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FOR FILES B-C-D-E-F-G-H

TECHNICAL ORDER No. 01-60EB-2

PRELIMINARY

HANDBOOK OF SERVICE INSTRUCTIONS

(CONTRACTOR'S UNEDITED INSTRUCTIONS ISSUED IN ACCORDANCE WITH PAR. 6, T. O. No. 00-5).

FOR THE

**MODEL O-47B CORPS AND ARMY
OBSERVATION AIRPLANE**

MANUFACTURED BY

NORTH AMERICAN AVIATION, INC.

INGLEWOOD, CALIFORNIA

On Contract W535 AC11994

Specification 98-409

NOTE: Reference to the periodic inspections specified in Section III will be entered, where applicable, on Air Corps Forms 41-A.



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NOTE: Electrical and Radio Wiring Diagrams are not included in this Handbook; See N.A. Dwg. Nos. 51-54002 and 51-71002, respectively, copies of which are maintained in the data case of the gunner's station.

SECTION I

INTRODUCTION AND REFERENCES

1. The purpose of this Handbook is to furnish personnel of operating units with the necessary information and instructions for servicing and maintaining the Model O-47B Observation Airplane.

2. The maintenance of a considerable number of items is dealt with in publications issued by the U. S. Army Air Corps and the manufacturers of aeronautical equipment and parts. These publications are referred to in this Handbook when they contain applicable instructions and are available to the Air Corps. Such publications will be found listed in the indices published as Technical Orders of the 00-1 series.

3. Reference is made in this Handbook to the following publications:

T. O. No.	00-1	Index of Technical Instructions and Information
	00-20A	The Visual Inspection System for Airplanes
	00-25-3	Distribution of Air Corps Maintenance Publications
	01-1-1	General - Cleaning of Aeronautical Equipment
	01-1-2	Anti-Corrosion Treatment for Airplanes Operating in Salt Water
	01-1-5	Installation of Static Ground
	01-1-18	Replacement of Wing Walkways
	01-1-58	Tightening of Radial Engine Mount Bolts and Replacement of Rubber Vibration Absorbers
	01-1B-1	Aircraft Storage Batteries
	01-60EB-1	Operations & Flight Instructions - O-47B
	02-1-1	Preparation of Engines for Storage
	02-1-6	Periodic Inspection & Adjustment of Valve Mechanism
	02-1-29	Ground Operation of Aircraft Engines
	02-1-34	Tightening Crankshaft and Propeller Shaft Thrust Bearing Nuts
	02-35-49	Installation, Inspection and Cleaning of Automatic Self-Turning Cuno Oil Strainers - R-1820-25, -39 and Subsequent Models
	02-35GB-1	Operation Instructions - R-1820-57 Engine
	02-35GB-2	Service Instructions - R-1820-57 Engine

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T. O. No.	03-1-2	Safety Belts
	03-5AA-1	Generators and Control Box
	03-5CA-1	Starters and Starter Motors (Eclipse)
	03-5D-4	Magnetos - Types SB-9R, SB-9L, SF-9R, SF-9L and VAG
	03-5E-1	Spark Plugs - Use and Reconditioning
	03-10-13	Operation and Inspection of Fuel Cock Controls
	03-10-15	Operating Fuel Systems
	03-10E-1	Modification, Inspection and Lubri- cation of Fuel Pump Drive Assem- blies
	03-20CA-1	Operation and Flight Instructions - Constant Speed Propeller Governor (Hamilton)
	03-20CA-2	Service and Overhaul instructions - Constant Speed Propeller Governor (Hamilton)
	03-20CB-1	Operation and Flight Instructions - Controllable Propellers (Hamilton)
	03-20CB-2	Service and Overhaul Instructions - Controllable Propellers - Two- Position and Constant Speed (Hamilton)
	03-20CB-5	Inspection of Hamilton Constant Speed Propellers
	03-25A-1	Inspection and Lubrication of Anti- Friction Bearings
	03-25C-2	Streamline Wheel & Brake Assemblies - (Bendix)
	03-25E-1	Air-Oil Shock Absorber Struts
	03-30CA	Engine Driven Hydraulic Pumps
	03-35A-1	Propeller Anti-Icer Pump
	03-35A-2	Treatment of Rubber Covered Pro- peller Spinners
	03-35B-1	Maintenance and Inspection of De- Icer Shoes
	03-45-1	Fire Extinguishers - Installation and Inspection - 1 Qt. Pump Type
	03-50-2	Charging of Oxygen Cylinders (Equalizer Method)
	03-55A-1	Pneumatic Rafts, Types A-1, A-2, B-2, B-3 and C-1 - Use, Mainte- nance and Inspection
	04-10-1	Aircraft Tire Pressures
	04-10-2	Inspection of Aircraft Tires
	05-1-1	Repair, Storage and Reinspection of Instruments
	05-1-3	Landing Gear Pressure Gages, Types E-1, E-2 & E-3

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T. O. No.	05-1-9	Aircraft Clocks, Types A-6, A-7, A-8 & A-9
	05-1-16	Identification of Aircraft Thermometers
	05-1-17	Marking of Aircraft Instruments
	05-3B-2	Service Instructions
	05-10-2	Service & Overhaul Instructions
	05-15-1	Operation and Flight Instructions - Magnetic Compasses
	05-15-2	Service and Overhaul Instructions - Magnetic Compasses
	05-20-2	Bank and Turn Indicators (Pioneer)
	05-20-10	Altimeters, Types C-6, C-7, C-8, C-10, C-11
	05-20-11	Rate of Climb Indicators, Type A-5
	05-20-19	Drift Meter, Type A-3
	05-55A-2	Service Instructions - Position Indicators - Wheels and Flaps
	05-65A-1	Preliminary Instructions - Electrically Operated Liquidometers
	06-1-2	Fluids for Hydraulic Equipment
	06-10-1	Aircraft Engine Lubricating Oil, Grades & Use
	06-10-3	Prevention of Thread Seizures
	08-5-1	Shielding and Bonding Aircraft
	08-10	Signal Corps Publications
	11-15-1	M-8 Parachute Flare
	13-5-1	Type A-1 Triangular, Construction, Maintenance, Storage and Use

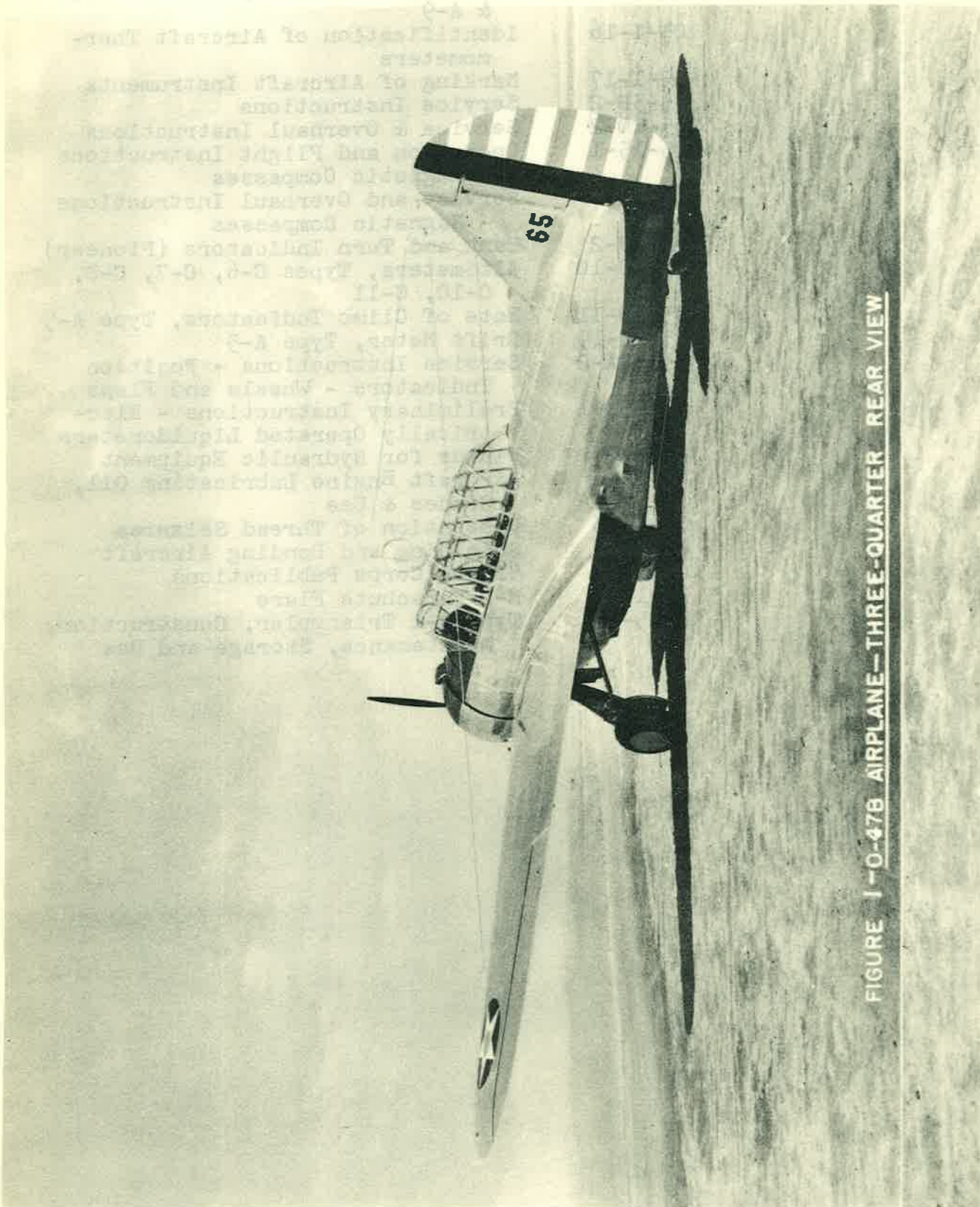


FIGURE 1-O-47B AIRPLANE-THREE-QUARTER REAR VIEW

SECTION II

GENERAL INSTRUCTIONS

1. Handling

Do not push, pull, or lift the O-47B Airplane by means of any part or assembly, or in any manner other than by use of the provisions and in accordance with the instructions outlined in the ensuing paragraphs. Care should be exercised in all handling operations in order to prevent damage to the airplane and equipment. Personnel shall not assist themselves to and from airplane by using windshield, antenna loop, or fixed gun cover as a hand-hold. Do not step on enclosure tracks or lean on seat backs when they are in the open position. When de-icer shoes are installed, care should be taken to avoid dragging fuel hose over de-icer shoes on leading edge of wing.

2. Lifting

A lift tube, passing through the lower part of the fuselage just forward of the tail surfaces, provides a means by which the aft portion of the airplane may be lifted. A bar up to 1-7/8 inches in diameter may be passed through this tube and the airplane lifted by support of personnel at each end of the bar or by means of a hoist. The lifting bar must be passed completely through the aperture to prevent damage to the lift tube.

3. Hoisting

Provisions are made in the nose-over structure for hoisting the complete airplane. Insert eye-bolt of hoisting sling assembly in hoist tube located in the upper portion of the nose-over structure, and secure with nut provided. The sling assembly, 25-55002, is provided with the airplane and may be installed with pilot's enclosure in either the open or closed position, after rubber plugs in enclosure are removed.

4. Towing and Jacking

A towing ring and jacking point is provided at the lower end of each landing gear strut, on the inboard side of the wheel fairing. Blocks equipped with jacking points are installed in the lower surface of the center wing on the front spar. A jacking point is also provided at the rear of the fuselage bottom, just forward of the tail wheel. The wing and fuselage jacking screws, 25-55007, may easily be removed and stowed in the baggage compartment of the airplane. A towing bar, N.A. Dwg. No. 51-55017, may be clamped to the tail wheel post for towing and steering the airplane backwards.

5. Leveling

Permanently installed longitudinal and lateral leveling brackets and plumb bob attaching points are provided. The longitudinal brackets are located on the right side of the fuselage and extend outboard just above the wing. The lateral brackets are mounted on the aft side of the rear spar bulkhead. A level on these brackets will be parallel to the longitudinal and lateral reference datum lines of the airplane, respectively. The longitudinal reference datum line is parallel to the thrust line. Longitudinal brackets, to be used in connection with gun sight setting, are provided immediately above the airplane leveling brackets on side of fuselage. For horizontal gun adjustment, a set of flush type nut plates is provided on bottom of fuselage at longitudinal center of airplane. The nut plates provide attaching points for plumb bobs. The forward nut plate is located on the front spar bulkhead, just aft of camera door oil shield, and the rear nut plate is located on the rearmost fuselage frame. Both plates are threaded, size No. 10-32, and are encircled with a ring of red paint for identification.

6. Steps and Walkways

A flush type hand grip and a step are installed on the left side of the fuselage for ease of ingress and egress of the crew. A collapsible step is located at each side of fuselage, just aft of engine. A walkway, extending the full length of the wing chord, is provided on the upper surface of the center wing, adjacent to the left side of the fuselage. A shorter walkway is provided on the center wing, at right side of fuselage, adjacent to fuel tank filler neck. The walkways are composed of one coat of plyosyn cement, covered with carborundum abrasives, and recoated with the same cement. The wings, other than provided walkways, should not be walked on unless the surface is protected with proper padding. Other well marked hand-holds, steps and walkways are provided throughout the airplane.

7. Filling Fuel Tanks

The O-47B Airplane is provided with four fuel tanks which accommodate a total of 200 gallons of fuel. Two 60-gallon tanks are located in the fuselage, one below the pilot's cockpit and one just aft of the observer's station. The filler neck for the front fuselage tank is located at the left side of the fuselage, directly forward of the center wing leading edge. Access to the filler neck is provided by means of a Dzus fastened door. The filler neck for the rear fuselage tank is located in the center wing at the left side of the fuselage, near the trailing edge. Access to filler neck is provided by means of a Dzus fastened door. A wing fuel tank is located in the center wing at each side of the fuselage. Each of the two wing tanks accommodates 40 gallons of fuel. Filler necks for the wing tanks are located in the upper surface of the center wing at each side of the fuselage. A fuel gauge of the float type is mounted on the front fuselage tank and is visible from the pilot's cockpit only. Ample illumination for the gauge is provided by cockpit lights

and by the extension light located at right side of pilot's seat. Fuel gauges of the liquidometer type are provided for the other three tanks. An indicator gauge and a three-point selector switch are located in the left side of the pilot's instrument panel. With the selector switch set for either of the three tanks, the fuel gauge will indicate the amount of fuel in that tank. The fuel gauges are accurate when the airplane is in the level flight position only. Fill the fuel tanks to overflowing. Turn fuel gauge selector switch to "OFF" when leaving the airplane. Also turn main line switch "OFF".

8. Filling Oil Tank

The oil tank is mounted in the upper portion of the engine mount structure. Access to the filler neck is provided through a Dzus fastened door at the left side of the removable engine compartment cowling. To fill the oil tank to the normal service capacity of 12.2 gallons, it is necessary to remove the left section of the engine compartment cowling, and open drain cock located on forward end of tank at the left side. When oil overflows from this point, the desired normal service capacity has been obtained. After filling tank for normal service capacity, make certain that drain cock is turned off and is properly safetied as required. To fill oil tank to its maximum capacity of 18.0 gallons, fill tank to overflow. Ample foaming space is provided. For grades and use of aircraft engine lubricating oil, refer to T. O. No. 06-10-1.

