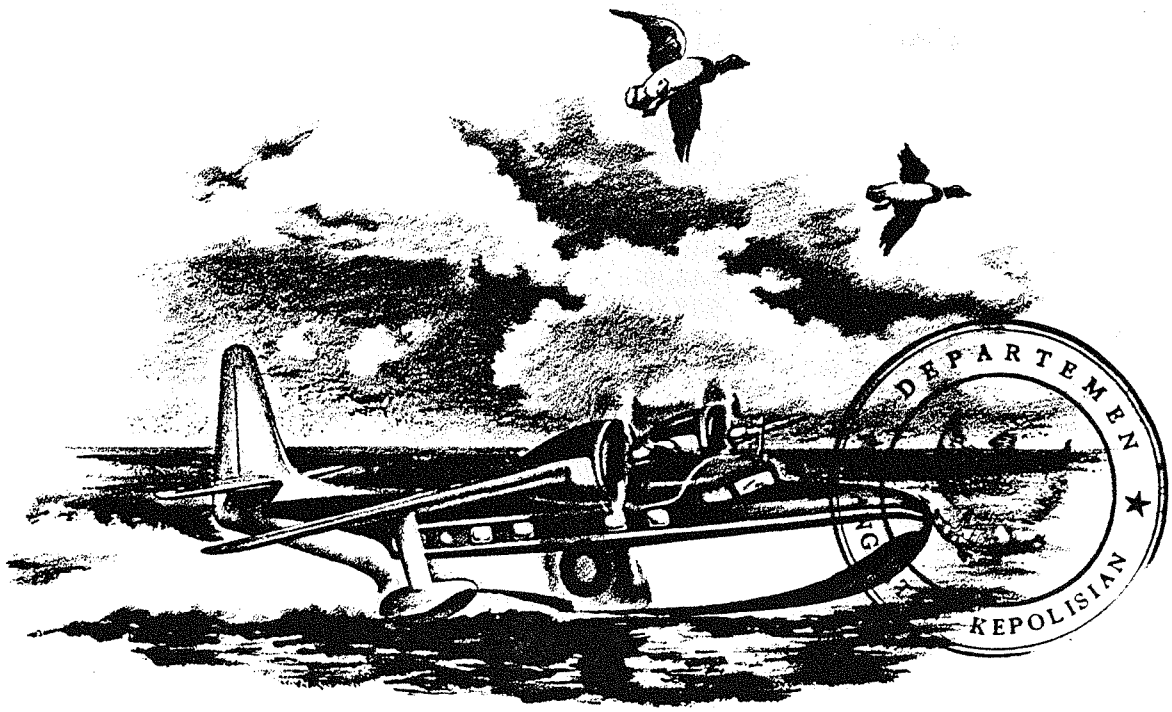
CAA APPROVED

Airplane Flight Manual



Grumman Mallard

AMPHIBIAN

Model G-73

Manufacturer's Serial No. _____ CAA Identification No. _____

THIS MANUAL TO BE CARRIED IN THE
PILOT'S COMPARTMENT AT ALL TIMES

Approved by: *Charles F. Dycer* XB
DIRECTOR AIRCRAFT COMPONENTS AND SERVICE

NOVEMBER 15, 1947
This manual supersedes any issued prior to June 30, 1947

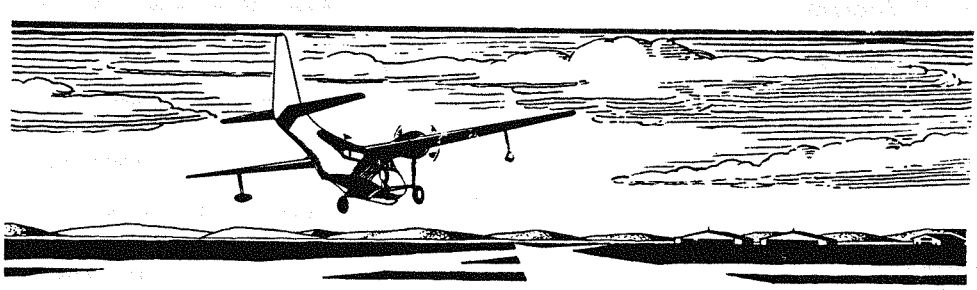
GRUMMAN AIRCRAFT ENGINEERING CORP. BETHPAGE, L.I., NEW YORK

John J. Bellercan

LOG OF REVISIONS

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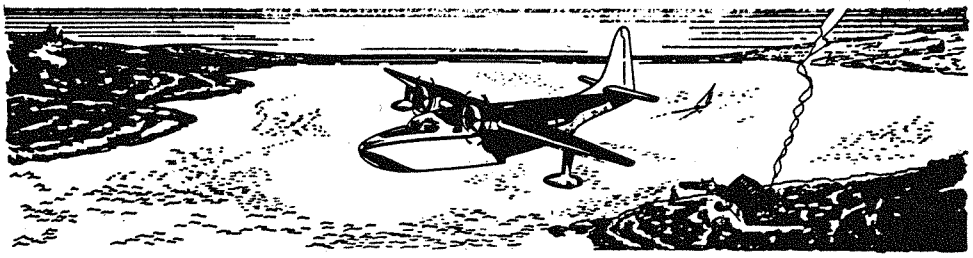
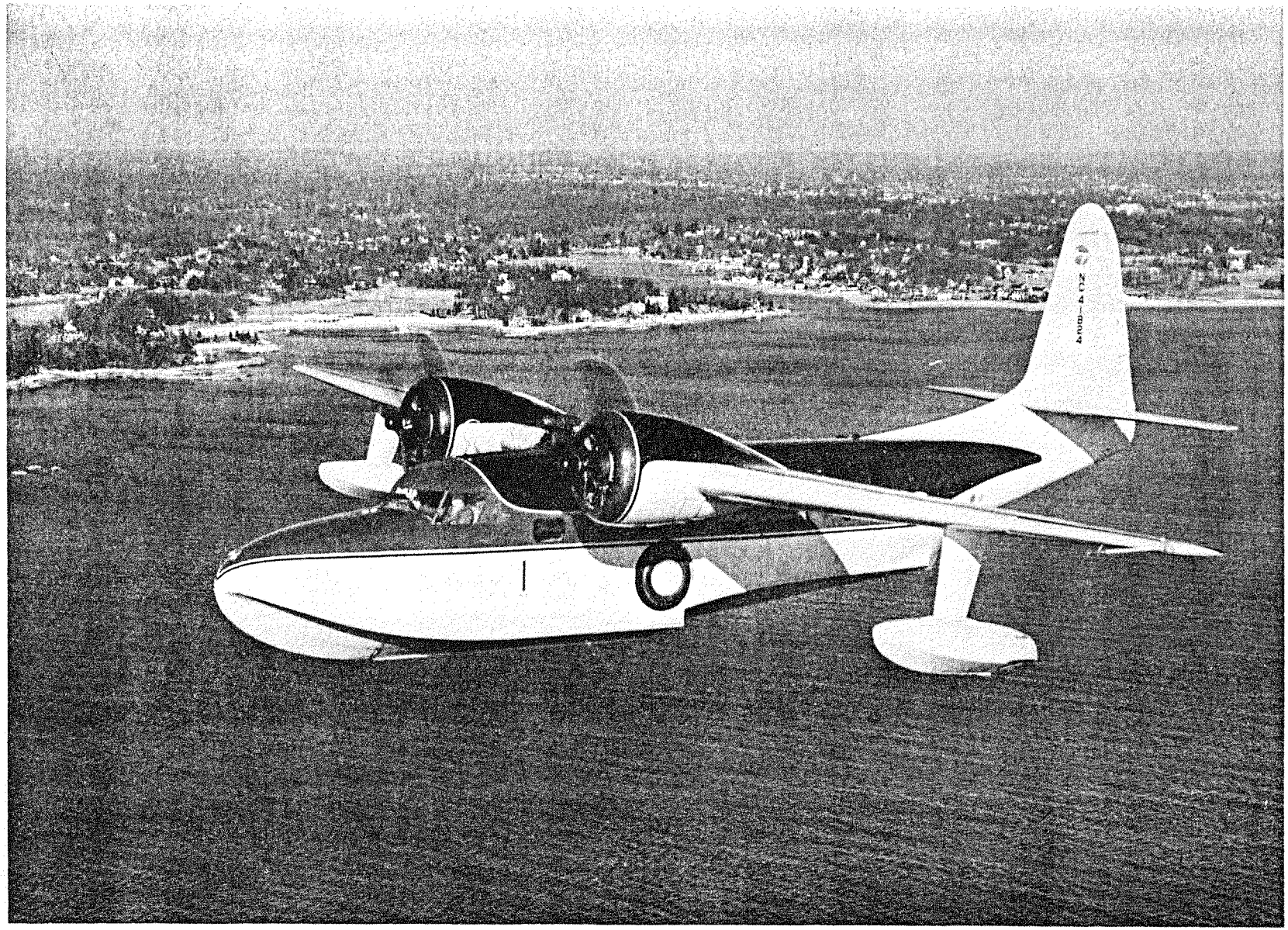
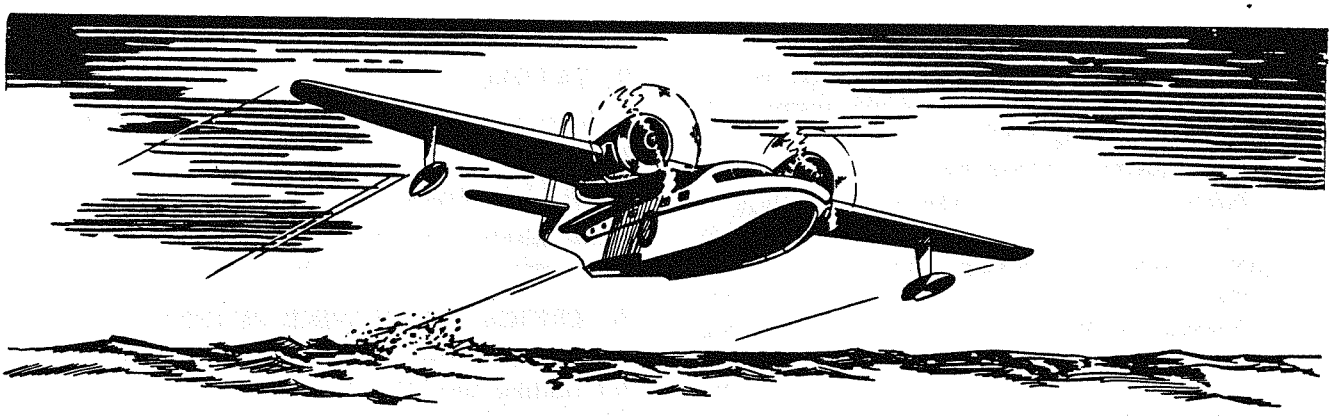


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The Mallard in Flight



SECTION I

Operating Limitations

Note

Compliance with the operating limitations noted in SECTION I is required by law.

1. WEIGHT.

a. Maximum take-off weight at sea level is 12,750 pounds.

b. Maximum landing weight at sea level is 12,750 pounds.

2. CENTER OF GRAVITY.

The airplane must be loaded in accordance with the approved charts and data (See Section V).

a. The maximum forward center of gravity position for operation is 15 per cent of the mean aerodynamic chord, wheels down.

b. The maximum aft center of gravity position for operation is 26.5 per cent of the mean aerodynamic chord, wheels down.

3. POWER PLANT.

The air cooled, radial, single row nine cylinder Pratt and Whitney Wasp "H"-S3H1 direct drive engines with NA-Y9E-1 carburetors drive Hamilton Standard Hydromatic Full Feathering propellers.

a. RATINGS.

Condition	*BHP*	*RPM*	*Altitude in Ft.*	*Manifold Pressure*
Take-Off (1 Min.)	600	2250	Sea Level	36" Hg.
Maximum (Cont)	550	2200	Sea Level	34" Hg.
Maximum (Cont)	550	2200	5000	32.5" Hg.

Maximum Permissible Cylinder Head Temperature ..... 260°C (500°F)

Desired Cylinder Temperature (Maximum Continous) .... 205°C (401°F) or less

Maximum Permissible Oil Inlet Temperature ..... 93°C (200°F)

b. PROPELLERS.—The propellers are three blade Hamilton Standard Hydromatic Full Feathering equipped with a 23D40-51 hub and 6533A-18 blades

	Degrees of Pitch
Low Pitch Setting	12°
Constant Speed Range	12°-30°
Locked Pitch Setting	30°
Feathered	84°

c. FUEL.—Use fuel of not less than 91 octane. Refer to Section III, Recommended Operating Procedures, 16, Wing Tip Float Auxiliary Fuel System (Special Equipment) page 39, if wink tip float tanks are installed.

d. OIL.—Use S.A.E. No. 60 and No. 50 in cold weather.

4. SPEEDS.

All speeds listed in this manual are true indicated airspeeds. See Figure 3, page 7, for air speed indicator calibration.

a. LIMITATIONS	MPH TIAS
Maximum Level Flight Speed.	220
Maximum Glide or Dive Speed.	270
Maximum Speed at which flaps may be used.	125
Maximum Speed at which gear may be used.	150
Minimum Speed at which airplane is controllable in flight with one engine failure (propeller windmilling in low pitch, other engine at take-off power, flaps in take-off position (up), landing gear up.)	90
Minimum take-off climb speed (V_2)	100
Design Maneuvering Speed.	148

b. DEMONSTRATION SPEEDS. — The performance data, shown in Section II of this manual, are based on the following speeds:

TWIN ENGINE CLIMB SPEED	
Normal	(See Figure 5 Page 9)
Landing	85
SINGLE ENGINE CLIMB SPEED	
Take-Off	100
Enroute to 5000 ft	100
above 5000 ft	110
Approach	100
CRITICAL ENGINE FAILURE SPEED	100

5. CREW.

The airplane may be safely operated with a crew of one. The left seat in the pilot's compartment is for the pilot.

6. FLAPS.

The performance shown in Section II of this manual is based on the following flap positions:

Take-Off	0°
Approach	0°
Landing	45°
Enroute Operation	0°

7. TAXIING.

There are no special limitations on taxiing this airplane.

8. WAVE HEIGHT.

The airplane may be landed or taken off from the water with waves 2½ ft high.

9. CRITICAL CROSS-WIND VELOCITY.

a. LAND.—The airplane is considered satisfactory for landings and take-offs in direct cross-winds up to 30 mph as six foot altitude.

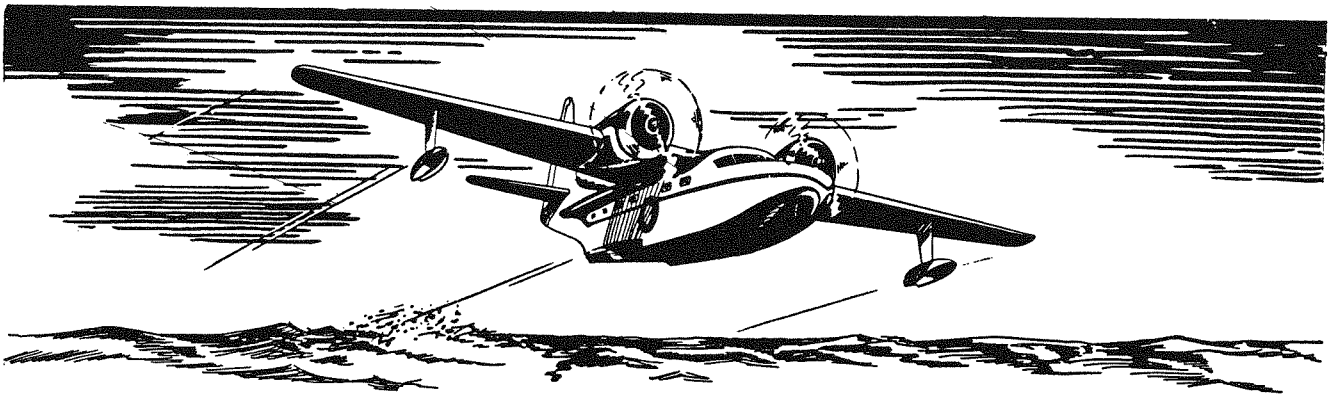
b. WATER.—The airplane is considered satisfactory for landings and take-offs in direct cross-winds of 20 mph at six foot altitude.

10. INSTRUMENT LIMIT MARKINGS.

Green Arc	Normal operating range
Red Radial Line	Maximum or minimum limits
Yellow Arc	Cautionary range
White Arc	Flap operating range

Note

The performance data given in Section II is applicable both with and without de-icer boots installed.



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Operating Limitations

Note

Compliance with the operating limitations noted in SECTION I is required by law.

1. WEIGHT.

a. Maximum take-off weight at sea level is 12,750 pounds.

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The air cooled, radial, single row nine cylinder Pratt and Whitney Wasp S1H1 direct drive engines with NA-Y9E-1 carburetors drive Hamilton Standard Hydromatic Full Feathering propellers.

a. RATINGS.

Condition	*BHP*	*RPM*	*Altitude in Ft.*	*Manifold Pressure*
Take-Off (1 Min.)	600	2250	Sea Level	36.5" Hg
Maximum (Cont)	550	2200	Sea Level	34" Hg
Maximum (Cont)	550	2200	8000	33" Hg

Maximum Permissible Cylinder Head Temperature ..... 260°C (500°F)

Desired Cylinder Temperature (Maximum Continous) .... 205°C (401°F) or less

Maximum Permissible Oil Inlet Temperature ..... 93°C (200°F)

b. PROPELLERS.—The propellers are three blade Hamilton Standard Hydromatic Full Feathering equipped with a 23D40-51 hub and 6533A-18 blades.

	Degrees of Pitch
Low Pitch Setting	12°
Constant Speed Range	12°-30°
Locked Pitch Setting	30°
Feathered	84°

c. FUEL.—Use fuel of not less than 91 octane. Refer to Section III, Recommended Operating Procedures, 16, Wing Tip Float Auxiliary Fuel System (Special Equipment) page 39, if wing tip float tanks are installed.

d. OIL.—Use S.A.E. No. 60 and No. 50 in cold weather.

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a. LIMITATIONS	MPH TIAS
Maximum Level Flight Speed.	220
Maximum Glide or Dive Speed.	270
Maximum Speed at which flaps may be used.	125
Maximum Speed at which landing gear may be used.	150
Minimum Speed at which airplane is controllable in flight with one engine failure (propeller windmilling in low pitch, other engine at take-off power, flaps in take-off position (up), landing gear up.)	90
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TWIN ENGINE CLIMB SPEED	
Normal	(See Figure 5 Page 9)
Landing	85
SINGLE ENGINE CLIMB SPEED	
Take-Off	100
Enroute to 5000 ft	100
above 5000 ft	110
Approach	100
CRITICAL ENGINE FAILURE SPEED	100

5. CREW.

The airplane may be safely operated with a crew of one. The left seat in the pilot's compartment is for the pilot.

6. FLAPS.

The performance shown in Section II of this manual is based on the following flap positions:

Take-Off	0°
Approach	0°
Landing	45°
Enroute Operation	0°

7. TAXIING.

There are no special limitations on taxiing this airplane.

8. WAVE HEIGHT.

The airplane may be landed or taken off from the water with waves 2½ ft high.

9. CRITICAL CROSS-WIND VELOCITY.

a. LAND.—The airplane is considered satisfactory for landings and take-offs in direct cross-winds up to 30 mph as six foot altitude.

b. WATER.—The airplane is considered satisfactory for landings and take-offs in direct cross-winds of 20 mph at six foot altitude.

10. INSTRUMENT LIMIT MARKINGS.

Green Arc	Normal operating range
Red Radial Line	Maximum or minimum limits
Yellow Arc	Cautionary range
White Arc	Flap operating range

Note

The performance data given in Section II is applicable both with and without de-icer boots installed.

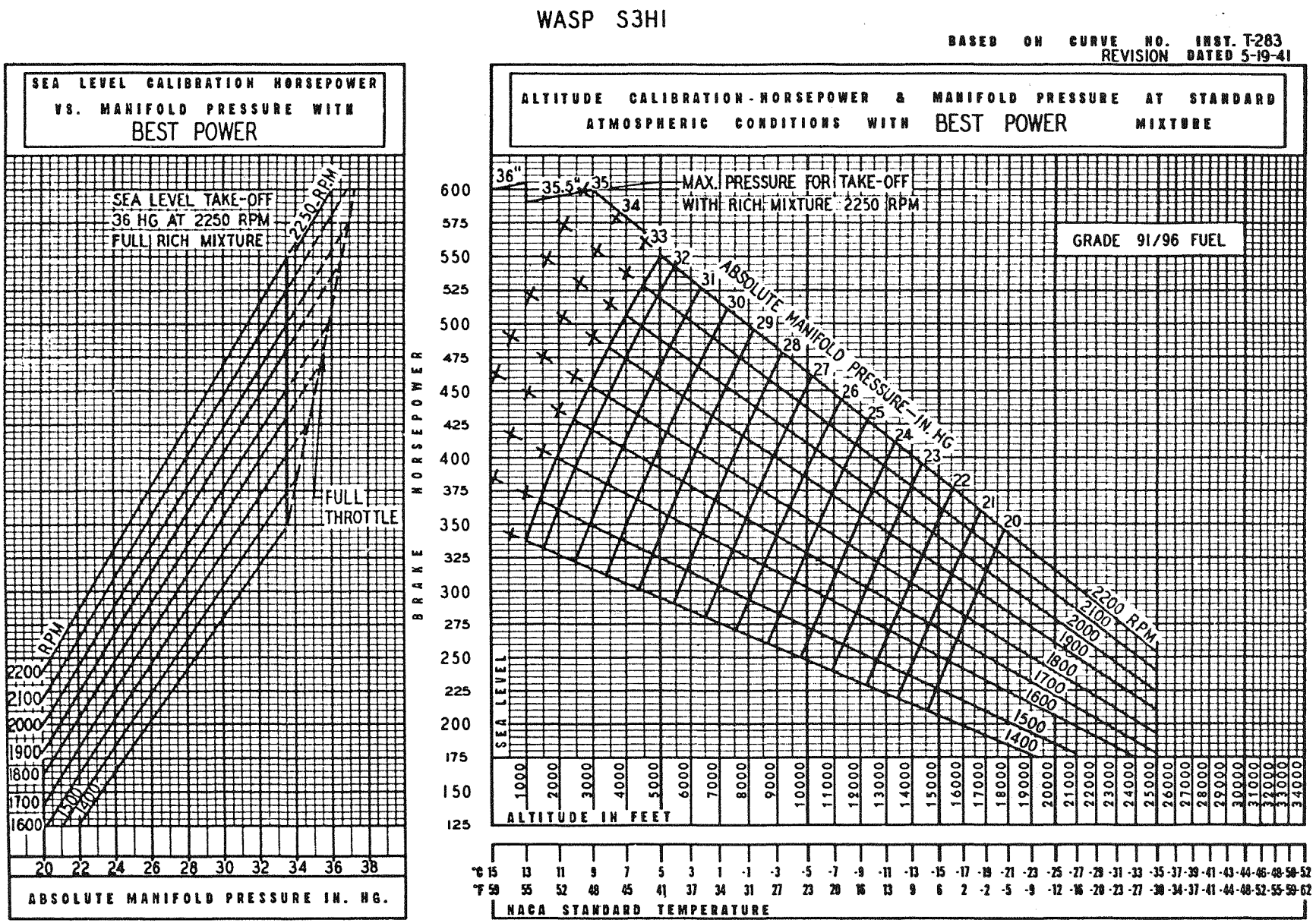


Figure 2—Engine Power Curve

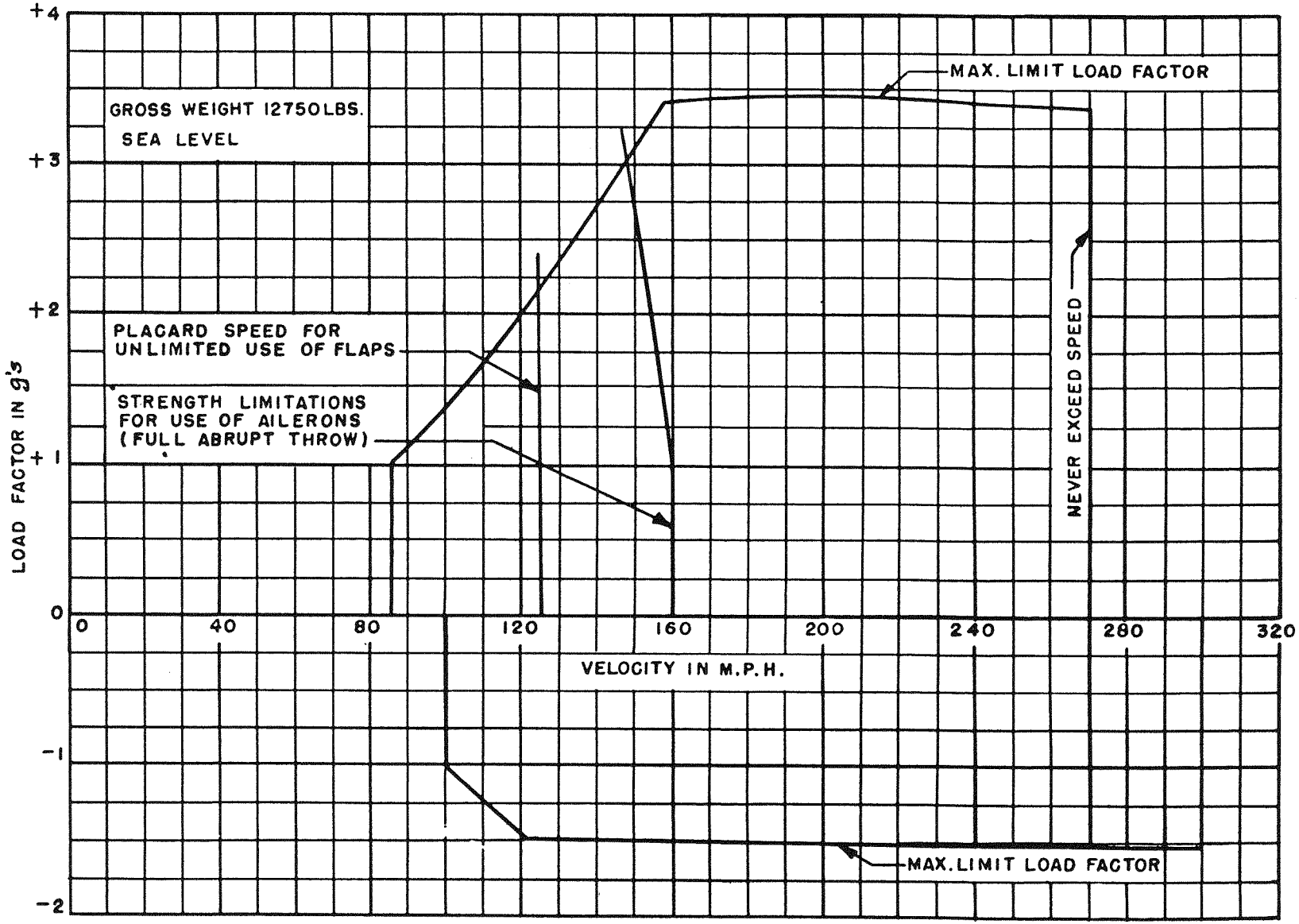
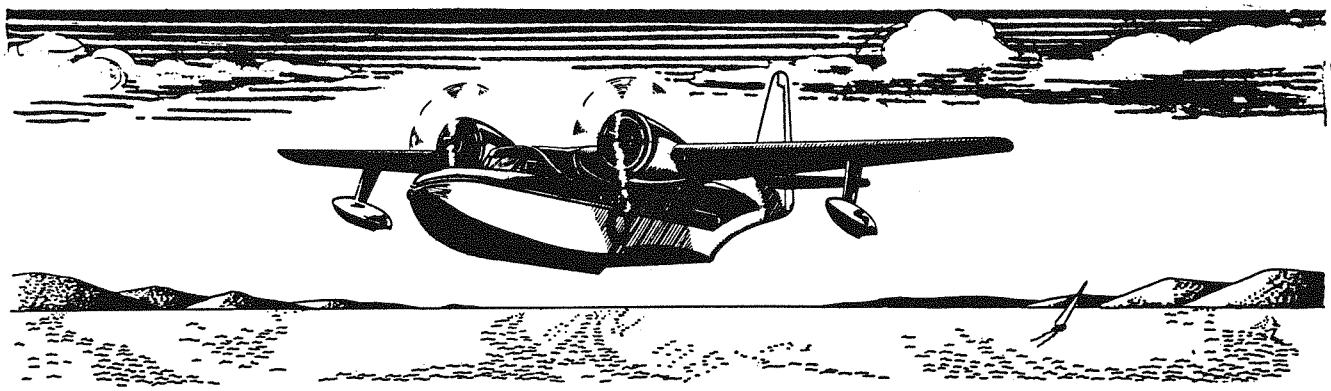


Figure 1—V-g Diagram



SECTION II

Performance Information

Note

With S1H1 engines installed, take-off critical altitude is increased by approximately 2000 feet over that shown on take-off, approach, and landing climbs. The climb performance above the critical altitude will be increased accordingly. METO power critical altitude is increased from 5500 feet to 8400 feet.

