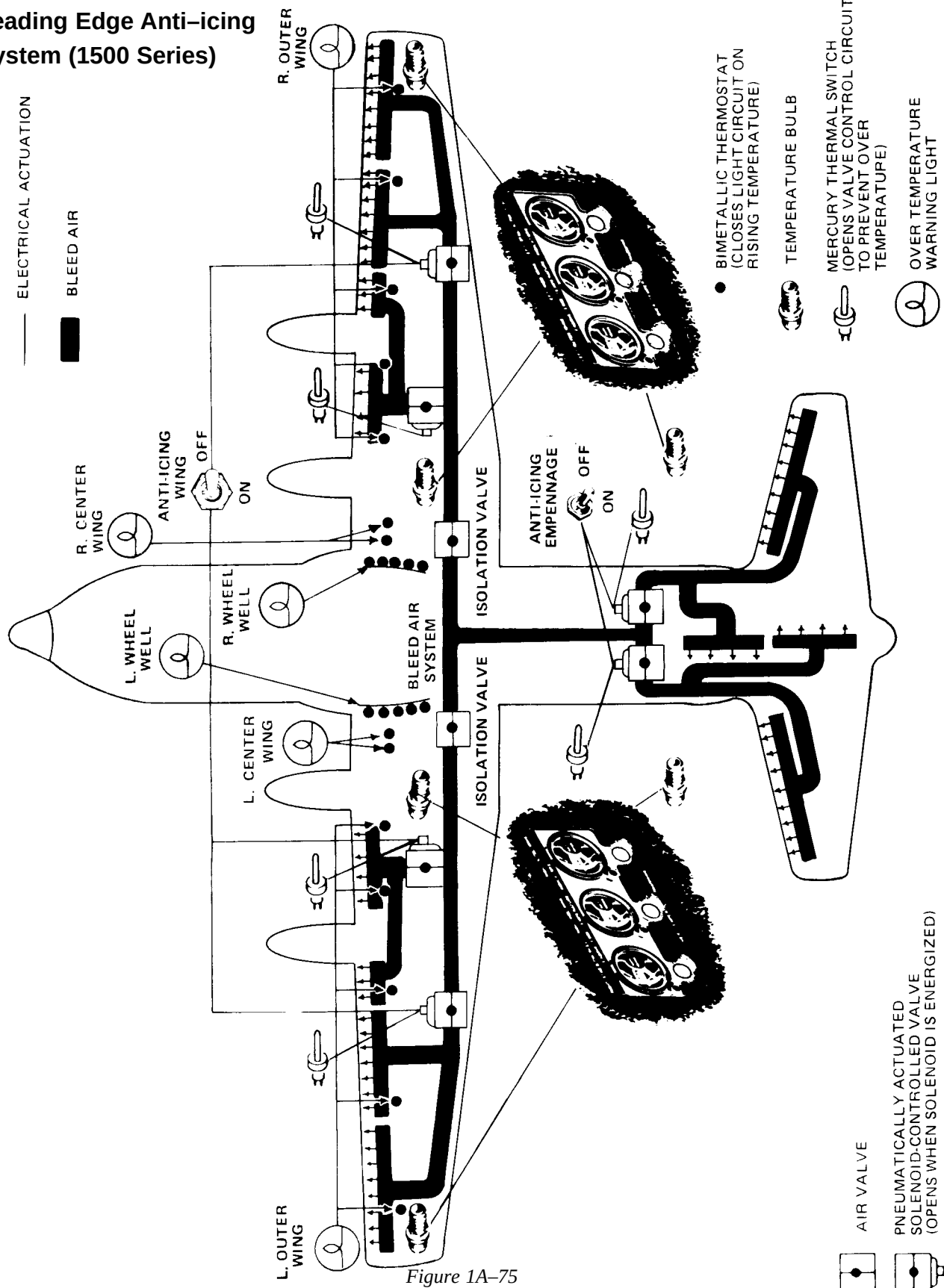


Figure 1A-75

Leading Edge Anti-icing System (1600 Series, CG 1790, and CG 1700 through 1704)

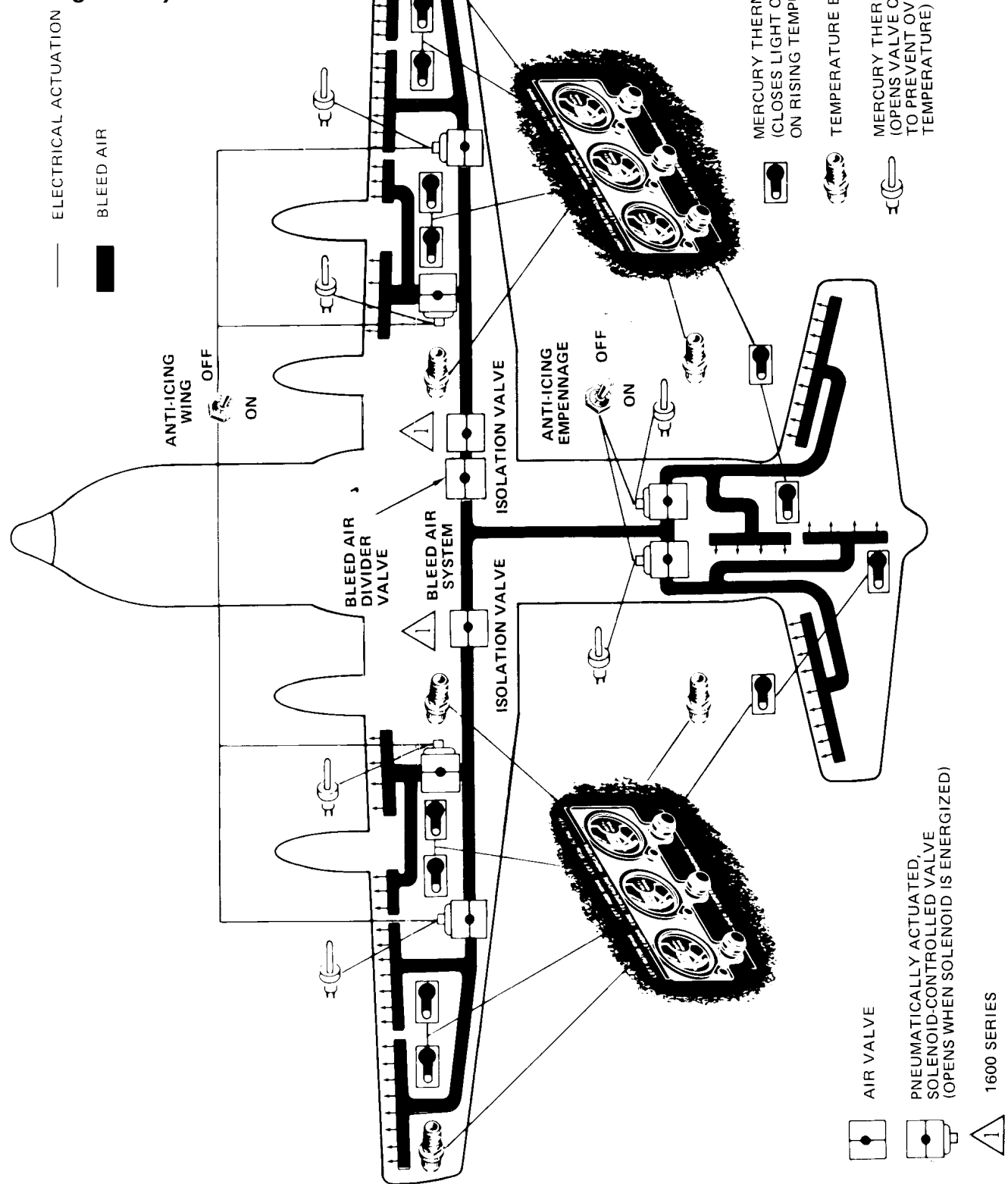


Figure 1A-76

Leading Edge Anti-icing System (CG 1705 and Up)

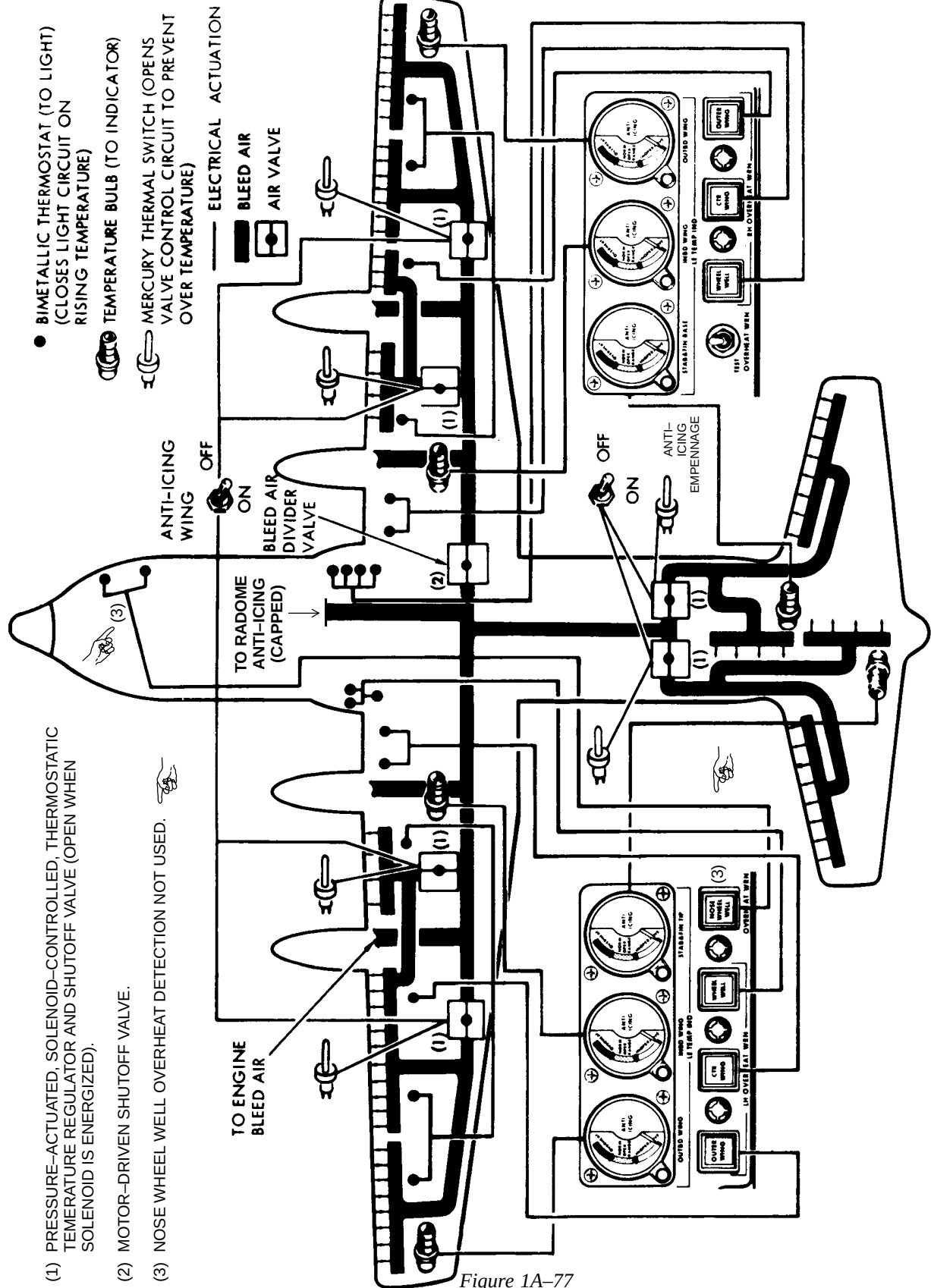


Figure 1A-77

Anti-ice Overheat Warning Panel (1500 Series)

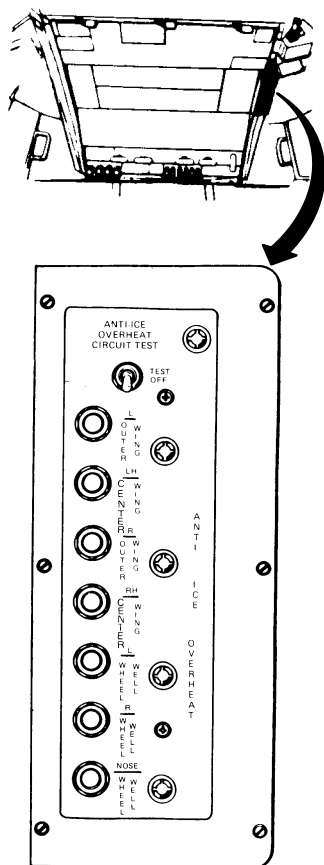


Figure 1A-78

wheel well light has sensors in the left wheel well, ATM compartment, and left center wing section at wing root. The right wheel well has sensors in the cargo compartment air conditioning unit, right wheel well, and right center wing section at the wing root. When the test switch is positioned to TEST, all seven lights should illuminate. If a light fails to illuminate, it indicates that the overheat warning for that area is inoperative. When the temperature reaches approximately 102 °C (215 °F) in any area, the overheat warning sensor(s) will complete the electrical circuit and the light for that area will illuminate.

Leading Edge Overtemperature Warning Lights (1600 Series, CG 1790, and CG 1700 through 1704)

28V ESS DC CP Side
WING & EMPENNAGE – OVERHEAT LIGHTS

Six overtemperature warning lights, one for each section of the leading edge anti-icing system, are located below the

temperature indicators on the anti-icing system control panel (figure 1A-65). When the temperature in the leading edge reaches approximately 102 °C (215 °F), the warning light for that area illuminates.

Leading Edge and Wheel Well Overtemperature Warning Lights (CG 1705 and Up)

28V ESS DC CP Side
WING AND EMPENNAGE – OVERHEAT LIGHTS

Seven overtemperature warning lights, labelled L OUTER WING, L CTR WING, L WHEEL WELL, NOSE WHEEL WELL, R WHEEL WELL, R CTR WING, and R OUTER WING, are located on the anti-icing control panel.

The overheat warning for the cargo compartment refrigeration unit is combined with the right wheel well area. There are no warning light circuits for the empennage stabilizer and fin; consequently the stab and fin temperature indicators are the only means of overheat detection. Temperature bulbs for the left outboard and left inboard temperature indicators are located in the left outer wing area and, therefore, correspond to the left outer wing overheat light only. Temperature bulbs for the right outboard and right inboard temperature indicators are located in the right outer wing area and, therefore, correspond to the right outer wing overheat light only. No temperature indicators are provided for the left or right center wing lights, left or right wheel well lights, or the nose wheel well light. A two-position, spring loaded to OFF, anti-ice overheat circuit test switch is located on the panel. When the test switch is positioned to TEST, all seven lights should illuminate. If a light fails to illuminate, it indicates that the overheat warning for that area is inoperative. When the temperature reaches approximately 215 °F in any area, the overheat warning thermostat(s) will complete the electrical circuit and the light for that area will illuminate.

PITOT TUBE ANTI-ICING SYSTEM (1500 and 1600 Series, CG 1790, and CG 1700 through 1716)

28V ESS DC CP Side
PITOT HEATER PILOT

28V ISOL DC P Side
PITOT HEATER COPILOT'S AND NAV

Pitot tube anti-icing is provided by dc electric heating elements on the two tubes. The pilot's pitot tube heater uses power from the essential dc bus and the copilot's and navigator's pitot tube heater uses power from the isolated dc bus. This arrangement permits power to be drawn from the battery to heat the copilot's and navigator's pitot tube when normal dc power sources have failed.

Pitot Heat Switches

The pilot's and copilot's pitot heater switches are located on the anti-icing systems control panel (figure 1A-65). These two-position toggle switches have ON and OFF positions. When a switch is placed in the ON position, the heating element for the corresponding pitot tube is energized. When the switch is in the OFF position, the heating element is deenergized.

PITOT TUBE ANTI-ICING (CG 1717 and Up)

115 V	ESS AC	P Side
PITOT HEAT (1,2,3,4)		

28V	ISOL DC	P Side
PITOT HEAT IND		

Pitot static tube anti-icing is provided by heating elements in the four pitot static tubes. All four heaters receive 115 VAC power from the essential AC bus through the PITOT HEAT NO.1, NO.2, NO.3, and NO. 4 circuit breakers located on the pilots upper circuit breaker panel. PITOT HEAT switches are located on the anti-icing systems control panel. When the pilots switch is placed in the ON position, heating elements in the No. 1 (upper left) and the No. 3 (lower right) pitot static tubes are energized. When the copilots switch is placed in the ON position, the heating elements in the No. 4 (lower left) and the No. 2 (upper right) pitot static tubes are energized. When either switch is placed in the OFF position, the corresponding heating elements are deenergized. Two PITOT HEAT OFF indicators on the main instrument panel illuminate when the appropriate PITOT HEAT switch is in the OFF position. The PITOT HEAT OFF indicators receive 28 VDC power from the isolated DC bus through DIMMER NO. 2 located in the left-hand distribution box. The indicators are powered through the LH PITOT HTR IND RELAY located on the left-hand distribution panel and by the RH PITOT HTR IND RELAY located on the right-hand distribution panel.

Pitot Heat Switches

The pilot's and copilot's pitot heater switches are located on the anti-icing systems control panel. (See figure 1A-65.) These two-position toggle switches have ON and OFF positions. The pilot's pitot heat switch energizes the No. 1 (upper left side) and the No. 3 (lower right side) pitot tube heating elements. The copilot's pitot heat switch energizes the No. 2 (upper right side) and the No. 4 (lower left side) pitot-static tube heating elements. When a switch is placed in the ON position, the heating elements for the corresponding pitot-static tubes are energized and the pitot heat off indicator light is extinguished. When the switch is in the OFF position, the

heating elements are deenergized and the pitot heat off indicator light is illuminated.

Pitot Heat Off Lights

Two amber pitot heat off indicator lights are installed on the main instrument panel to show that the affected system is turned off; or, if the system is turned on that a heating element is inoperative. (See figure 1A-7.) The indicator lights use 28-volt dc power from the isolated dc bus through the pitot heater indicator circuit breaker on the pilot's side circuit breaker panel.

WINDSHIELD ANTI-ICING SYSTEM

115V	LH AC	P Side
WINDSHIELD ANTI-ICING – FRONT OR BOTTOM		

The three windshields, the two windows on each side of the windshields, and the two lower windows in front of the pilot are Nesa-type. These panels are heated by applying primary ac power from the left-hand ac bus to a resistance material between the layers of glass. The ac power is applied by automatic dc control systems which cycle to maintain window temperature within specific limits. A center windshield system controls heating of the three center windshields, and a side and lower system controls heating of the side and lower windows. The two systems are identical except for the amount of total ac power provided. Provisions are made for selecting either normal or high rate of heating. When high rate is selected, higher voltage is applied for shorter periods of time so that the Nesa heats more rapidly, but not to a higher temperature. Provisions are also made for controlling the temperature increase manually when the Nesa panels are extremely cold. The control systems do not function automatically when window temperature is below -43°C (-45°F).

NESA WINDSHIELD SWITCHES

The Nesa windshield switches are on the anti-icing systems control panel (figure 1A-65). Each switch has NORMAL, OFF, and HI positions. When the center windshield switch is in the NORMAL position, the three center windshields are heated at the normal rate. If the switch is positioned to HI, the three center windshields have higher voltage applied to the heating material so that they heat more rapidly. Heating of the side and lower windows is controlled in the same manner by the side and lower windshield switch.

Nesa Windshield Cold-start Switches

The cold-start switches are located on the anti-icing systems control panel (figure 1A-65) next to the Nesa windshield control switches. The cold-start switches are push-type momentary switches. The purpose of the switches is to provide manual control of windshield heating to raise the windshield temperature gradually from extremely cold temperature so as to prevent damaging the glass panels. If temperature of

the windshield panels is below -43°C (-45°F) the control systems do not function automatically. Pressing the cold-start switches causes the control systems to apply ac power to the windshield panels while the switches are held.

HYDRAULIC POWER SUPPLY SYSTEMS

A booster hydraulic system, a utility hydraulic system, and an auxiliary hydraulic system comprise power supply sources (figures 1A-79 through 1A-81) for all hydraulic components operation on the airplane. The booster system furnishes hydraulic power to a portion of the surface control boost system only. The utility system normally operates the landing gear, wing flaps, brakes, flare launcher, nose wheel steering, and a portion of the surface control boost system. The auxiliary system normally operates the ramp system and provides emergency pressure for brake operation. The auxiliary system also provides pressure for emergency extension of the nose landing gear.

COMMON COMPONENT SYSTEMS

Suction Boost Pump Switch

28V ESS DC CP Side
HYD UTILITY SUCTION PUMP
HYD BOOST SUCTION PUMP CONTROL

115V ESS AC P Side
HYD SUCTION PUMP – BOOST OR UTILITY

The system suction boost pump switch (figure 1A-82) is a two-position (OFF, ON) toggle switch which furnishes 28-volt dc power to operate a relay which controls three-phase essential ac bus power to the suction boost pump motor.

Suction Boost Pump Pressure Warning Light

28V ESS DC CP Side
HYD BOOST SUCTION PUMP CONTROL
HYD UTILITY SUCTION PUMP

The suction boost pump low-pressure warning light (figure 1A-82) is an amber warning light controlled by a pressure-sensitive switch. The warning light will illuminate if pressure output of the suction boost pump drops below approximately 20 psi. The suction boost pump motor is protected by thermal circuit breakers which open and stop the motor if the current exceeds approximately 11 amperes. When this occurs, the low-pressure warning light will illuminate. As the circuit breakers cool, the circuits will close to restore power to the pump motor, and the light will go off.

Engine Pump Switch

28V ESS DC CP Side
FIRE SHUTOFF VALVES – HYDRAULIC

Engine pump OFF-ON switch (figure 1A-82) is a two-position toggle switch which controls two hydraulic shutoff valves. One of these valves shuts off supply flow to the engine-driven pump, and the other shuts off pump output. These are the same valves operated by the fire emergency handle. Since the engine pump continues to turn after both the supply and output valves are closed, normal flow from the pump case drain passes through a check valve back into the suction port of the pump to form a run-around circuit. This feature is provided to prevent damage to the engine-driven pumps that would otherwise result from lack of hydraulic fluid and overheating.

Engine Pump Pressure Warning Lights

28V ESS DC CP Side
HYDRAULIC PUMP PRESSURE WARNING

The engine pump pressure amber warning lights (figure 1A-82) are controlled by pressure actuated switches which sense the engine-driven pump output pressures. Whenever either engine pump output pressure drops below approximately 1,000 psi, its light will illuminate. The pressure warning light will also illuminate when the engine pump switch is placed in the OFF position.

UTILITY HYDRAULIC SYSTEM

The utility hydraulic system (figure 1A-79) operates from the output of number one and number two engine-driven hydraulic pumps and supplies hydraulic power to the wing flap hydraulic motor, the main landing gear hydraulic motors, the nose landing gear hydraulic system, the main landing gear brakes, nosewheel steering, and to a portion of the aileron, rudder, and elevator control boost systems, and flare launchers. The engine-driven variable displacement pumps are supplied hydraulic fluid under electrical suction boost pump pressure from a (1500, 1600 series, CG 1790 and CG 1700 through 1716) 3.2 gallon reservoir, (CG 1717 and up) 4.3 gallon reservoir. The pump reservoir contains a baffle plate and integral check valves which separate the upper and lower chambers to prevent fluid from rising above the pump inlet opening during negative (G) gravity conditions. The reservoir is mounted on the left side of the cargo compartment. The engine-driven pumps are provided with internal control mechanisms to vary their output volume with system demand and maintain approximately 3,000 psi output pressure. If the pump is not operating, the low-pressure warning light will glow. The pressurized output fluid of each pump passes through a filter, an electrically operated shutoff valve, and a one-way check valve before merging as system pressure. The one-way check valves provide individual pump failure

Utility Hydraulic System

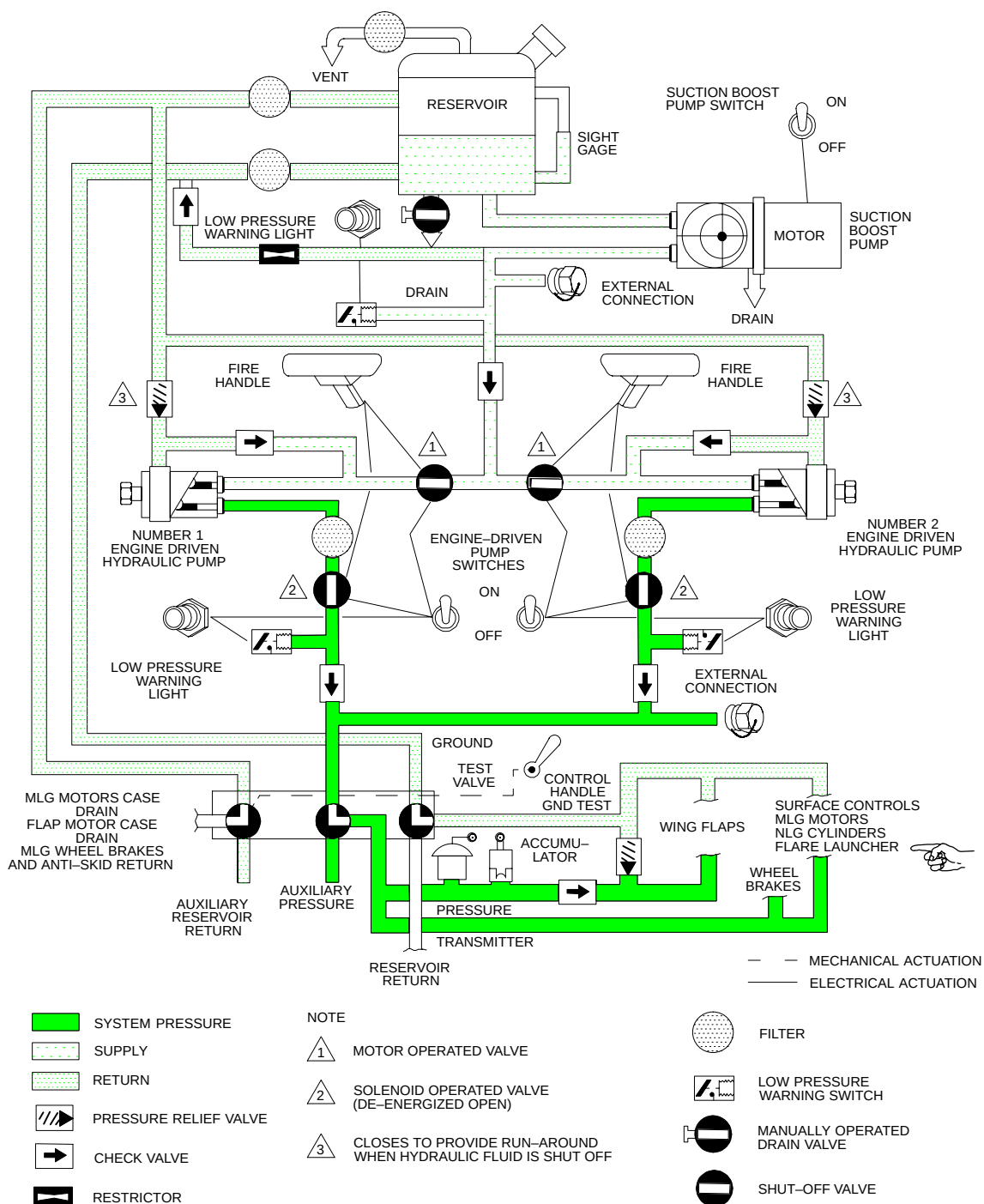


Figure 1A-79

Booster Hydraulic System

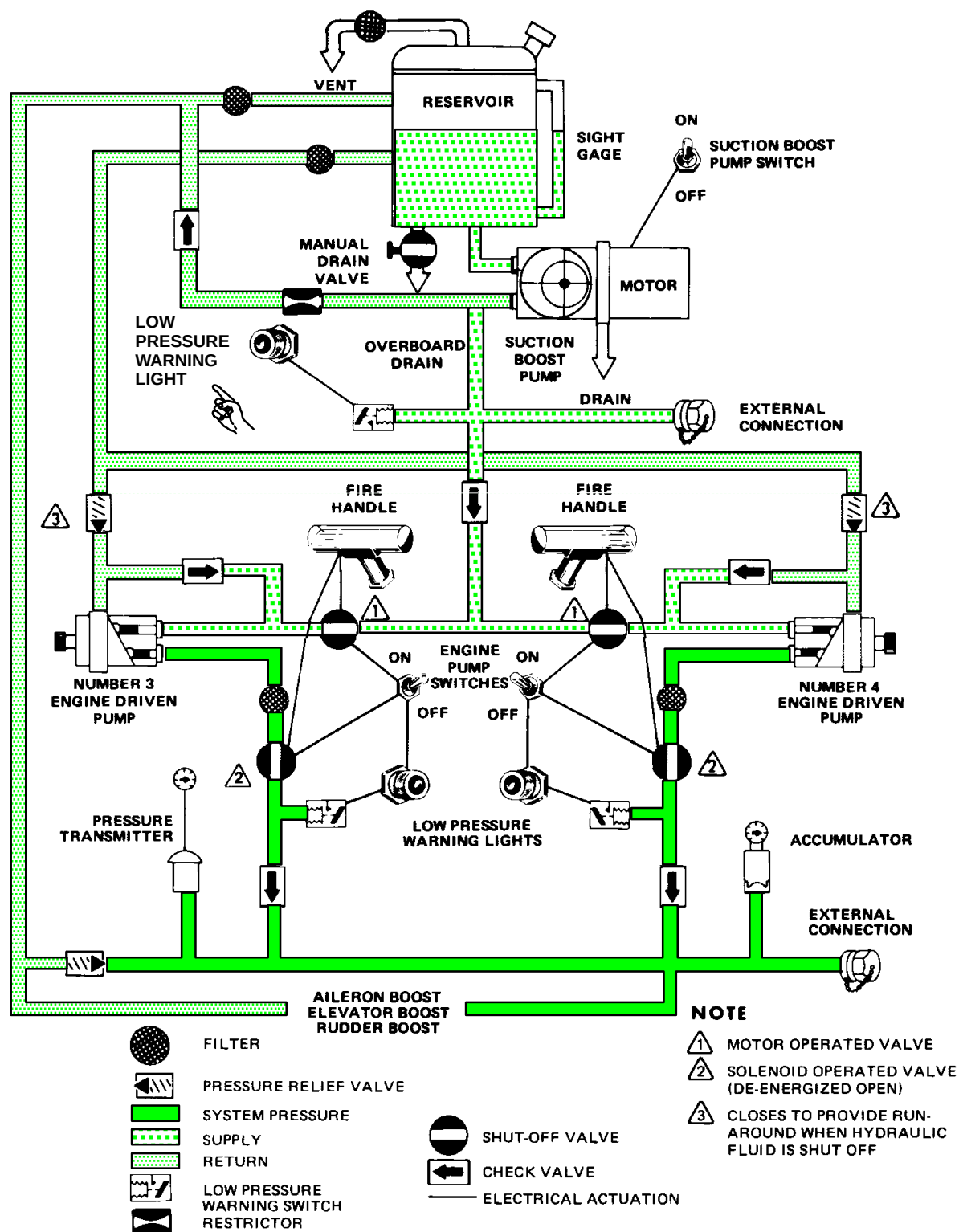


Figure 1A-80

Auxiliary Hydraulic System

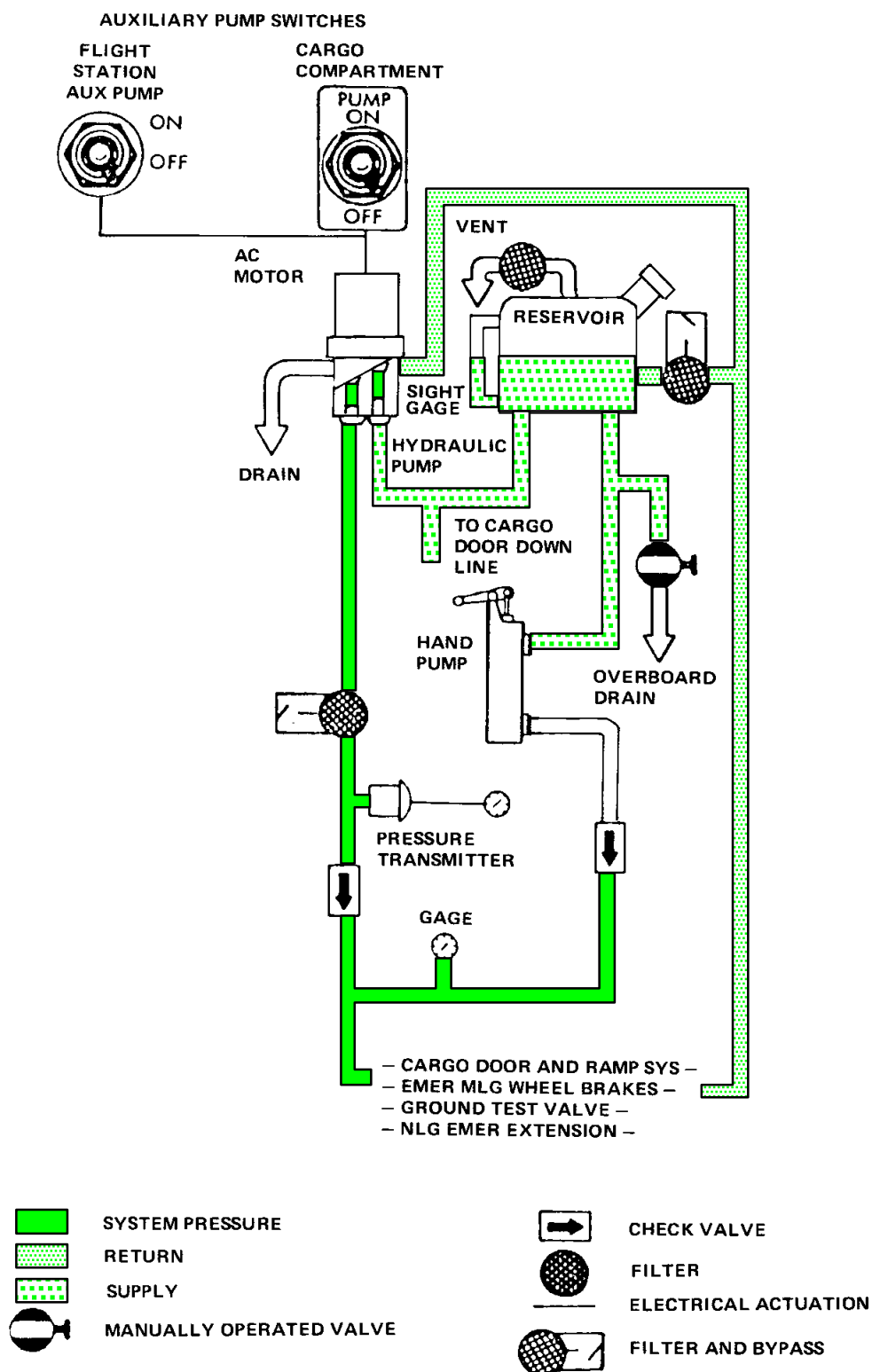


Figure 1A-81

warning by preventing the operating pump pressure from actuating the pressure warning switch for the failed pump. Fluid supply and output of the engine-driven pumps can be cut off by actuation of the fire handle or engine pump switch for that particular engine. The supply fluid and output is cut off by the closing of electrically actuated shutoff valves. External connections are provided so an external supply of pressure may be used for ground maintenance operation of the system. A ground test valve is incorporated in the system so that system pressure from the auxiliary hydraulic system may be used if desired in ground maintenance operations. A single nine-port ground test valve is used. This valve pro-

Hydraulic Control Panel

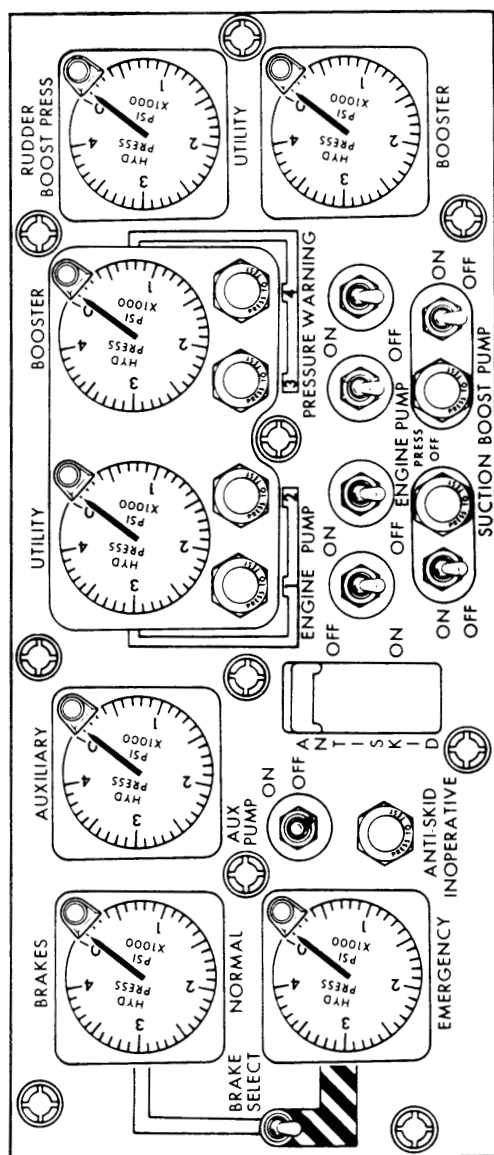


Figure 1A-82

vides supply, return, and case drain functions. Four filters are used in the system to provide protection from foreign material contamination. A pressure relief valve provides protection against system overpressures. An accumulator is installed in the utility hydraulic system pressure line to provide reserve pressure and a damping effect during demand and pressure fluctuations.

A sight level gauge mounted on the reservoir gives a visual indication of the reservoir fluid quantity. Provisions for control and monitoring of the utility hydraulic system are all located on the hydraulic control panel (figure 1A-82) on the copilot's instrument panel.

Utility Hydraulic Pressure Gauge

26V	AC INST & ENG	P Side
	FUEL CONT	Fuse
	#2 INST TRANS	

INDICATOR HYD PRESSURE - UTILITY

The utility system hydraulic pressure gauge is controlled by a remote transmitter and indicates utility system pressure.

BOOSTER HYDRAULIC SYSTEM

The booster hydraulic system (figure 1A-80) operates from the output of number three and number four engine-driven hydraulic pumps and supplies hydraulic power to a portion of the elevator, rudder, and aileron control boost systems. The engine-driven variable displacement pumps are supplied hydraulic fluid under electric suction boost pump pressure from a (1500, 1600 series, CG 1790 and 1700 through 1716) 2 gallon reservoir, (CG 1717 and up) 3.1 gallon reservoir. The pump reservoir contains a baffle plate and integral check valves which separate the upper and lower chambers to prevent fluid from rising above the pump inlet opening during negative (G) gravity conditions. The reservoir is mounted on the right side of the cargo compartment. The engine-driven pumps are provided with internal control mechanisms to vary their output volume with system demand and to maintain approximately 3,000-psi output pressure. If the pump is not operating, the low pressure warning light will glow. The pressurized output fluid of each pump passes through a filter, an electrically operated shutoff valve, and a one-way check valve before merging as system pressure. The one-way check valve provides individual pump failure warning by preventing system pressure from actuating the pressure warning switch of the failed pump. Fluid supply and output of the engine-driven pumps can be cut off by actuation of the fire handle or engine pump switch for that particular engine. The supply fluid and output is cut off by the closing of electrically actuated shutoff valves. Provisions are included in the system for manual overboard draining of the system fluid. External connections are also provided so an external supply of pressure may

be used for ground maintenance operation of the system. Four filters are incorporated in the system to provide protection from foreign material contamination. A pressure relief valve provides protection against system overpressures. An accumulator in the system provides reserve pressure and a damping effect during demand and pressure fluctuations.

A sight level gauge mounted on the reservoir gives a visual indication of the reservoir fluid quantity. Provisions for control and monitoring of the booster hydraulic system are all located on the hydraulic control panel (figure 1A-82) on the copilot's instrument panel.

Booster Hydraulic Pressure Gauge

26V	AC INST & ENG	P Side
	FUEL CONT	Fuse
	#1 INST TRANS	
INDICATOR HYD PRESSURE – BOOST		

The booster system hydraulic pressure gauge is controlled by a remote transmitter and indicates booster system pressure.

AUXILIARY HYDRAULIC SYSTEM

The auxiliary hydraulic system (figure 1A-81) operates from a three-phase, ac, electrically driven hydraulic pump; it powers the aft cargo door and ramp system, provides emergency pressure for the main landing gear brakes, and provides pressure for nose gear emergency extension. The system is mounted in the cargo compartment and may be manually or electrically operated from the ramp control panel, or electrically operated from the hydraulic control panel (figure 1A-82). A hand pump in the system provides an optional source of system pressure for ground or inflight operation. A direct measuring pressure gauge located near the hand pump shows system pressure. A remotely controlled pressure gauge located on the hydraulic control panel also indicates system pressure. The electrically driven system pump supplies hydraulic fluid from a (1500, 1600 series, CG 1790 and CG 1700 through 1716) 3.4 gallon reservoir, (CG 1717 and up) 5.3 gallon reservoir. The pump reservoir contains a baffle plate and an integral check valve which separate the upper and lower chambers to prevent fluid from rising above the pump inlet opening during negative (G) gravity conditions. The electrically driven system pump is a variable volume output type which will maintain approximately 3,000-psi output pressure.

Check valves allow hand pump pressure to operate the system when the hand pump is operated and the electric pump is off. A manually operated shut off valve is provided to furnish overboard drain provisions. A manually operated nose landing gear emergency extension valve connects the system to the nose landing gear system, allowing auxiliary system pressure to be transferred to the nose landing gear uplock and

to the down actuating cylinder for emergency extension of the nose gear. Two filters provide protection from foreign material contamination within the system.

Auxiliary Hydraulic Pump Switches

28V	ESS DC	CP Side
RAMP HYD PUMP CONTROL		
115V	ESS AC	P Side
HYD PUMP AUX SYS		

The auxiliary hydraulic pump may be controlled by either of two ON-OFF toggle switches, located on the hydraulic control panel (figure 1A-82) and the ramp control panel. When either switch is placed in the ON position, 28-volt dc power is supplied to energize the auxiliary hydraulic pump relay. When the relay is energized, 115/200-volt, three-phase, ac power is supplied to drive the auxiliary pump motor. When both switches are placed in the OFF position, the relay is deenergized and power is removed from the auxiliary hydraulic pump motor.

Auxiliary Hydraulic Pressure Gauges

26V	AC INST & ENG	P Side
	FUEL CONT	Fuse
	#2 INST TRANS	
INDICATOR HYD PRESSURE – RAMP		

The auxiliary hydraulic system pressure is indicated by the gauge located on the hydraulic control panel and the gauge located in the cargo compartment near the hand pump. The gauge located in the cargo compartment is a direct-reading instrument and shows system pressure at all times, whether from the hand pump or from the electric pump. The gauge located on the hydraulic control panel is controlled by a remote transmitter.

Ground Test Valve

A ground test valve is provided for pressurizing the utility hydraulic system with auxiliary system pressure without running the engines in order to check equipment operated by the utility system.

This valve is provided for maintenance purposes only and cannot be used for checking systems when airborne since the control for the valve is located in the left aft wheel well fairing and must be positioned manually.

FLIGHT CONTROLS

The flight controls (figure 1A-83) include the main surface control systems, which are aileron, rudder, and elevator systems, and tab control systems. The main surfaces are controlled by mechanical systems with hydraulic boost. The trim

tabs are controlled by electrical control systems. The autopilot, when operating, controls the main surfaces and elevator trim tabs.

MAIN SURFACE CONTROL SYSTEMS

28V ESS DC CP Side
SHUTOFF VALVES

The main surfaces (ailerons, rudder, and elevators) are controlled by mechanical control systems, consisting of cables, pushrods, bellcranks, and torque tubes. Hydraulically driven booster units provide most of the force required to move the surfaces. The booster units are driven by hydraulic pressure supplied simultaneously by the booster and utility hydraulic system (figure 1A-84), each of which serves to power one portion of the booster units. System operation is such that failure or malfunction of any component of either system in any booster unit will allow normal function of the other system powering the same unit. A loss of hydraulic pressure in either hydraulic system results in a corresponding loss in the booster unit, and a proportionate loss of power to operate the unit. The airplane may be controlled with complete loss of booster unit power by the use of trim tabs and engine power, plus coordinated increased efforts of the pilot and copilot. Solenoid-operated shutoff valves in each surface control system can be actuated by switches on the control boost switch panel (figures 1A-83 and 1A-84) at the flight station to shut off supply pressure to either portion of the systems. The valves are spring-loaded and will open when deenergized (control boost switches in the ON position). A booster off warning light for each switch is also powered by the solenoid shutoff valve switch and will illuminate when the switch is in the OFF position. An autopilot servomotor is cable-rigged to each booster unit to substitute for manual control during autopilot operation.

Rudder Booster Assembly

28V ESS DC CP Side
RUDDER HIGH BOOST CONTROL

NOTE

Snubber action may be detected on rudder booster assemblies containing Ronson actuators when moving from travel extremes with only one hydraulic system pressurized. This snubbing action is not binding or sticking. With both hydraulic systems pressurized, there should be no perceptible snubbing action when actuating from travel extremes toward center.

The rudder booster assembly is a single tandem-type hydraulic actuating cylinder which furnishes most of the force to actuate the rudder. During normal operation, fluid

supplied at approximately 3,000 psi pressure is routed by solenoid-controlled, normally deenergized diverter valves through pressure reducer valves in each of the systems; and from there at a pressure of approximately 1,300 psi, to the rudder booster assembly. This system pressure produces desirable characteristics of sensitivity and surface travel for normal inflight operation. Movement of the flap lever from the retracted (UP) position to approximately the 15 percent position or beyond will energize the solenoids of the diverter valves, actuating the valves in such a manner that the pressure reducers are bypassed thereby permitting supply fluid at approximately 3,000 psi pressure to reach the booster assembly. This doubles the available actuating force and gives desirable characteristics of sensitivity and surface travel at low airspeeds such as are encountered in takeoff, landing, flying traffic patterns, troop drops, and cargo drops where flaps are used. The amount of pressure actuating the rudder booster assembly (both the booster and utility portion of the system) is indicated on pressure gauges located on the hydraulic panel (figure 1A-82) of the copilot's instrument panel. Transmitters for these indicators are located downstream of the diverter valve and therefore will show high or low-pressure operation.

Aileron Booster Assembly

The aileron booster assembly is a single tandem-type hydraulic actuating cylinder which furnishes most of the force to actuate the ailerons. During normal operation, the booster assembly is furnished fluid through pressure-reducers at 2,050 psi from both the booster and utility hydraulic systems.

Elevator Booster Assembly

The elevator booster assembly has dual actuating cylinders connected to the booster assembly output power lever that operates the elevator control surfaces. The actuating cylinders operate simultaneously by 3,000 psi pressure supplied by the booster and utility hydraulic systems, each of which powers one actuating cylinder.

Surface Control System Controls

CONTROL COLUMNS AND WHEELS

Control columns and wheels (figure 1A-83) installed at the pilot's and copilot's stations operate the aileron and elevator surface controls are of the conventional type. Mechanical linkage actuates the hydraulically powered booster unit control valves and servomotors for each of these surface controls. Push rods (elevator) and a chain and cable arrangement (ailerons) connect the control column to bell cranks on torque tubes which are mounted under the flight station beneath the pilot's and copilot's seats. From there, dual sets of steel cables continue the elevator linkage as far as the pressure bulkhead at the extreme rear of the cargo compartment and the aileron linkage to the rear of the center section wing

Flight Control System Controls and Indicators

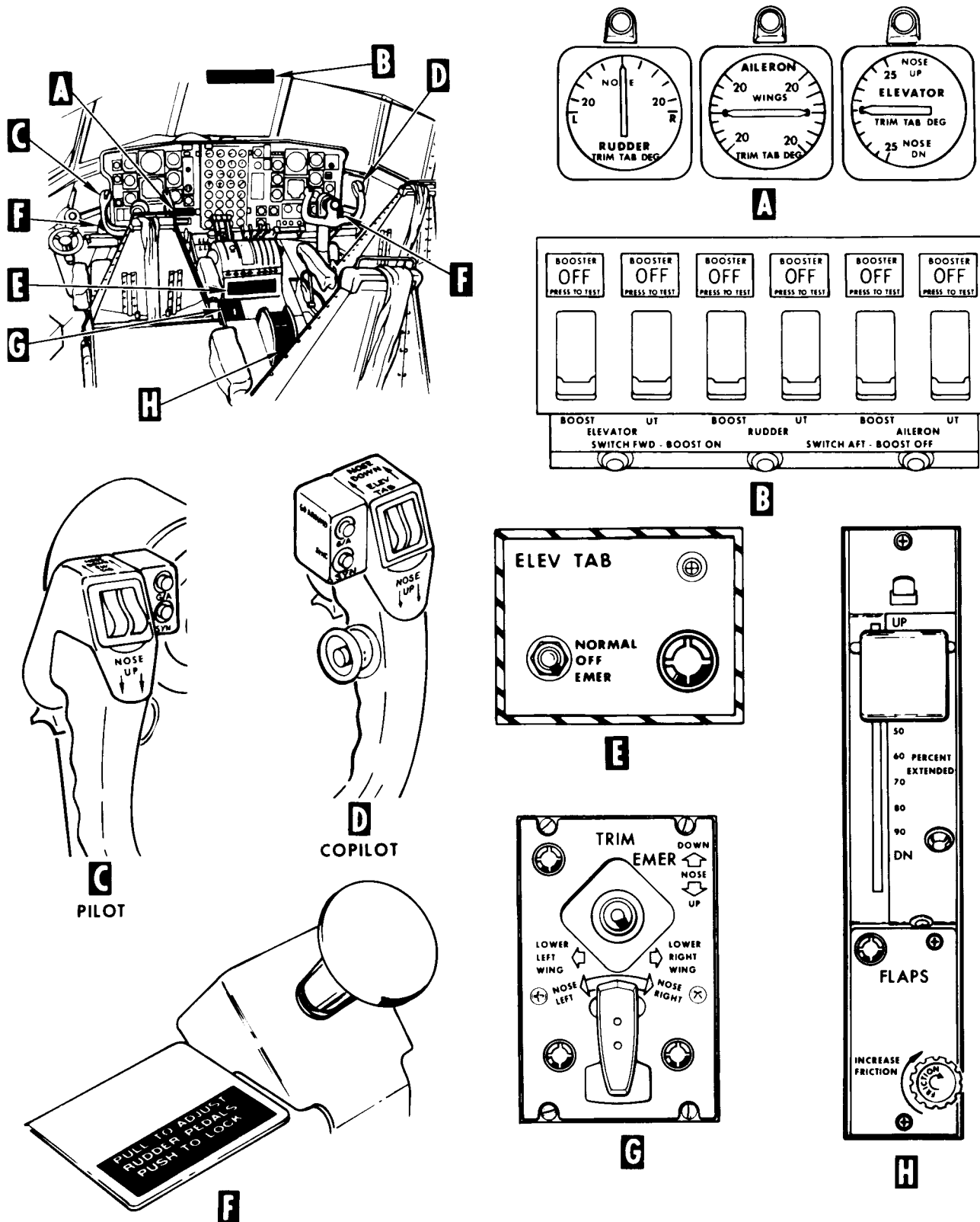


Figure 1A-83

Surface Control Systems

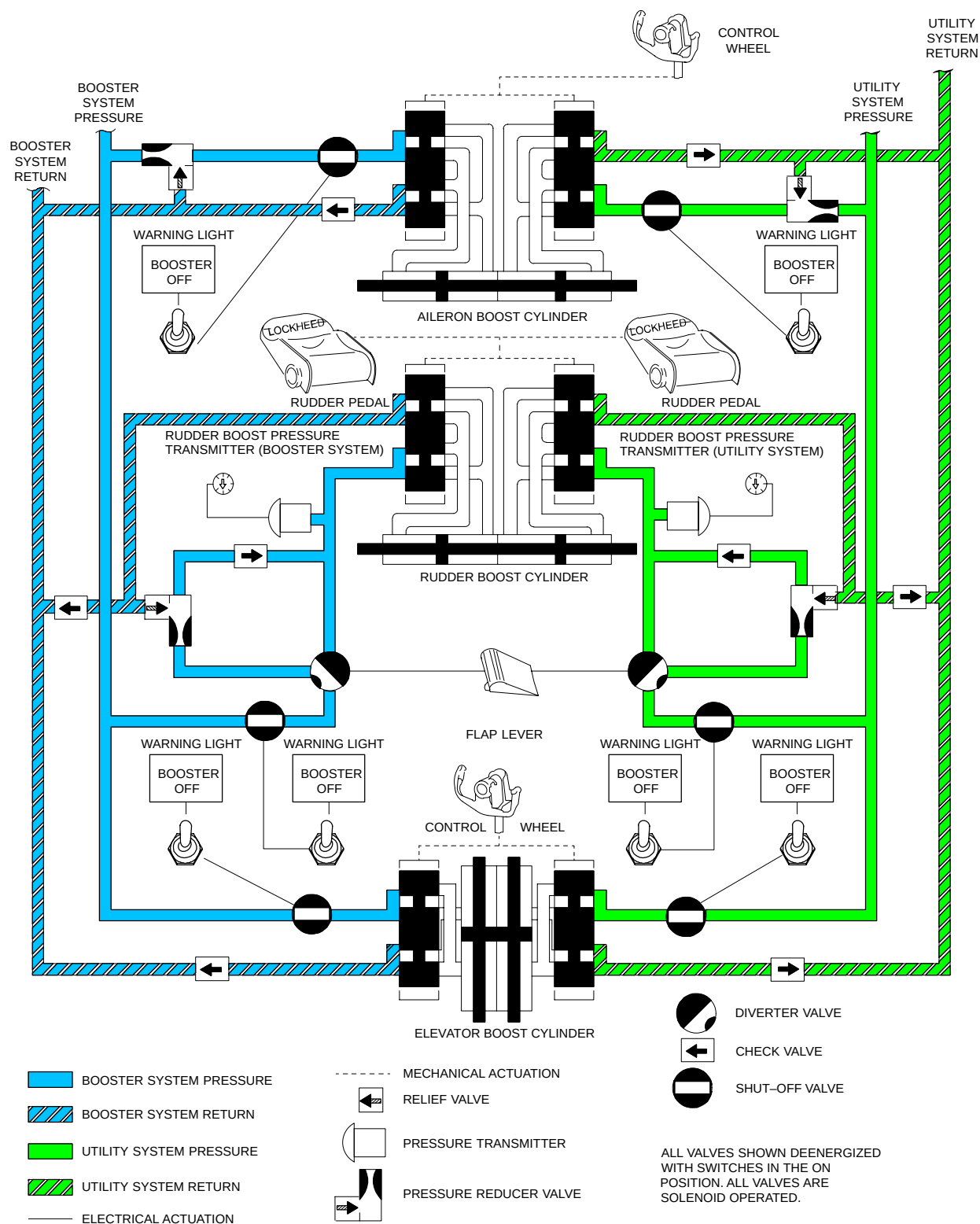


Figure 1A-84

rear beam web. From these points, push rods and bell cranks pick up the motion and transmit it to the booster unit control valves and servo units.

RUDDER PEDALS AND ADJUSTMENT LEVERS

Rudder pedals are of the conventional type. Each pair of rudder pedals can be adjusted individually by unlocking the rudder adjustment lever (figure 1A-83) and pushing or releasing the spring-loaded pedals to the desired position. The rudder pedals are used to operate the rudder booster when hydraulic power is available, and to operate the rudder manually when hydraulic power is not available. Toe pressure on the rudder pedals actuates the brakes during either normal or emergency braking.

CONTROL BOOST SWITCHES AND WARNING LIGHTS

28V ESS DC CP Side
SHUTOFF VALVES

The control booster unit shutoff valves actuating switches (figure 1A-83) are located on the control panel boost switch panel on the overhead control panel. There are six guarded two-position toggle switches (ON with cover down, deenergized) which will actuate the shutoff valves to isolate the corresponding booster package and energize six hooded warning lights which illuminate BOOSTER OFF when their respective switch is placed in the OFF position. The panel switches supply power to the warning lights directly through the copilot's lower circuit breaker panel when in the OFF position and therefore the lights furnish no independent indication directly of boost unit failure or that the shutoff valves are closed. The warning light only indicates that the switch is in the OFF position and dc power is routed to the solenoid shutoff valve. Individual pressure control from both the booster and utility system is available to each boost package. (See FLIGHT CONTROL SYSTEMS FAILURE in Section III for emergency procedures.)

TRIM TAB CONTROL SYSTEMS

28V ESS DC CP Side
AILERON TRIM TAB Control

115V SINGLE ESS AC P Side
TRIM TAB ELEVATOR or AILERON or RUDDER

Trim tabs are provided on the control surfaces to aid in trimming the airplane during flight. Lateral trim is obtained through operation of a trim tab on the left aileron. A ground adjustable tab is located on the right aileron to compensate for any inherent unbalance about the longitudinal axis of the

airplane. Nose-up and nose-down trim is obtained through operation of the trim tabs on the elevators, one trim tab on each elevator control surface. Minor directional control for yaw conditions is obtained by operation of the rudder trim tab. The autopilot elevator servo will function only when the elevator tab switch is placed in the NORMAL position. All trim tab actuators are driven by 115 volt, single-phase, ac motors, except during emergency operation when the elevator trim tab actuator is driven by a 28-volt dc motor. (The elevator trim tab normal system is inoperative for manual control when the autopilot is engaged. During (1600 series, CG 1790, and 1700 series) autopilot operation, operation of the elevator trim switch located on either of the control wheels will cause the autopilot to disengage.)

Trim Tab Systems Controls

Trim tab controls consist of switches for control of the tab actuators and a power selector switch to select emergency operation of the elevator tabs.

AILERON AND ELEVATOR TRIM TAB SWITCH

An aileron and elevator trim tab switch is located on the trim tab control panel of the flight control pedestal (figure 1A-83). It is a recessed, five-position (NOSE UP, NOSE DOWN, OFF, LOWER LEFT WING, LOWER RIGHT WING) toggle switch, with all switch positions spring-loaded to the OFF (center) position upon release of the switch. When the switch is held in the LOWER LEFT WING or LOWER RIGHT WING position, the trim tab on the left aileron control surface is actuated by a tab motor to trim the airplane laterally. When the switch is held in the NOSE UP or NOSE DOWN position, the elevator trim tabs are actuated by a tab motor to drive the tabs down or up. When the switch is in the OFF (center) position, the electric motors that actuate the trim tabs are deenergized.

Two control relays in the aileron trim tab power circuit are energized by the trim tab control switch. The relays eliminate the necessity to route the 115-volt, ac power required to operate the aileron trim tab actuator through the trim tab control switch. When the switch is placed in the LOWER LEFT WING position, it will energize the tab down relay which connects 115-volt ac power to the aileron trim tab actuator and drives the tab down. When the switch is placed in the LOWER RIGHT WING position, it will energize the tab up relay which connects 115-volt, ac power to the aileron trim tab actuator and drives the tab up.

ELEVATOR TRIM TAB SWITCH (1500 SERIES)

An elev tab switch is located on the outboard hand grip of each control wheel. It is a slide-type switch with NOSE UP,

NOSE DOWN, and center off positions. These two switches are connected in parallel. A runaway tab condition may be corrected by opposite movement of the other switch. When any one of these switches is in NOSE UP or NOSE DOWN position, a pair of dual relays is actuated to apply power to the elevator trim tab actuator. If the elevator tab power selector switch is in NORMAL, 115-volt ac power from the essential ac bus through the elev trim tab circuit breaker is applied to the actuator. Twenty-eight volt, dc power from the essential dc bus through the ELEV EMER POWER circuit breaker is applied to the actuator if the power selector switch is in EMERGENCY. The elevator tab switch on the control wheels is inoperative when the elevator tab power switch is placed in the EMERGENCY position.

With the elevator tab power selector switch positioned to NORMAL, the elevator tabs can only be operated from the tab switch on the pilot's and copilot's control wheel. With the elevator tab power switch positioned to EMER, the elevator tabs can only be operated from the elevator tab switch located on the flight control pedestal.

ELEVATOR TRIM TAB SWITCHES (1600 SERIES, CG 1790, AND 1700 SERIES)

Dual NOSE UP, NOSE DOWN, and center OFF elevator trim tab switches are located on the outboard handgrip of each control wheel. The dual switches on the pilot's or copilot's control wheels must be operated simultaneously on their respective wheels to provide both power and ground to the control relays. The two sets of dual switches are connected in parallel and either set of switches can control the tab when the ELEV TAB power selector switch is positioned to NORMAL. When either the pilot or copilot control wheel dual switches are in NOSE UP or NOSE DOWN position, dual relays are actuated to apply power to the elevator trim tab actuator. With the ELEV TAB power selector switch in NORMAL, 115-volt ac power from the essential ac bus through the TRIM TAB ELEVATOR circuit breaker, on the pilot's side circuit breaker panel, is applied to the actuator. The elevator tab switches on the control wheels are inoperative when the ELEV TAB power selector switch is placed in the EMER or OFF position.

ELEVATOR TRIM TAB POWER SELECTOR SWITCH

28V

ESS DC

CP Side

ELEVATOR EMER POWER

An elevator tab power selector switch (figure 1A-83) is located on the flight control pedestal. It is a three-position

(NORMAL, OFF, EMERGENCY) toggle switch used to select the source of electrical power for operation of the elevator trim tabs. When the switch is in the NORMAL position, 115-volt, ac power is supplied from the essential ac bus through the ELEVATOR TRIM TAB circuit breaker to a trim tab actuating motor relay for autopilot or manual operation of the elevator trim tabs. In the NORMAL position, the elevator trim tabs can be controlled from the control wheels. When in the EMERGENCY position, the elevator trim tabs can be controlled only from the elevator trim tab switch located on the pedestal. During emergency operation, 28-volt dc power is supplied from the essential dc bus through the ELEVATOR EMER POWER circuit breaker to a trim actuating motor that will drive the elevator trim tabs either up or down when the respective elevator trim tab control relay is energized by actuation of the trim tab control switch on the pedestal. When the elevator tab power selector switch is in the NORMAL position, the elevator trim tab control relays are powered by 28-volt dc from the essential dc bus through the ELEVATOR TAB CONTROL circuit breaker. When the elevator tab power selector switch is in the EMERGENCY position, the elevator trim tab control relays are powered by 28-volt dc from the essential dc bus, through the ELEVATOR EMER TAB CONTROL circuit breaker. When the elevator tab power selector switch is placed in the OFF position, all circuits to the elevator trim tabs are deenergized. (See FLIGHT CONTROL SYSTEMS FAILURE in Section III for emergency operation.)

RUDDER TRIM TAB SWITCH

A rudder trim tab switch is located on the trim tab control panel of the flight control pedestal (figure 1A-83). It is a three-position (NOSE LEFT, OFF, NOSE RIGHT) switch that controls operation of the rudder trim tab motor. The NOSE LEFT and NOSE RIGHT positions are spring-loaded to return to the OFF (center) position upon release of the control switch. When the switch is in NOSE LEFT or NOSE RIGHT position, 115-volt ac power from the essential ac bus through the RUDDER TRIM TAB circuit breaker energizes the rudder trim tab motor to position the rudder trim tab and trim the airplane.

Trim Tab Position Indicators

28V

MAIN DC

AFT Fuselage
Junction Box

TABS & FLAPS POSITION INDICATORS

Tab position indicators show the pilot the exact angle formed by any trim tab with its corresponding control surface and the direction in which the trim will act.

RUDDER TRIM TAB POSITION INDICATOR

A rudder trim tab position indicator is located on the pilot's instrument panel (figure 1A-83). The indicator is connected to a transmitter mounted on the rudder trim tab actuator housing and indicates to the pilot the degree of rudder trim tab positioning relative to the rudder control surface. The indicator dial face is calibrated from O to L (25°) and O to R (25°) in increments of 5 degrees of rudder trim tab travel from the neutral O marking. The needle on the indicator shows the exact angle between the rudder trim tab and rudder surface and the direction in which the trim will act.

AILERON TRIM TAB POSITION INDICATOR

An aileron trim tab position indicator is located on the pilot's instrument panel (figure 1A-83). This indicator is connected to a transmitter mounted on the left aileron trim tab actuator and indicates to the pilot the degree of left aileron trim tab positioning relative to the aileron control surface. The indicator dial face is calibrated from the neutral position of 0 to 20 up and 0 to 20 down in 5-degree increments of left aileron trim tab travel. The needle on the indicator shows the exact angle between the aileron trim tab and the left aileron surface and the direction in which the trim will act.

ELEVATOR TRIM TAB POSITION INDICATOR

An elevator trim tab position indicator is located on the pilot's instrument panel (figure 1A-83). The indicator is connected to a transmitter mounted on the elevator trim tab rotary actuator housing and indicates to the pilot the degree of elevator trim tab positioning relative to the elevator control surface. The indicator dial face is calibrated from the neutral position 0 to 25 UP or 25 DOWN, in 5-degree increments of elevator trim tab travel. The needle on the indicator shows the exact angle between the elevator trim tabs and the corresponding elevator surface and the direction in which the trim will act.

NOTE

Trim tab travel is controlled by limit switches set at 6 degrees nose down and 25 degrees nose up, and by mechanical stops set at 8 degrees nose down and 27 degrees nose up.

FLAP SYSTEM

28V MAIN DC CP Side
WING FLAP CONTROL

The airplane is equipped with four flaps, consisting of an outboard and an inboard flap in each wing. The flaps are of the Lockheed-Fowler, high-lift type in which the flap motion is

a combination of an aft movement to alter the airfoil section to increase lift and drag. The time required for full extension or retraction of the flaps is between 10 to 15 seconds. When 100 percent extended, the flaps form an angle of approximately 35 degrees with the wings. The flaps are operated by a reversible hydraulic motor, a cam-actuated microswitch follow-up mechanism, torque tubes, gearbox, and drive screw assemblies. Hydraulic pressure is directed through a check valve to the emergency flap brake valve, and wing flap control valve, where pressure is directed to the up or down system. The hydraulic motor operates the torque shaft section extending outboard to the gearbox, which rotates ball bearing drive screws for actuation of the flaps. The flaps may be operated manually with a handcrank. A disk-type, spring-loaded flap brake holds the flaps in the selected position and prevents movement by aerodynamic loads. The brake is released by fluid pressure supplied to the system for operation of the flap drive motor. Emergency flap brakes are splined to the outer ends of the flap drive torque shaft to prevent unequal actuation of the flaps during normal extension and retraction of the flaps. Utility hydraulic system pressure is used for operation of the flap system.

FLAP SYSTEMS CONTROLS

Flap system controls (figures 1A-83, 1A-85) are provided for normal operation of the flaps. Provisions exist for manual operation of the flaps if the normal operation system fails to function.

Flap Lever

A flap lever (figure 1A-83) is located on the aft end of a flight control pedestal. It is a manually actuated control lever with the lever range calibrated from UP to DOWN in increments of 10 percent. There is a detent at approximately the 50 percent position but the flaps can be extended to any desired position by placing the lever at the selected percent of flap extension. The lever is attached by cables to a movable cam inside a flap control unit mounted on the center section wing rear beam in the cargo compartment. Movement of this cam closes microswitches which close a 28-volt dc control circuit for the wing flap selector valve. The actuated valve directs a flow of hydraulic fluid to drive the flap motor in the selected direction. A rudder pressure diverter valve, electrically actuated by a switch on the flap control lever mechanism, controls the pressure available for operation of the rudder. Pressure available for rudder operation at flap settings from 0 to 15 percent is approximately 1,300 psi as compared to approximately 3,000 psi for flap settings from 15 to 100 percent. The pressure control system is provided to prevent excessive loads at high speeds. When the selected position of the flaps is reached, the microswitches open, the selector valve shuts off hydraulic flow, and a spring-loaded hydraulic brake locks the flaps in the selected positions.

Flap Control System

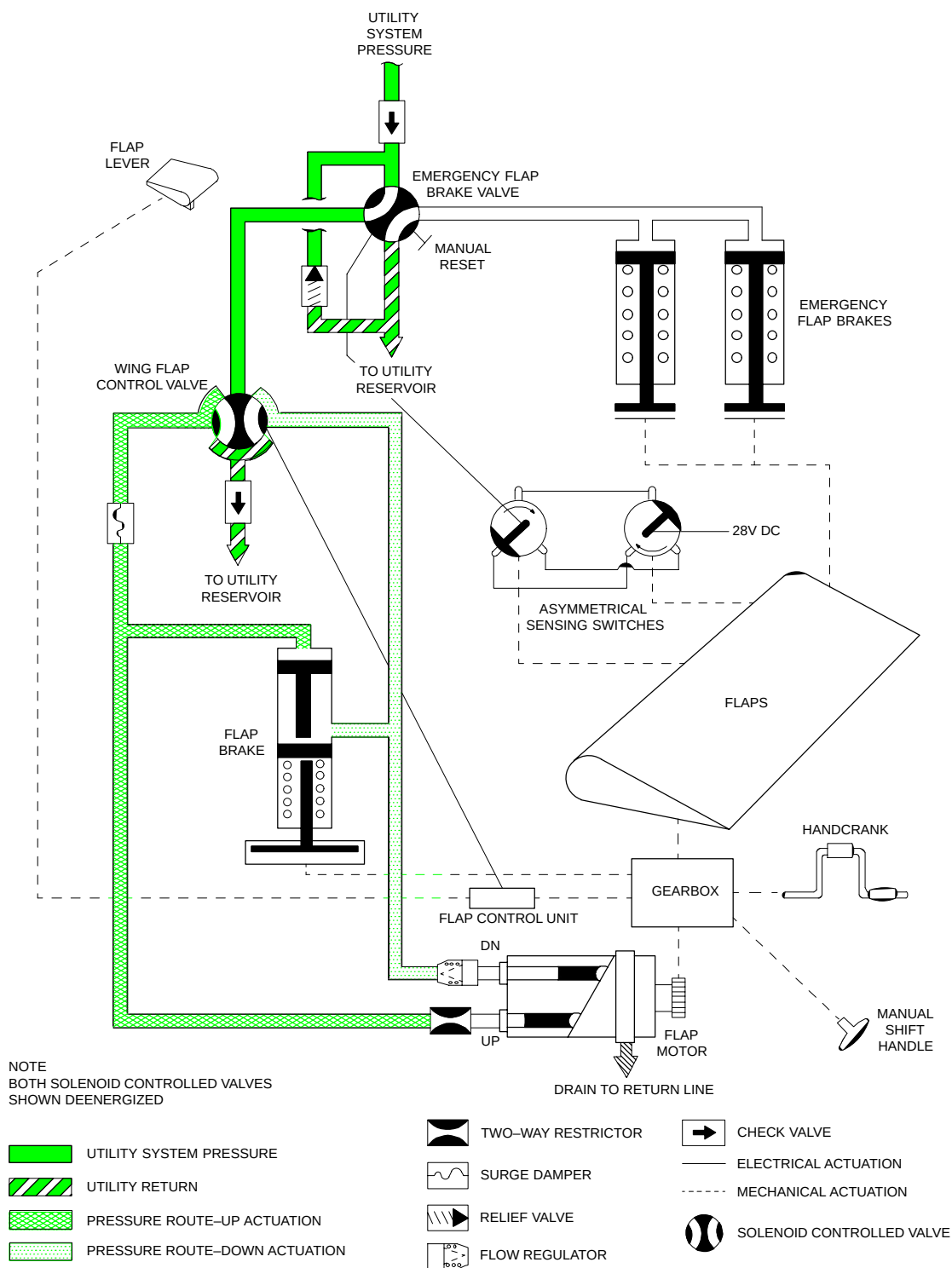


Figure 1A-85

NOTE

The landing gear warning horn is interconnected with the flap system. When the flap lever is set at approximately 70 percent or more with the landing gear up, the landing gear warning horn will sound; it cannot be silenced until the landing gear is down and locked or the flap lever is retracted above 70 percent.

NOTE

(CG 1790 and 1700 Series) The ground proximity warning system (GPWS) is interconnected with the flap system. A switch is located on the flap control lever mechanism, at the 40-percent flap setting, to signal the GPWS computer whenever the airspeed/altitude and flap setting are not commensurate to a landing configuration. The 40-percent flap switch may be inhibited by placing the GROUND PROXIMITY FLAP OVERRIDE switch to OVERRIDE position.

Flap Lever Friction Knob

A flap lever friction knob (figure 1A-83) is located on the flap control panel. Turning the knob clockwise mechanically tightens the friction on the flap cables, preventing the flap lever from vibrating out of its set position.

Wing Flap Selector Valve

28V MAIN DC CP Side
WING FLAP CONTROL

A wing-flap selector valve (figure 1A-85) is mounted on the left-hand hydraulic panel, forward of the left-hand wheel well. It is a solenoid-operated valve, directing the flow of utility hydraulic fluid to either the up or down side of the flap motor for normal raising and lowering of the flaps, depending on the position of the flap lever. Override controls, consisting of two buttons marked RAISE and LOWER, are located on the selector valve for use in case of electrical failure. Pushing the button marked LOWER routes hydraulic fluid to release the flap brake and to the gearbox drive motor to lower the flaps. Pushing the button marked RAISE routes hydraulic fluid to release the brake and to the gearbox drive motor to raise the flaps.

Manual Operation

An emergency method of operating the flaps mechanically is provided by an extension stub shaft connected through a universal joint to the torque shaft which drives the flap screw jacks. An emergency engaging handle shifts between the hydraulic and manual drive. The extension stub shaft and handcrank are located on the forward wall of the left-hand

main landing gear wheel well. (See FLAP SYSTEM FAILURE in Section III for manual operation.)

Emergency Flap Brake Valve

28V MAIN DC CP Side
WING FLAP CONTROL

The emergency flap brake valve is a solenoid-operated hydraulic valve, located on the left-hand hydraulic panel forward of the left wheel well. In its deenergized position, hydraulic pressure passes through it to the flap selector valve. It is equipped with a manual override that unlocks the emergency flap brakes. In the event that a torque tube in the system breaks or a coupling comes apart, the asymmetric sensing switches located at the ends of the torque tubing will sense the resulting out of phase condition. This sensing is immediately translated to the emergency flap brake valve by 28 volts to energize the brake valve and lock the flap brakes before further motion of the flaps can occur. The flap cannot then be raised or lowered by any means until the manual override is moved, resetting the valve to release the emergency brakes. The manual override is for ground use only. (See FLAP SYSTEM FAILURE in Section III.)

Flap Position Indicator

28V MAIN DC AFT Fuselage
Junction Box
TABS & FLAPS POSITION INDICATORS

A flap position indicator is located on the copilot's instrument panel (figure 1A-83). The indicator is connected to a transmitter that is mounted on the flap drive control unit located on the aft face of the wing rear beam. The indicator dial is calibrated from UP to DOWN in increments of 10 percent.

LANDING GEAR SYSTEM

The landing gear system includes a dual-wheel, steerable nose gear and two tandem-mounted main landing (ST) gears. Normal operation of the system is through the utility hydraulic system. The nose gear retracts forward into the nose section of the fuselage; the main landing gears retract vertically into the left and right wheel well on either side of the fuselage. In the retracted position, all landing gears are enclosed by mechanically operated flush doors. A landing gear position-indicating system gives a visual indication of the position of each gear and a visual and audible indication of an unlocked condition of the landing gear. Under normal operation, the time required for the nose and main landing gears to retract or extend is 19 seconds or less.

MAIN LANDING GEAR

The main landing gear system (figures 1A-86 and 1A-87) consists of four strut-wheel assemblies paired in tandem

Main Landing Gear System

NOTE

LANDING GEAR SHOWN
IN THE UP POSITION.

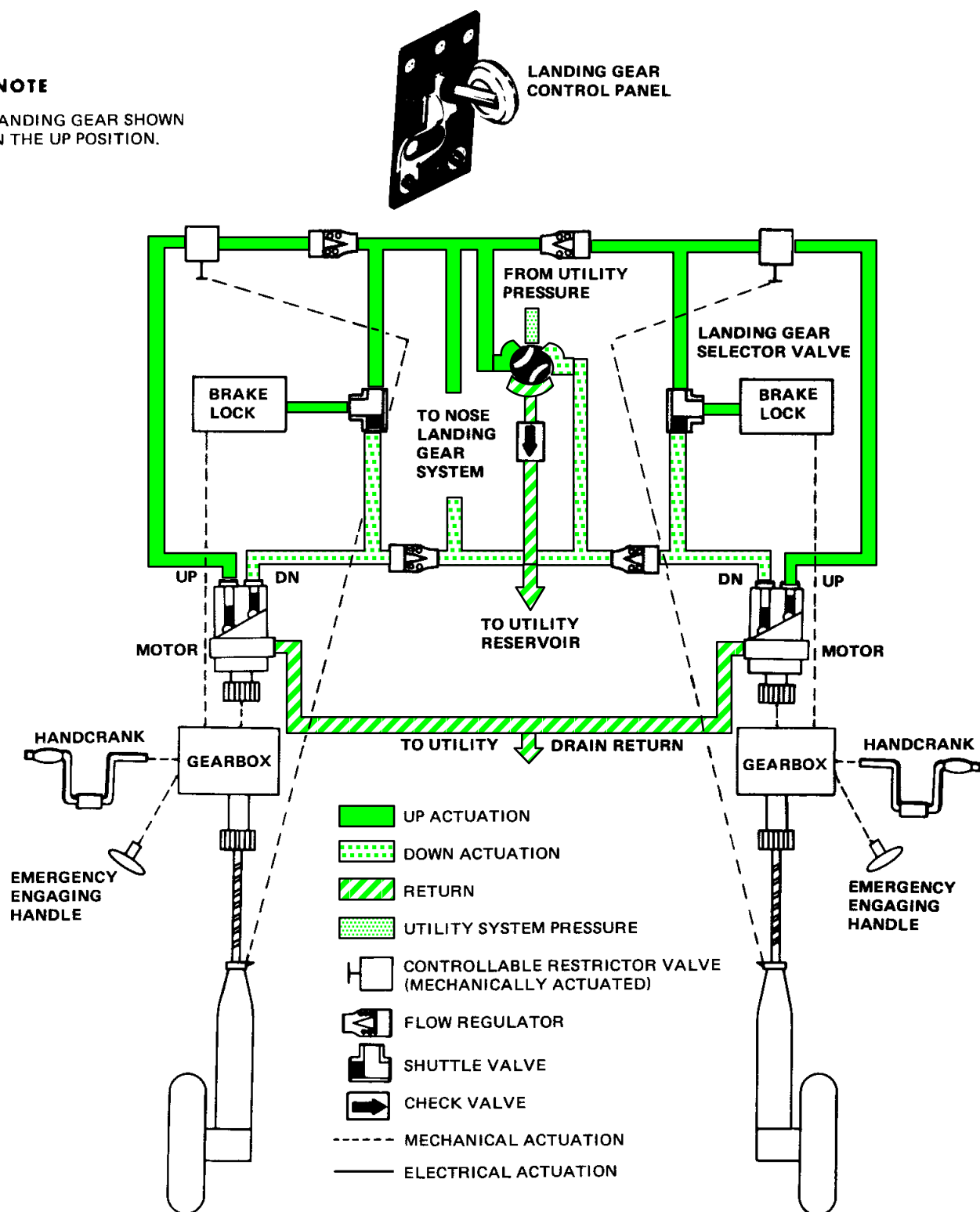


Figure 1A-86

Main Landing Gear Structure

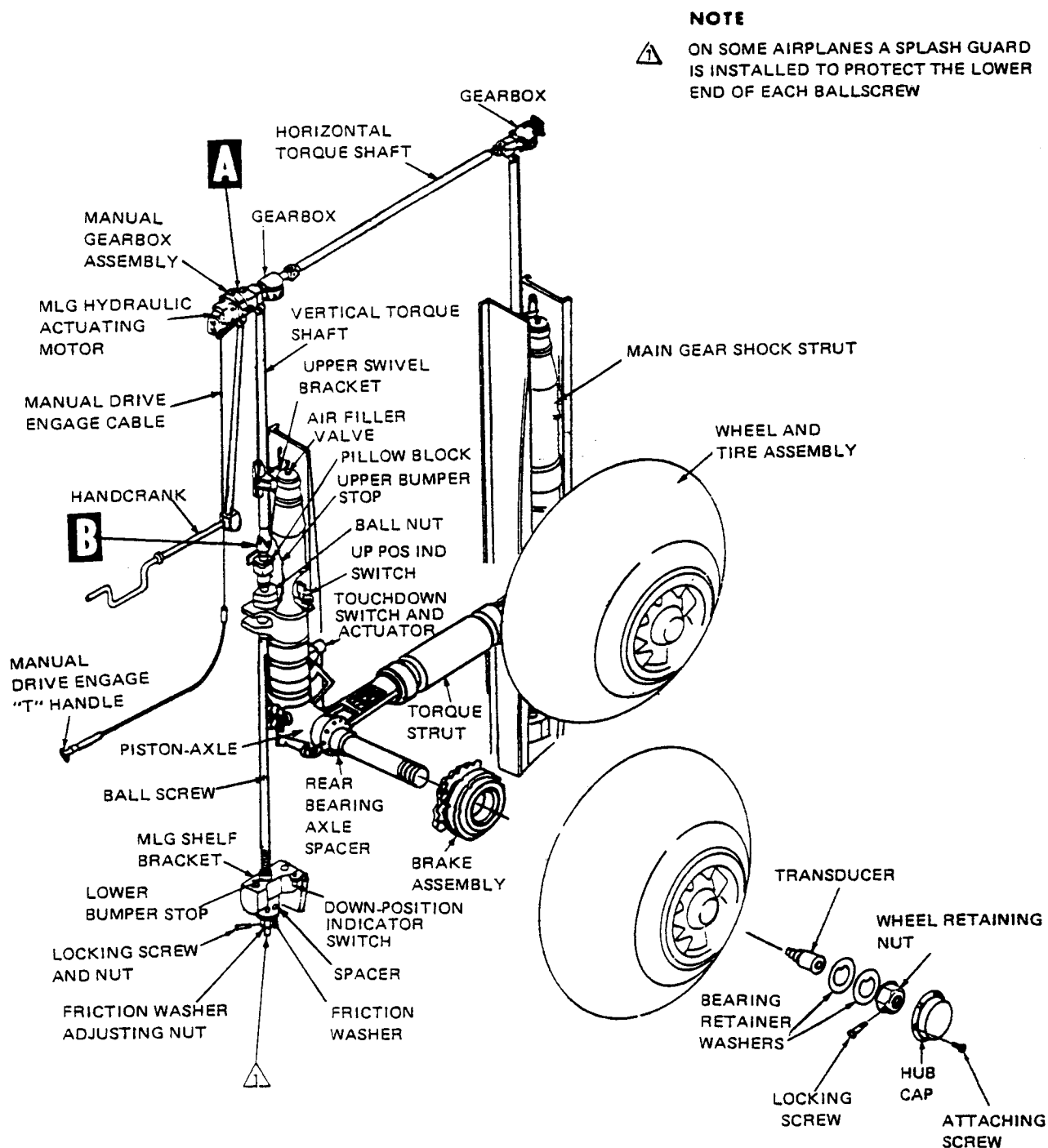
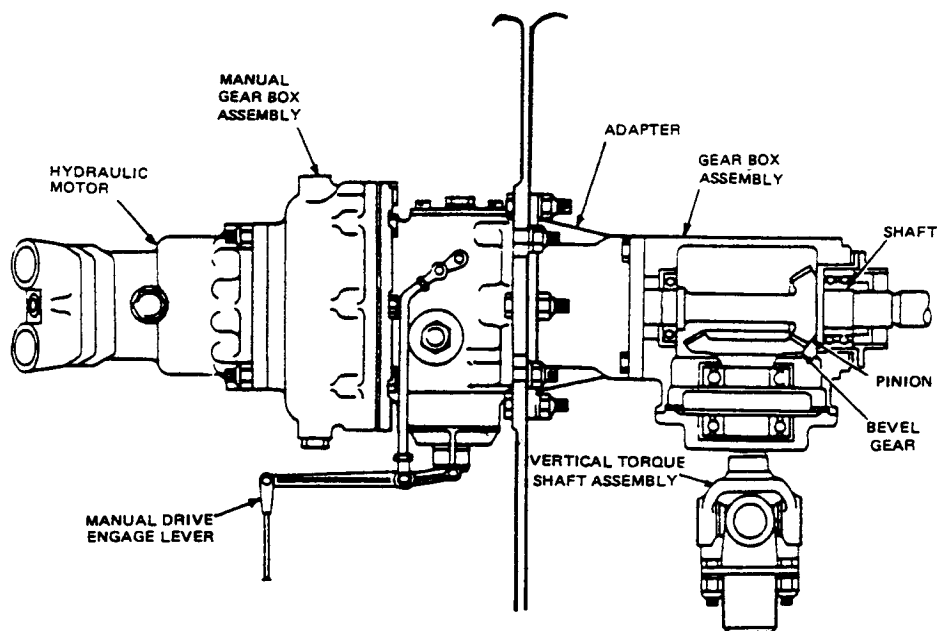


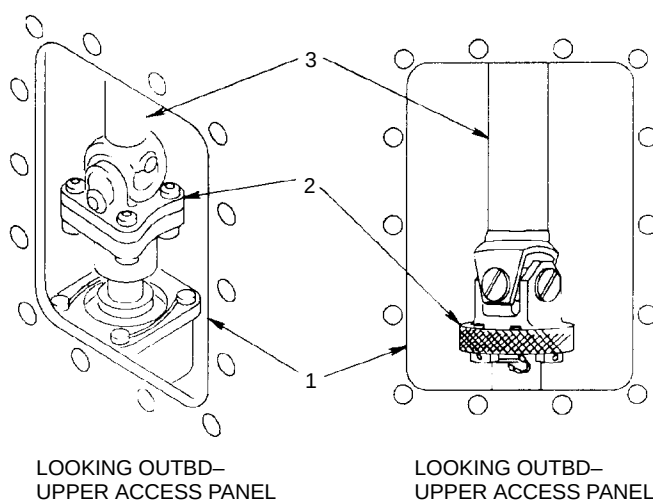
Figure 1A-87 (Sheet 1 of 2)

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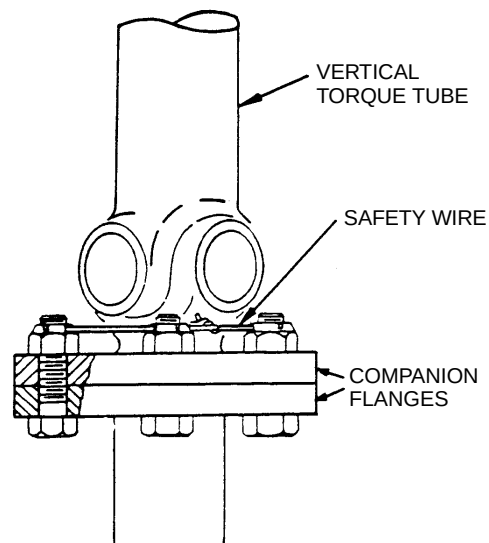


GEAR HYDRAULIC MOTOR AND GEARBOX ASSEMBLY

B



1. UPPER ACCESS PANEL
2. VERTICAL TORQUE SHAFT
3. COUPLING



BOLT HEADS SHOULD BE DOWN AFTER INSTALLATION ON AIRCRAFT

Figure 1A-87 (Sheet 2 of 2)

configuration and connected by a torque strut. Normal landing gear actuation is supplied by utility system pressure with hydraulic flow directed through a landing gear selector valve to each of the two main landing gear reversible hydraulic motors. Each pair of struts is raised and lowered vertically in tracks by means of screwjacks, connected by torque shafts which are driven by their respective hydraulic motors through a gear box. Flow regulators in the up lines and flow regulators in down lines regulate hydraulic return flow, controlling the extension and retraction time of the main gear. Mechanically actuated controllable restrictor valves are located in the up lines reducing hydraulic flow to the landing gear motors, thus slowing the retracting speed of the strut assemblies prior to contacting the upper bumper stop on their respective screwjacks. This controllable restrictor valve plunger is mechanically actuated during the final inches of each forward strut travel by a bracket. After contacting the uplimit switch, the landing gear selector valve remains energized, allowing landing gear up hydraulic pressure to be continuously applied to the main landing gear motors. In the event of loss of hydraulic pressure, the main landing gear spring-loaded retraction brakes are applied.

Manual Operation Provisions

Emergency methods of actuating the main landing gear mechanically or manually are provided by means of emergency engaging handles, two extension stub shafts, two handcranks, a main landing gear emergency extension wrench, and easily removed pressure-sealed doors. One emergency engaging handle is provided for each main landing gear. One handle is located on the forward side of each wheel well bulkhead. The emergency engaging handles are connected by cables to other respective gearbox assemblies. Pulling an emergency engaging handle disengages the main landing gear spring-loaded brake and the drive motor and engages the manual extension and retraction gears. A maximum of 120 pounds of force may be required to pull the handle out. Either handcrank (one is located on each side of the fuselage near the wheel well bulkheads) can then be used to operate the appropriate extension stub shaft. The shaft is connected by mechanical linkage to the gearbox assembly which drives the retraction screw jacks. One extension stub shaft is mounted on the forward wall of each main landing gear wheel well. The emergency extension wrench is provided for manually extending the main landing gear after both the normal and emergency extension systems have failed. Use of the wrench requires removal of the pressure-sealed doors in the wheel well. The upper pressure-sealed doors provide access to the main landing gear hydraulic gearboxes, permitting manual release of the respective hydraulic brake mechanism in the event of manual release cable jamming or failure. Release of the hydraulic brake mechanism will be accompanied by a shift of the gearbox mechanism from power to hand drive. The lower doors provide access to the respective ver-

tical torque shafts, permitting limited maintenance on some of the components of the torque shaft. The bolts retaining each of the pressure-sealed doors can be removed with a hand crank (a small wrench is required if rails are installed). Two glass panels are located on each of the right and left-hand wheel well walls. These panels are used for visual inspection to determine whether or not the main landing gear is fully extended when the manual emergency system is used. The landing gear down-and-locked indicators remain operative during manual operation.

NOSE LANDING GEAR

The nose landing gear (figure 1A-88) is a swinging-type gear, extending down and aft, actuated by a hydraulic cylinder, and secured in the up and down positions by locks. The gear is normally supplied with hydraulic fluid under pressure by the utility supply system; it can be supplied by the auxiliary hydraulic system for extension only. Hydraulic fluid from either the up or down side of the landing gear control valve flows to the landing gear uplocks and down locks and to the nose landing gear actuating cylinder.

The landing gear selector valve remains energized to the up position, allowing landing gear up hydraulic pressure to be continuously applied to the nose landing gear actuating cylinder and uplock. In the event of loss of hydraulic pressure, the nose landing gear is held in place by the uplock. Fluid for the nose landing gear steering control valve is supplied from the landing gear control valve in the down position only.

A two-way flow regulator in the up actuation line upstream of the nose landing gear actuating cylinder, restricts the flow of hydraulic fluid to and from the cylinder in order to modulate landing gear actuation.

A shuttle valve connects the utility pressure down line to the auxiliary system pressure, permitting the respective pressure to be used to place the nose landing gear in the down-and-locked position when the utility system is inoperative. The manual release handle at the flight station provides a mechanical means of unlocking the nose gear uplock.

The nose gear can be visually checked through a nose landing gear inspection window on the aft bulkhead of the nose wheel well under the flight deck. A removable access panel, which also includes the inspection window, is provided for emergency nose landing gear extension. There are no provisions for emergency retraction of the nose landing gear.

LANDING GEAR SYSTEM CONTROLS

28V	ESS DC	CP Side
LANDING GEAR CONTROL		

The landing gear system requires several types of controls, to lower and retract the landing gear hydraulically and manual-

Nose Landing Gear System

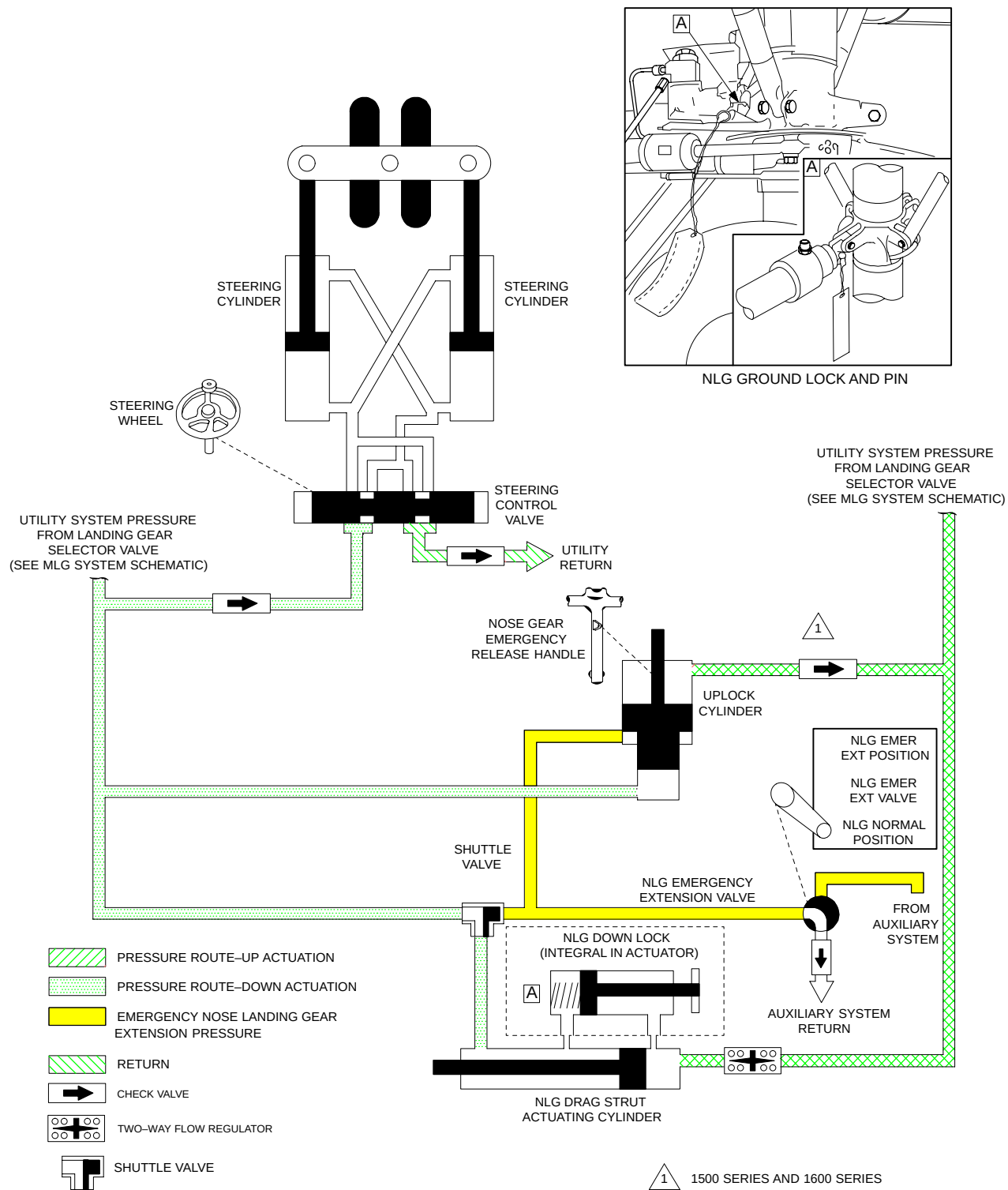


Figure 1A-88

ly, to hold the landing gear in the down-and-locked position, and to silence the warning horn.

Landing Gear Lever

A landing gear lever (figure 1A-89) is located on the left side of the copilot's instrument panel. It is a two-position (UP, DOWN) lever which directs the gear actuating mechanism to raise or lower the nose and main landing gear. When the lever is moved to the UP position, a solenoid-operated selector valve directs pressure from the utility hydraulic system to release the nose gear downlock and the landing gear retracts. When the lever is moved to the DOWN position, the nose landing gear uplock is released, the main landing gear motors are reversed, and the landing gear extends. When the landing gear lever is moved to the down position, it enters a detent which holds the gear lever down. After landing, the touchdown switch deenergizes the landing gear lever release solenoid, engaging a mechanical locking device to hold the gear lever down. During takeoff or in flight, the touchdown switch energizes the landing gear lever release solenoid and retracts the mechanical locking device. If the touchdown circuit fails, the lock release finger latch must be pulled down before the landing gear lever can be removed to the UP position.

Landing Gear Controls and Indicators

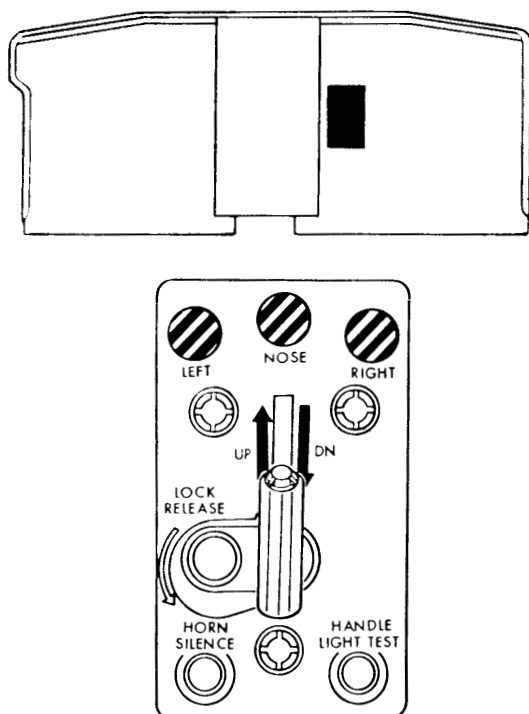


Figure 1A-89

Main Landing Gear Selector Valve

A landing gear selector valve (figure 1A-86) is mounted on the left-hand hydraulic panel, forward of the wheel well. It is a solenoid-operated valve, directing the flow of utility hydraulic fluid to either the up or down side of the landing gear hydraulic motor for the normal extension and retraction of the landing gear, as selected by the landing gear lever. Manual override controls, consisting of two buttons marked up and down, are located on the selector valve for use in case of electrical failure. Pushing the button marked down routes hydraulic fluid to release the landing gear spring-loaded brakes and drives the hydraulic motor gear boxes, extending the gear to the down position. Depressing and holding the up button will retract the landing gear. The valve provides positive down hydraulic pressure any time the gear is commanded to the down position through the use of a detent, locking the valve in the down position. This valve positioning also provides routing for hydraulic fluid for nosewheel steering.

Main Landing Gear Touchdown Switch

28V ISOL DC P Side
TOUCHDOWN RELAY

A touchdown switch is installed on the lower aft side of each forward main gear strut. The switches are safety devices which either prevent some airplane system from operating or permit it to operate when the airplane is on the ground, or in flight. The weight of the airplane on the gear operates these switches. Some systems are wired directly through the touchdown switches and others operate through relays which are controlled by the touchdown switches. Systems that are affected by the touchdown switches and relays are as follows:

Touchdown switch

1. Engine ground stop (inoperative in flight)
2. Dump mast shutoff valves (closed on ground, open in flight) (1500 series)
3. Touchdown relay
 - a. Landing gear control handle lock (unlocked in flight)
 - b. Wheel brakes (anti-skid) (brakes inoperative in flight)
 - c. Cockpit controls for ramp and aft cargo door (inoperative on the ground)
 - d. Bottom strobe light
4. Auxiliary touchdown relay

- a. GTC control power and door control (inoperative in flight) (1500 series)
- b. DC bus tie control (inoperative in flight)
- c. APU door control (door opens 35 degrees on the ground and 15 degrees in flight) (1600 series, CG 1790, and 1700 series)
- d. TAS input (inoperative on ground) (CG 1790 and 1700 series)
- e. Autopilot trim monitor test (inoperative in flight) (1600 series, CG 1790, and 1700 series)
- f. TCAS/Mode S

Emergency Engaging Handle

A yellow emergency engaging handle is located on the forward wall of each wheel well, just below the extension shaft of the landing gear manual operation stub shaft. The handle operates a cable which disengages the main landing gear hydraulic brake and the drive motor, and simultaneously engages the mechanical linkage which connects the stub shaft to the gearbox, thereby permitting manual raising or lowering of the main landing gear. The emergency engaging handle must be pulled out to its stop and rotated counterclockwise to engage the manual extension system. After each manual extension or retraction of the main landing gear, the handle must be turned one-quarter turn clockwise to unlock, and then be released to the normal position. Proper shifting of the mechanism can be verified by rotating the hand crank in both directions. If the handle is in the normal position, the hand crank will rotate freely.

Landing Gear Hand Crank

Two landing gear hand cranks are provided for the manual operation of the main landing gears. One hand crank is stored in retaining clips on the forward face of the left wheel well, and the other is stored on the fuselage wall forward of the right wheel well. One end of each crank is made to fit over the protruding end of the extension stub shaft. An extension stub shaft is located on each wheel well forward wall, just above the emergency engaging handles.

Main Landing Gear Emergency Extension Wrench

The emergency extension wrench is provided for manual extension of the main landing gear after both the normal and emergency extension systems fail to extend the gear. The wrench has a fixed socket on one end and a ratchet and socket on the other end. The wrench is used to manually rotate the landing gear ballscrews to lower the struts. The wrench is stowed on a sidewall litter stanchion, forward of the left main landing gear wheel well, on all airplanes.

Main Landing Gear Ground Lock

Two main landing gear ground locks are provided for use while performing maintenance on the gear, to prevent accidental retraction of the main landing gears. The locks are installed on the hexagonal ends of the main landing gear screw assemblies, one lock on each side of the airplane. The locks are stowed in the miscellaneous equipment box aft of the right paratroop door.

Nose Landing Gear Ground Pin

A nose landing gear ground pin (figure 1A-88) is provided to prevent accidental retraction of the nose landing gear while the airplane is parked. The ground pin consists of a ball-lock pin which is inserted in a hole in the actuator rod-end and prevents release of the internal downlock of the actuator. The pin is stored in the back of the pilot's seat or by the flight station ladder.

Nose Gear Emergency Release Handle

A nose gear emergency release handle (figure 1A-90) is located below the floor of the flight station under a hinged panel between the copilot's seat and the control pedestal. The handle operates a cable system which releases the nose landing gear uplock and allows the nose gear to fall free.

Nose Gear Uplock Emergency Release Handle

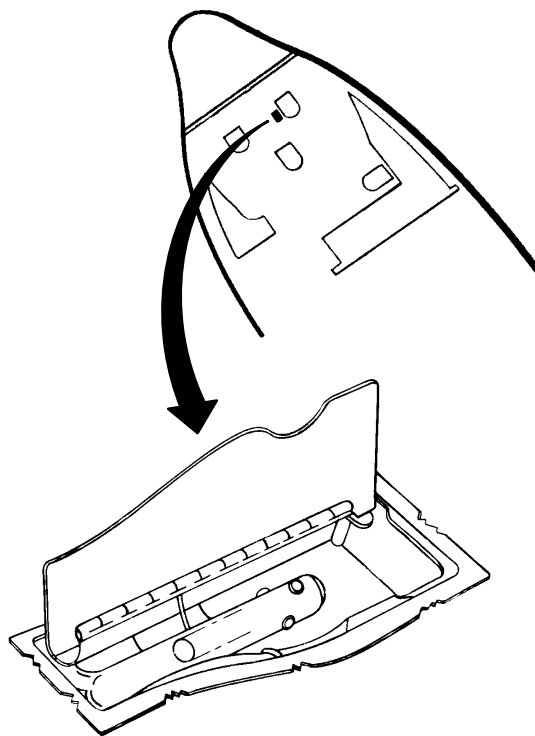


Figure 1A-90

MAIN LANDING GEAR SAFETY STRAP

Two main landing gear safety straps are provided to secure the main landing gear struts in the event of component failure or partial extension of the main landing gear (figure 1A-91). The main landing gear safety straps are stored in a rack provided aft of the right paratroop door. The main landing gear safety strap consists of four main parts: a beam to span the main landing gear access panel opening and to rest against the main landing gear vertical beams. A looped strap, which is used to wrap around the main landing gear strut. A hooked end rod, which hooks the looped strap, thereby completely encircling the main landing gear strut. A pin is used to connect the looped strap to the beam. The main landing gear safety strap replaces chains for securing the gear and does not normally require the repositioning of cargo positioned between the wheel wells.

LANDING GEAR SYSTEM INDICATORS

Landing gear warning signals are presented by a horn and a light. Landing gear positions are indicated by three indicators.

NOTE

The landing gear warning horn and light operate from the same circuit. Failure of either individual landing gear warning circuit will cause the horn to remain silent and the light to remain out.

Landing Gear Warning Horn and Silence Switch

28V ESS DC CP Side
LANDING GEAR-WARN LIGHT

The landing gear warning horn is located above and to the left of the pilot's seat. Two things will cause the landing gear warning horn to sound: retarding a throttle to a position within 5 degrees forward of the FLIGHT IDLE position with the landing gear up, and extending the flaps more than approximately 70 percent with the landing gear up. A warning horn silence switch (figure 1A-89) is located on the landing gear control panel. It is a press-type switch used to silence the landing gear warning horn when a throttle is retarded. It will not silence the horn when flaps are extended more than 70 percent with landing gear up. When the switch is pressed, the horn silencing relay is actuated, and the warning horn electrical circuit is broken. Cycling of the landing gear or advancement of an engine throttle will reset the horn-silencing relay, so that the horn can sound again.

Landing Gear Warning Light and Warning Light Test Switch

28V ESS DC CP Side
LANDING GEAR-WARN LIGHT

The landing gear warning light is connected to the landing gear retraction system and the throttle warning switches; it will illuminate whenever the landing gear is not in a locked position, or when an engine throttle is retarded to within 5 degrees of FLIGHT IDLE position and the landing gear is not fully extended. A warning light test switch (figure 1A-89) is located on the landing gear control panel. It is a press-type switch, used to test the continuity of the landing gear warning lights electrical circuit. When the switch is pressed, the landing gear warning light bulbs in the landing gear lever handle will illuminate. Failure of the bulbs to illuminate shows a defective circuit.

Landing Gear Position Indicators

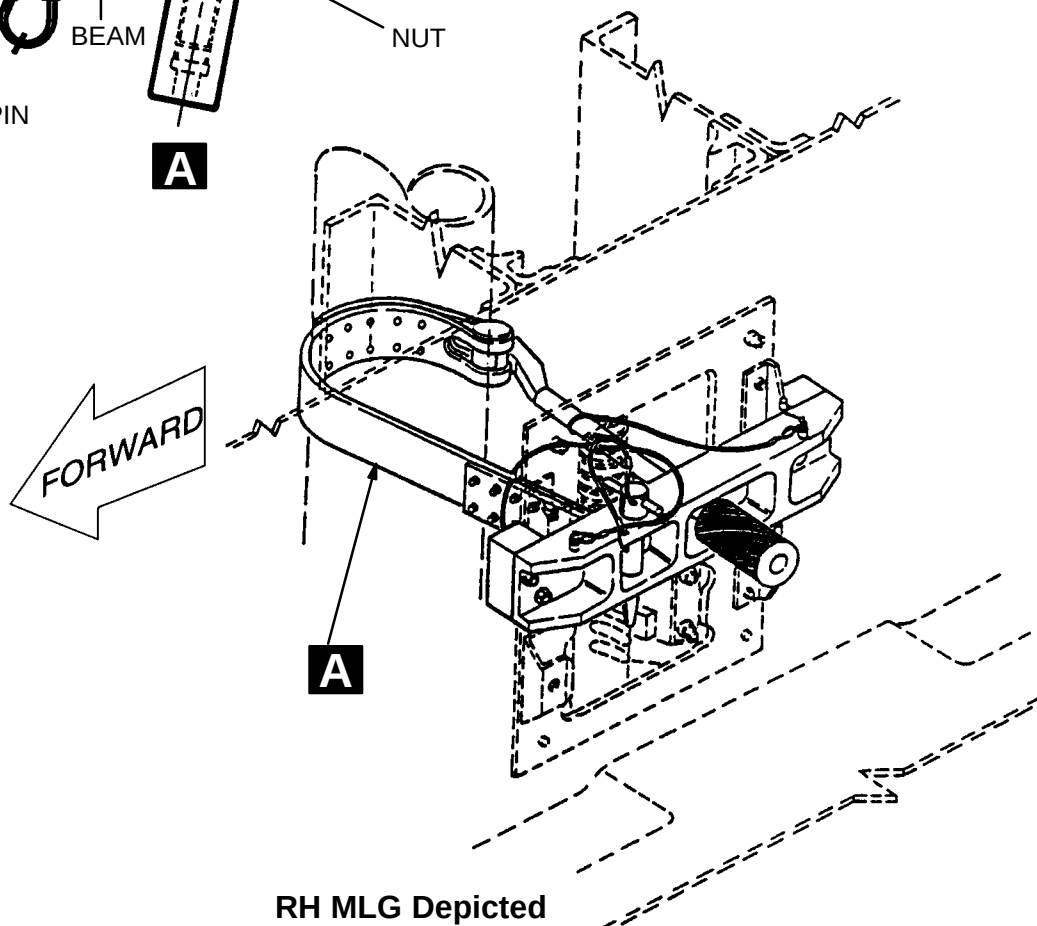
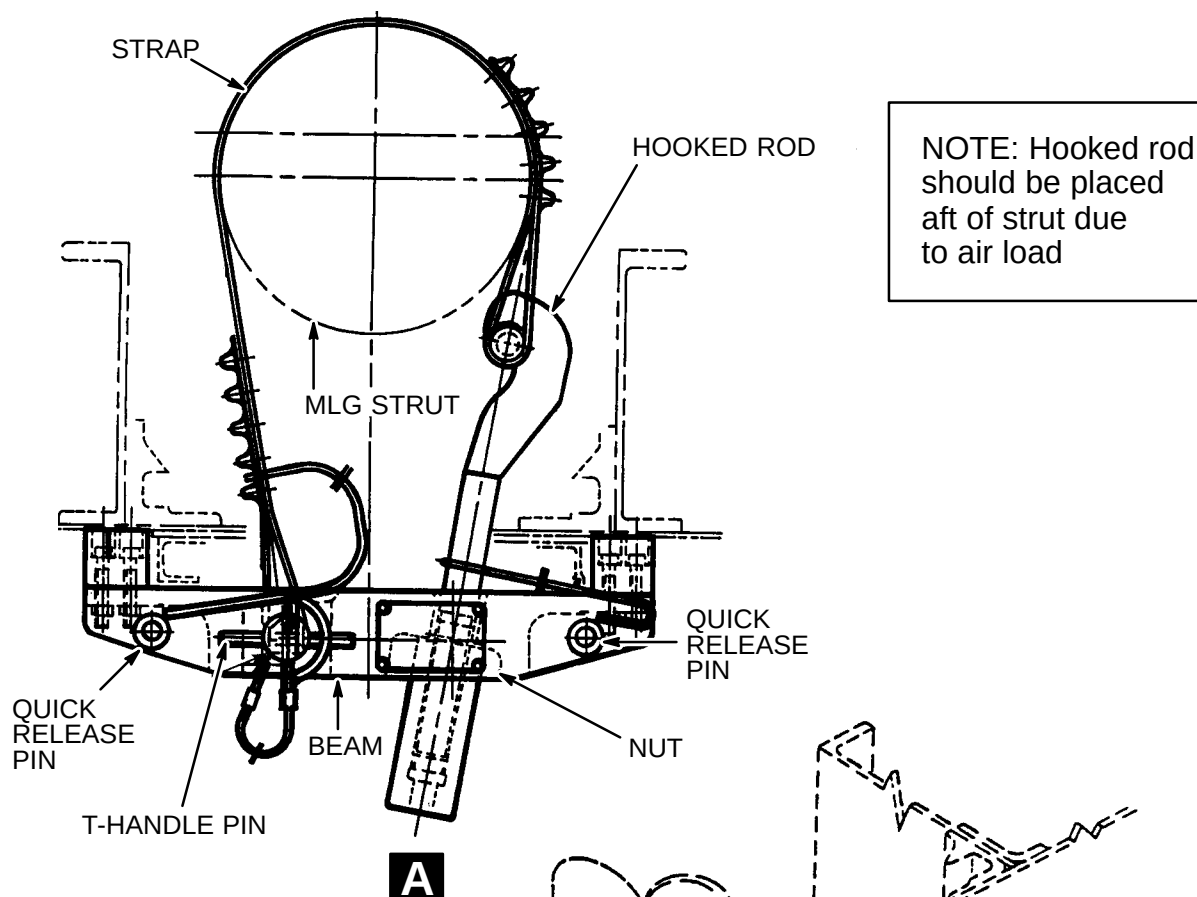
28V ESS DC CP Side
LANDING GEAR-POSITION IND

A left main gear position indicator, a nose gear position indicator, and a right main gear position indicator (figure 1A-89) are located on the landing gear control panel. These indicators give a visual indication of position of the landing gear. When the letters UP appear on the face of an indicator, it means that the gear represented by that indicator is retracted and locked. When the picture of a landing gear wheel appears on the face of an indicator, it means that the landing gear represented by that picture is extended and locked. Diagonal stripes on the face of an indicator mean that the landing gear represented by that indicator is somewhere between the extended and retracted positions or that the indicator is inoperative.

NOSEWHEEL STEERING SYSTEM

The airplane is steered during taxiing by directional control of the nose wheel. The nosewheel is hydraulically actuated and governed by a steering control valve in the utility hydraulic system. The steering control valve is connected by a cable to a manually operated nose steering wheel (figure 1A-92) located in the flight station at the left of the pilot's control column. Directional control of the nosewheel is limited by means of mechanical stops to 60 degrees right and left of center. One and one-quarter turns from center position of the nose steering wheel will turn the steering wheel to the full-left or the full-right position. Orifices in the steering cylinders provide snubbing action to dampen oscillations of the nosewheel and to prevent shimmy. Centering cams on the nose gear strut return the nosewheel to a centered position whenever the weight of the airplane is removed from the nose gear.

Main Landing Gear Safety Strap



RH MLG Depicted

Figure 1A-91

BRAKE SYSTEM

A hydraulically operated, multiple disk brake is installed on each of the main landing gear wheels. The nose landing gear wheels do not have brakes. The brakes normally operate from utility hydraulic system (figure 1A-93) pressure with an alternate supply available through the auxiliary hydraulic system. If electrical power is off, both systems are available to supply pressure to operate the brakes. The system with the higher pressure will cause the shuttle valve to shift as necessary to provide pressure. Fluid flows through a brake pressure selector valve to the right-hand and left-hand brake control valves where the hydraulic pressure is reduced from 3,000 psi to 2,030 psi. When the fluid leaves the brake control valves, it flows through the anti-skid valves and shuttle valves to the brakes. Each of the two halves (left and right) of the brake system contains a brake control valve, and anti-skid valve, and two brake shuttle valves. The auxiliary system supply flows through the emergency brake pressure selector valve.

Steering Wheel

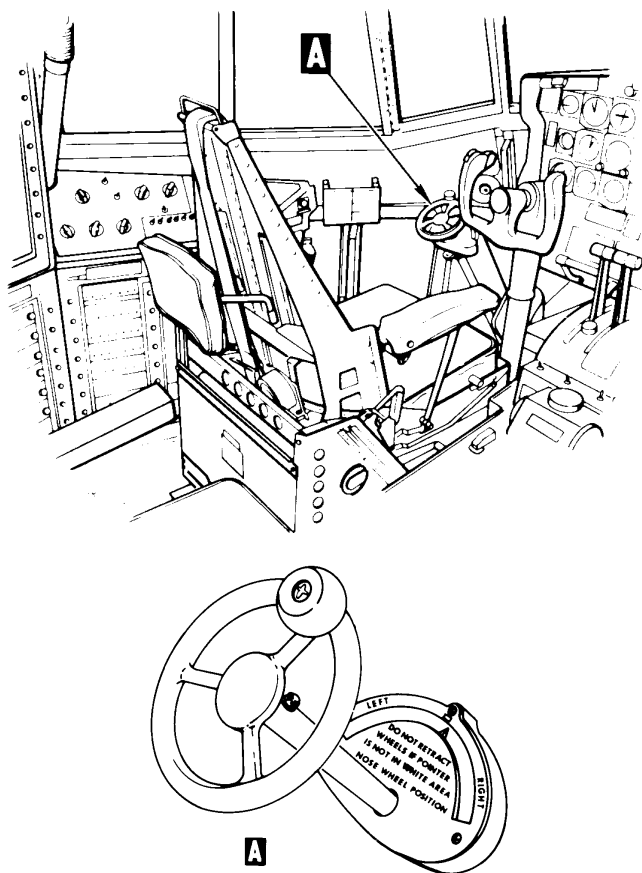


Figure 1A-92

When the emergency brake system is actuated, fluid is directed to the brake control valves, then through shuttle valves directly to the brakes, bypassing the anti-skid valves. Utility or auxiliary system pressure is selected by manually positioning a brake pressure selector switch. Auxiliary system hand pump pressure can also be used for brake operation during towing operations when utility or electrically-driven auxiliary hydraulic system pressure is not available. This will give only one brake application; therefore, the brake pedals should be depressed firmly and held when braking is required. System pressure will not build up when the brake pedals are pumped on and off while the auxiliary system hand pump is being operated.

BRAKE SYSTEM ACCUMULATORS

Air charged accumulators are used in both the normal brake and the emergency brake hydraulic systems to provide a reserve source of hydraulic pressure in the event of certain system failures and to absorb pressure surges. The accumulator in the normal system is 100 cubic inches and when fully charged is capable of supplying pressure for about two applications with the anti-skid off or on (providing there is no activation of the brake anti-skid control valves). The two brake applications should be made within 30 seconds of each other with good braking technique (one smooth application held until the aircraft stops) used. The accumulator in the emergency brake system is 50 cubic inches and is capable of supplying pressure for one brake application.

BRAKE SYSTEM CONTROLS

Mechanical and electrical brake system controls (figure 1A-93) are furnished to operate the brakes by hydraulic power.

Brake Pedals

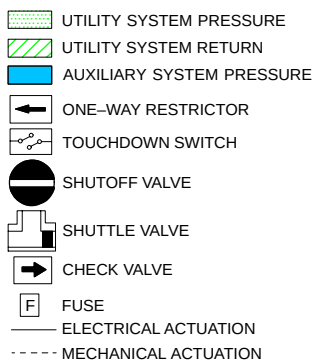
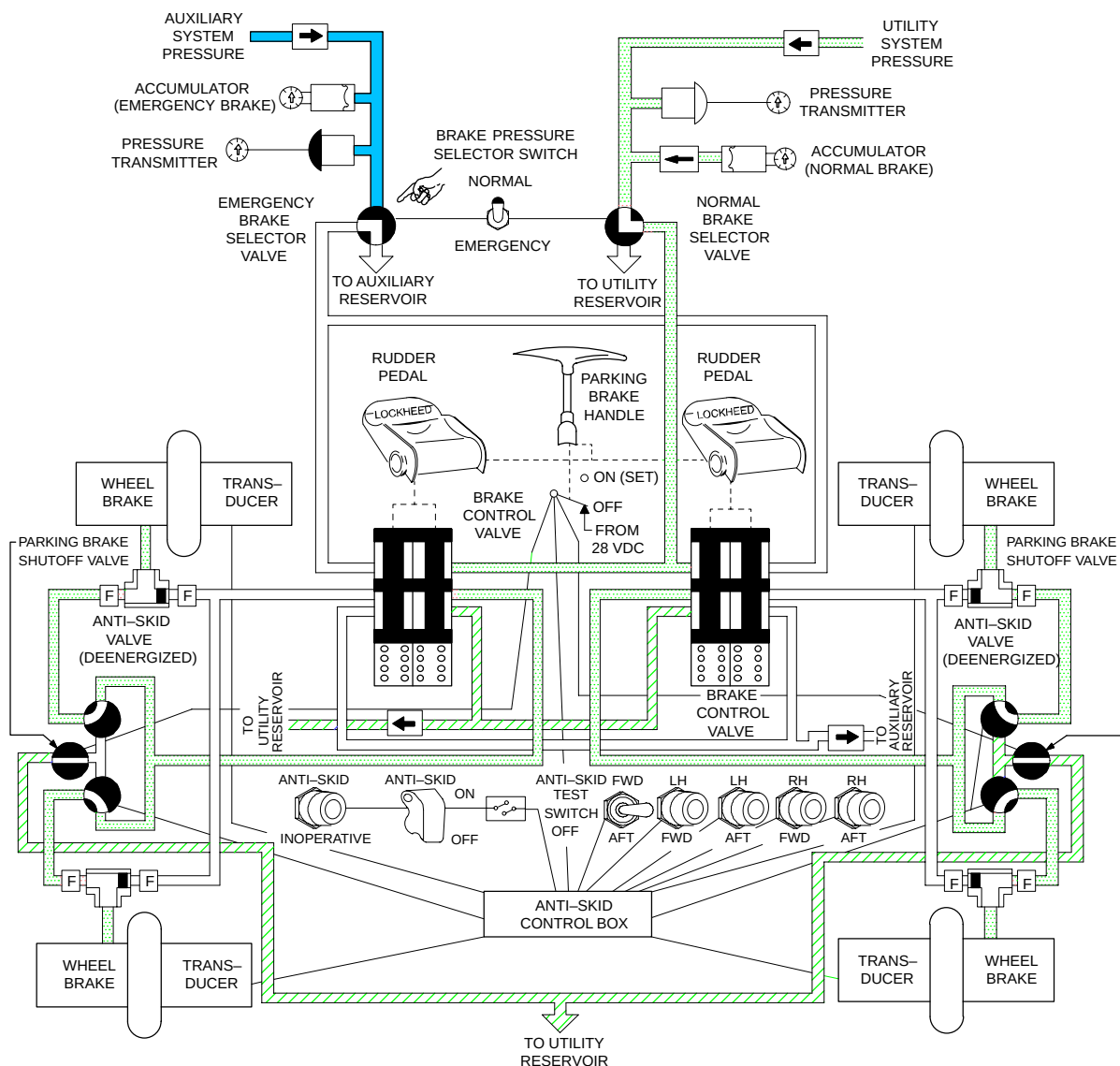
Actuation of the brakes is done through application of toe pressure on the rudder pedals at either the pilot's or copilot's station. The amount of braking force is proportional to the force applied to the brake pedals. The right pedals actuate the right brakes, and the left pedals actuate the left brakes. This arrangement allows directional control of the airplane through differential braking. Application of normal brake pressure before touchdown is prevented when the anti-skid system is energized.

Brake Pressure Selector Switch

28V	ESS DC	CP Side
LANDING GEAR CONTROL		
EMER-BRAKE VALVE		
28V	MAIN DC	CP Side
ANTI-SKID CONTROL		

A two-position (NORMAL, EMERGENCY) brake selector toggle switch (figure 1A-82) located on the hydraulic con-

Main Landing Gear Brake System



NOTE

BRAKE PRESSURE SELECTOR SWITCH SHOWN IN NORMAL (UP) POSITION, WITH NORMAL BRAKE SELECTOR VALVE DEENERGIZED AND EMERGENCY BRAKE SELECTOR VALVE ENERGIZED. IN EMERGENCY POSITION (SWITCH DOWN) THE NORMAL BRAKE SELECTOR VALVE IS ENERGIZED (TO RETURN) AND THE EMERGENCY BRAKE SELECTOR VALVE IS DEENERGIZED, CONNECTING AUXILIARY PRESSURE. COMPLETE POWER FAILURE LEAVES BOTH VALVES OPEN TO SUPPLY PRESSURE FROM THEIR RESPECTIVE SYSTEMS. BRAKE SELECTOR VALVES ARE SOLENOID CONTROLLED. ANTI-SKID VALVES ARE ELECTRO-HYDRAULIC OPERATED. PARKING BRAKE SHUTOFF VALVES ARE SOLENOID OPERATED (DEENERGIZED CLOSED).

Figure 1A-93

trol panel provides selection of either normal or auxiliary hydraulic pressure for applying the brakes. The NORMAL position will supply utility hydraulic pressure to the brakes, and the EMERGENCY position will supply auxiliary hydraulic pressure to the brakes. With the brake selector switch in the NORMAL position and the landing gear lever in the UP position, the normal brake selector valve is energized closed by 28-volt dc power from the essential dc bus through the landing gear control circuit breaker on the copilot's lower circuit breaker panel. When the landing gear lever is placed to DN, the normal brake selector is deenergized to open. With the brake selector switch in the EMERGENCY position, the normal brake selector valve is energized closed by 28-volt dc power from the main dc bus through the anti-skid control circuit breaker on the copilot's lower circuit breaker panel. The emergency brake selector valve is energized by 28-volt dc power from the essential dc bus received through the EMER BRAKE VALVE circuit breaker located on the copilot's lower circuit breaker panel. Both the normal brake selector valve and the emergency brake selector valve are deenergized open.

NOTE

In case of dc electrical power failure, the deenergized valves can admit either utility or auxiliary hydraulic system pressures to the brake system. The shuttle valve is positioned by the system supplying the greater pressure.

Parking Brake Control Handle

A parking brake handle (figure 1A-94) is located in front of the pilot's seat, to the right of the pilot's right foot rest. The handle is mounted on a panel support and is attached to a flexible cable. This cable pulls a pawl into a detent in the brake control lever to lock the pedals in a depressed (brakes on) position. The brakes are set for parking by first fully depressing the toe section of the rudder pedals, then pulling firmly on the parking brake handle while letting off slowly on the brakes. The brakes are released by depressing the toe section of the rudder pedals. When the parking brake is set with power on the airplane and the antiskid switch ON, a solenoid in the anti-skid valve is deenergized to block the return port of the anti-skid valve. This prevents rapid leakage and subsequent release of the pressure used for setting the parking brake. With power on the airplane, the anti-skid inoperative light will illuminate when the parking brake is set.

BRAKE PRESSURE INDICATORS

26V	AC INST & ENG FUEL	P Side
	CONT BUS	FUSE
	INST TRANSF	

INDICATOR HYD PRESSURE BRAKE-EMER or NORMAL BRAKE

Two brake pressure indicators (figure 1A-82) are located on the hydraulic control panel at the bottom of the copilot's instrument panel. The indicators are connected to pressure transmitters in the pressure lines of the brake control system and register the hydraulic pressure available in the brake sections of both the utility and auxiliary hydraulic systems.

ANTI-SKID SYSTEM

28V MAIN DC CP Side

ANTI-SKID CONTROL

ANTI-SKID FAIL-SAFE LIGHT

The anti-skid system consists of four wheel-speed transducers, an electrical control box, and two dual electrohydraulic servo brake pressure control valves.

Anti-Skid System Operation

The system (figures 1A-82, 1A-93 and 1A-95) prevents skidding of wheels when too much brake pressure is applied during airplane decelerations. This is done through a brake-releasing system, controlled by signals from wheel-speed transducers.

Parking Brake Handle

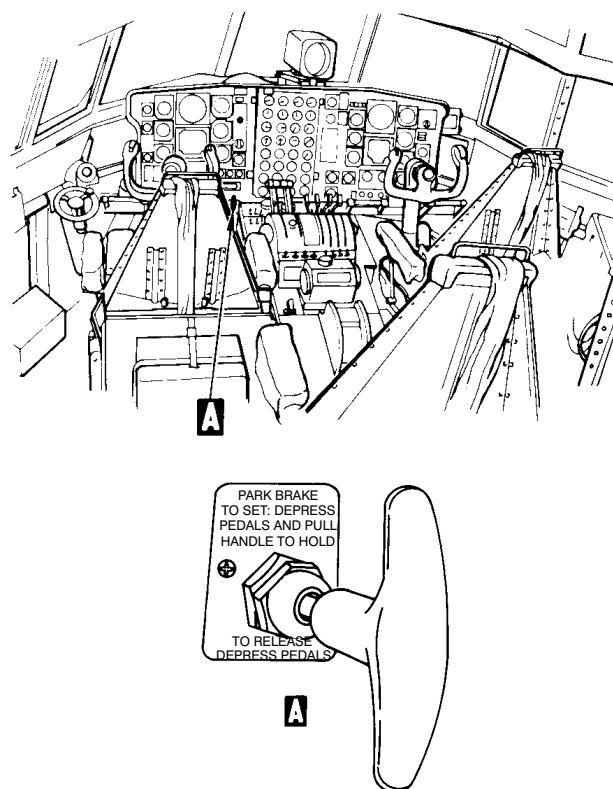


Figure 1A-94

SKID-DETECTOR OPERATION

The wheel-speed transducer unit mounted in the axle of each main landing gear wheel applies control to the braking operation through the anti-skid valves when the landing gear wheel begins to approach a skid condition. One dual anti-skid valve is located above the booster hydraulic reservoir on the right forward wheel well wall, and the other is on the left-hand hydraulic panel forward of the utility hydraulic reservoir. Each wheel-speed transducer unit contains a frequency generator which senses wheel rotational speed and wheel speed change. The transducers form part of an electrical circuit which prevents landing with brakes on, and which releases brakes in case of a locked condition. Should the wheel speed decrease rapidly, indicating approach of a skid condition, the control box sends an electric impulse to an anti-skid valve which reduces pressure to the affected brake below the pressure which caused sensing of the skid. As subsequent skids are sensed, they are electronically compared with the amount the hydraulic pressure had to be reduced to eliminate earlier skids detected. This comparison results in a more accurate determination of the minimum reduction in brake pressure required to eliminate the skid. The skid detection and control function is independent on each wheel. The skid control system will not function when the brake system is operating from the auxiliary hydraulic system or when the parking brakes are set.

Anti-Skid Test Panel

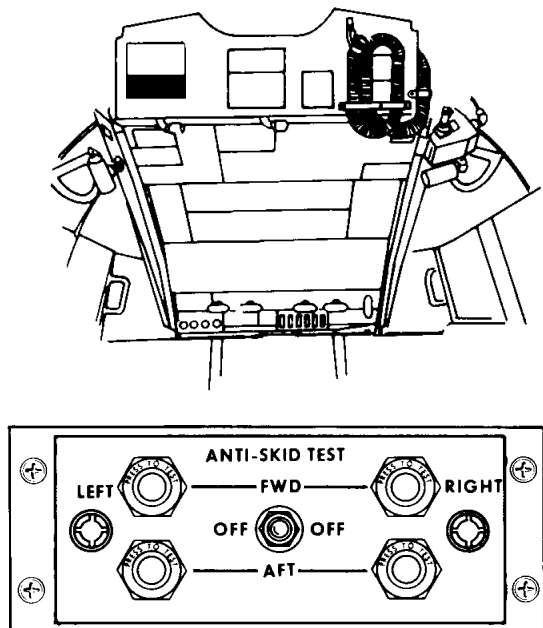


Figure 1A-95

ANTI-SKID SYSTEM CONTROLS AND INDICATORS

Anti-Skid Switch

An anti-skid two-position (OFF, ON) guarded toggle switch (figure 1A-82) is located on the hydraulic control panel. When the switch is in the ON position, the anti-skid system is operative and becomes an integral part of the wheel brake system. When the switch is in the OFF position, the landing gear brake system operates as a standard brake system.

Anti-Skid Inoperative Light

An anti-skid inoperative light (figure 1A-82), located on the hydraulic control panel, illuminates whenever the anti-skid system is not operating as an integral part of the landing gear brake system. It warns the pilot that skid protection has been lost on all wheels. A functional test of the light circuit is made by pressing on the light bulb cover. Failure of the light to illuminate shows a defective circuit.

The anti-skid inoperative light should illuminate under the following conditions: (1) When the anti-skid system is turned off, (2) Emergency brakes are selected, (3) Parking brake is set, or (4) A loss of electrical power to the control box.

Anti-Skid Test Switch and Indicator Lights

26V AC INST & ENG FUEL CONT P Side
ANTI-SKID TEST 26 VAC

An anti-skid test panel (figure 1A-95) is located on the aft end of the overhead control panel. The test panel contains a three-position (FWD, OFF, and AFT) anti-skid test switch and four green indicator lights identified as LEFT FWD, RIGHT FWD, LEFT AFT, and RIGHT AFT. When the test switch is placed in the FWD position, 26-volt, 400-cycle power obtained from the ac instrument and engine fuel control bus (through the anti-skid test circuit breaker, located on the pilot's lower circuit breaker panel) is applied to the anti-skid control box to simulate a skid condition. When the switch is released to the OFF position, the FWD indicator lights should illuminate momentarily. Illumination of the lights indicates that the anti-skid control box would have properly responded to an actual skid. When the test switch is placed in the AFT position and released, the AFT indicator lights should illuminate momentarily.

CARGO DOOR AND RAMP SYSTEM

The cargo door and cargo ramp, providing entry for wheeled vehicles and large loads, are used also for egress during aerial delivery system operations. Normal operation of the door

and ramp is achieved by hydraulic pressure supplied through the auxiliary hydraulic system (figure 1A-96). The operating pressure can be supplied in an emergency by a hand pump connected to the reservoir of the auxiliary hydraulic system. Control of the system is accomplished electrically or manually from a ramp control panel, located aft of the left paratroop door, or electrically from the airdrop system (ADS) control panel (figure 1A-99) on the flight control pedestal. The airdrop system control panel, however, cannot be operated while the airplane is on the ground. (CG 1790 and 1700 series) The cargo door actuating systems incorporate an independent hydraulic snubber to prevent the door from being rapidly driven from the uplock during closing. The snubber quantity indicator and servicing instructions are on the snubber cylinder.

CARGO DOOR AND RAMP CONTROL

28V	ESS DC	AFT Junction
RAMP AND ADS CONT		Box

Cargo Door Control Switch

A cargo door control switch is located on the ramp control panel (figure 1A-97) aft of the left paratroop door. This three-position (CLOSE, neutral, OPEN) toggle switch, spring-loaded to the neutral position, controls the normal ground operation of the aft cargo door. When the switch is held in the OPEN position, the aft cargo door control valve is energized. The control valve directs hydraulic pressure to the open side of the aft cargo door actuating cylinder to open the aft cargo door. As the door reaches the open position, it engages the cargo door uplock assembly, which latches mechanically. When the switch is held in the CLOSE position, hydraulic pressure is directed to the aft cargo door uplock cylinder, which unlatches the uplock. The control valve also directs pressure to the close side of the cargo door actuating cylinder, and the door swings downward to the closed position and locks in place. When the switch is released, the cargo door circuit is deenergized and the valves return to a neutral position.

Ramp Control Switch

A ramp control switch is located on the ramp control panel (figure 1A-97) aft of the left paratroop door. This three-position (RAISE, neutral, LOWER) toggle switch, spring-loaded to the neutral position, controls the normal ground operation of the ramp. When the switch is held in the LOWER position, the ramp control valve is energized. The control valve directs hydraulic pressure to the up side of the ramp-actuating cylinders and to the uplock side of the ramp uplock control valve, until the uplock is unlatched. The hydraulic pressure then is directed to the down side of the

ramp-actuating cylinders to lower the ramp. When the switch is held in the RAISE position, the ramp control valve directs hydraulic pressure to the up side of the ramp actuating cylinders to raise the ramp. At the same time, pressure is directed into the unlock side of the ramp uplock until the ramp is raised into the normal raised position. Pressure is then directed to the lock side of the ramp unlock control valve to lock the ramp in place. When the switch is released, the ramp circuit is deenergized, and the valves return to a neutral position.

Ramp Manual Control Knob

The ramp manual control knob (figure 1A-97) is a rotary selector located above the ramp control panel. It may be set to any of six numbered positions: DOWN 1 (unlock) and 2 (lower); N (neutral) 3; UP 4 (raise) and 5 (lock); N (neutral) 6. These settings of the knob manually position the system valves which control flow, supplied either from the hand pump or the auxiliary hydraulic system electrical pump, to and from the ramp actuating and ramp uplock cylinders. When the knob is placed in position 1, hydraulic pressure is directed to the up side of the ramp extension cylinders to raise the ramp off the uplocks; then pressure is directed to the unlock side of the ramp uplock cylinder to unlatch the ramp uplocks. When the knob is moved to position 2, pressure is directed to the down side of the ramp actuating cylinders to lower the ramp. Position 3 on the selector knob is a NEUTRAL position. When the knob is moved to position 4, pressure is directed to the up side of the ramp actuating cylinders to raise the ramp. Position 5 directs pressure to the lock side of the ramp uplock cylinders to lock the ramp in the closed position. Position 6 on the selector knob is a NEUTRAL position; the knob should be left in this position when the ramp is closed and not being operated.



When operating the ramp manually, always turn the ramp control valve clockwise following the numerical sequence. To do otherwise will cause the valve to malfunction.

Cargo Door Manual Control Valve Handle

The cargo door manual control valve (figure 1A-97) has three positions: OPEN, NEUT, and CLOSE. When the handle is set to OPEN, the valve directs hydraulic pressure, either from the hand pump or the auxiliary hydraulic system electric pump, to the up side of the door actuating cylinder, thus raising and opening the door. On reaching the fully open position, the door is secured by a spring-loaded uplock. When the handle is set to CLOSE, hydraulic pressure, either from the hand pump or the auxiliary system electric pump, is first directed by the valve to the uplock cylinder to release the uplock engagement of the door, and then is directed to the

Cargo Door and Ramp Hydraulic System

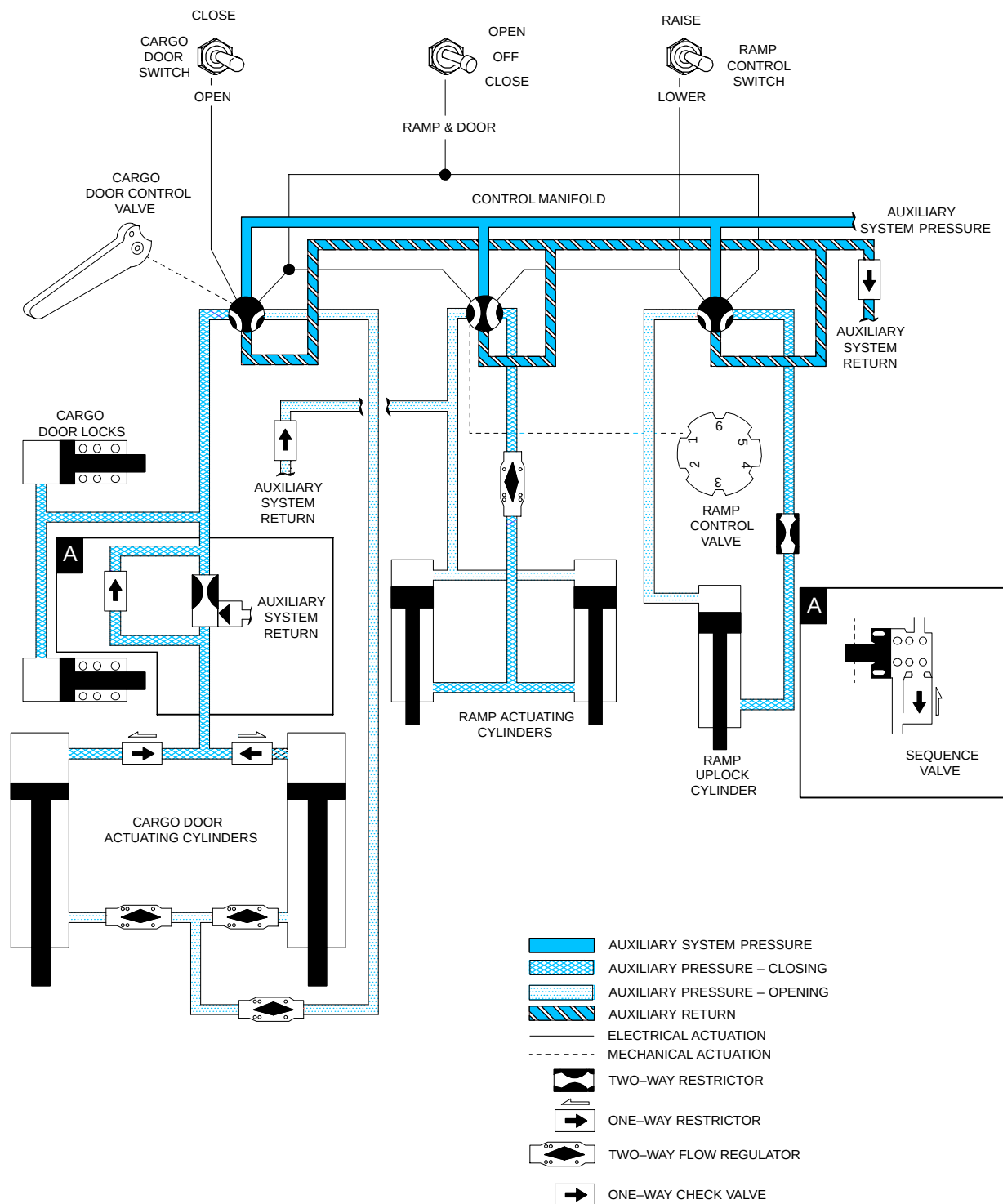
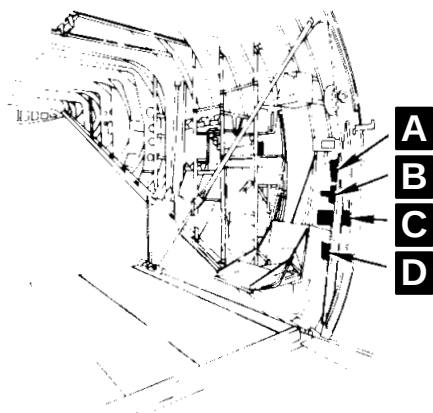


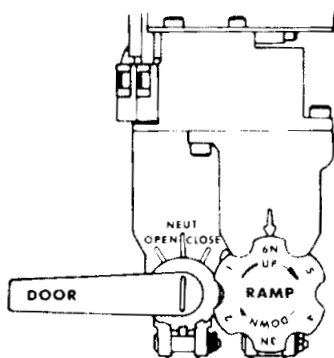
Figure 1A-96

Cargo Door and Ramp Controls

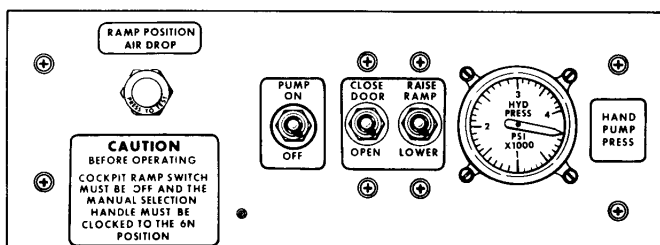


NOTE

TO CLOSE THE RAMP AND DOOR, REFER TO CARGO DOOR AND RAMP OPERATION PROCEDURES IN SECTION 2.



B
MANUAL CONTROL VALVE



C
RAMP CONTROL PANEL

WARNING

BEFORE MANUAL HAND PUMP OPERATION, MOVE SWITCH ON CONTROL PANEL BELOW TO PUMP OFF POSITION.

BEFORE LOADING OR UNLOADING AIRCRAFT AFTER THE RAMP IS IN THE DOWN POSITION, WHILE RAMP CONTROL DIAL IS IN POSITION 2, PUMP UNTIL GAGE INDICATES 500 PSI MIN. THEN DIAL RAMP CONTROL TO POSITION 3.

INSTRUCTIONS

HAND PUMP DOOR AND RAMP OPERATION

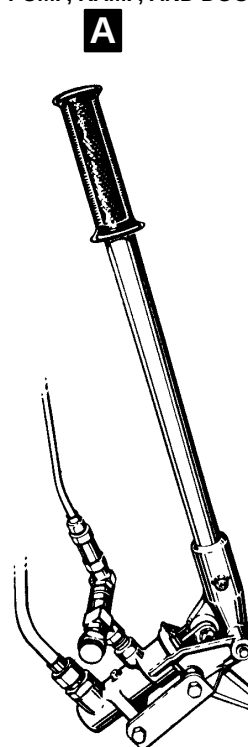
TO OPEN DOOR AND RAMP

1. MOVE DOOR CONTROL HANDLE TO OPEN. PUMP UNTIL DOOR IS UP AND LOCKED.
2. MOVE DOOR CONTROL HANDLE TO NEUTRAL.
3. DIAL RAMP CONTROL TO POSITION 1. PUMP UNTIL GAGE INDICATES 3000 PSI, AND ALL RAMP LOCKS VISIBLY DISENGAGE.
4. DIAL RAMP CONTROL TO POSITION 2. PUMP UNTIL RAMP STOPS IN DOWN POSITION, AND GAGE INDICATES 500 PSI MIN.
5. DIAL RAMP CONTROL TO POSITION 3. LEAVE IT THERE WHILE LOADING AND UNLOADING.

TO CLOSE RAMP AND DOOR

1. DIAL RAMP CONTROL TO POSITION 4. PUMP UNTIL RAMP CLOSES.
2. DIAL RAMP CONTROL TO POSITION 5. PUMP UNTIL GAGE INDICATES 3000 PSI, AND ALL RAMP LOCKS ARE VISIBLY ENGAGED.
3. DIAL RAMP CONTROL TO POSITION 6. LEAVE IT THERE.
4. MOVE DOOR CONTROL HANDLE TO CLOSE. PUMP UNTIL DOOR CLOSES AND LOCKS.
5. MOVE DOOR CONTROL HANDLE TO NEUTRAL.

OPERATING INSTRUCTIONS HAND PUMP, RAMP, AND DOOR



D
HYDRAULIC HAND PUMP

Figure 1A-97

down side of the door actuating cylinder to lower and close the door. Setting the handle in the NEUT (center) position shuts off hydraulic pressure to the door operating system and leaves the control valve in a position from which it can be actuated by selection at the aft cargo door control switch.

WARNING

Caution must be exercised when using the manual control valve handle to open/close the cargo door. On some airplanes, the valve handle must be placed in the down position to open the cargo door, while on other airplanes the valve handle must be placed in the up position to obtain the same results.

WARNING

The cargo door manual control valve handle and the ramp manual control knob must always be placed at the NEUTRAL position when manual operation is not desired; otherwise the door and ramp may open or close when the auxiliary hydraulic pump is turned on.

Auxiliary Hydraulic System Hand Pump

The auxiliary system hand pump (figure 1A-97), just below the ramp control panel, provides an alternative pressure source to operate the cargo door and ramp in an emergency.

NOTE

The hand pump can also be used to provide alternative pressure to operate the nose gear for emergency extension.

Cargo Door Uplock Emergency Manual Release

The cargo door uplock manual release (figure 1A-98) is a mechanical lever intended for emergency use in the event of failure of the hydraulic system to release the spring-loaded uplock. The lever, connected by a system of cables and pulleys to the door uplock mechanism, is mounted on the out-board side of the tubular strut aft of the left paratroop door. The lever, normally stowed in the vertical (locked) position, pivots forward and downward when pulled to release the door uplock mechanism. The lever resumes the vertical position when it is released.

NOTE

Prior to manual release of the uplock, ensure that the auxiliary hydraulic pump is off. After the door free-falls down, place the cargo door manual control valve to CLOSE and actuate the auxiliary hand pump until the door downlocks lock. Do not change position of the cargo door control switch or manual control switch or manual control valve handle while the door is in transit.

Auxiliary Hydraulic System Pump Switch

28V	ESS DC	CP Side
RAMP HYD PUMP CONTROL		
28V	MAIN DC	AFT
RAMP & ADS CONTROL		
115V	ESS AC	P Side
HYD PUMP AUX SYS		

A two-position (ON, OFF) toggle switch, located on the ramp control panel, is used to turn the auxiliary hydraulic system electrically driven pump on and off.

NOTE

If this switch is in the ON position the auxiliary pump cannot be turned off from the cockpit.

CARGO DOOR AND RAMP INDICATORS

Indicators are provided to show auxiliary hydraulic system pressure, engagement of the cargo door in the uplock mechanism, and open positions of the ramp and door for airdrop operations. The pressure indicators are a gauge on the ramp control panel and another on the hydraulic control panel; the door and ramp position indicators are lights on the ramp control panel and the ADS control panel; and the uplock engagement indicator is a mechanically operated metal flag, illuminated by a red inspection light, attached to the aft cargo door uplock mechanism.

Pressure Gauges

26V	AC INST & ENG	P Side
	FUEL CONT	Fuse
INDICATOR HYD PRESSURE-RAMP		

The pressure gauges, one mounted on the ramp control panel (figure 1A-97) and the other on the hydraulic control panel on the copilot's instrument panel, register the pressure of the auxiliary hydraulic system. The gauge located on the ramp control panel is direct indicating, while the one on the copilot's instrument panel is electrically operated. The gauge on the ramp control panel, although registering the system pressure supplied either by the electrically driven pump or the hand pump, is intended primarily for use during hand pump operations and is identified as such on the panel.

Cargo Door Uplock Manual Release

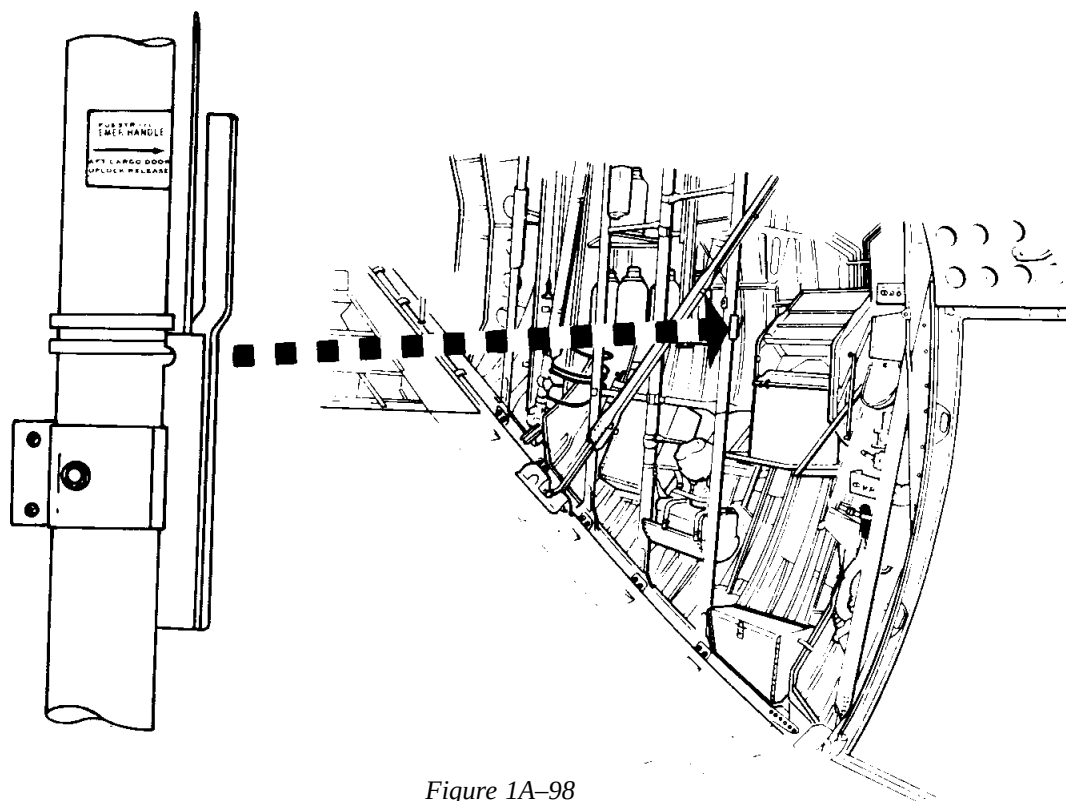


Figure 1A-98

Ramp Position Airdrop Light

28V	MAIN DC	AFT
RAMP & ADS CONTROL		Junction Box

A ramp position airdrop light is located on the ramp control panel (figure 1A-97) aft of the left paratroop door. It is a press-to-test light which illuminates when the ramp is in the airdrop position and the cargo door is open and locked. This press-to-test light will not illuminate when pressed unless the anchor arm supports are in the stowed (raised) position.