9. Parking Brakes

Parking brakes are provided and may be applied and released from the pilot's cockpit only. The parking brake control knob is located in the pilot's cockpit, just below the main instrument panel. To apply parking brakes, pull out on parking brake control knob and then press both brake pedals. Release brake pedals and then release control knob. The parking brakes may be released by pressing on the brake pedals.

10. Surface Control Lock

The control handle for locking and releasing the surface controls is located to the left of the control stick socket in the pilot's cockpit. To lock controls, neutralize rudder pedals and place control stick forward, centering it laterally. Release plunger holding lock in stowed position and engage the fitting on stick socket in the lock recess, allowing lock plunger to locate itself in the locked position. To release, reverse the above procedure. The lock handle should be stowed in the locked, down position when not engaged with the control stick.

11. Lashing Down

Prior to lashing the airplane down, the parking brakes should be set and the surface controls locked. A tie-ring socket is located on the lower surface of each wing, just aft of the landing

lights. The socket is plugged with an AN25-9 screw. Two eye-bolts, B1190, which are stowed in the baggage compartment, may readily be inserted in these sockets, after plugs are removed, and utilized as lashing points for the wings. The tail is lashed down by securing through the lift tube aperture, or by lashing directly to the tail wheel unit.

12. Locking Airplane

Provisions are made for locking the cockpit enclosure and baggage compartment of the airplane by means of padlocks. A hole is located in the left enclosure track at rear of each sliding section, through which padlocks can be inserted to prevent the sliding sections of the enclosure from opening. To prevent opening of the gunner's hood, insert a padlock through the metal hasp at rear of gunner's hood and through adjoining hasp on fuselage. The baggage compartment may be locked by inserting a padlock through the split type handle.

13. Starting the Engine

The engine shall be started in accordance with the instructions outlined in T. O. Nos. 01-60EB-1 and 02-35GB-1.

14. Stopping the Engine

Refer to T. O. No. 02-1-29. Stop engine with propeller in "HIGH PITCH" (low R.P.M.) position. An oil dilution system is provided; see T. O. No. 02-1-29. The carburetor is equipped with an idle cut-off device.

10. Surface Control Lock

The control handle for locking and releasing the surface controls is located to the left of the control stick socket in the pilot's cockpit. To lock controls, neutralize rudder pedals and place control stick forward, centering it laterally. Release rudder or holding lock in stowed position and engage the fitting on stick socket in the lock recess, allowing lock plunger to locate itself in the locked position. To release, reverse the above procedure. The lock handle should be stowed in the locked, down position when not engaged with the control stick.

11. Lashing Down

Before lashing the airplane down, the parking brakes should be set and the surface controls locked. A tie-ring socket is located on the lower surface of each wing, just aft of the leading

SECTION III

SERVICE, INSPECTION AND MAINTENANCE

(Inspection, Cleaning, Servicing, Lubricating and Adjusting)

1. General

a. The work outlined in this section is a normal function of the Operating Organizations at Air Corps Stations. It consists primarily of the routine inspection prescribed in the current issue of T. O. No. 00-20A, and the cleaning, servicing, lubricating, adjusting and such maintenance, repairs and replacements as the organization facilities will permit.

b. The following inspection and maintenance procedure conforms to the current issue of T. O. No. 00-20A in subject matter and arrangement, with the addition of the necessary supplementary requirements for the O-47B Airplane. All supplementary inspection and maintenance items should be recorded under proper column headings.

2. Lubrication

a. Detailed lubrication instructions and servicing instructions are provided at the proper inspection periods incorporated in this Section. In addition to these instructions, all service lubrication requirements are specified on diagram, Figure 2, page 20, of this Handbook.

b. A zerk type grease gun is mounted on the lower left engine mount tube. Fill gun with medium grade cup grease, Spec. VV-G-681, and use at all zerk type lubricator fittings except the zerk fittings on the fuel pump flexible drive assembly and propeller hub spider. See Lubrication Diagram.

c. Ball bearings used in pulleys, bellcranks, hinge points and rod ends are of the sealed type packed with lubricant at assembly, and require no further lubrication.

CAUTION: Keep oil and grease away from tires, fabrics, etc.
DO NOT use lubricants excessively.

3. Inspection and Maintenance

Column 16 - "Preflight Inspection"

Daily

Before Starting Engine:

Examine Airplane Flight Report - T. O. No. 00-20A.

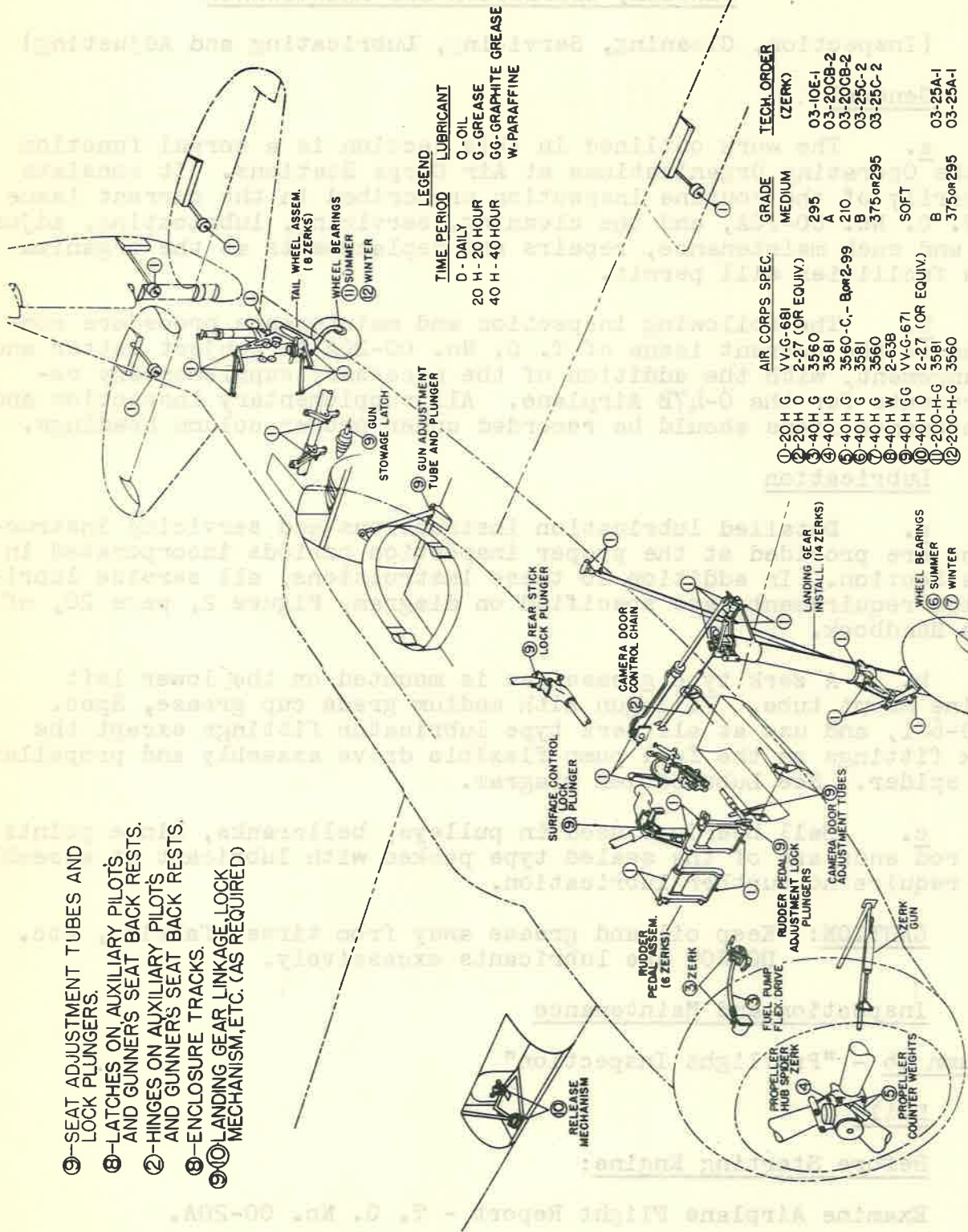


FIGURE 2 - LUBRICATION DIAGRAM

Note routine inspections due - T.O. 00-20A.
Check contents of aircraft data case (T.O. 00-25-3).
See that windshield, enclosure panels and windows are clean.
Keep airplane clean at all times - T.O. 01-1-1.
Check quantities of fuel and oil - T.O. 00-20A.
Fuel and oil caps properly secured - T.O. 00-20A.
See that all cowling is properly fastened.

See that there is nothing in the pilot's cockpit, observer's, auxiliary pilot's or gunner's station that will interfere with the controls.

See that the required sand bags (or other ballast) are in place, properly secured. WARNING: Three (3) men or equivalent weight in ballast (200 lbs. per man) shall be carried at all times and shall be disposed in pilot's seat, observer's or auxiliary pilot's seat, and gunner's seat. Ballast tie-down loops are provided at each side of fuselage below observer's seat. Ballast to replace gunner should be stowed in baggage compartment. When two or more men are carried, make certain ballast weights are removed as required.

Make certain instrument light reflector panels are securely locked in the up position.

When not in use, auxiliary pilot's control stick should be locked in the stowed position at right side of station.

Set rudder, elevator and left aileron trim tab controls for normal take-off position or at position specified by pilot.

Oxygen Equipment - T.O. 00-20A.

Flares - T.O. 00-20A.

When practical, before starting engine - T.O. 00-20A.

Turn fuel valve - T.O. 00-20A. CAUTION: Always set fuel valve by "click and feel" - T.O. 03-10-13.

Anti-Icer and De-Icer Equipment - T.O. 00-20A.

Instruments - General:

Prior to starting engine - T.O. 00-20A.

Clean all instrument cover glasses - T.O. 00-20A.

Inspect instrument lighting system - T.O. 00-20A. Each instrument is individually lighted. Spare lamps are located on instrument panels.

Check compasses for discoloration - T.O. 00-20A.

Clean drift meter lens - T.O. 05-20-19.

*Fuel Pressure Signal: - Test fuel pressure warning signal lamp for proper operation by turning "ON" main line switch located on pilot's electrical control panel and noting operation of lamp. With the engine not running, the signal lamp should glow steadily. If lamp does not operate, first test lamp, utilizing test

*-SIGNAL INOPERATIVE UNTIL FURTHER NOTICE.

switch located on pilot's electrical control panel and then test circuit. Spare lamp is located adjacent to signal lamp. Active and spare fuses are located in main fuse panel at left side of fuselage just aft of firewall. NOTE: This check must be made prior to building up fuel pressure with hand pump.

When certain lamp and circuit are functioning correctly, use hand fuel pump to obtain pressure and note pressure necessary to extinguish lamp. If this pressure is not lbs./sq.in., the necessary adjustment of the fuel pressure switch shall be accomplished.

Turn "ON" battery main line switch, located on electrical control panel, to check for proper operation of landing gear lock pin position indicator lamps. If lamps do not illuminate when landing gear is in the locked down position, first check lamps, then circuits. Test switch for checking lamps is located on instrument.

Engine Instruments:

During engine warm-up, check - T.O. 00-20A.

At engine warm-up, open manifold pressure gauge drain for a few seconds to clear the line of injurious acids. A valve is provided for this purpose and is located to the right of the pilot's instrument panel. For best results, line should be drained at idling speed.

Flight and Navigation Instruments:

See that the clocks are - T.O. 00-20A.
See that the airspeed tubes - T.O. 00-20A.
Check instrument boards for flexibility.

While Warming Up Engine:

CAUTION: Specific instructions have been issued covering operation of the controllable propeller, the R-1820-57 engine, and ground operation of engine. Be sure you are familiar with T.O. Nos. 03-20CA-1, 03-20CB-1, 02-35GB-1 and 02-1-29 before attempting to warm up the engine.

Magneto switches shall be tested - T.O. 00-20A.

Test functioning of engine and all fuel tanks: (front fuselage, rear fuselage, left wing and right wing) - T.O. 03-10-15.

Test operation of controllable propeller. See T.O. Nos. 03-20CA-1 and 03-20CB-1 and 02-1-29.

To stop engine at completion of warm-up, see T.O. 02-1-29.
If engine is not to be operated - T.O. 02-1-1.

Column 18 - "Gunnery Equipment" (A.C. Cir. 15-43 & T.O. 11- Series)

Column 19 - "Tow Target Equipment" (A.C. Cir. 15-43 & T.O. 11- Series)

Column 20 - "Communication Equipment" (A.C. Cir. 15-44, T.O. 08- Series)

WARNING: Do not test or operate radio transmitter until all parts of antenna system are at least one foot removed from any other object. This precaution should be taken to avoid possibilities of fire from sparks which would jump from the antenna to a near-by object, of such intensity as to ignite inflammable material.

Column 21 - "Photographic Equipment" (A.C. Cir. 15-45, T.O. 10- Series)

Column 22 - "Oxygen Equipment" (See preflight instructions, Column 16)

Column 25 - "Engine Controls"

Daily

Inspect operation, proper functioning, and general condition of the throttle, mixture, propeller and carburetor air heat control assemblies.

20 Hour

Inspect entire control assemblies - T.O. 00-20A.

See that quadrants are adjusted to prevent creeping of controls.

Column 26 - "Engine Instruments"

Daily: - As specified in Column 16 - "Preflight".

20 Hour: - Check fuel mixture indicator - T.O. 05-3B-2.

40 Hour

Check fuel mixture indicator - T.O. 05-3B-2.

Inspect instruments - T.O. 00-20A.

Check zero setting of electrical instruments - T.O. 00-20A.

Check manifold pressure gauge reading - T.O. 00-20A.

Check alignment of white index line at bottom of each instrument cover glass to make certain cover glass has not moved - T.O. 05-1-17.

Column 27 - "Ignition and Electrical"

Magnetos, generator, generator control, starter, starter and ignition switches, booster coil, spark plugs, high and low tension leads, etc.

Daily: - No routine daily inspection prescribed - T.O. 00-20A.

20 Hour

Magnetos: Scintilla Type SF-9L-2. Inspect as prescribed for Type V-AG Magnetos in T.O. 00-20A. Also refer to T.O. 03-5D-4.

Generator Type E-7 (Eclipse) and Generator Control Panel, Type A-1. Inspect as prescribed in T.O. 00-20A. Also refer to T.O. 03-5AA-1.

40 Hour

Starter (Type C-21) - T.O. 03-5CA-1 and 00-20A.

Magnetos (Type SF-9L-2) - T.O. 03-5D-4 and 00-20A.

Spark Plugs - BG298GS, T.O. 03-5E-1 and 00-20A.

Booster Coil (Type A-1) - Spec. 94-32083 and T.O. 00-20A.

Switches - T.O. 00-20A.

Generator and Control Box - T.O. 03-5AA-1 and 00-20A.

Wiring - T.O. 00-20A.

Column 28 - "Fuel System"

Daily

NOTE: Each time fuel is serviced to a tank, drain fuel system strainer and a small amount of fuel from tank sump by means of drain cock; sufficient to remove any accumulation of water or foreign matter present in tank. Access to front fuselage tank sump and fuel system strainer is gained through a door located on bottom of fuselage, immediately forward of front spar bulkhead. The rear fuselage tank sump drain cock extends through the fuselage bottom, just forward of the baggage compartment. A drain cock extends through lower surface of center wing at each side of fuselage for draining the two wing tank sumps.

Resafety all drain cocks.

Fuel Cocks: Rotate control handle one complete revolution and note whether binding occurs at any point. (T.O. 03-10-13). Note particularly that fuel cock is fully closed when tank selector valve control is in the "OFF" position.