Revised S1H1 Engines; C.A.A. Approved 5-18-50

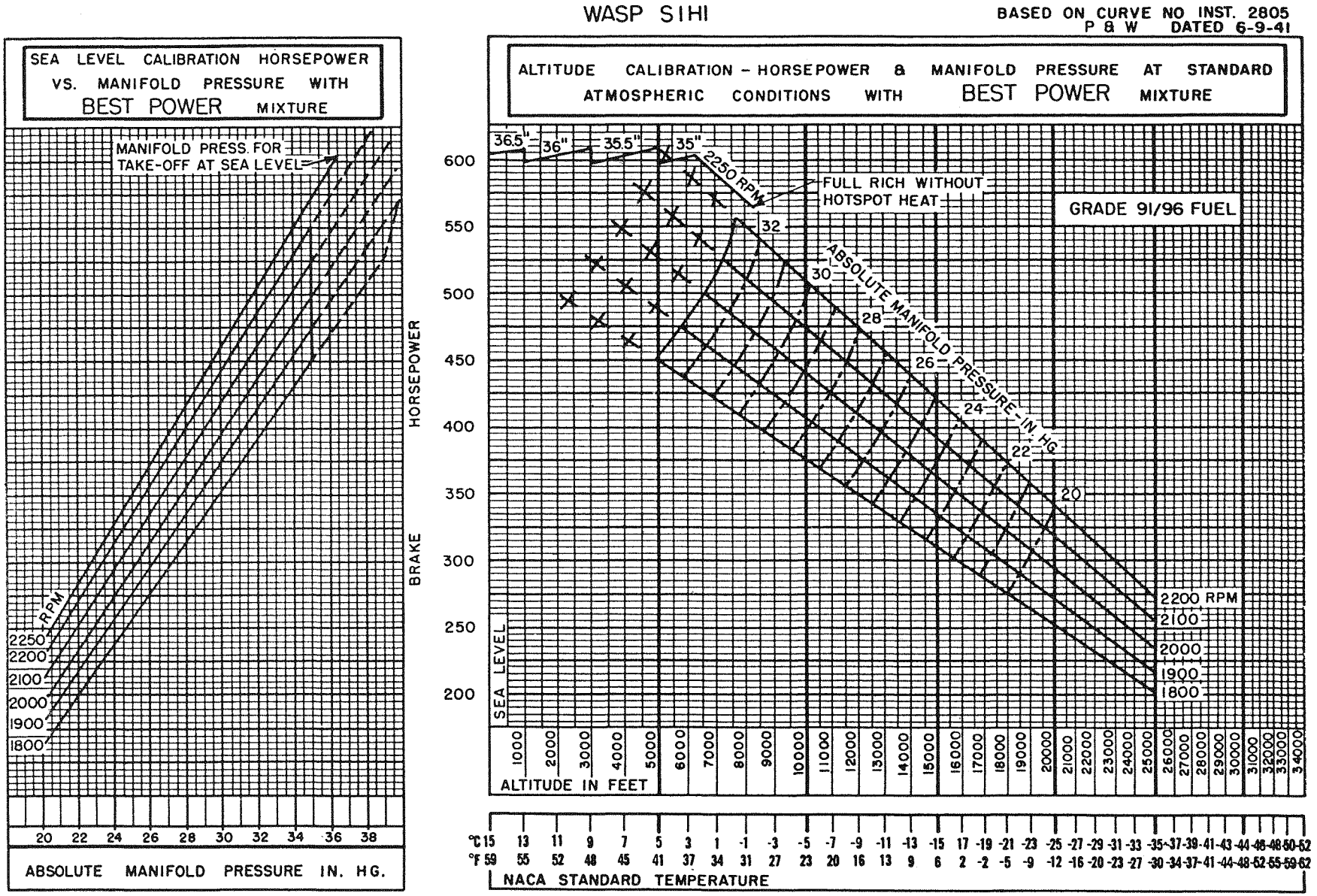


Figure 2—Engine Power Curve

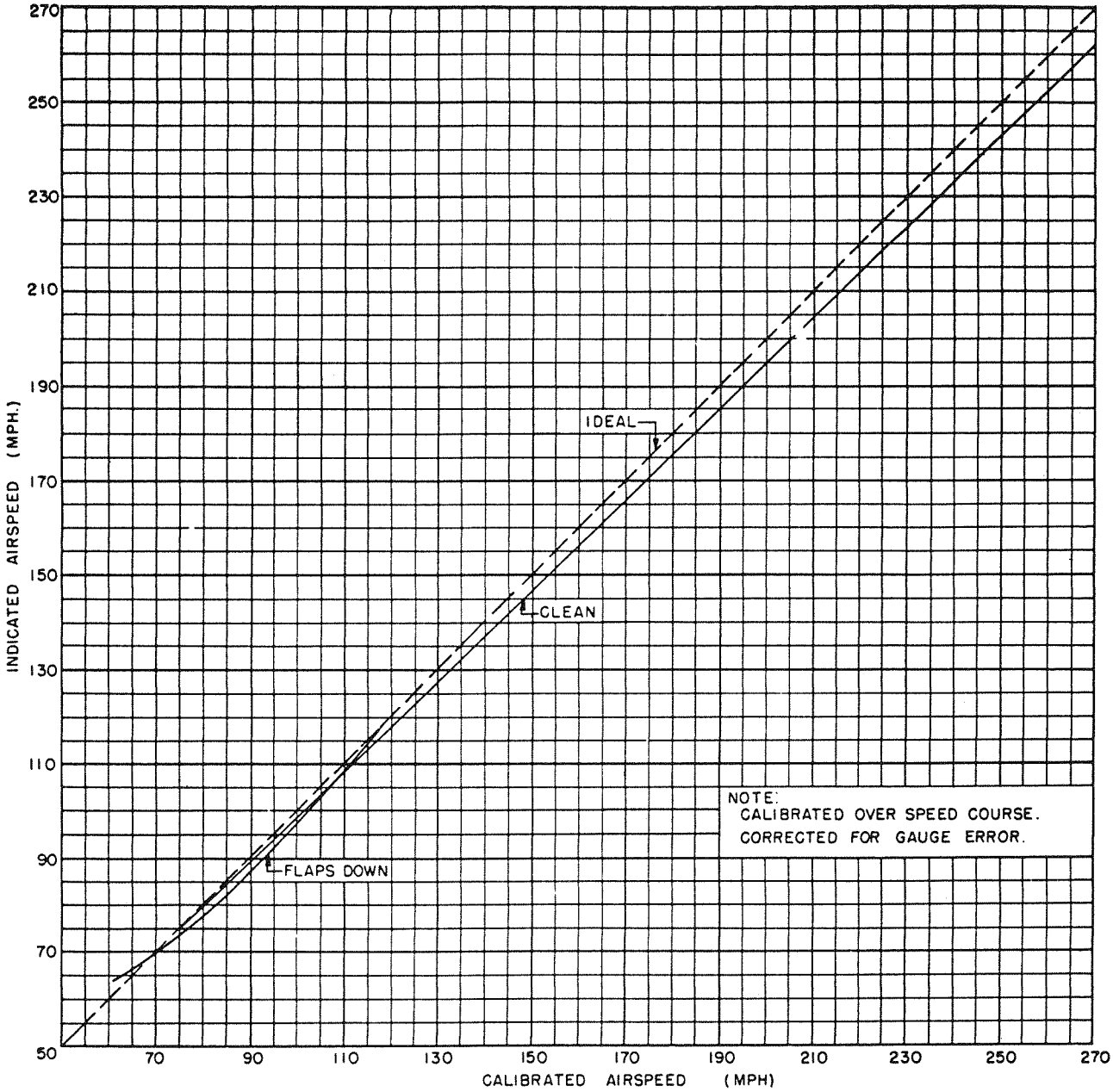


Figure 3—Airspeed Calibration

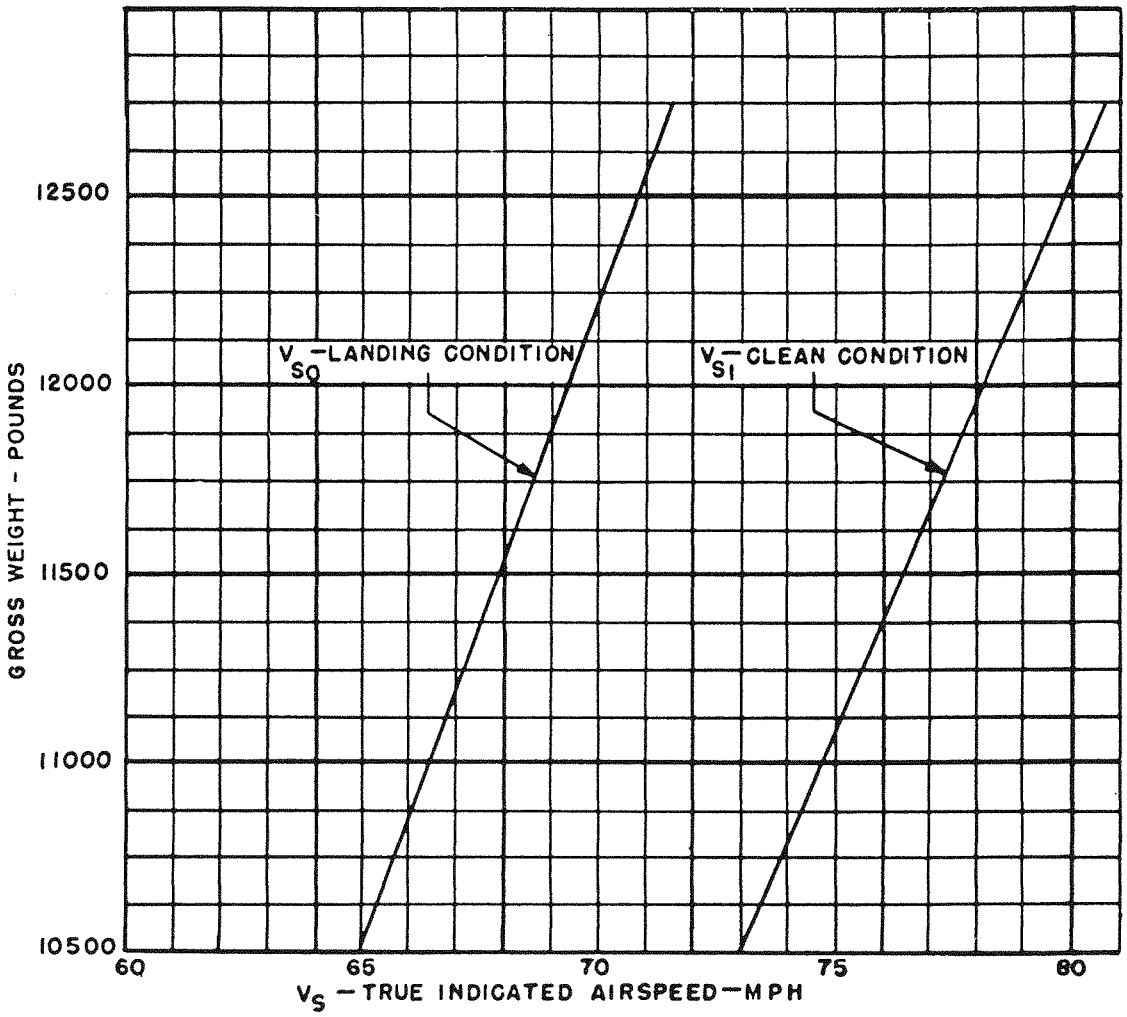


Figure 4—Stalling Speeds

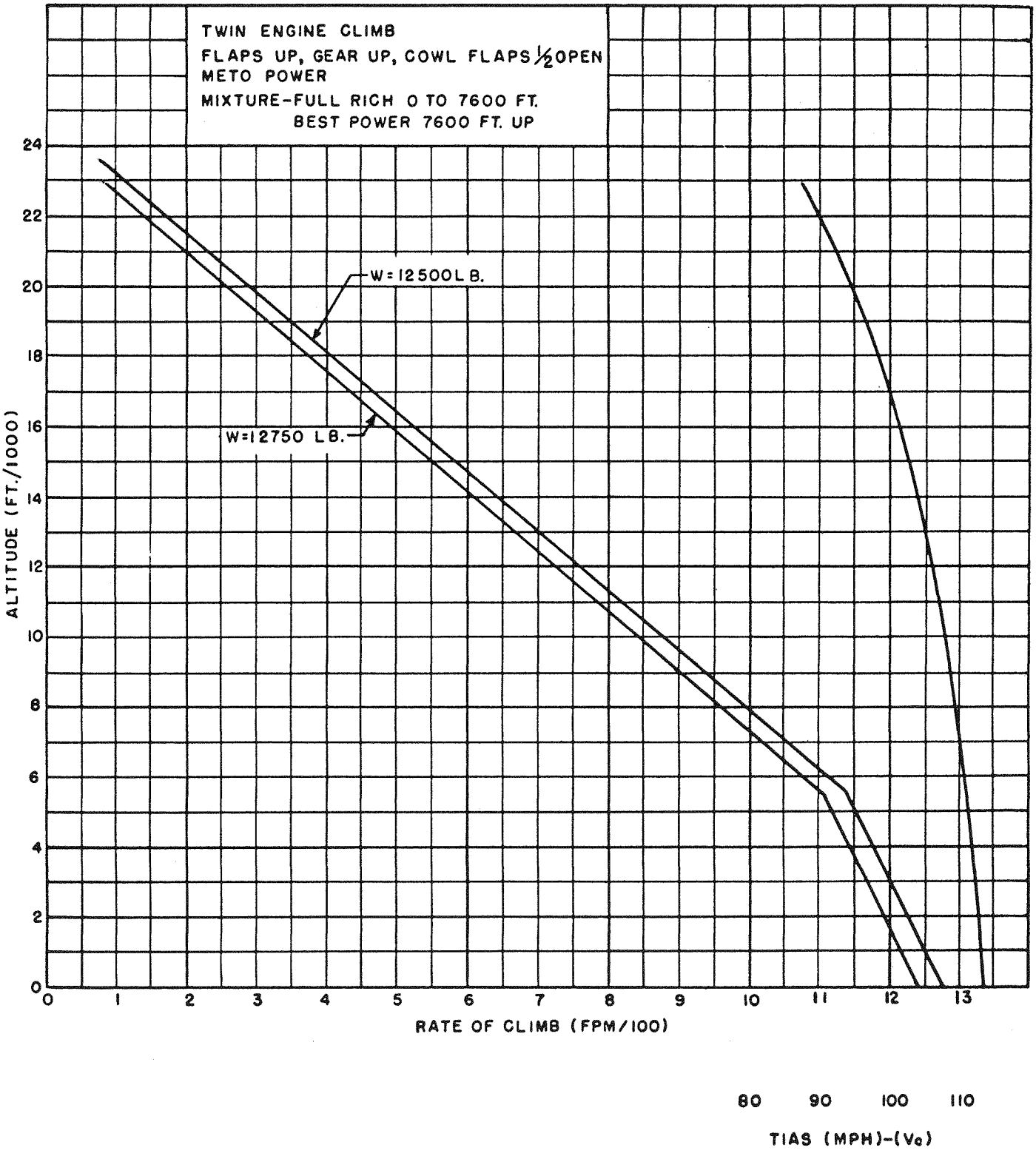


Figure 5—Twin Engine Climb

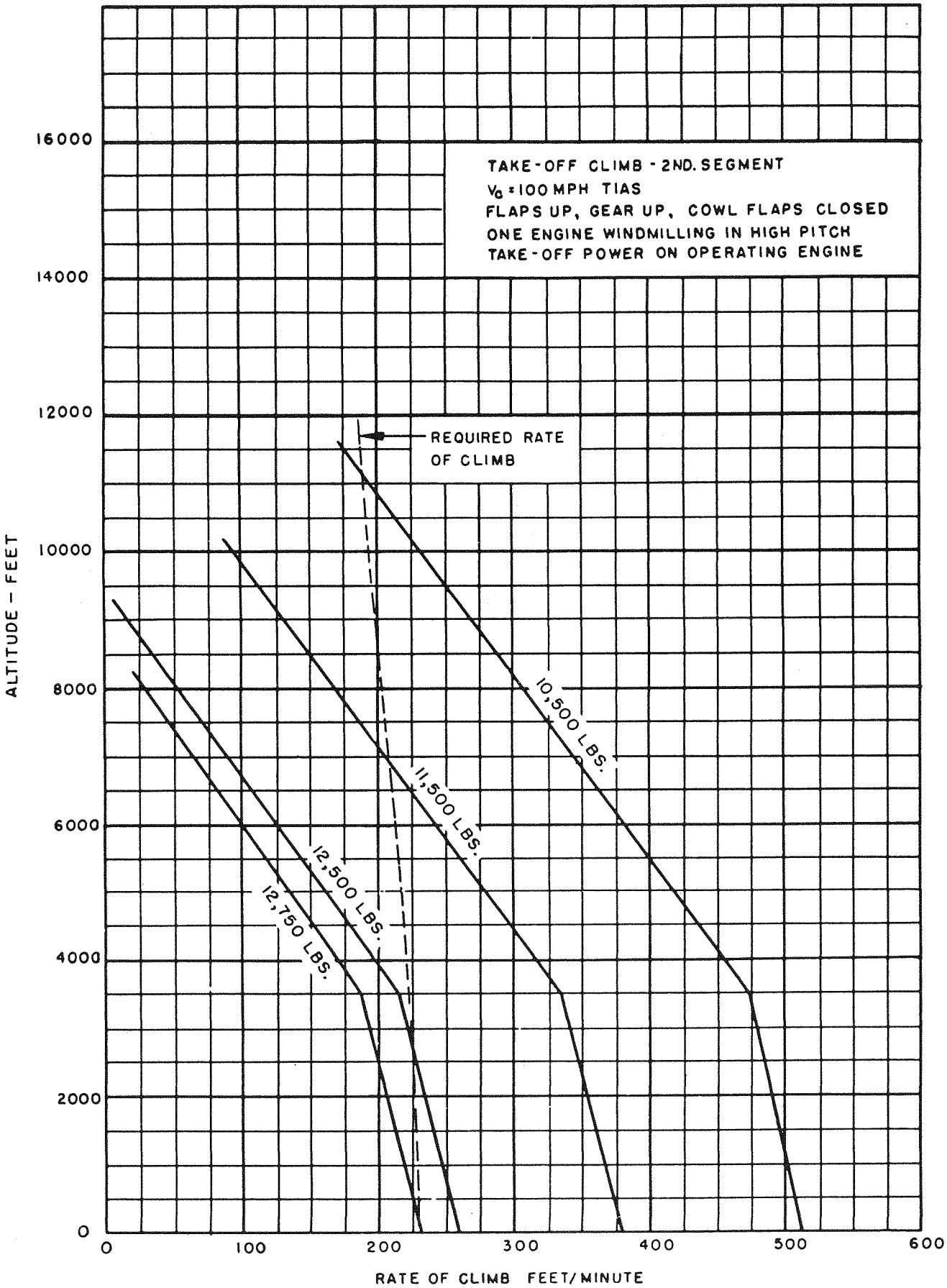


Figure 6—Take-Off Climb

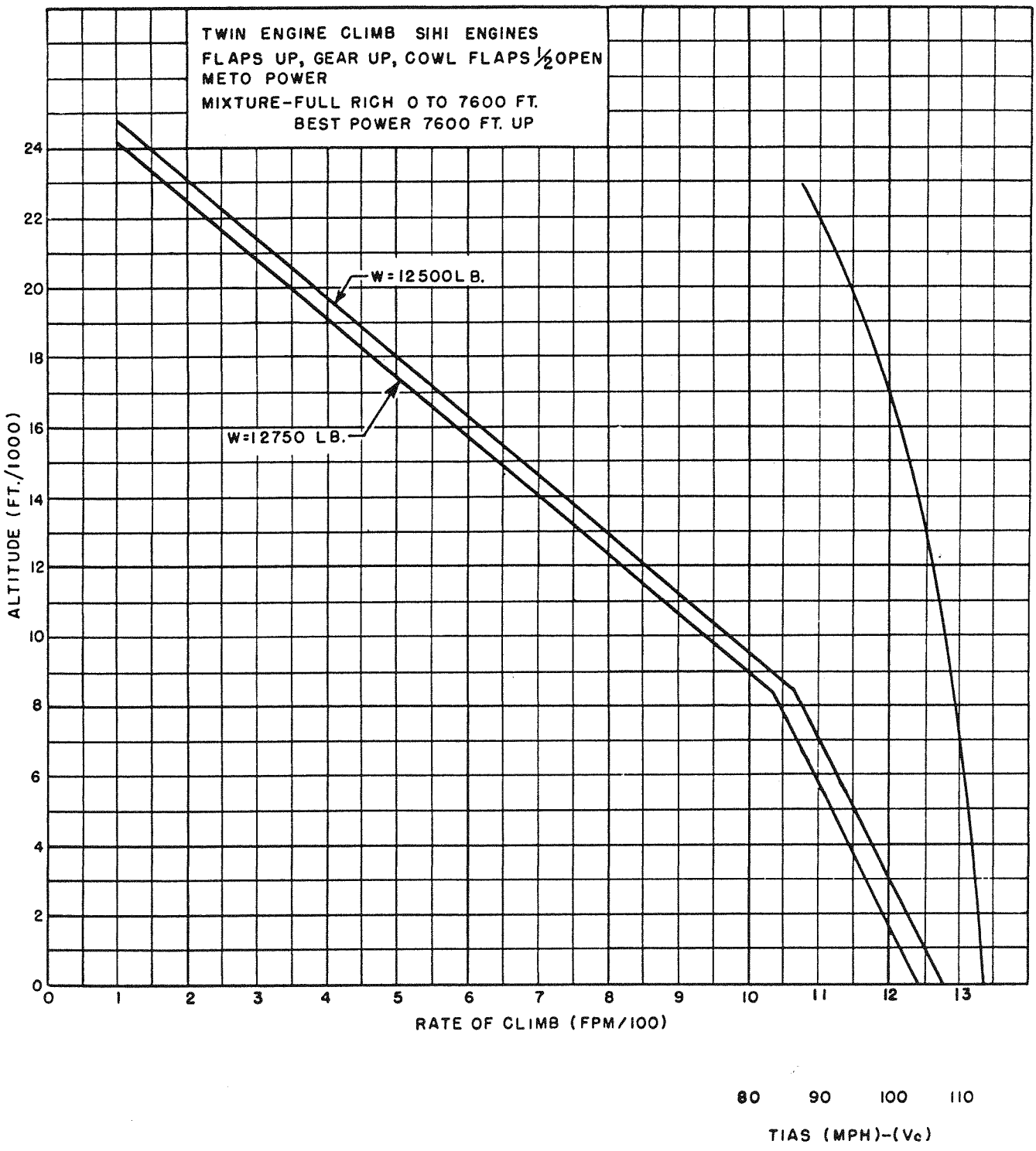


Figure 5—Twin Engine Climb

Revised S1H1 Engines; C.A.A. Approved 5-18-50

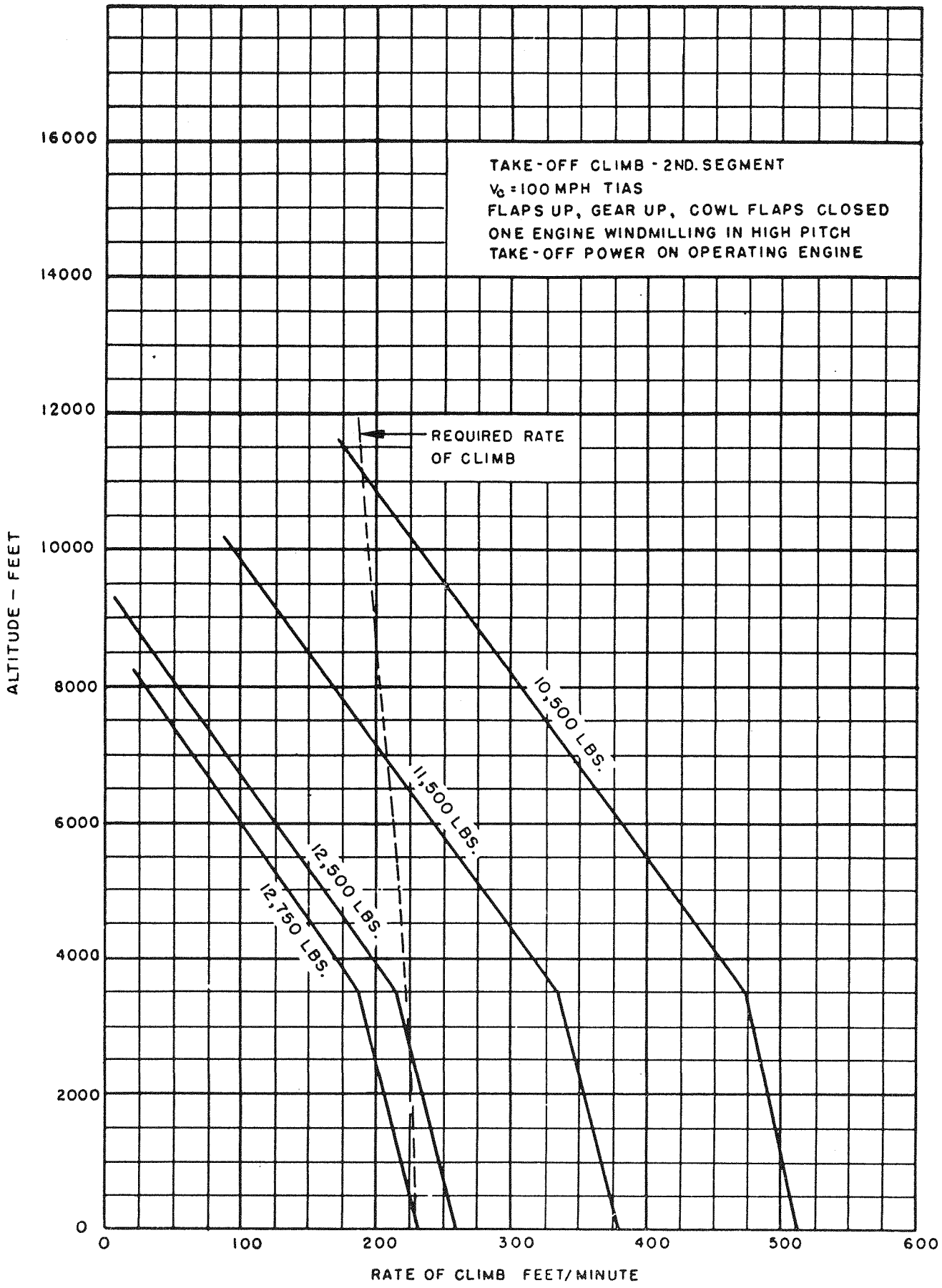


Figure 6—Take-Off Climb

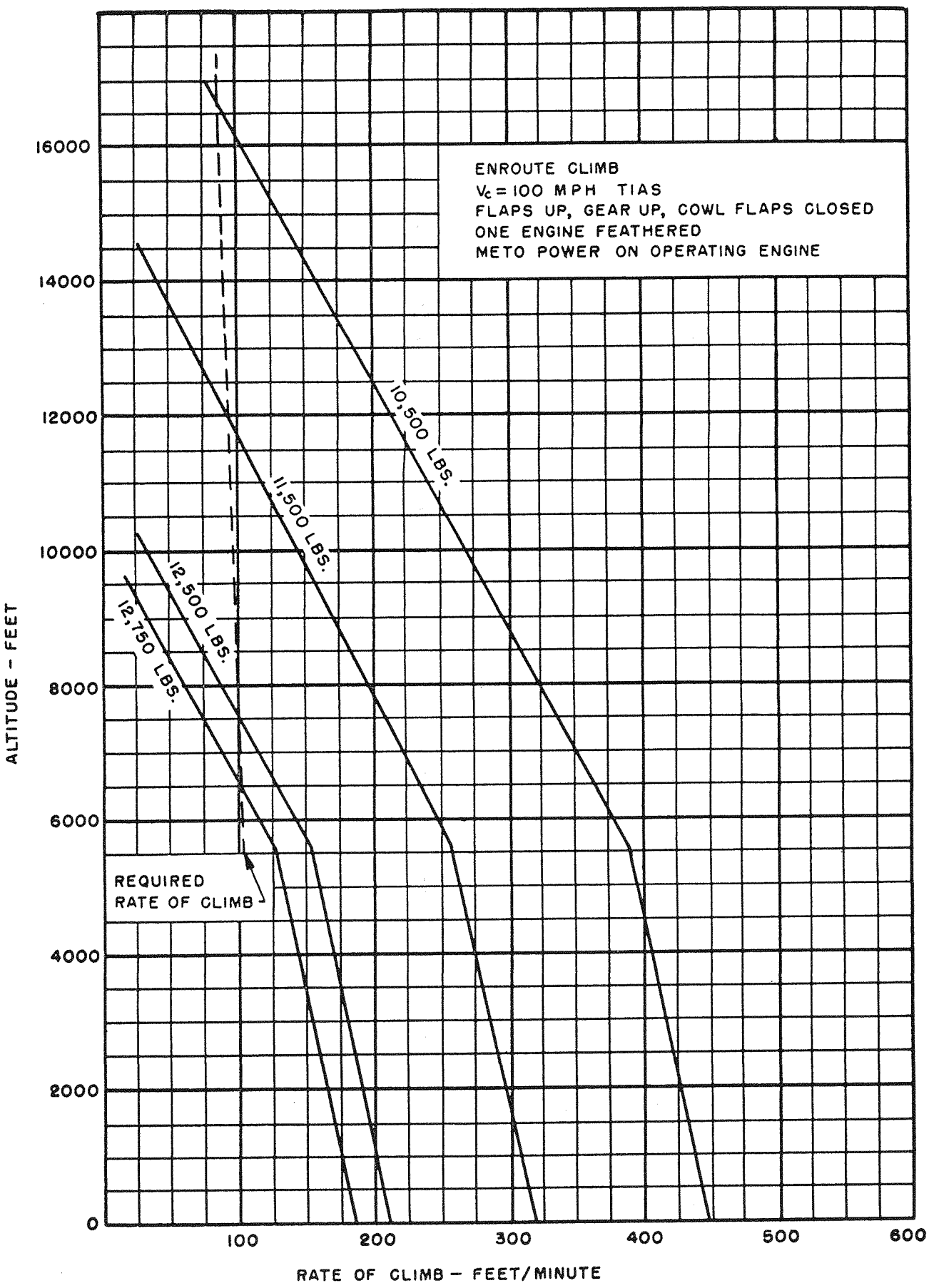


Figure 7—Enroute Climb

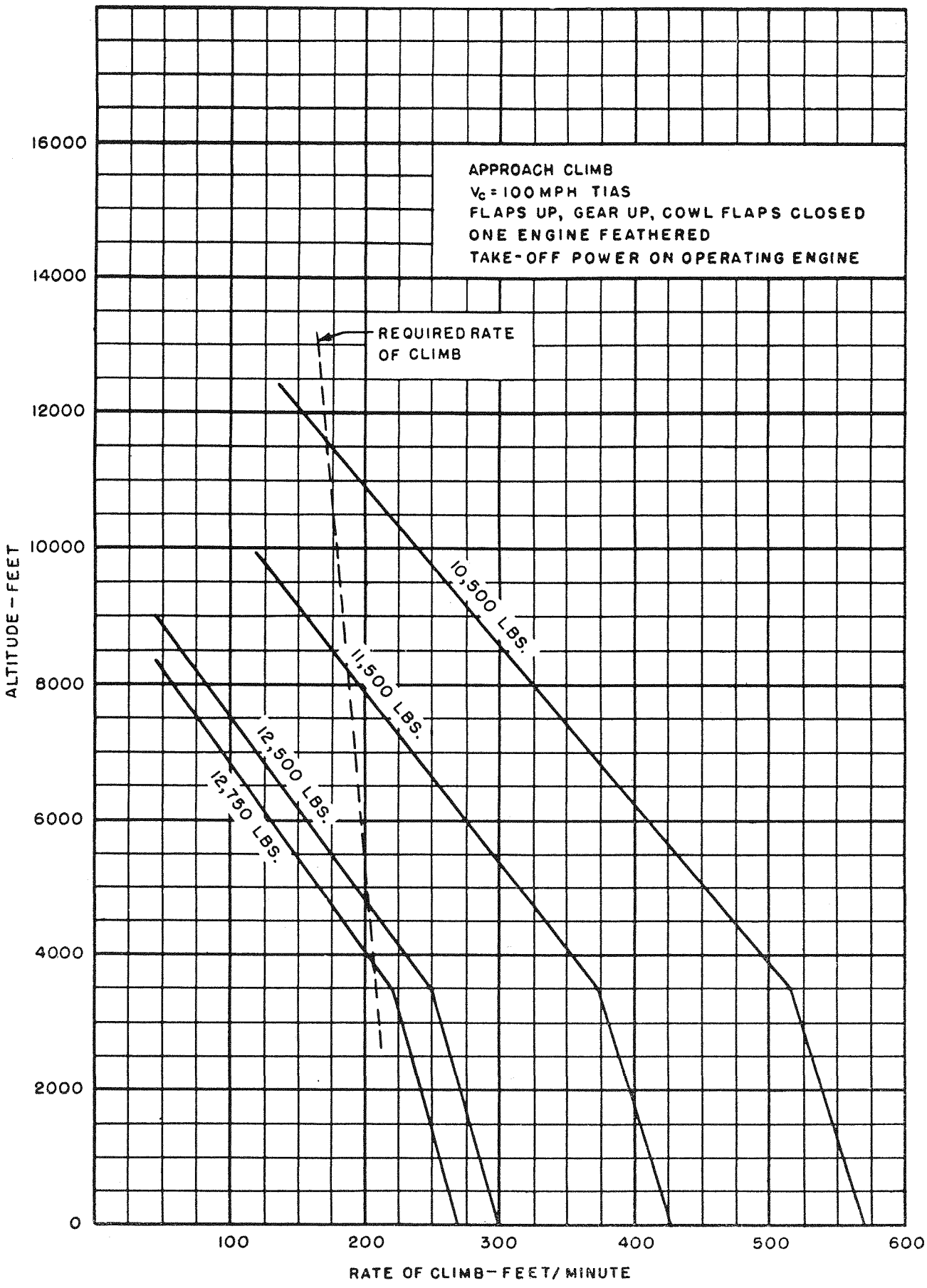


Figure 8—Approach Climb

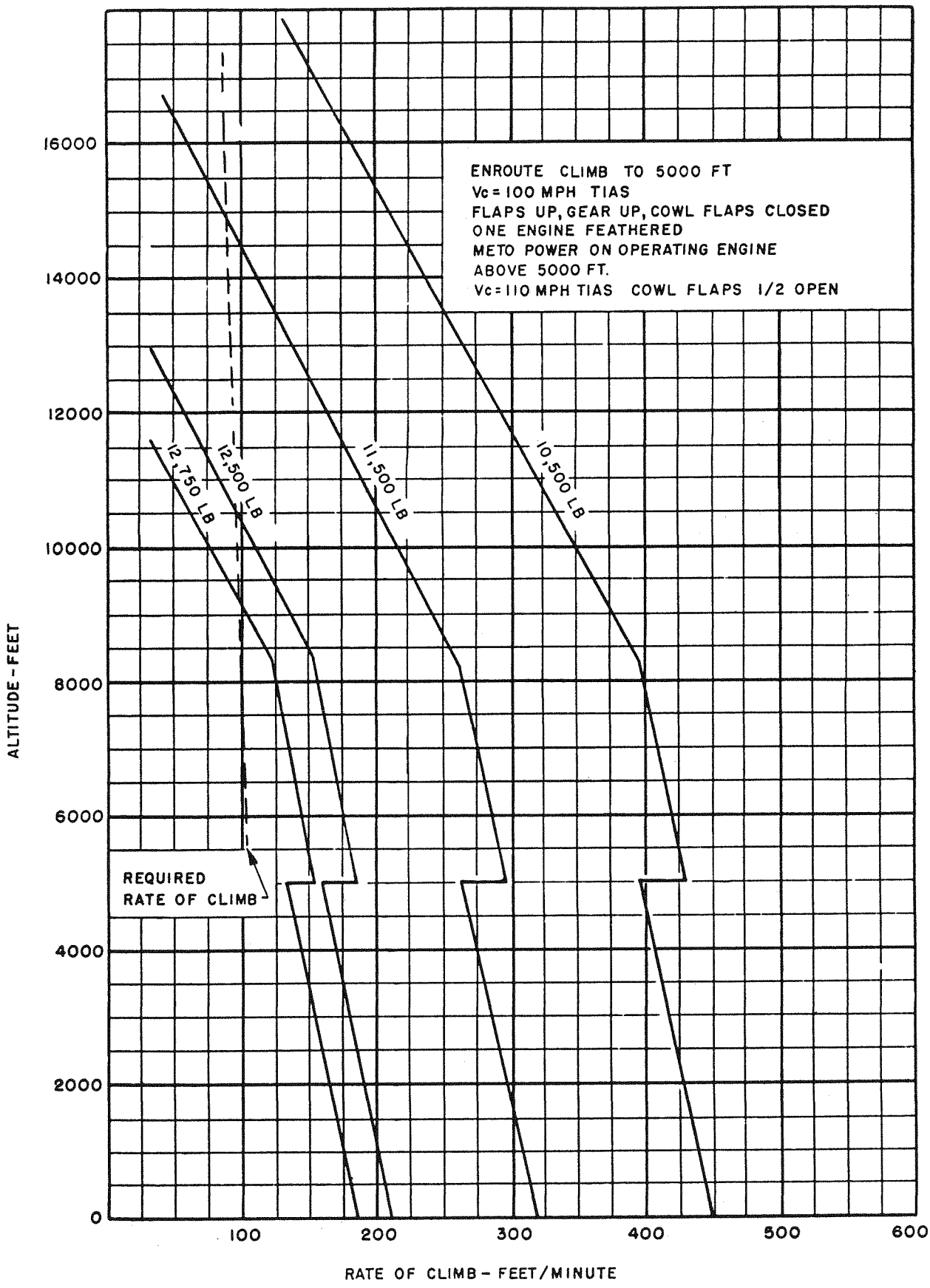


Figure 7—Enroute Climb

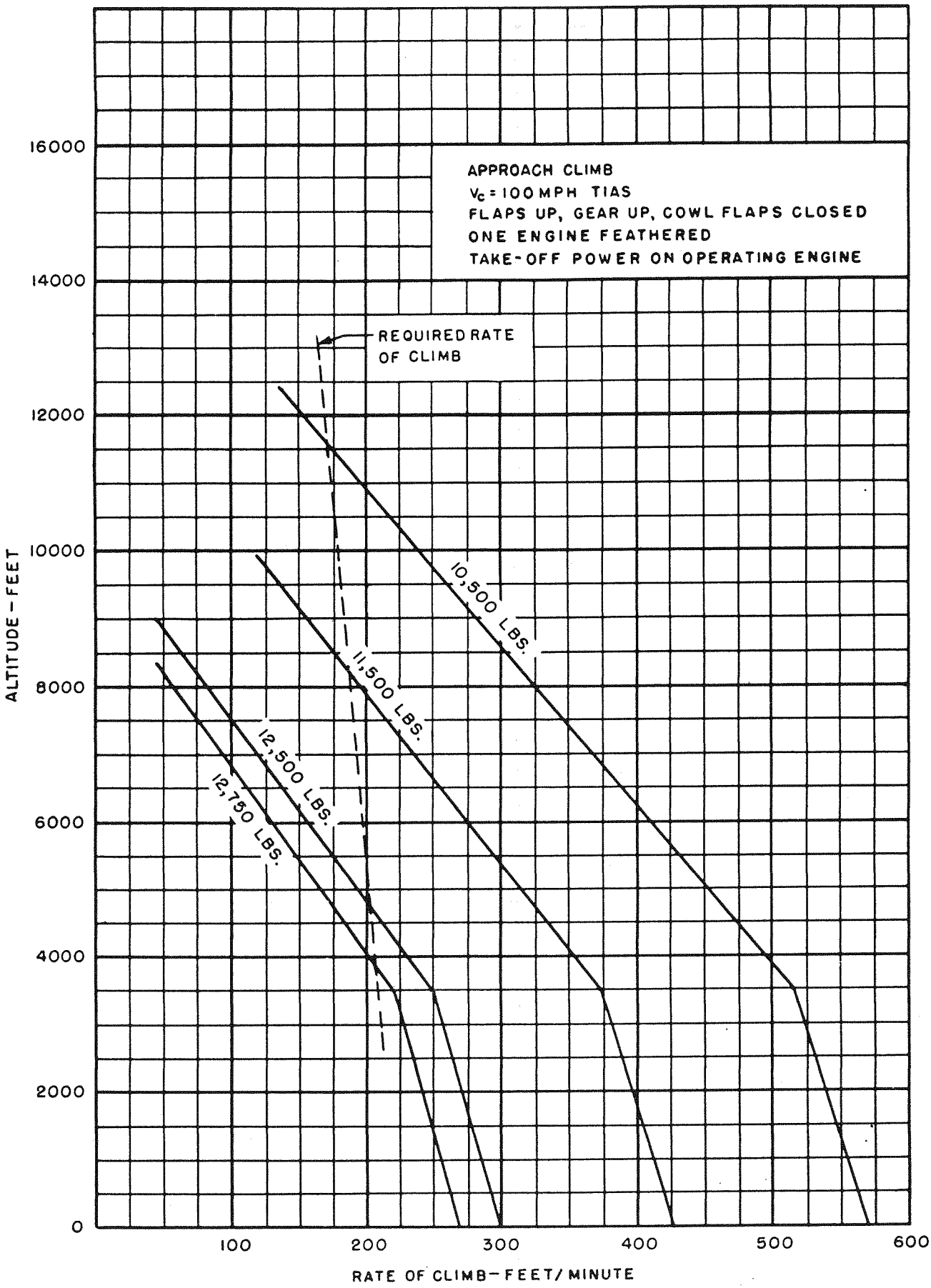


Figure 8—Approach Climb

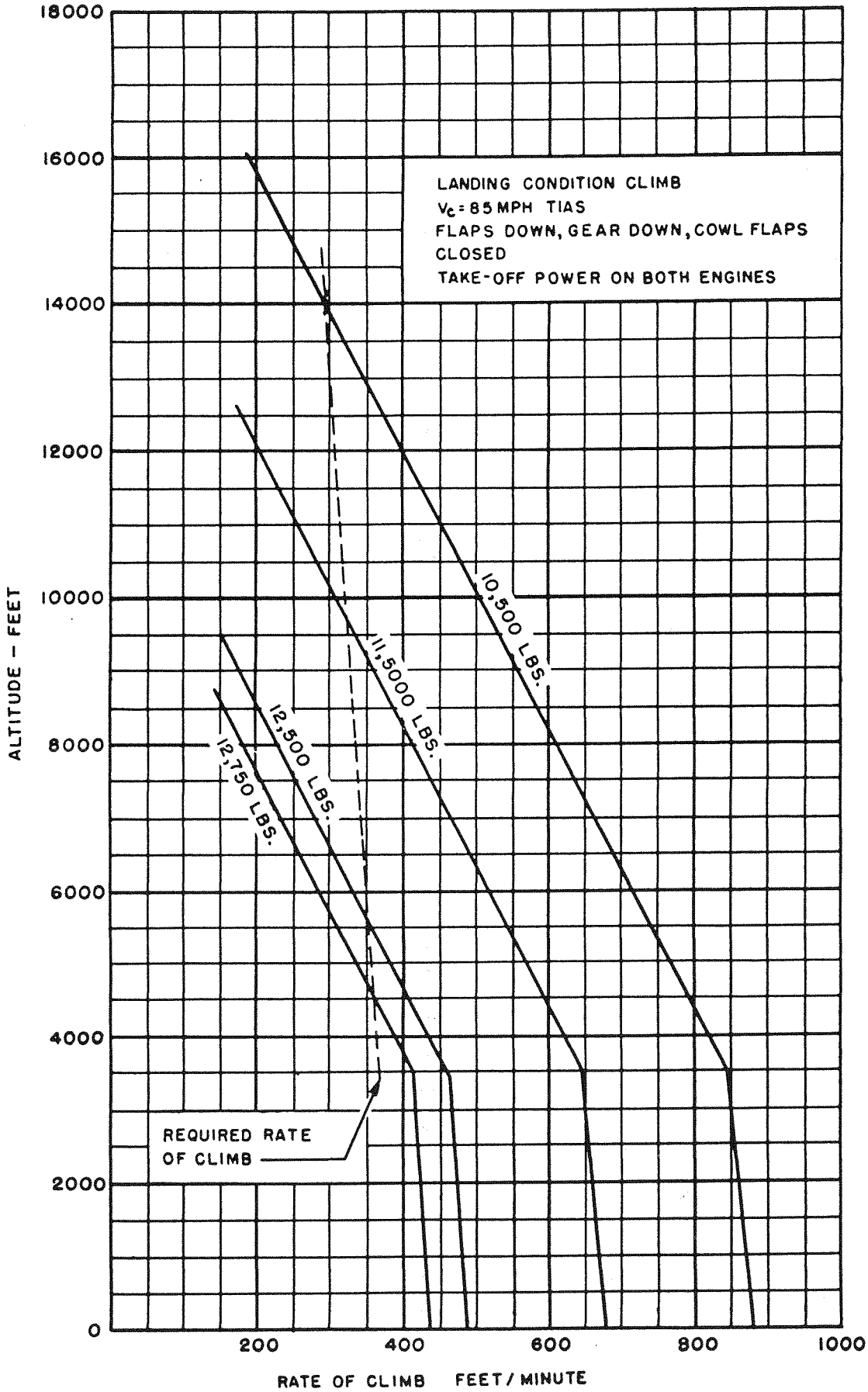


Figure 9—Landing Condition Climb

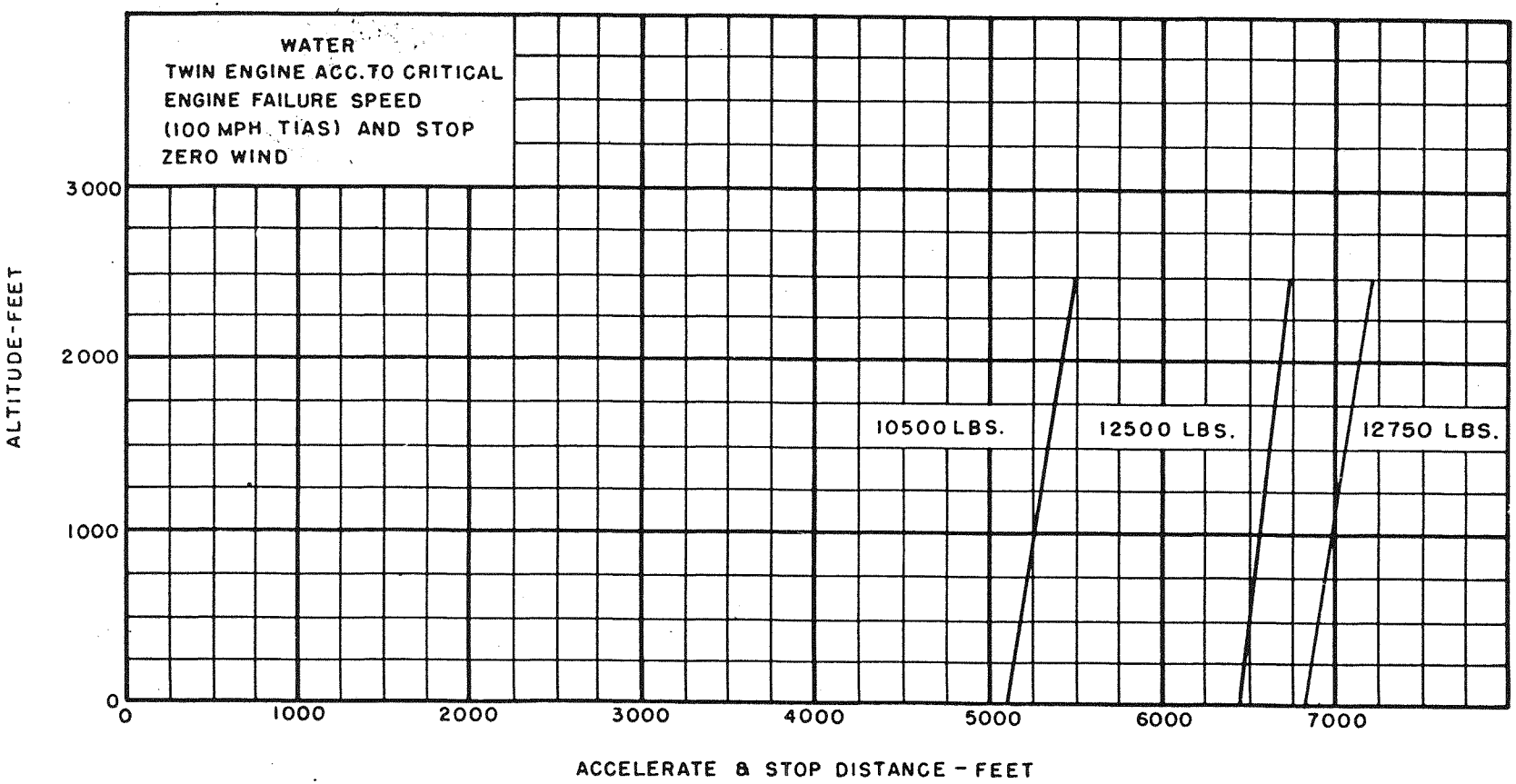


Figure 10—Accelerate and Stop Distance (Water)