Ramp and Door Open Light

28V	MAIN DC	AFT
RAMP & ADS CONT		Junction Box

A ramp and door open light is located on the ADS control panel (figure 1A-99) on the flight control pedestal. This push-to-test light illuminates when the cargo door is fully open and the ramp is lowered to the airdrop position.

Cargo Door Uplock Indicator

The cargo door uplock indicator is a black metal flag with a yellow circle. The flag is attached to the uplock mechanism so that when the cargo door is open and locked in the up position, the flag will swing down to provide a visual indication. The flag is spring-loaded to return to the masked position whenever the cargo door is not locked in the up position. A red inspection light is installed to illuminate the flag indicator. This light is controlled by a two-position (ON, OFF) toggle switch on the aft fuselage junction box and another switch on the forward public address control panel.

FLARE LAUNCHER SYSTEM

28V	ESS DC	CP Side
FLARE LAUNCHER – PWR		
FLARE LAUNCHER – CONTROL		

ADS Control Panel (Typical)



Figure 1A-99

A flare launcher (figure 1A-100), installed in the cargo door, provides launching facilities for ten flares. The launcher is hydraulically operated and electrically controlled from three main control panels and a deactivation switch on the flare launcher activation panel. The three main control panels are located at the copilot's position, left observer's position, and at the right observer's position. Operation of the launcher is achieved by hydraulic pressure supplied through the utility hydraulic system. The launcher is capable of operation with the cargo ramp and door in any position and with the airplane pressurized or unpressurized.

FLARE LAUNCHER HYDRAULIC SYSTEM

The flare launcher hydraulic system, with pressure supplied from the utility hydraulic system, consists of a solenoid-operated shutoff valve, ten two position solenoid-operated selector valves (one for each tube), and ten flare launching tube door actuating cylinders (one for each tube). The cylinders and selector valves (figure 1A-100) are installed at the launcher in the cargo door. The shutoff valve can be controlled by the arming switch on any of the flare launcher control panels. The selector valves can be controlled by the launching switches on any flare launcher control panel or manually overridden by the override buttons on the valve. When an arming switch is positioned to ARM, the shutoff valve is energized to allow hydraulic pressure to flow to each of the ten selector valves. When a launching switch on the same panel is positioned to FIRE, the corresponding selector valve is energized open, allowing pressure flow to the door actuating cylinder to open the door. When the launching switch is repositioned to OFF, the selector valve is deenergized allowing the door to close.

FLARE LAUNCHER SYSTEM CONTROLS AND INDICATORS

Except for a deactivation switch located on the flare launcher activation panel, which is used to deactivate the system, all controls are located on the three flare launcher control panels (figure 1A-100). One panel is located overhead at the copilot's position and a panel is located at each observer's position. Each control panel contains an arming switch, a system armed light, a system deactivated light, ten launching switches, and ten flare released lights.

Deactivation Switch

A deactivation switch is installed on the flare launcher activation panel (figure 1A-100). This switch is a two-position (ACTIVATE and DEACTIVATE) toggle type by which the flare launcher system may be rendered inoperative from the aft end of the cargo compartment. When the switch is in the ACTIVATE position, power is supplied to each of the launching switches on the flare launcher control panels.

When the switch is in the DEACTIVATE position, all power to the flare launcher system controls is cut off.

Arming Switch

An arming switch is installed on each of the three flare launcher control panels. This switch is a two-position (ARM and SAFE) guarded toggle type used to arm the flare launcher system for operation. When an arming switch on any flare launcher control panel is positioned to ARM and the deactivation switch on the flare launcher activation panel is at ACTIVATE, power is supplied to open the solenoid-operated hydraulic shutoff valve and allow hydraulic pressure flow to the ten flare launcher selector valves at the launcher. The arming switch also supplies power to the ten launching switches on the same control panel.

NOTE

For control of the flare launcher system from any flare launcher control panel, the arming switch on that panel must be positioned to ARM.

Launching Switches

Ten launching switches are installed on each of the three flare launcher control panels. Each switch is a two-position (FIRE and OFF) toggle type used to open a launcher tube door, which corresponds with the switch, thus allowing a flare to be ejected. When the system armed light on a flare launcher control panel is illuminated, and a launching switch on the same panel is positioned to FIRE, power is supplied to open a corresponding solenoid-operated selector valve at the flare launcher, allowing hydraulic pressure flow to the door actuating cylinder, thus opening the door and allowing the spring-loaded launching mechanism to eject the flare. When the flare-released light illuminates, and the switch is repositioned to OFF, the selector valve is deenergized, allowing the door to close.

System Armed Light

A system armed light is installed on each of the three flare launcher control panels and on the flare launcher activation panel. The light on each of the flare launcher control panels is of the press-to-test type. The light on the flare launcher activation panel will illuminate when an arming switch on any launcher control panel is positioned to ARM, and the deactivation switch is positioned to ACTIVATE. The system armed light on a launcher control panel will illuminate only when the arming switch on the same panel is positioned to ARM and the deactivation switch is positioned as outlined above.

Flare Released Lights

Ten flare-released lights are installed on each of the three flare launcher control panels. The lights, when illuminated,

Flare Launcher Controls

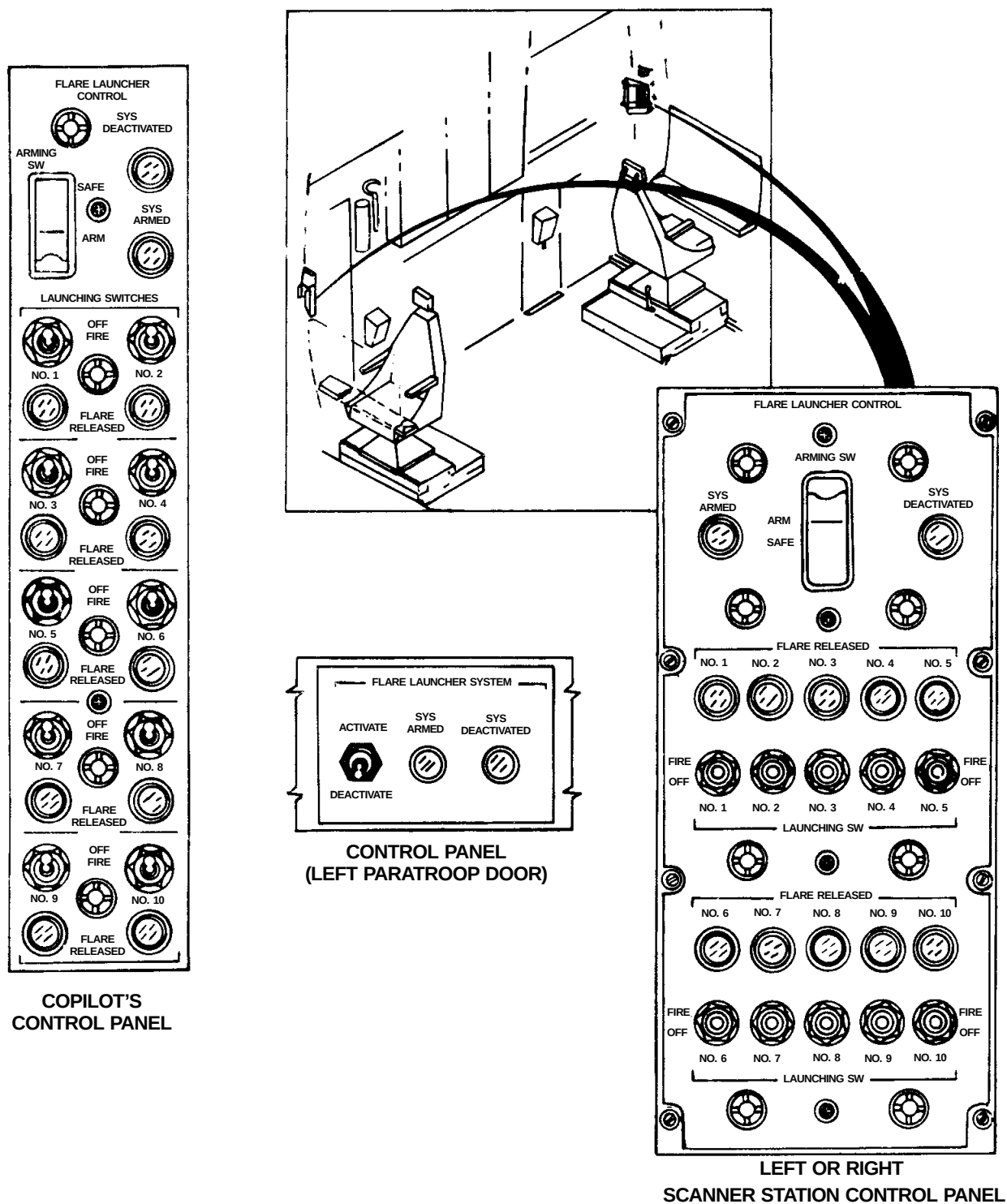


Figure 1A-100 (Sheet 1 of 2)

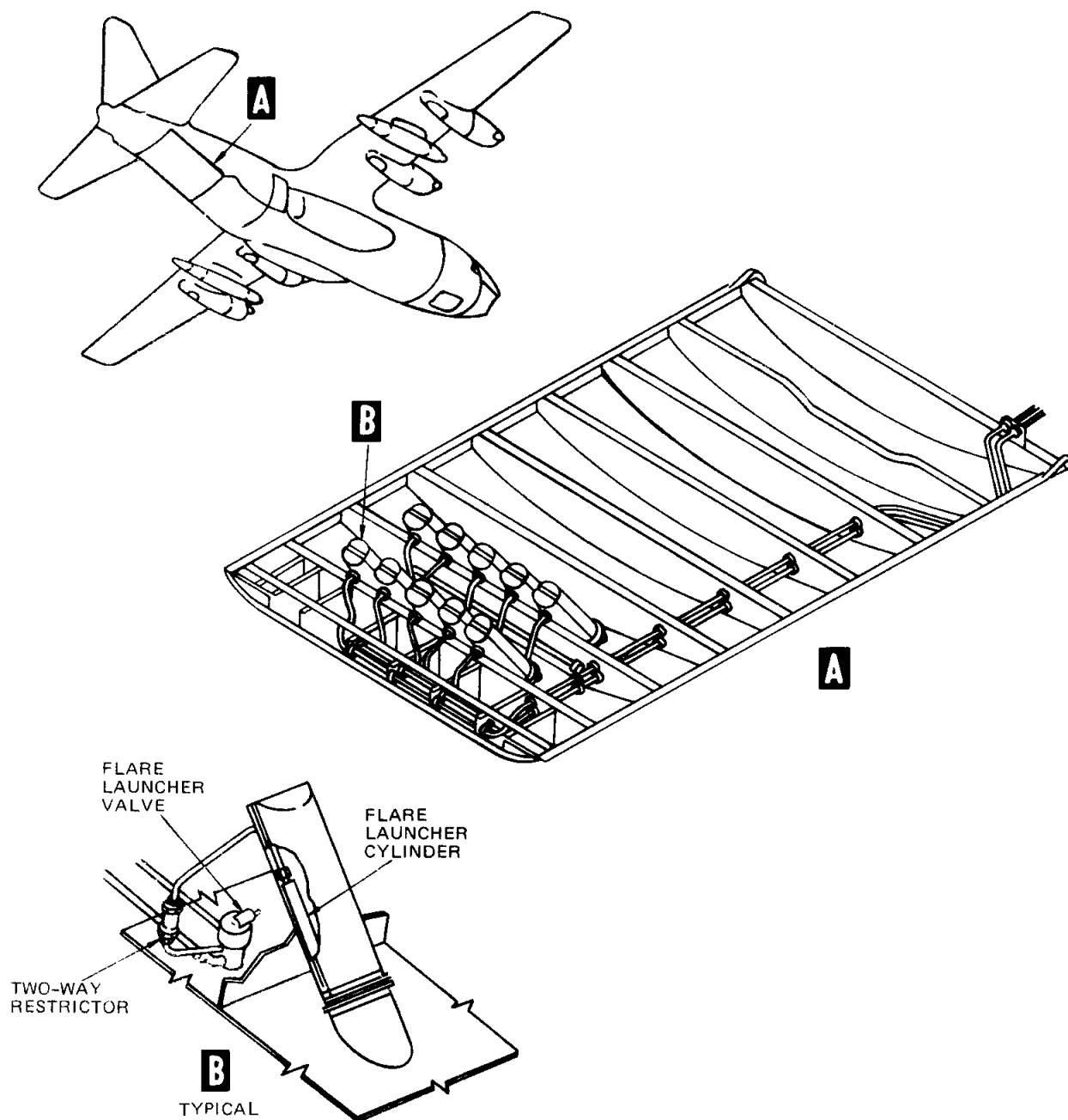


Figure 1A-100 (Sheet 2 of 2)

indicate that the flares have been released and that the spring-loaded ejector plates have reached the limit of their travel. The push-to-test lights will illuminate when the corresponding launch tube is empty and the arming switch on any flare launcher control panel is positioned to ARM. The light will remain illuminated until the arming switch on all panels is positioned to SAFE or the spring-loaded ejector plate is moved from the aft limit of travel.

System Deactivated Light

A system-deactivated light is installed on each of the three launcher control panels and on the flare launcher activation panel. The light on each launcher control panel is a push-to-test type and illuminates when the arming switch on the same panel is positioned to ARM and the system deactivation switch on the flare launcher activation panel is positioned to DEACTIVATE. The light on the flare launcher activation panel illuminates when an arming switch on any launcher control panel is positioned to ARM and the deactivation switch is positioned to DEACTIVATE.

INSTRUMENTS

Only those instruments which are not part of a complete system are covered under this heading. For the description of instruments that are part of a complete system, see the paragraph covering that system.

PITOT-STATIC INSTRUMENTS (1500 AND 1600 SERIES WITHOUT DUAL LN-100)

28V ISOL DC P Side
PITOT HEATER COPILOT'S AND NAV

28V ESS DC CP Side
PITOT HEATER PILOT

Ram air pressure and atmospheric pressure to operate the vertical velocity indicators, airspeed indicators, and altimeters are supplied by the pitot-static system (figure 1A-101). Two pitot tubes furnish the ram pressure for the airspeed indicators, and four static ports furnish static pressure for the

Pitot-Static System (1500 and 1600 Series without dual LN-100)

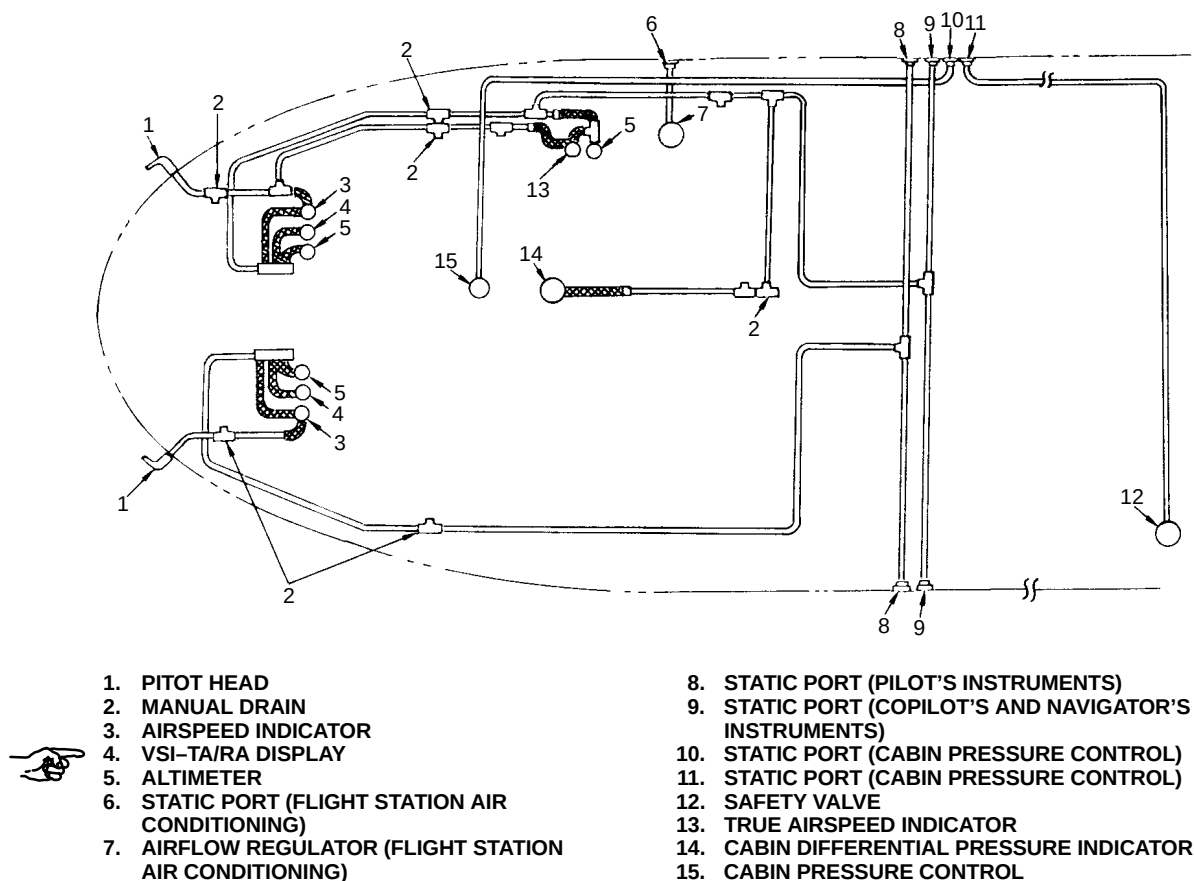


Figure 1A-101

airspeed and vertical velocity indicators and altimeters. Two static ports are located forward of the wheel well fairing on each side of the fuselage. The forward ports, one on each side of the airplane, serve the pilot's instruments; the aft ports, one on each side of the airplane, serve the copilot's and navigator's instruments.

Vertical Velocity Indicators

The two vertical velocity indicators, one mounted on the pilot's instrument panel the other mounted on the copilot's instrument panel (figures 1A-6 and 1A-7), are differential pressure measuring instruments that indicate the rate of change in altitude of the airplane.

Airspeed Indicators

The three airspeed indicators, one mounted on the pilot's instrument panel, one on the copilot's instrument panel, and a true airspeed indicator on the navigator's instrument panel (figures 1A-6, 1A-7, and 1A-11) are instruments which use differential air pressure to determine airspeed. The banded pointer on the airspeed indicators constantly indicates the structural speed limit at sea level and does not provide an accurate indication of airspeed limitation. The method of obtaining accurate information regarding airspeed limitation versus altitude is contained in Section V.

Altimeters

28V ESS DC CP Side
ALTIMETER-LOW RANGE

The three altimeters, one mounted on the pilot's instrument panel, one on the copilot's instrument panel, and one on the navigator's instrument panel, are barometric-type instruments measuring variation in pressure by means of aneroid units.

The pilot's altimeter (AAU-21/A in 1500 series, AAU-32/A in 1600 series) combines a conventional barometer altimeter and an altitude-reporting encoder in one self-contained unit. 10,000- and 1000-foot counter indicators and a 100-foot drum indicator provide a direct digital output and readout of altitude in increments of 100 feet, from -1000 to 38,000 feet. The encoder digital output is referenced to 29.92 inches of mercury and is not affected by changes in barometric setting. A pointer repeats the indications of the 100-foot drum, and serves both as a vernier for the drum and as a quick indication of the rate and sense of altitude changes. Two methods may be used to read indicated altitude on the counter-drum pointer altimeter: (1) read the counter-drum window, without reference to the pointer, as a direct digital readout in thousands and hundreds of feet, or (2) read the thousands of feet on the two counter indicators, without reference to the drum, and then add the 100-foot pointer indication.

The self-contained, servo-driven encoder provides altitude data encoded in 100-foot increments for automatic transmission when the air traffic control transponder is interrogated in Mode C. In case of power loss to the encoder servo-system (IFF portion), a CODE OFF flag will appear automatically in a window in the upper left portion of the display, indicating that altitude information is no longer being transmitted to the ground. In this condition the instrument continues to function as a normal barometric altimeter.

The altimeter setting is entered by use of a normally operated barometric set knob in the lower left front of the case. The altimetric setting appears on counters in the window in the right of the display and has a range of settings from 28.1 to 31.0 inches of mercury.

An internal vibrator operates continuously whenever airplane dc power is turned on. The vibrator minimizes internal mechanical friction, enabling the instrument to provide a smoother display during changing altitude conditions. Should vibrator failure occur, the altimeter will continue to function pneumatically, but a less-smooth movement of the instrument display will be evident with changes in altitude.

WARNING

If the altimeter internal vibrator is inoperative due to either internal failure or dc power failure, the 100-foot pointer may momentarily hang up when passing through 0 (12 o'clock position). If the vibrator has failed, the 100-foot pointer hang up can be minimized by tapping the case of the altimeter. Pilots should be especially watchful for this failure when their minimum approach altitude lies within the 800 - 1,000 foot part of the scale (1,800 - 2,000 feet, 2,800 - 3,000 feet, etc.), and should use any appropriate altitude backup information available.

The copilot's (AAU-27/A) altimeter is read in the same manner as the pilot's altimeter. However, the copilot's altimeter does not contain an altitude reporting encoder and hence, no CODE-OFF window.

The navigator's altimeter is the same as that installed in the navigator position in the 1700 series aircraft.

TRUE AIRSPEED COMPUTER (1600 SERIES)

28V ESS DC CP Side
TAS CMPTR

The true airspeed (TAS) computer provides TAS input to the INS INU for applicable system navigational functions. Ram air pressure and atmospheric pressure to operate the TAS system is provided by the pitot-static system. Outside air temperature is provided from a total temperature probe installed on the right-hand side of the nose of the airplane.

PITOT-STATIC INSTRUMENTS (1500 AND 1600 SERIES WITH DUAL LN-100, CG 1700-1716 AND 1790)

28V ISOL DC P Side
PITOT HEATER COPILOT'S AND NAV

28V ESS DC CP Side
PITOT HEATER PILOT

Ram air pressure and atmospheric pressure to operate the vertical velocity, airspeed, and altimeter indicators are supplied by the pitot-static system (see figure 1A-102). The pitot-static system also supplies pressure to the flight control system air data control, airspeed sensor, ground proximity warning system (GPWS) computer, and true airspeed computer. Two pitot tubes, located on opposite sides of the nose section of the airplane, furnish ram pressure to the airspeed indicators and sensors. The left tube supplies pressure to the pilot's airspeed indicator and the right tube supplies pressure to the copilot's airspeed indicator, navigator's flight control system airspeed sensor, GPWS computer, and true airspeed computer. Four static ports furnish static pressure for the airspeed and vertical velocity indicators, altimeter, cabin differential pressure indicator, GPWS computer, and true airspeed computer. The forward lower ports on each side of the airplane supply static pressure to the pilot's airspeed and vertical velocity indicators and altimeter. The lower aft ports, one on each side, supply static pressure to the copilot's airspeed indicator and altimeter, navigator's airspeed indicator and altimeter, cabin pressure differential pressure indicator, flight control airspeed sensor, GPWS computer, and airspeed computer. Two additional static ports furnish pressure for flight control system air data control units.

VERTICAL VELOCITY INDICATORS

The two vertical velocity indicators, one mounted on the pilot's instrument panel and the other mounted on the copilot's

instrument panel, are differential pressure-measuring instruments that indicate the rate of change in altitude of the airplane.

AIRSPEED INDICATORS

26V ESS AC P Side
AIRSPEED - PILOT - COPILOT

The three airspeed indicators, one mounted on the pilot's instrument panel, one on the copilot's instrument panel, and a true airspeed indicator on the navigator's instrument panel, are instruments which use differential air pressure to determine airspeed. The banded pointer (maximum allowable pointer) on the pilot's and copilot's indicator, constantly indicates the maximum recommended speed limit for the respective airplane altitude. The IAS pointer reflects the airplane airspeed. The IAS counter repeats the IAS pointer indication as a digital readout. An OFF flag will be displayed in the IAS counter window until the airplane speed exceeds 60 KIAS, at which time the flag will be biased out of view. An IAS push-to-test button, located on the lower right of the instrument face, is provided to test the IAS counter. Depressing and holding the pushbutton until the digital readout registers 300 ± 20 , indicates that the IAS counter is operational. The press-to-test is functional on the ground or in flight and does not affect the indicator signal output when activated.

NOTE

A loss of ac power to the indicator will cause the IAS counter to fail and the OFF flag to appear in the counter window. The IAS pointer will continue to operate.

The indicator also incorporates a "bug" type pointer which can be set with an adjustable knob on the face of the indicator. The pointer provides the pilot with a means of referencing appropriate selected airspeeds for approach, climb, etc. The pilot's and copilot's airspeed indicators provide signals to the respective ADI speed flag and speed deviation pointer to display the difference between actual airplane speed and a manually set speed. Signals from the pilot's airspeed indicator are used by air data control No. 1 for IAS hold mode during autopilot coupled operation.

ALTIMETERS

The three altimeters, one mounted on the pilot's instrument panel, one on the copilot's instrument panel and one on the navigator's instrument panel, are barometric-type instruments measuring variations in pressure by means of aneroid units.

Pitot-Static System
(1500 and 1600 series with dual LN-100, CG 1700-1716 and 1790)

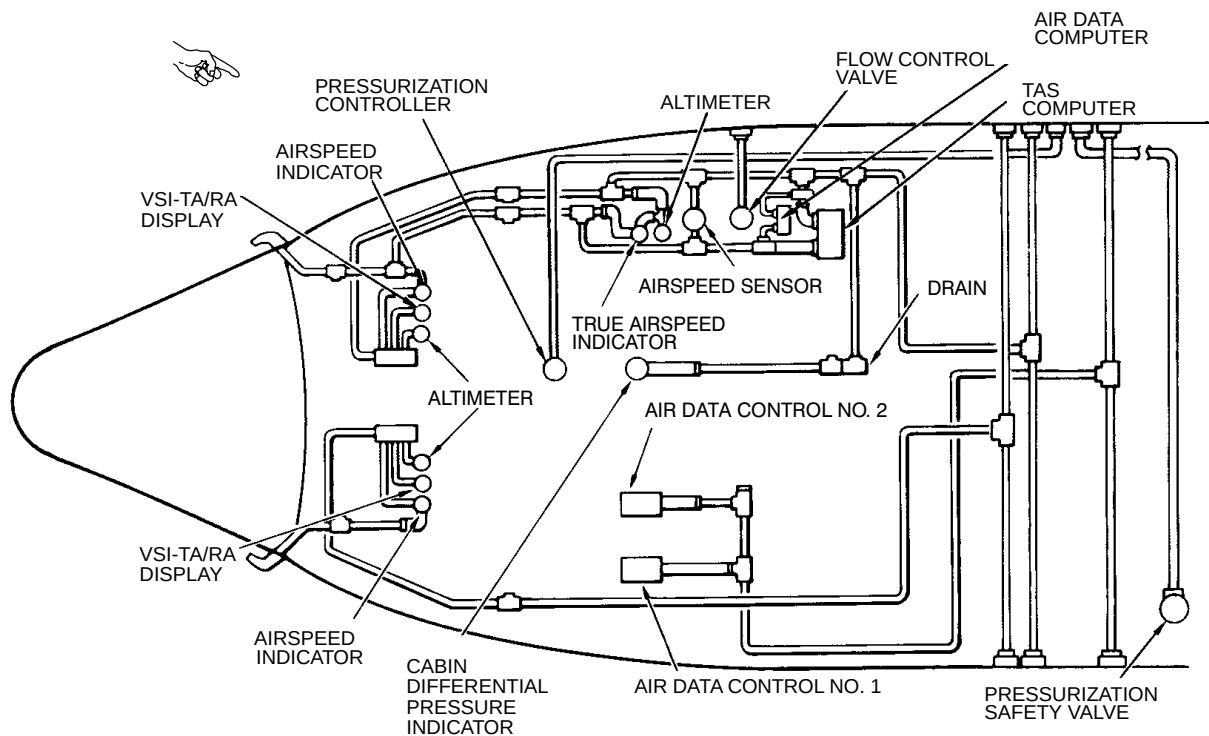


Figure 1A-102

Pilot's and Navigator's Altimeters

26V ESS AC P Side
 ALTM ENCODER PILOT
 26V ESS AC P Side
 ALTM ENCODER NAVIGATOR

The pilot's and navigator's altimeter combines a conventional barometric altimeter and an altitude-reporting encoder in one self-contained unit. A 10,000- and 1,000-foot digital counter indicator and a 100-foot drum indicator provide a direct digital output and readout of altitude in increments of 100 feet, from -1,000 to 50,000 feet. The encoder digital output is referenced to 1,013 millibars and to 29.92 inches of mercury and is not affected by changes in barometric setting.

A pointer repeats the indications of the 100-foot drum indicator and serves both as a vernier for the drum and a quick indication of the rate and sense of altitude changes. Two methods may be used to read indicated altitude on the counter-drum-pointer altimeter: (1) read the digital counter indicator and the 100-foot drum indicator, without reference to the pointer, as a direct digital readout in thousands and hundreds of feet; or (2) read the thousands of feet on the two digital counter indicators, without reference to the 100-foot drum indicator and then add the 100-foot pointer indication.

The self-contained servo-driven encoder provides altitude data encoded in 100-foot increments for automatic transmission when the air traffic control transponder is interrogated in Mode C.

In case of power loss to the encoder-altimeter, an orange OFF flag will appear in a window in the upper portion of the display, indicating that the pilot's altimeter is inoperative.

The pilot's altimeter is interconnected with the altitude alerter/preselect system to provide synchro outputs of barocorrected altitude and flag alarm signals. The altimeter setting is entered by use of a manually operated barometric set knob in the lower right front of the instrument case. The altimeter setting appears on digital displays at the right of the altitude display and has a range of settings from 950 to 1,050 millibars and from 28.1 to 31.0 inches of mercury. A press-to-test button, located on the lower left front of the indicator, is provided to functionally test the servo mechanism. When actuated, the button causes a negative pointer offset 300-800 feet from the altimeter reading indicating that the servo is operating.

WARNING

If the pilot's or navigator's altimeter doesn't offset 300 ft to 800 ft negative from the altimeter reading and the OFF flag doesn't appear when the test button is pushed, that altimeter is inoperative and should not be relied upon for flight.

Copilot's Altimeter

28V ESS DC CP Side
 ALTM VIBRATOR COPILOT

The copilot's altimeter is read in the same manner as the pilot's altimeter. However, this altimeter does not contain an altitude reporting encoder and, hence, contains no OFF flag. The altimeter also is not equipped with the functional test button. The copilot's altimeter has an internal vibrator which operates continuously whenever airplane dc power is turned on. The vibrator minimizes internal mechanical friction, enabling the instrument to provide a smoother display during changing altitude conditions. Should vibrator failure occur, the altimeter will continue to function pneumatically, but a less-smooth movement of the instrument display will be evident with changes in altitude.

WARNING

If the altimeter internal vibrator is inoperative due to either internal failure or dc power failure, the 100-foot pointer may momentarily hang up when passing through 0 (12 o'clock position). If the vibrator has failed, the 100-foot pointer hang-up can be minimized by tapping the case of the altimeter. Pilots should be especially watchful for this failure when their minimum approach altitude lies within the 800 - 1,000 foot part of the scale (1,800 - 2,000 feet, 2,800 - 3,000 feet, etc.), and should use any appropriate altitude backup information available.

TRUE AIRSPEED COMPUTER

115V ESS AC CP Side
 TAS CMPTR
 TAS PROBE HTR

The true airspeed (TAS) computer provides TAS input to the INS INU for applicable system navigational functions. The computer is mounted behind the large cover plate above the radio operator's console. Ram air pressure and atmospheric

pressure to operate the TAS computer is provided by the pitot-static system. Outside air temperature is provided from a total temperature probe installed on the left side of the airplane above the crew entrance door. The total temperature probe contains a deicing heater that is controlled by a two-position “ON,” “OFF,” TAS PROBE HEATER switch located on the navigator’s side console.

Free Air Temperature Indicators

28V MAIN DC CP Side
TEMP IND FREE AIR

Two free air temperature indicators, one on the copilot’s instrument panel or the copilot’s upper circuit breaker panel (figures 1A-6 and 1A-66) and the other on the navigator’s instrument panel (figure 1A-11), indicate ambient outside air temperature. This temperature must be corrected for compressibility for true air temperature during flight. The indicators are electrically connected to resistance bulbs mounted on each side of the airplane.

Magnetic Compass

A magnetic compass (Type B-21) (figures 1A-6 and 1A-7) is mounted on the pilot’s instrument panel. This is a standard floating-card type compass that indicates the direction the plane is headed with respect to magnetic north. A compass correction card shall accompany the magnetic compass.

Accelerometer

A Type MA-1 accelerometer is located on the pilot’s instrument panel (figures 1A-6 and 1A-7), and gives instantaneous as well as maximum and minimum readings of the g forces exerted on the airplane. The gauge scale indicates readings of from plus 4 g’s to minus 2 g’s. The maximum and minimum indication needles will remain at highest readings until the PUSH TO SET button on the gauge case is pushed, then they will both return to plus one g and will again register maximum or minimum readings of g forces until again reset. The accelerometer is designed for in-flight use only and does not accurately measure g forces during landing. This instrument is to be used in conjunction with the information on structural limitations in Section V.

Clocks

Three clocks, one on the pilot’s instrument panel (figures 1A-6 and 1A-7), one on the copilot’s instrument panel and one on the navigator’s instrument panel (figure 1A-11), are mounted in the airplane.

ROSEMOUNT PITOT STATIC SYSTEM (CG 1717 AND UP)

115V ESS AC P Side
PITOT HEATER NO. 1, NO. 2, NO. 3, and NO. 4

The pitot-static system supplies pitot pressure and static pressure to operate the airspeed indicators, altimeters, vertical speed indicator (VSI TA/RA) display, and cabin differential pressure indicator. The pitot-static system also supplies pitot and static pressure to the true airspeed computer, air data computer, and airspeed sensor. The pitot-static system supplies static pressure to the two air data control units. See figure 1A-103 for specific pitot and static pressure sources for instruments, components and drain locations.

The indicators used with the Rosemount pitot static system are the same indicators used in CG 1790 and CG 1700 through 1716. For indicator use, refer to the section on CG 1790 and CG 1700 through 1716.

EMERGENCY EQUIPMENT

Various types of emergency equipment are furnished to minimize hazards to the airplane and to personnel in case of fire or accident.

FIRE EXTINGUISHING SYSTEM

A two-shot fire extinguishing system (figure 1A-104) is connected through a series of directional flow valves to each of four engine nacelles and to the gas turbine compressor/auxiliary power unit compartment. Each bottle contains approximately 19 pounds of agent. One bottle is discharged each time the system is actuated. A check valve prevents the agent from entering a bottle which has previously been discharged. Each bottle is charged to approximately 600 psi, with nitrogen acting as a propellant for the chlorobromomethane (Halon 1011 or CB). Individual pressure gauges on each bottle show charged pressure.

Fire Extinguishing System Controls

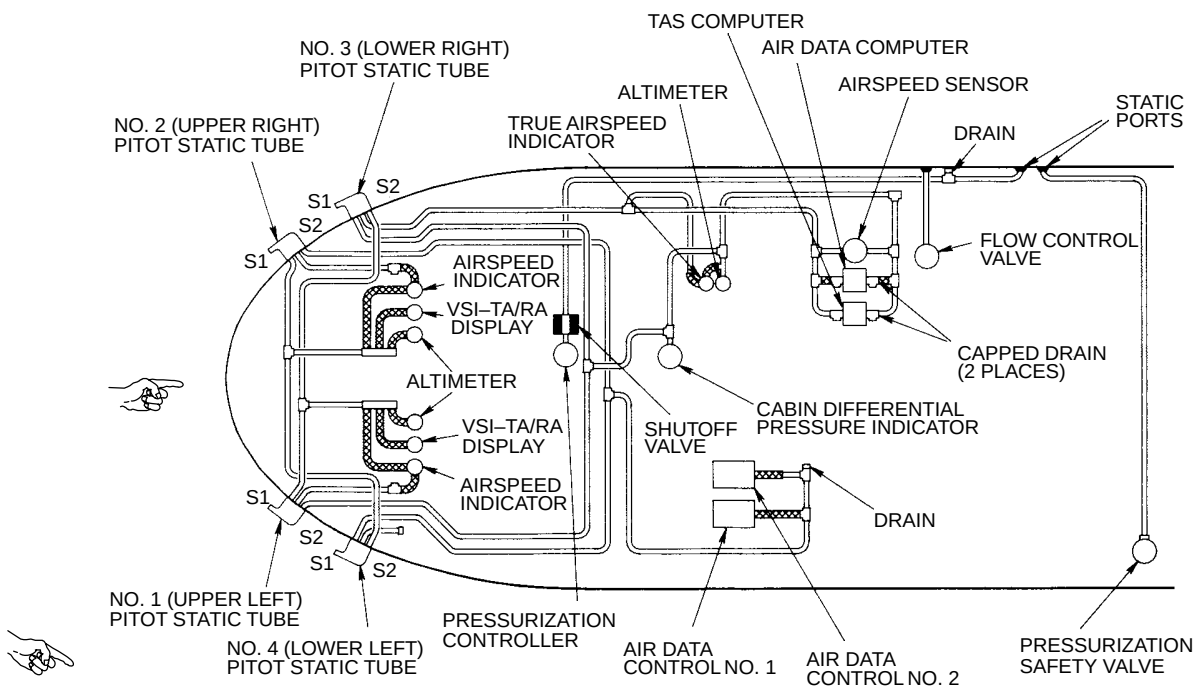
The fire extinguishing system controls are located on the fire emergency control panel forward of the overhead electrical control panel.

AGENT DISCHARGE SWITCH

28V BATT DC P Side

A three-position (NO 1, OFF, NO 2) toggle switch located on the fire emergency control panel (figure 1A-104) controls the discharge of the bottles. The agent discharge switch is spring-loaded to the OFF position. This circuit is completed whenever a fire handle is pulled. The fire handle circuit powers the correct sequence of solenoid directional control

ROSEMOUNT Pitot-Static System



INSTRUMENTS/COMPONENTS	PITOT PRESSURE SOURCE	STATIC PRESSURE SOURCE
Pilots instruments: airspeed indicator, altimeter, and VSI TA/RA display	No. 1 pitot-static tube	No. 1 pitot-static tube, S1 No. 3 pitot-static tube, S2
Copilots instruments: airspeed indicator, altimeter, and VSI TA/RA display	No. 2 pitot-static tube	No. 2 pitot-static tube, S1 No. 4 pitot-static tube, S2
Navigators instruments: true airspeed indicator, altimeter; cabin differential pressure indicator; true airspeed computer, air data computer, and airspeed sensor	No. 3 pitot-static tube	No. 3 pitot-static tube, S1 No. 1 pitot-static tube, S2
Air data control unit (2)	(No. 4 pitot pressure not used)	No. 4 pitot-static tube, S1 No. 2 pitot-static tube, S2

Figure 1A-103

valves in the system to direct flow of agent to the selected engine when one of the bottles is fired. The control valves move in the same order as the handles are pulled. If two fire handles are pulled, the agent will be routed to the engine for the last handle pulled. In order to route agent to the engine for the first handle pulled, the first handle must be pushed in and pulled again.

FIRE HANDLES

28V

FIRE EXT BATT DC P Side

28V

ESS DC CP Side

FIRE SHUTOFF VALVES

The five plastic fire handles (figures 1A-104, 1A-105) are mounted on the fire panel. They operate emergency shut-down switches for the gas turbine compressor/auxiliary

power unit and the four engines. When an engine fire handle is pulled out, it closes dc circuits to operate valves which isolate the engine as follows:

The shutoff valve on the engine fuel control is closed.

The firewall fuel shutoff valve is closed.

The engine oil shutoff valve is closed.

The firewall hydraulic shutoff valves are closed.

The engine bleed air is shut off.

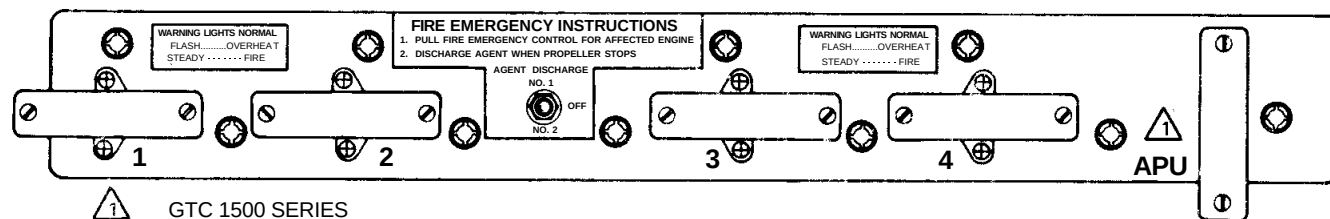
Engine starting control circuits are deenergized.

The propeller is feathered.

Positions the fire extinguisher system control valves.

Arms the extinguishing agent discharge switch.

Fire Extinguishing System



NOTE

ELECTRICALLY OPERATED VALVES ARE SOLENOID OPERATED, SHOWN IN THE NORMAL DEENERGIZED POSITION AFTER DISCHARGING AGENT. OPEN VALVES ARE HELD OPEN AS LONG AS THE FIRE EMERGENCY CONTROL HANDLE IS OUT, PROVIDING ANOTHER FIRE EMERGENCY CONTROL HANDLE IS NOT PULLED.

 CYLINDER DETONATOR

 2-WAY CHECK VALVE

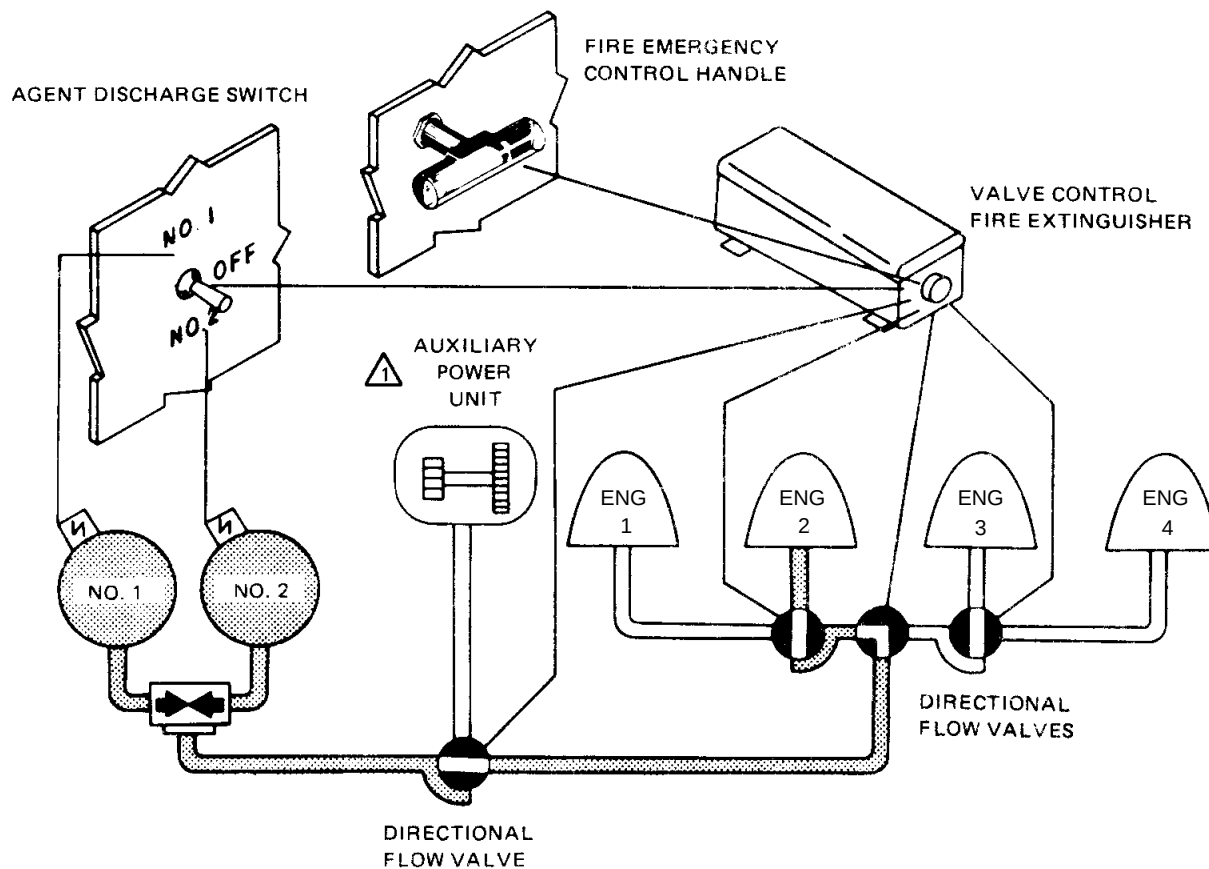
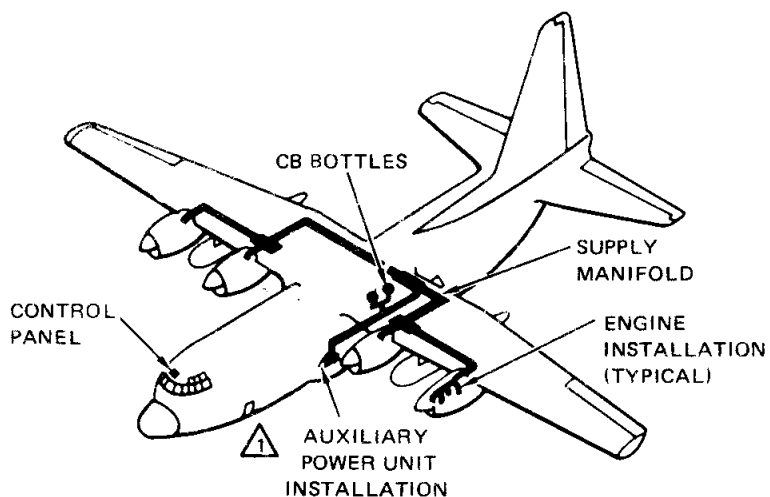


Figure 1A-104

Engine Fire and Overheat Controls and Indicators

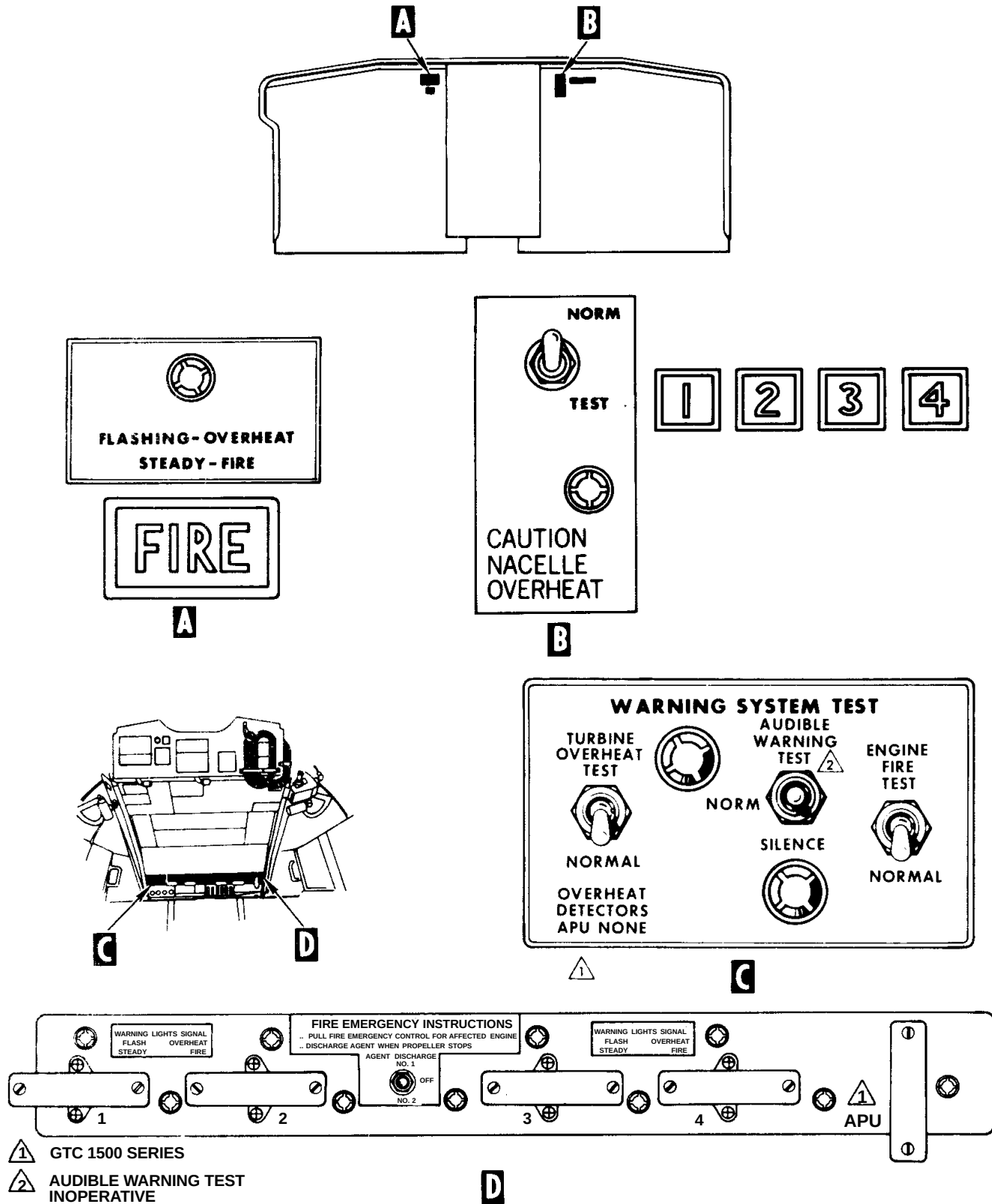


Figure 1A-105

28V
APU/GTC CONTROL ISOL DC P Side

When the GTC/APU handle is pulled, the GTC/APU is isolated as follows:

The GTC/APU fuel shutoff valve is closed.

The GTC oil shutoff valve is closed.

The GTC/APU bleed air valve is closed.

Positions the fire extinguisher system control valve.

Arms the extinguisher agent discharge switch.

The GTC door switch is disarmed (1500 series).

The APU door closes (1600 series, CG 1790, and 1700 series).

ENGINE TURBINE OVERHEAT WARNING SYSTEMS

28V ESS DC CP Side
OVERHEAT DETECTORS – TAILPIPE

An overheat warning system is provided for each engine hot section. Each system consists of four thermal-switch detector units mounted in the “hot section” of the nacelle aft of the fire wall, a flasher, and indicator lights. These components are interconnected so that an overheat condition sensed by any one of the detectors causes the lights to flash. The detectors are connected in parallel to a loop; and if part of the detectors are inoperable, the remaining detectors can still close the circuit to turn on the lights. A test switch permits testing of all four systems at the same time. The temperature at which the detector lights will give an overheat warning is approximately 371 ° C (700 ° F).

Indicator Lights

Two (top) red lights in each of the engine fire handles (figures 1A-104, 1A-105) are flashed to indicate an engine turbine overheat condition.

Master Fire Warning Panel

The master fire warning panel (figure 1A-105) is located on the pilot’s instrument panel. The panel lights are flashed whenever any one of the engine overheat warning systems senses an overheat condition. When the warning lights flash, the lights in the engine fire handle flash also, and those lights indicate the engine in which the overheat condition has been sensed. The master panel contains a master light and a panel light, both of which flash to indicate engine overheat.

Turbine Overheat Detector Test Switch

The overheat detectors test switch (figures 1A-105) is located on the warning system test panel on the overhead con-

trol panel. The switch has NORMAL and TEST positions. When positioned at TEST, it closes all four of the overheat warning system circuits in the same manner as if they were closed by detectors sensing an overheat condition. If the indicator lights flash when the switch is operated, circuit continuity and flasher operation are satisfactory.

NOTE

The test switch will only check circuit continuity and ensure that the switch is functioning properly. Even though all indicator lights illuminate and flash, this does not indicate the detectors are properly set or even operating.

NACELLE OVERHEAT WARNING SYSTEMS

28V ESS DC CP Side
OVERHEAT DETECTORS – NACELLE

A nacelle overheat warning system is provided for each nacelle. Each system consists of thermal-switch detector units, mounted in the nacelle area forward of the firewall, and a warning light on the copilot’s instrument panel. A test switch is provided for testing all four warning systems simultaneously. The purpose of each system is to warn of an overheat condition in the area around the engine compressor section. Overheat in this area can result from a rupture occurring in the bleed air system ducts.

The overheat condition could also result from fire. The overheat condition can be detected by any one of the six detectors, which are connected in parallel to a loop. The detector lights will give an overheat warning at approximately 149 ° C (300 ° F).

Indicator Lights

Four numbered nacelle overheat warning lights are located on a panel (figure 1A-105) on the copilot’s instrument panel. If overheat is detected in any nacelle, the corresponding light on the panel glows steadily. The panel itself is also lighted simultaneously. When the test switch is operated, all four nacelle warning lights and the panel lights are illuminated.

Nacelle Overheat Test Switch

A test switch is located on the nacelle overheat warning panel (figure 1A-105) next to the lights. Operation of the test switch closes all four nacelle overheat warning circuits, causing all four warning lights and the panel lights to glow as long as the switch is held in TEST. Failure of a light to come on indicates a break in continuity in the warning circuit.

NOTE

The test switch will only check circuit continuity and ensure that the switch is functioning properly.

Even though all indicator lights illuminate, this does not indicate that the detectors are properly set or even operating.

FIRE DETECTION AND WARNING SYSTEMS

28V ESS DC CP Side
FIRE DETECTOR

A fire detection and visual warning system is provided for each engine and gas turbine compressor/auxiliary power unit. Each engine system consists of a continuous loop detector, amplifier, and indicator lights located in the flight station. The gas turbine compressor/auxiliary power unit system is the same. Each system is sensitive to high temperature and, when detected, the amplifier unit initiates a signal to the indicator lights. These lights give a steady red glow when activated. The detector is set to activate when a rapid change in temperature occurs. A test system is provided to test operation of each detector and system. The test switch is located on the warning system test panel and, when actuated, will illuminate all fire warning lights simultaneously.

Fire Detection Systems Indicator Lights

Two lamps in each of the fire handles provide fire indication. The red lamps in a handle glow whenever fire is detected in the corresponding nacelle. The lamps glow steadily to distinguish the indication from the flashing overheat warning indication.

Master Fire Warning Panel

28V ESS DC CP Side
FIRE DETECTOR – MASTER FIRE WARNING

The master fire warning panel (figure 1A-105) is located on the pilot's instrument panel. The panel contains a warning light and a panel light. If fire is detected by any one of the detection systems, the panel and warning light will glow steadily. The steady light distinguishes the signal from an overheat warning indication, which is a flashing of the same lights. When the master panel indicates fire, the lamps in one of the fire handles will illuminate also to indicate the location of the fire.

HAND-OPERATED FIRE EXTINGUISHERS

NOTE

In the event a Halon 1211 hand-held fire extinguisher is found leaking, leave it in its bracket. Replace or remove from airplane upon next landing.

Halon 1211 (5 lbs) is used as the agent with nitrogen (125 psi) as the propellant. Halon 1211 is a colorless, faintly sweet-

smelling, electrically nonconductive gas that is an effective medium for extinguishing fires. Halon 1211 extinguishes fires by inhibiting the chemical reaction of fuel and oxygen. The extinguishing effect due to cooling, or dilution of oxygen or fuel vapor concentration, is minor. The discharge of Halon 1211 may create hazards to personnel such as dizziness, impaired coordination, reduced visibility and exposure to toxic decomposition products.

WARNING

At concentrations of the order of five to ten percent, there is a risk of unconsciousness and possible death if exposure is prolonged.

Partial discharge may cause extinguisher to leak. Total charged weight is approximately 8 lbs 2 oz. To operate, hold upright, pull pin, squeeze lever. Direct at base of flame. After discharge of extinguisher avoid exposure to smoke, vapors and other by-products of the fire. Do not direct at surface of burning liquid from closer than 8 feet. Suitable for use at temperatures from -40 °C (-40 °F) to +49 °C (+120 °F). It is a liquefied gas type fire extinguisher (Model 355) for B and C class fires (Bromochlorodifluoromethane) MIL-B-38741.

Four hand-operated fire extinguishers (figure 3-1) are provided for fighting interior fires, one in the flight station aft bulkhead and three in the cargo compartment. A trigger-type handle located at the top of the extinguisher permits operation with one hand.

ALARM SYSTEM

28V BATT DC P Side
ALARM BELL

The alarm system consists of four alarm bells in the cargo compartment and two switches, one on the pilot's side shelf and the other on the copilot's side shelf. The alarm system is used for crew and passenger warning or paratroop warning. All the bells sound when either guarded switch is ON.

DOOR WARNING SYSTEM

28V MAIN DC CP Side
DOOR WARNING LIGHT

The door warning system consists of a master door warning light on the pilot's side of the glare shield (figure 1A-106), a light and master light shutoff switch at each door and door warning switches on each door.

Door Open Warning Lights and Controls

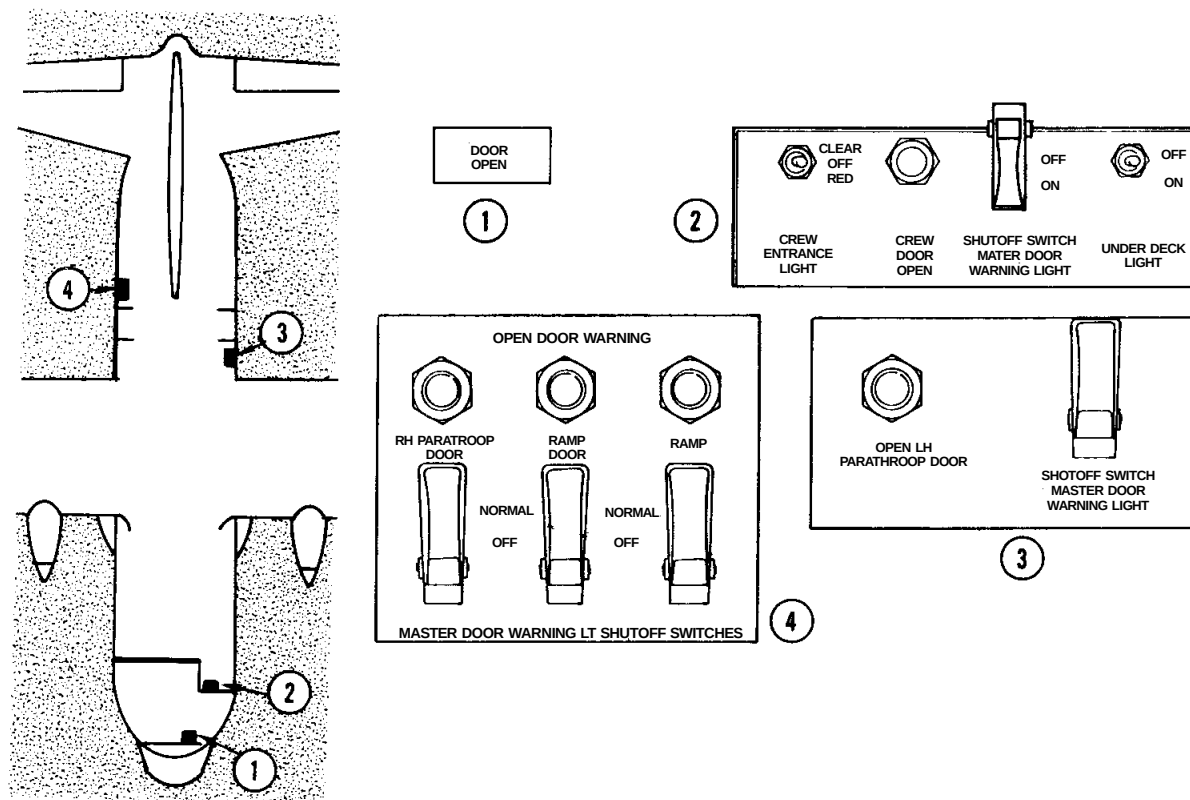


Figure 1A-106

Restraint Harness Use When Door Warning Lights/Doors Are Being Checked

When personnel restraint harness is used on the flight deck, the leash snap will be connected to the tie down ring mounted to the radioman's seat track. Should the affected door be other than the crew entrance door, the harness leash snap will be reconnected to a convenient cargo floor ring for checking the cargo compartment door(s).

Door Warning Lights

The master door warning light is located on the pilot's side of the glare shield. It illuminates whenever any one of the door warning switches is closed. The switches are closed when the doors are not closed and latched. It can be turned off by the master light shutoff switch for the affected door, and then will be turned on again if a warning switch on another door closes.

The left paratroop door light is located on a panel next to the door. The right paratroop door, ramp, and aft cargo door lights are located on a panel aft of the right paratroop door. The crew door warning light is located forward of the crew entrance door. Any one of these lights will be turned on when

the corresponding door is not securely locked, and these individual lights cannot be turned off except by securing the door.

Master Light Shutoff Switches

The master light shutoff switches are located on the door warning light panels in the cargo compartment next to the individual door warning lights. One switch is provided for each door. The purpose of the switches is to permit turning off the master warning light on the pilot's instrument panel, thus rearming the light so that it can give a second warning if another door becomes insecure.

FIRST AID KITS

Mounting provisions are provided for the installation of 23 emergency first aid kits (figure 3-1), two in the flight station and 21 in the cargo compartment. The kit installations for the flight station are located on the flight station aft bulkhead. Kit installation provisions in the cargo compartments are located as follows: six forward of the right wheel well, seven forward of the left wheel well, four forward of the right paratroop door, and four forward of the left paratroop door.

HAND AXES

Two hand axes are installed in the airplane, one on the forward or aft side of the forward bulkhead of the cargo compartment and the other aft of the right paratroop door (left paratroop door on CG 1705 and up).

EMERGENCY LIGHTS

28V BATT DC P Side
EMER EXIT LIGHT EXTINGUISH

28V ESS DC CP Side
EMER EXIT LIGHT CONTROL

Seven (eight, 1500 series) portable, battery-operated emergency lights (figures 1A-107) are installed on stationary terminal blocks located near each normal or emergency exit. One light is installed near the crew entrance door, one near each of the two paratroop doors, one near the right side emergency exit, one near each of the three overhead emergency escape hatches and (1500 series) one near the left side emergency exit. When installed, the lights can be either individually controlled by the three-position (ON, OFF, ARMED) switch on each light assembly or collectively extinguished by the emer exit light extinguish pushbutton on the overhead electrical control panel (figures 1A-41 and 1A-42). In order for the emergency exit light extinguish pushbutton to be able to extinguish a light, however, the associated light assembly switch must be positioned to ARMED. An inertia switch in each of the light assemblies actuates the light when the airplane is subjected to a decelerating force exceeding 2-1/2 g's. The lights will also illuminate if power on the essential

Emergency Exit Lights

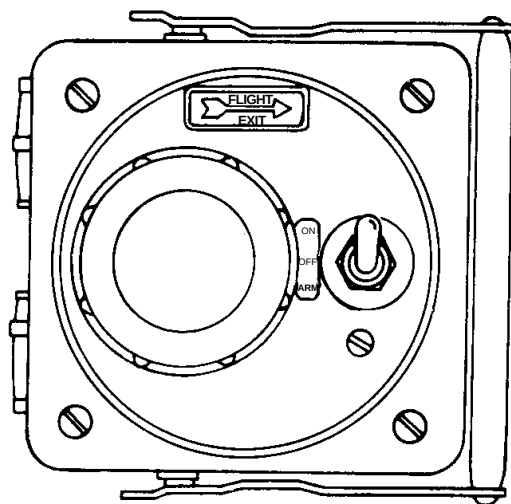


Figure 1A-107

dc bus fails. An individual light assembly can be removed for emergency portable use by pulling the release handle on the light assembly.

LIFE RAFTS

There are provisions for four 20-man life rafts in the top center wing trailing edge area although only two are installed (figure 3-1). Life raft release handles (figure 3-16) are located as follows: two on the flight station bulkhead below the escape hatch, two on the fuselage structure aft of the right paratroop door, and two on the wing upper surface inboard of their respective life raft compartments. The release handles on the wing upper surface can be reached by removing the protective fabric covering over the handle openings. The rafts are automatically inflated upon actuation of the release handles and are secured to the airplane by lanyards.

There are 12 life vests. The type and components are in accordance with COMDTINST M13520.1 (series) CG Aviation Life Support Manual.

EMERGENCY ESCAPE EXITS

Three overhead emergency escape hatches and a side emergency exit panel are provided on the airplane. The overhead emergency escape hatches are located forward of the flight station aft bulkhead, aft of the center wing section, and above the loading ramp. The side emergency exit panel is located forward of the right wheel well (1500 series have a side emergency exit on the left also). An emergency escape lever is mounted on the fuselage adjacent to each emergency escape exit. Moving this lever releases the locking latches, and allows the hatch or exit panel to be pulled into the airplane. The hatches and side exit panel may be released from outside of the airplane by means of flush-type finger handles mounted in the fuselage skin. Pulling these handles releases the hatches and side emergency exit panel in the same manner as do the emergency escape levers. Emergency chopping locations are identified by yellow markings, both inside and outside the airplane. These locations are above and forward (1500, 1600 series 1790 and 1700 through 1716) or directly above (1717 through 1721) the paratroop door on each side of the airplane.

Alternate Exits

See Section III for air, ground, and water emergency exits.

EMERGENCY ESCAPE ROPES

An emergency escape rope is installed aft of each overhead emergency escape hatch. One end of each rope is fastened to the fuselage structure. The ropes are looped into a bundle and are secured near the hatches in snap-fastened straps.

CREW ENTRANCE DOOR

The crew entrance door is located on the forward left side of the airplane. The door is opened from the outside by rotating

the door handle downward. The door should be allowed to swing slowly downward until the spring-loaded telescoping counterbalance and door stop holds the door at the proper angle for use. Steps on the inside of the door facilitate entrance to the airplane. A hand lanyard on the aft side of the inside face of the door is provided for pulling the door closed preparatory to flight. To open the door from the inside, turn the inside handle in a counterclockwise direction.

Crew Entrance Door Jettison Handle

The crew entrance door jettison handle (figure 1A-108) is a yellow handle located on the ceiling of the flight station, 3 feet to the left of the center line of the airplane and slightly aft of the pilot's seat. Pulling the handle down actuates a cable through a bellcrank assembly to pull the locking pins from the top of the door at the same time that the hinge pins drop from the bottom hinge and the telescoping counterbalance is released.

UNDERWATER ACOUSTICAL LOCATOR BEACON

An Underwater Acoustical Locator Beacon is located on the front of the Cockpit Voice Recorder at fuselage station 889 at waterline 270.9. When submerged in water, the beacon transmits a signal on 37.5 ± 1 kHz.

This unit provides a positive means of pinpointing the exact location of a downed airplane in the event of loss over water.

Crew Entrance Door Jettison Handle

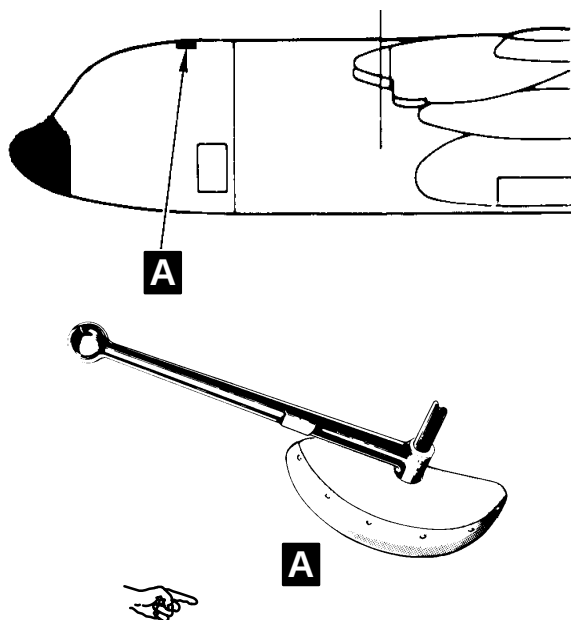


Figure 1A-108

LIGHTING SYSTEM

The lighting system is composed of exterior and interior groups of lights and their controls. Receptacles are also provided on the sides of the pilot's and copilot's side shelves for connecting a signal light. The pilot's and copilot's instrument lights and the engine instrument lights operate on ac power and all others operate on dc power. The pilot's and copilot's instrument lights and the engine instrument lights use 6-volt bulbs only. All other panel lights use 28-volt bulbs.

EXTERIOR LIGHTS

The exterior group of airplane lights (figure 1A-109) comprises a landing light on the undersurface of each wing; two taxiing lights on the main landing gear doors, nine formation; six navigation and two anti-collision lights, dispersed around the airplane, and a light on each side of the fuselage to illuminate the wing leading edges. (CG 1790 has two search lights installed in the lower leading edge of the wing.)

Landing Lights

28V ESS DC CP Side
EXTERIOR LIGHTS – LANDING LIGHTS MTR (LH/RH)

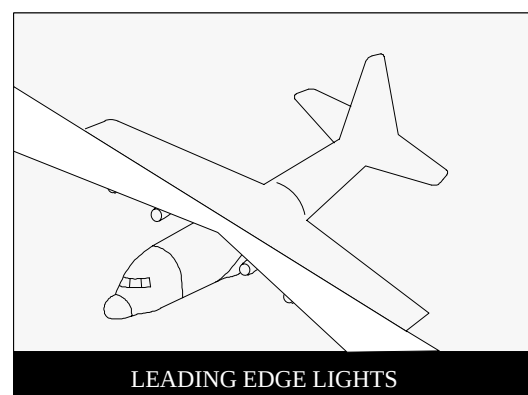
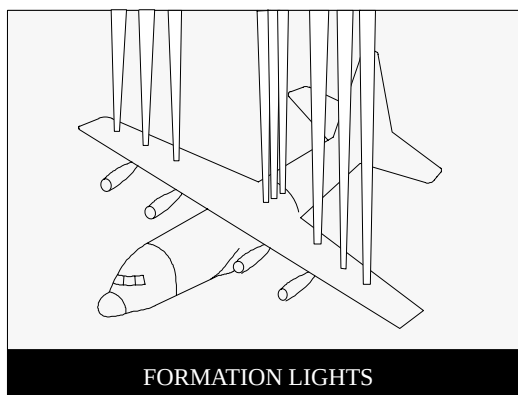
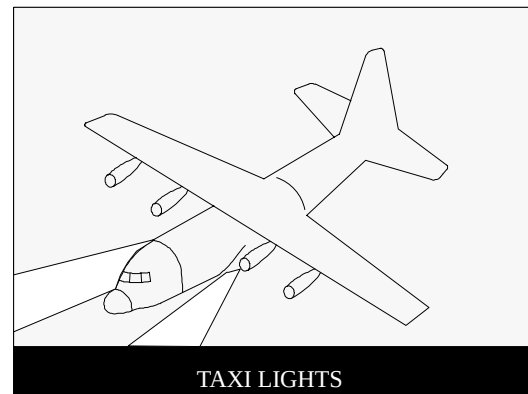
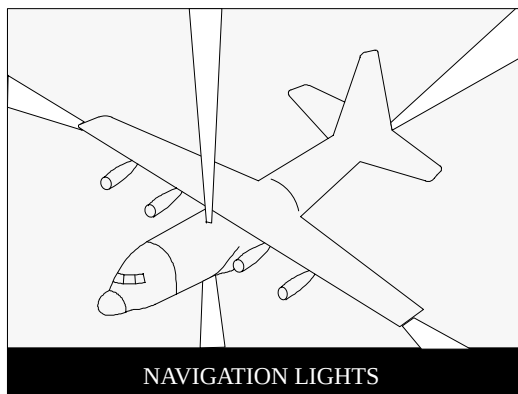
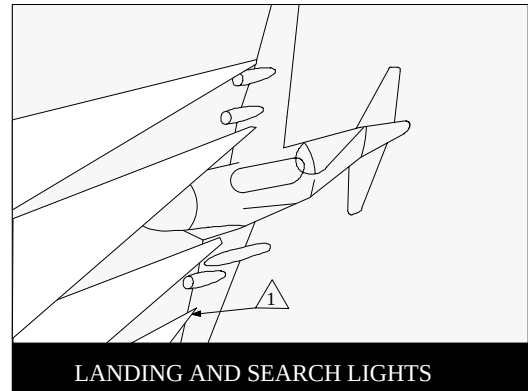
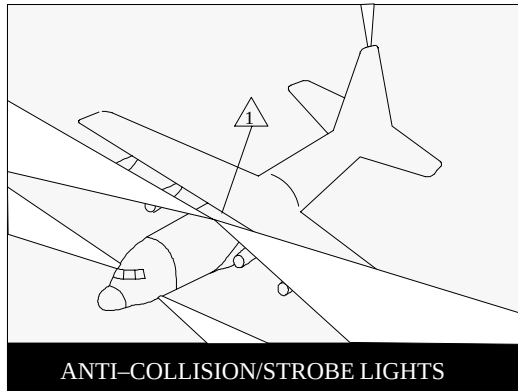
EXTERIOR LIGHTS – LANDING LIGHTS (LH/RH)

A retractable landing light is mounted in the underside of each wing approximately midway between the inboard and outboard engine nacelles. Switches for extension and retraction and for illumination control are located on the landing lights control panel (figure 1A-110). The two extension and retraction switches, labeled right and left, are three-position (EXTEND, HOLD, RETRACT) toggle switches. The right switch energizes the right-hand landing light actuator, retracting or extending the light when the switch is moved to RETRACT or EXTEND position. The left switch energizes the left-hand light in the same manner. When either switch is moved to the HOLD position, the landing light actuator motor is deenergized, and the light will lock in position. Two, two-position (ON, OFF) toggle switches control the illumination of the landing lights. When either switch is moved to the ON position, the corresponding light illuminates. When either switch is moved to OFF, the corresponding light is deenergized.



Do not operate landing lights for prolonged periods while airplane is on ground, since neither light has any cooling facility.

EXTERIOR LIGHTS LOCATIONS



△ CG 1790

Figure 1A-109

Exterior Lights Control Panels

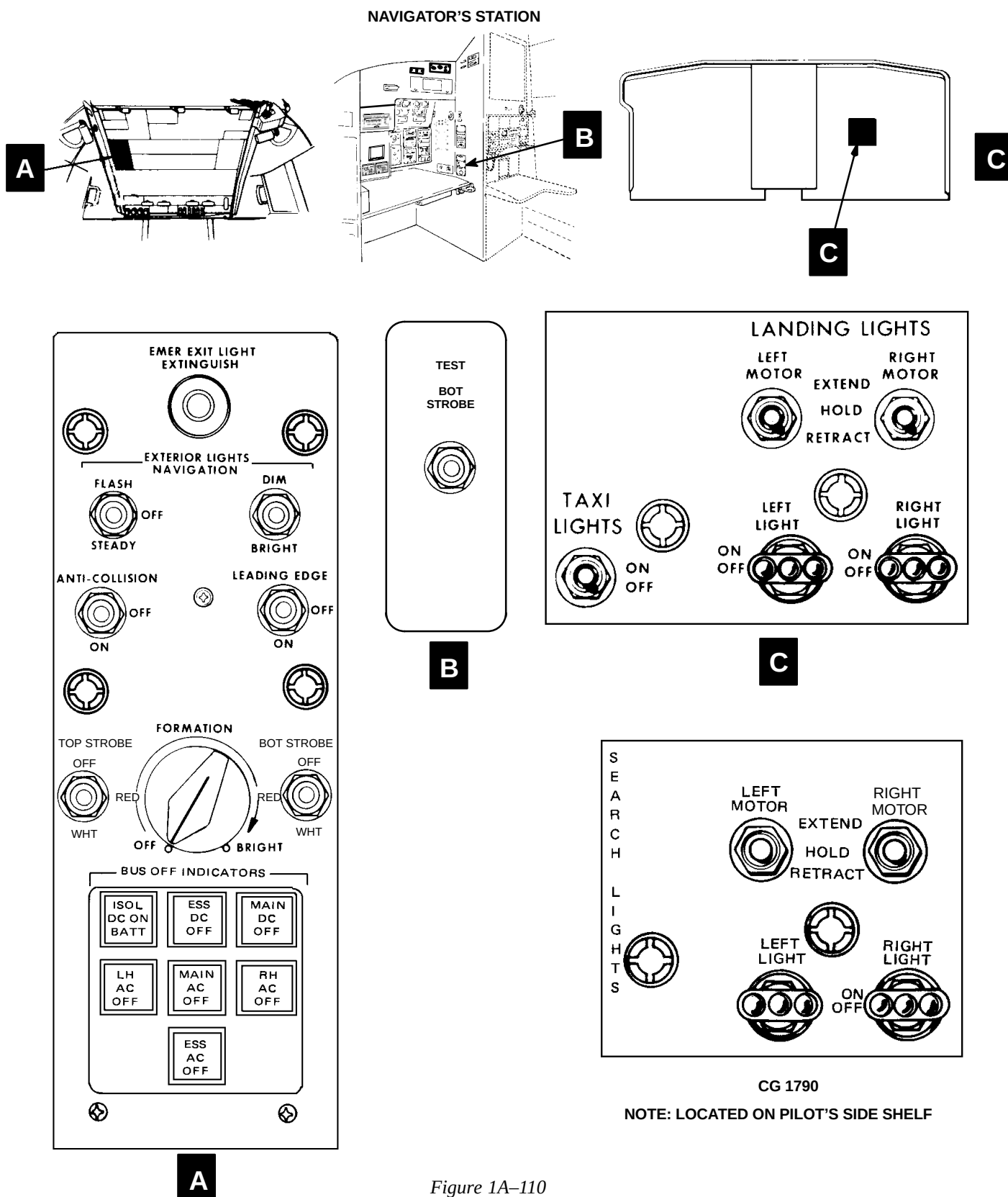


Figure 1A-110

Taxiing Lights

28V MAIN DC CP Side
EXTERIOR LIGHTS – TAXI

Illumination of the two taxiing lights, one mounted on the inside of each main landing gear door, is controlled by a two-position (ON, OFF) toggle switch on the landing light control panel (figures 1A-109, 1A-110).

Formation Lights

28V MAIN DC CP Side
EXTERIOR LIGHTS – FORMATION

The nine formation lights comprise three on the outer panel of each wing and three on top of the fuselage aft of the wing. The illumination and brilliance of all nine formation lights is controlled simultaneously through a single rheostat switch on the exterior lights control panel (figures 1A-109, 1A-110). The switch is turned clockwise from the OFF position to illuminate the lights and then further turned toward BRIGHT to increase the brilliance; rotation of the switch in the counterclockwise direction decreases the brilliance of the lights until the OFF position is reached.

Navigation Lights

28V ESS DC CP Side
EXTERIOR LIGHTS – NAVIGATION & POSITION

The navigation lighting system consists of six lights; a red light on the left wingtip, a green light on the right wingtip, two white lights on the trailing edge of the tail cone, a white light on top of the fuselage forward of the wing, and a white light on the lower surface of the fuselage. All lights can be set DIM or BRIGHT. The red and green wingtip lights and the white tail lights can also be set to flash or to glow continuously. The white lights on the top and bottom of the fuselage, however, will only illuminate continuously. The navigation lights selector switch turns the lights on and off and controls the flashing mechanism, and the navigation lights dimming switch controls the intensity of the lights. The selector switch is a three-position (STEADY, OFF, FLASH) toggle switch, located on the exterior lights control panel (figures 1A-109, 1A-110). When the switch is in the STEADY position, the lights glow continuously. When the switch is in the FLASH position, the wing tip lights and the white tail light flash simultaneously. The navigation lights dimming switch is a two-position (BRIGHT, DIM) toggle switch and is located on the exterior lights control panel.

Anti-collision Light

28V ESS DC CP Side
EXTERIOR LIGHTS – ANTI-COLLISION

The airplane carries one anti-collision light, on top of the wing. The light is contained within a red transparent housing and flashes through a motor-driven rotating reflector. The light is controlled by a two-position (ON, OFF) toggle switch, located on the exterior light control panel (figures 1A-109, and 1A-110), which also controls operation of the motor-driver reflector. When the switch is set to ON, the light is illuminated and the reflector commences to rotate.

WARNING

Operation of the anti-collision light when flying in actual instrument conditions is not recommended. The light reflecting on surrounding clouds may cause spatial disorientation.

STROBE LIGHTS

28V ESS DC CP Side
TOP AND BOT

The airplane is equipped with a Hella Dual RED/WHITE anti-collision strobe light system. Each system consists of a RED/WHITE strobe light unit and a remote power supply. A control switch is installed on the exterior light control panel (figure 1A-110) detail A, to turn the top and/or bottom system on/off and to select between red or white strobe light operation. The bottom strobe light is wired through the touch-down relay to prevent its operation on the ground. There is a TEST switch for the bottom strobe located at the NAV table (figure 1A-110) detail B. The dual systems are completely independent of each other. The bottom strobe is located on the bottom of the fuselage just aft of the ANS-4 antenna. The top strobe is located on top of the vertical stabilizer.

CAUTION

The brilliance of the white light and ultra violet radiation emitting from the light head unit can cause damage to the eyes.

WARNING

The power supply unit produces high voltage of 600 Vdc.

Interior Lighting Controls

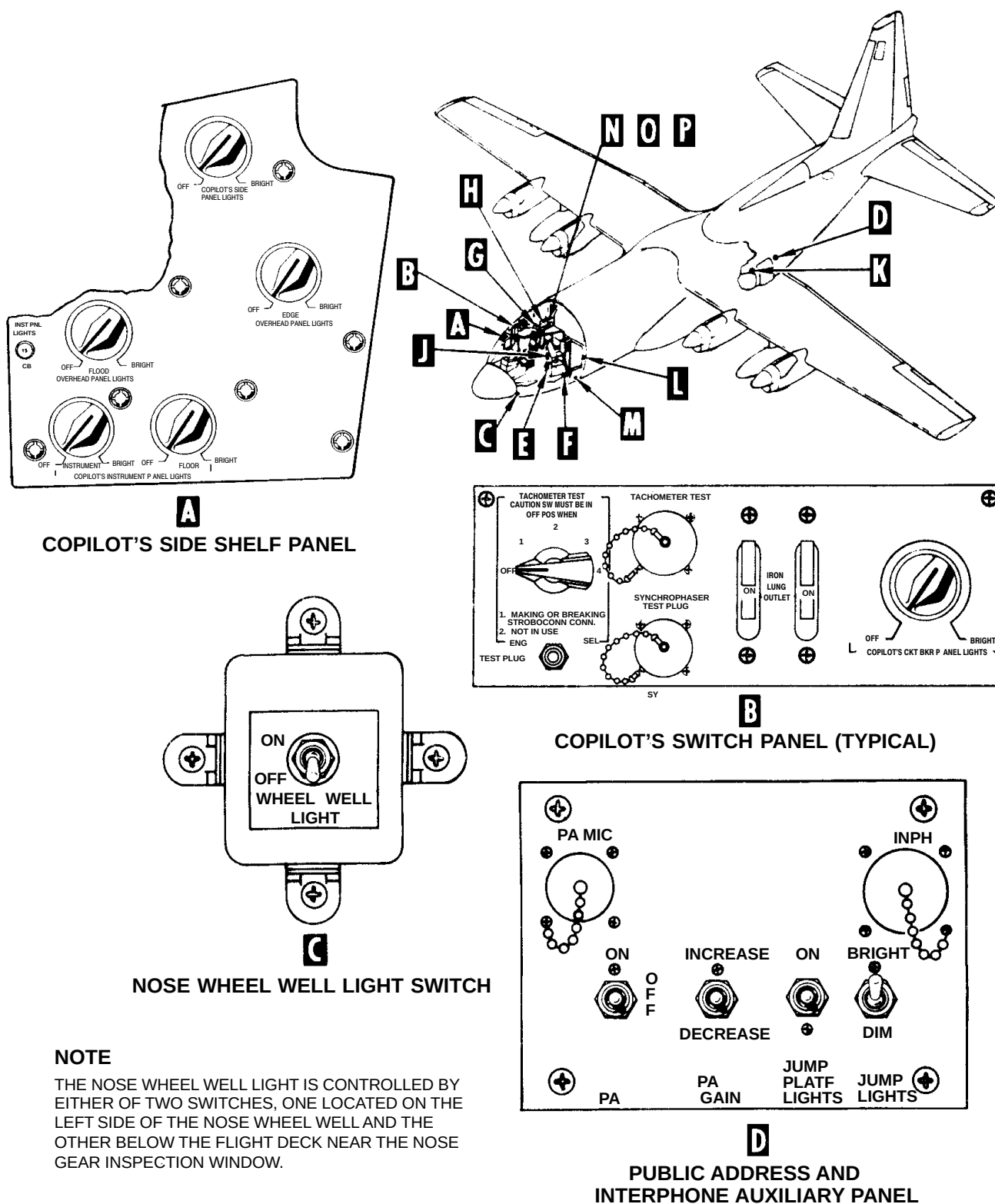
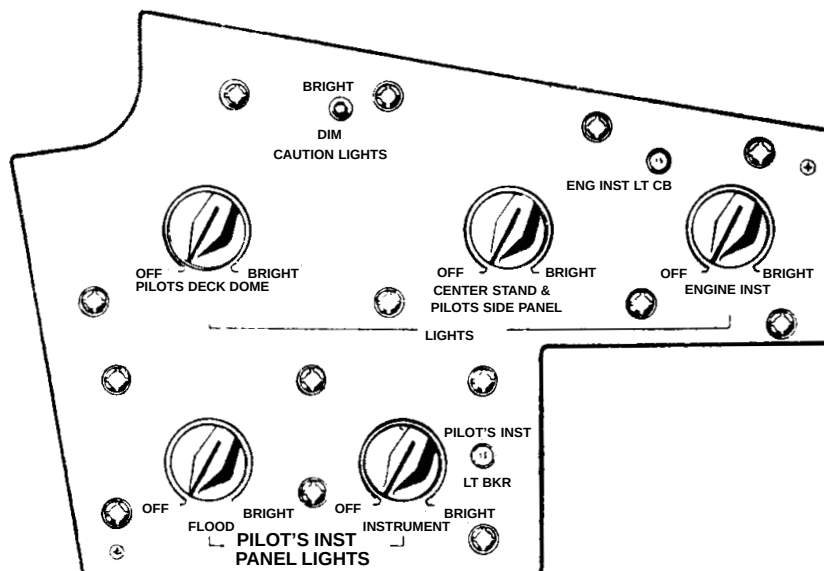
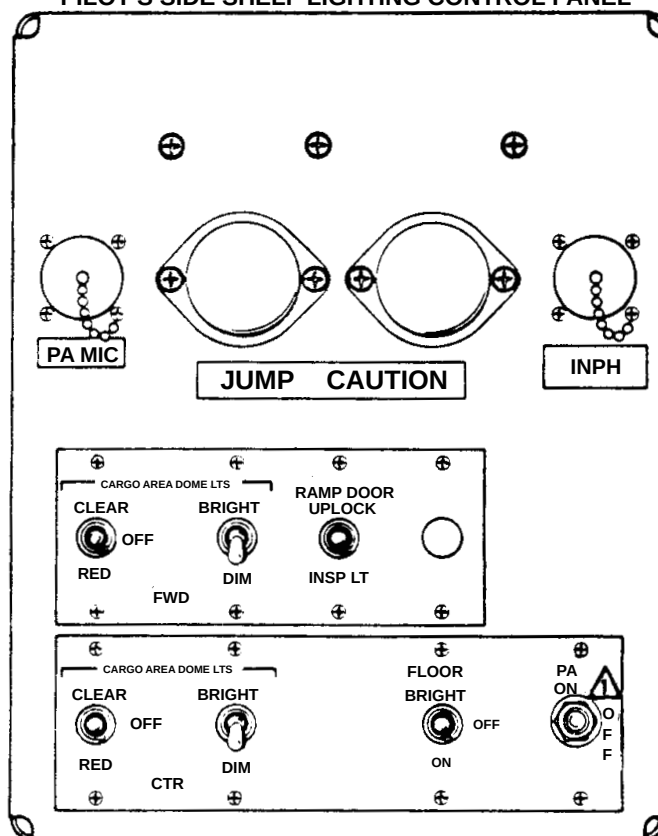


Figure 1A-111 (Sheet 1 of 4)

**E**

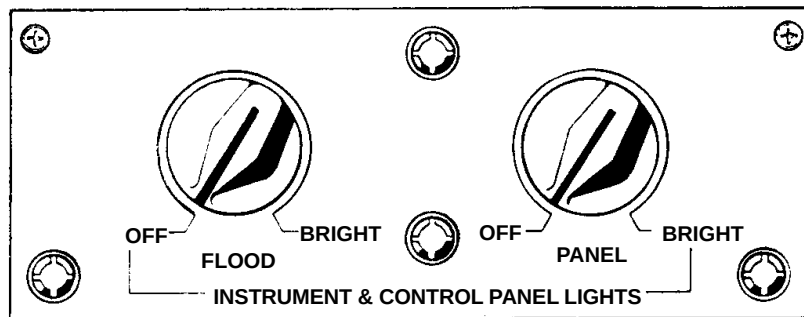
PILOT'S SIDE SHELF LIGHTING CONTROL PANEL

**F**

△ 1 CG 1705 AND UP

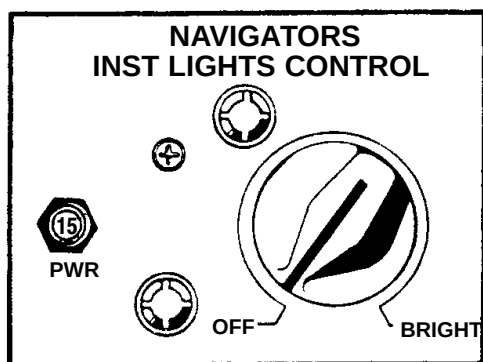
FORWARD CARGO COMPARTMENT
INTERPHONE/PUBLIC ADDRESS/
SIGNAL AND LIGHTING CONTROL PANEL

Figure 1A-111 (Sheet 2 of 4)



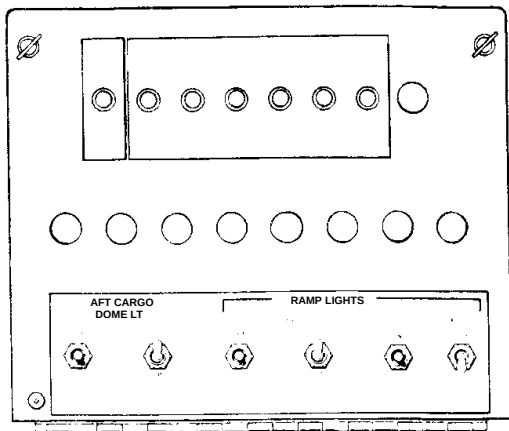
G

NAVIGATOR'S PANEL LIGHTS CONTROL PANEL



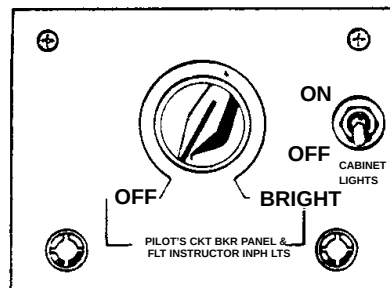
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NAVIGATOR'S INSTRUMENT LIGHTS CONTROL PANEL



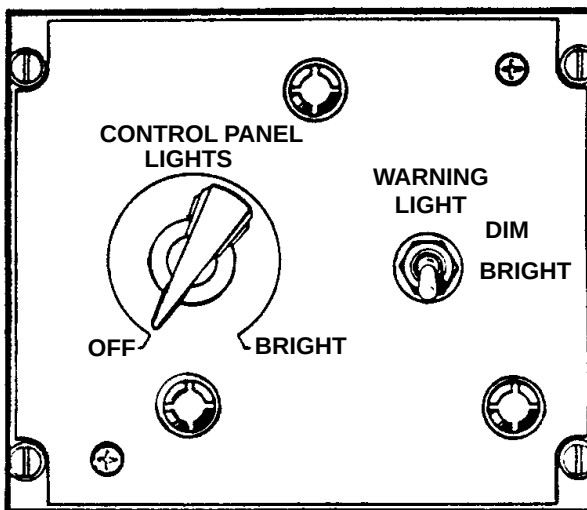
K

AFT FUSELAGE JUNCTION BOX PANEL



J

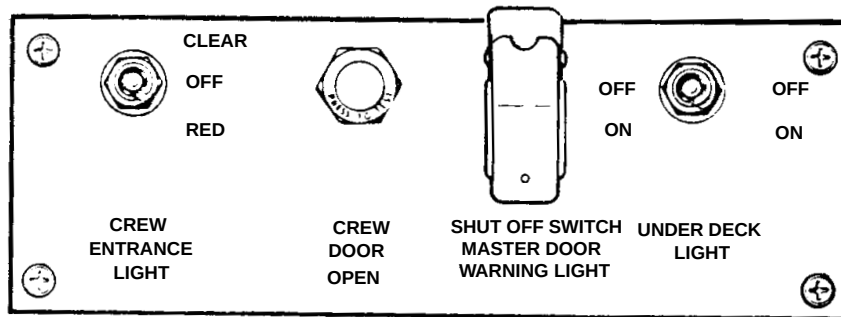
PILOT'S SWITCH PANEL



L

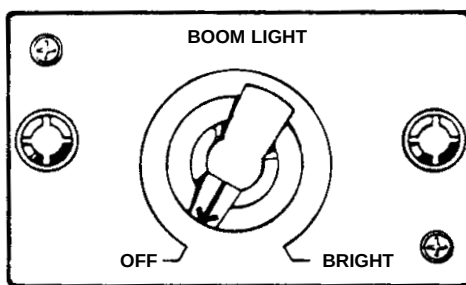
SCANNER'S STATION LIGHTS CONTROL PANEL

Figure 1A-111 (Sheet 3 of 4)



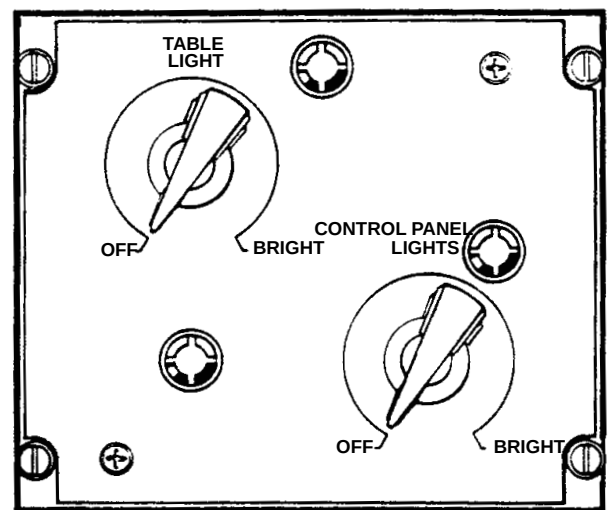
M

CREW DOOR WARNING LIGHT PANEL



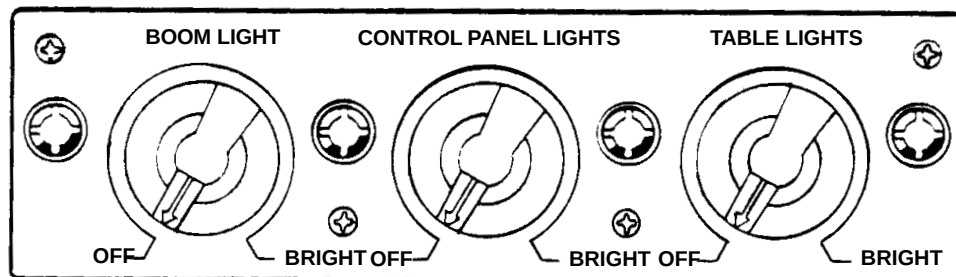
N

RADIO OPERATOR'S BOOM LIGHT CONTROL PANEL



O

RADIO OPERATOR'S PANEL LIGHTS CONTROL PANEL



P

RADIO OPERATOR LIGHT CONTROL PANEL (CG 1710 and Up)

Figure 1A-111 (4 of 4)

Interior Lighting

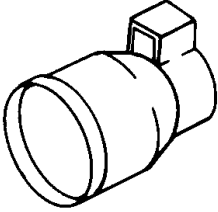
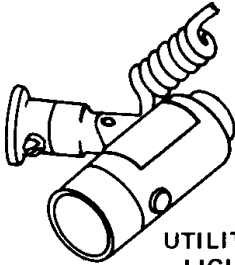
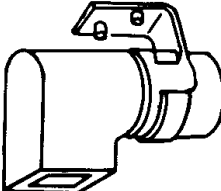
Flight Station				
	THUNDERSTORM LIGHT	UTILITY LIGHT	DOMELIGHT	FLOODLIGHT
PILOT	LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION	
	INSTRUMENT LIGHTING	PILOT'S SIDE SHELF	PILOT'S SIDE SHELF AND FUSE ON MAIN AC DISTRIBUTION PANEL	
	ENGINE INSTRUMENT LIGHTING	PILOT'S SIDE SHELF	PILOT'S SIDE SHELF AND FUSE ON MAIN AC DISTRIBUTION PANEL	
	CENTER STAND AND PILOT'S SIDE SHELF LIGHTING	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	FLIGHT DECK WHITE DOME LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	PILOT'S UTILITY LIGHT ON SIDE OF OVERHEAD PANEL	ON LIGHT	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	INSTRUMENT FLOOD LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
		(THUNDERSTORM LIGHTS SWITCH TURNS ON THESE LIGHTS)		
	TWO WHITE THUNDERSTORM LIGHTS ON SIDES OF OVERHEAD PANEL	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	FOUR WHITE DOME LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	INSTRUMENT FLOOD LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
		(DOME LIGHTS SWITCH TURNS ON THESE LIGHTS)		
	FOUR WHITE DOME LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	
	TWO WHITE THUNDERSTORM LIGHTS	PILOT'S SIDE SHELF	COPILLOT'S LOWER CIRCUIT BREAKER PANEL	

Figure 1A-112 (Sheet 1 of 4)

Interior Lighting

	LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
COPILOT			
	INSTRUMENT LIGHTING	COPILOT'S SIDE SHELF	COPILOT'S SIDE SHELF AND FUSE ON MAIN AC DISTRIBUTION PANEL
	INSTRUMENT PANEL WHITE FLOODLIGHTING	COPILOT'S SIDE SHELF	PILOT'S SIDE CIRCUIT BREAKER PANEL
	COPILOT'S SIDE SHELF LIGHTING	COPILOT'S SIDE SHELF	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	COPILOT'S UTILITY LIGHT ON SIDE OF OVERHEAD PANEL	ON LIGHT	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	SCROLL CHECKLIST HOLDER	ON HOLDER	COPILOT'S LOWER CIRCUIT BREAKER PANEL
NAVIGATOR			
	NAVIGATOR'S INSTRUMENT AND CONTROL PANEL LIGHTING	NAVIGATOR'S CONSOLE	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	NAVIGATOR'S PANEL WHITE FLOODLIGHTING	NAVIGATOR'S CONSOLE	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	NAVIGATOR'S INSTRUMENT LIGHTS 	NAVIGATOR'S INSTRUMENT PANEL	FUSE ON UPPER AC DISTRIBUTION PANEL AND CIRCUIT BREAKER ON THE CONTROL PANEL
	NAVIGATOR'S UTILITY LIGHT	ON LIGHT	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	SEXTANT LIGHTS	ON SEXTANT	COPILOT'S LOWER CIRCUIT BREAKER PANEL
ENGINEER			
	OVERHEAD PANEL EDGE LIGHTING	COPILOT'S SIDE SHELF	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	OVERHEAD PANEL WHITE FLOODLIGHTING	COPILOT'S SIDE SHELF	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	ENGINEERS UTILITY LIGHT	ON LIGHT	COPILOT'S LOWER CIRCUIT BREAKER PANEL
RADIO OPERATOR			
	INSTRUMENT PANEL LIGHTS	RADIO OPERATOR'S PANEL LIGHTS CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	WORK TABLE LIGHT	RADIO OPERATOR'S PANEL LIGHTS CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	BOOM LIGHT	BOOM LIGHT CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	RADIO OPERATOR'S UTILITY LIGHT	ON LIGHT	COPILOT'S LOWER CIRCUIT BREAKER PANEL
	 CG 1705 AND UP		

Figure 1A-112 (Sheet 2 of 4)

Interior Lighting

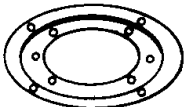
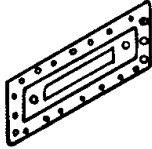
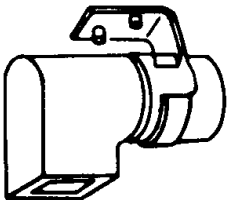
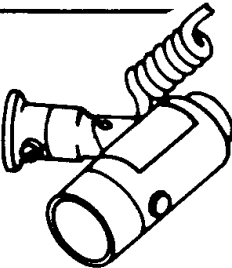
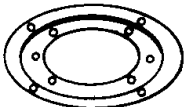
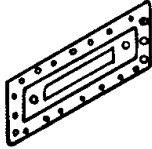
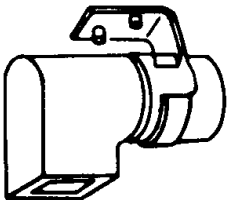
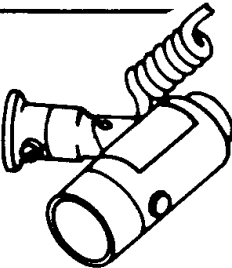
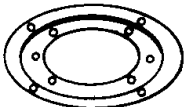
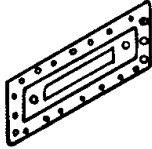
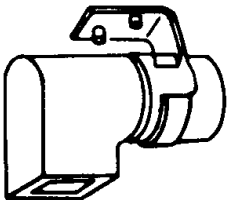
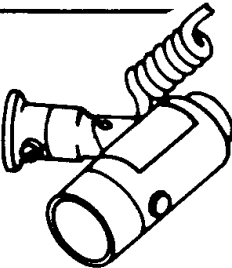
LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION						
MISCELLANEOUS								
PILOT'S CIRCUIT BREAKER PANELS EDGE LIGHTING	ON PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
COPILOT'S CIRCUIT BREAKER PANELS EDGE LIGHTING	ON PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
NOSE WHEEL WELL INSPECTION LIGHT	LEFT SIDE OF NOSE WHEEL WELL AND BELOW FLIGHT STATION NEAR NOSE GEAR INSPECTION WINDOW	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
PILOT'S CIRCUIT BREAKER PANEL CABINET LIGHTS	ON PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
Cargo Compartment <table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <td> DOME LIGHT</td><td> FLOOR LIGHT</td><td> RAMP LOADING LIGHT</td></tr> <tr> <td> JUMP PLATFORM LIGHT</td><td> UTILITY LIGHT</td><td> DOME LIGHT UNDER FLIGHT STATION FLOOR</td></tr> </table>			 DOME LIGHT	 FLOOR LIGHT	 RAMP LOADING LIGHT	 JUMP PLATFORM LIGHT	 UTILITY LIGHT	 DOME LIGHT UNDER FLIGHT STATION FLOOR
 DOME LIGHT	 FLOOR LIGHT	 RAMP LOADING LIGHT						
 JUMP PLATFORM LIGHT	 UTILITY LIGHT	 DOME LIGHT UNDER FLIGHT STATION FLOOR						
CARGO COMPARTMENT								
FLOOR LIGHTS	FORWARD CARGO COMPARTMENT INTERPHONE / PUBLIC ADDRESS / SIGNAL AND LIGHTING CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
FORWARD DOME LIGHTS (WHITE OR RED)	FORWARD CARGO COMPARTMENT INTERPHONE / PUBLIC ADDRESS / SIGNAL AND LIGHTING CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						
CENTER DOME LIGHTS (WHITE OR RED)	FORWARD CARGO COMPARTMENT INTERPHONE / PUBLIC ADDRESS / SIGNAL AND LIGHTING CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL						

Figure 1A-112 (Sheet 3 of 4)

Interior Lighting

LIGHTS	CONTROLS LOCATION	CIRCUIT BREAKER LOCATION
■ CARGO COMPARTMENT		
AFT DOME LIGHTS (WHITE OR RED)	AFT FUSELAGE JUNCTION BOX	AFT FUSELAGE JUNCTION BOX
RAMP DOME LIGHTS (WHITE OR RED)	AFT FUSELAGE JUNCTION BOX	AFT FUSELAGE JUNCTION BOX
TWO RAMP LOADING LIGHTS	AFT FUSELAGE JUNCTION BOX	AFT FUSELAGE JUNCTION BOX
TWO JUMP PLATFORM RED FLOOD LIGHTS	PUBLIC ADDRESS AND AUXILIARY PANEL	AFT FUSELAGE JUNCTION BOX
RAMP DOOR UNLOCK INSPECTION LIGHT	FORWARD CARGO COM- PARTMENT INTERPHONE/ PUBLIC ADDRESS/ SIG- NAL AND LIGHTING CON- TROL PANEL AND AFT FUSELAGE JUNCTION BOX	AFT FUSELAGE JUNCTION BOX
DOME LIGHT UNDER FLIGHT STATION FLOOR	CREW DOOR WARNING LIGHT PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
CREW ENTRANCE DOOR RED OR WHITE LIGHT	CREW DOOR WARNING LIGHT PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
SCANNER'S CONTROL PANEL LIGHT	SCANNER STATION LIGHTS CONTROL PANEL	COPILOT'S LOWER CIRCUIT BREAKER PANEL
SCANNER'S UTILITY LIGHTS	ON LIGHT	COPILOT'S LOWER CIRCUIT BREAKER PANEL

Figure 1A-112 (Sheet 4 of 4)

Searchlights (CG 1790)

28V ESS DC CP Side
LH and RH SEARCHLIGHT PWR

28V ESS DC CP Side
LH and RH SEARCHLIGHT CONT

A retractable searchlight is mounted in the lower leading edge of each wing, outboard of the No. 1 and No. 4 engine nacelles. Switches for extension, retraction, and illumination control are on the searchlights control panel located on the flight control pedestal. The searchlight switches are labeled the same as the landing lights control switches and operate in the same manner as the landing lights.

INTERIOR LIGHTING

Interior lighting consists of flight station and cargo compartment lighting. The various types of lighting, locations of light controls, and locations of circuit breakers for the light circuits are listed in figures 1A-111 and 1A-112. The pilot's and copilot's instrument lights and the engine instrument lights are ac powered from the essential ac bus and protected by fuses on the ac distribution panel aft on the 245 bulkhead and by circuit breakers located adjacent to the respective switches.

The secondary lights are white instrument panel flood lights. The copilot's secondary lights are powered by the isolated dc bus through a circuit breaker on the pilot's side circuit breaker panel. The pilot's and engine secondary instrument lights are powered by the essential dc bus through a circuit breaker on the copilot's lower circuit breaker panel. All other interior lighting is dc powered from the main dc bus and protected by circuit breakers on the copilot's lower circuit breaker panel.

Thunderstorm Lights

28V MAIN DC CP Side
INTERIOR LIGHTS – THUNDERSTORM & FLIGHT
DECK

Thunderstorm lighting is provided by four white dome lights, two white thunderstorm flood lights, and main instrument panel white floodlight. These lights are controlled by a two-position (ON, OFF) thunderstorm lights switch on the pilot's side shelf. Also, when the thunderstorm lights switch is placed in the ON position, the circuits to the instrument lights dimming relays are opened, thereby preventing the instrument and warnings lights from being dimmed.

Nosewheel Well Light

28V MAIN DC CP Side
NOSEWHEEL WELL LIGHT

A nosewheel well light aids in visual inspection of the nose landing gear while on the ground or while in flight. The light may be controlled from within the wheel well or from within the airplane by either one of two, two-position (ON, OFF) toggle switches (figures 1A-111). The switch inside the airplane is guarded to the OFF position, and is mounted adjacent to the nose landing gear inspection window on the aft bulkhead of the nosewheel well. The switch inside the wheel well is not guarded, and is mounted on the left side of the wheel well.

OXYGEN SYSTEM

The airplane is equipped with a gaseous-type oxygen system (figure 1A-113) with an initial (storage cylinders) pressure of approximately 1,800 psi. For crew consumption this pressure is reduced to an operating pressure of 300 to 400 psi.

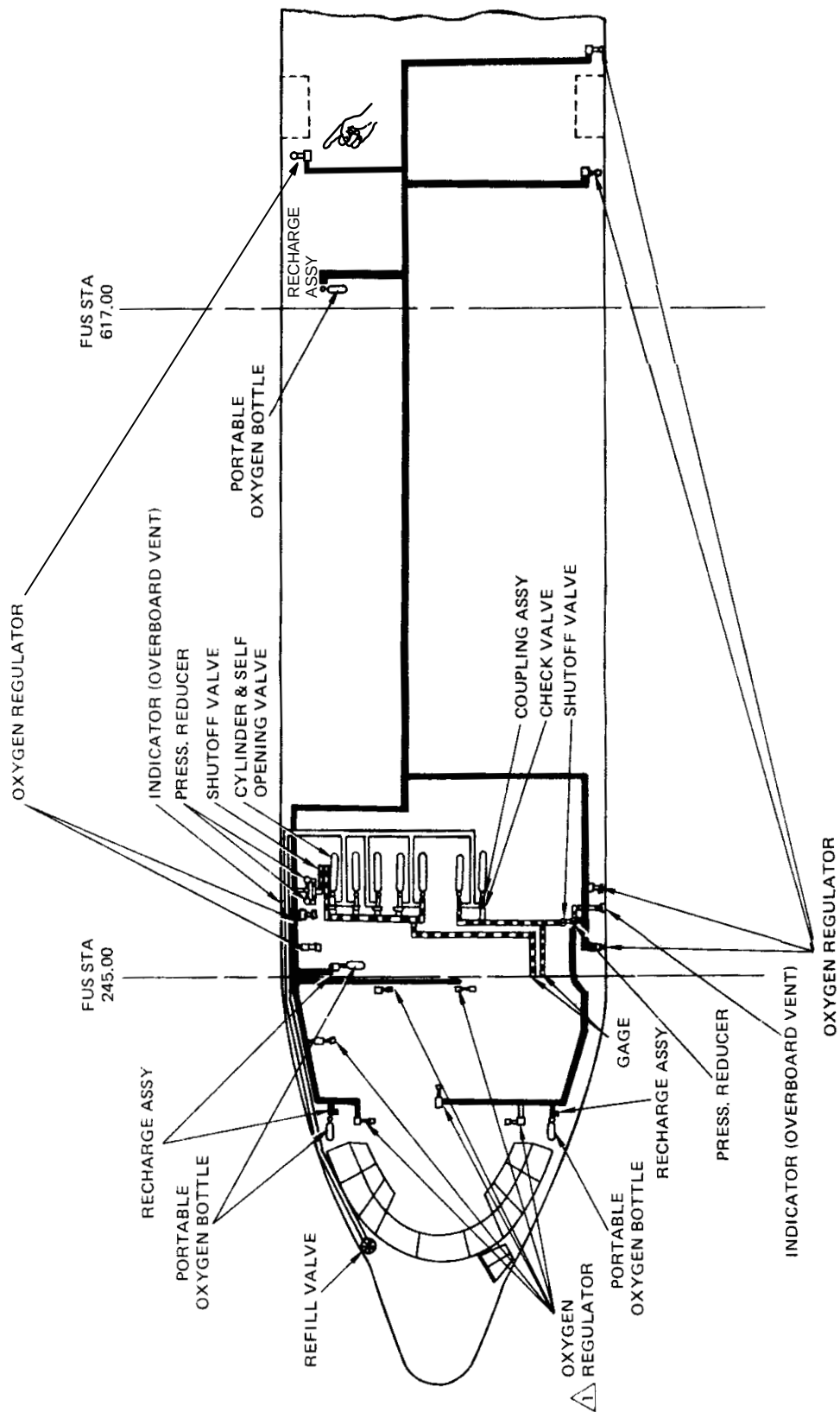
NOTE

Pressure reduction of the system occurs in the supply manifolds immediately downstream of the pressure shutoff valves.

Seven high-pressure storage cylinders grouped into two banks comprise the supply reservoir. A two-bottle bank supplies the regulators at the pilot's and flight engineer's stations. A five-bottle bank supplies the regulators at the copilot's, navigator's, and radiomen's stations, and the regulators located in the cargo compartment. The system is operated by manual selection to provide either oxygen that is diluted in different proportions to correspond to changes in cabin pressure altitude, or 100 percent oxygen for emergency use. Placing a demand on any of the regulators initiates oxygen flow.

Oxygen flow proceeds via high pressure tubing from the bank of storage cylinders associated with the chosen regulator through the pressure reducer valve(s), passing the respective high pressure gauge and high pressure shutoff valve in transit. From the pressure reducer valve it proceeds via low pressure tubing to the regulator and from there to the mask by means of the regulator-to-mask hose. To prevent high pressure oxygen from entering the low pressure system, a fail-safe feature having the physical configuration of a relief valve and a blow-out plug, venting overboard, is incorporated in the individual supply systems. The relief valves and blow-out plugs are located immediately downstream of the pressure reducer valves and are preset to crack open at, respectively, 500-600 psi and 20 psi. Two high pressure shutoff valves are installed immediately downstream of the high pressure gauges on modified airplanes to permit shutting off

Oxygen System (Typical)



NOTE
 1. ON CG 1790 AND 1700 SERIES
 THE ON SCENE COMMANDER'S
 REGULATOR IS NOT INSTALLED

Figure 1A-113

the high pressure supply in the event an emergency situation should make this action necessary. The system is charged through a filler valve located just aft of the radome on the right side. Dual check valves are installed in the filler and between cylinders lines to prevent depletion of the oxygen supply due to a leak in one of the storage cylinders.

When charged to capacity, a 5 hour's supply is normally provided for each crew member (figure 1A-114). The two banks of the system, once recharging is completed, are independent of each other and form independent units of supply. A leak in the line originating with the two cylinder bank will not deplete the supply in the five cylinder bank; and vice versa. A leak in the cargo compartment regulators, however, will deplete the supply in the five cylinder bank. In addition to the stationary system, four portable units are installed on the airplane to permit normal movement of crew members while performing functions removed from the flight station, or for emergency use. Recharging outlets for inflight recharging of the portable units are installed next to the portable units on the right and left side of the flight deck and on the cargo compartment. Care should be observed during any operation requiring use of the portable units at a point removed from the immediate vicinity of the flight deck or cargo compartment since they have a usable time-limit which decreases rapidly with decreasing altitude.

Oxygen Duration

BASED ON EIGHT CREW MEMBERS USING
SEVEN HIGH-PRESSURE TYPE CYLINDERS

CABIN ALTITUDE (feet)	1,800		1,575		GAUGE PRESSURE (PSI)						675		450		200		
					1,350		1,125		900								
35,000 AND ABOVE	HRS / MIN		HRS / MIN		HRS / MIN		HRS / MIN		HRS / MIN		HRS / MIN		HRS / MIN		HRS / MIN		EMERGENCY
	7	8	6	20	5	24	4	29	3	34	2	39	1	44	0	43	
	7	8	6	20	5	24	4	29	3	34	2	39	1	44	0	43	
30,000	5	9	4	34	3	54	3	14	2	34	1	55	1	15	0	31	DESCEND TO
	5	17	4	41	4	00	3	19	2	38	1	58	1	17	0	32	
25,000	3	58	3	31	3	00	2	30	1	59	1	28	0	58	0	24	ALTITUDE
	5	00	4	26	3	47	3	8	2	30	1	51	1	13	0	30	
20,000	3	1	2	41	2	17	1	54	1	30	1	7	0	44	0	18	NOT REQUIRING OXYGEN
	5	39	5	00	4	16	3	37	2	49	2	6	1	22	0	34	
15,000	2	22	2	6	1	47	1	29	1	11	0	53	0	35	0	14	
	6	52	6	5	5	12	4	20	3	26	2	33	1	40	0	41	
10,000	1	57	1	44	1	29	1	14	0	58	0	43	0	28	0	12	
	6	52	6	5	5	12	4	20	3	26	2	33	1	40	0	41	

UNSHADED FIGURES- INDICATE DILUTER LEVER "NORMAL OXYGEN"

SHADED FIGURES- INDICATE DILUTER LEVER "100% OXYGEN"

NOTE

When 100% oxygen is being supplied, less oxygen is consumed per person as altitude increases; therefore, the oxygen duration increases with an increase in cabin altitude (figure 1A-114).

OXYGEN SYSTEM COMPONENTS

The normal oxygen system components are pressure-demand regulators, seven high pressure storage cylinders, four portable units, four recharging outlets for in-flight filling of the portable units, seven dual-type check valves located in the filler and between-storage-cylinders lines, and a refiller connection for servicing the oxygen system.

Two high-pressure-supply shutoff valves, two high pressure gauges, three pressure reducer valves (one in the two cylinder bank supply line, and two, situated in parallel, in the five cylinder bank supply line), two blow-out plugs, venting overboard, and low pressure tubing running from the outlet side of the pressure reducers to the regulators.

Oxygen Regulators

A pressure-demand regulator (figure 1A-115) is located at each crew member's flight station, with numerous regulators in the cargo compartment, depending on the series. The navigator's regulator is located on the navigator's control panel,

NOTE

When all regulators are supplying oxygen, the pilot and flight engineer will have approximately 20% greater duration than the other crew members.

Figure 1A-114

and the flight engineer's regulator is located on the rear of the overhead panel. Each regulator is equipped with a flow indicator, a cylinder pressure gauge, and three toggle-type selector levers for selecting regulator operation.

Quick-Don Oxygen Masks

Quick donning oxygen masks are installed at each crew position to allow the flight crew to respond expeditiously to an emergency such as sudden depressurization or smoke and fumes. Each unit consists of a quick-don suspension device, oxygen mask and smoke goggles. The oxygen mask contains an integral microphone assembly which connects the crew member's headset with the aircraft communication system. Microphone switching from the headset to the oxygen mask is automatic for the pilot, copilot, and flight engineer and is completed as the suspension device is donned. All other crew members must disconnect from the headset microphone connection and then plug into the oxygen.

Full Face Oxygen and Smoke Mask

Full face oxygen and smoke masks are stowed at the portable low pressure walk-around oxygen bottles. The full face oxygen and smoke mask allows the flight crew to respond to an emergency such as smoke or fumes. The full face oxygen and smoke mask permits breathing of gaseous oxygen from a portable low pressure walk-around oxygen bottle or a demand regulator. The oxygen mask contains an integral microphone and headset assembly which connects to the aircraft communication system.

Oxygen Cylinders

Seven oxygen cylinders are installed in the airplane for oxygen storage. Cylinder charging pressure is 1,800 psi at 21 ° C (70 ° F). Each cylinder has a volume of 646 cubic inches, and the capacity is 42.9 cubic feet of oxygen based on 1,800 psi full pressure and 200 psi empty pressure. Pressure below 450 psi in either system should be reserviced.

Oxygen Regulator (Typical)

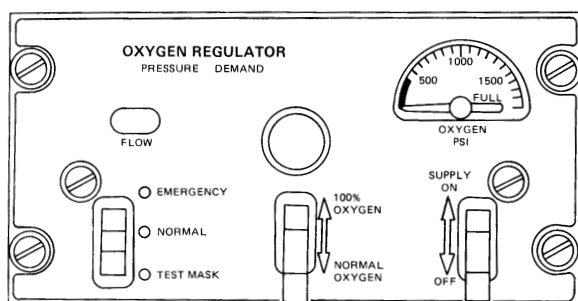


Figure 1A-115



Use of the oxygen supply system is not recommended below 50 psi. If the system pressure drops below 50 psi, an entry should be made in Form CG 4377.

PORTABLE UNITS

Four Type MA-1 portable oxygen units are provided for use by crew members at high altitudes, to facilitate movement within the airplane or for emergencies. The portable unit consists of a Type A-6 cylinder and a Type A-21 pressure-demand regulator. Each cylinder has a volume of 280 cubic inches and a capacity of 3.8 cubic feet of oxygen based on 400 psi full pressure and 50 psi empty pressure. The charging pressure of the portable cylinders is 450 psi maximum at 21 ° C (70 ° F). Each cylinder will supply approximately 30 minutes of oxygen (at 25,000 feet altitude) to a crew member during ordinary movement about the airplane. The portable units are mounted on the right and left sides of the flight deck, on the forward cargo compartment bulkhead, and aft of the left wheel well.

OXYGEN SYSTEM CONTROLS

Three levers are located on each oxygen regulator for manual supply, mixing, or shutoff of the oxygen low-pressure system.

Two serrated knobs which control the high-pressure-supply emergency shutoff valves are on the left and right sides of the forward cargo compartment.

Regulator Diluter Lever

A manually operated, two-position (NORMAL OXYGEN, 100% OXYGEN) diluter lever (figure 1A-115) is located in the lower center of the regulator. When the lever is in the NORMAL OXYGEN position, the regulator will provide automatic mixing of oxygen and air as required to maintain normal body oxygen requirements at all altitudes. When the lever is in the 100% OXYGEN position, the automatic air-oxygen mixing feature is bypassed, and 100 percent oxygen is supplied to the mask regardless of altitude.

Emergency Toggle Lever

A manually operated, three-position (EMERGENCY, NORMAL, TEST MASK) emergency lever (figure 1A-115) is located in the lower left corner of the regulator. When the lever is in the EMERGENCY position, oxygen is supplied at continuous positive pressure to the mask for emergency use. When the lever is in the NORMAL position, oxygen flow is controlled automatically by the regulator. The lever can be

moved to the TEST MASK position to supply a positive pressure at any altitude to test the mask fit.



When positive pressure is required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to ensure no leakage, the continued use of positive pressure under these conditions will result in rapid depletion of the oxygen supply.

Oxygen Supply Lever

A manually operated, two-position (ON, OFF) oxygen supply lever is located in the lower right corner of the regulator (figure 1A-115). When the lever is placed in the OFF position, oxygen from the storage cylinders is shut off. When the lever is placed in the ON position, normal oxygen flow is supplied to the regulator.

Oxygen High-Pressure-Supply Emergency Shutoff Valves

Two manually controlled high-pressure shutoff valves are installed. They function individually to shut off the high pressure supply from their respective storage cylinder banks. One shutoff valve is located on each side of the fuselage directly below the storage cylinders. Each shutoff valve can be controlled directly by means of a serrated knob located on top of the valve. The serrated knobs are equipped with window-like openings through which is presented a visual indication of the status (ON, OFF) of the high pressure supply system. The knobs are safetied to the ON position for normal operation. In the event an emergency situation exists, the valve pertinent to the emergency situation can be closed by breaking the safety wire and turning the knob clockwise until the word OFF appears in the window. The left knob controls the oxygen supply to the pilot's and flight engineer's regulators. The right knob controls the oxygen supply to the copilot's, navigator's, and cargo compartment regulators.

WARNING

When opening a pressure shutoff valve after it has been turned to the closed (OFF) position, caution must be exercised. The sudden rush of highly pressurized oxygen into a depleted system could cause a fire. To open the valve, turn the serrated knob slowly to ON (see decals located near the shutoff valves).

OXYGEN SYSTEM INDICATORS

Each regulator is provided with an operating-pressure gauge and a flow indicator (figure 1A-115), for checking the operation of the mask.

Oxygen Operating-Pressure Gauge

Each regulator is equipped with a dial-type pressure gauge that indicates pounds per square inch. ARO-type MD-2 regulators indicate system operating pressure only when the supply lever is in the ON position; Bendix type regulators indicate operating pressure in either the ON or OFF position.

Oxygen Flow Indicator

The flow indicator has a slide and window arrangement for indicating oxygen flow. When the crew member breathes in through the mask, the slide appears in the window to indicate oxygen flow. When the crew member stops breathing in and the flow of oxygen stops, the slide goes to a masked position. During normal mask operation the flow indicator blinks with each breath taken.

Oxygen High Pressure Gauge

Two dial-type high pressure gauges recording in pounds per square inch are mounted on the flight station forward cargo compartment bulkhead immediately above and slightly to the left of the door leading to the cargo compartment. Since these gauges are visible from the flight station they provide a convenient preflight and in-flight visual check of the pressures available in the respective banks of storage cylinders. The lower gauge presents a direct reading of the pressure in the two cylinder bank; the upper gauge presents a direct reading of the pressure in the five cylinder banks.

NOTE

Because of the decrease in temperature as the airplane ascends, the pressure indication may also decrease. Although a lower pressure is indicated, the usable oxygen remains the same. A rapid decrease in pressure while the airplane is in level flight or descending is an indication of a system leak.

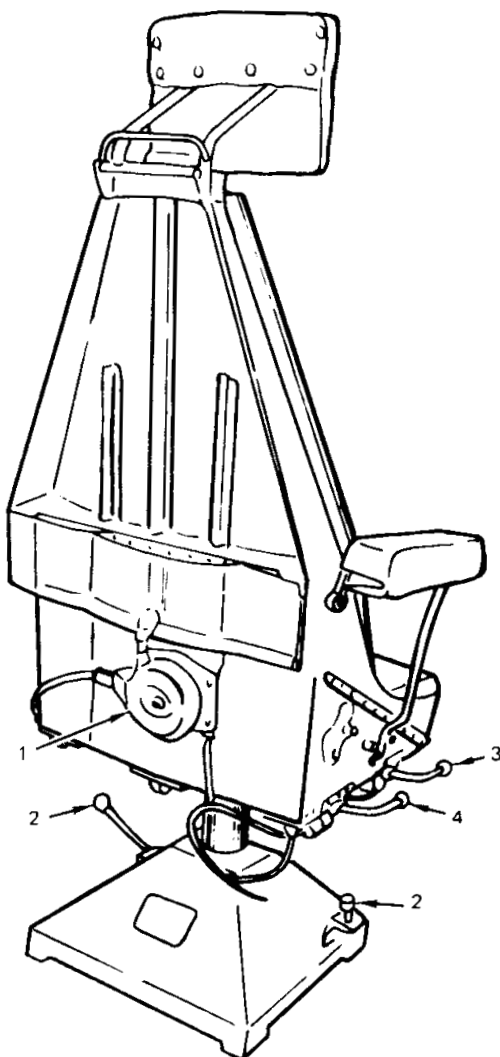
MISCELLANEOUS EQUIPMENT

Miscellaneous equipment consists of seats, windshield wipers, toilet and galley facilities, ladders, protective covers, blackout curtains, bells, rope ladder, and loading equipment.

SEATS

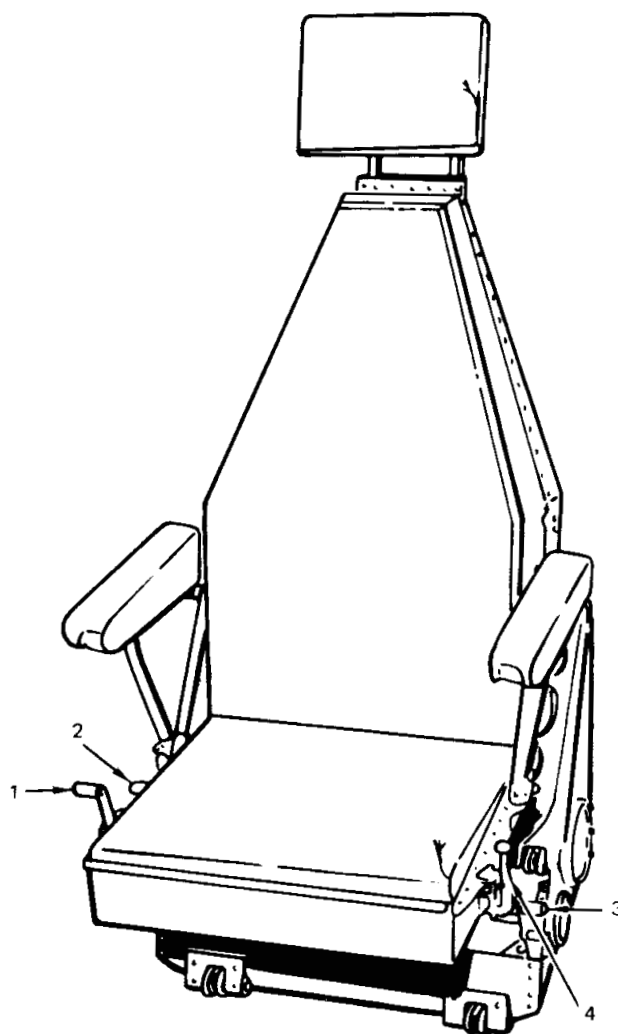
The crew is provided with tapered back seats (figure 1A-116), designed for use with back style parachutes. The pilot's, and copilot's seats are adjustable fore and aft and up and down. The engineer's, navigator's and radio operator's

**Crew Seats (CG 1500, 1600 Series, CG 1790,
and CG 1700 through 1704)**



ENGINEER'S AND NAVIGATOR'S SEAT

1. INERTIA REEL
2. HORIZONTAL ADJUSTMENT LEVER
3. SWIVEL RELEASE LEVER
4. VERTICAL ADJUSTMENT LEVER



PILOT'S AND COPILOT'S SEAT

1. SEAT TILT LEVER
2. VERTICAL ADJUSTMENT LEVER
3. HORIZONTAL ADJUSTMENT LEVER
4. INERTIA REEL LEVER

NOTE

THE NAVIGATOR'S SEAT DOES NOT HAVE ARM RESTS INSTALLED.

Figure 1A-116 (Sheet 1 of 2)

Crew Seats (CG 1705 and Up)

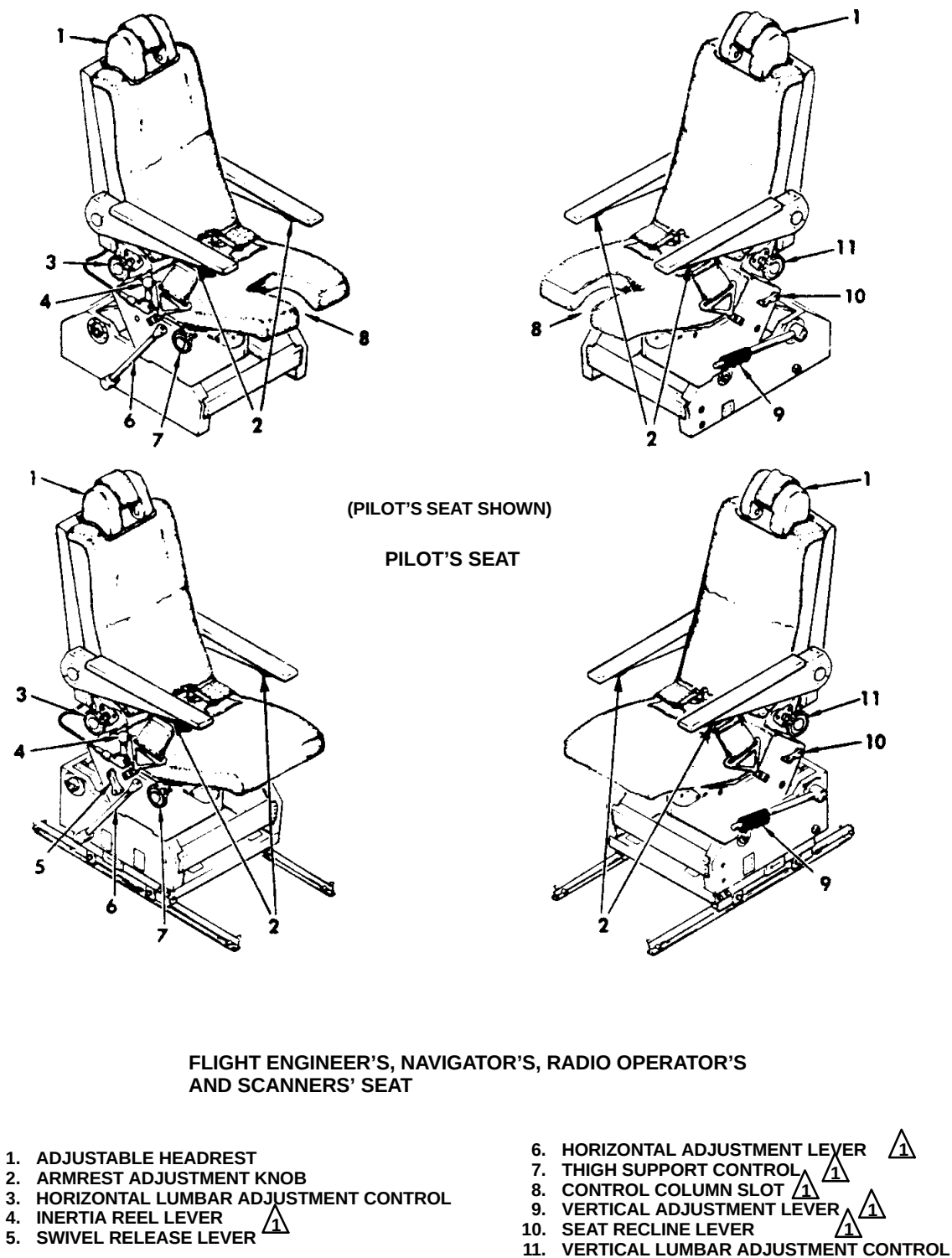


Figure 1A-116 (Sheet 2 of 2)

are mounted on a swivel base and allow the seats to be swiveled. (1500, 1600 series, CG 1790, and CG 1700 through 1704) The headrest is removable and may be stowed when not in use. (CG 1705 and up) The headrests are an integral part of the seat and adjust vertically. The seats are provided with adjustable armrests and vertical and horizontal lumbar support controls to provide additional crew comfort.

Seat Controls

PILOT'S AND COPILOT'S SEAT TILT LEVER

A seat tilt/recline lever, located on the side of the pilot's and copilot's seats, is a manual control which allows the seat to tilt forward or aft.

HORIZONTAL ADJUSTMENT LEVER

A horizontal adjustment lever, located on the side of the seats, locks and unlocks the seat adjustment mechanism, allowing the seat to be adjusted from an aft to a forward position. Moving the lever FORWARD locks the adjustment mechanism. Moving the lever AFT unlocks the adjustment mechanism.

SWIVEL RELEASE LEVER

A swivel release lever, located on the right side of the flight engineer's, navigator's, radio operator's, or observer's seats, controls the rotational movement of this seat. When the swivel release lever is moved, the seatlocking device is released and the seat can be rotated to any desired position. When the lever is released, the locking device engages to prevent rotation of the seat.

VERTICAL ADJUSTMENT LEVER

A vertical adjustment lever is located at the side of each seat. The seat itself is spring-loaded to its uppermost position. To adjust the seat for height, sit down in the seat, at the same time pulling up on the vertical adjustment lever. (CG 1705 and up). A button is located on the vertical adjustment lever; it must be depressed prior to moving the lever and released to lock it. The seat will tend to move up or down, depending on the weight applied to it. When the desired height is attained, release the lever, which will lock the seat in the desired position.

ARMREST ADJUSTMENT KNOB (CG 1705 AND UP)

The armrest adjustment knob, when rotated, sets the desired vertical angle of the individual armrest. The armrests may be rotated to the stowed position (full up) where they must be

physically pushed into the side of the seat. To unstow, the armrests must be pulled out away from the side of the seat and rotated down to their last adjusted position.

THIGH SUPPORT CONTROL (CG 1705 AND UP)

The thigh support control (THIGH), located on the side of the seat, is rotated to adjust the forward edge of the seat vertically to match the position of the thigh. This provides the crew member with a more comfortable thigh support.

HORIZONTAL LUMBAR (LUMBAR IN-OUT) ADJUSTMENT CONTROL (CG 1705 AND UP)

The horizontal lumbar adjustment control, located on the aft side of the seat, is rotated to adjust the back of the seat (lumbar area) fore and aft. This, coupled with the vertical lumbar support adjustment, will provide the crew member with the most comfortable back support.

VERTICAL LUMBAR (LUMBAR UP-DOWN) ADJUSTMENT CONTROL (CG 1705 AND UP)

The vertical lumbar adjustment control, located on the opposite side of the seat from the horizontal lumbar adjustment control, is rotated to adjust the back of the seat (lumbar area) up and down. This, coupled with the horizontal lumbar support adjustment, will provide the crew member with the most comfortable back support.

Safety Belts and Shoulder Harness

All crew seats are provided with a conventional seat safety belt and shoulder harness.

Shoulder Harness Inertia Reel Lock Control Handle

A two-position (LOCK, UNLOCKED) shoulder harness inertia reel lock control handle/lever (figure 1A-116) is located on the seat. A latch is provided for retaining the control handle securely at either position. By pressing in on the top of the control handle, latch is released and the handle may be moved freely from one position to another. When the control is in the UNLOCKED position, the reel harness cable will extend to allow a crew member to lean forward in his seat; however, the reel harness cable will automatically lock when an impact force of 2 to 3 g's on the airplane is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to LOCKED and then returned to the UNLOCKED position. When the handle is in the LOCKED position, the reel harness cable is manually locked so that the seat occupant is prevented from moving

forward. The LOCKED position is used only when a crash landing is anticipated. This position provides a safety precaution in addition to automatic safety lock. The navigator's, radioman's, flight engineer's, and scanner's (if installed), inertia reel will not function automatically, nor will the shoulder harness provide restraint if the seats are facing sideways. This is due to the plane of the inertia weight and spring.

A/A32H-4A CARGO HANDLING SYSTEM

GENERAL

This aircraft cargo handling system is designed to provide all series of C-130 airplanes with the capability to safely handle equipment and supplies for aerial delivery, and to expedite the handling and delivery of equipment for logistics.

DESCRIPTION

The A/A32H-4A cargo handling system consists of eight outboard restraint rail assemblies and 20 intermediate conveyor frame assemblies. The outboard restraint rails provide vertical restraint and lateral guidance for the pallets or platforms, while rollers in the conveyor frame assemblies give vertical support and facilitate transfer fore and aft during loading and unloading. Forward and aft restraint is provided by mechanical detent locks in the conveyor frame assemblies. Two sets of controls actuate the locking and release mechanisms. One set of controls actuates the left-hand mechanism, and one set actuates the right-hand mechanism.

RIGHT-HAND DETENT LATCHES

There are 11 variable restraint detent latches mounted outboard on the right-hand rails, 5 on both sections 2 and 4 and 1 on section 6. Each latch provides a constant forward restraining force of 20,000 pounds and a variable aft restraining force to 4,000 pounds. An adjusting bolt and a load indicator are provided on each latch to adjust for the desired spring tension. When the aft force exerted against the detent exceeds the preset value, the detent will disengage and remain disengaged. A lockout pin is provided to keep the detent in the fully retracted and locked out position.

LEFT-HAND DETENT LATCHES

There are 11 detent latches mounted outboard on the left-hand rail sections, 5 each on sections 1 and 3 and 1 on section

5. Each left-hand detent latch provides a constant restraining force of 20,000 pounds forward and 10,000 pounds aft.

DUAL RAIL QUICK RELEASE PINS

A quick release pin for each left dual rail latch is stored in a pouch located on the bulkhead at FS 240. They are used to lock out any malfunctioning latch(es). They are also used as an aid during the loading and unloading of pallets (single or married).

LEFT-HAND MASTER CONTROL

The left-hand master control device is composed of SIMUL OPEN control, and the LOCK-UNLOCK sequence control handles. The actuation of the left-hand master control, subject to the mode selected, will provide the following segments of operation.

- a. Engages and locks all left-handed detent latches sequentially, starting at the forwardmost latch.
- b. Unlocks and disengages all left-hand detent latches simultaneously.
- c. Unlocks and disengages all left-hand detent latches sequentially, starting at the aft-most latch.
- d. Retains detents in an unlocked position until relocked.

SIMUL OPEN CONTROL HANDLE

The left-hand SIMUL OPEN control handle is a four-position spring-loaded device which controls the actuation of the detent latches that have been locked by the use of the LOCK-UNLOCK sequence control handle. The four positions are as follows:

- a. Stowage Position – This is the full down-and-locked position which locks in all the latches simultaneously.
- b. Operation Position – This position is automatically attained by removing the quick release pin on the house assembly.
- c. Aft Restraint Release Position – In this position, aft restraint is removed but forward restraint is still in effect.

- d. Simultaneous Position – This is the full forward extended position. Both forward and aft restraint is removed from the detent body.

- (1) When the SIMUL OPEN control handle is actuated to the full forward position (detent latch release), a series of emergency release rods attached to the forward end of the bellcrank actuate the simultaneous release mechanism in each detent latch. This mechanical sequence retracts the detent latches into the rail, thereby eliminating all aft and forward restraint.

LOCK-UNLOCK SEQUENCE CONTROL HANDLE

The lock-unlock sequence control handle drives the draw bars fore and aft. The draw bar in turn drives the bellcrank forward and aft.

RIGHT-HAND MASTER CONTROL

The right-hand master control is at the forwardmost section of the conveyor and to the right of the left-hand master control. The master control is actuated by the RH EMERG REL handle. This handle is a four-position mechanical device that acts upon the right-hand detent latches as follows:

- a. The first position, CHECK, is the full down location. This position is used after loading to ensure all right-hand detents are properly engaged in the pallet or platform indents.

NOTE

The right-hand master control cannot be positioned in the CHECK position if any right-hand detent latch(es) is pinned out.

- b. The second position, NORM, is the normal or locked position. This position locks the right-hand detent latches to provide both forward and aft restraint.
- c. The third position, EMERG, eliminates the aft restraining force by removing the spring-loaded force applied to the detents.
- d. The fourth position, LOAD, completely retracts the detents, thereby removing all restraining forces in both forward and aft directions. This position is used for cargo loading.

RAMP DETENT ASSEMBLIES AND RETRACTABLE FLANGES

The retractable flanges and ramp detent assemblies are used when cargo is to be mounted aboard indented pallets and restrained on the ramp deck. There are three retractable flanges each in sections 7 and 8 to provide vertical restraint for pallets loaded on the ramp. Also, there is one detent each in sections 7 and 8 to provide fore and aft restraint. Normally, these spring-loaded devices stay retracted outboard to prevent them from being engaged inadvertently. For use, they are pushed into position manually and held by latches. For release the latches are moved simultaneously (in each section) by ramp emergency release handles, causing flanges and detents to retract. The ramp detents will restrain up to 5,000 pounds for 8G's forward.

NOTE

A maximum of 5,000 pounds may be carried on the cargo ramp including the weight of the conveyors. With dual rails installed, a maximum of 4,664 pounds may be carried on the ramp. With roller conveyors removed, a total of 4,824 pounds may be carried.

WINDSHIELD WIPER SYSTEM

28V	MAIN DC	CP Side
WINDSHIELD – WIPER		

Two electrically operated windshield wipers are installed: one on the pilot's windshield panel and one on the copilot's windshield panel. The speed of the windshield wipers is controlled by a six-position (PARK, OFF, SLOW, 2, 3, FAST) rotary-type windshield wiper control switch on the copilot's paratroop panel (figure 1A-117).

NOTE

At cruise speeds above approximately 180 KIAS, visibility through the windshield will be reduced by streaking as the windshield wipers are ineffective above this speed.

TOILET FACILITIES

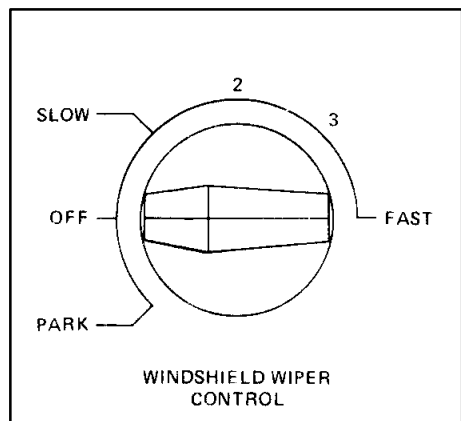
Toilet facilities consist of one chemical toilet or two urinals. The toilet is a fixed-type, located aft of the left paratroop door.

CHEMICAL FLUSH TYPE TOILET EQUIPPED AIRCRAFT

28V	MAIN DC	AFT FUS.J.B.
AFT TOILET		

Toilet facilities consist of an electrically powered flush-type toilet and two carry on/off type urinal holding tanks. The

Windshield Wiper Control

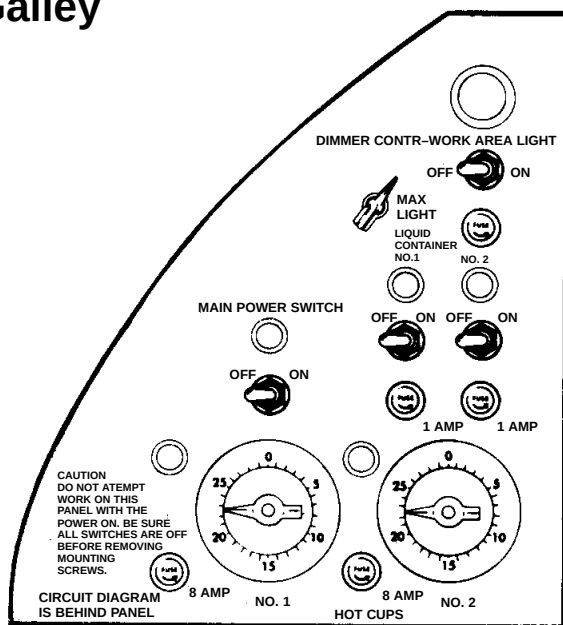


NOTE

LOCATED ON COPILOT'S PARATROOP PANEL

Figure 1A-117

Galley



A

GALLEY CONTROL PANEL

1. WATER TANK
2. LIQUID CONTAINERS
3. CUP DISPENSER
4. FOOD WARMING CUPS
5. REFUSE CONTAINER
6. REFRIGERATOR
7. STORAGE COMPARTMENTS
8. OVEN
9. FOOD STORAGE COMPARTMENTS
10. SINK
11. CAN OPENER

flush toilet is a fixed-type, located aft of the right paratroop door. It empties into an integral waste container and is serviced through an external adapter on the right aft fuselage.

GALLEY EQUIPMENT

115V

LH AC

P Side

GALLEY POWER – FLIGHT DECK

The flight crew galley (figure 1A-118) is located on the left side of the flight deck near the crew entrance. The galley floor shall be stored in the up position for takeoffs, landings, or touch-and-go's. It is recommended to be down during flight to protect the crew should the crew entrance door open during flight. The following facilities are provided:

1. A water tank connected by a tube to a pushbutton-type water spigot.
2. Two 2-gallon liquid containers with electrical heating elements for keeping liquids hot.

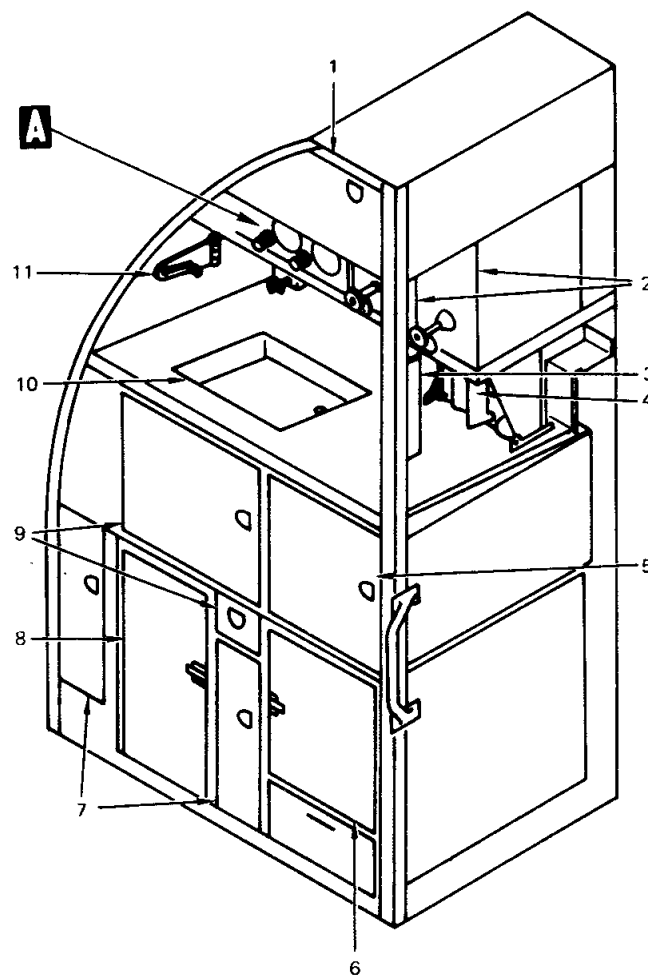


Figure 1A-118

3. A cup dispenser.
4. An electrically operated oven.
5. Two food warming cups.



The food warming cup timer should be turned to at least 5 minutes and then to the desired setting to ensure proper timer operation. Failure to comply with this may provide continuous heating to the cup and subsequent overheating.

6. A 1.5-gallon sink.
7. A refrigerator, dry-ice-cooled and mechanically operated, with a compartment for frozen foods and one for foods not requiring freezing.
8. A refuse container.
9. Food storage compartments.
10. A wall-mounted can opener.
11. Galley work area and switch panel lights.

The galley is also equipped with an electrical switch panel which incorporates the following:

1. A two-position (ON, OFF) main power switch and indicator light.
2. Two timers and two indicator lights for the food-warming cups.
3. Two two-position (ON, OFF) switches and two indicator lights for the liquid containers.
4. A two-position (ON, OFF) switch and a dimmer control for the galley work area light.
5. Cartridge fuses for the work area light, liquid containers, and food-warming cups.

Additional liquid containers (water), cup dispensers, and waste containers are installed in the cargo compartment aft of the paratroop doors.

LADDERS

Escape and maintenance ladders are provided. The escape ladders consist of a rigid metal and/or a rope ladder. The ladders should be installed in their position under the center escape hatch. The maintenance ladder has no specific area in which to be stowed.

WARNING

With the metal escape ladder installed it is impossible to exit the airplane from the center overhead cargo compartment escape hatch using the left side of the ladder.

Center Overhead Escape Hatch Rope Ladder

WARNING

Stand clear of area under rope ladder when the ladder is released.

A rope ladder is provided at the center overhead escape hatch to provide access to the escape hatch from the cargo floor. The ladder is secured near the hatch and is normally stowed in the rolled up position. A release mechanism, controlled by a T-handle on the aft side of the right-hand wheel well bulkhead, is provided to release one end of the ladder allowing it to unroll. Fittings on the loose end of the ladder and on the cargo floor permit securing the ladder to the floor.

PROTECTIVE COVERS

Protective covers for the engine tailpipes are stowed in a container attached to the left side of the cargo compartment near the aft cargo door. Covers for the engine inlet air ducts are stowed on the left side of the cargo compartment aft of the crew entrance door. Protective covers for the pitot tubes are stowed in the container. Covers for air conditioning and APU units are aft of the right paratroop door.

BLACKOUT CURTAINS

Blackout curtains for the windows in the cargo compartment are stowed in a pocket next to each window. A curtain is provided to divide the flight deck. The left and right forward observer stations (search windows) in the cargo compartment also have curtains.

APPROACH CHART HOLDERS

28V MAIN DC CP Side
CTR STD & PILOT SIDE PNL

A lighted lumipane approach chart holder is installed in the center of the pilot's and copilot's control wheels. The lights are controlled by two rheostats located on the front of the holders. One rheostat controls white and the other controls red light intensity.

CARGO LOADING EQUIPMENT

Cargo loading equipment includes hydraulically operated aft cargo door and loading ramp, and miscellaneous equipment for loading and securing vehicles, cargo, litters, and troop seats.

Tie-down Fittings

Tie-down fittings are installed on the cargo floor, ramp, and side walls for securing cargo, litters, and troop seats. The flush-mounted floor fittings consist of tie-down rings and attachment studs. The floor rings are rated at 10,000-pound strength. The ramp and side wall fittings are tie-down rings rated at 5,000-pound strength. Threaded sockets are distributed along the edges of the cargo floor for the attachment of 25,000-pound fittings. Two are available with rails installed.