Test fuel pressure signal as specified in Column 16 - "Preflight"

Check for proper operation of hand fuel pump and pressure gauge by turning the fuel tank selector valve "ON" and exercising hand pump until the proper operating pressure of 6 to 7 lbs./sq.in. is indicated on gauge.

Inspect for evidence of leaks in the fuel system.

Check primer for leaks when in the "OFF" position.

See that the fuel tank vent lines are clear

Inspect carburetor - T.O. 00-20A.

Inspect fuel and vacuum pumps - T.O. 00-20A.

20 Hour

With fuel on, pressure up, inspect fuel lines - T.O. 00-20A.
Inspect connections - T.O. 00-20A.
Inspect engine pump bypass valve assembly for leaks and proper operation.

Carburetor, Chandler-Evans No. CE-1375-DA-1:

Inspect parting surface - T.O. 00-20A.
Inspect for security of mounting - T.O. 00-20A.
Clean fuel strainer located in carburetor inlet port.
Inspect all fuel overflow or drain lines - T.O. 00-20A.

Remove and clean all fuel strainers and inspect strainer bodies for breaks or tears.

Check carburetor air intake system for general condition, security of attachment and proper operation.

40 Hour

Inspect all safeties, controls, etc. - T.O. 00-20A.

Lubricate fuel pump flexible drive shaft assembly and coupling assemblies (the latter at two zerk fittings provided) with high melting point grease, grade 295 (soft, medium), Spec. 3560. The drive shaft will be carefully inspected prior to application of lubricant. (T.O. 03-10E-1)

Lubricate hand fuel pump control handle at quadrant zerk fitting with medium grade cup grease, Spec. VV-G-681.

Check fuel cock controls - T.O. 03-10-13 and 00-20A.

Column 29 - "Oil System"

Daily

Inspect for evidence of engine throwing oil.
Inspect drain plugs and drain cocks for proper safetying.
Inspect oil cooler - T.O. 00-20A.
Remove and clean all oil screens if required - T.O. 00-20A.
Note that oil dilution cock does not leak when solenoid switch is in the "OFF" position.
Remove Cuno oil strainer turning shaft cap and with engine running observe shaft to determine whether it is turning. - T.O. 02-35-49.
During cold weather operations - (below +32°F) T.O. 00-20A.

20 Hour

Inspect all oil lines - T.O. 00-20A.
Inspect connections - T.O. 00-20A.
Inspect oil cooler - T.O. 00-20A.
Drain oil dilution solenoid, located on rear left side of fire-wall. A plug is provided on bottom of solenoid.

40 Hour

Clean Cuno oil strainer and strainer compartment - T.O. 02-35-49
Inspect oil tank - T.O. 00-20A.
Inspect oil dilution system for general condition and proper operation.

Column 30 - "Cooling System"

Daily: - See that cowling is not rubbing fins.

20 Hour: - Inspect cylinders for damaged or broken fins.

Column 31 - "Valves, Manifolds, Superchargers"

Daily

Check manifolds for security of attachment and "blown" gaskets.
Check carburetor air scoop for security of mounting.

Prior to initial operation - T.O. 00-20A.
(NOTE: If high temperatures or hard usage - T.O. 00-20A)

Inspect exhaust stack studs for tightness.

20 Hour

The rocker arm bearings are automatically lubricated by a pressure system utilizing oil from the engine. See T.O. 02-35GB-2 for detailed information. A complete and detailed inspection of the valve mechanism will be made at completion of the first 20 hours of flying of new or newly overhauled engines. (T.O. 02-1-6)

40 Hour

Inspect intake and exhaust system - T.O. 00-20A.
Hammer-tap the exhaust stacks - T.O. 00-20A.

Inspect to make certain bolt which attaches the rear end of exhaust tail pipe to eye-bolt on wing is loose enough to allow ready expansion and contraction of tail pipe in slot provided for that purpose.

160 Hour

Inspect to make certain hole in bottom of exhaust collector ring, and sump drain line located below collector ring are unobstructed.

The valve mechanism will be inspected and adjusted - T.O. 00-20A. Also refer to T.O. 02-35GB-2 for complete inspection and maintenance instructions.

NOTE: When it is known in advance - T.O. 00-20A.

Column 32 - "Propeller and Accessories"

Daily

Inspect propeller (03-20CA-2, 03-20CB-2, 03-20CB-5) - T.O. 00-20A.

If operating in salt water - T.O. 01-1-2 and 00-20A.

Coat all outside surfaces - T.O. 00-20A.

Rubber covered propeller spinners, if installed - T.O. 03-35A-2

On completion of each day's flying - T.O. 00-20A.

Hamilton controllable propeller governor - T.O. 03-20CA-2 and 00-20A.

20 Hour

Inspect propeller blades and hub thoroughly - T.O. 00-20A.

Inspect the entire leading edge - T.O. 00-20A.

Check retaining lock and clamp ring nuts - T.O. 00-20A.

NOTE: If a limit has been set - T.O. 00-20A.

Check spinner, if installed - T.O. 00-20A.

Lubricate propeller if required. (See Figure 2, page 20.)

Check propeller and control mechanism for security of mounting and proper functioning.

40 Hour

Check propeller shaft thrust bearing nuts - T.O. 02-1-34 and 00-20A.

Lubricate hub spider through fittings, using approximately 1/4 pound of grease, lubricating, grade A, (soft), Spec. 3581. When operating under extreme low temperatures, Mobilgrease No. 1, or Sinclair, Hamilton Standard Propeller grease, winter grade, may be used. T. O. 03-20CB-2.

Check control system - T.O. 03-20CA-2 and 00-20A.

400 Hour or Engine Change (T.O. 03-20CB-2): - Remove propeller and forward to depot for overhaul.

Column 33 - "Power Plant - General"

For complete information refer to T.O. 02-35GB-1 and 02-35GB-2.

Daily

Inspect engine cowling for security of attachment.
Excessive tightness of turnbuckle screws - T.O. 00-20A.
Inspect engine mount for security of attachment and exposed portions for general condition.

40 Hour

Inspect engine mount - T.O. 00-20A.
CAUTION: The primary purpose of - T.O. 00-20A and 01-1-58.
Inspect the cylinders - T.O. 00-20A.
Check tightness of cylinder hold-down nuts.
Inspect for general condition of "Lord" bushing in engine ring cowling former support bracket assemblies.

Make certain that all lines, conduit, controls, etc., are properly supported by means of clamps and protected against chafing.

120 Hour (Every third 40-Hour inspection): - Inspect the crank shaft breather screen for clearness - T.O. 02-35GB-2.

Column 34 - "Cockpits and Cabins"

Daily

See that the pilot's cockpit and the observer's, auxiliary pilot's and gunner's stations are clean and that there are no loose articles that may jam the controls or interfere with the operation of the airplane.

See that the sliding sections of the cockpit enclosure operate freely and are secure.

Check for proper operation of gunner's hood operating mechanism from gunner's station, from auxiliary pilot's station, and from outside fuselage. See that hood is secure and in good condition.

Check sand bags or other ballast for proper stowage. Refer to Column 16 - "Preflight", of this Handbook.

Ascertain that hand fire extinguisher, signal pistol and cartridges, life preserver cushions, life preserver, life raft, attachable parachutes, bilge pump, etc., are in good condition and securely stowed in their proper positions.

20 Hour

Inspect seats - T.O. 00-20A.
Inspect safety belts - T.O. 03-1-2 and 00-20A.

Inspect windshield, gunner's hood, fixed and movable sections of enclosure, and windows at observer's station - T.O. 00-20A.

Clean cockpit enclosure tracks, camera door and gunner's hood operating mechanisms. Lightly coating rollers and inner surface of enclosure tracks with parafin wax, Spec. 2-63B, is permissible. Do not lubricate enclosure tracks with grease or oil, which would attract foreign matter, with the resultant tendency to cause malfunctioning and increase wear.

Lubricate camera door operating chain with oil, Spec. 2-27.

Operate the cockpit enclosure, emergency panel release latches, and push panels free to ascertain that release mechanisms function properly and that panels are free.

Inspect the cockpit heating and ventilating system ducts and valves for general condition, security of attachment and proper operation. Ascertain that there is no leakage in the system.

Inspect condition of latches and hinges on back rests at auxiliary pilot's and gunner's stations. Make certain they operate freely. Lubricate if necessary by applying parafin wax, Spec. 2-63B, to latches and oil, Spec. 2-27, to hinges.

Make certain protective rubber strip is cemented to rear of gunner's seat back.

40 Hour

Inspect rubber sealing strip, located in forward frame of front movable section of cockpit enclosure, for deterioration.

Lubricate camera door operating tubes with grease, soft, Spec. VV-G-671.

Lubricate flexible gun muzzle stowage latch, gun rack adjustment tube and adjustment lock plunger with grease, soft, Spec. VV-G-681.

Lubricate fixed gun trunnion and mounting post release mechanisms with oil, Spec. 2-27.

Lubricate seat adjustment tubes and adjustment lock plungers with graphite grease, soft, Spec. VV-G-671.

Column 35 - "Flight and Navigation Instruments" (All instruments except engine instruments, Column 26.

Daily: - Daily inspection is specified as "Preflight, Column 16".

40 Hour

Lubricate bank and turn indicator - T.O. 05-20-2.

Clean screens in bank and turn, turn, and flight indicators.

Check vacuum pressure and static lines - T.O. 00-20A.
Inspect venturi and pitot static heads - T.O. 00-20A.
Check altimeters for proper setting.
Inspect drift meter (if installed) - T.O. 00-20A.
Check instrument boards - T.O. 00-20A.

Check bonding of boards, lines and instruments.

NOTE: Also see T.O. 05-1-1 and the handbooks or other Technical Orders covering the particular instruments.

Inspect all instruments - T.O. 00-20A.
Clean holes in airspeed head - T.O. 00-20A.

Clean and check airspeed lines. Access to static and pressure wells provided for draining the airspeed lines is made through the right wing joint cover plate at the leading edge. An additional static well is located in the forward portion of the observer's station. Static lines are identified by a band consisting of a black stripe and a light green stripe, and by the letter "S" stamped on connecting fittings. Pressure lines are identified by a single band of black, and by the letter "P" stamped on connecting fittings.

Check altimeters as specified in T.O. 05-20-10.

Inspect landing gear and flap position indicator instrument.
Refer to T.O. 05-55A-2.

SPECIAL:

80 Hour: - Check bank and turn indicators (T.O. 05-20-2).

120 Hour: - The fuel gauges of the O-47B Airplane are of the liquidometer type, except for the float type gauge used on the front fuselage fuel tank. Inspect both gauges as specified in T.O. 00-20A. Also see T.O. 05-65A-1.

NOTE: Seal gaskets of tank unit with "Parker Sealube".

Compensate compasses as specified in T.O. 05-15-1.

240 Hour: - Check bank and turn indicator - T.O. 05-20-2.

480 Hour

Rate of Climb Indicators (T.O. 05-20-11).
Bank and Turn Indicators (T.O. 05-20-2).
Altimeters (T.O. 05-20-10).

Column 36 - "Flight Control Mechanism"

Daily: - Inspect for freedom of operation.

20 Hour

Inspect rudder pedals - T.O. 00-20A.

Inspect entire rudder control assembly - T.O. 00-20A. For correct cable tension and adjustment, refer to following paragraphs a. and c., respectively.

During inspection, clean and lubricate each rudder and brake pedal assembly in the pilot's cockpit at three (3) zerk fittings with medium grade cup grease, Spec. VV-G-681.

Inspect entire stick control assembly as specified in T.O. 00-20A. For correct cable tensions and adjustment, refer to following paragraphs a., b., and d., respectively.

Stowage socket for auxiliary pilot's control stick is located on rear wall of station at the right side.

Trim Tab Control Mechanism: - While the mechanism is being operated from the pilot's cockpit, inspect for:

Freedom of operation.

Correct indication of control dial pointers.

Condition of cables, pulleys and fairleads.

Proper tension of cables. For correct cable tension and adjustment of trim tabs, refer to following paragraphs a. and e., respectively.

Lubricate the left aileron, rudder and elevator trim tab drums with medium grade cup grease, Spec. VV-G-681. An access door to the zerk fitting provided on each drum is located directly forward of each trim tab, in the leading edge of the control surface.

Flap Control Mechanism: - Inspect as prescribed in T.O. 00-20A. For instructions pertinent to the hydraulic system, refer to Column 43, of this Handbook. For flap and position indicator adjustment, refer to following paragraph f.

Flight Control Linkage: - Inspect as prescribed in T.O. 00-20A.

40 Hour - "Lubrication"

After all accessible parts are wiped clean, lubricate clevis bolts and clevises at ends of aileron, elevator, and rudder control cables as required with lubricating oil, Spec. 2-27.

Lubricate plunger on surface control lock mechanism by applying a small amount of graphite cup grease, Spec. VV-G-671.

Lubricate lock plunger on auxiliary pilot's control stick by applying a small amount of graphite cup grease, Spec. VV-G-671.

a. Cable Rigging Loads: - The initial tensions of the control cables should be maintained as follows: -

Aileron control cables	-	40-60 pounds
Rudder control cables	-	*40-60 pounds
Elevator control cables	-	40-60 pounds
Trim Tab control cables	-	15-30 pounds
Tail Wheel control cables	-	40-60 pounds

* - Except cables from tail wheel control bellcrank to rudder, which shall be 80-100 pounds.

b. Aileron Adjustment: - Prior to adjusting aileron, lock surface controls. Then make certain bellcrank, located just forward of center aileron hinge, is approximately parallel with center line of fuselage when aileron is positioned in alignment with the wing. If necessary, adjust aileron actuating rod to obtain this position. Prior to connecting cables to aileron bellcranks, unscrew cable turnbuckles located aft of landing gear wheel wells to obtain ample thread space for this and future adjustments. Cable turnbuckles are accessible through inspection doors in aft wall of landing gear wheel well. Attach aileron cables to adjustable links on bellcrank as required to compensate for variation in cable lengths and to position center line of aileron trailing edge approximately 1/8 of an inch below center line of wing trailing edge. Adjust cable turnbuckles to obtain the above droop and the tension specified in foregoing paragraph a. Stops are provided on a horn assembly attached to the aileron torque tube, directly below the pilot's seat, for limiting the aileron travel. Unlock surface controls and adjust these stops to limit the aileron travel to an angular movement of 21-1/2° (degrees) up and 13-3/4° (degrees) down. Check to make certain correct adjustment and cable tensions have been obtained and that turnbuckles, stops, etc., are safetied. Rein-stall all access doors and cover plates.

c. Rudder Adjustment: - Prior to adjusting the rudder, make certain stops provided on rudder pedal connecting tubes are adjusted so that they will engage with the surface control lock mechanism when the latter is in the locked position. With controls locked, the rudder should then be rigged for the neutral position, in alignment with the vertical stabilizer. Rudder cable turnbuckles are accessible through a hinged, Dzus fastened door at left side of fuselage, just forward of tail surfaces. Adjust turnbuckles to obtain the neutral position of the rudder and the cable tension specified in foregoing paragraph a. Stops are provided on brackets bolted to the fuselage structure,

just forward of the auxiliary pilot's rudder pedals, for limiting the rudder travel. Unlock surface controls and adjust these stops to limit the rudder travel to an angular movement of 35° (degrees) to the left and 35° (degrees) to the right. Check to make certain correct adjustment and cable tensions have been obtained and that turnbuckles, stops, etc., are safetied.