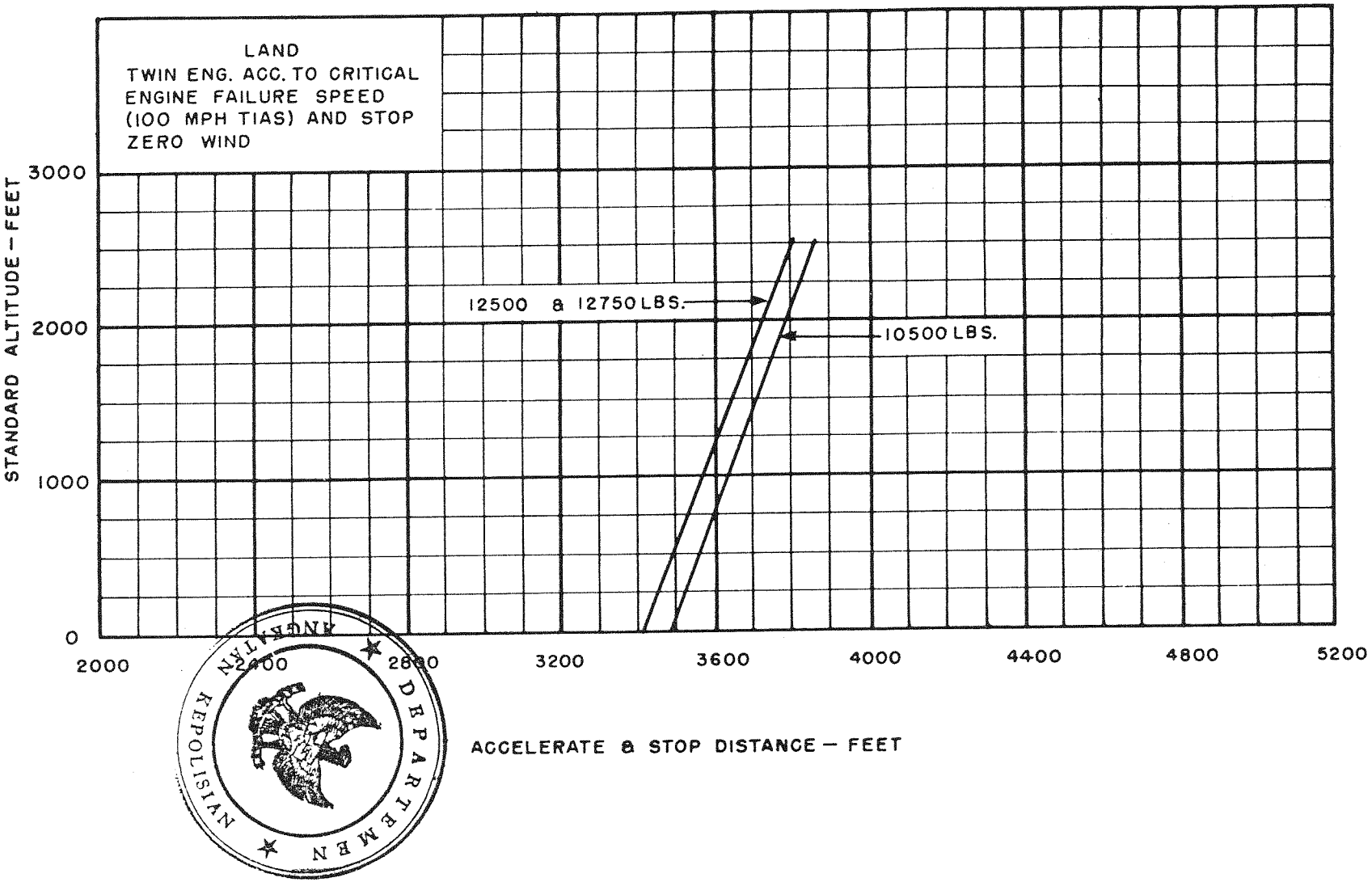


Figure 11—Accelerate and Stop Distance (Land)

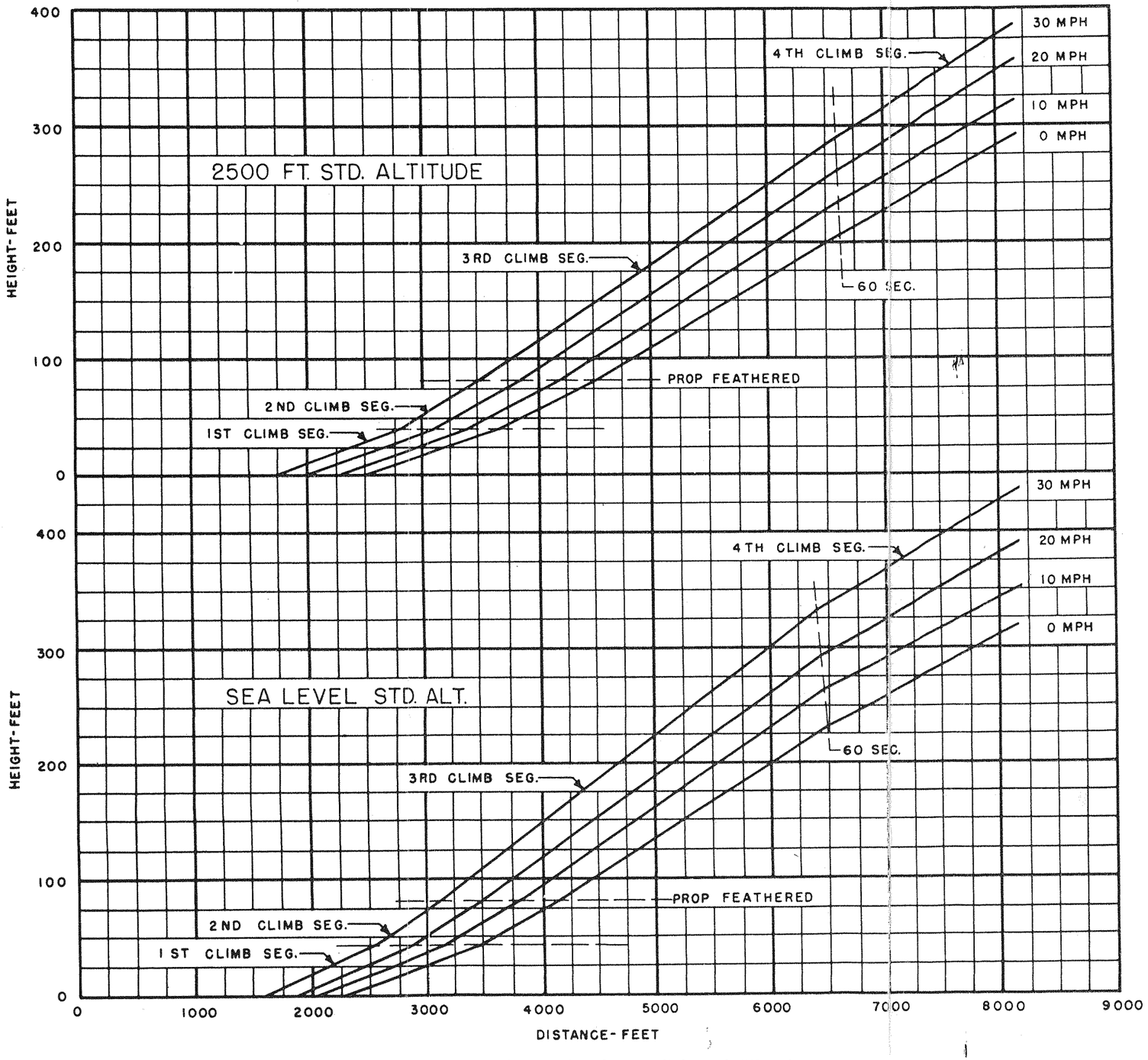


Figure 12 (Sheet 1 of 3 Sheets)—Flight Path (Water)

WATER TAKE-OFF FLIGHT PATH

WT.=10,500 LBS.
ONE ENGINE FAILURE AT
POINT OF TAKE-OFF
HEADWINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1 ST CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. LOW PITCH, WINDMILLING

(2) 2 ND CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH, WINDMILLING

(3) 3 RD CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED

(4) 4TH CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE

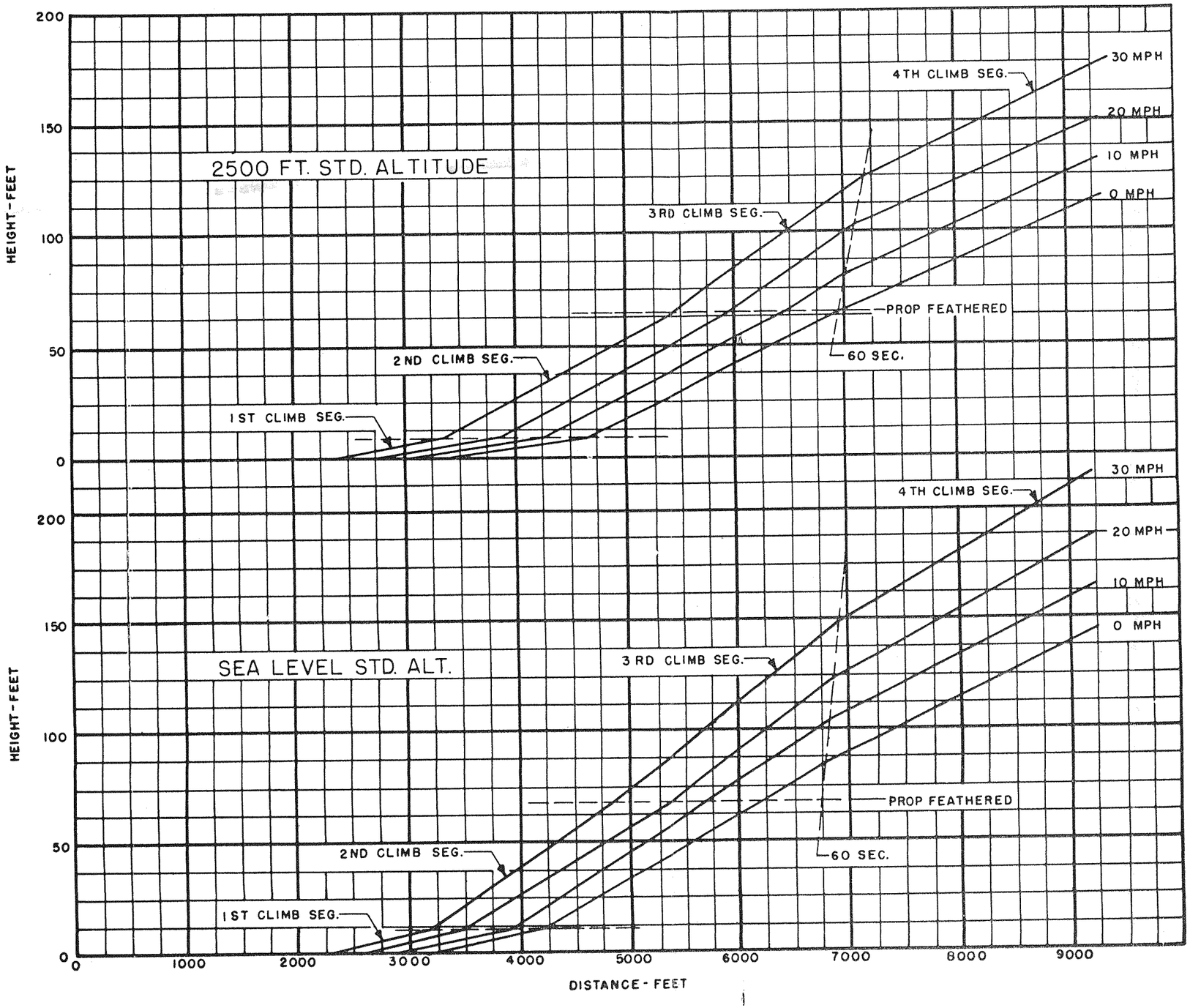


Figure 12 (Sheet 2 of 3 Sheets)—Flight Path (Water)

WATER TAKE-OFF FLIGHT PA

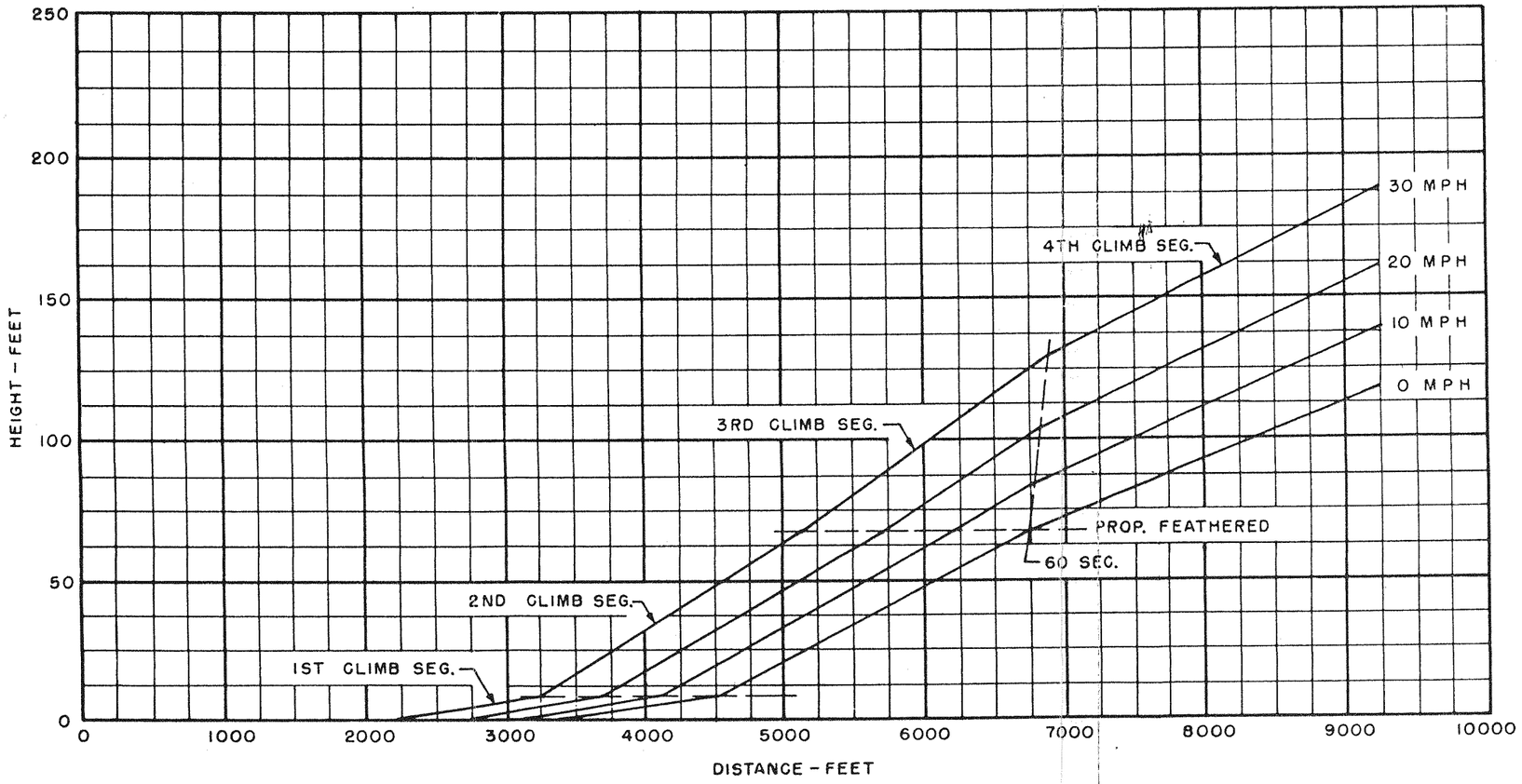
WT.=12,500 LBS.
ONE ENGINE FAILURE AT
POINT OF TAKE-OFF
HEAD WINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1ST CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. LOW PITCH, WINDMILLING

(2) 2ND CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH, WINDMILLING

(3) 3RD CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED

(4) 4TH CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE



WATER TAKE-OFF FLIGHT PATH

WT. = 12,750 LBS.
SEA LEVEL STD. ALTITUDE
ONE ENGINE FAILING AT
POINT OF TAKE-OFF
HEAD WINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1ST. CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. LOW PITCH, WINDMILLING

(2) 2ND. CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH, WINDMILLING

(3) 3RD. CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED

(4) 4TH. CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE

Figure 12 (Sheet 3 of 3 Sheets)—Flight Path (Water)

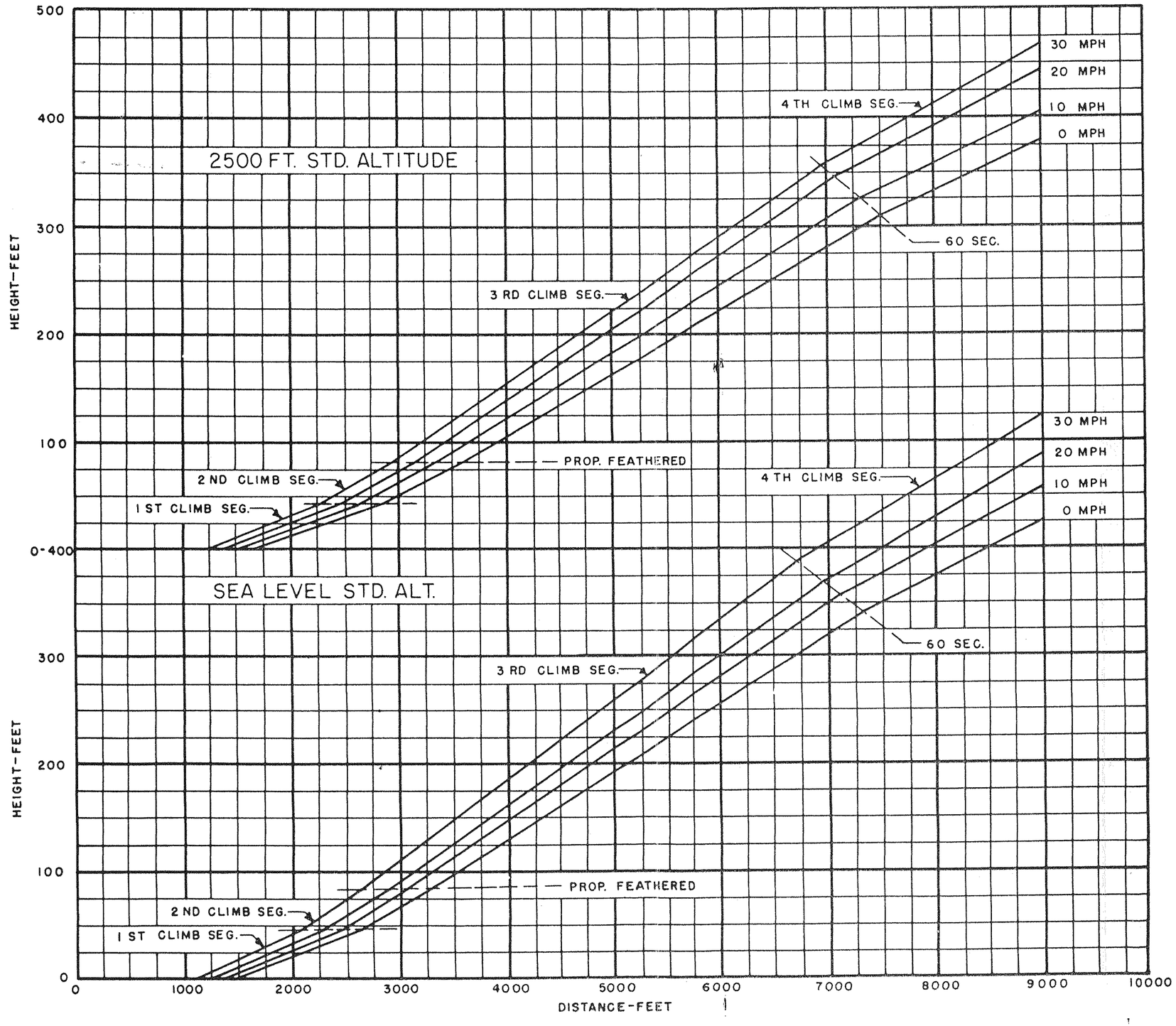


Figure 13 (Sheet 1 of 3 Sheets)—Flight Path (Land)

LAND TAKE-OFF FLIGHT PAT

WT.=10,500 LBS.
ONE ENGINE FAILURE AT
POINT OF TAKE-OFF
HEADWINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1 ST CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR DOWN
- C. PROP. LOW PITCH, WINDMILLING

(2) 2 ND CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH WINDMILLING

(3) 3 RD CLIMB SEGMENT
- A FLAPS UP
- B. GEAR UP
- C PROP. FEATHERED

(4) 4 TH CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE

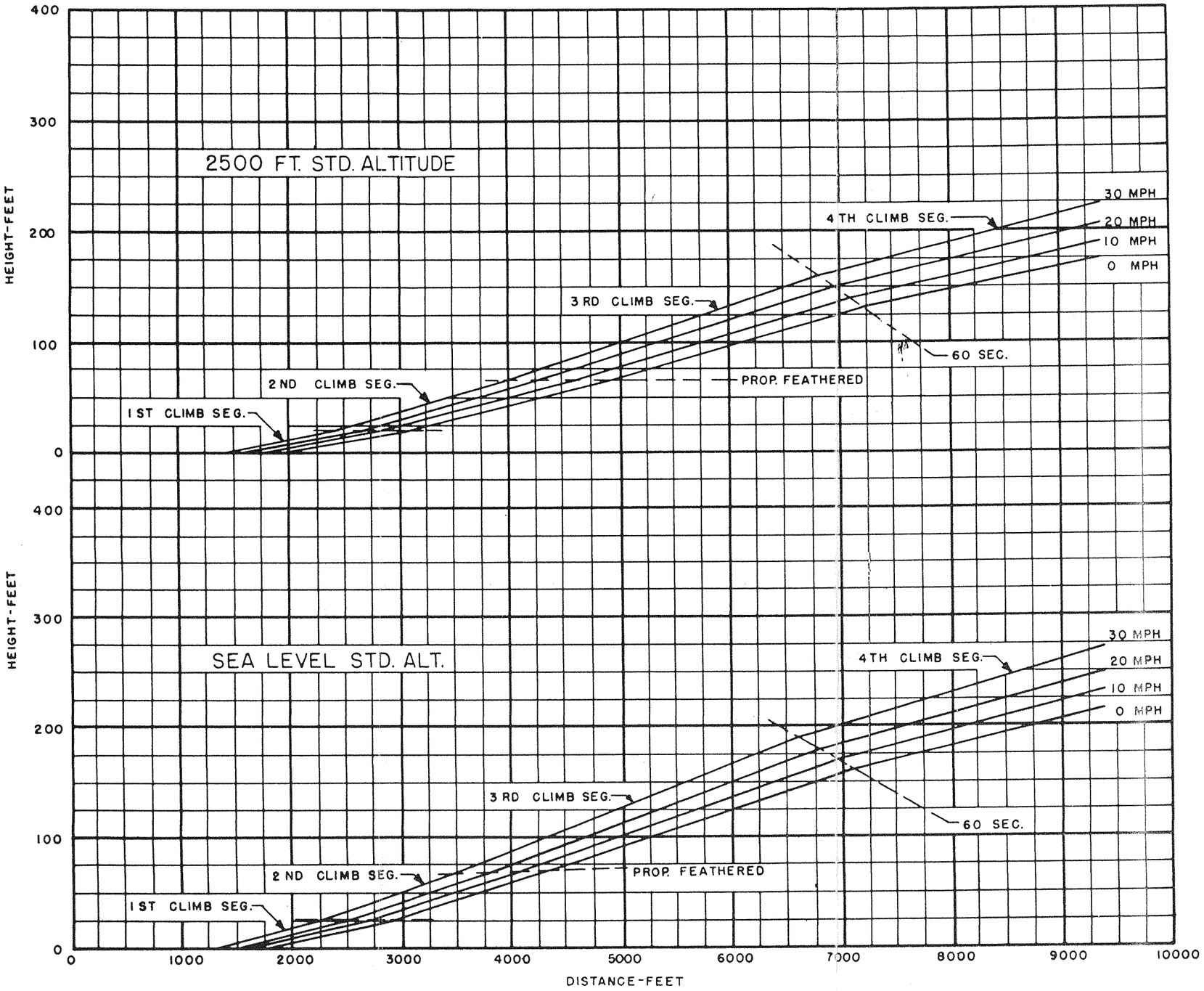


Figure 13 (Sheet 2 of 3 Sheets)—Flight Path (Land)

LAND TAKE-OFF FLIGHT PATH

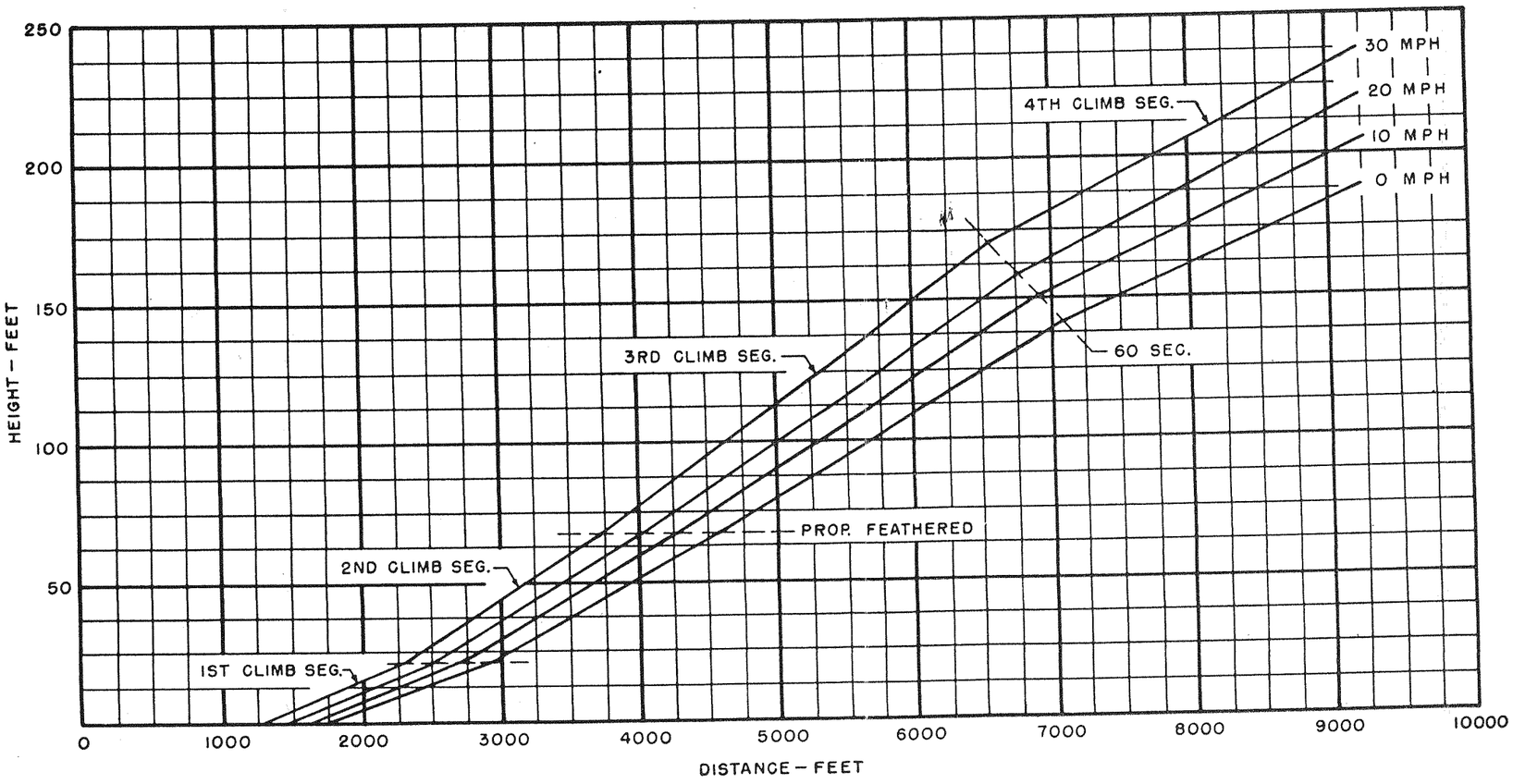
WT. = 12,500 LBS.
ONE ENGINE FAILURE AT
POINT OF TAKE-OFF
HEADWINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1 ST CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR DOWN
- C. PROP. LOW PITCH, WINDMILLING

(2) 2 ND CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH WINDMILLING

(3) 3 RD CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED

(4) 4 TH CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE



LAND TAKE-OFF FLIGHT PATH

WT. = 12,750 LBS.
SEA LEVEL STD. ALTITUDE
ONE ENGINE FAILING AT
POINT OF TAKE-OFF
HEAD WINDS AS NOTED
REPRESENT 50% ACTUAL WIND VEL.

(1) 1ST CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR DOWN
- C. PROP. LOW PITCH, WINDMILLING

(2) 2ND CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. HIGH PITCH, WINDMILLING

(3) 3RD CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED

(4) 4TH CLIMB SEGMENT
- A. FLAPS UP
- B. GEAR UP
- C. PROP. FEATHERED
- D. METO POWER ON OPERATING ENGINE

Figure 13 (Sheet 3 of 3 Sheets)—Flight Path (Land)

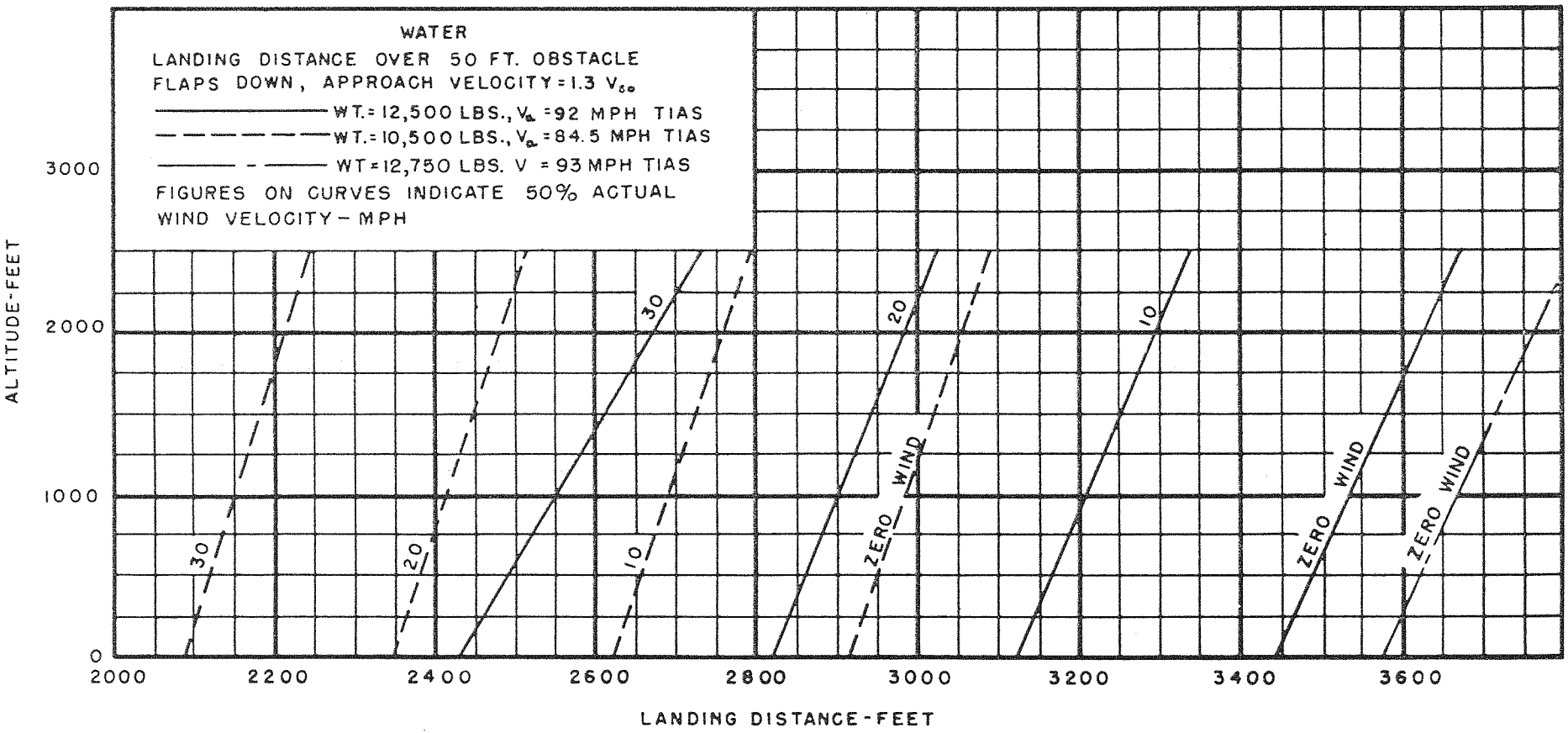


Figure 14—Landing Distance (Water)

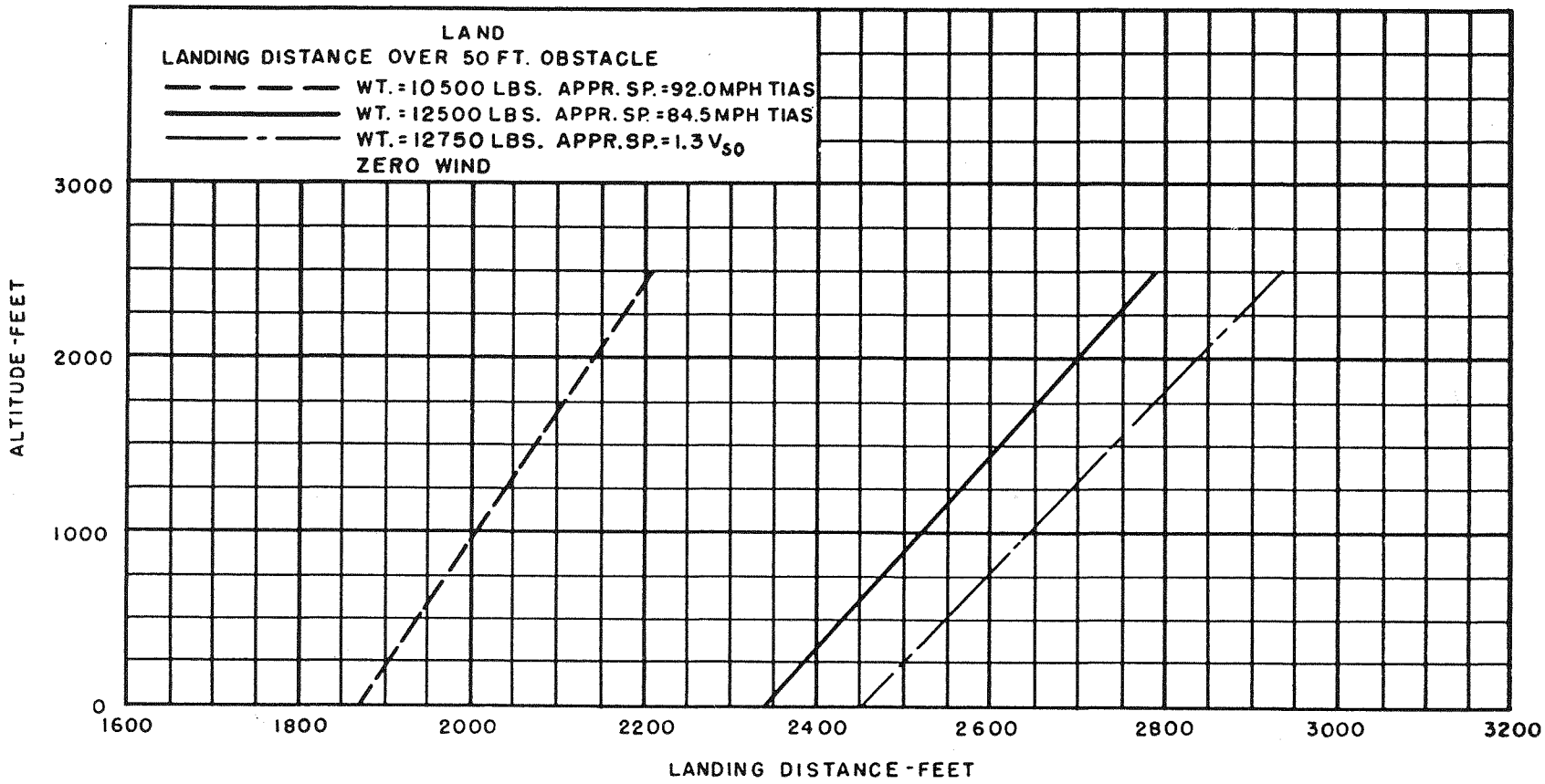


Figure 15—Landing Distance (Land)

"TEMPERATURE ACCOUNTABILITY CORRECTIONS TO RUNWAY LENGTH AND/OR WEIGHT ARE:

ALTITUDE (FT.)	STD. TEMP. (°F)	IF TEMP. IS ABOVE STD.		IF TEMP. IS BELOW STD.	
		FT./°F	LB./°F	FT./°F	LB./°F
S. L.	59	+ 17	−25	−10	+ 9
2500	50	+ 19	−26	−13	+ 10

USE EITHER COLUMN OR COMBINATIONS. THE CORRECTION IS ADDED ALGEBRAICALLY."