Cargo Nets

Cargo nets are supplied for tying down palletized cargo and small items stacked together. These nets have hooks and rings for attaching to the cargo floor and the installation of tie-down devices. The cargo nets are stowed in boxes on the left and right side wall above the ramp, and on the aft cargo door.

Snatch Blocks (Model C-141)

Two removable snatch blocks are stowed in the miscellaneous stowage box aft of the flight station. These snatch-blocks can be installed in the threaded sockets located beneath the forward cargo compartment bulkhead.

Wheeled Pry-bars

Two type MA-1 wheeled pry-bars are provided on the airplane. These pry-bars are used for handling boxes and crates in the cargo compartment, and may be used either singly or in pairs.



Although the wheeled pry-bar has a capacity of 5,000-pounds, the cargo floor will not withstand this load on the small area of contact of the wheels. Refer to T.O. 1C-130A-9 for pry-bar limitations.

Auxiliary Ramps

Four auxiliary ramps are supplied with the airplane. Two of these ramps are used during truck-loading operations and two for use during ground-loading operations. These auxiliary ramps are stowed on the right side wall above the ramp and inside the aft cargo door when not in use.

Portable Winch

A portable winch is available for each airplane. The winch is installed on the cargo floor by hooking it to two 10,000-pound tie-down rings. Twenty-eight volt, dc power is supplied to the winch through a receptacle located slightly below and to the right of the hand-operated fire extinguisher on the forward cargo compartment bulkhead. An additional cargo winch receptacle, mounted adjacent to the 28-volt, dc receptacle, provides 115/200-volt, 3-phase, ac power from the essential ac bus for operation of an ac-powered cargo winch.

Loading Instructions

For detailed information concerning cargo loading, tie-down, and aerial delivery instructions, see T.O. 1C-130A-9, Cargo Loading.

AIR DROP SYSTEM (ADS)

Ramp and Door Control Switch

28V ESS DC Aft
RAMP AND ADS CONTROL Junction Box

The ramp and door control switch is a three-position (CLOSE, OFF, OPEN) toggle switch located on the ADS control panel (figure 1A-99) that controls operation of the ramp system during flight. When the switch is in the OPEN position, electrical power through the ramp and ADS control circuit breaker on the aft fuselage junction box is supplied through a touchdown relay to energize the aft cargo door and ramp system. As long as power is supplied or until open and locked, the aft cargo door raises and the ramp lowers to the airdrop position.

When released, the switch moves to the OFF position removing power to the ramp and door. If the power is removed prior to obtaining open and locked indication, the ramp will

remain where it stopped and the door will drop to the closed position. When the switch is placed in the CLOSE position, power is applied to the aft cargo door and ramp system, and the aft cargo door and ramp move to and lock in the closed position.

WARNING

The ADS switch should be placed in the OFF position prior to takeoff. Failure to do so will result in the cargo door cycling open to closed upon takeoff.

PASSENGER CARRYING EQUIPMENT

NOTE

A passenger shall be defined as any person traveling on a Coast Guard aircraft not actively filling a crew position.

An LPP-1 Passenger Life Preserver, or similar approved flotation device, is required on board for each passenger. See COMDTINST M3710.1 (series).

An oxygen source is required for each passenger anytime passengers are transported simultaneously with hazardous materials. See AFJMAN 24-204 for further restrictions. If transporting more passengers than available oxygen regulators, emergency passenger oxygen systems (EPOS) must be provided. EPOS kits are one-time use devices, consisting of a fire retardant see-through hood and oxygen bottle. For further detailed information see T.O. 15X5-2-4-1, Operation and Maintenance Instructions.

TROOP CARRYING EQUIPMENT

When the airplane is used as a troop carrier, seating accommodations are provided for 58 paratroops or 86 ground troops. By using the seat attachment provisions on the wheel well walls, 14 additional ground troops can be carried.

For paratroop airdrop missions, the seats are installed on a 24-inch spacing. For ground troops or personnel transport, the seats are installed on a 20-inch spacing. The installed seats form a single row down each side of the cargo compartment and a double row (back-to-back) down the center of the cargo compartment. When the airplane is not being used for transporting troops, the seats are rolled up and stowed. The method of installing and stowing the seats is given on the instruction placards located on the center seat stanchions, cargo compartment forward bulkhead, and cargo compartment left wheel well wall. For detailed information, see T.O. 1C-130A-9, Cargo Loading.

CASUALTY CARRYING EQUIPMENT

Casualty transport facilities for up to 66 litters and 6 attendants, or up to 70 litters and 2 attendants, are possible. The litters are carried aboard the airplane through the aft cargo door and ramp, and are installed in four rows in the cargo compartment. For detailed instructions on litter installation and stowage, see T.O. 1C-130A-9, Cargo Loading.

PARATROOP EQUIPMENT

Paratroop equipment consists of seats, jump platforms, anchor lines, jump signals, and air deflectors.

Seats

Seats are provided for 58 paratroops. The seats are installed and positioned with a 24-inch spacing when used for paratroops. When not in use, the seats are stowed. For detailed instructions on seat installation and stowage, see T.O. 1C-130A-9, Cargo Loading.

Paratroop Jump Doors

A paratroop jump door is installed on each side of the fuselage just forward of the ramp. Each door is unlocked by a handle located in the center of the door. After the latch pins are released, the door is raised manually with an inward and vertical movement. The door is held in the open position by a spring-loaded latch which must be released manually before the door can be closed.

A pip pin is installed at the top forward edge of the door frame to prevent the uplock from opening. A storage point is provided adjacent to the door frame.

WARNING

The pip pin will not be installed in the locked position with the door closed except on the ground to secure the airplane.

Jump Signals

28V	BATT DC	P Side
TROOP JUMP LIGHTS		

Jump signals consist of red and green lights. A jump signal is located on the forward and aft frame of each paratroop door, on each paratroop anchor line support arm, on the forward cargo compartment interphone panel, and on the pilot's and copilot's paratroop panels. The lights are controlled from the pilot's or copilot's paratroop panel (figures 1A-119 and 1A-120) by two-position (ON, OFF) toggle switches. A cam is installed between the switches so the jump switch cannot be actuated until the caution switch is placed in the

ON position. When the caution switch is placed in the ON position, the red light illuminates; when the jump switch is placed in the ON position, the green light illuminates. The jump lights can be turned to bright or dim by a two-position (BRIGHT, DIM) toggle switch located on the aft cargo compartment interphone and PA panel.

Paratroop Anchor Line Support Controls

The controls for operating both the left and right paratroop anchor line control arms are on the aft side of FS 245 bulkhead (figure 1A-121).



The paratroop anchor line control arms must be stowed in the up position when not in use. Failure to do so may result in structural damage to the cargo

door and anchor arm should the cargo door be operated manually with the arms extended.

Static Line Retriever Winches

The static line retriever winches located on the aft side of FS 245 bulkhead are operated by controls colocated near the respective winches. There are two additional hand held controls located aft of the left and right paratroop doors for winch operation by the Dropmaster (figure 1A-122).

Air Deflectors

28V MAIN DC CP Side
PARATROOP AIR DEFLECTOR – CONTROL OR LIGHT

Air deflectors, located on each side of the fuselage just forward of the paratroop doors, form the rear section of the main landing gear wheel well fairing. These air deflectors open approximately 15.5 inches to serve as a wind break for paratroops. Three-position (OPEN, OFF, CLOSE) air deflector switches located on the pilot's and copilot's paratroop panels (figures 1A-119, 1A-120), control the air deflectors. These

Pilot's Paratroop Panel

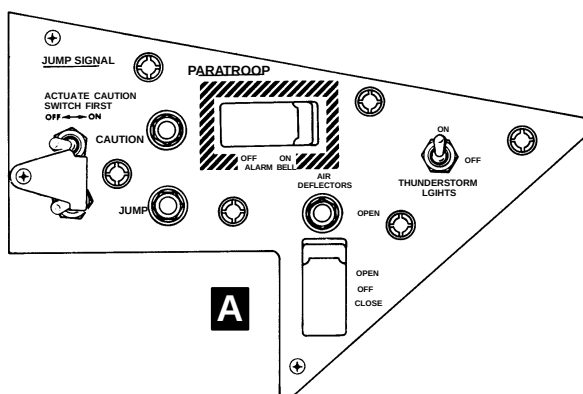
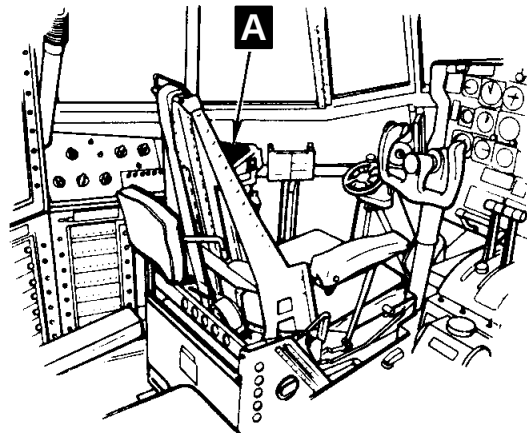


Figure 1A-119

Copilot's Paratroop Panel

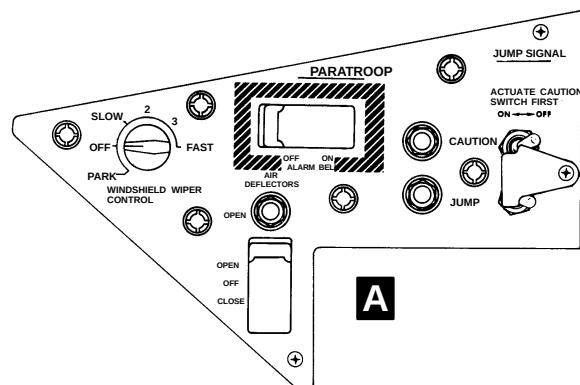
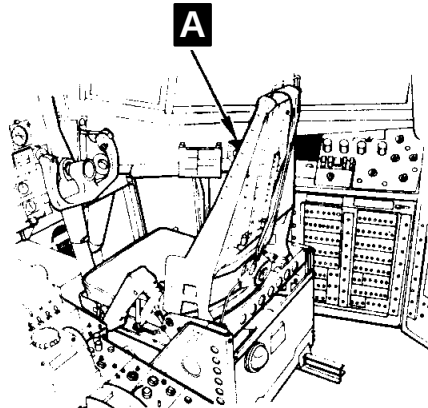


Figure 1A-120

switches have guards that can be closed to cover the switch in either the OFF or CLOSE position. A warning light above each switch illuminates when the doors are not completely closed. Placing either air deflector door control switch to the CLOSE position will cause the air deflector doors to close regardless of the position of the other control switch. The doors cannot be opened by either switch if the other switch is in the CLOSE position.

Paratroop Jump Platforms

Two metal, non-skid jump platforms are used in the paratroop jump door openings, for paratroop jump operation.

SINGLE POINT REFUELING AND DEFUELING SYSTEM

A single point refueling and defueling system enables all normal refueling and defueling operations to be accomplished through a single receptacle located in the aft end of the right wheel well fairing. All tanks may be serviced through the system. Controls and indicators for the system

are on the refueling control panel (figure 1A-123), located immediately above the receptacle.

When refueling, fuel enters the tanks by way of the refueling manifold, and a dual float valve in each tank shuts off the flow when the tank is filled to its single point refueling capacity. Defueling and ground tank-to-tank fuel transfer is accomplished by running the tank boost pumps and the auxiliary and external tank pumps. Defueling flow is through the crossfeed manifold, through the ground transfer valve to the refueling manifold, and out the single point refueling/defueling receptacle.

The fuel dump pumps may be used for defueling. The pumps are controlled from the flight station fuel control panel. Defueling flow, when using the dump pumps, is through the dump line to the refueling manifold and out the single point refueling/defueling receptacle. A surge suppressor is located in the refueling line to prevent damage to the fuel system components. A surge suppressor pressure gauge is located behind the right air deflector door.

Paratroop Anchor Line Support Controls

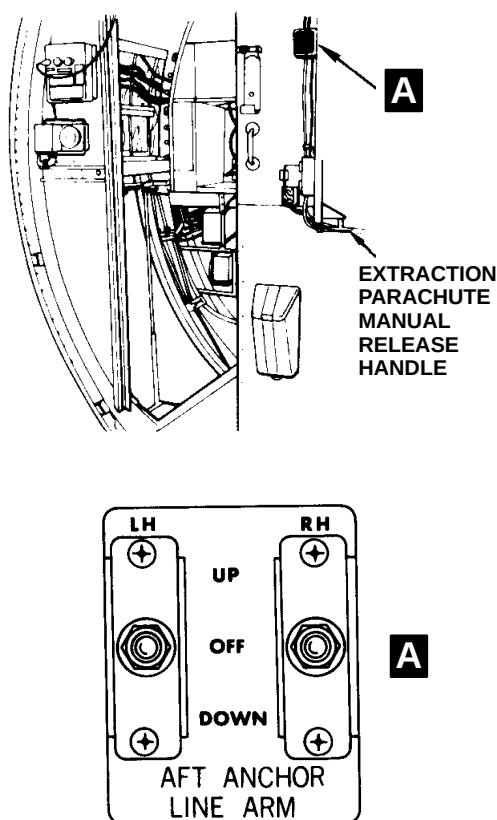


Figure 1A-121

Static Line Retriever Control Panels

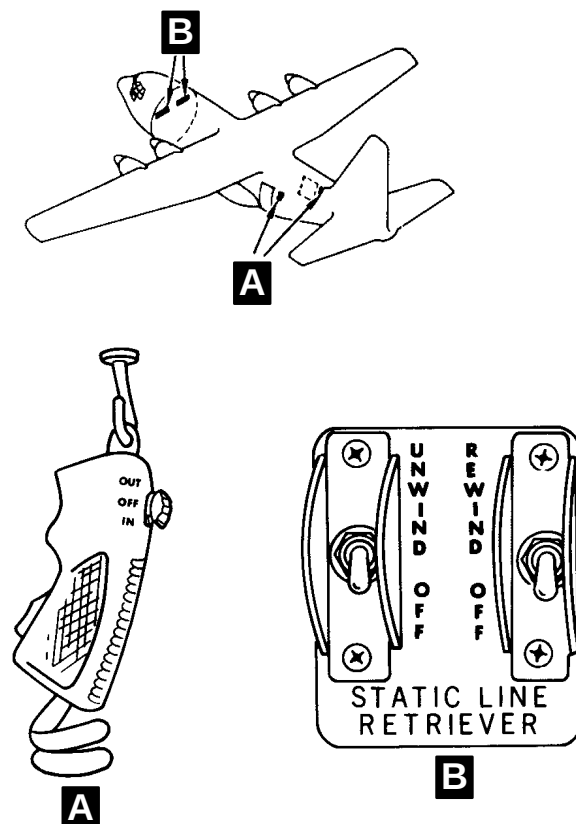
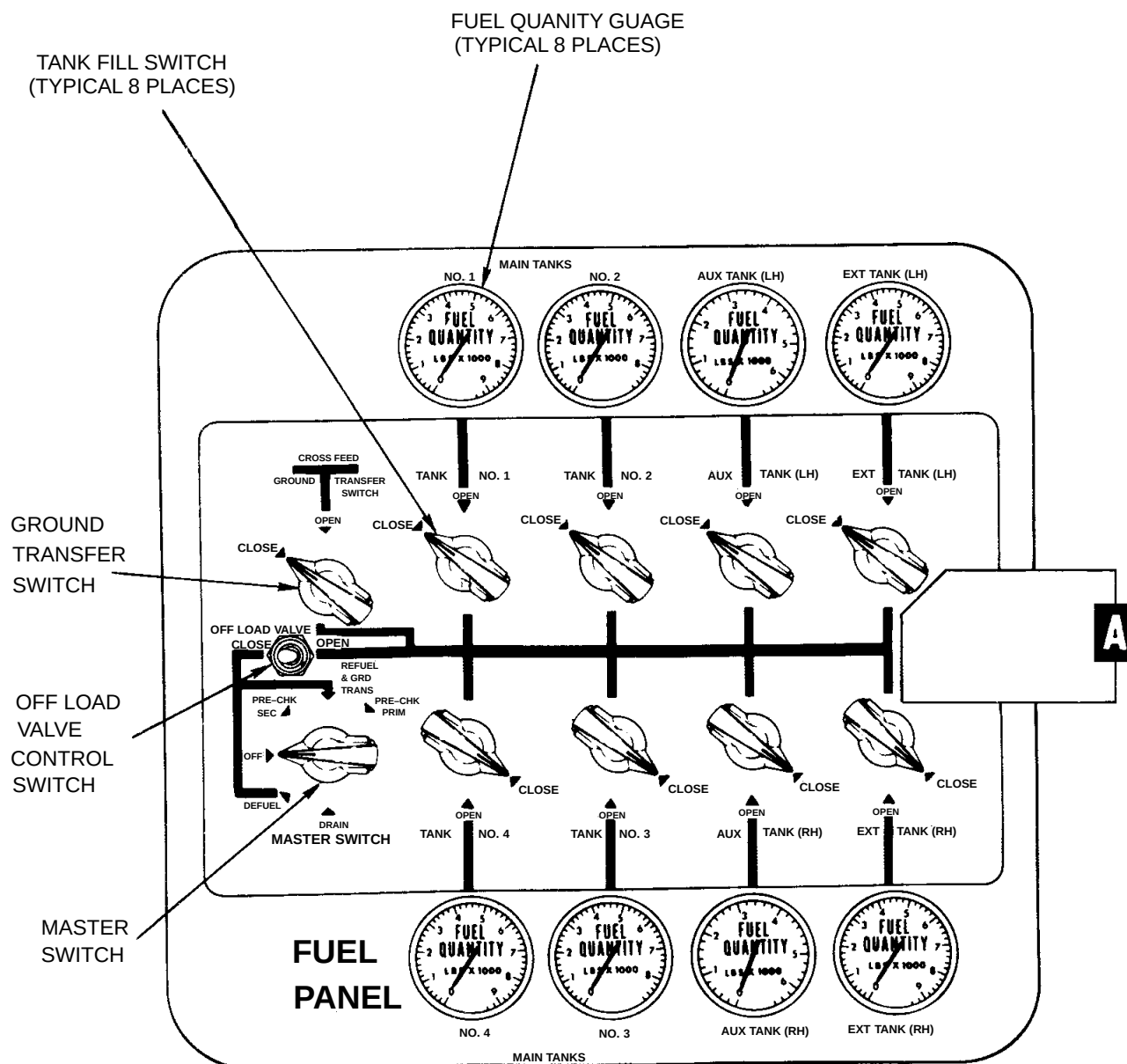


Figure 1A-122

Single-Point Refueling Control Panel

**NOTE**

1500 SERIES NOT CNMS/GPS MODIFIED

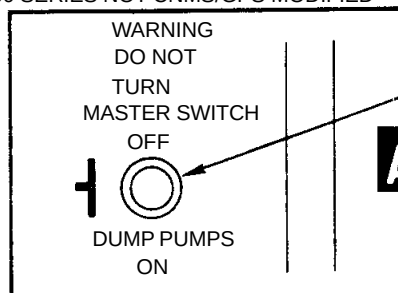


Figure 1A-123

SINGLE POINT REFUELING AND DEFUELING SYSTEM CONTROLS

Except for the pump switches, which are located on the fuel control panel and are used to operate the tank pumps during defueling operations, all the single point refueling and defueling controls are on the refueling control panel (figure 1A-123), above the fueling receptacle on the right wheel well fairing. These controls comprise a master switch, a selector switch, a fuel quantity gauge for each of the tanks, ground transfer switch, and an off-load valve.

Master Switch

28V MAIN DC CP Side
REFUELING PANEL – TANK SOLENOIDS

A master switch for the single point refueling system is located on the refueling control panel (figures 1A-123). The switch is a six-position (DRAIN, DEFUEL, OFF, PRE-CHK SEC, REFUEL & GRD TRANS PRE-CHK PRIM) rotary type by which the system function is selected. Placing the master switch in the REFUEL & GRD TRANS position supplies power to the tank selector switches and the ground transfer switch, permitting selective (OPEN, CLOSE) operation of the tank fill valves and the ground transfer valve. Placing the master switch in the DEFUEL position supplies power to operate the ground transfer valve only. The tank valves cannot be opened when the master switch is in the DEFUEL position. Placing the switch in either the PRE-CHK PRIM position or the PRE-CHK SEC position interrupts power to a solenoid in the tank fill valves, closing the fill valves and simulating a tank-full condition, thus providing a check on the automatic operation of the tank fill valves. In both the PRE-CHK PRIM and the PRE-CHK SEC positions, power is supplied to the ground transfer switch, permitting operation of the ground transfer valve. In the DRAIN position, power is supplied to open the drain valve and to operate the drain pump. Power is also supplied directly to the ground transfer valve, bypassing the ground transfer switch, to close the valve. In the OFF position, power is supplied directly to the ground transfer valve, closing the valve; and to the tank selector switches, rendering the switches inoperative. In all positions except OFF, the fuel quantity gauges are energized.

Tank Selector Switches

Tank selector switches are located on the single point refueling control panel (figure 1A-123). The switches are two-po-

sition (OPEN, CLOSE) rotary type that supply power to the primary and secondary solenoids of the tank valves. The master switch must be in the REFUEL AND GRD TRANS position before the switches will operate the tank valves.

Ground Transfer Switch

The ground transfer switch, located on the single-point refueling control panel (figure 1A-123), is a two-position (OPEN, CLOSE) rotary type used to control the ground transfer valve. The master switch must be in the DEFUEL, PRE-CHK SEC, REFUEL & GRD TRANS, or PRE-CHK PRIM position before the ground transfer valve will operate. When the master switch is in the OFF or DRAIN position, the ground transfer switch is bypassed, and the ground transfer valve is energized to the closed position (CG 1790 and CG 1700 through 1709). Placing the ground transfer switch to the open position, with the APU powering the ESS AC bus and no engine generators supplying power, will allow the APU to power the MAIN AC bus also.

Off-Load Valve Switch

The off-load valve switch, located on the single point refueling control panel (figure 1A-123), is a two-position (CLOSE, OPEN) toggle type used to control the off-load valve when the refueling control master switch is in any position except OFF and DRAIN. When the refueling master switch is in the OFF position, the off-load valve is energized to the closed position. When the fueling master switch is in the DRAIN position, power is supplied to open the off-load valve in either position of the off-load valve switch.

Fuel Quantity Gauges

A fuel quantity gauge, for each fuel tank, is installed on the fueling control panel (figure 1A-123). All the gauges, which indicate tank fuel quantity in pounds, are energized when the fueling control master switch is at any setting other than OFF. The gauges are powered through the FUEL QUANTITY-TOTALIZER circuit breaker.

REFUELING AND DEFUELING PROCEDURES

NOTE

At times it may be necessary for the flight crew to perform refueling or defueling operations. Refer to T.O. 1C-130H-2-12JG-10-1.

PART B – AVIONICS

NOTE

PART B IS AN ABBREVIATED AVIONICS SECTION. MORE DETAILED INFORMATION IS GIVEN IN CGTO 1C-130-1-D.

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INTERCOMMUNICATION SYSTEM (AN/AIC-18)

	1503, 1504	
28V	ISOL DC	CP Side
INTERPHONE	P, FE, R, OSC, LSCN, LPAR	
28V	ISOL DC	CP Side
INTERPHONE	CP, N, RSCN, RPAR	

	1601	
28V	ISOL DC	CP Side
INTERPHONE	P, FE, FI, R, LSCN, RPAR	
28V	ESS DC	CP Side
INTERPHONE	CP, N, RSCN, RPAR	

CNMS EQUIPPED AIRCRAFT

28V	ISOL DC	CP Side
INTERPHONE	P, FE, R, LSCN, LPAR, PROS	
28V	ESS DC	CP Side
INTERPHONE	FO, N, FI	
28V	ESS DC	CP Side
INTERPHONE	CP, RSCN, RPAR	

The intercommunication system permits voice communication among flight station intercommunication stations and auxiliary stations in the cargo compartment. Voice communication is also possible with the ground crew through an external interphone receptacle at the left aft edge of the radome. Audio signals from the radio receivers and transmitters can be monitored at each of the flight stations and left or right scanner intercommunication positions. Transmissions through all radio transmitters, however, can be accomplished only at the pilot's, copilot's, radio operator's, navigator's, flight engineer's, and flight instructor's intercommunication stations. Reception and transmission over the channels available at a particular station are made possible by headset microphones at each intercommunication station. A three-position microphone/interphone switch on both the pilot's and copilot's control wheels permits transmission from these positions. A press-to-talk button on the connector cords at all other intercommunication stations can be used to talk from these stations. A foot switch at the navigator's, flight engineer's, and radio operator's stations can be used as an alternate "switch-in" to talk from these stations. In appearance, flight station intercommunications control panels are identical (see figures 1B-1 and 1B-2). In capability, on non-CDNU modified 1500 and 1600 series aircraft, the flight engineer's intercommunication panels are restricted to intercommunication only.

Intercommunications Control Panel (CGNR 1503, 1504, 1601)

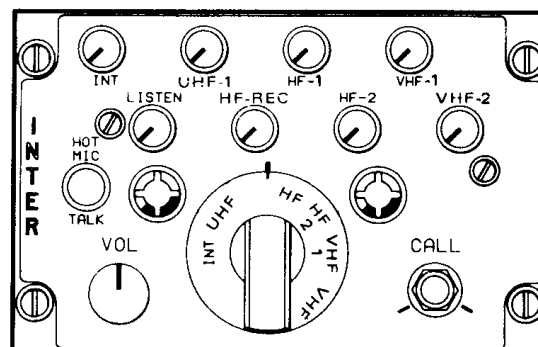


Figure 1B-1

Intercommunications Control Panel (Typical)

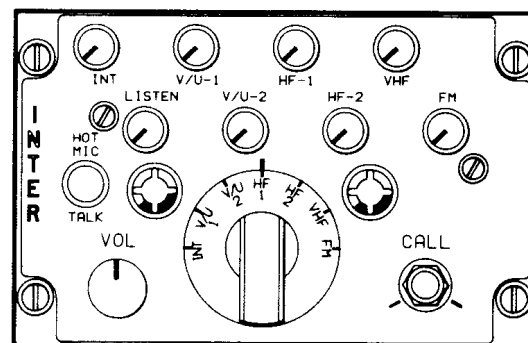


Figure 1B-2

PUBLIC ADDRESS SYSTEM (AN/AIC-13)

28V	MAIN DC	CP Side
PA System		

The public address system provides one-way communication with the cargo area through seven loudspeakers located in the cargo compartment.

The main control of the public address system is from the PA control panel (figure 1B-3). A power switch, a speaker selector switch, a volume control, and five mixer switches constitute the controls on the main control panel.

Once the public address system has been turned on and speaker selections have been made at the main control panel, the auxiliary control panels (figure 1B-4) can be used to operate the system. The PA on-off switch on the auxiliary panels in the cargo compartment serve to connect the associated stations to the PA system. The audio output of the public address system is controlled by a PA gain control switch on each of the auxiliary control panels.

Public Address Control Panel

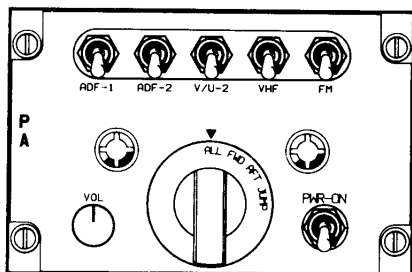
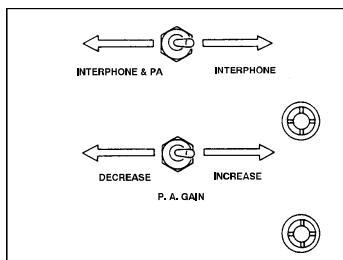
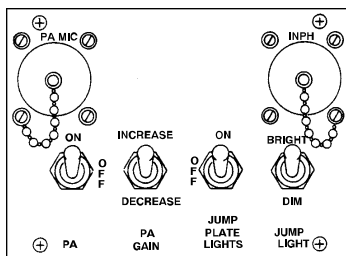


Figure 1B-3

Public Address Auxiliary Control



PILOT'S AUXILIARY CONTROL (TYPICAL)



CARGO COMPARTMENT AUXILIARY CONTROL PANEL

Figure 1B-4

VHF COMMAND RADIO (COLLINS 618M-3A)

28V
VHF Comm No. 1 ISOL DC

CP Side

The VHF command radio provides voice transmission and reception in the frequency range of 118.000 to 135.975 MHz. A total of 720 digitally synthesized frequencies is available in steps of 25 kHz. Effective range of the radio is line-of-sight distance. Average communication distance from the aircraft to a ground station is 30 miles at 1000 feet aircraft altitude, and 135 miles at 10,000 feet aircraft altitude.

The VHF communication system uses one antenna for both transmission and reception. The antenna is installed on top of the fuselage at fuselage station 730.

Direction finding is possible with the 618M-3A VHF command radio when used in conjunction with the DF-301E direction finding group.

VHF AM Control Panel (CGNR 1503, 1504)

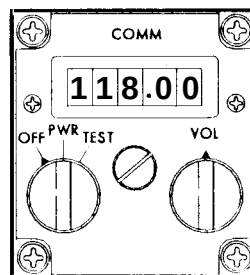


Figure 1B-5

VHF-FM MARINE RADIO SET (AN/ARC-513)

(1500, 1600, 1790, 1700-1704)

28 VDC

MAIN DC

CP Side

(1705 AND UP)

28 VDC

ESS DC

CP Side

The VHF-FM COMM System AN/ARC-513 is composed of a transceiver, a control panel (figure 1B-6), and a VHF-FM DF switch. This radio provides two-way voice communications from 150.00 MHz to 173.9975 MHz in 2.5 kHz increments or on 15 preset channels. The radio set includes two guard receivers which permit continuous monitoring of 156.800 MHz or 156.300 MHz at the same time the main transceiver is tuned to an operating frequency. The set is used in conjunction with the Direction Finder Group. Magnetic bearing will be displayed by the No. 2 pointer on both RMIs.

VHF-FM/Comm Radio (AN/ARC-513) Control Panel

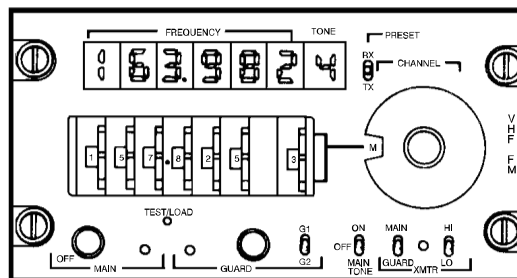


Figure 1B-6

WT-200B VHF-AM/COMM (RECEIVE ONLY) (CGNR 1503, 1504)

28V MAIN DC CP Upper
VHF REC

The (Wulfsberg) VHF-AM/COMM system permits voice reception (only) using a frequency range from 118–151.975 MHz. The receiver is designed to operate on crystal controlled channels spaced at 25 kHz intervals. The radio set control provides remote control of the receiver and contains two frequency selector knobs, a whole megahertz selector and a fractional megahertz selector. The radio set control also contains a VOL/OFF control and a momentary pushbutton switch used to check the squelch circuit. (See figure 1B-7.)

WT-200B VHF-AM/COMM

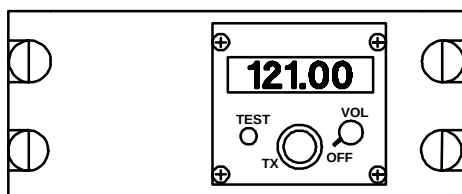


Figure 1B-7

VHF/UHF, AM/FM COMMAND RADIO (AN/ARC-182(V))

28 V CP Side
VHF/UHF COMM No. 1 ISOL DC
VHF/UHF COMM No. 2 ESS DC

Two AN/ARC-182(V) VHF/UHF Communication Systems are installed to provide voice communication on four radio bands. The frequencies used are between 30 MHz and 400 MHz. The total number of channels available is 11,960. The number of channels available in a radio band varies from 720 channels in band 3 to 7000 channels in band 4. Frequencies can be manually selected or selected from preset channels.

Each system consists of a transceiver, antenna selector switch, antenna selector relay, top and bottom antennas, and a keying relay. The keying relay operates in conjunction with the AN/APX-100 Identification Friend-or-Foe (IFF) System.

Two transceivers are located in the radio operator area. Each transceiver contains a main transceiver for normal communications and a guard receiver for monitoring guard frequencies. The transceivers contain built-in test (BIT) circuits which constantly monitor system performance. Malfunction signals are sent to the CNMS for display on the CDNUs. The transceivers can provide automatic direction finding (ADF)

capability when used in conjunction with the DF-301E UHF/VHF Direction Finder System.

<u>Band</u>	<u>Frequency (MHz)</u>
1	30 – 88
2	108 – 156
3	156 – 174
4	225 – 400

V/U ANTENNA SELECT SWITCH

The V/U Antenna Select Switch panel (figure 1B-8) is equipped with a single toggle-type switch, which can be set to one of three positions (TOP, AUTO, or BOT). The switch permits manual or automatic selection of operation through the top-mounted or bottom-mounted antenna.

V/U Antenna Select Switch

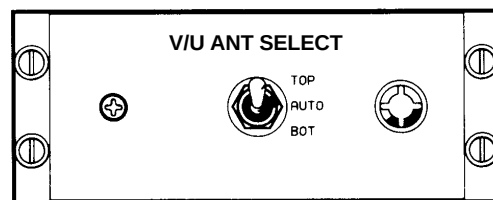


Figure 1B-8

VHF/UHF SECURE VOICE SYSTEM (KY-58 VINSON)

28V ISOL DC CP Upper
MULTIBAND (UHF)

The KY-58 (VINSON) system is tied into the No. 2 V/UHF-AM/FM (ARC-182) or the UHF system (AN/ARC-159, non CNMS equipped aircraft) and will operate on all channels available on that equipment. The KY-58 (VINSON) secure voice equipment is small cryptographic equipment used primarily to encrypt and decrypt voice information. After encryption, the cipher text information from the KY-58 is transmitted over the selected radio channels. Conversely, when operating with another KY-58, the unit can decrypt information to provide a complete closed loop secure voice communication link. The KY-58 is a half duplex, Push-to-Talk equipment that operates at an 8kb/s (Baseband, FM) or 16kb/s (Diphase, AM) rate (figures 1B-9 and 1B-10).

NOTE

If the RCU is not installed, then the RCU Bypass Unit must be installed.

NOTE

The SELECT DP/BB switch is kept in the BB mode on Coast Guard aircraft, even if the KY-58 is used with the UHF radio. Only use the DP mode if the other station is using DP mode.

NOTE

The KY-58 must have a good fill battery and obtain power from a primary source to turn ON.

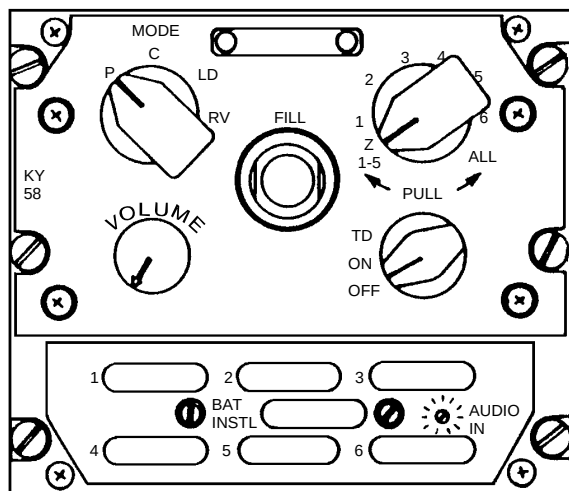
KY-58 Voice Processor (VP)

Figure 1B-9

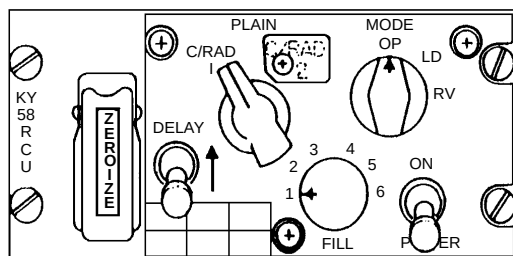
KY-58 Remote Control Unit (RCU)

Figure 1B-10

VHF, VHF-FM, UHF DIRECTION FINDER GROUP (COLLINS DF-301E)

28V MAIN DC CP Side
UHF/VHF DF

A direction finder group is used to indicate the relative bearing of, and to home on, MCW and voice communication signals being received by the selected communication radio. The indication received from the direction finder group is presented on the VHF/VHF-FM/UHF-DF bearing pointer

on the pilot's and copilot's radio magnetic indicator and on the navigator's radio magnetic indicator.

NOTE

DF operation shall be coordinated with HF transmissions to preclude interference.

HF RADIO (AN/ARC - 190)

HF1 115V ESS AC P Side
THREE-PHASE

HF2 115V MAIN AC CP Side
THREE-PHASE

The radio set provides long-range voice and data communications in the HF band from 2.0000 to 29.9999 MHz. It receives and transmits on any one of 280,000 manually selected frequencies spaced at 100-Hz increments, or on any one of 30 preset channels (figure 1B-11). It provides 400 watts of rf power when transmitting. The F-1535/ARC-190 Bandpass Filter is used in conjunction with the HF system to reject undesired rf signals received by the respective antennas. This prevents damage to the input section of the passive receiver when transmitting on the alternate HF radio.

A minimum separation of 2.5 MHz must be maintained between HF No. 1 and HF No. 2 in normal operation.

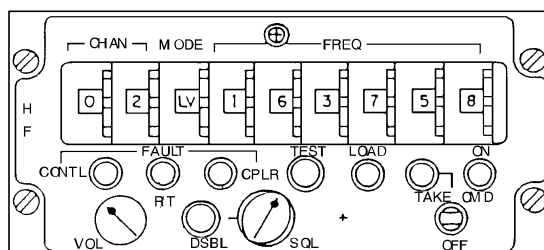
HF Radio Set Control Panel (AN/ARC-190)

Figure 1B-11

ADVANCED NARROWBAND DIGITAL VOICE TERMINAL (ANDVT)

28V ESS DC P Side
HF COMM No. 1 SECURE VOICE

28V MAIN DC CP Side
HF COMM No. 2 SECURE VOICE

The ANDVT is used in conjunction with the ARC-190 HF's to provide narrowband digitization of analog voice communications. It processes signals in either plain text (RED) or cipher text (GREEN).

The ANDVT consists of four components, CM TSEC/KYV-5, BTU, RCU IIA, and the RCU IIB.

COMSEC MODULE (KYV-5)

The Comsec Module (CM) provides encryption, decryption, and plain text functions. (See figure 1B-12.)

COMSEC MODULE (KYV-5)

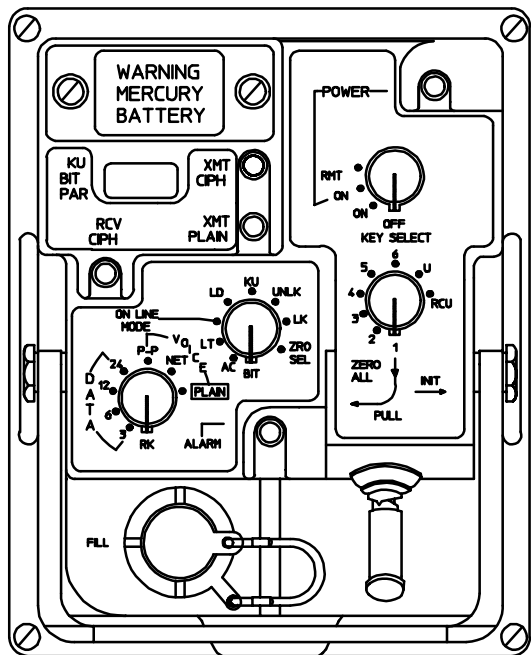


Figure 1B-12

BTU (CV-35919P0/U)

The Basic Terminal Unit (BTU) furnishes voice processing, coding and modulation functions. When the BTU is operating in the plain text mode, it will not receive cipher messages.

REMOTE CONTROL UNIT (RCU IIA)

The RCU allows the operator to control the CM/BTU from a remote location. It also provides the operator with system status. (See figure 1B-13.)

REMOTE CONTROL UNIT (RCU IIA)

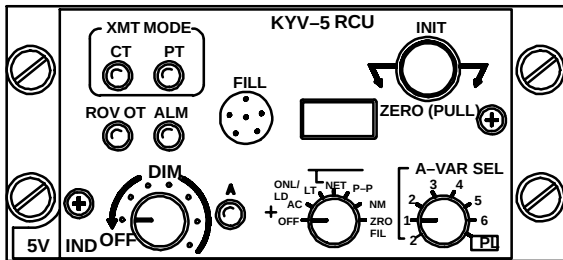


Figure 1B-13

REMOTE CONTROL UNIT (RCU IIB)

The RCU IIB is optional equipment; if used, it requires the use of RCU IIA. (See figure 1B-14.)

REMOTE CONTROL UNIT (RCU IIB)

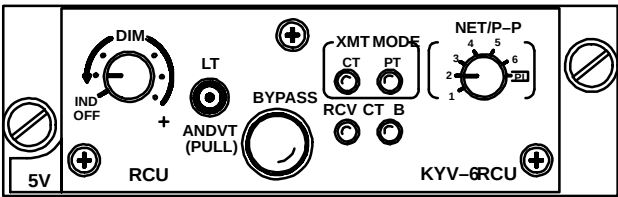


Figure 1B-14

UHF COMMAND RADIO (AN/ARC-159(V)) (CGNR 1503, 1504)

28V ISOL DC CP Side
UHF No. 1

The UHF command radio (figure 1B-15) provides voice transmission and reception in the frequency range of 225.000 to 399.975 MHz, with 7,000 frequencies in steps of 25 kHz. Receiver and transmitter tuning is accomplished automatically after a frequency change. In addition, the UHF radio set is capable of guard frequency reception and transmission. The guard receiver module is self-contained, fix-tuned, set to guard frequency, and can receive simultaneously with the main receiver. Two antennas are provided for use with the UHF command radio, one on top of the airplane and the other on the bottom of the airplane. Direction finding is possible with the AN/ARC-159(V)-1 UHF command radio when used in conjunction with the DF-301E direction finding group.

UHF Communication
Radio Control Panel

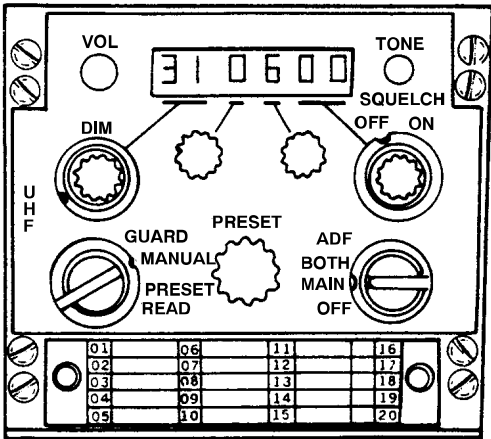


Figure 1B-15

COMMUNICATION-NAVIGATION MANAGEMENT SYSTEM (CNMS)

USE OF CNMS/GPS

The Communication-Navigation Management System (CNMS) may be used for en route and terminal navigation, but shall not be used for instrument approaches. The system was designed and tested for use only with cryptographic keys (P-codes) installed to obtain the GPS precise positioning service. Failure to load secure keys degrades the accuracy and signal tracking capability of the AN/ARN-151(V) GPS receiver.

NOTE

The system shall not be used for sole-source navigation; i.e., both pilot and copilot shall not select CDNU on their respective navigation selector control panels.

WARNING

Do not use this system for navigation without secure keys loaded.

CREW RESOURCE MANAGEMENT

The introduction of the communication and navigation management system poses challenges which, unless carefully managed, have the potential to degrade safe and efficient operation of the aircraft. Although a wealth of information is available through reference to the CDNU page displays, crewmembers must not allow themselves to neglect their integrated scan of the other instruments as well as outside for traffic and obstacles. The triple redundancy of the CDNU also has the potential to blur previously distinct crew duties. The following guidelines for CDNU crew duties apply:

- **Pilot at controls:** Maintain aircraft control. Refer primarily to PROGRESS pages to aid in maintaining situational awareness
- **Pilot not flying:** Tune communication and navigation radios as required. Maintain CDNU flight plan in absence of Navigator, or in conjunction with assigned Navigator
- **Navigator:** Maintain CDNU flight plan, including entry/deletion of waypoints, and direct/offset flight plan changes

SYSTEM DESCRIPTION

115V GPS RCVR	ESS AC	P Upper
115V SDC	ESS AC	P Upper
26V ISS NO. 1	AC	P Upper
26V ISS NO. 2	AC	P Upper
26V SDC	AC	P Upper
28V MDL	ESS DC	P Upper
28V GPS S.U.	ESS DC	P Upper
28V ISS NO. 1	ISOL DC	P Upper
28V ISS NO. 2	ESS DC	P Upper
28V PILOT CDNU	ISOL DC	P Upper
28V COPILOT CDNU	ISOL DC	P Upper
28V NAV CDNU	ISOL DC	P Upper

The CNMS controls the systems listed in the Table of CNMS-Controlled Systems. The items making up the system are listed in the Table of CNMS Components. System control and status monitoring is accomplished using control display navigation units (CDNUs). CDNUs are installed at the flight control pedestal, copilot side panel and navigator control panel. The pilot CDNU is designated as CDNU1, the copilot CDNU is designated as CDNU2, and the navigator CDNU is designated as CDNU3.

Each CDNU controls and/or monitors systems via the MIL-STD-1553B Data Bus. Two interface shipsets (ISS) are used to convert analog and discrete signals between each CDNU and the existing navigation aids and radio amplifiers to the digital format required by the CDNUs.

Table of CNMS-Controlled Systems

System	Type Designation
V/U Comm No. 1	AN/ARC-182(V)
V/U Comm No. 2	AN/ARC-182(V)
VHF Comm	618M-3A
VHF Nav No. 1	AN/ARN-123(V)
VHF Nav No. 2	AN/ARN-123(V)
TACAN No. 1	AN/ARN-118(V)
TACAN No. 2	AN/ARN-118(V)
Global Positioning System	AN/ARN-151(V)

Table of CNMS Components

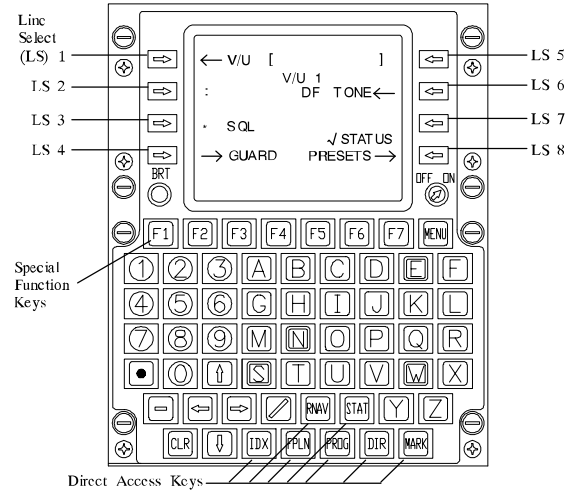
Unit	No. Used
Control Display Navigation Unit	3
Interface Shipset	2
Data Bus Couplers 1A and 1B	2
Data Bus Couplers 2A and 2B	2
Data Bus Couplers 3A and 3B	2

CONTROL DISPLAY NAVIGATION UNIT

Each CDNU (figure 1B-16) operates on the 1553B data bus as either a bus controller (BC) or a remote terminal/backup bus controller (RT/BBC). Any single CDNU has all the required resources to completely operate the CNMS and associated systems. The CDNU that is functioning as BC performs all navigation computations, builds all page displays, communicates with all associated equipment and performs all other computations required to support CNMS and associated systems operation. The RT/BBC CDNUs serve as spare BCs which process keystrokes, display pages built by the BC CDNU, and perform continuous built-in-testing (BIT) with all the free processor time.

AN/ARN-151(V) GLOBAL POSITIONING SYSTEM (GPS)

The AN/ARN-151(V) Satellite Signals Navigation Set, hereafter referred to as Global Positioning System (GPS), consists of the components listed in the following table.

Control Display Navigation Unit

- ← → Pressing line select key accesses different page (pointing to key)
- ← Pressing line select key selects item or enables mode
- * Indicates function is engaged or enabled
- : Alternate selection among modes
- ✓ Check, as in check status for equipment failures
- Indicates no computed data is available or meaningful, or power is off
- ↑ ↓ Indicates vertical page or line scrolling is possible
- ← → Indicates lateral page scrolling is possible
- ↕ Indicates lateral and vertical page scrolling is possible
- [] Indicates data entry from scratch pad is possible or required

*Figure 1B-16***Table of GPS Components**

Unit	Number Used	Part No.
Receiver R-2332/AR	1	622-8078-046
Signal Data Converter CV-4138/A	1	635670-G06
GPS Mode Annunciator Light Assy	1	15114-001
GPS Fill Panel	1	TE27161-1
Mission Data Loader	1	AN/ASQ-215

GPS Overview

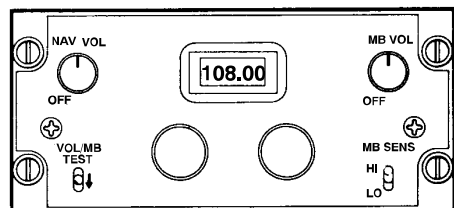
The GPS is a space-based radio positioning system which provides users with highly accurate timing data on which to base position and velocity calculations. GPS operates globally, continuously, and under all weather conditions. GPS receivers operate passively, thus allowing an unlimited number of simultaneous users. The GPS satellites transmit two digitally coded signals on two frequencies; L1 band (1575.42 MHz) contains the coarse acquisition (C/A)-code and precision (P)-code, and L2 band (1227.6 MHz) contains only the P-code. Each satellite transmits its own unique C/A- and P-codes so the receiver can determine the range between the satellite and the user. Superimposed on both the P-code and the C/A-code is the NAVIGATION-message (NAV-msg) containing satellite ephemeris data, atmospheric propagation correction data, and satellite clock-bias data.

The timing of the C/A-coded signal, available to the general public, is slightly degraded to limit horizontal position calculation accuracy to within 100 meters. Use of the P-coded signal requires knowledge of the secure coding scheme. With the proper secure code loaded, the receiver has access to extremely accurate timing information provided by the P-coded signal allowing it to calculate position within 16-meter spherical accuracy.

VHF NAVIGATION SYSTEM (AN/ARN-123)

28V ESS DC CP Side
VHF/NAV NO. 1
VHF/NAV NO. 2

VHF Nav Receiver Control Panel



(NON-CDNU AIRCRAFT)

Figure 1B-17

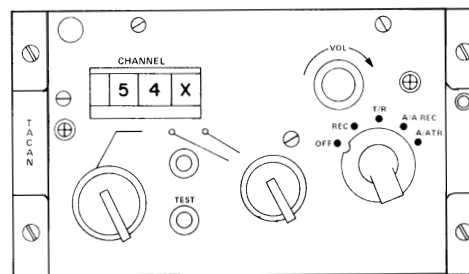
Two independent VHF navigation systems (figure 1B-17) are installed on the airplane. Each system's receiver performs multiple functions. When tuned to a VOR frequency, the receiver furnishes VOR magnetic bearing to the station on the pilot's, copilot's, and navigator's bearing-distance-heading indicators. When VOR/ILS is selected on the NAV SEL switch, VOR course deviation, to-from indication, and system validity are provided to the flight control system for display and flight computer steering.

TACAN (AN/ARN-118)

115V ESS AC CP Side
SINGLE-PHASE

28V ESS DC CP Side
TACAN No. 1
TACAN No. 2

TACAN Control Panel



(NON-CDNU AIRCRAFT)

Figure 1B-18

The TACAN Navigation Set AN/ARN-118 (figure 1B-18) is a polar coordinate navigation system that is used to determine the relative bearing and slant range distance to a selected TACAN station. The selected TACAN station can be ground, shipboard, or airborne station. The ground and shipboard TACAN stations are considered to be surface beacons. An airborne station supplies only slant range distance information unless the airplane is specially equipped with a bearing transmitter and rotating antenna. TACAN Navigation Set AN/ARN-118 is not capable of transmitting bearing information but does supply slant-range distance replies when interrogated.

The TACAN Navigation Set has provisions for 126 X channels and 126 Y channels. The Y channels differ from the X channels in frequency assignment and pulse spacing. The maximum operating range of the TACAN Navigation Set is 390 nm when the selected TACAN station is a surface beacon and 200 nm when the selected TACAN station is an airborne beacon.

The Y channels were developed to alleviate congestion of the X channels but have not yet been implemented in AF ground stations. Use of Y channels is encouraged in air-to-air modes.

RADIO COMPASS (AN/ARN-89)

28V ESS DC CP Side
 RADIO COMPASS NO. 1
 RADIO COMPASS NO. 2



Radio beacons are subject to disturbances that may result in erroneous bearing information. At night, radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the ADF bearing also affect the facility's identification. Noisy ID usually occurs when the ADF needle is erratic. Voice, music or erroneous ID may be heard when a steady false bearing is being displayed. Since ADF receivers do not have a "flag" to warn the pilot when erroneous information is being displayed, the pilot should continuously monitor the NDB ID.

Radio Compass Control Panel

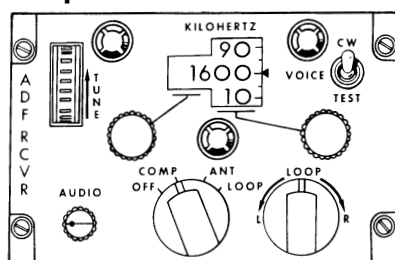


Figure 1B-19

The dual radio compass installation provides direction finding and homing in the 100– to 3000-kHz range. The radio compass is used for automatic or manual homing in the COMP (compass) and LOOP modes of operation, or as a communications receiver in the ANT (antenna) mode for receiving continuous wave (cw) or amplitude modulation (am) radio frequency (rf) signals. Control panels are located on the flight control pedestal and or NAV panel (figure 1B-19). Bearing information is shown by the radio magnetic indicators on the pilot's and copilot's instrument panels and by the left bearing-distance-heading indicator on the navigator's instrument panel. The No. 1 bearing pointer of the pilot's and copilot's indicators shows bearing information received from the No. 1 radio compass, and the No. 2 bearing pointer indicates the bearing information received from the No. 2 radio compass or the VHF/UHF-DF as selected by the DF control panel. The No. 1 bearing pointer on the navigator's indicator shows bearing information from the

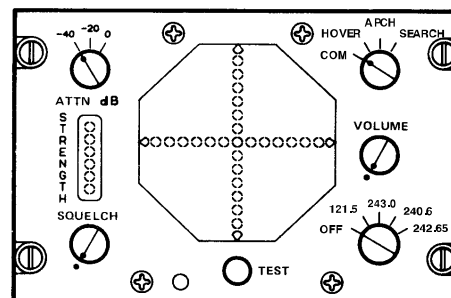
No. 1 radio compass and the No. 2 bearing pointer indicates bearing information from the No. 2 radio compass or No. 1 TACAN as selected by the navigator's pointer selector switch.

HOMING SYSTEM (ANS-4)

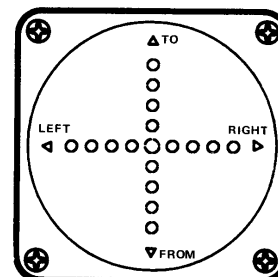
28V ESS DC CP Upper

The ANS/4 homing system is installed for use in homing on a ground-based or portable radio beacon such as an aircraft emergency locator transmitter. The system consists of a receiver/control at the navigator's station and a slave indicator on the copilot's instrument panel (figure 1B-20), a BRT DIM switch on the copilot's instrument panel, an antenna array and an antenna phasor unit. The system provides the aircrew with LEFT/RIGHT and TO/FROM guidance information using radio signals received on the standard emergency frequencies of 121.5 and 243.0 MHz, with two additional selections for UHF frequencies 240.6 and 242.65 MHz. The system works with either unmodulated or modulated signals conforming to aircraft AM standards for voice or emergency location purposes. The audio signal is supplied to the airplane intercom system through the PA switch on the intercom monitor panel. The display indications on the receiver/control and slave indicator are of the light-emitting type. Two perpendicular lines of lights arranged in a cross are used to provide guidance information.

ANS-4 Homer Controls and Indicators



RECEIVER/CONTROL



SLAVE INDICATOR

Figure 1B-20

RADIO ALTIMETER (806F-4) (AL-101 SYSTEM) (CNMS EQUIPPED AIRCRAFT)

115V ESS AC CP Side
SINGLE PHASE

LOW RANGE ALTIMETER

The radio altimeter is installed to provide absolute altitude information during the approach and landing phases of operation. The system consists of a receiver-transmitter, an indicator (figure 1B-21), and two antennas. Information is also provided from the receiver-transmitter to the ground proximity warning system (GPWS) computer for terrain clearance modes of operation. The system operates on a continuously varied frequency (100 Hz steps) between 4,250 and 4,350 MHz. The system operates on the principle of a signal being transmitted and later received as a reflected wave after a time interval. During this time interval, the transmitted frequency has changed. The difference between the new transmitted frequency signal and the received reflected signal frequency will depend on the distance (twice the altitude) the signal has traveled. The difference in frequency traveled is converted to absolute altitude and displayed on the indicator.

Radio Altimeter (AL-101 System)

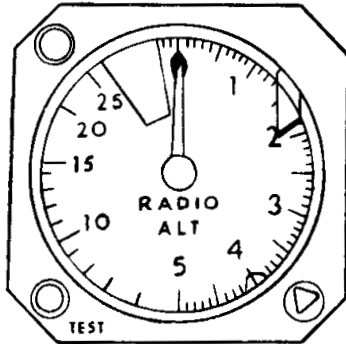


Figure 1B-21

NOTE

Three different models of the AL-101 are used, and each tests to a different altitude. Model 622-3890-002 tests to 40 ft. $\pm$ 5 ft., 622-3890-003 tests to 100 ft. $\pm$ 5 ft., and 622-3890-005 tests to 150 ft. $\pm$ 5 ft. There is no way to tell which model is installed without looking at the model number on the front of the R/T under the flight deck.

NOTE

Power is supplied to the radio altimeter any time ac power is applied to the essential ac bus and the ALTIMETER LOW RANGE circuit breaker is closed.

ALTITUDE ALERTER/PRESELECT SYSTEM (IDC) (CNMS EQUIPPED AIRCRAFT)

26VAC ESS AC P Side

The altitude alerter/preselect system consists of an altitude alerter/preselect control (figure 1B-22), located on the main instrument panel glare shield, and a tone generator mounted overhead in the flight station. The system provides automatic visual and aural signals during the approach to, or departure from, a preselected altitude. The operating range of the altitude alerter/preselect control is 0 to 50,000 feet in 100-foot increments. The system is interconnected with the pilot's altimeter-encoder, air data control No. 1, and the pilot's and copilot's interphone system for tone generation.

Altitude Alerter/Preselect System (IDC)

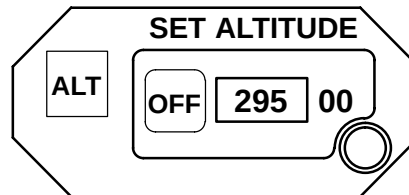


Figure 1B-22

GROUND PROXIMITY WARNING SYSTEM (CNMS EQUIPPED AIRCRAFT)

115V ESS AC CP Side
GPWS

28V ESS DC CP Side
GPWS

The ground proximity warning system (GPWS) is completely automatic in operation, requiring no operator action. The system provides both the pilot and copilot with visual and aural warnings of a flight condition or airplane attitude which, if uncorrected, would cause the airplane to come in close proximity to or in contact with the terrain in its flight path. The GPWS consists of a solid-state computer, warning lights on the pilot's and copilot's instrument panel and glare shield (figure 1B-23), a loudspeaker mounted in the flight station overhead, an air data computer (barometric altitude/rate) and switches to monitor landing gear and flap position. The GPWS receives signals from the radio altimeter, VHF navigation systems No. 1 and No. 2, flight director system No. 1 and the GPWS air data computer (barometric data).

GPWS ANNUNCIATOR/SWITCHES

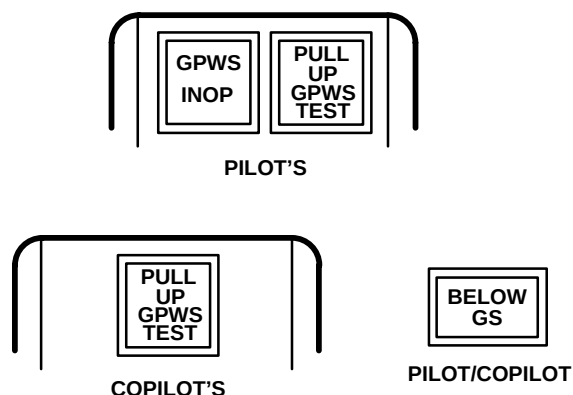


Figure 1B-23

GROUND PROXIMITY FLAP AND WHEELS OVERRIDE SWITCHES

The GROUND PROXIMITY FLAP OVERRIDE switch is a two-position NORMAL, OVERRIDE toggle switch on the ground proximity flap and wheels override control panel mounted on the copilot's side shelf. When the switch is placed to the NORMAL position, the circuit to the 40-percent flap switch (located in the flap control quadrant) is completed for appropriate airplane configuration signals (Mode 4B) to be validated by the GPWS computer. When the switch is placed to the OVERRIDE position, the 40-percent flap switch is inhibited and no warning signal is available. This feature is provided for operations requiring low-level flight with partial flap settings.

The GPWS WHEELS switch is a two-position NORMAL, OVERRIDE toggle switch on the GPWS OVERRIDE panel. The NORMAL position of the switch provides normal operation of Mode 4A when the landing gear is not down and locked. The OVERRIDE position inhibits Mode 4A warning signals. This feature is provided for operation requiring low-level flight with the landing gear up.

WARNING

The beam guidance coupler is not cut out automatically in the "zone of confusion" over the localizer transmitter when making an ILS approach or when flying inbound on the back beam.

FLIGHT CONTROL SYSTEM (FCS 105)

FD No. 1 – No. 2		
115V	ESS AC	CP Side
Single-Phase		
Flt Dir No. 1		
Flt Dir No. 2		
28V	ESS DC	CP Side
Flt Dir No. 1		
Flt Dir No. 2		

The FCS 105 is a combination of autopilot, guidance, displays, and sensors, and is made up of two flight director systems (Collins FD 109) and the autopilot (Collins AP-105V).

The flight director system supplies steering commands for the pilot and autopilot. The lateral modes are HDG, NAV/LOC, and APPR. The vertical modes are VS, IAS, ALT hold and ALT SEL. When the autopilot is engaged and coupled to the flight director system, the pilot monitors autopilot performance on the attitude director indicator. When the autopilot is not engaged, the pilot flies the airplane manually in response to the flight director commands.

The copilot's flight director system is separate from the pilot's. Either of the flight director systems can be coupled to the autopilot, but only one system can be coupled at any given time.

NAV SEL Switches

There are two navigation selector control panels (figure 1B-24) located on the pilot's and copilot's instrument panel. Each panel contains a NAV SEL switch. The multi-position NAV SEL switches are provided to connect a navigation system to the course indicators and the flight control system computers. Seven position (INS 1, INS 2, TAC 1, TAC 2, VOR/ILS 1, VOR/ILS 2, and CDNU) are available on the pilot's and copilot's switches.

Attitude Director Indicator

Two attitude director indicators (figure 1B-25) present a three-dimensional display of airplane attitude, steering commands, localizer and glide slope deviation, rate-of-turn, airplane slip or skid, radar altitude, and decision height. When the autopilot is coupled, the indicator is used to monitor autopilot performance. When the autopilot is not coupled, the pilot uses the display to manually fly the airplane.

Horizontal Situation Indicator

Two horizontal situation indicators (figure 1B-25) display a pictorial view of an airplane with respect to magnetic north, selected course, and selected heading. Selected heading and course are read against a servo-driven azimuth card. A digi-

Navigation Selector Control Panels

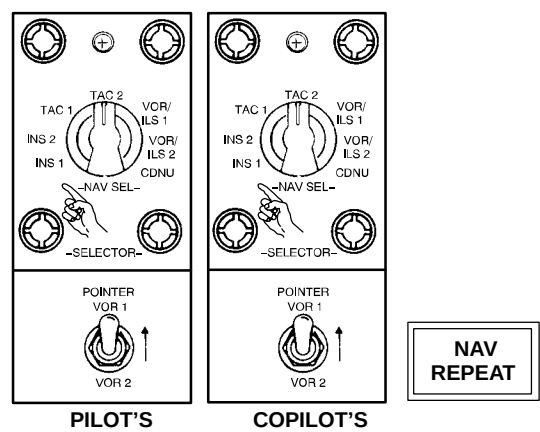


Figure 1B-24

tal miles and course display are provided. Meter movements display course deviation to-from indication and glide slope deviation. Warning flags monitor the azimuth card and navigation and glide slope signals. Remote selection of course and heading are controlled by the course indicator remote heading and course control knob.

Flight Selector (FLT SEL) Panels

Two flight selector panels (figure 1B-26) provide separate mode control over the No. 1 and No. 2 flight computers. Each flight selector panel contains solenoid-held pushbuttons (push on, push off). An FCS 105 flight mode can be engaged by depressing the desired mode pushbutton. If the pushbutton remains depressed, the green ON flag at the bottom of the pushbutton appears, and the mode is engaged. Depressing an engage pushbutton again will disengage the flight mode. Light intensity for the pushbutton is controlled through the cockpit dimmer. When a flight mode is engaged, steering commands from the flight computer will be displayed on the corresponding flight director indicator command bars. The autopilot, if engaged, can be coupled to either of the two flight computers by depressing the AP CPLD pushbutton. Once engaged, the autopilot will accept steering commands from the selected flight computer HDG and NAV LOC and APPR lateral modes. APPR is a combination of both lateral and vertical signals. ALT, ALT SEL, VS, and IAS are vertical modes and require prior lateral mode engagement before they will engage. When no lateral mode, including go-around, is engaged, the command bars are out of view, the flight computer is in the off mode, and the autopilot will not couple. Pitch attitude hold steering is provided when a lateral mode is engaged without a vertical mode being on.

IFF RADAR TRANSPONDER
SYSTEM (AN/APX-100(V))

115V	ESS AC	CP Upper
IFF NO. 1		
115V	MAIN AC	CP Upper
IFF NO. 2		
28V	ESS DC	CP Upper
IFF NO. 1		
28V	MAIN DC	CP Upper
IFF NO. 2		

This system provides automatic radar identification of the airplane when interrogated by surface or airborne radar sets. Also the system enables friendly airplanes to identify themselves apart from other friendly airplanes and provide a means of transmitting a special coded signal known as an emergency reply. In addition to the identification information, the reply signal reports the altitude of the airplane. The radar identification system consists of a transponder control panel (figure 1B-27) and a receiver-transmitter. The antenna selector switch is located on the transponder control panel. The system uses the altimeter-encoder installed on the pilot's instrument panel.

COCKPIT VOICE RECORDER

115V	ESS AC	CP Upper

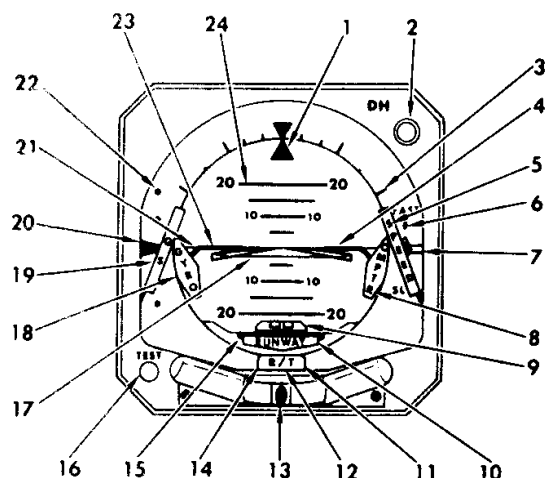
The Cockpit Voice Recorder is installed in the airplane to monitor and record audio from the pilot's, copilot's, and flight engineer's headset, and from an area microphone, installed in the flight station over the pilot. The area microphone on the Monitor/Control panel at the navigator's panel is not used. Sufficient tape is provided to allow a minimum of 1/2 hour recording before erasure and re-recording. The Monitor/Control panel (figure 1B-28) is located at the navigator's station above the electrical spares storage. The Underwater Acoustical Locator Beacon is located on the front of the Cockpit Voice Recorder.

EMERGENCY LOCATOR
TRANSMITTER (ELT)

28V	BATT BUS	P Side

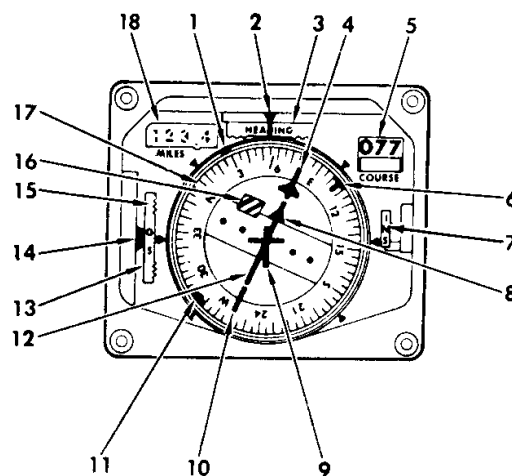
The ELT senses deceleration forces along the longitudinal axis of the aircraft. When activated, the transmitter will then continuously broadcast emergency signals on 121.5 and 243.0 MHz, until its battery pack is depleted or deactivated.

Flight Control System (FCS 105) Indicators



ATTITUDE DIRECTOR INDICATOR

1. BANK POINTER
2. DECISION HEIGHT ANNUNCIATOR
3. BANK SCALE
4. COMMAND BARS
5. SPEED FLAG
6. SPEED DEVIATION SCALE
7. SPEED DEVIATION POINTER
8. COMPUTER WARNING FLAG
9. RISING RUNWAY/LOCALIZER DEVIATION
10. RUNWAY WARNING FLAG
11. RATE OF TURN SCALE
12. RATE OF TURN POINTER
13. SLIP INDICATOR
14. RATE OF TURN WARNING FLAG
15. RUNWAY SCALE
16. TEST BUTTON
17. AIRPLANE SYMBOL
18. GYRO WARNING FLAG
19. GLIDE SLOPE WARNING FLAG
20. GLIDE SLOPE POINTER
21. HORIZON LINE
22. GLIDE SLOPE SCALE
23. ATTITUDE REFERENCE BARS
24. PITCH ATTITUDE TAPE



HORIZONTAL SITUATION INDICATOR

1. HEADING MARKER
2. LUBBER LINE
3. HEADING WARNING FLAG
4. COURSE ARROW
5. COURSE DISPLAY
6. INS TRACK POINTER
7. INS ANNUNCIATOR
8. TO-FROM INDICATOR
9. AIRPLANE SYMBOL
10. COURSE TAIL
11. BEARING POINTER
12. COURSE DEVIATION BAR
13. GLIDE SLOPE SCALE (UNDER FLAG)
14. GLIDE SLOPE POINTER
15. GLIDE SLOPE WARNING FLAG
16. NAV WARNING FLAG
17. AZIMUTH CARD
18. MILES DISPLAY

Figure 1B-25

The control head, located on the flight control pedestal, is not necessary for the ELT and antenna to accomplish their function; however, it does provide a means of deactivating the ELT. The switch on the control head provides the following functions (see figure 1B-29):

1. AUTO – places the ELT in the standby condition to be automatically activated by an impact force.
2. ON/TEST – bypasses the ELT's self-contained impact sensor and activates the transmitter.
3. RESET – A momentary-contact position which allows for deactivation of the ELT.

406 MHZ EMERGENCY LOCATOR TRANSMITTER

28V

BATT BUS

P Side

The ARTEX 406 Emergency Locator Transmitter installation consists of a fuselage mounted antenna, ELT unit, warning buzzer, and a remote control panel.

When activated, the ELT transmits a downward sweeping tone on 121.5 and 243.0 MHz. Every 50 seconds a short encoded digital message is sent on 406.025 MHz to a satellite. The 406.025 MHz transmitter will operate for 24 hours and then shut down automatically. The 121.5/243.0 MHz transmitter will operate until the unit self-contained battery power is exhausted. ELT activation can be monitored by a light flashing on the remote control panel and by an audio

Flight Control System (FCS 105) Controls and Annunciator Lights

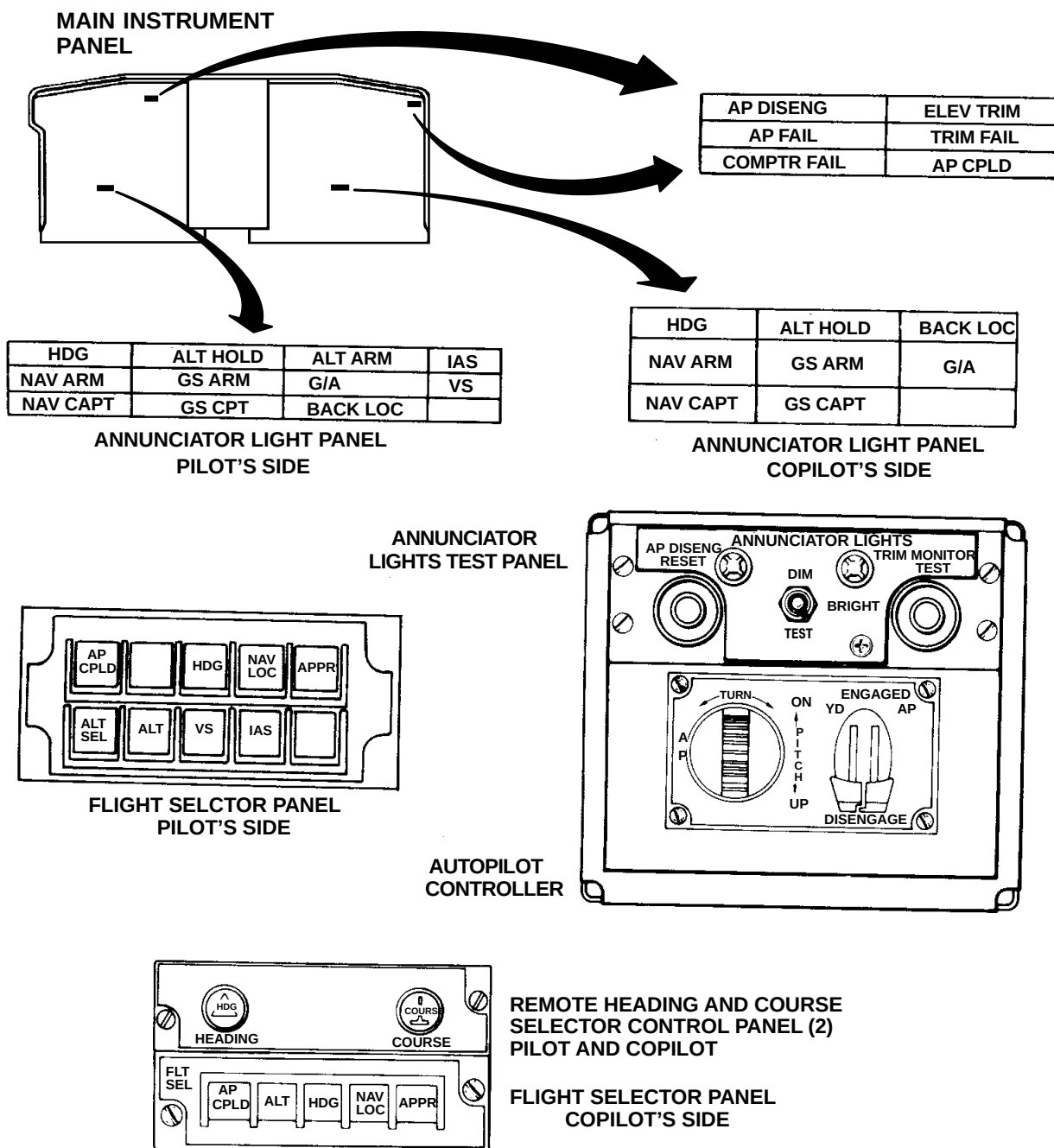


Figure 1B-26

IFF Transponder Control Panel (AN/APX-100(V))

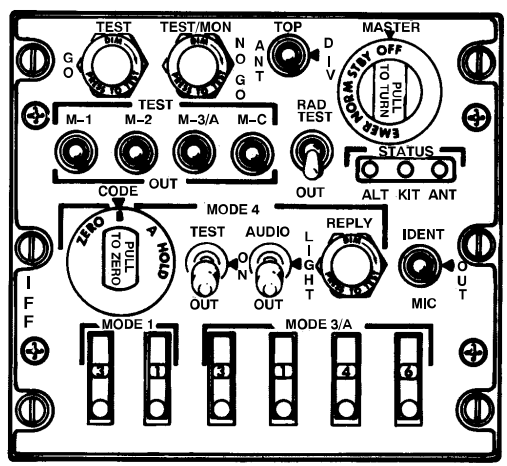
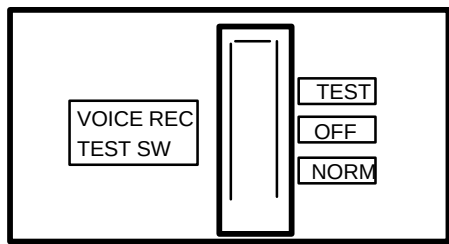


Figure 1B-27

Voice Recorder Test Switch



Voice Recorder Test Panel

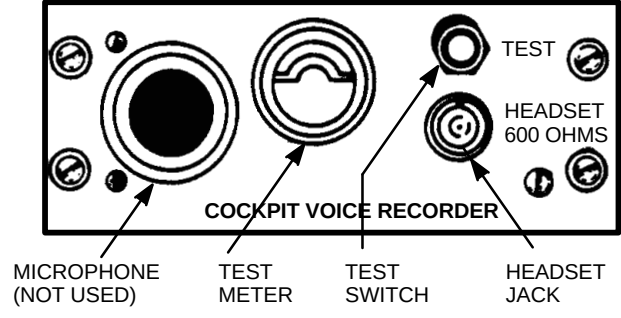


Figure 1B-28

alarm generated by a buzzer located on the aft center avionics rack.

The switch below the ELT light on the remote control panel (figure 1B-30) allows the ELT to be turned ON or to be reset to a READY state. Under normal operation, the switch on the remote control panel is in the ARM position, and the switch on the ELT unit is in the OFF position. Manual activation is accomplished by moving either switch to the ON position.

ELT Control Unit

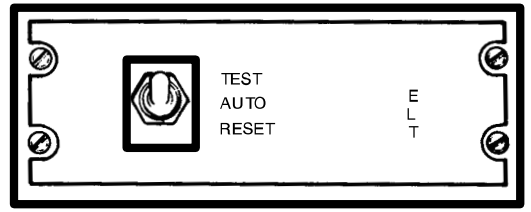


Figure 1B-29

If activated, the ELT can be reset by moving the remote control panel switch to ON for 1 second then back to ARM. It can also be reset at the ELT unit by positioning the switch on the ELT to ON then immediately back to OFF.

406 MHz ELT Control Unit

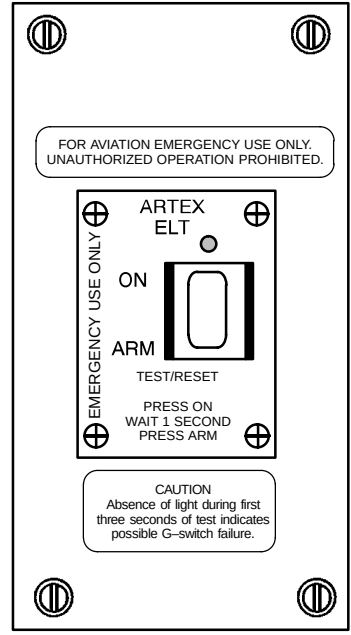


Figure 1B-30

STANDBY ATTITUDE INDICATOR (AI-803AU)

28V ISOL DC P SIDE
STANDBY ATT IND

The AI-803AU Standby Attitude Indicator (figure 1B-31) is a self-contained system, independent of the aircraft main attitude indicating systems, and is not integrated with the aircraft flight director/autoflight systems.

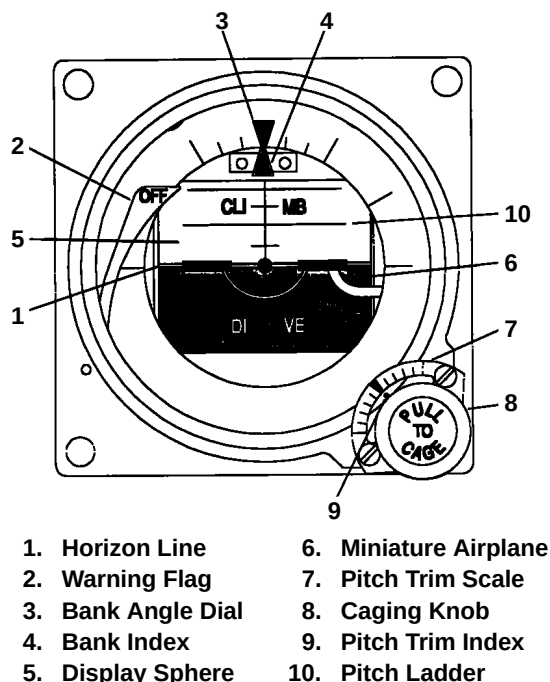


Figure 1B-31

NOTE

Pulling the caging/pitch trim knob to the fully extended position, rotating clockwise, and releasing to the detented position, locks the gimbals of the gyro. This position may be used during the turn-on procedure to eliminate wobbling of the drum. To unlock the gimbals, pull the caging/pitch trim knob from the detent, rotate counterclockwise to align the miniature airplane with the horizon line and slowly allow the knob to return to its retracted position. An increase in audible noise may be evident when operating in the caged and locked position.



Cage-lock the operating standby attitude indicator only when the aircraft is at a complete stop. Changing aircraft attitude while the gyro is cage-locked can damage the gyro.

DUAL LN-100 (INERTIAL NAVIGATION SYSTEM)

SYSTEM DESCRIPTION:

INS #1

26V	ESS AC	Pilots Upper
INERTIAL NAV SYS NO. 1		
28V	ISOL DC	Pilots Side
INS 1		
28V	ESS DC	Copilots Upper
INERTIAL NAV SYS NO. 1 CONT		
115V	ESS AC	Copilots Upper
INERTIAL NAV SYS NO. 1		
28V	MAIN DC	Copilots Upper
INU FAN WARN		

INS #2

26V	ESS AC	Pilots Upper
INERTIAL NAV SYS NO. 2		
28V	ISOL DC	Pilots Side
INS 2		
28V	ESS DC	Copilots Upper
INERTIAL NAV SYS NO. 2 CONT		
115V	ESS AC	Copilots Upper
INERTIAL NAV SYS NO. 2		



Both Inertial Navigation Systems shall be aligned and placed in NAV mode prior to takeoff. In the event this cannot be accomplished, serious consideration should be given to the continuation of the mission. Risk management assessment should be accomplished due to severe degradation of navigational equipment and instrumentation that is lost due to system failure.

NOTE

In dual LN-100 configured aircraft, INS Attitude will remain reliable when the CP AC INST INV switch is placed to the DC position.

The LN-100 provides an external Global Positioning System (GPS) interface. The GPS uses inertial position (latitude/longitude), velocity, heading, and attitude to speed initialization, reduce loss of lock time after turns, and improve jamming resistance.

The LN-100, through the operator's control, may use GPS velocity and position data for in-flight alignment (IFA) or

position data for automatic position, velocity, and bias updating in the NAV mode.

The LN-100 is independent of ground-based navigation aids. It supplies continual and accurate navigation and guidance data.

The C-130 is equipped with two redundant operating INS systems providing compass and navigation information independently to both pilot and/or copilot. Both pilot and copilot may receive their guidance information from either the No. 1 or No. 2 INS.

The LN-100 includes a built-in MIL-STD-1553B bus protocol feature that can support the aircraft's new Communication-Navigation Management System (CNMS).

The INS consists of the following units:

- MSU-Mode Selector Unit (figure 1B-32)
- Compass Mode Selector Panel (figure 1B-33)
- CDU-Control Display Unit (figure 1B-34)
- INU-Inertial Navigation Unit (LN-100)
- INS-Autopilot Search Hold Controller (figure 1B-35)

Mode Selector Unit

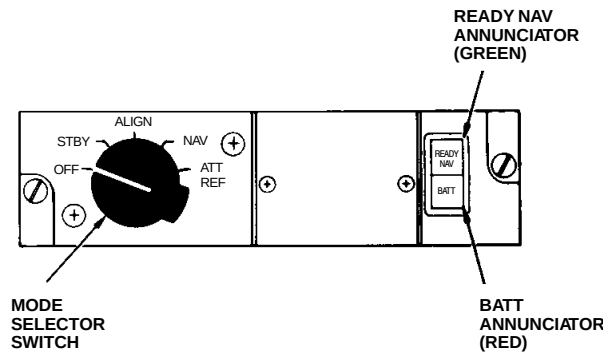


Figure 1B-32

Compass Mode Selector Panel

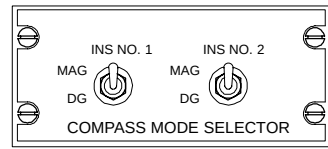


Figure 1B-33

Control Display Unit

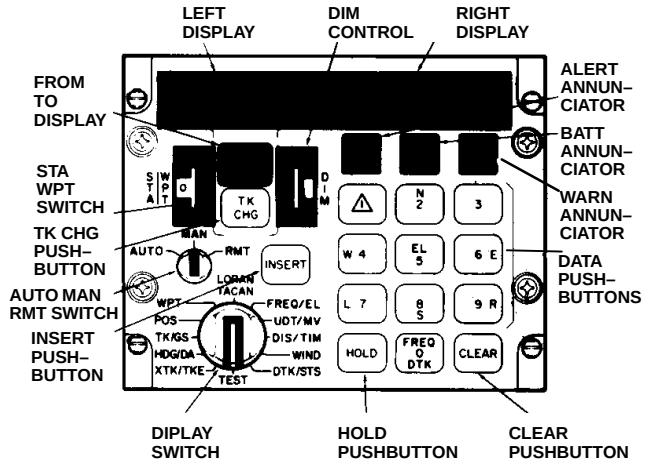


Figure 1B-34

INS Autopilot Search Hold Controller

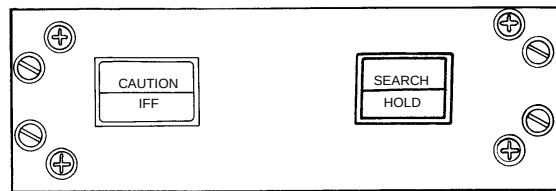


Figure 1B-35

TCAS SYSTEM DESCRIPTION

GENERAL

28V	ESS DC	P Upper
MODE S XPNDR		
115V	ESS AC	P Upper
PILOT VSI		
115V	ESS AC	P Upper
TCAS COMP		
115V	ESS AC	P Upper
TCAS CTRL		
115 V	MAIN AC	CP Upper
COPILOT VSI		

The CAS 81 TCAS (figures 1B-36 and 1B-37) is an airborne traffic alert and collision avoidance advisory system that operates without support from air traffic control (ATC) ground stations. The system detects the presence of nearby intruder aircraft equipped with transponders that reply to air traffic control radar beacon systems (ATCRBS) mode A, mode C or mode S interrogations. TCAS tracks and continuously evaluates the threat potential of these aircraft to own aircraft; displays nearby transponder-equipped aircraft on the Vertical Speed Indicator-Traffic Advisory/ Resolution Advisory (VSI-TA/RA) Display; and during threat situations, provides traffic advisory (TA) alerts and vertical

maneuvering resolution advisories (RA) to assist the pilot in avoiding midair collisions.

VSI-TA/RA Display Controls and Indicators

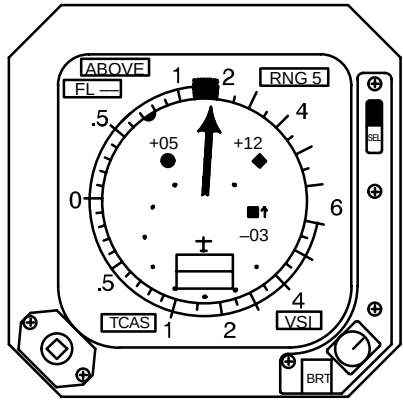


Figure 1B-36

TCAS/MODE S Control

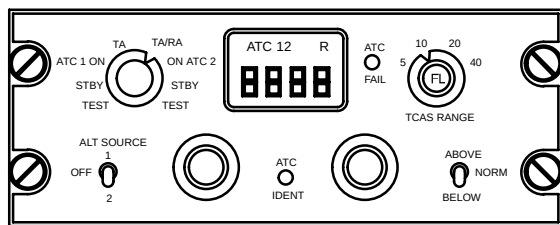


Figure 1B-37

The vertical maneuvering resolution advisories issued by TCAS can only be generated for intruder aircraft that report altitude data in their transponder replies to TCAS interrogations. For non-altitude reporting (NAR) aircraft, TCAS generates only traffic advisories.

WARNING

When an RA occurs, the pilot flying should respond immediately by direct attention to RA displays and should maneuver as indicated unless doing so would jeopardize the safe operation of the flight.

WEATHER RADAR (AN/APN-215(V))

115V ESS AC CP Upper
WEATHER RADAR PHASE A

28V ESS DC CP Upper
WEATHER RADAR DC

The AN/APN-215 weather radar system is a weather and terrain-mapping radar. The system consists of one multi-color digital indicator, a receiver transmitter located in the right hand underdeck rack, and an antenna located in the nose radome. The indicator provides continuous enroute weather information relative to cloud formation, rainfall rates, thunderstorms, and icing conditions. The indicator provides a three-color map display showing separate levels of rainfall intensity in green, yellow, and red. Blue segmented range marks, blue alphanumeric, a zero-degree azimuth line and a yellow track cursor are also provided. In addition to the primary purpose of weather mapping, the system can be used for ground mapping of prominent terrain features such as lakes, bays, islands, shoreline, and rivers for use as a supplementary navigational aid (figure 1B-38).

The system provides storm selection up to a distance of 240 miles. Video color circuits provide a means of distinguishing between relative density of rainfall areas. The storage returns from high density rainfall are displayed as red areas on the indicator. These red areas are normally surrounded by yellow areas of rings representing areas of lower rainfall rates. The yellow areas are surrounded by green areas which represent areas having the lowest rainfall intensity. Cloud formations having less moisture than required to reflect a minimum echo signal do not appear on the display and may be traversed with normal safety.

AN/APN-215 Color Weather Radar Indicator

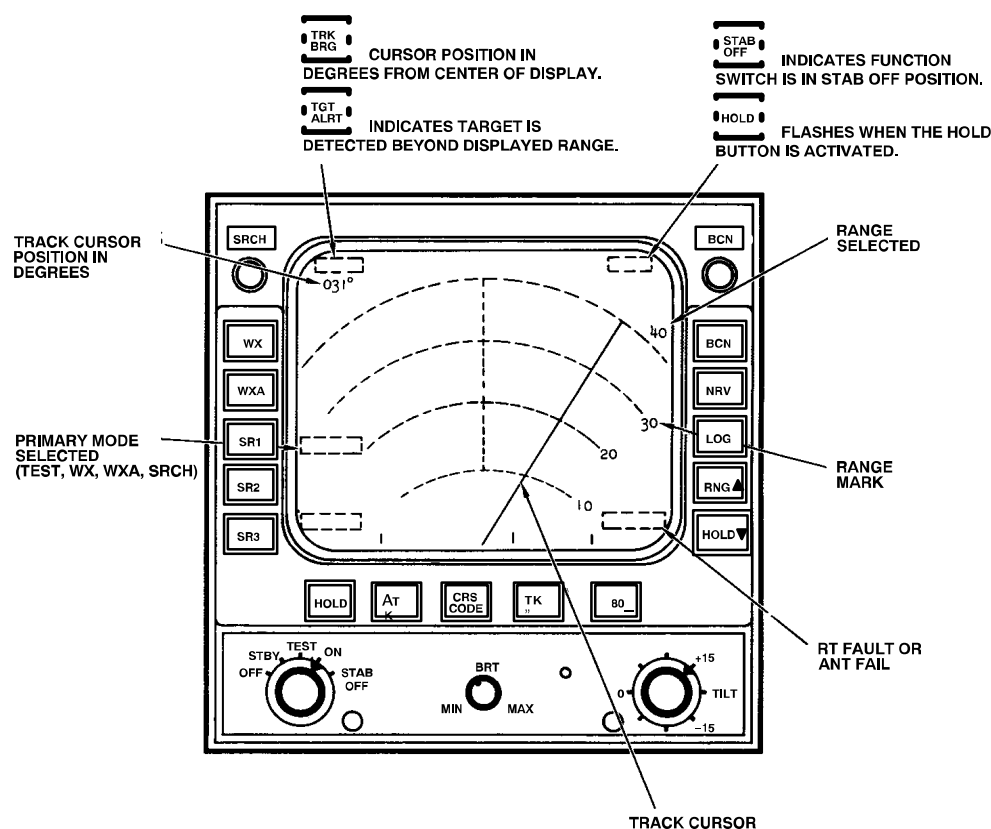


Figure 1B-38

FLIGHT DIRECTOR SYSTEM (CGNR 1503, 1504)

115V	CP AC	P Side
Two-Phase	INST	
FLT DIR GYRO & IND NO. 1		
FLT DIR GYRO & IND NO. 2		
115V	ESS AC	CP Side
Single-Phase		
COMPTR NO. 1		
COMPTR NO. 2		
28V	ESS DC	CP Side
GYRO NO. 1		
GYRO NO. 2		
28V	MAIN DC	CP Side
RELAY NO. 1		
RELAY NO. 2		

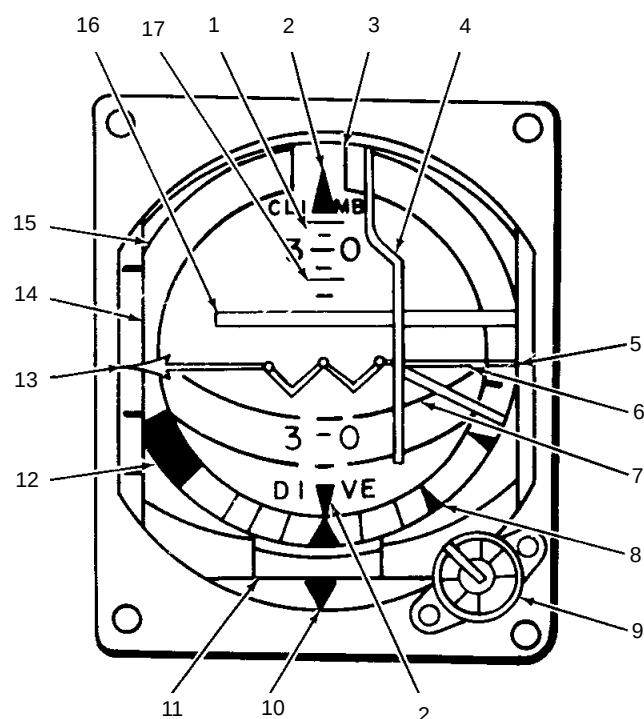
Two complete and separate flight director systems are installed in the airplane, one each for the pilot and copilot. Each consists of a flight director computer, an attitude direc-

tor indicator, a rate gyro and MD-1 gyro, a rate-of-turn sensor, and instrument selector switches for connecting navigation systems to the flight director. These systems are Doppler, TACAN, and VOR/ILS. Because the individual navigation systems are designed to supply only a certain number of instrument loads and only one course set knob can be used to control the course selected, it is necessary to have only one pilot using any one system at a time, with the pilot having priority. Therefore, the copilot is provided with a selected system off indicator light that illuminates when the copilot selects any mode of operation, other than HDG (Heading), that is selected by the pilot.

NOTE

Power for the flight director system should be obtained from the essential ac bus during all modes of flight operation. In the event that standby power from the copilot's inverter is being used in lieu of the essential ac bus, the bank and pitch steering bars may give jittery indications. If oscillation is excessive, it is recommended that the MODE SEL and FLT DIR switches on the instrument selector panels (figure 1B-40) should be positioned to HDG and NORMAL respectively.

Flight Director System Indicators

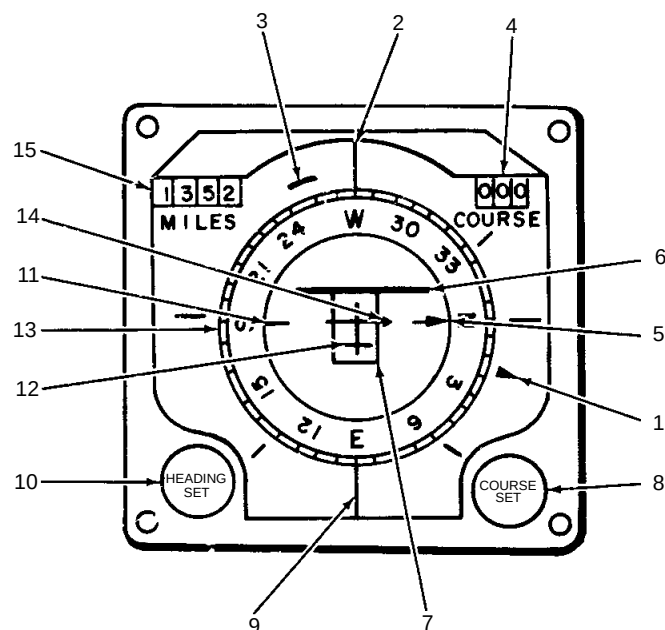


ATTITUDE DIRECTOR INDICATOR

1. ATTITUDE SPHERE
2. BANK POINTER
3. COURSE WARNING FLAG
4. BANK STEERING BAR
5. HORIZON BAR
6. MINIATURE AIRPLANE
7. GROUND PERSPECTIVE LINES
8. BANK INDEX SCALE
9. PITCH TRIM KNOB
10. TURN NEEDLE
11. SLIP INDICATOR
12. ATTITUDE WARNING FLAG
13. GLIDE SLOPE INDICATOR
14. GLIDE SLOPE WARNING FLAG
15. GLIDE SLOPE DEVIATION SCALE
16. PITCH STEERING BAR
17. PITCH REFERENCE SCALE

NOTE:

LOCATED ON PILOT'S AND COPILOT'S INSTRUMENT PANELS.



HORIZONTAL SITUATION INDICATOR

1. BEARING POINTER
2. UPPER LUBBER LINE
3. HEADING MARKER
4. COURSE SELECTOR WINDOW
5. COURSE ARROW (HEAD)
6. COURSE DEVIATION INDICATOR
7. COURSE DEVIATION DOTS
8. COURSE SET KNOB
9. LOWER LUBBER LINE
10. HEADING SET KNOB
11. COURSE ARROW (TAIL)
12. AIRCRAFT SYMBOL
13. COMPASS CARD
14. TO-FROM INDICATOR
15. RANGE INDICATOR (FLAG NOT SHOWN)

Figure 1B-39

Horizontal Situation Indicator

Each of the two horizontal situation indicators (figure 1B-39) presents a plan view display of the airplane with respect to heading, bearing, distance, displacement off course, and ambiguity information. A selected heading or course may be selected on either the pilot's or copilot's horizontal situation indicator and tied in with the flight director and navigation systems. The pilot's selection may be tied in with

the autopilot. Navigation systems are connected to the horizontal situation indicators by means of a mode sel switch.

Attitude Director Indicator

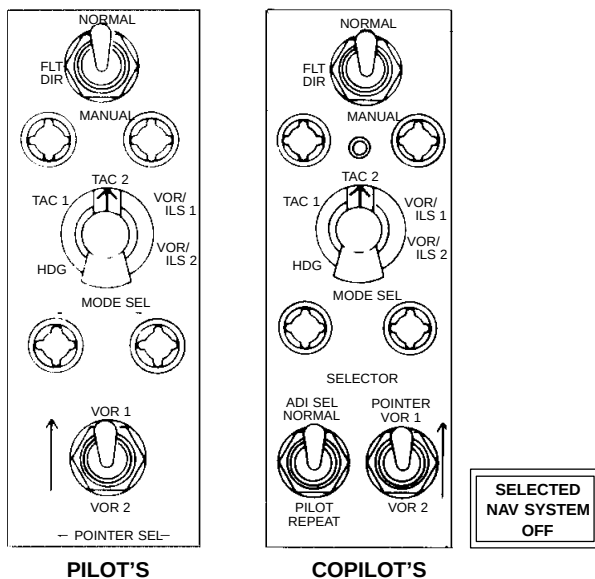
The attitude director indicators (figure 1B-39) present the forward display of the airplane and are the primary attitude instruments for combining roll and pitch, turn and slip, and computed steering information.

WARNING

If failure of the attitude sphere occurs and the copilot's inverter switch is in the NORMAL or AC position, place the switch to the STANDBY or INVERTER position.

Instrument Selector Control Panels

Each of the two instrument selector control panels (figure 1B-40) contains a FLT DIR switch, a MODE SEL switch, and a pointer selector switch. The copilot's panel is also equipped with an ADI selector switch.



NOTE:
LOCATED ON RESPECTIVE INSTRUMENT
PANELS

Figure 1B-40

AUTOPILOT (CGNR 1503, 1504)

115V ESS AC P Side
Single-Phase
AUTOPILOT

28V ESS DC CP Side
FILAMENT
AUTOPILOT OFF LT
SERVO CONTROL
FIELD & INTERLOCK

The E-4 autopilot (figure 1B-41) operates the flight control system of the airplane to maintain normal stabilized attitudes automatically. The autopilot also maintains any desired heading by using C-12 compass information. The system provides coordinated turn control, automatic elevator trim, constant-pressure altitude control, automatic VOR, and TACAN tracking, and automatic ILS approach control for instrument landing system approaches.

WARNING

Do not have the autopilot engaged below 500 feet above terrain. The only exceptions allowed are for automatic ILS approach control and operational missions, during which time (operational mode) the controls must be continuously monitored. Failure to immediately recognize a pitch axis malfunction may cause 1,000 feet altitude loss before completion of recovery with a two-G maneuver effectivity. One of the pilots will continuously guard the Autopilot Release button below 1,000 feet above terrain.

WARNING

Do not operate the autopilot system at speeds in excess of the recommended speed limit or 250 KIAS, whichever is lower.

WARNING

Do not operate with the autopilot engaged at gross weights above the maximum normal takeoff weight.

Autopilot Controls and Indicators

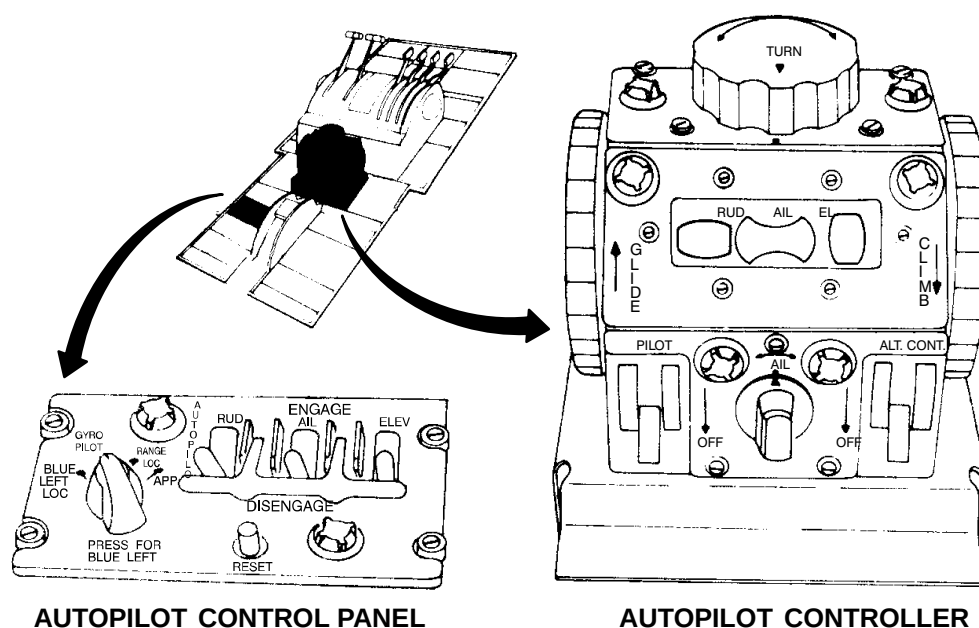


Figure 1B-41

WARNING

Trim the airplane for hands-off flight. An improperly trimmed airplane imposes an unnecessary load on the autopilot servo motors.

WARNING

Check that the trim indicators on the autopilot controller indicate an average signal of zero before placing the engaging switches in the ENGAGE position. A permanent deflection of any one of the meters indicates that the automatic synchronization is not functioning and that the servo for that axis should not be engaged. Engaging a servomotor for an axis with an out-of-trim condition may result in a violent maneuver.

WARNING

During normal operation, do not attempt to overpower or assist autopilot pitch control through use of the control column. To do so will cause the autopilot to oppose pilot input with elevator trim, causing an adverse out-of-trim condition. If the autopilot is disconnected while in this condition, a violent pitch maneuver may result, with possible structural damage.

WARNING

Continually monitor the autopilot trim indicators during normal autopilot operation to ensure that the airplane is properly trimmed. If a sustained out-of-trim condition is observed, disengage the appropriate autopilot axis, retrim the airplane, reengage the autopilot axis.

WARNING

Prior to disengaging any autopilot axis, maintain firm control of the rudder pedals and control wheel. Failure to do so may result in a violent maneuver if an out-of-trim condition exists during disengagement.

WARNING

To prevent possible structural damage to the vertical stabilizer in the event of a rudder malfunction, perform the following while accelerating or decelerating through 200 KIAS; disengage the autopilot rudder axis, retrim the airplane, reengage the rudder axis.

IFF RADAR IDENTIFICATION SYSTEM (AN/APX-72) (CGNR 1503, 1504)

115V Single-Phase IFF	ESS AC	CP Side
28V IFF IFF Test Set	ESS DC	CP Side

The IFF radar identification system (figure 1B-42) provides automatic radar identification of the airplane when interrogated by surface or airborne radar sets using correctly coded pulse transmissions. Five modes of interrogation are used in the IFF system, and the set will reply to any or all of these depending on how the master selector and MODE switches are set. Airplane identification, location, and pressure altitude are transmitted to interrogating radar sets utilizing Modes 1, 2, 3, and C. A special altimeter-encoder is used to produce a digital output of pressure altitude which is transmitted when interrogated on Mode C. Mode 4 provides a secure (encrypted IFF) capability. The special Mode 4 computer processes Mode 4 interrogations and causes the transponder to generate appropriately coded reply signals.

The system also provides a means of transmitting a special coded signal known as an emergency reply on MODES 1, 2, and 3.

NOTE

MODE 4 equipment is not installed in Coast Guard C-130 airplanes.

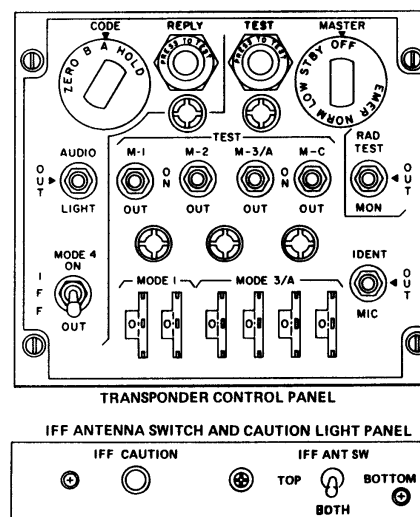
AN/APX-72 Control Panel

Figure 1B-42

RADIO ALTIMETER (AN/APN-171 (V)) (CGNR 1503, 1504)

115V ALTIMETER LOW RANGE	ESS AC	CP Side
28V ALTIMETER LOW RANGE	ESS DC	CP Side

Radio altimeter set (AN/APN-171 (V)) (figure 1B-43) consists of a receiver-transmitter, an indicator, and two antennas. The set provides instantaneous indication of actual clearance between the airplane and terrain from 0 to 5000 feet.

WARNING

System capability is inadequate to provide terrain avoidance during low-level flight. Geometry of the radar transmission cone is such that the radar set is only approved for information presentation during takeoff, landing, and go-around.

Depressing the PUSH-TO-TEST control switch provides a testing feature of the system at any time and altitude. When the PUSH-TO-TEST control knob is depressed, a visual indication of 100 ± 15 feet on the indicator is indicative of satisfactory system operation. Releasing the PUSH-TO-TEST control knob restores the system to normal operation.

Radar Altimeter Indicator/ Control (APN-171)

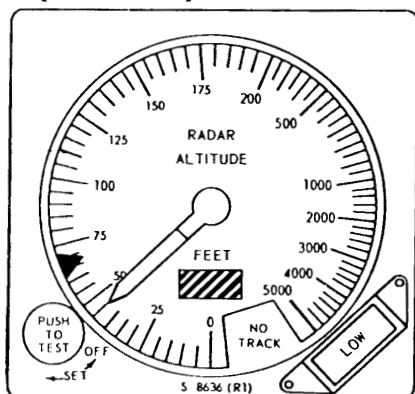


Figure 1B-43

C-12 COMPASS SYSTEMS (SINGLE LN-100 INSTALLATIONS)

115V ESS AC P Side
Single-Phase
C-12 Compass No. 1
C-12 Compass No. 2

Two individual C-12 compass systems are installed in the airplane. Each system provides an accurate heading reference to aid in navigation, regardless of the latitude position of the airplane. In addition to providing a visual heading reference, each system furnishes heading information to other navigation systems in the airplane. Operating controls and indicators for the No. 1 and No. 2 compass systems are located on the digital controller for each system located on the navigator's panel (figure 1B-44). Each system is capable of operating in either one of two modes. In the magnetic heading mode, used in latitudes where no distortion of the earth's magnetic field is encountered, the directional gyro in the system is slaved to the earth's magnetic field and the indicators display magnetic heading of the airplane. In the directional gyro mode, used in latitudes where the meridian convergence is excessive, or where the magnetic field is weak, the system gyro acts as a directional gyro and maintains the position manually selected by the operator. The indicators display the manually established heading.

C-12 Compass System Digital Controller

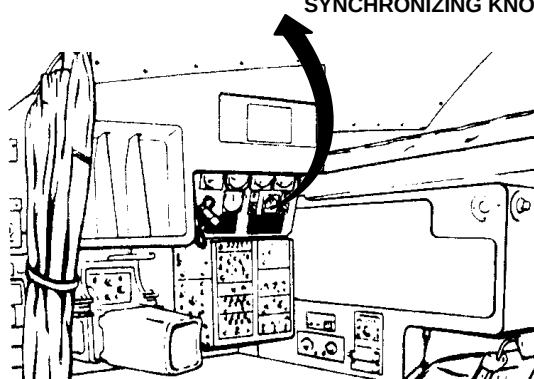
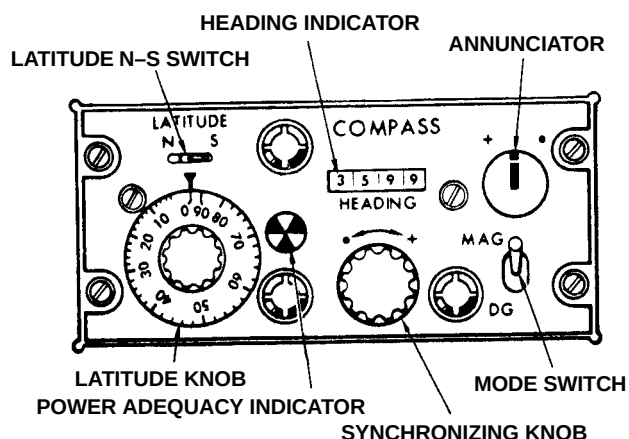


Figure 1B-44

AN/APS-137(V)4 INVERSE SYNTHETIC APERTURE RADAR

115V ESS AC P Side
Three-Phase

SEA SEARCH RADAR COOLING
FANS NO. 1
SEA SEARCH RADAR COOLING
FANS NO. 2
SEA SEARCH RADAR COOLING
FANS VCU
SEA SEARCH RADAR PWR SUPP
SEA SEARCH RADAR XMTR
SEA SEARCH RADAR CONV

26V ESS AC P Side
Single-Phase

SEA SEARCH RADAR

28V ESS DC CP Side

SEA SEARCH RADAR CONTROL
SEA SEARCH RADAR
INDICATORS NAV
SEA SEARCH RADAR
INDICATORS OP

NOTE

The circuit breakers labelled SEA SEARCH RADAR COOLING FANS RSCI are not used in this installation.

The Inverse Synthetic Aperture Radar (ISAR) system (figures 1B-45 through 1B-50) is a multi-mode radar system that provides weather avoidance, navigation, seaborne target surveillance, and imaging capabilities. The ISAR system provides automatic target tracking of up to 32 selected targets. Target data such as latitude and longitude, course, heading, bearing, distance, and speed are updated continuously. The radar system interfaces with the aircraft to obtain altitude, INS, and trackball information. The ISAR radar antenna is located along with the weather radar antenna beneath the aircraft radome. The antenna rotates at a speed that varies according to the operating mode that has been selected.

The ISAR system operates in one of four modes. Navigate mode is used for weather avoidance, ground mapping, target detection, and tracking. Search mode is used for target detection and tracking; it also provides for sea clutter suppression. Periscope mode is used for small target detection at low altitudes and short range; it also provides sea clutter suppression. Image mode is the inverse synthetic aperture mode which produces two-dimensional images of targets based on the targets' movement in the water and their aspect angles with respect to the radar antenna.

Provisions have been made for the installation of a cargo compartment ISAR operator's station.

WARNING

Do not operate the radar within 233 feet of ground personnel or within 330 feet of flammable liquids.

CAUTION

Do not operate the (ISAR) system without proper cooling.

Radar Remote Control Unit

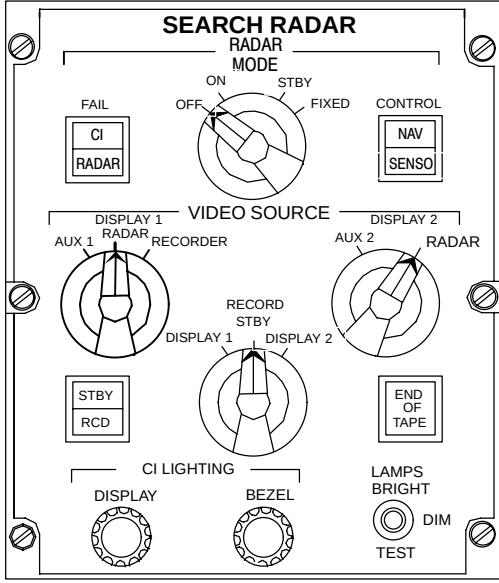


Figure 1B-45

Radar Control Panel

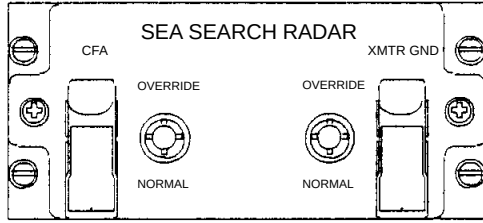


Figure 1B-46

Search Radar Cooling Fans

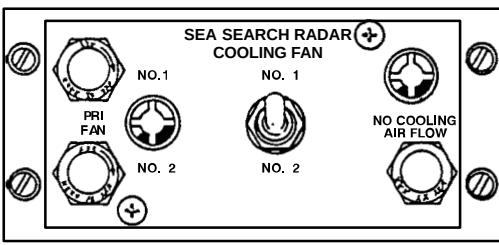
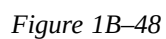


Figure 1B-47

PPI/Image Display



A/B-Scan Display

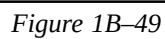


Figure 1B-50

CASPER SYSTEM

GENERAL

115V PASS	LH AC	P Upper
28V PASS	MAIN DC	CP Lower

The CASPER System consists of a nose mounted, Model 20TS FLIR/EO camera turret and a roll on/roll off, 3-bay, 2 seat Palletized Airborne Sensor Station (PASS) equipped with the controls required for the integrated operation of the Model 20TS Sensor System, the Airborne Tactical Worksta-

tion (ATW), MILSATCOM data/image/voice communications, and AN/APS-137(V)4 Inverse Synthetic Aperture Radar (ISAR). The sensor system operator (left seat) has access to the FLIR/EO system, ISAR, and MILSATCOM voice. The tactical system operator (right seat) has access to the tactical workstation functions, MILSATCOM voice and data, and FLIR/EO system controls. The turret contains a stabilized gimbal that mounts three sensors used to classify, evaluate and identify targets; one infrared and two visible spectrum. The ATW uses Over the Horizon Airborne Sensor Information System (OASIS) software to integrate the video sensors, ISAR, and aircraft avionics. The turret and pallet designs provide rapid removal and installation. CASPER connections to the aircraft are through 15 interconnect cables connected to a junction box at FS 939 RH.

AVIONICS LIMITATIONS QUICK REFERENCE GUIDE		
VHF (618M-3A)	118.0 – 135.975 MHz AM	Guard – 121.5 MHz
UHF (ARC-159)	225.0 – 399.975 MHz AM	Guard – 243.0 MHz
VHF/UHF (ARC-182)		
BAND 1	30.0 – 87.975 MHz FM	Guard – 40.5 MHz
BAND 2	108.0 – 155.975 MHz AM RX only on 108.0 – 117.975	TX/RX 118.0 – 155.975
BAND 3	156.0 – 173.95 AM/FM	Guard – 156.8 MHz
BAND 4	225 – 399.975 MHz AM/FM	Guard 243.0 MHz
VHF-FM (ARC-513)	150.0 – 173.975 MHz	Guard – 156.8, 156.3
HF (ARC-190)	2.0 – 29.9999 MHz	Guard – 2182.0 MHz
VOR (ARN-123)	108.0 – 117.95 MHz	
	HSI 315°, bearing pointer $\pm 2^\circ$, CDI $\pm 1/2$ dot, flag out of view, marker beacon lamps illuminated (#1 only)	
TACAN (ARN-118)	126 X channels, 126 Y channels	
	Flag pulled, bearing pointer 270°, DME 000.0 ± 0.5 , HSI 180° $\pm 3^\circ$, CDI $\pm 1/2$ dot, TO indicated	
RADALT (APN-171)	100 $\pm 15'$	
RADALT (AL-101)	40 $\pm 5'$ (model # 622-3890-002)	
	100 $\pm 5'$ (model # 622-3890-003)	
	150 $\pm 5'$ (model # 622-3890-005)	
BARALT	300' – 800' below set altitude	
Airspeed Indicator	300 ± 20 knots	
ADI	Pitch up 10 $\pm 3^\circ$, right bank 20 $\pm 5^\circ$, GYRO flag out of view	
ADF	Bearing pointer drives to 180° from received station during self-test	

SECTION II

OPERATION

PART A – NORMAL PROCEDURES

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PREPARATION FOR FLIGHT

FLIGHT RESTRICTIONS

Refer to Section V of this manual for information concerning the restrictions imposed on the airplane in flight.

CHECKLISTS

The flight manual contains only amplified procedures. Individual flight crew/scroll checklists are issued as separate technical orders. Scroll checklists are authorized when di-

rected by the using command. Flight crew checklists are designed for use with binders having plastic envelopes into which the individual pages are inserted. The scroll checklists are designed for use with flight deck coordinators and contain only normal procedures from the BEFORE STARTING ENGINES Checklist through the ENGINE SHUTDOWN Checklist. When scroll checklist use is directed, the flight crew checklist shall be available and used by each crew member for those phases of operation not covered in the scroll checklist. Checklist binders and flight deck coordinators are available through normal supply channels.

Checklist items followed by “As required” are items requiring varying procedures due to varying conditions. “As required” or “State setting” will not be used as a response; instead, the actual position or setting of the unit or system will be stated.

All flight crew members are required to use and refer directly to the appropriate checklist for all phases of operation in which they participate except during visual inspection, starting engines, taxi, takeoff, touch-and-go landings, emergencies, or when specifically allowed by the amplified portion of the checklist. In these instances, direct reference to checklist items will be made before performing them or afterward as a cleanup reference.

The flight engineer may accomplish all checklists from BEFORE STARTING ENGINES through ENGINE SHUT-DOWN without direct reference to the applicable checklist. All engineer system checks/items not requiring crew coordination may be accomplished as is practical on these checklists except that the flight engineer must review all items on each checklist for completion prior to responding checks “complete” for any phase of operation.

For simplification, this section will include only normal procedures applicable to the pilots and flight engineer. Procedures for other crew members are included only when their coordination is required. For duties of other crew members, refer to Section IV. The following crew-identifying codes are used throughout all checklists.

P –Pilot
CP –Copilot
E –Flight Engineer
N –Navigator
R –Radio Operator
LM –Loadmaster
DM –Dropmaster
SS –Sensor System Operator
TS –Tactical System Operator

NOTE

A comma between crew positions or responses indicates that both will be applicable. A virgule (/) between positions or responses indicates either one or the other will apply.

The PREFLIGHT and COCKPIT checklists are provided to prepare the airplane for flight and are performed by the flight engineer or a preflight crew in accordance with the following preflight check. The engineer will ensure that all access panels, escape hatches, and landing gear doors are closed/secured after completion of the Preflight. The flight engineer

shall inform the pilot of any checks or checklists not complete. The remaining checklists are performed on each flight with all necessary crew members in their respective duty positions.

Each checklist for a phase of operation will be initiated by the pilot except as indicated in the narrative introduction to that checklist. The copilot will be responsible for reading the pilot’s checklist. Only the response items need to be read aloud. The copilot will accomplish all non-response items prior to proceeding to the next item. When a checklist item is followed by a crew position (i.e., (P), (CP), (E), etc.), that crew member takes the action and, if the action is in quotes, responds aloud to the person reading the checklist. When more than one crew member has the same response to the same item, all subsequent to the initial crew member responding need respond only with his crew position. (Exception: when altimeters appear as a checklist item, each crew member shall state the altimeter setting and/or reading.) The sequence of response will be in the order as shown on the checklist. At the completion of each phase of operation (checklist), the copilot response indicates that the applicable checklist is complete. Before answering a challenge that indicates a panel or system, the responsible crew member will make sure that all switches/controls on that panel/system are as indicated by the subitems (letters) in the amplified checklist. When landing gear, flaps, or ground idle appear on a checklist, the action will be coordinated with the pilot prior to accomplishment if the airplane is moving. Checklist items not applicable to the airplane/model being flown (i.e., APU, GPWS, and TAS probe heater switch) need not be challenged nor responded to, when the airplane is flown more than once on the same mission and no maintenance or servicing is required, it is unnecessary for the Preflight checks to be performed after the first flight of the day. When maintenance or servicing is required, only those items or systems affected need to be checked prior to the next flight. The checklists have been designed so, for through-flight operation, the flight crew may begin with the COCKPIT Checklist to ensure safe operation. If checklists unique to a local unit are used (e.g., rinse rack procedures), they may be used in addition to, not in lieu of, the checklist requirements of this manual.

TAKEOFF AND LANDING DATA (TOLD) CARD

The flight engineer will complete a TOLD card for all take-offs and landings. Data may be obtained from either the performance charts in T.O. 1C-130H-1-1, or Tabulated Data. A TOLD card is provided in T.O. 1C-130H-1-1 as are specific instructions on TOLD completion.

PREFLIGHT CHECKLIST

It is the responsibility of the pilot to ensure that appropriate inspections have been accomplished.

WARNING

If, upon entering the airplane, fumes are present and suspected of being flammable or toxic, do not proceed with the PREFLIGHT CHECK until the cause of the fumes is investigated and eliminated.

BEFORE INTERIOR INSPECTION

1. Forms CG 4377 and CG 5181	Checked
a. Status of airplane	Checked
b. Fuel, oil, hydraulic, SAR equipment, and oxygen	As required
c. Ensure fuel sumps drained	Checked
2. Prior to entrance	
a. Chocks	In place
b. Static ground wire	In place
c. External ac or dc power	In place (when available)
d. Dust excluders and duct plugs	Removed
e. Aircraft free from ice, snow or frost	Checked
f. NLG pin	In place
g. Fire extinguisher	Serviceable, in place
h. Airplane location (for emergency notification purposes)	Noted

INTERIOR AND TOP OF AIRPLANE INSPECTION

CAUTION

When opening the crew entrance door, use the hand lanyard to prevent the door from falling free.

1. Crew entrance area	Checked

NOTE

Close the door and visually check that the hooks contact the eyebolts and the over-centering linkage contacts the stops.

CGTO 1C-130-1

a. Crew door, master door warning light	NORMAL
b. Radio and electrical equipment racks	Checked
2. Cargo compartment area – left side	Checked
a. Oxygen manual shutoff valve	Checked, ON
b. NLG emergency extension valve	NORMAL, shear-wired
c. Search window	Clean
d. TCAS GROUND TARGET DISPLAY and GROUND TEST switches	NORMAL

NOTE

If the GROUND TARGET DISPLAY switch is not in the NORMAL position and the ESS DC bus is energized, the TCAS COMP circuit breaker must be cycled to reset display mode.

e. Side emergency exit (1500 series)	Secure
f. MLG emergency extension wrench	Stowed
g. GTC oil level (1500 series)	Checked
h. Utility hydraulic reservoir fluid level, accumulator and cover	Serviced and closed
i. Left MLG and flap emergency engaging handles and hand crank	IN, Stowed



The MLG emergency engaging handles will not be pulled while the airplane is on the ground.

j. Left bleed air isolation valve (1500, 1600 series)	Open
k. Flight control and throttle cables	Checked
l. Aileron boost pack and flap motor	Checked
m. Fire extinguisher	Serviceable, in place
n. Aft fuselage junction box circuit breakers	Checked
o. Left paratroop door master door warning light shutoff switch	NORMAL
p. Flare launcher activation switch	Deactivated
3. Ramp area – left side	Checked
a. Cargo door and ramp controls and pump switch	NEUTRAL, ON, OFF

b. Auxiliary hydraulic reservoir fluid level	Checked
c. Ramp locks	Engaged
d. Ramp support arm	Connected
e. Door locks	Engaged
f. Overhead escape hatch and escape rope	Checked
g. Elevator and rudder boost packs	Checked
4. Ramp area – right side	Checked
a. Paratroop anchor cable and attachment arms	Stowed
b. Door locks	Engaged
c. Ramp support arm	Connected
d. Ramp locks	Engaged
e. Fire extinguisher and hand axe (some airplanes L.H. side)	Serviceable, in place
f. Life raft release handles	IN, shear-wired
g. Right paratroop door, cargo door and ramp master door warning light shutoff switches	NORMAL
5. Cargo compartment area – right side	Checked
a. Overhead escape/depressurization hatch, escape rope and ladder	IN, installed
b. Portable oxygen bottle and refiller hose	Checked
c. Right bleed air isolation valve (1500 and 1600 series)/divider valve (1600 series, CG 1790, and 1700 series)	Open
d. Right MLG emergency engaging handles and hand crank	In, stowed
e. Booster hydraulic reservoir, accumulator and cover	Serviced, closed
f. Side emergency exit	Secure
g. Oxygen manual shutoff valve	Checked, ON
h. Search window	Clean
i. Portable oxygen bottle and refiller hose	Checked
j. Fire extinguisher and hand axe	Checked

k. Spare fluids	As required
l. MLG safety straps (2)	Checked
6. Top of Airplane	Checked

NOTE

This inspection may be accomplished before or after the interior inspection.

WARNING

All necessary safety precautions should be observed. Conducting this inspection during high winds or other conditions which cause the airplane surfaces to be slippery could be hazardous. Under these circumstances, the pilot may waive this inspection.

WARNING

A hazard exists near radio antennas during the transmit mode. Ensure that radios are not operated during the TOP OF AIRPLANE INSPECTION.

CAUTION

Use extreme care at all times to avoid scratching or denting the skin while walking on the fuselage.

a. Empennage, fuselage, wing control surfaces, and flaps	Checked
b. Dry bay areas for fuel or hydraulic fumes and leaks	Checked
c. Oil servicing access panels	Secure
d. Fuel tank caps	Secure
e. Emergency equipment access panels	Secure
f. Escape hatches and release handles	Secure

FLIGHT DECK INSPECTION

1. Hydraulic panel	Set
a. Brake select switch	EMERGENCY
b. Auxiliary pump switch	OFF
c. Anti-skid switch	ON
d. Engine pump switches	ON
e. Suction boost pump switches	OFF
2. Landing gear lever	DOWN
3. IFF No. 2 (if installed)	OFF
4. Copilot's portable oxygen bottle and refiller hose	Checked
5. Alarm bell	Checked
6. Jump signals	Checked
7. Feather valve and NTS check switch	NORMAL
8. Copilot's circuit breaker panel	Checked
9. Navigator's station	Checked
a. Nose Radome heat switch	OFF
b. ADF	OFF
c. Radar	OFF
d. INS	OFF
e. Aldis lamp and lens	Checked
f. Flight deck refrigeration shut-off valve manual over-ride handle (1500 series)	NEUTRAL
g. TAS probe heater switch (if installed)	OFF
10. Radio Operator's Station	Checked
a. HF radios	OFF

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11. Life raft release handles	IN, shear-wired
12. Oxygen system pressure	Checked
13. Miscellaneous and emergency equipment	Checked
a. Escape rope	Checked
b. Emergency exit light	Checked, ARMED
c. First aid kits	Checked
d. Fire extinguishers	Serviceable, in place
e. All main ac distribution panel circuit breakers	Checked
f. Hand axe	Checked
g. Restraint harness or parachute	Checked, fitted
h. Life vest	Checked, fitted
14. Galley switches	OFF
15. Crew entrance door jettison handle	NORMAL, shear-wired
16. Fuel governing check switches	NORMAL, safetied
17. Pressurization test switches	OPEN, safetied
18. Emergency depressurization handle	IN, shear-wired
19. Pilot's circuit breaker panel	Checked
20. Pilot's portable oxygen bottle and refiller hose	Checked
21. Air conditioning panel	SET
a. Cargo compartment and flight deck shutoff switches	NORMAL
b. Air conditioning master switch	OFF
c. Flight station airflow switch (1600 series, CG 1790, 1700 series)	NORMAL
d. Cargo compartment and flight deck temperature controls	NORMAL

e. Cargo underfloor heating switch	OFF
f. Recirculating fan switch (1600 series, CG 1790, 1700 series)	OFF
g. Emergency depressurization switch	NORMAL
22. GTC/APU panel	SET
a. Door switch (1500 series)	OPEN
b. Control switch	OFF/STOP
c. Bleed air valve switch	CLOSED
d. Air turbine motor switch (1500 series)	STOP
23. Anti-icing panel	Set
a. Nesa windshield switches	OFF
b. Nacelle preheat switches	OFF
c. Prop and eng anti-icing master switch	AUTO
d. Pitot heat switches	OFF
e. Engine inlet duct anti-icing switches	OFF
f. Propeller ice control switches	OFF
g. Wing and empennage anti-icing switches	OFF
24. Flare launcher panel	CHECKED
a. Arming switch	SAFE
b. Launching switches	OFF
25. Wing and engine bleed air valves and switches	Set
a. Wing isolation valve switches (1500 and 1600 series)	NORMAL
b. Bleed air divider valve switch (1600 series, CG 1790 and 1700 series)	NORMAL
c. Engine bleed air switches	CLOSED/OFF

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26. Fuel panel	Set
a. Dump pump switches	NORMAL
b. Dump valve switches (1600 series, CG 1790, 1700 series)	NORMAL
c. Fuel boost pump switches	OFF
d. Crossfeed valve switches	Closed (No. 2 Open 1500 series)
27. IFF No. 1	OFF
28. ADS Control Panel switch	OFF
29. Electrical panel	Set
a. Inverter switches	OFF
b. AC bus tie switch (1710 and up)	OFF
c. Generator switches	OFF
d. Gen disconnect switches	OFF, shear-wired
e. Battery voltage	Checked

WARNING

Do not operate the airplane without a serviceable battery. Power would not be available to operate the fire extinguisher system, alarm bells, or emergency depressurization.

f. DC power switch	BATTERY

CAUTION

Ensure that the UHF radio is OFF prior to applying power to the aircraft.

g. DC bus tie switch	TIED
h. External ac power switch	EXT AC PWR

NOTE

External dc power may be used if external ac power is not available.

30. Fire handles and test panel

IN, Checked

- a. Place the turbine overheat switch in the TEST position. The lights in the engine fire handles and the master fire warning light will flash.



Operation of keyers during system testing should not exceed 30 seconds on. Do not test again for a period of 1 minute. Long continuous testing may result in failure of the keyer.

- b. Place the engine fire test switch in the TEST position. Check that the warning lights in the engine and GTC/APU fire handles and the master fire warning light glow steadily.
- c. Position the nacelle overheat warning switch to TEST. Check that all four warning lights and placard light illuminate.
- d. Position the anti-ice overheat warning panel test switch to TEST, check that all lights illuminate.

31. Radio (VHF)

ON, Checked

32. GTC/APU

Checked

- a. Start GTC/APU

"Clear" (LM), On speed

- b. Bleed air valve

OPEN

NOTE

Allow 1 minute warm-up for the GTC/APU before applying load.



Monitor the wing and empennage anti-icing indicators during operation of the GTC/APU. A temperature rise indicates that an anti-icing valve is OPEN, and the GTC/APU should be shut down.

33. Bleed air system

Checked

- a. All propellers

"Clear" (with LM)

- b. All systems using bleed air

Off

c. Engine bleed air switches	OPEN/OVRD
d. System pressure	Checked



If any engine START VALVE OPEN light (CG 1790, 1700 series) illuminates, close the engine bleed air valve. Maintenance action is required.

NOTE

Check system pressure for a reading of 35 psi minimum. Failure to reach this pressure indicates that a valve in the system has not closed, that a duct is leaking, or that compressor output pressure is low.

e. GTC/APU bleed air valve	CLOSED
f. System pressure leakage	Checked

NOTE

Time the drop from 30 to 15 psi. This time should not be less than 8.5 seconds. On CG 1705 and up and airplanes modified with chemical toilet, this time should not be less than 16 seconds.

g. Engine bleed air switches	CLOSED/OFF
h. GTC/APU bleed air valve	As required

34. ATM and generator/APU generator	Checked, ON

NOTE

If ac external power is available, the ATM generator, ATM, and GTC (or APU generator and APU) may be shut down at this time.

35. Wing isolation valve switches (1500 and 1600 series) Divider valve (1600 series, CG 1790, and 1700 series)	CHECKED

NOTE

The wing isolation valves/divider valve must be visually checked in the closed position. Reopening of the valves must be accomplished prior to the completion of the cockpit checklist.

36. Generator disconnect	Checked
a. Check that the DISC FIRED light is not illuminated. Check the continuity of the firing mechanism by holding the GEN DISC test switch to TEST. The DISC FIRED light should illuminate for each unit.	

37. Inverter systems

Checked

NOTE

The attitude director indicators will jitter when using copilot's inverter unless only battery power is being used.

- a. Turn each inverter control switch to the standby position. The SEL PWR OUT light should not be illuminated when the inverters have stabilized. Check attitude director, attitude displays, and TIT indicators for power indication.
- b. Place the VOLTAGE & FREQUENCY SELECTOR switch to the INVERTER position.
- c. Check the copilot's ac instrument inverter by placing the PHASE SELECTOR switch to PHASE A (phase A & B on 1500 series) and reading the voltage and frequency.
- d. Check the ac instrument and engine fuel control inverter by placing the PHASE SELECTOR switch to PHASE C and reading the voltage and frequency.
- e. Turn each inverter control switch to the normal position. The SEL PWR OUT lights should not illuminate after power has stabilized. The frequency and voltage cannot be read in this position. Check attitude director, attitude displays, and TIT indicators for power indications.

38. Fuel quantity and distribution

Checked

- a. Press the indicator test buttons and observe that the respective fuel quantity indicators move toward zero. Check the sum of the individual gauges against the totalizer indication.

WARNING

If a fuel quantity indicator is inoperative, pull the associated fuel quantity indicator circuit breaker. The circuit breaker will not be reset until proper inspection and repairs have been made.

39. Fuel system

Checked (Refer to System Operation, Section II, Part D.)

40. Surface boost shutoff switches

ON, shear-wired

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41. Warning press-to-test lights	Checked
42. Trim tabs	Checked
a. Check direction and movement of all tabs with the indicators.	
b. Check the elevator tab runaway override feature. Position the ELEV TAB power switch to EMER and check emergency trim tab control. Check for no trim with power switch in OFF, then return switch to NORMAL.	
c. Return all tabs to neutral.	
43. ADI warning flags	Checked
44. All hydraulic systems pressure	Depleted
45. All unnecessary equipment	OFF
46. Emergency exit light extinguish switch (if power is off)	Depressed

EXTERIOR INSPECTION

Walk-around Inspection

Conduct a walk-around inspection, following the route shown in figure 2A-1. Check the exterior structure of the airplane, including flight controls and flaps, for general condition and fluid leaks. If not previously checked by maintenance, a workstand/ladder will be required to check the engine inlets, exhaust areas, and the external tank caps. If required, these items may be accomplished at any time during the preflight inspection.

1. Nose section	Checked
a. Crew entrance door	
b. Battery compartment	
c. NLG components and wheel well area	
d. Steering scissors	Connected
e. Brake accumulator pressures	
f. Pitot masts and heads	
g. Radome and nose exterior	
h. FLIR/EO turret	

Inspection Diagram

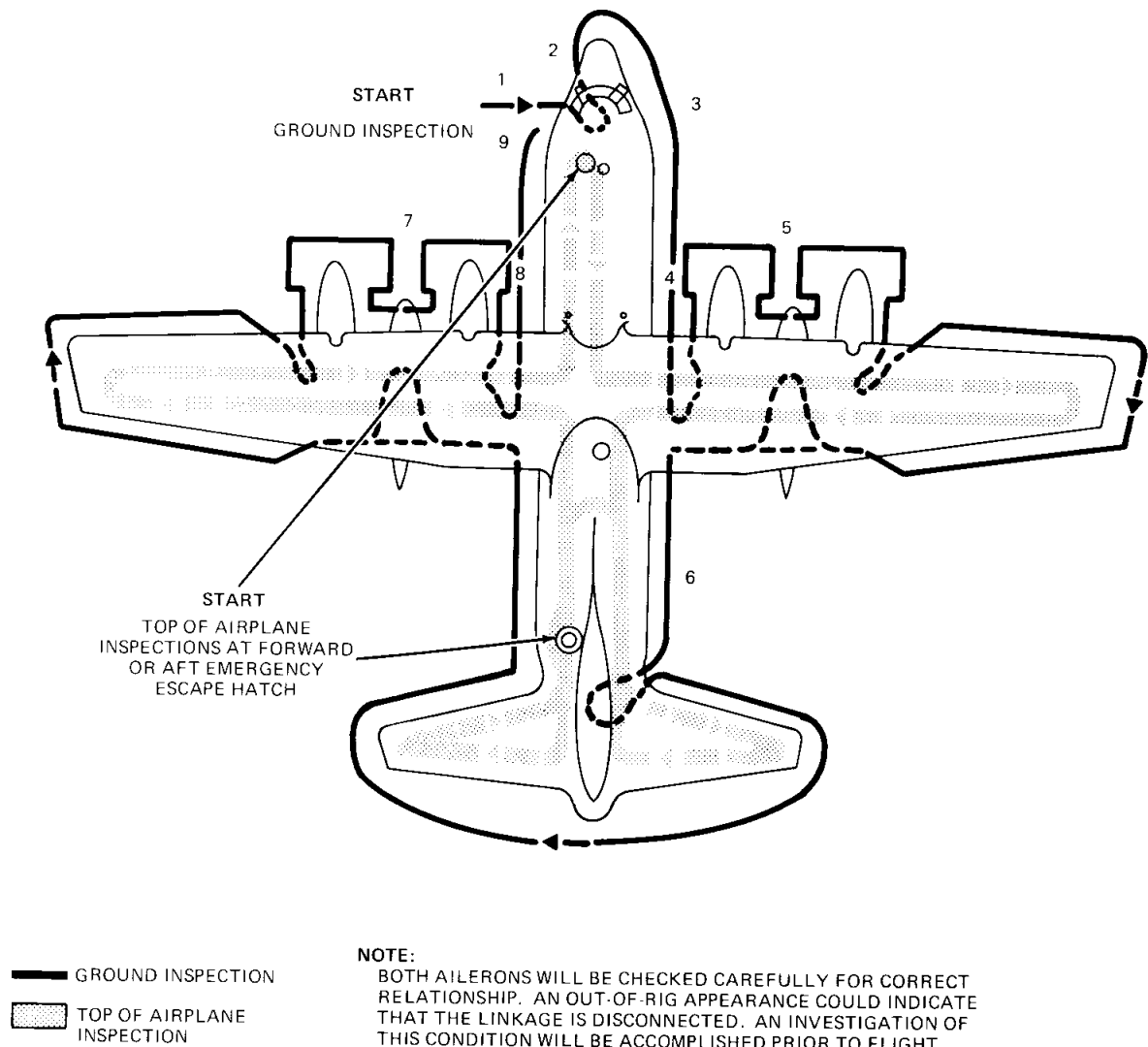


Figure 2A-1

- (1) Cover plate (turret plate not installed)
- (2) Radome fairing to radome seal
- (3) Radome seal to rainshield
- (4) Relative humidity indicator (turret installed)
- (5) Desiccant indicator (turret installed)
- (6) Purge valve (turret installed)
- (7) Turret general condition



Chips or cracks found in turret sensor windows could cause severe turret damage. If any chips or cracks are evident, do not operate the turret.

i. Windows

2. Forward fuselage, right side, and bottom Checked

- a. Flight station air conditioning intake, exhaust, (1600 series, CG 1790, and 1700 series) and oil level sight gauge
- b. Static air ports
- c. Oxygen system blowout plug
- d. Search window

3. Right wheel well area and center fuselage Checked

- a. Cargo compartment air conditioning intake, exhaust, (1600 series, CG 1790 and 1700 series) and oil level sight gauge
- b. Shock struts, brakes, wheels, and tires
- c. Wheel well area, components, MLG door attachment (secured)
- d. Auxiliary fuel tank magnetic sight gauge secured (visual scan only)

4. Right wing area Checked

- a. Propellers and nacelles
 - b. Wing for visible fuel leaks and vents for obstructions
 - c. Flight control surfaces – aileron and flaps
 - d. Life raft
5. Aft fuselage and empennage area Checked
- a. Single point refueling panel
 - b. Paratroop door
 - c. Toilet service panel (if installed)
 - d. Ramp and cargo door
 - e. Flare tubes
 - f. Elevator, rudder, and ailerons
(check for correct relationship)
 - g. Elevator, rudder, and aileron trim tabs
(check for neutral)
 - h. Tail skid
 - i. Ground test valve access door (closed)
6. Left wing area Checked
- a. Life raft
 - b. Wing for visible fuel leaks and vents for obstructions
 - c. Flight control surfaces – aileron and flaps
 - d. Propellers and nacelles
7. Left wheel well area and center fuselage Checked
- a. Auxiliary fuel tank magnetic sight gauge secured
(visual scan only)
 - b. Fire extinguisher bottles charge (checked, within limits)

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- c. Shock struts, brakes, wheels, and tires
- d. Wheel well area, components, MLG door attachment (secured)
- 8. Forward fuselage left side and bottom Checked
 - a. GTC/APU area, oil level sight gauge, and filler cap
 - b. Static air ports
 - c. Oxygen system blowout plug
 - d. Search window
 - e. TAS probe (if installed)

COCKPIT CHECKLIST

This checklist will be completed prior to commencing the BEFORE STARTING ENGINES CHECKLIST and will normally be completed by the flight engineer before the other crew members assume their crew positions. A crew member will remain at the airplane after completion of this checklist. If this checklist is completed and the airplane does not fly, complete the ENGINE SHUTDOWN CHECKLIST and the BEFORE LEAVING AIRPLANE CHECKLIST (as applicable) before securing the airplane.

- 1. NLG pin, pitot covers, dust excluders, duct plugs, and ground wires Removed
- 2. Radio operator's panel (when Radio Operator not aboard) Checked
 - a. Radios OFF
 - b. Public address panel (if required) ON, all
- 3. Navigator's panel (when Navigator not aboard) Set
 - a. TAS probe heater switch (if installed) OFF
 - b. Nose radome heat switch OFF
 - c. Radar switches OFF
 - d. INS Align or ATT. REF.
(if not to be used)
 - e. Voice recorder test switch (if installed) Normal

4. Circuit breakers	Checked
5. Propeller panel	Set
a. Feather valve and NTS check switch	NORMAL
b. Feather override buttons	OUT
c. Governor switches	NORMAL
d. Master trim knob (if installed)	ZERO
6. GPWS override switches (if installed)	NORMAL
7. Paratroop panels	Set
a. Air deflector door switches	OFF
b. Alarm bells and jump signal switches	OFF
8. Air conditioning panel	Set
a. Cargo compartment and flight deck shutoff switches	NORMAL
b. Air conditioning master switch	OFF
c. Flt sta airflow switch (1600 series, CG 1790, and 1700 series)	NORMAL
d. Cargo compartment and flight deck temperature controls	NORMAL
e. Cargo underfloor heating switch	OFF
f. Recirculating fan switch (1600 series, CG 1790, and 1700 series)	OFF



Ensure that the underfloor heating and fan switches are in the OFF position during engine starting and switching of generator loads from one to another. Failure to comply could result in a burned-out generator control panel.

g. Emergency depressurization switch	NORMAL

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9. GTC/APU panel	Set
a. Door switch (1500 series)	OPEN
b. Control switch	OFF/STOP
c. Bleed air valve	CLOSED
d. ATM switch (1500 series)	STOP
10. Anti-icing panel	Set
a. Nesa windshield switches	OFF
b. Nacelle preheat switches	OFF
c. Propeller and engine anti-icing master switch	AUTO
d. Pitot heat switches	OFF
e. Engine inlet air duct anti-icing switches	OFF
f. Propeller ice control switches	OFF
g. Wing and empennage anti-icing switches	OFF
11. Engine bleed air switches	CLOSED/OFF
12. Fuel panel	Set
a. Dump pump switches	OFF
b. Dump valve switches (1600 series, CG 1790, 1700 series)	NORMAL
c. Main fuel boost pump switches	ON
d. Auxiliary and external tank pumps	OFF
e. Main tank crossfeed and cross-feed separation valve switches	OPEN
f. Auxiliary and external cross-feed valves, and bypass valves	CLOSED
13. Fire handles	In

14. Oil cooler flap switches

As required

NOTE

Oil cooler flap switches should be placed in AUTO when ambient temperature is 15 ° C (59 ° F) or less. The switches should be placed to OPEN and then to FIXED when ambient temperature is above 15 ° C (59 ° F).

15. Landing gear lever

DOWN

16. IFF master switch(es)

STANDBY

17. Condition levers

GROUND STOP

18. Throttles

GROUND IDLE

19. Synchrophase master switch

OFF

20. TD control valve switches

AUTO



It is not recommended that an engine be started with the temp datum control valve switches in the NULL position. If a start must be made with the temp datum control valve switch in the NULL position, the TIT should be closely monitored since overtemperature protection is not provided.

21. Radios

ON (if power is available)



Ensure that the UHF radio is OFF prior to applying power to the aircraft.

BEFORE STARTING ENGINES CHECKLIST**NOTE**

If initial preparations for flight are made with the aircraft hangared, THE BEFORE STARTING AND PUSHBACK CHECKLIST shall be used in lieu of this checklist for the P, CP, E, and LM positions.

Crew members shall check/set their oxygen system, flight publications, individual interior lights, and clocks prior to initiating this checklist. Pilot and copilot will set hot mic system to LISTEN ON, TALK ON. All others will be set to LISTEN ON.

PILOTS**FLIGHT ENGINEER**

1. Cockpit checklist – “Complete”	(E)	1. Cockpit checklist – “Complete”	(E)
		2. NLG lock and pitot covers – “Removed”	(E)
2. Forms – “Checked”	(P)	3. Oxygen – “Checked”	(P)(E)(N)(R)(SS) (TS)(LM)(CP)
3. NLG lock and pitot covers – “Removed”	(E)	a. On/100% (Refer to oxygen system check.)	
4. Safety belt, shoulder harness – “Fastened, unlocked”	(P)(CP)	4. Electrical Panel – Set	
		a. DC power switch – Battery	
5. Lights – “Set”	(P)(CP)	b. DC bus tie switch – Tied	
a. Interior – As required		c. External ac power switch – EXT AC PWR (if available)	
b. Landing/Taxi – As required		d. DC power switch – EXT DC PWR (external dc power may be used if external ac power is not available)	
c. Search Lights (CG 1790) – As required		e. AC bus tie switch – OFF (CG 1710 and up)	
6. Oxygen – “Checked”	(P)(E)(N)(R)(SS) (TS)(LM)(CP)	5. Lights – Set	
a. On/100% (Refer to oxygen system check.)		a. Interior (as required)	
7. Fuel – “Checked”	(P)	b. Exterior – Nav – flash, bright Anti-collision – ON Strobe lights – OFF	
a. Quantity and distribution		c. Leading edge – ON	
8. Radios and navigational equipment – “Set”	(P)(CP)	6. Inverters – Set	
a. Radios – On	(CP)	a. Copilot’s inverter switch – Essential ac bus	
		b. AC inst and engine fuel control inverter switch – Essential dc bus	
		7. Fuel enrichment switches – As required	
		8. Ground idle buttons – LOW SPEED	

PILOT

FLIGHT ENGINEER

- b. Nav equipment – On (CP)
- c. Radar altimeter – Set (P)
- 9. IFF – STANDBY (CP)
- 10. Radio (UHF or VHF) – “Checked, (state radio) is primary” (CP)

- 9. Compass systems and heading indicators – “Checked, set, state headings” (N/E)(P)(CP)
- a. C-12 compasses
 - (1) Latitude N-S switch – Local latitude
 - (2) Latitude knob – Local latitude
 - (3) Mode selector switch – As required
- b. Dual INU installations:
 - (1) DG/MAG switch – MAG
 - (2) Read NAV station #1 and #2 BDHI headings.

NOTE

(1500 series) UHF radio not operative at this time without external ac power.

- 11. Clear GTC/APU – “CLEAR” (LM)
- 12. Autopilot – OFF/DISENGAGED (CP)
- 13. Flap lever – “Set” (CP)
 - a. Set flap lever to correspond with flap position indicator.
- 14. Flare launcher panel – Checked (CP)
- 15. Compass systems – “Checked, set, state heading” (N/E)(P)(CP)
 - a. The pilot will compare headings with the magnetic compass.
- 16. Instruments – “Checked” (P)(CP)
 - a. Attitude indicators – Check alignment and ensure the warning flag is not visible. Unlock and cage the Standby Attitude Indicator.

- b. Place flight director system in operation IAW Section II B of the flight manual and chapter 3 of CGTO 1C-130-1-D.
- c. Navigation equipment and instruments should be placed in operation IAW Section II B of the flight manual and chapter 3 of CGTO 1C-130-1-D.

NOTE

(Refer to Section I for limits.)

Compare No. 1 and No. 2 BDHI and state headings.

- 10. Radios and navigational equipment – Set (N/E)

PILOT

17. Altimeters – “Set, state setting, reading” (CP)(P)(N)

NOTE

Altimeter should read within 75 feet of a known elevation and within 90 feet of each other.

WARNING

It is possible to set an altimeter in error by 10,000 feet.

18. Takeoff and departure briefing – “Complete” (P)

NOTE

Pilot making the takeoff will brief crew about applicable items prior to takeoff. Only changed items need be included in briefing for multiple takeoffs/departures.

- a. TOLD data
 - b. Signals for gear and flap retraction
 - c. Copilot/Flight Engineer emergency actions during:
 - (1) Aborted takeoff
 - (2) Aircraft malfunction after refusal speed
 - d. Emergency return
 - e. Fuel dumping
 - f. SID/Departure procedures
 - g. Navigation Aids/Flight Director
 - h. Radar altimeter (set for emergency return)
 - i. Hazardous terrain/obstacles
 - j. Questions/additional information
19. Ramp and door – “Closed” (LM)

FLIGHT ENGINEER

11. Start GTC/APU – Set

NOTE

After GTC/APU is cleared by LM.