d. Elevator Adjustment: - The elevator should be rigged for an initial setting of 5° (degrees) above the neutral position when the control stick is positioned slightly aft of the vertical neutral position. Elevator cables are accessible through a hinged, Dzus fastened door at left side of fuselage, just forward of tail surfaces. Tighten turnbuckles to obtain the above setting and the cable tension specified in foregoing paragraph a. A stop is provided in each cockpit on the end fitting of the aileron control torque tube for limiting the elevator travel. With reference to the horizontal stabilizer, adjust these stops to limit the elevator travel to an angular movement of 30° (deg.) up and 20° (degrees) down, (25° above and 25° below the initial setting, which is 5° above the stabilizer). A minimum hand clearance of 1-7/8 inches must be maintained between auxiliary control stick and instrument panel.

e. Trim Tab Adjustment: - The elevator and aileron trim tabs should be rigged for the neutral position, in alignment with their respective control surfaces, when the position indicator arms at control wheels are pointing to zero. The rudder trim tab should be rigged for an initial setting of 5° (degrees) to the left when the position indicator arm at control wheel is pointing to zero. Adjust trim tab cable turnbuckles to obtain the tension specified in foregoing paragraph a. Adjustable stops are provided on all trim tab control cables. Access to cable stops is made through inspection door located on left side of fuselage, just forward of leading edge of the wing and below forward end of control shelf in pilot's cockpit. Set stops to limit the travel of trim tabs as follows: -

Aileron Trim Tab	-	12° Up and 12° Down
Elevator Trim Tabs	-	10° Down and 8° Up
Rudder Trim Tab	-	10° Left and 10° Right of initial setting (5° to Left)

f. Flap and Position Indicator Adjustment: - With hand hydraulic pump, operate flap controls to obtain position of actuating mechanism relative to the up position of the flaps. If flap panels are not connected to the operating cylinders, clamp flaps in the up position and adjust flap push-pull rods as required to align holes at points of attachment to actuating cylinder piston ends. Bolt push-pull rods to piston ends with AN4-11 bolts, and secure with nuts and cotters. Tighten lock nuts on push-pull rods and check for proper operation of flaps. To gain access to flap position indicator transmitter operating arm, located on flap panel center connecting tube, it is necessary to remove the inspection door on the forward wall of baggage compartment. To

adjust, rotate arm as required to obtain the correct indication on the instrument in the pilot's cockpit. When the correct indication is obtained, tighten operating arm clamp around torque tube. Again operate flaps to make certain that full and free movement has been obtained and the correct position of the flaps is indicated throughout their range of travel. See Figure 16.

Column 37 - "Flight Control Surfaces"

Daily

Inspect all surfaces for holes or other visible damage, and for general condition.

10 Hour

Inspect for the presence of foreign matter in the aileron and elevator trim tab hinge gaps.

20 Hour

Inspect ailerons, elevators and rudder - T.O. 00-20A. Also see that grommet drains on ailerons and elevators, and drain holes at bottom of rudder, are open.

Inspect horns and hinges - T.O. 00-20A.

Inspect flaps - T.O. 00-20A. Also see that all moving parts are free from foreign matter; that flap panels close properly in the up position and that small felt pads located between wing and flap panels are in good condition and securely attached.

Column 38 - "Wings"

Inspection of wing interior, including flotation compartment, may be accomplished through the landing gear wheel wells, inspection doors and flotation access doors.

Daily

Inspect general condition of metal covering and ribs, as indicated by displacement of covering.

20 Hour

See that the small drain holes located on lower surface of wing are open.

40 Hour

Inspect wings and center wing stubs - T.O. 00-20A.

Inspect wing bolting angles - T.O. 00-20A.

When removing outer wing panel bolting angle cover assemblies, inspect Neoprene strips for damage and signs of deterioration, in which event they should be replaced. When replacing cover assemblies, make certain Neoprene strips are cemented to cover assemblies with rubber to metal cement, Spec. 26544.

a. Flotation Compartment: - Flotation compartments have been provided in the outer wing panels by the use of cement compound ("Running Board Cement", Western Auto Supply, Los Angeles, California) at all fillets and seams; rubber seals or aluminum casting seals at corners; and wicking where joggles, skin laps, shims, radii, etc., create sizeable holes or crevices. The compartments are interconnected through structural members that separate them by means of holes, so located that all compartments are vented and drained to the lowest point. Two vent tubes from the compartment in each wing are terminated at each side of the fuselage. It is important that these vent lines be kept open for venting when not in use. Water-tight access doors are provided in the lower surface of the wing for periodic inspection. Nine small drain screws are provided on the lower surface of each outer wing panel to provide a means for draining the flotation compartments at their lowest points. For boundaries of flotation compartments, refer to Figure 4, of this Handbook.

b. Inspection Covers: - When installing an access door wing retainer seal, Part No. 25-12615, coat seal with waterproof cement compound and allow to become tacky before pressing into bead around wing cut-out. Allow to dry for twenty-four hours before attaching door. When attaching door, make certain that a water-tight joint is obtained. Access door attaching screws and flotation compartment drain screws should be sealed by means of 25-12617 and 25-12618 washers, respectively.

c. Flotation Pressure Test: - To test the flotation compartments for water-tightness, adhere to the following procedure:

- (1) Insert screws in drain holes and plug bilge lines. Make certain that access doors are secure.
- (2) Connect lines from a test door to a water manometer and to a compressed air supply through a globe valve.
- (3) Induce air into compartment by means of globe valve until compartment pressure registers 10 inches of water.
- (4) Close valve and time drop from 10 inches to 3 inches of water. If time elapsed is less than 5 minutes, rebuild air pressure to 10 inches of water and maintain this pressure while testing for leaks with a soap solution.
- (5) In testing with soap solution, the following points should be tested in the following order:
 - (a) Drain Screws and Bilge Line Plugs
 - (b) Access Doors
 - (c) Flap Spar Castings

- (d) Outboard Rib at Station 251.886
- (e) End of Spars at bolting sections
- (f) Inboard Ribs at Stations 64.778 and 63.65
- (g) Machine Gun Bay
- (h) Landing Light Bay
- (i) Bellcrank Bay
- (j) Flap Cylinder Bay
- (k) Wheel Well Bay
- (l) Top & Bottom of Flap Spar between Flange & Skin
- (m) Skin Laps

- (6) Apply waterproof cement compound to all leaks and allow to set over night. Retest with pressure. If time of fall is 5 minutes or more, panel is satisfactory and all excess compound within one (1) inch of any interior seam shall be removed; no compound covering rivets, angles, retainers, etc., of any interior seam or joint shall be removed.

Column 40 - "Fuel Tanks"

Daily

Each time fuel is serviced to the tanks, drain the fuel system strainer and a small amount of fuel from the tank sumps by means of the drain cocks; sufficient to remove any accumulation of water or foreign matter present in the tanks. Access to front fuselage tank sump and fuel system strainer is gained through a door located on bottom of fuselage, immediately forward of front spar bulkhead. The rear fuselage tank sump drain cock extends through the fuselage bottom just forward of the baggage compartment. A drain cock extends through the lower surface of the center wing at each side of the fuselage for draining the two wing tank sumps.

Resafety drain cocks.

40 Hour

Inspect fuel tanks - T.O. 00-20A.

The tanks in the O-47B Airplane are not droppable.

250 Hour

Drain tanks, remove tank sumps and thoroughly inspect each tank and sump.

Clean tank as required.

The drain cock assembly, located in the aft end of each tank sump, is equipped with a corrosion resistant cartridge. Check contents of cartridge and refill with chemically pure sodium

chromate crystals as required. This is accomplished by removing plug assembly from sump and removing circular clip and retainer from top of cartridge.

NOTE: When reinstalling tank sumps, use new gaskets and seal with "Parker Sealube", or the equivalent.

Column 41 - "Empennage"

Daily

Inspect horizontal stabilizer and vertical fin for general condition - T.O. 00-20A.

40 Hour

Inspect horizontal stabilizer and vertical fins - T.O. 00-20A.

Inspect all attaching fittings - T.O. 00-20A. Access to horizontal stabilizer attachment points is gained by removing the fuselage to stabilizer fairing which is attached by means of screws.

Column 42 - "Tail Gear"

Daily

Inspect tail wheel - T.O. 00-20A.

Inspect air-oil shock absorber strut for evidence of leakage of fluid or loss of pressure. (T.O. 03-25E-1)

Inspect tail wheel assembly for external damage and see that tire inflation appears normal. See following paragraph a.

20 Hour

Inspect entire assembly - T.O. 00-20A. Service strut if necessary and lubricate as specified in following paragraphs b. and c., respectively. Inspect swivel release mechanism.

NOTE: In event excessive leakage of oil around strut packing gland nut has occurred, deflate strut until all air is released and strut is fully compressed. Remove gland nut locking wire and tighten gland nut as required, using adjustable spanner wrench, 53983. Replace lock wire.

40 Hour

Tail wheel roller bearings will be cleaned, inspected for condition and repacked at each fifth (5th) 40-Hour inspection (200 hours) - T.O. 03-25A-1.

Tire: Remove and inspect as specified in T.O. 04-10-2.

a. Tire Inflation: - The tail wheel tire should be inflated until the deflection marks on the tire are just touching the ground. Under normal loading conditions, this pressure will be approximately 30 lbs./sq.in.

b. Shock Strut Servicing: - The air-oil shock absorber strut should be refilled only when there is an indication of oil leakage. Inspect and service the Bendix pneudraulic shock absorber strut in accordance with T.O. 03-25E-1. Two hinged Dzus fastened inspection doors are provided on the left side of the fuselage to facilitate inspection and servicing of the strut. The strut should be filled with oil in accordance with T.O. 06-1-2 (Spec. No. 3586). Oil level in the strut should be up to the filler plug opening with the ship in three-point landing position. To inflate shock strut, remove valve cap and attach high pressure air hose to air valve so that joint is tight. With airplane in a three-point landing attitude, add air until extension shown in diagram (5-7/8 inches) is obtained after rolling the airplane forward. This distance can easily be measured from the upper edge of the piston surface to the upper end of the cylinder, or until the red line at upper end of tail wheel fork is flush with the lower edge of the tail wheel fairing. Check valve and filler cap for leaks and seat valve snugly with wrench.

CAUTION: Do not attempt to fill or accomplish any disassembly of an oleo strut when it is in the extended position. Completely deflate by depressing the valve stem until all air is released and strut is fully compressed.

c. Lubrication: - Lubricate tail wheel support assembly at eight (8) zerk fittings provided with medium grade cup grease, Spec. No. VV-G-681.

Lubricate tail wheel and rudder cable control bellcranks with medium grade cup grease, Spec. VV-G-681. A zerk fitting is provided on each bellcrank and is accessible through a hinged, Dzus fastened door on left side of fuselage, just forward of tail surfaces.

Column 43 - "Landing Gear, Including Hydraulic System"

Daily: - Inspect for general condition - T.O. 00-20A.

20 Hour

Inspect struts, braces and fittings - T.O. 00-20A.

Inspect shock unit - T.O. 00-20A.

Inspect air hole in lock pin socket for obstruction.

Lubricate as instructed in following paragraph b.

Refer to following paragraph c. for shock strut servicing instructions.

NOTE: In the event excessive leakage of oil around shock strut packing gland nut has occurred, it is first necessary to deflate strut until all air is released and strut is fully compressed. Remove gland nut locking wire and tighten gland nut as required, using adjustable spanner wrench, "Bendix", 53983. Replace lock wire.

Clean strainer screen located in bottom of hydraulic fluid reservoir.

Inspect for excessive leakage in hydraulic system. If excessive leakage has occurred in any unit of the hydraulic system, replace packing cups and/or washers and gaskets as required. For pertinent instructions and sealing part requirements, refer to Section IV, paragraphs 9.a, and 9.c., of this Handbook. For pressure testing and adjusting hydraulic units (the former must be accomplished whenever a unit is disassembled), refer to the following paragraph e.

40 Hour

Thoroughly inspect all landing gear attachment fittings, etc. - T.O. 00-20A. By means of outer wing jacking points, jack airplane from ground to permit thorough inspection and operation of landing gear.

Test functioning of landing gear retracting and lowering mechanism - T.O. 00-20A. Utilize hand pump and ground hydraulic pump unit, if available, as individual sources of power. Connect suction and pressure lines of ground pump unit with the airplane's hydraulic system, utilizing the "tee" fittings in engine pump suction and pressure lines. These "tee" fittings are located at forward right side of firewall, below battery shelf. The high pressure flexible line should be disconnected from the "tee" fitting, and that portion of the "tee" plugged.

Inspect to make certain rubber guards over landing gear warning switch box levers are in good condition.

Inspect landing gear retracting and lowering mechanism - T.O. 00-20A.

See that landing gear position indicator instrument indicates the correct position of the gear throughout its range of travel. Make certain green lights on instrument illuminates when gear is in "locked down" position and battery main line switch is "ON".

Check functioning and general condition of warning horn located in nose-over structure of airplane. With down position lock pins not in place, and battery main line switch "ON", close throttle to a position equivalent to approximately 1000 R.P.M. Warning horn should operate until lock pins are in place or throttle is moved forward. Refer to following paragraph for adjustment.

a. Landing Gear Warning Horn and Lock Pin Position Indicator

Adjustment: - In order to coordinate the landing gear warning horn and the down position lock pin position indicator lights with the landing gear struts, two spring loaded toggle switches are provided on the aft side of the front wing spar, immediately forward of each landing gear lock pin. The switches are actuated by means of an adjustable bracket located on the forward side of the landing gear lock pin and guide roller fitting. With landing gear in the locked down position and battery main line switch "ON", loosen lock nut on adjusting screw and turn screw as required to turn landing gear warning horn switch "OFF" and lock pin position indicator light switches "ON". The adjusting screw should then be turned 1/8 of an inch beyond the off position and then locked. The throttle control is interconnected with the warning horn by means of a spring loaded toggle switch located at throttle control bellcrank on upper left side of the firewall. Adjust fitting on throttle control bellcrank to operate toggle switch at a throttle position equivalent to approximately 1000 R.P.M. For landing gear position indicator adjustment, refer to Section IV, paragraph 6.a.(8), of this Handbook. Also see Figures 15 and 16

NOTE: Landing gear warning system may be released (horn "OFF") when landing gear is in the retracted position, by momentary contact of the landing gear warning horn release switch mounted on the upper left corner of the pilot's electrical control panel. This operation, with throttle switch located on forward side of firewall closed, electrically locks the relay in the open circuit position, turning the horn off. To reset the horn circuit the throttle is opened which in turn opens the throttle switch, releasing the relay and closing the horn circuit.

b. Lubrication: - After wiping all accessible parts clean, lubricate fourteen (14) zerk fittings, located on each landing gear torque arm, retracting cylinder linkage, rear strut and down position lock mechanism with medium grade cup grease, Spec. VV-G-681. Two of the zerk fittings are located on each landing gear operating cylinder head and are accessible from the auxiliary pilot's station only. It is important that the down position lock pin and lock recess be wiped free of grease and accumulated foreign matter prior to lubrication at the four (4) zerk fittings provided at that point. DO NOT over-lubricate lock pin zerk fittings. Slide tube fittings for landing gear fairing are equipped with an "oilite" bushing. Keep tubes clean and dry. If necessary, lubricate retracting mechanism linkage, up and down lock mechanisms, and other necessary parts sparingly with lubricating oil, Spec. 2-27.

c. Servicing Shock Strut: - Instructions for servicing the shock strut are engraved on a metal plate attached to the strut. Also refer to T.O. 03-25E-1, which contains detailed servicing instructions and additional information.