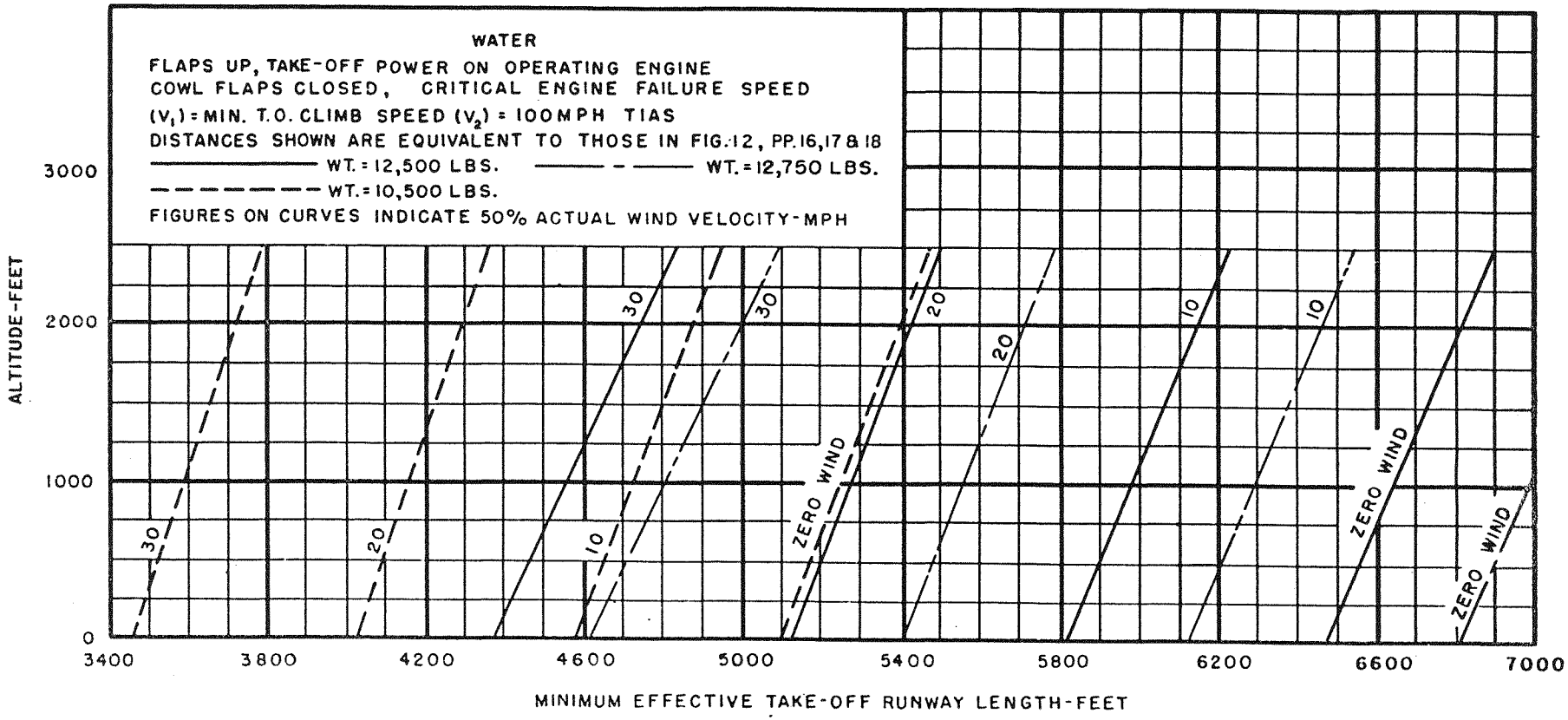


Figure 16—Minimum Take-Off Runway Length (Water)

"TEMPERATURE ACCOUNTABILITY CORRECTIONS TO RUNWAY LENGTH AND/OR WEIGHT ARE:

ALTITUDE (FT.)	STD. TEMP. (°F)	IF TEMP. IS ABOVE STD.		IF TEMP. IS BELOW STD.	
		FT./°F	LB./°F	FT./°F	LB./°F
S.L.	59	+12	-19	-6	+9
2500	50	+13	-20	-9	+13

USE EITHER COLUMN OR COMBINATIONS. THE CORRECTION IS ADDED ALGEBRAICALLY.

EXAMPLE: W = 12500 LB AT S.L., AIR TEMP. = 79° F AND 0 WIND.
DEVIATION FROM STANDARD TEMP. = 79 - 59 = 20°F
RUNWAY LENGTH CORRECTION = 20 x 12 = + 240 FT.
RUNWAY LENGTH, 0 WIND, STANDARD DAY = 3760
RUNWAY LENGTH, 0 WIND, 79°F = 3760 + 240 = 4000 FT."

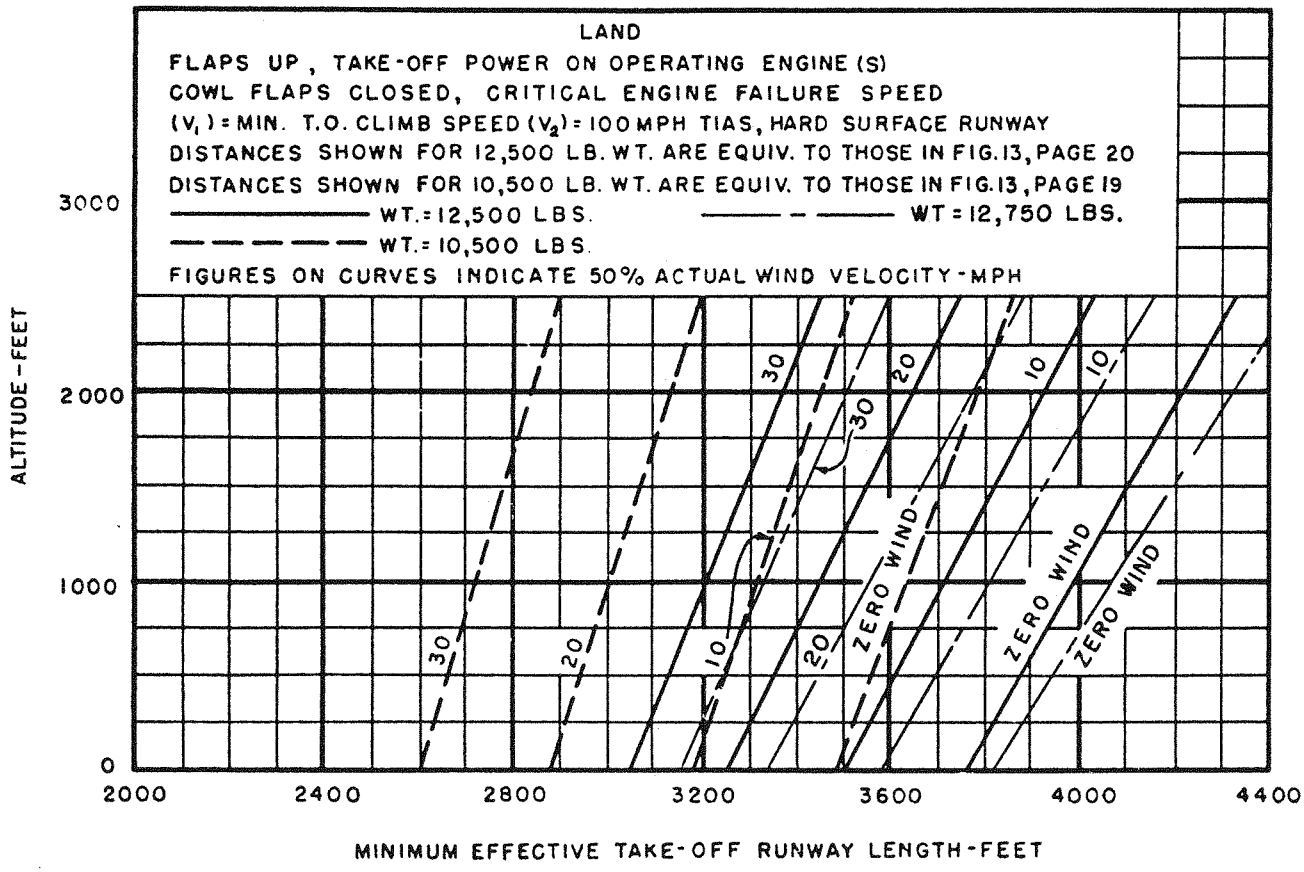


Figure 17—Minimum Take-Off Runway Length (Land)

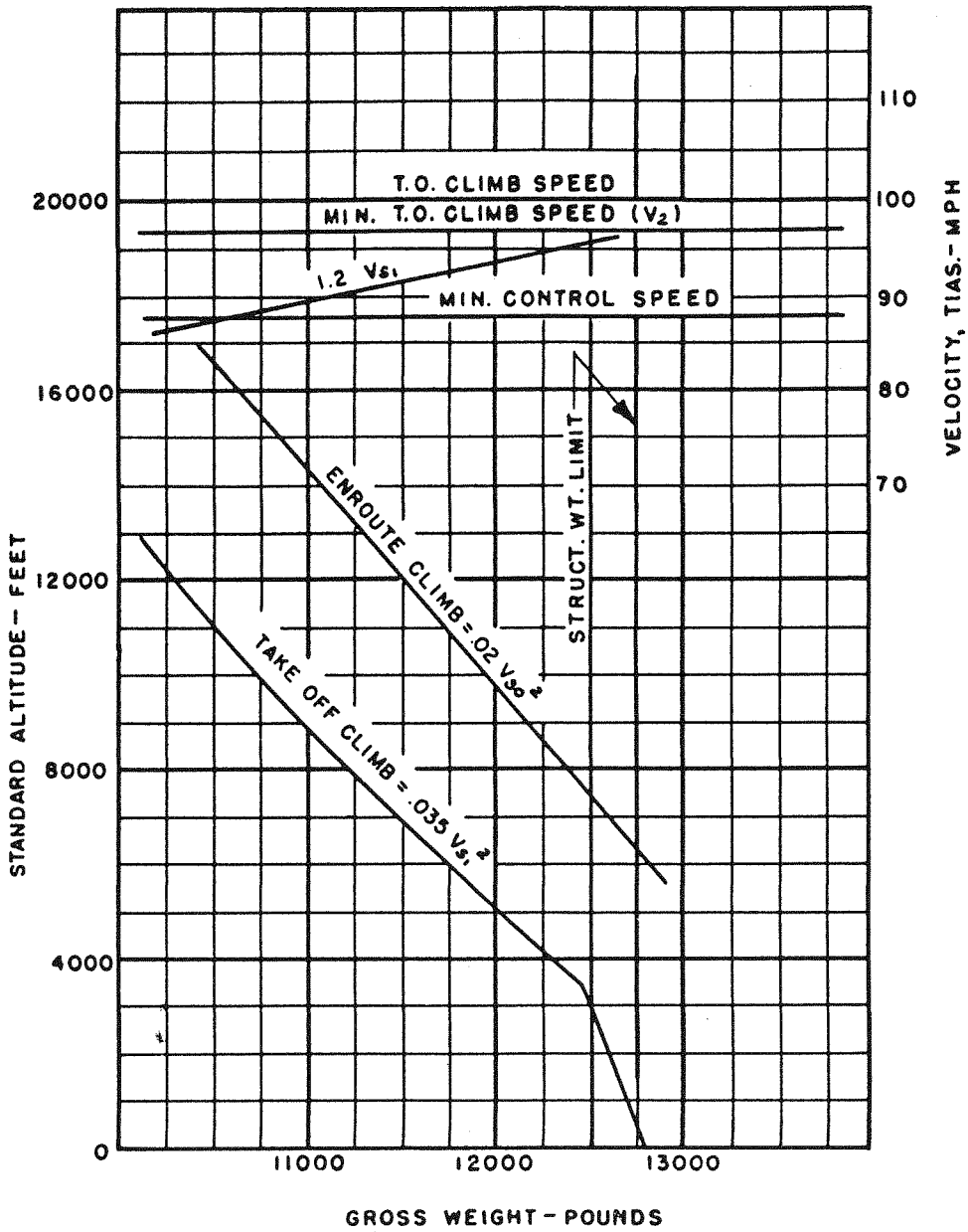


Figure 18—Take-Off Weight Limitation

"TEMPERATURE ACCOUNTABILITY CORRECTIONS TO RUNWAY LENGTH AND/OR WEIGHT ARE:

ALTITUDE (FT.)	STD. TEMP. (°F)	IF TEMP. IS ABOVE STD.		IF TEMP. IS BELOW STD.	
		FT./°F	LB./°F	FT./°F	LB./°F
S.L.	59	+12	-19	-6	+9
2500	50	+13	-20	-9	+13

USE EITHER COLUMN OR COMBINATIONS. THE CORRECTION IS ADDED ALGEBRAICALLY.

EXAMPLE: W = 12500 LB AT S.L., AIR TEMP. = 79° F AND 0 WIND.
DEVIATION FROM STANDARD TEMP. = 79 - 59 = 20°F
RUNWAY LENGTH CORRECTION = 20 x 12 = + 240 FT.
RUNWAY LENGTH, 0 WIND, STANDARD DAY = 3760
RUNWAY LENGTH, 0 WIND, 79°F = 3760 + 240 = 4000 FT."

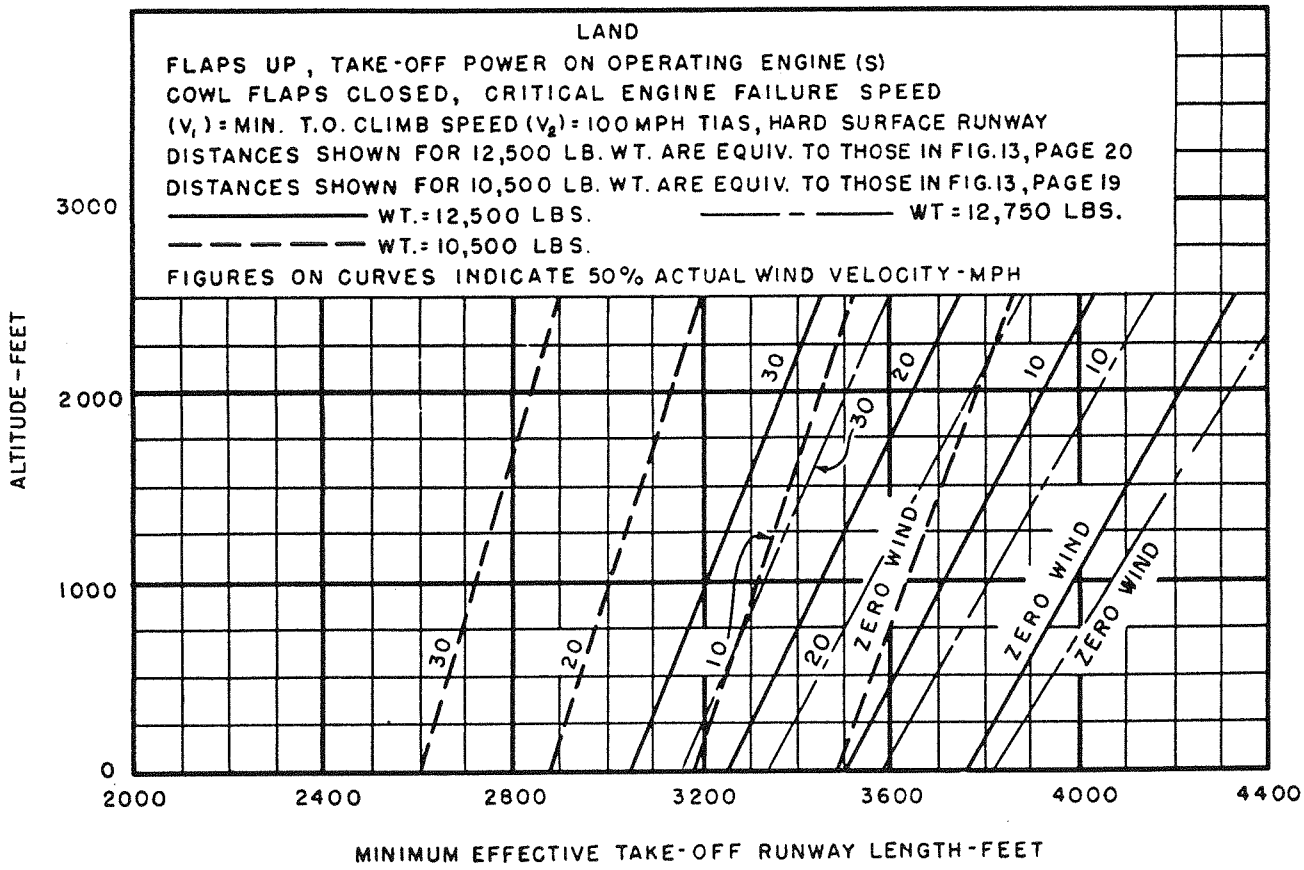


Figure 17—Minimum Take-Off Runway Length (Land)

Revised; C.A.A. Approved 5-18-50

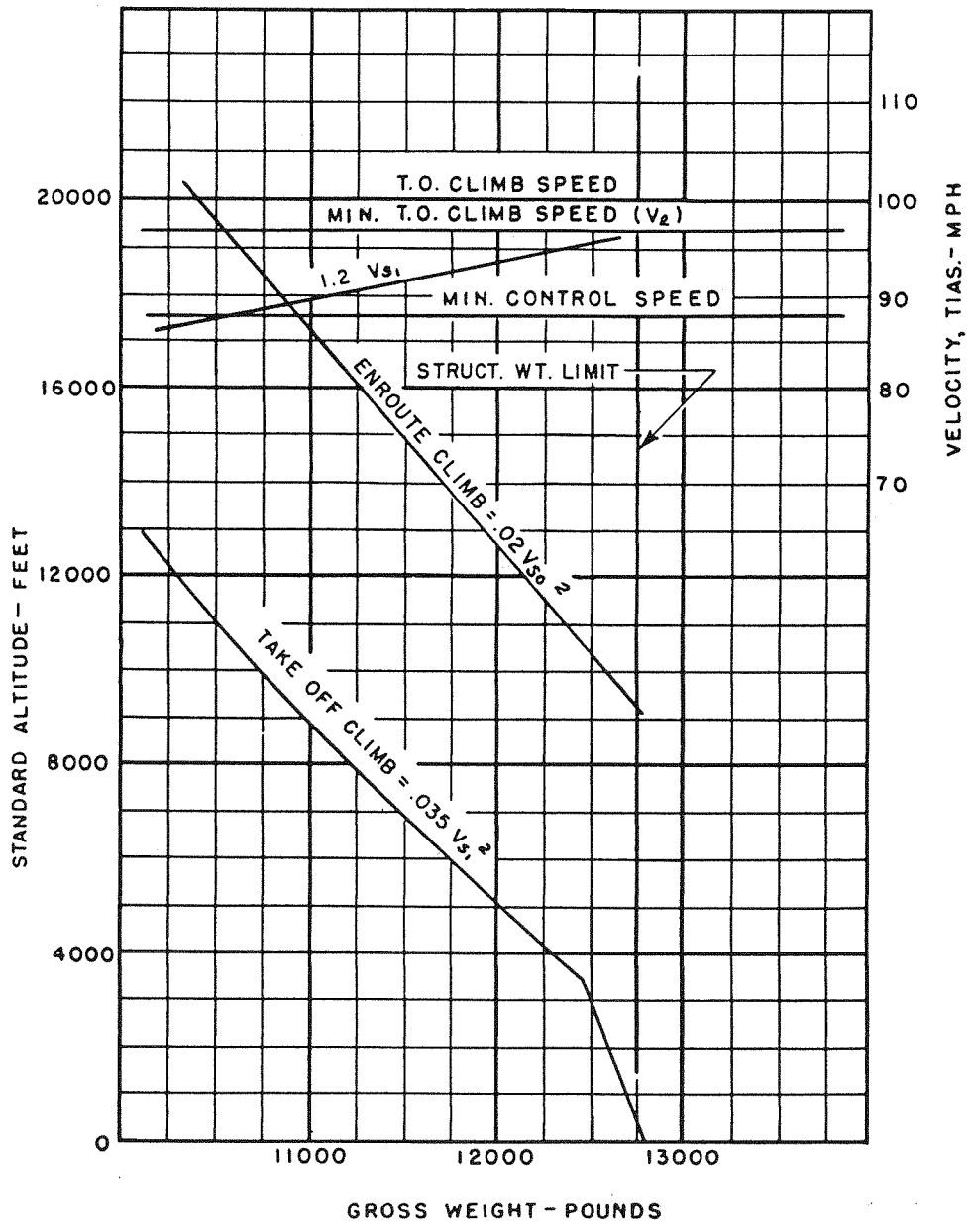


Figure 18—Take-Off Weight Limitation

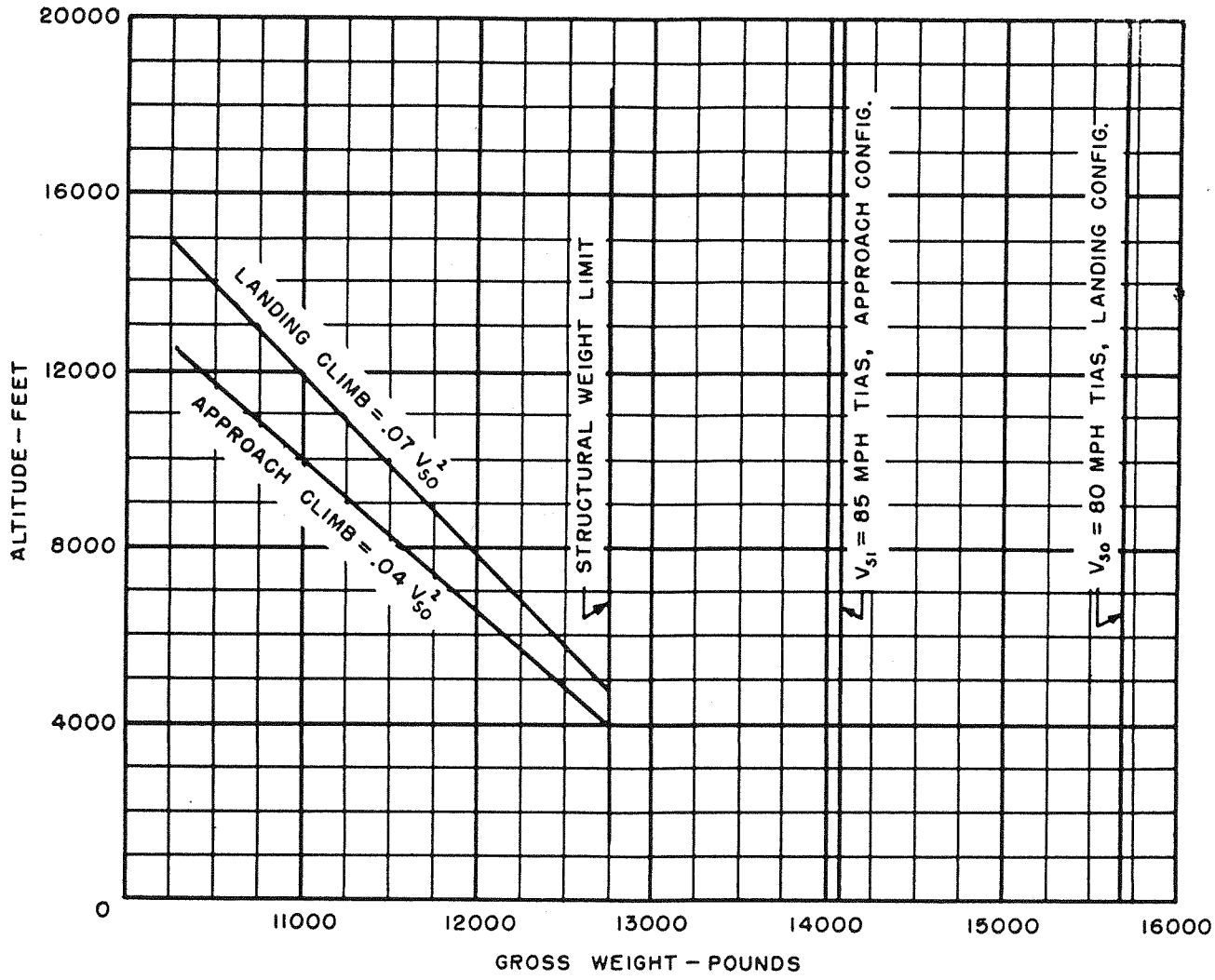


Figure 19—Landing Weight Limitation

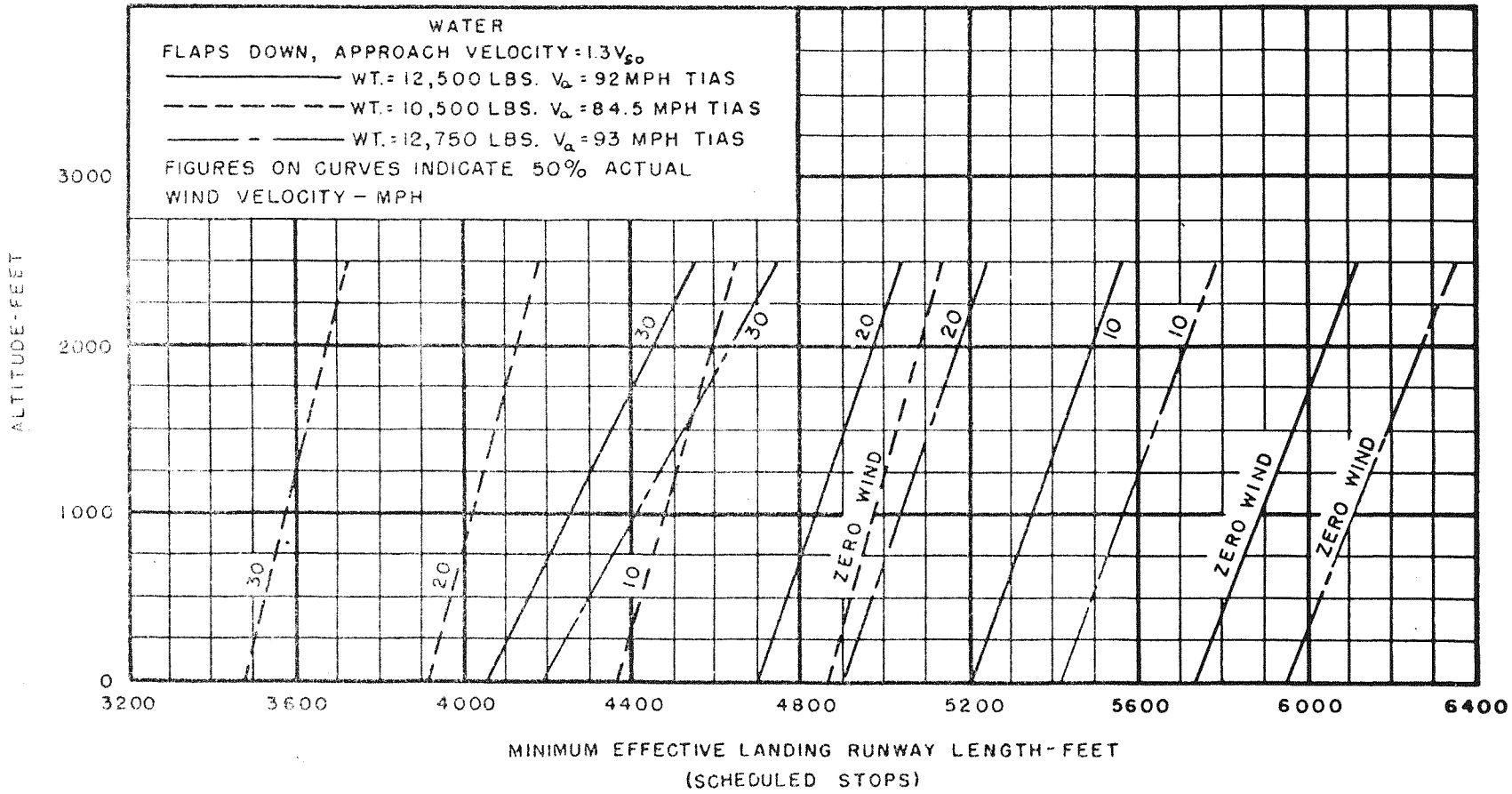


Figure 20—Minimum Effective Landing Runway Length (Water)

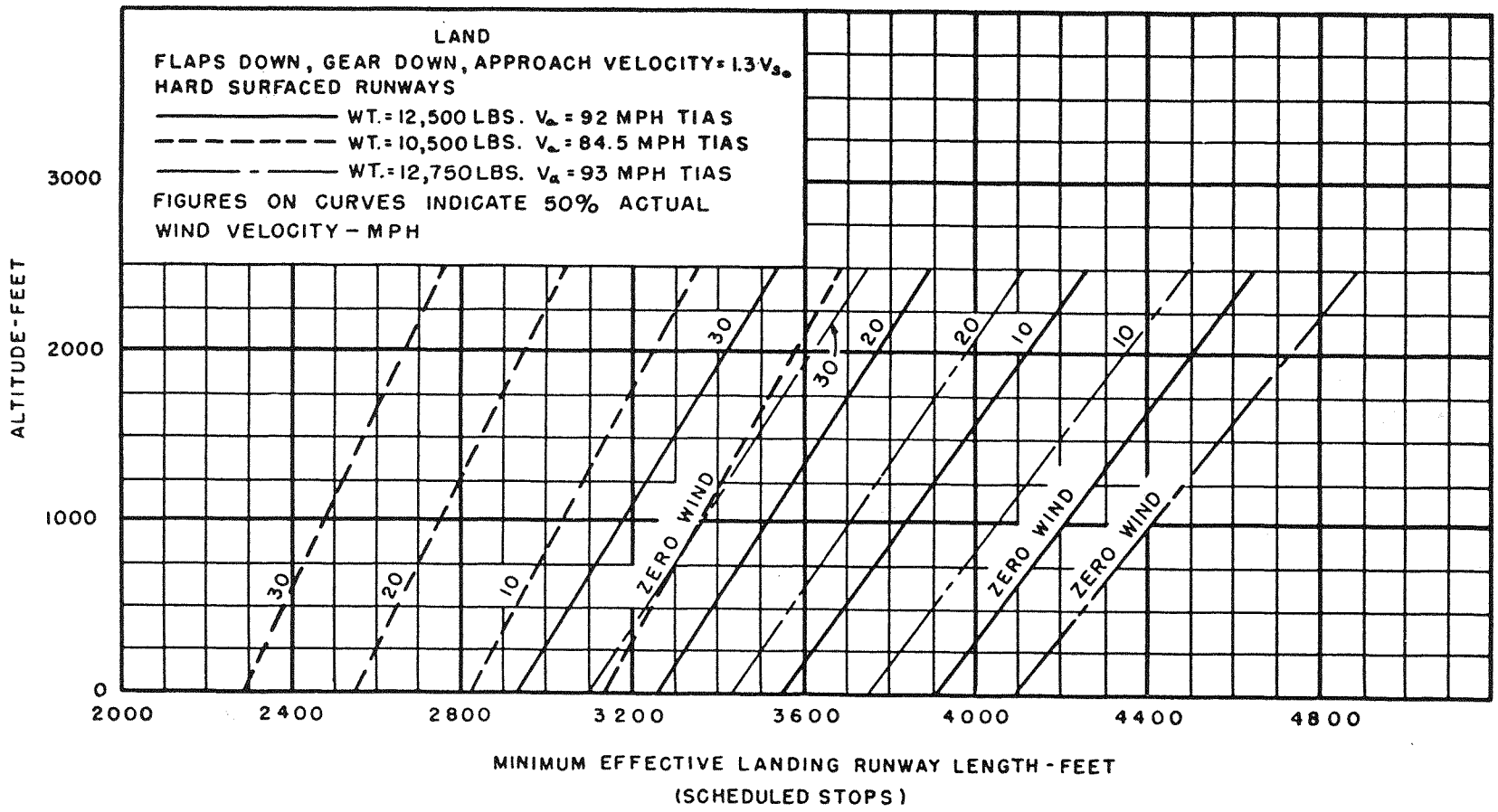


Figure 21—Minimum Effective Landing Runway Length (Land)

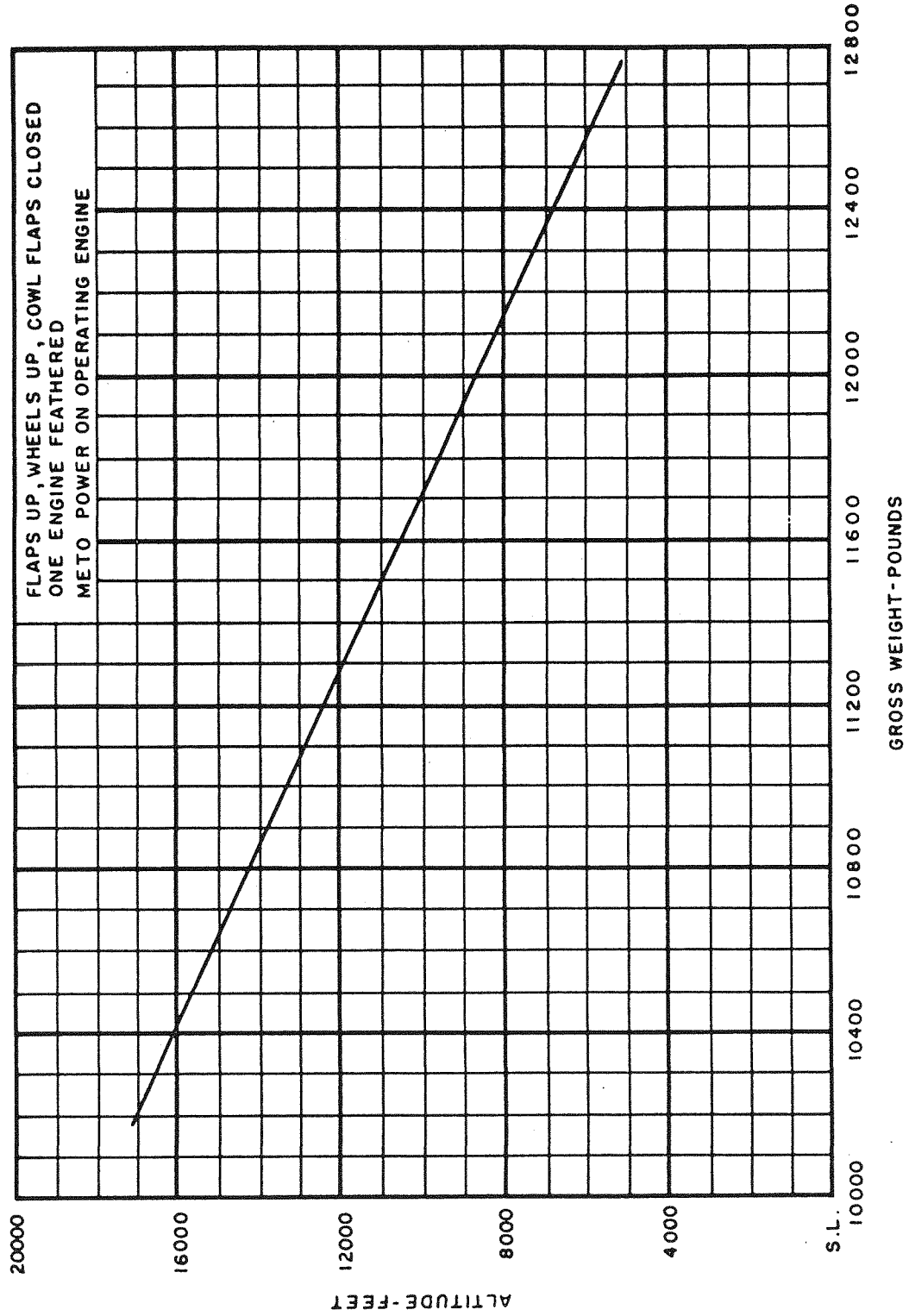


Figure 22—Altitude of Terrain

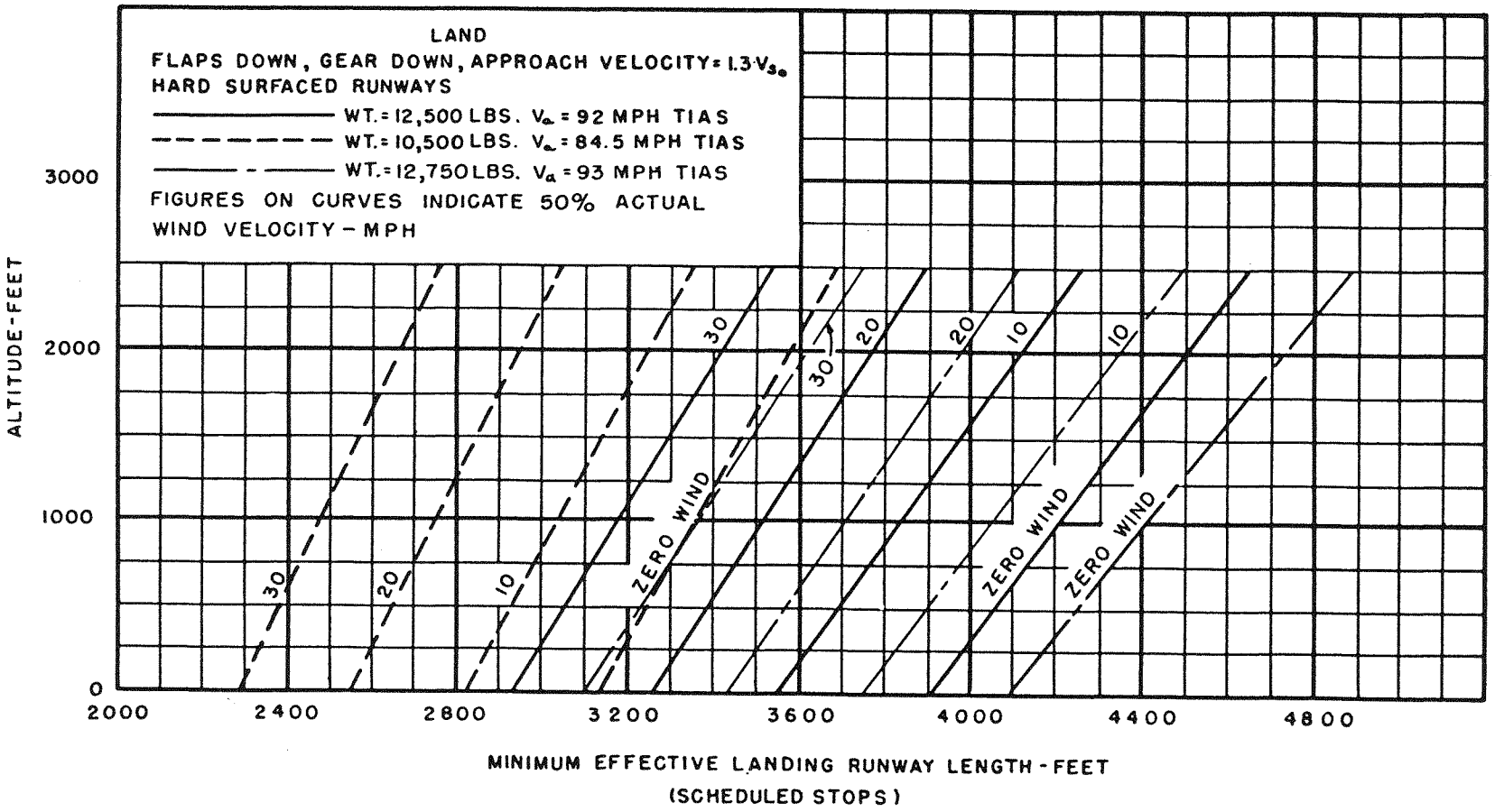


Figure 21—Minimum Effective Landing Runway Length (Land)