- a. Control switch – Start, run

NOTE

Allow 1 minute warm-up for GTC/APU before applying load.

- b. Bleed air valve – Open, pressure up

CAUTION

Monitor the leading edge temperature indicators. A rise in temperature indicates that an anti-icing valve is open. The GTC/APU must be shut down to prevent damage to a heated surface or fuel tank sealant.

PILOT

FLIGHT ENGINEER

20. INS – “Set, state setting” (N/E)

NOTE

The INS will normally be set to Navigate. If mission profile is such that the INS is not needed for Navigation, it will be set to Attitude Reference.

21. Hydraulic panel – Set (CP)
- a. Brake select switch – Emergency
 - b. Aux pump switch – On, pressure up
 - c. Anti-skid switch – On
 - d. Engine pump switches – On
 - e. Suction boost pump switches – On



Starting an engine with an inoperative suction boost pump may result in damage to the engine-driven hydraulic pump.

22. Parking brake – “Set, remove chocks” (P)
- a. Depress pedals and monitor the emergency brake pressure gage for pressure drop as pedals are depressed.
23. Chocks – “Removed” (LM)

NOTE

Chocks will be secured in the cargo compartment.

24. Before Starting Engines checks – “Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

12. ATM and generator/APU generator – As required

NOTE

If external ac power is available, the ATM should not be started at this time. The external ac power switch automatically goes to OFF when the ATM/APU generator switch is placed to ON, regardless of generator operation.

13. INS – “Set, state setting” (N/E)

14. Before Starting Engines checks – “Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

Taxiing on two engines is suggested for anticipated prolonged ground operations.

PILOTS

1. Clear No. 3 engine – “No. 3 clear” (LM)
“Turning No. 3” (P)



On airplanes with a GTC (1500 series), when the ATM and ATM generator are shut off for low-density conditions during the self-contained start, a fire hazard may exist if the battery relay opens or the GTC stops at a low engine rpm after light off. Should this occur, immediately position the condition lever to feather to mechanically cut off fuel flow to the engine. This may be an indication of a defective battery.

NOTE

After engine is cleared, the pilot will place the condition lever to RUN, actuate the ENGINE GROUND START button/switch and state, “Turning No. ___.” The ENGINE GROUND START button/switch should be held until 60 percent rpm is attained.

(1500 and 1600 series) The light in the starter button will glow. (CG 1790 and 1700 series) the START VALVE OPEN light should illuminate within 5 seconds. On all airplanes, propeller rotation should be noted within 5 seconds of starter actuation. The starting cycle is automatic and requires no further action. Keep one hand on the condition lever and the other on the starter button/start switch of the engine being started, and be prepared to discontinue the start immediately should a malfunction occur. The LM will state “Negative rotation” if propeller rotation is not observed within approximately 5 seconds after the pilot states “Turning No. ___.” Observe start sequence as outlined in this section.

FLIGHT ENGINEER

After the engine is cleared by LM:

1. Engine Bleed air switch – OPEN/OVRD



(CG 1790 and 1700 series)

Do not start engine if the START VALVE OPEN light is illuminated prior to ENGINE GROUND START switch actuation.



(CG 1790 and 1700 Series)

If the START VALVE OPEN light does not illuminate or the engine fails to rotate within 5 seconds after the ENGINE GROUND START switch is placed in START, discontinue the start by releasing the ENGINE GROUND START switch to OFF. Maintenance action is required prior to another start. Repeated attempts to start may result in internal starter damage.

NOTE

On airplanes with a GTC (1500 series), under low density conditions (high temp or press altitude), GTC mass output to accelerate the engine will be reduced. If the ATM and generator are being used, turn the generator OFF and ATM to STOP during engine start.

PILOTS

FLIGHT ENGINEER

NOTE

A positive hydraulic pressure indication should be noted by the time the engine is on speed. Normal operating pressure should be indicated within 30 seconds after on-speed. This pressure may not be reached if the control column is in the full forward position due to normal internal bypass of fluid in the elevator boost package. Pulling the column off its stop 2 to 3 inches will eliminate this bypass.

2. Call engine start sequence items a. through i.

After engine is on speed:

NOTE

After the first engine is started and stabilized at low speed ground idle and all engine instruments indicate normal, reset the engine to normal ground idle and allow engine to stabilize. Use this engine for starting air source for other engines.

Normal engine start sequence is 3, 4, 2, and 1. Optional engine start sequence is two symmetrical engines. Taxi with two engines may be used to reduce fuel consumption, FOD, brake wear, ramp noise, etc. The airplane must be stopped as the remaining engines are started separately. The BEFORE TAKEOFF CHECKLIST will be completed after all engines are operating. A crew member will scan the engines from the cargo compartment. The flight engineer has the primary duty to monitor the engine start. Should any crew member note a condition which would necessitate discontinuing a start, he/she shall call out "Stop start," and state the reason. The pilot will discontinue a start by placing the CONDITION LEVER to GROUND STOP and releasing the ENGINE GROUND START button/switch unless a specific emergency procedure dictates other action. During start, an engine should accelerate smoothly and continuously; TIT should increase slowly within normal limits, and the engine should stabilize on speed (either normal or low speed) within 1 minute. For a typical engine start, the sequence of events after starter actuation and the cautions to be observed are as follows:

- a. "RPM" – An indication



If the start button/switch is prematurely released, discontinue the start to preclude shearing of the starter shaft.

- b. "Fuel flow/enrichment" – With fuel enrichment off, fuel flow will increase to approximately 300 pph. If fuel enrichment is selected, fuel flow should rapidly increase above 300 pph, then rapidly decrease to approximately 300 pph.

NOTE

If negative deenrichment is observed, discontinue the start and motor the engine prior to attempting another start with enrichment off.



The secondary pump pressure light may illuminate momentarily, then go out. It must illuminate again before the engine reaches 65 percent rpm.

- c. "Ignition" – Should immediately follow fuel flow. Must occur by 35 percent rpm.



If an engine does not light off by 35 percent rpm, discontinue the start.

NOTE

Normal start is with enrichment off. If ignition is not achieved on first attempt, record on Form CG 4377. One restart is permitted with fuel enrichment on, provided TIT is below 100 ° C and an overtemp was not experienced on a previous start. During extreme cold weather, all starts should be accomplished without enrichment unless engine will not start. Do not select enrichment after the starter has been actuated.

- d. "Oil pressure" – Positive oil pressure (both engine and gearbox) must be indicated by 35 percent rpm.



If there is no positive indication of oil pressure on the engine and reduction gearbox by 35 percent rpm, immediately discontinue the start.

- e. "Hydraulic pressure" – Should be observed after observation of oil pressure. Must have positive indication by time engine is on speed.
- f. "Parallel" – Indicated by secondary fuel pump pressure light on (40 to 65 percent rpm).

NOTE

If there is no parallel light between 40% – 65%, continue start and check for series drop in TIT (which indicates series operation) and press-to-test light bulb. If light does not press-to-test properly, replace light bulb and try press-to-test again. If light operates properly, shut down engine and restart to check for proper operation of the pressure switch. If light does not illuminate during restart after replacing the light bulb, the pump or pressure switch has failed and maintenance is required before flight.

- g. "Starter" – The starter button/switch is held until 60 percent rpm. Starter operating limits: 1-minute ON, 1-minute OFF; 1-minute ON, 5 minutes OFF; 1-minute ON, 30 minutes OFF.

NOTE

Any starter engagement is considered as 1-minute for duty cycle purposes.



(CG 1790 and 1700 Series)

If the START VALVE OPEN light does not extinguish within approximately 15 seconds after releasing the ENGINE GROUND START switch, shut down the engine and place the ENGINE BLEED AIR switch OFF. Maintenance action is required.

- h. "Series" – Indicated by secondary fuel pump pressure light out and a drop in TIT at approximately 65 percent rpm.



The throttles must not be moved out of the GROUND IDLE detent during engine starting. The resultant increase in blade angle might overload the starter and/or reduce the rate of engine acceleration.



If, after lightoff, the engine does not accelerate smoothly to ground idle rpm and/or a rapid increase in TIT is indicated, a stalled start is occurring. Immediately discontinue the start. Before attempting another start on that engine, motor the engine to approximately 25 percent rpm with the condition lever in GROUND STOP to remove gases and unburned fuel from the turbine.

NOTE

Starts in extremely cold conditions may result in start TIT less than Normal Limits. If all engines are similar in TIT, no further action is required.

- i. "Peak TIT" (State Temperature) – Observe maximum TIT rise during start.

NOTE

Normal starting turbine inlet temperature should be between 751 ° C and 830 ° C, inclusive.

Starting Temperature Limits

TIT 720 °C or less

Record on Form 4377. Maintenance action required prior to flight.

TIT between 721 °C–750 °C

Record on Form 4377. Perform temperature controlling check in accordance with Section II E. Low starting temperature may indicate burned thermocouples or a low temp datum start setting. If a TIT indication system malfunction is suspected, maintenance action is required prior to flight.

TIT exceeds 830 ° C (excluding momentary peak at 94% rpm)

Record on CG Form 4377.

TIT exceeds 850 ° C (excluding momentary peak at 94% rpm)

Discontinue the start and record on Form 4377. One restart is permitted after cooling to below 200 ° C TIT. If TIT exceeds 850 ° C on second start, discontinue start and record. Restart is not recommended.

TIT exceeds 965 ° C

Discontinue the start and record on CG Form 4377 (an overtemperature inspection is required).



The Temperature Datum System provides no overtemperature protection with the Temperature Datum System in the NULL position. Monitor the TIT closely during NULL operation as maximum TIT can be exceeded under these conditions.



After moving a condition lever to GROUND STOP, do not move the lever from this position until engine rotation has stopped. Do not reengage the starter until rotation has stopped completely and starter duty cycles have been observed.

NOTE

The engine should accelerate to either normal or low-speed ground idle within 1 minute. If the engine does not stabilize on speed within this time, discontinue the start. Exception: During low air density conditions (high temperatures above approximately 28 ° C/high altitude), if the engine accelerates smoothly with no indication of stall and TIT limits are not exceeded, time to stabilize on speed is 70 seconds. Do not exceed starter duty cycle limits.

NOTE

If the engine oil temperature is 0 ° C or below prior to engine start, it is recommended the engine be run for at least 10 minutes (at either low speed or normal ground idle) prior to moving the throttles. This action is intended to reduce the number of propeller leaks resulting from hardened O-rings.

NOTE

The copilot should check each hydraulic pump after its engine is started by operating the flight controls while the respective pump is the only source of pressure for its respective system. After the controls are stable, check each pump's static pressure for normal limits prior to starting the next engine or turning the other pumps in the system back on. Prior to starting the second engine in the same system, bleed the pressure down to zero for the running engine.

NOTE

On 1600 series, CG 1790, and 1700 series airplanes, if the engine fails to rotate with the engine bleed air switch in OVRD, reduce bleed air manifold pressure below 45 psi and attempt start with the switch in ON. The bleed air manifold pressure may be reduced by turning off engine bleed air and using APU bleed air.

PILOT	FLIGHT ENGINEER
NOTE After the flight engineer directs external equipment removal/states GENERATOR ON, proceed with the check list.	
2. Clear No. 4 engine – “No. 4 clear” (LM) “Turning No. 4” (P)	3. Engine generator – “Generator on” NOTE On ESU-equipped airplanes, the generator voltage and frequency cannot be verified with the generator in the OFF/RESET position.
3. External equipment – “Removed and clear” (LM)	4. ATM and generator/APU generator – ON NOTE
4. Clear No. 2 engine – “No. 2 clear” (LM) “Turning No. 2” (P)	Check voltage and frequency of each phase prior to placing generator ON. The ATM/APU generator must be ON for low-speed ground idle operations since the engine generators will be off line. If the generator fails, the low-speed ground idle buttons must be disengaged to prevent a drain on the battery.
5. Clear No. 1 engine – “No. 1 clear” (LM) “Turning No. 1” (P)	5. DC power switch – BATTERY state “Remove external equipment.”
6. Crew aboard – “Crew aboard, doors closed and checked” (LM)	NOTE Repeat steps 1. through 3. for all engines as they are cleared/started. State “Generator ON” for subsequent engines after step 3.

PILOT

FLIGHT ENGINEER

NOTE

A & M frequency meters (identified by the word HERTZ on the face) are only accurate in the engine operating range above 90 percent rpm. Disregard any upscale reading at low-speed ground idle.

6. GTC (1500 series) – Set
 - a. Bleed air valve – CLOSED
 - b. Control switch – OFF
 - c. Door switch – CLOSED

NOTE

GTC may be set after second engine is started.

7. APU bleed air valve (1600 series, CG 1790 and 1700 series) – CLOSE
8. Air conditioning – Set
 - a. Master switch – NO PRESS
 - b. Recirculating fan switch (1600 series, CG 1790 and 1700 series) – as required



Do not turn the recirculating fan on until the No. 1 ac generator is powering the LH ac bus. Switching of fan-associated loads could result in a burned-out generator control panel.

9. Warning lights – Checked
10. Leading edge temperature – Normal
11. Ground idle – As required

NOTE

Hold checklist after item 11 until all engines are started.

12. Engine bleed air switches (1600 series, CG 1790 and 1700 series) – ON

TAXI

Skidding or skipping of the nosewheel may develop when the airplane is turning, either because of wet pavement or because of an aft center of gravity. These conditions can be prevented by avoiding abrupt steering changes or by asymmetrical power and brake applications.

Excessive or prolonged use of the brakes while taxiing will cause overheating of the brake assemblies with possible wheel failure and/or tire or brake fire resulting. Taxi speed can normally be controlled by use of minimum engine power and propeller reversing.

Propeller reversing over unprepared surfaces may cause foreign object damage to the propeller or engine compressor section. Every effort should be made to perform the propeller reverse check over hard surfaces.

NOTE

The service life of the aircraft will be increased if the taxi speeds are kept to a minimum and low-speed ground idle is used whenever possible.

It is recommended that the engines be changed to normal ground idle operation by disengaging the low-speed ground idle buttons rather than by throttle movement. Movement of the throttles beyond the limits of 9 to 30 degrees coordinator angle at ambient temperatures above 27 ° C may cause rpm stall or overtemperature. Should the low-speed ground idle buttons be inadvertently released with the throttles, return the throttles to ground idle; the engine should accelerate to normal ground idle rpm. When down-shifting from normal to low-speed ground idle, monitor the engine instruments and be prepared to shut down the engine if a stall or overtemperature of 850 ° C or greater occurs.

If, during prolonged ground operation, oil temperature approaches the maximum limit, the throttle should be advanced toward FLIGHT IDLE to increase airflow through the coolers. Operation in low-speed ground idle with some positive thrust will aid in controlling oil temperatures.

When taxiing over rough, pitted, undulating, or washboard terrain, extreme caution must be exercised and very low taxi speeds observed.



Turns with brakes locked on one side are prohibited. When possible, avoid braking in turns, since damage to gear and/or support structures may result. If a stop in a turn is required, record in Form CG 4377. See figure 2A-2 for the minimum space and clearances required for turning.

Taxi the airplane forward approximately 5 feet after taxiing in a turn to realign the main gear.

CROSSWIND TAXIING

With four engines operating the airplane can be taxied in a 30-knot, 90-degree crosswind by use of nosewheel steering and rudder control only. Taxiing can be accomplished in crosswinds up to 60 knots by use of rudder and aileron control, differential braking, and differential power. Turns to a crosswind heading should be performed with great caution and at slow speeds to prevent centrifugal force from aiding the wind in tipping the airplane.

REVERSE TAXIING

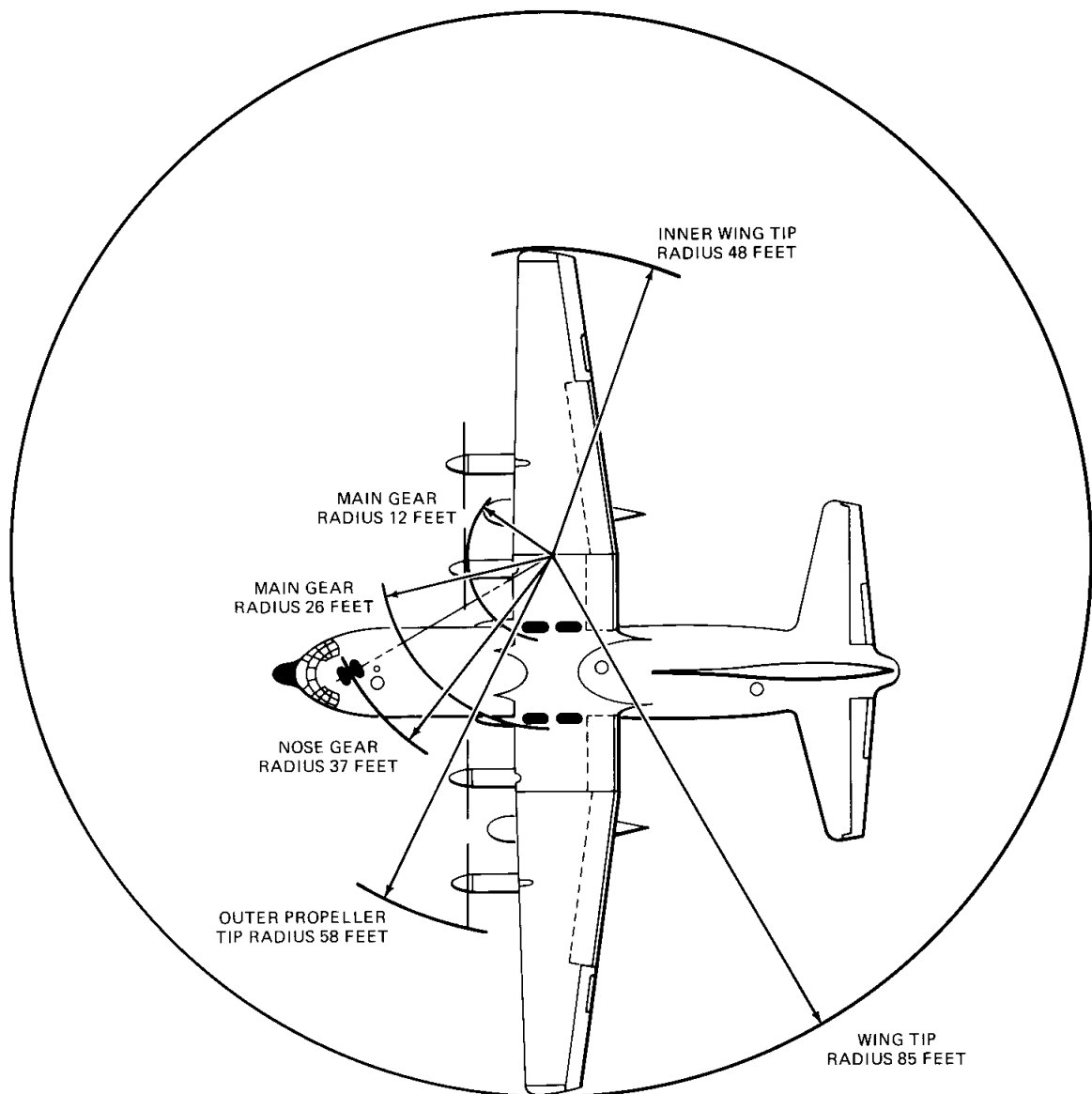
The following procedures should be adhered to during reverse taxiing:

- a. Ensure that the maneuvering area is free of all debris and obstructions which could cause damage to the airplane or injury to personnel.
- b. Reverse symmetrical propellers simultaneously.
- c. Use forward thrust to stop the backward movement of the airplane.



The use of brakes during reverse taxiing should be avoided to prevent the airplane from setting on the tail.

Turning Radii



VERTICAL CLEARANCES

WING TIP	12 FEET
VERTICAL STABILIZER TIP	38 FEET 6 INCHES
INBOARD PROPELLER	5 FEET 9 INCHES
OUTBOARD PROPELLER	6 FEET 5 INCHES

CAUTION

MINIMUM SPACE REQUIRED
FOR TURNING IS 170 FEET
WITH THE NOSE GEAR TURNED
TO THE MAXIMUM OF 60 DEGREES

Figure 2A-2



Oil temperature is very critical in reverse and should be monitored closely to avoid exceeding limits.

- d. Do not back the airplane when engine oil temperature is at or above 100 ° C.
- e. After reverse taxiing, move the airplane forward approximately 5 feet in a straight line to realign the main landing gear.

NOTE

If flaps are lowered before taxiing in congested areas, check hydraulic pressures (low boost) before lowering the flaps.

PILOT

FLIGHT ENGINEER

- 7. Brakes – “Checked” (P)

NOTE

NOTE

Pilot will check emergency brakes on beginning taxi. Upon reaching an uncongested area, copilot will switch to normal brakes and pilot will check normal brakes prior to responding.

Steps 13., 14., 15., 16., and 17. of the flight engineer’s checklist are not required on a subsequent flight on the same day. Step 14. is required on subsequent flights only after refueling.

- 13. Propeller and engine anti-icing – Checked

- 8. Instruments – “Checked” (P) (CP)
 - a. Heading indicators
 - b. Turn and slip indicators
 - c. Airspeed and vertical velocity indicators

NOTE

Hold checklist after step 8. until all engines are started.

NOTE

Steps 9. and 10. need not be accomplished if low boost was checked with flaps up prior to selecting full flaps for taxi in congested areas.

- a. Place the ice detector test switch in the No. 2 position and hold for 4 seconds. Note that the ice detection light illuminates. Place the PROP & ENG anti-icing master switch to the RESET position several times. The amber light should wink off and then come back on. After 12 seconds, the test cycle is complete and the ice detection light will then reset.
- b. Place the ice detector test switch in the No. 3 position and hold for 4 seconds. Note that the ice detection light illuminates. Place the PROP & ENG anti-icing master switch to the RESET position several times. The amber light should wink off and then come back on.

- 9. Flaps – Up (CP)
- 10. Hydraulic pressures – Checked (CP)
- 11. Flaps – “50 percent” (CP)(P)
- 12. Flight controls – “Checked” (P)(CP)

NOTE

The copilot will normally check the yoke for free and clear movement while the pilot will check the rudder. The pilot is still responsible for ensuring the flight controls are checked.



Spinner anti-ice, blade deice and spinner deice circuit breakers shall not be reset until proper inspection and repairs have been made unless a greater emergency exists. Resetting these circuit breakers may cause damage to the propellor control assembly.

PILOT

NOTE

Restrain the control column when checking elevator movement to prevent the bob weight from slamming the controls against the stops.

13. Hydraulic pressures – Checked (CP)
14. Propeller reversing – “Checked” (E)

NOTE

The pilot will place symmetrical pairs of throttles in full reverse. Flight engineer will advise pilot of any discrepancy. Pilot should note airplane pull (if any) and compensate as necessary for any discrepancy during subsequent reverse operation.

NOTE

Propeller-reversing check is required prior to the first flight of the day.

FLIGHT ENGINEER



Do not hold the ice detector test switch in the No. 2 or No. 3 position longer than 5 seconds. The test cycle may be repeated once, but then wait 5 minutes for the ice detector to cool before performing this test sequence again. Failure to comply can result in damage to the ice detector probe.

NOTE

If a solid-state detector is not installed the amber light will stay out when the PROP & ENG anti-icing master switch is placed to the RESET position.

- c. Check propeller blade, spinner, and spinner base as follows:

- (1) Determine the position of the deicing timer by turning each propeller ice control switch (starting with No. 4) ON, then OFF, until a load is indicated on all three ammeters (spinner anti-ice, spinner deice, and blade deice).

NOTE

The cycle must begin on No. 4 engine when equipped with solid-state timer.

- (2) Leave propeller ice control switch on until heating cycle is complete as noted by drop on the deicing ammeter.
- (3) Turn next switch in sequence to ON, and check for an approximate 20-ampere increase on the spinner anti-ice ammeter and a continuous amperage reading on the spinner and blade deice ammeters.
- (4) Repeat step (3) for each succeeding propeller.
- (5) When all propellers have been checked, place all ice control switches OFF.

PILOT

FLIGHT ENGINEER



When the airplane is on the ground, do not operate the propeller anti-icing or deicing for an engine that is not running. The engine must be running in order to dissipate the heat generated by the heating elements to prevent damage to the elements. Never operate the system for more than two cycles while the airplane is on the ground. Anti-icing and deicing may be used for a propeller feathered in flight.

NOTE

If the blade deicing ammeter falls below 65 amperes, do not fly into icing conditions.

- d. Place each engine inlet air duct anti-icing switch in the ON position (one at a time) and note a slight torque decrease and/or TIT increase. Place the switches in the OFF position (one at a time) and note a slight torque increase and/or TIT decrease.
- e. Place the PROP & ENG anti-icing master switch to the RESET position and note the ice detection light is extinguished.

14. Positive fuel flow – Checked

NOTE

A fuel system positive flow check for those tanks containing fuel will be made prior to flight.

- a. Main tank boost pumps – OFF.
- b. Wait at least 1 minute for gravity feed check while monitoring TIT and fuel flow.
- c. Close the crossfeed separation valve.
- d. Left and right aux tank switches – ON. Observe that all engine low-pressure warning lights go out and monitor TIT and fuel flow for at least 1 minute.
- e. Aux tank pump switches – OFF.
- f. Left and right fwd EXT tank pump switches – ON. Observe that all engine low-pressure warning lights go out and monitor TIT and fuel flow for at least 1 minute.
- g. External tank PUMP switches – OFF.

PILOT

FLIGHT ENGINEER

- h. Close all tank crossfeed valves and deplete pressure.
 - i. Main tank boost pump switches – ON.
15. Propeller reversing – “Checked” rpm 96 – 106%

NOTE

Flight engineer will observe rpm within limits and advise pilot of symmetric torque differences of 1,000 inch-pounds or more. Record discrepancies in Form CG 4377.

16. Generators and loads – Checked
- a. Place the ATM/APU generator switch to the OFF position and note that the No. 2 generator assumes the essential ac bus load.
 - b. Rotate the voltage and frequency selector to each engine generator position and check that voltage (110–125) and frequency (380–420) of each phase are within limits.
 - c. Rotate the phase selector switch to each phase position and check each engine generator loadmeter for an indication of a load (0–1.05) within limits.
 - d. Check each TR unit loadmeter for an indication of a load (0–1.03) within limits.
 - e. Place the ATM/APU generator switch in the ON position.
17. Engine bleed air regulators (1600 series, CG 1790, and 1700 series) – Checked
- a. Engines – Normal ground idle
 - b. Flt. deck air conditioning – Off
 - c. Cargo compartment air conditioning – On
 - d. APU bleed air – Off
 - e. All bleed air regulators – Off
 - f. Air conditioning master switch – No pressure
 - g. Bleed air manifold pressure gauge – Checked (Should read 4 psi or less with no sign of increasing pressure)

PILOT

FLIGHT ENGINEER

- h. Engine bleed air regulators – On, one at a time. They should indicate within approximately three (3) psi of each other.
- i. Engine bleed air regulators (All) – On
- j. Flt. deck air conditioning – On

NOTE

After all bleed air switches are on, bleed air pressure should be approximately 50 psi.

NOTE

If individual regulator pressures are not within three (3) psi of each other, asymmetrical power may be experienced when engine power is increased for takeoff. If asymmetrical power is significant, place all engine bleed air switches to the Override position.

NOTE

Setting the electrical panel and APU may be delayed until the Line Up Checklist if low speed operation on all four engines is desired to minimize taxi speeds.

- 18. Electrical panel – Set
 - a. Engine generators – ON
 - b. ATM/APU generator switch – OFF
 - c. ATM control switch – STOP



With the ATM/APU generator turned off, do not attempt to low-speed all four engines since electrical equipment may be damaged.

- d. AC inst. and engine fuel control
inverter switch – ESSENTIAL AC BUS
- e. DC bus tie switch – NORMAL
- f. DC voltmeter switch – BAT

PILOT

FLIGHT ENGINEER

19. APU control switch (1600 series, CG 1790, and 1700 series) – STOP
 20. Pressurization – Set
 - a. Rate knob – As required
 - b. Controller – As required (not below pressure altitude)
 - c. Air condition master switch – AUTO PRESS/as required
 21. Anti-icing panel – Set
 - a. NESA – NORMAL
 - b. Pitot heat – ON (except CG 1717 through 1720) ■
 - c. Propeller and engine anti-icing – ON, AUTO
 22. Fuel panel – Set
 - a. Crossfeed valves – CLOSED
 - b. Main tank boost pumps – ON
- NOTE**
- Turning on the Aux tank boost pump when fuel exceeds 5500 pounds in the associated tank will prevent venting during climbout.
- c. Aux tank boost pumps –As required
 23. Windows, hatches – Closed, secure
 24. Instruments – Checked
 25. Voice recorder – Checked (N/E)
- | | | | |
|--|---------------|--|---------------|
| 15. Before Takeoff checks – “Complete” | (E)(N)(R)(SS) | 26. Before Takeoff checks – “Complete” | (E)(N)(R)(SS) |
| | (TS)(LM)(CP) | | (TS)(LM)(CP) |

ENGINE RUN-UP CHECKLIST

The engine run-up checklist may be completed any time after all engines are started. Engine run-up is required prior to the first flight of the day. Select an area which is free of foreign objects. (See figures 2A-3 and 2A-4 for danger areas.)

PILOT

1. Nosewheel, parking brake – “Centered, set” (P)

CAUTION

Do not run up all four engines to maximum power simultaneously. The thrust available may be sufficient to skid locked wheels and chocks. Do not run up two engines on one side simultaneously. The thrust available is sufficient to skid the nosewheel sideways. Simultaneous full reverse on all engines may lift the nosewheel off the ground.

CAUTION

To prevent excessive stresses on the propeller, and to prevent wing lift and resultant severe structural damage due to a propeller contacting the ground, the airplane will be headed into the wind within 30 degrees of wind direction for engine power settings in excess of 7,000 inch-pounds torque when the wind velocity is in excess of 10 knots.

CAUTION

When operating the airplane on either snow-covered surfaces at temperatures near freezing or on slippery surfaces, deviations must be made for engine and propeller check procedure. Check the engines in symmetrical pairs when necessary. Use reverse thrust on the remaining pair of engines to prevent the airplane from sliding forward. Brakes alone will not prevent the airplane from moving forward if each of four engines is producing more than approximately 8,000 inch-pounds of torque. Avoid parking airplanes close together during ground tests. When run-up must be conducted on slippery surfaces, do not attempt to make full power checks until the airplane is lined up on the runway, ready for takeoff.

FLIGHT ENGINEER

1. Ground idle buttons – NORMAL
2. Engine run-up

NOTE

The flight engineer will request positioning of throttles, switches, and condition levers as required. The copilot will acknowledge the position of the switches.

- a. Ground idle rpm (94–102%) – Within limits
- b. Throttles – “FLIGHT IDLE”
 - (1) Note torque and rpm (92.5–100.5%)
- c. Propeller check – “8,000 pounds torque” (minimum)

NOTE

Run-up area wind conditions may cause rpm fluctuations.

NOTE

Fuel correction lights should be either all four off or all four on.

NOTE

Normal Limits (Normal or Mechanical Operation) 98–102%. If stable rpm cannot be maintained, excluding allowable cyclic variations of plus (+) and minus (–) 0.5% (total of 1%), refer to PROPELLER FAILURES in Section III. (Cyclic variation of plus (+) and minus (–) 0.5% is actually 1/2% on either side of a stable rpm for a total of 1%.)

- d. Propeller governor control switches (98–102%) – “MECH GOV” (Check rpm within limits using frequency meter (392–408) as a cross-check.)
- e. Propeller governor control switches (98–102%) – “NORMAL” (Check rpm within limits.)

NOTE

Refer to Part D of this section if reindexing is required.

Danger Areas

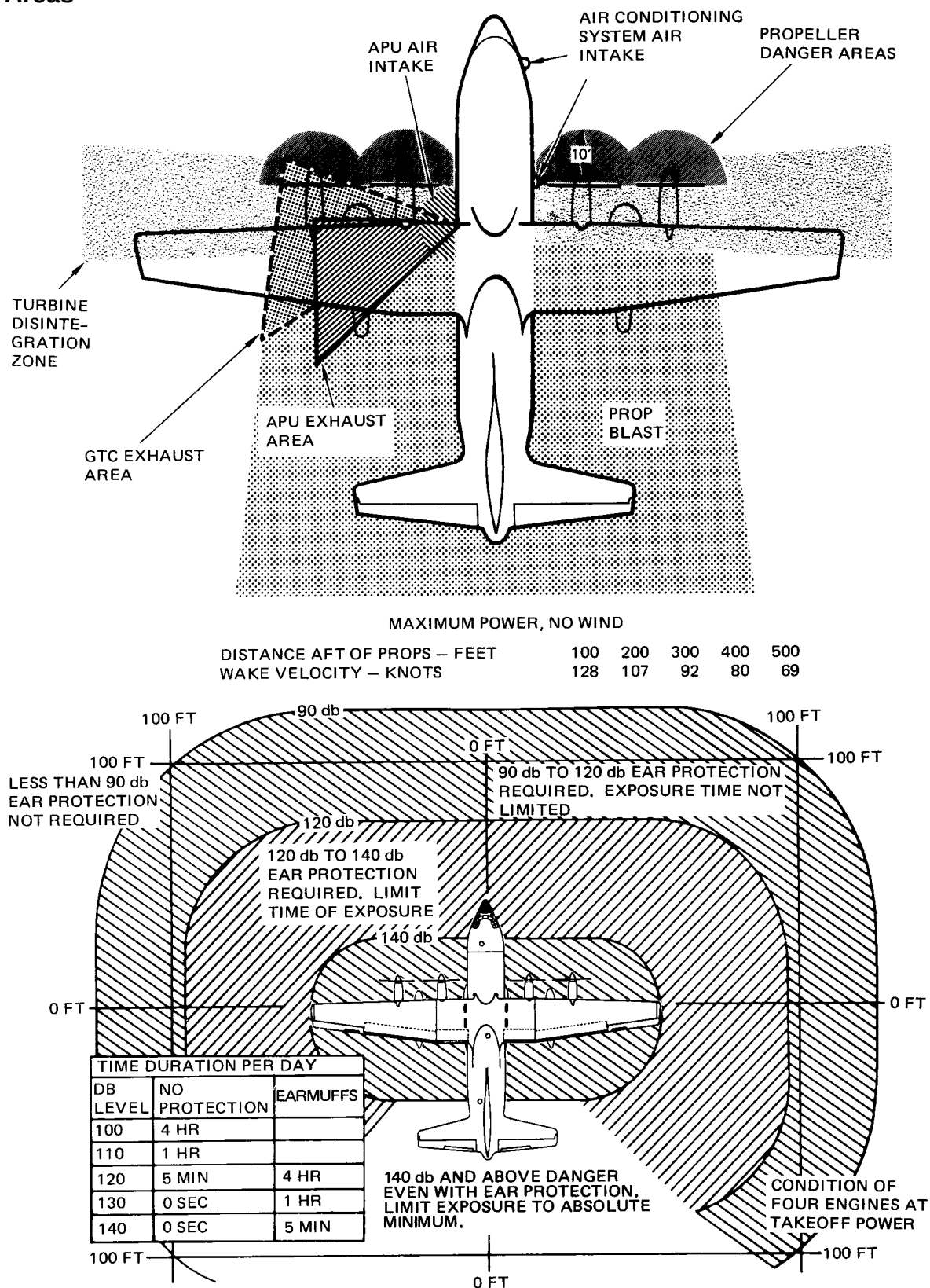
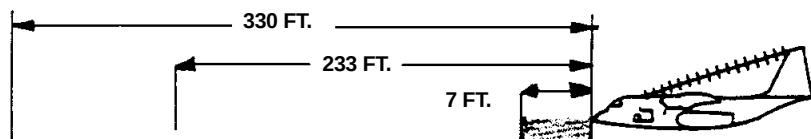


Figure 2A-3

Radiation Hazard Area



NOTE:

THE RADIATION HAZARD AREA SHOWN IS AROUND THE SEARCH RADAR ANTENNA. ACCIDENTAL ENTRY INTO THE HAZARD AREA DOES NOT RESULT IN INJURY. IT IS ONLY THROUGH PROLONGED EXPOSURE THAT THE POSSIBILITY OF DANGER EXISTS.

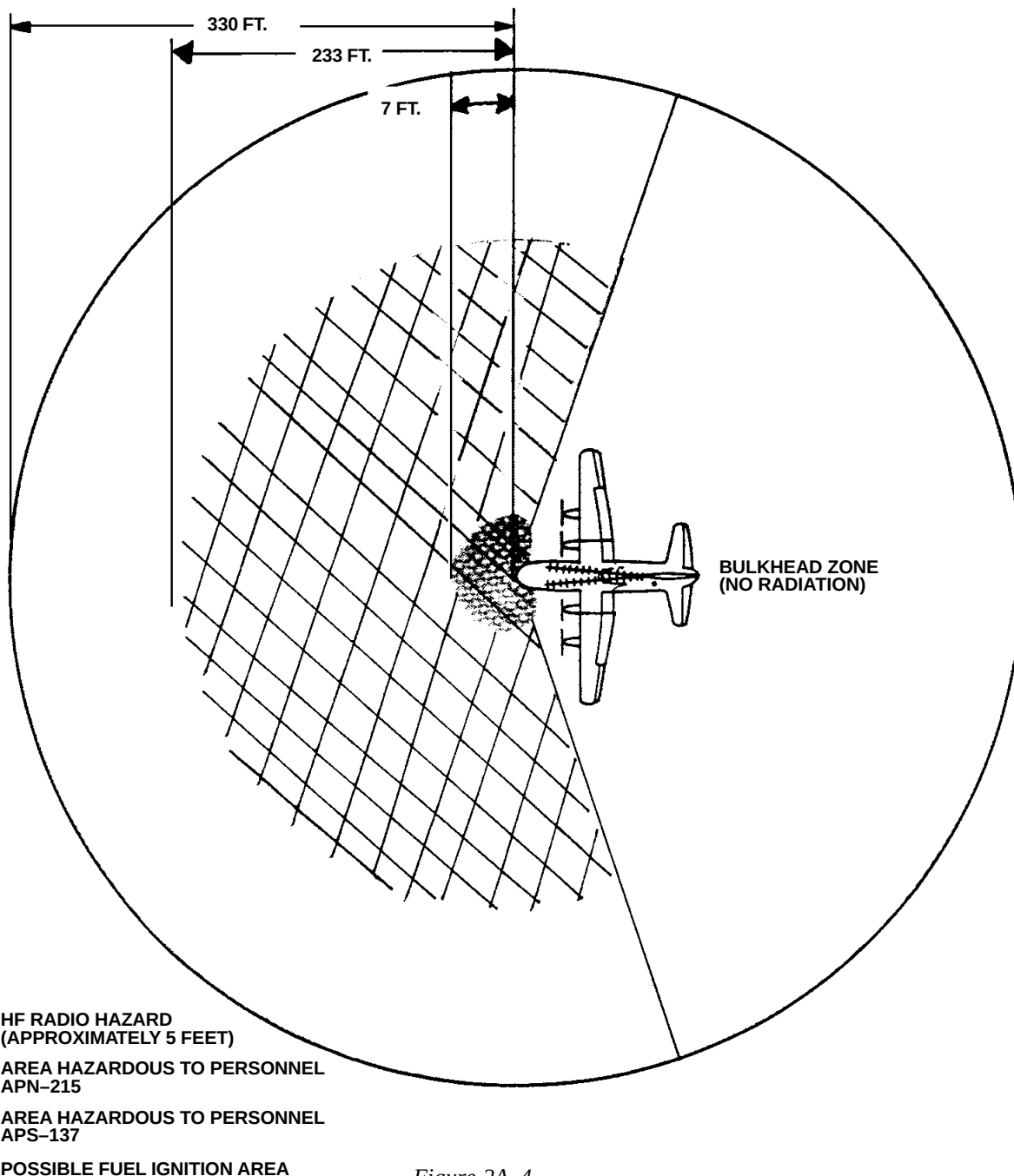


Figure 2A-4

PILOT

NOTE

If a malfunction is observed during engine run-up which requires the engine to be shut down, reduce power on all engines prior to engine shutdown.

NOTE

The flight engineer will request positioning of throttles, switches, and condition levers as required. The copilot will acknowledge the position of the switches.

FLIGHT ENGINEER

f. Engine instruments – Within limits

Torques	– Approx same
RPM	– 98–102%
TIT	– Approx same
F/F	– Approx same
Oil Temp	– 60°–85 ° C
Oil Press	– R/G – 150–250 psi P/S – 50–60 psi
Oil Qty	– 4–12 gal
Hyd Press	– 2900–3200 psi
Aux	– 2900–3300 psi

WARNING

If the engine instruments are not similar in fuel flow, TIT, or torque, with similar throttle position, a propulsion system malfunction may exist. Refer to this section, Part D.

g. Throttles – “FLIGHT IDLE” (note torque reading)

WARNING

Torque must be at least 200 inch-pounds higher per engine than those values observed in step 2.b. If not, a low-pitch stop malfunction exists. Maintenance action is required prior to flight.

h. Throttles – “GROUND IDLE”

WARNING

If a decrease in torque is not indicated when throttles are moved to GROUND IDLE, shut down the engine by placing the condition lever in GROUND STOP. Do not attempt to force the propeller out of flight idle with additional throttle movement. Maintenance action is required prior to flight.

PILOT

FLIGHT ENGINEER

3. Propeller auxiliary feather motor – “Checked” (E)

Request (CP) to place each condition lever to AIR START. Monitor the appropriate loadmeter for a load indication as verification of pump operation. (E) will state “No. 1, No. 2, No. 3, No. 4” respectively and then “checked” when operation is verified.

Propeller Auxiliary
Pump Operating Limits

1-minute ON, 1-minute OFF, not to exceed 2 minutes operation in any 30-minute period.



If the auxiliary feather motor operation is not indicated for a propeller, the malfunction shall be corrected prior to flight.

2. Engine Run-Up checks – “Complete” (E) 4. Engine Run-Up checks – “Complete” (E)

LINEUP CHECKLIST

This checklist will be accomplished immediately prior to, or while, taxiing onto the active runway.

PILOT

1. Anti-skid test – “Complete” (E)

NOTE

This test shall be conducted with the parking brake released.

- a. With ANTI-SKID INOPERATIVE light extinguished, fully depress and hold brake pedals while the (E) conducts the anti-skid checks. A bump may be felt in both pedals if the system is operating properly.

2. Exterior lights – As required (CP)

- a. Landing lights
- b. Taxi lights
- c. Search lights (CG 1790)

FLIGHT ENGINEER

NOTE

Perform steps 1. and 2. if not accomplished during the Before Takeoff or Ops Stop checks.

1. Electrical panel – Set
- a. Engine generators – ON
- b. ATM/APU generator switch – OFF
- c. ATM control switch – STOP



With the ATM/APU generator turned off, do not attempt to low-speed all four engines since electrical equipment may be damaged.

- d. AC inst. and engine fuel control inverter switch – ESSENTIAL AC BUS
- e. DC bus tie switch – NORMAL
- f. DC voltmeter switch – BAT

PILOT

3. Trim tabs – “Set” (P)
 - a. Indicators – Checked
 - b. Elevator tab power selector switch – Normal
4. Flaps – “Checked” (CP)(P)(E)
5. IFF/TCAS – “Set” (CP)

NOTE

Ensure MODE S transponder is set with proper code. Ensure that Mode 3/A and Mode C are disabled on the alternate transponder, AN/APX-72 (1500 & 1600 series), and AN/APX-100 (1700 series). If Mode 1 or 2 is required, ensure that the alternate IFF control panel is set accordingly.

6. Weather radar – “ON and set” (P)

FLIGHT ENGINEER

2. APU control switch (1600 series, CG 1790, and 1700 series) – STOP
3. Anti-skid test – “Complete” (E)



Do not attempt to test the anti-skid system while airplane is being taxied.

WARNING

After ANTI-SKID TEST switch is actuated to either FWD or AFT position, wait at least 3 seconds before selecting test switch to opposite set of wheels. A more rapid actuation of the switch could result in loss of brakes momentarily with normal brake system selected. Also, faster actuation of the switch will result in erroneous test light indications.

- a. Check that all four ANTI-SKID TEST lights are extinguished.
- b. Place ANTI-SKID TEST switch in the FWD position and release. The two FWD lights should illuminate and then extinguish.

NOTE

A slight bump may be felt in the pedals, which indicates anti-skid control valves are functioning.

- c. Place ANTI-SKID TEST switch in AFT position and release. The two AFT lights should illuminate momentarily and then extinguish.
- d. Check that the ANTI-SKID TEST switch is in the OFF position.
4. Exterior lights – As required (E)
 - a. Nav – Steady – Bright
 - b. Strobe lights – ON

WARNING

Operation of the bottom strobe light when flying in actual instrument conditions is not recommended. The light reflecting on surrounding clouds may cause spatial disorientation.

NOTE

Operate the strobe light in white during the day and red at night.

- c. Leading edge lights – ON

PILOT

FLIGHT ENGINEER

5. Engine bleed air switches – As required

NOTE

When takeoff performance is critical or when other conditions dictate, all engine bleed air switches should be shut off prior to takeoff to develop maximum power.

7. Lineup checks – “Complete”(E)(N)(SS)(TS)(LM)(CP)

6. Flaps – “Checked” (CP)(P)(E)
7. Pitot heat – ON (CG 1717 and up)
8. Ground idle buttons – NORMAL
9. Warning lights – Checked
10. Safety belt and shoulder harness – Fastened, unlocked
11. Lineup checks – “Complete”(E)(N)(SS)(TS)(LM)(CP) ■

TAKEOFF

The following paragraphs discuss normal, maximum-effort and obstacle clearance, and crosswind takeoffs. Use applicable performance manual (T.O. 1C-130H-1-1) as necessary to predict airplane performance for any takeoff. Refer to Section V for airplane limitations. Refer to Section III for procedures to be followed during takeoff emergencies.

CAUTION

Never place the throttles in the TAKEOFF position without monitoring the torquemeters, since it is possible to exceed the maximum allowable torque before reaching the maximum turbine inlet temperature specified in Section V. In addition, increasing ram effect during takeoff will increase torque for any fixed turbine inlet temperature.

CAUTION

Operation over raised barrier cables (especially slack cables) with disc-type support at speeds in excess of taxi speeds may result in damage to airplane antennas.

CAUTION

Nosewheel steering is required in addition to aerodynamic controls when takeoff is continued after an engine failure and prior to reaching ground minimum control speed.

NOTE

If the airplane is loaded to an aft center of gravity, forward pressure on the control column will aid steering effectiveness.

NORMAL TAKEOFF

The minimum field length required for a normal takeoff is critical field length as determined by the applicable performance manual (T.O. 1C-130H-1-1). If runway available is less than critical field length a maximum effort may be considered if criteria set forth in this manual, M3710.1 (series), and the applicable performance manuals are met.

Takeoff performance should allow a climb rate of at least 200 feet-per-minute on three engines for a climb in visual conditions. If an instrument departure is to be flown after takeoff, the three engine climb rate should be at least the rate depicted on the departure or 200 feet per nautical mile if a rate is not specified. The visual climb rate may be used on instrument departures if the visibility is such that terrain and obstacles may be avoided visually.

The throttles are gradually advanced toward takeoff power. The copilot will monitor the engine instruments, adjust throttles to prevent takeoff power from being exceeded, and call “GO” when obtaining refusal speed (if required) and “Takeoff” when reaching takeoff speed. Normal takeoff is made with 50 percent flaps. Any time charted performance is desired, takeoff power should be applied before the brakes are released as all takeoff performance data is based on this type of takeoff.

During the takeoff run, the pilot maintains directional control with the nosewheel steering and rudder until all flight controls become effective. Concurrently, the copilot shall hold the control column forward and keep the wings level with the ailerons. As speed increases, the pilot normally discontinues nosewheel steering and maintains control of the airplane throughout the remainder of the takeoff run by coordinated use of the flight controls and power, according to the circumstances of airspeed, crosswinds, and runway conditions. The engineer will monitor all systems and report any malfunctions to the pilot. Normal rotation for takeoff is 5 KIAS below computed takeoff speed but not less than one-engine out minimum control speed in ground effect.

Reduced power takeoffs are not authorized.

NOTE

When takeoff performance is critical, the engine bleed air should be shut off prior to takeoff for maximum power utilization. If bleed air pressure is then indicated on the bleed air pressure gauge (1600 series, CG 1790 and 1700 series), place the Air Conditioning Master Switch to “NO PRESS,” Flight Deck Air Conditioner OFF and the Cargo Compartment Air Conditioner ON. Pressure should read 4 psi or less.

MAXIMUM EFFORT TAKEOFF AND OBSTACLE CLEARANCE

WARNING

This type of takeoff requires that the airplane be capable of executing a four-engine ground run, lift-off, and climb out, clearing obstacles, provided no engine failure occurs. The only limitation is the airplane’s ability to execute the takeoff.

WARNING

If an engine failure occurs immediately after decision speed, it is unlikely that a successful takeoff can be made. Serious consideration should be given to executing a stop based on terrain, overrun, obstacles, etc. Because of the many variables, the decision to abort or attempt a takeoff must remain with the pilot.

WARNING

Do not attempt a three-engine lift-off at the computed maximum effort takeoff speed. Increase airspeed as much as possible above the maximum effort takeoff speed, obtaining air minimum control speed, if possible, before a lift-off is attempted.

Minimum field length for a maximum effort takeoff shall be as determined in the applicable performance manual (T.O. 1C-130H-1-1). A maximum effort takeoff is made by holding the brakes until engines are stabilized at maximum power. For a maximum effort takeoff, accelerate on the runway to takeoff speed, and pull the nose up until the airplane leaves the ground. Disregard minimum control speeds while attaining takeoff speed. Retract the landing gear and adjust the attitude of the airplane to attain obstacle clearance speed. Disregard minimum control speeds while maintaining obstacle clearance speed. After clearing the obstacle, accelerate to flap retraction speed and retract the flaps while maintaining altitude. Accelerate to climb speed. Refer to applicable performance manual (T.O. 1C-130H-1-1) for maximum effort takeoff data.

The minimum flap retraction speed for maximum effort takeoff is obstacle clearance speed plus 10 knots. Maximum effort takeoffs should be made only when authorized by the Commanding Officer concerned.

PRACTICE MAXIMUM EFFORT TAKEOFF AND OBSTACLE CLEARANCE

Maximum effort takeoffs may be practiced on training flights; however, minimum control airspeeds will not be disregarded. For takeoff, use computed maximum effort takeoff speed or one-engine inoperative air minimum control speed in ground effect, whichever is greater. For obstacle clearance, use computed normal obstacle clearance speed or one-engine inoperative air minimum control speed out of ground effect, whichever is greater.

Minimum flap retraction speed for a practice maximum effort takeoff is normal takeoff obstacle clearance speed.

NOTE

If bleeds are closed, actual one-engine out VMCA will be higher than charted value.

CROSSWIND TAKEOFF

Crosswind takeoffs, with regard to directional control of the airplane, are made in essentially the same way as normal takeoffs. Initially, the pilot maintains directional control with nose wheel steering and differential power, while the copilot maintains a wing-level attitude with the ailerons. In higher crosswinds, a greater amount of differential power and ailerons must be applied. After liftoff, the line of flight should be aligned with the runway until crossing the airfield boundary. Refer to applicable performance manual (T.O. 1C-130H-1-1) crosswind performance data.



If wind velocity exceeds 10 knots and wind direction exceeds 30 degrees from aircraft heading, the takeoff roll should be commenced as soon as desired power is set. This will reduce stress on the propellers and the possibility of wing lift, causing a propeller to contact the ground.

FLAPS UP TAKEOFF

Flaps up takeoff is not a recommended normal procedure and will be made only when authorized or directed by the Commanding Officer.

The throttles are advanced toward maximum power. The copilot will monitor the engine instruments and adjust throttles to prevent maximum allowable power from being exceeded during takeoff. Any time maximum performance is desired, maximum power should be applied before the brakes are released. (All takeoff performance data is based on this type of takeoff.)

During the takeoff run, the pilot maintains directional control with the nosewheel steering until flight controls become effective. Concurrently, the copilot holds the control column forward and keeps the wings level with the ailerons. As speed increases, the pilot discontinues nosewheel steering and maintains control of the airplane throughout the remainder of the takeoff run by coordinated use of the flight controls and power, according to the circumstances of speed, crosswind, and runway conditions.

To ensure high rudder boost for takeoff, pull the Flap Control circuit breaker and position the flap handle 15% or greater. The handle must be repositioned and the circuit breaker reset immediately after takeoff.

For smooth transition to takeoff attitude, rotation of the airplane should be started approximately 5 knots below takeoff speed or at the minimum control speed, whichever is greater.

AFTER TAKEOFF CHECKLIST

Steps 1. and 2. (Landing Gear and Flaps) of this checklist may be completed at the pilot's command without direct reference to the checklist. The copilot will review these items before proceeding after the checklist is initiated.

After becoming airborne, retract the landing gear at the command of the pilot. Normal flap retraction speed is 20 knots above takeoff speed. Minimum flap retraction speed for a normal takeoff is obstacle clearance speed. It is recommended that flap retraction not be commenced until reaching 400 feet AGL. When a safe altitude and flap retraction speed are reached, commence flap retraction at the command of the pilot. Hand signals as listed in COMDTINST M3710.1 (series) will be used when ICS communications are not possible.

NOTE

Retracting the landing gear and flaps simultaneously will result in slower than normal operation of both and may cause the hydraulic low-pressure warning light to illuminate.

After airborne, accelerate to the desired climb speeds as determined from applicable performance manual (T.O. 1C-130H-1-1) or use the following table to prevent excessive nose-high attitudes:

180 KIAS to 10,000 feet
 170 KIAS to 15,000 feet
 160 KIAS to 25,000 feet
 Performance charts above 25,000 feet

PILOT

1. Landing gear – “Up” (CP)
2. Flaps – “Up” (CP)
 - a. Rudder pressure – Checked
3. Landing light panel – Set (CP)
 - a. Taxi lights – OFF
 - b. Landing lights – ON

NOTE

The landing lights should be used for all landings, takeoffs, approaches and all other operations below 10,000 feet and 250 KIAS, day or night, unless operational or meteorological conditions prohibit their use.

NOTE

Turn the landing lights off prior to retraction to prevent disorientation.

- c. Search lights (CG 1790) – OFF, RETRACT, HOLD
4. Auxiliary hydraulic pump – OFF (CP)
5. Oil cooler flap switches – AUTO (CP)
6. Leading edge anti-icing – “As Required” (E)

FLIGHT ENGINEER

1. Engine bleed air switches – OPEN/ON
2. Synchrophase master switch – ENG 2/ENG 3

NOTE

Use of the prop resynchrophase switch should be limited to correction of an out-of-sync condition. Allow at least 1 minute between actuations of the switch to allow synchrophaser signals to stabilize.

NOTE

If a solid-state synchrophaser is installed, the propeller resynchrophase switch shall only be used for the propeller reindexing procedures outlined in SECTION II Part D.

3. Pressurization – Checked
4. Leading edge anti-icing – “As Required” (E)

NOTE

Leading edge anti-icing shall be checked on the first flight of the day in coordination with the pilot. Turn the wing and empennage anti-icing on until a temperature rise is noted on the indicators. This will also eliminate any moisture in the system. Monitor torque indicators for increase and leading edge temperature indicators for decrease when wing and empennage switches are turned off.

PILOT

FLIGHT ENGINEER

7. Safety check – “Complete”	(LM)	5. Navigator’s panel – Set	(N/E)
8. Radar altimeter – “As required”	(P)		
9. Hot mics – “OFF”	(CP/P)	a. TAS probe heater switch (if installed) – ON	
10. After Takeoff checks – “Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)	6. After Takeoff checks – “Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

CLIMB

For charted climb performance refer to the performance manual (T.O. 1C-130H-1-1). If charted performance is not required, then climbing at a reduced power setting of 970 °C TIT is recommended to prolong engine life.

CRUISE

Refer to this section for Fuel Management procedures. Refer to applicable performance manual (T.O. 1C-130H-1-1) for cruise power settings. The flight engineer will compute cruise data from applicable performance manual and, in coordination with the pilot, adjust engine controls to maintain required power.

The service life of the engines will be greatly increased if flights are conducted at long range cruise power settings at altitudes less than maximum continuous TIT cruise ceiling. Recommended temperature for continuous operation is 932 °C for aircraft with –15 engines. When operating at flight levels below cruise ceiling and at a given TIT/throttle position, the following guidance may be used to maximize fuel efficiency. Climb, if a ground speed decrease of less than 5 knots occurs for each 1,000 feet of altitude gained; descend, if a ground speed increase of more than 5 knots occurs for each 1,000 feet of altitude lost.



Do not place the engine condition levers in any position other than FEATHER, RUN, or AIR START during flight.

NOTE

If off-speed or fluctuation occurs within the limits specified in Section V (Propeller Governing Limits), resync and/or reindexing may correct the condition. If off-speed or fluctuation occurs outside the limits specified in Section V, refer to PROPELLER FAILURES in Section III. Turbulent flight conditions may cause excessive rpm fluctuations.

NOTE

The landing lights should be used for all landings, takeoffs, approaches and all other operations below 10,000 feet and 250 KIAS, day or night, unless operational or meteorological conditions prohibit their use.

FLIGHT CHARACTERISTICS

Refer to Section VI for detailed information on the airplane flight characteristics.

DESCENT**MAXIMUM RANGE DESCENT**

This type of descent is made by retarding all throttles to FLIGHT IDLE with gear and flaps retracted and descending at maximum lift over drag speeds as shown on the performance chart. This type of descent will provide a moderate rate of sink (approximately 1,500 fpm) for enroute letdown. Refer to the Maximum Range Descent chart in applicable performance manual (T.O. 1C-130H-1-1).

PENETRATION DESCENT

A penetration descent is made in two parts. The first part is from altitude to 20,000 feet at maximum lift over drag speeds, with throttles at FLIGHT IDLE and gear and flaps up. The second part is from 20,000 feet down at a constant 250 KIAS. Refer to the Penetration Descent chart in applicable performance manual (T.O. 1C-130H-1-1).

RAPID DESCENT

Gear and Flaps Up

The highest rates of descent are obtained by retarding all throttles to FLIGHT IDLE with gear and flaps retracted and descending at maximum speeds, as shown in Section V and tabulated on the performance chart. Refer to the Rapid Descent – Flaps Up chart in applicable performance manual (T.O. 1C-130H-1-1).

Gear and Flaps Down

At slow airspeeds, the highest rates of descent are obtained by retarding all throttles to FLIGHT IDLE, decreasing airspeed to flap limit speed (145 knots), and extending landing gear and full flaps. Descend at 145 knots. Refer to the Rapid Descent with Full Flaps chart in applicable performance manual (T.O. 1C-130H-1-1).

NOTE

Repeated actuation of the landing gear under full cabin pressure differential conditions is not recommended.

DESCENT CHECKLIST

The checks will be accomplished prior to traffic pattern entry and/or before commencing any type of instrument approach, or may be accomplished during the initial penetration descent.

WARNING

If at any time during the descent, approach and landing phase of flight, the GPWS provides a “Terrain” or “Too low, Flaps” aural warning, the pilot at the controls will confirm the aircraft’s configuration and acknowledge the warning with, “Acknowledge GPWS, Flaps are set _____, Landing Gear is ____.” If a “Glide Slope,” “Sink Rate,” or “Pull Up” aural warning is given, the pilot at the controls will acknowledge with “Acknowledge GPWS, correcting,” and will apply an appropriate correction. If at any time a “Terrain” warning is received and there is any doubt regarding the aircraft’s position, an immediate climb shall be initiated.

NOTE

Flight idle engine torque in slow-speed descent and approach speeds may go negative and cause an NTS signal on one or more engines. This will cause an rpm and power fluctuation, resulting in yawing of the airplane. To correct this condition, move the throttle(s) forward to bring engine torque out of the NTS range. The use of wing and empennage anti-icing will further decrease flight idle torque.

PILOT

1. Crew briefing – “Complete”
 - a. ATIS
 - b. Approach to be used
 - c. Minimums
 - d. Missed approach intentions
 - e. Radio/navigation aids
 - f. Terrain/arrival restrictions
 - g. Passengers

NOTE

The pilot will advise the flight engineer of the landing field elevation and runway temperature.

FLIGHT ENGINEER

1. Landing data – Computed

NOTE

New TOLD data will be required any time gross weight changes 5,000 pounds or more or outside temperature changes 5 ° C or more.

2. Pressurization – Set
3. Fuel panel – Set
4. TD valve switches – Set

PILOT

FLIGHT ENGINEER

- 2. Landing data – “Checked” (P)(CP)
- 3. Safety belt, shoulder harness – “Fastened, unlocked” (P)(CP)
- 4. Radar altimeter – “Set” (P)
- 5. Altimeter – “Set, state setting” (CP)(P)(N)

WARNING

Altimeters will be set to station pressure (QNH) if available when transiting the transition level. Altimeters may be set when above, but cleared through the transition level. The altimeter’s internal vibrator may become inoperative due to internal failure or dc power failure. If this should occur, the 100-foot pointer may momentarily hang up when passing through 0 (12 o’clock position). Pilots should especially watch for this failure when their minimum approach altitude lies within the 800- to 1,000-foot part of the scale (1,800–2,000 feet, 2,800–3,000 feet, etc.) and should use any appropriate altitude backup information available. The 100-foot pointer hang-up can be minimized by tapping the case of the altimeter.

- 6. TCAS – “SET (state setting)” (CP)
- 7. Altitude alert preset control (if installed) – “Set” (CP)
- 8. Flight director – “Set (state setting)” (CP)(P)
- 9. Descent checks – “Complete” (E)(N)(LM)(CP/P)

NOTE

A landing is normally made with the temp datum control valve switches in the AUTO position. When the LOCKED position is used, it is recommended that the switches be placed in LOCKED with the engines operating in the temperature-controlling range.

- 5. Descent checks – “Complete” (E)(N)(LM)(CP/P)

BEFORE LANDING CHECKLIST

The pilot may direct lowering of flaps and gear prior to initiating this checklist.

PILOT

FLIGHT ENGINEER

- 1. Hot mics – Listen and Talk – “ON” (CP/P)
- 2. Altimeters – “Set, state setting” (CP)(P)(N)
- 3. Flaps – “As required” (CP)(P)

- 1. Hot mic – Listen – ON
- 2. Synchrophase master switch – OFF
- 3. Landing gear – “Down, indicators checked” (CP)(P)(E)

PILOT

FLIGHT ENGINEER

4. Landing gear – “DOWN, indicators checked” (CP)(P)(E)



Just prior to landing, the nosewheel steering indicator shall be checked to ensure the nosewheel is not cocked.

5. Landing light panel – As required (CP)

NOTE

Extend landing lights prior to turning on to prevent disorientation.

6. Hydraulic panel – Set (CP)
- Brake select switch – As required
 - Auxiliary hydraulic pump – ON

NOTE

Higher than normal emergency brake system pressure may be encountered in flight. However, this should not cause damage to the system.

- c. Hydraulic pressure – Checked
7. Before Landing checks – “Complete” (E)(N)(R)(SS) (TS)(LM)(CP/P)

4. Anti-skid test – Complete (after gear is down)

- Check that all four anti-skid test lights illuminate after wheel rotation stops.
- Place test switch in FWD position. All four lights should go out.
- Release test switch to OFF position. The two forward lights should illuminate momentarily. After 2 to 3 seconds, all four lights should illuminate and remain illuminated.
- Place test switch in AFT position. All four lights should go out.
- Release test switch to OFF position. The two aft lights should illuminate momentarily. After 2 to 3 seconds, all four lights should illuminate and remain illuminated.

5. Cargo compartment air conditioner – As required

6. Safety belt, shoulder harness – Fastened, unlocked

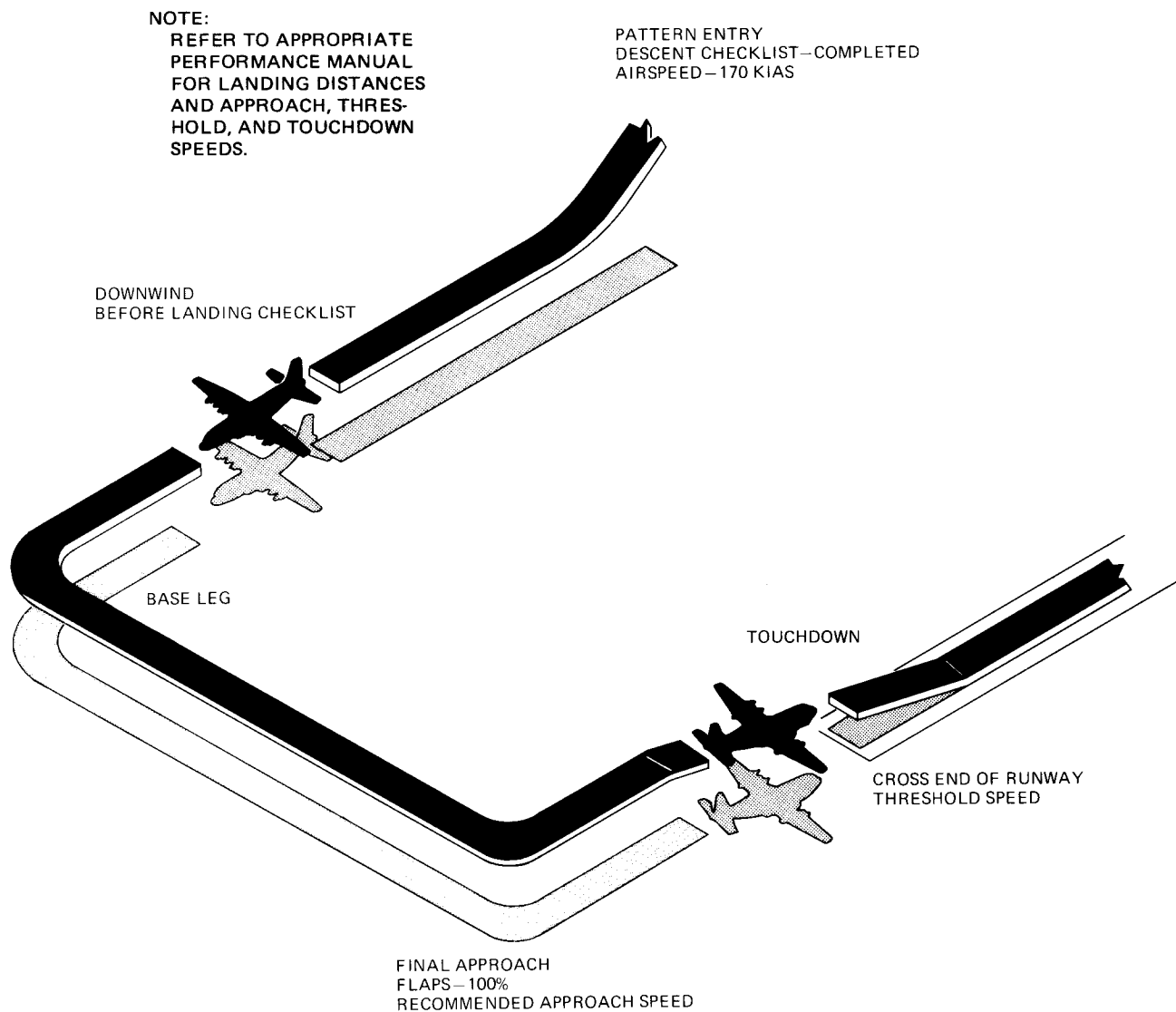
7. Before Landing checks – “Complete” (E)(N)(R)(SS) (TS)(LM)(CP/P)

LANDING**WARNING**

At high true airspeeds and/or high ambient conditions with the throttles at flight idle, the propeller blade angle may be in the pitch lock range. The exact airspeed at which this occurs is indeterminate due to the many variables involved. At the higher airspeeds, abrupt movement of the throttles into the ground range could result in pitch lock.

See figure 2A-5 for approach and landing pattern.

Normal Approach and Landing



NOTE:
TRAFFIC PATTERN AIRSPEED AFTER THE BEFORE LANDING CHECKLIST IS INITIATED WILL BE 150 KIAS OR APPROACH SPEED, WHICHEVER IS HIGHER (COMMENSURATE WITH GROSS WEIGHT AND/OR FLAP SETTING). BASE LEG AIRSPEED WILL BE 140 KIAS OR APPROACH SPEED, WHICHEVER IS HIGHER. SLOW TO RECOMMENDED APPROACH SPEED WHEN ESTABLISHED ON FINAL.

Figure 2A-5

WIND SHEAR

Wind shear is a complex phenomenon. It can affect the airplane in all phases of flight but is most critical during the takeoff, approach, and landing phases. Wind shear can exist as a rapid change in wind velocity and direction as well as vertical air movement. There are certain conditions which indicate the possibility of wind shear being present. As a general rule, the amount of shear is greater ahead of warm fronts, though the frequency of wind shear occurrence is greatest following the passage of cold fronts. When the temperature change across a front is 10 ° F or more, or if the front is moving at 30 knots or more, conditions are excellent for wind shear. Additionally, when thunderstorms are in the vicinity, wind shears should be anticipated.

Be alert for the following indications of wind shear:

1. An unusually steep or shallow rate of descent required to maintain glide path for a known surface wind.
2. An unusually high- or low-power setting to maintain approach airspeed.
3. A large variation between expected and actual ground speed or drift angle.

If wind shear avoidance is not possible or if wind shear conditions are anticipated, apply the full gust increment indicated by conditions and use 50 percent flaps to increase the aircraft's acceleration capability on approach and landing.

WARNING

If the airplane becomes unstable due to wind shear and the approach profile cannot be promptly reestablished, a go around should immediately be accomplished.

Microbursts are common sources of wind shear, consisting of powerful downdrafts on or near the surface. Normally the effects of microbursts, though severe, are extremely localized. In most cases an aircraft encountering a microburst will initially experience an increase in head wind. This may cause the airplane to exceed predicted performance parameters. Power reductions must not be applied at this time as the subsequent tail wind increase/headwind loss will place the airplane in an energy- deficient situation.

Due to the combined effect of head wind loss and rapid decrease in angle of attack caused by microburst type wind shear, immediate power application and deck angle increase is required for recovery. Upon microburst recognition, throttles should be advanced to takeoff power. At the same time deck angle should be increased to the maximum level sustainable, with consideration given to minimum control speeds for the aircraft's configuration. As a technique, obstacle clearance speed or three-engine minimum control speed out-of-ground effect, whichever is higher, may be maintained with throttles at takeoff power until the microburst is traversed.

NORMAL LANDING

Normal landing configuration is 100 percent flaps. The minimum field length for a normal landing is the landing distance over a 50-foot obstacle using two symmetrical engines in reverse and maximum braking available for the existing runway conditions. This distance should be lengthened if prevailing weather conditions increase the likelihood of longer than normal touchdowns (low visibility, etc.). Refer to applicable performance manual (T.O. 1C-130H-1-1) for landing speeds and distances. Normal landings should also be planned so as to use all of the available runway length to promote safe, smooth, and unhurried operating practices; to preclude abrupt reverse power changes; and to save wear and tear on brakes. On final approach, begin to decrease airspeed from approach speed at a point that will allow a gradual slow-up to cross the runway threshold at threshold speed. Touchdown should be planned at the speed computed from the appropriate landing speed chart. After the main wheels touch down, lower the nose-wheel smoothly to the runway before elevator control is lost. When the main and nose landing gear are firmly on the ground, the copilot must hold positive pressure on the control column and maintain wings-level attitude with ailerons, as needed. Concurrently, the pilot maintains directional control and decelerates the airplane through the coordinated use of the rudder, differential power, nosewheel steering, and differential brakes according to the speed, wind, and runway conditions. Reverse thrust is applied by moving the throttles from FLIGHT IDLE to GROUND IDLE, and then into REVERSE range in coordination with nosewheel steering. Brakes must be checked during the landing roll.

WARNING

The failure of one or more propellers to reverse may result in complete loss of directional control. After touchdown, if the throttles are moved into the ground range with a movement which is too rapid, it is possible to lose control of the airplane before a propeller malfunction can be detected. The movement from the flight range into the ground range should be made at a reasonable rate which will permit detection of a malfunction, such as failure of the low-pitch stop to retract. At the first indication of directional control difficulties during reversing, immediately return all throttles to GROUND IDLE. Maintain directional control with flight controls, differential braking, and nosewheel steering, as required. After identifying the affected propeller, symmetrical propellers may be reversed and the affected engine shut down while it is in ground idle. Rudder, differential power, and brakes are the primary means of directional control. During the final stages of landing roll, reduce reverse thrust, if conditions permit, to prevent debris from causing restriction of visibility or engine damage.

NOTE

When executing night landings, particularly at airfields with few visual cues, a precision approach, if available, is advised. The glide slope information should be used to assist in positioning the aircraft for a safe approach and landing.

CAUTION

Propeller reversing with an unbalanced fuel load can cause an extreme wing-low attitude and undesirable control characteristics.

CROSSWIND LANDING

Refer to applicable performance manual (T.O. 1C-130H-1-1) for maximum allowable crosswind and recommended increase in speeds. For gusty conditions, increase approach, threshold, and landing speeds by the full gust increment up to 10 knots. (At lighter gross weights, it is advisable to use less than 100 percent flaps in order to touch down the main gear first at these touchdown speeds, which are higher than normally recommended.) It is not recommended that less than 50 percent flaps be used. Immediately after the main wheels touch down, lower the nosewheels and hold in firm contact by using the elevators. During landing roll, control the airplane directionally by using aileron and rudder control, nosewheel steering, and differential power. The upwind wing has a tendency to rise when reverse thrust is applied. Since this tendency is especially pronounced if flaps are extended 100 percent, flaps should be raised before applying reverse power on landing in severe crosswinds.

CAUTION

An engine-out condition may add difficulty to a crosswind approach and landing by adding to the drift and weathervaning. Particular caution must be exercised when landing with an adverse crosswind (wind from the side with two operating engines). The combined effects of weathervaning and asymmetric drag may cause the aircraft to be uncontrollable in crosswinds less than indicated in T.O. 1C-130H-1-1.

MAXIMUM EFFORT LANDING

NOTE

Actual Maximum effort landings may be made only when authorized by the Commanding Officer.

Normal traffic patterns will be flown unless airfield situations or mission requirements dictate otherwise. The minimum field length for a maximum effort landing is computed ground roll plus 500 feet. As this distance is based on touching down within the first 500 feet of the runway, a go around must be executed if a touchdown within this distance is not accomplished. Consideration must be given to all environmental factors that may tend to cause difficulties in meeting maximum effort landing parameters (terrain, weather, pilot experience, etc.), prior to establishing a minimum field length. Complete the BEFORE LANDING Checklist. When established on the final approach, slow to approximately 10 KIAS above computed maximum effort threshold speed. Establish maximum effort threshold speed prior to arriving one-half mile from touchdown. Rate of descent on the approach should be adjusted to arrive over the end of the runway at maximum effort threshold speed with approximately a 500-fpm rate of descent. The touchdown area should normally be selected for 100 feet to 300 feet down from the approach end of the runway markers; however, touchdown within 500 feet is essential. Airspeed control during the final approach is important. After crossing the end of the runway, initiate flare and retard the throttles.



A rapid flare without a corresponding increase in power will reduce stall margin and may increase rate of sink. A nose-high attitude combined with a high rate of sink may result in damage to the aft fuselage.

During gusty wind conditions, the maximum effort threshold speed will be increased by the full gust increment, not to exceed 10 knots (any increase in touchdown speed will increase the minimum runway length required). Landings will be conducted only if computed touchdown speed is in the recommended area of the landing crosswind chart.

Immediately upon contact with the gear firmly on the ground, apply full reverse thrust and minimize nose gear loads by use of elevator back pressure. Apply braking action as required. Performance charts are based on full anti-skid braking, which should be used when maximum performance is required. Practice max effort landings to touch and go or full stop landings are authorized. Full anti-skid braking need not be used.

WARNING

The nose gear must be on the ground prior to reversing.

LANDING ON WET RUNWAYS

The anti-skid braking system, reverse thrust, and nosewheel steering capabilities minimize normal hazards associated with wet runways.

LANDING ON ICY RUNWAYS

Operation of the airplane on ice is hazardous and should be attempted only when the nature of the mission is such that this operation is necessary. Be careful when landing or taxiing on ice. Use of nosewheel steering should be minimized and used with caution. Taxi speed must be slow and taxi turns should be planned for large radius turns. Directional control can be maintained with asymmetrical power and nosewheel steering at taxi speeds and with asymmetrical power and rudder at speeds above rudder effectiveness. Touchdown should be made from a power approach at the minimum safe speed possible. Hold the nosewheel “off” as long as possible to obtain maximum aerodynamic drag. Braking after lowering the nosewheel must be made with caution; use symmetrical power and reverse thrust as the primary means to obtain braking action and to prevent sudden yawing and skidding. It is also difficult for the pilot to sense that the wheels are skidding. Landing on ice-covered runways should not be attempted if existing crosswinds will require large crosswind approach or taxiing correction applications.

FLAPS-UP LANDING

Flaps-up landing is not a recommended normal operational procedure and will be made only when authorized by the Commanding Officer concerned or when necessitated by the need to keep drag to an absolute minimum under partial power operation or by a failure of the flap system. If possible, extend the downwind slightly in order to have more time on final to properly set up the approach. Complete the turn to final and slow to flaps-up approach speed. Monitor airspeed closely. The airplane pitch (angle of attack) on final will approximate a landing attitude and the rate of descent should be controlled with the throttles. Do not attempt to round out or flare the airplane, but allow it to touch down by maintaining the landing attitude and using power, as necessary, to control the descent rate.

Minimum field length for a practice flaps-up landing is computed landing distance over a 50-foot obstacle plus 1,000 feet or 6,000 feet, whichever is greater. Crosswind components must be within the recommended zone of the landing chart.



If a normal landing round out or flare is used at touchdown with flaps up, the tail skid may contact the runway.

NOTE

If a landing is made with less than 40 percent flaps, the ground proximity warning system will give an aural warning, TOO LOW-FLAPS/TOO LOW - TERRAIN. If a no-flap landing is considered, activate GPWS Flap Override.

TOUCH-AND-GO LANDING

Touch-and-go landings require a significant element of caution because of the many actions that must be executed while rolling on the runway at high speed or while flying within the immediate proximity of the ground. The action required during touch-and-go landings is divided into three categories: on the runway, after takeoff, and before landing. This procedure and checklist is designed for use when touch-and-go landings are being accomplished and the airplane remains in the airport traffic/approach control area.

After the airplane has touched down, the pilot flying the airplane will call for flaps to be set at 50 percent; the other pilot will set/check the flap lever to 50 percent and set/check trim. When the trim is set for takeoff, the pilot will call: "Throttles", and "takeoff" when at or above charted takeoff speed.

After the normal checklists are complete through the BEFORE LANDING Checklist, the touch-and-go checklist may be used until the airplane either departs the airport traffic/approach control area or makes a full stop landing when an immediate takeoff is not planned. The TOUCH-AND-GO LANDING Checklist may be used for full stop and taxi back operations provided only flaps, trim tabs, low-speed ground idle buttons, and throttles are moved. The OPERATIONAL STOP Checklist and LINEUP Checklist must be used for full stop landings when hatches/doors are opened and/or controls not listed above are operated and a subsequent takeoff is planned. In this case, and when the airplane is going to remain in the airport traffic/approach control area, the TOUCH-AND-GO LANDING Checklist may be initiated immediately after takeoff.

WARNING

When moving the flaps at low airspeed, an asymmetrical flap may be undetected until near or above takeoff speed.

TOUCH-AND-GO CHECKLIST

ON THE RUNWAY and AFTER TAKEOFF Checklists may be accomplished without direct reference to the checklist. Reference to the BEFORE LANDING Checklist is required.

PILOT

FLIGHT ENGINEER

ON THE RUNWAY:

1. Flaps – “50 percent” (CP/P)
2. Trim tabs – “Set” (CP/P)
3. Throttles – “As required” (P/CP)

AFTER TAKEOFF:

1. Landing gear and flaps – “As required” (CP/P)
2. Landing light panel – “As required” (CP)
3. GPWS override switches – “NORMAL” (CP)

4. After Takeoff touch-and-go checks – “Complete” (CP/P)

BEFORE LANDING:

1. Crew briefing – “Complete” (P/CP)
2. Flaps – “As required” (CP)(P)
3. Landing gear – “Down, indicators checked” (CP)
(P)(E)
4. Landing light panel – “As required” (CP)
5. Hydraulic pressures – “Checked” (CP)
6. Touch-and-Go checks – “Complete” (E)(CP/P)

NOTE

The crossfeed valve switches may be left in the OPEN position for approach, landing, touch-and-go landing, and stop-and-go landings that remain in place on the runway for immediate take-off provided all main tank boost pump switches are in the ON position and the crossfeed separation valve is in the CLOSED position.

1. Landing gear – “Down, indicators checked” (CP)
(P)(E)

2. Anti-skid test – Complete

3. Touch-and-Go checks – “Complete” (E) (CP/P)

OPERATIONAL STOP CHECKLIST

PILOT

FLIGHT ENGINEER

1. IFF – Standby (CP)
2. Weather radar – “STBY” (P)
3. Nosewheel, parking brake –
“Centered and set” (P)

1. Air conditioning panel – Set
 - a. Master switch – NO PRESS
 - b. Underfloor heat – OFF
 - c. Recirculating fan (1600 series, CG 1790 and 1700 series) – OFF
2. APU (1600 series, CG 1790, and 1700 series) – Set
 - a. APU control switch – Start, run

PILOT

4. Exits – “Clear” (P)
(hold here until ready to taxi)
5. Crew aboard – “Crew aboard, doors closed and checked” (LM)
6. Forms – “Checked” (P)
7. Altimeters – “Set, state setting, reading” (CP)(P)
(N)

NOTE

Altimeter should read within 75 feet of a known elevation and within 90 feet of each other.

WARNING

It is possible to set an altimeter in error by 10,000 feet.

8. Takeoff and departure brief – “Complete” (P)

NOTE

Pilot making the takeoff will brief crew on applicable items prior to takeoff. Only changed items need to be included in the briefing for multiple takeoffs/departures.

- a. TOLD data
- b. Signals for gear and flap retraction
- c. Copilot/Flight Engineer emergency actions during:
 - (1) Aborted takeoff
 - (2) Aircraft malfunction after refusal speed
- d. Emergency return
- e. Fuel dumping

FLIGHT ENGINEER

3. Anti-icing panel – Set
 - a. NESA – OFF
 - b. Pitot heat – OFF
 - c. Engine anti-icing – OFF
 - d. Prop anti/deicing – OFF
 - e. Wing and empennage anti-icing – OFF
4. Exterior lights – Set
 - a. NAV – FLASH – BRIGHT
 - b. Strobe lights – OFF
5. Electrical panel – Set
 - a. ATM and generator/APU generator – RUN, ON/ON
 - b. DC bus tie switch – TIED
 - c. AC instrument and engine fuel control inverter – ESS DC
6. Radar – STANDBY (Hold here until ready to taxi.)
7. Pressurization – Set
 - a. Rate knob – As required
 - b. Controller – As required (not below pressure altitude)
 - c. Air condition master switch – AUTO PRESS/as required
8. Anti-icing panel – Set
 - a. NESA – NORMAL

NOTE

Operation of NESA anti-icing when outside air temperature is above 27 ° C (81 ° F) will increase the possibility of delamination within the NESA panels.

- b. Pitot heat – ON (except CG 1717 through 1720) ■

PILOT

FLIGHT ENGINEER

- f. SID/Departure procedures
- g. Navigation Aids/Flight Director
- h. Radar altimeter (set for emergency return)
- i. Hazardous terrain/obstacles
- j. Questions/additional information

- 9. Flight instruments – “Set” (P)(CP)
- 10. Flaps – “50 percent” (CP)(P)
- 11. Flight controls – “Checked” (P)(CP)
- 12. Ops Stop checks – “Complete” (E)(N)(R)(SS)(TS)(LM)(CP)

(Proceed with LINEUP CHECKLIST.)

GO-AROUND

The decision to go around should be made as soon as possible on approach. When a go-around is decided upon, alert the crew and proceed as follows:

- a. Advance throttles as required to establish safe airspeed and the appropriate climb profile.

WARNING

Retracting flaps from 100 percent to 50 percent will increase stall speed and decrease lift by 35 percent. Without proper power and attitude corrections, sink rate will also increase. This is particularly noticeable at lower than normal air speeds. If safe altitude and airspeed are not attained, inadvertent touchdown and/or stall may occur.

NOTE

Setting the electrical panel and APU may be delayed until the Line Up Checklist if low speed operation on all four engines is desired to minimize taxi speeds.

- 9. Electrical panel – Set
 - a. Engine generators – ON
 - b. ATM/APU generator switch – OFF
 - c. ATM control switch – STOP

CAUTION

With the ATM/APU generator turned off, do not attempt to low-speed all four engines since electrical equipment may be damaged.

- d. AC inst and engine fuel control inverter switch – ESS AC BUS
- e. DC bus tie switch – NORMAL
- f. DC voltmeter switch – BAT
- 10. APU – STOP
- 11. Fuel panel – Set
 - a. Crossfeed valves – CLOSED
 - b. Main tank boost pumps – ON
- 12. Windows/hatches – Closed, secure
- 13. Instruments – Checked
- 14. Ops Stop checks – “Complete” (E)(N)(R)(SS)(TS)(LM)(CP)

(Proceed with LINEUP CHECKLIST.)

NOTE

Go-arounds for training purposes will be initiated above threshold speed. Refer to Section III of this manual for practice engine out go-around criteria.

- b. When appropriate airspeed, altitude, and climb profile are established, direct the copilot to set/check flaps to 50 percent.
- c. Direct the copilot to raise the landing gear when certain that the airplane will not touch down (as required).
- d. After the above procedures have been accomplished, proceed as though from takeoff.

AFTER LANDING (AFTER COMPLETION OF LANDING ROLL) CHECKLIST

PILOT

FLIGHT ENGINEER

1. Flaps – “UP”	(CP)	1. Air conditioning panel – Set
		a. Master switch – NO PRESS
		b. Underfloor heat – OFF
		c. Recirculating fan (1600 series, CG 1790 and 1700 series) – OFF
2. Weather radar – “OFF”	(P)	2. APU/GTC – Set
		a. GTC (1500 series)
		(1) Door – Open
		(2) Control switch – Start, Run
		(3) Bleed air valve – Open
3. Lights – As required	(CP)	b. APU control switch (1600 series, CG 1790, and 1700 series) – Start, Run
		3. Anti-icing panel – Set
a. Landing and taxi – As required		a. NESA – OFF
		b. Pitot heat – OFF
		c. Engine anti-icing – OFF
		d. Prop anti-icing – OFF
		e. Wing and empennage anti-icing – OFF
b. Interior – As required		4. Exterior lights – Set
		a. NAV – FLASH – BRIGHT
		b. Strobe lights – OFF
4. Engine shutdown – As required	(CP)	5. Electrical panel – Set
		a. ATM and generator/APU generator – RUN, ON/ON
		b. DC bus tie switch – TIED

PILOT



To prevent inadvertent decoupling, an engine shutdown from normal ground idle should not be attempted if the combination of head wind and taxi speed exceeds 40 knots



To reduce fuel nozzle carbon and extend turbine life, operate engines in Low Speed Ground Idle for at least 2 minutes prior to engine shutdown.

NOTE

It is recommended to low-speed engines prior to engine shutdown to reduce wear on the safety coupling.

5. After-Landing checks – “Complete” (E)(N)(CP)

ENGINE SHUTDOWN CHECKLIST

PILOT

1. Nosewheel, parking brake – “CENTERED, SET” (P)
2. Unnecessary equipment – Set (CP)
 - a. IFF – OFF

NOTE

If mode 4 is to be retained, place code switch to HOLD position momentarily and wait 15 seconds before turning master switch OFF.

NOTE

Classified IFF codes must be removed or properly protected.

- b. Radios – As required
- c. Navigational aids – OFF
- d. Radar – OFF

FLIGHT ENGINEER

- c. AC instrument and engine fuel control inverter – ESS DC
 6. Fuel panel – Set
 - a. Boost pumps – As required
- NOTE**
- On 1600 series, CG 1790, and 1700 series airplanes, when operating the APU with less than 2,000 pounds of fuel in the No. 2 main tank, turn the fuel boost pump on to maintain surge box fuel level.
- b. Crossfeed valves – (1500 series) No. 2 OPEN, (1600 series, CG 1790, 1700 series) – CLOSED
 7. Oil cooler flaps – OPEN/FIXED
 8. Ground idle buttons – As required
 9. Navigator’s panel – Set (N/E)
 - a. Radar – STANDBY
 - b. TAS probe heater switch (if installed) – OFF
 10. After Landing checks – “Complete” (E)(N)(SS) (TS)(CP)

FLIGHT ENGINEER

NOTE

Flight engineer should monitor engine instruments during shutdown for zero fuel flow, TIT, rpm decrease, and NTS light.

1. Navigator’s panel – Set (N/E)
 - a. Radar – OFF
 - b. INS (if installed) – OFF
2. Oxygen – “OFF” (P)(E)(N)(R)(LM)(CP)
3. Air conditioning panel – Set
 - a. Master switch (1500 series) – OFF (1600, CG 1790, 1700 series) – AUX VENT

PILOT

FLIGHT ENGINEER

- e. Standby Attitude Indicator – Cage and lock
- 3. Engine shutdown – Complete (CP)
 - a. Place feather valve and NTS check switch in NTS position.
 - b. Ensure throttles in ground idle.
 - c. Place condition levers in GROUND STOP and observe zero fuel flow.
 - d. Observe the NTS lights.



During ground stop procedure, do not move the engine condition lever from STOP to RUN while the engine is still rotating.

NOTE

If NTS lights do not illuminate when shutting down engines, a recheck of the NTS system must be made before the next flight.

- 4. Radar altimeter (1500 series, 1600 series) – “OFF” (P)
- 5. Oxygen – “OFF” (P)(E)(N)(R)(LM)(CP)
- 6. Exits – “Clear, insert chocks” (P)
- 7. Chocks – “In place” (LM)
- 8. Parking brake – “As required” (P)
- 9. Hydraulic panel – Set (CP)
 - a. Aux pump switch – OFF
 - b. Suction boost pump switches – OFF
- c. Brake select switch – Emergency



The engine pump switches are to be left in the ON position after engine shutdown. If the switch is left in the OFF position, pressure buildup due to thermal expansion of the hydraulic fluid may cause the suction line hydraulic firewall shutoff valve to fail.

- 4. Engine bleed air switches – CLOSED/OFF
- 5. Engine generators – OFF
- 6. Inverters – OFF
- 7. Fuel boost pumps – OFF
- 8. TD valve switches – NULL

PILOT

FLIGHT ENGINEER

10. Exterior lights – OFF/RETRACTED (CP)

- a. Landing lights
- b. Search lights (CG 1790)
- c. Taxi lights

11. Engine Shutdown checks – “Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

9. Engine Shutdown checks – “Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE LEAVING THE AIRPLANE CHECKLIST

Make appropriate entries on CG Form 4377, covering any limits in the Flight Manual that have been exceeded during flight. Entries must also be made when, in the judgment of the pilot, the airplane has been exposed to unusual or excessive braking action during aborted takeoffs. The flight engineer will complete a brief general condition interior and exterior visual inspection, ensuring the NLG pin and wheel chocks are in place and the electrical ground is connected prior to leaving the airplane.

Each crew member should turn off all lights (as required), both interior and exterior, which are controlled from his crew station.

This checklist will be accomplished as practical by the flight engineer.

- 1. Lights – As required

NOTE

The remaining items are not required at night if external power is not available and qualified maintenance personnel remain at the airplane.

- 2. Radios – OFF
- 3. APU generator and ATM/generator – OFF, STOP/OFF
- 4. GTC/APU panel – Set
 - a. Bleed air valve – CLOSED
 - b. Control switch – OFF/STOP
- 5. Electrical panel – Set
 - a. DC bus tie switch – NORMAL
 - b. AC, dc power switches – OFF or EXTERNAL PWR

NOTE

External power may remain applied if qualified maintenance personnel remain at the airplane.

- c. DC voltmeter switch – MAIN DC BUS
- 6. Emergency exit light extinguish switch – Depressed (if electrical power is turned off)
- 7. Chocks – Repositioned as necessary



Never install rig pins in the control system nor secure the flight station controls as a means of locking the surfaces against wind gust. Otherwise, damage to the hydraulic booster and/or cable system is likely to result.

CRUISE ENGINE SHUTDOWN CHECKLIST

Engine shutdown may be performed during cruise flight to achieve optimum fuel economy for various mission requirements.

1. Crew briefing "Complete" (P)

- a. Prior to engine shutdown(s), the pilot will brief the crew as follows:

Normal Air Starts – Refer to this section, Normal Air Start Checklist.

Emergency Air Starts – The Aircraft Commander will call "Emergency Air Start." The flight engineer will immediately air start the secured engines.

WARNING

The emergency air-start procedures disregard the requirement to monitor the NTS check light and engine instruments, thus increasing the risk of compounding the emergency should a start malfunction occur. Therefore, Emergency Air Start should be initiated only in the most extreme situation and only by the Aircraft Commander.

WARNING

Operating at 10 ° C IOAT or below with visible moisture present may cause icing that will prevent restart of shutdown engines.

2. NTS check "Complete" (E)(CP)

WARNING

The NTS check should be accomplished on one engine at a time.

- a. Synchrophaser master switch – OFF (E)
- b. Feather valve and NTS check switch – VALVE (CP/E)
- c. Propeller governor control switch – MECH GOV (CP/E)
- d. Throttle (engine being checked) – Set 4,000 inch-pounds or more (P/CP)
- e. Wing and empennage anti-icing switches – ON (E)
- f. Bleed air switch (engine being checked) – OPEN/OVRD (E)

- g. Bleed air switches (other engines) – CLOSED/OFF (one at a time) (E)
- h. Throttle (engine being checked) – Retard (P/CP)

NOTE

Slowly retard the throttle, observing decreasing torque value. As torque decreases, read the highest negative value. NTS should occur at negative 1,260 (± 600) inch-pounds. NTS action is indicated by an increase in torque and may fluctuate up to a positive 500 inch-pounds. NTS action should result in rhythmic fluctuation of torque and intermittent illumination of the NTS light.

After the engine has been checked, perform the following:

- i. Engine bleed air switches – OPEN/ON (E)
- j. Wing and empennage anti-icing – OFF (E)

WARNING

Do not continue with the CRUISE ENGINE SHUTDOWN procedure for an engine with a malfunctioning NTS system.

WARNING

If NTS is NOT observed within the NTS range of $-1260 (\pm 600)$ inch-pounds, proceed as follows:

- a. Advance the throttle to normal operating range.
 - (1) Wing and empennage anti-icing switches – OFF
 - (2) Bleed air switches (other engines) – OPEN/OVRD
 - (3) Bleed air switches (engine being checked) – CLOSED/OFF
 - (4) Feather valve and NTS switch – NORMAL
 - (5) Prop governor control switch – NORMAL

CAUTION

Before performing cruise engine shutdown on an engine supplying power to the LH ac bus, secure the CASPER system.

3. Underfloor heat switch	OFF (E)
4. Underfloor heating fan switch (1600 series, 1700 series and CG 1790)	OFF (E)
5. Radar (ISAR and weather)	“SET” (N/E)(P)

NOTE

Place radars to STBY prior to engine shutdown. After completion of engine shutdown, reset radars as required. Place radars to STBY prior to restarting engines.

6. Circuit breakers

Checked (E)

WARNING

Do not shut down the engine if any of the following circuit breakers are popped:

ESS AC BUS	MAIN AC DISTRIBUTION PANEL (FS.245)
ESS AC BUS	PILOT'S SIDE CB PANEL
ESS DC BUS	FEATHER PUMP MOTOR (PILOT'S SIDE CB PANEL)
	FEATHER AND AIR START (COPILOT'S CB PANEL)

7. Throttle (engine being feathered)

FLIGHT IDLE (P/CP)

8. Condition lever

FEATHER (P/CP)

CAUTION

If the propeller override button fails to pop out within 5 seconds after completion of feather cycle, pull out manually to shut off pump.

CAUTION

If the prop rotates backwards (top toward 1), airstart the engine. This may be an indication of a worn prop brake. Record on Form 4377. Maintenance action is required prior to next flight.

After propeller rotation has stopped

9. Cleanup/prepare for air start

"Complete" (E)

- a. Engine bleed air switch – CLOSED/OFF

NOTE

If starter, engine scoop anti-icing, or oil cooler scoop anti-icing are required, place the bleed air switch to OPEN/OVRD.

- b. Engine generator – OFF
- c. Fuel boost pump – ON
- d. Fuel enrichment switch – NORMAL
- e. Oil cooler flap – AUTO
- f. Synchrophaser master switch – Reset as required
- g. Essential ac bus, feather pump motor, feather and airstart circuit breakers – Checked

- h. Fire handle – IN
- i. Throttle – 1-inch above Flight Idle
- j. TD valve control switch – AUTO

WARNING

After shutdown of the first engine, allow the TIT to decrease to 200 ° C prior to shutting down the second engine.

NORMAL AIR START CHECKLIST

WARNING

Unless a greater emergency exists, do not attempt to restart an engine that was shut down for a malfunction.

WARNING

Do not attempt to restart an engine with an inoperative NTS except in case of a greater emergency. Prior to air-start of an engine on which the NTS has been previously determined to be inoperative, reduce the air speed to 130 KIAS and the altitude to below 5,000 feet.

CAUTION

Before restarting an engine that has been shut down in flight, be sure that the TIT for that engine has dropped below 200 ° C. Temperature higher than 200 ° C will increase the likelihood of a hot start. Never move the throttle below the flight idle position in flight. The position of the condition lever is assumed to be FEATHER. The recommended airspeed for an air-start is 180 KIAS or less.

1. Prepare for air-start “Complete” (E)
 - a. Engine bleed air switch – CLOSED/OFF
 - b. Engine generator – OFF
 - c. Fuel boost pump – ON
 - d. Fuel enrichment switch – NORMAL
 - e. Oil cooler flap – AUTO
 - f. Synchrophaser master switch – OFF
 - g. Essential ac bus, feather pump motor, feather and airstart circuit breakers – Checked
 - h. Fire handle – IN

- i. Throttle – 1-inch above Flight Idle
- j. TD valve control switch – AUTO
- k. Feather valve and NTS check switch – VALVE
- l. Prop governor control switch – MECH GOV

WARNING

If the flight engineer does not state NTS by 10 percent engine RPM, the copilot will discontinue the start by immediately placing the condition lever to FEATHER.

WARNING

Normal light off should occur by the time engine RPM reaches 30 percent. If the engine does not light off prior to reaching 40 percent RPM, discontinue the start by returning the condition lever to FEATHER immediately.

WARNING

If NTS is not indicated, interruption of the start cycle after light off by an attempt to feather before the engine has reached a stabilized speed may result in decoupling and severe overspeed. If this condition is experienced, allow the engine to come to normal RPM, and only shut down the engine if another emergency exists.

WARNING

When using AVGAS, enrichment should remain OFF if TIT is above 100 ° C to prevent explosive ignition or torching.

- 2. Condition lever “AIR START” (CP)
(on pilot’s command)
 - a. The copilot should hold the condition lever in AIRSTART until light off, then release to RUN. Monitor engine instruments as during a normal groundstart. Guard the condition lever until the engine is on speed and operating normally. Provided “NTS” was stated, the engine may be shut down for any engine emergency during air start.
 - b. The flight engineer monitors for NTS action, states “NTS” when the NTS check light illuminates, then monitors the engine start.

NOTE

If an air-start cannot be accomplished because of failure of the propeller to rotate, and blade angle change is indicated by illumination of NTS light, return the condition lever to FEATHER. A start may be attempted by placing the bleed air switch to OPEN/OVRD and using the engine starter to help unlock the propeller brake, while simultaneously holding the condition lever in AIR START.

- 3. Engineer’s report “Complete” (E)

After the engine has stabilized on speed, complete the following:

- a. Engine bleed air switch – OPEN/ON

- b. Engine generator – ON

NOTE

Check voltage and frequency of each phase prior to placing the generator on line.

- c. Fuel enrichment switch – OFF
- d. Propeller governor control switch – NORMAL
- e. Feather valve and NTS check switch – NORMAL
- f. Synchrophaser master switch – As required
- g. Radars – As required
- h. Underfloor heating fan switch – As required
- i. Underfloor heat switch – As required
- j. Engine instruments – Within normal limits

BUDDY AND WINDMILL TAXI START**NOTE**

Buddy starts should have priority over a windmill taxi start and may be used to start an engine if it cannot be started by normal procedures. Buddy and windmill taxi starts will be used only when authorized by the Commanding Officer.

BUDDY STARTS

Buddy starts are defined as an engine start utilizing the propeller airblast of another airplane to effect engine starting.



Prior to attempting a buddy start, the entire procedure must be read aloud with all crew members at their stations.

NOTE

Align the airplanes as nearly as possible into the wind.

1. Assure the ramp area is free of any objects that might cause FOD.

2. Inspect engine to be started as necessary to assure maximum safety.



Prior to attempting a buddy start because of a defective starter, assure that the starter or starter shaft is removed, as it may remain engaged with resultant damage to the starter, engine, or airplane.

3. Place the condition lever to feather until the propeller blade cuff is in line with the island on the spinner base.
4. Position airplane with the engine to be started approximately 10 feet behind the starter airplane.
5. The two airplanes will establish and maintain radio contact throughout the operation.
6. Set the parking brakes.
7. Place chocks fore and aft of each forward MLG wheel.
8. Brief crews of special signals that will be used during starting with special emphasis on safety of the ground observer when positioning/removing chocks and the danger of wind blast.

9. Position ground observers for visual sighting from each cockpit and each other. Position the Loadmaster in the appropriate position (with interphone contact) to observe for a normal start and notify the pilot when rotation starts.
10. Perform Normal Procedures checklists through Before Starting Engines checklist with the following exceptions:
 - a. Place throttle in flight idle.
 - b. Leave chocks in place.
 - c. Fuel enrichment switch to normal. Ensure TIT for engine to be started is below 100 ° C.
11. Close all doors, windows, and hatches.
12. Condition lever – Run, leave bleed air valve/regulator closed/off until engine is on speed.
13. Front airplane, upon notification from rear airplane, increase power to 900° TIT or 15,000 in-lbs torque (whichever occurs first) on all engines.
14. If propeller rotation does not begin, request 18,000 in-lbs torque or maximum TIT (whichever occurs first) on front airplane.

CAUTION

Both crews must be constantly alert for any airplane movement from the chocks, and be prepared to stop the start and/or take appropriate action.

15. After propeller rotation starts, observe normal start and at 60% rpm place throttle at Ground Idle.
16. Signal front airplane to reduce power.

NOTE

In the event that above procedures are ineffective, starting may be attempted by presetting propeller blade angles at an intermediate position between alignment with spinner base island and the full feather position and/or changing airplane position to offset propeller alignment approximately 6 feet. Continue start as outlined above.

NOTE

If constant acceleration fails to occur prior to 16% rpm, move condition lever to feather position momentarily and return to run. Increased rpm and acceleration should occur. Do not move condition lever towards feather after 16% rpm unless a stop-start situation exists.

WINDMILL TAXI START

CAUTION

Prior to attempting a windmill taxi start, the entire procedure must be read aloud with all crew members at their stations.

CAUTION

Prior to attempting a windmill taxi start because of a defective starter, assure that the starter or starter shaft is removed, as it may remain engaged with resultant damage to the starter, engine, or airplane.

NOTE

Use of the following procedure is not recommended when operating the airplane at gross weights above 135,000 pounds.

NOTE

Refer to Appendix A for parameters for executing a practice windmill taxi start.

The following procedure can be used to start an engine if it cannot be started by normal procedures. It should be used only if mission requirements dictate. Complacency or operational abuse should not be allowed to result from the knowledge of this unusual capability. A dry runway of 7,000 feet or more is required to assure safety in accomplishing a windmill taxi start.

1. Inspect engine to be started as necessary to assure maximum safety.
2. Perform the Before Takeoff checklist to assure that all controls and switches are in the proper position.
3. Fuel enrichment – On (TIT below 200°).
4. Set wing flap lever to 15%.

NOTE

This will provide a full rudder boost pressure without inducing extra drag and operating lift at low speeds. Auxiliary hydraulic pump will be on to have positive braking action if emergency brakes should be selected.

5. Place the throttle in the FLIGHT IDLE position.
6. Align the aircraft on the runway without the parking brake set.
7. Perform the anti-skid check.
8. Place condition lever to FEATHER until the blade cuff is precisely in line with the island on the spinner base.

WARNING

Failure to properly align the blade cuff in line with the island on the spinner base may cause inadvertent pitch lock of the propeller and directional control problems.

9. Place the condition lever in the RUN position. Leave bleed air switch CLOSED/OFF until after engine is on speed.
10. Advance the throttles to FLIGHT IDLE for the operating engines; then advance the throttles on the symmetrical engines to maximum power. Release the brakes and increase power on the other operating engine as directional control becomes available through coordinated use of nosewheel steering and rudder. The copilot should monitor the control column, maintaining positive pressure on the nosewheel. The pilot should maintain control of nosewheel steering, throttles, and rudder.

WARNING

Failure to maintain forward pressure on the nosewheel may result in the airplane becoming inadvertently airborne.

11. The propeller should begin to rotate and a normal light-off should occur. As rpm steadily increases above 40%, retard all throttles to GROUND IDLE. Reverse symmetrical on-speed engines and apply brakes as required to stop the airplane.

BEFORE WASH RACK CHECKLIST (AFTER COMPLETION OF AFTER LANDING CHECKLIST)

The use of a wash rack (when available) will prolong airframe life by removing corrosive deposits from low altitude flight over salt water. However, wash water with a high mineral content will cause material build-up on operating engine compressor blades. To minimize this effect, operating engines will be at low-speed ground idle when they are in the wash rack spray. Consideration may be given to shutting down two symmetrical engines (on After Landing Checklist) to limit mineral build-up to only two engines. Consider turning off recycled water and using only fresh water. Rinse airframe only long enough to remove salt and avoid prolonged exposure of engines to a high volume water bath.

The engine should accelerate and come on-speed as the airplane is stopped. Monitor engine instruments as for a normal start.

WARNING

Torque on the engine being started should be monitored closely to assure that the propeller is in the ground range prior to moving the throttle out of ground idle.

CAUTION

If rpm has not increased above 40%, airspeed may be maintained at 100 KIAS until 4,000 feet of runway remains.

NOTE

If an engine malfunction is observed during windmill taxi start, perform the ABORT PROCEDURE as during a normal takeoff.

12. Resume normal operation beginning with the Before Takeoff checklist.

CAUTION

Successive windmill taxi runs with repeated braking applications will result in hot brakes, decreased braking efficiency, and/or wheel well fires. Prior to attempting a second windmill taxi start allow at least 60 minutes and/or temperature of all brakes, wheels and tires to return to ambient temperature.

CAUTION

Cooling should be accomplished by parking the airplane with the brakes released as soon as possible after the windmill taxi attempt. Prolonged taxiing to a parking spot can cause extreme heat buildup in the wheel and brake assembly.

CAUTION

Monitor battery voltage when all engines are at low-speed ground idle. If voltage drops below 20 volts, immediately bring two engines to normal ground idle speed and taxi clear of wash rack. Maintenance action is required for the battery.

WARNING

If battery relay opens, fire protection may not be available due to low battery voltage. Taxi clear of wash rack and perform ENGINE SHUTDOWN CHECKLIST as soon as possible. Some indications that the battery relay has opened include: low-speed ground idle buttons popping to normal ground idle and/or voltage dropping to 11 to 14 volts. Prolonged taxi, except to clear congested area, will not be attempted. Except for wash rack operations and other approved procedures, routine prolonged operation with the battery supplying aircraft power is not permitted.

Deplane wash rack operator or taxi director prior to commencing checklist (if required).

1. Flaps	“100 percent” (CP)
2. Pressurization	“MANUAL, 1 inch” (E)
3. Electrical panel	“Set” (E)
a. DC bus tie switch	TIED
b. Engine generators	ON
c. AC engine instrument/engine fuel control inverter switch	Essential DC Bus
d. Copilot instrument inverter switch	OFF
e. Battery	ON, checked
4. Instrument flood lights	“As required” (P)(CP)
5. Landing lights	“OFF/RETRACTED” (CP)
6. Oil cooler flaps	“OPEN/FIXED” (E)

CAUTION

When the CASPER turret is installed, taxi into washrack to ensure that the turret is beyond direct force of water spray before starting rinse. This will prevent possible damage to the turret from direct force of water spray.

Hold here, taxi up to sprinklers and stop aircraft.

7. Engines	“Low Speed Ground Idle”(P)(E)
(Engines may be shifted after aircraft is slowly rolling forward to prevent inadvertent popping of buttons.)	
8. APU/GTC	“Set” (E)

a. APU gen/ATM and gen	OFF/STOP, OFF
b. APU/GTC bleed air valve	CLOSE
c. APU/GTC control switch	STOP/OFF
d. GTC door switch	CLOSE



Severe damage to flight control hinges and boost packages may result if flight controls are allowed to slam against their stops.



Turbine Overheat Light may illuminate after entering the wash rack due to water ingestion in the turbine area. If condition persists, move all the throttles to Ground Idle and place the condition lever for the affected engine to Ground Stop.

9. Engine bleed air switches (ALL)	“OFF/CLOSED” (E)
10. Before Wash Rack checklist	“Complete” (CP)

RINSE PROCEDURE



If any problem is encountered while taxiing through the wash rack, restore ac power by returning symmetrical engines to Normal Speed Ground Idle and taxi clear of wash rack.

As full spray begins, start taxiing slowly on centerline at a rate which allows adequate rinsing of airframe. A good technique is to start taxiing, then shift remaining engines to low-speed ground idle to avoid popping buttons. Hold nosewheel steering centered and start windshield wipers as water hits windshield. As soon as the engines are clear of the wash water and prior to starting the APU, return two symmetrical engines to Normal Speed Ground Idle (1600, 1700 series). Exercise flight controls as water washes them. Turn ATM and generator ON (1500 series).

AFTER WASH RACK CHECKLIST

1. Engine ground idle speed	“As required” (P)(E)
2. Engine bleed air switches	“ON/OPEN” (E)
3. Flight controls	“Exercised” (P)(CP)
4. Electrical panel	“Set” (E)
a. GTC door	OPEN
b. APU/GTC control switch	START, RUN
c. Bleed air valve	OPEN
d. APU gen/ATM and gen	ON/RUN, ON
e. Copilot instrument inverter switch	Normal
5. Pressurization	“Set” (E)
a. Air conditioning master switch	NO PRESS

6. Flaps	“UP” (CP)
7. Engine shutdown	“As required” (CP)



To reduce fuel nozzle carbon and extend turbine life, operate engines in Low Speed Ground Idle for at least 2 minutes prior to engine shutdown.

8. After Wash Rack checklist	“Complete” (CP)

BEFORE STARTING AND PUSH-BACK CHECKLIST

NOTE

This checklist is to be completed in lieu of the BEFORE STARTING ENGINES CHECKLIST only when aircraft is being towed from inside a hangar or from a confined area with all crewmembers in position.

The LM has a key role in the effective use of this checklist. The LM must serve as the direct contact between the flight crew and the Tow Team Captain.

PILOT		FLIGHT ENGINEER	
1. Cockpit checklist – “Complete”	(E)	1. Cockpit checklist – “Complete”	(E)
2. Forms – “Checked”	(P)		
3. NLG lock and pitot covers – “Installed”	(E)	2. NLG lock and pitot covers – “Installed”	(E)
4. Safety belt, shoulder harness – “Fastened, unlocked”	(P)(CP)		
5. Lights – “Set”	(P)(CP)	3. Oxygen – “Checked”	(P)(E)(N) (R)(LM)(CP)
a. Interior – As required			
b. Landing/Taxi – As required			
c. Search Lights (CG 1790) – As required		4. AC inst and eng fuel control inverter – “AC position”	(E)
6. Oxygen – “Checked”	(P)(E)(N) (R)(LM)(CP)		
a. On/100% (Refer to oxygen system check)		5. GTC/APU door – Open	
7. Fuel – “Checked”	(P)		
a. Quantity and distribution			
8. Radios and navigational equipment – “Set”	(P)(CP)	6. DC power – BATTERY	
a. Radios – On	(CP)		
b. Nav equipment – On	(CP)		
c. Radar altimeter – Set	(P)		

NOTE

The dc bus should remain tied to ensure continuous communications between all crew stations.

PILOT

- 9. IFF – STANDBY (CP)
- 10. Radio (UHF or VHF) – Checked (CP)
- 11. Autopilot – OFF/DISENGAGED (CP)
- 12. Flap lever – “Set” (CP)
 - a. Set flap lever to correspond with flap position indicator.
- 13. Flare launcher panel – Checked (CP)
- 14. Altimeters – “Set, state setting, reading” (CP)(P)(N)

NOTE

Altimeter should read within 75 feet of a known elevation and within 90 feet of each other.

WARNING

It is possible to set an altimeter in error by 10,000 feet.

- 15. Takeoff and departure briefing – “Complete” (P)

NOTE

Pilot making the takeoff will brief crew about applicable items prior to takeoff. Only changed items need be included in briefing for multiple takeoff/departures.

- a. TOLD data
- b. Signals for gear and flap retraction
- c. Copilot/Flight Engineer emergency actions during:
 - (1) Aborted takeoff
 - (2) Aircraft malfunction after refusal speed

FLIGHT ENGINEER

- 7. DC bus tie switch – Tied



If delays are encountered in push-back, consideration should be given to placing the dc bus tie switch to normal or connecting external power, in order to conserve battery power.

- 8. Ready to tow – “Ready” (E)(LM)(P)
- 9. Ext ac power switch – “OFF” (E)

- 10. Start GTC/APU – Set

NOTE

Start GTC/APU only after area is cleared by LM.

- a. Control switch – Start, run

NOTE

Allow 1 minute warm-up for GTC/APU before applying air load.

- b. Bleed air valve – Open, pressure up



Monitor the leading edge temperature indicators. A rise in temperature indicates that an anti-icing valve is open. The GTC/APU must be shut down to prevent damage to a heated surface or fuel tank sealant.

PILOT

- d. Emergency return
- e. Fuel dumping
- f. SID/Departure procedures
- g. Navigation Aids/Flight Director
- h. Radar altimeter (set for emergency return)
- i. Hazardous terrain/obstacle
- j. Questions/Additional Information
- 16. Ramp and door – “Closed” (LM)
- 17. INS – “Set, state setting” (N/E/CP)

NOTE

The INS will normally be set to Navigate. If mission profile is such that the INS is not needed for Navigation, it will be set to Attitude Reference.

- 18. Parking brake – “Released” (P)

NOTE

The parking brake may have been released prior to this point in the procedure.

- 19. AC Inst and ENG FUEL control inverter – “AC position” (E)
- 20. Hydraulic panel – Set (CP)
 - a. Brake select switch – Emergency
 - b. Aux pump switch – On, pressure up
 - c. Anti-skid switch – On
 - d. Engine pump switches – On
 - e. Suction boost pump switches – ON



Starting an engine with an inoperative suction boost pump may result in damage to the engine driven hydraulic pump.

- 21. Aux hyd pump switch – “OFF” (CP)

FLIGHT ENGINEER

- 11. APU generator/ATM – “ON” (E)
- 12. Electrical panel – Set
 - a. Power switch – Battery
 - b. Bus tie switch – Tied
 - c. AC bus tie switch – OFF (CG 1710 and up)

- 13. Inverters – Set
 - a. Copilot’s inverter switch – Essential ac bus
 - b. AC inst and engine fuel control inverter switch – Essential dc bus

- 14. Lights – Set
 - a. Interior (as required)
 - b. Exterior – Nav – flash, bright
Anti-collision – ON
Strobe lights – OFF

- c. Leading Edge – ON

- 15. Fuel enrichment switches – As required

- 16. Ground idle buttons – LOW SPEED

PILOT

22. Chocks – “Removed” (LM)

NOTE

The LM will ensure that the Tow Team is ready prior to reporting ready.

23. Ready to tow – “Ready” (E)(LM)(P)
24. Ext ac power switch – “OFF” (E)
25. Ext ac power plug/cover – “Removed and closed” (LM)

NOTE

The LM will not clear the APU until the NLG is clear of the hangar door tracks.

26. Clear GTC/APU – “Clear” (LM)
27. APU generator /ATM – “ON” (E)
28. Aux hyd pump switch – “ON” (CP)
29. Parking brake – “Set” (P)

- a. Depress pedals and monitor the emergency brake pressure gauge for pressure drop as pedals are depressed.

30. Chocks – “In place” (LM)

31. Compass systems – “Checked, set, state heading” (N/E)(P)(CP)

- a. The pilot will compare headings with the magnetic compass.

32. Instruments – “Checked” (P)(CP)

- a. Attitude indicators – check alignment and ensure the warning flag is not visible.
- b. Place flight director system in operation IAW Section II B of the flight manual and chapter 3 of CGTO 1C-130-1-D.

FLIGHT ENGINEER

17. Compass systems – “Checked, set, state headings” (N/E)(P)(CP)

- a. C-12 compasses

- (1) Latitude N-S switch – Local latitude

- (2) Latitude knob – Local latitude

- (3) Mode selector switch – As required

- b. Dual INU installations

- (1) DG/MAG switch – MAG

- (2) Read NAV station #1 and #2 BDHI headings. ■

NOTE

(Refer to Section I for limits.)
Compare No. 1 and No. 2 BDHI and state headings. ■

18. Bleed air system – “Checked” (E)

- a. ATM generator – OFF (1500 series)

NOTE

On 1500 series aircraft, power will not be available to the ESS AC bus during this check. ■

- b. All systems using bleed air – OFF

- c. Engine bleed air switches – OPEN/OVRD

- d. System pressure – Checked

- e. GTC/APU valve – CLOSED

PILOT

- c. Navigation equipment and instruments should be placed in operation IAW Section II B of the flight manual and chapter 3 of CGTO 1C-130-1-D.
- 33. Nose wheel steering scissors – “Connected” (LM)
- 34. NLG lock and pitot covers – “Removed” (LM)
- 35. Chocks – “Removed” (LM)

NOTE

The chocks will be secured in the cargo compartment.

NOTE

After removing chocks LM will check that the area is clear of all obstructions and personnel before calling the checklist complete.

- 36. Bleed air system – “Checked” (E)
- 37. Before Starting and Push-back checks – “Complete” (E)(N)(R)(LM)(CP)

NOTE

Proceed with the Before Takeoff checklist.

FLIGHT ENGINEER

- f. System pressure leakage – CHECKED

NOTE

Time drop from 30 to 15 PSI should not be less than 16 seconds.

- g. Engine bleed air switches – CLOSED/OFF

- h. GTC/APU bleed air valve – OPEN

- i. ATM generator – ON (1500 series)

- 19. Before Starting and Push-back checks – “Complete” (E)(N)(R)(LM)(CP)

NOTE

Proceed with the Before Takeoff checklist.

PART B – INSTRUMENT PROCEDURES

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INSTRUMENT FLIGHT PROCEDURES

The airplane is completely equipped for the use of all standard radio navigational and flight aids. It is the responsibility of the pilot to ensure that each crew member is thoroughly briefed on the exact procedures he is expected to follow during all phases of airplane operation. In planning IFR flights, remember that the airplane has turboprop engines. Fuel requirements at low altitudes are greater than fuel requirements at higher altitudes. Therefore, if required to land under IFR conditions, additional allowance must be made for letdown and holding procedures, and the maximum range and endurance are reduced accordingly.

PREFLIGHT AND GROUND CHECKS

Perform the normal preflight inspections, as outlined in the normal operating procedures in this section.

INSTRUMENT TAKEOFF

1. Select, tune, and identify navigational aids to be used during departure.

NOTE

It is recommended that all available navigational aids be tuned and the takeoff and climb be radar-monitored when possible. This will provide backup navigational capability in the event of equipment malfunction and will facilitate return to the departure airfield if necessary.

2. Select the primary navaid to be used for departure on the flight director. Set the departure course in the course window on the horizontal situation indicator.
3. Align the airplane on the takeoff runway. Set the heading marker to runway heading. Check the HSI, RMI, compass cards, and magnetic compass against the runway heading.
 - a. (1500 series) Select MAN with FLT DIR switch. Set pitch to level with pitch trim knob.
 - b. (1600 series, CG 1790, 1700 and up) Push G/A button, and depress HDG on the flight selector panel.
4. Apply takeoff power release brakes and use nosewheel steering (until rudder control becomes available) as the primary directional control during takeoff roll.
5. At minimum control speed or 5 knots below charted takeoff speed, whichever is greater (refer to applicable performance data), raise the nosewheel off the ground smoothly, establish a 7-degree nose-up attitude change on the attitude director indicator, and allow the airplane to fly off the ground.

6. When the airplane is in a definite climb as indicated by the altimeter and vertical velocity indicator, retract the gear.
7. Make an initial climb of at least 300 feet per minute, and retract the flaps after the airplane accelerates to a minimum of 20 knots above takeoff speed. Allow the airplane to accelerate to the desired climb speed.
8. Minor trim changes may be required at flap retraction.
9. Establish climb power, and turn on anti-icing as required. Be alert for the loss of engine power that occurs when wing and empennage anti-icing is used.

INSTRUMENT CLIMB

1. Complete the AFTER TAKEOFF checklist.
2. If the mission permits, climb speeds may be adjusted to avoid an excessively nose-high attitude.
3. Limit the angle of bank to that required for standard rate (3 degrees per second) turns, or 30 degrees, or 25 degrees, provided a flight director system is used; whichever is less.

CRUISE

Conduct instrument cruise flight according to the normal operating procedures outlined in this section, except that existing published instructions for utilization of radio aids and instructions from air traffic control must be followed.

HOLDING

Conduct holding operations at 170 KIAS. If maximum endurance is required, conduct holding operations at maximum endurance airspeed plus 20 KIAS according to instructions from the air traffic controller. This airspeed permits holding to be accomplished at a constant power setting and allows turns to be executed with little, if any, loss of airspeed. Any loss of airspeed may be regained when level flight attitude is resumed.

PENETRATIONS

Penetrations may be accomplished in the airplane, making certain that the current airspeed limitations in Section V are adhered to. Handling characteristics are very good and pitch attitude is not extreme. A typical penetration is shown in figure 2B-1.

NOTE

Operations in the area between recommended speed limits and maximum speed limits in figure 5-5 are permissible for initiating penetrations from 20,000 feet at 250 knots provided the corresponding maneuver load factors are not exceeded.

The recommended procedure is as follows:

1. Before reaching the initial approach fix, begin the DESCENT checklist. Checklist will be completed when cleared through the transition level.
2. Begin the penetration at or below penetration airspeed from the initial approach fix, in the clean configuration, by retarding throttles to FLIGHT IDLE and smoothly establish descent at least 4,000 fpm until reaching the penetration airspeed.
3. Follow the published penetration procedure.

Typical Penetration

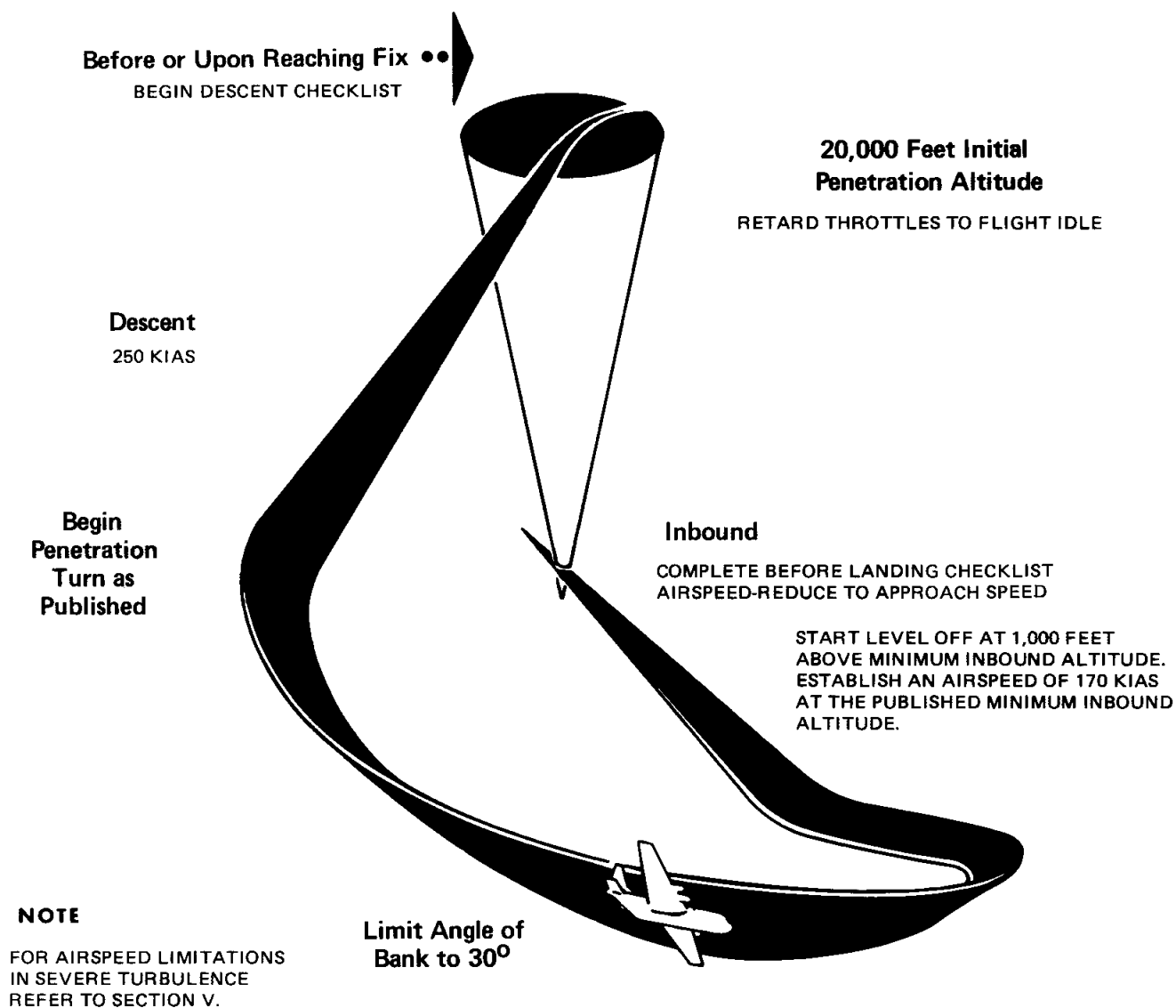


Figure 2B-1

4. Start level-off 1,000 feet above the published minimum inbound altitude. Establish an airspeed of 170 KIAS at the published minimum inbound altitude.
5. Complete the BEFORE LANDING checklist prior to reaching the final approach fix. Allow the airspeed to decrease to approach speed and execute an approach as depicted in figures 2B-2 through 2B-9.

INSTRUMENT APPROACHES

All conventional types of instrument approach may be made. Flight characteristics during instrument approaches do not differ from those encountered during normal visual flight. Entry into an instrument approach is accomplished at 170 KIAS. After crossing the initial approach fix or established on radar downwind leg, the BEFORE LANDING checklist will be completed and the airplane slowed to pattern airspeed. Approach airspeed will be established prior to reaching the glide slope or on final approach to the station of fix. See figures 2B-2 through 2B-9 for typical approaches.

CIRCLING APPROACH

The penetration and approach procedures are based on straight-in approach speeds. If a circling approach is required, maintain 140 KIAS or approach speed, whichever is higher; when established on final, slow to approach speed.

MISSED APPROACHES

In the event of a missed approach, immediately apply required power and establish a climb. When a definite climb is shown on the vertical velocity indicator and altimeter, complete the normal go-around procedure described in this section. For three-engine operation, complete the go-around procedure described in Section III. Accelerate to climb speed and maintain until reaching desired missed-approach altitude. Execute the appropriate missed-approach procedure.

Typical Instrument Approach – Four or Three Engines – ADF, VOR, or Localizer Procedures

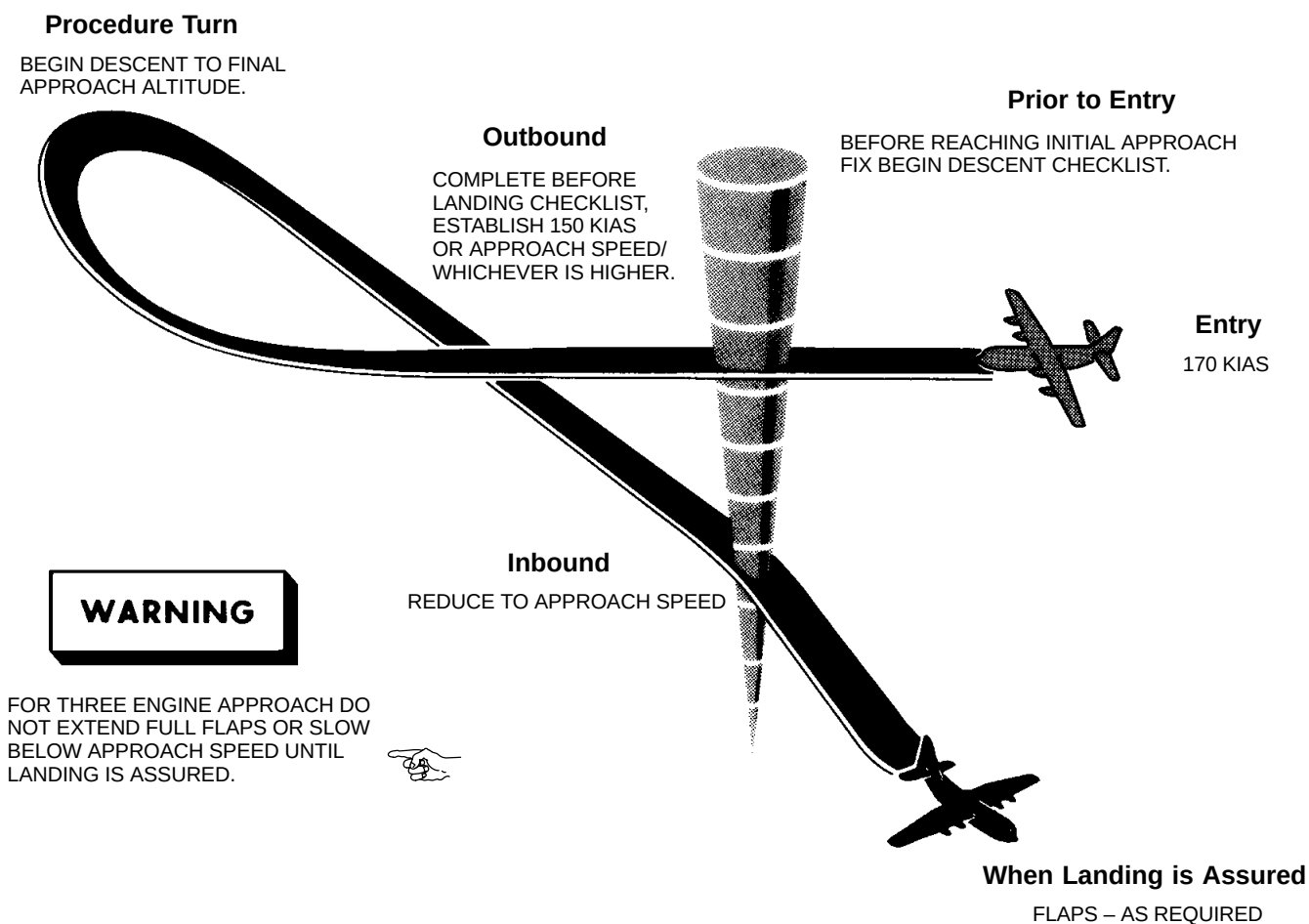


Figure 2B-2

Typical Instrument Approach Two Engines – ADF, VOR, or Localizer

WARNING

TWO ENGINE OPERATION ABOVE 120,000 LBS IS MARGINAL. TIME AND CONDITIONS PERMITTING, CARGO AND FUEL SHOULD BE JETTISONED TO DECREASE WEIGHT AS MUCH AS POSSIBLE.

Procedure Turn

Outbound

FLAPS - UP
GEAR - AS REQUIRED
160 KIAS (MINIMUM)

Prior to Entry

BEFORE REACHING INITIAL APPROACH FIX BEGIN DESCENT CHECKLIST.

Entry
170 KIAS

CAUTION

PILOT MUST BE AWARE OF ADDITIONAL TIME REQUIRED TO EXTEND GEAR AND FLAPS, SHOULD BOTH NO. 1 AND NO. 2 ENGINES BE INOPERATIVE.

Final Approach

COMPLETE BEFORE LANDING CHECKLIST. 150 KIAS OR APPROACH SPEED - WHICHEVER IS HIGHER - UNTIL LANDING IS ASSURED.

Inbound

REDUCE TO 150 KIAS OR APPROACH SPEED WHICHEVER IS HIGHER.

WARNING

A GO-AROUND IS NOT RECOMMENDED AFTER FLAPS ARE LOWERED

When Landing is Assured

FLAPS - AS REQUIRED

WARNING

DO NOT EXTEND FULL FLAPS OR SLOW BELOW TWO ENGINE MINIMUM CONTROL SPEED UNTIL LANDING IS ASSURED.

Figure 2B-3

Typical ILS Four or Three Engines

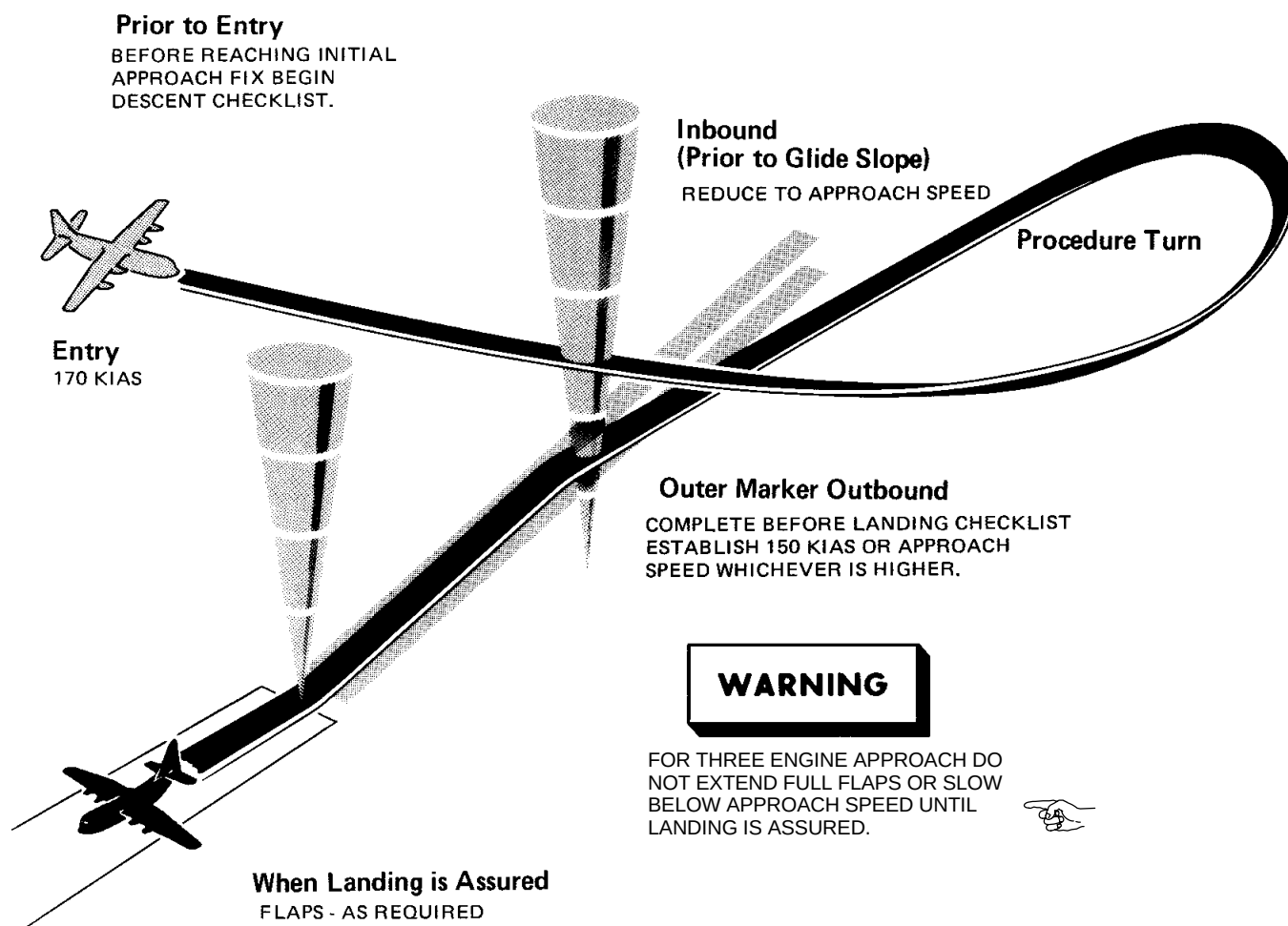


Figure 2B-4

Typical ILS Two Engines

WARNING

TWO ENGINE OPERATION ABOVE 120,000 POUNDS IS MARGINAL. TIME AND CONDITIONS PERMITTING, CARGO AND FUEL SHOULD BE JETTISONED TO DECREASE WEIGHT AS MUCH AS POSSIBLE.

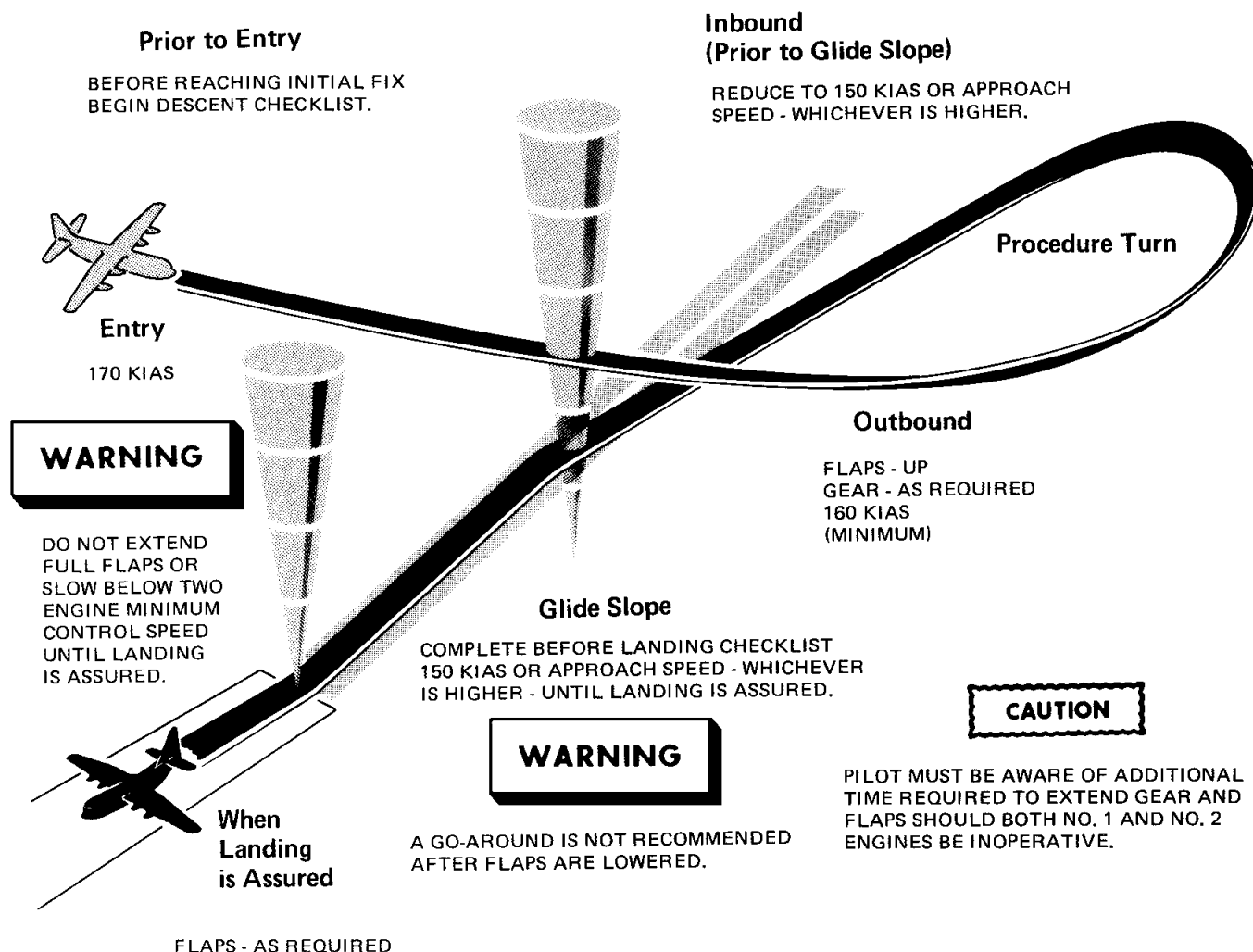


Figure 2B-5

Typical Radar Approach Pattern – Four or Three Engines

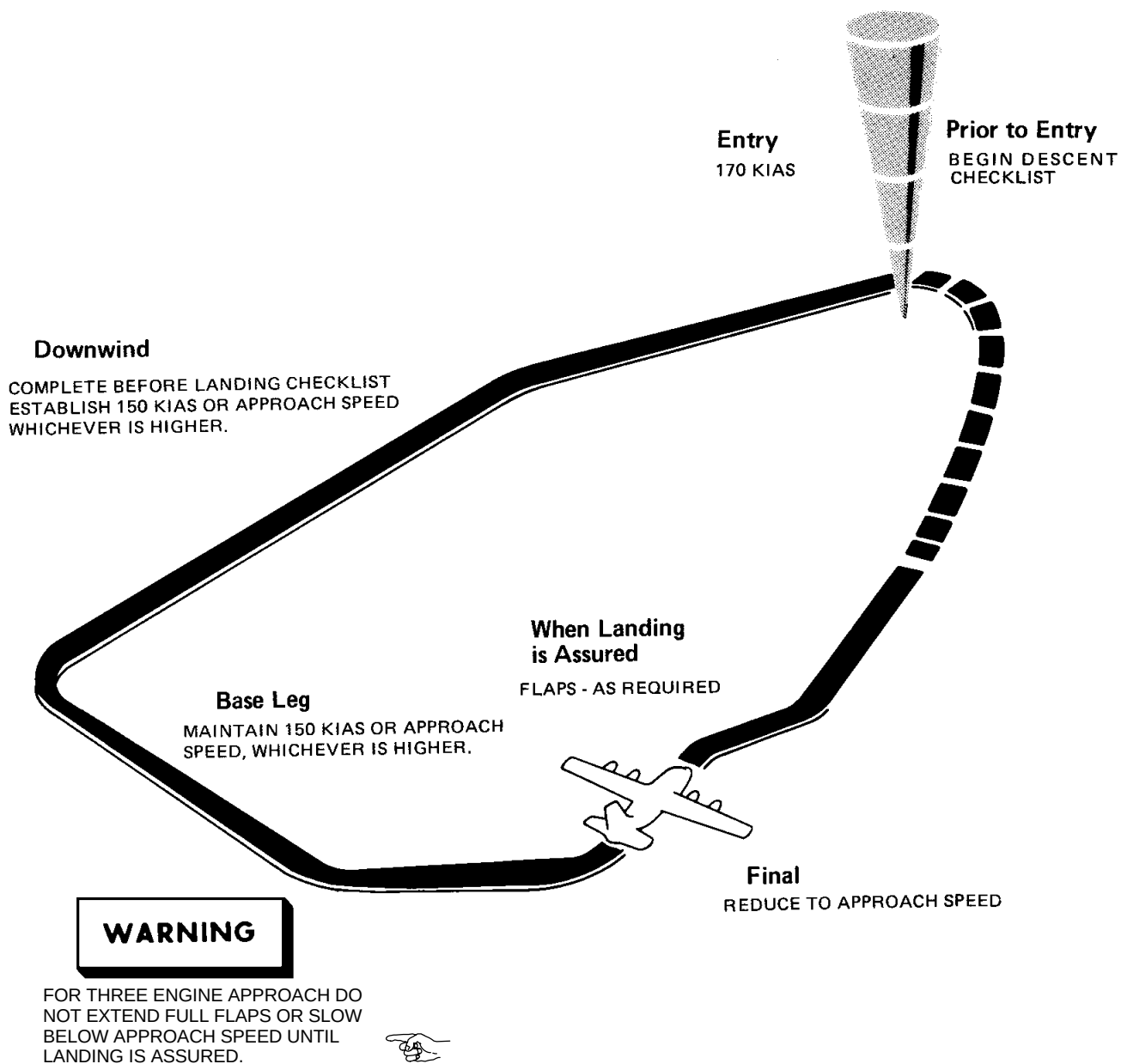


Figure 2B-6

Typical Radar Approach Pattern – Two Engines

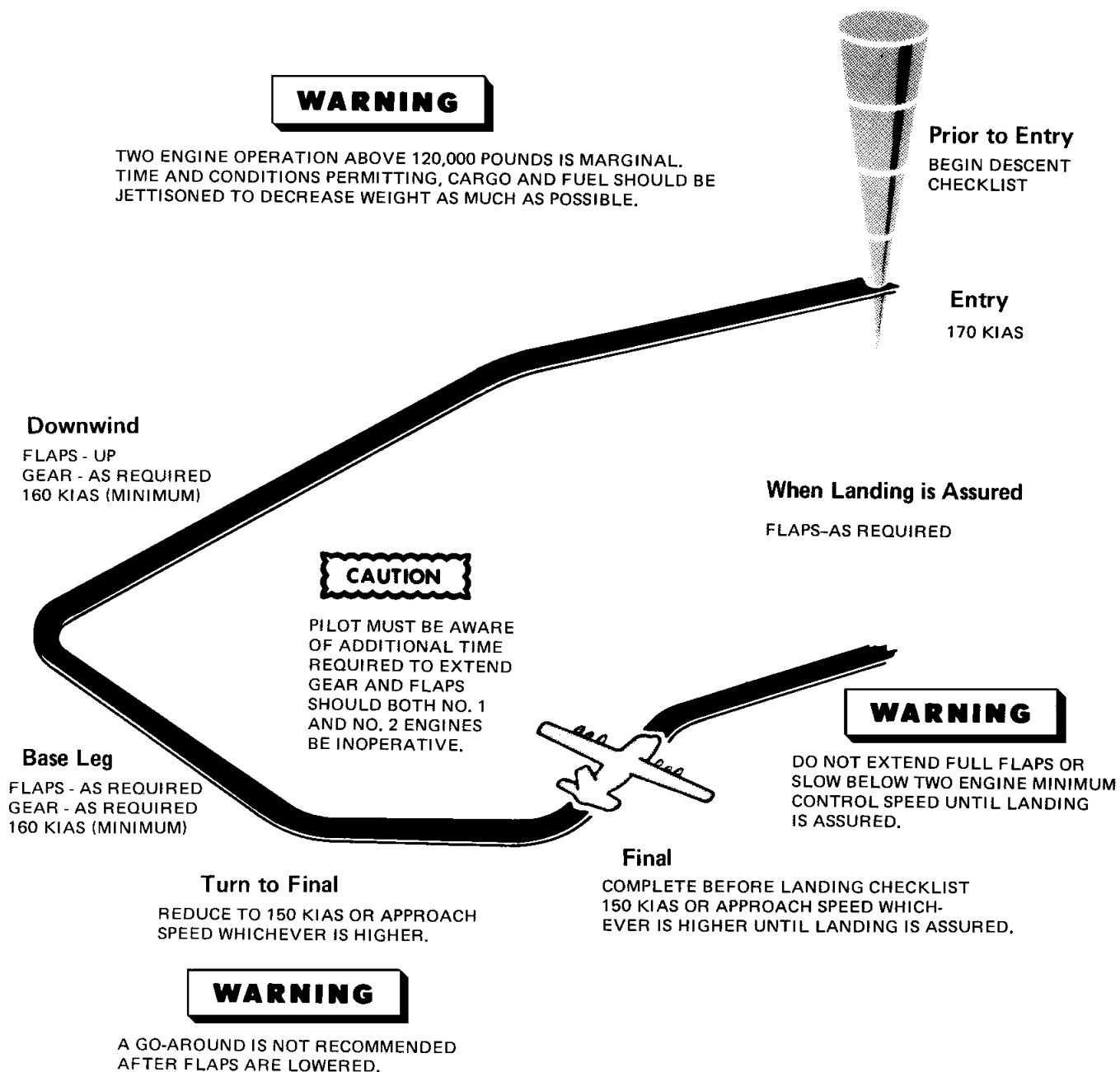


Figure 2B-7

Typical TACAN Pattern – Four or Three Engines

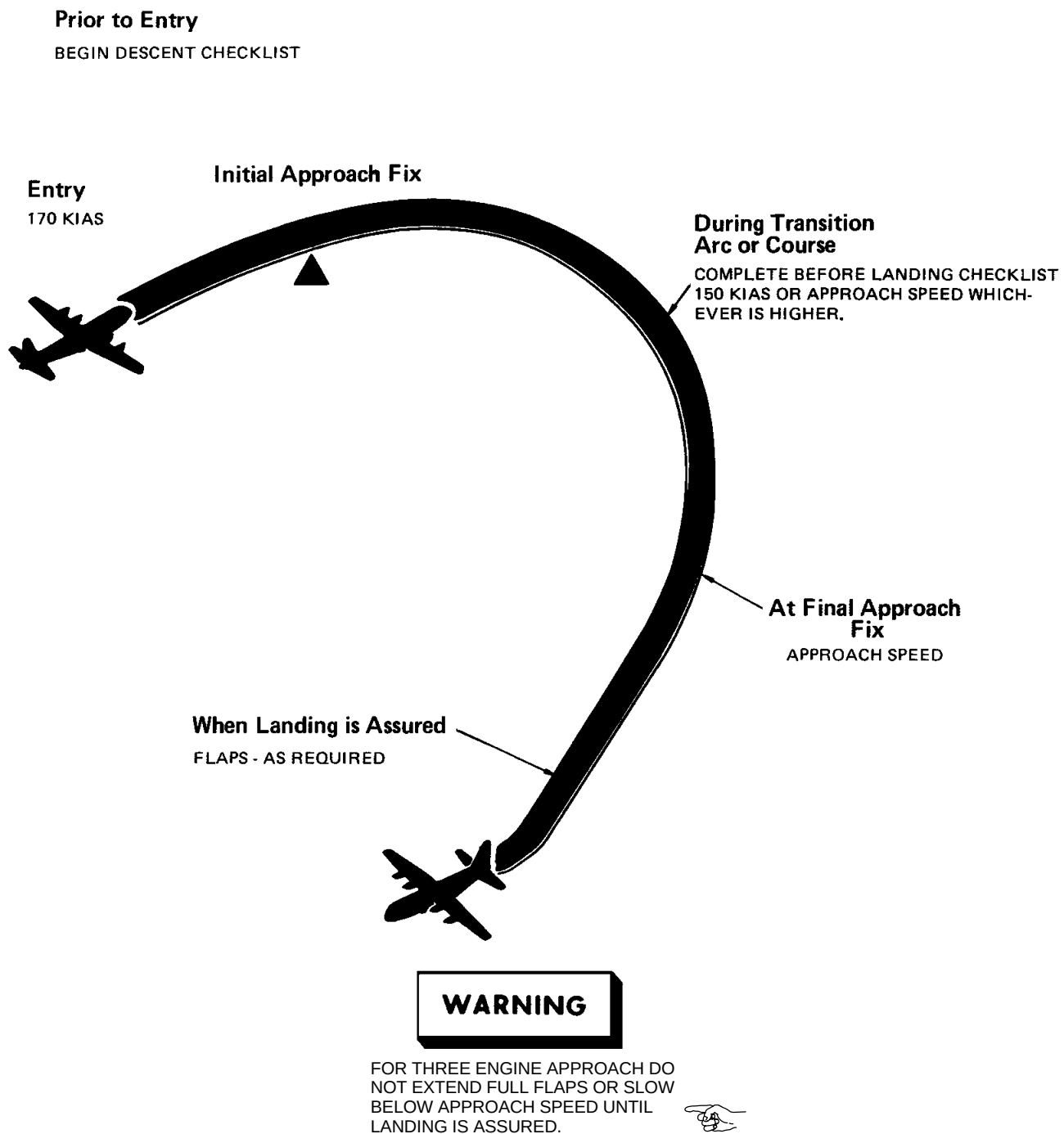


Figure 2B-8

Typical TACAN Pattern – Two Engines

WARNING

TWO ENGINE OPERATION ABOVE 120,000 POUNDS IS MARGINAL. TIME AND CONDITIONS PERMITTING, CARGO AND FUEL SHOULD BE JETTISONED TO DECREASE WEIGHT AS MUCH AS POSSIBLE.