(1) Refilling Shock Strut: - The air-oil shock absorber struts should be refilled only when there is an indication of oil leakage. Always check and service strut with airplane in normal three-point landing position. Shock struts may be serviced through landing gear strut wells located in lower surface of wing. The combination filler plug and air valve is located near top of strut on the aft side. DO NOT remove plug on forward side of strut. The latter plug is provided only to accommodate the interchangeability of the struts. DO NOT attempt to fill or accomplish any disassembly of an oleo strut when it is in the extended position. Remove hex cap on air valve at top of strut. Slowly release all air from strut by depressing stem of valve core until all air is released and strut is fully compressed. Remove the filler plug and check the fluid level. The level of the fluid should be flush with the filler plug hole when the strut is fully compressed, and airplane is in a three-point landing position. Fill if required with fluid (Spec. 3586) in accordance with T.O. 06-1-2. Replace air valve body and gasket and seal with a wrench.

(2) Inflating Shock Strut: - To inflate strut, remove valve cap and attach high pressure air hose to air valve so that a leakproof joint is obtained. With airplane in a three-point landing position, inflate strut until extension shown on diagram, (3-5/8 inches), is obtained. This distance can easily be measured between the upper edge of the lower torque arm attachment bracket and the lower edge of the upper torque arm attachment bracket. Replace hex cap, which is a secondary seal, and seat with wrench to obtain a snug fit, but not so tight that the tin seat in the cap is forced inward, thereby depressing the valve core stem. Test valve core and seat around filler plug for leaks.

d. Filling Hydraulic Fluid Reservoir: - With airplane in normal three-point position, fill reservoir until fluid overflows from filler neck. Filler plug is located in leading edge of left center wing stub, adjacent to fuselage. Total fluid capacity of the reservoir when airplane is in the normal three-point landing position is 1.40 gallons. A standpipe, incorporated in the reservoir, provides a reserve of 0.66 gallons for hand pump operation. Hydraulic fluid (Mineral Oil, Spec. 3580) shall be used in the landing gear and flap hydraulic system. Refer to T.O. 06-1-2.

CAUTION: Mineral Oil, Spec. 3580, is to be used in the O-47B landing gear and flap hydraulic system. DO NOT use diacetone alcohol and castor oil, as used in the O-47A Airplanes.

The hydraulic fluid reservoir may be drained by removing the plug and strainer located in bottom of tank. To gain access to drain plug, remove the Dzus fastened inspection door located on lower surface of center wing leading edge.

e. Pressure Testing and Adjusting Hydraulic Units:

(1) General: - Whenever a hydraulic unit is disassembled, parts repaired, or sealing mediums replaced, it shall be pressure tested for leaks, tested for proper functioning, and certain units shall be readjusted. Some units may, in addition to the adjustment after disassembly, require readjustments while they are in service in the airplane. Information pertinent to pressure testing, adjustment after disassembly and readjustment while in service is incorporated in the ensuing paragraphs. Pressure testing requires a high pressure pump (capacity 2500 lbs./sq.in.) pressure gauge (3000 lbs.), fluid reservoir and the necessary lines and fittings.

In the following test instructions, the expression "Apply test pressure" shall include all of the following procedure: - Apply a pressure of 2500 lbs./sq.in. at the port indicated. If the pressure shows a slight tendency to fall off during the first half-minute, recharge to 2500 lbs./sq.in. Then allow unit to stand for 15 minutes, at the end of which time there should be no reduction of pressure evident. If the pressure has fallen off during this period, inspect unit for leaks.

NOTE: Special care must be taken when adjusting a hydraulic unit installed in the airplane to prevent unintentional retraction of the landing gear.

(2) Engine Driven Hydraulic Pump:

(a) Testing: - In the event that slow action in operating the hydraulic system cannot be traced to malfunctioning of

other units of the system, the engine driven hydraulic pump is probably at fault due to excessive wear. Remove pump and test at 3000 R.P.M. for output of 2.1 gals./min. and a pressure of 800 lbs./sq.in. For additional instructions concerning the 3869-L Eclipse pump, refer to Technical Orders of 03-30CA Series.

(3) Pressure Control Valve:

(a) Adjusting: - The pressure control valve requires adjustment after disassembly for any reason and may require adjustment while in service in airplane. The time required for disengagement of time lag pressure control valve for a given setting will vary with temperature of hydraulic system, being less when system is warm and vice versa. Therefore, it may be necessary to adjust valve for summer and winter operation. In either case, adjustment should be made with valve installed in airplane. It is necessary either to connect a ground test hydraulic pump into the system or to run the engine. When checking time of engagement of valve, the system shall be warm (approx. 100°F) but not hot. The power control may remain engaged as long as ten minutes the first time it is engaged in very cold weather. Such a condition is not undesirable under the circumstances.

The adjustment of the pressure control valve is obtained by loosening lock nut at bottom of pressure control knob and adjusting knob to the length of stroke desired. For maximum time lag adjustment, knob may be unscrewed until $3-23/32$ inches (disengaged) is measured from control shelf to top of control knob. For minimum time lag adjustment, screw knob down until $3-7/32$ inches (disengaged) is measured from control shelf to top of control knob. The desired time lag is 1 to 2 minutes with a pressure of 1000 lbs. on hydraulic system pressure gauge, located on pilot's instrument panel.

If, after adjusting valve stroke as outlined above, control disengages under one minute or over two minutes, remove valve from control shelf, completely disassemble, and inspect all parts for damage or deterioration. Thoroughly clean all parts with white gasoline, giving special attention to chamber and metering pin, located under plug on upper side of valve. Replace sealing parts as required. Refer to Section IV, paragraph 9.c.(2), for part requirements. Reassemble valve and test as follows: -

(b) Testing:

1. "Apply test pressure" at pressure inlet port, located on side of valve on center line of control plunger, with two lower ports plugged.
2. Plug pressure outlet port located on side of valve near bottom and apply motor pump pressure of 1000 lbs./sq.in. at pressure inlet port, located on side of valve on center line of control plunger. Engage power control. Leakage from return port located at bottom of valve must not be in excess of three-quarters ($3/4$) of a pint per minute.

3. Apply motor pump pressure of 1000 lbs./sq.in. at pressure outlet port, located on side of valve near bottom. Combined leakage at the return and pressure inlet ports must not exceed 5 cu.in./minute.
4. With control engaged, a flow of 2 to 2.5 G.P.M., in at pressure inlet port located on side of valve on center line of control plunger and out at pressure outlet port located on side of valve near bottom, should produce 55 to 85 lbs./sq.in. back pressure.
5. If above test proved successful, reinstall valve in airplane and adjust time lag. See foregoing paragraph (a).
6. If, after adjusting knob as in foregoing paragraph (a), time required for disengagement is still unsatisfactory, the metering pin should be replaced or reworked. If time lag is greater than desirable, the pin may be hand finished to a slightly smaller diameter to allow faster leakage. On the other hand, if time lag is less than desirable, the pin must be replaced by one of a greater diameter. If no new pins are available, the diameter may be increased slightly by tinning the pin.

(4) Pressure Relief Valve:

(a) Testing: - Apply 500 lbs./sq.in. pressure at side port with end port plugged. Inspect for external leaks.

(b) Adjusting: - This valve, which is effective for the hand pump output as well as the engine pump, requires adjustment after disassembly for any reason, and may require readjustment while in service. In either case, adjustment should be made with valve installed in the airplane. It is necessary either to connect a ground test hydraulic pump into the system or to run the engine. If engine is used, minimum R.P.M. shall be 1200. The normal output of the engine driven hydraulic pump used on the airplane is 2 gals./minute. The ground test pump unit used should have a capacity of at least 1 to 2 gals./minute in order to simulate actual operating conditions of the airplane. To adjust relief valve, loosen lock nut and turn adjusting screw to obtain desired relief at 1000 lbs./sq.in. Adjust bolt in to raise and out to lower pressure. Test functioning of relief valve by holding pressure control down until relief valve functions. Note pressure reading on gauge on pilot's instrument panel. When above relief pressure is obtained, tighten lock nut.

(5) Testing Hydraulic Hand Pump: - Connect a 1/2 inch line from end port of pump to a reservoir tank containing hydraulic fluid and located approximately 2-1/2 feet below the pump. Care should be taken to see that test line and fittings are tight. With side port open, operate pump handle. The number

of full strokes required for pump to prime itself should not exceed 150. When a full flow of fluid is obtained and lines are cleared of all air, check output of pump, which should be 100 cu.in. for 100 strokes (200 - 1/2 strokes) at the rate of approximately 100/minute. The non-adjustable piston stroke is 1-1/8 inches. Test pump for leakage with 1/2 inch line still attached. Position pump handle so that pump piston is extended and "apply test pressure" to side port. An appreciable reduction of pressure with no external leaks evident indicates leakage of the one-way valve located at the suction end of the pump.

(6) Testing Landing Gear and Flap Selector Valve: - The ports of the landing gear and flap selector valve are not identified by markings on the valve body. In order to simplify reference to the four (4) ports of the valve, the ports shall be designated by numbers as follows and should be marked accordingly prior to testing: - (See Figure 18.)

Port No. 1 - Shall be that port which is on the "return" port side of the valve and nearest to the plunger bridge end of the valve.

Port No. 2 - Shall be that port nearest to port No. 1.

Port No. 3 - Shall be that port which is on the "return" port side of the valve and farthest from the plunger bridge of the valve.

Port No. 4 - Shall be that port nearest port No. 3.

1. "Apply test pressure" at port marked "supply" with all other ports open and the plungers in neutral. (Neutral position is 1-9/16 inches measured from face of forging to center line of pin hole in plunger bridge.)

2. "Apply test pressure" as above with ports No. 1 and No. 2 plugged and other ports open, and with plungers pulled fully out.

3. "Apply test pressure" as in procedure 1., with ports No. 3 and No. 4 plugged and all other ports open, and with plungers pushed fully in.

4. "Apply test pressure" at port No. 1, with all other ports open and plungers pulled fully out.

5. "Apply test pressure" at port No. 2, with all other ports open and plungers pulled fully out.

NOTE: When reassembling selector valve, note that the two springs located in lower portion of valve are similar but not identical. An inspection of the two springs will disclose that spring, Part No. 25-58184, is the stronger of the two and this spring must be installed in the flap side of the valve. This side of valve is opposite return port side of valve.

(7) Testing Landing Gear Operating Struts: - "Apply test pressure" at one end of swivel head pin and then at the other, in each case leaving port not being tested open. A total stroke of 15-11/16 inches is required for landing gear retraction.

(8) Flap Operating Struts:

(a) Testing: - "Apply test pressure" alternately at each of the two ports, having port not being tested open. A total stroke of 2-13/16 inches is required to operate the flaps through the 45° (degree) range of travel.

(9) Fluid Reservoir:

(a) Testing: - Apply 5 lbs./sq.in. air pressure to any one of the four ports, with the remaining three ports plugged. Immerse in water and check for leakage.

(10) Thermal Expansion Relief Valves:

(a) Testing: - To test either valve for external leakage, "apply test pressure" to any one port with remaining port or ports plugged. In the event leakage develops around aluminum plugs, Part No. 25-58199, they should be replaced with steel plugs.

(b) Adjustment: - These valves require adjustment after disassembly for any reason. Should they improperly function on the ship they should also be readjusted. Remove valve or valves from airplane and adjust, using equipment described in foregoing paragraph e.(1)

To check landing gear relief valve, (N.A.A. Dwg. No. 25-58195) for proper relief pressure, apply hydraulic fluid pressure at any one port, with port directly across from it plugged. Slowly increase pressure and note pressure at which valve relieves. The correct relief pressure is from 1600 to 1800 lbs./sq.in. at a leak flow. If this pressure is not obtained, remove hydraulic pressure and then remove hex plug on the opposite side from that to which pressure was applied. Adjustment is then obtained by adding or removing B985-14-10-31 washers under hex cap nut, as required. Adding washers raises the pressure at which the valve will function and removing washers will lower the pressure. Repeat the above procedure until desired relief pressure is obtained. Repeat entire procedure on other side of the valve.

To check wing flap relief valve (N.A.A. Dwg. No. 25-58196) for proper relief pressure, apply hydraulic fluid pressure at either port farthest from hex plug, with port directly across from it plugged. Slowly increase pressure and note pressure at which valve relieves. The correct relief pressure is from 1600 to 1800 lbs./sq.in. Adjustment of the wing flap relief valve is obtained in the same manner as the landing gear relief valve adjustment outlined above.

(11) Testing Check Valve (Parker 6ANVCT-CHK-S): - Test assembly for leakage by applying 1500 lbs./sq.in. hydraulic fluid pressure at side port, with end port open. Inspect to make certain there are no external leaks in valve body or at open port.

(12) Pressure Gauge Snubber (Parker 4PSGGXX):

(a) Testing: - "Apply test pressure" at either port with remaining port plugged.

(b) Adjusting: - Add, remove, or replace pins under hex cap in order to procure proper action of gauge; that is, the gauge should be snubbed sufficiently to prevent flutter of the gauge needle and yet not require over approximately three seconds to show pressure after pressure control is engaged. It is to be noted that after gauge line has been disconnected at any point, it should be bled to free it of air. To do this, remove one screw from adapter joining the flexible line and the pressure gauge. Using hand pump, allow flow from screw hole until the flow is free of air bubbles. Replace and lock-wire screw.

(13) Testing and Adjusting Landing Gear Restrictor Valve: This valve should be checked for correct restricted flow. Apply a pressure of 400 - 500 lbs./sq.in. at the hexagon end of the valve. At this pressure the flow through the valve should be two (2) gallons per minute. If the above flow is exceeded, the internal pin, 36-58017, should be replaced, in which case it may be hand finished to give the required flow.

Column 44 - "Wheel and Brakes"

For complete instructions on service and maintenance of Bendix wheel and brake assemblies, refer to T.O. 03-25C-2.

Daily

Inspect wheels - T.O. 00-20A.

Inspect wheel fairing - T.O. 00-20A.

Keep wheel fairing free of mud.

Inspect tires for proper inflation (T.O. 04-10-1). Refer to following paragraph a.

20 Hour

Make inspection of brakes and brake control assembly - T.O. 00-20A and 03-25C-2.

Brakes should be adjusted - T.O. 00-20A.

Check brake hydraulic system for entrapped air; refer to ensuing paragraph e., for instructions pertinent to bleeding the brake system.

CAUTION: Brake pedals should be adjusted - T.O. 00-20A.

Check fluid level in master brake cylinder; see following paragraph b.

Inspect hydraulic lines and connections - T.O. 00-20A.

If excessive leakage occurs at the master brake cylinder, replace sealing mediums as required. Refer to Section IV, paragraph 10.b. of this Handbook. After replacing sealing mediums or otherwise disturbing cylinder, it must be pressure tested as outlined in ensuing paragraph d.

40 Hour

Inspect wheels - T.O. 00-20A.

Remove wheels and inspect brake drums - T.O. 00-20A.

Inspect entire assembly - T.O. 00-20A.

Tires: Every 40 Hours - Remove and inspect - T.O. 04-10-2.

Clean, inspect and lubricate roller bearings - T.O. 03-25C-2;

(See Figure 2, page 20).

Inspect brake mechanism - T.O. 00-20A.

Inspect all brake cables, cable guides and pulleys - T.O. 00-20A.

Reinstall wheels and adjust brakes - Refer to T.O. 03-25C-2.