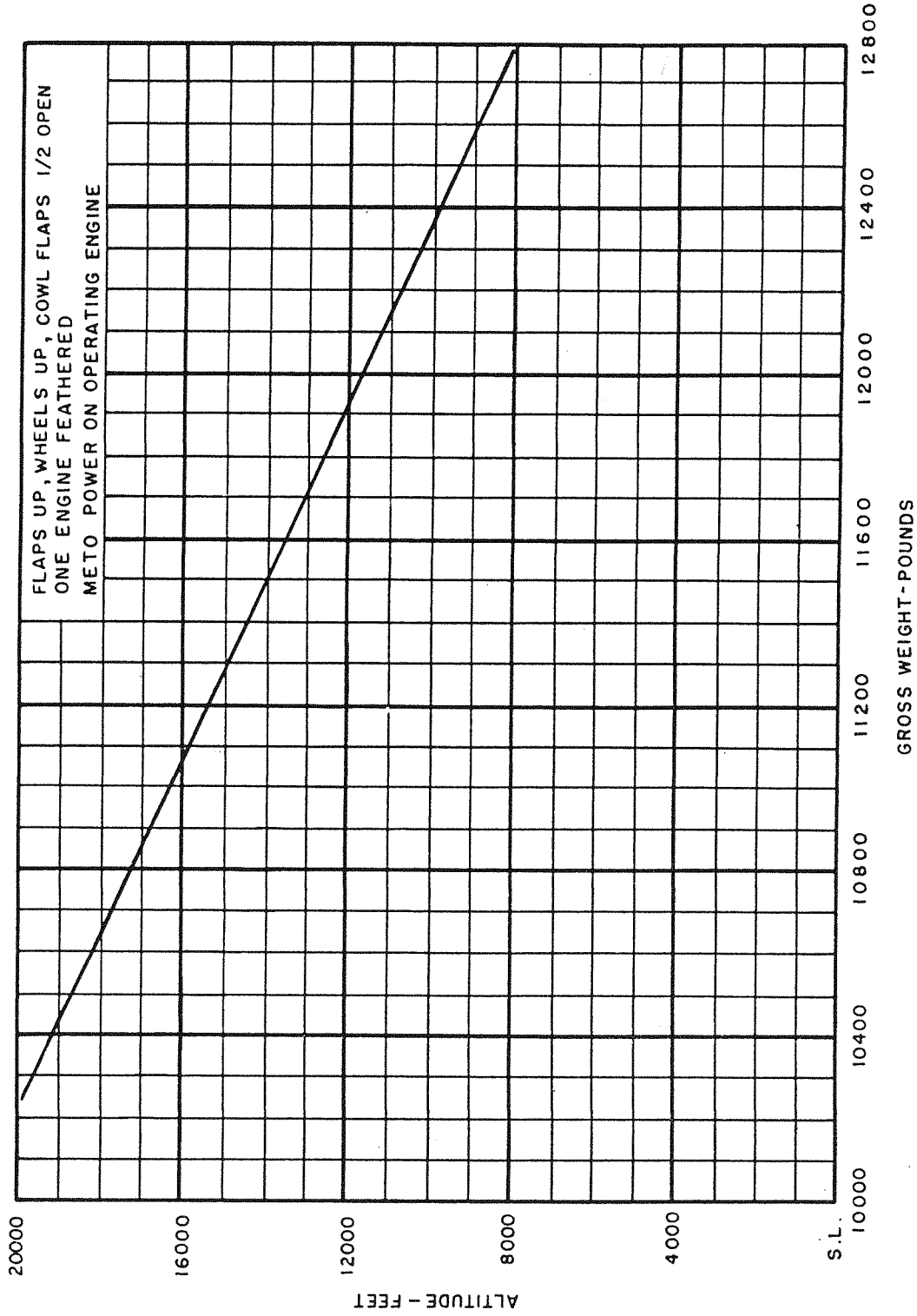


Figure 22—Altitude of Terrain

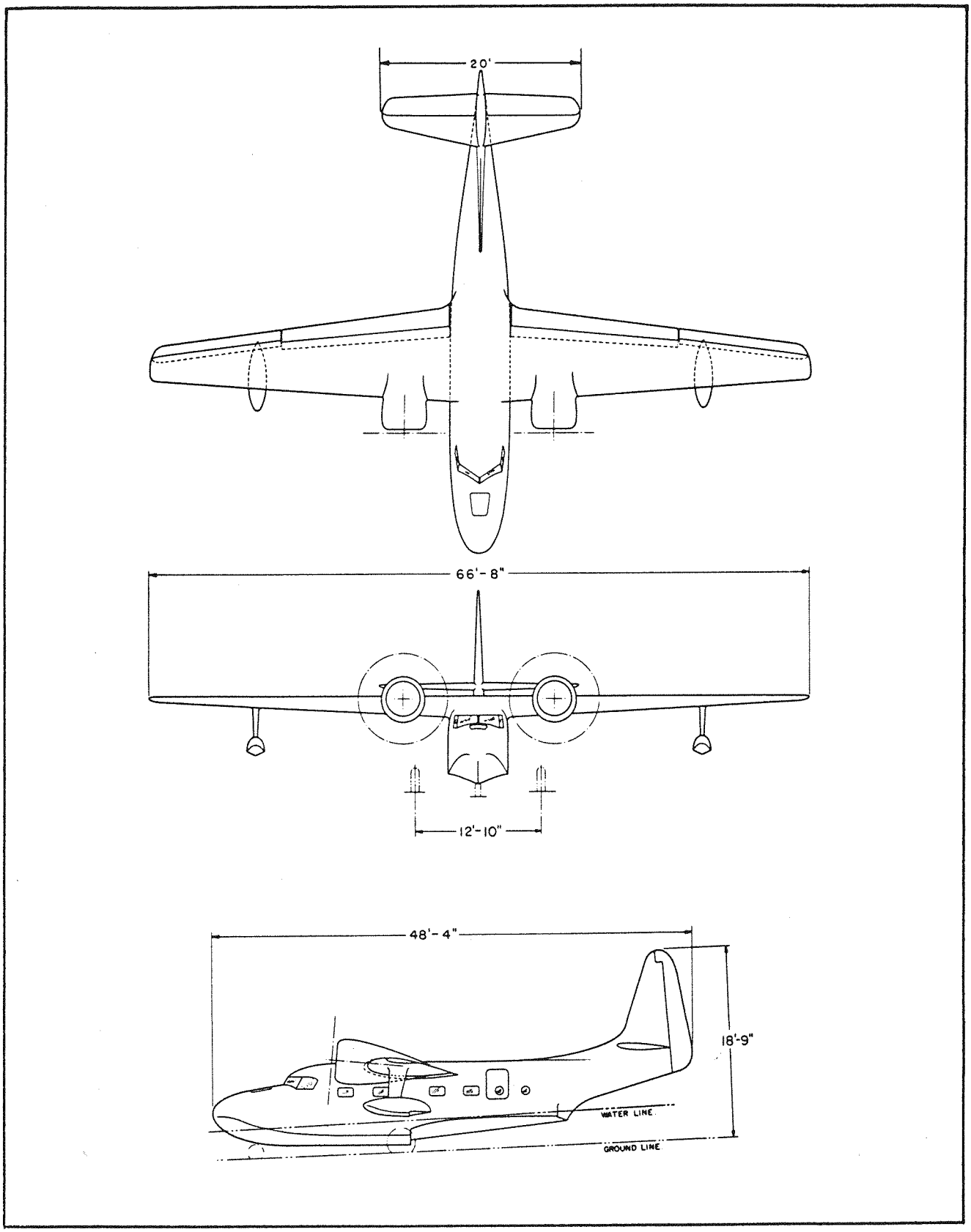
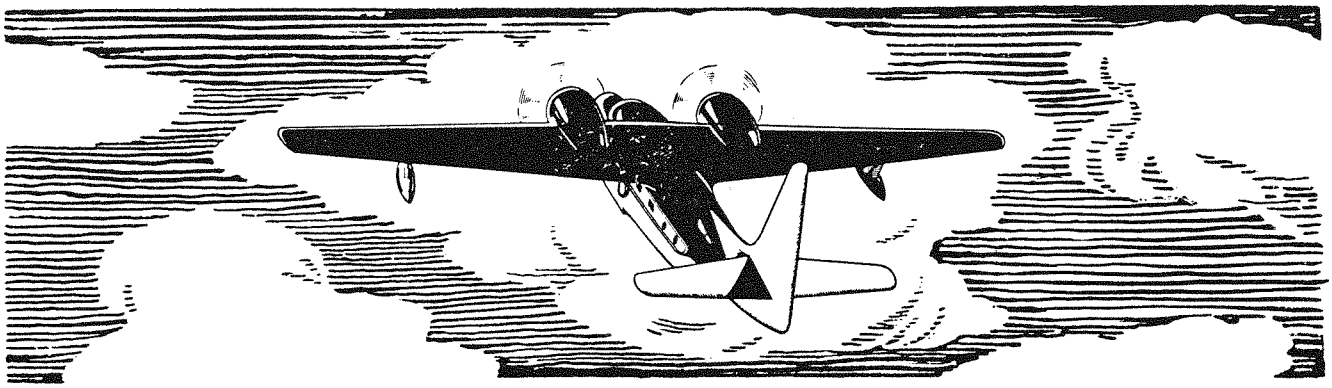


Figure 23—Three View Drawing of Airplane



SECTION III

Recommended Operating Procedures

Note

The following procedure is suggested for safest and most efficient operation of the airplane—it is not mandatory.

1. PRE-FLIGHT CHECK.

a. Remove controls lock and stow.

b. Set battery master switch to ON.

Note

If external power is available plug to right nacelle before turning battery master switch on.

c. Generator switches to ON.

CAUTION

Generator switches should never be OFF except in event of generator failure or fire.

d. Ignition master switch OFF.

e. Check fuel supply.

f. Make certain that all scoops, vents etc. are uncovered.

g. Wheels chocked (main wheels only).

h. Adjust rudder pedals and seat as desired.

i. Check control wheel, column and pedals for free movement through full throw.

j. Check that all circuit breakers are set.

Note

Circuit breakers replace fuses and are normally always set. When a breaker trips (and the reset button pops out) a short or overload is indicated. Do NOT hold closed manually unless safety of the airplane depends on that circuit when the button may be held closed for a short period at the possible expense of the equipment.

k. Mixture controls forward to RICH.

l. Propeller controls forward to INCREASE RPM.

m. Set sensitive alitmeter for field.

n. Night flying—navigation, cockpit and instrument lights ON.

o. Test baggage compartment smoke detector.

2. START AND WARM-UP.

a. Pull propellers through three or four times if engines have been standing idle for some time.

b. Set fuel tank selectors—RIGHT SELECTOR ON-RIGHT ENGINE
LEFT SELECTOR ON-LEFT ENGINE

c. Carburetor air controls—COLD.

d. Throttles—cracked.

e. Ignition master switch—ON.

f. Fuel booster pumps—ON, (gage should show 4-6 psi.)

Note

Start right engine first, as battery (and external power plug) is located in right hand nacelle and electrical line drop is less.

g. Primer switch to right to—ON (Right engine).

Note

Flick switch two or three times—oftener for a cold engine.

h. Starter switch to right to—ON (Right engine).

i. After one revolution, set right ignition switch to ON-BOTH.

j. Idle engine at 600 rpm.

k. Primer switch to left to ON (Left engine).

l. Starter switch to left to ON (Left engine).

m. After one revolution, set left ignition switch to ON-BOTH.

n. Set hydraulic selector valve to SYSTEM (which releases parking brake) and hold airplane with brake pedals.

o. Open cowl flaps (check position visually).

p. Idle both engines at 1000 rpm. If oil pressure gage indicators do not show pressure within 30 seconds, stop engines and investigate.

q. Idle engines at 1000 rpm until oil temperatures reach 104°F. A drop in oil pressure when the throttle is opened indicates that further warm-up is necessary.

r. Check propeller governor controls—with engine speed at 2000 rpm, move propeller control aft to DECREASE RPM until a drop in rpm is shown, then return control to INCREASE RPM.

s. Check instruments, with engines running at 1500 rpm, and propellers in low pitch:

(1) Oil temperatures—104°-185°F.

(2) Oil pressure—60 psi. (min.), 80-90 max.

(3) Fuel pressure — 4-6 psi. (Switch booster pumps OFF to check engine driven pumps).

(4) Cylinder head temperature — 200°-450°F. (max.)

(5) Note M.P. as reference for future checks.

t. Check magnetos—when oil temperature is in 100° F range, run engines at 2000 rpm—manifold pressure should then equal field barometric pressure.

(1) Right engine ignition switch from "BOTH" to "RIGHT" and back to "BOTH", then to "LEFT" and back to "BOTH". Normal drop-off in either right or left position is 50-75 rpm, and should not exceed 100 rpm. Difference in drop between left and right should not exceed 30 to 40 rpm.

(2) Repeat with left engine ignition switch.

u. Check electrical generating system.

(1) Disconnect external power, if used.

(2) On airplanes equipped with generator warning lights:

(a) With one engine idling, run other engine up until its generator warning light goes out. Press button to obtain voltmeter reading—should show 28 volts.

(b) Run engine at 2250 rpm—voltage should remain constant.

(c) Repeat steps *(a)* and *(b)* for other engine.

(3) On later airplanes from which generator warning lights have been removed.

(a) Set ammeter selector switch to RIGHT. With left engine idling, run right engine up to 1400 rpm. Ammeter should show 5 to 60 amperes, depending on connected load.

(b) Press voltmeter button—voltage should read 28.

(c) Run engine up to 2250 rpm—voltage should remain constant.

(d) Repeat steps *(a)*, *(b)* and *(c)* with left engine run up and ammeter selector switch set to LEFT.

(4) With both engines running at 1400 rpm, turn on a sufficient number of circuits to indicate a load of approximately 20 amperes.

(5) Set switch to indicate load of the other generator. This should be 20±5 amperes.

v. Check operation of all electrical equipment.

w. Check radio equipment. Refer to SECTION IV paragraph 8, page 67.

x. Check hydraulic pressure gage—1400 to 1650 psi.

y. Check wing flaps operation—push button on lever and move control aft to DOWN. Check flap position visually and on indicator—and return control to UP.

3. TAXIING.

a. LAND OPERATION.

(1) Entrance ladder-up and stowed in baggage compartment, and cabin door closed. Forward hatch closed—anti-squat strut up.

(2) Safety belts fastened.

(3) Have chocks removed.

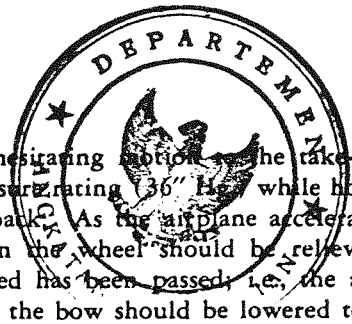
(4) Land operation. Apply even power to the engines to begin rolling—steer and control speed by throttling the engines and using the brakes. Taxi slowly over rough ground. Taxi to take-off position, allowing the airplane to roll a few feet in the direction of take-off to straighten the nose wheel. When taxiing cross-wind, to control the airplane carry less power on the lee engine.

b. WATER OPERATION.

(1) OFF THE STEP.—Taxiing off the step should be done slowly in order to minimize spray on the propellers. Lowering of the landing gear will reduce the idle taxi speed considerably. When the landing gear is extended in the water with the engines idling prior to beaching or ramping it may be necessary to give the throttle several short bursts to lock the gear in the down position.

(2) ON THE STEP.—Long taxi runs should be made by accelerating the airplane, using take-off power through the hump speed and onto the step. The power may then be reduced to maintain any taxi speed desired while on the step.

(3) RAMPING.—Make sure that there is sufficient depth of water to allow the landing gear to lock in the down position. It is advisable to approach



the ramp as slowly as possible. Once the climb up the ramp is started sufficient power must be maintained at all times in order to prevent the tail from squatting.

(4) BEACHING.—It is recommended that the final approach to a beach be made at an angle of not greater than 45° to the shoreline. When the wheels touch bottom the airplane should be accelerated quickly and at the same time turned at least 90° back towards the water. It is advisable to hold the wheel full back during the procedure to relieve the weight on the nosewheel.

4. TAKE-OFF.

a. CHECK-OFF.

(1) Safety belts fastened.
(2) Cabin door—CLOSED.
(3) Tabs—
Rudder 0°
Elevator 0°
Aileron 0°
(4) Propellers forward to HIGH RPM.
(5) Mixture—forward to RICH .
(6) Fuel selectors—Right ON—RIGHT ENGINE.
Left ON—LEFT ENGINE
(7) Fuel booster pumps—ON.
(8) Cowl Flaps—CLOSED.

Note

Normally a take-off is made with the cowl flaps closed. However, it may be necessary to open the flaps slightly to avoid exceeding the maximum allowable cylinder head temperature.

(9) Carburetor heat—COLD.
(10) Flaps—UP.

CAUTION

DO NOT use flaps for take-off.

(11) Generator switches—ON.
(12) If water take-off, check that landing gear is UP.

b. LAND OPERATION.—Use throttles and brakes to maintain direction until rudder becomes effective at approximately 25 mph. Accelerate the airplane to 100 mph, take off, and retract gear immediately.

c. WATER OPERATION

(1) It is advisable to start the take-off with the carburetor heat control in alternate air and move it to cold air after the throttles are open. This will prevent the coughing that generally occurs if the throttles are opened when the engines are cold.

(2) The best trim angle for take-off can be determined readily with experience. To reduce excessive propeller wear the throttles should be opened with a smooth non-hesitating motion to the take-off power manifold pressure rating (36" Hg.) while holding the wheel full back. As the airplane accelerates the back pressure on the wheel should be relieved. After the hump speed has been passed; i.e., the airplane is on the step, the bow should be lowered to a point slightly higher than the level flight attitude and held in this attitude by use of the elevator until the take-off is accomplished.

5. CLIMB AND CRUISING.

Refer to applicable charts in Section II, Performance Information.

a. Cylinder head temperature limits.

(1) Take-off (1 minute) 500°F.
(2) Normal rated continuous 500°F (max.)
(3) Cruise—400°F or less (desired).

b. Oil temperature limits.

(1) Take-Off and Climb (max.) 185°F.

c. Check that landing gear is UP.

d. After take-off and climb is completed, level off and reduce power to that desired for cruising altitude.

e. Adjust cowl flaps to maintain cylinder head temperature.

f. MIXTURE CONTROL—FULL RICH. When above 5000 ft., lean out for smooth engine operation. Lean out as follows:

(1) Move one mixture control lever aft until synchroscope moves.

(2) Return mixture control lever forward until synchroscope movement stops.

(3) Set other mixture control lever to match.

g. Electric fuel booster pumps—OFF.

h. Carburetor heat control.

(1) Airplanes serial numbers J1-J31 inclusive. On these early airplanes there is a single control with three settings—COLD at extreme right, ALTERNATE at mid-position and FULL HOT at extreme left. For normal operation keep at COLD; if icing is evident or suspected shift to ALTERNATE or to HOT (various settings as necessary). Return to COLD as soon as feasible for better engine operation .

(2) Airplanes serial numbers J32 and subsequent. On these later airplanes there are two controls installed in the cockpit ceiling with two settings (alternate setting eliminated). COLD—forward and HOT—aft. For normal operation keep controls at COLD; if icing is evident or suspected pull aft as required. Return to COLD as soon as feasible for better engine operation.

6. APPROACH.

a. Descent—Do not exceed the permissible indicated gliding speed, 270 mph.

b. INITIAL APPROACH.

(1) Mixtures—forward to FULL RICH.

(2) Check fuel quantity gage.

(3) Fuel selectors—set to feed both engines from best tank.

(4) Electric fuel booster pumps—ON.

(5) Carburetor heat—If long power-off glides are made the control should be on alternate air. Power approaches should be made on cold air.

(6) Cowl flaps—to cool.

(7) Reduce TIAS to 125 mph.

(8) If night landing, landing lights ON.

Note

Extension of landing lights causes slight aileron buffeting.

(9) Landing gear for land—DOWN (check indicator and visually).

Note

Landing gear extension time is 6 seconds.

(10) Landing gear for water—UP.

c. FINAL APPROACH.

(1) Propeller controls—2200 rpm.

(2) Wing flaps control aft to Landing Flaps (45°).

(3) Operate brake pedals to check that there is pressure.

(4) Approach at 90 to 95 mph TIAS.

7. LANDING.

a. ON LAND.—Refer to applicable charts in Section II, Performance Information.

Hold the nose wheel off, making contact with the main wheels, then dropping the nose wheel. Do not apply brakes until the nose wheel is down, then apply brakes slowly and evenly.

b. ON WATER.

(1) Keel, step and full stall landings can be made without any skipping or porpoising tendencies. Following the touchdown it is recommended that the touchdown attitude be held or perferably increased as the airplane decelerates. Increasing the trim angle by use of the elevator will reduce the distance of the landing run.

Partial or zero flap landings may be made if an unlimited landing area is available.

(2) Retract flaps after the speed has been reduced to approximately 50 mph to avoid excessive spray on flaps.

c. STOPPING ENGINES.

(1) After taxiing in, have main wheels chocked or apply parking brakes and set anti-squat strut to down.

(2) With propeller controls forward to HIGH RPM idle engines at 1000 rpm, then set mixture controls aft to IDLE CUT-OFF, and gradually open throttles until engines stop.

(3) Ignition master switch and individual engine switches to OFF (after engines stop).

d. CHECK-OFF BEFORE LEAVING THE AIRPLANE.

(1) a. Main wheels chocked or parking brake set (land).

b. Secure anchor or mooring line to cleat (water).

(2) Master radio switch off.

(3) Fuel selectors—OFF.

(4) Cowl flaps—CLOSED.

(5) Ignition master switch—OFF.

(6) All electric switches (including battery)—OFF.

(7) Attach controls locking harness.

(8) Cabin windows, hatch and door closed.

8. SINGLE ENGINE OPERATION.

a. ENGINE FAILURE DURING TAKE-OFF.—The critical engine failure speed is 100 mph. All performance data in this manual are based on the assumption that over 100 mph the take-off will be completed and that under 100 mph the live engine throttle should be closed and the airplane braked to a stop.

(1) Lower the live engine wing approximately 5° and maintain a straight flight path with rudder.

(2) Retract landing gear immediately—100 mph.

(3) Move propeller control of inoperative engine to full aft position (Refer to 9 following).

(4) Inoperative engine mixture control aft to "IDLE CUT-OFF".

(5) Feather propeller of inoperative engine (Refer to 9 following).

(6) Inoperative engine electric fuel pump to "OFF".

(7) Inoperative engine fuel selector to "OFF".

(8) Inoperative engine generator switch to "OFF".

(9) Inoperative engine ignition switch to "OFF".

(10) Retrim airplane as necessary.

b. ENGINE FAILURE DURING FLIGHT.

(1) Move both propeller controls full forward to HIGH RPM to determine inoperative engine.

(2) Mixture controls RICH.

(3) Throttles forward to METO power.

(4) Move propeller control of inoperative engine to full aft position (Refer to 9 following).

(5) Inoperative engine mixture control to "IDLE CUT-OFF".

(6) Feather propeller of inoperative engine (Refer to 9 following).

(7) Inoperative engine fuel selector to "OFF".

(8) Inoperative engine generator switch to "OFF".

(9) Inoperative engine ignition switch to "OFF".

the ramp as slowly as possible. Once the climb up the ramp is started sufficient power must be maintained at all times in order to prevent the tail from squatting.

(4) BEACHING.—It is recommended that the final approach to a beach be made at an angle of not greater than 45° to the shoreline. When the wheels touch bottom the airplane should be accelerated quickly and at the same time turned at least 90° back towards the water. It is advisable to hold the wheel full back during the procedure to relieve the weight on the nosewheel.

4. TAKE-OFF.

a. CHECK-OFF.

(1) Safety belts fastened.
(2) Cabin door—CLOSED.
(3) Tabs—
Rudder 0°
Elevator 0°
Aileron 0°
(4) Propellers forward to HIGH RPM.
(5) Mixture—forward to RICH .
(6) Fuel selectors—Right ON—RIGHT ENGINE.
Left ON—LEFT ENGINE
(7) Fuel booster pumps—ON.
(8) Cowl Flaps—CLOSED.

Note

Normally a take-off is made with the cowl flaps closed. However, it may be necessary to open the flaps slightly to avoid exceeding the maximum allowable cylinder head temperature.

(9) Carburetor heat—COLD.
(10) Flaps—UP.

CAUTION

DO NOT use flaps for take-off.

(11) Generator switches—ON.
(12) If water take-off, check that landing gear is UP.

b. LAND OPERATION.—Use throttles and brakes to maintain direction until rudder becomes effective at approximately 25 mph. Accelerate the airplane to 100 mph, take off, and retract gear immediately.

c. WATER OPERATION

(1) It is advisable to start the take-off with the carburetor heat control in alternate air and move it to cold air after the throttles are open. This will prevent the coughing that generally occurs if the throttles are opened when the engines are cold.

(2) The best trim angle for take-off can be determined readily with experience. To reduce excessive propeller wear the throttles should be opened with a smooth non-hesitating motion to the take-off power manifold pressure rating (36.5" Hg) while holding the wheel full back. As the airplane accelerates the back pressure on the wheel should be relieved. After the hump speed has been passed; i.e., the airplane is on the step, the bow should be lowered to a point slightly higher than the level flight attitude and held in this attitude by use of the elevator until the take-off is accomplished.

5. CLIMB AND CRUISING.

Refer to applicable charts in Section II, Performance Information.

a. Cylinder head temperature limits.

(1) Take-off (1 minute) 500°F.
(2) Normal rated continuous 500°F (max.)
(3) Cruise—400°F or less (desired).

b. Oil temperature limits.

(1) Take-Off and Climb (max.) 200°F.

c. Check that landing gear is UP.

d. After take-off and climb is completed, level off and reduce power to that desired for cruising altitude.

e. Adjust cowl flaps to maintain cylinder head temperature.

f. MIXTURE CONTROL—FULL RICH. When above 5000 ft., lean out for smooth engine operation. Lean out as follows:

(1) Move one mixture control lever aft until synchroscope moves.

(2) Return mixture control lever forward until synchroscope movement stops.

(3) Set other mixture control lever to match.

g. Electric fuel booster pumps—OFF.

h. Carburetor heat control.

(1) Airplanes serial numbers J1-J31 inclusive. On these early airplanes there is a single control with three settings—COLD at extreme right, ALTERNATE at mid-position and FULL HOT at extreme left. For normal operation keep at COLD; if icing is evident or suspected shift to ALTERNATE or to HOT (various settings as necessary). Return to COLD as soon as feasible for better engine operation

(2) Airplanes serial numbers J32 and subsequent. On these later airplanes there are two controls installed in the cockpit ceiling with two settings (alternate setting eliminated). COLD—forward and HOT—aft. For normal operation keep controls at COLD; if icing is evident or suspected pull aft as required. Return to COLD as soon as feasible for better engine operation.

6. APPROACH.

a. Descent—Do not exceed the permissible indicated gliding speed, 270 mph.

b. INITIAL APPROACH.

(1) Mixtures—forward to FULL RICH.

(2) Check fuel quantity gage.

(3) Fuel selectors—set to feed both engines from best tank.

(4) Electric fuel booster pumps—ON.

(5) Carburetor heat—If long power-off glides are made the control should be on alternate air. Power approaches should be made on cold air.

(6) Cowl flaps—to cool.

(7) Reduce TIAS to 125 mph.

(8) If night landing, landing lights ON.

Note

Extension of landing lights causes slight aileron buffeting.

(9) Landing gear for land—DOWN (check indicator and visually).

Note

Landing gear extension time is 6 seconds.

(10) Landing gear for water—UP.

c. FINAL APPROACH.

(1) Propeller controls—2200 rpm.

(2) Wing flaps control aft to Landing Flaps (45°).

(3) Operate brake pedals to check that there is pressure.

(4) Approach at 90 to 95 mph TIAS.

7. LANDING.

a. ON LAND.—Refer to applicable charts in Section II, Performance Information.

Hold the nose wheel off, making contact with the main wheels, then dropping the nose wheel. Do not apply brakes until the nose wheel is down, then apply brakes slowly and evenly.

b. ON WATER.

(1) Keel, step and full stall landings can be made without any skipping or porpoising tendencies. Following the touchdown it is recommended that the touchdown attitude be held or perferably increased as the airplane decelerates. Increasing the trim angle by use of the elevator will reduce the distance of the landing run.

Partial or zero flap landings may be made if an unlimited landing area is available.

(2) Retract flaps after the speed has been reduced to approximately 50 mph to avoid excessive spray on flaps.

c. STOPPING ENGINES.

(1) After taxiing in, have main wheels chocked or apply parking brakes and set anti-squat strut to down.

(2) With propeller controls forward to HIGH RPM idle engines at 1000 rpm, then set mixture controls aft to IDLE CUT-OFF, and gradually open throttles until engines stop.

(3) Ignition master switch and individual engine switches to OFF (after engines stop).

d. CHECK-OFF BEFORE LEAVING THE AIRPLANE.

(1) a. Main wheels chocked or parking brake set (land).

b. Secure anchor or mooring line to cleat (water).

(2) Master radio switch off.

(3) Fuel selectors—OFF.

(4) Cowl flaps—CLOSED.

(5) Ignition master switch—OFF.

(6) All electric switches (including battery)—OFF.

(7) Attach controls locking harness.

(8) Cabin windows, hatch and door closed.

8. SINGLE ENGINE OPERATION.

a. ENGINE FAILURE DURING TAKE-OFF.—The critical engine failure speed is 100 mph. All performance data in this manual are based on the assumption that over 100 mph the take-off will be completed and that under 100 mph the live engine throttle should be closed and the airplane braked to a stop.

(1) Lower the live engine wing approximately 5° and maintain a straight flight path with rudder.

(2) Retract landing gear immediately—100 mph.

(3) Move propeller control of inoperative engine to full aft position (Refer to 9 following).

(4) Inoperative engine mixture control aft to "IDLE CUT-OFF".

(5) Feather propeller of inoperative engine (Refer to 9 following).

(6) Inoperative engine electric fuel pump to "OFF".

(7) Inoperative engine fuel selector to "OFF".

(8) Inoperative engine generator switch to "OFF".

(9) Inoperative engine ignition switch to "OFF".

(10) Retrim airplane as necessary.

b. ENGINE FAILURE DURING FLIGHT.

(1) Move both propeller controls full forward to HIGH RPM to determine inoperative engine.

(2) Mixture controls RICH.

(3) Throttles forward to METO power.

(4) Move propeller control of inoperative engine to full aft position (Refer to 9 following).

(5) Inoperative engine mixture control to "IDLE CUT-OFF".

(6) Feather propeller of inoperative engine (Refer to 9 following).

(7) Inoperative engine fuel selector to "OFF".

(8) Inoperative engine generator switch to "OFF".

(9) Inoperative engine ignition switch to "OFF".

Note

For optimum performance, trim the airplane with the live engine wing approximately 5° low.

c. SINGLE ENGINE APPROACH.

(1) INITIAL APPROACH.

(a) It is recommended that a high straight approach at 110 mph be made for the last mile into the field.

(2) FINAL APPROACH.

(a) Landing gear extension should be started from ½ to 1 mile from the field.

Note

Gear extension time is approximately 8 seconds.

(b) After the landing gear is down and locked, and it is obvious that the landing will be made, the flaps should be set in the landing position (45°).

9. PROPELLER OPERATION.

a. FEATHERING.

(1) Pull propeller control full aft to lock pitch position.

(2) Push feathering button ONCE AND RELEASE. It is possible that, if the button is pressed at too high a propeller rpm the feathering motor will automatically shut off when the propeller reaches the lock pitch blade angle. If this should occur, push feathering button in and hold ONLY until the rpm reaches 400. From this point the propeller will go into the feathered position and the button will automatically pop out.

Note

If the feathering button is held in, the propeller will go to the feathered position and immediately unfeather. Therefore:

(a) When attempting to feather never hold the feathering button in after the rpm is down to 400.

(b) Before feathering MAKE CERTAIN you don't push the wrong button. If this should be done and the error is noted quickly, the feathering button may be pulled out and the feathering cycle will stop provided the rpm is above 300.

(c) If nothing happens when the feathering button is pushed, depress the circuit breaker, located between the feathering buttons, and try again.

b. UNFEATHERING.

(1) Fuel selector to best tank.

(2) Mixture control in IDLE CUT-OFF.

(3) Generator switch ON.

(4) Carburetor heat control to COLD.

(5) Propeller control to governing rpm. (1800 to 2000 rpm) (aft side of control on dividing line between red and green sectors).

(6) THROTTLE CLOSED.

(7) Push feathering button in and hold in until rpms build up to 600-800 maximum and then release.

(8) Ignition switch to ON BOTH.

(9) WAIT UNTIL ENGINE WINDMILLS UP TO 1300-1500 RPM and then push mixture control forward to RICH. This engine speed can normally be reached at an airspeed of 130-135 mph. If the mixture control is operated at a lower rpm, there is danger of overloading the engine and causing a damaging backfire.

(10) Open throttle slowly.

(11) The same procedure should be used in warming up the engine after unfeathering as is used on the ground, namely: check oil pressure, oil temperature and head temperature before drawing high power.

Note

THIS FEATHERING AND UNFEATHERING PROCEDURE IS GIVEN FOR THE PURPOSE OF MAKING PERIODIC CHECKS OF THE SYSTEM AND OPERATION. To avoid overloading the engine sump, do not repeat this test until the engine has run for at least two minutes at approximately 1000 rpm. Caution should be taken regarding unfeathering in cases where the propeller was feathered because of a damaged engine, as returning the engine to operation may result in further damage. Under such conditions, it may prove impossible to feather the propeller again due to damage to oil passages in the engine.

CAUTION

UNDER NO CIRCUMSTANCES SHOULD AN ENGINE BE STARTED ON THE GROUND WHEN THE PROPELLER IS FEATHERED OR IN LOCKED OR HIGH PITCH POSITIONS. Bring the feathered propeller back to locked high pitch with the feathering motor and from there down to flat pitch by hand with propeller "paddles". Be sure to drain the engine sump to avoid loading the engine with oil.

10. CONTROLS LOCK.

The controls lock or parking harness is supplied to prevent damage to the control surfaces when the airplane is unmanned, on the ground.

11. WING FLAP CONTROL.

The flap control lever is located on the pilot's overhead panel. Push button at bottom of lever to unlock and move control. Take-off flap setting is 0° (lever full forward) and landing flap setting is 45° down (lever full aft).

12. FIRE EXTINGUISHER EQUIPMENT.

a. CO_2 SYSTEM (Airplanes J1-J31 inclusive.)—A fifteen pound, electrically controlled CO_2 fire extinguisher for the engine nacelles and cabin heater is installed in the wing box beam (accessible from the main cabin). Three lines of tubing with individual solenoid operated valves, run out from the extinguisher to the left and right nacelles and to the heater compartment in the aft end of the hull. The tubing line to each nacelle terminates in a perforated ring, to take care of the engine and accessory compartment; and two branches, one to the carburetor header and one to the oil cooler air intake duct. The line to the heater directs CO_2 to the heater muff.

Direction of CO_2 to the nacelles is manually controlled; if fire should occur, the toggle switch on the right side of the overhead control panel is set to left or right as needed, the solenoids are actuated to open the bottle valve and the valve in the selected line, and the entire contents of the bottle are directed to that nacelle.

The direction of CO_2 to the cabin heater is automatic; when the temperature reaches 400°F, a thermal switch closes and the bottle and line valves are opened.

Note

1.

The system is a "one-shot type"; once the extinguisher is used the entire contents are discharged.

2.

Turn heater OFF immediately when warning light glows and DO NOT START until properly repaired.

b. CO_2 SYSTEM (Airplane J32 and subsequent). On these airplanes there are two fifteen pound extinguisher bottles, teed to the original distribution tubing by a special check valve Tee. No other change has been made in the distribution tubing.

On these airplanes also the direction of CO_2 to the nacelles is manually controlled. There are 13 fire detectors installed in the engine compartment and carburetor which will cause the warning light to glow when they are subjected to fire. Also there is a two-position toggle switch to select one of the extinguishers as well as the RIGHT or LEFT nacelle selector.

Note

There is no OFF position for the extinguisher selector. If extinguisher has been used, the selector must be set to the other bottle to have liquid available for possible subsequent use.

On these airplanes, the automatic extinguishing of cabin heater fires has been eliminated—fire detectors in the heater shroud will cause warning light to glow when fire occurs. To put out fire:

(1) Turn heater OFF.

(2) Turn fire extinguisher to ON-HEATER.

c. HAND EXTINGUISHERS.—Two one quart carbon tetrachloride hand extinguishers are installed; one on the bulkhead behind the pilot's seat and one at the aft end of the cabin, on the right hand side at the lavatory bulkhead.

WARNING

In event of fire in baggage compartment, cabin or cockpit do not open cockpit windows. Close if open. Take care not to inhale extinguisher fumes (stand away from fire when using).

After fire is out the main cabin door may be opened slightly to hasten exhaust of fumes or smoke.

d. SMOKE DETECTORS.—A smoke detector is installed in the baggage compartment which will cause a warning light to glow in the pilot's compartment should a fire occur which would not be discernible to the crew otherwise. In such a case, the hand extinguishers must be used.

e. FIRE SHUT-OFF VALVES.—Two (1L-1R) "T" type handles are installed on the bulkhead above and behind the pilot's head, which close valves in the oil-in-to-engine and hydraulic lines at the engine firewall.

f. ENGINE SECTION FIRE.—Proceed as follows if conditions permit.

(1) Fuel selectors to cut off engine afire.

(2) Pull fire shut-off valve.

(3) Mixture control to "IDLE CUT-OFF".

(4) Feather propeller.

(5) Close cowl flaps.

(6) Fuel booster pump OFF (if in use).

(7) Ignition switch of engine afire to "OFF".

(8) Set fire extinguisher switch to engine on fire.

(9) Do not restart affected engine.

g. CABIN OR HULL FIRE.—Use hand fire extinguisher. Refer to WARNING above.

h. HEATING SYSTEM FIRE.—Use hand fire extinguisher if operation of CO_2 is ineffective.

13. WINDSHIELD WIPERS.

The hydraulically operated windshield wiper control is located on the cowling at the bottom of the pilot's windshield. Turn the control clockwise to ON and to increase speed; turn counter clockwise to slow and "OFF".

CAUTION

Do not operate on dry windshields.

14. LANDING GEAR.

a. NORMAL OPERATION.—The tricycle landing gear is operated hydraulically. The landing gear control (selector valve) is located in the bulkhead behind the pilot's seat. In airplane J24 and subsequent, to prevent inadvertent operation of the gear from either position, the control lever is located in place by a spring-loaded guard which must be released before moving the lever. In airplanes J1-J23 inclusive, a spring-loaded, solenoid operated latch is installed in lieu of the guard.

To raise landing gear—move lever up.

To lower landing gear—move lever down.

CAUTION

Lever must always be left in FULL UP or FULL DOWN position—NEVER IN A MIDWAY POSITION.

An electric landing gear (and flaps) position indicator is located on the center instrument panel; in addition the position of the nose wheel may be checked by an indicator on the bow compartment floor or by sighting, from the co-pilot's seat, on the gear directly through a plexiglas window in the wheel well.

b. AUXILIARY AND EMERGENCY OPERATION.

(1) AUXILIARY OPERATION.

(a) RETRACTION.

1. Set the Landing Gear selector control in "UP" position.

2. Move Hydraulic Hand Pump selector valve (on floor between pilot's and co-pilot's seats) to "LAND GEAR".

3. Operate the hand pump for NOT MORE THAN 35 strokes.

CAUTION

If pressure is not developed and/or the landing gear has not moved, follow the extension procedure, *(b)*, immediately.

4. If pressure is developed and landing gear has started to retract, continue with hand pump until the gear is fully up and locked.

(b) EXTENSION.