Prior to Entry

BEGIN DESCENT CHECKLIST

Entry

170 KIAS

Initial Approach Fix

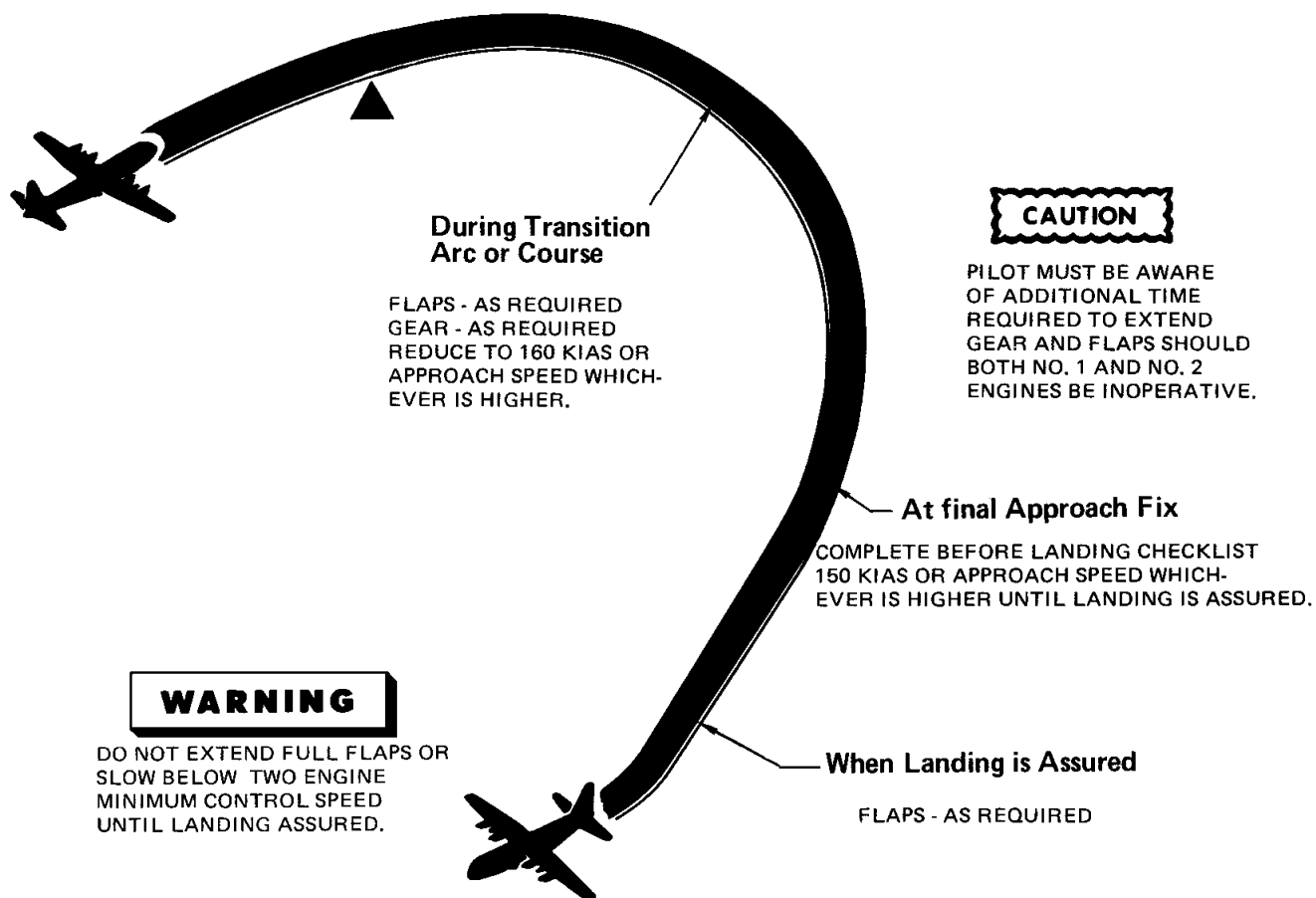


Figure 2B-9

PART C – SAR PROCEDURES

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SAR PROCEDURES CHECKLIST USE

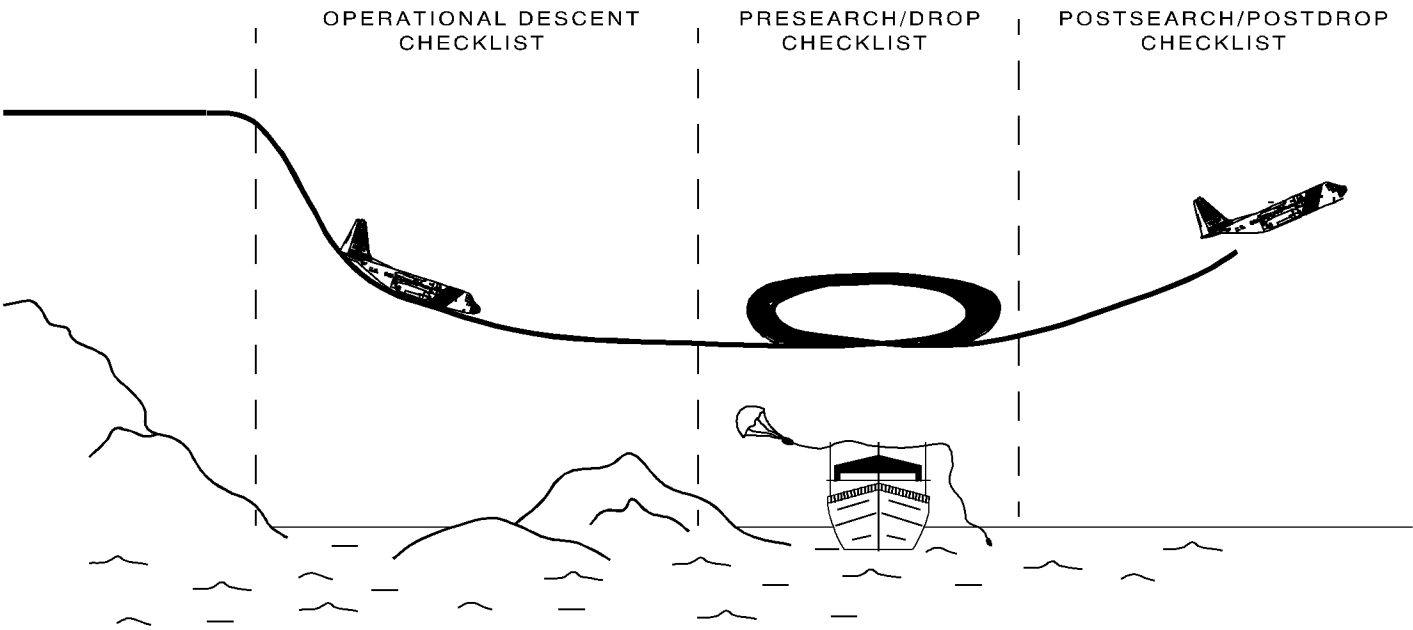


Figure 2C-1

NOTE

The following checklists shall be used for all search, patrol, and aerial delivery missions (figure 2C-1).

- Operational Descent Checklist – prior to all operations.
- Presearch/Predrop Checklist – prior to all searches, patrols, and aerial deliveries.

NOTE

The Presearch/Predrop checklist will be run again as the mission evolves (i.e.: Search locates target requiring aerial delivery of equipment).

- Postsearch/Postdrop Checklist – when complete with all operations.

OPERATIONAL DESCENT CHECKLIST

Extremely large changes in the altimeter setting may occur during long-range operations. Descents to MDA on pressure altimeter with RADALT inoperative should not be made unless a predicted altimeter setting is available. Frequent updating of the pressure altimeter setting, by whatever means available, is required.

WARNING

If at any time during the descent, approach and landing phase of flight, the GPWS provides a “Terrain” or “Too low, Flaps” aural warning, the pilot at the controls will confirm the aircraft’s configuration and acknowledge the warning with, “Acknowledge GPWS, Flaps are set ____, Landing Gear is ____.” If a “Glide Slope,” “Sink Rate,” or “Pull Up” aural warning is given, the pilot at the controls will acknowledge with “Acknowledge GPWS, correcting,” and will apply an appropriate correction. If at any time a “Terrain” warning is received and there is any doubt regarding the aircraft’s position, an immediate climb shall be initiated.

1. Crew	“Notified”	(P)
2. Pressurization	“As Required” “Set”	(P) (E)

Pilot will direct engineer to:

- a. Adjust controller so that airplane is depressurized at completion of descent, if required.

■ 3. Altimeters	“Set, state setting”	(CP)(P)(N)
a. Set altimeters to predicted altimeter setting for the area.		
■ 4. Radar altimeter	“Set, state setting”	(P)
a. Set RADALT to desired minimum descent altitude		
■ 5. Altitude alert	“Set, state setting”	(CP)

NOTE

The altitude alert warning signal (CG 1790 and 1700 series) is activated when the pilot’s altimeter indicates 300 feet below and above the selected setting.

6. Life vests	“As required”	(P)

NOTE

The Aircraft Commander will direct the crew to don life vests if the situation dictates. If the use of vests is not directed, individuals may use them at their option. If life vests are desired, they will be worn.

7. Operational Descent checks	“Complete”	(CP)

SEARCH/PATROL

The parameters listed in figure 2C-2 below provide for safe, standardized procedures while achieving flexibility in mission accomplishment and increased endurance. If, at any time, the Aircraft Commander feels that continued operation on reduced number of engines or in other conditions is approaching unsafe or marginal limits, the Aircraft Commander should restart the engines and/or adjust the mission accordingly.

Condition (NA – NOT AUTHORIZED)	Airspeed Range or Parameter	Minimum Altitude					
		4 Engines		(3) 3 Engines (135,000 lbs and below)		(3) 2 Engines (120,000 lbs and below)	
		Day	Night	Day	Night	Day	Night
Clean (above 135,000 lbs)	170–Vh	200	200	NA	NA	NA	NA
Clean (120,000 – 135,000 lbs)	170–Vh	↓	↓	500	500	NA	NA
Clean (120,000 lbs) and below	150–Vh	↓	↓	(2) ↓	↓	500	1000
20% Flaps, Ramp Closed, Door Open	145–185	(1)	(1)	500	500	500 (2)	1000
35% Flaps, Ramp Open, Door Closed	145–150	↓	↓	500	NA	1000	NA
50% Flaps, Ramp Open, Door Open	145–150	↓	↓	NA	NA	NA	NA
P&CP in Seats (3)	Required Below	200	200	500	1000	1000	ALL
Autopilot Engaged (4)	Not Below	500	500	500	500	500	1000
Instrument or Icing (5) Condition Min Descent	RADALT OPER	400	400	NA	NA	NA	NA
	RADALT INOP	1000	1000	NA	NA	NA	NA
NOTE (1) Descents below these altitudes authorized for investigating contacts. Identification passes on vessels shall be made no lower than 150 feet. Under abnormal conditions, lower descents may be made for the purpose of obtaining further information. (2) Descents below 500 feet (day only) on 2 or 3 engines in these configurations authorized for investigating contacts, provided IAS is 180 knots or more. If descent below 150 feet is required, it shall be done with 4 engines operating. (3) One of the pilots must be a qualified Aircraft Commander. (4) Any time the autopilot is engaged below 1,000 feet, AGL/AWL, the pilot in control will have a hand on the yoke in vicinity of the autopilot disengage switch. (5) When executing an instrument descent, if good visual contact with the surface cannot be made at the minimum descent altitude (MDA), the approach shall be aborted and a climb initiated immediately. The rate of descent for the last 500 feet before reaching MDA shall not exceed 500 FPM. The MDA shall be adjusted upward to allow for adequate clearance of surface objects such as vessels, icebergs, off-shore structures, islands, etc., if the radar is inoperative or unreliable.							

Figure 2C-2

PRESEARCH/PREDROP CHECKLIST**NOTE**

Run this checklist in its entirety for each evolution

1. Briefing	“Complete”	(P)
a. Brief the crew as follows:		
(1) Copilot and Flight Engineer– Configuration, airspeeds, altitude, angle of bank. Estimated fuel endurance/intended BINGO fuel.		
(2) Navigator – Area, pattern, courses, track spacing, Nav equipment, and radar use.		
(3) Copilot and Radioman – Control, on scene, and radio guard communications; homing and listening watch.		
(4) Dropmaster – Location markers, drop equipment and safety strap.		
(5) All – Pattern, voice procedures and ICS use, object description, lookout techniques, sighting and relocation procedures, safety precautions, altimeter setting (match BAR ALT to RAD ALT for low level ops), emergency procedures.		
2. Location markers	“Standing by with ____”	(DM)

NOTE

Items 3–7 for use of flare launcher.

3. Pressurization	As required	(E)
a. The aircraft may be repressurized once the flare loading sequence is complete and no other doors, hatches, or the ramp are to be opened.		
4. Flare launch panel	“OFF and SAFE”	(DM)(CP)
a. Copilot and dropmaster ensure that individual flare launch panels are OFF and SAFE.		
5. Flare launch activation switch	“ACTIVATED”	(DM)
6. Flare launch panel	“ARMED”	(CP)



To prevent inadvertent ignition, salt shall not be added to flares when utilizing the flare launch tubes.

7. Flare launch tubes “ ____MK-25/MK-58(s)
loaded in tube(s)
number ____” (DM)
- a. Dropmaster load tubes and notify crew of pyrotechnic load by type and tube number.

NOTE

Items 8-17 for Drops or Ramp Search. All engines will be running for airdrops. ■

8. Pressurization “No pressure” (E)
9. Ramp support arms “Connected” (DM)
10. Dual rail ramp conveyors “Removed” (DM)
- a. Remove at least the center two sections of conveyors.
11. Safety equipment “On and checked” (DM)
- a. For equipment with static line drops, personnel actually doing the drop will wear helmets and adequate eye protection.
- b. Safety/emergency equipment will include (as a minimum) gloves, shroud line cutter or knife (readily accessible), and a safety strap at FS 617.
12. Drop equipment “Standing by with ____” (DM)
- a. Dropmaster will notify crew of type equipment that is being deployed.
13. Flaps “As required” (P)(CP)
- a. Set flaps for desired configuration.
- b. For drops set flaps to 50% if gross weight is 130,000 pounds or below; set to 70% if gross weight is above 130,000 pounds.
14. Air deflector doors “If required” (DM)(CP)
- a. Open air deflectors if paratroop door drop is to be made, or if requested by the dropmaster.
15. Restraint harness “On and checked” (DM)

WARNING

Ensure that all crew members involved are wearing properly adjusted restraint harnesses and understand the exact operation to be performed prior to the operation. All other personnel aft of fuselage station 617 (wheel well) will wear restraining harnesses or will be seated with seat belts fastened.

16. ISAR

“Set”

(N)
- a. Set ISAR to STBY prior to activation of Aux pump.
After the Aux pump is ON and stable, the ISAR may
be returned to an operating mode.
17. Cargo ramp and door or paratroop door

“Clear to open”

(P)
- “Aux pump ON”

(DM)
- “Open and Locked”

(DM)

WARNING

For dropmaster safety, the cargo ramp and/or door and paratroop door will not be open simultaneously during drops.

CAUTION

In the event the aerial delivery equipment becomes entangled during deployment or fails to deploy away from the aircraft, it will be necessary to sever the static line or inflation lanyard connecting the equipment to the aircraft. This will be accomplished utilizing the emergency shroud cutter. Notify the pilot of the equipment condition. All attempts should be made to release the equipment over an unpopulated area.

NOTE

Normally, all drops will be made with cargo ramp and door open; however, either paratroop door may be used. If the ramp is opened, it shall be in the airdrop or horizontal position. The cargo door should be fully open and locked with both flags visible. Operation of the ramp and door will normally be completed by the dropmaster at the aft control panels. If using one of the paratroop doors, the door shall be in the fully up and locked position with the safety pin installed.

18. Flaps

“As required”

(P)(CP)
19. Landing lights

“As required”

(P)
20. Complete CRUISE ENGINE SHUTDOWN
Checklist

“As required”

(P)
21. Presearch/Predrop checks

“Complete”

(E)(N)
(DM)(CP)

NOTE

Pilot and dropmaster involved in the drop evolution shall ensure all personnel understand the exact operation to be performed prior to replying “Complete.”

AERIAL DELIVERY (LIGHT EQUIPMENT)

Authorized Drop Equipment

ITEM	PATTERN
Marine Location Marker	Free Fall
Datum Marker Buoy	Free Fall
Message Container	Free Fall
Navy Plastic Sonobuoy Container	Free Fall

Aerial Sea Rescue Kit	Sea Rescue Kit
Aerial Delivery Survival Kit	PADS
Aerial Drop Dewatering Pump	PADS
Aerial Drop Raft	PADS
Aerial Delivery System Can	PADS
AXBT Buoy (IIP)	PADS
WOCE Buoy (IIP)	PADS
Air Droppable (Version 1) Goods Container (P1G)	PADS

Datum Marker Buoy (DMB) and Self Locating DMB (SLDMB)

There are currently two types of Datum Marker Buoys used by the Coast Guard. The first is a battery powered transmitter designed to float with most of the case submerged. Four fins on the float assembly stabilize the buoy ensuring perpendicular entry into the water during low altitude drops. Three different models of this DMB are available, transmitting on either 240.6 MHz AM, 242.65 MHz AM, or 156.75 MHz FM. This DMB is not drogue equipped and is deployed from the aircraft by hand. Some downward thrust should be used on launching to prevent contacting the aircraft structure during deployment. The second type of DMB in use is the self locating DMB (SLDMB). This is a parachute delivered orange colored buoy that transmits on a frequency of 406 MHz. Each SLDMB has a unique ID code that allows for multiple DMB insertions in a given area. This type of DMB is tracked via satellite. There is no way to relocate this DMB electronically from the aircraft.

SAR EQUIPMENT

This section provides a brief description and the approved configuration of SAR equipment that is normally carried in the C-130 aircraft. Deviation from the approved configurations are not authorized and waivers shall be submitted to Commandant (G-OCA) IAW COMDTINST M3710.1 (series).

Marine Location Marker (MK-25/MK-58)

There are two types of marine location markers carried onboard; the MK-25 and the MK-58. They are used to mark a surface position by day or night. Both types produce a yellow flame and white smoke. The burn time for the MK-25 and the MK-58 are 13 to 18 minutes and 40 to 60 minutes, respectively.

Message Container

The message container consists of a small sealable weighted container, a message form, and a brightly colored 8 foot streamer. The message container is used to deliver a hand-written message when two-way communications cannot be established between the aircraft and survivors on land or at sea.

Sonobuoy Container (AN/SSQ-57A)

The sonobuoy container is a plastic cylindrical tube which is designed to hold up to 18 pounds. The sonobuoy container is used when items such as survival gear, food, parts, etc., are to be delivered to survivors or vessels at sea.

Air Droppable (Version 1) Goods Container (P1G)

The P1G container is a plastic cylindrical barrel which is designed to hold from 20 to 200 pounds. The P1G container gross weight limits are minimum 70 pounds and maximum 250 pounds. The P1G container is used when items such as survival gear, food, parts, etc., are to be delivered to survivors or vessels. The 28 foot ADS shall be used.

MA-3 (ASRK-24)

The MA-3 (ASRK-24) is an aerial sea rescue kit which consists of three POD-8 eight place life rafts and two waterproof survival equipment supply containers designed to remain afloat for 6 hours. Each raft is equipped with an inflation lanyard. The life rafts should normally be dropped inflated. The containers are interconnected by four 250 foot long buoyant polypropylene lines. The total length of the kit is 1000 feet when fully deployed.

MA-3 Modified (ASRK Modified)

The MA-3 (ASRK Modified) is an aerial sea rescue kit which consists of two POD-8 eight place life rafts and two waterproof survival equipment supply containers designed to remain afloat for 6 hours. Each raft is equipped with an inflation lanyard. The life rafts should normally be dropped inflated. The containers are interconnected by three 250 foot long buoyant polypropylene lines. The total length of the kit is 750 feet when fully deployed. The ASRK Modified configuration should only be used if the number five container of the ASRK-24 has been or will be deployed separately as an ADR-8.

CG-P1 (ADDP)

The ADDP is an aerial drop dewatering pump. If the aerial drop dewatering pump is dropped with the polyethylene or metal can, the 28 foot ADS shall be used. If the polyethylene or metal can is to be used to drop equipment other than the aerial drop dewatering pump, the 28 foot ADS shall also be used. While the 28 foot parachute is capable of handling weights of up to 250 pounds, the limiting factor for this configuration is the container. Neither the metal nor polyethylene cans are tested or rated for dropping anything other than the aerial drop dewatering pump, so any alternate equipment item shall not exceed the weight of an aerial drop dewatering pump. If the polyethylene or metal container is to be used to drop equipment other than the aerial drop dewatering pump, the weight of the alternate equipment shall be between 50 and 80 pounds.

ADSK

The ADSK is an aerial delivery survival kit which can be delivered to land or sea. The ADSK contains miscellaneous survival items necessary to sustain survivors until rescuers arrive. It is packed into an ADS-Can and is deployed using a 12 foot ADS.

MA-1 (ADR-8)

The ADR-8 is a single POD-8 eight place aerial drop raft. The ADR-8 is equipped with an inflation lanyard and can be dropped inflated or uninflated. In either case the 12 foot ADS shall be used.

MA-20 (ADR-20)

The ADR-20 is a single LRU-15/A 20 place aerial drop raft. The ADR-20 is equipped with an inflation lanyard and can be dropped inflated or uninflated. In either case the 12 foot ADS shall be used.

ADS-Can (A-20)

The ADS-Can is an aerial system delivery can which is used as the container for the air droppable portable radio and aerial delivery survival kit. If the ADS-Can is to be dropped with a portable radio and/or the aerial delivery survival kit, the 12 foot ADS shall be used. If the ADS-Can is to be used to drop equipment other than the portable radio and/or the aerial delivery survival kit, the 12 foot ADS shall also be used. The limiting factor for the ADS-Can configuration is the buoyancy of the can itself. The ADS-Can has a ballast weight which can be removed to facilitate certain cargos. Tools are required to remove the ballast, and can be performed by the dropmaster if necessary. If the weight of the alternate equipment to be dropped is between 0 and 30 pounds, the ballast should remain in the can. If the weight of the alternate equipment to be dropped is between 30 and 55 pounds, the ballast should be removed from the can. Seventy pounds is the maximum weight limitation for the ADS-Can.

Aerial Delivery System (ADS)

There are two sizes of ADS carried onboard; a 12 foot and a 28 foot. Each consists of a 12 or 28 foot parachute, line cutter, strobe light, and trail line, which is packed into one container and is attached to equipment requiring its use for deployment. The line cutter is designed to automatically separate the parachute from the equipment 10 seconds after deployment. The strobe light is located at the drogue chute end of the trail line (opposite end of the equipment) when fully extended. The trail line consists of 400 feet of polypropylene line and 30 feet of 5/8-inch manila line, which is connected to the equipment. The ADS provides a fall time for equipment of 8-10 seconds from 200 feet AWL.

Authorized Drill equipment

All practice aerial delivery equipment will be constructed and maintained IAW ALSE instructions which may be found on the ALSE/ARSC web.

SEA RESCUE KIT DELIVERY PATTERN (figures 2C-6 and 2C-7)

After determining whether to drop upwind or downwind of the target, maneuver the aircraft on the reciprocal of the drop heading, and perpendicular to the wind line, to pass approximately 50 feet abeam of the target. (Note: only a downwind drop is depicted.) Three seconds after passing the target, drop a drift signal. Continue heading for 15 seconds and drop a second drift signal; then make at least a 40 degree standard rate turn to the right. After at least 15 seconds, make a standard rate 180 degree turn to the left, maintain heading until final turn to the drop heading to pass 50 feet abeam of the target. For upwind drops, with surface winds in excess of 15 knots, increase upwind distance 25 feet for each additional 10 knots. After rolling out on final heading, advise Dropmaster "30 second standby." When abeam second drift signal dropped, advise "15 second standby." When directly abeam of the first drift signal advise "Drop, Drop, Drop." If for any reason the drop can not be made, abort as briefed and refly the pattern.

PADS DELIVERY PATTERN (figures 2C-3 through 2C-5 and 2C-7)

Fly over the target heading into the wind. After passing over the target make a standard rate turn to the left to fly downwind. After 30 seconds turn back into the wind line and advise "30 second standby." 15 seconds later advise "15 second standby." Passing over drop point call "Drop, drop, drop."

FREE FALL DELIVERY PATTERN (figures 2C-3 and 2C-7)

POSTSEARCH/POSTDROP CHECKLIST

1. Air start engines	"As required"	(CP)
2. Armed location markers	"Jettisoned"	(DM)(CP)
3. ISAR	"Set"	(N)
4. Cargo ramp and/or door or paratroop door	"Clear to close"	(P)
	"Aux pump ON"	(DM)
	"Closed and Locked"	(DM)
5. Air deflector doors	"Closed"	(CP)
6. Flare launch panel	"OFF and SAFE"	(DM)(CP)
a. Copilot/dropmaster check to ensure all switches on flare launch panel are OFF and SAFE.		
7. Flare launch activation switch	"DEACTIVATED"	(DM)
8. Landing lights	"As required"	(CP)
9. Flaps	"Up"	(CP)
10. Pressurization	"Set, state setting"	(E)
11. Altimeters	"Set, state setting"	(CP)(P)(N)
12. Radar Altimeter	"Set, state setting"	(P)
13. GPWS override switches (if installed)	"NORMAL"	(CP)
14. Unused location markers and drop equipment	"Removed and Stowed"	(DM)
15. Postsearch/Postdrop checks	"Complete"	(E)(N) (DM)(CP)

Pads or Free Fall Delivery Pattern

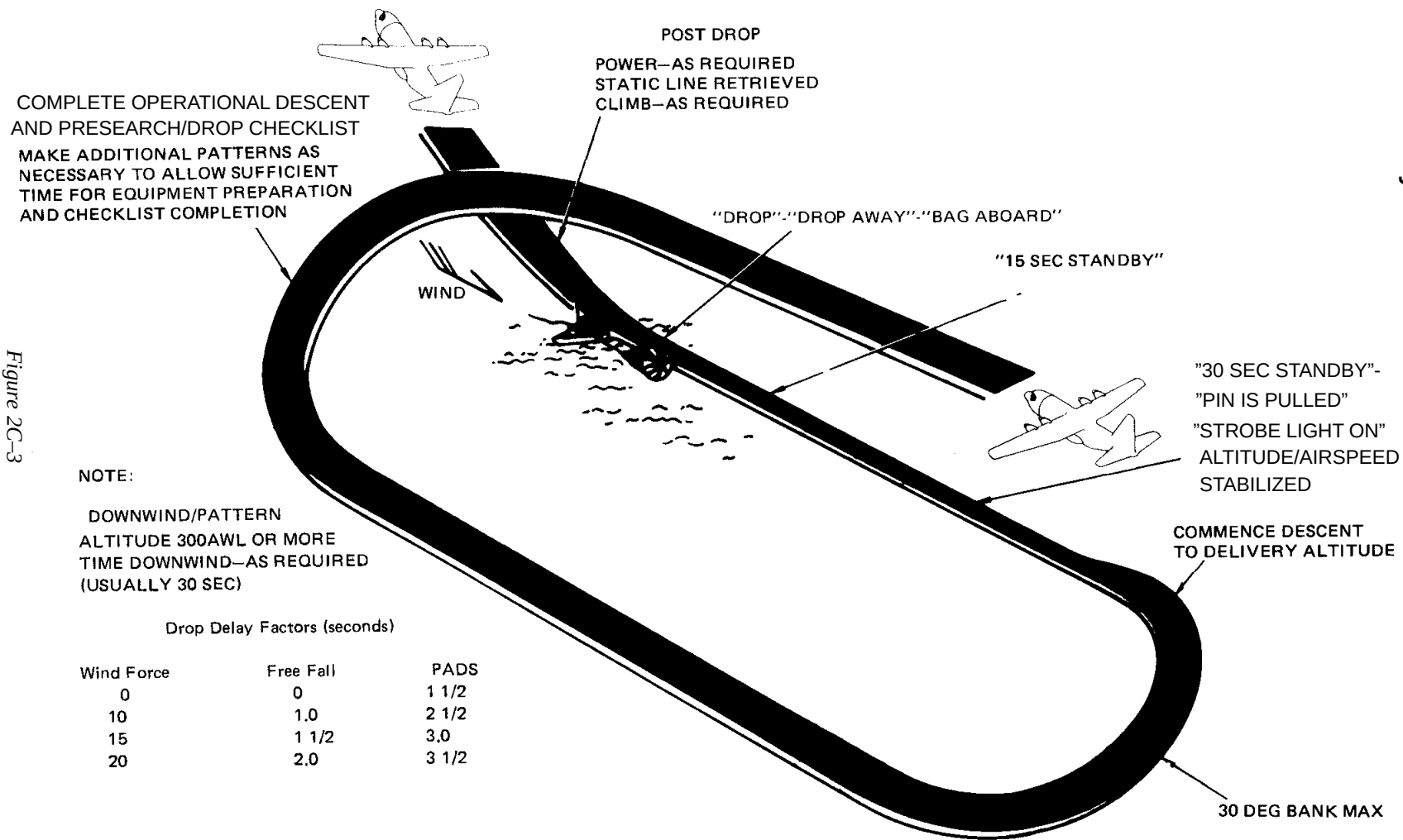
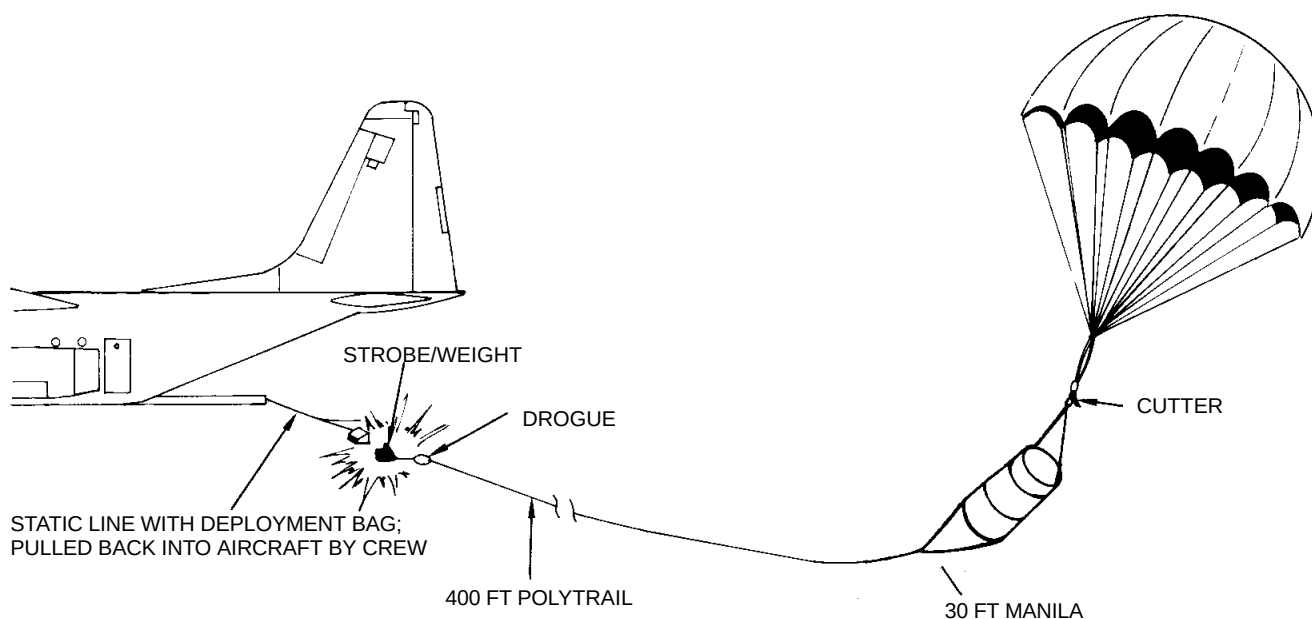


Figure 2C-3

PADS Completely Deployed



WARNING

AFTER PADS DROP, MAINTAIN STRAIGHT AND LEVEL FLIGHT UNTIL DM REPORTS "BAG ABOARD". THIS ALLOWS DM TIME TO RETRIEVE AND STOW THE LINE/BAG TO PREVENT POSSIBLE ELEVATOR ENTANGLEMENT AND POSSIBLE PERSONAL INJURY.



WARNING

WITH THIS SYSTEM IT IS MORE DESIRABLE TO DROP EARLY RATHER THAN LATE. IN CASE OF PARACHUTE FAILURE AFTER A LATE DROP, THE CONTAINER WILL FREE FALL AND MAY HIT THE TARGET ENDANGERING PERSONNEL/PROPERTY ON THE SURFACE.

Figure 2C-4

PADS Splashdown

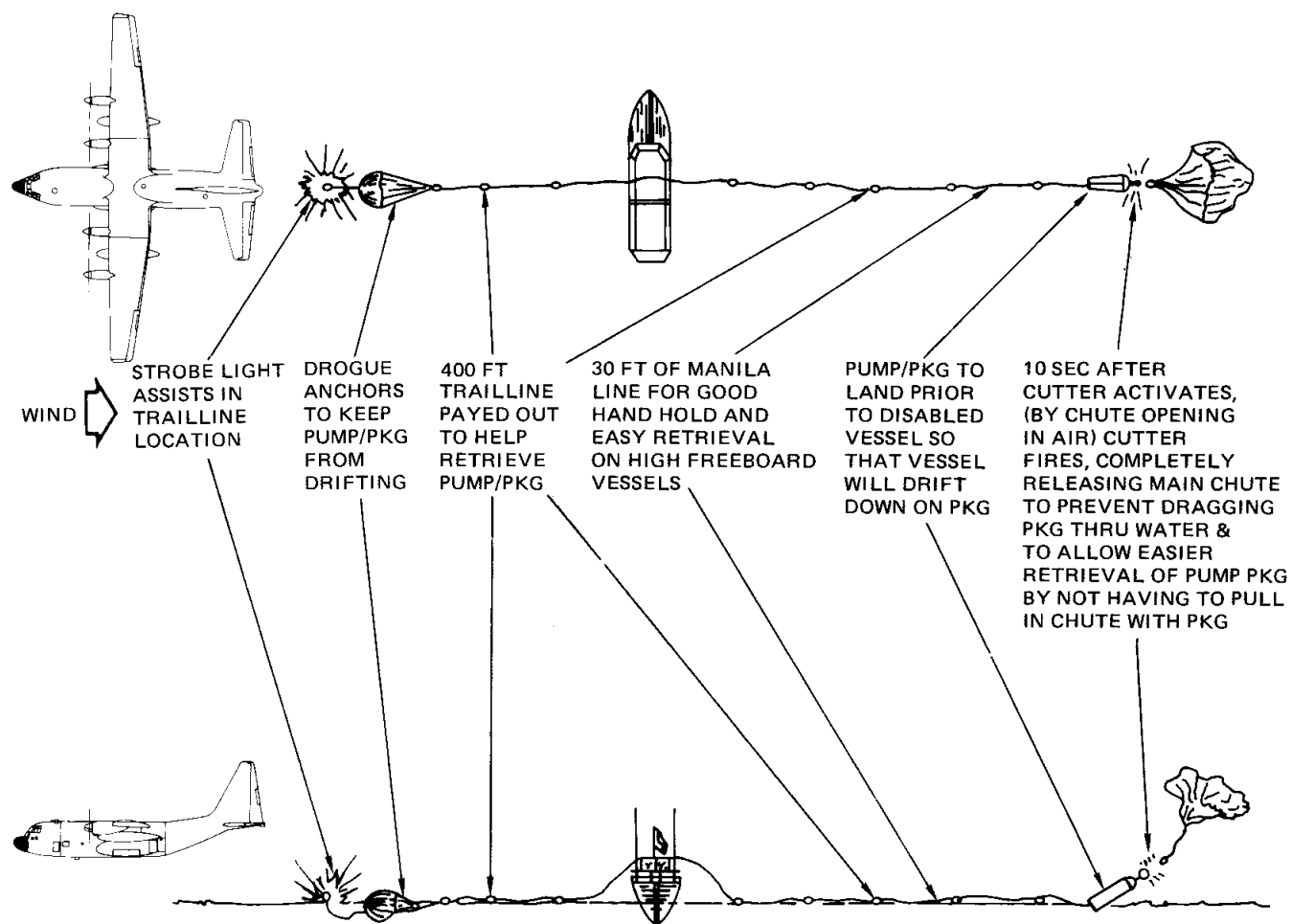
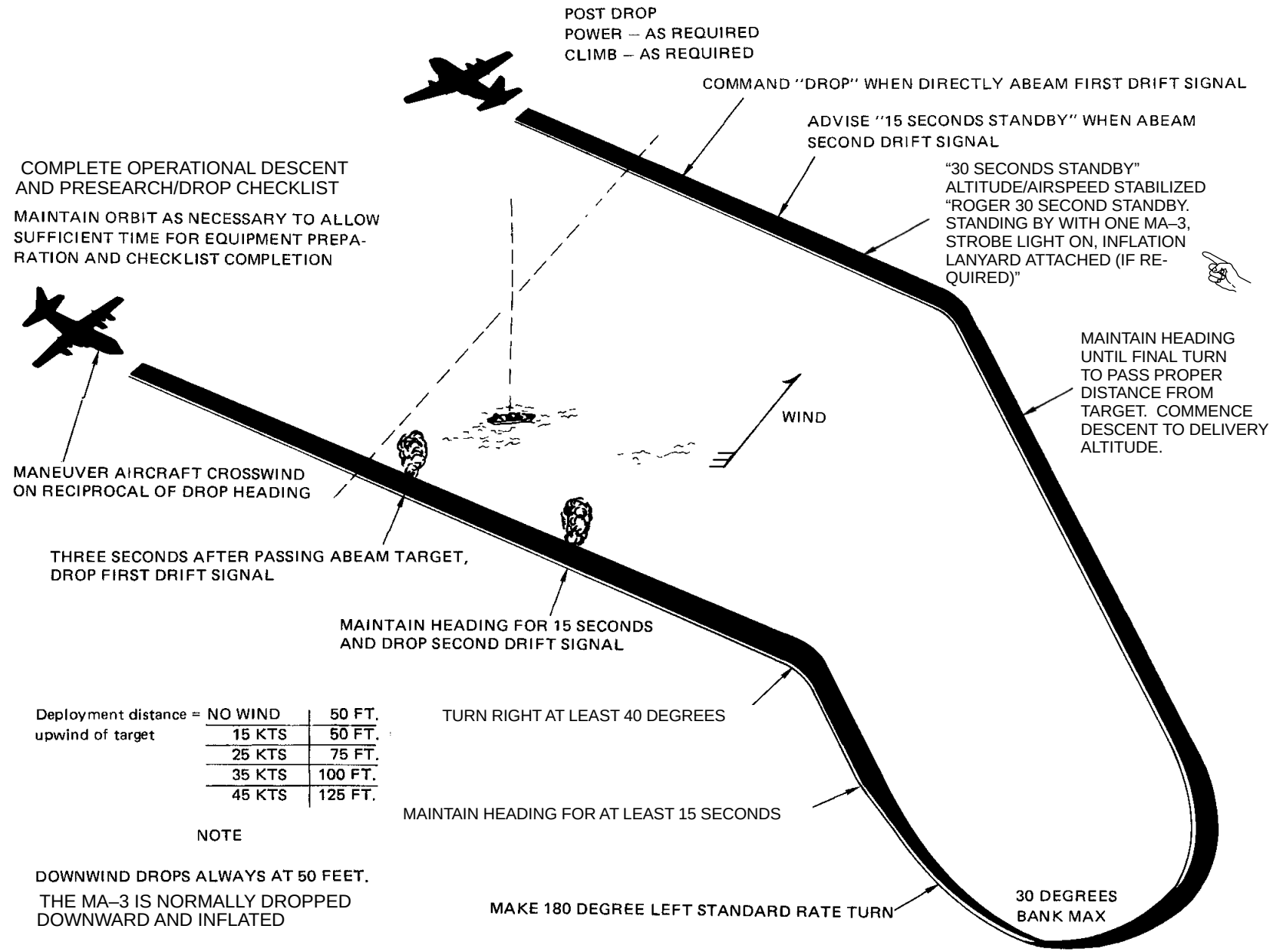


Figure 2C-5

Sea Rescue Kit Delivery Pattern

CGTO 1C-130-1



Deployment distance = NO WIND | 50 FT.
upwind of target

15 KTS	50 FT.
25 KTS	75 FT.
35 KTS	100 FT.
45 KTS	125 FT.

NOTE

DOWNWIND DROPS ALWAYS AT 50 FEET.
THE MA-3 IS NORMALLY DROPPED
DOWNWARD AND INFLATED

Figure 2C-6

Aerial Delivery (Light Equipment)

The parameters listed below shall be followed for aerial delivery of light objects. This table is utilized for ramp or paratroop door aerial delivery only.



Gross Weight	Flaps	Light Equipment		Turns (2)	
		ALT	IAS	Min IAS	Max Bank Angle
120,000 and below	50%	200	130	135	30°
120,001 – 130,000	50%	↓	↓	145	↓
130,001 – 135,000	70%		↓	↓	
135,001 – 142,000	70%		135	↓	
142,001 – 155,000	70%	↓	140	150	↓
NOTES: (1) Descent to 50 feet for freefall drops may be made provided good day, VFR, and non-glassy water conditions exist. (2) When possible, a climb to at least 300 feet during turns is recommended, especially for night operations. (3) Datum Marker Buoy Drop Parameters a. Altitude 300 to 500 b. Airspeed 130 – 150 kts c. Water depth 12 feet or deeper d. Ramp					

Figure 2C-7

PART D – AERIAL DISPERSANT DELIVERY SYSTEM

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SYSTEM DESCRIPTION

The ADDS Pack is a self-contained airborne spraying system designed to be installed in rear-loading cargo aircraft and requires no aircraft modification. It is intended to be used in aerial delivery of oil spill dispersants. The system consists of a 5500 gallon tank, a rolling chassis, two extendable airfoil-shaped arms with multiple nozzles, pumps and associated plumbing. This system is specifically designed to easily roll into the cargo compartment and be secured to the aircraft's structure via tie-down devices. All electrical and pump equipment is contained and mounted within a steel framework with a single-point aircraft electrical system interface provided. The system requires 28 volt dc and 208 volt ac electrical power from the aircraft's electrical system.

AIRCRAFT PREPARATION

PRIMARY RESTRAINT METHOD

Before installation of the ADDS Pack aboard a C-130 Hercules aircraft, the cargo compartment, rear loading ramp, and deck areas must be cleared of any obstructions. APS-137 equipment racks should not interfere with a properly loaded ADDS Pack and may be left in place. All ramp conveyors, pallets, and troop seats should be removed, although outboard troop seats may be placed in the upright position in lieu of removal.

When utilizing the primary restraint method, the dual rail system must be removed from the outboard edges of the cargo compartment to access the 25,000 lb. tie-down points. The FAA Supplemental Type Certificate (STC) No. SA3934NM mandates their use for commercial operators using the ADDS Pack. It is the policy of the Coast Guard to comply with this STC unless the alternate restraint method

and devices are in use. The 9 G capable cargo net forward of the ADDS Pack is not required.

The aircraft cargo door shall be fully opened, and the cargo ramp lowered to the horizontal position with a milkstool installed. It is recommended the Adjustable Ramp Support (PN 219-800-101) be used to enable more accurate adjustment of ramp to ground clearance. Air Delivery System (ADS) arms must be installed. After configuring the aircraft, all power should be turned OFF. Plywood shoring will be installed in the cargo compartment due to the pressure exerted on the deck by the wheel system of the ADDS pack.

AIRCRAFT PREPARATION ALTERNATE RESTRAINT METHOD

The alternate restraint method may be used only when the approved alternate restraint devices are available. The dual rail system need not be removed, and the 9 G capable cargo net forward of the ADDS Pack is not required. All ramp conveyors, pallets, and troop seats should be removed, although outboard troop seats may be placed in the upright position in lieu of removal. Approved materials and plans for the Alternate Adapter Plates are maintained at USCG ARSC Technical Services for units desiring this capability (reference ARSC drawing numbers 400-184-1 for Type A and 400-184-2 for Type B). See figure 2D-3.

The aircraft cargo door shall be fully opened, and the cargo ramp lowered to the horizontal position with a milkstool installed. It is recommended the Adjustable Ramp Support (PN 219-800-101) be used to enable more accurate adjustment of ramp to ground clearance. Air Delivery System (ADS) arms must be installed. After configuring the aircraft, all power should be turned OFF. Plywood shoring will be installed in the cargo compartment due to the pressure exerted on the deck by the wheel system of the ADDS pack.

ADDS PACK PREPARATION

The tank should be in the fully retracted position, with the ADDS Pack seated firmly on its platform. The tank is checked visually to ensure that it is empty, then the tank lid is closed and locked. All electrical cables and chains are coiled and stowed on their appropriate tank brackets to avoid dragging or catching during loading.

ADDS PACK LOADING

Loading the ADDS Pack requires a ground crew of four to six persons. The ADDS Pack is maneuvered so the end of the tank marked "To Aircraft" is facing forward, and the trailer is flush with the cargo ramp. The system is transported on a flatbed trailer that allows the tank to be raised and lowered, to simplify this procedure. Once the device and trailer are centered, the ADDS Pack is raised on to its built-in hydraulic wheel system.

A pump handle located on the forward end of the tank is used to hand pump the tank on to its wheel system. Approximately 40 strokes of the hand pump are required to raise the tank to the full up position. The wheel system is designed to raise the empty tank only – a filled or partially filled tank may damage the wheel system.

The pump valve is turned clockwise until it seats, then the breather vent at the top is opened approximately one-half turn. The handle is pumped until the tank is in the full up position.

The ADDS Pack is now positioned in the aircraft. Positioning is critical—the centerline of the dispersant tank must be placed at flight station (FS) 527 and on the lateral centerline, with a tolerance of ± 1 inch both longitudinally and laterally.

WARNING

Failure to properly position the ADDS pack may result in an out of limits CG condition.

Once the tank is positioned, the wheels are retracted. This is accomplished by turning the pump valve counterclockwise one-half turn. After the tank has settled to the deck, the pump valve is turned clockwise to return it to the seated position, and the breather valve is closed.

TANK/ADAPTOR FRAME TIE DOWN PRIMARY RESTRAINT METHOD

Tank tie-down is accomplished by using a series of turnbuckles and chain sling assemblies. Sixteen assemblies are utilized, two for each shackle securing plate. First, the turnbuckles are extended to allow for tie-down and adjustment. The chain sling hooks are connected to the outboard cargo tie-down rings, and the free ends (small hooks) are hooked into the turnbuckles. The assemblies are tightened by hand by turning the turnbuckles. A staggered tightening sequence ensures even load distribution. See figure 2D-1.

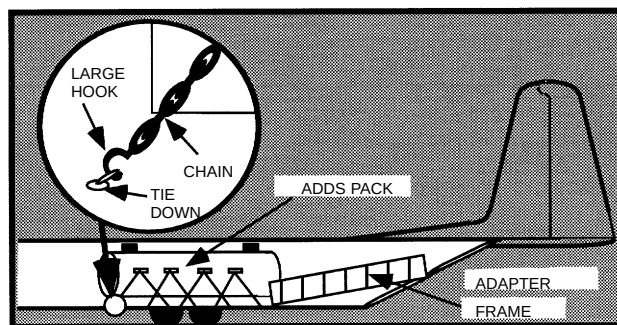


Figure 2D-1

The adaptor frame stabilizer bar is then removed from the adaptor frame. The adaptor frame is drawn out aft until the end frame is positioned over the last set of cargo tie-down rings on the ramp. It may be necessary to remove two shipping bolts securing the adaptor frame to the tank prior to drawing out the frame. The end frame is then secured to the deck using two shackle tie-down devices. These shackles are connected to the tie-down rings directly beneath them and tightened by turning the yellow wing nuts above them. See figure 2D-2 (view of cargo ramp from behind).

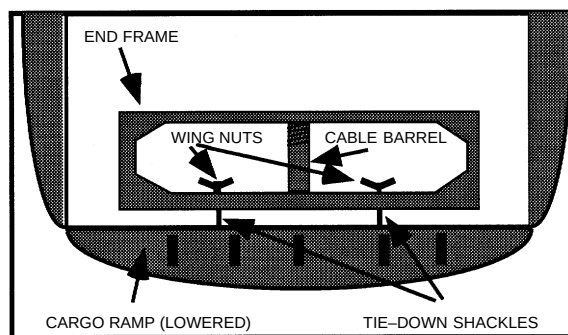


Figure 2D-2

The adaptor frame stabilizer bar is then installed on the second set of sockets located midway on the frame. Boom support cables and pulleys are drawn out from under the adaptor frame and the pulleys are secured to the first row of tie-down rings on the ramp. The ADDS Pack should now be completely secured.

**TANK/ADAPTOR FRAME TIE DOWN
ALTERNATE RESTRAINT METHOD**

The alternate restraint device system for ADDS consists of a total of 12 adapter plates which tie into the 10,000-pound devices on the dual rail system. There are two types of devices. These are Type A and Type B Adapter Plate Assemblies. In order to properly restrain the ADDS pack, 8 Type A and 4 Type B Adapter Plates are required. See figure 2D-3.

Tank tie down is accomplished by using a series of turnbuckles and chain sling assemblies. Sixteen assemblies are utilized. First, the turnbuckles are extended to allow for tie down and adjustment. The chain sling hooks are connected to the shackles on the Alternate Adapter Plates, and the free ends (small hooks) are hooked into the turnbuckles. The assemblies are tightened by hand by turning the turnbuckles. A staggered tightening sequence ensures even load distribution. See figure 2D-4.

The adaptor frame stabilizer bar is then removed from the adaptor frame. The adaptor frame is drawn out aft until the end frame is positioned over the last set of cargo tie-down rings on the ramp. It may be necessary to remove two shipping bolts securing the adaptor frame to the tank prior to drawing out the frame. The end frame is then secured to the deck using two shackle tie-down devices. These shackles are connected to the tie-down rings directly beneath them and tightened by turning the yellow wing nuts above them. See figure 2D-2 (view of cargo ramp from behind).

The adaptor frame stabilizer bar is then installed on the second set of sockets located midway on the frame. Boom support cables and pulleys are drawn out from under the adaptor frame and the pulleys are secured to the first row of tie-down rings on the ramp. The ADDS Pack should now be completely secured.

Type	Tie-down Locations
A	FS 380/400
A	FS 440/460
B	FS 480/500/520
B	FS 540/560/580
A	FS 600/620
A	FS 640/660



TYPE A



TYPE B

Figure 2D-3

ALTERNATE RESTRAINT DEVICE LOCATIONS

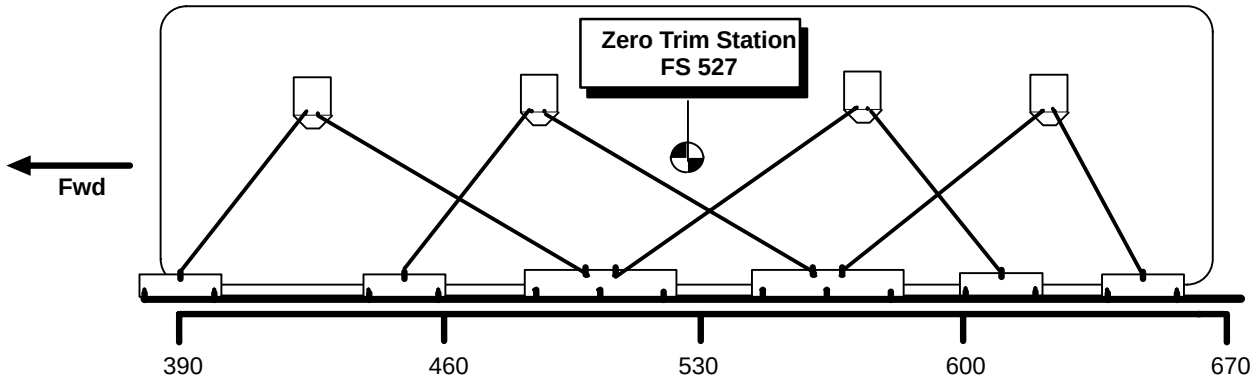


Figure 2D-4

P2 - Control Head Cable
P3 - #1 Pump Motor Cable
P4 - #2 Pump Motor Cable
P5 - Valve Control Cable
P6 - Boom Drive Motor Cable
P7 - Limit Switch Cable
P8 - #1 AC In Cable
P9 - #2 AC In Cable
P12- DC In Cable

The ADDS Pack is next connected to aircraft 28 volt dc power. The rectifier located under the flight deck ladder is utilized. The 5/8-inch nut at the power output terminal is loosened and the ADDS dc hookup will connect directly to the rectifier. The ADDS cable is circuit breaker protected.

Next, ac connections are made. All connections are made at the UPPER MAIN DISTRIBUTION PANEL on the aft side of the FS 245 bulkhead. Two sets of ac leads must be connected – one to the RIGHT-HAND AC BUS, and the other to the LEFT-HAND AC BUS. The 208 volt ac hookups are connected as illustrated in figure 2D–6.

Electrical loads on the aircraft generators are not heavy, and should pose no problems to in-flight operations as long as the aircraft remains clear of icing conditions. Loads may be monitored normally on the flight deck using generator load meters. All electrical wiring is tie-wrapped or otherwise secured in the UPPER MAIN DISTRIBUTION PANEL area to relieve strain on the contacts caused by the weight of the ADDS Pack cables and circuit breaker boxes. Although not originally provided by the manufacturer, the unit should be equipped with a dedicated ground.

Finally, the safety harness for the Control Head Operator and the cable control personnel are checked and adjusted, then secured to the deck using tie-down rings.

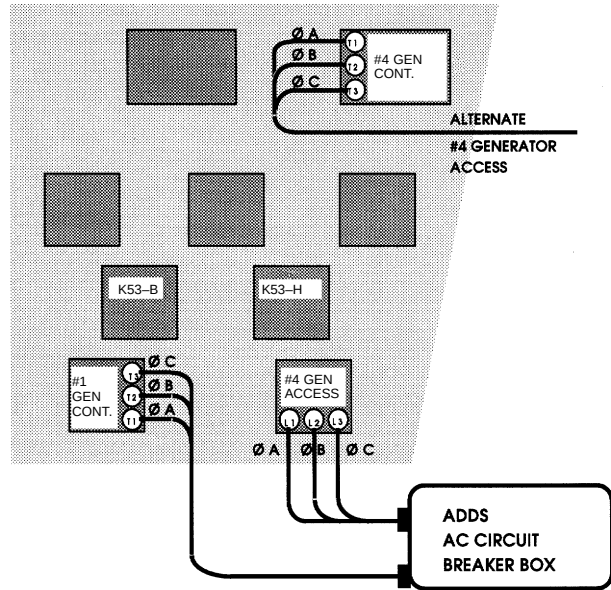


Figure 2D-6

GROUND TESTING THE ADDS PACK

The ADDS Pack should be ground tested before attempting in-flight operations. Ground testing ensures proper function of the system and provides the flight crew an opportunity to familiarize themselves with the equipment.

Ramp and Door Operation

With the tank installed and the adaptor end frame secured to the cargo ramp, close the ramp and door slowly while ensuring that the end frame and booms will not interfere with the ramp operation. Once clearance is confirmed, lower the ramp to the horizontal position and close the door.

CAUTION

Do not lower the loading ramp below the horizontal position as this could result in damage to the adaptor frame unit.

Boom Operation

Ground testing boom extension and retraction of the ADDS Pack requires four personnel. Boom extension and retraction are tested in accordance with the ADDS Manual.

Spray Pump Operation and Rotation

Before the ADDS Pack is filled with dispersant, the spray pumps should be checked for operation and correct direction of rotation. Procedures are specified in the ADDS Manual.

LOADING THE ADDS PACK

The tank can be loaded through the dry disconnect adaptor or directly through the top of the tank lid openings. Procedures are specified in the ADDS Manual.

ADDS PACK OPERATION

ADDS Pack operation is directly controlled by the Control Head Operator stationed in the cargo compartment. Operation of ADDS can be monitored utilizing the Remote Control Head shown in figure 2D-7.

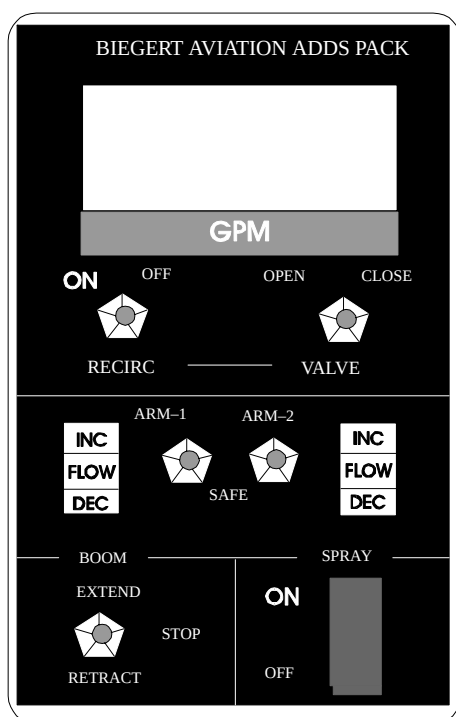


Figure 2D-7

Boom extension and retraction is controlled by the spring loaded BOOM switch. Extension or retraction stops automatically at the limit of travel or upon release of the switch. A technique of boom deployment involves active monitoring by ADDS personnel to ensure cables and pulleys operate smoothly and do not become fouled. This technique is described fully in the ADDS manual. A safety feature of ADDS prevents the pumps from being activated until the booms are fully extended.

Prior to spraying, the Control Head Operator must first arm one or both spray pump motors by pushing forward on the two position safe locking switch, snapping it to the "ARM" position. Most desired flow rates can be obtained using only one pump.

To commence spraying, the Control Head Operator must lift the SPRAY switch guard and place the "Spray" switch in the "ON" position. Spraying ceases when the SPRAY switch is returned to the "OFF" position. The pumps will shut down completely when the safe locking switch is returned to the "SAFE" position.

Flow rates to the booms are controlled by the rocker type switches and can be monitored on the GPM readout on the Control Head. Coverage rates can also be controlled by directly adjusting the aperture on the individual nozzles. This adjustment changes droplet size, and in conjunction with flow rate control, gives a wide range of options for dispersant delivery.

DISPERSANT CHEMICAL HAZARDS

The Contractor will furnish the loading and flight crews with Material Safety Data Sheets (MSDS) for the specific dispersant used on a particular mission. Advise local emergency services or medical personnel of the material being used prior to beginning operations. After first aid has been administered for exposure, get prompt medical attention.

All personnel involved with dispersant applications must receive training in the following topics before beginning dispersant application operations or handling of the dispersant material:

- Hazards associated with chemical exposure and routes of entry
- Review of the MSDS
- Symptoms of exposure and first aid treatment
- PPE requirements
- Actions to take in the event of personal exposure
- Actions to take in the event of a spill
- Decontamination of equipment

Studies have shown that product blow back into the aircraft is not a significant source of exposure. The dispersant is similar in composition to soapy water, and is comparable in weight (approximately 8.14 lbs/gallon). Personnel are not in the direct vicinity of the ramp during actual spraying. The following health information is provided for Corexit®, the most commonly used dispersant:

- Eye contact: May cause irritation or severe pain. May injure eye if not removed promptly.
First Aid. Flush eyes immediately with large amounts of water for at least 15 minutes.

- Skin Contact: Irritating. May be absorbed through the skin to produce hemolytic anemia and kidney damage which may be indicated by pale or possible red color in urine.
First Aid. Flush exposed skin immediately with large amounts of water. Remove all contaminated clothing. Wash with plenty of soap and water.
- Inhalation: Vapors and aerosol mists are irritating to the eyes and respiratory tract in high concentrations.
First Aid. Move affected individual into clean air. Administer rescue breathing if breathing has stopped. Keep victim at rest.
- Ingestion: Low order toxicity.
First Aid. If swallowed and individual is conscious, induce vomiting.

PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS

Flight Deck Crew

If the flight deck crew remains clear of the aircraft and loading operations while material is being loaded, normal flight gear will be worn.

PRODUCT LOADERS, MAINTENANCE, DECONTAMINATION, AND SPILL RESPONSE PERSONNEL

The following PPE will be worn:

- Chemical protective overalls; polyethylene coated Tyvek®
- Gloves; nitrile or butyl rubber. Sleeves or coveralls will be worn over glove gauntlets
- Boots; butyl rubber. Cuffs of coveralls will be worn over boot tops
- Goggles; chemical protective with indirect venting
- Face shield

ADDS OPERATOR AND BOOM CONTROLLERS

The following PPE will be worn:

- Chemical protective overalls; polyethylene coated Tyvek®. Coveralls will be worn over normal flight suits. Cuffs will be taped with duct tape to secure them over boots

- Gloves; nitrile or butyl rubber. Sleeves of coveralls will be worn over glove gauntlets
- Boots; chemical resistant leather
- Goggles; chemical protective with indirect venting

Additional Requirements

Portable eye wash stations capable of delivering one gallon per minute for 15 minutes will be available at the loading site and within the aircraft. Provide a deluge shower or other means of delivering large quantities of water in case of exposure at the loading site.

Access to the aircraft and loading site will be limited to those individuals who are necessary to the operation.

Decontamination

- Personnel: Wash with soap and water after operations are completed. Wash hands and face prior to eating meals, smoking, and coffee breaks
- PPE. Wash with soap and water. Do not launder coveralls or other contaminated clothing with personal clothing. If the services of a commercial laundry are used, the laundry must be informed of the possible contaminants
- Aircraft and Application Equipment. Wash with soap and water. Consult applicable maintenance publications for specific guidance

Spill Control Procedures

- Eliminate ignition sources.
- Prevent additional discharge of material if this can be done without additional exposure
- Contain spill using sand or soil. Do not use combustible materials such as sawdust. Prevent liquid from entering water or sewer
- Recover liquid by pumping or by using nonflammable sorbents. Place contaminated sorbents in leak proof containers

MISSION PROFILE

The ADDS mission requires extensive planning due to the heavy weight of the system and dispersant load. Since dispersant cannot be quickly jettisoned in the event of engine failure, three engine performance combined with limitations imposed by the Weight Limitations charts must be closely considered. Assuming standard day conditions, the following conditions illustrate the limitations imposed by the heavy weight of the ADDS: Aircraft operating weight

80,000 lbs, fuel 29,000 lbs, total ADDS 43,000 lbs (4,590 gal Corexit® 9554 @ 8.38 lb/gal), gross takeoff weight 152,000 lbs. In the event of engine failure, fuel dumping to 8,000 lbs remaining (wing limiting fuel) would yield acceptable three engine aircraft climb rate. This would allow a 2 hour (round trip) transit and 1 hour on scene with a 12,000 lb reserve.

LIMITATIONS

- Minimum climb performance (3 engine) 300 fpm
- Minimum altitude 100 feet AWL (level)
Non-glassy conditions required for descents below 150 feet AWL
- Minimum airspeed (50% flaps) 140 knots
- Maximum bank angle below 500 feet AWL 30°
- Required flap setting (spray booms deployed) 50%
- Fuel Management Primary
- Aft CG limit (spray booms deployed) 28% M.A.C.



To prevent generator overloading, simultaneous operation of electrical anti-icing/deicing equipment, cargo compartment underfloor heating and ADDS Pack electrical equipment is prohibited.

EMERGENCY OPERATION OF ADDS

The ADDS manual does not make specific recommendations for in-flight failure, although general maintenance is described. Probably the most common occurrence would be the failure of the booms to retract or deploy normally. Biegiert Aviation claims that aerodynamic characteristics of deployed booms are virtually unnoticeable to the pilot, and provisions exist for manual retraction. It appears that a landing with booms deployed may cause damage to the boom tips themselves, but is feasible without significant risk to aircraft or crew.

Jettisoning the ADDS Pack in the event of an emergency is not feasible. The tie-down arrangement would take considerable time to undo, and the tank cannot be raised on to its wheel system while it contains fluid, so rolling it out is virtually impossible.

Dispersant Product Jettison

Prior to takeoff, hoses are removed from the spray arms and positioned against the closed left paratroop door. These two hoses are then secured to the deck using standard tie-down devices, leaving about one foot of hose free and lying at the bottom of the door. In an emergency, the paratroop door is partially opened and the hoses further secured to the cargo floor using another tie-down device. The hoses protrude approximately four inches into the slipstream. In this configuration, the pumps can discharge the product at a rate of approximately 100 gallons/minute. Back force on the open hose ends is approximately 100 pounds.

It is possible to drain the tank while in the aircraft, even in the event of a dual pump failure. Using the boom hoses, it should be possible to drain the dispersant using gravity, and dump most of the fluid overboard via the ramp or paratroop doors, although this may result in some fluid blowing back into the cargo compartment.

CHECKLISTS

The following checklists include Dispersant checklists: Pilot's Abbreviated Checklist (C.G.T.O. 1C-130-1CL-1), Loadmaster/Dropmaster Abbreviated Checklist (C.G.T.O. 1C-130-1CL-3), and Flight Engineer's Abbreviated Checklist (C.G.T.O. 1C-130-1CL-5). Due to the uniqueness of the dispersant mission; notes, cautions, and warnings are included in the abbreviated checklists.

TRAINING

Initial Qualification: Both Pilots, the Flight Engineer, and Loadmaster must be qualified to fly an ADDS mission. If a person is flying the mission and is unqualified or noncurrent, he/she shall perform their duties under the direct supervision of an ADDS qualified instructor in the applicable crew position.

Currency: Both Pilots, the Flight Engineer, and Loadmaster must fly one ADDS Mission on a semi-annual basis. If an aircrew member fails to complete the required currency requirements he/she lapses to unqualified for ADDS missions. To regain qualification, he/she shall perform their duties under the direct supervision of an ADDS qualified instructor in the applicable crew position.

NOTE

For the purpose of this manual, one ADDS mission consists of loading the ADDS pack on the ground, flying the pack and deploying the booms with or without spraying, and unloading the system again.

PRE-DISPERSANT CHECKLIST

NOTE

Complete Operational Descent Checklist prior to initiating the Pre-Dispersant Checklist. The Loadmaster operates the ADDS and ramp/door control panels. The two Dropmasters attach/detach and monitor movement of boom support cables and hoses.

1. Air start engines
- If required
- (CP)



All engines/generators will be running for ADDS drops. If an engine or generator fails during dispersant application, abort dispersant mission.

2. Drop Briefing
- Completed
- (P)
- a. Copilot, flight engineer, and dropmaster – Configuration, airspeeds, altitude.
- b. Navigator – Radar and INS use.
- c. Dropmaster – Spray on/off commands.
- d. ALL – Pattern, voice procedures and ICS use, safety precautions, emergency procedures.
3. Pressurization
- No pressure
- (E)
4. Ramp support arms
- Connected
- (DM)
5. Safety/Personal Protective Equipment
- On, checked
- (LM)
6. Flaps
- 50 percent
- (CP)(P)
7. Safety harness
- On, checked
- (LM)



Ensure that all crew members involved are wearing properly adjusted restraint harnesses. All other personnel aft of the forward end of the ADDS Pack will wear restraint harness or will be seated with seat belts fastened. In the event of dispersant spill or leak, personnel participating in repair cleanup shall use oxygen equipment set to 100%.

8. ISAR
- Set
- (N)

NOTE

The ISAR may be returned to an operating mode after the AUX Pump is ON and stable.

9. Ramp and door
- Clear to open
- (P)
- Aux pump On
- (LM)
- Open and locked
- (LM)

NOTE

The Dropmasters will ensure that ADDS hoses/cables remain clear during ramp and door movement. The ramp shall be in the airdrop or horizontal position. The cargo door shall be fully open and locked with flag visible.

10. Boom support cables/ramp actuator covers	“Attached”	(DM)
11. Ready for boom deployment	“Ready”	(LM)
12. Spray booms	“Clear to extend”	(P)
	“Extending”	(LM)
	“Extended”	(LM)



Boom support cables must not be allowed to drop below and under the ramp during extension. If this occurs, the Loadmaster must stop boom extension and allow the Dropmaster to correct the routing of the cables. If this condition is not corrected, serious damage to the boom extension system will result.

NOTE

The Loadmaster actuates the BOOM switch to the EXTEND position until the booms are fully extended. The ISOL DC ON BATT light may illuminate momentarily. The Dropmasters ensure cables and hoses remain clear of obstructions during deployment and, if necessary, attach hoses to booms after partial boom extension.

13. Landing lights	“As required”	(P)
14. Underfloor heating switch	“OFF”	(E)
15. Recirculating fan switch	“OFF”	(E)
16. Propeller ice control switches	“OFF”	(E)
17. Ready for spray	“Ready”	(P)(LM)(CP)
18. Pre-dispersant checks	“Complete”	(E)(N)(LM) (DM)(CP)

DISPERSANT APPLICATION

1. Spray pump motor #1 and/or #2	“Clear to arm”	(P)
	“Armed”	(LM)

NOTE

Most required flow rates can be obtained by arming only one of the two spray pumps. The second pump is intended as a backup system; however, higher flow rates can be obtained by arming both pumps.

2. SPRAY switch	“ON” (on command of pilot)	(LM)
3. SPRAY switch	“OFF” (on command of pilot)	(LM)

NOTE

On command from the Pilot, the Loadmaster actuates the spray switch as needed. Continuous ICS coordination is required.

POST-DISPERSANT CHECKLIST

1. ARM-1 and ARM-2 switches	“SAFE”	(LM)
2. Armed location markers	“Jettison”	(CP)(LM)
3. Spray booms	“Clear to retract”	(P)
	“Retracting”	(LM)
	“Fully retracted”	(LM)
4. Boom support cables/ramp actuator covers	“Detached”	(DM)

NOTE

The Dropmasters pass cables around ADDS arms and ramp actuator pistons, guide the cables back to the boom support pulleys, and detach boom support cables from the booms.

5. ISAR	“Set”	(N)

NOTE

The ISAR may be returned to an operating mode after the AUX Pump is OFF.

6. Ramp and door	“Clear to close”	(P)
	“Aux pump On”	(LM)
	“Closed and locked”	(LM)
7. Pressurization	“As required”	(E)
8. Underfloor heating switch	“As required”	(E)
9. Recirculating fan switch	“As required”	(E)
10. Propeller ice control switches	“On”	(E)
11. Landing lights	“As required”	(CP)
12. Flaps	“Up”	(CP)(P)
13. Pressurization	“Set”	(E)
14. Altimeters and RADALT	“Set, state setting”	(CP)(P)(N)
15. GPWS override switches	“NORMAL”	(CP)
16. Unarmed location markers/equipment	“Removed and stowed”	(LM)
17. Post-dispersant checks	“Complete”	(E)(N)(LM) (DM)(CP)

NOTE

After spraying operation, correct any leaking nozzles as soon as possible to prevent spillage of dispersant on the aircraft deck. Any spillage in the ramp area should be cleaned up immediately.

PART E – SYSTEM OPERATION

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INTRODUCTION

The descriptions and operating instructions contained in this section are for systems which are peculiar to those airplanes or systems that require emphasis. In some cases the information given overlaps that given in the general description of the system concerned. In other cases, instructions are given which do not appear elsewhere in the manual.

ELECTRONIC FUEL CORRECTION

Electronic fuel correction is controlled by the TD control valve through operation of the temp datum control valve switches on the flight control pedestal. Refer to Section I for description of the TD valve and switches.

Locking the TD valve provides these advantages:

During the landing approach, locking the TD valve before the throttles are retarded should give more equal power distribution on all engines.

In the event of a TD control malfunction causing rpm and temperature fluctuations, locking the TD valve may stop the fluctuation.

During pitch-lock propeller operation, locking the TD valve will prevent a crossover bump which could cause an increase in blade angle that could break pitch lock.

Do not lock the TD valve under the following condition:

During power transients – wait for the engine to stabilize at new power setting.

TEMPERATURE CONTROLLING CHECK

NOTE

If the temperature controlling check is being performed for a suspected TD system/TIT indicating problem during engine start, it is imperative that the suspect system be compared to the symmetrical engine during these checks. Significantly higher fuel flow and/or torque in comparison with the other engines for the same throttle setting is indicative of a faulty TD/TIT system. Maintenance action is required before flight.

Advance the throttles and observe the turbine inlet temperature change as electronic fuel controlling is reached. (Normally fuel correction lights go out when temperature-controlling is reached.) The turbine inlet temperature at this point, when normal, will be 800 ° C to 840 ° C (–15 engines).

If the TIT does not change when electronic fuel controlling is reached, proceed as follows:

1. Symmetrical throttles – Set approximately 910 °C (–15 engines) TIT
2. Wing or empennage anti-icing switch – ON



Do not operate the wing or empennage anti-icing on the ground for more than 30 seconds.

The TIT should rise slightly and then return to the previous setting. If the TIT does not return to the previous setting, the temperature controlling system has malfunctioned.

3. Wing or empennage anti-icing switch – OFF
4. Throttles – As required



If the temperature controlling system has failed and the mission dictates, place the TD valve switch for that engine to the null position. If the TIT stabilizes, continue operation, and monitor TIT closely as maximum TIT can often be exceeded at advanced throttle settings. If the malfunction persists, other engine systems are at fault. Maintenance action is required prior to flight.

PROPELLER NORMAL GOVERNING REINDEXING

This procedure should be performed to correct certain indications of propeller malfunction caused by the synchrophaser.

Since propeller operation is more stable in-flight than on the ground, reindexing, when necessary, should be performed during stable flight conditions. However, if normal governing is out of limits or fluctuating on the ground, this procedure should be performed before considering the condition discrepant. During the reindexing procedure, the time elements and steps must be closely followed in correct sequence or the procedure may not be effective. If the first attempt to reindex proves ineffective, the entire procedure should be

carefully repeated before the airplane is returned to maintenance.

Reindexing Procedure:

NOTE

Run-up area wind conditions may cause excessive rpm fluctuations, and may also affect reindexing procedures.

If this procedure is performed on the ground, all throttles must be set 8,000 to 9,000 inch-pounds torque. This will ensure that the propellers are governing.

1. Place all propeller governor control switches to MECH GOV.
2. Select a master engine and wait 20 seconds.
3. Hold the prop resynchrophase switch in the RESYNC position while performing steps 4. and 5.
4. Place all propeller governor control switches to NORMAL and wait 20 seconds.
5. Place the synchrophase master switch to OFF.
6. Release the prop resynchrophase switch to normal and wait 20 seconds.
7. Repeat steps 1. through 6. for the other master.

INVERTER SYSTEM

OPERATIONAL CHECK

1. Turn each inverter control switch to the DC BUS position. The selected power off light should not illuminate when the inverters have stabilized. Check attitude indicators and TIT gauges for power indication.

NOTE

(1600 series, CG 1790 and 1700 series) Allow the pilot's and copilot's ADIs to erect (flags out of view) prior to changing position of the copilot's ac instrument switch. If the power is switched prior to gyro erection, the gyro may not erect properly. Improper gyro erection is indicated by the flags being out of view and the gyro attempting to erect very slowly. If a slow erection occurs to both ADIs at the same time, place the copilot's ac instrument switch to the OFF position for approximately 10 minutes. If only one ADI is affected, remove the Flt Dir Gyro and Ind fuses (Phase A and B) located on the copilot's AC Inst Bus for the affected system for approx-

imately 10 minutes, then reset. Do not place the inverter control switch to the OFF position.

2. Place the voltage and frequency selector switch to the inverter position.
3. Check the copilot's inverter by placing the phase selector switch (1500 series) to A and B phase, (1600 series, CG 1790, 1700 series) A phase only and reading the voltage and frequency.
4. Check the ac instrument and engine fuel control inverter by placing the phase selector switch to the C phase and reading the voltage and frequency.
5. Turn each inverter control switch to the AC BUS position. The selected power off light should not illuminate. The frequency and voltage cannot be read in this position. Check attitude indicators and TIT gauges for power indications.

FUEL SYSTEM

WARNING

Main tank boost pump switches will not be turned OFF in flight unless directed by a specific procedure in the flight manual.

OPERATIONAL CHECK (on ground)

NOTE

When the ATM/APU generator is used for supplying ac power, only the No. 2 boost pump will be operative and fuel system check will be accomplished on the BEFORE TAKEOFF checklist.

1. All pumps OFF.
2. Open all crossfeed valves, close crossfeed separation valve.
3. Turn No. 1 boost pump on. Check that no pressure is indicated. Open crossfeed separation valve and check that pressure is within limits. Close No. 1 crossfeed valve and deplete pressure. (Pressure buildup indicates internal leakage of crossfeed valve, or valve did not close.) Turn pump off.
4. Repeat step 3. for No. 2 main tank.

NOTE

If either the auxiliary or external tank(s) is empty when performing steps 5. through 10., the respective crossfeed valves must still be checked to ensure proper operation by opening the bypass valve and the crossfeed valve of the empty tank, noting a pressure buildup, then closing the valves.

5. Turn left auxiliary boost pump on. Check that pressure is within limits. Close left auxiliary crossfeed and deplete pressure. (Pressure buildup indicates internal leakage of crossfeed valve, or valve did not close.) Open left bypass valve. Check pressure. Close left bypass valve and deplete pressure. Turn pump off.
6. Turn forward left external boost pump on. Check that pressure is within limits. Turn pump off and deplete pressure.
7. Turn aft left external boost pump on and check pressure. Close left external crossfeed valve and deplete pressure. Turn pump off.
8. Turn aft right external boost pump on and check pressure. Close right external crossfeed valve and deplete pressure. Turn pump off.
9. Turn forward right external boost pump on and check for no pressure. Open right bypass valve (note pressure indication). Close bypass valve and deplete pressure. Turn pump off.
10. Turn right auxiliary boost pump on and check pressure. Close right auxiliary crossfeed valve and deplete pressure. Turn pump off.
11. Repeat step 3. for No. 3 and No. 4 main tanks, except after No. 4 pump has been checked, depress the crossfeed primer button for 30 seconds. Close No. 4 crossfeed valve and the crossfeed separation valve. Deplete pressure. (This checks crossfeed separation valve operation with primer button.)
12. Open No. 2 crossfeed valve (1500 series).

FUEL MANAGEMENT

Fuel management is accomplished at the main fuel control panel (figures 1A-39 and 1A-40). Fuel routing is governed by fuel tank selection and crossfeed and bypass valve positioning. Fuel gauges on the panels indicate individual tank quantities, and a totalizer indicates total fuel remaining in the wing and external tanks. An additional check of fuel

quantity may be made by keeping a log based on engine fuel flow and time.

CAUTION

When the airplane is parked with the fuel tanks more than three quarters full, all crossfeed valves must be closed. Otherwise, low tanks may be overfilled by slow transfer of fuel through the boost pump check valve bleed orifice from the crossfeed manifold.

NOTE

Fuel tank gauges should be read while airplane attitude is within 3° roll and 0° pitch to obtain the most reliable readings. Because fuel tanks are located in the wings, it is important to maintain a balanced weight. If fuel weight becomes unbalanced through varied rates of consumption or from having engines shut down, periodic trimming is required. The distribution limits are listed below.

1. Outboard tank fuel should be maintained at 500 to 1000 pounds more than the corresponding in-board tank.
2. The distribution between symmetrical main or external tanks should never vary more than 1000 pounds.
3. The total fuel weight of one wing should be maintained within 1500 pounds of the other wing (including auxiliary tanks) except as stated in paragraph 4.
4. If the auxiliary tanks differ by more than 1500 pounds, all other tanks must be either symmetrically loaded or loaded up to 1500 pounds heavier on the wing with the lighter auxiliary tank. Paragraphs 1 and 2 must still be complied with.

Fuel Flow

Design of the airplane allows tank-to-engine or crossfeed fuel flow. Tank-to-engine routing is normally used at all times when fuel is being taken from the main tanks. Crossfeed is used when using fuel from the auxiliary, external, or fuselage tanks, when trimming a tank, or in other special uses. Boost pump operation is recommended at all times to ensure adequate engine supply pressure. Refer to Section I for the fuel system schematic diagram.

STANDARD FUEL SEQUENCE

Standard fuel tank usage sequence is external, auxiliary, then main. As the auxiliary fuel tanks have only one boost pump, auxiliary fuel may be used before external fuel on long range missions if failure of the auxiliary boost pump(s) would preclude reaching a suitable landing field.

Main tank fuel may be used prior to auxiliary fuel when high rate-of-sink landings are planned on missions requiring more total fuel than is allowed in the main tanks.

When opening main tank crossfeed valves, observe fluctuation of fuel pressure for indication that the valve has opened. When operating an engine on crossfeed from any tank that fuel has not previously been used, monitor TIT, torque and fuel flow for approximately 1 minute.

CAUTION

When operating with less than 6,000 pounds of total fuel in the main tanks, place the crossfeed valve switch to OPEN and the boost pump switch to ON for all tanks containing fuel; place the crossfeed separation valve switch to OPEN. When fuel quantity of any main tank is less than 1,000 pounds, the engine being fed by that tank will be placed on crossfeed operation.

NOTE

If the secondary fuel pump pressure light flickers or comes on steady while on crossfeed from the auxiliary or external tanks, discontinue crossfeed. If the secondary fuel pump pressure light is extinguished, this may be an indication of a malfunctioning pressure switch, secondary pump outlet check valve in the high pressure filter assembly, or paralleling valve. Normal crossfeed operation may be resumed; closely observe fuel flow, turbine inlet temperature and torque.

Takeoff

To obtain the correct fuel flow for takeoff:

1. All crossfeed valves – CLOSE
2. All main tank boost pumps – ON

Fuel Tank Trimming

WARNING

Maintain two engines on tank-to-engine flow during fuel tank trimming.

To take fuel from a heavy tank:

1. Boost pump (heavy tank) – ON
2. Crossfeed valve (heavy tank) – OPEN
3. Crossfeed separation valve – OPEN

4. Crossfeed valve (light main tank or tanks) – OPEN
5. Boost pump (light main tank or tanks) – OFF

When trimming is complete:

6. Boost pumps and crossfeed/separation valves – As required

Approach and Landing

The crossfeed valve switches may be left in the OPEN position for approach, landing, touch-and-go landing, and stop-and-go landings that remain in place on the runway for immediate takeoff provided all main tank boost pump switches are in the ON position and the crossfeed separation valve switch is in the CLOSE position.

USE OF WHEEL BRAKES

It is absolutely necessary that airplane brakes be treated with respect. Always use reverse thrust to minimize brake wear. Although the anti-skid system will give consistently shorter landing rolls on dry runways, it should not be used to its maximum potential to make all landings as short as possible.

To minimize brake wear, the following precautions should be observed insofar as practicable:

Use extreme care when applying brakes immediately after touchdown or at any time there is considerable lift on the wings if the anti-skid system is inoperative. A heavy brake pressure can result in locking the wheels more easily if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the airplane is on the wheels. A wheel once locked in this manner will not unlock when the load is increased, as long as brake pressure is maintained. Brakes, by themselves, can merely stop the wheel from turning. Stopping the airplane is dependent on the friction of the tires on the runway. There are two reasons for this loss of braking effectiveness in a skid. First, the immediate action is to scuff the rubber, tearing off little pieces which act like small rollers under the tire. Second, the heat generated starts to melt the rubber and the molten rubber acts as a lubricant. Therefore, if one pair of wheels is locked during application of brakes, there is a tendency for the airplane to turn away from the locked wheels, and further application of brake pressure to those wheels will offer no corrective action. Since the coefficient of friction goes down when a wheel begins to skid, it is apparent that a wheel, once locked, will never free itself until brake pressure is reduced.

Anti-skid systems are intended to prevent skids at high speeds under light wheel loads. Therefore, brakes may be applied immediately after touchdown, with anti-skid, but this should be done only when definitely necessary. The anti-skid system will function to prevent tire skidding if it is operating properly; however, it is not designed to perform as a completely automatic braking system. Continuous braking from the point of touchdown will result in considerable overworking of the anti-skid system in addition to causing excessive wear and extreme heating of the brakes.

If maximum braking is required after touchdown, lower the nose as soon as possible, and apply the brakes. Reverse thrust should be used whenever possible.

For short-field landings, a single, smooth application of the brakes with constantly increasing pedal pressure is most desirable.

If maximum braking has been used in landing, it is recommended that the gear be left extended after subsequent takeoff for a minimum of 15 minutes before retraction or before another braked landing is attempted. The parking brakes should not be set if the airplane is parked subsequent to such a landing, and the airplane should be taxied using the minimum amount of brakes necessary for safety.

WARNING

Failure to cool the brakes could result in a tire explosion and damage to the airplane.

The full landing roll and propeller reversing should be used at all times to minimize the use of brakes. After normal landings where the brakes are not used and only checked during landing ground roll, allow 15 minutes cooling time preceding the next takeoff to account for brakes used during taxi. This is required because critical field length increases due to brakes being above ambient temperature. If the runway is at least 300 feet longer than critical field length, the 15-minute cooling time may be omitted. At the first indication of brake failure or after the brakes have been used excessively or hot brakes are suspected, have the fire department crash crew make an inspection of the brakes and tires as brake fires are possible.

Maximum braking during landing at heavy gross weight is the most likely case where hot brakes should be suspected.

WARNING

All personnel other than those in the fire department should evacuate the immediate area. The area on both sides of the wheel will be cleared of personnel and equipment for at least 300 feet. Do not approach the main wheel area when extreme temperatures due to excessive braking are suspected. If conditions require personnel to be close to an overheated wheel or tire assembly, the approach should be from the fore or aft only.

Do not taxi into crowded parking areas or set the parking brake when the brakes are overheated. Peak temperatures occur in the brake assembly from approximately 1 to 5 minutes and in the wheel and tire assembly from approximately 20 to 30 minutes after a maximum braking operation.

Do not taxi or tow the airplane for at least 15 minutes after overheated brakes have been cooled.

Do not drag the brakes while taxiing. If taxiing downhill or downwind and use of reverse thrust results in excessive oil temperature, stop the airplane with brakes, then allow the airplane to accelerate until brakes must be reapplied to avoid high taxi speed. Continue this cycle as required. Note that this will result in less heat buildup than dragging the brakes. Use the brakes as little as possible for turning the airplane on the ground.

Release the parking brakes as soon as possible after the wheel chocks are in place.

WARNING

After any full anti-skid braking operation (maximum effort landing, aborted takeoff, engine-out/ flaps-up landing, etc.) assure adequate brake/tire cooling prior to further aircraft operation. Approximate cooling time for the brake is 60 minutes.

AIR CONDITIONING SYSTEMS

The air conditioning systems can be operated from bleed air supplied by the gas turbine compressor/auxiliary power unit or by the engines while the airplane is on the ground, or an external ground compressor unit may be attached. The engines supply the bleed air for operating the air conditioning systems in flight.

GROUND AIR CONDITIONING

Ground air conditioning is accomplished by using either an external unit or the airplane air conditioning system.

Air Conditioning with an External Unit

1. Place a ground air conditioning adapter in the air scoop of the system to be operated.
2. Attach the hose of the ground air conditioning unit to the adapter.
3. Position the air conditioning master switch to AUX VENT.

NOTE

Air scoop adapters for ground air conditioning are stowed on a rack aft of the right paratroop door.

Air Conditioning with Airplane System

1. Place the engine bleed air switches in the CLOSED/OFF position.
2. Start the gas turbine compressor/auxiliary power unit.
3. Place the gas turbine compressor/auxiliary power unit bleed air switch in OPEN.
4. Check the bleed air pressure gauge.
5. Position the air conditioning shutoff switches to NORMAL.
6. Position the emergency depressurization switch to NORMAL.
7. Turn the air conditioning master switch to AIR COND GTC (1500 series), NO PRESS (1600 series, CG 1790, and 1700 series).

CAUTION

(1500 series) If the engine bleed air valve switches are in the OPEN position and the air conditioning master switch is in the AIR COND GTC position, the cargo compartment airflow regulator will go to the full flow position. In this position, sufficient air may not be available to operate the ATM and the flight deck air conditioning system.

CAUTION

(1600 series, CG 1790, and 1700 series) If both the flight station and cargo compartment air conditioning units are operated with only the APU supplying bleed air or with all engines in low-speed ground idle, APU EGT limits may be exceeded.

8. Hold the temperature switches in COOL or WARM as desired for 30 seconds; then return to AUTO. This procedure will position the temperature control valve to the approximate desired position more rapidly and minimize the amount of hot bleed air entering the compartment when the temperature rheostats are in COOL.
9. Position temperature rheostats as desired.

NOTE

(1600 series, CG 1790, and 1700 series) Use recirculating fan if LH ac bus is powered.

10. Turn the air conditioning master switch to OFF before starting an engine.
11. With one or more engines operating, place the air conditioning master switch in AIR COND NO PRESS.

IN-FLIGHT AIR CONDITIONING

1. Place the air conditioning master switch in AIR COND AUTO PRESS, AIR COND MAN PRESS, or AIR COND NO PRESS, as desired.
2. Position temperature switches to AUTO.
3. Position temperature rheostats as desired.
4. Position underfloor heat switch to ON.

CABIN PRESSURIZATION SYSTEM**PRESSURIZED FLIGHT – AUTOMATIC PRESSURE CONTROL**

To allow rapid egress in event of an emergency, do not pressurize the airplane during taxi or takeoff operations.

Before Takeoff

1. Turn the rate knob to MIN.
2. Set the cabin alt knob to the desired cabin altitude, but never less than field pressure altitude.
3. Set the air conditioning master switch to AIR COND AUTO PRESS.

After Takeoff/Climb

1. Set the rate knob to the desired rate.

Adjust the rate setting as required during climb so that the cabin reaches the selected altitude at the same time the airplane reaches cruise altitude. Thus, the rate of cabin pressure change is held to a minimum. The rate of cabin pressure change is held constant only up to pressure controller differential limit.

NOTE

Monitor cabin altitude against airplane altitude to make sure that cabin altitude stays within the isobaric range. (See figure 1A-73.)

Cruise

During pressurized flight, monitor the cabin differential pressure and cabin altitude. Do not allow cabin differential pressure to exceed the maximum allowable for the airplane.

Descent

1. Set the cabin alt knob for the desired cabin altitude.
2. Set the rate knob to desired rate.

Before Landing

Check the cabin differential pressure before landing. If more than 1.5 inches of mercury is indicated, the cabin altitude selector and the rate knob should be adjusted to higher settings to increase the rate of depressurization.

NOTE

Cabin differential pressure will be zero for landing. If the differential pressure is less than 0.5 inch of mercury, no discomfort will be experienced if the air conditioning master switch is turned to a non-pressure position.

PRESSURIZED FLIGHT – MANUAL PRESSURE CONTROL**Before Takeoff**

1. Set cabin altitude selector to 10,000 feet and position air conditioning master switch to AIR COND MAN PRESS.

2. Hold the manual pressure control switch to the INCREASE position until a pressure indication is noted on the cabin rate-of-climb indicator. Then toggle switch to the decrease position until the decrease pressure indication has returned to zero rate. Maintain the cabin in the nonpressurized condition until airborne.

After Takeoff/Climb

Hold the manual pressure control switch in the INCREASE position until an indication of cabin pressure is observed on the cabin vertical velocity indicator. Exercise caution during manual pressure control in order to prevent excessive rates of cabin pressure change which can cause extreme discomfort to passengers and crew. Operation of the manual pressure control switch by momentarily holding it in the desired position and then releasing it to the OFF position will provide satisfactory control. Monitor the airplane vertical velocity indicator, cabin vertical velocity indicator, the cabin differential pressure gauge, and the cabin altimeter. Establish, as closely as possible, a constant cabin rate-of-climb by intermittently positioning the manual pressure control switch momentarily to the INCREASE position. By reaching the normal differential pressure at the desired cabin altitude when the airplane reaches cruise altitude, the minimum rate of cabin pressure change will be attained.

NOTE

Monitor cabin altitude against airplane altitude to make sure that cabin altitude stays within the isobaric range. (See figure 1A-73.)

Cruise

When the airplane has reached stabilized cruise conditions, adjust the outflow valve with the manual control switch to maintain a constant differential pressure and constant cabin pressure gauge and the cabin altimeter so as not to exceed the allowable limits.

Descent

As soon as the airplane starts the descent, position the manual pressure control switch momentarily to the INCREASE position, in order to establish a decrease of cabin pressure altitude. Maintain a comfortable rate of cabin pressure change by intermittently positioning the outflow valve until the desired altitude is reached. Allow cabin differential pressure to decrease by positioning the manual pressure control switch to open the outflow valve.

Before Landing

Check the cabin differential pressure prior to landing. If more than 1.5 inches of mercury differential pressure exists, momentarily position the manual pressure control switch to

the DECREASE position, to control the rate of cabin depressurization.

Set air conditioning master switch (as required).

NOTE

Cabin differential pressure will be zero for landing. If cabin differential pressure does not exceed 0.5 inch of mercury, no discomfort will be experienced if the airplane is depressurized by turning the air conditioning master switch to a nonpressure position.

NONPRESSURIZED FLIGHT

Before Takeoff

1. Set the air conditioning master switch to AIR COND NO PRESS or AUX VENT.

TRANSITION FROM NONPRESSURIZATION TO PRESSURIZATION DURING FLIGHT

1. Turn rate knob to MIN.
2. Set cabin alt knob to desired cabin altitude.
3. Turn air conditioning master switch to AIR COND AUTO PRESS.

Allow cabin differential pressure to build up to approximately 2 inches of mercury to provide sufficient pressure for the pneumatically actuated controller to stabilize and maintain a selected rate.

4. Turn rate knob to desired rate.

Adjust the rate setting so that the cabin reaches the selected altitude at the same time the airplane reaches cruise altitude. The rate of cabin pressure change is thus held to a minimum.

TRANSITION FROM PRESSURIZATION TO NONPRESSURIZATION DURING FLIGHT

1. Set rate knob to desired rate.
2. Set cabin altitude knob to airplane altitude at altitudes below 10,000 feet.
3. When above 10,000 feet, turn the air conditioning master switch to AIR COND MANUAL PRESS, and hold the manual pressure control switch in the DECREASE position.

Cabin altitude will increase at the rate selected until cabin pressure equals atmospheric pressure. The differential pressure is thus reduced at a controlled rate.

4. Turn air conditioning master switch to AIR COND NO PRESS (as soon as differential pressure reaches zero).

PRESSURIZATION TRANSITION FROM AUTOMATIC TO MANUAL

NOTE

The most successful pressurization transition operation is accomplished when the airplane is operating under stable conditions at altitude, and the cabin vertical velocity indicator shows zero change in vertical velocity.

1. Place the air conditioning master switch to AIR COND MAN PRESS.
2. Hold the manual pressure control switch in the INCREASE position approximately 40 seconds or until the needle of the cabin vertical velocity indicator indicates a slight descent (approximately 300 to 500 feet), while the aircraft altitude remains constant.
3. Set the cabin altitude selector to 10,000 feet.



Do not force the cabin altitude knob above 10,000 feet. To do so may damage the pressure controller.

4. Operate the pressurization system as described in the Manual Pressure Control paragraph.

PRESSURIZATION TRANSITION FROM MANUAL TO AUTOMATIC

NOTE

The most successful pressurization transition is accomplished when the aircraft is maintained at a constant altitude.

1. With the air conditioning master switch in AIR COND MAN PRESS, rotate the cabin altitude selector knob on the pressure controller until the cabin altitude indicator indicates slightly below the cabin altimeter.

2. Set the rate knob to the mid-position (approximately 900 feet per minute).
3. After approximately 3 minutes, hold the manual pressure control switch to the DECREASE position momentarily. Ensure that a change on the cabin vertical velocity indicator does not occur.

NOTE

Do not hold the manual pressure control switch in INCREASE or DECREASE position for more than a few seconds. Doing so will not allow the pressure controller to gain control of the outflow valve.

- a. Positive control of the outflow valve by the pressure controller is confirmed when no vertical velocity change is noted on the cabin vertical velocity indicator and the airplane altitude remains steady, while operating the manual pressure control switch momentarily.
 - b. If a change of vertical velocity is noted while operating the manual pressure control switch, the pressure controller has not yet assumed the control of the outflow valve. In this case, allow additional time before repeating step 3.
4. Place air conditioning master switch to AIR COND AUTO PRESS.
 5. Rotate the rate selector knob on the pressure controller to minimum or as desired.
 6. Continue operation in Automatic Pressurization.

LEADING EDGE ANTI-ICING SYSTEM

The wing and empennage leading edge anti-icing system is turned on or off by the anti-icing switches on the anti-icing systems control panel. Regulation of temperatures within the leading edges is achieved automatically by thermostatic control of the valves, permitting entry of bleed air to the system ejectors. The temperature indicators on the control panel, however, should be monitored while the system is operating, since an emergency condition will exist if either the associated indicators or the warning lights show an overheated condition in any section.



The leading edge anti-icing system must not be used to remove ice from surfaces when the airplane is on the ground. With no airflow over the surface, the air within the leading edge area quickly rises in temperature, and the excessive heat damages fuel tank sealants, paint, structure, and other equipment. If the system is operated for testing, constant monitoring of the temperature indicators must be maintained, and the system must not remain on more than 30 seconds.

NOTE

When the WARNING ICING CONDITION “ON” light illuminates, the propeller and engine anti-icing and radome anti-ice systems will automatically be turned on by the ice detection system. If wing and empennage anti-icing is required, the WING and EMPENNAGE ANTI-ICING switch must be manually placed in the “ON” position. If the anti-icing system does not clear the wing and empennage of ice, place the ENGINE BLEED AIR switches to “OVRD.” (1600 series, CG 1790, 1700 series.)

ENGINE INLET AIR DUCT ANTI-ICING SYSTEMS

1. To turn the systems on manually, position the prop and engine anti-icing master switch to MANUAL and the engine inlet air duct anti-icing switches to ON.
2. To allow the system to be turned on automatically by the ice detection system, position the prop and engine anti-icing master switch to AUTO and the engine inlet air duct anti-icing switches to ON.
3. To shut the systems off while leaving them subject to automatic control, position the prop and engine anti-icing master switch to RESET and release to the AUTO position. Let the engine inlet air duct anti-icing switches remain in the ON position.
4. To shut the systems off, place the engine inlet air duct anti-icing switches in the OFF position.

NOTE

If an engine is shut down during flight, the inlet duct anti-icing should be left on if icing conditions exist.

However, this will not be possible if the fire handle was pulled.

PROPELLER ANTI-ICING AND DEICING SYSTEMS

1. To turn on the anti-icing and deicing systems manually, place the prop and engine anti-icing master switch in the MANUAL position and the propeller ice control switches in the ON position.

NOTE

To allow the systems to be turned on automatically by the ice detection system, place the prop and engine anti-icing master switch in the AUTO position and the propeller ice control switches in the ON position.

2. To turn off the system and leave them subject to automatic control by the ice detection system, move the prop and engine anti-icing master switch to the RESET position, and release it to the AUTO position.
3. To turn off the propeller anti-icing and deicing systems, place the propeller ice control switches in the OFF position.



When the airplane is on the ground, do not operate the propeller anti-icing or deicing for an engine that is not running. The engine must be running in order to dissipate the heat generated by the heating elements to prevent damage to the elements. Never operate the system for more than two cycles while the airplane is on the ground. Anti-icing and deicing may be used for a propeller feathered in flight.

WARNING

Before flying into known or suspected icing conditions, turn on the propeller blade deicing systems. If a blade deicing ammeter reading falls below 65 amperes for a period of 15 seconds in each 1-minute deicing cycle, do not fly into known or suspected icing conditions.

WINDSHIELD ANTI-ICING SYSTEM

1. Always place the Nesa windshield anti-icing switches in the NORMAL position before takeoff to reduce thermal shock and the possibility of cracking the windshield.
2. If ice is forming on the windshields at a rate higher than it can be removed by operating the anti-icing system in NORMAL, set the switches to HI until out of the extreme icing conditions. Do not use the HI position when turning on a system initially.
3. When ambient temperature is below -43°C , place the Nesa windshield anti-icing switches in the NORMAL position. Actuate the cold-start switches, 5 seconds ON and 10 seconds OFF, until the temperature of the windshield is above -43°C .



Do not exceed the operating limits of 5 seconds on, 10 seconds off when operating the cold start switch. To do so might cause the windshield panels to be damaged.

OXYGEN SYSTEM

The following is applicable to all airplanes.

For normal operation of the system, the oxygen supply lever is placed in the ON position and the diluter lever set at the NORMAL OXYGEN position. If any symptoms of anoxia are felt or if doubt exists that the diluter mixture is sufficient, place the diluter lever in the 100% OXYGEN position. Use the 100% OXYGEN position when exposure to smoke or fumes is experienced.

The emergency toggle lever is used for short emergency periods of time or to pressure-check oxygen mask operation and fit.

NOTE

Each crew member will check his/her oxygen mask communication and regulator with mask on, fitted, and connected to oxygen supply hose as follows:

1. Supply lever – ON
2. Diluter level – 100% OXYGEN

3. Emergency toggle lever – Emergency
4. Breathe normally for a minimum of three cycles. The blinker should show alternately black and white.
5. Hold breath momentarily (blinker should remain black). Return emergency toggle lever to NORMAL (blinker should remain black).
6. Breathe normally for a minimum of three cycles as in step 4. above. Leave the regulator in the following positions:
 - a. Emergency toggle lever – NORMAL
 - b. Diluter lever – 100% OXYGEN
 - c. Supply lever – ON
 - d. Oxygen mask – Connected
7. Perform communication check by crew position in normal checklist order with mask on. Loadmaster/Dropmaster responds only at position seated.

GTC

(1500 series) The GTC can be operated on the ground only. The air intake door and GTC are operated from the GTC control panel on the overheat control panel.

WARNING

During starting and operation of the GTC, personnel must stand clear of compressor air intake and exhaust and plane of rotation of turbine and compressor wheels. Exercise extreme care to prevent foreign material from entering the air intake, as turbine failure may be sufficiently violent to damage equipment and endanger nearby personnel.

STARTING THE GTC

Start the GTC as follows:

1. Turn on dc power. (If external dc power is available, turn the battery switch to EXT DC PWR position. If external ac power is available, turn the external ac power switch to the EXT AC PWR position and turn the dc power switch to BATTERY. If no external power is available, turn the dc power switch to the BATTERY position.)
2. Open the GTC air intake door by placing the GTC door switch in the OPEN position.

NOTE

A limit switch prevents starting of the GTC unless the air intake door is fully open.

3. Tie the dc bus tie switch (if required).
4. Route fuel to the GTC by opening a cross-feed valve.
5. Place the bleed air valve switch in the CLOSED position.
6. Turn the GTC control switch to the spring-loaded START position. The start light should illuminate immediately.
7. Release the control switch. The spring return will move to the RUN position.



As soon as the GTC starter disengages, the starter light will go out. If the light does not go out within 1 minute, move the control switch to OFF, and wait 4 minutes before making another start attempt. The starter duty cycle is 1-minute on, 4 minutes off.

After the GTC control switch is placed in START, power is supplied to the starter, the start light, and to the fuel and ignition circuits, though the fuel and ignition circuits are not yet complete. When the starter brings the GTC up to approximately 12 percent rpm, a switch operated by oil pressure closes to complete the fuel and ignition circuits. After light-off, the combined power of the starter and combustion gases on the power turbine continues the acceleration of the assembly.

NOTE

If the GTC does not lightoff, the cause could be a lack of oil in the line to actuate the switch to complete the fuel and ignition circuits. If this is the case, the oil system can be primed manually by pressing the primer button on the check valve in the pump assembly while motoring the compressor. Then attempt another start.

At approximately 35 percent rpm the 35-percent switch opens, deenergizing the starter, the ignition circuit, and the start light. The GTC is now under its own power, and acceleration continues. At 95-percent speed, another centrifugal switch closes and connects power to the bleed air valve switch and the on-speed light. When full speed is reached,

the governor assumes control and limits rotation to approximately 100 percent rpm. In case of governor failure, the overspeed switch prevents the turbine from “running away” by breaking the circuit to the fuel shutoff valve holding relay, which shuts off the fuel.

NOTE

If dc power is interrupted while the GTC is operating, the control circuit will be opened, causing the unit to stop.

LOADING OPERATION

Apply load to the GTC as follows:

1. Ensure that the unit is on speed.

NOTE

Allow the GTC to stabilize on speed for 1 minute prior to applying a load.

2. Place the bleed air valve switch in the OPEN position.
3. Check bleed air pressure.



During ground operation monitor the leading edge temperature indicators. A rise indicates that an anti-icing valve is open and GTC must be shut down to prevent damage to heated surfaces.

Stop the GTC as follows:

1. Place the bleed air valve switch in the CLOSED position.

NOTE

Allow the GTC to stabilize on speed for 2 minutes without a load before turning GTC off.

2. Turn the GTC control switch to the OFF position.
3. Place the GTC intake door switch in the CLOSED position, and check that the GTC door warning light is out.

APU

(1600 series, CG 1790 and 1700 series) The APU can be operated on the ground to supply bleed air/electrical power, and in flight to supply electrical power only. It is operated from the APU control panel on the overhead control panel. The APU will operate when on speed at altitudes from -1,000 feet to 20,000 feet.

NOTE

The APU may not start or run at altitudes above 20,000 feet, or air speed above 200 KIAS.

WARNING

APU operation in flight with door in fixed flight position is not recommended since the door is a part of in flight fire protection and provides fire containment within the fire proof area.

CAUTION

In flight use of the APU is limited to ac generator operation. Do not attempt to use APU bleed air during flight.

NOTE

Refer to Section V for APU limitations.

WARNING

During ground starting and operation of the APU, personnel must stand clear of compressor air intake and exhaust and plane of rotation of turbine and compressor wheels. Exercise extreme care to prevent foreign material from entering the air intake, as turbine failure may be sufficiently violent to damage equipment and endanger nearby personnel.

NOTE

When operating the APU with less than 2,000 pounds of fuel in the number 2 tank, turn the fuel boost pump on to maintain surge box fuel level.

STARTING THE APU

1. Inspect area around APU for foreign objects to prevent FOD to the APU. (Ground operation)
2. Inspect APU inlet for freedom of obstruction and APU for condition. (Ground operation)

3. Provide adequate isolated dc power.
4. APU generator – OFF
5. APU bleed air valve switch – CLOSE
6. APU control switch – START

After the APU control switch is placed in START, power is supplied to open the APU inlet door. When the door opens the APU door open light illuminates. When the door opens to the 15-degree position, power is then supplied to the starter, the start light, and to the holding circuits. When the starter brings the APU up to approximately 10 percent rpm, a switch operated by oil pressure closes to complete the fuel and ignition circuits.

After light-off, the combined power of the starter and combustion gases on the power turbine continues the acceleration of the assembly.

7. APU control switch – RUN

Release the control switch to RUN when the start light illuminates. At approximately 35-percent rpm the 35-percent switch opens, deenergizing the start, the ignition circuit, and the start light. The APU is now under its own power, and acceleration continues. At 95-percent speed, another centrifugal switch closes, deenergizing the ignition circuit, and connects power to the bleed air valve switch and the on speed light. When full speed is reached, the governor assumes control and limits rotation to approximately 100-percent rpm. In case of governor failure, the overspeed switch prevents the turbine from exceeding 110-percent rpm by opening the circuit to the fuel shutoff valve holding relay, which shuts off the fuel.

NOTE

If the APU does not light-off during ground start in extreme cold weather, preheat the APU with an external source of heat prior to second start attempt.

CAUTION

At approximately 35-percent rpm, the start light will go out. If the light does not go out within 1 minute, move the control switch to STOP and wait 4 minutes before making another start attempt. The starter duty cycle is 1-minute on, 4 minutes off. Do not reengage the starter while the turbine is rotating.



If isolated dc power is interrupted while the APU is operating, the control circuit will be opened, causing the unit to stop. Place the APU control switch to STOP and perform the APU starting procedures.

LOADING THE APU

1. Assure that the APU is on speed and warmed up for a minimum of 1 minute.

NOTE

The 1-minute warm-up is only required if the APU will be used to provide bleed air.

2. APU bleed air valve switch – OPEN



During ground operation, monitor the leading edge temperature indicators. A rise indicates that an anti-icing valve is open and APU must be shut down to prevent damage to heated surfaces.

3. Manifold air pressure – Checked (35 psi minimum)
4. Bleed air duct leakage – Checked (Ground operation)
5. APU generator – Checked/as required



Operation of the APU in sandy, graveled, or other loosely surfaced areas may cause foreign object ingestion.

STOPPING THE APU

1. APU bleed air valve switch – CLOSE

2. APU generator – OFF

NOTE

Allow the APU to stabilize on speed for 2 minutes without a load before turning APU off.

3. APU control switch – STOP

APU will shut down, door will close after oil pressure drops to approximately 20 psi (approximately 18 percent rpm).

4. APU door open, start, and on speed light – extinguished

BLEED AIR SYSTEM CHECK

The bleed air pressure gauge can be used to check the bleed air system. Use the following steps to check out the bleed air system with air supplied by an engine:

1. Place the engine bleed air switches to CLOSED/OFF and turn off all systems which use bleed air.
2. Place the engine bleed air switch for one engine operating at normal ground idle and all engines not operating to OPEN/OVRD.
3. When the system pressure reaches 70 psi or higher, place the bleed air switch of the operating engine to CLOSED/OFF. If pressure does not drop, the engine bleed air has failed to shut off.
4. Time the pressure drop from 65 to 35 psi. This time should not be less than 10 seconds, or 16 seconds if the chemical toilet is installed.

CARGO DOOR AND RAMP

The cargo door and ramp can be operated by either the electrically driven pump or hand pump of the auxiliary hydraulic system. The valves can be positioned by electrical selection or manual selection.

OPERATION OF CARGO DOOR AND RAMP WITH ELECTRICALLY-DRIVEN PUMP PRESSURE

Operation of the cargo door and ramp, using pressure from the electrically driven pump in the auxiliary hydraulic system, can be accomplished through the switches on the ramp control panel (figure 1A-97).



The ADS control panel ramp and door control switch must be set to OFF, and the ramp manual control knob, above the ramp control panel must be set at the 6N (neutral) position before operating the pump switch on the ramp control panel.

With the pump switch set to ON, the aft cargo door is opened by holding the cargo door control switch in the OPEN position until the door is fully opened and retained by the uplock; the ramp then is moved to the desired position by holding the ramp control switch at LOWER.

NOTE

The ramp can be stopped at any position by releasing the ramp control switch. The cargo door will free-fall back to the closed position if the door control switch is released prior to the moment the door reaches the up-and-locked position.

The ramp is closed by holding the ramp control switch in the RAISE position until the ramp is up and locked.



Prior to raising the ramp, ensure that locks are retracted and the ramp seal area is clear.

NOTE

When being raised, the ramp can be stopped in any position by releasing the ramp control switch.

The door is closed by holding the cargo door control switch to the CLOSE position until the door is closed and locked.

MANUAL OPERATION OF CARGO DOOR AND RAMP WITH HAND PUMP PRESSURE

The cargo door and ramp can be operated manually through the auxiliary hydraulic pressure system by means of the hand pump (figure 1A-97) located below the ramp control panel. An instruction plate (figure 1A-97) for hand pump operation of the ramp and cargo door is installed on the side of the fuselage above the ramp control panel.



Before manual hand pump operation, check that the pump switch on the ramp control panel is at the OFF position.

To open the cargo door and lower the ramp by use of the hand pump, proceed as follows.



When operating the ramp manually, turn ramp manual control knob clockwise only, following the number sequence.

1. Move the cargo door manual control valve handle to OPEN, and operate the hand pump until the door is up and locked.
2. Move the cargo door manual control valve handle to the NEUT (center) position.
3. Move the ramp manual control knob to the No. 1 (unlock) position; operate the hand pump until the hand pump pressure gauge on the ramp control panel shows 3,000 psi and all the ramp locks are visibly disengaged.
4. Move the ramp manual control knob to the No. 2 (lower) position. Operate the hand pump until the ramp is lowered and the hand pump pressure gauge registers 500 psi.
5. Move the ramp manual control knob to the 3N (neutral) position. Leave the knob in this position while loading and unloading.



Do not use the ramp for loading or unloading when the hand pump pressure gauge on the ramp control panel shows less than 500 psi. Serious damage may result if the locking action of the ramp cylinders is lost because of insufficient hydraulic pressure.

To close the cargo door and raise the ramp by using the hand pump, proceed as follows:

6. Check that the pump switch, on the ramp control panel, is at the OFF position.
7. Move the ramp manual control knob to the No. 4 (raise) position, and operate the hand pump until the ramp is fully closed.
8. Move the ramp manual control knob to the No. 5 (lock) position. Operate the hand pump until the hand pump pressure gauge registers 3,000 psi and all ramp locks are visibly engaged.
9. Move the ramp manual control knob to 6N (neutral), and leave it in that position.
10. Move the cargo door manual control valve handle to OPEN position. Operate the hand pump until the pressure gauge reads a minimum of 500 psi, pull the cargo door uplock manual release to the unlock position and move the manual control valve to NEUT. Door will free-fall.

NOTE

In the event the cargo door is released from the uplock by the uplock emergency manual release handle, the door should be allowed to free-fall closed and the auxiliary hydraulic system hand pump used to close and lock the door. Do not change position of the cargo door control switch or manual control valve handle while the door is in transit.

11. Move the cargo door manual control valve handle to CLOSE, and operate the hand pump until the door is locked.
12. Move the cargo door manual control valve handle to the NEUT (center) position. The handle does not have a positive stop at the NEUT (center) position, so it should be checked to ensure that it has not been inadvertently moved beyond this setting.

IN-FLIGHT OPERATION OF CARGO DOOR AND RAMP FROM FLIGHT STATION

1. Depressurize the airplane.
2. Operate the auxiliary hydraulic system electric-driven pump by placing the pump switch, on the hydraulic system control panel, in the ON position. Check the system pressure.

3. Move the ramp and door control switch on the ADS panel to the OPEN position.



Do not open the cargo door and ramp above the limiting airspeed shown in Section V.

4. When the ramp and door open light and the master door warning light illuminate, move the ramp and door control switch to the OFF position.
5. When the loadmaster signals that the cargo is dropped and the ramp and door area is clear, move the ramp and door control switch to the CLOSE position.
6. When the ramp and door open light and the master door warning light go off, move the ramp and door control switch to the OFF position.
7. Turn auxiliary hydraulic pump OFF.

FLARE LAUNCHER

FLARE LAUNCHER PANEL CHECK

Each of the three flare launch panels may be checked as follows:

1. Place all launching switches to OFF.
2. Place arming switch to ARM.
 - a. System deactivate light should illuminate.
 - b. All flare released lights should illuminate.
3. Place arming switch to SAFE.
 - a. All lights should go out.

LOADING THE FLARE LAUNCHER

WARNING

Due to possible accidental ignition of flares, the launch tubes should not be loaded with flares while the airplane is on the ground.

1. Depressurize the aircraft.

2. Place the flare launch activation switch to ACTIVATE.

NOTE

When the arming switch on any flare launcher control panel is positioned to ARM and the system deactivated switch on the flare launcher activation panel is positioned to ACTIVATE, electrical power is supplied to open the solenoid operated flare launcher hydraulic shut off valve which allows hydraulic pressure to flow to each of the ten flare launcher selector valves at the launcher tubes. Positioning the arming switch to ARM also supplies electrical power to the ten launching switches on the same flare launcher control panel.

3. Place the arming switch on at least one flare launcher control panel to ARM.
4. Open the flare tube cover.

WARNING

Do not allow the spring-loaded ejector plate to slip and strike the flare.

CAUTION

To prevent inadvertent ignition, salt shall not be added to flares when utilizing the flare launch tubes.

5. Place it in the tube. Make sure the flare is loaded facing the correct direction and resting against the ejection door.
6. Close and latch the flare tube cover.
7. Repeat steps 4.-6. for each tube to be loaded.
8. After loading is complete, the other flare launcher control panels can be armed.

UNLOADING THE FLARE LAUNCHER

To unload the flare launcher, reverse the loading procedures. Refer to Loading the Flare Launcher in this section.

WARNING

The MK-25 MOD 4 Marine Location Marker is the only flare that can be returned to SAFE, provided the arming cap was never removed when loaded into a flare launcher tube. If the arming cap was removed for any period of time and/or was loaded into a flare launcher tube without the arming cap installed, the flare must be jettisoned.

WARNING

All unused armed flares should be jettisoned over water prior to landing.

OPERATION OF THE FLARE LAUNCHER

NOTE

Lighting for the copilot's flare launcher panel is controlled through the pilot's lighting control panel. Lighting for the scanner's flare launcher panel is controlled through the scanner light control panel.

Arm and activate the flare launcher system as follows:

1. Place the flare launcher deactivated switch on the flare launcher activation panel to ACTIVATE.

NOTE

When the arming switch on any flare launcher control panel is positioned to ARM and the system deactivated switch on the flare launcher activation panel is positioned to ACTIVATE, electrical power is supplied to open the solenoid operated flare launcher hydraulic shut off valve which allows hydraulic pressure to flow to each of the ten flare launcher selector valves at the launcher tubes. Positioning the arming switch to ARM also supplies electrical power to the ten launching switches on the same flare launcher control panel.

NOTE

For control of the flare launcher system from any flare launcher control panel, the arming switch on that panel must be positioned to ARM.

2. Place the arming switch on at least one flare launcher control panel to ARM. The system armed light for that

panel should illuminate. A flare released light on each panel should illuminate for each empty tube. The sys deactivated light on the flare launcher activation panel and the sys deactivated light on the armed flare launcher control panel(s) should not illuminate.

3. On an armed flare launcher control panel, position the launching switch to FIRE. When the corresponding flare released light illuminates, the flare has been ejected.
4. Position the launching switch to OFF to close the ejection door.
5. Repeat steps 3. and 4. for each flare to be ejected.

Disarm and deactivate the flare launcher system as follows:

WARNING

All unused armed flares shall be jettisoned over water prior to landing.

1. If there are flares remaining in the tubes, remove and stow only those flares which can be returned to SAFE, otherwise jettison those flares which can not be returned to a safe state.
2. Position all flare launcher control panel arming switches to SAFE. All lights on each flare launcher control panel and the flare launcher activation panel should go out.

NOTE

The sys deactivated light on either the flare launcher control panels or the flare launcher activation panel will not illuminate when the flare launcher deactivated switch is placed in DEACTIVATE unless one of the flare launcher control panels is armed.

3. Place the flare launcher deactivated switch on the flare launcher activation panel to DEACTIVATE.

MALFUNCTION OF THE FLARE LAUNCHER SYSTEM

This section provides instructions for the operation of the flare launcher system in case of malfunction.

If electrical control to the flare launcher system is lost, proceed as follows:

1. Select EMER on the hydraulic shutoff valve.
2. Jettison the flare(s) via manual override button(s).
3. Select NORM on the hydraulic shutoff valve.

If hydraulic control to the flare launcher system is lost, proceed as follows:

1. Remove flare(s) from the tubes.
2. Complete the PREDROP CHECKLIST.
3. Hand jettison flare(s) through a paratroop door or cargo ramp and door.
4. Complete the POSTSEARCH/POSTDROP CHECKLIST.

PARATROOP JUMP PLATFORMS

INSTALLATION AND USE OF THE PARATROOP JUMP PLATFORMS

1. Install and inspect the platforms for cracks, hinge deformation, and proper hooking and operation during the aircrew preflight. Replace defective platforms. Identify right and left platforms for proper in flight installation. Refer to the Loading Instructions Manual for installation procedures.
2. After troops are seated, and before opening the paratroop doors, inspect the platforms for tight hinge slot fit.
3. Slow the airplane to 150 knots.
4. Open the air defectors.
5. Open the paratroop doors.
6. Fold out the jump platforms from a position in front of the paratroop doors in order to assure that the hook catches on the forward door frame.
7. After paratroop exit, release hook from frame, fold platforms in, close paratroop doors and air defectors (in this order) before exceeding 150 KIAS.

SECTION III

EMERGENCY PROCEDURES

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SECTION III

EMERGENCY PROCEDURES

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INTRODUCTION

This section contains the procedures to be used in coping with the various emergencies and malfunctions that may be encountered. It is possible to establish certain specific procedures, even though it is not possible to cover every facet of every emergency or malfunction that may confront the crew. A thorough knowledge of these procedures and airplane systems will enable crewmembers, under the leadership of the pilot in command, to judge more quickly the seriousness of the emergency and perform their emergency duties in an orderly manner. This will permit early planning for contingencies which are not covered in this section. The pilot in command must make a firm decision and provide clear direction. The overriding matter of importance in any emergency is very basic: **SOMEBODY MUST FLY THE AIRPLANE.**

The procedures for emergencies and certain malfunctions consist of items classified as critical or noncritical. Critical items for emergencies are presented in boldface type and must be committed to memory. After completing the boldface items the pilot performing the procedure will call for the checklist. The flight engineer will read the entire abbreviated checklist aloud. The crewmember(s) assigned each item will repeat the response after assuring the item is accomplished. Upon completion of the checklist the flight engineer will announce “_____ checklist complete.” The flight engineer will then refer to the expanded checklist for additional or supplementary information when time and conditions permit.

In the procedures the codes, P, CP, E, N, R, and LM stand for pilot, copilot, flight engineer, navigator, radioman, and loadmaster respectively. This presentation does not preclude the pilot in command from re delegating the duties at crew briefing. Never initiate a procedure before command of the pilot. The pilot will command initiation by calling for the procedure desired and stating the item(s) that must be performed immediately to avoid aggravating the condition and causing injury or damage. The affected crewmembers will accomplish the required steps in accordance with the appropriate checklist. The flight engineer will monitor all engine shutdown steps and other coordinated emergency procedures.

When an airborne emergency occurs, the following rules apply:

1. Maintain aircraft control. It is desirable for one pilot to fly the aircraft and not be directly involved in the emergency actions.
2. Analyze the situation. Emergency procedures should be accomplished only after the crewmember has positively identified the malfunctioning system and considered the effect of emergency-related actions on aircraft performance.
3. Take coordinated corrective action. Although many in-flight emergencies require immediate corrective action, difficulties can be compounded by the tempo of the pilot's commands and hurried execution by the crew. Commands must be clear and concise, allowing time for acknowledgement of each command prior to issuing further instructions. The pilot must exercise positive control of the crew by allowing time for acknowledgement and execution. The other crewmembers must be certain their reports to the pilot are clear and concise, neither exaggerating nor understating the nature of the emergency. This eliminates confusion and ensures efficient, effective, and expeditious handling of the emergency.
4. Establish communication with a ground station. The ground station should be given a complete description of the emergency, the action taken, and an accurate position report. The ground station should be notified of any changes or developments in the emergency.
5. Study the aircraft's configuration and land as the situation dictates. A controllability check may be advisable.

DEFINITIONS

Land as soon as possible – An emergency will be declared. A landing should be accomplished at the nearest suitable airfield considering the severity of the emergency, weather conditions, field facilities, ambient lighting, and aircraft gross weight.

Land as soon as practicable – Emergency conditions are less urgent, and although the mission is to be terminated, the degree of the emergency is such that an immediate landing at the nearest adequate airfield may not be necessary.

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Emergency Equipment (Typical)

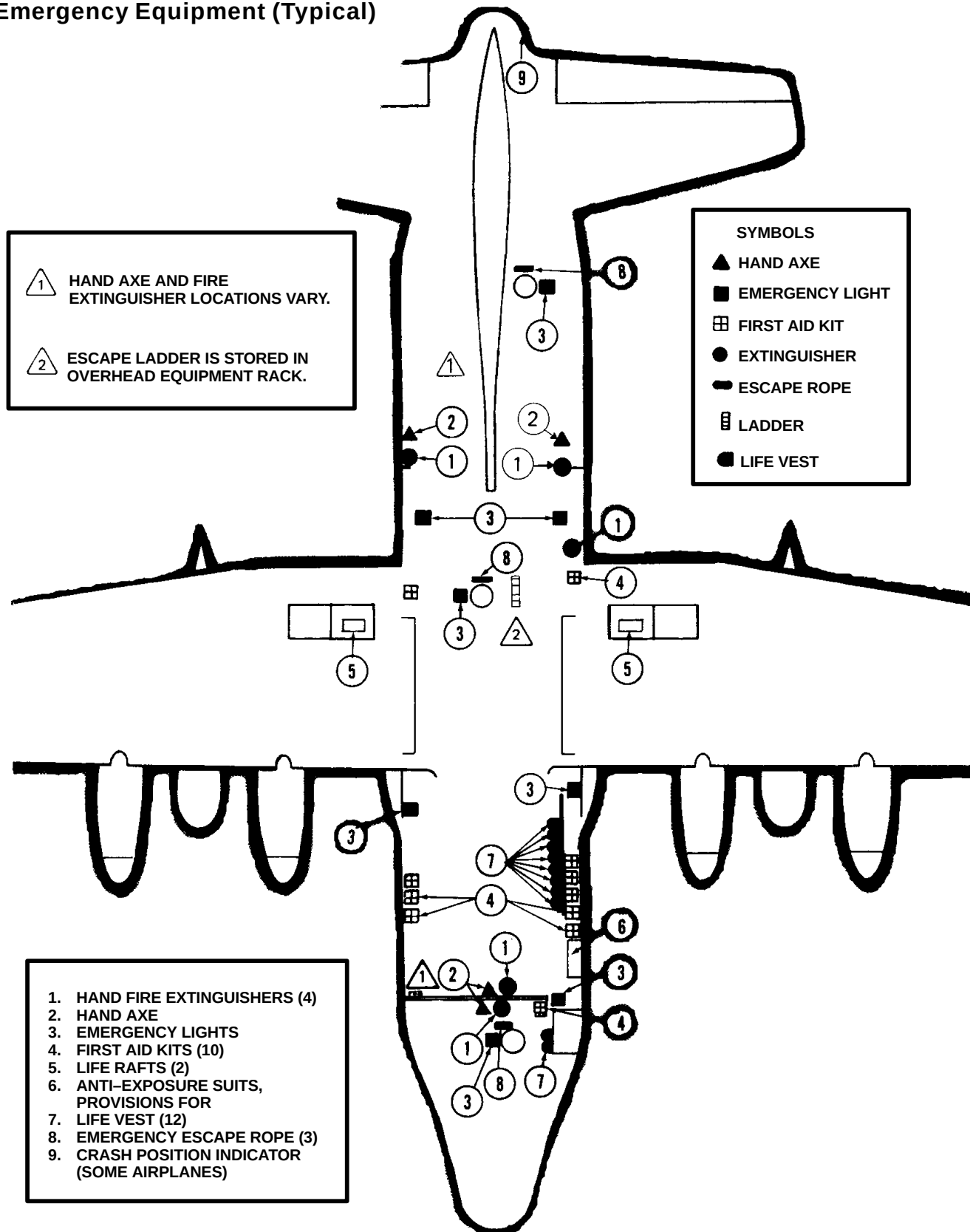


Figure 3-1

ENGINE SHUTDOWN CONDITIONS

If any of the following conditions occur, shut down the affected engine when the necessary corrective action fails to remedy the adverse condition.

If flight conditions or other emergencies warrant continued operation of an engine with any of these conditions present, in the interest of safety of the airplane and crew, operate the engine with extreme caution, and at the minimum power required.

1. Engine fire
2. Turbine overheat
3. Nacelle overheat
4. Uncontrollable power
5. Propeller malfunctions
6. High turbine inlet temperature
7. Increasing oil temperature
8. Decreasing oil pressure
9. Throttle control failure
10. Unusual vibration or roughness
11. Visible fluid leak
12. Start valve open light illumination (CG 1790 and 1700 series)

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ENGINE SHUTDOWN PROCEDURE

1. CONDITION LEVER

"FEATHER" (CP)

WARNING

If binding occurs or the condition lever will not move, immediately pull the fire handle.

CAUTION

When pulling a condition lever to FEATHER, pull it all the way to the detent to assure that the propeller is fully feathered when the engine fuel is shut off. If the lever is left at midposition, and NTS is inoperative, an engine decoupling is possible.

2. FIRE HANDLE

"PULLED" (FOR FIRE, NACELLE OVERHEAT, OR VISIBLE FLUID LEAK) (CP)

3. AGENT

"DISCHARGED" (FOR FIRE OR NACELLE OVERHEAT) (CP)

WARNING

If condition persists, a break in the bleed air manifold may exist. Isolate the wing by closing the engine bleed air valve/regulator for the other engine on the wing and the wing isolation valve/bleed air divider valve. If the fire or nacelle overheat continues, discharge the remaining bottle on command of the pilot.

CAUTION

Do not hold the AGENT DISCHARGE switch in No. 1 or No. 2 position longer than 1 or 2 seconds. To do so may cause the FIRE EXT circuit breaker to open.

NOTE

The intent of step 3. is to require the agent to be discharged when an indication continues after the fire handle has been pulled. However, if any other indication or malfunction is suspected which requires fire extinguisher agent, it should be discharged on command of the pilot.

4. FLAPS	"As required"	(CP)
5. LANDING GEAR	"As required"	(CP)
6. CLEANUP	"Complete"	(E)

- a. Feather override button

Checked

NOTE

If the button fails to pop out after the feather cycle is completed, the button should be pulled out manually to turn off the auxiliary pump.

- b. Engine bleed air switch

CLOSED/OFF

- c. Generator switch

TRIPPED/OFF

- d. Fuel boost pump switch

OFF

NOTE

If on crossfeed, assure source of fuel to operate engines before shutting off fuel boost pump and cross-feed valve for the affected engine.

- e. Crossfeed valve switch

CLOSED

- f. Oil cooler flap switch

CLOSED/FIXED

- g. Propeller governor control switch

MECH GOV

- h. Synchrophase master switch

Reset as necessary

- i. TD valve switch

NULL

- j. Throttle

Full forward

7. If the Engine Shutdown Procedure successfully corrects the emergency condition, land as soon as practicable. If the condition persists, land as soon as possible.

NOTE

Performance data should be checked.

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GROUND/IN-FLIGHT EMERGENCIES

GTC/APU EMERGENCY SHUTDOWN (GROUND/IN-FLIGHT)

1. FIRE HANDLE

"PULLED"

(CP/E)
2. AGENT

"DISCHARGED"
(FOR FIRE)

(CP/E)



Do not hold the AGENT DISCHARGE switch in No. 1 or No. 2 position longer than 1 or 2 seconds. To do so may cause the FIRE EXT circuit breaker to open.

NOTE

The intent of step 2. is to require the agent to be discharged when an indication continues after the fire handle has been pulled. However, if any other indication or malfunction is suspected which requires fire extinguisher agent, it should be discharged on command of the pilot.

3. Bleed air

"Isolated"
(In-flight)

(E)



The intent of step 3. if in flight and conditions persist; a break in the bleed air manifold may exist. Isolate the GTC/APU by closing both wing isolation valves (1500 series) or by placing the #1 and #2 bleed air regulator valves to OFF and closing the bleed air divider valve (1600 & 1700 series). If condition is not corrected within 1 minute, discharge the remaining bottle on command of pilot.

NOTE

Closing No. 1 and No. 2 bleed air regulators and the bleed air divider valve, as required in certain emergencies, isolates the bleed air from the jet pump control in the outflow valve and from the safety valve. Automatic pressurization will be inoperative and emergency depressurization will be slower.

4. Cleanup

"Complete"

(E)
- a. ATM and GEN/APU GEN

STOP, OFF/OFF
- b. Control switch

OFF/STOP
- c. Bleed air valve

CLOSED
5. Land as soon as practicable. If conditions persist, land as soon as possible.

DIRECTIONAL CONTROL PROBLEMS

WARNING

If directional control problems are encountered on the ground below refusal speed, a takeoff shall not be attempted. If directional control problems are encountered on landing, a go-around shall not be attempted. Certain propeller/engine control malfunctions, which result in directional control problems, can also render the airplane uncontrollable during flight.

Directional control problems are most often encountered during airplane deceleration, either during abort or landing, and as the throttles are retarded into the ground range, becoming more pronounced as the throttles are placed into reverse, but can occur as the airplane is accelerating for takeoff. The loss of directional control is usually the result of a propeller failing to change blade angle, but may be caused by engine/engine control failure resulting in abnormal power and severe asymmetric thrust.

WARNING

The magnitude and severity of asymmetric thrust may vary, depending upon the malfunction and prevailing conditions. Immediate and positive action is required to prevent an uncontrollable situation.

NOTE

For malfunctions which result in asymmetric thrust, the airplane will attempt to turn toward the malfunctioning power plant during airplane acceleration and will generally attempt to turn away from the malfunctioning power plant during airplane deceleration. Specific procedural steps are as follows:

Directional Control Problems with Throttles in Flight Range

Follow ABORT PROCEDURES.

Directional Control Problems with Throttles in Ground Range

WARNING

In order to maintain directional control while stopping, the pilot must immediately make maximum use of nosewheel steering, flight controls, and differential braking.

1. Throttles GROUND IDLE (P)
2. Condition Lever FEATHER (If (CP)
required) (on
command of the
pilot)
3. Reverse symmetrical engines and apply brakes
as required.

START VALVE OPEN LIGHT ILLUMINATION (CG 1790 AND CG 1700 SERIES)

If the start valve open light illuminates other than during the normal start cycle, perform ENGINE SHUTDOWN PROCEDURE and shut off the respective engine bleed air regulator.

ENGINE FIRE (GROUND/IN FLIGHT)

Engine fires are indicated by a steady illumination in the respective fire handle and the master fire warning light on the pilot's instrument panel. If an engine fire is experienced, proceed as follows:

On the ground

1. Move all throttles to GROUND IDLE. (P)
2. Perform the ENGINE SHUTDOWN PROCEDURE.

In flight

1. Perform the ENGINE SHUTDOWN PROCEDURE.

TAILPIPE FIRES

A tailpipe fire is defined as abnormal flame or torching coming from the engine tailpipe.

Tailpipe Fire During Start

1. Place condition lever to GROUND STOP. (P)
2. Continue to motor the engine with the starter if the button/switch has not been released. (This will normally clear the engine of unburned fuel.) (P)
3. If flames spread beyond the tailpipe, follow the GROUND EVACUATION PROCEDURE.

Tailpipe Fire During Engine Shutdown

1. Follow the GROUND EVACUATION PROCEDURE.



Tailpipe fire during engine shutdown may be caused by an oil leak in the turbine section. Do not motor the engine when a tailpipe fire exists on engine shutdown.

ENGINE OVERHEATING (GROUND/IN FLIGHT)

There are four indications of overheating in the engines and nacelles: the turbine overheat warning light, nacelle overheat warning light, high turbine inlet temperature, and increasing oil temperature.

Turbine Overheat Warning

If an overheat condition is indicated by the flashing of the master fire warning light and/or lights in a fire handle, proceed as follows:

On the ground

1. Move all throttles to GROUND IDLE. (P)
2. Place condition lever to GROUND STOP. (CP)

In flight

1. Retard the throttle for the affected engine toward FLIGHT IDLE. (P)
2. Land as soon as practicable.
3. If condition persists: perform the ENGINE SHUTDOWN PROCEDURE.

Nacelle Overheat Warning

If an overheat warning is indicated by a nacelle overheat warning light on the copilot's instrument panel, proceed as follows:

On the ground

1. Move all throttles to GROUND IDLE. (P)
2. Perform the ENGINE SHUTDOWN PROCEDURE.

In flight

1. Perform the ENGINE SHUTDOWN PROCEDURE.

High Turbine Inlet Temperature

If an overtemperature is indicated by a high turbine inlet temperature, proceed as follows:

On the ground

1. Move all throttles to GROUND IDLE. (P)
2. Place the temperature datum control switch for the affected engine in the NULL position. (E)
3. If this fails to eliminate the overtemperature condition, place the condition lever in GROUND STOP. (P)

In flight

WARNING

If TIT is stabilized at 1083 ° C (–15 engines), or at 977 ° C (–7 engines) and throttle position is unrelated, refer to ENGINE SYSTEMS FAILURES in this section.

1. Retard the throttle for the affected engine toward FLIGHT IDLE. (P)
2. Place the temperature datum control switch in the NULL position. (E)
3. If condition persists, perform the ENGINE SHUTDOWN PROCEDURE.

Increasing Oil Temperature

For corrective action to be taken in case of increasing oil temperature, see ENGINE OIL SYSTEM FAILURE.

COMPRESSOR BLOCKAGE

If compressor blockage is suspected, such as due to a bird strike, and verified by lower torque, higher TIT, etc., perform ENGINE SHUTDOWN PROCEDURE. In cases where blockage is suspected but not verified, the ENGINE SHUTDOWN PROCEDURE is recommended. If engine operation is continued due to extenuating circumstances, land as soon as possible for inspection.

EMERGENCY ENTRANCES

Emergency entrances are those used by ground rescue personnel (figure 3-2).

External Releases

The side emergency exit(s) and the three escape hatches (figure 3-2) are equipped with external pull-type releases. The releases are flush-mounted on the fuselage surface next to the exit they release. Pulling the release permits the exit to be pushed inward, and entrance may be made.

Chopping Locations

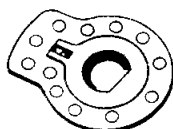
Chopping locations, marked in yellow (figure 3-2), are painted on each side of the fuselage above and forward of the paratroop jump doors. The locations are marked on the inside and outside of the fuselage.

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Emergency Entrances

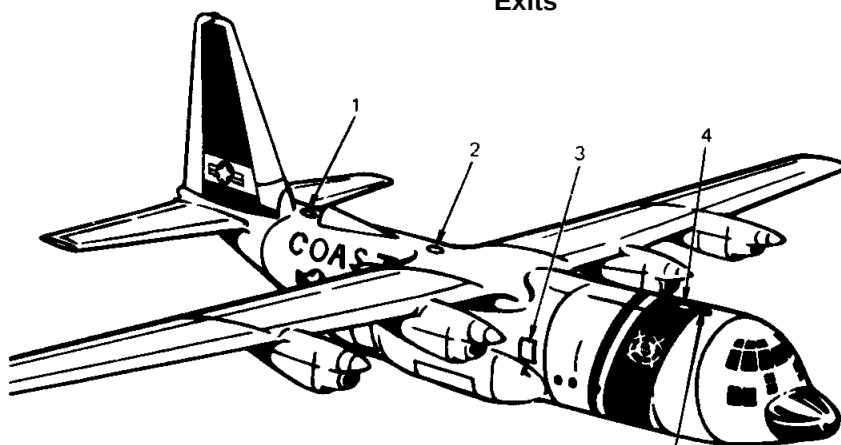
1. AFT ESCAPE HATCH
2. CENTER ESCAPE HATCH
3. SIDE EMERGENCY EXIT
4. FORWARD ESCAPE HATCH

⚠ 1500 SERIES
HAVE ONE ON
EACH SIDE



EXTERNAL RELEASE FOR
ESCAPE HATCHES AND
SIDE EMERGENCY EXIT

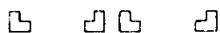
Escape
Exits



EXTERNAL RELEASE (TYPICAL)

INTERIOR AND EXTERIOR
CHOPPING MARKING

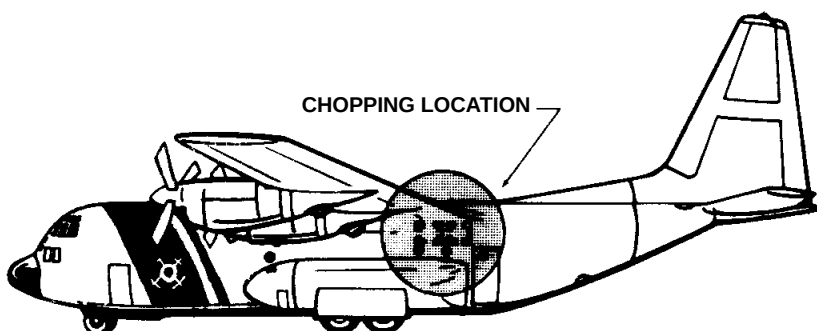
CG 1790, 1500s, 1600s AND
1700 THROUGH 1716



CG 1717 AND UP



Chopping
Locations



LEFT-HAND LOCATION SHOWN (RIGHT OPPOSITE)

Figure 3-2

GROUND EVACUATION

If it becomes necessary to evacuate the airplane, proceed as follows:

1. TOWER/GROUND	"NOTIFIED"	(CP)
2. PARKING BRAKE	"SET"	(P)
CAUTION If a hot brake is suspected or if a fire exists in either of the main wheel wells, set opposite brake only.		
3. DC BUS TIE SWITCH	"TIED"	(E)
4. PRESSURIZATION	"EMERGENCY DEPRESSURIZATION"	(E)
5. CONDITION LEVERS (ALL)	"FEATHER"	(CP/E)
6. FIRE HANDLES (ALL)	"PULLED"	(CP/E)
7. CREW/PASSENGERS (interphone, PA system, and/or alarm bell)	"NOTIFIED"	(P)

WARNING

If main wheel well fire exists, all personnel other than those in the fire department should evacuate the immediate area. The area on both sides of the wheel will be cleared of personnel and equipment for at least 300 feet. Do not approach the main wheel area when extreme temperatures due to excessive braking are suspected. If conditions require personnel to be close to an overheated wheel or tire assembly, the approach should be from the fore or aft only.

NOTE

Prior to leaving the airplane, the pilot should brief which exit is preferred. He should also direct the crew/passengers where to muster once outside the airplane.

8. DC POWER SWITCH	"OFF"	(E)
9. Chock airplane (if possible)		(LM)

WARNING

If a hot brake is suspected or a main wheel well fire exists, chock nose gear only.

BRAKE SYSTEM FAILURE

If a malfunction occurs in the normal brake system, proceed as follows:



If loss of the normal brake system occurs, the crew should expect abrupt braking action after selecting emergency brakes, unless pedal pressure is released prior to changing systems.

1. Brake select switch – EMERGENCY.

NOTE

The auxiliary hydraulic system hand pump may be used for stopping the airplane in an emergency by holding the brake pedals down while the hand pump is being operated.

Anti-Skid System Failure

Whenever the anti-skid system is not operating as an integral part of the brake system, an anti-skid inoperative light will illuminate. Use of the anti-skid system after the illumination may result in uneven braking and a tendency for the airplane to swerve. If the anti-skid inoperative light illuminates, proceed as follows:

1. Anti-skid switch – OFF

NOTE

Refer to the applicable performance manual (TO 1C-130H-1-1) for changes in aircraft landing/takeoff performance with inoperative anti-skid.

Anti-Skid Test Unsatisfactory

During test of the anti-skid system, failure of a wheel to test properly indicates that the wheel may have braking without anti-skid protection, or that the wheel may rotate freely without any braking capability. Use of the anti-skid system

after an unsatisfactory test indication may result in uneven braking and a tendency for the airplane to swerve when brakes are applied. If the test indicates a system malfunction, proceed as follows:

1. Anti-skid switch – OFF

TAKEOFF EMERGENCIES

WARNING

Under certain conditions it may be impossible to obtain or maintain safe flight. When ground contact is unavoidable maintain directional control and touchdown with wings level.

ENGINE MALFUNCTION DURING TAKEOFF

If an engine malfunction occurs before reaching refusal speed, the airplane must be stopped. If an engine malfunction occurs after exceeding refusal speed, the takeoff must be continued because the airplane cannot be stopped on the remaining runway.

WARNING

During takeoff or in flight, if an outboard engine fails near minimum control speed, it is imperative that a 5-degree bank angle away from the failed engine be established immediately. This should be done by use of ailerons before reaching full rudder inputs, in order to maintain directional control. Failure of an outboard engine may require the reduction of power on the opposite outboard engine.

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ABORT PROCEDURE

If it becomes necessary to abort a takeoff, it will be initiated by the word “REJECT” followed by a brief description of the problem; then proceed as follows:

1. THROTTLES	FLIGHT IDLE	(P)
2. BRAKES	AS REQUIRED	(P)
3. CONDITION LEVER	“FEATHER” (if required) (on command of the pilot)	(CP)

WARNING

If aborting for a propeller malfunction or for any other malfunction which could result in asymmetric power causing directional control problems when the throttles are placed in the ground range, shut down the affected engine while the throttle is in FLIGHT IDLE. Directional control problems may be encountered if throttles are placed in the ground range and a malfunction prevents the affected propeller from entering the ground range, or if engine power output is abnormal.

4. THROTTLES	GROUND IDLE	(P)
5. Reverse symmetrical engines.		(P)
6. If required, initiate or continue with ENGINE SHUTDOWN PROCEDURE after safe control of the airplane is assured.		

NOSEWHEEL SHIMMY

Nosewheel shimmy is an indication of an unbalanced condition of one or both of the nosewheel tires or failure of the steering system. If this occurs during takeoff, the decision to continue or abort the takeoff will depend on the severity of the shimmy and whether refusal speed has been reached. If the decision is made

to abort the takeoff, minimize use of nosewheel steering. Attempt to control the aircraft through the use of flight controls, differential power, and differential braking. If the takeoff is continued, the nosewheel should be raised as soon as directional control permits to reduce the severity of the shimmy.

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TAKEOFF CONTINUED AFTER ENGINE FAILURE**WARNING**

Careful rudder control is absolutely essential during asymmetric thrust conditions. Exercise extreme care when counteracting asymmetric thrust/yaw conditions. If not carefully applied, rudder inputs made into the operating engines then neutralized may cause an accelerated yaw rate to quickly develop.

This may result in exceeding the critical sideslip angle within seconds, and total loss of aircraft control. This yaw and subsequent sideslip is considerably aggravated when any rudder input into the actual/simulated inoperative engine(s) is applied.

1. Maintain directional control with flight controls and engine power as necessary.

NOTE

If takeoff is continued after an engine failure, complete the ENGINE SHUTDOWN PROCEDURE as soon as time permits to reduce asymmetric drag.

2. When safely airborne and certain that the airplane will not touch down, raise gear while accelerating to flap retraction speed.
3. After gear is up, and airspeed permits, commence flap retraction.

WARNING

Selecting less than 15 percent flaps or operating the gear or flaps will increase the minimum control speed due to reduction in available hydraulic pressure.

WARNING

If obstacle clearance is a consideration, pilots should be aware that obstacle clearance performance data is based on the assumption that gear retraction is initiated 3 seconds after takeoff and propeller feathering initiated 6 seconds after takeoff. Flap retraction should be accomplished in 10 percent increments with airspeed increasing approximately 5 knots between retraction increments. This procedure will prevent the airplane from settling during flap retraction at heavy gross weights.

WARNING

It is important to attain two-engine minimum control speed as soon as possible, and prior to raising the flaps above 15 percent.

4. After gear and flaps are up, continue as a normal takeoff, accelerating to three-engine climb speed.

THREE-ENGINE TAKEOFF

It is possible to make a three-engine takeoff when required. This type of takeoff requires particular caution because of the possibility of losing another engine during the takeoff prior to reaching minimum control speed. A three-engine takeoff will be made only when authorized by COMMANDANT (G-OCA-2).

A three-engine takeoff should be made only:

1. When absolutely necessary.
2. By the most highly qualified crewmembers trained in three-engine operation.

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WARNING

Careful rudder control is absolutely essential during asymmetric thrust conditions. Exercise extreme care when counteracting asymmetric thrust/yaw conditions. If not carefully applied, rudder inputs made into the operating engines then neutralized may cause an accelerated yaw rate to quickly develop. This may result in exceeding the critical sideslip angle within seconds, and total loss of aircraft control. This yaw and subsequent sideslip is considerably aggravated when any rudder input into the actual/simulated inoperative engine(s) is applied.

WARNING

It is imperative that the following limitations be observed and the procedure be followed exactly since the loss of an additional engine after liftoff and prior to reaching two-engine minimum control speed results in a hazardous situation. Failure to follow the procedure may result in loss of directional control and destruction of the airplane.

NOTE

If the inoperative engine could not be started because of a faulty starter, and if an air start of the inoperative engine is to be made, the starter or starter shaft should be removed prior to takeoff.

NOTE

Although not required, ATO should be used for three-engine takeoff when it is available.

Limitations

1. Maximum airplane gross weight: 110,000 pounds.
2. No passengers.
3. No cargo.
4. Minimum fuel required to reach destination with safe reserves.
5. Minimum crew.
6. Nosewheel steering shall be operable.
7. Dry hard surface runway.
8. VFR day operations only.
9. Three-engine performance data is computed and utilized IAW the Performance Manual (TO 1C-130H-1-1).
10. Pending publication of additional performance data, the following shall apply.
 - a. The minimum runway length for a three-engine takeoff is takeoff ground run plus 2,000 feet.
 - b. The maximum airport pressure altitude for a three-engine takeoff is 4,000 feet.

Takeoff Procedure

The propeller on the inoperative engine must be feathered. The inoperative engine oil cooler flap must be closed and the switch placed in FIXED. The throttle of the inoperative engine must be in TAKEOFF. Accomplish the normal pre-takeoff procedures contained in Section II. Accomplish the following steps for takeoff.

1. Direct the copilot to maintain wings level with ailerons during the takeoff roll.
2. Adjust the rudder trim to 10 degrees toward the operating asymmetric engine.
3. Taxi into takeoff position and hold the nose steering wheel turned toward the operating asymmetric engine to remove any slack from the steering mechanism and prevent castering.
4. If 19,600 inch-pounds of torque cannot be attained, close all engine bleed valves/regulators. Turn off the engine inlet air duct anti-icing.
5. Advance the throttles for all operating engines to 8000 in-lb minimum and then retard the throttle for the asymmetric operating engine to FLIGHT IDLE.
6. Advance the throttles for symmetrical engines to maximum power, then release the brakes and increase power for the other operative engine as rudder control will permit.
7. After attaining V_{MCA} speed, the operating asymmetric engine may be advanced to the same torque setting as the symmetrical engines.
8. As soon as airborne, maintain heading using 5 degrees bank away from the inoperative/failed engine and rudder as required.

9. When safely airborne and certain that the airplane will not touch down again, raise gear while accelerating to flap retraction speed.

WARNING

It is important to attain two-engine minimum control speed as soon as possible and prior to raising the flaps above 15 percent.

10. Upon reaching a safe height (400 feet or higher) begin flap retraction in 10 percent increments while maintaining altitude or a positive rate of climb.
11. Continue acceleration to three-engine climb speed but not less than two-engine V_{MCA} .
12. Reduce to climb power and continue climb to cruise altitude.

SIMULATED THREE-ENGINE TAKEOFF

An engine can be simulated inoperative for a practice three-engine takeoff by advancing the throttle to a minimum of 8,000 inch-pounds of torque and then retarding it to FLIGHT IDLE. This will ensure that the propeller blade angle is on or above the low pitch stop setting. A simulated three-engine takeoff should be made only when authorized by the Commanding Officer.