Star adjustment locking clip on O-47B brake assemblies has been moved from outboard side of brake to inboard side. Adjustment of brakes may be accomplished by removing dust pan on wheel and reaching through to star adjustment with long shanked screw-driver.

a. Tire Inflation: - Landing gear tires should be inflated until the deflection marks on the tires just contact the ground when the airplane is in a three-point position on hard, level ground. Under normal loading conditions, this pressure will be approximately 30 lbs./sq.in.

b. Filling Brake System Reservoir: - Check level of fluid in master brake cylinder reservoir located on the forward side of the firewall, near the top. Access to the reservoir is gained by removing the upper section of the removable engine compartment cowl. Remove filler plug on forward side of reservoir and if necessary fill reservoir to overflowing with fluid conforming to (Spec. 3586) T.O. 06-1-2. While checking and filling fluid reservoir, ascertain that parking brakes are disengaged.

CAUTION: DO NOT use mineral oil in the brake hydraulic system.

c. Draining Brake System: - To drain the brake hydraulic system, it is necessary to disconnect brake line at fitting on each brake assembly and place end of each line in a suitable receptacle. Then slowly pump brake pedals until fluid leaves the system.

d. Testing Master Brake Cylinder:

(1) General: - Testing the master brake cylinder requires certain auxiliary equipment and preparations as follows: -

One special handwheel fitting, see page 50, Detail "A".
One 2000 lb./sq.in. hydraulic pressure gauge.
One small ball check one-way valve.
One auxiliary reservoir - desirable but not necessary.
One suitable receptacle.

(2) Procedure: - Each half of the master cylinder should be tested separately, as follows: -

(a) Attach one-way valve and special fitting, less sleeve, as shown on right side of brake cylinder illustration, page 50.

(b) Fill reservoir with fluid. Refer to 40-Hour inspection, paragraph b., of this Column. Care should be taken to keep reservoir filled during all the ensuing tests.

(c) Pull right piston in and out by hand to free test system of air and to make certain cylinder will pump fluid through one-way valve and out into receptacle. To begin with, use a full stroke and allow piston to extend fully against its stop. When it will pump properly with a full stroke, use only partial strokes, not allowing piston to fully extend or retract. It should also act as a pump when operated thus. It will, however, only give an output of fluid in either case on the out stroke of the piston and not when the piston is retracting.

(d) Next, remove the one-way valve and install gauge in its place. Also install sleeve to handwheel as shown on the left side of brake cylinder illustration, page 50. The fitting at the gauge should be left loose in order to allow leakage. Pull the piston out to allow any air to leak out around the gauge fitting, then tighten same.

(e) Turn handwheel counter-clockwise to allow piston to fully retract, then turn clockwise to tighten handwheel until 1200 lbs./sq.in. is indicated on gauge. Allow to stand five minutes and if any small loss of pressure is indicated, inspect for any visible leakage in cylinder or gauge line. If no leaks are in evidence, but a small pressure loss is indicated, simply turn handwheel clockwise until 1200 lbs./sq.in. is again indicated and allow to stand for one-half hour. No loss of pressure should be evident at the end of this time. The possible light loss of pressure after the first five minutes is normal, due to parts settling into place.

(f) To check for proper release of piston valve, turn wheel counter-clockwise in order to retract piston. The pressure

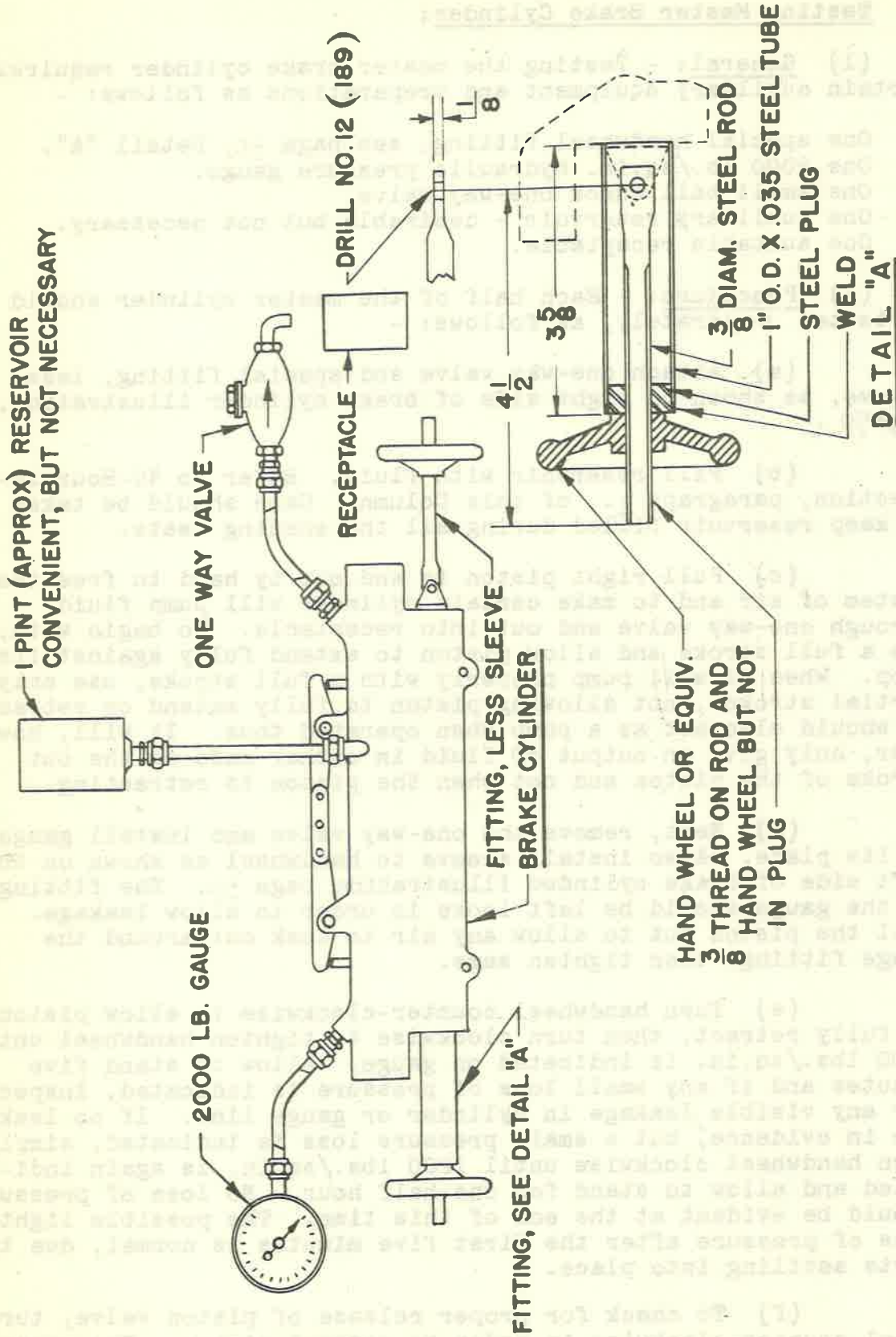


FIGURE 3 - TEST EQUIPMENT - MASTER BRAKE CYLINDER

should decrease as the wheel is backed off, and when the piston nearly reaches its full retracted position, the pressure should fall off rapidly and completely.

(g) Turn wheel counter-clockwise to allow piston to fully retract and bottom. Push down on parking brake valve. Turn handwheel clockwise until 1200 lbs./sq.in. is indicated. Then, still holding down parking brake valve, turn handwheel counter-clockwise until it is free; remove hold on parking brake valve. The gauge should now continue to read 1200 lbs. Allow to stand for one-half hour, at the end of which time no reduction of pressure should be evident.

(h) Next check for release of parking brake. With the parking brake engaged and pressure applied as under procedure g., turn handwheel clockwise. Two or three turns of wheel after it begins to tighten should snap out the parking brake valve, and the pressure should drop as the wheel is turned counter-clockwise.

(i) Repeat entire procedure for the other side of the cylinder.

e. Bleeding the Brake System: - Whenever the hydraulic line connecting the master cylinder to the wheel brake cylinder is disconnected, air will be admitted to the system and the line must be bled to remove the air. This same condition may develop if the fluid reservoir in the brake cylinder becomes empty. Air in the line may be determined by the action of the brake pedals. If the brake pedal has a spongy action when applying the brake, the cause may be due to air compressing in the system. It will be noted that there are two fittings on each brake actuating cylinder; that is, the inlet fitting and the bleeder. The bleeder is a needle valve with a cap or dust cover on the end. To bleed the line, proceed as follows: -

1. Fill the reservoir with fluid, see 40-Hour inspection, paragraph b., of this Column. During the bleeding operation it will be necessary to check the fluid level in the reservoir several times, never allowing it to become empty.
2. Remove the screw from the bleeder fitting.
3. Unscrew the bleeder valve one-half turn.
4. Prepare a piece of rubber tubing at least 14 inches long. Slip one end of tubing over end of bleeder fitting, allowing free end to hang in a receptacle.
5. Operate brake pedals back and forth slowly, which pumps fluid out of the reservoir and through the system. Pull out on parking brake knob while working pedals. Continue this operation until fluid from hose connection on bleeder is free of air bubbles. At least one pint of fluid must be pumped through the system before all air is removed.
6. Close bleeder fitting tightly and install dust cover screw.
7. Check fluid level in reservoir, adding fluid if necessary.

Column 45 - "Fuselage"

Daily: - Inspect fuselage - T.O. 00-20A.

40 Hour

Inspect all accessible parts - T.O. 00-20A.

Make certain small drain holes in bottom of fuselage are open.

Inspect Neoprene weathering strips cemented to fuselage around instrument inspection doors, flexible gun trough cover and baggage compartment for deterioration and security of attachment. Use talcum to prevent strips from sticking to doors. Use rubber to metal cement, Spec. 26544, to secure loosened strips.

Column 46 - "Night Flying Equipment"

Daily

Inspect functioning and condition - T.O. 00-20A. Make certain cockpit extension lights operate freely.

Inspect flare holders and release mechanism for security of mounting and general condition.

20 Hour

Remove and inspect installed flares - T.O. 00-20A and 11-15-1.

Check flare carrying and release mechanism for proper operation.

NOTE: In case of appreciable deterioration - T.O. 00-20A.

Column 47 - "Airplanes - General"

Daily

On completion of each day's flying, thoroughly coat de-icer rubber covered propeller spinner with oil, de-icer, B.F. Goodrich, No. 114-JR186.

Check attachable parachute for general condition and serviceability every 10 days (T.O. 13-5-1).

Check condition of airplane static ground wire installed near tail wheel, (T.O. 01-1-5).

Fire Extinguisher (carbon tetrachloride):

Inspect installed fire extinguisher - T.O. 03-45-1 and 00-20A. Replace a leaking extinguisher.

Anti-Icer and De-Icer Equipment (T.O. 03-35A-1, 03-35A-2 and 03-35B-1): - Refer to paragraphs a. and b., of this Column, for de-icer and anti-icer adjustment instructions.

A drain cock is located in the anti-icer fluid line from tank to metering pump and may be used when draining the de-icer pump and storage tank. The cock is accessible through a Dzus fastened door at right side of fuselage, immediately forward and below wing leading edge.

During engine warm-up - T.O. 00-20A.

Air Rafts: - Inspect air rafts - T.O. 03-55A-1 and 00-20A.

20 Hour

Check de-icing equipment - T.O. 03-35B Series and 00-20A.

40 Hour

Inspect air rafts - T.O. 03-55A-1 and 00-20A.

Inspect anti-icer pump - T.O. 03-35A-1 and 00-20A.

Six Months: - Inspect air raft - T.O. 03-55A-1 and 00-20A.

SPECIAL

Check carbon tetrachloride fire extinguisher - T.O. 03-45-1 and 00-20A.

NOTE

When necessary, wing walkways will be replaced as instructed in T.O. 01-1-18.

a. De-Icer System Adjustment: - In the event that adjustments are to be made without engine running, a means should be devised to supply approximately the total free air capacity of the system at a pressure of not over 10 lbs./sq.in. Disconnect vacuum line at exhaust or pressure side of vacuum pump and connect air supply to line so that it will pass through conventional type oil separator before entering the other units of the de-icer system. Also connect a pressure gauge to oil separator. Access to separator is obtained through a Dzus fastened door, located in right side of fuselage, just forward of wing leading edge. Remove plug at rear of separator and install pressure gauge. Turn battery main line switch "ON". Turn de-icer control dial assembly, located on control shelf at right side of pilot's cockpit, "ON". If excessive pressure is built up, the system should be turned "OFF" immediately. The relief valve in bottom of oil

separator is set to open at 7 lbs./sq.in. pressure, but cannot be relied upon to handle large volumes of air. It is therefore advisable to begin test with a small volume of air, gradually working up to 7 lbs. pressure. If pressure does not build up properly in system, check for loose connections and other conditions which would cause loss of pressure. The pressure gauge will fluctuate with the various phases of the inflation cycle, but it should indicate not less than 6 lbs. or more than 7 lbs., as each group of tubes is fully inflated. A complete cycle takes place approximately every 40 seconds, therefore a peak should be noted every 8 seconds. The de-icer operating pressure may be increased or decreased, respectively, with a clockwise or counter-clockwise adjustment of the relief valve adjusting screw. However, no adjustment should be made until all other possibilities of pressure variation have been eliminated. If de-icer action is sluggish, check lines leading to affected tubes for restriction or congealed oil. All air lines should be kept clean and unrestricted at all times. It is important that inflation and deflation be rapid and complete, as this is the governing factor in de-icer effectiveness.

b. Propeller Anti-Icer Adjustment: - The correct position of propeller blade feeding tubes should be such that the open ends of the tubes are at least one inch short of the spinner radius, and under shelter of the spinner to provide protection from airflow. They should also be positioned to point outward, parallel to the center lines of the blades, and from points just below respective entering edges when blades are in cruising pitch position. After installing the slinger ring as instructed in Section IV, paragraph 13.b., of this Handbook, it is advisable to check the position of the tubes feeding the anti-icing fluid to the blades by a test flight. This can be done quite readily by dying a small quantity of anti-icing fluid with methyl violet and observing distribution of dye over blades after a flight test. If the tube ends were properly located, the main flow should be out the thrust side of blades, just back of entering edges. The fluid should spread from this position over both the thrust and convex sides of the blades. Fluid conforming to Spec. 3585 shall be used in the system.

Column 48 - "Battery" (T.O. 01-1B-1)

Weekly: - Once each seven days - T.O. 00-20A.

Column 49 - "Engine Change"

When an engine is changed - T.O. 00-20A.

Newly installed engines - T.O. 00-20A.

Clean Cuno oil strainer - T.O. 00-20A.

Check compass - T.O. 05-15-1, 05-15-2, and 00-20A.

Replace rubber vibration absorbers - T.O. 01-1-58 and 00-20A.

Prepare replaced engines for storage - T.O. 02-1-1.

Inspect fuel cock - T.O. 03-10-13.

Check thermometers - T.O. 05-1-16 and 00-20A.

4. Additional Inspection and Line Maintenance Instructions Issued by the Air Corps

(Will be issued when available)

General

a. The work outlined in this section can be performed with the facilities usually available at Air Corps Stations. But it may require a function of the operating organization.

b. The following special tools, furnished for the airplane, are required to perform the work outlined in the special instructions -

12-75487	One Weston and Brown Cylinder Wrench
84004	Engine Tools (light)
12-52411	Fixed Gun Tool Wrench
25-52175	Hydraulic System Valve Wrench
84004	Leaking Gear Slow Adjustable Spanner Wrench
84004	Propeller Grease Gun Extension
84004	Propeller Hub Nut Wrench

The following items of equipment are also furnished to facilitate handling and servicing the airplane -

25-55009	Aluminum Hoisting Ring
25-55017	Aluminum Towing Bar
25-75003	Engine Cover
84004	Engine Sling
25-55007	Leaking Grease Gun Wing Center Section and Fuselage
25-75000	Sealed Grease Gun Spout
25-52175-1	Grease Gun
25-52175	Two Two Rigs for Lower Wing Panels
25-52175-2	Wing Hoisting Sling
25-52175-3	Wing Hoisting Sling
84004	Self Gun

c. In the list of subject matter involved in the following instructions for the installation of a particular item or items, it is assumed that the level of work is covered in complete and that all other related and important instructions are made. The following instructions shall be changed to compensate for any variations in the assumed status of the equipment involved. If discrepancies are to be accomplished and electrical connections are affected, make certain that the status is in the "OFF" position.