1. Set the Landing Gear selector control in "DOWN" position.

2. Move Hydraulic Hand Pump selector valve to "LAND GEAR".

3. Operate the hand pump 35 strokes.

CAUTION

If pressure is not developed and/or if the landing gear has not moved, follow EMERGENCY OPERATION—(2).

4. If pressure is developed and landing gear has started to extend, continue with hand pump until gear is fully down and locked.

(2) EMERGENCY OPERATION—EXTENSION ONLY.

(a) Set the Landing Gear selector control in "UP" position.

(b) Move Hydraulic Hand Pump selector valve to "LAND, GEAR EMERG".

(c) Actuate the hand pump.

CAUTION

After landing, move L.G. control to "DOWN" before changing setting of Hand Pump Selector Valve.

15. EMERGENCIES.

a. HYDRAULIC SYSTEM.—If normal hydraulic system operation fails:-

(1) LANDING GEAR.—See Paragraph 14.*b* above.

(2) FLAPS. — Set HYDRAULIC SYSTEM SELECTOR VALVE to WING FLAPS. Set FLAP CONTROL as desired and operate hand pump to lower flaps.

CAUTION

If there is an hydraulic system failure lower landing gear first, then flaps.

(3) BRAKES.—Set HYDRAULIC SYSTEM SELECTOR VALVE to BRAKES, and operate hand pump to develop 600 psi. maximum.

b. ELECTRICAL.—If either generator red warning light glows, cut off as many circuits as necessary, to reduce load to 60 amperes or less.

If any circuit breaker reset button pops out, press in but DO NOT HOLD, unless absolutely necessary for operation. Closing the circuit against the breaker may cause fire.

16. WING TIP FLOAT AUXILIARY FUEL SYSTEM (SPECIAL EQUIPMENT.)

On certain airplanes, the wing tip floats are modified to serve as auxiliary fuel tanks, each to carry 50 gallons of fuel (100 gallons total). Two special electric pumps, controlled by a switch located on Sta. 140 bulkhead, behind the co-pilot's seat, are installed in the wings and the respective feed lines are led into the tops of the respective main tanks (left aux. to left main, etc.).

CAUTION

Do not use fuel from float tanks until 70 to 80 gallons have been used from each main tank.

a. OPERATION:

1. Check quantity gage (main tank)-should read 110-120 gallons or less.

2. Set switch for aux. tanks up to ON.

3. Turn off at completion of transfer (a minimum of 1 hour).

17. AUTOMATIC PILOT (SPECIAL EQUIPMENT).

The fully electrical Sperry A-12 gyropilot installed on certain airplanes, is made up of several control units, the operating units and four servos: one each for the aileron, elevator, elevator trim tabs and the rudder system.

The pilots controls are; the main power switch on the radio panel; the pedestal controller installed on the pilot's chair frame; the pilot mechanical engaging control installed on the cockpit floor between the pilot's and co-pilot's chairs; and the emergency electrical release buttons installed on the outboard side of each control wheel.

For more detailed information refer to Sperry Gyroscope Co., Inc. Manual for the Operation and Service of Model A-12 gyropilot.

18. OXYGEN SYSTEM (SPECIAL EQUIPMENT).

The oxygen system installed on certain airplanes is made up of two (2) 514 cu. in. capacity Kidde

(923748) cylinders and valves, a regulator (ARO 0655-E), with the necessary tubing and ten outlet couplings (AN6009-2). The couplings are located on the side walls adjacent to the pilot's and co-pilot's seats, at each rear cabin chair and behind the divans.

The cylinders are installed in a cradle on the right of the bow compartment floor between Stas. 53 and 72. Lines from the cylinders run through check valves, are teed together and the single line is led to the regulator installed on the right (co-pilot's) side of the cockpit aft of Sta. 93.

a. OPERATION:

1. Turn on either or both cylinders before a flight requiring oxygen.

2. Set regulator to normal flow.

Note

In an emergency a manual override of the regulator permits turning the control knob clockwise until the indicator on the knob is diametrically opposite the normal setting position. This permits approximately double the normal flow.

3. Plug in mask to convenient outlet coupling.

4. Turn off cylinder valves at completion of flight.

Five individual nasal masks (Ohio Chemical Parts Co. B-11-B) are supplied with the installation.

WARNING

Keep all oxygen equipment free of any oil, grease or any easily oxidized material. Such material, when in contact with oxygen under pressure will ignite violently.

19. PROPELLER ANTI-ICING SYSTEM (SPECIAL EQUIPMENT).

The anti-icing system consists of a pump rheostat control switch, a pump and filter, the tank and lines to each propeller slinger ring.

a. PUMP SWITCH.—The rheostat switch which controls the pump is installed on the radio panel and is calibrated from six (6) G.P.H. to three and nine tenths (3.9) G.P.H.

b. PUMP.—The system pump (Weldon No.-100B) is installed in the left nacelle aft of the tank. The maximum pump capacity is six (6) gallons per hour and it is controlled by the "rheostat" switch in the cockpit. The two supply lines are led forward from the pump to feed the slinger rings on the propeller hubs.

c. TANK.—The tank, including "a dip-stick" gage, is installed on the center line of the left nacelle, on the rear face of the rear wing beam. The filler neck, on the top, is led up above the upper wing skin line and is accessible under the upper nacelle access door. Access for draining or inspecting the tank is had by removing the lower rear nacelle skin.

The tank capacity is seven and one-half (7½) U.S. Gallons (6.25 Imperial gallons) and the recommended fluid is a denatured alcohol solution with 95% Ethyl and 5% Methyl, or "Isopropyl".

d. OPERATION.—To operate the system turn the pump rheostat control switch clockwise to the desired flow-rate.

20. OIL DILUTION SYSTEM (SPECIAL EQUIPMENT).

The oil dilution system, if installed, consists of a line assembly in each nacelle which incorporates a solenoid control valve. The line assembly is installed in the fuel feed line between the electric boost pump and the engine driven pump, to a fitting in the "oil-in" to engine line. To operate the system:

a. Set engine speeds to 1000 rpm.

b. Turn both electric boost pump switches to ON.

Note

Oil dilution will not be obtained unless the electric booster pumps are turned on.

c. Turn oil dilution control switch to ON.

d. Run engines at 1000 rpm for two minutes only.

e. Cut throttles to "IDLE CUT-OFF" position.

f. Hold oil dilution control switch ON until engines stop.

21. WING AND TAIL SURFACES DE-ICING SYSTEM (SPECIAL EQUIPMENT).

The de-icing system consists of boots, installed on the wing leading edge, outboard of the nacelles and on the leading edge of the fin and stabilizers, together with the push-pull control installed on the floor under the co-pilot's seat, a distributing valve in the right wing and a pressure gage on the radio panel.

a. OPERATION.—To actuate de-icer boots:

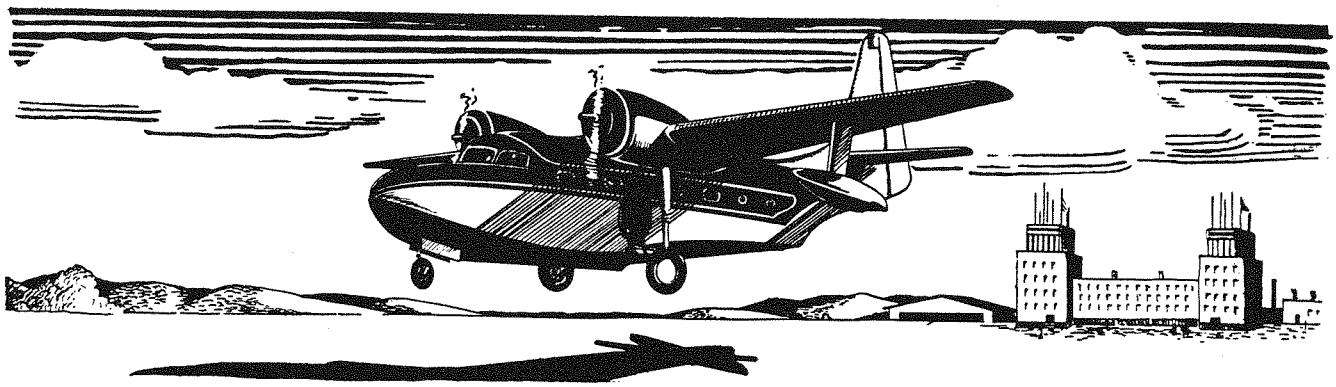
(1) Turn control handle counter-clockwise to unlock.

(2) Pull and turn clock-wise to lock in "ON" position.

(3) Check pressure gage for proper reading (8-10 psi.).

Note

Stalling speeds with the boots operating are approximately 8 to 10 m.p.h. higher than with the boots not operating.



SECTION IV

Design Features

1. FUEL SYSTEM.

The fuel system is made up of two tanks (one left and one right) and selector valves, strainers, electric booster pumps, engine driven pumps, lines and fittings for each. The left and right installations are independent of each other but are interconnected; i.e. fuel from the left tank may be fed to the right engine and fuel from the right tank may be fed to the left engine.

a. TANKS.—The intergral tanks are formed by the wing box beam structure; the interiors of the tanks are coated with a thiokol compound (Stoner-Mudge process) to prevent leakage.

(1) TANK CAPACITIES.

Airplanes ser. Nos. J1 to J7 incl., J9, J10 and J11
165 U.S. gals. each (330 U.S. gals. total)
137 imp. gals. each (275 imp. gals. total)

Airplanes ser. Nos. J8, J12 and subsequent
190 U.S. gals. each (380 U.S. gals. total)
158 imp. gals. each (316 imp. gals. total)

The electrically operated fuel quantity gage (indication for both tanks on one dial) is located on the overhead panel on the centerline.

b. SELECTOR VALVES.—The two selector valves (mounted on the face of the box beam) are operated by chain and cable assemblies from handles installed on the pilot's overhead panel. The valves have three settings: left tank, "OFF", "ON-TO LEFT ENGINE" and "ON-TO RIGHT ENGINE"; right tank "OFF", "ON-TO RIGHT ENGINE" and "ON-TO LEFT ENGINE".

c. ELECTRIC BOOSTER PUMPS. — The two electric booster pumps are controlled by "ON-OFF" toggle switches located above the selector valves, on the pilot's overhead panel. The pumps are used for starting, warm-up, take-off, and landing. In normal cruising operation, the pumps are unnecessary, except in conditions of extreme heat where vapor lock might occur, or in case of failure of the engine driven pump. The pumps are set to deliver 4-6 psi. pressure.

d. FUEL SYSTEM MANAGEMENT.

(1) Starting Engines, Ground Test and Take-off.

(a) Left Fuel Selector—ON—LEFT ENGINE FROM LEFT TANK.

(b) Right Fuel Selector — ON — RIGHT ENGINE FROM RIGHT TANK.

Note

Check quantities on gage. If one tank is low, set selector for that tank to draw from other tank.

(c) Electric booster pump switches—ON.

(2) ENGINE FAILURE.

(a) Check quantity gage (to see if tank in use is empty).

(b) Switch selector to feed from full tank (if necessary).

(c) Check that electric booster pump is ON.

CAUTION

If forced landing is necessary set electric booster pumps to OFF before contact.

(3) CRUISING.—Operate normally (left engine —left tank, right engine—right tank) checking quantity gage; set electric booster pump switches to OFF.

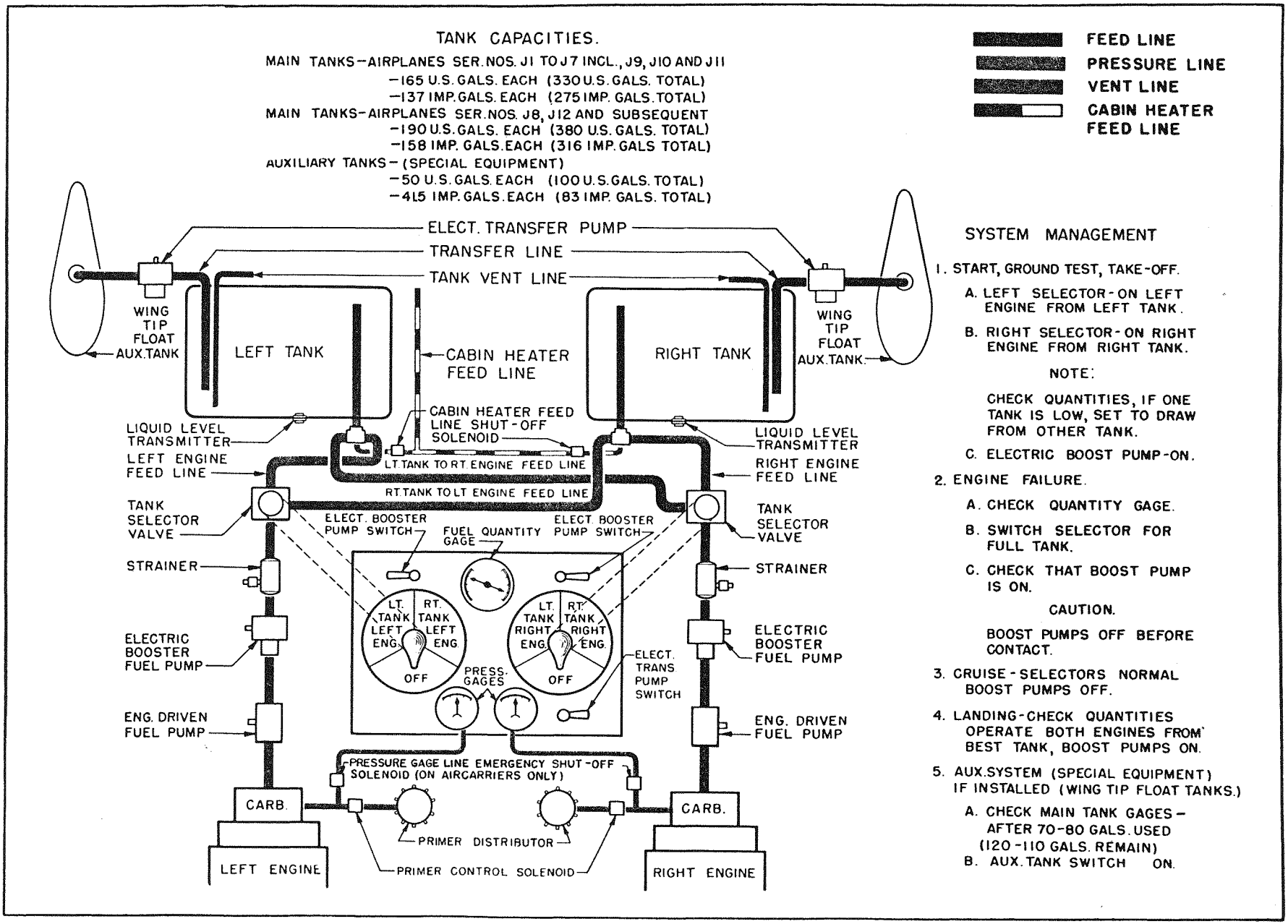
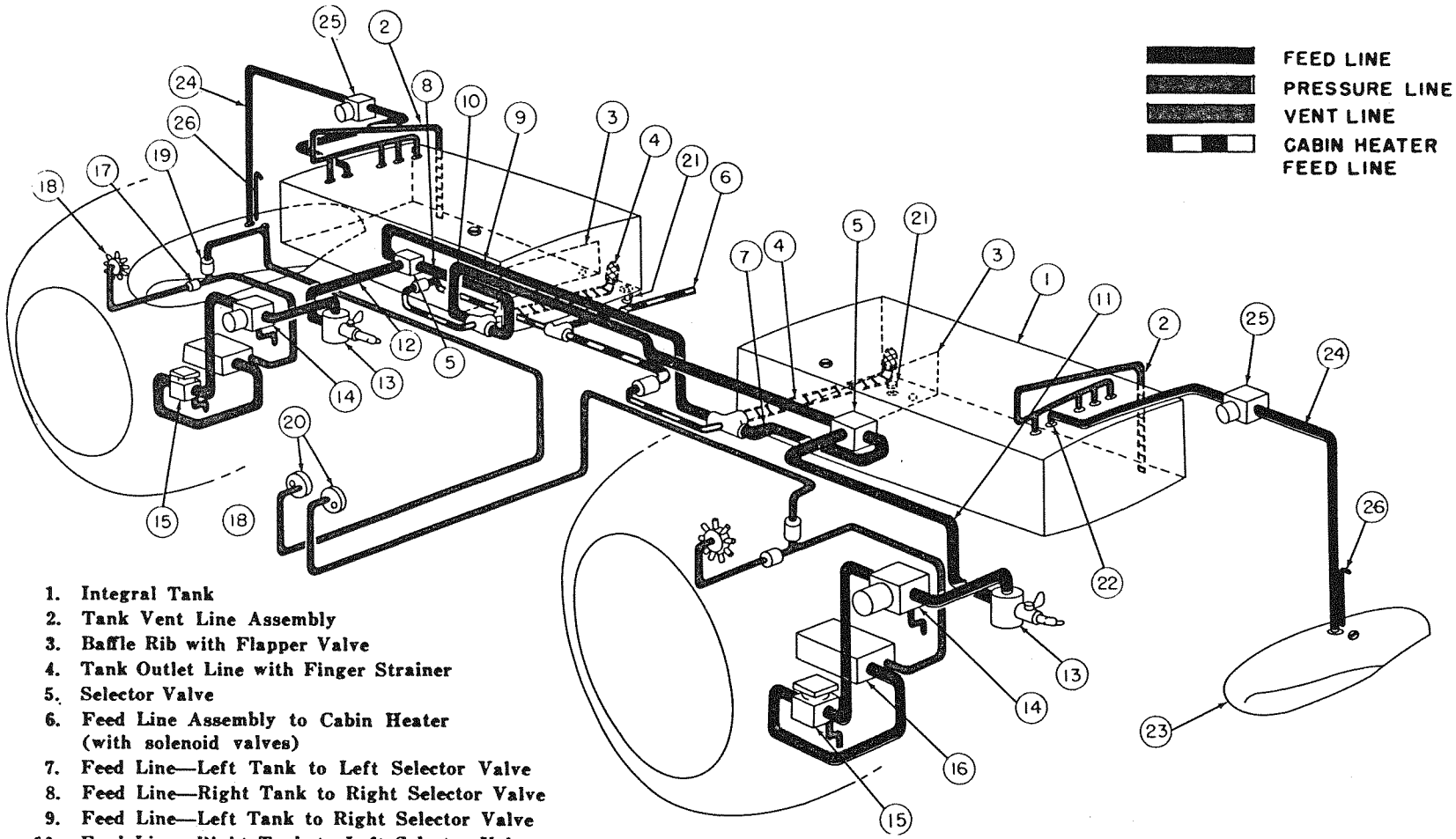


Figure 24—Fuel System Management Diagram



1. Integral Tank
2. Tank Vent Line Assembly
3. Baffle Rib with Flapper Valve
4. Tank Outlet Line with Finger Strainer
5. Selector Valve
6. Feed Line Assembly to Cabin Heater (with solenoid valves)
7. Feed Line—Left Tank to Left Selector Valve
8. Feed Line—Right Tank to Right Selector Valve
9. Feed Line—Left Tank to Right Selector Valve
10. Feed Line—Right Tank to Left Selector Valve
11. Feed Line—Left Selector to Left Engine
12. Feed Line—Right Selector Valve to Right Engine
13. System Strainer—With System Drain Valve and Snap Spring Drain Valve
14. Electric Booster Pump with Drain Line
15. Engine Driven Pump with Drain Line
16. Carburetor
17. Primer Solenoid
18. Engine Primer Rose
19. Pressure Gage Line Emergency Shut-Off Solenoid (on scheduled air-carriers only)
20. Pressure Gage
21. Snap Spring Drain Valve on Inboard End of Tank
22. Fitting for Connection of Line from Auxiliary Wing Tip Float Tank
23. Wing Tip Float (Auxiliary Tank)
24. Transfer Line from Auxiliary Tank
25. Electric Transfer Pump for Auxiliary Fuel System
26. Vent Line for Auxiliary Tank

Figure 25—Fuel System Diagram

(4) LANDING. — Check fuel quantities and operate both engines from best tank: for example left selector — ON — LEFT ENGINE FROM LEFT TANK; right selector — ON — RIGHT ENGINE FROM LEFT TANK. Electric booster pump switches to ON.

2. OIL SYSTEM

Individual oil systems are provided for each engine, each system is made up of a tank, a cooler with a temperature regulator, a fire shut-off valve, lines and fittings.

a. TANK CAPACITIES.—10 gallons, plus 2 gallons expansion space; includes 1½ gallons used for propeller feathering and ½ gallon in sediment trap.

b. OPERATION.—Oil flows from the tank (located in the nacelle on top of the box beam) through the firewall to the engine crank case. Warm oil is returned to the temperature regulator on top of the cooler and if its temperature is below 103°F, is returned to the tank and then to engine; if the temperature has reached 160°F, it is directed through the cooler and back to the upper part of the tank.

c. FIRE SHUT-OFF VALVE. — This valve is installed on the aft side of the nacelle firewall, in the oil-in-to-engine line. It is controlled by a flexible shaft from a "T" handle in the cockpit. The valve is used to shut off oil flow from the tank should an engine fire occur.

Note

The cable control to this "OIL-IN "shut-off valve is also connected to a shut-off valve in the hydraulic pump suction line and shuts off flow of hydraulic oil to the respective pump simultaneously. Refer to Section III-Paragraph 12.*c.*

3. CARBURETOR AIR AND HEATING SYSTEM.

Air is carried from the nacelle leading edge by an inter-cylinder duct to a header assembly attached to the carburetor. A heater avlve, to which are led two heat intensifier tubes, is attached to the header.

In normal operation on earlier airplanes, the single control on the pilot's overhead panel is set to the right to COLD and air from the leading edge enters the carburetor header from the duct. If icing is suspected, the control is moved to the left, to ALTERNATE; a door in the header is swung to partially close off air from the duct, and suction opens a door on the other side of the header, drawing warm air from the accessory compartment. When the control is moved further left to HOT, the cold air duct door is completely closed, and a door in the heater valve is opened to admit accessory compartment air and hot air from the intensifier tube (there are various settings to provide varying amounts of hot air). The intensifier tubes run through the left and right exhaust collectors.

The control is mechanical, linked to the header and heater valve by cables.

On later airplanes (J32 and subsequent) there are two controls (one for each engine) installed on the cockpit ceiling. There are two settings for each handle (the alternate setting has been removed): forward—COLD and aft—HOT. The operation of this system with dual controls is identical with that installed in previous airplanes, with the exception that the flapper type hot air valve has been replaced by a slide type valve.

4. ELECTRICAL SYSTEM.

Electrical power for the 28 volt system is provided by two generators (one on each engine). A 24 volt 34 ampere hour battery in the right hand nacelle supplies power when the engines are not operating. Each generator is connected to a voltage regulator and generator control relay. One generator can maintain the electrical system up to an allowable output of 60 amperes.

Note

If one generator fails, as indicated by a voltameter check or the lighting of the red warning lights (if installed), cut out that generator with the generator emergency switch, and turn off as many circuits as necessary to reduce the load to 60 amperes or less.

a. CONTROLS. — Master switches and circuit breaker reset buttons for all circuits are located in the pilot's cockpit; individual switches for the cabin lights etc. are adjacent.

Automatic switches are provided for the landing gear and flaps position indicator, the landing gear control lock, the cabin heater and the cabin heater fire extinguisher line solenoid valve. The nacelles fire extinguisher lines and flare solenoid are controlled by toggle switches located on the right side of the pilot's overhead panel.

A flasher motor for the tail lights is provided for transport operation.

5. HYDRAULIC SYSTEM.

The hydraulic system operates the landing gear, wing flaps, cowl flaps, windshield wipers and parking brake. The brakes are operated independently by master cylinders.

Pressure is provided by two engine driven pumps; a hand pump is installed to serve as an auxiliary in case of partial hydraulic failure or when the engines are not operating. The operating pressure is 1650 psi; the pressure gage is located on the radio panel.

a. LANDING GEAR.—The selector valve is located behind the pilot's seat. It is impossible to raise

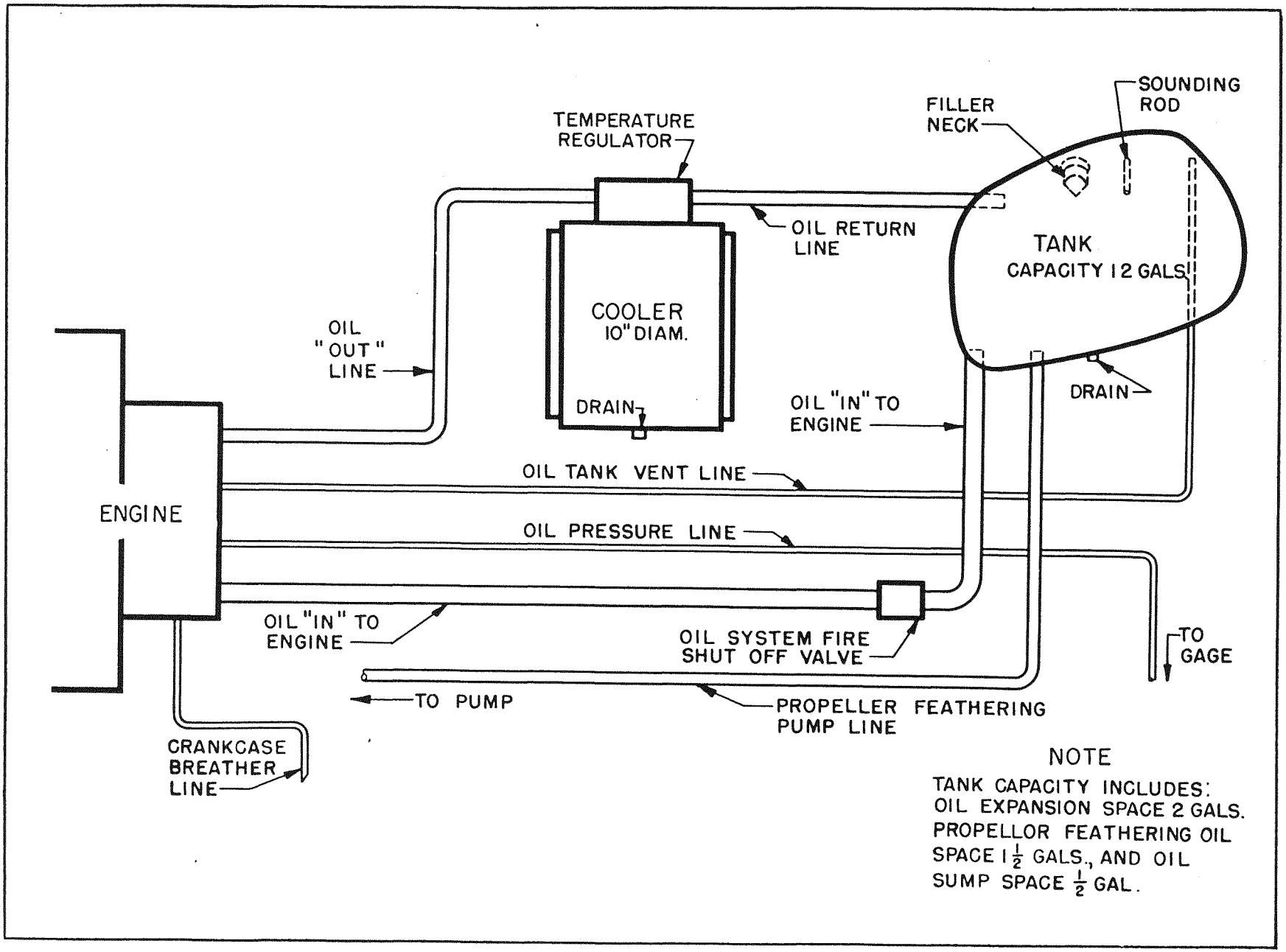
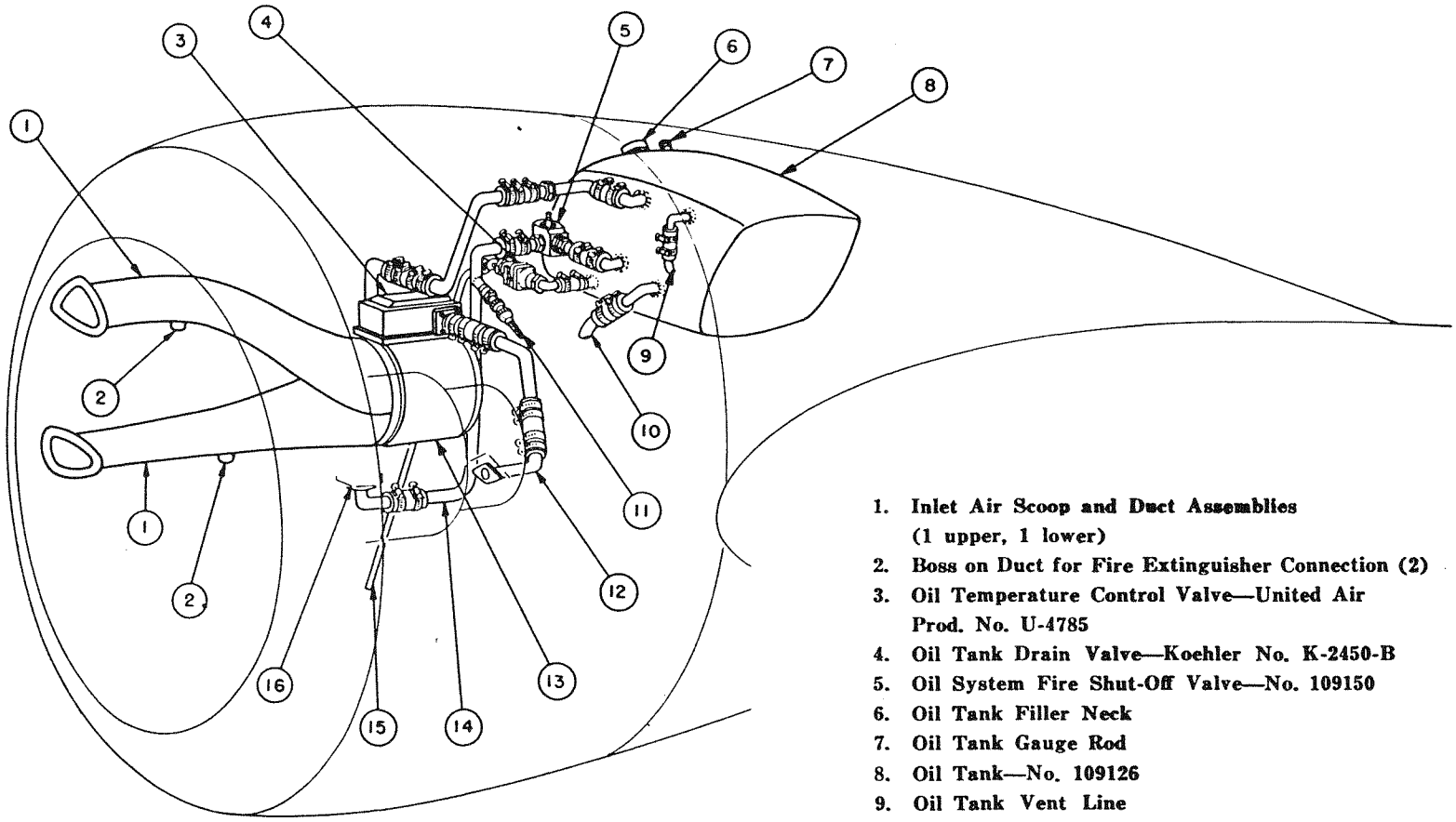


Figure 26—Oil System Schematic Diagram



1. Inlet Air Scoop and Duct Assemblies (1 upper, 1 lower)
2. Boss on Duct for Fire Extinguisher Connection (2)
3. Oil Temperature Control Valve—United Air Prod. No. U-4785
4. Oil Tank Drain Valve—Koehler No. K-2450-B
5. Oil System Fire Shut-Off Valve—No. 109150
6. Oil Tank Filler Neck
7. Oil Tank Gauge Rod
8. Oil Tank—No. 109126
9. Oil Tank Vent Line
10. Propeller Feathering Suction Line
11. Oil Temperature Element
12. Oil "Out" from Engine Line
13. Oil Cooler—Clifford No. B-36690
14. Oil "In" to Engine Line
15. Oil Tank Drain Line
16. Engine Crankcase

Figure 27—Oil System Diagram

1. Hydraulic Reservoir—No. 109570
2. Shut-Off Valve—No. 109563 (2)
3. Engine Driven Pump, Pesco No. S-1428 (2)
4. Check Valve—AN6207-6 (2)
5. Filter—AN6234-3 (1)
6. Main Relief Valve—Airex No. 1068 or Electrol No. 508
7. Unloader Valve—No. 109567
8. Accumulator—Vickers No. AA-14007-B
9. Check Valve—AN6207-6
10. Pressure Gage—AN5771-4A
11. Pressure Snubber—Ray No. 11D-2
12. Hand Pump Selector Valve—Kenyon No. 5-2000
13. Hand Pump—Electrol No. 190
14. Filter AN6234-1
15. Check Valve—AN6207-4 (6)
16. Wing Flap Selector Valve—No. 25250
17. Restrictors—No. 25247-1 (8)
18. Wing Flap Cylinder—No. 109551
19. Flap Blow-up Relief Valve—Electrol No. 285 (625 psi)
20. Landing Gear Selector Valve—No. 56219
21. Nose Wheel Cylinder—No. 109556
22. Main Wheel Down Lock Cylinder—No. 109552
23. Main Wheel Cylinder—No. 109555 (2)
24. Vent and Dump Valve—No. 109561
25. Cowl Flap Selector Valve—Airex No. D-357 (2)
26. Cowl Flap Cylinder—No. 109553 (2)
27. Windshield Wiper Speed Control—Kearfott No. 2331-2
28. Windshield Wiper Control Unit—Kearfott No. 2069-2
29. Windshield Unit—Kearfott No. 2068-6 (2)
30. Master Brake Cylinder—Warner No. 10576 (2)
31. Shuttle Valve—No. 109562 (2)
32. Restrictor Check Valve—No. 109610 (2)
33. Thermal Relief Valve—Elector No. 332 (2200 psi)

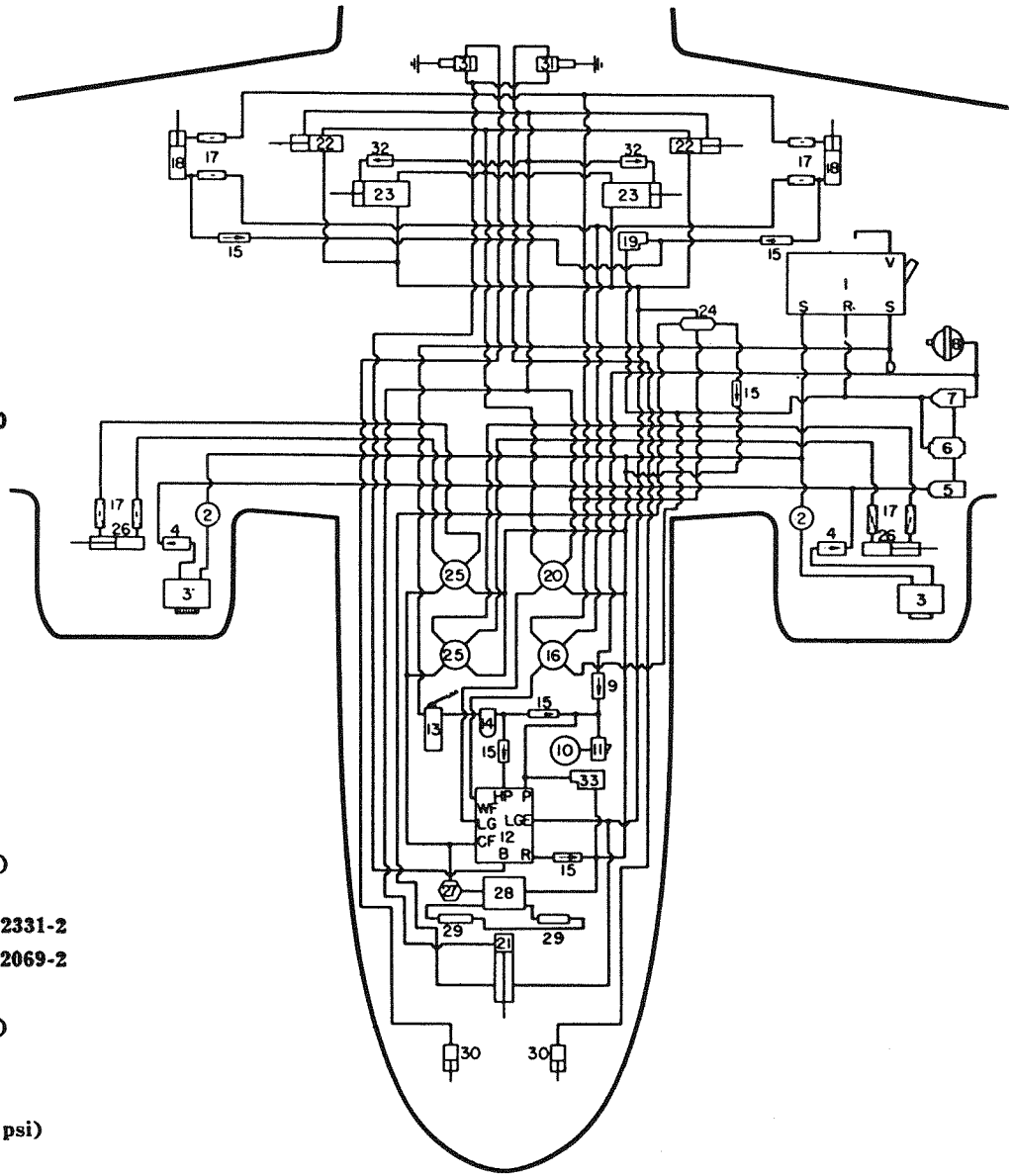


Figure 28—Hydraulic System Flow Diagram

the gear when the airplane is on the ground because of the safety latch; refer to Section III, 14, Landing Gear. When the lever is moved down, the main wheel actuating cylinder pistons extend to lower the gear and the lock cylinder pistons extend to lock the gear into the down position; the nose wheel actuating cylinder piston retracts to lower and lock the wheels down. When the lever is moved UP the pistons reverse and the units are raised.

b. WING FLAPS.—The selector valve is located on the left side of the pilot's overhead panel. For normal operation, the lever is moved full forward for flaps UP and full aft for flaps DOWN (45°). The intermediate settings (7½° and 30°) are for gusty conditions; a balancing mechanism regulates the selector valve action in the intermediate settings. A relief valve allows the flaps to blow up when air loads become heavy enough to cause structural damage.

c. COWL FLAPS.—The selector valves are located on the right hand side of the pilot's overhead panel; the controls are moved forward to OPEN and AFT to close the cowl flaps; the flaps remain in any intermediate position when the control is released.

d. WINDSHIELD WIPERS. — The wipers are turned on and their speed is controlled by a needle valve operated by a knob on the cowl to the right of the centerline.

e. PARKING AND EMERGENCY BRAKE.—The parking brake is controlled by the hand pump selector valve—the lever is set to BRAKE—PARKING AND EMERGENCY and the hand pump operated to set the brakes.