PRACTICE TAKEOFF ENGINE FAILURE

If engine failure is simulated before refusal speed is reached:

1. Follow ABORT PROCEDURE. Simulate engine shutdown procedure as required.

If engine failure is simulated after refusal speed, follow TAKEOFF CONTINUED AFTER ENGINE FAILURE procedures in this section.

IN-FLIGHT EMERGENCIES

WARNING

During takeoff, or while airborne, do not move the throttles below the FLIGHT IDLE position. Placing any propeller in the ground range may result in immediate loss of control of the airplane.

ENGINE FAILURE

WARNING

Careful rudder control is absolutely essential during asymmetric thrust conditions. Exercise extreme care when counteracting asymmetric thrust/yaw conditions. If not carefully applied, rudder inputs made into the operating engines then neutralized, may cause an accelerated yaw rate to quickly develop. This may result in exceeding the critical sideslip angle within seconds, and total loss of aircraft control. This yaw and subsequent sideslip is considerably aggravated when any rudder input into the actual/simulated inoperative engine(s) is applied.

The effect of losing various combinations of engines must be understood and anticipated, because related systems are integrated between the engines. (See figure 3-3.) In all combinations of two-engine failures, watch the generator loading. If generator loading is too high, shut off electrical equipment, as required, to keep loading within the range of available output. Depending on airplane weight, it may not be possible to maintain level flight with two engines inoperative and wing flaps extended. Upon loss of either number one or number two engine, retraction of the wing flaps may be advisable.

WARNING

Two-engine operation above 120,000 pounds or at high density altitude is marginal.

Flight Characteristics Under Partial Power Conditions

The airplane has excellent flight characteristics even when an engine is inoperative. All control surfaces are booster-operated, so that no great amount of pilot force is necessary

Two Engines Inoperative



IN ALL COMBINATIONS OF TWO-ENGINE FAILURES, MONITOR GENERATOR LOADING TO KEEP IT WITHIN THE RANGE OF AVAILABLE OUTPUT.

ENGINES INOPERATIVE	SYSTEMS AFFECTED	
	HYDRAULIC	ELECTRICAL
NO. 1 AND NO. 4	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 1 AND NO. 4 GENERATOR OUT.
NO. 2 AND NO. 3	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	AUTOMATIC ICE DETECTION SYSTEM WILL BE OUT. DE-ICING SYSTEMS MAY BE OPERATED MANUALLY. NO. 2 AND NO. 3 GENERATOR OUT. SYNCHROPHASER MASTER WILL BE INOPERATIVE.
NO. 1 AND NO. 2	UTILITY SYSTEM PUMPS WILL BE OUT. WING FLAPS AND MAIN LANDING GEAR TO BE OPERATED MANUALLY. AUXILIARY SYSTEM IS AVAILABLE FOR NOSE GEAR EXTENSION. AUXILIARY SYSTEM AVAILABLE FOR EMERGENCY BRAKE OPERATION. FLIGHT CONTROLS BOOST TO BE SUPPLIED BY BOOSTER SYSTEM AT HALF NORMAL FORCE.* NOSEWHEEL STEERING AND ANTISKID ARE NOT OPERATIVE AFTER LOSS OF UTILITY SYSTEM.	NO. 1 AND NO. 2 GENERATOR OUT.
NO. 1 AND NO. 3	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 1 AND NO. 3 GENERATOR OUT.
NO. 2 AND NO. 4	ONE PUMP EACH FOR BOOSTER AND UTILITY SYSTEMS WILL BE OUT. OPERATION OF EQUIPMENT WILL TAKE LONGER.	NO. 2 AND NO. 4 GENERATOR OUT.
NO. 3 AND NO. 4	BOOSTER SYSTEM PUMPS WILL BE OUT. FLIGHT CONTROLS BOOST TO BE SUPPLIED BY THE UTILITY SYSTEM AT HALF NORMAL FORCE.*	NO. 3 AND NO. 4 GENERATOR OUT.

*ADDITIONAL RUDDER HYDRAULIC BOOST OBTAINED BY SELECTING MORE THAN 15 PERCENT FLAPS

Figure 3-3

to correct the turning action caused by uneven power conditions. Some trim changes will be required. More rudder deflection will be required at low speed to counteract the unbalanced thrust. With uneven power conditions, the minimum control speed will be limited by the available rudder effectiveness. Failure of an outboard engine may require the reduction of power on the opposite outboard engine. Consult the appropriate performance data for recommended cruise and climb procedure for two- and three-engine operation. In the event two engines fail and a safe altitude cannot be maintained, jettison fuel and equipment as necessary.

WARNING

If the airplane is allowed to fly in an extreme out-of-rudder trim condition, it is possible to experience engine failure(s) due to fuel starvation.

Simulated Engine Failure

Engine failures may be simulated for practice, when desired. To simulate a feathered propeller, retard one or more throttles to FLIGHT IDLE position, but not less than zero torque. The checklist procedure for engine failure can be called out without actually performing the operations named.

Negative thrust from propeller(s) at FLIGHT IDLE will be greater than that from feathered or windmilling propeller(s) above approximately 109 knots for one engine simulated out and between approximately 117 and 128 knots for two engines simulated out. This increases the minimum speed at which directional control can be maintained by as much as 8 knots. Outside these speed ranges, the propeller thrust effect is positive and no increase in minimum control speeds is necessary. Setting the torque(s) on the idling engine(s) to zero or slightly above eliminates the need for any increase to the charted two-engines-inoperative air minimum control speed (V_{MCA}); however, to ensure directional control when simulating one engine out, add 4 knots to charted one-engine-inoperative V_{MCA} .

WARNING

Negative thrust from propeller(s) at FLIGHT IDLE will produce enough drag to increase minimum control speeds by as much as 8 knots over charted V_{MCA} for certain conditions.

Turns

Turns can be made safely with one or more engines inoperative on the same side if an adequate speed margin is maintained above the respective charted minimum control speed. The minimum speed increment required is 20 knots for one engine inoperative and 25 knots for two engines inoperative. Such turns should be well coordinated to minimize slip or skid. Minimum control speeds are defined for straight flight using the favorable sideslip effect on yawing moment developed, by maximum of 5 degrees of bank away from the failed engine. The above speed margins allow the use of the rudder for turn coordination and a safety margin for inadvertent slip or skid. Banking into the inoperative engine(s) increases minimum control speed.

Effect of Speed on Trim

During engine-out operation, as in all other types of operation, trim is affected by speed. After trim is set, any increase of airspeed increases the effect of trim tabs; conversely any decrease of airspeed reduces the effect of trim tabs.

Landing and Go-Around

Landings and go-arounds with feathered engines may be simulated at altitude by flying a traffic pattern over a basic altitude. Roll out most of the trim as touchdown point is reached. During a go-around practice, note the altitude lost between the go-around decision and the time the airplane is safely in a climb condition. Note the airplane acceleration characteristics during these maneuvers.

Air Minimum Control Speed

Minimum control speed is defined as the minimum speed at which directional control of the airplane may be maintained for a set of specified conditions. With one engine inoperative, the air minimum control speed is the minimum speed for directional control with maximum power on all operative engines, the inoperative engine propeller windmilling on NTS, full rudder deflection, or 180 pounds of pedal force and 5 degrees of bank away from the failed engine. The two-engine inoperative air minimum control speed is the minimum speed for directional control with the two engines inoperative on the same side, with the propeller feathered on the inboard inoperative engine and the propeller windmilling on NTS on the outboard, the operative engines at maximum power, full rudder deflection, and with 5 degrees of bank away from the failed engines. Banking away from the failed engine reduces air minimum control speed because of the favorable effect of the sideslip angle which must accompany the increased bank angle. 5° bank is specified because it minimizes air minimum control speed while maximizing climb performance. For the one-engine-inoperative condition, full hydraulic system pressure (3,000 psi) is assumed to be effective, with only half the system output when two en-

gines are inoperative. As described in the performance manuals (TO 1C-130H-1-1), the 3,000 psi pressure is obtained only when the flap lever is placed between the 15 and 100 percent flap positions. Placing the flap lever between zero and 15 percent positions reduces the effective rudder pressure to 1,300 psi, and will reduce the maximum rudder deflection, resulting in higher air minimum control speeds. The air minimum control speed is the minimum speed at which the yawing tendency caused by asymmetric thrust and windmilling propellers can be balanced with maximum rudder throw at the specified bank angle.

PROPELLER MALFUNCTIONS

A propeller malfunction may be caused by synchrophaser, electrical or hydro/mechanical malfunction, and will be indicated by one or more of the following conditions:

1. Propeller low oil light.
2. Rpm outside allowable limits (surge, fluctuation exceeding cyclic variation limits, or stabilized operation outside normal governing limits).
3. Failure of propeller to feather.

NOTE

A tachometer generator failure or TD system malfunction may give a false indication of propeller malfunction by causing rpm indications outside allowable limits. Refer to the appropriate system failure.

NOTE

If an immediate landing is not feasible, Propeller Low Oil indication coupled with visible propeller fluid leaks must be analyzed carefully. The presence of a visible propeller fluid leak and/or Propeller Low Oil Warning Light may indicate that there is insufficient fluid remaining to accomplish feathering. In this instance continued operation of the engine may be the best choice. Careful consideration should be given to the adverse effect on controllability, range, and service/cruise ceiling caused by drag from a windmilling propeller.

NOTE

150 KTAS is referred to several times in this section as a desirable speed to attain. This speed is considered high enough to cause decoupling but not high

enough to produce excessive drag or overspeed after decoupling. Drag produced by a windmilling propeller coupled to the power section is approximately six times greater than drag of a decoupled propeller.

Propeller Malfunctions During Takeoff

Before Refusal Speed, follow ABORT PROCEDURE.

After Refusal Speed, proceed as follows:

NOTE

Propeller malfunctions during takeoff may be difficult to analyze at this most critical phase. If the engine is shut down immediately and the propeller fails to feather, it is possible that higher than normal minimum control speed may result. When fire is not indicated, it is recommended that the engine be allowed to run until at least two-engine inoperative air minimum control speed is reached.

1. Do not adjust throttle position of the affected engine before the malfunction has been analyzed.
2. Continue the takeoff while maintaining directional control.

WARNING

During takeoff, it may be necessary to reduce power on the symmetrically opposite engine to achieve directional control. As airspeed increases this power should be restored as directional control permits.

3. When safely airborne and certain that the airplane will not touch down, raise the gear.
4. After gear is up, commence flap retraction as airspeed permits.

WARNING

It is important to attain two-engine minimum control speed as soon as possible and prior to raising the flaps above 15 percent.

5. Refer to PROPELLER MALFUNCTIONS DURING FLIGHT.

Propeller Malfunctions During Flight**PROPELLER LOW OIL WARNING LIGHT ILLUMINATION****WARNING**

Do not adjust throttle position for the affected engine before performing the following procedure.

1. RPM WITHIN LIMITS

- a. Immediate landing is feasible – attain 150 KTAS (if possible) and perform the ENGINE SHUTDOWN PROCEDURE.
- b. Immediate landing is not feasible – perform the following pitchlock procedures:

- (1) Propeller governor switch – MECH GOV
- (2) TD valve for the affected engine – LOCKED

NOTE

Locking the TD valve will prevent a crossover “bump” if the throttle is moved through the crossover position.

- (3) Engine bleed air valve/regulator (affected engine) – CLOSED/OFF
- (4) Slowly move the throttle (until a TIT change is noted) while maintaining a constant TAS and observing rpm.
- (5) If rpm follows the throttle/TAS –
 - (a) Establish 96 to 98 percent rpm with throttle and/or airspeed adjustment and continue to operate in this rpm range.
 - (b) Upon reaching a suitable landing area, attain 150 KTAS (if possible).

WARNING

Do not allow airspeed to decrease below two-engine inoperative air minimum control speed.

- (c) Upon reaching 150 KTAS or a point where 96 percent rpm cannot be maintained with the throttle, whichever

occurs first, perform the ENGINE SHUTDOWN PROCEDURE.

- (6) If rpm does not follow the throttle/TAS –
 - (a) Monitor RPM.

NOTE

A pitchlock may occur at anytime without warning.

- (b) Perform the ENGINE SHUTDOWN PROCEDURE in the landing pattern.

- (7) Land as soon as practicable.

2. RPM OUTSIDE ALLOWABLE LIMITS**WARNING**

Do not adjust throttle position for the affected engine before performing the following procedure. Failure of one or more of the propeller’s safety features may cause uncontrollable overspeed and directional control problems. Reduce airspeed until safe control is regained. Reduction below two-engine minimum control speed, however, may increase directional control problems.

- a. Propeller governor switch – MECH GOV
- b. If rpm returns to normal limits or remains outside allowable limits and immediate landing is feasible, attain 150 KTAS (if possible) and perform the ENGINE SHUTDOWN PROCEDURE before landing.
- c. If rpm returns to normal limits and immediate landing is not feasible, perform the following checklist:

- (1) Monitor RPM.

NOTE

A pitchlock may occur at anytime without warning.

- (2) Perform the ENGINE SHUTDOWN PROCEDURE in the landing pattern.
- d. If rpm remains outside allowable limits and immediate landing is not feasible, perform the following pitchlock procedures:

- (1) TD valve for the affected engine – LOCKED

NOTE

Locking the TD valve will prevent a crossover “bump” if the throttle is moved through the crossover position.

- (2) Engine bleed air valve/regulator (affected engine) – CLOSED/OFF
- (3) Slowly move the throttle (until a TIT change is noted) while maintaining a constant TAS and observing rpm.

NOTE

If a TIT change is not noted and engine rpm is high, the engine may be on fuel control governing and throttle travel may be insufficient for rpm to follow. In this case, a change in TAS will be necessary to verify pitchlock. A reduction in TAS is recommended (not below two-engine out minimum control speed) as rpm is already on the high side.

- (4) If rpm follows the throttle/TAS –
 - (a) Establish 96 to 98 percent rpm with throttle and/or airspeed adjustment and continue to operate in this rpm range.
 - (b) Upon reaching a suitable landing area, attain 150 KTAS (if possible).

WARNING

Do not allow airspeed to decrease below two-engine inoperative air minimum control speed.

- (c) Upon reaching 150 KTAS or a point where 96 percent rpm cannot be maintained with the throttle, whichever occurs first, perform the ENGINE SHUTDOWN PROCEDURE.
- (5) If rpm does not follow the throttle/TAS, perform the ENGINE SHUTDOWN PROCEDURE.
- e. Land as soon as practicable.

RPM OUTSIDE ALLOWABLE LIMITS
(Without Prop Low Oil Light Illuminated)
WARNING

Do not adjust throttle position for the affected engine before performing the following procedure. Failure of one or more of the propeller’s safety features may cause uncontrollable overspeed and directional control problems. Reduce airspeed until safe control is regained. Reduction below two-engine minimum control speed, however, may increase directional control problems.

1. Propeller governor switch – MECH GOV
 - a. If rpm stabilizes within limits, continued operation is permissible.
 - b. If rpm remains outside allowable limits and immediate landing is feasible, attain 150 KTAS (if possible) and perform ENGINE SHUTDOWN PROCEDURE before landing.
 - c. If rpm remains outside of allowable limits and immediate landing is not feasible, perform PITCHLOCK CHECK PROCEDURES.

PITCHLOCK CHECK PROCEDURE

1. TD valve switch for affected engine – LOCKED

NOTE

Locking the TD valve will prevent a crossover “bump” if throttle is moved through the crossover position.

2. Engine bleed air valve/regulator (affected engine) – CLOSED/OFF
3. Slowly move the throttle (until a TIT change is noted) while maintaining a constant TAS and observing rpm.

NOTE

If a TIT change is not noted and engine rpm is high, the engine may be on fuel control governing and throttle travel may be insufficient for rpm to follow. In this case, a change in TAS will be necessary to verify pitchlock. A reduction in TAS is recommended (not below two-engine minimum control) as rpm is already on the high side.

4. If rpm follows the throttle/TAS, continue to operate in accordance with the PITCHLOCKED PROPELLER OPERATION.

5. If rpm does not follow the throttle/TAS, perform the ENGINE SHUTDOWN PROCEDURE.

Pitchlocked Propeller

When a pitchlock occurs, the blade angle will decrease a minimum of 1.8 degrees as the pitchlock teeth engage.

This will normally result in an rpm increase and the prop should stabilize in fuel governing rpm (103.5 – 105%). The rpm should remain outside allowable limits, cause an audible beat, and follow power and/or TAS changes.

In nearly all cases after an in-flight pitchlock, the propeller can be utilized to provide some positive thrust. Rpm will be determined by engine power and true airspeed.

When determination of a pitchlock is made, it is desirable to operate the propeller in an underspeed condition (96 – 98%). Then, if intermittent governing is experienced, the propeller will try to decrease pitch to return to an on-speed condition, thus assuring a more positive pitchlock. It is necessary that the underspeed not be low enough for the engine acceleration bleed valves to open (94%).

Points of major importance concerning a pitchlocked propeller are:

1. A pitchlocked propeller may not feather.
2. If at least 96 percent rpm cannot be maintained by throttle advancement when slowing to 150 KTAS, it can be assumed that blade angle is high and shutdown at higher airspeed will produce an acceptable windmilling drag and rpm.
3. If rpm can be maintained at 150 KTAS, blade angle is probably near or at the low pitch stop. In this case, shutdown at higher true airspeed would produce excessive drag or overspeed.

Pitchlock Propeller Operation

1. TD valve switch – LOCKED
2. Engine bleed air valve/regulator – CLOSED/OFF
3. Establish 96 to 98 percent rpm with throttle and/or airspeed adjustment and continue to operate in this rpm range.
4. Upon reaching a suitable landing area, attain 150 KTAS (if possible).

WARNING

Do not allow airspeed to decrease below two-engine inoperative air minimum control speed.

5. Upon reaching 150 KTAS or a point where 96 percent rpm cannot be maintained with the throttle, whichever occurs first, perform the ENGINE SHUTDOWN PROCEDURE.

Propeller Fails To Feather

If propeller fails to feather, a landing can be made with it windmilling. The drag will be greater than with a feathered propeller and high rpm and noise may be experienced.

WARNING

It may be necessary to reduce power on the symmetrically opposite engine to maintain directional control.

If propeller rotation continues after feathering, proceed as follows:

1. Fire handle – Reset (if pulled and no indication of fire exists).
2. Feather override button – Hold in for 30 seconds, then pull out.
3. If airspeed is less than 150 KTAS, attain 150 KTAS (if possible).
4. Land as soon as practicable.

WARNING

Maintain airspeed above two-engine inoperative air minimum control speed until the landing is assured. A go-around should not be attempted if airspeed is below two-engine inoperative air minimum control speed. Go-around with a windmilling propeller may be marginal.

IN-FLIGHT DECOUPLING OF ENGINE AND PROPELLER

The reduction gear section decouples from the power section of the engine if a propeller attempts to drive the power section, and the engine negative torque control system fails to operate. As negative torque builds up before decoupling of

an engine takes place, airplane yaw may be noticed. However, there may be little or no difference in airplane feel, and the knowledge that an engine has decoupled must be gained from instrument indication. If the decoupling is caused by engine failure or flame out, torque, turbine inlet temperature and fuel flow will drop to near zero, and power section oil pressure will drop. Rpm may temporarily increase, then settle to normal.

Hydraulic pressure, generator output, and reduction gear section oil pressure will remain normal. Extremely low turbine inlet temperature and fuel flow for a given power lever position, accompanied by fluctuating and near zero torque, may be an indication of a decoupling in which the engine has continued to operate. When decoupling is observed, follow the ENGINE SHUTDOWN PROCEDURE. Do not restart the engine.

ENGINE SYSTEMS FAILURE

Throttle Control Failure

Throttle control failure may be indicated by any of the following conditions:

1. Throttle moves independently of pilot input.

WARNING

Do not attempt to restrain a throttle which moves on its own. To do so may cause the propeller to go immediately into reverse or to full power.

2. Throttle frozen or binding.
3. Power indication unrelated to throttle position.

If a power increase/decrease, not pilot-initiated, occurs or is suspected, a throttle control cable or TD System malfunction should be suspected. Proceed as follows:

1. TD Valve (affected engine) – NULL
 - a. If power returns to normal, refer to TD Control Valve System Malfunction.
 - b. If power remains unrelated, perform the ENGINE SHUTDOWN PROCEDURE.

WARNING

Do not move the throttle prior to engine shutdown. To do so could cause the propeller to go immediately into reverse pitch or to full power.

TD Control Valve System Malfunction

CAUTION

Transmitting on the HF radios in the 11 MHz through 13 MHz range may cause up to a 100 ° C TIT input signal on airplanes equipped with solid-state TD amplifiers.

A malfunction of the TD control valve system of an engine may cause a sudden increase or decrease in TIT with an accompanying change in torque and fuel flow indication. If this condition occurs during stabilized operation, place the TD control valve switch for that engine in the NULL position. If TIT stabilizes and returns to near normal, place the switch in the LOCKED position, and continue operation. If the malfunction persists, other engine systems are at fault. Monitor TIT closely during NULL operation as maximum TIT can often be exceeded at advanced throttle settings under these conditions.

Secondary Fuel Pump Pressure Light Illumination

NOTE

If the secondary fuel pump pressure light flickers or comes on steady while on crossfeed from the auxiliary or external tanks, discontinue crossfeed. If the secondary fuel pump pressure light is extinguished, this may be an indication of a malfunctioning pressure switch, secondary pump outlet check valve in the high pressure filter assembly, or paralleling valve. Normal crossfeed operation may be resumed; closely observe fuel flow, turbine inlet temperature and torque.

Illumination of the secondary fuel pump pressure light above 65 percent engine rpm may be caused by failure of the engine-driven fuel pump, pressure switch, paralleling valve stuck closed, or failure of the 65 percent switch in the speed-sensitive control. If the light is extinguished when the ignition control circuit breaker for the corresponding engine is pulled, failure of the 65 percent switch in the speed-sensitive control is indicated. Leave the circuit breaker pulled and continue operation.

NOTE

When an inboard engine ignition control circuit breaker is pulled, the ice detector in the affected nacelle will be inoperative.

After landing, proceed as follows:

1. Circuit breaker – Reset
2. Condition lever – GROUND STOP

If the secondary fuel pump pressure light remains illuminated with the ignition control circuit breaker pulled, reset the circuit breaker. Failure of the primary fuel pump could cause metal contamination of the engine fuel system. Engine shutdown may be advisable.

Speed-Sensitive Control Failure (Sheared Shaft)

A sheared shaft on the speed-sensitive control with the throttle above 65 degrees travel may be indicated by momentary illumination of the secondary fuel pump pressure light; fuel correction light and TIT will not exceed start limiting temperature of approximately 830 °C. A sheared shaft with throttle below 65° may be indicated by momentary illumination of the secondary fuel pump pressure light and TIT will not exceed start limiting temperature of 830 °C. If either of the above conditions occurs, retard the throttle, place the TD valve switch to NULL, pull the ignition control circuit breaker and continue operation. After landing, use normal ground idle speed only and shut down the engine as follows:

1. Circuit breaker – Reset
2. Condition lever – GROUND STOP

Engine Oil System Failure

The indications of an engine oil system failure that may lead to engine failure are:

1. Decreasing oil pressure.
2. Increasing oil temperature.

3. Decreasing oil quantity.

DECREASING OIL PRESSURE

NOTE

A negative g condition may allow air to enter the engine oil supply line, resulting in a loss of oil pressure approximately 30 to 90 seconds later due to oil pump cavitation.



Following a negative g condition, closely monitor gearbox and engine oil pressure for 2 minutes. If loss of oil pressure occurs and does not return to normal within 10 seconds, shut down the engine in accordance with the ENGINE SHUTDOWN PROCEDURE in this section. After the propeller stops rotating, an air start may be attempted in accordance with the AIR START PROCEDURE.

This condition warrants careful monitoring of the engine instruments for the engine with the decreasing oil pressure, but no corrective action is required as long as the engine instrument readings are within limits. If oil pressure is decreasing out of limits, perform the ENGINE SHUTDOWN PROCEDURE.

INCREASING OIL TEMPERATURE

Increasing oil temperature may result from failure of an oil cooler flap to function in AUTOMATIC. If oil temperatures exceed the normal range proceed as follows:

1. Hold the oil cooler flap switch in the OPEN position until the oil cooler flap is open.
2. Thereafter, manually open or close the oil cooler flap as required to maintain normal engine oil temperature.
3. If engine oil temperature cannot be maintained within limits, perform the ENGINE SHUTDOWN PROCEDURE.

DECREASING OIL QUANTITY

The low oil quantity warning light illuminates when the oil level in a tank drops to approximately 4.0 gallons. This condition warrants careful monitoring of the engine instruments for the engine with the low oil quantity gauge reading, but no corrective action is required as long as the engine instrument readings are within limits. If engine instrument readings are out of limits, perform the ENGINE SHUTDOWN PROCEDURE.

NOTE

If the rate of quantity loss is gradual and length of mission would require engine shutdown prior to termination, the pilot may elect to shut down the affected engine and restart at a later time when conditions necessitate.

If during flight the aircrew notices a loss of engine oil quantity with heavy smoke coming out of the tailpipe area, the engine should be monitored during flight and the aircrew should perform the ENGINE SHUTDOWN PROCEDURE prior to landing. This should prevent oil combustion in the tailpipe after landing.

Tachometer Generator Failure

A tachometer generator failure may be indicated by the following:

1. Decrease or fluctuation of rpm.
2. Decrease or fluctuation of torque.

If a tachometer generator failure occurs, the flight engineer will proceed as follows:

1. Synchrophase master switch (if the affected engine is selected) – OFF/other MASTER
2. Propeller governing control switch – MECH GOV

Overtorque

If an overtorque is experienced proceed as follows:

1. Note amount of overtorque.
2. If overtorque was between 19,600 in/lbs and 21,500 in/lbs, record on CG Form 4377.

3. If overtorque exceeded 21,500 in/lbs, land as soon as practicable.
4. Maintenance action is required prior to further flight.

FUEL SYSTEM FAILURE

Fuel Boost Pump Failure

A fuel boost pump failure, in a tank containing fuel, will be indicated by a low-pressure warning light (Main tanks) or a tank empty light (Aux/External tanks). Pressure loss will be verified by use of the fuel pressure indicator for all tanks except the external tanks.

If an external tank empty light illuminates when its quantity gauge indicates fuel aboard, it can be due to failure of the pump or one of several other components. To locate the failure, first turn on the tank's alternate pump and turn off the one used when the light illuminated. If the light goes out, illumination was due to failure of the pump previously used. However, if the light remains illuminated, go on main tank feed for all engines and check the external tank pump pressure on the manifold pressure gauge. Open the crossfeed separation valve and turn off all crossfeed valves except for the external tank being checked. Check pressure for each of the pumps in the external tank. The crossfeed prime button may be used to bleed the crossfeed pressure to zero between checks. If no pressure is obtained, the pumps are inoperative. Fuel remaining in that tank will not be available and the flight must be altered accordingly. If a pressure of approximately 28 psi is indicated, the pumps are operating properly, and the pressure-sensing external tank empty light switch is malfunctioning. Flight may be continued normally except that the quantity gauge for that tank must be monitored to determine an empty condition. A pressure of less than 28 psi on a single boost pump is an indication of a possible failure. Operation under these conditions may be continued with caution, except that other boost pumps supplying pressure to the same manifold must be turned off to allow the tank with the lower boost pressure to dominate. Refer to Section II Part D for allowable fuel imbalance.

If failure is confirmed or popout of either A, B, or C phase circuit breaker is experienced, proceed as follows:

1. Boost pump switch – OFF
2. Boost pump circuit breakers – Pull
3. Set up another fuel supply – As required

WARNING

The affected fuel boost pump switch should not be turned on or the circuit breakers reset until proper inspection and repairs have been performed. Resetting of the circuit breakers and turning the switch on should be considered only to prevent fuel starvation of the engines when a landing cannot be accomplished within the range of available fuel.

Operation with Boost Pump Failure

If a main tank boost pump failure occurs during climb, crossfeed the engine from another tank and continue climb to mission altitude. Allow the fuel to stabilize for several minutes, then switch the engine back to the tank with the inoperative boost pump, closely observe fuel flow, turbine inlet temperature, and torque. If the engine operates satisfactorily in this condition, continue the mission as planned; if the engine will not operate satisfactorily in the tank to engine position, switch back to crossfeed operation.

NOTE

When operating in tank-to-engine position with an inoperative boost pump, avoid rapid acceleration or nose low attitudes. Descents should be made with minimum nose down attitude. If a high rate of descent is required, it is advisable to select crossfeed operation.

Wait several minutes and repeat preceding step. If engine fails to operate satisfactorily return to crossfeed operation. At this time it may be necessary for the pilot to change his flight plan to avoid major fuel imbalance and loss of range due to unavailable fuel. If the mission can be accomplished at a lower altitude, descend until engine will run satisfactorily on tank-to-engine flow.

NOTE

Do not select crossfeed unless the crossfeed system is pressurized by operating boost pumps in other tanks.

On CG 1600 series, CG 1790, and CG 1700 series airplanes: If a main fuel tank boost pump has failed and crossfeed from another tank is not desired, the affected tank dump pump may be used to feed the engine by use of the following procedure:

1. Main tank crossfeed valves – CLOSED
2. Affected tank dump pump – DUMP

3. An external tank crossfeed valve – OPEN
4. Crossfeed separation valve – OPEN
5. Crossfeed primer button – Press for 30 seconds
6. Affected tank crossfeed valve – OPEN

Gradual power losses will occur between 12,000 and 20,000 feet during rapid climb out to an engine without boost pump pressure. This altitude will vary with the prevailing fuel temperature and type fuel in tanks (the higher the fuel temperature the lower the altitude at which the power loss will occur). This condition results from the highly aerated condition of the fuel caused by rapidly decreasing atmospheric pressure during climb, allowing entrapped air in the fuel to expand. The period of time required for the fuel to stabilize from this aerated condition will depend upon both the rate of climb and fuel temperature. Fuel stabilization should occur in a few minutes after level off at cruise altitude once the excess air has escaped from the fuel. Maximum power setting can be maintained up to an altitude of 30,000 feet with a boost pump inoperative if nose up or nose down attitude and rapid acceleration are avoided. Fuel aeration does not occur during descent. The water removal system will be turned off when the boost pump switch is placed in the OFF position. This may result in fuel starvation for the affected engine in an extreme nose-down attitude unless crossfeed operation is used. It is impossible to gravity feed fuel from a tank with an inoperative boost pump through the crossfeed system to another engine. If a partial tank and an empty tank are on crossfeed with the boost pump inoperative in the partial tank, the engine being fed from the empty tank will be starved by air being drawn into the fuel line.

Fuel Quantity Indicator Failure

A malfunction of any fuel quantity indicator may indicate a possible failure that would, with the proper sequence of events, allow the introduction of high voltage electrical power into the associated fuel tank. If the fuel quantity indicator goes to off scale high or off scale low, the following action must be complied with:

Pull the associated fuel quantity indicator circuit breaker.

WARNING

The indicator will not be removed or changed and the circuit breaker will not be reset until proper inspection and repairs have been made.

External or Auxiliary Tank Dump Valve Failure

If an external or auxiliary tank dump valve fails to open when fuel dumping from that tank is desired, the fuel may be

dumped through the bypass valve and the operative dump system for the external or auxiliary tank on that side.

External or Auxiliary Tank Crossfeed Valve Failure

If an external or auxiliary tank crossfeed valve fails to open when crossfeed operation from that tank is desired, open the bypass valve for that tank and the operative external or auxiliary tank crossfeed valve on the same side.

External Fuel Leaks (Drip or Running Type)

Due to the complexity of the fuel system, a fuel leak from an undetermined source may be difficult to analyze. If the source of a fuel leak is unknown it is recommended to establish tank to engine fuel burn and establish a fuel log.

External fuel leaks encountered in flight present a fire hazard if the leak is in close proximity to an engine. The possibility of a wing fire from an external fuel leak is increased on landing if reverse thrust is applied. If an external fuel leak is encountered near an engine, shutdown of the engine should be considered. Land as soon as possible at the nearest airfield which has sufficient runway to complete the landing ground roll without use of reverse thrust. Because of the possibility of fire, an emergency shall be declared and fire suppression equipment requested.

FUEL DUMPING

Should it become necessary to dump fuel in preparation for an emergency landing, to reduce gross weight in an emergency, or to provide for additional buoyancy in a ditching operation, follow the procedure outlined below:

1. Advise an air traffic control facility of the intentions to dump fuel.
2. Set the fuel system for tank-to-engine flow.

WARNING

If the fuel dump switches for the auxiliary tanks (or external tanks) are placed in the DUMP position while those tanks are supplying fuel to the engines, the respective tank crossfeed valves are automatically closed, shutting off fuel flow to the crossfeed manifold.

3. (CG 1600 series, CG 1790 and CG 1700 series). Place the DUMP VALVE switches to OPEN.

NOTE

After completion of fuel dumping, return the DUMP VALVE switches to NORM.

4. Place the fuel dump switch for each of the fuel tanks from which fuel is to be jettisoned in the DUMP position.

NOTE

Dump symmetrical tanks at the same time in order to maintain lateral balance.

5. Monitor the fuel quantity indicators closely.
6. Return the fuel dump switches to NORMAL/OFF when the fuel quantity in each tank has been decreased as required.

The following procedures and precautions are recommended when dumping fuel if conditions permit:

1. Do not dump fuel under 5,000 feet above the terrain. This will prevent the possibility of a ground source igniting the fuel vapors.
2. Do not dump in a circular pattern. This will prevent turning into dropping fuel.
3. After completing fuel dumping, if time permits prior to landing, the fuel dumping manifold should be cleared of residual fuel. Cross-controlling the airplane, and ensuring a wing-low attitude with slight skid, will deplete all residual fuel except that located at low points in the manifold. This will minimize the fire hazard of excessive fuel drainage coming from the fuel dumping jettison mast due to normal wing deflections and attitudes during taxi or while the airplane is parked.

WARNING

If the airplane is allowed to fly in an extreme out-of-rudder trim condition, it is possible to experience engine failure(s) due to fuel starvation.

DUMPING CHART

APPROXIMATE DUMP TIME				
POUNDS FUEL TO BE DUMPED	MINUTES TO DUMP			
	4 PUMPS OPERATING	6 PUMPS OPERATING	8 PUMPS OPERATING	10 OR MORE PUMPS OPERATING
5,000	3.0	2.0	1.0	1.0
10,000	6.0	4.0	3.0	2.0
20,000	12.0	8.0	6.0	4.0
30,000	17.0	12.0	9.0	7.0
40,000	23.0	15.0	12.0	9.0
50,000	29.0	19.0	14.0	12.0

ELECTRICAL SYSTEMS FAILURE

WARNING

Do not operate the airplane without a serviceable battery. Power would not be available to operate the fire extinguisher system, alarm bells, or emergency depressurization.

With modern complex airplanes, it is extremely difficult to anticipate all the possible electrical failures and to plan corrective action and procedures for each failure. However, a broad analysis of the situation indicates that failures fall into three possible categories:

1. Malfunctions of one or more of the primary power sources.
2. Malfunctions on the distribution system.
3. Malfunctions within equipment items.

Malfunctions in the distribution system and load circuits should be controlled through protective devices such as circuit breakers, fuses, and current limiters. Should one of these devices fail to operate, considerable smoke can result and some emergency action on the part of the crew may be needed. If a malfunction occurs to the left-hand, right-hand, or main ac bus or equipment on these buses, it may be necessary to turn off all four engine-driven generators to isolate the problem. In this case, the ATM/APU generator should be turned on prior to turning the engine driven generators off.

This will supply power to the essential ac bus. This will allow the crew to evaluate the situation and determine which bus and/or component caused the malfunction and to take the proper corrective action. Loss of one or more of the primary power sources will require the crew to take prompt action by closely watching electrical loads, so that the remaining power sources will not be overloaded.

NOTE

If electrical power to the IFF is lost, Mode 4 codes will be zeroized unless the HOLD function has been activated.

Battery Overtemperature

The NICAD battery has a battery intercell connector to sense the internal temperature of the battery. A thermal switch is actuated and illuminates the BATT OVERTEMP warning light. If the battery is allowed to remain in an overtemp condition, the possibility of a thermal runaway exists.

Indications of a thermal runaway are:

1. Smoke, fumes, or flames
2. Sounds described as “bangs” or “thuds”
3. Leakage of electrolyte

If a battery overtemperature is indicated by a BATT OVERTEMP warning light on the electrical panel, proceed as follows:

1. DC power switch – OFF



If the BATT OVERTEMP warning light goes off after a period of time, the dc power switch should remain in the OFF position.

2. Land as soon as possible.
3. Alert the fire department of the situation and the corrective action required.
4. Follow the GROUND EVACUATION PROCEDURE.

Corrective action:

WARNING

The battery compartment shall be opened only by a properly outfitted (face, hand, and body protective clothing) crash crewmember, with fire fighting equipment standing by.

1. Standby with fire fighting equipment.
2. Check for the following conditions and take the action indicated:
 - a. If flame is present, use any available extinguishing agent.
 - b. If no flame or fire, but smoke, fumes or electrolyte is being emitted from the battery or vent tubes, use water fog to lower the battery temperature.
 - c. If no flame, smoke, hydrogen/oxygen gases or electrolyte is being emitted from the battery or vent tubes, ventilate.

WARNING

In no case should CO₂ be directed into a battery compartment to effect cooling or displace explosive gases. The static electricity generated by CO₂ could cause the hydrogen/oxygen gases trapped in the compartment to explode. CO₂ is an acceptable fire extinguishing agent once a fire has developed.

3. Remove the quick disconnect fitting.
4. Remove battery by cutting safety wire and disconnecting clamps at top of battery.
 - a. Additional cooling may be accomplished with water fog.

Generator Failure

Generator failure or generator system malfunction will be indicated by one or more of the following:

1. Illumination of a generator out light.
2. Illumination of a bus off light.
3. Illumination of a generator failed bearing light (if installed).
4. Fluctuation/out of limits voltage and/or frequency.

If the average phase voltage of a generator is below approximately 90 volts, the bus off light will illuminate. If any phase voltage is below approximately 70 volts, the generator off light will illuminate.

The flight engineer will take corrective action for each condition as covered in the following paragraphs.

NOTE

If generator failure is confirmed during taxi, the affected engine may be shut down by placing the condition lever to ground stop in lieu of generator disconnect.

Illumination of a Generator Out Light (Non ESU Equipped Airplanes)



If at any time inflight generator output voltage exceeds 130 volts on any phase, it is recommended to disconnect the generator to preclude damage to electrical control system equipment. On the ground the engine may be shut down by placing the condition lever to ground stop in lieu of generator disconnect.

NOTE

If the generator is disconnected, land as soon as practicable.

1. Check frequency, voltage and load.
2. If frequency, voltage, and load are normal, leave the generator switch on and monitor.

NOTE

If the generator control switch is turned OFF, it may not be possible to utilize power from the generator

because the power to energize the contactor relay is supplied by the transformer rectifier unit within the generator control panel.

3. If frequency and voltage are normal with no indication of load, place the generator switch to OFF and monitor the voltage and frequency.
4. If abnormal frequency and/or voltage are noted, turn the generator off and monitor the generator. If indications are subsequently lost, disconnect the generator.
5. If no frequency and voltage are indicated, place the generator switch to RESET.
 - a. If frequency and voltage are normal, resume normal operation.
 - b. If frequency and voltage are not indicated on all three phases after placing the switch to RESET, it can be assumed the generator has failed. Disconnect the generator. Land as soon as possible.
 - c. If frequency and voltage are indicated but voltage is observed to momentarily peak above normal and return to zero, it can be assumed an overvoltage or generator feeder fault condition causes illumination of the light. In this case, disconnect the generator. Land as soon as practicable.

Illumination of a Generator Out Light (Airplanes modified by ESU)

CONDITION: Overvoltage, undervoltage, underfrequency, or a ground fault.

CORRECTIVE ACTION: Check for frequency, voltage, and load of the affected generator.

- a. If frequency, voltage, and load are normal, leave generator ON. Continue operation.
- b. If frequency and voltage are normal, but no load is indicated, leave the generator switch ON and monitor generator frequency and voltage. If voltage and frequency indications are lost, disconnect the affected generator using the Generator Disconnect Procedure in this section.
- c. If no frequency, voltage, or load are indicated, place the generator switch to OFF/RESET or OFF and then to ON.

- (1) If frequency, voltage and load are normal, resume normal operation.

- (2) If no frequency, voltage, or load are indicated, place the generator switch to OFF/RESET or OFF and disconnect the affected generator using the Generator Disconnect Procedure in this section of the Flight Manual.

Illumination of Generator Failed Bearing Light (If Installed)

1. Disconnect the generator. This light indicates the possibility of a generator mechanical failure.
2. Land as soon as practicable.

Generator Disconnect

The generator can be mechanically disconnected from the engine by holding the GEN DISC switch to DISC for approximately 2 seconds. Activation of the disconnect mechanism is indicated by the illumination of the DISC FIRED light. Once disconnected, a generator cannot be reconnected in flight. If the generator cannot be disconnected, shut down the engine in accordance with the ENGINE SHUTDOWN PROCEDURE.

Loss of Electrical Systems

The possibility of the loss of all electrical systems is very remote. In the event of a complete loss of electrical power, the following systems will be operable.

Flight instruments:

Altimeter (CP only CG 1790 and 1700 series), Airspeed Indicator (pointer only, CG 1790, CG 1700 series), Attitude Director Indicator (slip indicator portion) Accelerometer

Engines and Propellers:

Engine shutdown can be accomplished only by placing condition lever to FEATHER.

Throttle control only (TD valves locked – no overtemp protection)

Tachometer

Propellers will go to mechanical governing

Anti-icing and Deicing:

Engine

Pressurization and Air Conditioning (CG 1500 series)

Flight Controls:

Normal boost (Rudder boost pressure reduced to low boost)

Wing flaps (Hydraulic override)

NOTE

Due to the loss of power to the trim tab system, a no flap landing is recommended.

Fuel available from main tanks

Normal brake system (no anti-skid)

Nosewheel steering

Landing gear system (hydraulic override)

Emergency lights

Oxygen system

Aft cargo door and ramp system (manual)

Illumination of an AC Bus Off Light (Non ESU Equipped Airplanes)



If the Essential AC Bus OFF light illuminates, check for indications of a partial loss of the Essential AC Bus (secondary indications). If secondary indications are present, proceed with PARTIAL LOSS OF THE ESSENTIAL AC BUS procedures. If no indications are present, continue with ILLUMINATION OF AN AC BUS OFF LIGHT procedures.

NOTE

If the generator is disconnected, land as soon as practicable.

1. Place the affected generator switch to the OFF position; ensure another generator picks up the failed bus.
2. Check for frequency and voltage.
3. If frequency and voltage are normal and the bus Off light remains illuminated, and no item on that bus has failed, resume normal position. This is an indication of a bus off indicator relay failure rather than a bus failure.
4. If abnormal frequency and/or voltage are indicated, leave the generator off and monitor. If indications are lost, disconnect the generator.
5. If no frequency or voltage are indicated, go to RESET then OFF.
 - a. If frequency and voltage are normal, turn the generator ON and resume normal operation.
 - b. If no frequency or voltage are indicated, disconnect the generator.

6. If the other generator does not pick up the failed bus and the failed bus cannot be restored to normal operation, Section I should be reviewed to ascertain which systems have been lost.

7. Land as soon as practicable.

Illumination of AC Bus Off Light (Airplanes modified by ESU)

CONDITION: Possible AC BUS power failure.

CORRECTIVE ACTION:

1. If the affected generator OUT light is also illuminated, place the generator switch to OFF/RESET.
 - a. Ensure that another generator assumes the bus and the AC Bus Off Light extinguishes.
 - b. Perform the generator disconnect procedure for the generator that was turned off.
2. If the affected generator OUT light is not illuminated and systems associated with the failed bus are operating normally, verify normal voltage, frequency and load indications for the affected generator.
 - a. If voltage, frequency and load are normal, continue operation. The BUS OFF indication is a result of a failed bus off indicator relay.
 - b. Monitor the affected generator and the systems associated with the ac bus for any further indications of failure.
3. If the affected generator OUT light is not illuminated, systems associated with the failed bus are malfunctioning, and the failed bus cannot be restored to normal operation, follow the Electrical Bus Isolation Procedures in this section. Section I should be reviewed to ascertain which systems have been lost.

Illumination of an Avionics AC Bus Off Light (Airplanes modified by ESU)

CONDITION: Possible Essential or Main Avionics Bus Failure

CORRECTIVE ACTION:

1. If systems powered by the avionics buses are operating normally, this is due to a failed bus off indicator relay. Continue normal operation.
2. If systems are not normal, check the affected Avionics bus power circuit breakers. If circuit breakers are

open, reduce load on the affected avionics bus and attempt to reset the circuit breakers.

3. If power is restored, and the problem was with the essential avionics bus, continue operation with the reduced load, and land as soon as possible.
4. If power is not restored, leave the avionics bus isolated, and if the problem was the Essential Avionics Bus, land as soon as possible.

Illumination of an Essential or Main BSS Advisory Light (Airplanes modified by ESU)

CONDITION: Possible failure of the associated Bus Switching System (BSS).

CORRECTIVE ACTION:

1. If either the Essential or Main avionics advisory lights illuminate, it can be assumed that the associated Bus Switching System (BSS) has failed and the Failed Bus Contactor has engaged, reverting the associated avionics bus to unconditioned (unregulated) ac power.
 - a. Refer to this section for electrical isolation procedures of the associated Bus Switching System (BSS).

Illumination of the Isolated DC Bus on Battery Light

In-flight failure of the reverse current relay connecting the essential and isolated dc buses will be indicated by illumination of the ISOL DC ON BAT light and/or a battery voltmeter indication of 24 volts or less. If these indications are observed, battery power conservation measures must be initiated. An assessment of flight conditions and electrical power requirements should be made to determine what battery and isolated dc-powered items may be turned off to conserve battery power. Land the aircraft as soon as possible.

Partial Loss of the Essential AC Bus

A loss of one phase of the essential ac bus may occur with or without illumination of the essential ac bus off light. The malfunction is most likely to occur during high load conditions of the essential ac bus and may be indicated by one or more of the following conditions:

1. Failure of normal brakes (if on the ground).
2. Erratic autopilot operation (if in use).
3. Loss or malfunction of heading indication.
4. Auxiliary hydraulic pump failure.

5. Illumination or flickering of the No. 2 fuel boost pump low-pressure warning light.
6. Illumination of a hydraulic suction boost pump light.
7. Illumination of the essential ac bus off light, which remains illuminated after the affected generator is turned off (another generator does not assume the bus load).
8. Loss of propeller synchrophaser.
9. Illumination of the pitot heat off lights. (CG 1717 and up)

If partial loss of the essential ac bus either occurs or is suspected, proceed as follows:

1. Turn the generator switch for the generator powering the essential ac bus at the time of the malfunction to the OFF position and monitor while performing the following procedures.
 - a. If power is restored to the essential ac bus, leave the generator switch Off and proceed with generator malfunction procedures found in this section.
2. If power is not restored, proceed as follows:
 - a. Place the anti-skid switch to the OFF position.
 - b. Disengage all FCS-105 modes. (CG 1790, 1600/1700 series)
 - c. Disengage INS ATT SEL.

NOTE

If INS Attitude Select for the pilot is being used to provide ADI gyro information, it will become erratic and unreliable when the CP AC INST INV switch is placed to the DC position.

- d. Place both inverter switches to the DC position.
- e. Place all propeller governor control switches to MECH GOV.

NOTE

If all four propeller governor control switches are not placed in the MECH GOV position prior to restoring power to the essential ac bus, a significant power fluctuation may be experienced.

- f. Reduce the load on the essential ac bus to the minimum. Do not operate the auxiliary hydraulic pump.

NOTE

The circuit breakers that may be used to reduce the load on the Essential AC bus are color coded yel-

low for easy recognition. Confirm the identity of the desired circuit breakers prior to pulling.

- g. Check all A, B, and C phase essential ac bus power circuit breakers on the pilot's side circuit breaker panel and on the main ac distribution panel at FS 245. Reset any tripped breakers.
- h. If the circuit breakers are in, will not reset, or trip again, place the ATM and generator switches to ON (CG 1500 series) or start the APU and place the APU generator switch to ON (CG 1790, 1600/1700 series).
- i. If breakers still will not reset or trip again, isolate the essential ac bus.
- j. Review Section I to ascertain which systems have been lost.
- k. If an essential ac bus malfunction is experienced, the airplane will be landed as soon as possible, regardless of apparent success of the corrective action.

erratic engine performance or fuel starvation, leading to serious reductions in power output or flameout of multiple engines.

Electrical system malfunctions that introduce abnormally low voltage to the Essential AC bus can cause the four temperature datum amplifiers to malfunction, producing multiple engine torque reductions of up to 1,600 inch pounds per engine.

Low voltage, Electromagnetic Interference (EMI), or other electrical malfunctions can also cause the synchrophaser to reduce propeller RPM by a maximum of four percent. This may occur with or without torque or other engine instrument fluctuations caused by other system's reactions to the low voltage.

Low or fluctuating ac voltage can also cause erroneous instrument indications, which can be misinterpreted as actual fluctuations. TIT, torque, and fuel flow may be affected, as well as other systems on the affected bus.

MULTIPLE ENGINE POWER LOSS/RPM ROLLBACK

Loss of positive fuel boost pressure, fuel system malfunction, or non-standard fuel management techniques can cause

When multiple engine power loss/rpm rollback of an undetermined nature is incurred (either sequentially or simultaneously) the following procedures should place the aircraft in the most stable configuration.

WARNING

Airstart of engines is not possible, on CG 1500 series aircraft, with complete loss of ac power due to four engine failure.

WARNING

Airstart of the APU/Generator (CG 1790, 1600, and 1700 series) is required in order to airstart the engines after four engine failure.

1. All main tank boost pumps	ON
2. All fuel crossfeed valves	CLOSED
3. Crossfeed separation valve	CLOSED
4. All four temperature datum valve switches	NULL
5. Propeller synchrophaser master switch	OFF
6. Propeller governor switches	MECHANICAL GOVERNING

NOTE

If all four propeller governor control switches are not placed in mechanical prior to restoring power to the Essential AC bus, a significant power fluctuation may be experienced.

7. Propeller synchrophaser essential ac and essential dc circuit breakers	PULLED
8. Generator supplying the essential ac power	OFF

NOTE

Ensure that another generator has picked up the load of the essential ac bus.

9. If the Multiple Engine Power Loss/RPM Rollback procedure successfully corrects the emergency condition, land as soon as practicable. If the condition persists, land as soon as possible.

WARNING

If power loss conditions still persist after pulling the synchrophaser essential ac and essential dc bus circuit breakers, remove the synchrophaser unit from the rack mount to eliminate any inputs to the propeller control assemblies.

WARNING

These procedures should correct propulsion system malfunctions arising from fuel systems, loss of RPM due to low voltage on the essential ac bus, or electromagnetic interference (EMI), but there are other malfunctions that could cause a loss of engine power such as a failure in the bleed air system. When the procedure has been completed, the crew should check all other essential systems for proper operation.

CAUTION

Transmitting on the HF radios in the 11 MHz through 13 MHz range may cause up to a 100 ° C TIT input signal on airplanes equipped with solid-state TD amplifiers.

ELECTRICAL FIRE

WARNING

Because of the important part electrical controls play in the operation of this airplane, electrical power should not be shut off until the pilot is reasonably certain that it is, or will be, a contributing factor to smoke or fire, and that loss of electrical controls will not be a greater hazard than the smoke or fire.

NOTE

In the event a fire is near an oxygen component or there is a possibility that the oxygen could increase the fire, consideration should be given to closing

the oxygen manual shutoff valve, provided portable oxygen bottles are adequate for the situation.

If fire, smoke, or overheat of electrical equipment occurs, every attempt should be made to locate the malfunctioning unit(s)/bus. If able to locate the source of the malfunction, isolate by turning off/pulling circuit breaker(s)/removing the electrical plug(s).

If unable to locate the malfunctioning unit(s), the flight engineer will proceed as follows:

1. ATM and generator/APU and generator – START, ON. If ATM/APU generator inoperative, proceed to step 4.
2. All engine generators – OFF

If the situation stabilizes:

- a. Again attempt to locate the malfunctioning unit(s) and isolate by turning off/pulling circuit breaker(s)/removing the electrical plug(s).
 - b. If the malfunctioning unit(s) is located and isolated, restore power to the remaining buses.
 - c. If the malfunctioning unit(s) cannot be located, land as soon as practicable.
3. If conditions persist, proceed as follows:
 - a. Copilot's inverter – DC
 - b. Oil cooler flap – Open and fixed

NOTE

If INS Attitude Select for the pilot is being used to provide ADI gyro information, it will become erratic and unreliable when the CP AC INST INV is placed in the DC position.

- c. ATM and generator/APU and generator – OFF, STOP

WARNING

(CG 1790, 1600/1700 series) The airplane will depressurize any time power is removed from the essential dc bus due to the engine bleed air regulators closing.

- d. Land as soon as possible.

NOTE

The final isolation procedure should be used as a last resort when the malfunctioning unit(s) cannot be located, but the malfunctioning bus is known. The purpose of this procedure is to allow a return to normal operation of the unaffected buses. If a bus must be isolated, refer to Section I to ascertain which systems have been lost.

See figure 3-4 for final bus isolation procedure.

4. If an electrical fire occurs while operating with an inoperable ATM/APU generator and the affected BUS is unknown, take the following action:
 - a. Place oil cooler flaps to OPEN/FIXED.
 - b. Turn the copilot's inverter to the DC position.
 - c. Turn off all engine-driven generators.

- d. Remove the three current limiters on the main AC BUS at station 245.
- e. Turn on one engine-driven generator. If fire goes out, determine the malfunctioning BUS and proceed with the BUS isolation procedure.
- f. If the fire persists, turn off the generator.
- g. Land as soon as possible.

BUS SWITCHING SYSTEM POWER TRANSITION PROCEDURES

Essential Avionics bus

In the event that it becomes necessary to transition from BSS output (regulated) power to unconditioned (unregulated) power on the ESS Avionics AC Bus proceed as follows:

1. Pull the ISOL DC BUS AVIONICS ESNTL BY-PASS CNTOR CONTROL circuit breaker on the pilot's side circuit breaker panel.

If it becomes further necessary to isolate/remove power from BSS No. 1 proceed as follows:

2. Pull the following two sets of three "ganged" circuit breakers for the affected BSS on the aft lower main distribution panel at FS 245.
 - a. ESS AVI SEC PWR
 - b. ESS AVI PRI PWR

Main Avionics Bus

In the event that it becomes necessary to transition from BSS output (regulated) power to unconditioned (unregulated) power on the MAIN Avionics AC Bus proceed as follows:

1. Pull the ISOL DC BUS AVIONICS MAIN BY-PASS CNTOR CONTROL circuit breaker on the pilot's side circuit breaker panel.

If it becomes further necessary to isolate/remove power from BSS No. 2 proceed as follows:

2. Pull the following two sets of three "ganged" circuit breakers for the affected BSS on the aft lower main distribution panel at FS 245.
 - a. MAIN AVI SEC PWR
 - b. MAIN AVI PRI PWR

AVIONICS BUS FINAL ELECTRICAL ISOLATION PROCEDURES

In the event that it becomes necessary to isolate/remove power from an Avionics AC Bus, proceed as follows:



Before pulling the ESS AVI AC BUS PWR circuit breakers, place the Copilot's AC Instruments Inverter Switch to the DC position.

1. ESS AVI
 - a. Pull the three ESS AVI AC BUS POWER circuit breakers on the pilot's upper circuit breaker panel.
2. MAIN AVI
 - a. Pull the three MAIN AVI AC BUS PWR circuit breakers on the copilot's upper circuit breaker panel.

FINAL ISOLATION PROCEDURE

BUS	ISOLATION PROCEDURE
LH AC	REMOVE THE THREE LH AC BUS POWER CURRENT LIMITERS AT STATION 245.
RH AC	REMOVE THE SIX CURRENT LIMITERS AT STATION 245 (THREE RH AC BUS POWER AND THREE DEICING POWER).
MAIN AC	REMOVE THE THREE MAIN AC BUS CURRENT LIMITERS AT STATION 245.
MAIN DC	PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOT'S UPPER CIRCUIT BREAKER PANEL AND THE MAIN GROUND CONTROL CIRCUIT BREAKER ON THE COPILOT'S LOWER CIRCUIT BREAKER PANEL. 
ESS AC	PULL THE NINE ESSENTIAL AC CIRCUIT BREAKERS AT STATION 245 AND THE NINE ESS AC CIRCUIT BREAKERS ON THE PILOT'S SIDE CIRCUIT BREAKER PANEL.
ESS DC	PLACE THE OIL COOLER FLAPS TO OPEN/FIXED. PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOT'S UPPER CIRCUIT BREAKER PANEL AND THE SIX ESSENTIAL TR CIRCUIT BREAKERS ON THE PILOT'S SIDE CIRCUIT BREAKER PANEL. DO NOT TIE THE BUS TIE SWITCH AFTER LANDING.  WARNING IF CONTINUED ADI USE IS DESIRED, PRIOR TO ISOLATING THE ESS DC BUS, THE COPILOT'S INVERTER SHOULD BE PLACED IN THE DC POSITION. THE COPILOT'S INVERTER WILL GREATLY REDUCE USEFUL BATTERY LIFE. WARNING ON CG 1600 SERIES, CG 1790, AND CG 1700 SERIES AIRPLANES, ANY TIME POWER IS REMOVED FROM ESSENTIAL DC BUS THE ENGINE BLEED AIR REGULATORS WILL CLOSE, SHUTTING OFF AIR FLOW TO BOTH AIR CONDITIONING UNITS, THUS DEPRESSURIZING THE AIRPLANE.

ISOL DC	PULL THE SIX MAIN TR CIRCUIT BREAKERS ON THE COPILOT'S UPPER CIRCUIT BREAKER PANEL. THE SIX ESSENTIAL TR CIRCUIT BREAKERS ON THE PILOT'S SIDE CIRCUIT BREAKER PANEL, AND TURN THE DC POWER SWITCH TO THE OFF POSITION. WARNING IF POWER IS REMOVED FROM THE ISOLATED DC BUS USING THIS PROCEDURE, POWER WILL NOT BE AVAILABLE TO THE ADI'S REGARDLESS OF POWER SOURCE SELECTED.
BAT BUS	THE BATTERY BUS IS POWERED ANYTIME THE BATTERY IS CONNECTED. THERE IS NO ISOLATION PROCEDURE FOR THE BATTERY BUS.
	NOTE ANY TIME THE MAIN AND ESSENTIAL AC BUS TR CIRCUIT BREAKERS HAVE BEEN PULLED AS A METHOD OF ISOLATING A DC BUS, THE BATTERY IS POWERING THE REMAINING DC BUSES AND IS NOT BEING CHARGED FROM THE AC BUSES. 1 WHEN PULLING TR CIRCUIT BREAKERS, PULL ALL THREE CIRCUIT BREAKERS IN A, B, C ORDER FOR ONE TR UNIT, THEN PULL ALL THREE CIRCUIT BREAKERS IN A, B, C ORDER FOR THE OTHER TR UNIT. <i>Figure 3-4</i>

CASPER EMERGENCY POWER OFF PROCEDURE

When a failure of equipment is incurred in the CASPER system that poses a hazard to the aircraft or crew, proceed as follows:

1. FLIR/EO TURRET STOWED
2. CASPER MAIN POWER SWITCH OFF



While it may not be possible to stow the turret, stowing will prevent possible damage to the turret gim-bals. If the turret can not be stowed, land as soon as practicable to reduce the possibility of damage to the turret assembly.

If failure is confirmed, or either the LH AC A, B, or C phase circuit breakers or the MAIN DC circuit breaker pops, proceed as follows:

CASPER ELECTRICAL ISOLATION PROCEDURE

1. CASPER MAIN POWER SWITCH OFF
2. LH AC CIRCUIT BREAKERS, PHASES A, B, AND C PULLED
3. MAIN DC CIRCUIT BREAKER PULLED



The APS-137 at the CASPER pallet will continue to receive power even after performing the above isolation procedure. If the emergency condition persists, it may be necessary to isolate the APS-137.



In the event of a bird strike to the turret, secure the CASPER system and land as soon as practicable. If the turret housing separates from the turret much greater aerodynamic loads will be experienced. To reduce the risk of aircraft structural damage, airspeeds should be kept as slow as practicable until landing. If turret housing separation occurs, the aircrew will conduct controllability checks to determine appropriate landing speeds.

FUSELAGE FIRE/SMOKE AND FUME ELIMINATION

If a fire, smoke, or fumes develop in the fuselage, notify the crew and passengers and proceed as follows:

1. OXYGEN

“ON/100 PERCENT” (ALL)

- a. The pilot will direct all crewmembers to don oxygen masks and to select 100 percent on their oxygen regulators.
- b. The pilot will direct the loadmaster to don the smoke mask or quick don mask with goggles.

NOTE

The A-21 regulator on the walk-around bottle will provide 100 percent oxygen even in the “NORMAL” position.

NOTE

The pilot will direct crewmembers to fight the fire as required.

WARNING

With Halon 1211 concentrations on the order of five to ten percent, there is a risk of unconsciousness and possible death if exposure is prolonged.

NOTE

If cockpit visibility is obscured, use of autopilot should be considered.

2. PRESSURIZATION

**“EMERGENCY DEPRESSURIZATION” (E)
(on command of the pilot)**

WARNING

If flammable fumes are present, electrical equipment not required to complete these steps should not be turned on or off until the fumes are eliminated. If the source of fumes is fuel venting from cargo, remaining pressurized may be advisable.

If depressurization was accomplished proceed as follows:

3. AIR CONDITIONING MASTER SWITCH

“AUX VENT” (E)

WARNING

If passengers are aboard and oxygen equipment is not available for them, descend to a lower altitude before depressurizing the airplane.

4. DESCENT

“AS REQUIRED” (P)

5. Engine bleed air switches

“CLOSED/OFF” (E)
(if source of smoke or fumes has not been identified)

CAUTION

(CG 1500 series) In the event the ATM generator is powering the essential ac bus, shutting off all the engine bleed air will eliminate the pneumatic air source for the ATM. The resulting underspeed condition and ATM generator disconnect may cause essential ac bus power loss.

If depressurization was accomplished proceed as follows:

6. Forward escape hatch

“Open” (E)

NOTE

Dense smoke and/or fumes may develop in the cargo compartment from burning cargo, leaking fuel, or ignited pyrotechnics. Smoke or fumes will be drawn through the flight deck and out the forward escape hatch when opened.

7. Restraint harness
8. Paratroop doors

“ON AND CHECKED” (LM)

“Open” (on command of pilot) (LM)

WARNING

When opening or closing the doors, a restraint harness will be worn.

WARNING

Do not use Air Deflector Doors during the Smoke and Fume Elimination procedure.

NOTE

In-flight tests indicate that smoke will be cleared from the cargo compartment in approximately 2 minutes using these procedures.

9. If the situation stabilizes, land as soon as practicable.
10. If situation does not stabilize, land as soon as possible.
11. If cleanup of the aircraft following the smoke and fumes elimination checklist is desired, proceed as follows:
 - a. Forward escape hatch "IN" (E)
 - b. Paratroop doors "Closed" (on command of pilot) (LM)
 - c. Restraint harness "Stowed" (LM)
 - d. Engine bleed air switches "As required" (E)
 - e. Emergency depressurization switch "Normal" (E)
 - f. Air conditioning master switch "As required" (E)
 - g. Oxygen "As required" (ALL)

THIS SPACE INTENTIONALLY LEFT BLANK.

IN-FLIGHT DOOR WARNING

When the door open warning light illuminates, notify crew and passengers and proceed as follows:

1. Seat Belts	“Fastened” (All)

WARNING

Upon notification of an in-flight door warning the loadmaster will immediately notify the passengers to fasten their seat belts. He will then fasten his seat belt.

2. Oxygen	“As Required” (All)
3. Pressurization	“Begin depressurization” (E)

NOTE

If range is an important consideration, and passengers without supplemental oxygen are not being carried, the pilot may elect to have the airplane depressurized and the door inspection made at altitude. Oxygen duration increases if NORMAL is selected.

WARNING

The airplane shall be completely depressurized before making a door check. Do not unlock any door with the airplane pressurized. While depressurizing, note at what IN. HG the light goes out, if any.

4. Descent	“As Required” (P)
5. Air conditioning master switch	“AUX VENT” (E)
6. Doors	“Checked” (E)

WARNING

The flight engineer will check the doors, wearing a restraint harness. To check the crew entrance door, connect the restraint harness leash snap to the tie down ring mounted on the radioman’s seat track. If it cannot be determined what caused the door light to illuminate, the flight may be continued with partial pressurization, at the discretion of the pilot (below the point where the light illuminates and with all personnel secured by safety belts). If the doors are secure and the trouble is determined to be a door warning switch, the airplane may be fully pressurized.

7. Master door warning light switch	“OFF” (E)

WING FIRE

If a fire develops in the wing, proceed as follows:

1. Close the engine bleed air valves/regulators and wing isolation valve on that wing, (CG 1790 and 1700 series) close bleed air divider valve.

NOTE

Closing the left wing bleed air valves/regulators (or on CG 1600 series airplanes, closing the left wing isolation valve) and bleed air divider valve isolates the bleed air from the jet pump control in the out-flow valve and from the safety valve. Automatic pressurization will be inoperative and emergency depressurization will be slower than normal.

2. Close all fuel crossfeed valves.
3. Turn generators/all electrical equipment (for affected wing) OFF.
4. Turn off both engine hydraulic pumps and suction boost pump for the affected wing, provided an alternate hydraulic source is supplying hydraulic pressure to the flight control packages.
5. Sideslip the airplane to keep the fire away from the fuselage.
6. Put on parachutes and survival equipment (if installed).
7. Land as soon as possible.

BLEED AIR SYSTEM FAILURE

A bleed air system failure, caused by a leak in a duct, coupling, or a valve, may occur in any of the following areas:

Nacelle manifold
Wing manifold
Fuselage manifold
Wing anti-icing
Empennage anti-icing
Radome heat
Left wheel well fairing
Right wheel well fairing
Flight station air conditioning compartment

BLEED AIR SYSTEM FAILURE (GROUND/IN-FLIGHT)

A bleed air system failure may be a minor leak from a valve, coupling, or component, or may be a severe leak caused by a rupture of a duct or the total failure of a coupling. Normally

minor leaks will be indicated by an Anti-icing Overheat Warning or an Overheat Warning Light. Corrective actions will depend on the location and severity of the leak/failure.

Anti-icing Overheat Warning Light

Refer to figure 3-5 for procedures to follow in the event of an overheat condition. If actions required by figure 3-5 correct the overheat condition, land as soon as practicable. If the nature of the leak is more severe or the actions required by figure 3-5 do not correct the problem, proceed with the MAJOR BLEED AIR LEAK PROCEDURE.

Major Bleed Air Leak

A serious bleed air system leak may cause burning of electrical wire bundles, overheating of airplane equipment, and/or structural damage, and may be indicated by one or more of the following conditions:

1. Illumination of the APU/GTC fire warning lights.
2. Erratic operation of engine instruments.
3. Lower than charted engine torque (normally a marked and even reduction).

NOTE

This torque drop may be transitory followed by near normal values.

4. Erratic operation of electrical equipment.
5. Inoperative or intermittent radar operation.
6. A wing overheat may occur without an accompanying leading edge overtemperature warning due to possible wiring damage.
7. Reduced bleed air manifold pressure.
8. Abnormal sounds, described as a roaring or whistling.

If bleed air is being lost from the system, the engineer will proceed as follows:

1. Engine bleed air switches on the affected wing – “CLOSED/OFF”
2. Bleed air divider valve/wing bleed air isolation valves switch(es) – “CLOSED”

NOTE

(CG 1600 series)

If further isolation is desired, the bleed air isolation valves may be used at the discretion of the flight crew.

After isolation of a bleed air leak following a bleed air duct failure proceed as follows:

1. Reduce airspeed to no more than 180 KIAS.
2. Operate the airplane at minimum bank angles and maneuvering loads.
3. Reduce cabin pressure to a maximum of 10 in. Hg.
4. Land as soon as possible.
5. After landing, ensure that bleed air will not be supplied to a damaged duct/component prior to starting the GTC/APU or using an external air source.

WARNING

Bleed air valves or regulators closed in response to an overheat condition should not be reopened unless a greater emergency exists.

If the uncontrolled loss of bleed air cannot be isolated, proceed as follows:

WARNING

Shutting off all engine bleed air will stop the air supply for cabin pressurization, radome heat, wing and empennage anti-icing and ATM (CG 1500 series) operation.

WARNING

If an engine bleed air regulator/bleed air valve cannot be closed (closure is determined by observing torque increase on the affected engine) and the engine continues to supply bleed air to the system, it may be necessary to shut down the engine.

WARNING

If the uncontrolled loss of bleed air cannot be isolated, do not open the APU/GTC bleed air valve. Operation of the APU/GTC bleed air valve may repressurize the area where the failure occurred.

1. All engine bleed air switches "CLOSED/OFF"

2. Reduce airspeed to no more than 180 KIAS.
3. Operate the airplane at minimum bank angles and maneuvering loads.
4. Land as soon as possible.

WING/EMPENNAGE/WHEEL WELL/CARGO COMPARTMENT REFRIGERATOR OVERHEAT

If an overheat warning light or gauge indicates an overheat condition, proceed as follows:

1. Refer to overheat chart (figure 3-5).
2. If the overheat condition is eliminated, land as soon as practicable.
3. If the overheat persists, land as soon as possible.

EMERGENCY OPERATION OF AIR CONDITIONING SYSTEMS

An air conditioning system failure can result in an emergency condition when cabin pressurization cannot be maintained as a result of the failure, or when the system is malfunctioning and cannot be shut down. As long as operation of the cargo compartment air conditioning system (70 pounds per minute) can be maintained, sufficient air output is available to keep the airplane pressurized. (CG 1500 series) With the cargo compartment air conditioning unit inoperative, the flight deck unit may not be able to maintain selected cabin pressure, depending on cabin leakage rate. (CG 1600 series, CG 1790, and CG 1700 series) Either flight deck or cargo compartment air conditioning system alone will provide sufficient air output to keep the airplane pressurized.

When the temperature of the air output of an air conditioning system cannot be controlled either automatically or manually, the crew has the option of shutting down the system or suffering the discomfort in order to maintain pressurization if at altitude. If a system is leaking hot bleed air into the airplane, it should be shut down immediately. If the system cannot be shut off because of regulator malfunctioning and it is leaking bleed air, (CG 1500 series) the engine bleed air valves must be closed to depressurize the bleed air system. (CG 1600 series) The system may be isolated by use of the wing isolation and bleed air divider valves. (CG 1790 and CG 1700 series) Close bleed air regulators on that wing, and close bleed air divider valve. (CG 1600 series, CG 1790, and CG 1700 series) With fumes/smoke emitting from the air conditioning system, it may be necessary to place the FLT STA AIR-FLOW SWITCH to MAX to determine which system has the malfunction.

Overheat Chart (CG 1500 and CG 1600 Series)

OVERHEAT INDICATED OR LIGHT ILLUMINATED	ACTION
EITHER L OR R OUTER WING/INNER WING/ CENTER WING	a. TURN RESPECTIVE SYSTEM OFF, IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. ENGINE BLEED AIR VALVE/REGULATOR SWITCHES (AFFECTED WING) –CLOSED/OFF c. WING ISOLATION VALVE SWITCH (AFFECTED WING) – CLOSE
EITHER L OR R WHEEL WELL (CG 1500 SERIES)	a. TURN RESPECTIVE SYSTEM OFF (GTC, ATM, CARGO COMPARTMENT REFRIGERATION). IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. BOTH WING ISOLATION VALVES – CLOSE c. GTC – OFF NOTE IF EITHER THE L OR R WHEEL WELL OVERHEAT CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, A BREAK IN THE BLEED AIR MANIFOLD MAY HAVE OCCURRED OUTBOARD OF THE ISOLATION VALVE IN THE WHEEL WELL SENSOR AREA. IN THIS CASE, PLACE ENGINE BLEED AIR VALVE SWITCHES TO CLOSED. (AFFECTED SIDE) IF THE OVERHEAT OCCURRED AFTER TAKEOFF, IT MAY BE INDICATIVE OF OVERHEATED BRAKES. IN THIS CASE, IT MAY BE ADVISABLE TO LOWER THE LANDING GEAR FOR COOLING. d. MONITOR THE AFFECTED WHEEL WELL BY CAREFULLY FEELING WITH A GLOVED HAND TO ENSURE THAT THE LEAK DOES NOT PERSIST.
EMPENNAGE	a. TURN RESPECTIVE SYSTEM OFF, IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. ALL ENGINE BLEED AIR VALVES – CLOSED (CG 1500 SERIES) c. #1 AND #2 BLEED AIR REGULATOR SWITCHES – OFF AND BLEED AIR DIVIDER VALVE – CLOSE (CG 1600 SERIES) d. GTC/APU – OFF
CARGO COMPARTMENT REFRIGERATOR OVERHEAT WARNING LIGHT (CG 1600 SERIES)	a. TURN SYSTEM OFF. IF LIGHT DOES NOT GO OUT WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. RIGHT WING ISOLATION VALVE AND BLEED AIR DIVIDER VALVE – CLOSE

NOTE

IF ANTI-ICING IS NECESSARY TO SUSTAIN FLIGHT, ENGINE BLEED AIR VALVES/REGULATORS MAY BE OPENED AS NECESSARY PROVIDED THE LEADING EDGE AND EMPENNAGE TEMPERATURES DO NOT GO ABOVE THE NORMAL OPERATING RANGE.

IF AN ENGINE BLEED VALVE/REGULATOR CANNOT BE CLOSED (VALVE/REGULATOR CLOSURE IS DETERMINED BY OBSERVING TORQUE INCREASE ON THE AFFECTED ENGINE) AND THE BLEED AIR SYSTEM IS LEAKING, IT MAY BE NECESSARY TO SHUT DOWN THE ENGINE.

IF THE ISOLATION/DIVIDER VALVE MUST BE CLOSED, THE LOADMASTER SHOULD VISUALLY VERIFY THE VALVE CLOSED.

Figure 3-5 (Sheet 1 of 2)

Overheat Chart (CG 1790 and CG 1700 Series)

OVERHEAT INDICATED OR LIGHT ILLUMINATED	ACTION
EITHER L OR R OUTER WING/INNER WING/ CENTER WING	a. TURN RESPECTIVE SYSTEM OFF, IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. ENGINE BLEED AIR REGULATOR SWITCHES (AFFECTED WING) – OFF c. BLEED AIR DIVIDER VALVE – CLOSE d. APU – OFF (FOR L WING)
EITHER L OR R WHEEL WELL (CG 1705 AND UP)	a. TURN RESPECTIVE SYSTEM OFF (APU, CARGO COMPARTMENT REFRIGERATION). IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. ENGINE BLEED AIR REGULATOR SWITCHES (AFFECTED SIDE) – OFF c. BLEED AIR DIVIDER VALVE – CLOSE NOTE IF EITHER THE L OR R WHEEL WELL OVERHEAT LIGHT ILLUMINATES AFTER TAKEOFF AND THE CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, IT MAY BE INDICATIVE OF OVERHEATED BRAKES. IN THIS CASE, IT MAY BE ADVISABLE TO LOWER THE LANDING GEAR FOR COOLING. d. MONITOR THE AFFECTED WHEEL WELL BY CAREFULLY FEELING WITH A GLOVED HAND TO ENSURE THAT THE LEAK DOES NOT PERSIST.
EMPENNAGE	a. TURN RESPECTIVE SYSTEM OFF. IF CONDITION IS NOT CORRECTED WITHIN 1 MINUTE, PROCEED AS FOLLOWS. b. #1 AND #2 BLEED AIR REGULATOR SWITCHES – OFF c. BLEED AIR DIVIDER VALVE – CLOSE d. APU – OFF
CARGO COMPARTMENT REFRIGERATOR OVER- HEAT WARNING LIGHT (CG 1790, CG 1700 – CG 1704)	a. TURN SYSTEM OFF. IF LIGHT DOES NOT GO OUT WITHIN 1 MINUTE, PROCEED AS FOLLOWS: b. #3 AND #4 BLEED AIR REGULATOR SWITCHES – OFF. BLEED AIR DIVIDER VALVE – CLOSE

NOTE

IF ANTI-ICING IS NECESSARY TO SUSTAIN FLIGHT, ENGINE BLEED AIR REGULATORS MAY BE OPENED AS NECESSARY PROVIDED THE LEADING EDGE AND EMPENNAGE TEMPERATURES DO NOT GO ABOVE THE NORMAL OPERATING RANGE.

IF AN ENGINE BLEED AIR REGULATOR CANNOT BE CLOSED (REGULATOR CLOSURE IS DETERMINED BY OBSERVING TORQUE INCREASE ON THE AFFECTED ENGINE) AND THE BLEED AIR SYSTEM IS LEAKING, IT MAY BE NECESSARY TO SHUT DOWN THE ENGINE.

IF THE BLEED AIR DIVIDER VALVE MUST BE CLOSED, THE LOADMASTER SHOULD VISUALLY VERIFY THE VALVE CLOSED.

Figure 3-5 (Sheet 2 of 2)

**FLIGHT DECK/CARGO COMPARTMENT
AIR CONDITIONING SYSTEMS FAILURE
(CG 1600 series, CG 1790, and CG 1700
series)**

1. FLT STA airflow switch – MIN (E)

NOTE

In the event an air conditioning unit fails, selecting MIN on the FLT STA AIRFLOW SWITCH opens the valve and permits the transfer of conditioned air

to the ducts of the failed unit. Selecting MIN positions the valve to full open and allows 30% of the air to flow to the flight station and 70% to the cargo compartment.

2. Cargo compartment fan – ON (E)

NOTE

If the flight station air conditioning unit has failed, turning ON the Cargo Compartment Fan will aid in forcing airflow up to the flight station.

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NOTE

(CG 1600 series, CG 1790, and CG 1700 series) Either of the airflow regulators will be closed automatically to stop the entry of bleed air if an over-pressure condition occurs in the water separator inlet duct. In the event that either air conditioning unit is shut down automatically, select a warmer temperature with the temperature control switch/knob for the affected system. After at least 3 minutes, place the air conditioning master switch to OFF and then back to the original position. After the air conditioning unit operation stabilizes, select temperature as desired.

EMERGENCY OPERATION OF CABIN PRESSURIZATION SYSTEM

NOTE

Closing No. 1 and No. 2 bleed air regulators and the bleed air divider valve, as required in certain emergencies, isolates the bleed air from the jet pump control in the outflow valve and from the safety valve. Automatic pressurization will be inoperative and emergency depressurization will be slower.

WARNING

Shutting off all engine bleed air will shut off the air supply to both air conditioning units and depressurize the airplane.

Two types of pressurization system failures may occur; increasing pressure or decreasing pressure.

Increasing Pressure

Increasing pressure can result from failure of the outflow valve in a closed or nearly closed position when it cannot be opened either by automatic or manual control methods. In this case, cabin pressure might increase at an excessive rate and could not be reduced by normal means. If this condition is encountered, proceed as follows:

1. Immediately shut off engine bleed air, one engine at a time, until the rate of pressure increase is at a safe (comfortable) value.
2. Control pressure by using engine bleed air as necessary to vary the amount of conditioned air supplied for pressurization.

3. If necessary for further control when descending, one of the air conditioning systems can be shut down to expedite depressurization of the airplane.

Decreasing Pressure

Loss of ability to pressurize or maintain pressurization on either automatic or manual control may result from any of several causes. If this situation is encountered, proceed as follows:

1. The crew should don oxygen masks immediately.
2. Descend to or maintain an airplane altitude where oxygen is not required.

WARNING

Consideration should be given to range with or without use of oxygen before descent.

3. Check for excessive cabin leakage by checking doors, windows, hatches, and the safety valve.

WARNING

Do not attempt to lock or unlock any window, door, or hatch while the airplane is pressurized. First, depressurize the airplane; then turn the AIR CONDITIONING master switch to "AUX VENT."

4. Check the bleed air system for excessive external leakage. Turn off all pneumatic systems, and observe the bleed air pressure gauge. Shut off all engine bleed air, and time the bleed air system pressure drop from 65 to 35 psi. The time required for the pressure to drop from 65 to 35 psi should not be less than 10 seconds, 16 seconds if the chemical toilet is installed.

IN-FLIGHT RELEASE OF LIFE RAFT

The in-flight release of a life raft may be indicated by vibrations which can range from slight to severe. These vibrations could be accompanied with bumps or bangs coming from the wing root area, and pitch or yaw control problems.

WARNING

Conduct controllability check.

NOTE

If the autopilot was engaged, the pilot may experience excessive elevator trim pressures when the autopilot is disengaged.

If severe vibration occurs in flight, cause unknown, proceed as follows:

1. Retard power and decrease airspeed.
2. Lower the flaps, and have an aircrewmember make a visual inspection of the life raft compartments and tail through a rear cargo compartment window. (The absence of a life raft should be noticeable through one of the inspection windows provided on the lower sides of the life raft compartments.)
3. If a raft has released and lodged on the tail, “fish-tail” the airplane slightly, or execute a shallow banking maneuver right or left. Land as soon as possible, and conduct a thorough inspection.

CAUTION

Do not reverse propellers on landing if the life raft(s) cannot be removed in flight. To do so may draw the raft into the propeller.

WINDSHIELD AND WINDOW FAILURE

If the inner or outer pane of the windshield or cargo compartment windows crack during flight, reduce the cabin differential pressure to 10 inches of mercury or less. If both panes of the windshield crack, flight may be continued at 10 inches of mercury or less; however, if both panes of a cargo compartment window crack, reduce the cabin differential pressure to zero. Adjust mission altitude as required.

NESA MALFUNCTION

Monitor operation of the anti-icing systems by feeling the glass and observing ice formation on the panels. Turn off the system if any of the following conditions is noticed:

1. Panels feel excessively hot.

WARNING

Do not check the temperature of a crazed glass with the bare hand with the NESA switches ON.

2. Electrical arcing is observed in one of the panels.
3. One of the panels containing thermistors is not heating. This might cause the other panels in the same system to overheat.

INOPERATIVE WINDSHIELD ANTI-ICING

Operation with inoperative windshield anti-icing is permissible provided:

1. The airplane is not flown in known icing.
2. The maximum speed limit below 10,000 feet is 185 KIAS due to possible bird strikes.

Descent from high altitude into warm moist air with an inoperative nesa windshield anti-icing system will cause fogging and possible icing of the windshield. To minimize this, increase cabin air temperature and open the pilot's and copilot's windshield defogging valves. Position the FLT STA AIRFLOW switch (CG 1600 series, CG 1790 and CG 1700 series) to direct maximum air to the flight station. It is recommended that a gradual descent be made to allow the windshield, which has been cold-soaked at altitude, to warm with ambient cabin air.

ILLUMINATION OF PITOT HEAT OFF INDICATORS (CG 1717 AND UP)

If the Pitot Heat Off indicators on the pilot's or copilot's instrument panel illuminate in flight, secure the affected system by placing the control switch to the OFF position and avoid flight into icing conditions. If the pilot's system is secured and icing conditions are experienced, the following equipment may be lost:

Pilot's Altimeter
 Pilot's Vertical Velocity Indicator
 Pilot's Airspeed Indicator
 Navigator's True Airspeed Indicator
 Navigator's Altimeter
 Airspeed Sensor
 True Airspeed Computer
 Cabin Differential Pressure Indicator

If the copilot's system is secured and icing conditions are experienced, the following equipment may be lost:

Copilot's Altimeter
 Copilot's Vertical Velocity Indicator
 Copilot's Airspeed Indicator
 FCS Air Data Controllers (No. 1 and No. 2)

RAPID DECOMPRESSION

Sudden and uncontrollable loss of cabin pressure is known as rapid decompression. This may result from losing a non-structural member, such as a door or window, or from a rupture in the fuselage. If a rapid decompression occurs, proceed as follows:

1. Oxygen – “On/100%” (ALL)
2. Seat belts – “FASTENED” (ALL)

The flight engineer should make an inspection of the fuselage during descent (using a walk-around oxygen bottle, if required, and wearing a restraint harness) to determine what caused the decompression and the extent of any damage. With no structural damage, descent airspeed may be increased not to exceed maximum speeds, as shown in Section V. With structural damage, the flight will be completed at a safe speed as determined by the pilot. The flap configuration for landing will depend on the type of structural damage.

3. Descend – As required.



With certain types of structural damage, changing the center of lift with the flaps may induce further damage. Careful consideration should be given to type of damage prior to changing airplane's configuration.

HYDRAULIC SYSTEMS FAILURE

Loss of System Pressure or Leakage from an Undetermined Source

If a pressure or fluid loss is indicated, proceed as follows:

1. Hydraulic pump switches – OFF (affected system only)
2. Suction boost pump switch – OFF (affected system only)
3. Hydraulic reservoir level – Checked

4. If reservoir is low, check for fluid loss at units being supplied by malfunctioning system.
5. Isolate unit(s) causing leak. Land as soon as practicable.
6. If leak cannot be isolated, leave pump switches OFF and land as soon as possible.

Engine-Driven Pump Failure

If engine-driven pump failure is indicated, proceed as follows:

1. Hydraulic pump switch – OFF
2. Hydraulic reservoir level – Checked
 - a. If supply is normal, no further corrective action is necessary. Land as soon as practicable.
 - b. If fluid level is decreasing, follow LOSS OF SYSTEM PRESSURE procedure.



It should be noted that an actual internal engine-driven pump failure can lead to a flight hazard for the following reasons:

There is approximately 1 gallon of hydraulic fluid trapped in the isolation circuit and a line or pump rupture can dump this fluid in the nacelle.

The engine-driven pump is geared directly to the engine and if the shear neck of the pump drive spline does not separate, the pump can disintegrate internally causing a fire hazard. Because of this hazard, pilot's discretion should be exercised as to the need of continued engine operation.



In the event utility or booster hydraulic pressure in excess of 3500 psi is indicated (failed hydraulic pump compensator), do not shut off the individual hydraulic pump switches. If the hydraulic pump shutoff valves are closed, the pressure line between the hydraulic pump and the shutoff valve is isolated from its means of pressure control. Excess pressure may build up until the hydraulic pump or line ruptures, dumping hydraulic fluid into the engine nacelle.

NOTE

Hydraulic system temperature stabilizes below 135 °C when one pump has a failed compensator and is dumping its full output through the system relief valve. This malfunction poses no safety hazard.

In the unlikely event hydraulic pressure in either system exceeds 3900 psi (loss of system pressure relief valve and a failed hydraulic pump compensator) proceed as follows:

1. Shut down an engine supplying pressure to the affected hydraulic system by using the CRUISE ENGINE SHUTDOWN PROCEDURE.
2. If hydraulic pressure drops to normal, that pump was the defective one. Continue with three-engine operation procedure.
 - a. If hydraulic pressure remains high, perform an Air-start on the shutdown engine.
 - b. Shut down the other engine affecting the hydraulic system by using the ENGINE SHUTDOWN PROCEDURE.

Electric Suction Boost Pump Failure

Loss of the electric suction boost pump may be indicated by illumination of the suction boost pressure warning light. If the suction boost pump fails, a 100 to 200 psi drop in the static system pressure may also be indicated. If a suction boost pump failure is indicated, proceed as follows:

1. Suction boost pump switch – OFF
2. Static pressure and hydraulic reservoir level – Checked
 - a. If system static pressure is less than 2500 psi, or fluid level is decreasing, follow LOSS OF SYSTEM PRESSURE procedure.
 - b. If system static pressure is 2500 psi or above, leave suction boost pump switch OFF and continue operation, minimizing hydraulic system use.

NOTE

After failure of the utility suction boost pump, high flow demand conditions such as lowering/raising landing gear and flaps may cause the number one and two engine driven pump low pressure warning lights to illuminate momentarily. This is considered normal. System pressure should return to normal values after completion of the landing gear/flap cycle. Monitor system pressure and quantity to

ensure a leak has not developed in addition to the suction boost pump failure.

Utility System Failure**NOTE**

High flow demand requirement during single utility pump operation will cause substantial hydraulic pressure drop during main landing gear, flap extension/retraction and elevator control surface operation, which may cause the remaining hydraulic low-pressure warning light to illuminate momentarily.

Failure of the utility hydraulic system will result in loss of normal landing gear extension and retraction, normal flap retraction and extension, normal brake supply, nose wheel steering, flare launcher, and half the power supplied to the flight controls. In each case, alternate provisions are made for essential operations. For emergency operation of the particular systems, see LANDING GEAR SYSTEM FAILURE, FLAP SYSTEM FAILURE, and FLIGHT CONTROLS SYSTEM FAILURE. For emergency brake pressure, refer to BRAKE FAILURE.

Booster System Failure

Failure of the booster hydraulic system affects only the flight control systems. See FLIGHT CONTROL SYSTEMS FAILURE for information on emergency management.

Auxiliary System Failure

Failure of the motor-driven pump in the auxiliary hydraulic system results in the loss of hydraulic power for normal in-flight operation of the ramp and cargo door, loss of electrically controlled emergency hydraulic power for the main landing gear brakes, and loss of electrically controlled emergency hydraulic power for extension of the nose landing gear. If circumstances require opening the ramp and cargo door, or supplying emergency brake pressure manually, or lowering the nose landing gear without electrically controlled hydraulic system pressure, the hand pump may be used. If both utility and auxiliary pressure are lacking for brakes, stopping and taxiing control must be accomplished with reverse thrust and differential power application. Stop the airplane as soon as possible.



Taxiing the airplane under its own power without brakes is not recommended.

Flare Launcher System Failure

If an electrical power failure of the flare launcher system is experienced, proceed as follows:

1. Select EMER on the hydraulic flare launcher shut off valve, located left side FS 844.
2. Manually actuate the flare launcher valve (at tube) to eject the flare. Repeat this step for each tube that is loaded.
3. Select NORM on the hydraulic flare launcher shut off valve, located left side FS 844.
4. When flare launching is complete, disarm and deactivate the flare launcher system. Refer to Operation of Flare Launcher System in Section II.

If a flare launcher light fails to illuminate with launching switch positioned to FIRE, proceed as follows:

1. Leave flare launcher ARMED and ACTIVATED.
2. Position all launcher switches to OFF.
3. Press-to-test the flare released light.
4. Verify that the flare released light has failed to illuminate on the other flare launcher control panels. If the flare released light has failed to illuminate on the other flare launcher control panels for that tube, either the flare has not ejected or the switch (located inside the launcher tube) which controls that light has not been actuated.
5. Manually actuate the flare launcher valve (at tube) to eject the flare.
6. If flare released light illuminates, flare has ejected. If light fails to illuminate, continue with this procedure.
7. Depressurize the aircraft.
8. Open the flare tube cover and verify that the tube has flare inside.
 - a. If flare has ejected and the flare released light has not illuminated, close tube cover and continue with the flight.
 - b. If flare is in tube, remove flare and load into another tube. Close the tube cover, manually actuate the flare launcher valve (at tube) to eject flare and continue with the flight.
9. When flare launching is complete, disarm and deactivate the flare launcher system. Refer to Operation of Flare Launcher System in Section II.

If a hydraulic power failure of the flare launcher system is experienced, proceed as follows:

1. Disarm and deactivate the flare launcher system. Refer to Operation of Flare Launcher System in Section II.
2. Remove flares from launcher tubes.

WARNING

When opening or closing the doors, a restraint harness will be worn.

3. Hand drop flares through paratroop door or cargo ramp and door.

FLIGHT CONTROL SYSTEMS FAILURE

Flight Control Hydraulic Booster Unit Failure

If a leak develops in a booster unit, proceed as follows:

1. Determine location of leak.
2. Respective system control boost switch – OFF
3. If the leak was isolated and the other hydraulic system is still supplying pressure to the booster unit, land as soon as practicable.

If a flight control hydraulic booster unit fails in a hardover position, verify that the cockpit control matches the maneuver being experienced. Proceed as follows:

1. Both respective control boost switches – OFF

Loss of hydraulic assistance for ailerons, elevator, or rudder will result in loss of ability to move these controls, except at low airspeeds. Maneuvering the airplane under these conditions must be accomplished with trim tabs and high manual forces.

2. Land as soon as possible.

Landing the airplane without hydraulic assistance is a marginal operation and requires skillful handling of trim tabs and engine power, plus coordinated efforts of both pilots on the flight controls. When possible, avoid crosswinds, short fields, or narrow runways, since chances of making a successful landing will be decreased.

When landing without hydraulic assistance for the flight control(s), proceed as follows:

1. Reduce weight of airplane.
2. If elevator control should fail (hydraulic assistance lost), the elevators can be moved manually with greatly increased effort. Reduce airspeed and use engine power, normal trim coordinated with pilot's yoke inputs to recover pitch control. Achieve approximately level flight and 170 KIAS, using the inboard engine power to assist in pitch control (increase in power produces pitch up; decrease in power produces pitch down). Use the outboard engine power to adjust the Airspeed. Land with 0 to 50 percent flaps (50 percent recommended). Plan for a long, flat approach to minimize attitude change at touchdown and fly the airplane onto the ground.

WARNING

Never purposely remove hydraulic assistance from the flight control boosters to simulate loss of boost assistance. An immediate and unpredictable control response may occur upon either removal or restoration of boost assistance.

Tab System Failure

NOTE

The circuit breakers used for these procedures are color coded red for easy recognition. Confirm the identity of the desired circuit breakers prior to pulling.

If all power to a trim tab system is lost, land as soon as practicable.

Aileron Trim Tab Failure

Failure or "runaway" of the aileron trim tab will not cause a serious control problem. Should the aileron trim tab "runaway:"

1. Hold the aileron trim tab switch in the opposite direction.
2. Pull the AILERON TRIM TAB circuit breaker on pilot's side circuit breaker panel.

Rudder Trim Tab Failure

Directional control cannot be maintained at high airspeeds if the rudder trim tab "runs away" to an extreme position. If this occurs, airspeed should be reduced until directional control is regained. Should the rudder trim tab "runaway:"

1. Hold the RUDDER TRIM TAB switch in the opposite direction.
2. Pull the rudder trim tab power circuit breaker on the pilot's side circuit breaker panel.

Elevator Trim Tab System Failure

Should the elevator trim tab "runaway:"

1. Hold the elevator tab switch on the control wheel in the opposite direction of tab indicator movement, and place the elev tab power selector switch in the OFF position. This should stop the "runaway" tab.
2. Place the elev tab power selector switch in the EMER position, and operate the elevator trim tab switch on the control pedestal to retrim the airplane. Tab movement will be slower in EMER than NORMAL. Land as soon as practicable.
3. If trouble is encountered using emergency power, return the elev tab power selector switch to OFF.
4. If the failure results in an uncontrollable nose-up condition, bank the airplane as necessary and slow down. Extend flaps as structural limitations permit for increasing nose down pitching moment. Continue reducing airspeed, decreasing bank as necessary to maintain control. If the failure results in a nose-down condition, reduce power and reduce airspeed to maintain control.

NOTE

The elevator tab switches on the control wheels will not operate the emergency system. Emergency operation is controlled only by the pedestal-mounted switch.

NOTE

When on autopilot operation and the elev tab power selector switch is in the EMER or OFF position, (CG 1500 series) the elevator servo is disconnected from the autopilot and the elevator must be controlled manually. (CG 1600 series, CG 1790, CG 1700 series) The autopilot is disengaged.

FLAP SYSTEM FAILURE

WARNING

If an outboard flap fails, it is possible that contact between the flap and aileron will result in binding, and restriction of movement of the aileron. Under these conditions, if it is possible to control the airplane, no attempt should be made to move the flaps. If movement of the flaps must be attempted, return them in increments of 10 percent toward the position last selected before failure. During flap movement, check aileron control constantly. If aileron control is freed, or if it is noted that binding increases, stop flap movement immediately.

NOTE

The “Flap Control” circuit breaker is color coded green for easy recognition. If required, confirm the identity of the desired circuit breaker prior to pulling.

Failure of the wing flaps to operate normally may be caused by:

1. Failure of the flap electrical control.
2. Failure of the utility hydraulic system.
3. Mechanical failure.

Protection against asymmetrical extension or retraction of the flaps is provided only when dc power and utility hydraulic pressure are simultaneously available for the flap system. If flaps fail to operate normally, alternate methods of operation listed in order of preference are:

1. Override of the flap selector valve, located on the left hydraulic panel. (Electrical Control Failure)
2. Mechanical operation of the flaps. (Loss of Hydraulic Pressure)

Electrical Control Failure

If the circuit breaker is in, or if resetting the circuit breaker does not clear the trouble:

1. Pull wing flap control circuit breaker.
2. Place flap lever in the desired position.

NOTE

This will assure proper rudder boost pressure.

If the flaps are to be operated proceed as follows:

3. Remove utility hydraulic panel cover.

Crewmember accomplishing this operation will remain in communication with the flight station.

WARNING

Protection against asymmetrical operation is provided only during normal hydraulic flap operation. Should a failure of flap drive torque tubes occur during override operation, resulting in a change in trim about the roll axis, stop flap movement immediately. Return the controllable flaps to the position assumed by the uncontrollable flaps.

4. Lower or raise flaps to desired position.

Depress lower or raise button intermittently on the flap selector valve (figure 3-6), moving the flaps in approximately 10 percent increments, until flaps are fully lowered or raised, or until directed by pilot to stop.

Loss of Hydraulic Pressure

Normal operation of the flaps will cause a drop in utility hydraulic pressure as long as the flaps are in motion. A leak in the flap system hydraulic plumbing will be indicated by a rapid loss of pressure while the flaps are operating, and by slower than normal flap movement. Under these conditions, proceed as follows:

1. If a loss of system pressure is indicated, follow Loss of System Pressure Procedure, then proceed with step 2.
2. Pull the wing flap control circuit breaker on the copilot's lower circuit breaker panel.
3. Place the FLAP lever in the desired position.

NOTE

This will give desired rudder boost pressure.

If the flaps are to be operated, continue the procedure as follows:

4. Establish communications between the flight station and crewmember stationed at the forward face of the left wheel well by means of an intercommunication extension cord.

Wing Flap Selector Valve

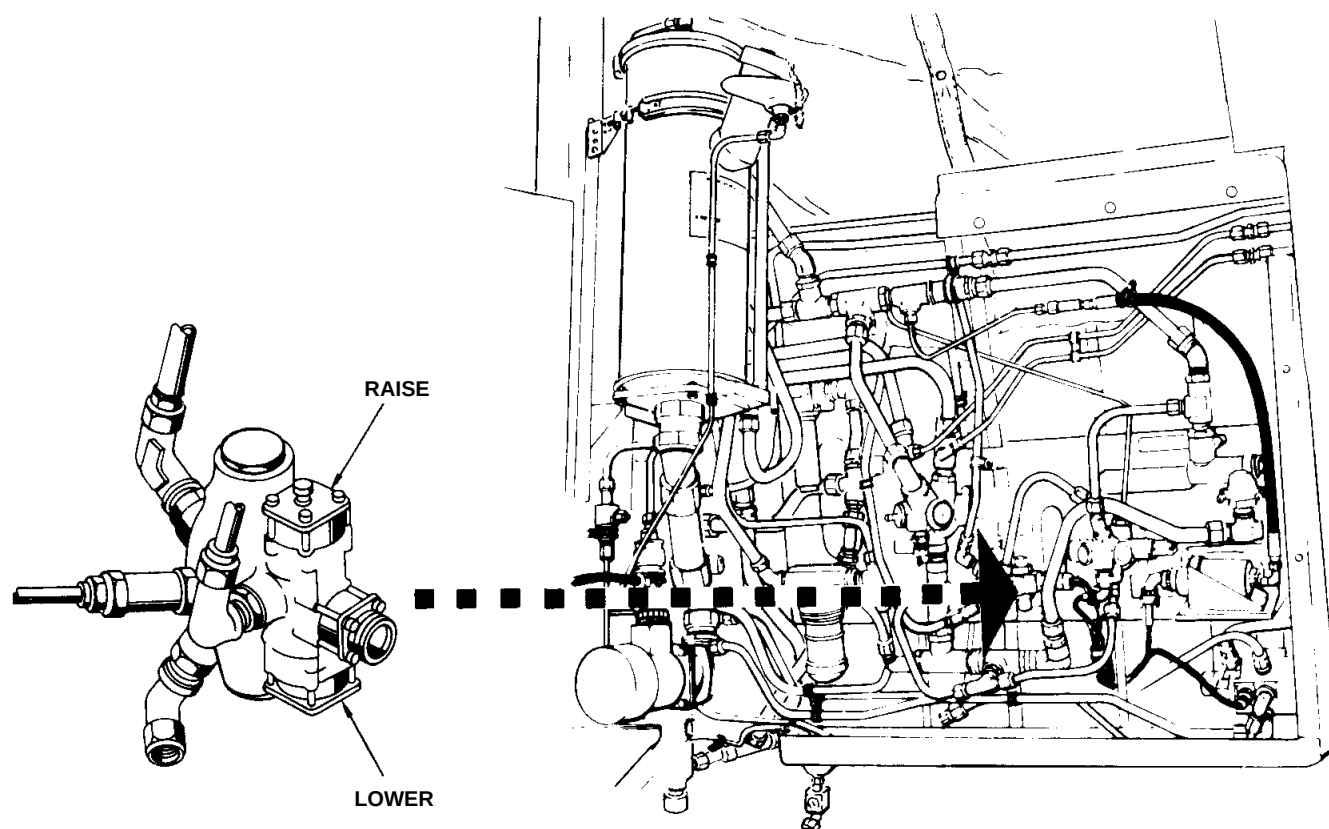


Figure 3-6

5. Turn the No. 1 and No. 2 ENGINE PUMP and UTILITY SUCTION BOOST PUMP switches OFF and deplete the utility system pressure.

WARNING

6. Remove the hand crank from the stowed position, in the cargo compartment. (See figure 3-7.) Engage the hand crank on the input shaft, and hold the crank firmly to prevent rotation.
7. Remove the pin from the input shaft. It may be necessary to rotate the crank slightly in either direction to relieve binding on the pin.
8. Rotate the manual shift handle clockwise to its stop, and pull (approximately 2 inches) to engage the manual extension system; then turn counterclockwise to lock the handle out.

Protection against asymmetrical operation is provided only during normal hydraulic flap operation. Should a failure of flap drive torque tubes occur during manual operation, resulting in a change in trim about the roll axis, stop flap movement immediately. Manually return the controllable flaps to the position assumed by the uncontrollable flaps.

9. Move the flaps to the desired position.

NOTE

Manually operate flaps to position indicated on the flap position indicator. Approximately 650 turns are required for full extension.

Wing Flap Manual Operation Controls

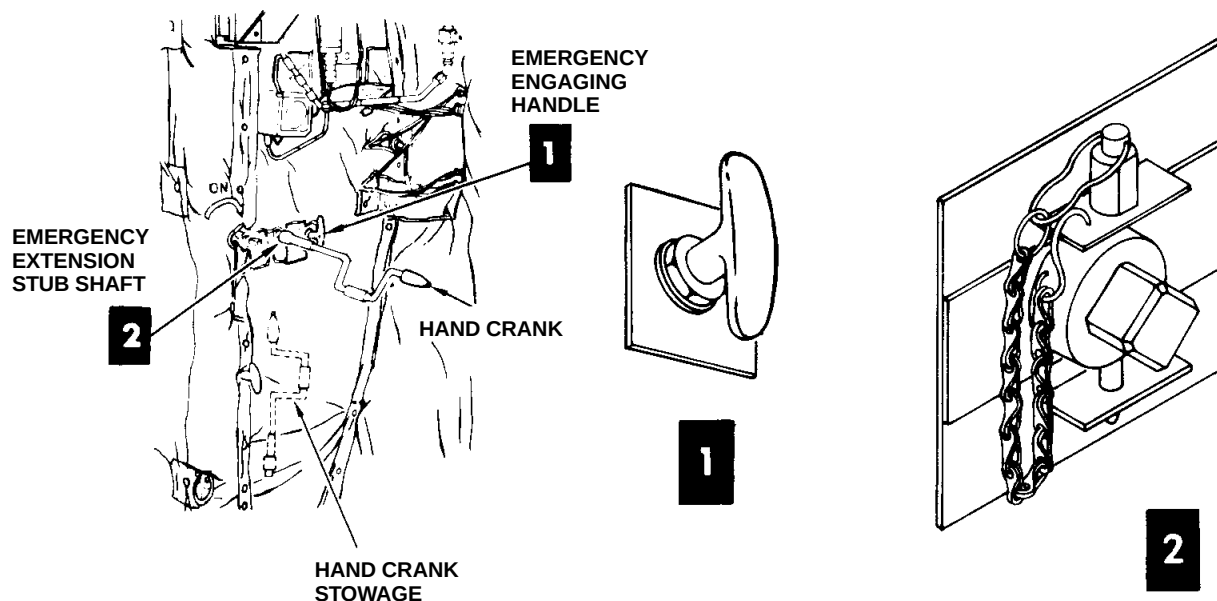


Figure 3-7

NOTE

A slip clutch is provided in the manual gearbox to prevent the operator from overloading the drive system. Slippage of the clutch indicates the jack-screw nuts are bottomed, and the flaps are full up or full down, or that interference will not permit flap operation.

10. Replace input shaft pin.
11. Remove and stow the hand crank.
12. Leave manual shift handle out.
13. Return pressure to utility hydraulic system (unless hydraulic pressure is not available). Turn on utility suction boost pump, and No. 1 and No. 2 engine-driven hydraulic pumps.

NOTE

The shift from manual back to hydraulic drive after an in-flight failure of the hydraulic system normally would be accomplished on the ground.

Practice manual extension of the wing flaps is accomplished by following the procedure for manual extension. After practice manual extension of the flaps, use the following procedure to shift back to hydraulic drive:

1. Rotate the manual shift handle clockwise against its stop, and push in as far as possible.
2. Remove the pin in the input shaft, and rotate the shaft with the hand crank. The shaft should turn freely, indicating that the manual drive has disengaged.
3. Replace the pin in the input shaft, and remove the hand crank and return it to the stowed position.
4. Place the FLAPS lever to correspond with the position of the flaps.

- Reset the WING FLAP CONTROL circuit breaker.



When the wing flap control lever is first moved after shifting from manual to hydraulic actuation, observe the utility hydraulic system pressure and the wing flap position indicator. A drop in pressure with no result in flap movement indicates a failure of the flap drive to reengage. If this happens, immediately return the wing flap lever to its original position and pull the wing flap control circuit breaker. If these steps are not observed, serious damage to the wing flap drive could result.

Mechanical Flap Failures

Failure of the Flaps to Move to the Selected Position

Normally, if a torque tube fails, the emergency flap brake will engage, preventing uncommanded roll/bank of the aircraft. This will be indicated by failure of the flaps to move in either direction or movement to stop before reaching the selected position. Proceed as follows:

- The flap lever should be positioned to correspond to the position of the flaps.
- No further in-flight movement of the flaps should be attempted.

WARNING

Do not release the manual override on the emergency flap brake valve while the airplane is in flight. This override is for ground use only.

- Land as soon as practicable.

Uncommanded Roll/Bank of the Aircraft During Flap Movement

If the emergency flap brake fails, or if a flap screwjack fails, uncommanded roll/bank of the aircraft may be experienced.

Proceed as follows:

- Stop flap movement – match FLAP lever to correspond with position of flaps.

WARNING

If an outboard flap fails, it is possible that contact between the flap and aileron will result in binding, and restriction of movement of the aileron. Under these conditions, if it is possible to control the airplane, no attempt should be made to move the flaps. If movement of the flaps must be attempted, return them in increments of 10 percent toward the position last selected before failure. During flap movement, check aileron control constantly. If aileron control is freed, or if it is noted that binding increases, stop flap movement immediately.

- Pull wing flap control circuit breaker.

WARNING

Excessive airspeed may intensify rolling tendency of the aircraft.

NOTE

Position flap lever for desired rudder boost pressure.

- Perform CONTROLLABILITY CHECK if possible.
- Land as soon as possible.

Wing Flap Position Indicator Failure

If no change in flap position is shown on the wing flap position indicator after movement of the flap lever, the trouble may be in the indicator rather than in the flap system. This trouble may be identified by observing hydraulic pressure and by observing the pitch attitude of the airplane. Immediately after selecting a change in flap position, a pressure drop in the utility hydraulic system indicates either that the flaps are moving or that there is a hydraulic leak or failure in the actuating system. If the flaps are moving, this will be indicated by a change in the pitch attitude of the airplane. During flap extension the pilot may direct a crewmember to make a visual inspection of the flap position. Also while in the cargo compartment, check the tabs and flap position indicators circuit breaker on the aft fuselage junction box.

LANDING GEAR SYSTEM FAILURE

CAUTION

If a malfunction is encountered in lowering the landing gear, once the landing gear is down and locked, it will not be moved from this position. If one or more landing gear will not retract, do not attempt to obtain an up and locked condition by recycling the gear. Extend the gear and attempt to obtain a down and locked condition. Visually confirm all the gear is down and locked and land as soon as practicable.

CAUTION

If the configuration permits, prior to landing with any main landing gear system malfunction, depressurize the airplane, and remove the affected main landing gear inspection windows. Visually confirm that the bottom of the ball nuts contact bumper stops. (See figure 3-11.)

If any landing gear fails to extend after normal operation of the landing gear control lever, attempt to identify the malfunction before making further attempts to lower the gear. Do not recycle the gear. Check circuit breakers, utility hydraulic pressure, and hydraulic fluid quantity. Check for evidence of hydraulic leaks or mechanical failures. (See figure 3-9.)

NOTE

If a hydraulic leak is the cause of the malfunction, or if hydraulic pressure was lost when the landing gear handle was placed in the down position, return the gear handle to the up position prior to losing all hydraulic pressure. Then proceed with the manual gear extension procedure. This will ensure the landing gear selector valve is in the trail center position, isolating the normally pressurized section of the landing gear system. In all other cases where the gear fails to extend normally, continue with alternate extension methods. The following alternate methods of gear operation are listed in order of preference:

NOTE

The landing gear indicators should continue to operate regardless of landing gear malfunction. The pilot should inform the crewmember when a down position is attained. If a malfunction of the landing gear position indicating system is suspected, observe the position of all landing gear through the glass panels on the

wheelwells and the nose gear position through the nosewheel inspection window. Removal of the dual rail cover and the inspection window may be required.

1. Overriding the landing gear selector valve.
2. Manual gear extension (main gear).
3. Emergency hydraulic extension (nose gear).
4. Nose landing gear manual extension after complete loss of hydraulic pressure (free fall).
5. Main gear extension after normal and manual failure.

Pressure-sealed doors in the wheel well bulkheads permit access to inspect the gearbox and hydraulic brake assemblies, and the vertical torque shafts (figures 3-9 and 3-11). A window in the nosewheel well aft bulkhead permits visual inspection and access to the nose landing gear. The emergency extension hand cranks fit the nuts on the pressure-sealed doors and nose landing gear inspection window.

Always depressurize the airplane before removing the pressure-sealed doors or window.

NOTE

It may be possible to thaw frozen main landing gear by removing access doors and heating the cargo compartment.

Overriding the Landing Gear Selector Valve

If the landing gears fail to extend while using utility hydraulic system pressure because of failure of the control valve to operate (no evidence of hydraulic pressure loss), proceed as follows:

1. Pull the landing gear control circuit breaker.

NOTE

The "Landing Gear Control" circuit breaker is color coded green for easy recognition. If required, confirm the identity of the desired circuit breaker prior to pulling.

2. Place the landing gear lever in the DN position.
3. Remove the utility hydraulic panel cover.

The crewmember accomplishing this operation will remain in communication with the flight station.

4. Depress landing gear selector valve DOWN button and hold, if required, to lower the landing gear (figure 3-8).



If the button requires holding to lower the gear, hydraulic pressure will not be available for nosewheel steering unless the button is physically held in.

5. Ensure that the landing gear is down and locked by visual inspection through the inspection access opening. Removal of the dual rail cover and the inspection window may be required.

Manual Gear Extension (Main Gear)

If hydraulic pressure is not available for gear operation, proceed as follows:

NOTE

Complete depressurization of the airplane during manual operation of the main landing gear may assist in the extension of the gear.

1. Pull LANDING GEAR CONTROL circuit breaker.
2. Place landing gear lever in the DN position.
3. Turn off No. 1 and No. 2 engine-driven hydraulic pumps, the utility suction boost pump, and operate the flight controls to deplete the utility hydraulic pressure.



Do not force the emergency engaging handle out. To do so may result in a bent manual drive shift lever, making it difficult or impossible to engage the manual drive. It may be necessary to place the extension hand crank on the emergency extension stub shaft and rotate slightly until the manual drive gear teeth align.

NOTE

If the manual drive fails to engage, or the spring-loaded brake fails to release, it may be an indication of the emergency engaging handle cable being broken or disconnected. This may be indicated by the emergency engaging handle being extremely easy to pull to the extended position. Should this occur, remove the access panel on the forward upper wheel well area (figure 3-11) for main landing gear brake and gearbox assembly. Pull down and hold (secure) the manual shift lever at the bottom of the gearbox to disengage the brake and shift gearbox to manual drive. Continue with manual extension of gear.

4. Engage manual extension system. Pull the emergency engaging handle (figure 3-10) out to its stop and rotate counterclockwise to engage the manual extension system. The handle will lock out after rotation to its stop.

WARNING

Make sure the ratchet on the hand crank is set for down rotation before placing it on the emergency extension stub shaft. If the main landing gear starts to free fall after the hand crank is placed on the emergency extension stub shaft, immediately remove the hand crank. The extension handle ratchet may change direction due to the rotation speed of the emergency extension stub shaft.

5. If main landing gear does not free-fall, extend with the extension hand crank. Place extension hand crank on the emergency extension stub shaft and rotate approximately 330 turns in direction of the arrow above the shaft.
6. Ensure that the landing gear is down and locked by visual inspection through the inspection access openings. Removal of the dual rail cover and the inspection window may be required.
7. After manual operation, return the emergency engaging handle(s) to the disengaged position by rotating clockwise to its stop and pushing in. Verify proper disengagement by rotating the hand crank one turn in each direction. If the manual shift lever was manually pulled and secured, ensure its return to the up position.
8. Return utility hydraulic pressure. Turn on utility suction boost pump and No. 1 and No. 2 hydraulic pumps to obtain hydraulic pressure (when available) for operation of the flaps and normal brakes.



Nose wheel steering will not be available regardless of the status of the utility hydraulic system.

9. Check that the landing gear stays in the down position.

NOTE

If the landing gear returns to the up position, place the utility hydraulic switches in the OFF position, and crank the landing gear down manually.

Landing Gear System Selector Valve Typical

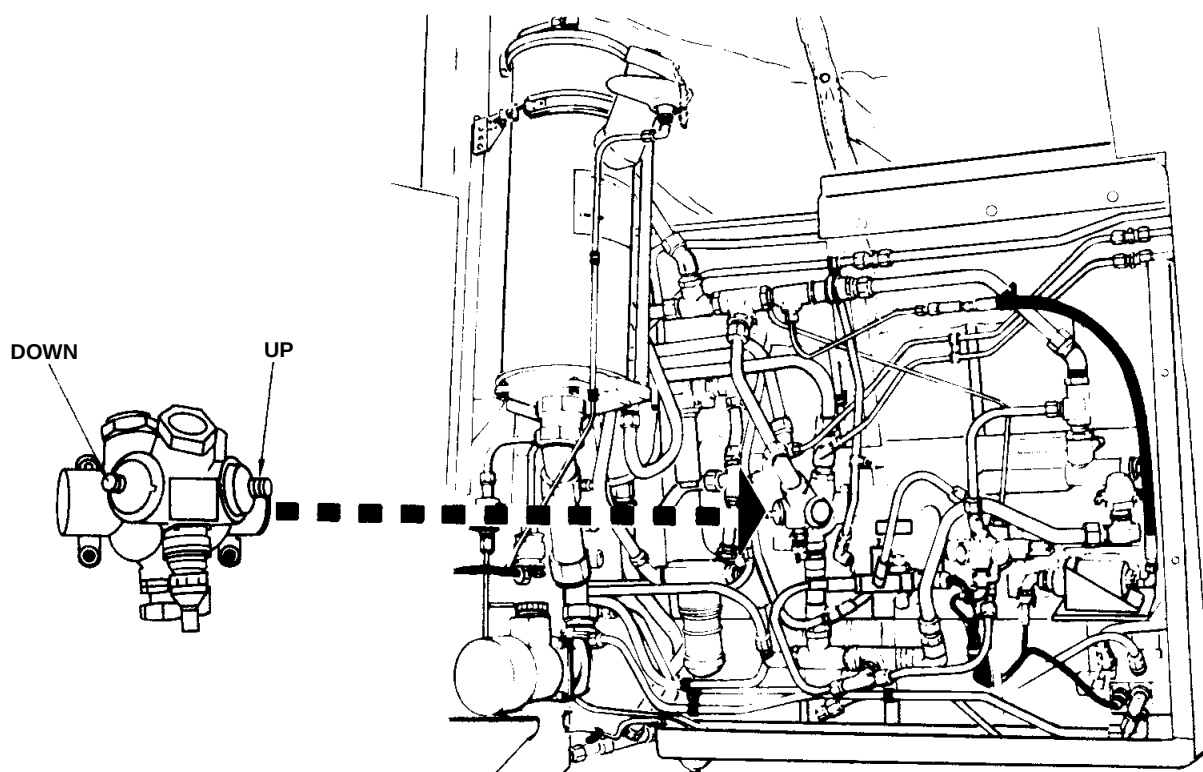


Figure 3-8

Emergency Hydraulic Extension (Nose Gear)

1. Nose gear emergency extension valve (figure 3-10) – NLG EMER EXT
2. Operate the auxiliary hydraulic pump or handpump to lower the nose landing gear.

CAUTION

Do not move the nose landing gear emergency extension valve handle from the NLG EMER EXT POSITION until after the airplane lands and the nose gear ground safety lock is installed. Maintain hydraulic pressure on the system.

3. Ensure that the nose landing gear is down and locked by visual inspection through the inspection window.

NOTE

An alternate method of lowering the nose landing gear is pulling the nose landing gear emergency release handle (figure 3-10) which is recessed into

the flight station floor at the left of the copilot's seat. This method of lowering the nose gear does not, however, ensure that the gear will move to the down-and-locked position. The above procedures of positioning the nose gear emergency extension valve handle to NLG EMER EXT POSITION and pumping the handpump must still be followed to make sure the nose gear is placed in the down-and-locked position. Dropping the nose landing gear by using the emergency release handle may allow air to enter the hydraulic system and may require bleeding before normal operation can be restored.

Nose Landing Gear Manual Extension After Complete Loss of Hydraulic Pressure (Free Fall)

NOTE

Due to nose gear configuration, tie down is not necessary.

If complete loss of hydraulic pressure is experienced, the following instructions shall apply:

1. Position the landing gear lever to the DN position.

2. Decrease airspeed to or below 120 KIAS, but not below air minimum control speed for the aircraft configuration.
3. Pull the nose gear emergency release handle.

NOTE

The nose gear should extend into the slip stream. Allow the nose gear to extend until the forward gear door starts to close at reduced speed. This may require 30 to 45 seconds.

4. Increase airspeed as rapidly as possible not to exceed 165 KIAS. The nose gear should extend to the down-and-locked position.

NOTE

If landing gear is indicating down and locked, a normal landing can be accomplished. If landing gear does not indicate down and locked proceed with the following:

Remove the nose gear inspection panel. Visually check the pin which protrudes from the aft end of the actuator and operates the down-and-locked indicator switch. If the indicator groove on the pin is visible, the downlock is engaged. Replace the inspection panel prior to landing. During landing, hold the nosewheels off the ground as long as possible, but touch down while elevator effectiveness allows gentle lowering of the nose. Do not attempt to taxi the airplane. Set the parking brake. Place chocks in front of the nosewheels, or jack the nose of the airplane, and install the ground lock pin

Main Landing Gear Extension After Normal and Emergency System Failure

A malfunction that locks any component of the main landing gear extension system may also lock the remainder of the system. In such a case, if the universal joints on the vertical torque shaft are disconnected, the landing gear may free-fall to the down position. If the landing gear does not free-fall, each landing gear strut can be extended by rotating the jack-screws, using the vertical torque shaft as an improvised wrench, or with the emergency extension wrench. Use this procedure to lower the main landing gear only after all other normal and emergency procedures have failed. Refer to figure 3-11 for access doors or cutting areas.

NOTE

On most airplanes the vertical torque shaft lower universal joint companion flanges are connected by four bolts. Some airplanes may have the preferred spare vertical torque shaft assembly installed on

one or more MLG. The preferred spare vertical torque shaft lower universal joint companion flange is connected by a single knurled quick disconnect coupling nut.

NOTE

Extend the aft strut first. The main landing gear doors are opened by a mechanical connection from the aft strut, and damage to the doors could result if the forward strut is extended first.

1. Leave the main landing gear manual extension system engaged, the utility hydraulic system depleted, and the landing gear control circuit breaker pulled. Depressurize the airplane. Place the air conditioning master switch to AUX VENT.
2. Remove the upper access doors with the emergency extension hand crank.

NOTE

On airplanes with the quick disconnect coupling nut, use the following steps to disconnect the universal joint companion flange.

- a. At the aft strut, cut and remove the two safety wires from the vertical torque shaft lower universal joint quick disconnect coupling nut.
- b. Place a screwdriver or drift against the coupling nut lugs and tap counterclockwise and remove nut.

NOTE

One-quarter to one-half turn is sufficient to allow the coupling nut to drop free of the companion flange.

- c. Place the tip of a blade-type screwdriver into one of the slots between the companion flanges and pry the flanges apart until the lower flange pins disengage from the upper flange. Immediately withdraw the screwdriver once the pins are disengaged.
3. At the aft strut, remove the two outboard bolts and nuts connecting the companion flanges at the lower end of the vertical torque shaft. (Refer to figure 3-9.)
 4. Prior to removing the last inboard bolt, secure the lower half of the companion flange to the bulkhead. Remove the nuts from the two inboard bolts, and remove the bolts without extending the hands through the access hole.

WARNING

The weight of the landing gear may cause the gear to extend rapidly when released. If the above steps are not followed in proper sequence, serious injury to the hands may result when the gear falls.

CAUTION

If the flange is dropped, the MLG components may become jammed, preventing the gear from lowering.

NOTE

If the strut does not free-fall, application of g forces may aid in extending the strut.

5. If the aft strut free-falls approximately halfway down, attempt to extend the forward strut using the manual extension system. The horizontal torque strut will prevent the landing gear strut from fully extending.
6. If the landing gear does not extend using the above procedure, extend the struts using the emergency extension wrench (if available) or the vertical torque shaft.

NOTE

It may be necessary to partially retract the aft strut to relieve binding before the forward strut can be extended.

7. To remove the vertical torque shaft on airplanes without the emergency extension wrench, cut a hole above the upper access door. (See figure 3-11.) Secure the top of the vertical torque shaft to some point inside the cargo compartment with wire to prevent loss of the shaft. Remove the bolt and nut that retains the upper end of the shaft spline to the gearbox. Pull the vertical torque shaft into the cargo compartment through the upper access hole.

NOTE

Cutting areas for this step are depicted on figure 3-11, area 4.

NOTE

On airplanes having the emergency extension wrench, do not disconnect the upper end of the shaft, but move the vertical torque shaft clear of the companion flange on the upper end of the ball screw.

8. At the aft strut, slip the companion flange off the splines on the upper end of the jackscrew.
9. Using the vertical torque shaft or the emergency extension wrench, engage the splines on the upper end of the jackscrew. Rotate the jackscrew counterclockwise approximately one-half revolution and remove wrench. Application of g forces may aid in extending the strut.

NOTE

On airplanes with an emergency extension wrench installed, use the fixed end of the wrench to start the jackscrew.

10. If the strut has not extended, rotate the jackscrew counterclockwise to extend the strut halfway down.

NOTE

Use the ratchet end of the emergency extension wrench to rotate the jackscrew. The hand crank may be installed in the square drive of the wrench to extend the strut more rapidly.

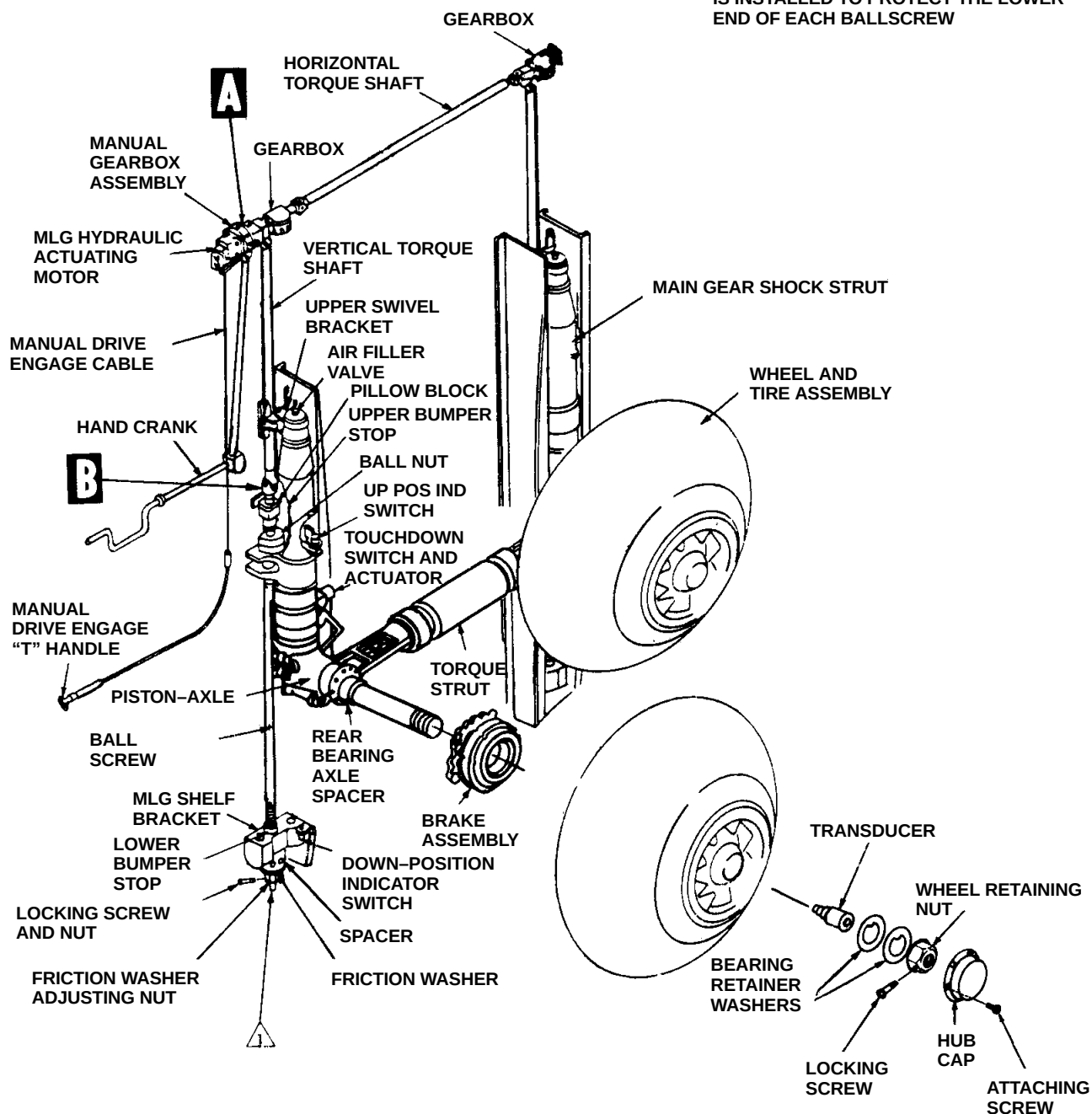
11. Extend the forward strut using the above procedure. Check that the aft strut is fully extended.
12. If possible, without incurring further leakage or system damage, restore utility hydraulic pressure. Turn on the utility suction boost pump and No. 1 and No. 2 hydraulic pumps to provide hydraulic pressure for operation of the flaps, normal brakes, and flight controls.

Main Landing Gear Structure

NOTE



ON SOME AIRPLANES A SPLASH GUARD IS INSTALLED TO PROTECT THE LOWER END OF EACH BALLSCREW



C-130H AIRPLANES

Figure 3-9 (Sheet 1 of 2)

Main Landing Gear Structure

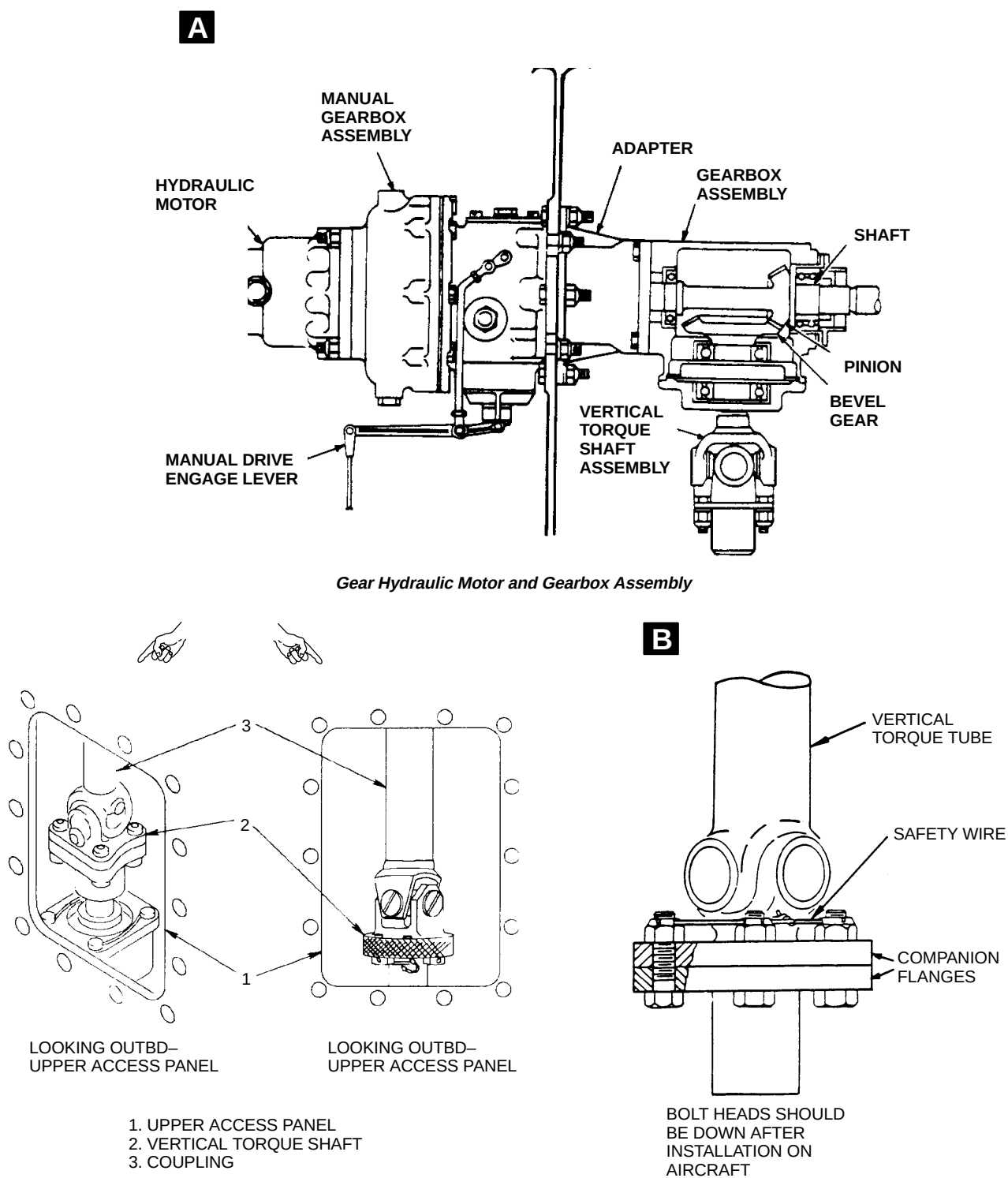


Figure 3-9 (Sheet 2 of 2)

Landing Gear Emergency Extensions Controls

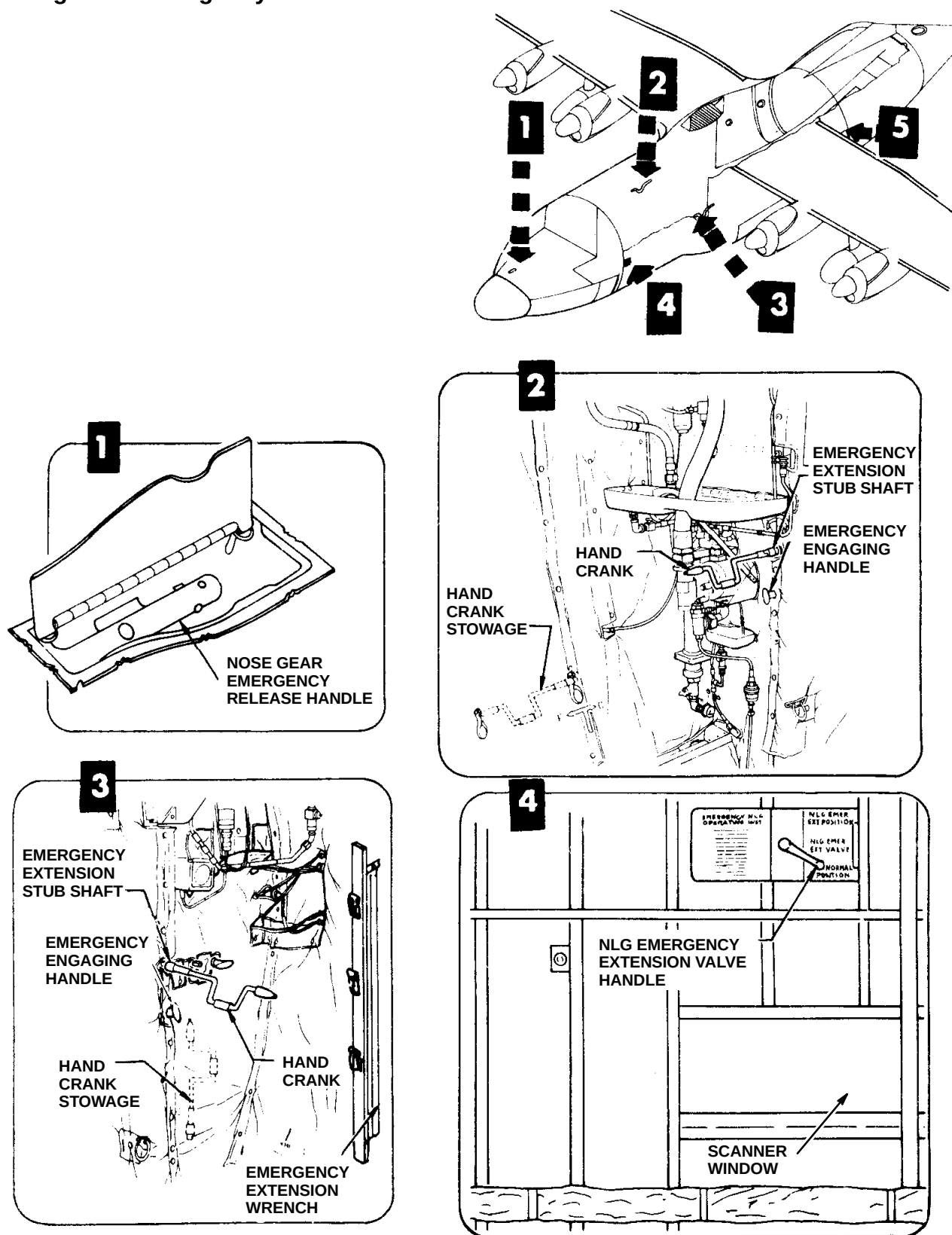


Figure 3-10 (Sheet 1 of 2)

Landing Gear Emergency Extensions Controls

NOTE



PRESSURE FOR EMERGENCY EXTENSION OF THE NOSE LANDING GEAR SUPPLIED BY EITHER THE MOTOR-DRIVEN OR THE HAND-OPERATED PUMP OF THE AUXILIARY SYSTEM.

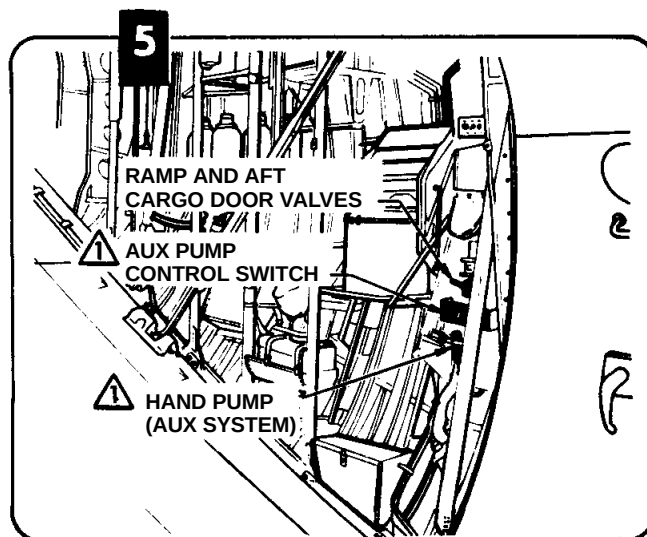


Figure 3-10 (Sheet 2 of 2)

MLG Wheel Well Access Doors and Cutting Areas

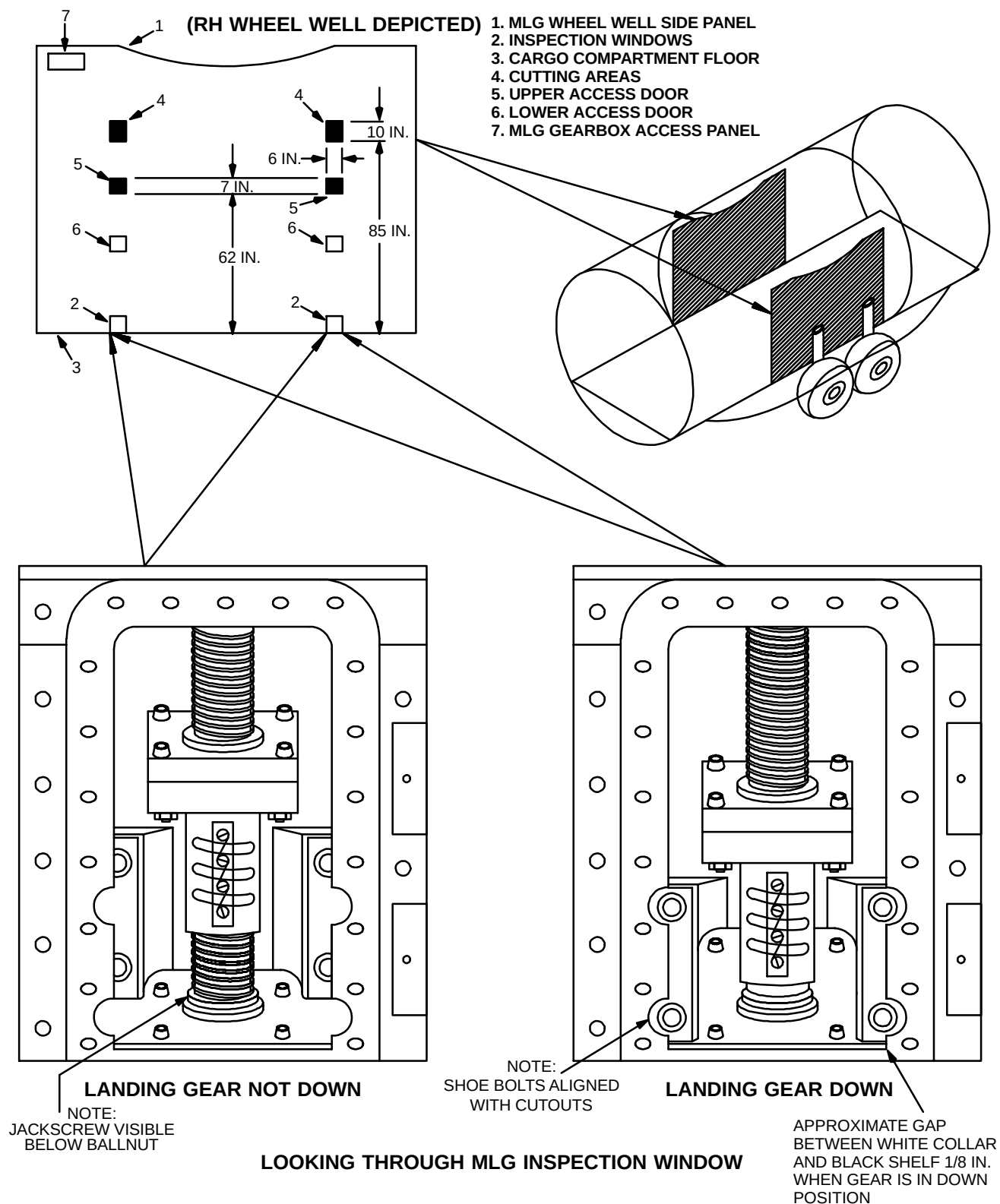


Figure 3-11

Emergency Retraction

If the landing gear lever will not move to the UP position, pull down the LOCK RELEASE finger latch and place the landing gear lever in the UP position. This may be due to a malfunction of the touchdown switch or the lock release solenoid. Land as soon as practicable. Refer to Section I for systems lost.

If either or both of the main gears fail to retract, an emergency retraction may be attempted at the discretion of the pilot. Investigation of the system should be made prior to manual retraction. To accomplish emergency retraction proceed as follows:

WARNING

If an emergency retraction of a main landing gear is performed, it may not be possible to extend the main landing gear. When possible, the landing gear should be left down and the airplane landed.

1. Remove the left hydraulic panel cover.
2. Depress and hold the UP button on the landing gear selector valve until the landing gears are retracted and the doors are closed. Release the button.

If the main landing gears fail to retract after operation of the manual override of the landing gear selector valve, proceed as follows:

3. Pull the landing gear control circuit breaker located on the copilot's lower circuit breaker panel.
4. Place the landing gear control handle in the UP position.
5. Deplete the utility hydraulic pressure by turning off the No. 1 and No. 2 engine-driven hydraulic pumps and operating the flight controls.
6. Rotate the emergency engaging handle (figure 3-10) counterclockwise to its stop, and pull while rotating the hand crank until the force required for rotation indicates engagement of the manual extension system. The handle will lock out after it is pulled.
7. Retract the main landing gears with the hand cranks, reversing the rotational direction used in extending the gears.

8. After retraction, return the emergency engaging handle to the disengage position by rotating clockwise to its stop and pushing in.
9. Verify proper handle position by rotating the hand cranks one revolution each way.
10. Check visually that the main landing gears are up.

NOTE

No provisions exist for manual retraction of the nose landing gear.

Main Landing Gear Tie Down

NOTE

The airplane is serviceable for landing, taxiing, or towing if the measurement between the lower surface of the bracket (moveable assembly), which attaches the drag pin to the strut, and the upper surface of the shelf bracket does not exceed 0.5 inch in flight or 0.7 inch after landing. No further flights are authorized until repairs are made.

Prior to landing with a broken shelf bracket or with a drag pin not engaged in the shelf bracket, the main landing gear strut must be secured to the side of the airplane. The preferred method of securing the main landing gear is with the main landing gear safety strap. The following procedure will be used to install the safety straps. See figure 3-12 for safety strap component identification and installation location.

1. Depressurize the airplane and position the air conditioning switch to AUX VENT.
2. Pull the LANDING GEAR CONTROL circuit breaker.
3. Remove the dual rail cover adjacent to the wheel well access by releasing the cam lock fastener.
4. Remove the wheel well access windows by removing the bolts and hinge pin.

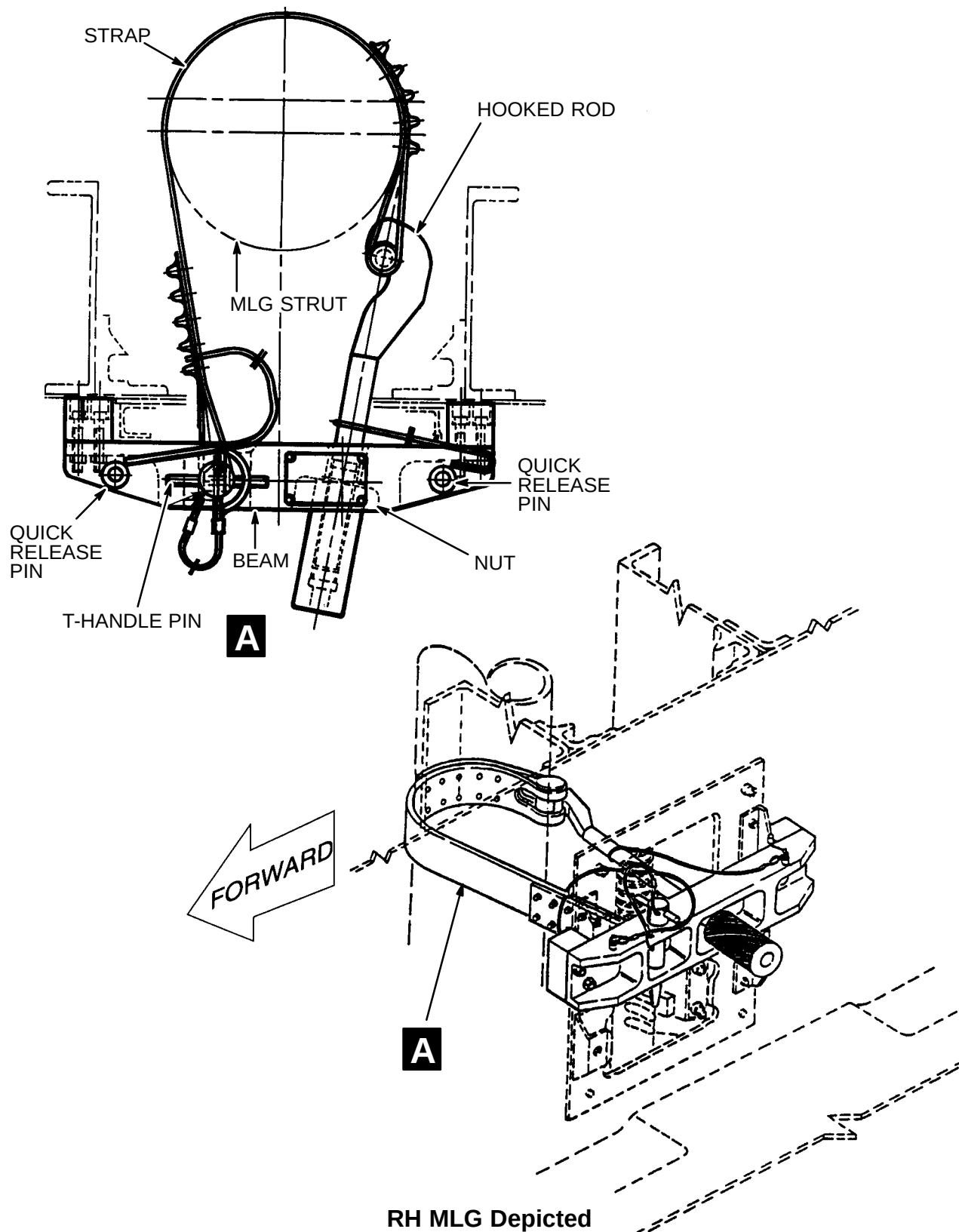
NOTE

Any felt strips in the area of contact between the safety strap beam and the wheel well bulkhead must be removed. The beam must make direct contact with the bulkhead to allow the strap to completely encircle the main landing gear strut.

NOTE

Attach the main landing gear safety strap and hook to the beam by means of the quick release pins tied to each of the items.

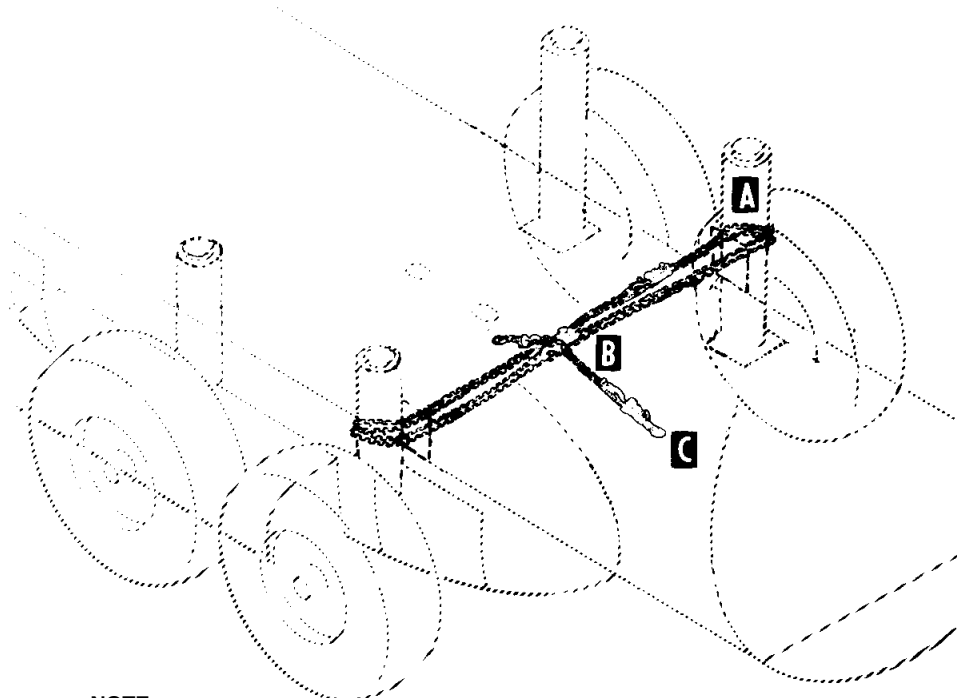
Main Landing Gear Safety Strap



RH MLG Depicted

Figure 3-12 (Sheet 1 of 2)

Main Landing Gear Tie-Down



NOTE

- ⚠ IF 25,000-LB CHAINS ARE AVAILABLE, USE SINGLE LOOP AROUND GEAR STRUTS AND ACROSS CARGO COMPARTMENT INSTEAD OF DOUBLE LOOP OF 10,000-LB CHAINS SHOWN. WHEN USING 25,000-LB CHAINS, USE ONLY MB-2 TIE-DOWN DEVICES. WHEN USING 10,000-LB CHAINS USE ONLY MB-1 TIE-DOWN DEVICES.