5. Wing Installation

a. General - The major sub-assemblies of the complete wing are usually mounted on the outer panels, two fuselage ribs, two ailerons,

SECTION IVINSTALLATION, MAINTENANCE, REPAIR AND REPLACEMENT, AND MINOR REPAIR1. General

a. The work outlined in this section can be performed with the facilities usually available at Air Corps Stations, but is not normally a function of the operating organization.

b. The following special tools, furnished for the airplane, are required to perform the work outlined in the ensuing instructions: -

19-33447	Dzus Fastener and Brake Cylinder Wrench
84004	Engine Tools (Wright)
19A-53417	Fixed Gun Post Wrench
25-58178	Hydraulic System Valve Wrench
53983	Landing Gear Strut Adjustable Spanner Wrench
51693	Propeller Grease Gun Extension
81402	Propeller Hub Nut Wrench

The following items of equipment are also furnished to facilitate handling and servicing the airplane: -

25-55002	Airplane Hoisting Sling
51-55017	Airplane Towing Bar
51-73003	Engine Cover
83297	Engine Sling
25-55007	Jacking Screws for Wing Center Section and Fuselage
25-55008	Landing Gear Jury Struts
EA-5743-1	Starter Crank
B1190	Tie-Down Rings for Outer Wing Panels
25-55015-2	Wing Hoisting Sling
25-55015-3	Wing Hoisting Sling
6556	Zerk Gun

c. In the treatment of subject matter involved in the following instructions for the installation of a particular item or items, it is assumed that the status of each item concerned is complete and that all other related and incidental installations are made. The following instructions shall be changed to compensate for any variations in the assumed status of the equipment involved. If disassembly is to be accomplished add electrical connections are affected, make certain main line switch is in the "OFF" position.

2. Wing Installation

a. General: - The major sub-assemblies of the complete wing assembly consist of two outer panels, two removable tips, two ailerons,

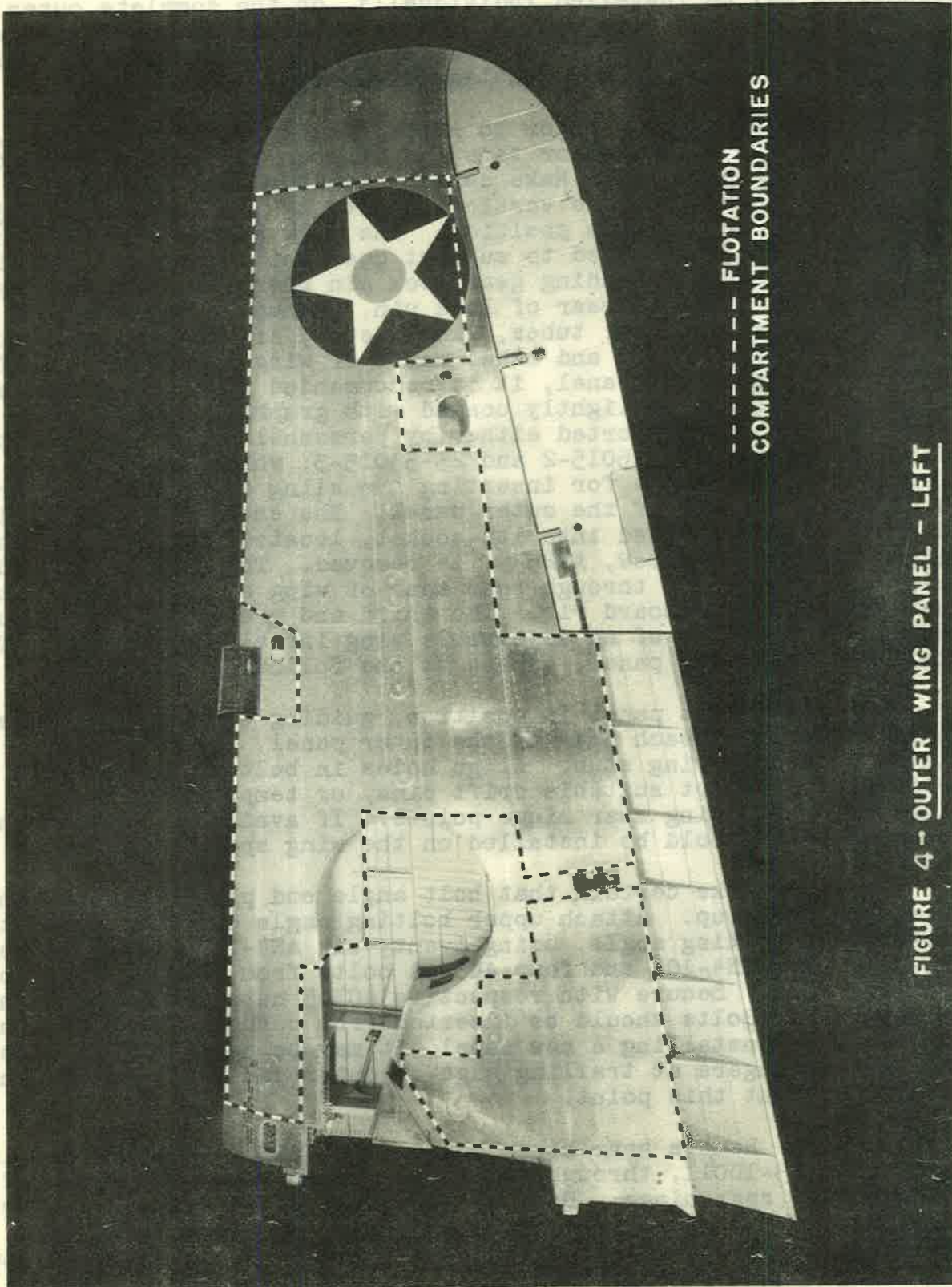
one left aileron trim tab, and two landing flap panels. The sub-assemblies may be installed individually, or the complete outer panel assembly, except flap panels, may be attached to the center wing stubs in one unit. The center wing of the O-47B Airplane is built as an integral part of the fuselage structure.

b. Outer Panel: - Prior to installing an outer wing panel, it is desirable to clamp and/or tape the aileron and left aileron trim tab in neutral position. Make certain landing gear is slanting slightly outboard from the vertical position. If necessary, adjust jury strut to obtain this position. The jury strut, 25-55008, has been temporarily installed to support gear while the outer panel is removed. Disconnect landing gear lock pin operating link and hydraulic operating strut at rear of lock pin. Manually retract lock pin. Make certain all cables, tubes, lines, etc., are located or supported clear of bolting angles and other parts of wing structure. To facilitate installation of panel, it is recommended that the surfaces of the hinge fittings be lightly coated with graphite grease. The outer panel may then be supported either by personnel or by wing hoisting sling assemblies, 25-55015-2 and 25-55015-3, which are provided with airplane. Two sockets for inserting the sling assemblies are provided on upper surface of the outer panel. The shorter outboard sling assembly may be screwed into its socket, located just aft of landing light, after plug screw, AN25-9, is removed. The longer inboard sling assembly bolts through rear spar of wing at intersection of the spar with first outboard rib. The third and preferred way to support the panel is by use of an adjustable wing installation stand. To install an outer wing panel, adhere to the following procedure:

(1) Hoist panel in position, guiding the two hinge assemblies, located on each spar of the outer panel, into respective hinge plates on center wing stub. Align holes in bolting angles with drift pins. Insert suitable drift pins, or temporarily install hinge bolts, in wing spar hinge points. If available, bullet shaped thread guides should be installed on the wing spar bolts.

(2) Make certain that bolt angle end plate is flush and holes are lined up. Attach upper bolting angle of outer panel to center wing bolting angle, using twenty-six AN4-11A, twenty-three AN5-11A, nine AN4-10A and four AN3-4A bolts from leading edge to trailing edge. Secure with respective AC365 nuts and AN960 washers, as required. Bolts should be inserted from outboard side of wing joint. When installing a new panel, it may be necessary to file wing skin and stringers at trailing edge of outer panel if interference should occur at this point.

(3) Remove spar hinge point drift pins, if used, and insert bolt, 25-10011, through front spar hinge, and bolt 25-10012 through rear spar hinge. Both bolts should be inserted from the forward side. Six B985C-74-72-10 and eight B985C-66-76-10 shim washers should be located as required to fill gaps at forward and rear hinge points, respectively.



----- FLOTATION
COMPARTMENT BOUNDARIES

FIGURE 4 - OUTER WING PANEL - LEFT

T. O. NO. 01-60EB-2

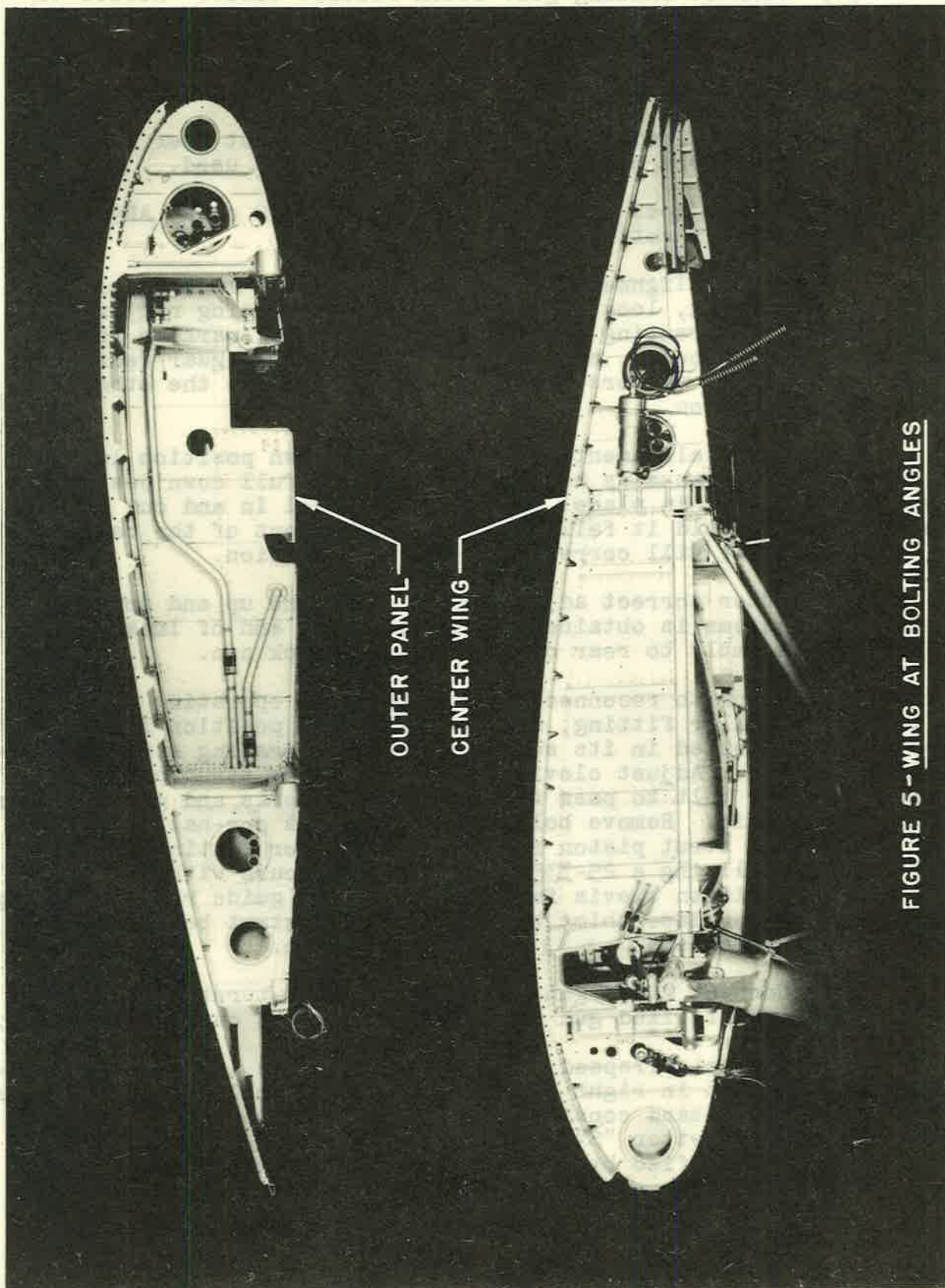


FIGURE 5-WING AT BOLTING ANGLES

(4) Connect landing gear catch release cable. Access to connecting link is gained through door on lower surface of center wing at leading edge.

(5) Jack airplane, using center wing jacking points.

(6) Remove landing gear jury strut, retract gear and remove thread guides from hinge bolts, if latter were used.

(7) Secure spar hinge bolts with AN320-12 nuts, AN920-1216 washers and AN380-4-5 cotters.

(8) Check alignment of landing gear strut locking roller with up position hook, located in wheel well by coating roller with graphite grease, retracting gear and observing hook mark on roller. Should misalignment occur, adjustment of the landing gear rear strut assembly or shifting washers from one side of hook to the other will correct this condition.

(9) Check alignment of landing gear down position lock pin with its socket by manually holding gear in the full down position and pushing lock pin in place. Pin should travel in and out of its socket freely. Should it fail to do so, adjustment of the center wing brace assembly will correct the faulty condition.

(10) After correct adjustment of both the up and down position lock mechanisms is obtained, connect clevis end of lock pin operating link assembly to rear of landing gear lock pin.

(11) Prior to reconnecting landing gear operating strut to lock pin guide roller fitting, make certain down position lock pin is completely inserted in its socket and that operating strut is completely retracted. Adjust clevis end of operating strut piston as required to allow bolt to pass freely through clevis and guide roller fitting on lock pin. Remove bolt, unscrew clevis one-half turn, and connect operating strut piston rod to guide roller fitting with an AN26-24 bolt, utilizing a 25-33557 spacer and secure with nut and cotter. Should piston clevis fail to align with guide roller fitting it is necessary to place shims behind operating strut bearings. Refer to ensuing paragraph 9.b.(1) of this Section.

(12) Connect fixed gun charging cable at turnbuckle, located at inboard end of fixed gun compartment in right outer panel only.

(13) Connect airspeed, static and pressure lines. Line connections are located in right wing joint nose gap only. Static lines are identified by a band consisting of a black and a light green stripe, and by the letter "S" stamped on connecting fittings. Pressure lines are identified by a single band of black, and by the letter "P" stamped on connecting fittings.

(14) Connect de-icer lines located at wing joint nose gap. Place each rubber tube over its opposite metal tube and secure with AC745-1B and AC745-2A clamps, as required. De-icer lines are identified by a band consisting of a light blue and a green stripe.

(15) Connect landing and running light wires and landing gear warning switch wires at junction box located in leading edge of each outer panel, just outboard of wing joint bolting angle.

(16) Connect fixed gun solenoid and pitot heater wires, at right outer panel junction box only.