Note

600 psi. maximum required.

f. HAND PUMP.—The hand pump selector valve must be set to the desired system to use the hand pump. Push down the handle (against the spring load), set as desired, and operate hand pump, located behind the co-pilot's seat.

Note

If landing gear operation by hand pump is necessary, first set selector valve to LANDING GEAR; if ineffective, then set to LANDING GEAR EMERGENCY.

WARNING

When the hand pump is not in use, set hand pump selector valve to SYSTEM.

g. EMERGENCY SHUT-OFF VALVE.—This valve is installed in the pump suction line to cut off the flow of hydraulic oil to the pump in the event of fire. The control is a flex. shaft from a "T" handle in the cockpit (same control as engine "oil-in" shut off—see paragraph 2(*c*) above).

6. CONTROL SYSTEM.

The aileron and elevator controls are operated by a conventional type control wheel and column through a chain and cable system. An additional control wheel and arm for a co-pilot may be attached or removed as desired. The rudder is operated by conventional type pedals; the pilot's pedals also serve as brake pedals—the co-pilot's pedals operate the rudder cables simultaneously but are not connected to the brakes.

Aileron trim is controlled by an infinite position bungee installed on the top of the column; the elevator and rudder tabs are controlled by handwheels located on the overhead panel.

The flaps are operated hydraulically, and a positioning mechanism is installed for intermediate settings.

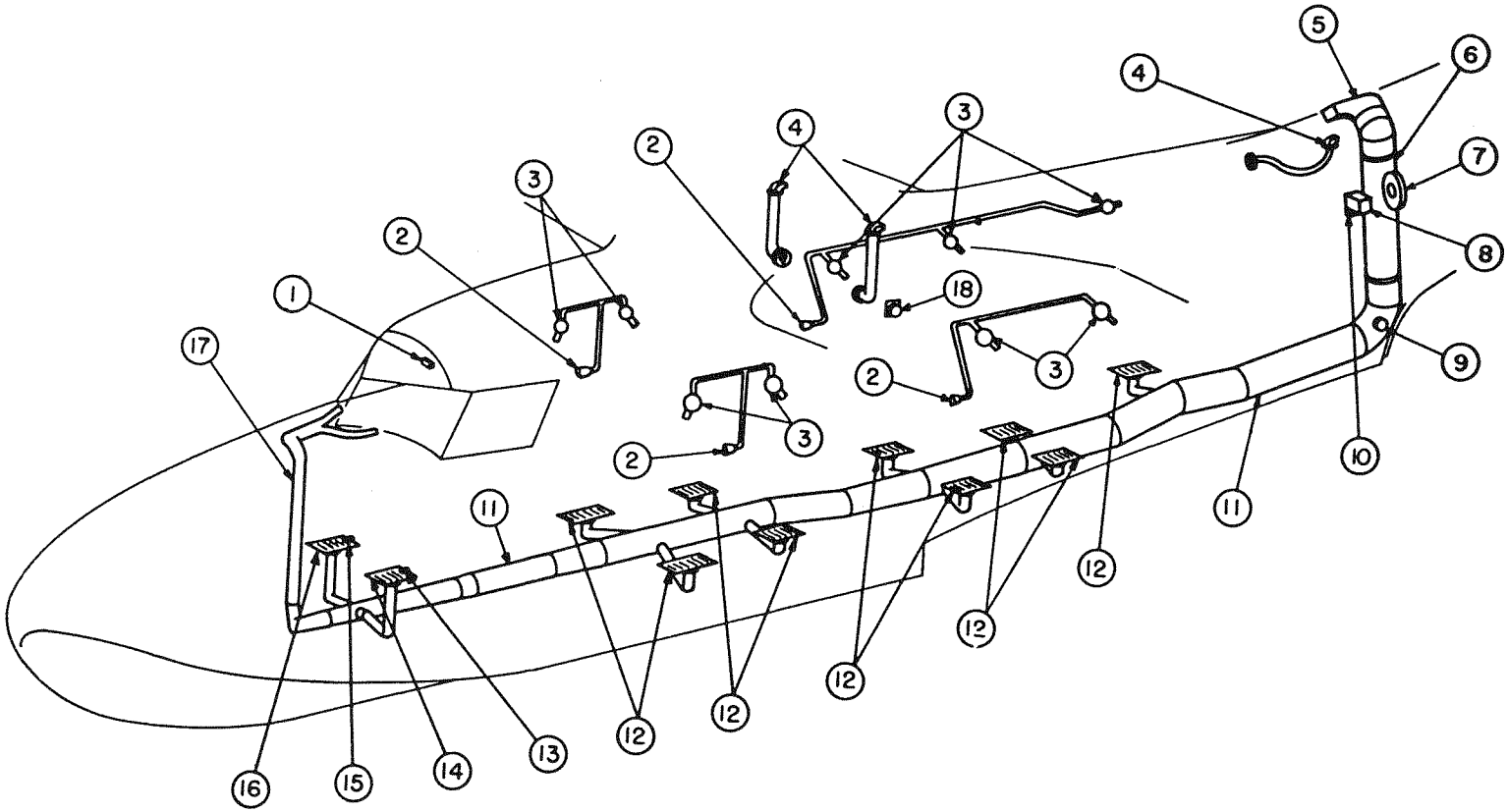
7. HEATING AND VENTILATING.

The surface combustion type heater, operated on engine fuel, is installed in the hull aft of the baggage compartment; the master control toggle switch is located on the pilot's overhead panel.

Heating air is taken in by a scoop on the top of the hull and carried forward from the heater by a main duct installed below the floor; branch ducts lead off from the main duct to distribute heated air to outlets in the floor and to the windshield. The outlets below the pilot's seats are equipped with sliding controls to regulate or shut off the heated air. Refer to Figure 29, page 49. A duct damper, with "T" handle in Toilet compartment floor, may be closed if heater becomes inoperative.

When the master switch is set to "HEAT", the heater fuel pump and ignition unit are turned on and, when the airplane is not moving a blower is turned on (when the switch is set to "CABIN FRESH AIR" only the blower operates)—when the airplane gains speed, pressure switches operate to cut off the blower. Thermal switches in the cabin cut the heater off and on, to regulate temperatures, and a thermal switch in the air duct cuts the heater off if overheating occurs. If fire occurs, another thermal switch opens the CO_2 fire extinguisher valves and lights a warning light on the pilot's overhead panel. On airplanes J-32 and subsequent the automatic operation of the fire extinguisher has been eliminated and it must be manually controlled.

A separate fresh air ventilating system is installed; air is taken in through openings in the wing leading edges and carried by tubing to controllable valves at the seats and in the cockpit.

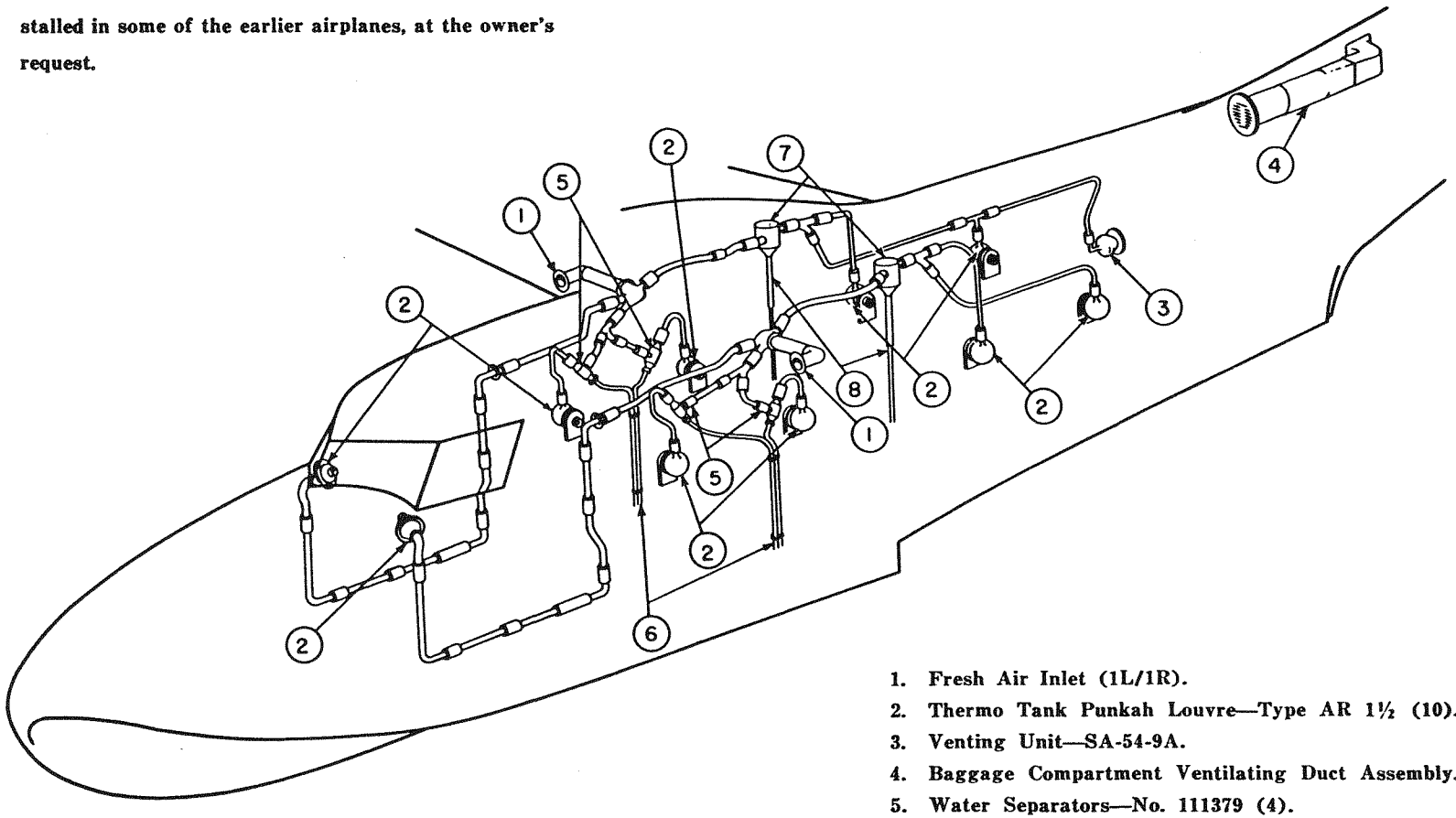


1. Heater Switch
2. Cabin Ventilating Fresh Air Scoop
3. Fresh Air Assembly (9)
4. Ventilating Air Exhaust (3)
5. Heater Air Inlet Scoop and Duct Assembly
6. Heater Unit
7. Combustion Air Blower
8. Heater Ignition Box
9. 350°F Over-heat Switch
10. 400°F Fire Extinguisher Thermo-Snap Switch
11. Heater Duct
12. Cabin Heated Air Outlets
13. Regulator Knob on Pilot's Heated Air Outlet
14. Pilot's Heated Air Outlet
15. Regulator Knob on Co-Pilot's Heated Air Outlet
16. Co-Pilot's Heated Air Outlet
17. Duct to Defroster Units
18. Cabin Thermostat

Figure 29—Heating and Ventilating Duct System

NOTE

This system is installed in airplanes, serial numbers J28, J29, J30, J32 and subsequent. It has been installed in some of the earlier airplanes, at the owner's request.



1. Fresh Air Inlet (1L/1R).
2. Thermo Tank Punkah Louvre—Type AR 1½ (10).
3. Venting Unit—SA-54-9A.
4. Baggage Compartment Ventilating Duct Assembly.
5. Water Separators—No. 111379 (4).
6. Drain Lines—Rubber Tubing.
7. Water Separators—No. 110611 (1L/1R).
8. Drain Line—Aluminum Alloy Tubing.

Figure 30—Modified Ventilating System

8. RADIO EQUIPMENT.

a. GENERAL.—The information contained herein covers the general description and operation of the standard radio system only.

b. EQUIPMENT.—The radio system consists of the following equipment:

(1) ADF (Automatic Direction Finder).
(2) Range Receiver.
(3) Two-way 10 Channel Transmitter-Receiver.
(4) Marker Beacon Receiver.
(5) Controls for the above equipment.
(6) Antennas for the above equipment.

c. THE RADIO EQUIPMENT IS INSTALLED AS FOLLOWS:

(1) ADF RECEIVER.

(a) The MN-31 Automatic Direction Finder (Radio Compass) consists of a Bendix MN-26K receiver (200 to 1750 KC), an MN-36C automatic loop, an MN-31C loop controller, and an MN-37B bearing indicator.

(b) The receiver and the loop controller are located in the bow, the receiver just forward of the pilot in the baggage compartment under a protective enclosure, and the loop director further forward on the centerline. The automatic loop is on the top of the airplane approximately in line with the leading edge of the wing. The bearing indicator and associated dimmer rheostat are on the sloping radio panel, just to the left of the master radio panel.

(2) RANGE RECEIVER.

(a) The range receiver consists of a Bendix MN-26K receiver (200 to 1750 KC) and an MN-54 fixed anti-static loop.

(b) The receiver is located in the bow, adjacent to the ADF loop controller, on the right side of the airplane. The anti-static loop is directly above the cockpit.

(3) TRANSMITTER-RECEIVER.

(a) The Two-way transmitter-receiver is a Bendix RTA-1B. This set has provisions for 10 pre-set channels in the frequency range of 2.5 to 13 MC.

Note

One channel is operative (transmission and reception) on 3105 KC in all airplanes. The other nine channels are not equipped with coils and crystals unless specified by the customer.

(b) The transmitter-receiver is in the aft baggage compartment, under the protective enclosure. The front and top panels of this enclosure are hinged to permit easy access to the equipment.

(4) MARKER RECEIVER.

(a) The marker receiver consists of a Bendix MN-53A and indicator lights. This set operates at 75 MC.

(b) This receiver is in the aft baggage compartment, to the right of the transmitter-receiver. The indicators are on the sloping radio panel, directly in front of the pilot.

d. THE CONTROLS FOR THE ABOVE RADIO EQUIPMENT ARE COMBINED INTO THREE MAJOR PANELS WHICH ARE AS FOLLOWS:

(1) The Master Radio Control Panel, Bendix MS-120A, is on the centerline of the airplane, just below the main instrument panel.

(2) The Pilot's Audio Control Panel, Bendix MS-121A, is on the left side of the cowl, just below the windshield.

(3) The Co-Pilot's Audio Control Panel, Bendix MS-131A, is on the right side of the cowl, just below the windshield.

(4) In addition to the three major controls, the following are installed:

(a) The Radio Master Switch, a 50 ampere circuit breaker type, is on the left side of the overhead panel to the left of the battery switch.

(b) Circuit breakers for the Compass and Range receivers and the dual audio level potentiometer for RTA-1B transmitter-receiver are on the bow terminal panel, just forward of and below the main instrument panel.

(c) Circuit breakers for the Two-Way RTA-1B transmitter-receiver and Marker receiver are located in the aft baggage compartment, to the extreme left looking aft, on the forward vertical panel of the equipment enclosure.

(d) Head phone and Microphone Jack Boxes, Bendix type MS-18B are installed on the cockpit aft bulkhead, outboard of the pilot and co-pilot. The airplane is also equipped with Bendix MR-8G head phones and Bendix MT-42B microphones.

(e) WIRE ANTENNAS.—Individual antennas are provided for each equipment. A single mast directly above the cockpit on the airplane centerline supports the ADF, Range and Two-Way Antennas.

The ADF sense antenna extends from the forward insulator in front of the windshield aft to the vertical stabilizer, passing first through the mast then through the stand-off insulator on the right wing which pulls the wire to the right of the centerline.

The Range Receiver antenna extends from the aft insulator in front of the windshield aft to the vertical stabilizer passing through the mast and the stand-off insulator on the left wing.

The Two-Way antenna extends from the mast to the vertical stabilizer and down to the lead-in insulator in the upper left side of the baggage compartment.

The Marker Receiver antenna extends from the rear step fairing aft to a short mast. A lead-in insulator is provided on the bottom centerline, slightly off the center of the antenna.

e. FUNCTION.

(1) RADIO COMPASS.

(a) The radio compass (ADF) is an airborne navigational instrument and utilizes signals transmitted from a range, commercial or standard broadcast station to obtain directional or locational information.

(b) Under favorable conditions, stations up to 250 miles distant may provide the necessary signal to operate this equipment, depending upon the power of the transmitting station.

(c) When the azimuth scale is set at 0°, the pointer on the MN-37B bearing indicator continuously indicates the bearing of the station being received with relation to the airplane heading. The azimuth scale on the indicator may be rotated with the "Variation" knob on the face of the instrument.

The intensity of the indicator dial light is controlled by the dimming resistor which is located to the left of the indicator.

The loop dehydrator, through which all air entering the loop antenna housing must pass, is located in the left wheel well enclosure under the top horizontal bulkhead. The silica gel crystals in the dehydrator should be replaced as soon as more than one-half of them become saturated. These crystals are blue in color when dry and turn pink when saturated.

(d) For complete description of the facilities provided by this equipment, see Bendix Instruction Book for Model MN-31 series.

(2) The radio range receiver is identical to the radio compass receiver and is used for navigation on airways radio ranges and as a general communication receiver. This receiver is equipped with the fixed anti-static loop for use during the occurrence of precipitation static. For a complete description of the facilities provided by this equipment, see Bendix Instruction Book for Model MN-31 series.

(3) The RTA-1B Transmitter-Receiver provides long range, two-way radio telephone communication with ground stations or other airplanes. This unit is used for all transmission from the airplane and for reception on the same channel, if desired. For additional information on this equipment, see Bendix Instruction Book for Model RTA-1B.

(4) The Marker Beacon Receiver detects modulated 75 MC marker signals and provides aural and visual indications by means of headset and lamps to identify passage over an airways marker. The type of marker is distinguished by the modulation tone and by the color of the indicator lamp.

Indicator Lamp	*Headset Tone*	*Type of Marker*
White (Steady)	3000 Cycles—Steady Tone	Airways (Z Marker)
White (On-Off in Dashes)	3000 Cycles—Dashed Tone	Airways (Fan Marker)
Amber (On-Off in Dots)	1300 Cycles—Dotted Tone	Inner Marker (Instrument Landing System)
Purple (On-Off in Dashes)	400 Cycles—Dashed Tone	Outer Marker (Instrument Landing System)

For additional information on this equipment, see Bendix Instruction Book for Type MN-53A and MN-55A Marker Receivers.

(5) THE MS-120A MASTER RADIO CONTROL PANEL IS MADE UP OF THE FOLLOWING:

(a) ADF rotary function selector switch, band change switch, loop rotator switch and tuning crank. These controls permit use of this equipment as an automatic or manual direction finder or as a standard communications receiver on the frequencies within its range. For slow speed rotation of loop, turn the rotator knob left or right as desired; for high speed rotation, depress knob and turn as desired.

(b) Range Receiver rotary function selector switch, band change switch, and tuning crank. These controls permit use of this equipment on frequencies within its range either on antenna or anti-static loop.

(c) Channel selector switch and indicator lamp for the RTA-1B transmitter-receiver. The light indicates when the transmitter is ready for use.

(d) Trans-Interphone selector switch which is used to select either transmission or interphone on the RTA-1B transmitter-receiver.

Note

The normal position of the Trans-Interphone selector switch is in the Interphone position.

(e) Tuning meter for use with the ADF and Range receiver. The position of the ADF-RANGE selector switch determines which receiver output is indicated on the meter. Maximum deflection indicates that the receiver is tuned exactly to the frequency of the transmitting station.

For aural radio range reception the volume should be reduced BELOW the point where the tuning meter becomes operative. When using the ADF Receiver in the compass position, changing the volume control will not effect the tuning meter because of the AVC action in the Receiver. The ADF Receiver, therefore, should NOT be used for aural Radio Range Reception when operating in the COMPASS position.

(f) Dimming rheostat for light control on tuning meter, ADF and Range Receiver tuning dials.

(6) The MS-121A Pilot's Audio Control Panel is composed of the following:

(a) The ADF, Range, Marker, and Two-Way Audio ON-OFF switches to the extreme left of the panel are used to control all audio to the pilot's jack box. The pilot's and co-pilot's audio circuits are independent of each other.

(b) The ADF-Range Filter selector switch permits independent or combined reception of range or voice signals. The audio ON-OFF switches must previously be set up as desired.

(c) The ADF and Range volume controls are to the extreme right of the pilot's audio panel.

(7) The MS-131A Co-Pilot's Audio Control Panel is made up of the following:

(a) The ADF, Range, Marker and Two-Way Audio ON-OFF switches to the extreme right of the panel are used to control all audio to the co-pilot's jack box.

(b) The ADF-Range Filter selector switch has the same function as the similar switch on the pilot's audio panel.

(c) The two-way volume and the Marker sensitivity controls are to the extreme left of the panel.

f. OPERATIONAL CHECK. — The operational check for all equipment is fully described in the applicable Bendix handbook.

g. PRE-FLIGHT CHECK.

(1) Insert the microphone and headset plugs into the jacks and make certain that they are completely engaged.

(2) Set the battery switch and the radio master switch to ON.

Note

If an extensive pre-fliht check is to be made, when the engines are not running, use an External Power Supply to prevent running down the airplane battery.

(3) ADF.

(a) Rotate the red function switch to COMPASS, turn the ADF Audio switch ON (up), rotate the range filter switch to BOTH, rotate the red volume control clockwise until a strong hissing noise is heard, flip the meter input selector switch to ADF, and rotate the band change switch and the tuning crank to the desired frequency using the meter to determine the exact setting of the dial. By aural check make certain that the correct station is being received. The compass indicator will indicate the bearing of the transmitting station relative to the heading of the airplane. Reduce the volume control to a comfortable level. (The ADF receiver has very high gain and the volume control will normally be in the reduced position.)

(b) Rotate the function selector through all other positions and check for proper operation. Check the loop rotator while the function switch is on LOOP.

(c) Turn the ADF audio switch and function switch OFF at the completion of this check.

(4) RANGE.

(a) Rotate the green function switch to ANT, turn the range audio switch ON (up), rotate the green volume control clockwise until a strong hissing noise is heard, flip the meter input selector switch to RANGE, and rotate the band change and the tuning crank to the desired frequency using the meter to determine the exact setting of the dial. Rotate the function switch through all positions, checking for proper operation.

Note

The fixed loop antenna is suitable for reception of stations roughly in line with the heading of the airplane. As the range loop cannot be rotated, stations 90° from the airplane heading will be weak or inaudible.

(b) Turn the RANGE audio switch and function switch OFF at the completion of this check.

(5) TWO-WAY.

(a) Rotate the channel selector switch from OFF to the desired channel, place the trans-interphone switch in the trans position, wait 45 seconds for tubes to heat then press microphone button and talk. The transmitter side tone is heard with the TWO-WAY audio switch in either the ON or the OFF position.

(b) If reception is desired on the transmitting channel, turn the TWO-WAY audio switch to ON, advance the volume control clockwise until the desired audio level is reached.

(c) Turn the TWO-WAY audio switch and the channel selector switch OFF at the completion of this check.

(6) MARKER RECEIVER.—The Marker Beacon receiver cannot be given a pre-flight check. This equipment is always operating while the radio master switch is set to ON. When in flight, the sensitivity control is normally at HIGH until a marker signal is received, at which time it should be turned back to LOW in order to obtain more definite indications. If aural reception is desired, turn the Marker audio switch to ON.

(7) INTERPHONE.

(a) Rotate the TWO-WAY rotary selector switch from OFF to any channel.

(b) Place the TRANS-INTERPHONE selector switch in the INTER-PHONE position.

(c) Press the microphone button and talk.

Note

1.

Traffic will not be heard on the TWO-WAY receiver while the microphone button is depressed, regardless of the position of the TWO-WAY audio switch. The interphone will operate with the TWO-WAY audio switch in either the ON or OFF position.

2.

The TWO-WAY volume control on the co-pilot audio panel does not affect the side tone or interphone levels.

b. AUDIO AND SENSITIVITY ADJUSTMENTS.

Note

These adjustments are made upon installation and normally require no attention unless the equipment is changed.

(1) TWO-WAY RADIO.

(a) The dual audio potentiometer is used to set the pilot and co-pilot audio level and is on the bow radio connector panel which is just forward and slightly below the master radio panel. To adjust the audio level, tune in a station which will provide a usably weak signal, set the TWO-WAY volume control on the co-pilot's audio panel to the maximum (full clockwise) position, then by means of the dual potentiometer, reduce the audio output to a suitable level, thereby establishing the maximum volume of incoming signals from the RTA-1B transmitter-receiver.

(b) After adjusting the dual potentiometer, the sidetone and interphone audio levels should be adjusted to obtain the desired headphone volume with the sidetone control (R108) on the transmitter-receiver. This adjustment is on the left side of the transmitter-receiver, as viewed from the front.

Note

When adjusting the sidetone level, do not inadvertently change the modulation level adjustment which is on the right side of the transmitter, viewed from the front.

(2) ADF RECEIVER.

(a) The sensitivity control is located on the receptacle bracket on the forward (back) side of the Master Radio Panel.

(b) On the Master Radio Panel, rotate the ADF function switch to COMPASS and tune in a usably weak signal. The Range Filter switch on the audio panel should be in the BOTH position and the ADF audio switch in the ON position.

(c) Advance the sensitivity control (R108) as far as possible without introducing too much noise. This will normally be almost the maximum (full clockwise) setting. Turning back the potentiometer will reduce both the noise level and the sensitivity.

(d) This adjustment affects the ADF receiver output only when the rotary function switch is in the COMPASS position, and should be made in conjunction with the loop control sensitivity (below) for optimum ADF performance.

(3) ADF LOOP CONTROLLER.

(a) A small access hole is provided through the bulkhead just aft of the MN-31C controller unit.

(b) Set the sensitivity control to prevent excessive hunting by the automatic loop as described in the instruction book.

(4) RANGE RECEIVER KEYING.

(a) In order to prevent reception on the Range Receiver while transmitting, an audio relay (RE-2) in the receiver is energized whenever the pilot or co-pilot transmits. With this arrangement, transmitter sidetone and interphone are heard without interference from the range receiver.

(b) To permit the above relay action, jumpers have been removed from resistors R36B and R37-2 in all MN-26K receivers installed.

9. EMERGENCY EXIT.

The emergency exit is located on the right side of the hull, at the aft end of the main cabin. Refer to Figure 31.

10. HULL COMPARTMENTATION.

Refer to Figure 31.

11. EMERGENCY EQUIPMENT.

Refer to Figure 31.

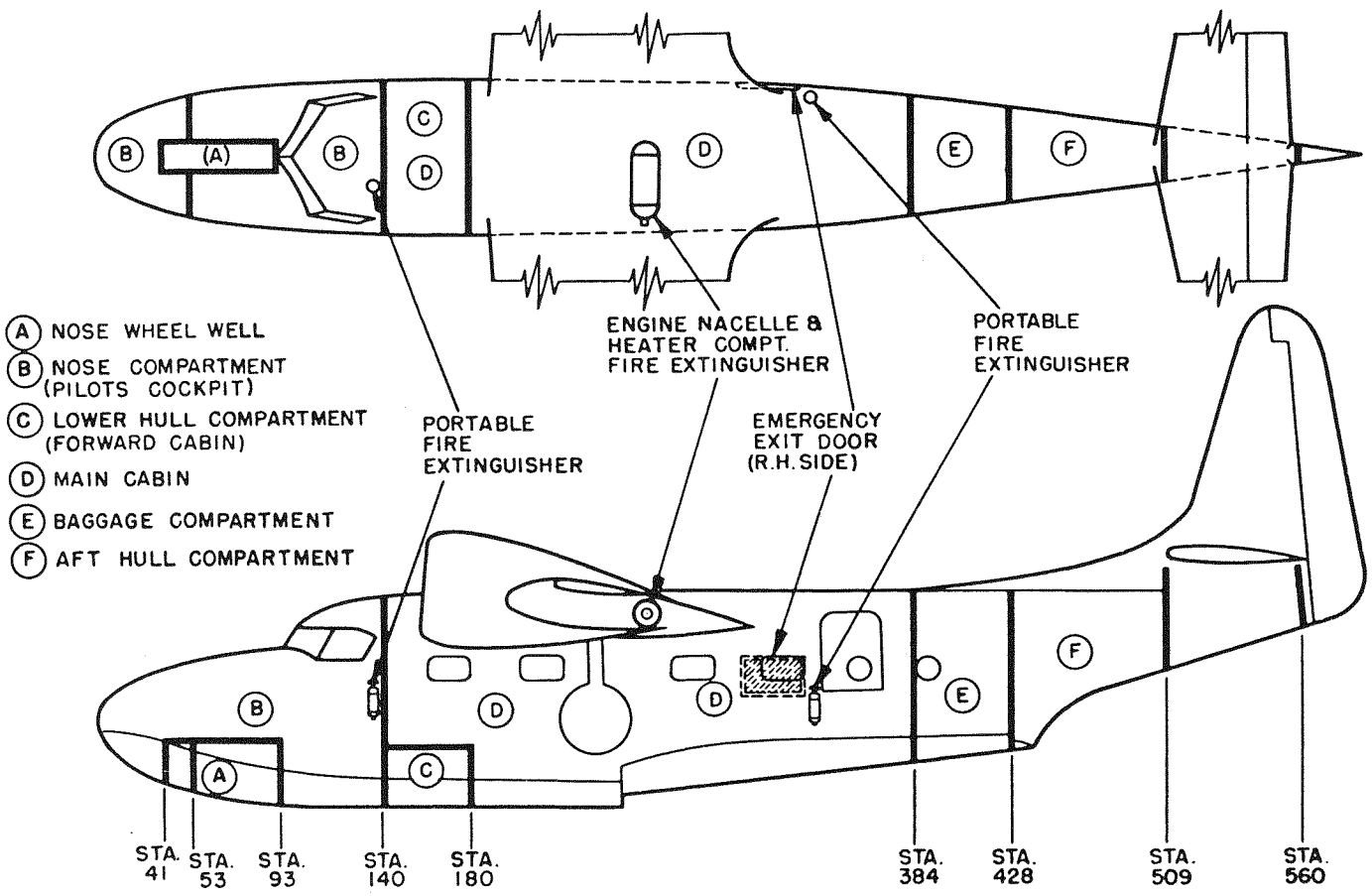
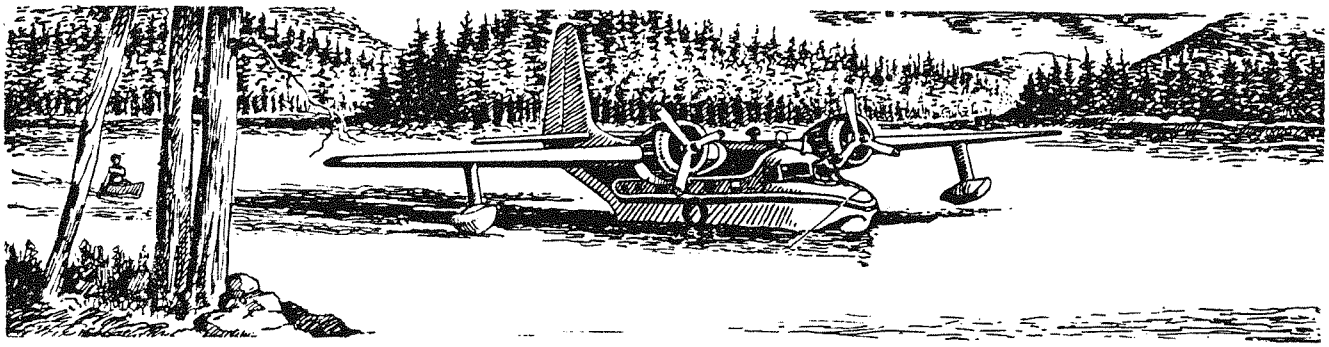


Figure 31—Emergency Exits and Equipment and Hull Compartmentation



SECTION V

Loading Information

The Civil Aeronautics Administration requires that a loading chart or device be prepared and made a part of the Weight and Balance Report for each individual airplane. This is done by Grumman for every new airplane and also for any airplanes altered at the factory. When the airplane is altered in the field the Loading Chart must be altered accordingly. A method for keeping a running log of the airplane "Basic Weight and Index" is provided on page 65 where all changes may be entered.

In an attempt to provide a more usable Loading Chart, a tabular type chart has been prepared rather than a graph type. Although this method is not quite as accurate as the coordinate graph, it is satisfactory. With this type chart the operator is able to determine take-off and landing weight, center of gravity location to the nearest percent of the M.A.C., and ascertain if these C.G. locations fall within the airplane operational limits. These limits are more conservative than the absolute C.G. limits (15% to 26½%) in that they have been brought in to take into account C.G. travel during flight due to fuel and oil consumption and landing gear retraction.

For simplicity, and in order to agree with all the drawings on the airplane, Hull Station "O", which is 250 inches forward of the Main Step and 10 inches forward of the nose of the airplane, has been selected as the zero datum point for preparing the loading chart.

To simplify the method of depicting moments of the airplane, the term "Index Unit" is used. The "Index Unit" for an item is computed by substituting in the following expression:

$$\text{Index Unit} = \frac{A \times W}{10000}$$

where: A = arm to C.G. of item in inches aft of datum (Hull Sta. 0).

W = weight of item in pounds.

If the engine, oil coolers, oil tank are changed, and the airplane is reweighed before the engine is run, the following weights of residual fuel and oil must be added to obtain the weight empty on page 63. (Add only the ones which apply.)

TRAPPED FUEL & OIL

Fuel & Oil Trapped In:		*Weight*	*Arm*	*Moment*	*Index Unit*
Oil Cooler (10" Dia.)	Trapped Oil	20.0	193	3860	.4
Oil Tanks		4.0	212	848	.1
Engines		46.3	178	8241	.8
Propeller Syst. Lines		6.1	190.6	1163	.1
Oil Lines		7.0	197	1379	.1
Fuel Tanks—3 Pt. Position		26.0	220	5720	.6
Fuel Lines		3.0	215	645	.1
Carburetor		1.0	190	190	.0
Trapped Fuel & Oil—3 Point Position		113.4	194.4	22046	2.2
Additional Fuel Trapped in Tanks in flight (Glide 125 mph, flaps and L.G. down)*		54.0	220	11880	1.2
Total Non-Usable Fuel & Oil		167.4	206.4	33926	3.4

*This weight of trapped fuel and its resultant index unit applies to airplanes J12 to J25 inclusive and airplane J27 only.

For airplanes J1 to J7 inclusive and J9 to J11 inclusive the weight is 30 pounds and its index unit is 0.7.

For airplanes J8, J26 and J28 and subsequent the weight is 18 pounds and its index unit 0.4.

Note

The operator of a MALLARD must correct the weight empty and index unit for that airplane, when necessary, in accordance with the above data.

The airplane selected as an example includes two three-place divans in the forward cabin and four passenger chairs in the rear cabin arranged as indicated on the plan-view outline of the standard airplane on page 64 of the Loading Chart. The passenger locations are numbered according to type of seat and rows reading from front to rear, e.g. FC1, Forward Cabin, forward seat. Page 64 shows standard arrangement but the positions not applicable to this airplane have been blocked out. The Index Unit is calculated by substituting in the Index Unit Formula, using 170# for each passenger and the arm for each individual chair or place as in the case of the divan.

The next step is to determine the index unit for the Basic airplane. Referring to the Basic Loading Calculation on Page 64 the Basic Weight is carried forward to the Basic Weight Log on Page 65. The "Moment" is then divided by 10,000 and entered under "Index Unit", because

$$\text{"Index Unit"} = \frac{W \times A}{10000} \quad \text{and} \quad W \times A = \text{Moment}$$

To clarify the use of the loading chart, the following sample loading will be discussed in detail.

SAMPLE LOADING

Item	*Weight*	*Index Unit*
Basic Weight (Sample Only)	9600	209.4
Plus Items of Useful Load:		
Fuel (180 Gals.)	1080	23.7
Oil (20 Gals.)	150	3.2
Passengers:		
Position FC-1 (1)	170	2.8
FC-3 (1)	170	3.6
RC-1 (2)	340	9.4
RC-2 (2)	340	10.8
Baggage:		
Compt. I	20	.7
Compt. J	220	8.8
Take-Off Gross Weight	12090	272.4

The basic weight and index unit is obtained from the Log on Page 65. For loading 180 gals. of fuel in the wing tanks, refer to fuel chart on Page 59, and follow down the gallon column until 180 is reached, then read across to the right for the weight in the next column and the index unit in the third column. The weight and index unit for the oil and cargo are determined in a similar manner by referring to the appropriate chart on the same page.

The take-off gross weight and index unit is totaled, (The Gross Weight must not exceed the maximum allowable), and by referring to the Center of Gravity Limit Chart (Page 60), it is possible to determine the

11249

ITEM	WEIGHT	H. ARM	INDEX
AIRCRAFT EMPTY (Includes Unusable Fuel and Oil)	10,849	-13.61	-147,627
PILOT	400	125	50,000
BASIC WEIGHT	11249		197,627
BASIC INDEX	11249		

12750 197623

BASIC WEIGHT AND BASIC INDEX

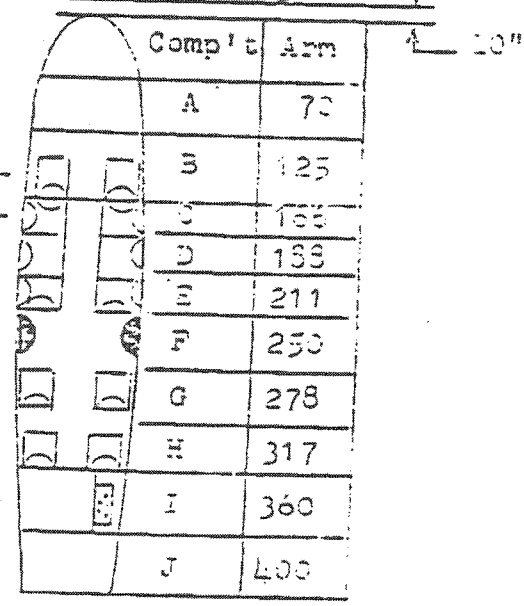
TABLE 5-1

LOADING CHART DATUM - HULL STATION "0"

PASSENGERS AT 170# EACH

INDEX UNITS

1 PASS.	2 PASS.	ROW
2.1		C - 1
2.8	5.6	FC - 1
3.2	6.4	FC - 2
3.6	7.2	FC - 3
4.7	9.4	RC - 1
5.4	10.8	RC - 2
6.1		T - 1



PASSENGER AND CARGO LOADING DIAGRAM
10 SEAT CONFIGURATION
TABLE 5-2

1 JULY 1981

23-24 %

airplane C.G. to the nearest percent of the M.A.C. The index unit will appear on line with the gross weight used only if C.G. is within allowable limits. Since the take-off gross weight for the sample above is 12090 lbs. it is well within the gross weight limitations (Page 60). The index unit for this weight is 272.4. Now run your pencil down the "Gross Weight" side of the chart to 12100# which is closest to 12090#. Then follow across to the right until you reach 272.3 which is the nearest index unit, and read vertically upward to find the C.G. In this case the take-off C.G. is at approximately 25% M.A.C. Since the loading condition falls within the loading limits, the loading is satisfactory. If the C.G. should fall outside the maximum indicated loading limits, the loading must be revised by shifting either passengers or cargo, or both, so that these maximum limits are not exceeded.