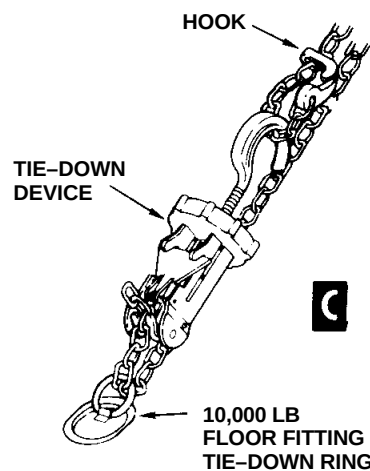
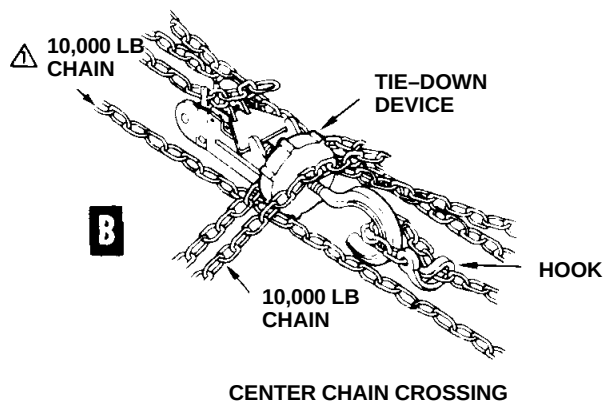
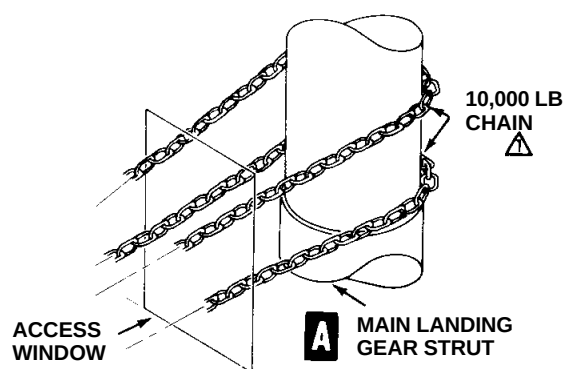


Figure 3-12 (Sheet 2 of 2)

5. Grasp the strap by the long end and, holding it vertically with the looped end down, maneuver the strap into the lower main landing gear access hole. As the strap enters the access hole, lower the long end of the strap until it is horizontal. Holding the strap in this position, insert the holding tool into the loop at the long end of the strap. Once the holding tool is positioned in the strap, push the strap further into the access hole, allowing the strap to rest against the main landing gear strut. With the strap positioned across the strut, rotate the strap toward the strut until the flat of the strap is resting against the strut. At this point pull back sharply and snap the strap into position on the strut.
6. Remove the holding tool from the strap and insert the loop on the long end into the beam and lock in place with the "T" handled pin.
7. Insert the hook end of the nut and hook assembly through the beam and the main landing gear access hole. Place the hook end around the pin in the loop at the end of the strap.
8. After insuring the beam is centrally situated vertically and horizontally about the main landing gear access hole, tighten the nut. Following the initial tightening, check for gaps between the periphery of the main landing gear strut and the strap and between the beam and the bulkhead. If a gap is present, attempt to shift the assembly and retighten the nut.



Do not take off with a known or suspected landing gear malfunction.

If main landing gear safety straps are unavailable, or if more than two main landing gear struts require securing, the following procedure will be used to secure the main landing gear.

NOTE

Variable pallet configurations preclude jettisoning loads under some circumstances. Outsized and bulky cargo on pallets will cause the aircrew to secure the questionable gear by any means possible.

If 25,000 pound tie-down chains are not available, three tie-down devices and seven 10,000 pound chain segments, forming two chain loops, are required to tie down each pair of opposite struts. If 25,000 pound chains are available, one 25,000 pound connector with three chains and one 10,000

pound chain segment and connector are required. See figure 3-12 for the arrangement of the chains.

1. Depressurize the airplane and position the air conditioning switch to AUX VENT.
2. Pull LANDING GEAR CONTROL circuit breaker.
3. Remove dual rail cover, adjacent to wheel well access, by releasing the cam lock fastener.
4. Remove the wheel well access windows by removing the bolts and hinge pin.

NOTE

Secure a length of safety wire or similar material to the chain as a guide. Routing the guide around the gear front to aft will be easier due to air flow.

5. Pass the ends of two 10,000 pound chain segments (or the end of a single 25,000 pound chain segment, if available) around the applicable strut and back through the inspection opening. Repeat this for the opposite strut.
6. Fasten two other 10,000 pound chain segments (or a single 25,000 pound chain segment, if available) between the ends of the chains placed around the struts.
7. Install tie-down devices between the remaining loose ends of the chains around the struts, and tighten the devices.
8. Pass the end of a 10,000 pound chain through the center cargo tie-down rings. Join the chain with a tie-down device to form an aft-forward loop across the strut chains. This will remove any possible slack from the strut cross chains.
9. Repeat the process for the other pair of opposite struts, if necessary.

WARNING

Move all personnel away from the wheel well to prevent injury if a chain should break.

10. Land the airplane in a normal configuration after notifying the control tower of the difficulty and requesting that the crash equipment be alerted. Do not attempt to taxi the airplane after landing.



Do not attempt a takeoff with a known or suspected main landing gear malfunction.

CARGO RAMP AND DOOR SYSTEM FAILURE

Cargo Door Uplock Emergency Release

To release the cargo door uplock after normal procedures have failed, proceed as follows:

1. Pull the cargo door uplock manual release lever forward and down.
2. After the cargo door free-falls, proceed with normal closing procedures to lock the door in the closed position.



If the door hook(s) is/are broken, do not pressurize the airplane.

Ramp Locks Fail to Lock

In the event the ramp locks fail to lock the ramp in the closed position, proceed as follows:

1. Check the fluid level in the auxiliary hydraulic system reservoir.
2. If the fluid level is low, attempt to find the leak and isolate it.
3. If the reservoir fluid level is normal, turn the auxiliary hydraulic pump off and allow system pressure to deplete.
4. Attain an airspeed of 1.2 Vs (flaps up), not to exceed 150 KIAS.
5. Retract the flaps.
6. Rotate the RAMP control knob, on the ramp and door manual control valve, in a clockwise direction to position 4.
7. Turn the auxiliary hydraulic pump on to ensure that the ramp is closed.

8. Turn the auxiliary hydraulic pump off and allow system pressure to deplete.
9. Rotate the RAMP control knob to position "5" and turn the auxiliary hydraulic pump on.
10. If the ramp locks actuate to the locked position (locks visually checked for engagement and door warning light extinguished), continue the mission (pressurized if desired).
11. If the ramp locks still fail to lock the ramp in the closed position, repeat the sequence of steps 6 through 9 using hand pump pressure at approximately 4,100 psi in lieu of the auxiliary hydraulic pump.
12. If the ramp locks still fail to lock, ensure that the auxiliary hydraulic pump is off and that system pressure is depleted. Rotate the RAMP control knob in a clockwise direction to position 4. Turn the auxiliary hydraulic pump on. Leave the RAMP control knob in position 4 and the auxiliary hydraulic pump on for the remainder of the flight.



Do not pressurize the airplane if the ramp fails to lock.

CARGO JETTISON

Jettisoning of cargo can be dangerous, due to possible loss of airplane control or structural damage; therefore, the aircraft commander must consider carefully the emergency situation, operational consideration, availability of suitable drop area, and whether jettisoning is necessary.

Restraint harness will be worn by personnel jettisoning cargo. Depressurization will be required prior to jettison operations, and the crew members must use oxygen or the airplane must descend to an altitude where oxygen is not required. Cargo should be jettisoned out through the ramp and aft cargo door opening. The ramp and aft cargo door should be in the airdrop position.

Jettison by Hand

Relatively lightweight cargo should be jettisoned by hand. The ramp and cargo door will be used for cargo jettisoning. Use the paratroop door if ramp and cargo doors cannot be opened.

Jettisoning Palletized Cargo on Rollers

Cargo palletized on logistics pallets or platforms supported by rollers (not rigged for airdrop) may be jettisoned if the

load center of gravity in figure 3-13 is observed and the CARGO JETTISON TECHNIQUE in this section is used. Oversized cargo palletized on multiple pallets should be considered as one unit. Pallets/platforms joined together in a train by a coupler should be separated, if the conditions of the emergency permit, and jettisoned one at a time. Jettisoning should be planned so that the airplane CG would be within normal limits for landing.

Jettisoning Cargo Not on Rollers

Jettison of large heavy palletized or unpalletized cargo resting on the floor should be attempted only as a last resort.



Heavy cargo resting on the floor may move slowly and/or become misaligned and wedged in the aft area and could cause out-of-limit CG travel and loss of airplane control.

Cargo Jettison Technique

Detailing of emergency procedures is not practical, because of the many variables. The following provides a basic procedure applying to emergency jettison of palletized cargo on rollers, but must be supplemented by sound pilot judgment for the specific conditions:



- 1. Establish a nose-up attitude (10°), to obtain a component of gravity for the extraction force.
- 2. Apply power to accelerate the airplane and increase the effective extraction force.

Before attempting to jettison, the loadmaster should compute the airplane CG to insure that normal CG would be maintained within normal limits for landing and that cargo is jettisonable in accordance with figure 3-13.



During cargo jettison move the elevator control slowly, smoothly and no more than is necessary, to avoid the possibility of exceeding structural limits.

AERIAL DISPERSANT DELIVERY SYSTEM

DISPERSANT PRODUCT JETTISON

1. Pump safety override clip	“Installed”	(LM)
2. Safety/Personal Protective Equipment	“On, checked”	(LM)
3. ADDS tank cover	“Open”	(LM)

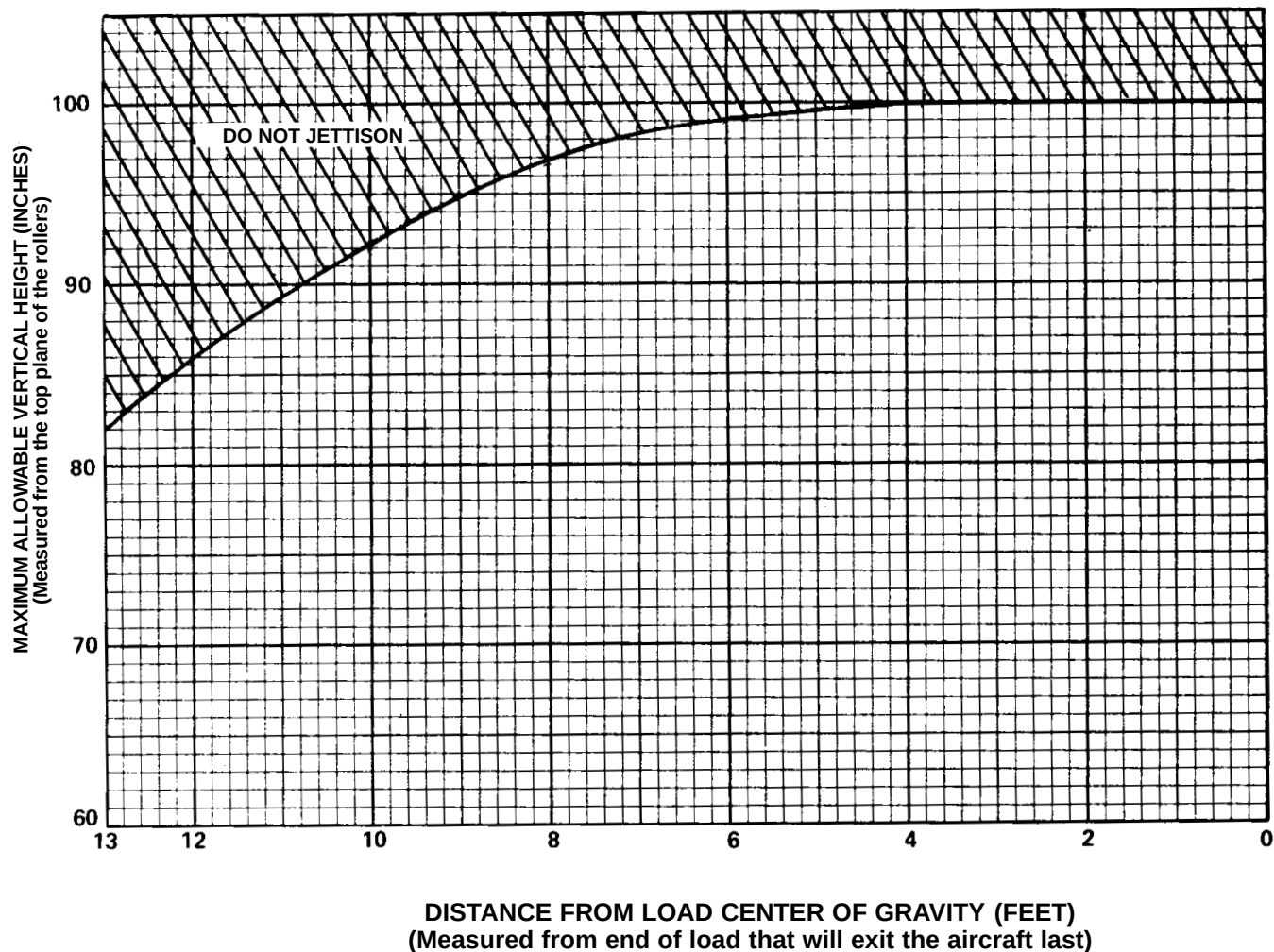


Failure to open hatch cover will create negative tank pressure, decreasing jettison rate and damaging ADDS equipment. If both pumps are used for jettison, they may cavitate due to internal tank baffling.

4. OXYGEN	“ON/100 PERCENT”	(ALL)
5. Pressurization	“Emergency Depressurization” (on command of pilot)	(E)
6. Descent	“As required”	(P)
7. Air conditioning master switch	“AUX VENT”	(E)

Cargo Jettison

VERTICAL HEIGHT LIMITATIONS AT VARIOUS PALLET/PLATFORM STATIONS



NOTE: MAXIMUM ALLOWABLE VERTICAL HEIGHTS ARE BASED ON:

1. A 10° NOSE UP ATTITUDE.
2. A MAXIMUM VERTICAL C.G. HEIGHT OF THE LOAD OF 55 INCHES FROM THE BOTTOM OF THE PALLET/PLATFORM.

CAUTION

IT IS RECOMMENDED THAT PALLETS WEIGHING LESS THAN 35 POUNDS PER SQUARE FOOT NOT BE JETTISONED. THERE IS A POSSIBILITY THAT LIGHT WEIGHT PALLETS COULD STRIKE THE AIRCRAFT DUE TO THEIR LIGHT WEIGHT AND LARGE AREA. (35 PSF IS EQUIVALENT TO 2500 POUNDS FOR A STANDARD PALLET).

Figure 3-13

CGTO 1C-130-1

8. Safety harness	“On, checked”	(LM)
9. Left paratroop door	“Open” (on command of pilot)	(LM)
10. ADDS hose restraining straps	“Installed”	(LM)

WARNING

During jettison, hose back force is approximately 100 pounds. Failure to secure restraining straps adequately may result in injury and/or equipment damage.

11. Underfloor heating switch	“OFF”	(E)
12. Recirculating fan switch	“OFF”	(E)
13. Propeller ice control switches	“OFF”	(E)
14. Spray pump motor #1 and/or #2	“Clear to arm” “Armed”	(P) (LM)
15. Spray switch	“ON” (on command of pilot)	(LM)

CAUTION

During pump operation, monitor loadmeters closely.

16. Spray switch	“OFF” (when ADDS tank is empty or desired gross weight is attained)	(LM)
17. ARM-1 and ARM-2 switches	“SAFE”	(LM)
18. Left paratroop door	“Closed”	(LM)

NOTE

Proceed with POST-DISPERSANT CHECKLIST

LIQUID LEAK OF DISPERSANT DURING SPRAY OPERATIONS

1. OXYGEN	“ON/100 PERCENT”	(LM)(DM)
2. Personal Protective Equipment	As required	(LM)(DM)

CAUTION

Dispersant product is combustible. In the event of dispersant leak, eliminate ignition sources.

3. SPRAY switch	“OFF”	(LM)
4. ARM-1 and ARM-2 switches	“SAFE”	(LM)

NOTE

Proceed with POST-DISPERSANT CHECKLIST

SPRAY BOOM RETRACT FAILURE

1. BOOM switch	“OFF”	(LM)
2. ADDS electrical power	“OFF”	(E)

NOTE

Pull ADDS circuit breaker under flight deck and six ADDS circuit breakers on aft side of FS 245.

3. BOOM retraction handcrank	“Connected”	(LM)

NOTE

Retract spray booms using handcrank. If handcrank is not available or gearbox is damaged, proceed with step 4.

4. Retraction cables	“Cut” (if required)	(LM)
5. Spray booms	“Manually retracted”	(DM)

NOTE

If booms cannot be retracted manually and the cargo ramp and door cannot be fully closed, raise ramp as high as possible, approximately six inches, without damaging spray boom support structure.

NOTE

Proceed with POST-DISPERSANT CHECKLIST

BAILOUT PROCEDURES

In-flight evacuation exits are shown in figure 3-14. If the airplane is under control and time permits, the order of preference for bailout exits are aft cargo door and ramp, paratroop doors, and forward crew door. When time and airplane control permit, proceed as follows:

1. Give bailout warning over the public address system, interphone, and three short rings on the alarm bell. Use the paratroop jump lights if troops have been briefed.	3. With passengers aboard, descend to an altitude at which the use of oxygen is not required, if possible.
2. Reduce airspeed if possible.	4. Depressurize the airplane.
	5. Place the air conditioning master switch in the AUX VENT position.
	6. Don survival equipment and parachutes.
	7. If possible, head the airplane toward an isolated area and engage the autopilot.
	8. Open the cargo door and ramp.

Emergency Exits – Air and Ground

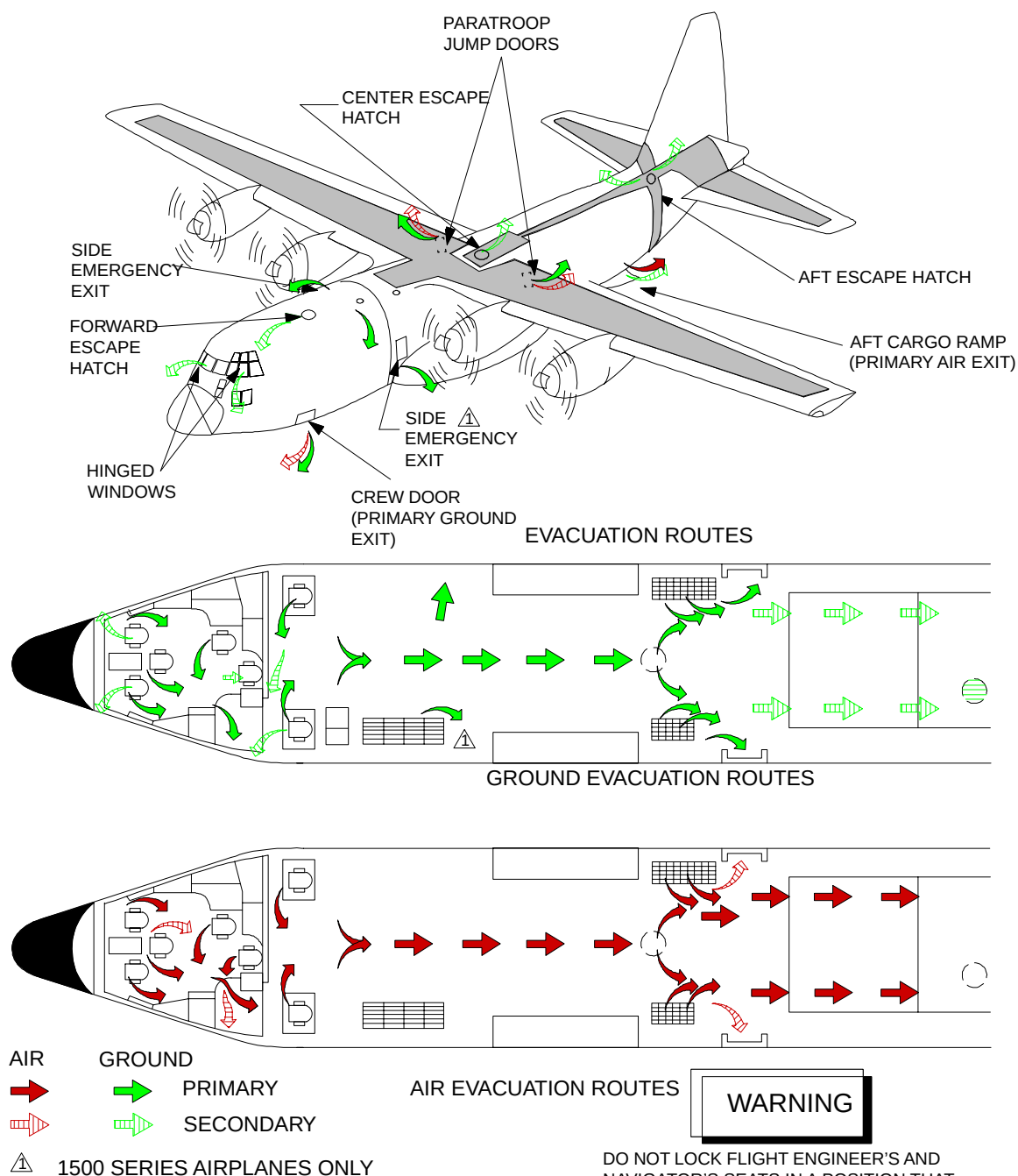


Figure 3-14

CAUTION

Lowering the ramp above 150 knots may cause severe buffeting. If airspeed cannot be reduced to 150 knots, open only the cargo door.

9. If unable to open cargo door, open the air deflectors and paratroop doors.
10. Give abandon airplane signal over the public address system, interphone, by one long ring on the alarm bell.
11. Evacuate the airplane.

When time and airplane control or cargo load do not permit crew use of the paratroop doors or the ramp door, proceed as follows:

12. Give bailout warning over the public system, interphone, and by three short rings on the alarm bell.
13. Jettison the crew door by pulling the emergency release handle just forward of the flight station emergency escape hatch release.

NOTE

It may not be possible to jettison the crew entrance door at a pressure differential greater than 3.1 inches of mercury due to the load on the door hinge and the latching mechanism.

14. Reduce airspeed if possible.

WARNING

Bailout from the crew entrance door is not recommended at airspeeds above 150 knots or with the landing gear extended.

15. Give abandon-airplane signal over the public address system, interphone, and by one long ring on the alarm bell.
16. Bail out of the crew entrance door from a squatting position at the rear edge. Push head first outward and downward, using the rear edge of door frame for leverage. Do not attempt to exit feet first or in a spread position.

Bailout Over Water

Consideration of various unfavorable factors involved in an overwater bailout limits the decision recommending overwater bailout to several specific instances, namely: when visual contact is made with land or adequate surface help; when wind and sea conditions are such as to preclude ditching, when fire or loss of control makes ditching impossible. Should a bailout over water be required, the following procedures, in addition to normal BAILOUT PROCEDURES, will be employed:

1. Give spoken warning over the public address system and interphone and give three short rings of the alarm bell.
2. Turn IFF to EMERGENCY. The copilot should send distress signals and position reports as directed by the pilot.
3. If time permits (approximately 1 extra minute is required) put on exposure suits over flying clothing. (Exposure suits are carried on special missions.)
4. Don life jackets and parachutes. Personnel should check each other's equipment for completeness and proper adjustment.

WARNING

Do not attempt to inflate the life jacket prior to bailing out as it may be damaged in egress from the airplane, as well as hinder the wearer in his exit.

5. Reduce airspeed as much as possible without losing control.
6. Trim airplane to approximately level flight.
7. Open cargo door and ramp.
8. If a ship is in the vicinity, make a run so that personnel, on bailing out, will drift onto the course and just ahead of the ship.
9. Give bailout order over the public address system and interphone and one long ring of the alarm bell.

LANDING EMERGENCIES

WARNING

Careful rudder control is absolutely essential during asymmetric thrust conditions. Exercise extreme care when counteracting asymmetric thrust/yaw conditions. If not carefully applied, rudder inputs made into the operating engines then neutralized, may cause an accelerated yaw rate to quickly develop. This may result in exceeding the critical sideslip angle within seconds, and total loss of aircraft control. This yaw and subsequent sideslip is considerably aggravated when any rudder input into the actual/simulated inoperative engine(s) is applied.

WARNING

Prior to crash landing or ditching the airplane or in the event of fire in the vicinity of the flare launcher (if installed) the pilot shall, time and conditions permitting, direct ejection of the remaining flares.

CAUTION

Airplanes landing with an unsecured external panel or broken HF antenna should avoid the use of reverse thrust except for a greater emergency.

CONTROLLABILITY CHECK

A controllability check is conducted to determine the minimum safe airspeed to maintain during approach and landing. If suspected or actual in-flight damage, fuel imbalance, or differential airspeed occurs, the following procedure should be used as necessary to determine the extent of the damage and controllability for landing. Maintain careful control of the airplane at all times throughout this procedure. If at any time it becomes apparent that you will be unable to land the airplane, consider bail-out procedure while controlled flight is still possible.

1. Conduct a preliminary check for airplane damage and personnel injuries.
2. Attempt climb to 10,000 feet AGL.
3. Consider dumping fuel to lighten airplane.
4. Complete the DESCENT checklist.

5. Configure the airplane for landing.

WARNING

The speed must never be decreased to the point at which full control deflection is required since there may be no recovery capability beyond this point. Control and configuration changes should be input gradually.

WARNING

With structural damage there is a possibility of a flap malfunction when the flaps are lowered.

6. Gradually slow the airplane in 5-knot increments while evaluating the control capabilities in turns and simulated landing approaches. Any impending control problems are indicated by an excessive rolling, yawing, or pitching moment. The airspeed is decreased until the desired landing speed is attained or an undesirable control problem is approached.
7. If a stall buffet occurs, immediately accelerate the aircraft to a safe flying speed. If a stall buffet occurs, plan touchdown speed to be 1.2 times speed at buffet for the selected flap setting. The landing flare requirement can be decreased by making a low flat landing approach.

LANDING WITH ONE ENGINE INOPERATIVE

The approach for landing with one engine inoperative is made in essentially the same manner as for a normal landing.

WARNING

Do not extend full flaps until landing is assured.

Below 110 knots airspeed during flareout, the combined flight idle thrust on the side with two operating engines will tend to turn the airplane into the side with only one operating engine. This effect is particularly noticeable when a landing is made with an outboard engine feathered.

After the nosewheel is firmly on the ground, retard the throttles to ground idle and use braking and reverse thrust to slow the aircraft. Maintain directional control of the airplane during roll out through coordinated use of rudder, nosewheel steering, asymmetric power application, and brakes.

NOTE

If runway conditions permit, delay moving the throttles from the flight range to the ground range until the aircraft has been slowed to between 90 and 100 knots. This will minimize the swerve and associated control problems encountered when moving the throttles at higher airspeeds.



An engine-out condition may add difficulty to a crosswind approach and landing by adding to the drift and weathervaning. Particular caution must be exercised when landing with an adverse crosswind (wind from the side with two operating engines). The combined effects of weathervaning and asymmetric drag may cause the aircraft to be uncontrollable in crosswinds less than indicated in the applicable performance manual (T.O. 1C-130H-1-1).

LANDING WITH TWO ENGINES INOPERATIVE

WARNING

Two-engine operations above 120,000 pounds or at high density altitude are marginal.

After loss of two engines, attempt to decrease airplane weight, if necessary, by dumping fuel and/or jettisoning cargo before landing.



If both No. 1 and No. 2 engines are inoperative, additional time is required to extend gear and flaps.

Change the landing procedures as follows:

1. DOWNWIND LEG

160 KIAS minimum

Gear as required.

2. BASE LEG

160 KIAS minimum

Gear and Flaps as required.

3. TURN TO FINAL

150 KIAS or approach speed, whichever is higher, until landing is assured.

4. FINAL APPROACH

Maintain 150 KIAS or approach speed, whichever is higher, until landing is assured.

Landing Gear down.

NOTE

When landing gear is required to be manually extended or with only one hydraulic pump, additional time will be necessary.

Flaps as required.

NOTE

Selecting greater than 15 percent flaps will decrease minimum control speed due to an increase in available hydraulic pressure.

WARNING

A go-around is not recommended after flaps are lowered. Do not extend full flaps until landing is assured.

WARNING

When landing with two engines inoperative, assure firm nosewheel contact before reversing and use reverse thrust only as needed.

NOTE

If a no flap landing is considered, activate GPWS Flap Override.

NOTE

If runway conditions permit, delay moving throttles to the ground range until the aircraft has been slowed to between 90 and 100 knots. This will minimize the swerve and associated control problems caused by asymmetric drag. Refer to Landing with One Engine Inoperative section for crosswind considerations.

GO-AROUND WITH ONE OR TWO ENGINES INOPERATIVE

The decision to go around should be made as soon as possible on approach. When a go-around is decided upon, alert the crew and proceed as follows:

1. Begin the go-around at or above minimum control air-speed.

WARNING

It is important to attain two-engine minimum control speed as soon as possible and prior to raising the flaps above 15 percent.

NOTE

If a go-around must be attempted and speed is less than minimum control speed, it may be necessary to reduce power on the opposite engine to help maintain directional control until minimum control speed is attained.

WARNING

The use of five degrees of bank away from the inoperative engine is necessary to maintain directional control when power is applied during go-around. Attempting to fly with wings level increases minimum control as much as 20 knots. Go-around with two engines inoperative should be avoided unless absolutely necessary. Every precaution should be taken so as not to let a situation develop that necessitates a go-around under these conditions. Descent below safe, comfortable altitudes and airspeeds should not be made until absolutely assured of landing.

2. Advance throttles for all operating engines to maximum power as directional control will permit. Power applied to the asymmetrical engines will depend on the airspeed of the airplane at initiation of go-around.
3. When appropriate airspeed, altitude, and climb profile are established, direct the copilot to set/check flaps to 50 percent.

WARNING

Retracting flaps from 100 percent to 50 percent will increase sink rate and stall speed. This is particularly noticeable at lower than normal airspeed. If safe altitude and airspeed are not attained, inadvertent touchdown and/or stall may occur.

4. Direct the copilot to raise the landing gear when certain that the airplane will not touch down.

After gear retraction:

5. Continue to raise flaps as airspeed and altitude permit.

CAUTION

Selecting less than 15 percent flaps or operating the gear or flaps will increase the minimum control speed due to reduction in available hydraulic pressure.

NOTE

At low airspeeds, raise flaps in 10 percent increments with airspeed increasing approximately 5 knots between retraction increments.

6. After gear and flaps are up, continue as a normal take-off using three-engine climb speed if on three engines. Climb out airspeed, on two engines, should be at minimum of V_{MCA} (two engines out) or two engine out landing pattern airspeed of 160 knots, if gross weight and altitude permit.

TIRE FAILURE

Nose Landing Gear Tire Failure

If one nosewheel tire is flat at time of landing, a normal landing may be made. If both nosewheel tires are flat at the time of landing, keep the nosewheels off the ground as long as possible. After nose gear contact use maximum reverse thrust and minimum braking. This procedure gives minimum nosewheel loading. Taxiing is not recommended.

Main Landing Gear Tire Failure

If a main landing gear tire is flat at the time of landing, touch down the nose gear as soon as possible and use maximum reverse thrust. Taxiing is not recommended. If both tires of the main landing gear are flat, there will probably be a tendency to swerve toward that side. Line up and land on the side of

the runway with the good tires. Touch down the nose gear as soon as possible, hold forward pressure on the control column, and ensure directional control with the nosewheel steering system. Use wheel brakes (on the side opposite the flat tires only) to assist the nose gear in maintaining directional control. Use reverse thrust cautiously, but to the fullest extent possible to reduce landing roll to a minimum. Do not attempt to taxi.

LANDING GEAR RETRACTED

Landing with One or Both Main Gears Retracted

NOTE

To extend only the nose gear when the utility system is pressurized, raise the landing gear and pull the landing control circuit breaker after the gear indicates up and locked, then proceed with EMERGENCY HYDRAULIC EXTENSION (NOSE GEAR) procedure. The landing gear control circuit breaker should remain pulled and the landing gear control lever will remain up for the landing.

If one main landing gear cannot be extended, the recommended procedure is to retract the other main gear and land with only the nose gear down, or to land with all landing gears retracted. (Refer to GEAR-UP LANDING.)

Landing With Nose Gear Retracted and Main Gears Down

If the nose gear cannot be extended, an emergency landing may be accomplished holding the nose of the airplane up as long as possible. Use the following procedure to make a nose-gear-up landing:

1. Give warning over the public address system and the interphone, and give six short rings on the alarm bell.
2. If cargo can be safely moved, shift it to a maximum allowable aft center of gravity limitation computed for the airplane gross weight.
3. Stow or secure all loose equipment.
4. Depressurize the airplane and place all engine bleed air switches to CLOSE/OFF.
5. Open and secure the emergency escape hatches and the paratroop doors.
6. Turn off all unnecessary electrical equipment.
7. Pull LANDING GEAR WARN LIGHT circuit breaker and activate GPWS LANDING GEAR OVERRIDE.
8. Don helmet (if available) and gloves and take crash position, with passengers and crew behind cargo.
9. Lock shoulder harness inertia reel and face seat forward.

WARNING

Ensure that all controls which cannot be easily reached are properly positioned before locking the harness.

10. Request foam on the runway if available.
11. Assume a normal landing attitude.
12. Give warning over the public address system and the interphone, and give one long ring on the alarm bell to brace for impact.
13. Immediately upon ground contact, apply sufficient up-elevator to keep the airplane in a level attitude as long as possible. Do not use brakes.
14. After nose contact, use reverse thrust, but do not allow the nose to rise off the ground.
15. When the airplane comes to a complete stop, follow ground evacuation procedures as necessary.

Gear-Up Landing

Before making a gear-up landing, perform the following operations:

1. Give warning over public address system and the interphone, and give six short rings on the alarm bell.
2. Stow or secure all loose equipment.
3. Depressurize the airplane and place all engine bleed air switches to CLOSE/OFF.
4. Jettisoning of cargo should be considered.
5. Dump or consume all unnecessary fuel. (Refer to FUEL DUMPING.)
6. Open and secure the emergency escape hatches and the paratroop doors.
7. Turn off all unnecessary electrical equipment.

8. Pull LANDING GEAR WARN LIGHT circuit breaker and activate GPWS LANDING GEAR OVERRIDE.
9. Don helmet (if available) and gloves and take crash position, with passengers and crew behind cargo.
10. Lock shoulder harness inertia reel and face seat forward.

WARNING

Ensure that all controls which cannot be easily reached are properly positioned before locking the harness.

11. Request foam on the runway (an area 3000 feet long by 30 feet wide should be requested) if available. Make a normal approach.
12. Assume a normal landing attitude.
13. Give warning over the public address system and the interphone, and give one long ring on the alarm bell to brace for impact.
14. When the airplane comes to a complete stop, follow ground evacuation procedures as necessary.
15. Evacuate the airplane.

EMERGENCY LANDING ON SOFT GROUND

If it should become necessary to land on soft ground or an unprepared runway, the decision to land with gears extended or retracted must be made by the pilot.

LOSS OF NOSEWHEEL STEERING DURING LANDING

Whenever a loss of nosewheel steering is indicated by an immovable pilot's steering wheel, no further attempt will be made to "force" the wheel to turn, as this might prevent the nose from castering. Under this condition, the pilot will pull back on the control column to relieve pressure on the nosewheel and maintain directional control of the airplane through the coordinated use of flight controls, differential power and differential brakes according to the prevailing circumstances of speed, crosswinds, engine out, and runway conditions.



With complete utility hydraulic system failure, do not use nosewheel steering on landing roll. Inadvertent use of nosewheel steering may allow hydraulic fluid to be bled from the shimmy dampener and allow the wheel to shimmy or turn from center.

LANDING WITH A COCKED NOSEWHEEL

The procedure for landing with a cocked nosewheel is the same as landing with loss of nosewheel steering, with the following addition: Request foam on the runway (if available).

NOSEWHEEL SHIMMY

Nosewheel shimmy is an indication of an unbalanced condition of one or both of the nosewheel tires or failure of the steering system. If shimmy occurs during the landing roll, decelerate gradually and apply up-elevator to keep as little load on the nosewheels as possible. When landing with a known shimmy condition, keep the nosewheels off the ground as long as possible, but touch down while elevator effectiveness allows gentle lowering of the nose.

DITCHING

Under ideal conditions of wind and sea, and by skillful execution of the recommended techniques, the ditching of transport-type airplanes can often be accomplished with a high degree of success. However, due to the high-wing configuration of this airplane, the fuselage may be expected to settle after touchdown with consequent flooding of the cargo compartment. In any event, the decision to ditch must be made by the pilot in view of the existing circumstances. This decision should never be delayed until the fuel supply is exhausted since the most effective ditching approach is made with power on at a speed slightly above the stall speed.

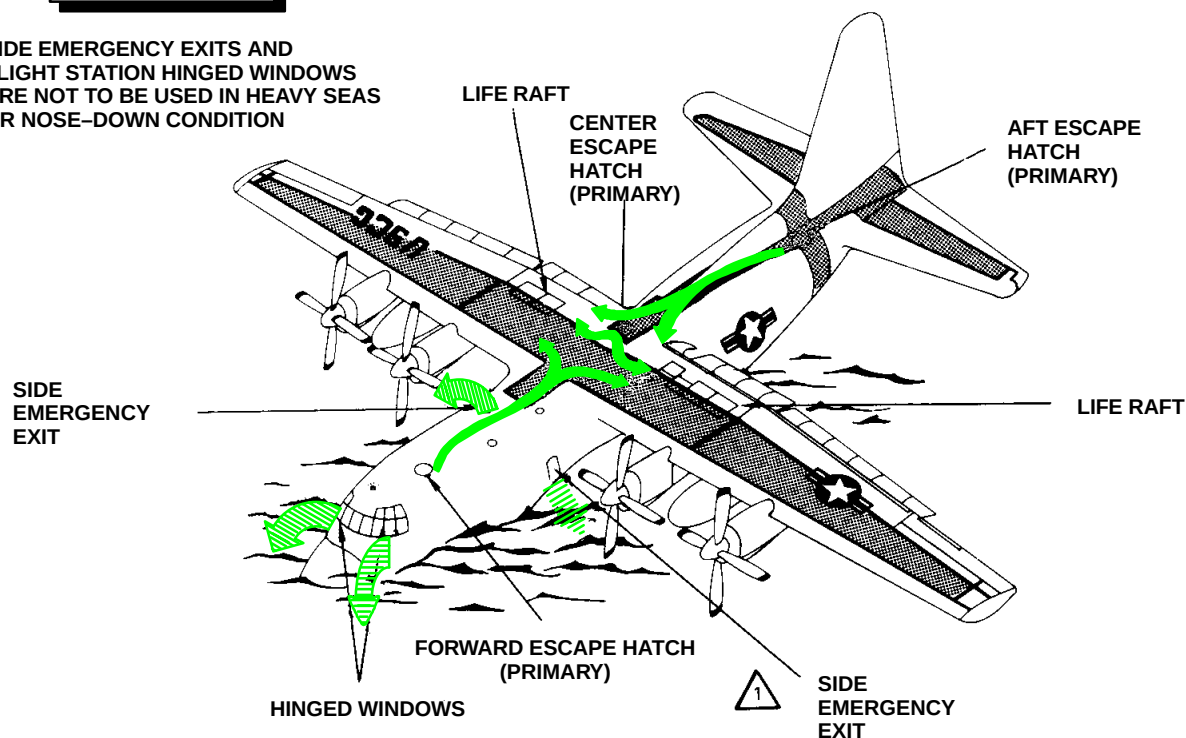
Preparation for Ditching

Plans for ditching cannot be made without taking the wind direction into consideration. Waves move downwind, and the spray from wave crest is also blown downwind. Swells, however, do not always indicate wind direction and can be very large even when the wind is calm. Over a sea, a pilot must be more exacting and alert when judging height. The Preditching and Ditching Checklists give duties of personnel prior to and during ditching. Figure 3-15 illustrates the emergency exits and evacuation routes used during ditching. Figure 3-16 shows the life raft releases.

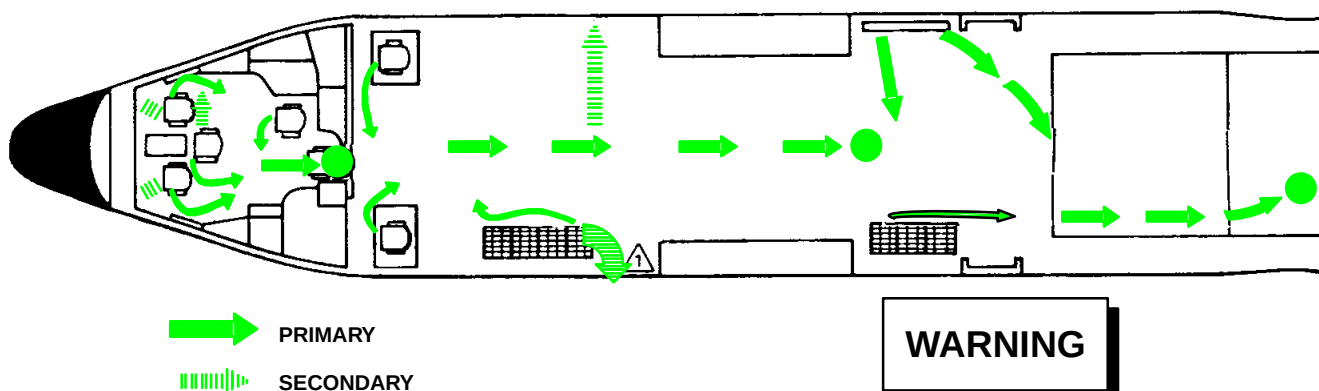
Emergency Exits – Water

WARNING

SIDE EMERGENCY EXITS AND FLIGHT STATION HINGED WINDOWS ARE NOT TO BE USED IN HEAVY SEAS OR NOSE-DOWN CONDITION



EVACUATION ROUTES



NOTE

1500 SERIES ONLY

WARNING

DO NOT LOCK FLIGHT ENGINEER'S AND NAVIGATOR'S SEATS IN A POSITION THAT WILL BLOCK THE COPILOT'S EVACUATION ROUTE. MAKE SURE THE NAVIGATOR'S SEAT IS STOWED. MAKE SURE THAT THE GALLEY FLOOR IS UP AND LOCKED. PLACE THE ON SCENE COMMANDER'S TABLE IN THE STOWED POSITION.

Figure 3-15

Life Raft Releases

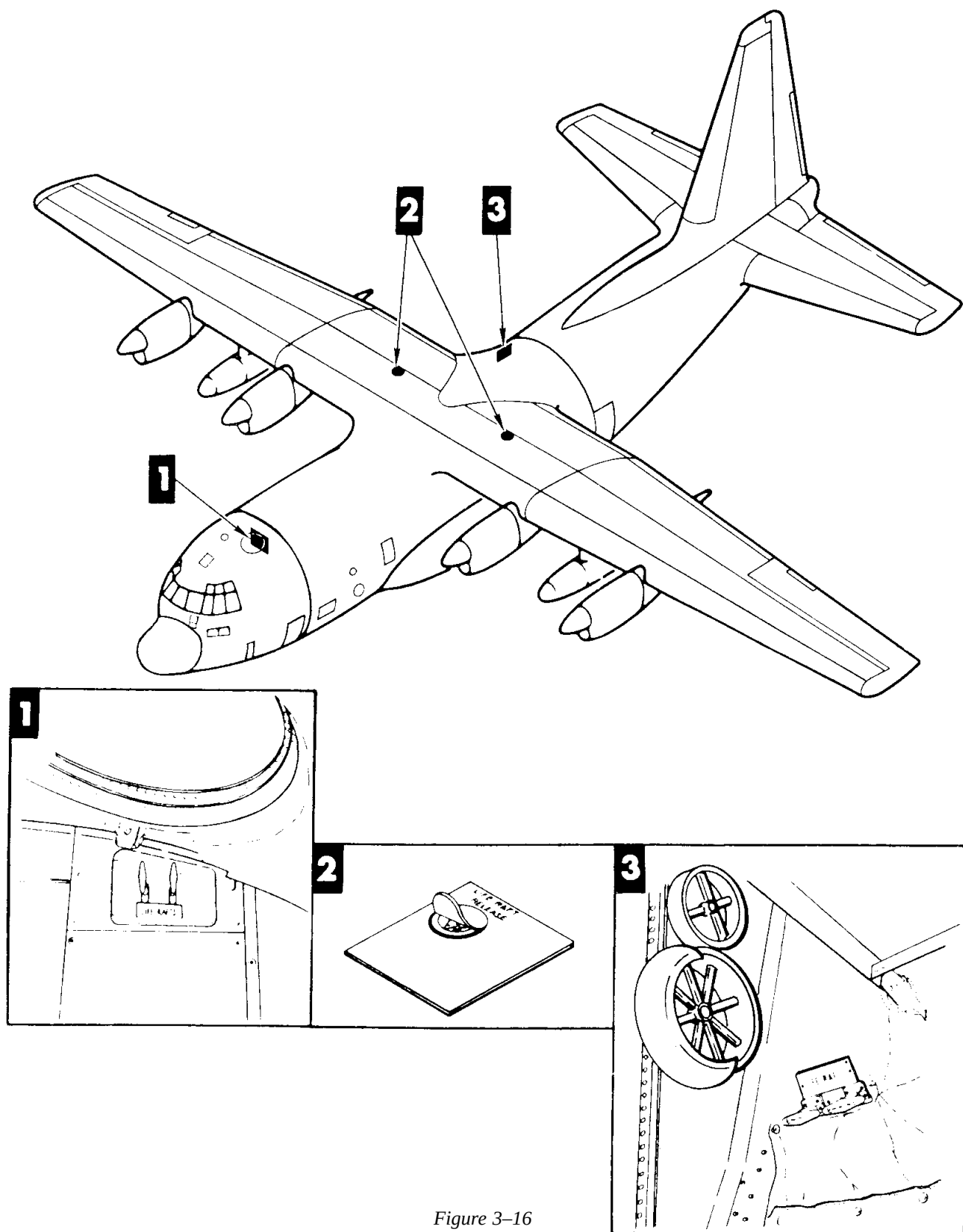


Figure 3-16

Ditching Characteristics

Actual experience in ditching the C-130 is limited; however, NACA-controlled ditching tests of models similar to the C-130 in configuration indicate that there is a reasonably high probability that the airplane can be landed on water without major collapse of structure or a sudden rush of water into occupied compartments. On the basis of the limited experience and the NACA tests, it is concluded that the following results can be expected upon ditching:

NOTE

These characteristics assume a power-on approach, approximate 7-degree nose high pitch attitude with full flaps extended, landing gear retracted, and touchdown at 10 knots above stall speed. Any speed above full-flap approach speed will result in additional structural damage on touchdown.

Upon contact with the water, moderate bottom damage may occur in the area immediately forward of the cargo loading ramp hinge. The bottom damage will tend to stabilize the airplane directionally during the ditching run, maintaining the wings in an essentially level attitude. Wing dipping or water looping are not expected.

During the initial portion of the ditching run (the tail-down portion) the aft cargo door may be damaged. But the damage probably will not affect either the ditching run or the sinking rate since the location of the door is such that it will be above the water line when the nose settles during the latter part of the run. It is very unlikely that the ramp will open. The crew door, the side emergency exit, and the paratroop doors, which will be out of the water during the tail-down portion of the ditching run, probably will not experience damage at any time during the ditching run.

During the tail low initial contact with the water, the water-drag forces on the airplane will tend to bring the nose-down and continued up elevator force should be applied. This nose-down tendency plus possible damage to the elevator will result in the airplane assuming a nose-down, tail-high attitude and could generate porpoising. If in this nose-down attitude a wave or swell of large magnitude is encountered, considerable damage to the radome and nose of the airplane will occur, with probable rupture of the forward bulkhead and immediate flooding of the flight station. Some damage may occur in the area of the cargo door and ramp, but expect the primary flooding to occur in the forward portion of the airplane, if the ditching is in a heavy sea.

Ditching Alarm Signals

The following are the standard alarm signals for ditching:

SIX SHORT RINGS . . . PREPARE FOR DITCHING

ONE LONG RING . . . BRACE FOR IMPACT

Instructions will be given by pilot to don helmets (if available) and gloves, and to remain seated with safety belts fastened until the airplane has stopped forward movement.

WARNING

Immediately prior to touchdown, the copilot will activate the alarm bell for one long ring. Upon hearing the bell, all crew members brace for impact.

On water landings, there are normally two or more water impacts. The initial impact is (normally) lighter than the second water impact and the subsequent impacts (if any) will diminish in force.

Ditching Equipment

Ditching equipment should be in readiness at all times when flying overwater. Prior to each overwater flight, the pilot will ensure that the necessary equipment is aboard, in serviceable condition, and stowed in the proper places. If possible, seats and safety belts should be provided in the cargo compartment aft of the wheel wells for all personnel on board except for the pilot, copilot, flight engineer and, at the pilot's discretion, the navigator. The cargo compartment is the safest area with the greatest possibility of escape during ditching; therefore, the number of personnel in the flight station should be kept to a minimum due to the probability of immediate flooding of the flight station.

Ditching Exits

Refer to figure 3-15 for emergency exits. Normally, crew members on the flight deck will use the forward escape hatch for exit after ditching. Crew members in the cargo compartment will use the center and aft escape hatches for exit. If cargo permits, the center escape hatch ladder should be installed prior to takeoff.

Ditching Technique

WARNING

Maintain deck angle of at least seven degrees, optimum nine degrees. Do not exceed recommended airspeed. Rate of descent not to exceed 200 feet per minute (recommend 100 feet per minute). Maintain constant back pressure on control column. Under no circumstances should the airplane be allowed to stall, since this will result in severe impact and cause the airplane to nose into the water.

If possible, use up or dump most of the fuel supply to lighten the airplane and reduce stalling speed. Empty tanks also help keep the airplane afloat. Jettison cargo, if possible, to lighten the airplane.

Normal Power-On Ditching. Best results will be obtained by following the procedures outlined below:

1. Ditch while power is available. Power will allow the pilot to choose the spot for ditching, and the most favorable landing position and attitude.
2. Use 100% flaps with gear up. Pull LANDING GEAR WARN LIGHT circuit breaker and activate GPWS LANDING GEAR OVERRIDE.
3. Ditch at 10 knots above power-off stall speed.

In daylight it is recommended that the airplane be ditched along the top of the swell, parallel to the rows of swells, if the wind does not exceed 30 knots. In high winds, it is recommended that ditching be conducted upwind to take advantage of lowered forward speed. However, it must be remembered that the possibility of ramming nose-on into a wave is increased, as is the possibility of striking the tail on a wave crest and nosing in.

Partial Power Ditching. When ditching with one or more engines inoperative, the following technique is recommended.

1. With two engines inoperative on the same side of the airplane, use power on the operative inboard engine only.
2. If power is available from the No. 2 and 4 engines or the No. 1 and 3 engines, considerable power may be used to control the airplane. With symmetrical power conditions, use power as required using 100 percent flaps and gear up.

3. On final approach, it is advisable to hold speed 20 knots above power-off stall speed until flareout, at which time speed will be reduced to 10 knots above power-off speed.

Crosswind Ditching. The basic rules for ditching listed in NORMAL POWER-ON DITCHING will apply, in addition to the following:

1. Keep the wings level and crab the airplane to kill drift. It may be advantageous to permit some drift to maintain a parallel relationship with a wave.

2. Land on the downward side of the swell or wave.

Upwind Ditching. The basic rules for ditching listed in NORMAL POWER-ON DITCHING will still apply, in addition to the following:

1. Maintain a nose-up condition to prevent the nose striking the wave face.
2. Touch down immediately behind the crest of a rising wave and avoid the face of the wave.
3. Hold the nose up after the first impact.

Night Ditching. Night ditching will be conducted with the aid of instruments to establish the proper airplane attitude.

1. Make an instrument approach, holding airspeed 20 knots above stall speed.
2. At 500 to 700 feet above the water (use radar altimeter if available) set up approximately 200 feet-per-minute rate of descent and establish an airspeed 10 knots above stall speed with gear up and wing flaps 100 percent.
3. Use landing lights as necessary.
4. Hold wings level to avoid digging a wing into the water and cartwheeling the airplane.
5. Land at 10 knots above power-off stall speed with gear up and 100 percent flaps.

Abandoning the Airplane

Evacuation of the airplane should be accomplished in an orderly manner in the shortest time possible. Practice abandonment will aid in evacuating the airplane during an actual ditching.

WARNING

Personnel must not leave their ditching positions until it is ascertained that the airplane has stopped forward movement. When it is certain that the airplane has come to a complete stop, each crew member will proceed with the duties shown in the Ditching Checklists. Additional emergency equipment may be collected and distributed to crew members. Each crew member will evacuate the airplane through the assigned exit and board a life raft.

WARNING

With the rope escape ladder rigged it is impossible to exit the airplane through the center overhead escape hatch using the right side of the ladder.

WARNING

Life raft release handles must be pulled through their full travel for complete ejection and inflation of the life raft.

WARNING

Assure that personnel are out of the airplane and clear of the escape hatches prior to inflating their life vests.

NOTE

Ascertain that life rafts have ejected properly; pull release handles on top of wing if they did not eject.

WARNING

With the escape ladder installed, it is impossible to exit the airplane from the center overhead cargo compartment escape hatch using the left side of the ladder.

NOTE

Assure that all emergency supplies and equipment are secured in the life rafts to prevent them from being lost overboard.

PREDITCHING CHECKLIST

(FIRST ACTION)

PILOT

1. Crew	“Notified”	(P)
a. The pilot will direct the crew to prepare for ditching over the PA system and with six short rings of the alarm bell. Inform the crew of situation and time remaining. Assign liferafts for additional crew members and passengers.		
2. Order to Ditch	“Acknowledged”	(E)(N)(R) (LM)(CP)
3. Emergency Communications	“Complete”	(CP)
a. The copilot and radio operator will attempt to establish communications with any other unit. As a minimum, pass position, situation, persons on board, and estimated time and position for ditching.		
4. Pressurization (On command of the pilot)	“No Pressure”	(E)

WARNING

If the reason for ditching is a wing fire, the use of the dump system is not advisable.

5. Fuel Dumping (If required, on command of the pilot)	“Set”	(E)
a. Dump the maximum amount of fuel possible to decrease weight and ditching speed.		
6. GPWS Wheels Override Switch	“OVERRIDE”	(CP)
7. Emergency Depressurization Switch	“NORMAL”	(E)

WARNING

The Emergency Depressurization Switch must be placed in NORMAL to ensure the safety, outflow, and air conditioning shutoff valves will close.

8. Cargo Jettison (If required, on command of the pilot)	(As required)	(LM)
9. Emergency Supplies	Checked	(P,CP)
a. Pilot provides flashlight and first aid kit and copilot provides flashlight, first aid kit, and classified material.		

WARNING

If the survival suit is donned, it may hinder evacuation of the aircraft. Each individual should make the decision whether to wear the suit or not based on the knowledge of that risk. If the intent is to carry the exposure suit out of the aircraft, it should be secured at the individuals flight station.

10. Exposure Suit (If available)	(As required)	(P,CP)
11. Life Vest	Donned	(P,CP)
12. Preditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

FLIGHT ENGINEER

1. Order to Ditch	“Acknowledged”	(E)(N)(R) (LM)(CP)
2. Pressurization (On command of the pilot)	“No Pressure”	(E)

WARNING

If the reason for ditching is a wing fire, the use of the dump system is not advisable.

3. Fuel Dumping (If required, on command of the pilot)	“Set”	(E)
a. Dump the maximum amount of fuel possible to decrease weight and ditching speed.		
4. Engine Bleed Air Valves/Regulators	CLOSE/OFF	(E)
5. Emergency Depressurization Switch	“NORMAL”	(E)

WARNING

The Emergency Depressurization Switch must be placed in NORMAL to ensure the safety, outflow, and air conditioning shutoff valves will close.

6. Air Conditioning Panel	Set
a. Air Conditioner Master Switch	MAN PRESS
b. Manual Pressure Control Switch	Hold in INCREASE for 90 seconds
7. Synchrophaser Master Switch	Off
8. Landing Gear Warning Light Circuit Breaker	Pulled
a. Located on CP lower CB panel	
9. Emergency Supplies	Checked
a. Provide flashlight, first aid kit, and galley supplies.	

WARNING

If the survival suit is donned, it may hinder evacuation of the aircraft. Each individual should make the decision whether to wear the suit or not based on the knowledge of that risk. If the intent is to carry the exposure suit out of the aircraft, it should be secured at the individuals flight station.

10. Exposure Suit (If available)	(As required)	
11. Life Vest	Donned	
12. Preditching Checks	“Complete”	(E)(N)(R) (LM)(CP)
-

PREDITCHING CHECKLIST**(FIRST ACTION)****NAVIGATOR**

1. Order to Ditch	“Acknowledged”	(E)(N)(R) (LM)(CP)
2. Flight Data	Provided	
a. The navigator will provide position, heading, TAS, altitude, and estimated ditching position to the copilot and radio operator for the distress broadcast.		
3. Emergency Supplies	Checked	
a. Provide flashlight, GPS (including battery), and navigation supplies.		

WARNING

If the survival suit is donned, it may hinder evacuation of the aircraft. Each individual should make the decision whether to wear the suit or not based on the knowledge of that risk. If the intent is to carry the exposure suit out of the aircraft, it should be secured at the individuals flight station.

4. Exposure Suit (If available)	(As required)	
5. Life Vest	Donned	
6. Preditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

RADIO OPERATOR

1. Order to Ditch	“Acknowledged”	(E)(N)(R) (LM)(CP)
a. The copilot and radio operator will attempt to establish communications with any other unit. As a minimum, pass position, situation, persons on board and estimated time and position of ditching.		
2. Emergency Communications	Complete	
3. Secure Communications Gear	Zeroized	
a. The radio operator will zeroize the secure communications gear and stow all classified material.		
4. Galley	Secured	
a. Power Secured, galley floor up and locked.		
5. Emergency Supplies	Checked	
a. Provide flashlight, first aid kit, galley supplies.		

WARNING

If the survival suit is donned, it may hinder evacuation of the aircraft. Each individual should make the decision whether to wear the suit or not based on the knowledge of that risk. If the intent is to carry the exposure suit out of the aircraft, it should be secured at the individuals flight station.

6. Exposure Suit (If available)	(As required)	
7. Life Vest	Donned	
8. Preditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

LOADMASTER

1. Order to Ditch	“Acknowledged”	(E)(N)(R) (LM)(CP)
2. Passengers	Briefed	
a. The loadmaster will prepare the passengers and pass out life vests to all personnel.		
3. Cargo Jettison (If required, on command of the pilot)	(As required)	

4. Doors and Hatches	Complete
a. Close all doors and remove and stow all cargo compartment overhead escape hatches.	

WARNING

If the survival suit is donned, it may hinder evacuation of the aircraft. Each individual should make the decision whether to wear the suit or not based on the knowledge of that risk. If the intent is to carry the exposure suit out of the aircraft, it should be secured at the individuals flight station.

5. Emergency Supplies	Checked	
a. Provide a flashlight, first aid kit, emergency radio.		
6. Exposure Suit (If available)	(As required)	
7. Life Vest	Donned	
8. Preditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

DITCHING CHECKLIST**(10 MINUTES LEFT)****PILOT**

1. Final Distress Signal	Complete	(CP)
2. ELT	TEST	(P)

NOTE

Placing the ELT to TEST will manually activate the ELT.

3. Overhead Escape Hatch	“Removed”	(R/E)
4. Safety Belt/Shoulder Harness	“Fastened, Locked”	(P,CP)
5. Ditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

NOTE

Immediately prior to touchdown, the copilot will activate the alarm bell for one long ring.

AFTER DITCHING**NOTE**

The first crewmembers to exit through the escape hatch will remove the emergency escape rope from the stowed position and pass it through the escape hatch.

When it is certain that the airplane has come to a complete stop, proceed with the following:

Check persons for injury.

Pilot shall ensure all necessary emergency supplies have been removed from the aircraft. Check that crewmembers have been safely evacuated. Pilot shall exit from the forward overhead escape hatch and board the left wing raft.

Copilot shall pass emergency supplies through the forward overhead escape hatch. Copilot shall exit from the forward overhead escape hatch and board the right wing raft. Assist with loading emergency supplies into life rafts.

FLIGHT ENGINEER

1. Overhead Escape Hatch	“Removed”	(R/E)
2. Loose Items	Secured	
3. Safety Belt/Shoulder Harness (Seat forward, full down)	Fastened, Locked	
4. Fuel Dump Valves	CLOSED	
5. Ditch Speeds	Posted	

NOTE

Refer to the following “Recommended Airspeeds for Ditching 100% Flaps” chart appropriate speeds.

6. Ditching Checks	“Complete”	(E)(N)(R) (LM)(CP)

WARNING

Use weight anticipated after completion of dumping operations.

RECOMMENDED AIRSPEEDS FOR DITCHING 100% FLAPS

Aircraft Gross Weight	All Aircraft Except CG 1717 and Up	CG 1717 and Up
80000	80	83
85000	82	85
90000	84	87
95000	86	89
100000	88	91
105000	90	93
110000	92	95
115000	94	97

DITCHING CHECKLIST**(10 MINUTES LEFT)****FLIGHT ENGINEER (CONT)****RECOMMENDED AIRSPEEDS FOR DITCHING 100% FLAPS**

Aircraft Gross Weight	All Aircraft Except CG 1717 and Up	CG 1717 and Up
120000	96	99
125000	98	101
130000	100	103
135000	102	105
140000	104	107
145000	105	109
150000	106	111
155000	108	112

AFTER DITCHING**NOTE**

The first crewmembers to exit through the escape hatch will remove the emergency escape rope from the stowed position and pass it through the escape hatch.

When it is certain that the airplane has come to a complete stop, proceed with the following:

Check persons for injury. Pull life raft release handles. Exit from the forward overhead escape hatch. Assist with the unloading of the emergency supplies. Board the right wing raft.

NAVIGATOR

1. Flight Data Provided
 - a. The Navigator will provide final ditching position to the copilot and radio operator for the distress broadcast.

2. Emergency Supplies Complete

NOTE

If the navigator remains in the cargo compartment for the ditching, gather the emergency supplies prior to proceeding aft.

3. Safety Belt/Shoulder Harness (Seat forward, full down) Fastened, Locked
4. Ditching Checks “Complete” (E)(N)(R)
(LM)(CP)

DITCHING CHECKLIST

(10 MINUTES LEFT)

NAVIGATOR (CONT)

AFTER DITCHING

NOTE

The first crewmembers to exit through the escape hatch will remove the emergency escape rope from the stowed position and pass it through the escape hatch.

When it is certain that the airplane has come to a complete stop, proceed with the following:

Check persons for injury.

If positioned on the flight deck, exit from the forward overhead escape hatch and board the left wing raft.

If positioned in the cargo compartment, exit from the center or aft overhead escape hatch and board the left wing raft.

RADIO OPERATOR

1. Final Distress Signal	Complete	
2. Overhead Escape Hatch	"Removed"	(R/E)
3. Emergency Supplies	Complete	

NOTE

If the radio operator remains in the cargo compartment for the ditching, gather the emergency supplies prior to proceeding aft.

4. Safety Belt/Shoulder Harness (Seat forward, full down)	Fastened,Locked	
5. Ditching Checks	"Complete"	(E)(N)(R) (LM)(CP)

AFTER DITCHING

NOTE

The first crewmembers to exit through the escape hatch will remove the emergency escape rope from the stowed position and pass it through the escape hatch.

When it is certain that the airplane has come to a complete stop, proceed with the following:

Check persons for injury.

If positioned on the flight deck, pull life raft release handles and exit from the forward overhead escape hatch and board the right wing raft.

If positioned in the cargo compartment, exit from the center or aft overhead escape hatch and board the right wing raft.

DITCHING CHECKLIST

(10 MINUTES LEFT)

LOADMASTER

1. Emergency Exit Lights	ON	
1. Passengers	Checked	
a. Check passenger seat belts/survival gear. Place passengers behind cargo if possible.		
2. Seat Belt	Fastened	
a. The loadmaster will occupy the troop seat forward of the right-hand paratroop door.		
3. Ditching Checks	"Complete"	(E)(N)(R) (LM)(CP)

AFTER DITCHING

NOTE

The first crewmembers to exit through the escape hatch will remove the emergency escape rope from the stowed position and pass it through the escape hatch.

When it is certain that the airplane has come to a complete stop, proceed with the following:

Check persons for injury. Pull the life raft release handles aft of right-hand paratroop door. Ensure passengers have exited airplane. Pass emergency supplies through the center overhead escape hatch. Exit from the center or aft overhead escape hatch and board the left wing raft.

SECTION IV

CREW DUTIES

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INTRODUCTION

Each flight crew member has duties other than the main duties covered in NORMAL PROCEDURES, Section II. These additional duties are prescribed in this Section. A passenger briefing checklist is provided at the end of this Section.

PILOT

The checklist for the pilot is covered in detail in Section II.

- Ensures that a thorough inspection of the airplane and all equipment is properly conducted.
- Plans the mission by analyzing information concerning its nature, the expected weather over the mission routes, and special instructions.
- Prepares or supervises the preparation of the flight plan and clearance.
- Supervises and coordinates the activities of the crew members during flight planning and preparation.
- Determines that the weight and center of gravity are within prescribed limits.
- Ensures that the passengers have been briefed on the location and operational use of emergency equipment and are familiar with in-flight emergency signals and emergency exits.
- Ensures that crew members are properly prepared for flight.
- Authorizes fuel loads, cargo/passenger load, airplane security, and additional equipment.
- Operates controls to start and test engines and to taxi, takeoff, land, and maintain airplane in flight under varying conditions of weather, daylight and darkness, on long, medium, or short range missions.
- Monitors operation of pressurization system to ensure safety of airplane and personnel.

11. Directs the employment of navigational and communications equipment by the navigator, copilot, and radio operator.
12. Coordinates the activities of crew members in para-drops of cargo or SAR drops.
13. Ensures that required flight logs, records, and maintenance forms are prepared.

COPILOT

The checklist for the copilot is covered in detail in Section II.

1. Assists the pilot in planning mission by obtaining pertinent weather forecast, intelligence reports, maps, and other documents.
2. Assists navigator in plotting the mission route and calculating the route information and fuel requirements.
3. May perform inspections upon instructions of the pilot.
4. Arranges for and checks customs regulations.
5. Arranges for in-flight meals, orders, advance per diem, customs.
6. Obtains clearances, codes, orders, wx brief.
7. Accepts custody of registered mail, classified material, and narcotics.
8. Assists the pilot in operating controls and equipment on the ground and in flight.
9. Operates the airplane on the ground and in flight upon instructions from the pilot.
10. Prepares the flight log and required records and maintenance forms.
11. Operates the communications equipment and assists the pilot in navigating the airplane in the absence of a navigator.
12. Performs emergency procedure actions as required by the flight manual and/or the pilot.

FLIGHT ENGINEER

The checklist for the flight engineer is covered in detail in Section II.

1. Verify fuel load and obtain any special instructions from the airplane commander prior to flight.
2. Performs preflight and postflight inspections.
3. Ensures that appropriate publications such as flight manuals, maintenance manuals, M3710 series manuals, etc., are on board.
4. Computes takeoff, climb, cruise, and landing data; adjusts engine controls in coordination with the pilot to maintain required power during cruise flight conditions. Maintains power plant cruise control data.
5. Starts gas turbine compressor and air turbine motor/auxiliary power unit to provide auxiliary power as required.
6. Calls engine starts, monitors systems indicators and control devices.
7. Operates navigator's equipment when navigator is not on board.
8. Observes warning lights and fire detection indicators.
9. Continuously monitors torquemeters, tachometers, and turbine inlet temperature indicators and reports unusual conditions to pilot.
10. Performs emergency procedure actions as required by the flight manual and/or the pilot.
11. Operates external light panel.
12. Reports abnormal conditions to pilot and recommends corrective action.
13. Operates system controls; regulates electrical system.
14. Controls cabin air to provide proper cabin ventilation, pressurization, and temperature.
15. Operates all anti-icing systems.
16. Monitors circuit breakers, fuel flow, temperatures and pressure indicators, electrical voltage and loads, and cabin pressure control and altitude indicators.
17. Performs fuel management; keeps fuel log.
18. May operate cargo door and ramp in flight.

19. Troubleshoots malfunctioning airplane systems in flight.
20. Inspects turboprop engine for general condition (compressor, turbine blades) and for absence of leaks.
21. May supervise/perform the removal and replacement of airplane system components (if qualified maintenance personnel are/are not available).

NAVIGATOR

The following duties are performed by the navigator:

1. Assists in planning navigational phase of the mission.
2. Attends briefings to obtain information on type of mission to be performed and conditions under which it must be accomplished.
3. Assists in preparing detailed navigation flight plan (computer flight plan if available) based upon latest available weather and intelligence information; this includes route, headings, and altitudes to be flown, checkpoints (ADIZ, DEWIZ, FIRS, etc.) ETAs.
4. Obtains navigational data and equipment such as maps, charts, flight publications, and navigational instruments needed for the mission.
5. Inspects and tests (prior to flight) navigational devices such as compasses, radios, and radar sets to ensure that they are operating satisfactorily.
6. Navigates airplane to accomplish missions employing dead reckoning, aided by map reading, radio, radar, GPS, and INS as required.
7. Furnishes pilot and other crew members with information on heading to be flown, estimated time of arrival, current position, wind direction and velocity, and ground speed.
8. Maintains flight navigational logs, records, and assigned maintenance reports; performs appropriate inspections.
9. Performs emergency procedure actions as required by flight manual and/or the pilot.
10. Provides radar bearing and range of land to the pilot. Compares airplane altitude to minimum enroute/terrain altitude and advises pilot.
11. Monitors airplane heading and altitude compared to published approach charts during instrument approaches.

LOADMASTER

The following duties are performed by the loadmaster:

1. Complies with appropriate checklists.
2. Plans all aircraft cargo loads.
3. Ensures that the aircraft cargo compartment is properly configured for flight.
4. Ensures that a life preserver is available for each seat that could be occupied by a passenger.
5. Ensures EPOS (Emergency Passenger Oxygen System) is available for passengers when transporting hazardous materials.
6. Accepts custody of all cargo and passengers and maintains shipping and custody documents. Screens all hazardous materials for correct packaging, marking, labeling and certification IAW AFJMAN 24-204.
7. Directs and supervises all cargo on/off loading operations.
8. Operates aircraft systems pertaining to on/off loading operations.
9. Computes aircraft weight and balance.
10. Monitors cargo and adjusts restraints in flight.
11. Acts as a scanner during patrols/searches.
12. Reports abnormal conditions to pilot.
13. Performs emergency procedure actions as required by the flight manual and/or the pilot.

DROPMASTER

The following duties are performed by the dropmaster:

1. Complies with appropriate checklists.
2. Ensures that the aircraft cargo compartment is properly configured for flight.
3. Ensures aircraft is equipped for all types of aerial delivery missions.
4. Operates aircraft systems pertaining to aerial delivery operations.
5. Directs and supervises other crew members in the cargo compartment during aerial delivery operations.

6. Delivers rescue equipment in flight.
7. Acts as a scanner during patrols/searches.
8. Reports abnormal conditions to pilot.
9. Performs emergency procedure actions as required by the flight manual and/or the pilot.

RADIO OPERATOR

The radio operator performs the following duties:

1. Inspects and checks (prior to flight) all communication equipment to ensure satisfactory operation.
2. Obtains all meals, liquids, and galley supplies. Operates galley controls and floor for takeoffs and landings.
3. Obtains additional equipment such as ICS cords, headsets, and spare avionics equipment as required.
4. Obtains secure communication material required for mission.
5. Obtains time hack with WWV; sets and winds all aircraft clocks.
6. Maintains communications with appropriate Air Traffic Control agencies, mission control agencies, and other mission aircraft as necessary on HF, UHF, VHF, and VHF-FM as directed by the pilot.
7. Maintains sighting report forms (Alpha and SEER) as required.
8. Records all communications activity in the radio log as required.
9. Maintains On Scene Commander (OSC) log when mission dictates.
10. Establishes emergency communications through the use of national and international procedures as directed by the pilot.
11. Performs emergency procedure actions as required by flight manual and/or the pilot.
12. Maintains CG 4377s, passenger manifests, customs declarations, and radio time sheets.

13. Maintains cleanliness of the cockpit before and after flight.

SENSOR SYSTEM OPERATOR

The following duties are performed by the sensor system operator:

1. Complies with appropriate checklists.
2. Operates the FLIR/EO system.
3. Inspects and checks (prior to all flights) the CASPER system.
4. Assists tactical system operator with maintaining communications with mission control agencies/aircraft as necessary.
5. Coordinates with the navigator to acquire FLIR/EO targets using the APS-137 ISAR.
6. Performs emergency procedure actions as required by the flight manual/or the pilot.
7. If a TSO is not assigned to flight, obtains ATW and communications material required for mission.
8. If qualified as a Dropmaster, perform Dropmaster duties in flight as required.

TACTICAL SYSTEM OPERATOR

The following duties are performed by the tactical system operator:

1. Complies with appropriate checklists.
2. Attends briefings to obtain information on type of mission to be performed and conditions under which it must be accomplished.
3. Obtains secure communication material required for mission.
4. Inspects and checks the CASPER system.
5. Establishes and maintains tactical communications.
6. Assists navigator with maintaining communications with mission control agencies/aircraft as necessary.
7. Records contact data.

BASIC AIRCREW MEMBER

The following duties are performed by the basic aircrew member:

NOTE

The basic aircrew member will use the Loadmaster/Dropmaster checklist to perform duties.

1. Complies with appropriate checklist in the absence of a qualified loadmaster or dropmaster.
2. Ensures that the aircraft cargo compartment is properly configured for flight.
3. Assists loadmaster with cargo loading duties.
4. Assists dropmaster during aerial delivery operations.
5. Acts as a scanner during patrols/searches.
6. Reports abnormal conditions to pilot.
7. Performs emergency procedure actions as required by the flight manual and/or the pilot.

NAVIGATOR'S CHECKLIST

Items with a response in quotation marks indicate that a response is required. The navigator must be thoroughly familiar with the navigator's challenge items in Section II and the emergency procedures as they pertain to his duties.

PREPARATION FOR FLIGHT

1. Flight plan	Obtain copy
2. Range control chart	Assist pilot/as required
3. Maps and charts	Required courses and reporting points plotted and checked

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4. Professional and personal equipment	Checked, stowed
5. Weather briefing	Attended/as required
6. Time hack	Obtained
7. Forms CG 4377 and CG 5181	Checked

INTERIOR (POWER ON)**NOTE**

Due to the time required for equipment warm-up and operational checks, the navigator may be required to check several systems at one time when performing the Interior (Power On) checklist. All applicable Power On checklist items will be completed prior to takeoff.

1. Panel lights	Checked/as required
2. INS	ALIGNED
3. Weather Radar	TEST/STBY

WARNING

Before placing the radar in operation, make sure that all personnel are clear of the antenna radiation hazard area. Avoid directing the energy beam toward inhabited structures, personnel, or areas where airplanes are being refueled/defueled.

CAUTION

If refueling or defueling operations are taking place in the vicinity of the airplane, the radar system check will be completed during taxi or run-up.

4. TCAS	Checked
5. Compass Systems	Checked/Set
a. C-12 Compasses	Set
(1) Crossed-checked with magnetic compass for proper orientation	Checked
b. Dual INU installations	
(1) DG/MAG switch	MAG

(2) Compare NAV station # 1 and # 2 BDI readings	Checked
6. ADF	Checked/OFF
7. ISAR	
a. Equipment check	Completed
(1) Freon bottles gauges	500 psig
(2) Freon bottle (A or B)	Selected
(3) Mechanical warning button	Green
(4) Transmitter oil pressure	20 –40 psi
(5) Equipment racks	Checked
(6) Cable connectors	Checked
(7) Fans	Checked
b. Operational checkout procedures	Completed



Ensure the XMTR GND override switch is in the normal position, with the switch guard down, before applying power to the radar system.



Do not transmit within 233 feet of personnel.



Do not transmit within 330 feet of flammable liquids.



ISAR equipment can be damaged if aircraft electrical power sources are energized. Secure ISAR equipment before changing aircraft power sources.

NOTE

Ensure INS is on and aligned: the INS must be in status 40 or less before data is supplied to the ISAR system.

(1) RRCU

ON



Ensure that the amber SEARCH RADAR COOLING FAN LAMP for the selected fan is illuminated, and that the red, NO COOLING AIRFLOW lamp is not on.

(a) VIDEO SOURCE DISPLAY 1

RADAR

(b) VIDEO SOURCE DISPLAY 2

RADAR

(c) RECORD STBY

(d) LAMPS

TEST – FAIL C-I RADAR, CONTROL NAV/SENSO, STBY/RCD, END OF TAPE capsules lighted

(e) C-I LIGHTING

1. DISPLAYED

Set

2. BEZEL

Set

(2) PPI/Image display

ON

(3) A/B – Scan display

ON

(4) PPI/Image display

Bite – 9 Shades of gray test pattern

(5) PPS bite reset

Set – Bite ball black

(6) Control indicator

STBY Menu display

(a) RSCI reinitializing

Displayed

(b) ACK

Press to scroll through messages

1. WARM-UP IN PROGRESS

Checked

2. HV OFF

Checked

3. RF OFF

Checked

(c) TEST

Pressed

1. INS DATA MSG

Pressed

a. LAT/LONG

Checked

b. Heading

Checked

c. North/South velocity

Checked

d. East/West velocity	Checked
e. CLOCK SET	Set
f. BIT	Pressed
g. WARM UP IN PROGRESS	Out of View (after 5 minutes)
c. Recorder Group Test	Completed
(1) VCU mode	Standby
(2) BITE RESET	Pressed
(a) Bite ball	Black (not set)
(b) MEM, VCU, REC, STBY, EOT	Lighted
(3) THUMBWHEEL SWITCHES	
(a) Month/day	Set, entered
(b) Time Zulu	Set, entered
(4) Video tape	Inserted
(5) VIDEO RECORDER PLAY, REC KEYS	Pressed/Set
(6) VCU VIDEO DISPLAY	IRDS
(7) VCU VIDEO RECORDER	IRDS
(8) TEST	Pressed
(a) MEM LED	Lighted
(b) BITE	Black (not set)
(c) MEM LED	Extinguished
(d) VCU LED	Lighted
(9) TEST	Pressed
(a) VCU LED	Extinguished
(b) REC LED	Lighted
(c) RRCU RECORD	DISPLAY 1 –A test pattern is sent to the VTR – record for about 30 seconds
(d) RRCU RECORD	STBY
(10) TEST	Pressed
(a) REC LED	Extinguished
(11) PLAY BACK	
(a) VTR	
1. REWIND	Press

2. <u>PLAY</u>	PLAY
(b) RRCU	
1. <u>VIDEO SOURCE DISPLAY</u>	RECORDER – Observe test pattern playback.
2. <u>VIDEO SOURCE DISPLAY</u>	RADAR
(c) VTR	
1. <u>STOP</u>	Press
2. <u>REWIND</u>	Press
3. <u>PLAY AND REC</u>	Press simultaneously
d. Equipment Power:	
(1) VCU mode switch	OFF
(2) A/B Scan display	OFF
(3) PPI/Image display	OFF
(4) RRCU mode switch	OFF
8. Cockpit voice recorder	Checked/Normal
9. Pilot/copilots instrument check. Perform operational check on all installed equipment in accordance with Section IB.	Complete
10. Fuel reading	Checked and entered on range control chart (if required).
11. Navigation publications	Checked
12. Oxygen	Checked

NOTE

Refer to Section II for system checks.

BEFORE STARTING ENGINES CHECKLIST

1. Interphone	Set
2. Navigator's panel	Set
a. Radome heat switch	OFF
3. Lights	As required
4. Oxygen	"Checked" (P)(E)(N)(R) (SS)(TS)(LM)(CP)
a. On/100% (Refer to Section II for system check.)	
5. Compass system and heading indicators	"Checked (set, state headings)" (N/E)(P)(CP)

- a. C-12 compass systems
 - (1) C-12 compasses Set
 - (2) Cross-checked with wet compass for proper orientation Checked
- b. Dual INU installations
 - (1) DG/MAG switch MAG
 - (2) Compare NAV station # 1 and # 2 BDI headings Checked

NOTE

Compare No. 1 and No. 2 and state headings.

- 6. Altimeters “Set, state setting, reading” (CP)(P)(N)
- 7. Radios and navigation equipment
 - a. ADF Set
 - b. UHF and VHF Monitored
 - c. INS Programmed/as required
- 8. PA system As required
- 9. INS “Set, state setting” (N/E)

NOTE

The INS will normally be set to Navigate. If mission profile is such that the INS is not needed for Navigation, it will be set to Attitude Reference.

- 10. Before Starting Engines checks “Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

- 1. ATC clearance Copied
- 2. Departure procedures Coordinated with pilot
- 3. Safety belt, shoulder harness Fastened, unlocked
- 4. INS Programmed/checked – as required
- 5. Before Takeoff checks “Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

LINE UP CHECKLIST



The ISAR system turn on procedure should be completed only after all engines are at normal speed ground idle.

1. ISAR	Complete
a. ISAR system turn on procedure.	

WARNING

Ensure the XMTR GND override switch is in the normal position, with the switch guard down, before applying power to the radar system.

(1) Waveguide pressurization	Set, A
(2) RRCU RADAR mode	ON



Ensure that the amber SEARCH RADAR COOLING FAN LAMP for the selected fan is illuminated, and that the red, NO COOLING AIR FLOW lamp is not on.

(3) PPI/ Image display	ON
(4) A/B – Scan display	ON
(5) INS data msg	Depressed
(a) Lat/Long	Checked
(b) Heading	Checked
(c) North/South velocity	Checked
(d) East/West velocity	Checked
(6) Clock	Set
b. Recorder Group Turn-on Procedure – As Required	Complete
(1) VCU Mode	STBY
(2) VCU THUMBWHEEL SWITCHES	

- (a) MONTH/DAY
- (b) TIME Zulu
- (3) Video tape

Set, entered

Set, entered

Inserted

“Complete” (E)(N)(SS)(TS)(LM)(CP)

- 2. Line Up checks

AFTER TAKEOFF CHECKLIST

- 1. Forms
- 2. TAS probe heater switch (if installed)
- 3. After Takeoff checks

As required

ON

“Complete” (E)(N)(R)(SS)
(TS)(LM)(CP/P)

DESCENT CHECKLIST

- 1. Arrival procedures

Coordinated with
pilot



Do not transmit on HF communications equipment during VOR/ILS/ADF approaches due to possible electro-magnetic interference.

- 2. Altimeters
- 3. Descent checks

“Set, state setting” (CP)(P)(N)

“Complete” (E)(N)
(LM)(CP/P)

BEFORE LANDING CHECKLIST

- 1. Interphone
- 2. Altimeters
- 3. Seat
- 4. Safety belt, shoulder harness
- 5. ISAR

Set

“Set, state setting” (CP)(P)(N)

Facing forward

Fastened, unlocked

STBY

NOTE

The ISAR may be returned to an operating mode after the AUX pump is on and stable, but should be placed in STBY before landing.

6. Before Landing checks

“Complete”

E)(N)(R)(SS)
(TS)(LM)(CP/P)

TOUCH AND GO LANDING CHECKLIST

1. ISAR (before landing)

STBY

NOTE

The ISAR may be returned to an operating mode after the AUX pump is on and stable, but should be placed in STBY before landing.

OPERATIONAL STOP CHECKLIST

1. TAS Probe heater (if installed)

OFF

2. ISAR

- a. VCU mode switch

OFF

- b. A/B Scan display

OFF

- c. PPI/Image display

OFF

- d. RRCU mode switch

OFF

(Proceed with checklist when ready to taxi)

3. Altimeters

“Set, state setting,
reading”

(CP)(P)(N)

4. Departure procedures

Coordinated with
pilot

5. Safety belt, shoulder harness

Fastened, unlocked

6. Ops Stop checks

“Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

AFTER LANDING CHECKLIST

1. Unnecessary equipment

OFF
2. TAS probe heater (if installed)

OFF
3. ISAR
- a. VCU mode switch

OFF
- b. A/B Scan display

OFF
- c. PPI/Image display

OFF
- d. RRCU mode switch

OFF
4. After Landing checks

“Complete” (E)(N)(SS)(TS)(CP)

ENGINE SHUTDOWN CHECKLIST

1. INS

OFF
2. PA

OFF (if installed)
3. Oxygen

“OFF” (P)(E)(N)(R)(LM)(CP)
4. Engine Shutdown checks

“Complete” (E)(N)(R)(SS)(TS)(LM)(CP)

BEFORE LEAVING THE AIRCRAFT CHECKLIST

1. Waveguide pressurization unit manual selector valve

A or B

OPERATIONAL DESCENT CHECKLIST

1. Altimeters

“Set, state setting” CP)(P)(N)
2. Life vest

“As required” (P)

PRESEARCH/PREDROP CHECKLIST

1. ISAR

“SET” (N)
- a. Set ISAR to STBY prior to activation of Aux pump. After the Aux pump is ON and stable the ISAR may be returned to an operating mode.
2. Presearch/Predrop checks

“Complete” (E)(N)(DM)(CP)
- a. Pilot and dropmaster shall ensure all personnel understand the exact operation to be performed prior to replying “Complete.”

POSTSEARCH/POSTDROP CHECKLIST

1. ISAR	“SET”	(N)
a. Set ISAR to STBY prior to activation of Aux pump. After the Aux pump is ON and stable the ISAR may be returned to an operating mode.		
2. Altimeters	“Set, state setting”	(CP)(P)(N)
3. Postsearch/Postdrop checks	“Complete”	(E)(N) (DM)(CP)

PRE-DISPERSANT CHECKLIST

1. ISAR	“SET”	(N)
a. Set ISAR to STBY prior to activation of Aux pump. After the Aux pump is ON and stable the ISAR may be returned to an operating mode.		
2. Pre-dispersant checklist	“Complete”	(E)(N)(LM) (DM)(CP)

POST-DISPERSANT CHECKLIST

1. ISAR	“SET”	(N)
a. Set ISAR to STBY prior to activation of Aux pump. After the Aux pump is ON and stable the ISAR may be returned to an operating mode.		
2. Altimeters	“Set, state setting”	(CP)(P)(N)
3. Post-dispersant checklist	“Complete”	(E)(N)(LM) (DM)(CP)

LOADMASTER/DROPMAS-TER CHECKLISTS

Although the dropmaster and loadmaster are separate crew positions, their checklists are combined here because both dropmas-ter and loadmaster are not carried on every flight. The crew member performing ground controller and cargo compartment duties will respond as “loadmaster” until aerial delivery operations, at which time “dropmaster” is the required response.

PRIOR TO ENTERING

1. Forms CG 4377 and CG 5181	Checked for airplane status and discrepancies
2. Chocks	In place
3. Static ground wire	Connected
4. External power	As required
5. Nose gear lock	Installed

INITIAL PREFLIGHT

Cargo Compartment (Left side)

■ 1. Weight and balance data	Checked/on board/current
2. Load adjuster	Checked
3. Emergency exit light	ARMED/checked
4. Oxygen regulator	Checked/100%/OFF

NOTE

Refer to Section II for system check.

5. NLG emergency extension valve	NORMAL, Shear-wired
6. Oxygen manual shutoff valve	Checked/ON
7. Search window	Clean
8. Oxygen regulator	Checked/100%/OFF

NOTE

Refer to Section II for system check.

9. First aid kits	Checked
10. Seats and safety belts	Check condition/installed as required
11. Emergency exit light	ARMED/checked

12. Side emergency exit (1500 series)	Secure
13. MLG emergency extension wrench	Stowed
14. GTC oil level (1500 series)	Checked
15. Utility hydraulic reservoir fluid level, accumulator and cover	Serviced/closed
16. Left MLG and flap emergency engaging handles and hand crank	IN/stowed



The MLG emergency engaging handles will not be pulled while the airplane is on the ground.

17. Left bleed air isolation valve (1500, 1600 series)	Open
18. Flight control and throttle cables	Checked
19. Wheelwell seats and belts	Check condition/installed as required
20. Aileron boost pack and flap motor	Checked
21. Fire extinguisher	Checked
22. Aft fuselage junction box circuit breakers	Checked
23. Center seat support extensions	Checked (if installed) ■
24. Wheelwell seat supports	Checked/as required
25. First aid kits	Checked
26. Center seat support beams	Checked (if installed) ■
27. Oxygen regulator	Checked/100%/OFF

NOTE

Refer to Section II for system check.

28. Seats and safety belts	Check condition/installed as required
29. Flare launcher activation switch	DEACTIVATED

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30. Emergency exit light	ARMED/checked
31. Left paratroop door master door warning light shutoff switch	NORMAL
32. Paratroop door	Check operation
■ 33. Gunners belt	Checked/installed

Ramp Area (Left side)

1. Oxygen regulator	Checked/100%/OFF
NOTE Refer to Section II for system check.	
2. Ramp and door controls, manual control valves/switches	NEUTRAL/6N/OFF
3. Headset	Installed
4. Tiedown container	Checked for proper content
5. Latrine facilities	Checked for cleanliness (if installed)
6. Fire extinguisher and hand axe	Checked (if installed)
7. Tiedown devices	Checked
8. Center cable support attaching brackets/pins	Checked (if installed)
9. Paratroop jump platform (misc equip)	Checked (if installed)
10. Auxiliary hydraulic system	Checked for leaks/reservoir level
11. Ramp locks	Engaged
12. Ramp support arm	Connected
13. Tiedown rings on row 30	Checked for security
14. Liquid containers	Checked as required
15. Cargo net	Checked
16. Manually operated hydraulic shutoff valve (for flare launcher system)	NORMAL
17. Litter stanchion	Checked
18. Anchor cable reels	Checked (if installed)

19. Paratroop ladders (misc. equip.)	Checked/secure (if installed)
20. Static line extension “Y” cables	Checked (if installed)
21. Anchor line cable arm	Checked (if installed)
22. Cargo door up-locks	Unlocked
23. Cargo door locks	Engaged
24. Emergency exit light	ARMED/checked
25. Overhead escape hatch and escape rope	Checked
26. Door storage compartments	Checked for proper contents
27. Elevator and rudder boost packs	Checked

Ramp Area (Right side)

1. Door locks	Engaged
2. Tiedown devices	Checked
3. Anchor line cable arm	Checked (if installed)
4. Static line extension “Y” cables	Checked (if installed)
5. Anchor cable reels	Checked (if installed)
6. Litter stanchion	Checked
7. Ramp support arm	Connected
8. Ramp locks	Engaged
9. Liquid containers	Checked
10. Tiedown container	Checked for proper contents
11. Waste container	Checked/clean
12. Fire extinguisher and hand axe	Checked (if installed)
13. Cargo net	Checked
14. Latrine facilities	Checked for cleanliness
15. Tiedown devices	Checked

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16. Tiedown containers	Checked for proper contents
17. Truck loading ramps	Checked (if installed)
18. Center anchor arm support braces	Checked for pins/proper storage (if installed)
19. Oxygen regulator	Checked/100%/OFF

NOTE

Refer to Section II for system check.

20. Life raft release handles	Checked/shear-wired
21. Center anchor cable support attaching brackets/pins	Checked (if installed)
22. Paratroop jump platform (misc. equip.)	Checked (if installed)

Cargo Compartment (Right side)

1. Paratroop door	Check operation
2. Emergency exit light	ARMED/checked
3. Center seat support beams	Checked/installed as required
4. Overhead escape/depressurization hatch	IN, installed
5. Emergency exit light	ARMED/checked
6. Escape ladder, rope (metal if installed)	Check condition/installed
7. Seats and safety belts	Check condition/installed as required
8. Wheelwell seat supports	Checked/as required
9. First aid kits	Checked
10. Oxygen bottle, smoke mask and refiller hose	Checked
11. Rope ladder T handle	Shear-wired
12. Wheelwell seats and belts	Check condition/installed as required
13. Right bleed air isolation valve (1500 and 1600 series)/divider valve (1600 series, CG 1790, 1700 series)	Open

14. Booster hydraulic reservoir, accumulator and cover	Serviced/closed	
15. Right MLG emergency engaging handle and hand crank	IN/stowed	
16. Side emergency exit and release handle	Secure, shear-wired	
17. Emergency exit light	ARMED/checked	
18. Seats and safety belts	Check condition/installed as required	
19. First aid kits	Checked	
20. Center seat back support beams	Checked (if installed)	■
21. Oxygen manual shutoff valve	Checked/ON	
22. Oxygen regulators	Checked/100%/OFF	

NOTE

Refer to Section II for system check.

23. Search window	Clean	
24. Oxygen bottle, smoke mask and refiller hose	Checked	■
25. Snatch blocks (for external winching only)	Checked as required	
26. Winch accessory kit	Checked/serviceable/as required	



Ensure that winch snatch block hooks are equipped with operable spring safety clips.

27. Seat and litter stanchions	Checked (if installed)	■
28. Tiedown devices	Checked/secure	
29. Forward anchor cable support U-bolts	Checked (if installed)	■
a. Check both for security of attachment.		

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30. Fire extinguisher and hand axe	Installed/checked
31. Flashlights	Checked

Cargo Compartment (Center)

1. Emergency equipment	Checked
a. Parachutes/restraint harness (if installed)	
b. Survival equipment, quantity sufficient for crew/passengers	
c. Emergency landing gear tiedown equipment	
d. Smoke masks	Connected to cargo compartment portable oxygen bottles; fitted, and adjusted
2. Cargo floor	Check condition
3. Dual rail system/core bolts/roller conveyers	Checked/installed



Airplanes will be restricted from flight unless core bolts are installed at F.S.s 397, 477, 517, 597, 617, 677 and at locations near tiedown rings A-30 and G-30.

4. SAR equipment (as required)	Checked/installed
a. Observer’s stool	
b. Drop pump(s)	
c. ADS parachute assemblies	
d. MA-3 kit/(ARSK-24) (three rafts and two equipment containers)	
e. MK-25 (Marine location marker)	
f. MK-58 (Marine location marker)	

g. MA1/(ADR-8)	If installed	■
h. Message containers		
i. ADSK kit		
j. A-20 can (for radio drop)		
k. Gunner's belts		
l. Datum marker buoy		
m. A-16 survival sled		
n. Dropmaster helmets		
o. CG-1 strobe lights		
p. SAR bin pallet (for storage of above equipment)		
5. Extra equipment	Checked/installed	
a. Engine oil		
b. Hydraulic fluid		
c. Nylon cargo nets		
d. Ground loading ramps		
e. Pry bars		
f. MLG safety straps		
g. Ramp support		
h. Navigator's cabinet		
i. Ear plugs		
j. Insect spray		

6. Top of airplane

Checked/secure

WARNING

All necessary safety precautions should be observed. Conducting this inspection during high winds or other conditions which cause the airplane surfaces to be slippery could be hazardous. Under these circumstances, the pilot may waive this inspection.

WARNING

A hazard exists near radio antennas during the transmit mode. Ensure that radios are not operated during the TOP OF AIRPLANE INSPECTION.

CAUTION

Use extreme care at all times to avoid scratching or denting the skin while walking on the fuselage.

NOTE

This inspection may be accomplished before or after the interior inspection.

NOTE

Report any discrepancies to the flight engineer.

- a. Empennage, fuselage, wing control surfaces, and flaps
- b. Dry bay areas for fuel or hydraulic fumes and leaks
- c. Oil servicing access panels
- d. Fuel tank caps
- e. Emergency equipment access panels
- f. Escape hatches and release handles

Power On Checklist

1. Forward interphone station	Checked
a. Interphone	
b. Cargo area lights	
2. Flare launcher panels	Checked for proper operation
a. Check that all ten flare release lights and system deactivated light illuminates.	
3. Cargo winch (if installed)	Checked operation/serviceable/ as required



Check that cable hook is securely fastened to winch cable and that the hook has an operating spring clip.

4. Static line retrievers	Checked (if installed)

WARNING

Inspect static line retriever winches (Western Gear) to ensure that there are two beadtype retainer chains installed with a specific length of 4 3/4 inches measured inside-to-inside between attaching points. Check condition of the compression spring.

5. Aft fuselage junction box panel	Checked
a. Cargo area lights	
b. Circuit breakers	
6. Aft interphone station	Checked
a. Jump light intensity switch	
7. Cargo door and ramp	Check proper operation of door and ramp



Prior to raising the ramp, ensure that the ramp locks are retracted. Ensure that ADS arms are connected to the ramp or secured with the safety pin to the support storage pin prior to operation of the cargo ramp.

- 8. Aft anchor cable support arms

Check (if installed)
9. Form CG 4377

Enter discrepancies

NOTE

If loading is not to be accomplished, continue with the AFTER LOADING Checklist.

PRIOR TO LOADING CHECKLIST

1. Load planning

Completed
2. Cargo door and ramp

Positioned as required



Ensure that ADS arms are connected to the ramp or secured with safety pin to the support storage pin prior to operation of the cargo ramp.

NOTE

Refer to Section VII of this flight manual for cold weather operation.

3. Manifest

Check manifest against cargo, and check for items that require special handling.
4. Cargo inspection

Check general condition, and check for dangerous material and contaminated items. Check for insects.

LOADING

Refer to T.O. 1C-130A-9, AFJMAN 24-204, Appendix B to this manual, and other appropriate publications for handling and loading instructions.

AFTER LOADING CHECKLIST

1. Cargo door and ramp

Closed/locks checked/ramp support arms connected



Ensure that ADS arms are connected to the ramp prior to completion of After Loading checks.



Prior to raising the ramp, ensure that the locks are retracted and the ramp seal area is clear.

2. Loose equipment

Stowed

3. Maintenance ladder

Stowed

4. Cargo leakage

Check for any fumes or leaks

5. Load restraint

Completed/checked

- a. Dual rail left and right locks

ENGAGED

WARNING

Ensure locks are locked in required position to prevent shifting cargo in flight.

- b. Cargo tiedown equipment

Applied/checked

6. Passenger manifest and Form 365-4

Submit to pilot

7. Passenger briefing

As required

BEFORE STARTING ENGINES CHECKLIST

NOTE

If initial preparations for flight are made with the aircraft hangared, the BEFORE STARTING AND PUSH-BACK CHECKLIST shall be used in lieu of this checklist, for the P, CP, E and LM positions.

1. Headset and extension cord

Ready
2. All cargo comp. oxygen regulators

ON/100%
3. Oxygen

“Checked”

(P)(E)(N)(R)
(SS)(TS)(LM)(CP)
- a. ON/100% (Refer to Section II for system check.)
4. Clear GTC/APU

“Clear”

(LM)
5. Ramp and door

“Closed”

(LM)

NOTE

If the ramp and door are open, the loadmaster will close it at this time while control of the auxiliary hydraulic pump can be maintained at the ramp control panel.

6. Chocks

“Removed”

(LM)

NOTE

Chocks will be secured in the cargo compartment.

7. Before Starting Engines checks

“Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

1. Clear No. 3 engine

“No. 3 clear”

(LM)

NOTE

The loadmaster will state, “Negative rotation,” if the propeller fails to rotate within approximately 5 seconds after the pilot states, “Turning,” for each engine.

NOTE

The loadmaster will be positioned parallel with the nose of the airplane and directly in front of the external fuel tank on the side being started. This will permit the loadmaster to observe the propellers and exhaust area during engine start. The loadmaster will also be in a position to give visual signals to the pilots if interphone contact should be lost. The loadmaster will direct removal/disconnect of external equipment (as practical) when directed by flight engineer.

2. Clear No. 4 engine	"No. 4 clear"	(LM)
3. External equipment	"Removed and clear"	(LM)
4. Nose ground wire	Removed	
5. Clear No. 2 engine	"No. 2 clear"	(LM)
6. Clear No. 1 engine	"No. 1 clear"	(LM)

NOTE

Ensure that surrounding area is clear of obstructions prior to entering the airplane.

7. Crew aboard	"Crew aboard, doors closed and checked"	(LM)

WARNING

Ensure that hooks on crew entrance door latches engage eyebolts on door and that over-center mechanism is against stop.

8. Hydraulic quantities	Checked
9. Hatches	Secure
10. Hydraulic quantities	Checked (after flaps are lowered)
11. Interior and exterior scan	Completed
a. Flap position	Checked

NOTE

When checking the flap position (either on the ground or in flight), the outboard and inboard sections on both sides of the airplane will be checked utilizing the window just forward of each paratroop door.

12. Cabin/load restraint	Secure
13. Before Takeoff checks	"Complete" (E)(N)(R)(SS) (TS)(LM)(CP)

NOTE

To preclude delaying takeoff, loadmaster will re-
turn to seat and fasten seat belt upon completion of
engine runup checklist. If engine runup checklist is
not performed, loadmaster will return to seat and
fasten seatbelt upon completion of before takeoff
checklist.

ENGINE RUNUP CHECKLIST

- 1. Monitor cargo compartment hydraulic panels
for leaks and quantities.
- 2. Observe lower side of wings, the external
tanks, and engine nacelles for leaks, etc.

LINEUP CHECKLIST

- 1. Safety belt Fastened
- 2. Lineup checks “Complete”(E)(N)(SS)(TS)(LM)(CP)

AFTER TAKEOFF CHECKLIST

NOTE

The loadmaster will remain clear of the ramp area
until the leading edge anti-icing check is complete
(if applicable).

- 1. Landing gear Checked
 - a. Visually check all wheelwells
- 2. Flaps Checked
 - a. Visually check wing flaps



If flaps are still down during the safety check,
inform the pilot immediately.

- 3. Interior and exterior scan Checked
 - a. Interior
 - (1) Visually check under flight deck
 - (2) Check hydraulic systems for proper quantity
and leaks
 - (3) Check aileron boost package
 - (4) Check flap drive motor
 - (5) Recheck all ramp and door locks
 - (6) Check the elevator and rudder boost packages

b. Exterior

(1) Visually inspect the underside of the wings:

- (a) Check landing lights
- (b) Check for leaks on each engine nacelle
- (c) Check dump mast
- (d) Check pogo drains
- (e) Check gap bands
- (f) Check each tailpipe for security
- (g) Check each propeller and propeller afterbody for leaks

4. Repeat steps 1., 2., and 3. at least every 30 minutes and report, "Safety Check Complete," to the engineer.

5. Safety check

"Complete"

(LM)

NOTE

The safety check will include at least items 1., 2., and 3.

6. Inform flight engineer of cargo compartment temperature changes when necessary.

7. After Takeoff checks

"Complete"

(E)(N)(R)(SS)
(TS)(LM)(CP)

DESCENT CHECKLIST

1. Passengers

Briefed

a. Passenger safety belts

Fastened

2. Cabin/cargo

Secure

3. Descent checks

"Complete"

(E)(N)(LM)(CP/P)

BEFORE LANDING CHECKLIST

1. Landing gear

Visually checked down

2. Hydraulic quantities

Checked

3. Safety belt

Fastened

4. Before Landing checks

"Complete"

(E)(N)(R)(SS)
(TS)(LM)(CP/P)

ENGINE SHUTDOWN CHECKLIST

1. Exit

2. Oxygen

3. Chocks

4. Engine Shutdown checks
- Door open on clearance from pilot

“OFF” (P)(E)(N)(R)(LM)(CP)

“In place” (LM)

“Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

OFF-LOADING (AT DESTINATION) CHECKLIST

1. Cargo door and ramp

CAUTION

Ensure that the ADS arms are connected to the ramp or secured with safety pin to the support storage pin prior to operation of the cargo ramp.

2. Off-loading of passengers

3. Off-loading of cargo and baggage
- As required

Completed

Completed

OPERATIONAL STOP CHECKLIST

1. Exit (proceed with checklist after cargo/passengers are loaded)

2. Crew aboard

WARNING

Ensure that hooks on crew entrance door latches engage eyebolts on door and that overcenter mechanism is against stop.

3. Hatches

4. Interior and exterior scan

a. Flap position
- Door open on clearance from pilot

“Crew aboard, doors closed and checked” (LM)

Secure

Completed

Checked

NOTE

When checking the flap position (either on the ground or in flight), the outboard and inboard sections on both sides of the airplane will be checked utilizing the window just forward of each paratroop door.

5. Cabin/load restraint	Secure	
6. Safety belt	Secure	
7. Ops Stop checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

BEFORE LEAVING AIRPLANE CHECKLIST

1. Airplane	Cleaned
2. Cargo door and ramp	Closed



Ensure that the ADS arms are connected to the ramp or secured with safety pin to the support storage pin prior to operation of the cargo ramp.

3. Equipment	Checked/secured
4. Cargo compartment emergency exit lights switches	ARMED
5. Form CG 4377	Discrepancies entered

OPERATIONAL DESCENT CHECKLIST

1. Life vests	“As required”	(P)

NOTE

The pilot will brief the crew on the use of life vests.

PRESEARCH/PREDROP CHECKLIST

1. Location markers	“Standing by with _____”	(DM)
NOTE Steps 2.–4. for use of flare launcher.		
2. Flare launch panel	“OFF and SAFE”	(DM)(CP)
a. Copilot and dropmaster ensure that individual flare launch panels are OFF and SAFE.		
3. Flare launch activation switch	“ACTIVATED”	(DM)



To prevent inadvertent ignition, salt shall not be added to flares when utilizing the flare launch tubes.

4. Flare launch tubes
- “__ MK-25/MK-58(s)
loaded in tubes number __” (DM)
- a. Dropmaster load tubes and notify crew
of pyrotechnic load by type and tube number.

NOTE

Steps 5.–11. for Drops or Ramp Search. All engines will be running for airdrops.

5. Ramp support arms
- “Connected” (DM)
6. Dual rail ramp conveyors
- “Removed” (DM)
- a. Remove at least the center two sections of conveyors.
7. Safety equipment
- “On and checked” (DM)
- a. For equipment with static line drops, personnel actually doing the drop will wear helmets and adequate eye protection.
- b. Safety/emergency equipment will include (as a minimum) gloves, shroud line cutter or knife (readily accessible), and a safety strap at FS 617.
8. Drop equipment
- “Standing by with _____” (DM)
- a. Dropmaster will notify crew of type equipment that is being deployed.
9. Air deflector doors
- “If required” (DM)(CP)
- a. Open air deflectors if paratroop door drop is to be made, or if requested by the dropmaster.
10. Restraint harness
- “On and checked” (DM)



Ensure that all crew members involved are wearing properly adjusted restraint harnesses and understand the exact operation to be performed prior to the operation. All other personnel aft of fuselage station 617 (wheel well) will wear restraining harnesses or will be seated with seat belts fastened.

11. Cargo ramp and door or paratroop door

“Clear to open” (P)
 “Aux pump ON” (DM)
 “Open and locked” (DM)

WARNING

For dropmaster safety, the cargo ramp and/or door and paratroop door will not be open simultaneously during drops.

NOTE

Normally, all drops will be made with cargo ramp and door open; however, either paratroop door may be used. If the ramp is opened, it shall be in the air-drop or horizontal position. The cargo door should be fully open and locked with both flags visible. Operation of the ramp and door will normally be completed by the dropmaster at the aft control panels. If using one of the paratroop doors, the door shall be in the fully up and locked position with the safety pin installed.

12. Presearch/Predrop checks

“Complete” (E)(N)
 (DM)(CP)

- a. Pilot and dropmaster shall ensure all personnel understand the exact operation to be performed prior to replying “Complete.”
- b. Dropmaster shall ensure all drop equipment is rigged as briefed, including inflation lanyards, static lines and trail lines.
- c. For a PADS drop ensure the strobe light is activated and the static line is attached to the tiedown ring on row 30, column C.
- d. For MA 3 Rescue Kit ensure that inflation lanyards are attached (if applicable) to tiedown ring row 30, columns B, D, and F.

POST SEARCH/POST DROP CHECKLIST

1. Armed location markers
2. Cargo ramp and/or door or paratroop door
3. Flare launch panel

“Jettisoned” (DM) (CP)

“Clear to close” (P)
 “Aux pump ON” (DM)
 “Closed and locked” (DM)

“OFF and SAFE” (DM) (CP)

- a. Copilot/dropmaster check to ensure all switches on flare launcher panel are OFF and SAFE.

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4. Flare launch activation switch	“DEACTIVATED”	(DM)
5. Unused location markers and drop equipment	“Removed and stowed”	(DM)
a. Ensure that all unused location markers and drop equipment (i.e., PADS trail-line bags, safety strap, gunners belts, etc.) are stowed in proper locations.		
6. Postsearch/Postdrop checks	“Complete”	(E)(N)(DM)(CP)

BEFORE STARTING AND PUSH-BACK CHECKLIST

NOTE

This checklist is to be completed in lieu of the BEFORE STARTING ENGINES CHECKLIST only when aircraft is being towed from inside a hangar or from a confined area with all crewmembers in position. The LM has a key role in the effective use of this checklist. The LM must serve as the direct contact between the flight crew and the Tow Team Captain.

1. Headset and extension cord	Ready
2. All cargo compartment regulators	ON/100%
3. Oxygen	“Checked” (P)(E)(N)(R)(LM)(CP)
4. Ramp and door	“Closed” (LM)
5. Chocks	“Removed” (LM)

NOTE

The LM will ensure that the Tow Team is ready prior to reporting ready.

6. Ready to tow	“Ready”	(E)(LM)(P)
7. Ext ac power plug/cover	“Removed and closed”	(LM)

NOTE

The LM will not clear the APU until the NLG is clear of the hangar door tracks.

8. Clear GTC/APU	“Clear”	(LM)
9. Chocks	“In place”	(LM)
10. Nose wheel steering scissors	“Connected”	(LM)
11. NLG lock and pitot covers	“Removed”	(LM)
12. Chocks	“Removed”	(LM)

NOTE

The chocks will be secured in the cargo compartment

NOTE

After removing chocks, LM will check that the area is clear of all obstructions and personnel before calling the checklist complete.

13. Before Starting and Push-Back checks

“Complete” (E)(N)(R)(LM)(CP)

NOTE

Proceed with the Before Takeoff Checklist.

SUGGESTED PASSENGER BRIEFING CHECKLIST

Prior to block time, a crew member will brief passengers utilizing the applicable checklist.

NOTE

Flying time (flying time should be from takeoff to block-in) will be obtained prior to conducting the departure briefing.

DEPARTURE BRIEFING NUMBER ONE

(Passenger Information Cards are available.)

1. May I have your attention please? Welcome aboard _____. The flying time to _____ is _____ hour(s) and _____ minutes.
2. Butane or other pressurized lighters are prohibited in the aircraft.
3. The use of all electronic equipment is prohibited in the aircraft except for nonprinting hand-held battery-operated calculators, portable voice recorders, and electric shavers.
4. Smoking is not permitted.
5. Emergency exits are outlined in yellow (indicate location). Please familiarize yourself with the exit nearest you.
6. At this time ensure your seat belt is securely fastened.

NOTE

If mission is scheduled over water, continue with step 7.; if not, continue with step 8.

7. Because our routing takes us over water, either a life vest or your seat cushion is available as a flotation device. The donning of the life vest will be demonstrated by (title/name). Please observe.
8. We have disposable type ear plugs for issue upon request. If you have any questions, don't hesitate to ask.

ENROUTE STOP DEPARTURE BRIEFING

1. May I have your attention please? Welcome aboard the continuation of flight _____. The flying time to _____ is _____ hour(s) and _____ minutes.

NOTE

When additional passengers are boarded at enroute stations, the appropriate departure briefing will be accomplished beginning with step 2. If no passengers are boarded at enroute stations, the following additional briefing will be given.

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2. Please ensure your seat belt is securely fastened.
3. Again, we remind you that smoking is not permitted. THANK YOU.

AFTER TAKEOFF BRIEFING

1. Please remain seated with your seat belt secured until we have reached cruise altitude. You will be advised when it is safe to move around.

NOTE

Upon verbal notification from the pilot that cruise altitude has been reached, the loadmaster will give the following briefing:

2. May I have your attention please? We have reached cruising altitude. Movement within the cabin is now permitted. However, throughout the flight when you are seated, your seat belt must be worn.
3. Because of current directives, access to checked baggage is prohibited.
4. Again, we remind you that smoking is not permitted.

IN-FLIGHT ANNOUNCEMENTS

NOTE

All in-flight announcements should begin with "May I have your attention please?" followed by a short information statement of general interest to the passengers.

AFTER LANDING BRIEFING

Please remain seated until the airplane comes to a complete stop. You will be advised when to deplane from the crew entrance door.

NOTE

If it is necessary to off-load passengers with engines running on the left side, the loadmaster will form a barrier with the long wire.

NOTE

Provide information that is appropriate to the landing station and condition of the stop-over (terminating, through, no off-load of passengers, refueling stop, all passengers deplane, etc.).

RADIO OPERATOR'S CHECKLIST

The following will be assigned to the radio operator by the pilot when a radio operator is included as a crew member. Items in quotation marks indicate that a response is required.

PREPARATION FOR FLIGHT

1. Communication requirements	Checked
2. Professional and personal equipment	Checked, stowed

BEFORE EXTERIOR

1. Communication T.O.s	Checked, stowed
2. Forms CG 4377 and CG 5181	Checked

EXTERIOR

1. All navigation and communication antennas	Checked
2. Radome for cracks, dents, holes, and soft spots	Checked
3. Nose wheelwell area	Checked
4. Static discharge wicks for presence, condition, and security	Checked

INTERIOR (POWER OFF)

1. Ramp area	Secure
2. Overhead equipment rack	Secure
3. Under flight deck avionics	Secure
4. Galley	Checked
a. Cleanliness	
b. Galley supplies	
c. Forms supply	
5. Windows	Clean
6. Trash cans	Empty
7. Flight deck and instruments	Clean
8. Secure Comms	OFF
9. Headsets	As required
10. Radar	OFF
11. INS	OFF
12. Clocks	Set

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13. All navigation and communication equipment

OFF
14. PA

OFF

INTERIOR (POWER ON)

1. Oxygen

Checked
- NOTE

See Section II for system checks.
2. Interior lights (radio position)

Checked/set
3. Interphone panel (radio position)

Checked/set
4. Secure communications

As required
5. HF radios No. 1 and No. 2

On/checked
6. Public address system

As required

BEFORE STARTING ENGINES CHECKLIST

1. Radio log (if required)

Open
2. Interphone

Set
3. Lights

As required
4. Oxygen

“Checked”

(P)(E)(N)(SS)
(TS)(R)(LM)(CP)
- a. ON/100% (Refer to Section II for system check.)
5. IFF mode 2

Set (as required)
6. Taxi and ATC clearance

Monitored
7. Before Starting Engine checks

“Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

1. Safety belt and shoulder harness

Fastened/unlocked
- a. Seat facing forward
2. Galley, floor, switches

Set/up/OFF
3. Before Takeoff checks

“Complete”

(E)(N)(R)(SS)
(TS)(LM)(CP)

AFTER TAKEOFF CHECKLIST

1. Establish and maintain communications	As required	
2. Galley, floor, switches	Set/down/ as required	
3. After Takeoff checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

BEFORE LANDING CHECKLIST

1. Interphone	Set

WARNING

Do not transmit on HF radios during VOR/ILS/ADF approaches due to possible electromagnetic interference.

2. Safety belt and shoulder harness	Fastened/unlocked	
a. Seat facing forward		
3. Galley, floor, switches	Set/up/OFF	
4. Before Landing checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

OPERATIONAL STOP CHECKLIST

1. Taxi and ATC clearance	Monitored	
2. Safety belt and shoulder harness	Fastened/unlocked	
3. Ops Stop checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

AFTER LANDING CHECKLIST

1. Unnecessary equipment	OFF

ENGINE SHUTDOWN CHECKLIST

1. Secure communication equipment	Zeroized/OFF
2. Converter	OFF
3. Radio log (if required)	Closed
4. Oxygen	“OFF” (P)(E)(N)(R)(LM)(CP)
5. Engine Shutdown checks	“Complete” (E)(N)(R)(SS) (TS)(LM)(CP)

BEFORE LEAVING AIRPLANE CHECKLIST

1. Publications	Stowed
2. IFF mode 2	Cleared
3. Flight Station	Cleaned

OPERATIONAL DESCENT CHECKLIST

1. Life vest	“As required” (P)

SENSOR SYSTEM OPERATOR’S CHECKLIST

The pilot will assign the following to the sensor system operator when a sensor system operator is assigned as a crew member. Items in quotation marks indicate that a response is required.

PREPARATION FOR FLIGHT

1. Communications requirements	Checked
2. Mission VTR cassettes (no TSO assigned)	Obtained
3. ATW removable hard drives (no TSO assigned)	Obtained
4. Professional and personal equipment	Checked, stowed
5. Communications T.O.s and messages	Checked, stowed
6. Forms CG 4377 and CG 5181	Checked

INTERIOR (POWER OFF)

1. PASS circuit breakers (no TSO assigned)	Checked
2. PASS junction box connectors (no TSO assigned)	Checked
3. PASS interconnect panel connectors (no TSO assigned)	Checked
4. PASS dual rail left and right locks	Engaged
5. Radar	OFF
6. OCU POWER pushbutton	Off
7. Communications equipment	Off

INTERIOR (POWER ON)

1. SSO oxygen bottle and mask	Checked
2. PASS MAIN PWR switch (no TSO assigned)	ON
3. SSO panel lights	Checked/set
4. Interphone panel	Checked/set
5. Converter	ON
6. Chronometer	Checked/set
7. Mission VTR cassettes (no TSO assigned)	Loaded
8. ATW removable hard drives (no TSO assigned)	Loaded
9. ATW (no TSO assigned)	Checked/set



Time data in each of the subsystems (GPS, ISAR, DP/DCS and CARP) is mission critical and shall be kept consistent. Set all on-board time devices to the atomic clock available from the GPS. Failure to comply will result in CASPER system performance degradation, invalid position information, and event timing.

10. OCU POWER pushbutton	Depressed/on
11. FLIR/EO sensor system	Checked/set
12. FLIR/EO date and time	Checked/set

NOTE

Model 20TS date and time are set in the MISSION 2nd Level Video Menu. Any changes made to the fields will not take affect until the >SET TIME < field is selected, followed by >DONE<. Atomic clock time, available from the GPS, should be used for setting time.

EXTERIOR

1. FLIR/EO turret

Checked
- a. Relative humidity indicator

Checked
- b. Desiccant indicator

Checked
- c. Purge valve

Checked
- d. Optical windows

Cleaned, checked



Use only manufacturer’s recommended cleaning materials on turret optical windows. Do not use paper towels, dirty rags or cleaning fluids containing ammonia. Use of these materials may damage the optical windows beyond repair.

- e. Turret general condition

Checked



Chips or cracks found in or around the turret windows could cause the glass to fail in flight. If any chips or cracks are evident, do not operate the turret. Leave the turret in the stowed position during flight.

BEFORE STARTING ENGINES CHECKLIST

1. Interphone

Set
2. Panel lights

As required
3. Oxygen

“Checked” (P)(E)(N)(R)
(SS)(TS)(LM)(CP)
4. OCU MODE switch

STOW/stow verify LED illuminated
5. OCU POWER pushbutton

Depressed/off
6. ATW power (no TSO assigned)

OFF
7. Radios

Set
8. Before Starting Engines checks

“Complete” (E)(N)(R)(SS)
(TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

1. Safety belt, shoulder harness	Fastened/unlocked	
2. Seat	Facing forward	
3. Before Takeoff checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

LINEUP CHECKLIST

1. OCU POWER pushbutton	As required	
2. Turret	Verified stowed	
3. ATW power (no TSO assigned)	As required	
4. Lineup checks	“Complete”	(E)(N)(SS)(TS) (LM)(CP)

AFTER TAKEOFF CHECKLIST

1. Establish and maintain communications	As required	
2. ISAR	As required	
3. CASPER system status	As required	
4. After Takeoff checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

BEFORE LANDING CHECKLIST

1. Interphone	Set	
2. Safety belt, shoulder harness	Fastened/unlocked	
3. Seat	Facing forward	
4. OCU MODE switch	STOW/stow verify LED illuminated	
5. OCU POWER pushbutton	Depressed/off	
6. ATW power (no TSO assigned)	OFF	
7. Before Landing checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

OPERATIONAL STOP CHECKLIST

1. Safety belt, shoulder harness	Fastened/unlocked	
2. Seat	Facing forward	
3. Ops Stop checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

AFTER LANDING CHECKLIST

1. Unnecessary equipment	Off	
2. After Landing checks	“Complete”	(E)(N)(SS) (TS)(CP)

ENGINE SHUTDOWN CHECKLIST

1. Converter	OFF	
2. ATW removable hard drives (no TSO assigned)	Removed	
3. Mission VTR cassettes (no TSO assigned)	Removed	
4. SSO panel lights	Off	
5. PASS MAIN PWR switch (no TSO assigned)	OFF	
6. Engine Shutdown checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

BEFORE LEAVING AIRPLANE CHECKLIST

1. Publications	Stowed
2. SSO station	Cleaned
3. Turret	Inspected

TACTICAL SYSTEM OPERATOR'S CHECKLIST

The pilot will assign the following to the tactical system operator when a tactical system operator is assigned as a crew member. Items in quotation marks indicate that a response is required.

PREPARATION FOR FLIGHT

1. Communications requirements	Checked
2. Secure communications material	Obtained
3. Mission VTR cassettes	Obtained
4. ATW removable hard drives	Obtained
5. LEIS II update floppy disk	Obtained
6. Professional and personal equipment	Checked, stowed
7. Forms CG 4377 and CG 5181	Checked

INTERIOR (POWER OFF)

1. PASS T.O.s	Checked
2. PASS circuit breakers	Checked
3. PASS junction box connectors	Checked
4. PASS interconnect panel connectors	Checked
5. MILSATCOM radio	OFF

INTERIOR (POWER ON)

1. PASS MAIN PWR switch	ON
2. TSO oxygen bottle and mask	Checked
3. TSO panel lights	Checked/set
4. Interphone panel	Checked/set
5. Mission VTR cassettes	Loaded
6. Secure communications	Loaded
7. MILSATCOM radio	On

8. ATW removable hard drives	Loaded
9. LEIS II floppy disk	Loaded
10. ATW	Checked/set



Time data in each of the subsystems (GPS, ISAR, DP/DCS and CARP) is mission critical and shall be kept consistent. Set all on-board time devices to the atomic clock available from the GPS. Failure to comply will result in CASPER system performance degradation, invalid position information, and event timing.

BEFORE STARTING ENGINES CHECKLIST

1. Interphone	Set
2. Panel lights	As required
3. Oxygen	“Checked” (P)(E)(N)(R)(SS) (TS)(LM)(CP)
4. Radios	Set
5. ATW power	OFF
6. Before Starting Engines checks	“Complete” (E)(N)(R)(SS) (TS)(LM)(CP)

BEFORE TAKEOFF CHECKLIST

1. Safety belt, shoulder harness	Fastened/unlocked
2. Seat	Facing forward
3. Before Takeoff checks	“Complete” (E)(N)(R)(SS) (TS)(LM)(CP)

LINEUP CHECKLIST

1. ATW power	As required
2. Lineup checks	“Complete” (E)(N)(SS)(TS) (LM)(CP)

AFTER TAKEOFF CHECKLIST

1. Establish and maintain tactical communications	As required	
2. CASPER system status	As required	
3. After Takeoff checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

BEFORE LANDING CHECKLIST

1. Interphone	Set	
2. Safety belt, shoulder harness	Fastened/unlocked	
3. Seat	Facing forward	
4. Before Landing checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP/P)

OPERATIONAL STOP CHECKLIST

1. ATW power	OFF	
2. Safety belt, shoulder harness	Fastened/unlocked	
3. Seat	Facing forward	
4. Ops Stop checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

AFTER LANDING CHECKLIST

1. Unnecessary equipment	Off	
2. MILSATCOM radio	Zeroize/off	
3. After Landing checks	“Complete”	(E)(N)(SS) (TS)(CP)

ENGINE SHUTDOWN CHECKLIST

1. LEIS II update floppy disk	Removed
2. ATW removable hard drives	Removed
3. Mission VTR cassettes	Removed
4. TSO panel lights	Off

5. Utility lights	Off	
6. PASS MAIN PWR switch	OFF	
7. Engine Shutdown checks	“Complete”	(E)(N)(R)(SS) (TS)(LM)(CP)

BEFORE LEAVING AIRPLANE CHECKLIST

1. Publications	Stowed
2. TSO station	Cleaned

CRUISE ENGINE SHUTDOWN CHECKLIST



Before performing cruise engine shutdown on an engine supplying power to the LH ac Bus, secure the CASPER System.

SECTION V

OPERATING LIMITATIONS

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INTRODUCTION

This airplane has certain well-defined limitations to its operation. Maximum performance requires careful consideration of these limitations. The instrument marking illustrations (figure 5-1) and the engine and propeller limitations illustrations (figure 5-2) contain certain limitations which are not repeated in text. This fact should be remembered when using this section.

MINIMUM CREW REQUIREMENTS

The minimum crew required to operate this airplane is a pilot, copilot, and flight engineer. Additional crew members may be added, as required, at the discretion of the commanding officer.

INSTRUMENT MARKINGS

Flight and engine instrument markings are shown in figure 5-1 and are not repeated in text.

NOTE

The markings shown in this section are for flight station indications and are not to be confused with

limits shown in the manual of Maintenance Instructions.

ENGINE AND PROPELLER LIMITATIONS

Operating time limits, allowable observed turbine inlet temperature ranges, and oil temperature, oil pressure, engine speed, propeller governing, and starter operation limits respectively, are tabulated in figure 5-2 and are not repeated in text.

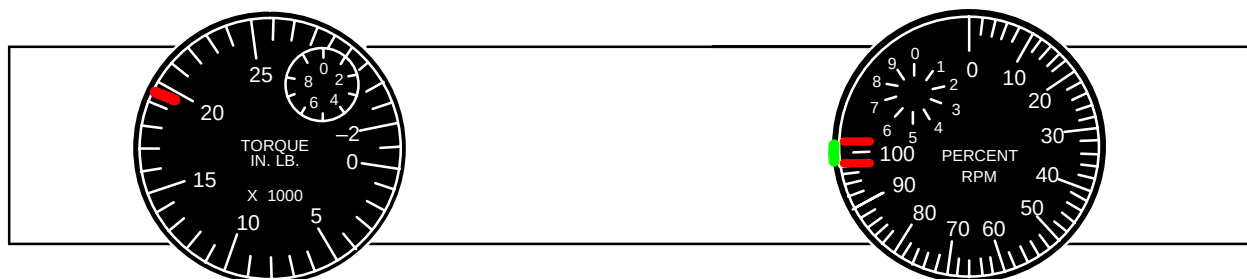
NOTE

All limits given in figure 5-1 are flight station indicated limits and are not to be confused with maintenance manual limits.

FUEL

The fuel recommended for the T56 engine is Specification MIL-T-5624, JP-4. If JP-4 fuel is not available, certain other fuels may be used as alternate or emergency fuels. (See

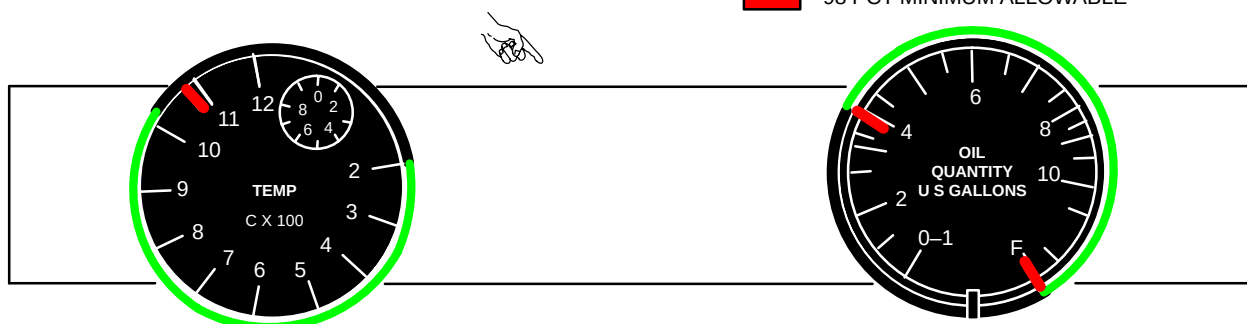
Instrument Markings

**TORQUEMETER**

19,600 IN. LB. MAXIMUM ALLOWABLE

TACHOMETER

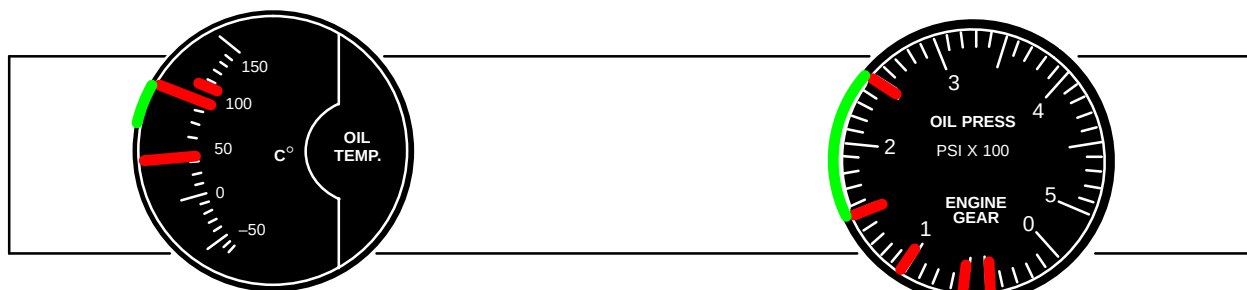
102 PCT MAXIMUM ALLOWABLE
 98 PCT TO 102 PCT NORMAL
 98 PCT MINIMUM ALLOWABLE

**TURBINE INLET TEMPERATURE**

1083 °C MAXIMUM ALLOWABLE
 200 °C TO 1010 °C NORMAL (CONTINUOUS)

OIL QUANTITY

12 GALLONS MAXIMUM
 4-12 GALLONS NORMAL
 4 GALLONS MINIMUM ALLOWABLE

**OIL TEMPERATURE**

85 °C TO 100 °C TAXI MAXIMUM (30 MIN.) AND IN-FLIGHT 5-MINUTE MAXIMUM
 85 °C MAXIMUM CONTINUOUS
 60 °C TO 85 °C NORMAL
 40 °C (AND INCREASING) MINIMUM ALLOWABLE

OIL PRESSURE

BOTH POWER SECTION AND GEAR SECTION OIL PRESSURE ARE INDICATED ON THIS INSTRUMENT: POWER SECTION PRESSURE BY THE FRONT POINTER; GEAR SECTION PRESSURE BY THE REAR POINTER

GEAR SECTION

250 PSI MAXIMUM ALLOWABLE—EXCEPT START AND WARM UP (250 PSI MAY BE EXCEEDED DURING START AND WARM UP)
 150 PSI TO 250 PSI NORMAL
 150 PSI MINIMUM ALLOWABLE (100% RPM, OIL TEMP, NORMAL)

POWER SECTION

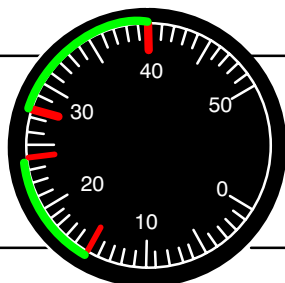
100 PSI MAXIMUM ALLOWABLE – START AND WARM UP
 60 PSI MAXIMUM – EXCEPT START AND WARM UP
 50 PSI TO 60 PSI NORMAL
 50 PSI MINIMUM ALLOWABLE (100% WITH OIL TEMP. NORMAL)

NOTE

THE INSTRUMENT MARKINGS SHOULD REFLECT THE CORRESPONDING NUMERICAL VALUES. ACTUAL NUMERICAL VALUES GOVERN.

IF OIL CONSUMPTION EXCEEDS 0.35 GALLONS/HR, RECORD ON FORM 4377

Figure 5-1 (Sheet 1 of 5)

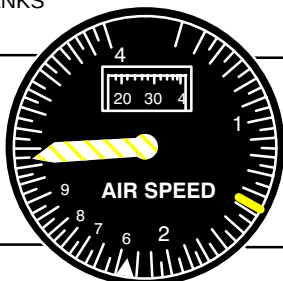
**NOTE:**

THE MARKINGS ON THIS INSTRUMENT ARE FOR PREFLIGHT REFERENCE ONLY. INFLIGHT LOW-PRESSURE WARNING IS SUPPLIED BY THE PRESSURE WARNING LIGHTS ON THE FUEL CONTROL PANEL. THE FUEL PRESSURE LIMITS ARE FOR A NO-FLOW CONDITION. PRESSURE BELOW THESE LIMITS IS ACCEPTABLE WITH ENGINES OPERATING, PROVIDED THE PRESSURE IS WITHIN LIMITS WITH NO FLOW AND THE ELECTRICAL FREQUENCY IS 400 ± 20 HZ

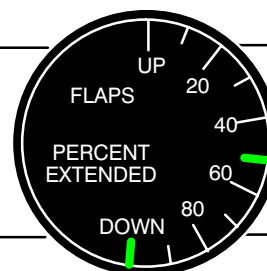
**FUEL PRESSURE TEST INDICATOR**

- 40 PSI MAXIMUM ALLOWABLE – AUX AND EXT TANKS
- 28 PSI – 40 PSI NORMAL – AUX AND EXT TANKS
- 28 PSI MINIMUM ALLOWABLE – AUX AND EXT TANKS

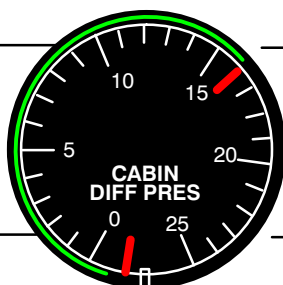
- 24 PSI MAXIMUM ALLOWABLE – MAIN TANKS
- 15 PSI – 24 PSI NORMAL – MAIN TANKS
- 15 PSI MINIMUM ALLOWABLE – MAIN TANKS

**AIR SPEED**

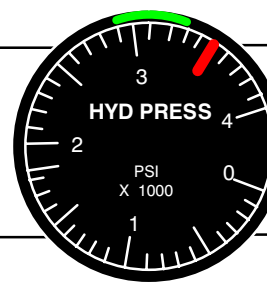
- RADIAL; 145 KNOTS MAXIMUM ALLOWABLE WITH FULL FLAPS
- ▨ THE BANDED POINTER CONSTANTLY INDICATES THE STRUCTURAL SPEED LIMIT AT SEA LEVEL (CG 1500 and 1600 SERIES)
- THE WHITE POINTER (NOT SHOWN) SHOWS INDICATED AIR SPEED
- ▲ .64 LIMITING MACH NUMBER

**FLAP POSITION**

- FLAPS 50% DOWN
- FLAPS 100% DOWN

**CABIN DIFFERENTIAL PRESSURE GAUGE**

- 15.8 IN. HG. MAXIMUM ALLOWABLE
- -1.2 IN. HG. TO 15.8 IN. HG. NORMAL
- -1.2 IN. HG. MINIMUM ALLOWABLE

**HYDRAULIC PRESSURE (AUXILIARY)**

- 3,500 PSI MAXIMUM ALLOWABLE PRESSURE
- 2,900 TO 3,300 PSI NORMAL

Figure 5-1 (Sheet 2 of 5)

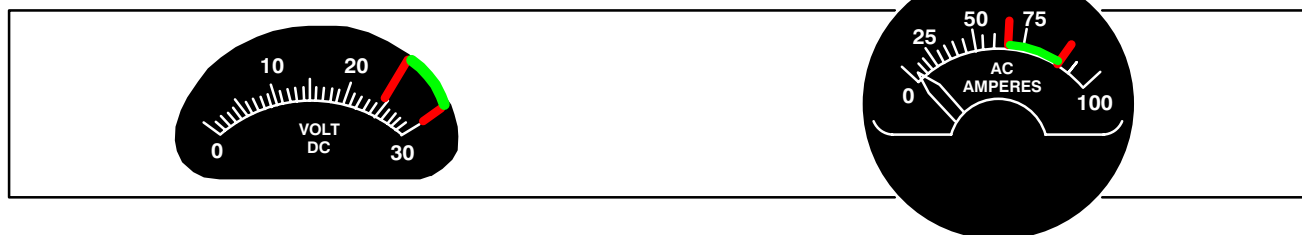


FREQUENCY METER

- 420 CYCLES MAXIMUM ALLOWABLE
- 380 CYCLES TO 420 CYCLES NORMAL
- 380 CYCLES MINIMUM ALLOWABLE

VOLTMETER (AC GENERATORS AND INVERTERS)

- 125 VOLTS MAXIMUM ALLOWABLE
- 110 VOLTS TO 125 VOLTS NORMAL
- 110 VOLTS MINIMUM ALLOWABLE



DC METER

- 30 VOLTS MAXIMUM ALLOWABLE
- 25 TO 30 VOLTS NORMAL
- 25 VOLTS MINIMUM ALLOWABLE

AMMETERS (SPINNER ANTI-ICING, SPINNER DEICING, AND BLADE DEICING)

- 90 AMPS MAXIMUM ALLOWABLE
- 65 AMPS TO 90 AMPS NORMAL
- 65 AMPS MINIMUM SUFFICIENT



AC LOADMETER

- 1.05 MAXIMUM ALLOWABLE
- 0 TO 1.05 NORMAL

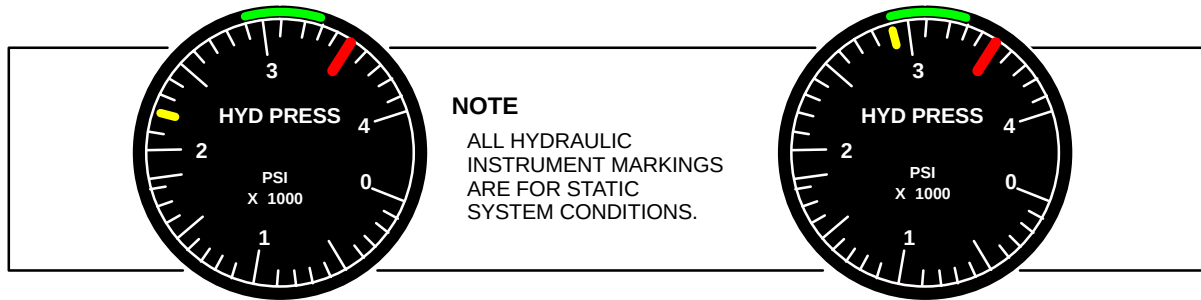
DC LOADMETER

- 1.03 MAXIMUM ALLOWABLE
- 0 TO 1.03 NORMAL

NOTE

ATM GENERATOR 1.0 MAX LOAD WITH COOLING AIR, 0.66 MAX LOAD WITHOUT COOLING AIR, OR IF OUTSIDE TEMPERATURE IS ABOVE 40 °C (104 °F).

Figure 5-1 (Sheet 3 of 5)



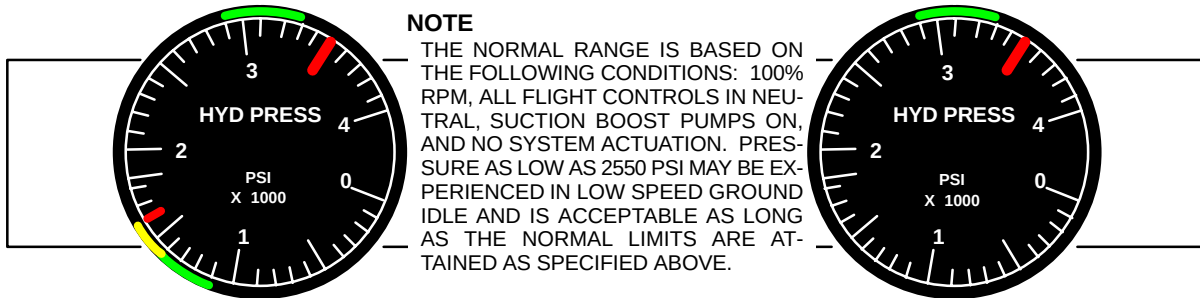
NOTE
ALL HYDRAULIC
INSTRUMENT MARKINGS
ARE FOR STATIC
SYSTEM CONDITIONS.

NORMAL BRAKE PRESSURE

- 3,500 PSI MAXIMUM ALLOWABLE
- 2,900 PSI TO 3,200 PSI NORMAL
- 2,250 PSI MINIMUM PRESSURE,
ONE BRAKE APPLICATION REMAINING

EMERGENCY BRAKE PRESSURE

- 3,500 PSI MAXIMUM ALLOWABLE PRESSURE
- 2,900 PSI TO 3,300 PSI NORMAL
- 2,900 PSI MINIMUM PRESSURE,
ONE BRAKE APPLICATION REMAINING



NOTE
THE NORMAL RANGE IS BASED ON
THE FOLLOWING CONDITIONS: 100%
RPM, ALL FLIGHT CONTROLS IN NEU-
TRAL, SUCTION BOOST PUMPS ON,
AND NO SYSTEM ACTUATION. PRES-
SURE AS LOW AS 2550 PSI MAY BE EX-
PERIENCED IN LOW SPEED GROUND
IDLE AND IS ACCEPTABLE AS LONG
AS THE NORMAL LIMITS ARE AT-
TAINED AS SPECIFIED ABOVE.

**RUDDER BOOSTER PRESSURE
(UTILITY AND BOOST)**

- 3,500 PSI MAXIMUM ALLOWABLE PRESSURE
(15% TO 100% FLAPS)
- 1,600 PSI MAXIMUM ALLOWABLE PRESSURE
(0% TO 15% FLAPS)
- 2,900 TO 3,200 PSI NORMAL
(15% TO 100% FLAPS)
- 1,100 PSI TO 1,400 PSI NORMAL
(0% TO 15% FLAPS)
- 1,400 PSI TO 1,600 PSI CAUTION
(0% TO 15% FLAPS)

**HYDRAULIC PRESSURE
(UTILITY AND BOOST)**

- 3,500 PSI MAXIMUM ALLOWABLE
- 2,900 PSI TO 3,200 PSI NORMAL



**FIRE EXTINGUISHER SYSTEM
PRESSURE GAUGE**

- 600 TO 640 PSI NORMAL
PRESSURE AT 70 °F.

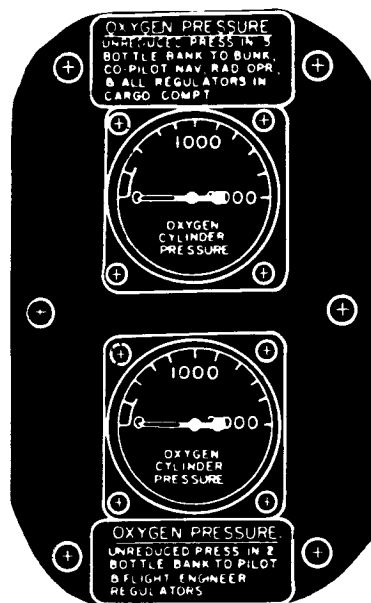
FIRE EXTINGUISHER SYSTEM PRESSURE GAUGE READINGS					
Temperature DEG C DEG F		Gauge Reading			
		Minimum CB DB		Maximum CB DB	
-7	20	535	490	605	570
-1	30	545	510	615	590
4	40	555	530	625	610
10	50	565	550	635	625
16	60	575	565	645	645
21	70	585	580	655	660
27	80	595	595	665	675
32	90	610	610	680	685
38	100	620	620	690	695
43	110	635	630	705	710
49	120	645	640	715	720
60	140	675	660	745	735
82	180	705	675	775	750

Figure 5-1 (Sheet 4 of 5)



1600 SERIES, CG 1790, AND 1700 SERIES
APU EXHAUST GAS TEMPERATURE

- █ 650 °C MAXIMUM ALLOWABLE
- █ 260 °C TO 650 °C NORMAL

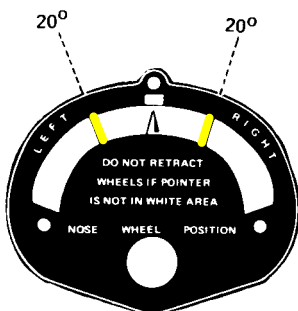


OXYGEN TANK PRESSURE GAUGES

OXYGEN SYSTEM PRESSURE GAUGES
1800 PSI MAXIMUM (FULL) TO
200 PSI NORMAL USABLE RANGE

NOTE

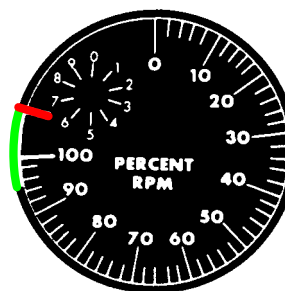
IN CASE OF EMERGENCY, OXYGEN USAGE
MAY BE CONTINUED UNTIL SYSTEM IS EMPTY
(0 PSI)



NOSE WHEEL POSITION INDICATOR



TURN LIMIT IS 20 DEGREES
WHEN GROSS WEIGHT EXCEEDS
155,00 POUNDS OR TAXI SPEED
IS 20 KNOTS OR HIGHER REGARDLESS
OF RUNWAY TERRAIN CONDITIONS.



1600 SERIES, CG 1790, AND 1700 SERIES
APU TACHOMETER

- █ 106 PCT MAXIMUM ALLOWABLE
- █ 95 PCT TO 105 PCT NORMAL (GENERATOR OPERATION)

Figure 5-1 (Sheet 5 of 5)

Engine and Propeller Limitations

ENGINE LIMITS						
ENGINE CONDITION	TIT °C	RPM %	OIL PRESSURE (PSIG)		OIL TEMP °C	MAXIMUM INDICATED TORQUE IN-LB
			R/G 	P/S 		
GROUND OPERATION						
START LIMITS	See sheet 2		Positive oil pressure indication by 35% RPM		<u>100</u> -40	
LOW SPEED GROUND IDLE		<u>75.5</u> <u>69</u>	<u>250</u> 	100 (Start and warm-up only)	85 to <u>100</u> for 30 minutes (flight idle and below) then 85	<u>Minimum</u> until oil temperature is above 0 °C
NORMAL GROUND IDLE		<u>102</u> <u>94</u>	<u>250</u> 	60		
MAXIMUM REVERSE		<u>106</u> <u>96</u>			-40 to 40 for start and warm-up only	
FLIGHT IDLE		<u>100.5</u> <u>92.5</u>	<u>150</u> 	<u>50</u> 	<u>-40</u>  	<u>4,500</u> maximum at oil temperature 0 to 40 °C.
TAKEOFF						
TAKEOFF (5 minutes)	<u>1083</u> <u>1067</u>	<u>102</u> <u>98</u>	<u>250</u> <u>150</u>	<u>60</u> <u>50</u>	85 to <u>100</u> for 5 minutes then: <u>85</u> 60-85 <u>40</u> and increasing	<u>19,600</u>
FLIGHT OPERATION						
MILITARY (30 minutes)	<u>1049</u>	<u>102</u> <u>98</u>	<u>250</u> <u>150</u>	<u>100</u> (Start and warm-up only) <u>60</u> <u>50</u>	85 to <u>100</u> for 5 minutes then <u>85</u> 60-85	<u>19,600</u>
CLIMB	<u>1010</u>					<u>19,600</u>
 <u>5</u> MAXIMUM CONTINUOUS	<u>1010</u>					<u>40</u> and increasing

NOTE

 Under stable conditions, allowable fluctuation is ± 10 psi (20 psi excursion) for power section and ± 20 psi (40 psi excursion) for reduction gear section.

 250 psi may be exceeded during start warm-up.

 If pressure is below 50 psig at low speed ground idle, condition is acceptable provided pressure is within limits at 100% rpm with oil temperature normal.

 Operation below 150 psig when rpm is below 100% is permitted if 150 psig can be maintained at 100% rpm, with oil temperature normal.

 Use of maximum continuous TIT during cruise will reduce engine turbine life.

 -40 °C is the minimum oil temperature for Mobil Jet Oil 254.

Figure 5-2 (Sheet 1 of 2)

OVERTEMPERATURE OPERATION

STARTING OVERTEMPERATURE

CONDITION	ACTION REQUIRED
TIT exceeds 830 °C (excluding momentary peaks at 94% rpm)	Record on Form 4377
TIT exceeds 850 °C (excluding momentary peaks at 94% rpm)	Discontinue the start and record on Form 4377. One restart is permitted after cooling to below 200 °C TIT. If TIT exceeds 850 °C on second start, discontinue start and record. Restart is not recommended.
TIT exceeds 965 °C	Discontinue the start and record on Form 4377. (An overtemperature inspection is required.)

A torch other than normal enrichment burst requires an overtemperature inspection.

STARTING UNDERTEMPERATURE

CONDITION	ACTION REQUIRED
TIT 720 °C or less	Record on Form 4377. Maintenance action required prior to flight.
TIT between 721 °C – 750 °C	Record on Form 4377. Perform temperature controlling check in accordance with Section II E. Low starting temperature may indicate burned thermocouples or a low temp datum start setting. If a TIT indication system malfunction is suspected, maintenance action is required prior to flight.

POWER ACCELERATION PEAK

Exceeds 1083 °C for more than 5 seconds or exceeds 1175 °C momentarily.	Reduce power to hold temperature within limits. Record on Form 4377. (Overtemperature check/inspection required before next flight.)

STARTER OPERATING LIMITS

1-minute ON, 1-minute OFF, 1-minute ON, 5 minutes OFF, 1-minute ON, 30 minutes OFF
(CG 1790 and 1700 series Start valve open light should extinguish within 15 seconds after starter switch is released.)

PROPELLER GOVERNING LIMITS

Normal limits. (Normal or Mechanical Operation) 98.0 – 102.0 percent
If a stable RPM cannot be maintained, excluding allowable cyclic variations of plus (+) or minus (–) 0.5% (total of 1%), refer to PROPELLER MALFUNCTIONS in Section III. (Cyclic variation of plus(+) and minus(–) 0.5% is actually 1/2% on either side of a stable RPM for a total of 1%.)

PROPELLER AUXILIARY PUMP OPERATING LIMIT

1-minute ON, 1-minute OFF, not to exceed 2 minutes operation in any 30 minute period.

NOTE

Underscored values on sheet 1 denote limits; values not underscored on sheet 1 denote normal operating values. All limits on this figure are flight station limits and are not to be confused with maintenance manual limits.

Figure 5–2 (Sheet 2 of 2)

Fuel Availability Chart

	MILITARY SPECIFICATION	FUEL GRADE	NATO SYMBOL	FREEZE POINT °C (°F)	COMMERCIAL DESIGNATION
RECOMMENDED FUELS					
	MIL-T-5624	JP-4 	F-40	-58 (-72)	
ALTERNATE FUELS					
HIGH FLASH POINT KEROSENE	MIL-T-5624	JP-5 	F-44 	-47 (-52)	
		JP-5B	F-42	-37 (-34)	
				-50 (-58)	JET B
	MIL-T-83133	JP-8	 F-34	-47 (-52)	JET A-1
KEROSENE			F-34	-40 (-40)	JET A
			F-34  F-35	-50 (-58) -50 (-58)	JET A-1
EMERGENCY FUELS					
LEADED AVIATION GASOLINE (NOT CONTAINING TCP)	MIL-G-5572	80/87	F-12	-60 (-76)	AvGas 80/87
	MIL-G-5572	100/130	F-18	-60 (-76)	AvGas 100/130
	MIL-G-5572	115/145	F-22	-60 (-76)	AvGas 115/145

NOTE

1. FUELS LISTED FROM TOP TO BOTTOM IN ORDER OF PREFERENCE

 CONTAINS FUEL SYSTEM ICING INHIBITOR (FSII)

 DOES NOT CONTAIN FUEL SYSTEM ICING INHIBITOR (FSII)



To avoid fuel freezing, fuel temperature shall not be lower than 4 °C (6 °F) above the freeze point defined in figure 5-3. The fuel temperature should be considered to be equal to the indicated OAT (stagnation temperature). If the OAT drops below the above limit, the airplane should be moved to an area where temperatures are higher.

Figure 5-3

Fuel Characteristics

PROPERTY	MIL-T-5624		MIL-T-83133	ASTM-D-1655			MIL-G-5572
	JP-4	JP-5	JP-8	JET B	JET A-1	JET A	100/300
SPECIFIC GRAVITY (MIN)	0.751	0.788	0.775	0.7507	0.7753	0.7753	— — —
SPECIFIC GRAVITY (MAX)	0.802	0.845	0.840	0.8017	0.8398	0.8398	— — —
SPECIFIC GRAVITY (TYPICAL) 	0.769	0.817	0.805	0.769	0.805	0.817	0.703
DENSITY, POUNDS/GALLON (TYPICAL) 	6.5	6.9	6.7	6.4	6.7	6.8	6.0
FLASH POINT, MIN, °C(°F)	-29(-20) 	60(140)	38(100)	-29(-20) 	38(100)	38(100)	-32(-25) 
VAPOR PRESSURE, (PSI, RANGE)	2.0-3.0	— — —	— — —	2.0-3.0	— — —	— — —	5.5-7.0
FREEZING POINT, MAX, °C(°F)	-58(-72)	-46(-51)	-50(-58)	-50(-58)	-50(-58)	-40(-40)	-60(-76)
VISCOSITY AT -40 °C, (ESTIMATED)	3.6	16.5	15	3.6	15	15	1.2
BTU PER GAL MIN 	115,000	120,000	119,000	115,000	119,000	119,000	109,000 
BTU PER POUND (MIN)	18,400	18,300	18,400	18,400	18,400	18,400	18,700
FUEL SYSTEM ICING INHIBITOR	YES	YES	YES	(OPTIONAL FOR COMMERCIAL FUELS)			NO
CORROSION INHIBITOR	YES	YES	YES	(PERMITTED BY AGREEMENT)			(OPTIONAL)
 — TYPICAL AVERAGE FOR FUELS PROCURED SINCE 1970 IN CONTINENTAL U.S.A.  — VALUE BASED ON MINIMUM FUEL SPECIFIC GRAVITY FROM SPECIFICATION AND REPORTED TO THREE SIGNIFICANT FIGURES  — VALUE BASED ON TYPICAL FUEL SPECIFIC GRAVITY  — TYPICALLY MEASURED VALUES, NO SPECIFICATION REQUIREMENT STATED							

Figure 5-4

figures 5-3 and 5-4.) Mixing of these fuels with each other or with NATO equivalents of these fuels is permissible. In this case, the mixture will be considered as the grade which predominates in the mixture, and all operations will be in accordance with the operating instructions for that grade.

The following defines fuel categorizations:

1. Recommended Fuel: A fuel which has been determined through engine qualification testing to satisfactorily perform in affected engines under all conditions.
2. Alternate Fuel: A fuel which can be used with a possible loss of efficiency. The use of this fuel might result in increased maintenance or overhaul cost. Limitations of significant nature such as reduced rate of climb, altitude, range, etc., properly places a fuel in the alternate rather than recommended category.
3. Emergency Fuel: A fuel which will cause significant damage to the engine or other systems; therefore, its use is limited to a one-time flight.

The following fuels are listed in order of preference:

1. Recommended Fuels: Specification MIL-T-5624, JP-4.
2. Alternate Fuels:
 - a. Specification MIL-T-5624, JP-5.
 - b. High flash point kerosene (JP-5 type, JP-8 type).
 - c. Kerosene fuels, and Jet A and Jet A-1.
3. Emergency Fuels: Aviation gasoline (leaded grades) 80/87, 100/130, 115/145 not containing TCP.

See figures 5-3 and 5-4 for fuels that may be used in the T56-A-15 engine.



NATO fuels F-30 and F-42 should not be used if mission requirements necessitate operation in temperatures below -37°C (-34°F). NATO fuels F-34 and F-44 should not be used if temperatures below -47°C (-52°F) are anticipated on the ground.



The presence of even relatively small quantities of TCP results in severe erosion, scaling, and pitting of the first stage turbine nozzle vanes and the turbine inlet thermocouples. Automotive gasoline is not acceptable due to the common use of TCP and a variety of other undesirable additives. The use of aviation gasoline containing tetraethyl lead (grades 80/87, 100/130, and 115/145) must be held to a minimum due to the heat absorbing quality of the lead coating which is deposited in the turbine section. If engines have operated an accumulated total of 50 hours on emergency fuels, the hot section of the engine must be inspected. When aviation gasoline is used, decreased lubrication of all fuel components can be expected. Further, continued use of aviation gasoline will result in engine power loss and decreased engine operating efficiency.

The engine power available when using alternate or emergency fuels is not affected in electronic fuel scheduling, since a specific turbine inlet temperature is scheduled for each throttle position. However, external temperature datum valve adjustment may be necessary for consistent engine starts when using alternate or emergency fuels.



When attempting a start with JP-5 and kerosene type fuels at ambient temperatures below -37°C (-35°F), the TIT and RPM should be closely monitored since stall and overtemperature may be experienced during the start.

NOTE

Refer to T.O. 42B1-1-14 for additional fuel usage data.

HIGH RATES OF CLIMB

High rates of climb may create a fuel boiling-venting problem. The rate of climb should be restricted to the values shown in the following table, depending on the fuel used and the fuel temperature. (All figures estimated.)

Type of Fuel	Fuel Temperature, Start of Mission	Rate of Climb
JP-4	Up to 52 ° C (125 ° F)	Not restricted
JP-5, JP-8	Up to 57 ° C (135 ° F)	Not restricted
JP-4	52 ° C (125 ° F) to 57 ° C (135 ° F)	Max rate of climb to 29,000 ft. Above 29,000 ft, 300 ft/min.
Aviation gasoline	27 ° C (80 ° F) to 32 ° C (90 ° F)	Max rate of climb to 30,000 ft. Above 30,000 ft, 300 ft/min.
Aviation gasoline	32 ° C (90 ° F) to 38 ° C (100 ° F)	Max rate of climb to 24,000 ft. Above 24,000 ft, 300 ft/min.
Aviation gasoline	38 ° C (100 ° F) to 43 ° C (110 ° F)	Max rate of climb to 18,000 ft. Above 18,000 ft, 300 ft/min.
Aviation gasoline	43 ° C (110 ° F) to 49 ° C (120 ° F)	Max rate of climb to 14,000 ft. Above 14,000 ft, 200 ft/min.

When using high vapor pressure fuel, loss of fuel can be incurred during climb by boil-off due to volatility, and by slugging. Slugging occurs as a result of fuel frothing and departing vapors entraining large quantities of froth while spewing from the vents. Foaming tendencies are aggravated by high vapor pressures, low ambient pressures, high initial fuel temperatures, high rates of climb, and presence of kerosene or JP-4 (10 percent or more) with the gasoline.

CAUTION

If it is necessary to use aviation gasoline with turbine fuels, foaming may occur.

Loss of fuel due to boil-off and slugging should occur in a relatively short period following arrival at boiling altitude. All such losses should be assumed to occur during climb. As with JP-4, JP-5 turbine fuel is characterized by low volatility; therefore, boil-off and slugging are considered unlikely. Aviation gasoline has relatively high volatility and, under normal operating conditions, boil-off and slugging are likely to occur.

The following table demonstrates the estimated loss of range due to boil-off when using aviation gasoline:

Fuel Temperature	Approximate Loss of Range When Climbing to These Cruise Altitudes	
	25,000 Ft.	35,000 Ft.
52 ° C (125 ° F)	12 percent	20 percent
43 ° C (110 ° F)	8 percent	15 percent
32 ° C (90 ° F)	3 percent	10 percent
21 ° C (70 ° F)	0 percent	5 percent

EFFECT OF ALTERNATE FUEL ON RANGE

The BTU content per pound of all fuels does not vary significantly; therefore, the range will depend primarily on the pounds of fuel aboard.

For a given volume of fuel, the approximate variation of range, using JP-4 as the basis for comparison, is: JP-5, six percent greater range; aviation gasoline, eight percent less range; high flash point (NATO standardized F-34 type), four percent greater range.

NOTE

For maximum total wing tank fuel weight refer to figure 1A-38 for servicing limits and to figure 5-5 for operational limits.

AIRSPEED LIMITATIONS

The limiting airspeed for a mission is interrelated with the cargo weight and maneuver load factors required for the mission and the gust load that may be encountered in turbulence. Recommended and maximum airspeeds are shown on the Limit Flight Speed vs. Altitude Chart of figure 5-5. These speeds are referenced to specific fuel-cargo combinations

on the Weight Limitations Chart of figure 5-5 and to the allowable maneuver load factors. Any cruise speed up to the recommended speed may be utilized up to and including moderate turbulence.

NOTE

Operation in the areas between recommended speed limits and maximum speed limits is permissible for initiating penetrations from 20,000 feet at 250 knots provided the corresponding maneuver load factors are not exceeded.



Maximum speed limits should never be exceeded. Maneuver load factors and weight limitation should be carefully observed.

The airplane should not be operated in conditions of severe turbulence because gusts can be encountered that may impose excessive loads. However, if flight in severe turbulence cannot be avoided, flight should be in the range of 65 KIAS above power-off stalling speed for the operating gross weight not to exceed 180 KIAS. (See figure 6-1.)

Never exceed the following indicated airspeeds for the condition noted:

1. FLAPS EXTENDED

Percentage	Airspeed (KIAS)
10	220



Avoid abrupt or full rudder deflection with flaps lever positioned 15 percent or greater (high rudder boost) and airspeed 210 KIAS or greater.

20	210
30	200
40	190
50	180
60	165
70	155
80	150
90	145
100	145

2. LANDING GEAR EXTENDED

Do not exceed 165 KIAS with the landing gear extended.

3. CARGO DOOR AND/OR RAMP OPEN

Do not exceed 150 KIAS with the ramp (or ramp and aft cargo door) open regardless of whether the paratroop doors are open or closed or the position of the air deflectors. Do not exceed 185 KIAS with the ramp up and locked and cargo door open.

4. PARATROOP AIR DEFLECTORS

Do not exceed 150 KIAS when operating the paratroop air deflectors or with the air deflectors extended regardless of whether the paratroop doors are open or closed.

5. PARATROOP DOORS

Do not exceed 150 KIAS while opening or closing the paratroop doors. Do not exceed 250 KIAS with the paratroop doors open.

6. LANDING LIGHTS/SEARCH LIGHTS EXTENDED

Do not exceed 250 KIAS when operating with the Landing/Search lights extended.

7. PAINTED FLIGHT CONTROL SURFACES

Do not exceed 250 KIAS when any flight control surface is painted, unless the following has been accomplished:

- a. The underside of the ailerons and elevators and either side of the rudder have been stenciled as follows.



Subsequent repainting is restricted to minor touch-ups unless performed at depot level.

or

Only minor touch-up is authorized. Repaint in accordance with T.O. 1C-130H-2-2.

8. LANDING GEAR DOORS REMOVED

NOTE

Flight with the doors removed will be accomplished only when authorized or directed by the Commanding Officer concerned.

Maximum speed 200 KIAS. Flight is only permitted with the various doors removed in the following manner:

Main	All doors of the affected
Landing	wheel well must be removed.
Gear	(MLG may be up or down.)

Nose	(1) Both forward and
Landing	aft doors removed,
Gear	or (2) aft nose door
	removed with forward
	door installed.



Flight is not permitted with the forward nose gear door removed with the aft door installed.

ACCELERATION LIMITATIONS

Never exceed the structurally-safe maneuver load factor for the applicable flight condition and for the airplane load distribution. The limit load factor for the fuel load and cargo load combination is given in the Weight Limitations Chart (figure 5-5). Do not exceed 60-degree angle of bank. The airplane is equipped with an accelerometer for the determination of g loading. Since feel is often misleading, particularly when the pilot's attention is diverted or distracted, abrupt and unnecessary maneuvering must always be avoided.

LOAD FACTORS

A load factor is the ratio of the load imposed on the object to the weight of the object. It is expressed in terms of g's; 1.0 being one times the weight of the object. The letter "G" stands for gravity, the accelerating pull the earth exerts on all objects. Since gravity is an acceleration, it is easy to understand that other types of acceleration also can produce load factors. The accelerations in which the pilot is most interested occur as a result of changes in his flight path, such as turns, pull-ups, and touchdowns on landings.

NOTE

To avoid overstressing the aircraft due to the compounding effects of maneuvers made in two axes, rolling pullouts should be avoided. Similarly, avoid flight control reversals prior to the aircraft stabilizing, following a control input.

Because the airplane structure (particularly the wings) can only withstand certain maximum forces acting on it, it is nec-

essary to limit the number of g's (the load factor) which may be safely applied. A load factor in excess of these safety limits may result in structural damage to the airplane.

NOTE

The wing load factors on the weight limitations chart are valid only when the fuel sequence in FUEL MANAGEMENT, Section II, is followed.



Operation of the airplane in area D of the weight limitations chart is authorized only with a standard sequence fuel load.



It is not recommended that airplanes be operated at a gross weight exceeding 175,000 pounds. To do so may subject the airplane to structural damage or failure.



The maximum maneuver load factor, regardless of cargo load, with any flap extension is 2.0g in symmetrical maneuvers and 1.5g in unsymmetrical maneuvers.

WEIGHT LIMITATIONS

Weight, more than any other single factor, determines the capability and performance of an airplane. In airplane design, weight always has been a primary restrictive factor as it has a direct effect on airplane configuration, power, and range. An airplane is designed with sufficient strength to accomplish a certain basic mission without undue allowance for overloading or improper weight distribution. When an airplane is loaded beyond the established limits, ceiling and range are decreased, stall speeds become higher, and rate of climb suffers. In addition, the wings are more vulnerable to air loads during maneuvers or flight through turbulent air. These resultant effects can reach serious proportions when weight limitations are disregarded. For summary of weight limitations see figure 5-5 sheet 6 of 6.

NOTE

The gross weight of the airplane should never exceed that required for the mission, since unnecessary risk and wear of the equipment will otherwise result. The consideration of takeoff gross weights must also take into account the available runways, surrounding terrain, altitude, atmospheric conditions, mission requirements, and the urgency of the mission.

NOTE

The Weight Limitations chart is valid only when the fuel sequence in FUEL MANAGEMENT, Section II, is followed.

AIRPLANE WEIGHT LIMITS

Do not exceed the fuel quantities specified in Fuel Servicing Capacities Table in figure 1A-38.

The following are the airplane weight limits for the indicated conditions:



Emergency War Planning (EWP) gross weights are not for peace time operation unless approved by the COMDT (G-OCA-2).

Maximum Taxi Gross Weight

Observe the limitations given in TAXI AND GROUND LIMITATIONS of this section.

Maximum Takeoff Gross Weight

Takeoff gross weights must take into account the available runways, surrounding terrain, airfield elevation, atmospheric conditions, mission requirements, and the urgency of the mission.

NOTE

Gross weights exceeding those required for the mission will result in unnecessary risk and wear of the airplane.

MAXIMUM LANDING GROSS WEIGHTS

The airplane is designed to be able to land at any gross weight up to the maximum for takeoff provided limiting relationships between landing gross weight, contact rate of sink, and fuel weight are observed. The airplane is designed for a maximum contact rate of sink of 540 feet per minute at gross weights up to the normal landing gross weight with the fuel weight limitations given on the Weight Limitations Chart, figure 5-5 sheet 2 of 6 or sheet 4 of 6.

The airplane may be landed at a contact rate of sink of 300 feet per minute at the maximum landing gross weight, which is equal to the maximum takeoff gross weight, or with capacity fuel.

NOTE

Although the airplane can be landed at the maximum landing gross weight/(EWP), it is recommended that fuel be dumped to reduce gross weight.

NOTE

The service life of the airplane will be increased if fuel is managed so that landings are made with no fuel in the external tanks and at gross weights less than 130,000 pounds.

OPERATION WITH 215 PSIG MAIN GEAR STRUT PRESSURE

It is permissible to land the airplane with 25,000 pounds of wing fuel remaining, in standard fuel sequence, at gross weights up to 130,000 pounds, provided the limit contact sinking speed does not exceed nine feet per second (540 feet per minute). It is permissible to land the airplane at a contact sinking speed of nine feet per second, at gross weights up to 130,000 pounds, with more than 25,000 pounds of fuel. However, fuel must be managed so that each outboard tank contains no more than 6,600 pounds of fuel and the fuel-payload values shown by the landing rate of sink reference line of figure 5-6 are followed. The limit rate of sink for all gross weights is five feet per second (300 feet per minute) if the fuel in either outboard wing tank exceeds 6,600 pounds.

OPERATION WITH 285 PSIG MAIN GEAR STRUT PRESSURE

It is permissible to land the airplane with 20,250 pounds of wing fuel remaining, in standard fuel sequence, at gross weights up to 130,000 pounds, provided the limit contact speed does not exceed nine feet per second (540 feet per minute).

It is permissible to land the airplane at a contact speed of nine feet per second, at gross weights up to 130,000 pounds, with more than 20,250 pounds of fuel. However, fuel must be managed so that each outboard tank contains no more than 5,420 pounds of fuel and the fuel-cargo values shown by the landing rate of sink reference line of figure 5-5 sheet 2 of 6 are followed. The limit rate of sink for all gross weights is five feet per second (300 feet per minute) if the fuel in either outboard wing tank exceeds 5,420 pounds.

OPERATION WITH 450 PSIG MAIN STRUT PRESSURE (modified by CGTO 93200.0) (Soft Struts)

It is permissible to operate the airplane for taxi and takeoff with a total fuel weight of 62,842 pounds of JP-4 or 65,742 pounds of JP-5. It is also permissible to land the airplane with 25,000 pounds of wing fuel remaining, in standard fuel sequence, at gross weights up to 130,000 pounds, provided the limit contact sinking speed does not exceed nine feet per second (540 feet per minute). It is permissible to land the airplane at a contact sinking speed of nine feet per second, at gross weights up to 130,000 pounds, with more than 25,000 pounds of fuel. However, fuel must be managed so that each outboard tank contains not more than 6,600 pounds of fuel and fuel payload values shown by the landing rate of sink reference line of figure 5-5 sheet 4 of 6 is followed. The limit rate of sink for all gross weights is five feet per second (300 feet per minute) if the fuel in either outboard wing tank exceeds 6,600 pounds.

Primary Fuel Management

On airplanes not modified by CGTO 93200.0, the primary fuel management is based on JP-4 fuel at the standard day density of 6.5 pounds per gallon. On those airplanes modified by CGTO 93200.0, fuel management is based on JP-5 fuel at a standard day density of 6.8 pounds per gallon. This does not preclude the use of either JP-4 or JP-5 fuel by Coast Guard aircraft. The following distribution requirements define the primary fuel management:

- a. Maximum usable fuel weights are those shown in figure 1A-38 for JP-4 and/ JP-5 fuel.
- b. Tanks No. 1 and No. 4 always contain 500 to 1,000 pounds more fuel per tank than tanks No. 2 and No. 3, except when usable fuel in these tanks is less than 1,000 pounds.

- c. The main tanks are full except for fuel used for taxi and takeoff, when the external and/or auxiliary tanks contain usable fuel.
- d. Fuel asymmetry is within limits specified by the AIRSPEED LIMITATIONS and FUEL UNBALANCE LIMITS paragraphs in this section.

NOTE

Do not exceed the usable fuel weights per tank for JP-4 or JP-5 fuel as shown in the FUEL SERVISING CAPACITIES TABLE, figure 1A-38.

Secondary Fuel Management

NOTE

Due to the negative effects of using secondary fuel management on the aircraft structure, these procedures should be used only when operationally necessary.

Any fuel management which fails to meet the requirements for primary fuel management is defined as a secondary fuel management. This will occur any time there is usable fuel in the external and/or auxiliary tanks and the main tanks are partly filled, or when the 500 to 1,000 pound difference between inboard and outboard main tank is not observed. An extreme case would be operation with tanks No. 1 and No. 4 or tanks No. 2 and No. 3 empty. The fuel asymmetry limits for secondary fuel management are the same as for primary fuel management.



The airplane should be flown with tanks No. 1 and No. 4 empty only in an emergency or when it must be ferried to another base for repair of a fuel leak in either of these tanks.

NOTE

Although not required for secondary management, it is recommended that the 500 to 1,000 pounds difference between inboard and outboard main tanks for primary fuel management be observed for secondary fuel management whenever possible.

NOTE

Effects of secondary fuel management on aircraft service life and inspection requirements have not been established; therefore, secondary fuel management should be used advisedly, especially when operating near the gross weight limit for the applicable maneuver or airspeed.

Weight Limitations Chart (Primary Fuel Management)

The Weight Limitations Chart (Primary Fuel Management) (figure 5-5 sheets 2 of 6 or 4 of 6) shows the design weight capabilities of the airplane. This chart may be used in three ways:

- a. With operating weight, cargo weight, and fuel weight established, determine airspeed and maneuver limitations.
- b. With operating weight, cargo weight, and/or maneuver requirements established, determine maximum and minimum fuel or gross weight.
- c. With operating weight, fuel weight, airspeed and/or maneuver requirements established, determine maximum cargo weight.

Weight Limitations Chart (Secondary Fuel Management)

The Weight Limitations Chart (Secondary Fuel Management) (figure 5-5 sheets 3 of 6 or 5 of 6) is derived from the Weight Limitations Chart (Primary Fuel Management). Airspeed and maneuver limitations for Areas A, B, and C of the charts for secondary fuel management are the same as for primary fuel management. Landing gross weight and fuel weight limits for secondary fuel management are the same as primary fuel management.

The Weight Limitations Chart (Secondary Fuel Management) is entered on the inboard fuel scale. The entry fuel weight on sheet 3 of figure 5-5 is the smaller of: (1) the actual weight of fuel in tanks No. 2 and No. 3 or (2) the weight of fuel in tanks No. 1 and No. 4 minus 1,430 pounds. The latter corresponds to the design difference of 715 pounds less fuel per tank in tanks No. 2 and No. 3 than in tanks No. 1 and No. 4, which is used to define the Weight Limitations Chart (Primary Fuel Management).

See sheet 6 of figure 5-5 for landing weight limits.

Maneuvering and Turbulence

During maneuvering and flight through turbulent air, additional loads are imposed on the airplane. These loads, caused by the acceleration of the airplane, are added to the normal 1.0g load which the structure is supporting. The most important structure is that of the wings which must sustain the airplane in flight. As the payload is increased the wings become more and more vulnerable to the loads imposed by turbulence, sudden control movements, or excessive angles of bank. Thus, it is possible to exceed structural strength by the combined forces of weight and air loads. As the maximum weight which an airplane can safely carry is dependent upon its capacity to withstand air loads in accelerated flight, an understanding of air loads is essential.

Operating Weight Effects

The cargo carrying capability of the airplane is determined for a specific operating weight which includes crew, oil, unusable fuel, and standard equipment, but does not include cargo and usable fuel. Since the operating weight of the individual airplanes will vary because of special equipment variations in standard equipment, modifications, and other factors, the cargo weight must be adjusted accordingly by a pound-for-pound trade-off; that is, if 2000 pounds of special equipment are added to an airplane, the cargo capability is reduced by 2000 pounds. To facilitate accounting for a range of operating weights, an operating weight scale is shown on the left side of the Weight Limitations Chart.

Fuel Distribution Effects

The Weight Limitations Chart and the Limit Flight Speed Chart are based on JP-4 fuel at the standard day density of 6.5 pounds per gallon used, according to the fuel sequence given under FUEL MANAGEMENT in Section II. Under these conditions, the outboard tank contains 715 pounds more fuel than the inboard tank (500 to 1000 lbs. is the operational limit).

For flight, this distribution helps reduce wing upbending by maintaining a spanwise center of gravity of the fuel that is outboard of the center of lift on the wing. Fuel carried in the auxiliary and external tanks decreases the cargo capability because of their spanwise location.



It is not recommended that the airplane be flown with less fuel in the outboard tanks than in the inboard tanks. The airplane should be flown with the outboard tanks empty only as an emergency measure.

Fuel in the outboard tanks is limited, as shown in the Weight Limitations Chart, at landing rates of sink exceeding 300 feet per minute.

NOTE

Do not exceed the usable fuel weights per tank shown in the Fuel Quantity Data Table, figure 1A-38.

NOTE

The service life of the airplane will be increased if missions are planned so that landings are made without fuel in the external tanks.

Recommended Loading Areas

The Weight Limitations Chart, sheets 2 through 5 of figure 5-5, has three areas of recommended cargo-fuel combinations or gross weights, provided the associated limits on maneuver load factor and airspeed are observed. These recommended areas are shown in different shades of green. Area A encompasses those cargo-fuel combinations or gross weights for which the maximum symmetrical maneuver load factor is 3.0 g at speeds up to the highest recommended speed, Vh  on sheet 1 of figure 5-5. Areas B and C encompass those cargo-fuel combinations or gross weights for which the maximum symmetrical maneuver load factor is 2.5g and, to preclude excessive forces due to turbulence, the recommended speed is Vh  for Area B and Vh  for Area C.

Cautionary Loading Areas

On sheet 2 of figure 5-5 the cautionary area, Area D, which is shown in yellow, encompasses those cargo-fuel combinations or gross weights which are permissible for Emergency War Planning purposes, but which require extra caution to avoid damaging the airplane. For area D, the recommended speed is Vh  , shown on sheet 1, and the maximum symmetrical maneuver load factor is 2.25g. Limitations given in TAXI AND GROUND LIMITATIONS of this section must be observed.

Loading Area Not Recommended

The red area, Area E, of the Weight Limitations Chart encompasses those cargo-fuel combinations or gross weights which present a high degree of risk of structural damage. Under conditions of extreme emergency, when the risk of damage to the airplane is secondary, the Commanding Offi-

cer will determine if the degree of risk warrants operation of the airplane at loadings appearing in the red zone. Fuel weights in the red area on the right of the chart represent a high risk of damage to the wing structure during ground operation. Cargo weights in the red area at the top of the chart represent a high risk of damage during flight; if used, the maximum symmetrical maneuver load factor is 2.0g and flight through severe turbulence is prohibited. Exceeding the maximum gross weight shown on the chart imposes a high risk of damage to the landing gear and supporting structure during taxi.

NOTE

Whenever flights are conducted at weights shown in the red area of the chart, entry on Form 5181 is required.

WING LIMITATIONS

The loads which the wing will sustain under different combinations of fuel and cargo loading are represented by the lines on the Weight Limitations Chart (figure 5-5), which separates the colored areas.

LANDING GEAR LIMITATIONS

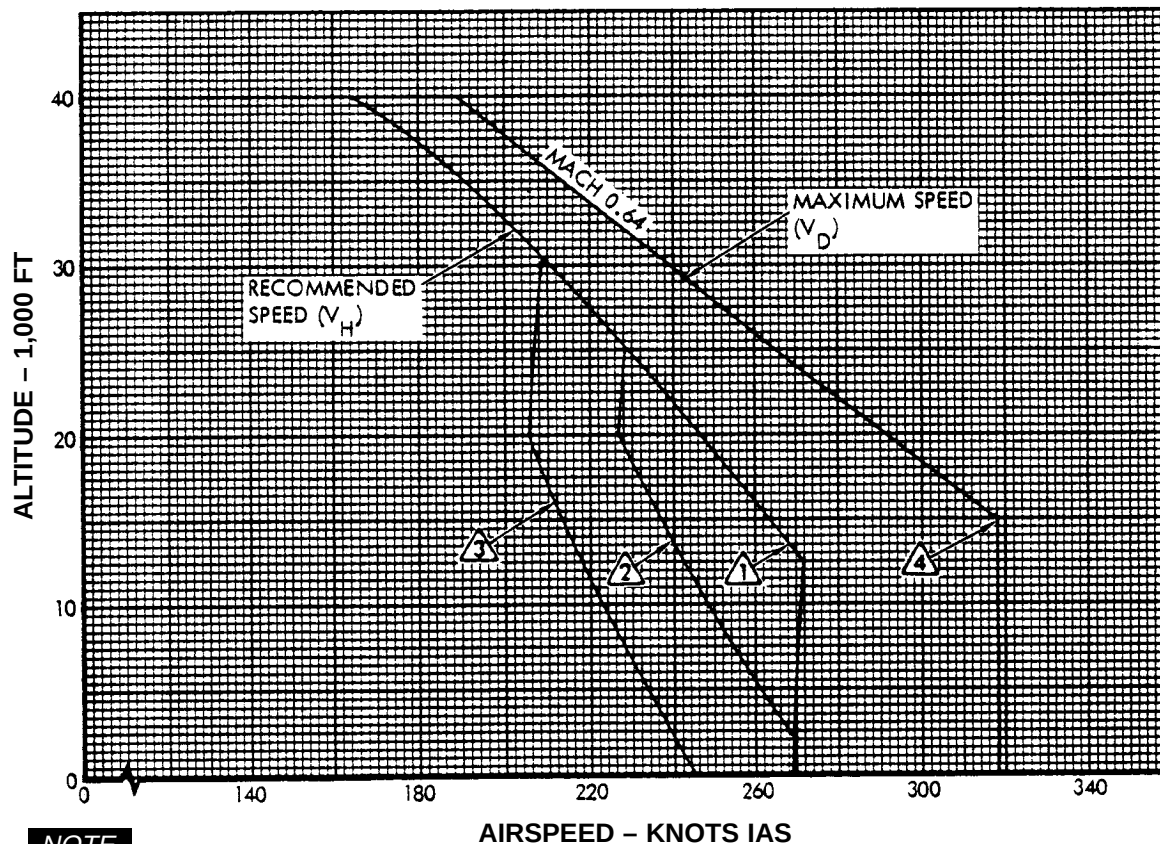
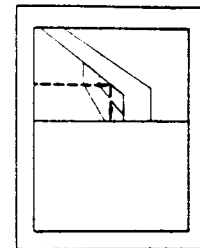


Turns with brakes locked on one side are prohibited. When possible, avoid braking in turns, since damage to landing gear and/or support structures may result. If a stop in a turn is required, record on Form CG 4377. See figure 2A-2 for the minimum space and clearances required for turning.

PERFORMANCE LIMITATIONS

Gross weight is an important factor in determining the structural and performance limitations of an airplane. Added gross weight results in a decreased structural margin of safety and rate of climb, longer takeoff and landing rolls, and greater control forces. If established weight limits are exceeded, the airplane strength and performance may be inadequate. The performance limitations discussed here do not account for the variations in operating conditions. Airplane performance is discussed in the appropriate performance manual (T.O. 1C-130H-1-1.)

Limit Flight Speed Vs Altitude Chart

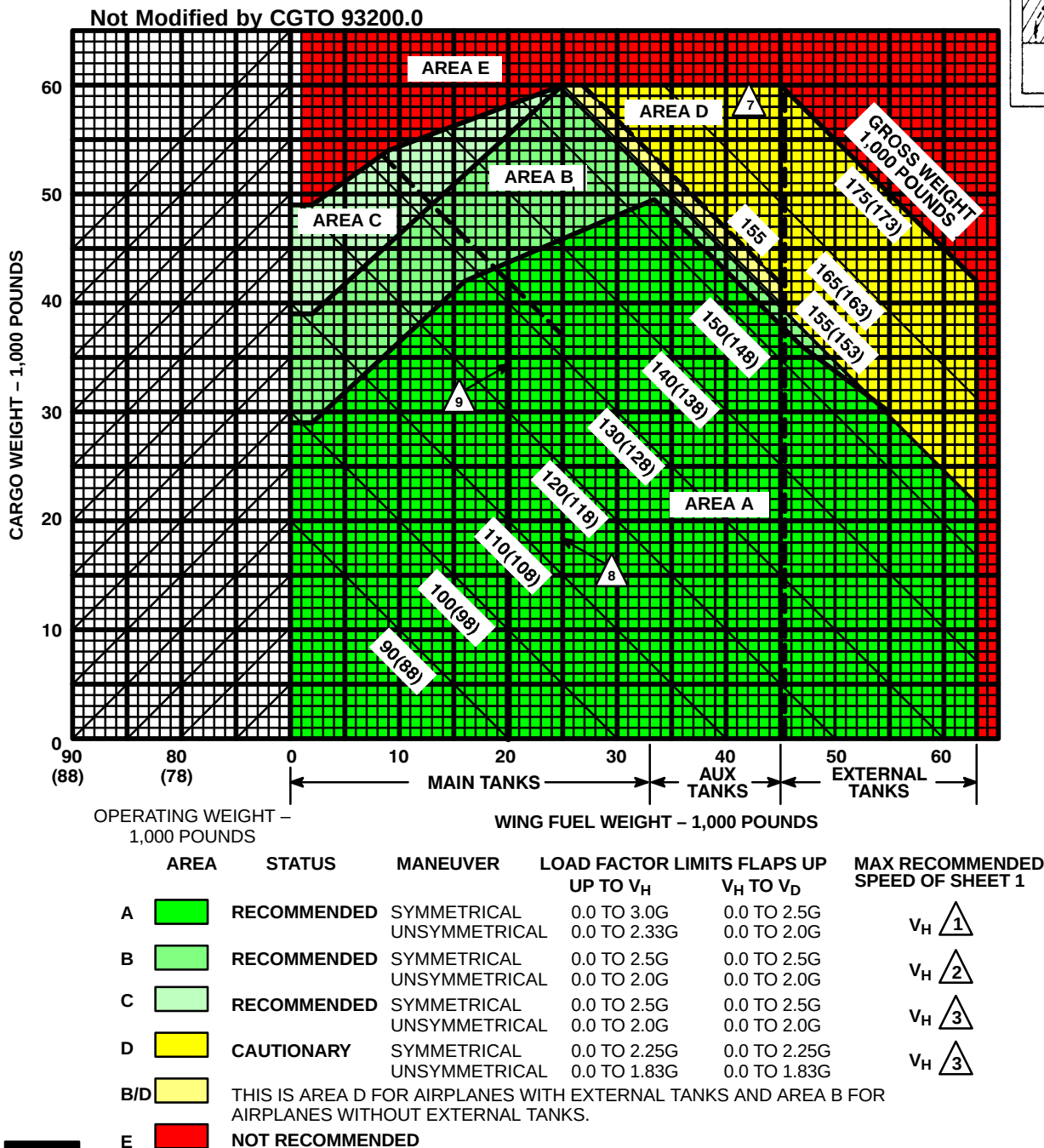
**NOTE****recommended speed** V_H - MAXIMUM RECOMMENDED SPEED FOR AREAS A OF WEIGHT LIMITATIONS CHART. V_H - MAXIMUM RECOMMENDED SPEED FOR AREAS B OF WEIGHT LIMITATIONS CHART. V_H - MAXIMUM RECOMMENDED SPEED FOR AREAS C AND D OF WEIGHT LIMITATIONS CHART.**maximum speed** V_D - MAXIMUM SPEED FOR AREAS A, B, C, AND D OF WEIGHT LIMITATIONS CHART.

5. THIS FIGURE IS BASED ON A SYMMETRICAL FUEL LOAD OF JP-4 (6.5 POUNDS/GAL) AND JP-5 (6.8 POUNDS/GAL).

5a UNSYMMETRICAL MANEUVERS ARE THOSE INVOLVING AILERON INPUTS/DEFLECTIONS (BANKING, TURNING, ROLLING PULLUPS, COUNTERACTING TURBULENCE, ETC.). SYMMETRICAL MANEUVERS INVOLVE NO AILERON INPUTS (SIMPLE CLIMB OR DIVE OR STABILIZED TURN WITH NO AILERON DEFLECTION).

Figure 5-5 (Sheet 1 of 6)

Weight Limitations Chart (Primary Fuel Management)



NOTE CONTINUED

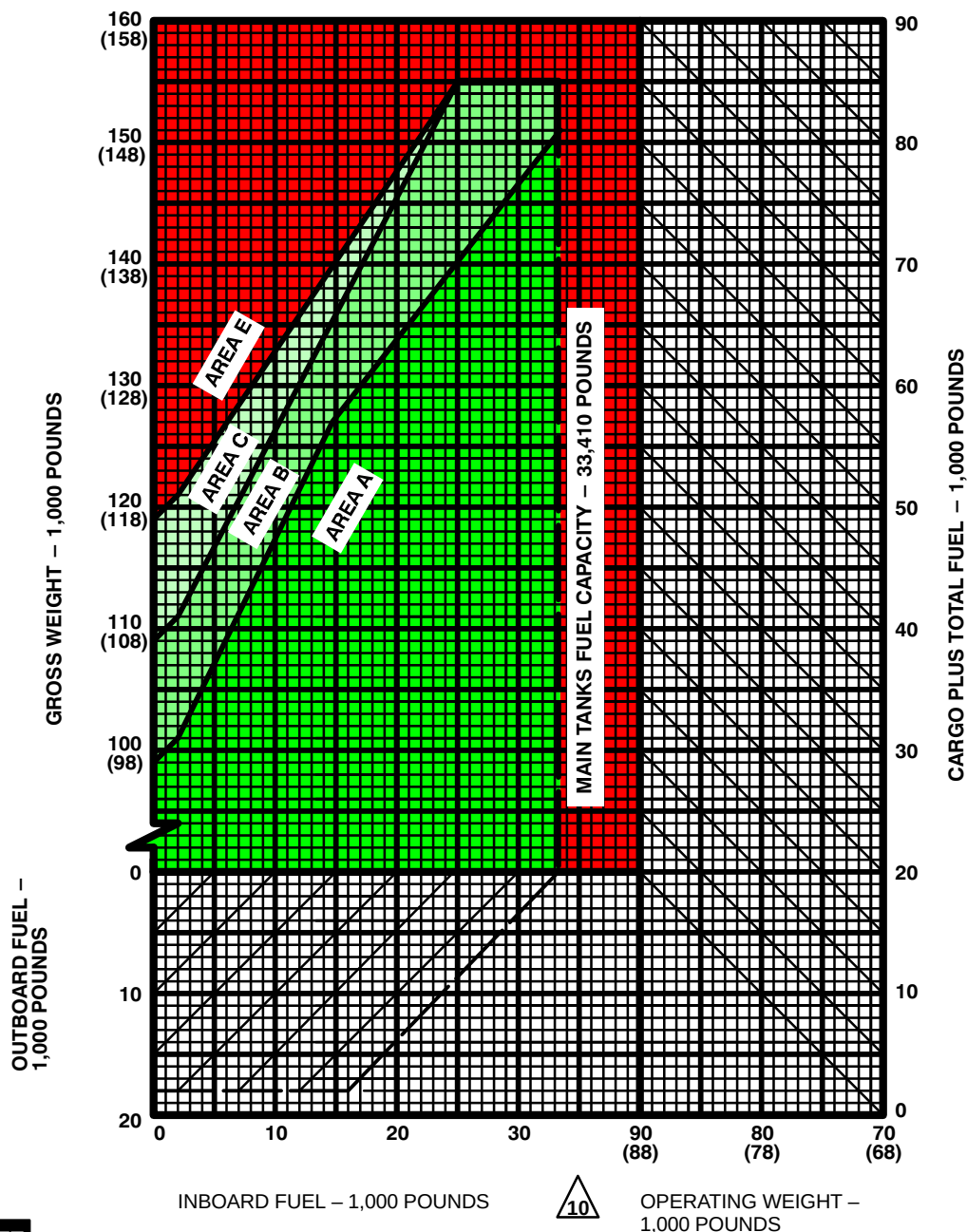
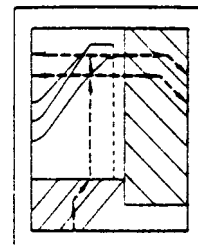
6. WEIGHTS IN PARENTHESES AND BROKEN LINES ARE FOR AIRPLANES WITHOUT EXTERNAL TANKS.

- ⑦ EXCEEDING THE LIMIT LOAD FACTOR OR PERMISSIBLE AIRSPEED CAN RESULT IN STRUCTURAL DAMAGE TO THE AIRPLANE. OBSERVE THE TAXI AND GROUND LIMITATIONS IN THIS SECTION FOR EMERGENCY WAR PLANNING GROSS WEIGHTS.
- ⑧ MAXIMUM FUEL FOR LANDING RATE OF SINK OF 540 FPM WITH MLG STRUTS AT 215 PSIG. FUEL IN TANKS 1 AND 4 IS LIMITED TO 6,600 POUNDS EACH. IF EITHER FUEL LIMIT IS EXCEEDED OR GROSS WEIGHT EXCEEDS 130,000 POUNDS, MAXIMUM RATE OF SINK IS 300 FPM.
- ⑨ MAXIMUM FUEL FOR LANDING RATE OF SINK OF 540 FPM WITH MLG STRUTS AT 285 PSIG. FUEL IN TANKS 1 AND 4 IS LIMITED TO 5,420 POUNDS EACH. IF EITHER FUEL LIMIT IS EXCEEDED OR GROSS WEIGHT EXCEEDS 130,000 POUNDS, MAXIMUM RATE OF SINK IS 300 FPM.

Figure 5-5 (Sheet 2 of 6)

Weight Limitations Chart (Secondary Fuel Management)

Not Modified by CGTO 93200.0



NOTE CONTINUED



ENTER ON THE INBOARD FUEL SCALE AT THE SMALLER OF:

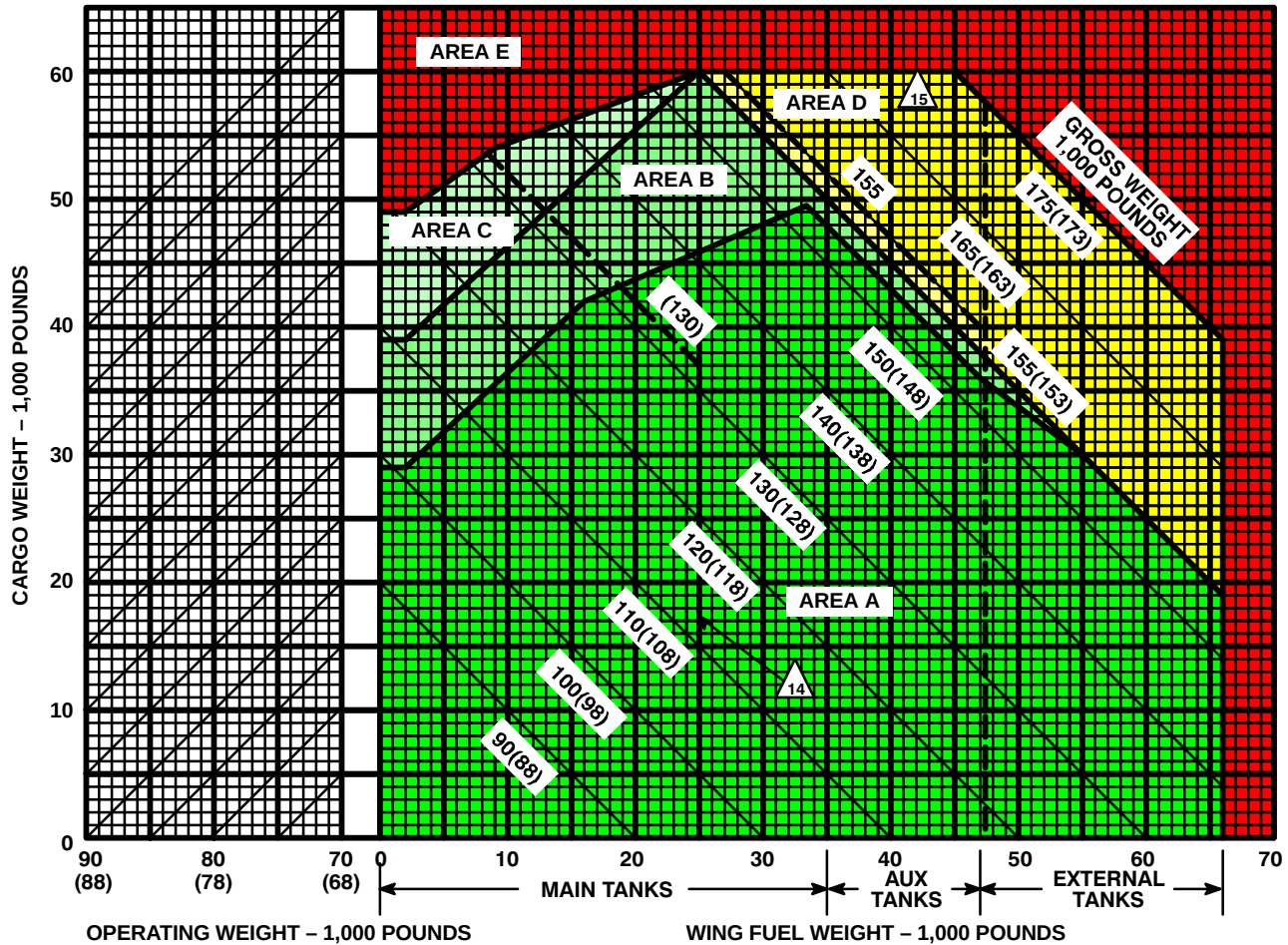
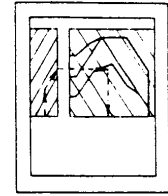
- a. ACTUAL WEIGHT OF FUEL IN TANKS 2 AND 3.
- b. WEIGHT OF FUEL IN TANKS 1 AND 4 MINUS 1,430 POUNDS.

11. WEIGHTS IN PARENTHESES ARE FOR AIRPLANES WITHOUT EXTERNAL TANKS.
12. AREA COLOR CODE AND STATUS FOR MANEUVER LOAD FACTOR LIMITS AND MAX RECOMMENDED SPEED DATA ARE THE SAME AS DEPICTED FOR PRIMARY FUEL MANAGEMENT.

Figure 5-5 (Sheet 3 of 6)

Weight Limitations Chart (Primary Fuel Management)

Modified by CGTO 93200.0 (Soft Struts)



AREA	STATUS	MANEUVER	LOAD FACTOR LIMITS UP TO V_H	FLAPS UP V_H TO V_D	MAX RECOMMENDED SPEED OF SHEET 1
A	RECOMMENDED	SYMMETRICAL	-1.0 TO 3.0G	0.0 TO 2.5G	V_H 1
		UNSYMMETRICAL	0.0 TO 2.33G	0.0 TO 2.0G	
B	RECOMMENDED	SYMMETRICAL	0.0 TO 2.5G	0.0 TO 2.5G	V_H 2
		UNSYMMETRICAL	0.0 TO 2.0G	0.0 TO 2.0G	
C	RECOMMENDED	SYMMETRICAL	0.0 TO 2.5G	0.0 TO 2.5G	V_H 3
		UNSYMMETRICAL	0.0 TO 2.0G	0.0 TO 2.0G	
D	CAUTIONARY	SYMMETRICAL	0.0 TO 2.25G	0.0 TO 2.25G	V_H 3
		UNSYMMETRICAL	0.0 TO 1.83G	0.0 TO 1.83G	
B/D	THIS IS AREA D FOR AIRPLANES WITH EXTERNAL TANKS AND AREA B FOR AIRPLANES WITHOUT EXTERNAL TANKS.				
E	NOT RECOMMENDED				

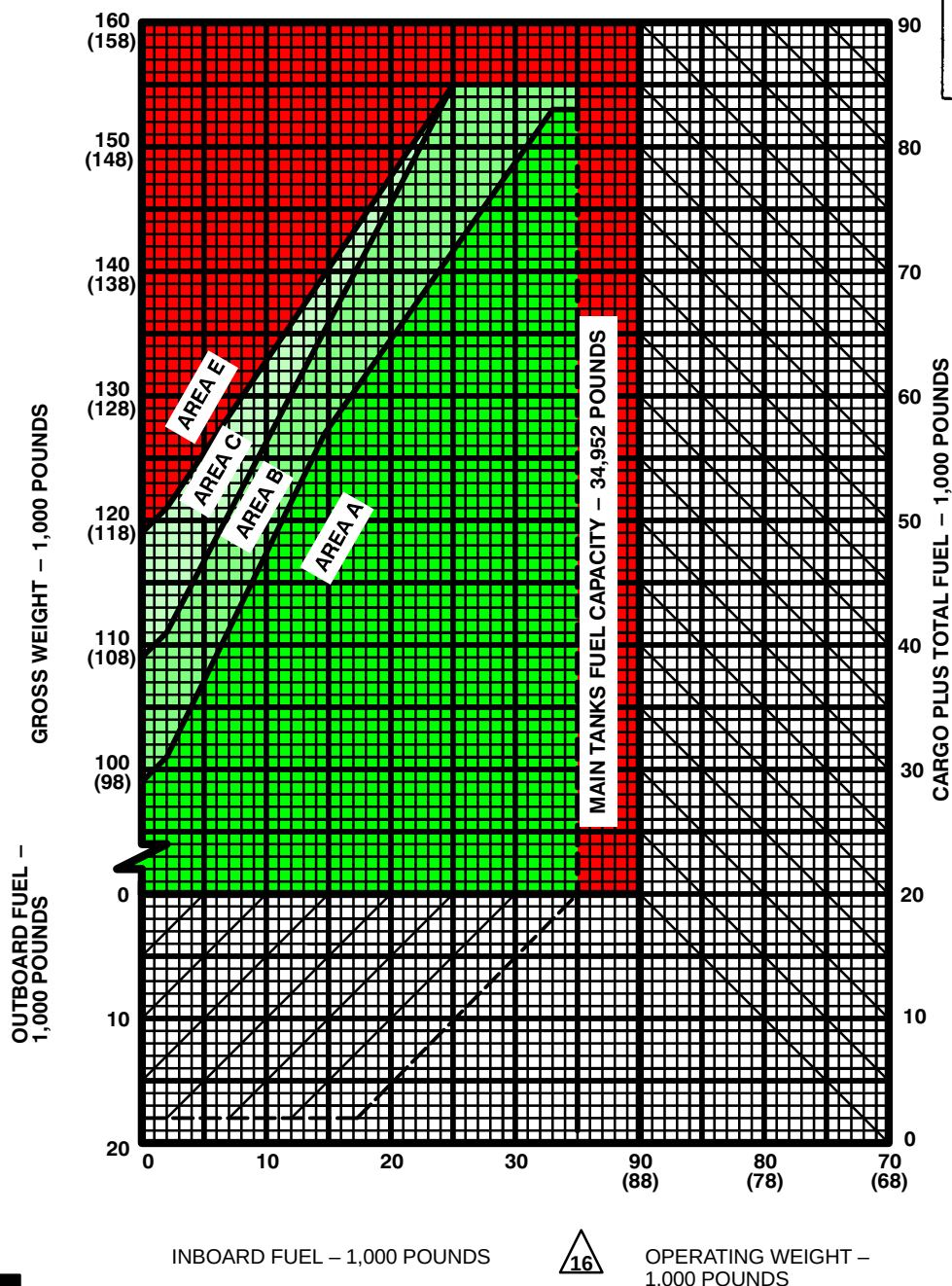
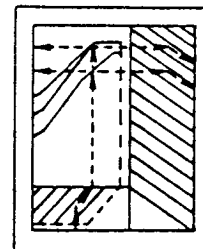
NOTE

13. WEIGHTS IN PARENTHESES AND BROKEN LINES ARE FOR AIRPLANES WITHOUT EXTERNAL TANKS.

14. MAXIMUM FUEL FOR LANDING RATE OF SINK OF 540 FPM. FUEL IN TANKS 1 AND 4 IS LIMITED TO 6,600 POUNDS EACH. IF EITHER FUEL LIMIT IS EXCEEDED OR GROSS WEIGHT EXCEEDS 130,000 POUNDS, MAXIMUM RATE OF SINK IS 300 FPM.
15. EXCEEDING THE LIMIT LOAD FACTOR OR PERMISSIBLE AIRSPEED CAN RESULT IN STRUCTURAL DAMAGE TO THE AIRPLANE. OBSERVE THE TAXI AND GROUND LIMITATIONS IN THIS SECTION FOR EMERGENCY WAR PLANNING GROSS WEIGHTS.

Figure 5-5 (Sheet 4 of 6)

Weight Limitations Chart
(Secondary Fuel Management)
 Modified by CGTO 93200.0 (Soft Struts)



NOTE



ENTER ON THE INBOARD FUEL SCALE AT THE SMALLER OF:

- ACTUAL WEIGHT OF FUEL IN TANKS 2 AND 3.
- WEIGHT OF FUEL IN TANKS 1 AND 4 MINUS 1,430 POUNDS.

17. WEIGHTS IN PARENTHESES ARE FOR AIRPLANES WITHOUT EXTERNAL TANKS.

18. AREA COLOR CODE AND STATUS FOR MANEUVER LOAD FACTOR LIMITS AND MAXIMUM RECOMMENDED SPEED DATA ARE THE SAME AS DEFINED FOR PRIMARY FUEL MANAGEMENT.

Figure 5-5 (Sheet 5 of 6)

GROSS WEIGHT CHART

GROSS WEIGHT-POUNDS			
CONDITION			MAXIMUM RATE OF SINK
	PYLON TANKS ON	PYLON TANKS OFF	
MAXIMUM TAXI	155,000	155,000	
△ EWP	175,000	△ 173,390	
△ EWP	175,000	△ 173,500	
MAXIMUM TAKEOFF	155,000	155,000	
△ EWP	175,000	△ 173,390	
△ EWP	175,000	△ 173,500	
MAXIMUM LANDING	155,000	155,000	300 FPM
△ EWP	175,000	△ 173,390	300 FPM
△ EWP	175,000	△ 173,500	300 FPM
NORMAL LANDING	130,000	130,000	540 FPM
MAXIMUM WEIGHT WITH ZERO FUEL			
	<u>PYLON TANKS ON</u>	<u>PYLON TANKS OFF</u>	
△ (2.5G) AREA C	119,142	117,532	
△ (2.5G) AREA B	109,142	107,532	
△ (3.0G) AREA A	99,142	97,532	
NOTE			
△	Emergency War Planning (EWP) gross weights are not for peace time operation unless approved by COMDT (G-OCA-2) 		
△	Airplanes not modified by CGTO 93200.0		
△	Airplanes modified by CGTO 93200.0		
△	Refer to areas on appropriate Weight Limitations Chart		

Figure 5-5 (Sheet 6 of 6)

USING THE CHARTS

The following examples illustrate the use of the Weight Limitations Chart.

Example 1:

PROBLEM: Determine load factor limits (unsymmetrical maneuver) and maximum recommended speed (at sea level) for an aircraft with an operating weight of 79,000 pounds, a fuel weight of 51,000 pounds (in standard fuel sequence), and a cargo weight of 15,000 lbs. The airplane is not modified by CGTO 93200.0.

SOLUTION: Enter the Weight Limitations Chart (Primary Fuel Management) figure 5-5 sheet 2 of 6, on the operating weight scale at 79,000 pounds. Move vertically up to the line at a cargo weight of 15,000 pounds. From this point move parallel to the diagonal operating weight guide line to the minimum operating weight. Then move horizontally to the right until the fuel weight of 51,000 pounds is reached. Note that at this point you are in Area A and also right of the line that limits rate of sink. Area A load factor limits are listed below the chart at 0.0G to 2.33G.

To find recommended speed, enter the Limit Flight Speed vs. Altitude Chart (figure 5-5 sheet 1 of 6) with 0 feet of altitude on the vertical scale; move horizontally to the right until intersecting the $\triangle$ line and read vertically down to 270 KIAS.

Example 2:

PROBLEM: Determine the load factors (symmetrical maneuver) and recommended airspeeds at 10,000 feet as mission progresses for an aircraft with an operating weight of 80,000 pounds, a fuel weight of 35,000 pounds (in standard fuel sequence), and a cargo weight of 35,000 pounds. The airplane is not modified by CGTO 93200.0.

SOLUTION: Enter the Weight Limitations Chart (Primary Fuel Management) figure 5-5 sheet 2 of 6, at 80,000 pounds on the operating weight scale. Move vertically up the line to 35,000 pounds of cargo. From this point, move along the diagonal operating weight guideline to minimum operating weight. Then move horizontally to the right until the fuel weight of 35,000 pounds is reached. Note that at this point you are in Area A; therefore, for the early portion of the mission, the maximum symmetrical maneuver load factor is 3.0G and the recommended speed is $V_h \triangle$. When fuel burns off to 23,100 pounds, Area B is entered and the recommended load factor is reduced to 2.5G and the recommended speed is reduced to $V_h \triangle$. If the flight is continued until the fuel weight becomes less than 8,600 pounds, Area C is entered, and the recommended speed is reduced to $V_h \triangle$,

although the recommended maximum symmetrical load factor remains 2.5G.

Example 3:

PROBLEM: Determine the maximum takeoff gross weight and cargo weight for an aircraft with an operating weight of 80,000 pounds, $V_H \triangle$ and a symmetrical maneuver load factor of 3.0g. With a fuel distribution of:

No. 1 and No. 4 main tanks – 7,000 pounds each.

No. 2 and No. 3 main tanks – 6,000 pounds each.

Auxiliary tanks – 5,000 pounds each.

Total fuel – 36,000 pounds. The airplane is not modified by CGTO 93200.0

SOLUTION: The fuel distribution does not meet the requirements for primary fuel management. Therefore, figure 5-5 sheet 3 of 6, Weight Limitations Chart (Secondary Fuel Management), must be used. The fuel in tanks No. 2 and No. 3 equals 12,000 pounds, which is smaller than the fuel in tanks No. 1 and No. 4 (14,000 pounds) minus 1,430 pounds. (This corresponds to the standard 715 pounds more in the outboard tank than in the inboard tank). Enter sheet 3 of figure 5-5 at 12,000 pounds on the inboard fuel scale and move up to 14,000 pounds of outboard fuel. Now follow the guidelines upward to the right to zero outboard fuel and then move vertically up to the edge of Area A. From this point first move to the left and read a maximum takeoff gross weight of 142,300 pounds. Next move to the right to the operating weight of 80,000 pounds and then follow the guidelines downward to the right to read a total of cargo and fuel of 62,300 pounds. Since total fuel is 36,000 pounds, maximum cargo weight is 26,300 pounds. Fuel must be used from the auxiliary tanks immediately after takeoff or operation will move into Area B.

Example 4:

PROBLEM: Determine load factor limits (symmetrical maneuver) and maximum air speed (at 15,000 ft.) for an aircraft with an operating weight of 80,000 pounds, fuel weight of 35,000 pounds and a cargo weight of 39,000 pounds. The airplane is modified by CGTO 93200.0.

SOLUTION: Due to the struts being modified by CGTO 93200.0 use the Weight Limitations Chart, figure 5-5 sheet 4 of 6 (Primary Fuel Management). Enter the Weight Limitations Chart on the operating weight scale at 80,000 pounds. Move vertically up the line to a cargo weight of 35,000 pounds. From this point move parallel to the diagonal operating weight guide line to the minimum operating weight. Then move horizontally to the right until the fuel weight of 39,000 pounds is reached. Note at this point you are in AREA B and also right of the line that limits rate of sink. AREA B load factor limits for a symmetrical maneuver are listed below the chart at 0.0G to 2.5G with a maximum rec-

ommended airspeed of $V_H \triangle$. To find recommended speed, enter the Limit Flight Speed vs. Altitude Chart (figure 5-5 sheet 1 of 6) with 15,000 feet of altitude on the vertical scale; move horizontally to the right until intersecting the $\triangle$ line and read vertically down to 238 KIAS.

EXAMPLE 5:

Determine the maximum takeoff gross weight and cargo weight for an aircraft with an operating weight of 80,000 pounds with a fuel distribution of:

No. 1 tank – 7,000 pounds

No. 4 tank – 7,000 pounds

No. 2 tank – 6,000 pounds

No. 3 tank – 6,000 pounds

Lt. Auxiliary – 5,000 pounds

Rt. Auxiliary – 5,000 pounds

For a total fuel weight of 36,000 pounds.

The operating limits are $V_H \triangle$ and a symmetrical maneuver load factor of 3.0G.

Airplane modified by CGTO 93200.0

SOLUTION: The fuel distribution does not meet the requirements for primary fuel management. Therefore, sheet 5 of 6 of figure 5-5 of the Weight Limitations Chart (Secondary Fuel Management) must be used. The fuel in tanks No. 2 and No. 3 is 12,000 pounds, which is smaller than the fuel in tanks No. 1 and No. 4 (14,000 pounds) minus 1,430 pounds corresponds to the standard 715 pounds more in the outboard tank than in the inboard tank). Enter sheet 5 of figure 5-5 at 12,000 pounds on the inboard fuel scale and move up to 14,000 pounds of outboard fuel. Now follow the guidelines upward to the right to zero outboard fuel and then move vertically up to the edge of AREA A. From this point first move to the left to read a maximum takeoff gross weight of 142,300 pounds. Next, move to the right to the operating weight of 80,000 pounds and then follow the guidelines downward to the right to read a total of cargo and fuel of 62,300 pounds. Since total fuel is 36,000 pounds, maximum cargo weight is 26,300 pounds. Fuel must be used from the auxiliary tanks immediately after takeoff or operation will move into AREA B.

Example 6:

PROBLEM: Determine the maneuver load factor limits and recommended airspeed for an aircraft with an operating weight of 80,000 pounds, with a fuel distribution of:

No. 1 and No 4 main tanks – empty.

(Due to fuel leaks in No. 1 tank, flight is required to fuel cell repair facility.)

No. 2 main tank – 8,000 pounds

No. 3 main tank – 8,000 pounds

Rt. Auxiliary – 4,000 pounds

Lt. Auxiliary – 4,000 pounds

Rt. External – 4,000 pounds

Lt. External – 4,000 pounds

Total fuel weight – 32,000 pounds.

Airplane modified by CGTO 93200.0.

SOLUTION: The fuel distribution does not meet the requirements for primary fuel management. Therefore, sheet 5 of 6 of figure 5-5 must be used. With tanks No. 1 and No. 4 empty, the entry fuel on the inboard fuel scale is zero. Enter sheet 5 of figure 5-5 at zero inboard fuel and move up to zero outboard fuel.

Continue vertically up to the gross weight of 112,000 pounds. This point is in AREA C, but note that when 2,900 pounds of fuel is used, AREA B is entered. Go to sheet 1 to determine the limitations for AREA C as $V_H \triangle$ airspeed limit and 2.5G load factor limit. The limitations for AREA B are $V_H \triangle$ airspeed limit and 2.5G load factor limit.

CENTER OF GRAVITY LIMITATIONS

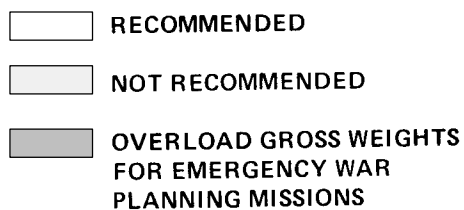
The location of the center of gravity for any gross weight configuration, determined from T.O. 1-1B-40, Handbook of Weight and Balance Data, must fall within the percent of the mean aerodynamic chord (MAC) shown on the center of gravity limitations charts (figure 5-6). These limitations represent the combined structural, aerodynamic, and control limitations that must be observed to obtain safe and effective airplane performance. For information and method of calculating the airplane center of gravity, refer to T.O. 1C-130A-9, Cargo Loading Manual, and T.O. 1-1B-40, Manual of Weight and Balance Data.

If a landing must be made with the center of gravity forward of the normal limit, use 50 percent flaps, airspeed for a normal 50 percent flap landing, maximum reverse thrust, and minimum wheel brakes.

PROHIBITED MANEUVERS

Aerobatics of any kind (including those that produce a negative g condition), intentional spins, excessively nose-high stalls, steep dives, and any other maneuvers resulting in excessive accelerations are strictly prohibited. Do not exceed a 60-degree angle of bank with flaps retracted or a 45-degree angle of bank with flaps extended. Do not make hard rudder kicks that result in large angles of yaw.

Center of Gravity Limitations

**NOTE**

1. LOAD SUFFICIENTLY BEHIND THE FORWARD C.G. LIMIT SO THAT WEIGHT REDUCTION THROUGH FUEL CONSUMPTION WILL NOT BRING C.G. LOCATION OUT OF ALLOWABLE RANGE.
 2. THIS CHART IS APPLICABLE FOR ALL CARGO WEIGHTS WITHIN LIMITS OF WEIGHT LIMITATION CHARTS.
-  C.G. LIMIT IF FUEL IS CARRIED IN EXTERNAL TANKS.

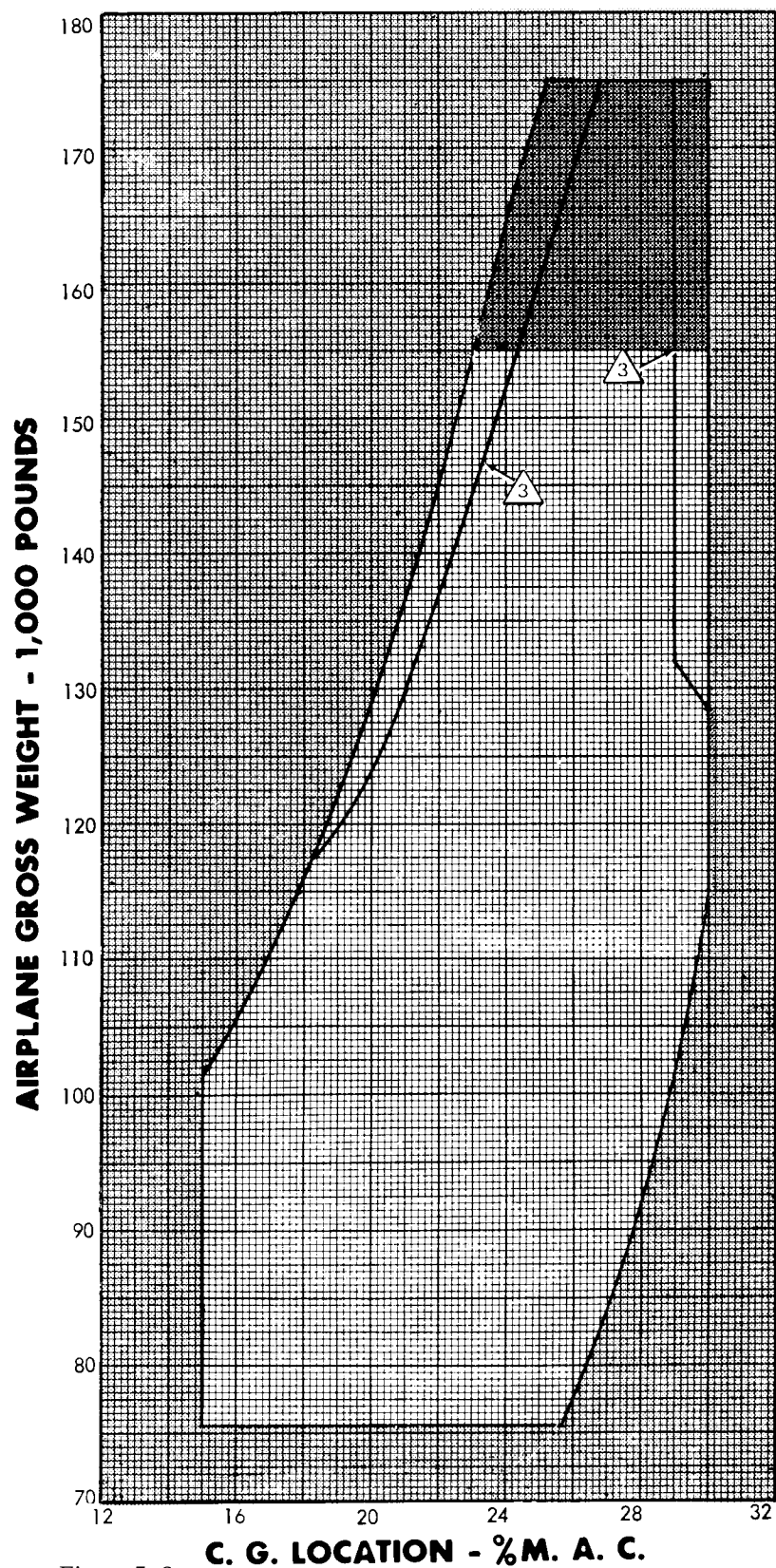


Figure 5-6

RAMP LOADING LIMITATIONS

Loading of cargo on the ramp may impose restrictions on the CG range. The ramp loading limitations are contained in T.O. 1C-130A-9.

TAXI AND GROUND LIMITATIONS

At gross weights up to 155,000 pounds, taxiing over rough terrain should be avoided. If this is unavoidable, extreme caution must be exercised and very low taxi speeds observed. Do not exceed the following taxi speeds, regardless of runway conditions:

Five knots with nose gear deflected 60 degrees.

Twenty knots with nose gear deflected 20 degrees.

NOTE

For taxi limitations on rough terrain airfields, see SUBSTANDARD AIRFIELD OPERATIONS.

For Emergency War Planning gross weights, 155,000 to 175,000 pounds, observe the following taxi limitations:

1. Taxi and takeoff are permissible only on surfaces where qualities of smoothness and freedom from dips, depressions, and holes are comparable to those of a major air base.
2. Maximum taxi speed is 10 knots.
3. Taxi shortest distance possible.
4. Use minimum braking during all taxi operations.
5. Do not use brakes while turning.
6. Limit nose gear steering angle to 20 degrees.
7. Avoid abrupt or uneven application of brakes.
8. Pivoting is not permitted.
9. Towing and jacking are not permitted.

NOTE

At gross weights above 155,000 pounds and airplanes not modified by CGTO 93200.0, inflate main gear struts to 285 psig and the tires as shown in the maintenance manual.

GROUND FLotation CHARACTERISTICS CHART

The ground flotation characteristics chart (figure 5-7) is presented for information purposes only. It can be used for generalized operational planning when it is desired to determine airfield/runway strength capabilities. However, it must be emphasized that the chart only relates the load that the airplane imposes on an airfield/runway. It must not be construed as a measure of the capability of the airplane to land on substandard runways. Ground flotation characteristics are correlated from the following five methods of evaluating airfield/runway strength.

FOOTPRINT LOADING (PRESSURE)

For operational planning purposes footprint loading is the same as tire inflation pressure. Figure 5-7 shows tire pressure values versus gross weights for normal operation from either high strength airfields or marginal strength airfields.

UNIT CONSTRUCTION INDEX (UCI)

UCI values are used to determine relative flotation characteristics of comparative airplanes and are seldom used in operational planning.

EQUIVALENT SINGLE WHEEL LOAD (ESWL)

Values of ESWL are determined from the geometry of the multiple wheeled landing gears, the number and size of the tires, and the airplane gross weight. Where airfield strength data are given in terms of ESWL, values of UCI and LCN can be calculated from these values of ESWL when required.

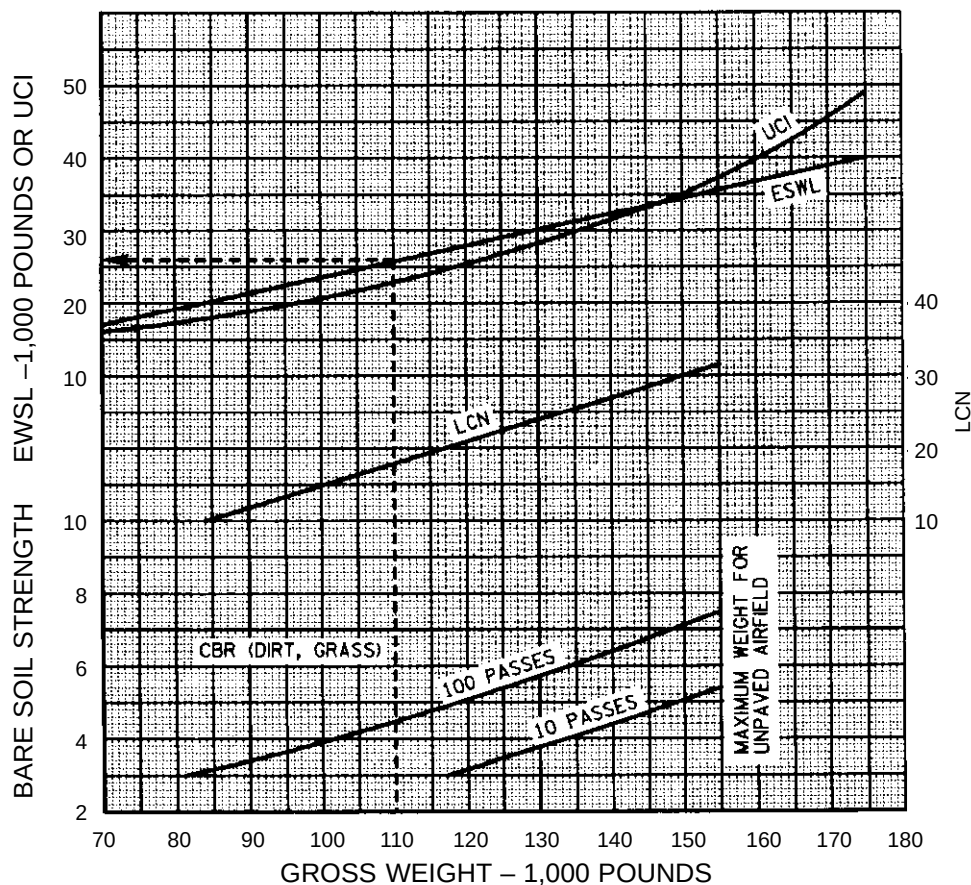
LOAD CLASSIFICATION NUMBER (LCN)

When LCN airfield strength data are used (primarily outside the United States) the data shown on the ground flotation chart can be used to estimate the capability of the airplane to operate from a given airfield.

CALIFORNIA BEARING RATIO (CBR)

Values of CBR shown in figure 5-7 represent the required airfield surface hardnesses for operation of the airplane in terms of gross weight and number of passes. Only unpaved surfaces (dirt, grass, gravel, coral, etc.) can be evaluated in terms of CBR.

Ground Flotation Characteristics

**NOTE**

1. FOR SOFT FIELD OPERATION REDUCE THE VALUES OF ESWL AND UCI BY 10 PERCENT.
2. ON AIRPLANES WITH HARD STRUTS INSTALLED, IF OPERATION ABOVE 155,000 POUNDS IS REQUIRED, INFLATE THE MAIN GEAR STRUTS TO 285 PSIG. REFER TO MAINTENANCE MANUAL FOR SERVICING INSTRUCTIONS.
3. AT WEIGHTS ABOVE 155,000 POUNDS, INFLATE TIRES TO THE HIGH STRENGTH AIRFIELDS PRESSURE (PSI).
4. LCN ARE BASED ON LOWER TIRE PRESSURE WITH THE DEFLECTION APPROXIMATELY 39 PERCENT ASSUMING RIGID PAVEMENT STIFFNESS OF $L=30$ AND FLEXIBLE PAVEMENT THICKNESS OF 20 INCHES OVER CBR 6.
5. SOIL STRENGTH IS BASED ON LOWER INFLATION PRESSURE.

MAIN TIRE 20.00 - 20/26 PR

AIRPLANE GROSS
WEIGHT (POUNDS)HIGH STRENGTH
AIRFIELDS PRESSURE (PSI)MARGINAL STRENGTH
AIRFIELDS PRESSURE (PSI)

UP TO 90,000
90,001 - 100,000
100,001 - 110,000
110,001 - 120,000
120,001 - 130,000
130,001 - 140,000
140,001 - 160,000
160,001 - 175,000

63 ± 5
69 ± 5
75 ± 5
81 ± 5
87 ± 5
93 ± 5
105 ± 5
114 ± 5

57 ± 5
60 ± 5
63 ± 5
66 ± 5
69 ± 5
72 ± 5
78 ± 5
83 ± 5

Figure 5-7 (Sheet 1 of 3)

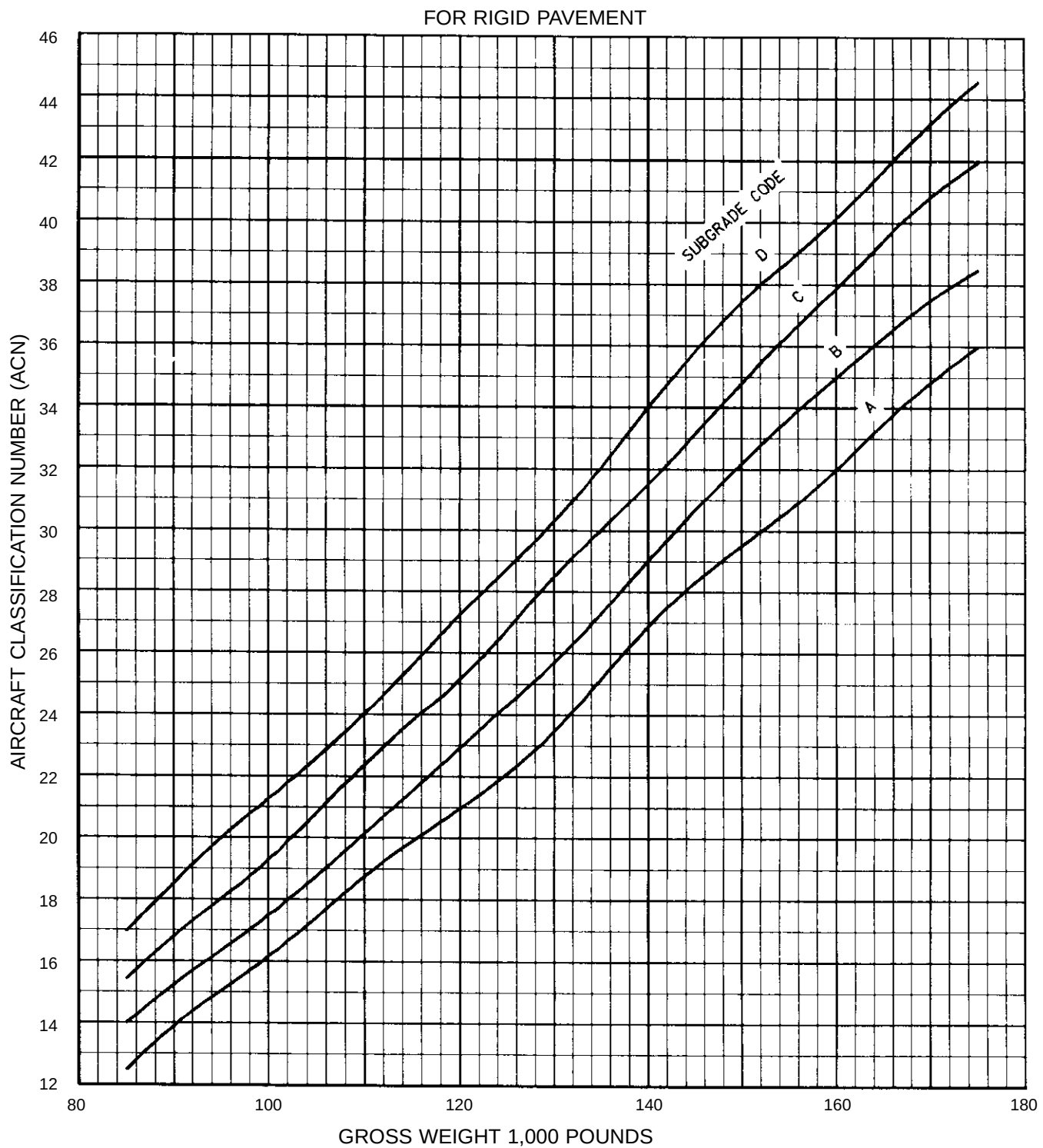
Aircraft Classification Number (ACN) 

Figure 5-7 (Sheet 2 of 3)

Aircraft Classification Number (ACN)

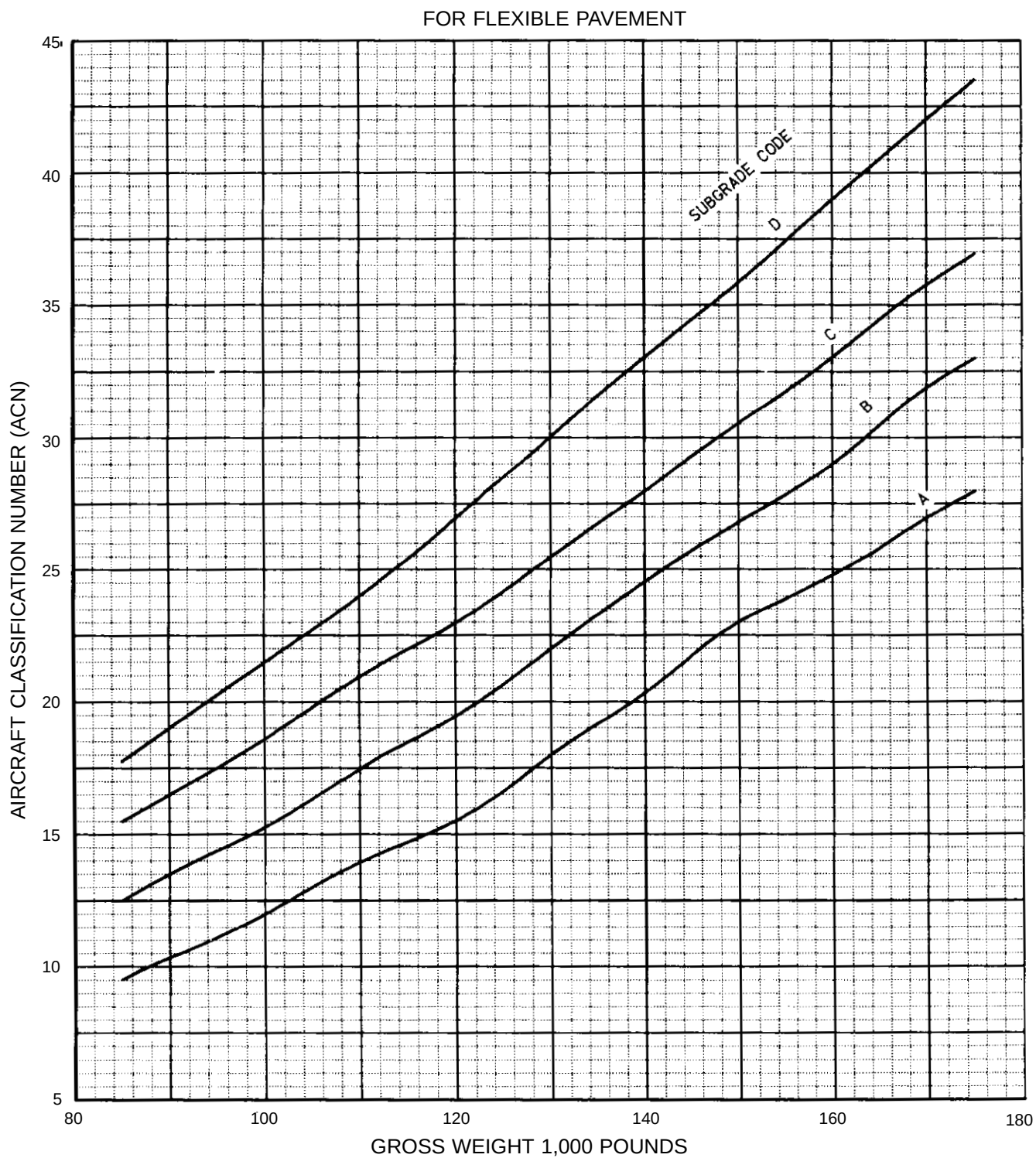


Figure 5-7 (Sheet 3 of 3)

AIRFIELD CONDITIONS

High Strength Airfields

Where airfield/runway strength data are available in terms of any of the methods shown in figure 5-7, the chart should be used as a guide to airfield-airplane compatibility. Where airfield/runway data are not available, the airplane can operate satisfactorily from most smooth, relatively hard-surfaced airfields. Permanent type (paved) airfields listed in the USAF/USN Flight Information Publications are adequate for most operations. For normal operation, tire pressure for a nominal tire deflection of 35 percent is recommended as shown by the high strength airfield data on figure 5-7.

Marginal Strength Airfields

This category includes marginal strength airfields, temporary airfields such as airfields with minimum surfacing, or unsurfaced airfields such as would be encountered at forward areas, or airfields in remote areas of the world. The minimum soil strength required for operation of C-130 type airplanes is within the CBR values of 3 to 5. Operational feasibility on unsurfaced airfields depends upon the type of soil, soil moisture content, and operational frequency. For marginal strength airfields, a tire deflection of 39 percent is used as shown on figure 5-7.



Do not exceed 39 percent tire deflection.

USING THE CHART

Example 1:

GIVEN:

A C-130 type airplane is required to operate into an unsurfaced airfield with a gross weight of 110,000 pounds.

FIND:

Footprint loading and ESWL for soft field operation.

SOLUTION:

Enter figure 5-7 for 20/26 PR tire at 110,000 pounds for marginal strength airfields and read 63 PSI (minimum) for main landing gear tire inflation pressure. Where the vertical line representing 110,000 pounds gross weight crosses the ESWL line read 26,000 pounds; then reduce this value by 10 percent for soft field operation to obtain a final ESWL value of 23,400 pounds.

Example 2:

GIVEN:

A C-130 type airplane is required to operate into an airfield with an LCN of 25.

FIND:

Footprint loading and maximum gross weight for unpaved runway operation.

SOLUTION:

Enter figure 5-7 on the horizontal line representing an LCN value of 25; where this line crosses the LCN line, proceed vertically down from this point to read a maximum gross weight of 133,000-pounds. From the tire inflation data for 20/26 PR tires at 133,000-pound gross weight on marginal strength airfields, read a minimum main gear tire inflation pressure of 72 psi.

ACN/PCN

The aircraft classification number/pavement classification number (ACN/PCN) is a method of reporting the load bearing capability of a runway. When the ACN is greater than the PCN, then the airplane is normally not allowed to land on the runway. The ACN/PCN is presented in figure 5-7, sheets 2 and 3, as a function of the airplane's gross weight, the subgrade code, and the flexibility of the runway. The subgrade codes are A for high, B for medium, C for low, and D for very low strength of the soil bearing the runway. The runway pavement will be either R for rigid or F for flexible. Each runway should have a PCN, a subgrade code, and a flexibility reported before the ACN/PCN is used.

Example Problem:

GIVEN:

Gross weight: 120,000 pounds

PCN: 21

Subgrade code: C

Flexible pavement

FIND:

ACN

Is the airplane allowed to land on the runways?

SOLUTION:

Enter the ACN for flexible pavement chart (figure 5-7, sheet 3) at 120,000 pounds. Move up to line C and left to read an ACN of 23.

The airplane should not land since 23 is greater than the PCN of 21.

MAXIMUM EFFORT/SUBSTANDARD AIRFIELD OPERATIONS

Maximum effort operations are those operations which require use of procedures outside the parameters of normal takeoffs and landings due to runway length or environment. They may or may not be conducted on substandard airfields.

Substandard airfields are generally considered to have usually rough, undulating, rutted or pitted runways and/or taxiways. They may be either paved or unpaved. Conversely, some unpaved surfaces (dirt, gravel, etc.) need not be considered substandard if the surface is hard and smooth.

Both maximum effort and substandard airfield operations have potential to place similar stresses on the airplane.

Because these operations may be critical, and to minimize the possibility of damaging the airplane, the following instructions apply:

1. Maximum effort operations (regardless of runway condition).
 - a. The landing gross weight should be planned not to exceed the NORMAL LANDING GROSS WEIGHT limits in this section.
- b. The maximum rate-of-sink (540 fpm) should be used for planning and wing fuel loads should be reduced accordingly. This is summarized as follows:
 - (1) External tanks must be empty.
 - (2) 6600 pounds (450 psig and 215 psig strut pressures) or 5420 pounds (285 MLG strut pressure) of fuel in outboard wing tanks and 715 pounds less in inboard wing tanks.
2. Substandard airfield operations; both the above and the following additional instructions apply:
 - a. For airplanes not modified by CGTO 93200.0, service 215 psig MLG struts to 285 psig.
 - b. Service main gear tires as shown on the GROUND FLOTATION CHARACTERISTICS chart in this section.
 - c. Minimize nose gear loads by use of elevator during takeoff and landing roll.
 - d. Minimize braking if porpoising results.
 - e. Taxi at minimum speed (approximately 10 knots or less).
 - f. Refer to TAXI and GROUND LIMITATIONS in this section.

SUMMARY TABLE OF LIMITATIONS

NOTE

REFERENCES SHOULD BE MADE TO APPLICABLE DISCUSSIONS WITHIN THIS SECTION FOR THE VALUES SHOWN BELOW. WEIGHTS AND SPEED ARE BASED ON 26 PLY TIRES.

WEIGHT – POUNDS				
CONDITION	PYLON TANKS ON		PYLON TANKS OFF	
MAXIMUM TAXI	155,000		155,000	*173,390 FOR AIRCRAFT
EWP	175,000		173,500 *	NOT MODIFIED BY
MAXIMUM TAKEOFF	155,000		155,000	CGTO 93200.0.
EWP	175,000		173,500 *	
MAXIMUM LANDING	155,000		155,000	300 FPM RATE OF SINK
EWP	175,000		173,500 *	300 FPM RATE OF SINK
NORMAL LANDING	130,000		130,000	540 FPM RATE OF SINK
SPEEDS – KNOTS INDICATED AIRSPEED				
FLAPS EXTENDED:				
10%	220	LANDING GEAR EXTENDED		165
20%	210	LANDING LIGHTS EXTENDED		250
30%	200	CARGO DOOR AND RAMP OPEN		150
40%	190	PARATROOP AIR DEFLECTORS OPEN		150
50%	180	PARATROOP DOORS (OPERATION)		150
		PARATROOP DOORS OPEN		250
60%	165	THUNDERSTORM OPERATION	65 KNOTS ABOVE	
70%	155		POWER OFF STALL	
80%	150		(NOT TO EXCEED	
90%	145		180 KNOTS)	
100%	145	MAXIMUM TIRE ROTATION	NLG 139 MLG 174	
		PAINTED CONTROL SURFACES (NOT STENCILED)		250
SYSTEM LIMITS				
FUEL				
MAIN TANK BOOST PUMP PRESSURE		MIN 15 PSI – MAX 24 PSI		
AUX AND EXT TANK BOOST PUMP PRESSURE		MIN 28 PSI – MAX 40 PSI		
HYDRAULIC				
UTILITY SYSTEM	NORMAL 2900 TO 3200 PSI–MAX 3500 PSI		RUDDER BOOST	
BOOSTER SYSTEM	NORMAL 2900 TO 3200 PSI–MAX 3500 PSI		0–15% FLAPS NORMAL 1100 TO 1400 PSI–MAX 1600 PSI	
AUXILIARY SYSTEM	NORMAL 2900 TO 3300 PSI–MAX 3500 PSI		15–100% FLAPS NORMAL 2900 TO 3200 PSI–MAX 3500 PSI	
ACCUMULATOR PRELOAD				
UTILITY SYSTEM	1500 PSI	± 100	NORMAL BRAKE	1500 PSI ± 100
BOOSTER SYSTEM	1500 PSI	± 100	EMERGENCY BRAKE	1000 PSI ± 100
PRESSURIZATION				
CABIN DIFFERENTIAL PRESSURE		MIN–1.2 IN HG – MAX 15.8 IN HG		
OXYGEN				
MIN. FOR NORMAL USE 50 PSI				
STARTER				
1 MIN ON, 1 MIN OFF; 1 MIN ON, 5 MIN OFF; 1 MIN ON, 30 MIN OFF				
RELEASE: AT 60 % RPM				
PROPELLOR AUXILIARY PUMP				
1 MIN ON, 1 MIN OFF, NOT TO EXCEED 2 MINUTES OPERATION IN 30 MINUTE PERIOD				
ELECTRICAL				
FREQUENCY		MIN 380 CPS – MAX 420 CPS		
AC VOLTS (GENERATOR AND INVERTER)		MIN 110 VOLTS – MAX 125 VOLTS		
DC VOLTS		MIN 25 VOLTS – MAX 30 VOLTS		
AC LOAD		MAX CONTINUOUS 1.050		
DC LOAD		MAX CONTINUOUS 1.030		
PROP DE-ICING		MIN SUFFICIENT 65 AMPS – MAX 90 AMPS		
BATTERY VOLTAGE		MIN 21 VOLTS (LEAD ACID)		
		MIN 23 VOLTS (NICAD)		

Figure 5–8

SECTION VI

FLIGHT CHARACTERISTICS

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INTRODUCTION

The airplane has the following widely diversified mission capabilities: long range, for transportation of personnel, cargo, or equipment to remote bases; aerial delivery facilities for personnel, cargo, or equipment airdrops; and shortfield takeoff and landing characteristics for support and utility operations from small fields and emergency airstrips. In these and all other areas of flight operations, including formation and instrument flying, the airplane has satisfactory flight characteristics. The outstanding and most useful characteristic in all ground and flight operating conditions is the capability of the airplane for rapid acceleration and its immediate and precise response to power and control applications.

STALLS

The stall characteristics of the C-130 are conventional for a four-engine propeller transport airplane. With flight idle power, stall warning buffet initially occurs at 4 to 15 percent above stall speed, depending upon configuration, and progresses to moderate or heavy buffet at the stall. The greatest stall warning airspeed margin exists with 50 percent flaps and less margin exists with 0 percent and 100 percent flaps. The stall of the C-130 is characterized by either a mild pitch down or a mild roll-off to the right or left depending on slightly unequal power settings. Flight control response is normal and satisfactory throughout the stall entry, stall, and recovery. The rolling tendency is easily controlled by use of ailerons and rudder.

WARNING

Do not raise flaps during recovery due to the resulting increase in sink rate and stall speed.

Power-off stalling speeds for typical configurations and bank attitudes are given in figure 6-1 and figure 6-2. Use care to avoid accidental stalls. Should a stall be entered, it is recommended that recovery be made as follows:

1. If in level flight, immediately drop the nose and apply symmetrical power to limit loss of altitude. Use ailerons and coordinated rudder to counteract any wing-dropping tendency. Move controls smoothly, avoiding abrupt actions. Avoid diving the airplane, and avoid abrupt or accelerated pull-up after recovery.
2. If in climbing or banked attitude, immediately drop the nose, level the wings, and apply symmetrical power to limit loss of altitude. Move controls smoothly, and avoid abrupt actions. Avoid diving the airplane, and avoid abrupt or accelerated pull-up after recovery.
3. Heavy gross weight cruise configuration power-on stalls will be accompanied by reduction of rudder and elevator control forces. Recovery should be made by applying nose down elevator.

MODEL: C-130H
T56-A-7/15 ENGINES
DATE: JANUARY 1986
DATA BASIS: FLIGHT TEST

POWER-OFF STALL SPEEDS
SEA LEVEL ICAO STANDARD ATMOSPHERE
FLAPS UP OUT-OF-GROUND EFFECT

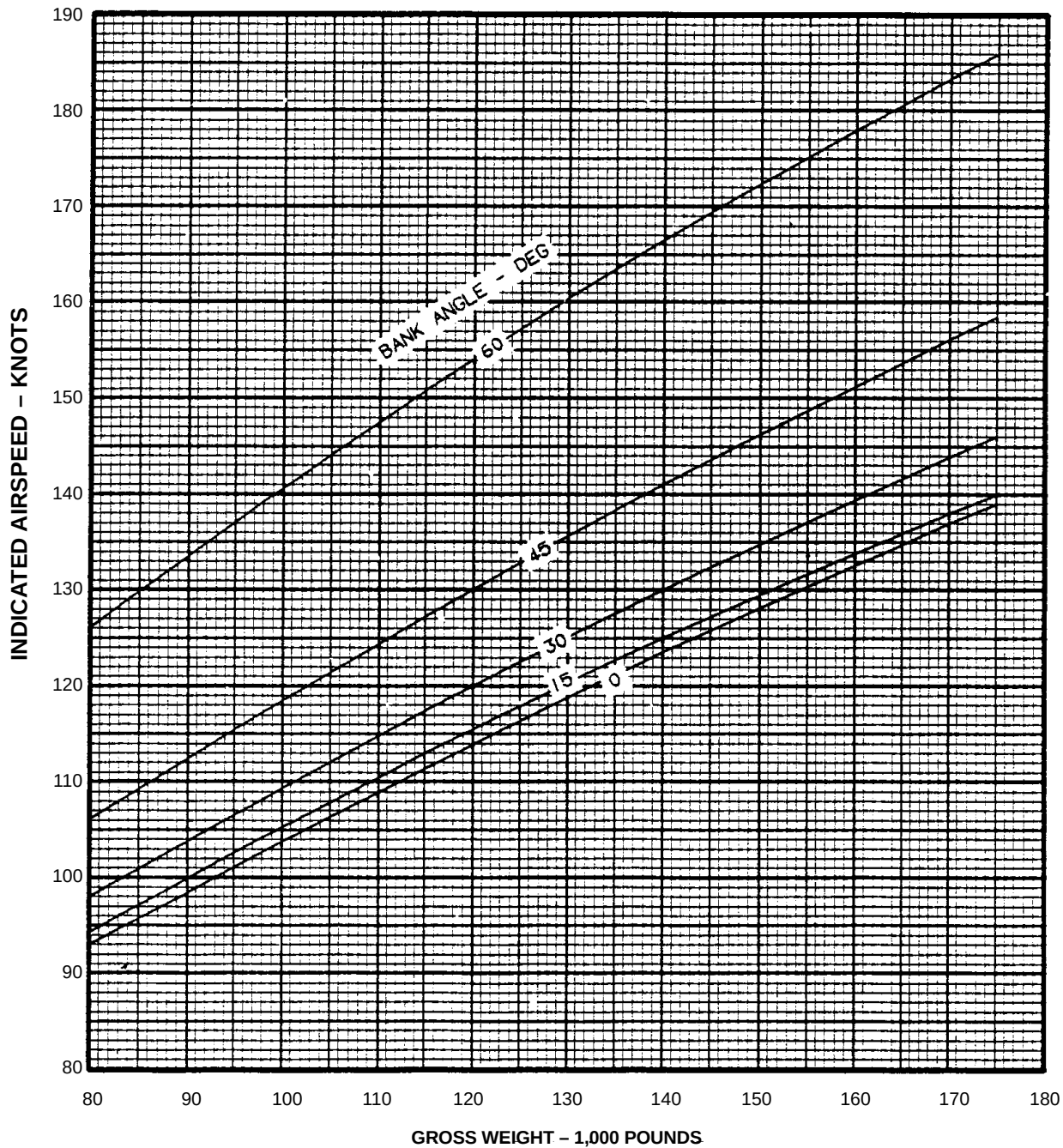
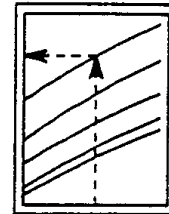
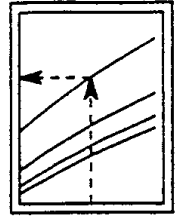


Figure 6-1 (Sheet 1 of 3)

382C(-15S)-P3-0-050-1

POWER-OFF STALL SPEEDS

SEA LEVEL ICAO STANDARD ATMOSPHERE
50% FLAPS OUT-OF-GROUND EFFECT



MODEL: C-130H
T56-A-7/15 ENGINES
DATE: JANUARY 1986
DATA BASIS: FLIGHT TEST

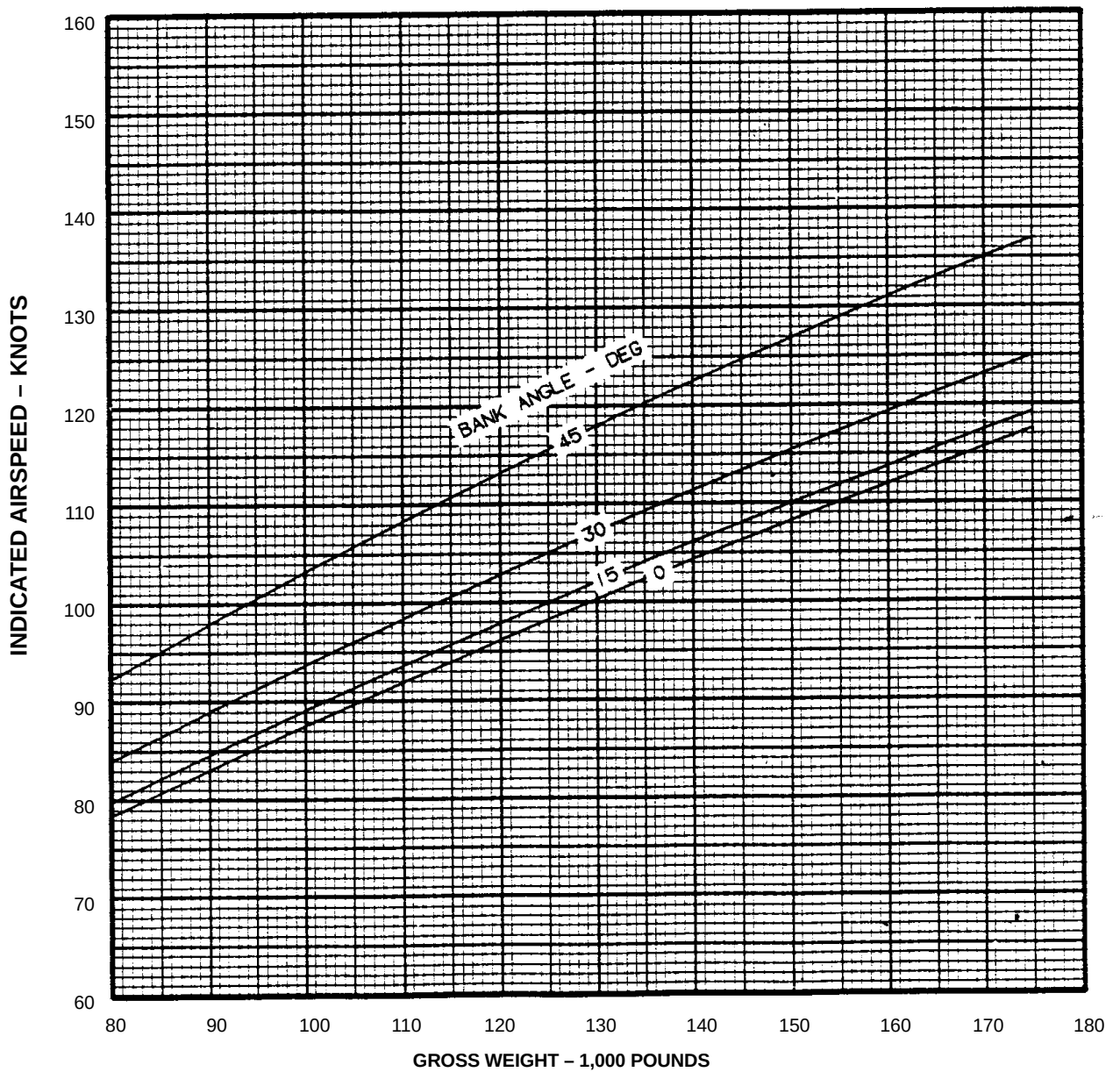
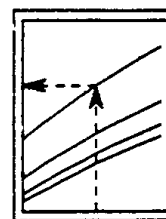


Figure 6-1 (Sheet 2 of 3)

382C(-15S)-P3-0-050-2

POWER-OFF STALL SPEEDS

SEA LEVEL ICAO STANDARD ATMOSPHERE
100% FLAPS OUT-OF-GROUND EFFECT



MODEL: C-130H
T56-A-7/15 ENGINES
DATE: JANUARY 1986
DATA BASIS: FLIGHT TEST

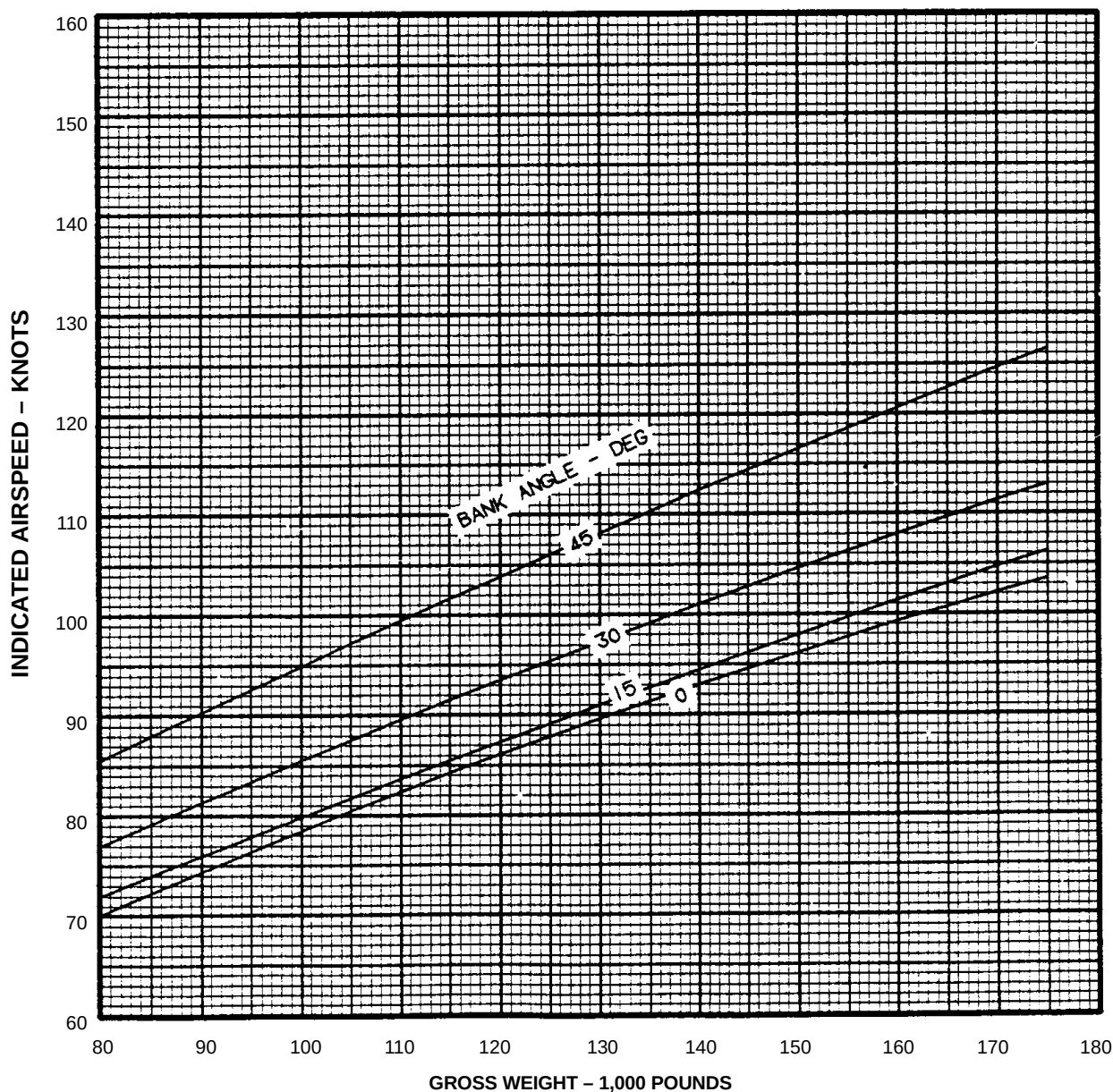
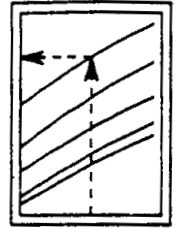


Figure 6-1 (Sheet 3 of 3)

382C(-15S)-P3-0-050-3

POWER-OFF STALL SPEEDS

SEA LEVEL ICAO STANDARD ATMOSPHERE
FLAPS UP OUT-OF-GROUND EFFECT



MODEL: C-130H (ROSEMOUNT)
T56-A-7/15 ENGINES
DATE: MAY 1986
DATA BASIS: ESTIMATED

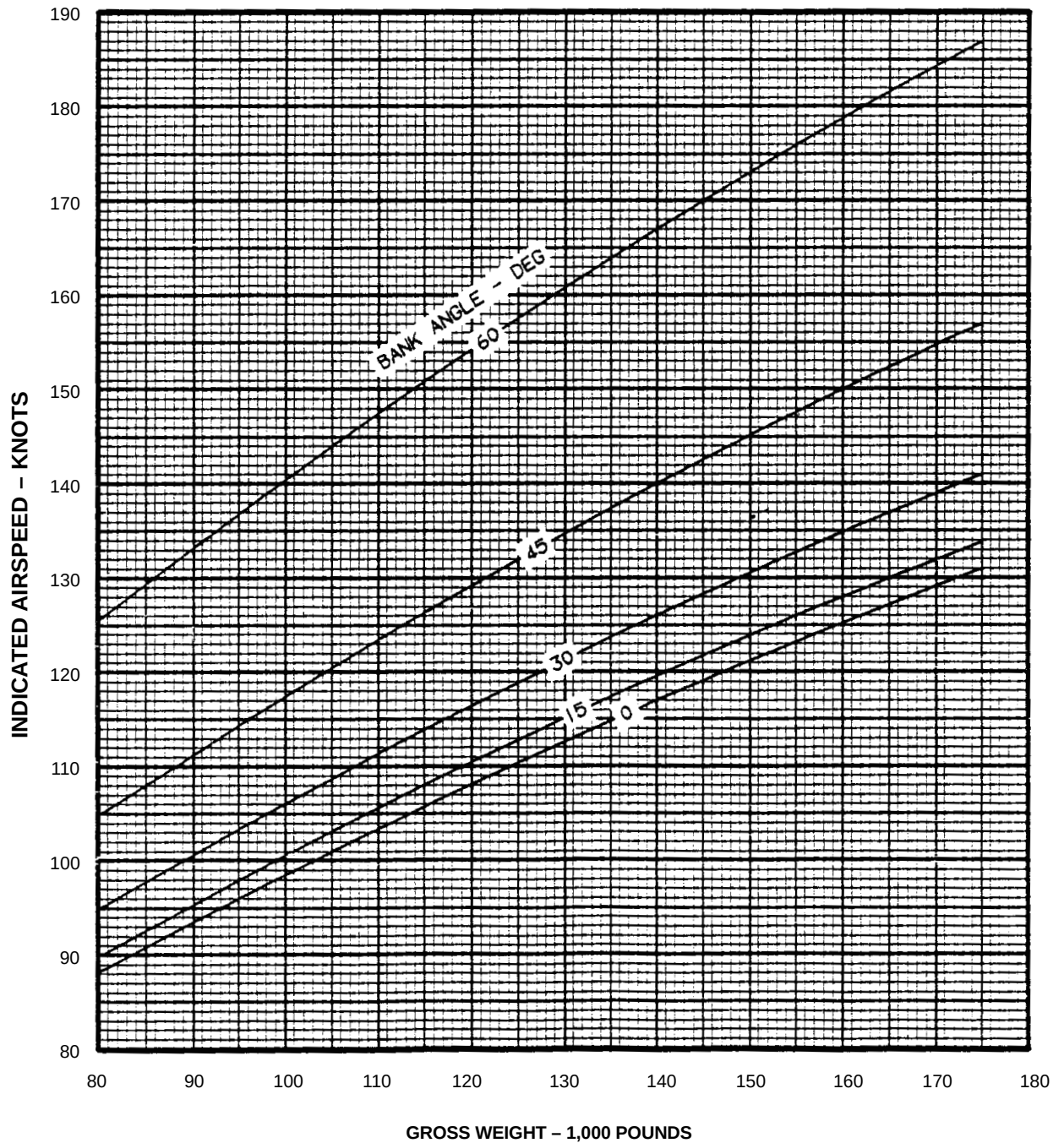
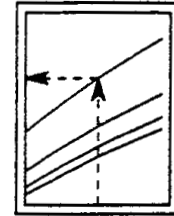


Figure 6-2 (Sheet 1 of 3)

POWER-OFF STALL SPEEDS

SEA LEVEL ICAO STANDARD ATMOSPHERE
50% FLAPS OUT-OF-GROUND EFFECT



MODEL: C-130H (ROSEMOUNT)
T56-A-7/15 ENGINES
DATE: JANUARY 1986
DATA BASIS: ESTIMATED

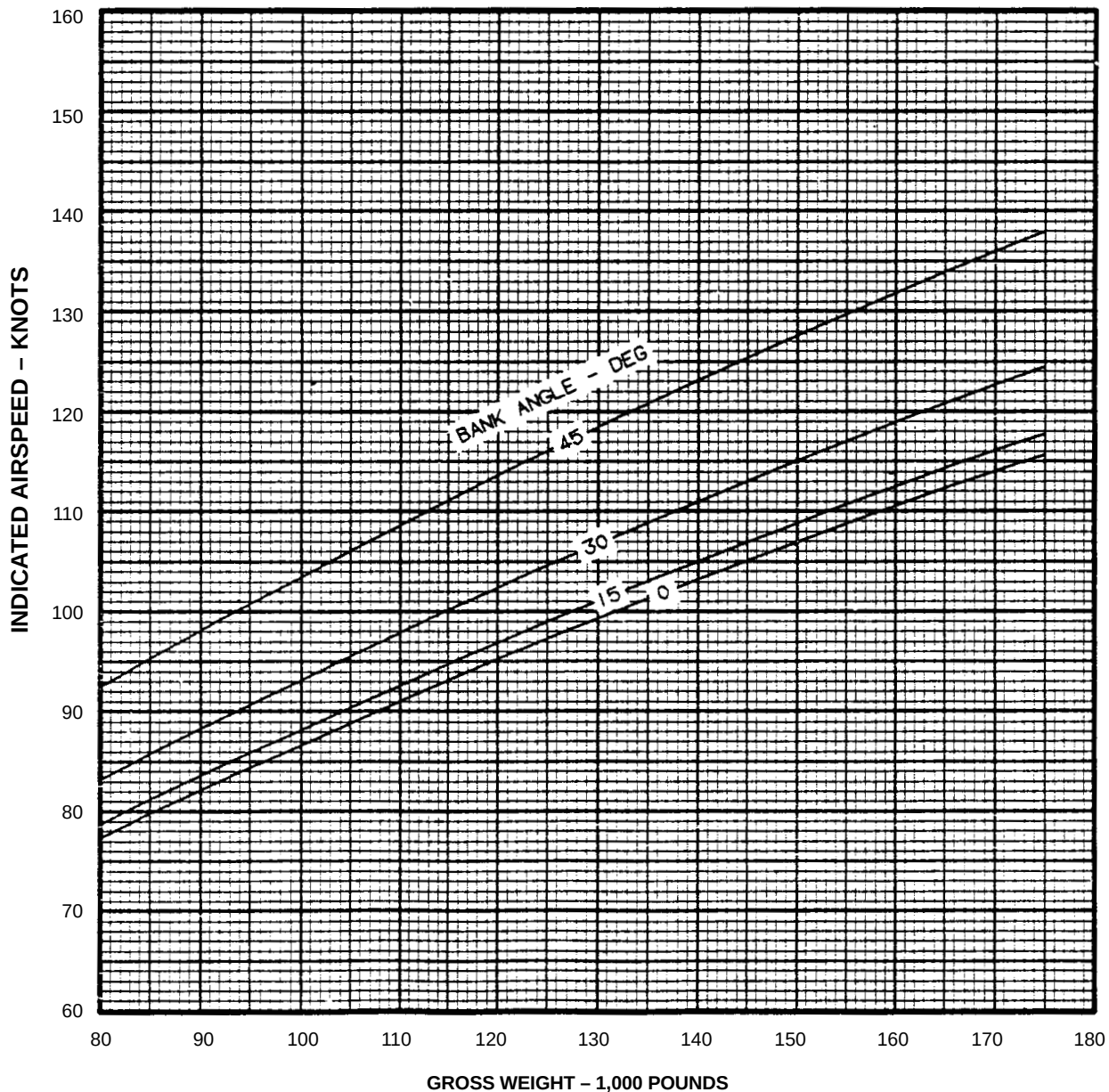
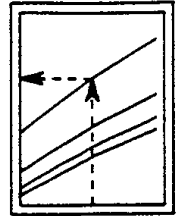


Figure 6-2 (Sheet 2 of 3)

382C(-15S)-P3-0-051-2

POWER-OFF STALL SPEEDS

SEA LEVEL ICAO STANDARD ATMOSPHERE
100% FLAPS OUT-OF-GROUND EFFECT



MODEL: C-130H (ROSEMOUNT)
T56-A-7/15 ENGINES
DATE: JANUARY 1986
DATA BASIS: ESTIMATED

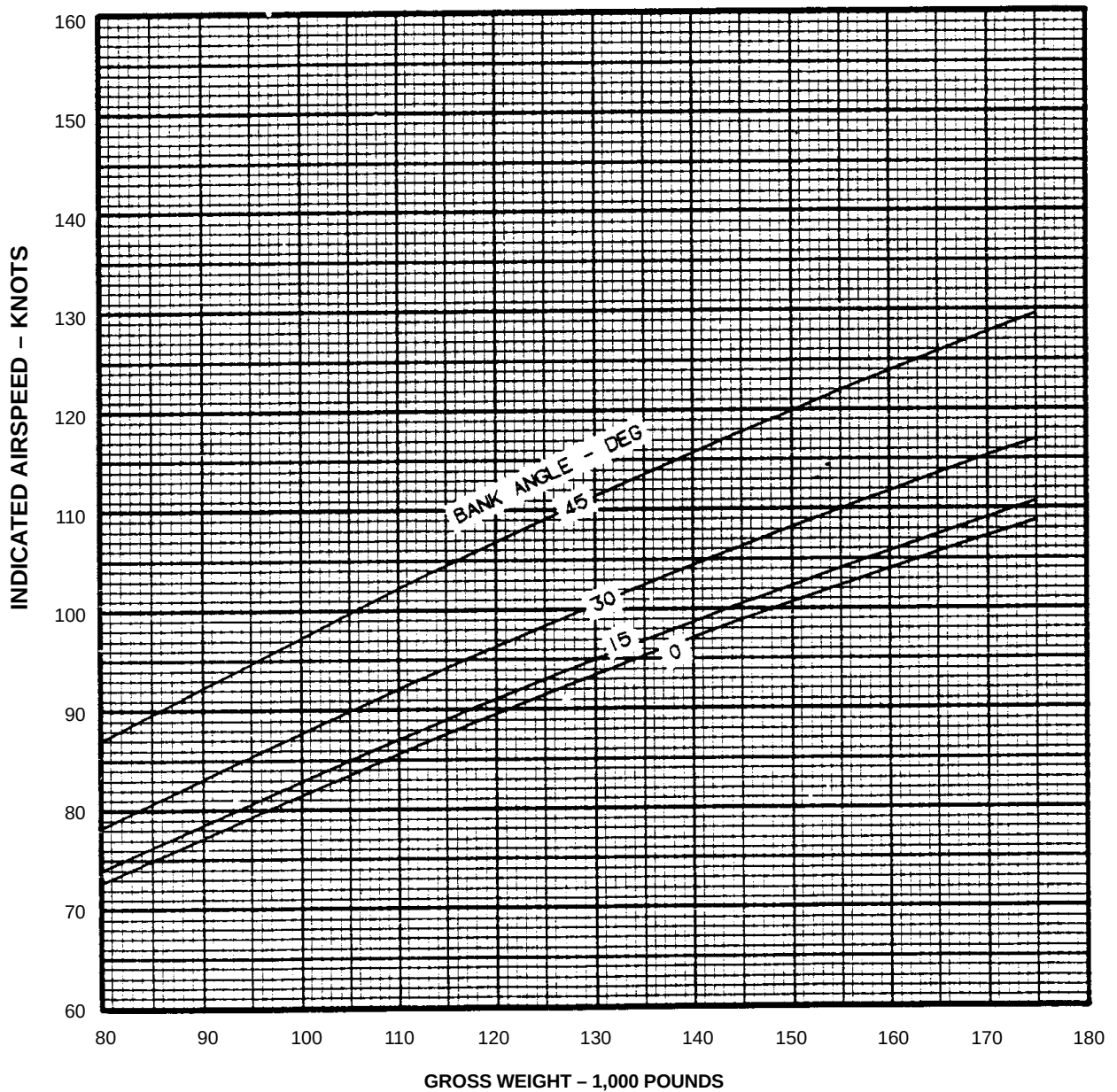


Figure 6-2 (Sheet 3 of 3)

382C(-15S)-P3-0-051-3

PRACTICE STALLS

Any practice stall entry and recovery should be made at light weights and with the cargo compartment empty. Practice at a minimum altitude of 5,000 feet above the ground. The airplane should be trimmed at a speed not less than 1.4 times the stall speed for the entry configuration and weight and should not be adjusted until recovery is completed.

During stall entry, the nose should be raised at a rate to produce an airspeed decrease of approximately 1 knot per second.

The throttle should be increased above FLIGHT IDLE only as necessary to prevent NTS action from occurring during entry into the stall. The synchrophase master switch should be **OFF**. When stall warning in the form of light airframe buffeting occurs, recovery should be initiated. Avoid abrupt control movements and avoid any control action that may result in sudden attitude change or in excessive acceleration or buffeting. The following conditions adversely affect stall characteristics and/or performance and should be taken into consideration prior to any practice stall training.

1. High power settings.
2. Asymmetric power.
3. One or more engines producing negative torque or causing a negative torque signal.
4. Retrimming or continually trimming the elevator nose up during stall entry.
5. Changing flap deflection during stall entry or recovery.
6. Increasing power during stall entry.
7. Practicing stalls at too low an altitude or over an over-cast.
8. High fuel weights – low cargo weight conditions.
9. Aft center of gravity position.

WARNING

Power-on stalls should not be attempted because of the excessively nose-high attitude required.

WARNING

Recovery of practice stalls should be initiated upon:

1. Onset of buffet.
2. Stall speed being reached.
3. Any propeller rpm below 98 percent rpm.

SPINS

Spins are a prohibited maneuver, and should never be intentionally entered. Accidental spins can be prevented by immediate recovery from any stall conditions. If a spin is accidentally entered, it is anticipated that a normal recovery for multiengine airplane will be effective. Reduce power to flight idle, apply full rudder opposite the direction of the spin and ailerons against the spin and hold until rotation stops, hold elevator control forward of the neutral position. When rotation stops, immediately return rudder and aileron to neutral. Perform dive recovery. As in any maneuvering flight proper care should be taken to avoid exceeding the structural limits of the airplane by a sudden pull-up.

FLIGHT CONTROLS

The flight controls are designed to be operated with hydraulic boost on at all times.

WARNING

Do not deliberately turn off a properly functioning boost control in flight. To do so may result in an uncontrollable attitude change and acceleration.

With boost on, the airplane can be controlled without undue effort by the pilot under any reasonable load, flap, and power combinations. Lighter stick forces are encountered in the power approach configuration with aft center of gravity loadings. At airspeeds below 100 knots in the power approach configuration, a less positive roll stability effect is experienced.

WARNING

Landing under these conditions will be marginal if turbulence or crosswinds are encountered.

In case of complete failure of the hydraulically powered control systems, the airplane can be controlled by careful manipulation of the trim tabs.

LEVEL-FLIGHT CHARACTERISTICS

The range between slow and high-speed flight is usually large, but control and stability are normal for any trimmed condition. During landing at light gross weights, the airplane has a tendency to float due to the large wing area, the propeller blade angle, and the flight idle horsepower.

MANEUVERING FLIGHT

Maneuvering flight within the category of acrobatics is prohibited. Do not make hard rudder kicks that result in large angles of yaw. Normal maneuvers may be accomplished with moderate pilot effort, since control movement is assisted by the boost system. There are no conditions of normal maneuvering flight which will produce a reversal of control pressures, and maneuvers can be accomplished with ease. In executing turns under combat conditions, remember that 60 degrees is the maximum bank angle. The recommended speed for minimum-radius turns is the best climb speed at that altitude.

FIN STALL (RUDDER FORCE REVERSAL)

If the airplane is maneuvered to abnormally high sideslip angles (15–20 degrees), a fin stall resulting in large yawing transients and a loss of directional stability can be encountered. This is an unusual flight maneuver. It is a progressive condition and will not result from power transients, gusts, wake turbulence, or execution of normal flight maneuvers. It begins when an aircraft yaws due to an excessive, abrupt rudder input. The yaw itself can be aggravated by high engine power or wake turbulence.

When yaw approaches 15 degrees to the relative wind, the pilot feels a lateral buffet at the tail. The buffet moves forward with greater intensity as yaw increases. The yaw and buffet do not constitute a fin stall. They merely indicate the

airflow boundary layer is separating from the vertical stabilizer, identical to the boundary layer separation on a wing. As yaw continues increasing a nose up pitching tendency occurs and the aircraft begins to bank in the direction of yaw. Bank will increase as the aircraft continues to turn. If the pilot attempts to correct this bank with opposite aileron, the aircraft is in a slip condition and rudder force reversal is likely. The yaw must be maintained 10 to 20 seconds before aerodynamic pressures change and hold the rudder in position. This is rudder force reversal or fin stall. Any time before this point is reached, the pilot can return the rudder to neutral. Fin stall can occur at all speeds between stall speed and approximately 170 KIAS in all flap configurations with power on. Aerodynamic engineers and test pilots characterize fin stall as a violent maneuver. It exposes the crew to substantial lateral force caused by the rudder movement and the abnormal flight position. A power-on condition, usually power for level flight or greater, is required. Right rudder force reversals are difficult due to the left turning tendency of the C-130 with power on. As mentioned earlier, a significant amount of time is required for rudder force reversal. While the pilot may feel the buffet immediately after establishing the yaw, it requires 10–20 seconds to attain rudder force reversal. Even after reversal occurs, airspeed does not drop off dramatically and recovery is still possible. Lowering the nose and neutralizing both rudder and aileron will allow the aircraft to recover with minimum loss of altitude. If the condition persists, reducing power will assist in neutralizing the rudder.

NOTE

Intentional sideslip maneuvers to increase decent rate are not recommended.

NOTE

Once rudder force reversal occurs, it will require approximately 50 to 100 pounds of opposite rudder force to return the rudder to neutral.

FIN STALL RECOVERY

Fin stall recovery must be initiated at the onset of buffet by immediately and simultaneously accomplishing the following:

1. Returning the rudder to neutral.
2. Rolling to a wings level attitude.
3. Retarding all throttles toward FLIGHT IDLE.

WARNING

If wing stall in turbulent air (buffet with yawing tendency) is misinterpreted as fin stall, throttle reduction will aggravate the situation.

NOTE

If flight conditions permit, pushing the nose down will assist in recovery. Ensure that adequate flying speed is maintained at all times.

CAUTION

Abrupt push-over to a negative g condition with flaps up or down should be avoided. This type of maneuver will result in a reduction in maneuvering longitudinal stability, in that the angle of pitch-down and the negative g condition continues to increase even after the stick direction has been reversed. After movement of the stick toward the former position is begun, there is a time lag before the airplane starts to reverse its pitching motion.

Final recovery from the maneuver requires considerable pull force. This is due to the large pitching inertia of the airplane and the longitudinal rotational effect on the hinge moments of the elevator. These characteristics could result in an excessive negative load factor, an uncomfortable nose-down attitude, and an excessive positive load factor due to an abrupt recovery.

FLIGHT CHARACTERISTICS WITH ASYMMETRIC POWER

With the aircraft trimmed for existent flight conditions, the sudden loss of power on one engine will result in laterally unbalanced thrust and a consequent yawing tendency (yawing moment about a vertical axis through the center of gravity) toward the side with the loss of power. In addition, the aircraft will tend to roll toward the failed engine and the aileron deflection required to prevent roll will exacerbate the yawing tendency. As the aircraft begins to yaw, the balance ball will displace in the opposite direction (away from the failed engine). In order to counter the yawing moment to maintain directional control, the rudder must be deflected so that the vertical fin will produce a side force (toward the side with the failed engine) sufficient to create an equal but opposite yawing moment. The slowest airspeed at which rudder authority is sufficient to produce the side force required to

counter the yawing moment is the minimum control airspeed for the existent conditions (asymmetry of thrust, center of gravity location, environmental conditions, etc.).

With the wings level, the side force produced by the vertical fin will cause the aircraft to sideslip toward the failed engine sufficiently so that the side force is countered by the aircraft's resistance to sideslip (lateral drag). Because the sideslip is in the same direction as the side force which causes it, the leading edge of the vertical fin will actually be at a negative angle of incidence with respect to the relative wind. Thus, large rudder deflections will be required which will increase drag, and which, at low airspeed with large asymmetry of thrust, may be insufficient to maintain directional control. With the wings held level and the heading maintained by rudder deflection, the balance ball, acting as a spirit filled level, will be centered. The sideslip will cause a sharp reduction of overall aircraft performance due to increased drag and will give the pilot the same visual and instrument indications as a crosswind from the side with more power.

Banking the aircraft away from the loss of power will introduce a horizontal component of the lift vector in the direction of the bank. If the aircraft is then controlled through the rudder to maintain a steady heading while banked away from a loss of power, the horizontal component of the lift vector will be in a direction approximately opposite to the side force required of the vertical fin. Thus it will reduce sideslip and improve aircraft performance through reducing drag. Furthermore, with less sideslip the vertical fin will be more efficient in producing side force (lateral lift) so less rudder deflection will be required for given airspeed, less rudder pedal force will be required to achieve the smaller rudder deflection necessary, making it easier for the pilot to control the aircraft. With the aircraft banked, but in steady heading flight, the balance ball will seek the vertical low point which will be displaced from the centered position in the direction of the bank angle (i.e., away from the loss of power).

Five degrees of bank, with the aircraft cross controlled to maintain a steady heading, will result in balance ball displacement of approximately two-thirds of the ball width in the direction of the bank angle (away from a failed engine). This displacement will establish a balanced flight condition approximately sufficient to compensate for a large amount of asymmetric power. With 5 degrees of bank, the horizontal component of the lift vector will be more than 8 percent of the aircraft gross weight while the additional lift requirement will be less than 0.5 percent.

So long as the balance ball is maintained at about two-thirds of a ball width deflection away from a failed engine as its new reference position, turns may be made in either direction with equal effect, keeping in mind that the neutral refer-

ence roll attitude includes the previously established 5 degrees of bank.

In the event of sudden engine failure while at high power settings, it is recommended that the pilot not recenter the balance ball but accomplish the following:

1. Establish and maintain a balance ball position displaced two-thirds of a ball width from center in a direction away from the failed engine.
2. Utilize 5 degrees of bank away from the failed engine as the new neutral reference for roll attitude.

NOTE

If the amount of power asymmetry is subsequently reduced, less bank angle and balance ball displacement will be required to maintain a minimum side-slip condition.

SECTION VII

ALL-WEATHER OPERATIONS

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TURBULENCE AND THUNDER- STORMS	7-2	HOT WEATHER PROCEDURES	7-6
		DESERT PROCEDURES	7-8

INTRODUCTION

This section contains only those procedures that differ from, or are in addition to, the normal operating instructions covered in Section II, except for some repetition necessary for emphasis, clarity, or continuity of thought. References in this section to operation of the airplane component systems or auxiliary equipment mean the operation described in Sections II and I, respectively.

ICING CONDITIONS

Avoid icing conditions whenever possible. The biggest danger caused by ice accumulation is the reduced aerodynamic efficiency of the airplane. Increased drag and diminished lift due to airfoil deformation, and loss of thrust due to lowered propeller efficiency and engine power, are typical results. Specifically, ice accumulation may have the following effects:

Increases liftoff speed and increases stalling speed. Higher takeoff, landing, and minimum flight speeds are then required.

Reduces rate-of-climb.

Increases power requirements, thus increasing fuel consumption and decreasing range and endurance.

Impairs control response.

Reduces engine power by obstructing the engine inlet air duct.

If cruise must be made in icing conditions, consideration must be given to the effect of using bleed air from the engines for the anti-icing system. Use of bleed air for anti-icing will reduce speed, and thus range, for any power setting. Additional power or a descent to a lower altitude may be necessary to maintain cruise speed. Refer to the appropriate performance manual (T.O. 1C-130H-1-1) for cruise performance with anti-icing systems in operation. It is recommended that altitude be changed, when possible, until icing no longer occurs. The airplane can penetrate icing conditions if the procedures given are followed:

1. Select the least severe altitude, from the standpoint of icing conditions, consistent with mission objectives and with traffic or combat conditions. Consider outside air temperature, nature of clouds, type of icing (rime, clear) anticipated or being encountered, and duration of icing.
2. Ensure that all anti-icing systems are on and operating.
3. Use deicing systems as required.

WARNING

When ice forms on the airplane and the automatic ice detection system fails, place the prop and engine anti-icing master switch to the manual position. A delay could result in ice collecting in the inlet scoop and partial or complete loss of engine power.

NOTE

When the WARNING ICING CONDITION ON LIGHT illuminates, the propeller and engine anti-icing systems will automatically be turned on by the ice detection system. If wing and empennage anti-icing is required, the switches must be manually placed in the ON position. (1600 series, CG 1790 and 1700 series) if the anti-icing system does not clear the wing and empennage of ice, place the engine bleed air switches to OVRD.



If possible, avoid prolonged flight in freezing rain, particularly at low airspeeds with corresponding higher angles of attack, as there is a possibility of ice accretion on the upper inside of the engine inlet air ducts and other areas that are not normally exposed and that are not anti-iced. This condition may result in a multi-engine power loss or flame out.

4. Delay extension of flaps and landing gear until absolutely necessary; for example, until the airplane is in the landing pattern. This will help to avoid excessive ice accumulation on the flaps and landing gear. While flying through icing conditions, monitor the leading edge temperature indicators and the deicing and anti-icing current indicators to make certain that anti-icing equipment is working properly. Make frequent visual checks of wing leading edges, engine inlet air duct leading edges, and propeller spinners. If leading edge anti-icing is seen to be inadequate for preventing ice accumulation, seek a non-icing or less severe icing level.

When icing conditions no longer exist and the green no-ice light is illuminated, turn the prop and eng anti-icing master switch to the RESET position. When turned to the RESET position all anti-icing systems, except the wing and empennage, are automatically turned off. The wing and empennage anti-icing switches must be manually turned to the OFF position. (1600 series, CG 1790 and 1700 series) return the engine bleed air switches to ON.

CLEAR AIR ICING

Engine inlet air duct icing in clear air is possible in some combinations of temperature and humidity, depending on the engine power setting and the airspeed. This icing is caused by the sudden drop in temperature resulting from pressure loss in the engine inlet air duct. Such icing is indi-

cated by a falling torquemeter indication. If torquemeter indication falls for no apparent reason, assume that engine inlet air duct icing is occurring, take the following actions immediately.

1. Turn the prop & eng anti-icing master switch to the MANUAL position, and place the engine inlet air duct anti-icing switch in the ON position.
2. Increase airspeed to the maximum consistent with continuous operation to increase ram pressure in the air duct.
3. Seek an altitude that is less likely to produce air duct icing.

TURBULENCE AND THUNDERSTORMS

Flying under conditions of extreme turbulence, such as through thunderstorms, must be avoided whenever possible. When flying under conditions of low visibility, clear passage of thunderstorms can normally be found with the weather radar. Attempt to avoid intense radar echoes indicating severe thunderstorms by at least 20 miles. It is recommended to have at least 40 miles between moderate or greater thunderstorm cells before attempting to fly between them. Flight into areas of forecast embedded thunderstorms or reported thunderstorms will not be attempted without an operable weather radar. The possibility remains that a storm cannot be avoided, or that flight through a storm may be a matter of necessity. To minimize the possibility of lightning strikes when operating in the vicinity of thunderstorms, avoid flight near the icing level. Lightning strikes are most common with an outside air temperature of between +5° and -5° C.

Prior to entering areas of known turbulence or thunderstorms, ensure that cockpit lights are set, crew and passengers are briefed, safety belts fastened, and all loose equipment secured. Airplane trim should be set prior to entry and adjustments avoided during flight through turbulence or thunderstorms.

The autopilot may be used, and in some cases is desirable. The altitude hold mode should be disengaged and the autopilot should not be either assisted or overpowered in the autopilot mode. If the autopilot cannot control attitude, disengage and fly manually.

Recommended airspeed for penetration into turbulent air is 65 knots above power-off stall speed, not to exceed 180 KIAS.

HEAVY RAIN AND WIND SHEAR

NOTE

For further guidance on wind shear avoidance and procedures refer to Section II.

Heavy rain has a significant effect on aircraft and may have contributed to several accidents thought to have been caused solely by wind shear. Heavy rain decreases the effectiveness of an airfoil, increases drag and stall speed, and decreases the momentum of the aircraft by impact force. This degradation of performance in addition to the windshear prevalent near weather phenomenon causing heavy rain, may create a situation that is beyond the performance capability of the aircraft. Use on-board weather radar to avoid heavy rain cells. If avoidance is impossible or wind shear is anticipated, apply gust factors in accordance with the performance manual (T.O. 1C-130H-1-1) and use 50% flaps to improve acceleration capability on approach and landing.

COLD WEATHER PROCEDURES

Extreme cold causes general bad effects on airplane materials. Rubber, plastic, and fabric materials stiffen and may crack, craze, or even shatter when loads are applied. Oils and lubricants congeal. Adjoining metals contract differentially, and could result in adverse variations in tolerances. Moisture, usually from condensation or melted ice, freezes in critical areas. Tire, landing gear strut, fire extinguisher bottle, and accumulator air pressures decrease with a temperature decrease. Extreme diligence on the part of both ground and flight crews is required to ensure successful cold-weather operation. The procedures and precautions outlined here pertain to operating unhangared airplanes in cold weather and are in addition to the normal procedures given in Section II.

NOTE

Cold weather procedures are considered to be applicable when the temperature is 0° C (32° F) and below.

NOTE

A preheating period will be arranged by the ground crew using portable ground heaters or the gas turbine compressor/auxiliary power unit so that airplane components will be warmed and inspected prior to starting engines.

NOTE

For Nose Radome Anti-icing Tank Time-to-Heat Chart, refer to Section IV.

BEFORE ENTERING THE AIRPLANE

Perform a normal preflight inspection of the airplane as outlined in Section II. In particular, check the following:

1. Check for removal of all exterior protective covers not required for heating airplane.

WARNING

Do not attempt takeoff with ice, snow, or frost on the wings, empennage, or fuselage. The roughness caused by ice and snow on the surfaces varies the airfoil shape with a resulting loss of efficiency. Takeoff run is increased and rate of climb is decreased. Stall speed is increased, and stall characteristics are unpredictable.

WARNING

If anti-icing compound has not been used on the crew door telescoping rod, frozen condensation may prevent full opening until the rod is heated.

CAUTION

Ensure that moisture from melted ice is not allowed to remain in critical areas where it may refreeze.

CAUTION

Do not attempt to scrape or chip ice from flight surfaces or fuselage. Exercise care to prevent personnel injury from slipping and falling.

2. Check that fuel tank vents, fuel drains, static ports, and pitot tubes are free of ice and snow.
3. Check for proper inflation of landing gear struts, tires, and hydraulic accumulators.
4. Check that landing gear strut extensions have been wiped with a hydraulic fluid soaked cloth to remove ice and dirt.
5. Check that a warm well-charged battery has been installed.

6. Check that all condensation has been drained from drains.
7. Check that dry bays are free of hydraulic fluid and fuel seepage.
8. Ensure that all items to be operationally checked during the preflight (power on) are preheated to prevent damage to components.

BEFORE STARTING ENGINES

In addition to the normal procedures outlined in Section II, perform the following checks:

1. If isopropyl alcohol has been used to remove frost from the airplane, check the interior of the airplane for alcohol leaks and fumes. This condition may create a fire hazard.
2. If external ac power is available, energize the Nesa windshields. Bring temperature up gradually to prevent cracking glass. As ice and frost begin to melt, operate the windshield wipers to help clear the windshield. Other windows may be cleared by portable ground heaters.

NOTE

When operating in temperatures below -37°C (-35°F), ensure engines, GTC/APU and ATM are preheated prior to starting.

NOTE

Either portable ground heaters or the gas turbine compressor/ auxiliary power unit may be used to heat the interior of the airplane during the interior inspection. In extreme cold weather it may be necessary to preheat the gas turbine compressor/auxiliary power unit before it can be started. During starting, torching may be observed. After start, allow approximately 4 minutes warm-up before applying load.

3. After the GTC/APU is warmed up and the ATM and generator/APU generator are on and checked, turn the auxiliary hydraulic pump on and operate the emergency brake system with light pedal pressure several times prior to setting the parking brake. Have an inspection made of each main wheel for evidence of hydraulic leakage after full pressure has been applied to the brake pedals. Seeps and moderate leaks caused by hardened O-rings can often be stopped by direct appli-

cation of hot air from a ground heater for a few minutes.



Do not attempt to taxi if evidence of hydraulic leakage is found in any main landing gear area. Danger of fire and loss of brakes exist when hydraulic fluid contacts hot brakes.



When the ATM is operated in an environment of high humidity and is shut down in temperatures below freezing, preflight inspection should include starting the ATM. If the ATM does not start, heat should be applied in the compartment as moisture may have frozen in the ATM controls.

4. Before starting engines, remove all ground heater ducts from the airplane.
5. In extremely cold temperatures, the crew door seals may stiffen, thus making it impossible to close the door from inside the airplane. When ground crewmen are not available to assist in closing the door, it may be necessary to have one or more flight crew members assist closing the door from outside, and then enter the airplane through one of the paratroop doors.

STARTING ENGINES

NOTE

During extreme cold weather, starts may be accomplished with or without fuel enrichment. Characteristics of the starts will vary somewhat, however. With fuel enrichment OFF, lightoff occurs between 22.0 and 26.5 percent rpm and several seconds will probably elapse between maximum turbine starter-driven rpm and lightoff. Torching may occur also. Starting with fuel enrichment in NORMAL produces lightoff between 19.0 and 27.0 percent rpm with rapid engine acceleration. If a stalled start takes place, it can be noted by rpm lag at about 40 percent rpm and a sharp TIT increase. When the engine is still hot from previous operation, stalled starts are more likely to occur with fuel enrichment ON. After an unsuccessful attempt to start the engine with fuel enrichment; the next attempt should be made with fuel enrichment OFF.

CAUTION

When attempting a start with JP-5 and kerosene type fuels at ambient temperatures below approximately -37°C (-35°F), the TIT and rpm should be closely monitored since stall and over-temperature may be experienced during the start.

NOTE

If the engine oil temperature is 0°C or below prior to engine start, it is recommended the engine be run for at least 10 minutes (at either low speed or normal ground idle) prior to moving the throttles. This action is intended to reduce the number of propeller leaks resulting from hardened O-rings.

BEFORE TAXI

1. If not already accomplished with external power, energize the Nesa windshield, bringing temperature up gradually to prevent cracking the glass. As ice and frost begin to melt, operate the windshield wipers to help clear the windshield. Other windows may be cleared by air blast from the defogging ducts.
2. When the airplane is operated in icing conditions, ensure that the inlet duct and guide vane anti-icing is in manual for ground operation and all anti-icing systems are on prior to takeoff.

CAUTION

Do not overheat anti-icing systems on the ground. Do not operate propeller anti-icing and deicing systems unless engines are running.

3. If the engine oil temperature is 0°C or below prior to engine start, it is recommended the engine be run for at least 10 minutes (at either low speed or normal ground idle) prior to moving the throttles. This action is intended to reduce the number of propeller leaks resulting from hardened O-rings.

TAXIING INSTRUCTIONS

At the start of taxiing on snow or ice, visually check the landing gear to ensure that the wheels are rotating. The combination of increased engine power at low temperatures and slippery ramp surfaces due to ice and snow require that utmost caution be used during taxiing operations. Ground handling

characteristics of the airplane on loose or compacted snow at temperatures below -18°C (0°F) are good and braking action is fair to good. However, as temperatures rise toward freezing, snow-covered surfaces become more slippery and increasing caution must be exercised. Use of anti-skid is recommended during all taxiing in cold weather.

WARNING

In cold weather, make sure all instruments have warmed up sufficiently to ensure normal operation. Check for sluggish instruments during taxiing.

CAUTION

Nose wheel steering becomes ineffective when abrupt turns are attempted on slippery surfaces. Use nose wheel steering, differential braking, and differential power for best directional control. Maintain safe taxi speeds by use of brakes and partial application of reverse thrust. Excessive reverse thrust will cause loss of visibility when taxiing over loose snow.

When operating on snow-covered or slushy surfaces, use of Nesa and pitot heat is recommended prior to and during use of reverse power.

ENGINE RUN-UP

Select the area that has the best available surface for braking and conduct the engine and propeller checks outlined in Section II. Avoid parking airplanes close together or near obstructions when performing ground tests.

NOTE

Surfaces covered with loose snow generally provide better braking than surfaces covered with compacted snow.

A modification of normal procedures may be required when making run-up on slippery surfaces. Engines and propellers may be checked in symmetrical pairs while using reverse thrust on the other pair to prevent the airplane from sliding forward. When run-up must be conducted on snow-covered surfaces, do not attempt to make full power checks until the airplane is lined up on the runway and ready for takeoff.

TAKEOFF

If the airplane starts to slide before takeoff power is reached, release the brakes and begin the takeoff run. Continue the power check during the early part of the run.



Under low ambient temperature conditions, never place throttles in TAKEOFF position without monitoring the torquemeters. At these temperatures, it is possible to exceed maximum allowable torque without exceeding the maximum allowable turbine inlet temperature. In addition, increasing ram effect during the takeoff will increase torque for any fixed turbine inlet temperature. This means either that torque must be set below the maximum allowable when setting for takeoff or that power must be reduced as airspeed builds up.

After takeoff from slushy runways where ground operations were conducted in freezing moisture, cycle the landing gear to reduce the possibility of landing gear components freezing in the up position.

NOTE

During operation of the propeller anti-icing system there is a possibility that an indicator “jitter” may occur in the turbine inlet temperature, indicators, torquemeters, tachometers, and fuel flow gauges. This needle “jitter” may make monitoring the affected instruments difficult. If this condition occurs, momentarily turn the prop & eng anti-icing master switch to RESET; then read the indicators.

NOTE

Pour temperature of hydraulic fluid MIL-H-83282B is -55°C (-67°F).

LANDING

Make a normal pattern and landing as outlined in Section II. Use nose wheel steering gently. Use reverse thrust during the early part of the landing roll. As forward speed decreases, decrease reverse power. If reverse thrust is used at slow speeds on snow or slush-covered surfaces, complete loss of visibility may occur. Use Nesa and pitot heat during landing and be prepared to turn on windshield wipers.

NOTE

During use of maximum braking on slippery surfaces, cycling of the anti-skid system will be felt on the brake pedals.

Landing on Icy Runways.

Refer to LANDING ON ICY RUNWAYS as outlined in Section II.

AFTER LANDING

NOTE

Allow approximately 4 minutes warmup for GTC/APU before applying load.

STOPPING ENGINES

Make a normal engine shutdown as outlined in Section II.

BEFORE LEAVING THE AIRPLANE

Perform normal Before Leaving the Airplane checklist as outlined in Section II and:

1. Remove ice and dirt from shock struts.
2. Install all exterior protective covers and shields.
3. If the airplane is to remain outside more than 4 hours at temperatures below -29°C (-20°F), remove the battery and store it in a heated area.
4. Close all doors and hatches.

HOT WEATHER PROCEDURES

Hot weather operation means operation in temperatures above 35°C (95°F) with or without high humidity. Possible results include malfunctioning of electrical equipment, fogging of instruments, rusting of steel parts, and the growth of fungi in vital areas of the airplane. Further results may be pollution of lubricants and hydraulic fluids, and deterioration of non-metallic materials. The procedures essential to operation and maintenance under such conditions are given in the following paragraphs. They are in addition to normal procedures in Section II.

PREFLIGHT CHECK

Give special attention to the following:

1. Cool the flight station and cargo compartments with portable coolers, if available. If instruments, equipment, and controls are moisture-coated, wipe them dry with a clean, soft cloth.
2. Inspect for freedom from corrosion or fungus at joints, hinge points, and similar locations.
3. Check for hydraulic leaks as heat and moisture may cause seals and packings to swell.

4. Inspect the shock struts for cleanliness.
5. Inspect tires for proper inflation.
6. Remove all protective covers and shields.

STARTING ENGINES

1. When practical, position the airplane heading into the wind.
2. Alternate between the four engines for the first engine to be started. On airplanes equipped with a GTC do not operate the ATM while starting an engine with the GTC.
3. During sustained hot weather operation, record in Form CG 4377 when an engine does not lightoff between 16 percent and 25 percent rpm, especially during APU/GTC starts.

NOTE

Attaining lightoff between 16 percent and 25 percent rpm provides better turbine assist for acceleration to on-speed rpm at the earliest possible time in the start cycle.

4. Before turning bleed air on for air conditioning, turn the AIR CONDITIONING MASTER switch to NO PRESS and manually position the temperature control switches to WARM, then operate the system 20 to 30 seconds before selecting AUTO and/or COOL.



If a popping noise (compressor stall) is experienced when changing from normal ground idle to low-speed ground idle or from low-speed ground idle to normal ground idle, return the airplane for maintenance action.

TAXI

1. Use brakes as little as possible to avoid overheating.
2. Taxi with all engines in low-speed ground idle.

BEFORE TAKEOFF/LINEUP

Turn engine bleed air off to increase power available during takeoff and climbout flight path.

TAKEOFF

Takeoff run is considerably increased and rate of climb decreased in high temperatures.

CRUISE

Fuel densities will decrease as the ambient temperature rises, resulting in a decrease in operating range. In addition, the boiloff rate will increase and it may be necessary to restrict rate of climb of the airplane at altitude. Refer to FUEL in Section V.

DESCENT

1. During descent adjust the throttles to prevent NTS action.
2. During descent (for landing) below 15,000 feet, manually open the oil cooler flaps and place the switches to the "FIXED" position. Monitor oil temperature and manually control the oil cooler flaps to keep the oil temperature close to 60° C (140° F).

LANDING



Rapid movement of throttles to reverse at high airspeeds can cause engines to bog down.

AFTER LANDING

When practical, park the airplane heading into the wind.

STOPPING ENGINES

As soon as the airplane is parked, chock wheels and release brakes in order to avoid possible damage to brake components from excessive heat generated while taxiing.

BEFORE LEAVING THE AIRPLANE

1. Have appropriate protective covers installed for protection from the sun.

2. When weather conditions permit, leave flight station windows and cargo compartment doors open to ventilate the airplane.

DESERT PROCEDURES

Desert operation generally means operation in a very hot, dry, dusty, often windy atmosphere. Under such conditions, sand and dust will often be found in vital areas of the airplane, such as hinge points, bearings, landing gear shock struts, and engine cowling and intakes. Severe damage to the affected parts may be caused by the dust and sand. Position the airplane so the propwash will not expose other airplanes, personnel, and ground equipment to blown sand or dust. The necessary operations under such conditions are given in the following paragraphs. They are in addition to normal procedures in Section II.

PREFLIGHT CHECK

1. Cool the flight station and cargo compartments with portable coolers, if available.

NOTE

Use of the GTC/APU for ground air conditioning may pull in quantities of sand and dust.

2. Inspect all control surface hinges and actuating linkage for freedom of sand and dust.
3. Inspect tires for proper inflation.
4. Inspect shock struts for cleanliness.
5. Remove all protective covers and shields.
6. Wipe out the inlet ducts to remove any accumulated sand or dust.

BEFORE STARTING ENGINES

Inspect instrument panels, switches, and controls for freedom of sand and dust.

TAXI

1. Operate all flight controls through at least two full cycles to ensure unrestricted operation.
2. Do not operate the air conditioning system on the ground.
3. Use care to avoid blowing sand or dust on other airplanes, personnel, or equipment.

4. Plan to make shallow turns. Use differential power to assist nose wheel steering for directional control.
5. Minimize ground operation to avoid excessive sand and dust accumulation in the air conditioning and APU/GTC inlet ducts.
6. Taxi with all engines in low-speed ground idle.



If a popping noise (compressor stall) is experienced when changing from normal ground idle to low-speed ground idle or from low-speed ground idle to normal ground idle, return the airplane for maintenance action.

7. If normal ground idle is required during ground maneuvering of the airplane (except for reverse taxi), do not move the throttles below the GROUND IDLE position.
8. Use minimum speed when making turns.
9. During taxi-out for takeoff, do not lower flaps until lined up with the runway and ready for takeoff.
10. When making propeller reverse check before flight, stop the airplane, advance the throttles to at least crossover to blow loose sand away; then make reverse checks. Perform the reverse checks over hard surface areas if possible, two engines at a time, while the other two engines remain at crossover.

REVERSE TAXIING

1. If it is absolutely necessary to back the airplane using propeller reversing, first advance the throttles to at least crossover to blow loose sand away.
2. After the airplane is positioned, move the throttles to a position slightly above GROUND IDLE until the sand/dust cloud has been blown aft of the airplane.

TAKEOFF/CRUISE

1. Avoid takeoff during or flying through sand or dust storms, if possible.
2. When sand/dust is in the atmosphere, attain an altitude above the contamination as soon as possible.

LANDING

1. Turn the air conditioning system off prior to landing.
2. Compute landing performance data using maximum anti-skid braking and four engines in ground idle.
3. When propeller reversing is used during landing, start moving the throttles from MAXIMUM REVERSE to GROUND IDLE at approximately 60 KIAS and have the throttles at GROUND IDLE by the time 40 KIAS is reached.

STOPPING ENGINES

As soon as the airplane is parked, check the wheels and release the brakes to avoid damage to brake components due to excessive heat generated while taxiing.

BEFORE LEAVING THE AIRPLANE

Give special attention to the following:

1. Have all protective covers and shields installed.
2. Except in dust or rainy weather, leave flight station windows and cargo compartment doors open to ventilate the airplane.

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