It should be noted that cargo or baggage can be substituted for a passenger at the passenger position at any time.

BAGGAGE OR CARGO*
COMP'T. LETTER** & INDEX UNITS

Lbs.	A	B	C	D	E	F	G	H	I	J***
30	.2	.4	.5	.6	.6	.8	.8	1.0	1.1	1.2
60	.4	.8	1.0	1.1	1.3	1.5	1.7	1.9	2.2	2.4
90	.6	1.1	1.5	1.7	1.9	2.2	2.5	2.9	3.2	3.6
120	.8	1.5	2.0	2.3	2.5	3.0	3.3	3.8	4.3	4.8
150	1.0	1.9	2.5	2.8	3.2	3.8	4.2	4.8	5.4	6.0
180	1.3	2.2	3.0	3.4	3.8	4.5	5.0	5.7	6.5	7.2
210	1.5	2.6	3.5	4.0	4.4	5.2	5.8	6.7	7.6	8.4
240	1.7	3.0	4.0	4.5	5.1	6.0	6.7	7.6	8.6	9.6
270	1.9	3.4	4.5	5.1	5.7	6.8	7.5	8.6	9.7	10.8
300	2.1	3.8	5.0	5.6	6.3	7.5	8.3	9.5	10.8	12.0
330	2.3	4.1	5.5	6.2	7.0	8.2	9.2	10.5	11.9	13.2
360	2.5	4.5	6.0	6.8	7.6	9.0	10.0	11.4	13.0	14.4
390	2.7	4.9	6.5	7.3	8.2	9.8	10.8	12.4	14.0	15.6
420	2.9	5.2	7.0	7.9	8.9	10.5	11.7	13.3	15.1	16.8
450	3.2	5.6	7.5	8.5	9.5	11.2	12.5	14.3	16.2	18.0
480	No baggage permitted in airplanes delivered subsequent to Sept. 30, 1947.	6.0	8.0	9.0	10.1	12.0		15.2	17.3	19.2
510		6.4	8.5	9.6	10.8	12.8		16.2	18.4	20.4
540		6.8	9.0			13.5		17.1	19.4	21.6
570		7.1	9.5			14.2		18.1	20.5	
600		7.5	10.0			15.0		19.0	21.6	
630			10.5			15.7		20.0	22.7	
660			11.0			16.5		20.9	23.8	
690			11.5			17.2		21.9	24.8	
720			12.0					22.8	25.9	
750								23.8		
780								24.7		
810								25.7		
840								26.6		
870								27.6		
900								28.5		
930								29.5		
960								30.4		
990								31.4		
1020								32.3		
1050								33.3		
1080								34.2		
1110								35.2		

FUEL (6 LB./GAL.)
MAIN TANKS
(ARM 219.7)

Gal.	*Lbs.*	*Index Units*
20	120	2.6
40	240	5.3
60	360	7.9
80	480	10.5
100	600	13.2
120	720	15.8
140	840	18.4
160	960	21.1
180	1080	23.7
200	1200	26.4
220	1320	29.0
240	1440	31.6
260	1560	34.3
280	1680	36.9
300	1800	39.5
320	1920	42.2
340	2040	44.8
360	2160	47.4
380	2280	50.1

TIP FLOAT TANKS
(ARM 241.)

25	150	3.6
50	300	7.2
75	450	10.8
100	600	14.5

OIL (7.5 LB./GAL.)
(ARM 212.0)

Gal.	*Lbs.*	*Index Units*
5	37.5	.8
10	75	1.6
15	112.5	2.4
20	150	3.2

*Floor Loading must not exceed 50 lbs. per sq. foot except in rear baggage compartment which is limited to 75 lbs. per sq. foot.

**See Diagram on page 64.

***Include Wash Water.

Notes:

Maximum Fuel-Oil Ratio 25 to 1.

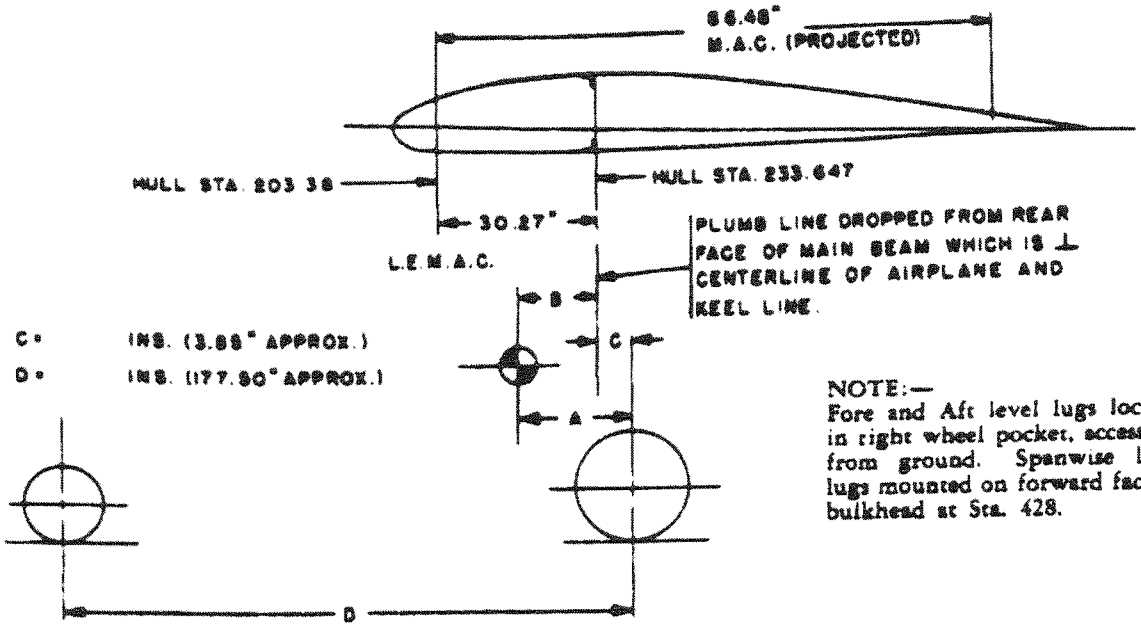
Weight of special equipment must be subtracted from the baggage capacity of the compartment in which it is installed.

MALLARD LOADING CHART
CENTER OF GRAVITY LIMIT CHART

Center of Gravity in Percent of M.A.C.

Gross Wt.	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%	26%	26.5%
10000	216.4	217.2	218.1	219.0	219.8	220.7	221.5	222.4	223.3	224.1	225.0	225.9	226.4
10050	217.4	218.3	219.2	220.0	220.9	221.8	222.6	223.5	224.4	225.3	226.1	227.0	227.5
10100	218.5	219.4	220.3	221.1	222.0	222.9	223.8	224.6	225.5	226.4	227.3	228.1	228.6
10150	219.6	220.5	221.4	222.2	223.1	224.0	224.9	225.7	226.6	227.5	228.4	229.2	229.7
10200	220.7	221.6	222.4	223.3	224.2	225.1	226.0	226.9	227.7	228.6	229.5	230.4	230.9
10250	221.8	222.7	223.5	224.4	225.3	226.2	227.1	228.0	228.9	229.7	230.6	231.5	232.0
10300	222.8	223.7	224.6	225.5	226.4	227.3	228.2	229.1	230.0	230.9	231.8	232.6	233.1
10350	223.9	224.8	225.7	226.6	227.5	228.4	229.3	230.2	231.1	232.0	232.9	233.8	234.3
10400	225.0	225.9	226.8	227.7	228.6	229.5	230.4	231.3	232.2	233.1	234.0	234.9	235.4
10450	226.1	227.0	227.9	228.8	229.7	230.6	231.5	232.4	233.3	234.2	235.1	236.0	236.5
10500	227.2	228.1	229.0	229.9	230.8	231.7	232.6	233.5	234.4	235.3	236.3	237.2	237.7
10550	228.2	229.2	230.1	231.0	231.9	232.8	233.7	234.6	235.5	236.5	237.4	238.3	238.8
10600	229.3	230.3	231.2	232.1	233.0	233.9	234.8	235.8	236.7	237.6	238.5	239.4	239.9
10650	230.4	231.3	232.3	233.2	234.1	235.0	235.9	236.9	237.8	238.7	239.6	240.5	241.0
10700	231.5	232.4	233.3	234.3	235.2	236.1	237.0	238.0	238.9	239.8	240.8	241.7	242.2
10750	232.6	233.5	234.4	235.4	236.3	237.2	238.2	239.1	240.0	241.0	241.9	242.8	
10800	233.6	234.6	235.5	236.5	237.4	238.3	239.3	240.2	241.1	242.1	243.0	243.9	
10850	234.7	235.7	236.6	237.6	238.5	239.4	240.4	241.3	242.2	243.2	244.1	245.1	
10900	235.8	236.8	237.7	238.7	239.6	240.5	241.5	242.4	243.4	244.3	245.3	246.2	
10950	236.9	237.9	238.8	239.8	240.7	241.6	242.6	243.5	244.5	245.4	246.4	247.3	
11000	238.0	238.9	239.9	240.8	241.8	242.7	243.7	244.7	245.6	246.6	247.5	248.4	
11050	239.1	240.0	241.0	241.9	242.9	243.9	244.8	245.8	246.7	247.7	248.6	249.6	
11100	240.1	241.1	242.1	243.0	244.0	245.0	245.9	246.9	247.8	248.8	249.8	250.7	
11150	241.2	242.2	243.2	244.1	245.1	246.1	247.0	248.0	248.9	249.9	250.9	251.8	
11200	242.3	243.3	244.2	245.2	246.2	247.2	248.1	249.1	250.1	251.0	252.0	253.0	
11250	243.4	244.4	245.3	246.3	247.3	248.3	249.2	250.2	251.2	252.2	253.1	254.1	
11300	244.5	245.5	246.4	247.4	248.4	249.4	250.3	251.3	252.3	253.3	254.3	255.2	
11350	245.6	246.5	247.5	248.5	249.5	250.5	251.4	252.4	253.4	254.4	255.4	256.4	
11400	246.6	247.6	248.6	249.6	250.6	251.6	252.6	253.5	254.5	255.5	256.5	257.5	
11450	247.7	248.7	249.7	250.7	251.7	252.7	253.7	254.7	255.6	256.6	257.6	258.6	
11500	248.8	249.8	250.8	251.8	252.8	253.8	254.8	255.8	256.8	257.8	258.8	259.7	
11550	249.9	250.9	251.9	252.9	253.9	254.9	255.9	256.9	257.9	258.9	259.9	260.9	
11600	251.0	252.0	253.0	254.0	255.0	256.0	257.0	258.0	259.0	260.0	261.0	262.0	
11650	252.0	253.1	254.1	255.1	256.1	257.1	258.1	259.1	260.1	261.1	262.1	263.1	
11700	253.1	254.1	255.2	256.2	257.2	258.2	259.2	260.2	261.2	262.2	263.3	264.3	
11750	254.2	255.2	256.2	257.3	258.3	259.3	260.3	261.3	262.3	263.4	264.4	265.4	
11800	255.3	256.3	257.3	258.4	259.4	260.4	261.4	262.4	263.5	264.5	265.5	266.5	
11850	256.4	257.4	258.4	259.5	260.5	261.5	262.5	263.6	264.6	265.6	266.6	267.6	
11900	257.5	258.5	259.5	260.6	261.6	262.6	263.6	264.7	265.7	266.7	267.8	268.8	
11950	258.5	259.6	260.6	261.6	262.7	263.7	264.7	265.8	266.8	267.8	268.9	269.9	
12000	259.6	260.7	261.7	262.7	263.8	264.8	265.8	266.9	267.9	269.0	270.0	271.0	
12050	260.7	261.8	262.8	263.8	264.9	265.9	267.0	268.0	269.0	270.1	271.1	272.2	
12100	261.8	262.8	263.9	264.9	266.0	267.0	268.1	269.1	270.2	271.2	272.3	273.3	
12150	262.9	263.9	265.0	266.0	267.1	268.1	269.2	270.2	271.3	272.3	273.4	274.4	
12200	263.9	265.0	266.1	267.1	268.2	269.2	270.3	271.3	272.4	273.5	274.5	275.5	
12250	265.0	266.1	267.1	268.2	269.3	270.3	271.4	272.5	273.5	274.6	275.6	276.7	
12300	266.1	267.2	268.2	269.3	270.4	271.4	272.5	273.6	274.6	275.7	276.8	277.8	
12350	267.2	268.3	269.3	270.4	271.5	272.5	273.6	274.7	275.7	276.8	277.9	278.9	
12400	268.3	269.4	270.4	271.5	272.6	273.6	274.7	275.8	276.9	277.9	279.0	280.1	
12450	269.4	270.4	271.5	272.6	273.7	274.7	275.8	276.9	278.0	279.1	280.1	281.2	
12500	270.4	271.5	272.6	273.7	274.8	275.9	276.9	278.0	279.1	280.2	281.3	282.3	
12550	271.5	272.6	273.7	274.8	275.9	277.0	278.0	279.1	280.2	281.3	282.4	283.4	
12600	272.6	273.7	274.8	275.9	277.0	278.0	279.1	280.2	281.3	282.4	283.5	284.6	
12650	273.7	274.8	275.9	277.0	278.0	279.2	280.2	281.3	282.4	283.5	284.6	285.7	
12700	274.8	275.9	277.0	278.1	279.2	280.3	281.4	282.5	283.6	284.6	285.8	286.8	
12750	275.8	277.0	278.0	279.2	280.2	281.4	282.5	283.6	284.7	285.8	286.9	288.0	

AIRPLANE WEIGHING DATA:
DATE WEIGHED—



NOTE:—
Fore and Aft level lugs located in right wheel pocket, accessible from ground. Spanwise level lugs mounted on forward face of bulkhead at Sta. 428.

REACTIONS	SCALE READING	TARE	CORRECTED READING
Right Wheel — W_R	5004.0		
Left Wheel — W_L	4910.0	0	
Nose Wheel — W_N	946.0		10,860.0
	10,860.0		

A = C.G. inches forward of centerline Main Wheels $= \frac{W_N \times D}{W_R + W_L + W_N \text{ (corrected)}} = 15.46$

B = C.G. inches forward of Rear Face Main Beam = A − C = 12.41

C.G. inches aft of Reference Datum = 233.65 − B = 221.60

CORRECTION FOR MISSING ITEMS

	WEIGHT	ARM	MOMENT
Airplane as Weighed	10,860.0	221.60	24026.6
Additional Trapped Fuel in ~~Flight~~ TOTAL	- 167.4	209.4	- 345.5
Full Oil 20.0 Gal	- 150.0	212.0	- 318.0
Empty Weight	10,542.6		23363.1

Empty weight C.G. = 221.65 " Aft of Reference Datum or 11.99 " Forward of Hull Sta. 233.65 (Rear Face of Main Wing Beam) = $\frac{-203.38}{86.48} \times 100 = 21.06$ % M.A.C.

Witnessed: Craig S Hunt
IA & P 5374211 95 IA
2-24-05

ITEM	WEIGHT	H. ARM	INDEX
AIRCRAFT EMPTY (Includes Unusable Fuel and Oil)	10860	212.	23363.1
PILOT	160		20.0
BASIC WEIGHT	11020		23383.1
BASIC INDEX			

Fuel 1406 ~~6~~ 8

23414.7

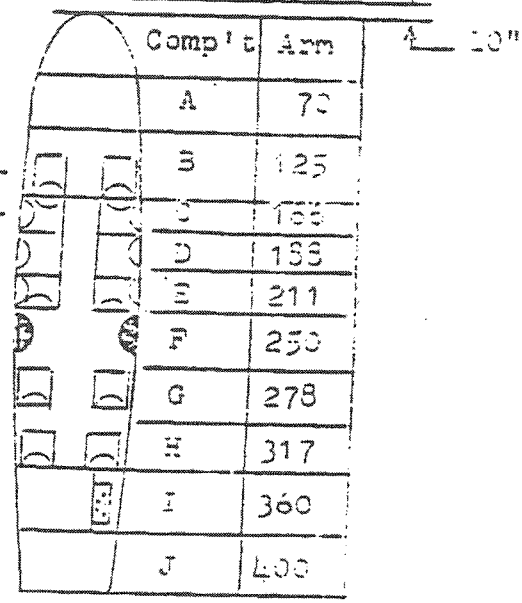
BASIC WEIGHT AND BASIC INDEX

TABLE 5-1

LOADING CHART DATUM - HULL STATION "0"

PASSENGERS AT 170# EACH

INDEX UNITS 1 PASS.	2 PASS.	ROW
2.1		C - 1 ---
2.8	5.6	FC - 1 ---
3.2	6.4	FC - 2 --
3.6	7.2	FC - 3 --
4.7	9.4	RC - 1 --
5.4	10.8	RC - 2 ---
6.1		T - 1 ---



PASSENGER AND CARGO LOADING DIAGRAM
10 SEAT CONFIGURATION
TABLE 5-2

1 JULY 1981

ITEM	WEIGHT	H. ARM	INDEX
AIRCRAFT EMPTY (Includes Unusable Fuel and Oil)			
PILOT			
BASIC WEIGHT			
BASIC INDEX			

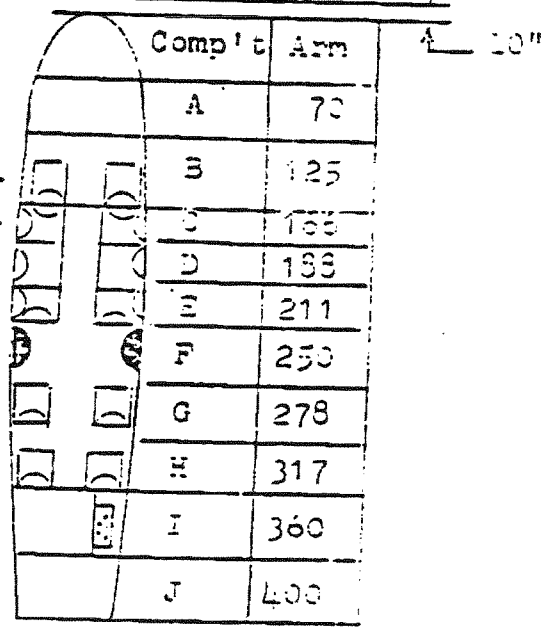
BASIC WEIGHT AND BASIC INDEX

TABLE 5-1

LOADING CHART DATUM - HULL STATION "0"

PASSENGERS AT 170# EACH

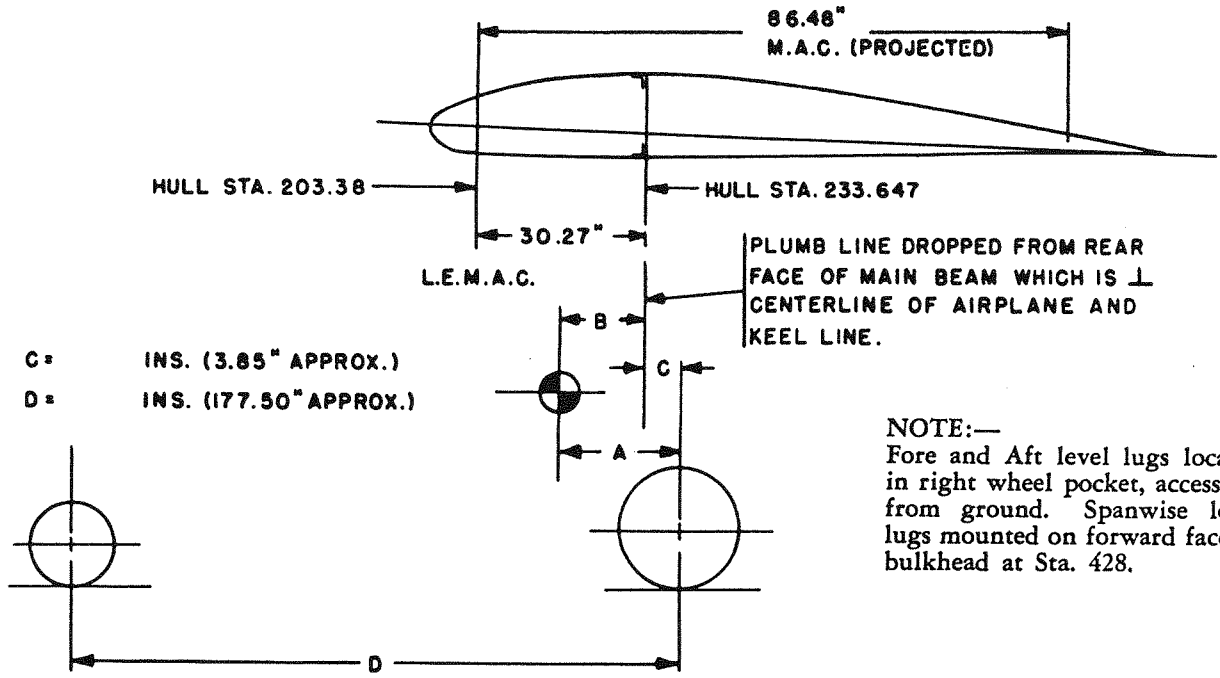
INDEX UNITS 1 PASS.	2 PASS.	ROW
2.1		C - 1
2.8	5.6	FC - 1
3.2	6.4	FC - 2
3.6	7.2	FC - 3
4.7	9.4	RC - 1
5.4	10.8	RC - 2
6.1		T - 1



PASSENGER AND CARGO LOADING DIAGRAM
10 SEAT CONFIGURATION
TABLE 5-2

1 JULY 1981

AIRPLANE WEIGHING DATA:
DATE WEIGHED—



NOTE:—
Fore and Aft level lugs located in right wheel pocket, accessible from ground. Spanwise level lugs mounted on forward face of bulkhead at Sta. 428.

REACTIONS	SCALE READING	TARE	CORRECTED READING
Right Wheel — W_R			
Left Wheel — W_L			
Nose Wheel — W_N	_____	____	_____

A = C.G. inches forward of centerline Main Wheels $= \frac{W_N \times D}{W_R + W_L + W_N \text{ (corrected)}} =$

B = C.G. inches forward of Rear Face Main Beam = A—C =

C.G. inches aft of Reference Datum = 233.65 — B =

CORRECTION FOR MISSING ITEMS

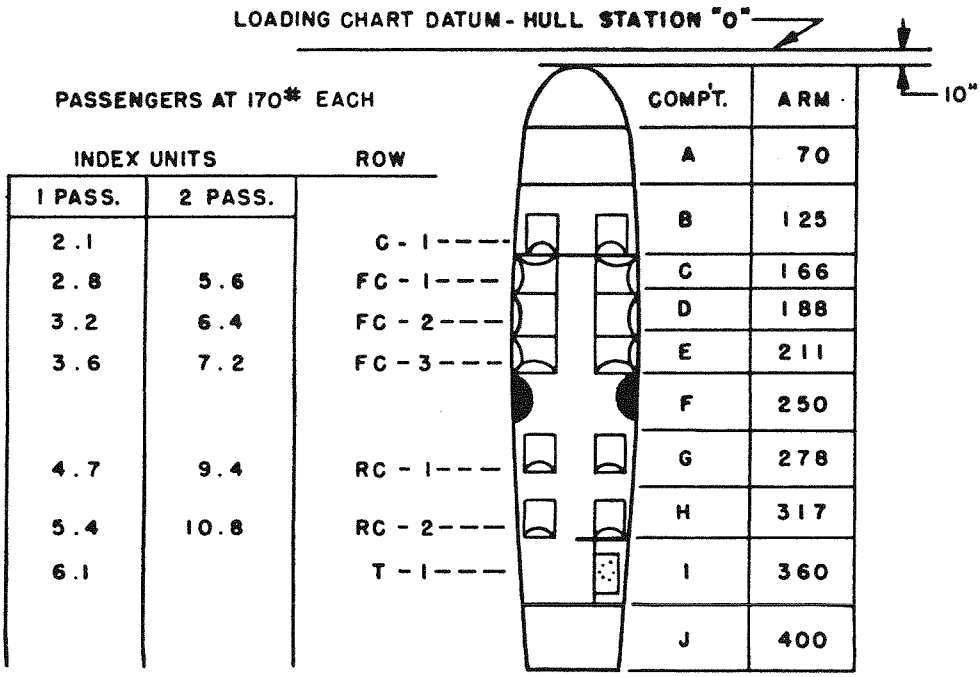
	WEIGHT	ARM	MOMENT
Airplane as Weighed			
Additional Trapped Fuel in Flight		220	
Empty Weight	_____	____	_____

Empty Weight C.G. = " Aft of Reference Datum or " Forward of Hull Sta. 233.65 (Rear Face of Main Wing Beam) = $\frac{\text{—203.38}}{86.48} \times 100 =$ % M.A.C.

Witnessed:

PASSENGER AND CARGO LOADING DIAGRAM

Maximum Allowable Take-Off Gross Weight 12750
Maximum Allowable Landing Gross Weight 12750



BASIC LOADING

The following values apply to this airplane as licensed:

ITEM	WEIGHT	ARM	MOMENT	INDEX UNIT
Empty Weight (p. 63) Pilot Basic Weight and Index Unit*	170	125	21250	2.1

* See p. 65 for latest Basic Weight and Index Unit.

NOTE: 1. The airplane shall be so loaded that the plot of Gross Weight vs. Index Units falls within the limiting lines on the Center of Gravity Limit Chart on page 60. Basic Weight and Index Units for the empty airplane plus Pilot are given above or on page 65. Index Units for Fuel, Oil, Cargo or Baggage, and Miscellaneous items are obtained from their respective tables, and Index Units for Passengers from diagram above.

2. IT IS THE RESPONSIBILITY OF THE OWNER AND THE PILOT to insure that the airplane is loaded properly. The Empty Weight and Empty Weight C.G. are listed on page 63 for this airplane as delivered from the factory. If the airplane has been altered, refer to the latest approved Alteration and Repair Form (A.C.A.—337) for the information necessary to revise the Airplane Basic Weight on page 65 of this report.

Flight and Maintenance Log
Grumman Mallard J57

Preflight:

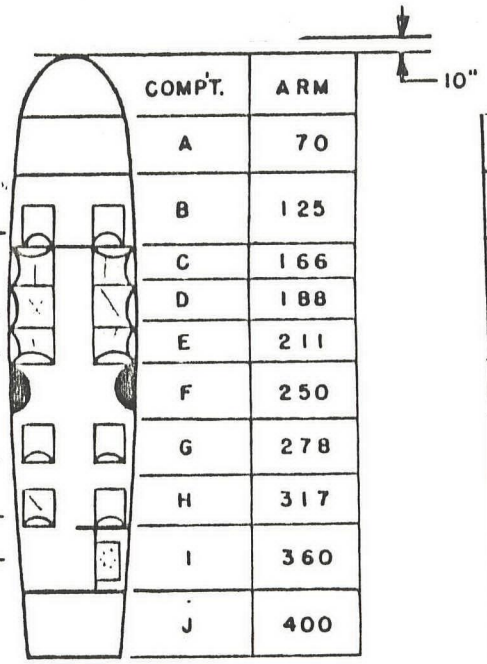
1. Remove control lock, check fuel gauge, pump down cowl flaps. check volts.
2. Check fuel, oil, hydraulic, alcohol levels. accumulator, pitot covers.
3. Remove chocks, tie-downs, gear locks, pitot and float covers.
4. Inspect and drain hull and floats
5. Inspect gear and brakes. Tire and strut pressure.
6. Check flaps, ailerons, rudder, elevator, trim tabs.
7. Check cowl flaps, engine cowlings, 4 Fuel drains. .
8. Check/dress props, pull through.
9. Clean windows. Check wings for frost/ice.
10. Check for headsets, flashlights, charts, nav box, pen/pad.

Weight and Balance:

9660 219.7

PASSENGERS AT 170# EACH

INDEX UNITS		ROW
1 PASS.	2 PASS.	
2.1		C - 1
2.8	5.6	FC - 1
3.2	6.4	FC - 2
3.6	7.2	FC - 3
4.7	9.4	RC - 1
5.4	10.8	RC - 2
6.1		T - 1



COMPT.	ARM
A	70
B	125
C	166
D	188
E	211
F	250
G	278
H	317
I	360
J	400

Wt.	Index	
10.660	227	Base a/c Wt.
350	2.1	
350	5.6	
		Shelf
200	8.4	Comp.
1200	26.4	Fuel
11,760	269.5	Total

Flight Log:

From	To	Flt Time	Log Time	Ldg Water	Land

Time for	Aircraft	L. Engine	R. Engine	Date:
Brought fwd.				
Today				
Total				

LOG — BASIC WEIGHT AND INDEX UNIT
(List all changes made subsequent to weighing)

ITEM	WEIGHT EACH	ARM	INDEX UNIT EA.
Basic Weight and Index Unit as weighed at Factory			

STANDARD EQUIPMENT
(X indicates items installed)

INSTALLED	ITEM NO.	ITEM	WEIGHT EACH	ARM	INDEX UNIT EA.
		PROPELLERS AND PROPELLER ACCESSORIES			
X	1	Two Hamilton Standard propellers, hubs 23D40-51, blades 6533A-18 to 6533A-20 inclusive. Diameter 8′ 6-5/16″ max., 8′ 4-5/16″ min.	252	155	3.91
X	2	Two Hamilton Standard propeller governors #4K11	6	163	.10
		ENGINE AND ENGINE ACCESSORIES— FUEL AND OIL SYSTEMS			
X	101	Two Eclipse starters #1416-15	27	192	.52
X	102	Two aluminum oil coolers, Clifford 10″ Dia. x 9″ long #B36690 with UAP 4 port valve #UD4785	18	193	.35
X	103	Residual fuel and oil in drained system (See p. 58)			
		Fuel—	30	218.5	.66
		Oil—	83	185.7	1.54
X	104	Two elect. driven fuel pumps, Thompson Prod. #TFD10300	7	205	.14
X	105	One Surface Combustion heater #ADS-100N-P41C	21	439	.92
		LANDING GEAR			
X	201	Two aluminum wheel assemblies, Goodyear 9.50 x 16 (Includes brakes. 6 ply-nylon tires and tubes)	120	237.5	2.85
X	202	One nose wheel, Bendix #145308-19 x 6.80-10 (Includes fairing, 6 ply Goodrich rayon tire and tube)	37	60	.22
		ELECTRICAL AND RADIO EQUIPMENT			
X	301	Two generators—100 amp. Leece-Neville #2473-G12	32	184.5	.59
X	302	One battery AN3150 34AH (12-TS-9L)	73	230	1.68
X	303	Two landing lights #G-3801 Grimes	7	220	.15
	304	Standard radio instal.—bow compt.)	93	60	.56
		—rear compt.) See page 68	95	414	3.93
		—misc.)	69	140	.97
		INTERIOR EQUIPMENT			
		Miscellaneous cabin furnishings			
X		(a) Four passenger chairs (rear cabin)	35	297	1.04
		(b) 1, 2, 3 or 4 passenger chairs (forward cabin)	35		
		(c) 1 or 2 divans (forward cabin)	92	188	1.73
X		(d) One revolving table GAEC #111046 (stowed.)	6	425	.25
X		(e) Two hand operated fire extinguishers (1 qt. Pyrene)	7	225	.16
		MISCELLANEOUS (NOT LISTED ABOVE)			
X	401	One C.A.A. Approved Airplane Flight Manual	1	93	.01
X	403	One windshield wiper installation, Kearfott	4	102	.04
X	404	Two safety belt and harness assemblies, NAF1201-1	3.5	125	.04
X		One Mk. IV Danforth anchor with 100 ft. ½″ nylon rope	19	60	.11
X		One First Aid kit	3	345	.10
X		Two Engine Log books and one Airplane Log book	.5	93	-
X		One Bilge pump, Perko	9	41	.04
X		One boarding ladder (stowed)	7	390	.27
X		20 ea. Fire Detectors—engine compartment, Wilcolator A4981	.15	190	-
X		1 ea. Smoke detector installation	3.5	366	.13

SPECIAL EQUIPMENT

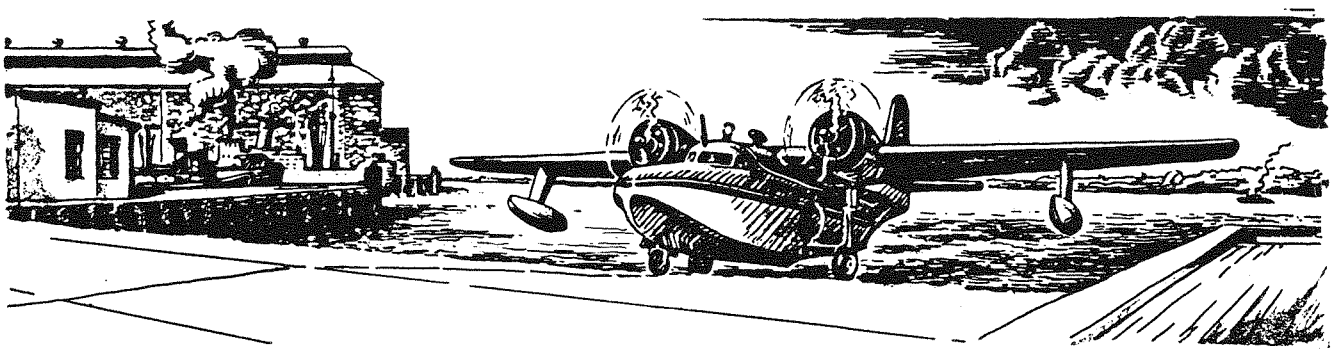
(X installed or furnished with airplane)
(* not included in Weight Empty)

INSTALLED	ITEM NO.	ITEM	WEIGHT EACH	ARM	INDEX UNIT EA.
		1 ea. Automatic Pilot, Sperry Type A-12	193.7	90.1	1.74
		1 ea. Wing & Tail De-icer installation	131.0	281.2	3.68
*		2 gals. Propeller anti-icing fluid (per gal.)	6.6	240	.16
		1 ea. Propeller anti-icer installation	18.2	227.2	.41
		1 ea. "Ship to Shore" radio telephone—Avidmeter Corp.	4.5	220	.10
*		1 ea. Very Pistol installation	4.0	120	.05
		1 ea. Fuel Analyzer instal.—dual type	13.0	199.4	.26
*		Collapsible 4 man life raft—MK IV	50.0	400	2.00
		1 ea. Pontoon Fuel Tank installation	37.2	243.6	.91
*		Life Preservers			
		1 ea. Parachute rack (for 4 chutes)	5.0	405	.20
*		Chest type parachutes—SWITLIK Q.B.	19.0	405	.77
		1 ea. *Add'l. sensitive altimeter—instrument operation only	2.0	93	.02
		1 ea. Set of wheel brakes for co-pilot	10.8	95	.10
		1 ea. Bird Proof Windshield, GAEC #107469 (In lieu of Std.)	9.7	107	.10
		1 ea. Position light flasher	2.1	200	.04
		2 ea. Tail Light—Model C—Grimes—1 red—1 white 32CP	.3	400	.01
		4 ea. Solenoid shut-off valves for fuel and oil gages, General Controls #40R342	.9	192	.02
		1 ea. Pressure gage installation on accumulator	.7	231	.02
*		gals. Wash water (per gal.)	8.3	390	.32
		1 ea. Add'l airspeed indicator—instrument operation only	1.2	120	.01
		1 ea. Electrically heated pitot for add'l airspeed indicator	2.2	198	.04
		Oxygen installation	61.0	78.5	.48
		1 set Chair and divan slip covers, per set	18.5	222.8	.41
		2 ea. Flashlights, accessible to both pilots	2.0	125	.02
		1 ea. Signs "Fasten Seat Belt", "No Smoking", "Use Oxygen Equipment", operable by either pilot or co-pilot	2.2	135	.03
		1 ea. Fuel pressure warning indicator	1.7	93	.02
		1 ea. Oil pressure warning indicator	1.7	93	.02
	402	2 ea. Parachute flares (3 minute)	23.0	455	1.05

RADIO EQUIPMENT

(X indicates items installed)
(* indicates Standard Radio items)

INSTALLED	ITEM NO.	ITEM	WEIGHT EACH	ARM	INDEX UNIT EA.
		RADIO COMPASS EQUIPMENT			
	304	*MN-26K Receiver and mount	37.9	65	.25
	304	MN-26K Receiver and mount	37.9	41	.16
	304	*MN-36C Loop and dehydrator	10.2	192	.20
	304	MN-36C Loop and dehydrator	10.2	144	.15
	304	*MN-37B Bearing indicator	1.4	96	.01
	304	MN-42C Dual Azimuth indicator	2.0	96	.02
	304	*MN-31C Loop control unit	17.6	46	.08
	304	MN-31C Loop control unit	17.6	46	.08
	304	*Sense antenna (wire)	.5	144	.01
		RANGE RECEIVER EQUIPMENT			
	304	*MN-26K Receiver and mount	37.9	41	.16
	304	*MN-54A Loop antenna	5.8	144	.08
	304	*Range antenna	.5	144	.01
		COMMUNICATIONS RADIO AND INTERPHONE			
	304	*RTA-1 Receiver-Transmitter, amplifier and mount	75.8	414	3.14
	304	sets Additional crystals at .7#/set		414	
	304	TA-17 Transmitter	38.4	414	1.59
	304	Antenna loading coil installation	3.5	414	.14
	304	*Antenna (wire)	1.5	315	.05
	304	*MR-39B Dual audio amplifier	5.1	37	.02
		MARKER BEACON RECEIVER EQUIPMENT			
	304	*MN-53A Marker Beacon Receiver and mount	17.0	416	.71
	304	*"T" antenna (wire)	2.5	480	.12
	305	*Miscellaneous panels, controls, cables, etc.	48.4	132	.64
		GLIDE PATH LANDING EQUIPMENT			
	304	R-89B/ARN-5A Receiver and mount	13.8	125	.17
	304	BC-732A Control unit and mount	.6	120	.01
	304	AS-27A/ARN-5A Antenna	3.5	115	.04
	304	ID-48/ARN Pilots indicator	2.1	93	.02
		V.H.F. RECEIVING, TRANSMITTING AND I.L.S. EQUIPMENT			
	304	R-13 Receiver	8.5	125	.11
	304	B-10 Converter	5.8	125	.07
	304	Mount for R-13 and B-10	2.4	125	.03
	304	F-10 Filter-amplifier and mount	5.4	125	.07
	304	R-15 Receiver and mount	8.5	125	.11
	304	P-10 Power unit with D-10 dynamotor	3.8	35	.01
	304	AN-104B Antenna mast	2.8	234	.06
	304	"To-From" indicator	.4	93)	
	304	Course selector indicator	1.5	93)	.02
	304	C-12 Control unit and mount	1.5	120	.02
	304	C-13A Control unit and mount	.3	120	-
	304	C-14 Control unit and mount	.8	120	.01
	304	C-15 Control unit and mount	1.0	120	.01
	304	C-17 Control unit and mount	1.5	120	.02
	304	C-21 Control unit and mount	1.0	120	.01



SECTION VI

Weight and Balance Report

Model G-73

Serial No. _____

Certificate No. _____

Date: _____

Prepared by: _____

Checked by: _____

Approved by: _____