(17) Connect passing light wires at left outer panel junction box only.

(18) Thread aileron control cables over pulleys and through holes provided, attaching cable ends at turnbuckles located in landing gear wells in outer panel. At disassembly aileron cables should have been identified for convenience of assembly and their ends attached to prevent them from slipping into the wing structure. Access doors are provided on the aft wall of the wheel wells to facilitate installation and adjustment. Refer to Section III, Column No. 36, paragraphs a. and b., of this Handbook, for cable rigging loads and aileron adjustment instructions.

(19) Connect hydraulic line to "tee" fitting on inboard flap actuating cylinder, located in lower rear portion of wing joint gap. Hydraulic lines are identified by a band consisting of a yellow stripe between two light blue stripes.

(20) Connect bilge lines with rubber connecting hose and secure with AC745-2A clamps. Bilge lines are located in lower rear portion of wing joint gap, directly under inboard flap actuating cylinder, and are identified by a single band of light blue.

(21) Thread free air thermometer bulbs through lightening hole in end rib of left outer panel, and through holes provided in lower surface of wing, utilizing rubber grommet when tubing passes through wing skin. Attach thermometer bulbs to lower surface of wing, just forward of holes in wing skin, with clamps and attaching screws. Clamp capillary tubes to small angle located on rim of rib lightening hole. CAUTION: Do not bend or pinch capillary tubes.

(22) Connect left aileron trim tab drum cable to trim tab cables at turnbuckles located in trailing edge of center wing, just outboard of fuselage. Make certain cables are correctly strung over open-end fairleads and around pulleys. For cable rigging loads and trim tab adjustment instructions, refer to Section III, Column 36, paragraph a. and e., of this Handbook.

(23) Prior to installing right wing nose gap cover, insert fresh air duct flexible tubing in casting bolted to inner surface of cover plate, and secure with an AN3-26A bolt.

- (24) Install wing joint nose gap cover.
- (25) Install fuel tank door assembly over wing joint gap and center wing fuel tank.
- (26) Connect landing gear fairing door assembly to actuating link, located at top of oleo strut on inboard side, with an AN4-14 bolt and secure with nut and cotter.
- (27) Install lower wing joint cover plate over gap at trailing edge.
- (28) Install upper wing joint cover assembly over bolting angle. Make certain Neoprene chafing strips are in good condition and cemented to cover assembly with rubber to metal cement, Spec. 26544.
- (29) Check for proper adjustment and operation of landing gear, including lock mechanism, control linkage, position indicators, warning horn, and fairing. Pertinent instructions concerning each of the above devices will be found under their respective headings in this Handbook.

c. Wing Tip: - Prior to engaging wing tip to outer wing panel, connect running light wires and conduit to junction box located at inboard rib of wing tip. Slide edge of wing tip assembly over outer panel and secure with AN526-1032-7 screws. Utilizing same screws, install upper and lower covers over wing tip gap at trailing edge.

d. Aileron: - Prior to installing aileron, attach adjustable clevis end of actuating rod to link assembly located above center hinge on aileron spar, using an AN24-17 bolt. Place aileron in position, inserting actuating rod through hole provided in wing fairing and spar. Also insert the three 5/16 inch ball bearing eye-bolts, N.A. Std. B1074, through the reinforced holes in aileron spar. Secure eye-bolts with nuts, washers, and cotter through the small apertures located on the lower surface of the aileron. The eye-bolts are pinned to the wing hinge brackets by means of AN4-13 clevis bolts at the hinge point centers. In the event that any of the hinge brackets have been replaced, or a new aileron is being installed, be sure to check alignment of hinge point centers. Position aileron in alignment with the wing and position aileron bellcrank parallel to center line of fuselage. Adjust aileron actuating rod as required to obtain this position, and attach to bellcrank with an AN4-77 bolt. Tighten lock nut at adjustable end of actuating rod. Connect aileron control cables at turnbuckles located in outer wing panel landing gear well. Inspection doors are provided on the aft wall of the landing gear wheel well to facilitate assembly and adjustment. Lower flap panels if left aileron is being installed and thread trim tab drum cables over pulleys and through fairleads provided in trailing edge of outer panel ribs. Attach trim tab drum cables to trim tab control cable at turnbuckles located in trailing edge of center

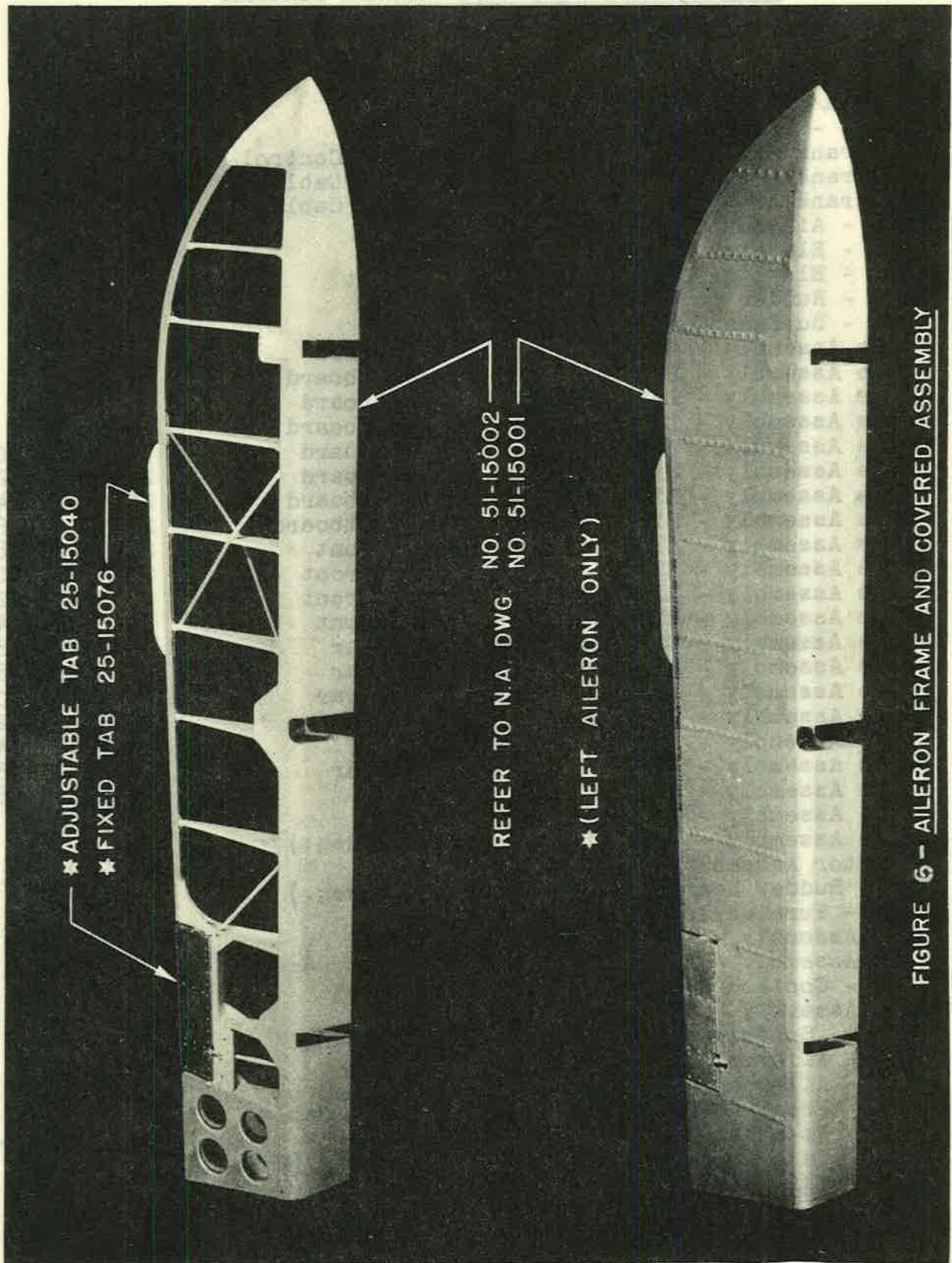


FIGURE 6 - AILERON FRAME AND COVERED ASSEMBLY

NOMENCLATURE - SURFACE CONTROL DIAGRAM

(Refer to Figure 7 and N. A. Dwg. No. 51-52001)

1.	Aileron Assembly - Covered	25-15001
2.	Barrel - Turnbuckle (2 Req.)	AN155-32L
3.	Bellcrank Assembly - Outer Wing Aileron Control	25-52304
4.	Bellcrank Assembly - Tail Wheel Control Cable	25-34017
5.	Bellcrank Assembly - Tail Wheel Control Cable	25-34017-1
6.	Bolt - Aileron Control Adjustment	B1175-7
7.	Bolt - Elevator Control Rear Adjustment	B1175-10
8.	Bolt - Elevator Control Front Adjustment	B1175-14
9.	Bolt - Rudder Pedal Stop Adjustment	B1175-16
10.	Bolt - Surface Control Lock Adjustment	B1174-21
11.	Cable Assembly - Left Aileron Rear Inboard	25-52227-2
12.	Cable Assembly - Right Aileron Front Inboard	25-52227-4
13.	Cable Assembly - Left Aileron Rear Outboard	25-52227-6
14.	Cable Assembly - Left Aileron Front Outboard	25-52227-8
15.	Cable Assembly - Left Aileron Front Inboard	25-52227-10
16.	Cable Assembly - Right Aileron Rear Inboard	25-52227-12
17.	Cable Assembly - Right Aileron Rear Outboard	25-52227-14
18.	Cable Assembly - Right Aileron Front Outboard	25-52227-16
19.	Cable Assembly - Elevator Left Lower Front	25-52227-18
20.	Cable Assembly - Elevator Right Lower Front	25-52227-20
21.	Cable Assembly - Elevator Right Upper Front	25-52227-22
22.	Cable Assembly - Elevator Left Upper Front	25-52227-24
23.	Cable Assembly - Elevator Left Upper Rear	25-52227-26
24.	Cable Assembly - Elevator Left Lower Rear	25-52227-28
25.	Cable Assembly - Elevator Right Upper Rear	25-52227-30
26.	Cable Assembly - Elevator Right Lower Rear	25-52227-32
27.	Cable Assembly - Rudder Left Front	25-52227-34
28.	Cable Assembly - Rudder Left & Right Rear	25-52227-36
29.	Cable Assembly - Rudder Right Front	25-52227-38
30.	Cable Assembly - Rudder Pedal Equalizer	25-52424
31.	Cable Assembly - Tail Wheel Control (2 Req.)	25-34005-4
32.	Elevator Assembly - Covered	51-22001
33.	Eye - Rudder Rear Cable Turnbuckle (2 Req.)	25-52428
34.	Fork - Turnbuckle (2 Req.)	AC161-32LL
35.	Horn Assembly - Elevator	25-52203
36.	Horn Assembly - Elevator	25-52203-2
37.	Horn - Control Stick Aileron Torque Tube	25-52120
38.	Horn Assembly - Rudder	51-24041
39.	Latch - Surface Control Lock Handle Stowing	25-52116
40.	Link - Aileron Cable (4 Req.)	25-52314
41.	Link - Aileron Cable (4 Req.)	25-52314-1
42.	Link - Front Cockpit Control Stick Elev. Cable Attaching	25-52122-1,8
43.	Link - Tail Wheel Steering Cable Attaching (2 Req.)	51-34020
44.	Link - Tail Wheel Steering Cable Attaching (2 Req.)	51-34020-1
45.	Lock Installation - Surface Controls	25-52106
46.	Nut - Surface Control Lock & Rudder Pedal Bolt Lock	AN315-4R
47.	Nut - Aileron & Elevator Adjustment Bolt Lock	AN316-5R



FIGURE 7 - SURFACE CONTROL DIAGRAM

Nomenclature - Surface Control Diagram (Contd.)

48.	Pedal Assembly - Front Cockpit Rudder	51-52410
49.	Pedal Assembly - Rear Cockpit Rudder	51-52411
50.	Pulley - Control	AN210-2A
51.	Pulley - Control	AN210-3A
52.	Pulley - Control	AN210-4A
53.	Rod Assembly - Outer Wing Aileron Control	25-52311
54.	Rudder Assembly - Covered	51-24001
55.	Spring - Surface Control Lock Arm	25-52118
56.	Spring - Tail Wheel Cable Shock (2 Req.)	23-34009
57.	Spring - Tension Coil (2 Req.)	19-52440
58.	Stick Assembly - Front Cockpit Control	25-52103
59.	Stick Assembly - Rear Cockpit Control	25-52102
60.	Stop - Rudder Pedal	51-52408
61.	Tail Wheel - Installation	51-34001
62.	Tube Assembly - Control Stick Aileron Torque	25-52104
63.	Tube Assembly - Elevator Control Stick Connecting	19-52112-10
64.	Tube Assembly - Rudder Pedal Connecting	25-52409-1
65.	Turnbuckle Assembly - Fork (2 Req.)	AC150-21S
66.	Turnbuckle Assembly - Fork (6 Req.)	AC150-32L
67.	Turnbuckle Assembly - Fork (4 Req.)	AC150-32S

wing, just outboard of fuselage. Make certain cables are correctly strung over open-end fairleads and around pulleys. For cable rigging loads and aileron and aileron trim tab adjustment, refer to Section III, Column 36, paragraphs a, b, and e., respectively, of this Handbook. When correct adjustment has been obtained, install cover plates over inspection doors in wheel wells, lower surface of outer panel, and aileron.

e. Flap Panel: - Prior to installing a new or reworked flap panel, or if hinge point eye-bolt has been removed, it is first necessary to make certain hinge point centers are in correct alignment. This is accomplished by installing five 5/16 inch ball bearing eye-bolts, N.A. Std. B1074, in reinforced holes of auxiliary wing spar and drawing bolts up tight. Then stretch piano wire through eye-bolt centers to determine where adjustments are necessary. Should a hinge center be out of line, it is necessary to either spot-face the rear of the support casting on auxiliary spar or use N.A. 25-18037 shims between eye-bolts and support castings as required. When the proper number of shims is determined, they should be drilled and staked to the casting with AC530-4-4 screws. When certain correct alignment has been obtained, remove the eye-bolts and install them in their respective wing flap hinge brackets with three AN4-12 and two AN4-13 bolts. To install flaps, operate flap controls to obtain position of actuating mechanism relative to the full up position of the flaps. Place either flap panel in position, inserting the five ball bearing eye-bolts into the auxiliary wing spar holes, starting with inboard eye-bolt and working outboard. Secure each eye-bolt with an AN960-516 washer and an AN310-5 nut and an AN380-2-2 cotter through the small apertures or doors located on lower surface of wing at each hinge point. Clamp flaps in the correct up position and from within fuselage, insert center connecting tube assembly, 51-18036-2 through hole in left side of fuselage and over shaft at inboard end of flap panel. Secure tube to flap shaft with two AN24-25 bolts, washers, nuts, and cotters. Following the above procedure, secure tube assembly, 51-18036-3, to right flap panel shaft. Locate two sets of holes in center connecting tube adjusting collars that correctly align; place two shims, 51-10022, between the collars; and secure with two AN4-10A bolts and stop nuts. Lower flap panels and attach tube assembly, 25-52611-3, to inboard flap panel control arms and tube assembly, 25-52611-2, to outboard flap panel control arms with AN4-13 bolts, washers, nuts, and cotters. Attach tube assemblies to actuating cylinder piston ends and clamp position indicator transmitter operating arm to center connecting tube, with reference to flap and position indicator adjustment instructions in Section III, Column 36, paragraph f., of this Handbook.

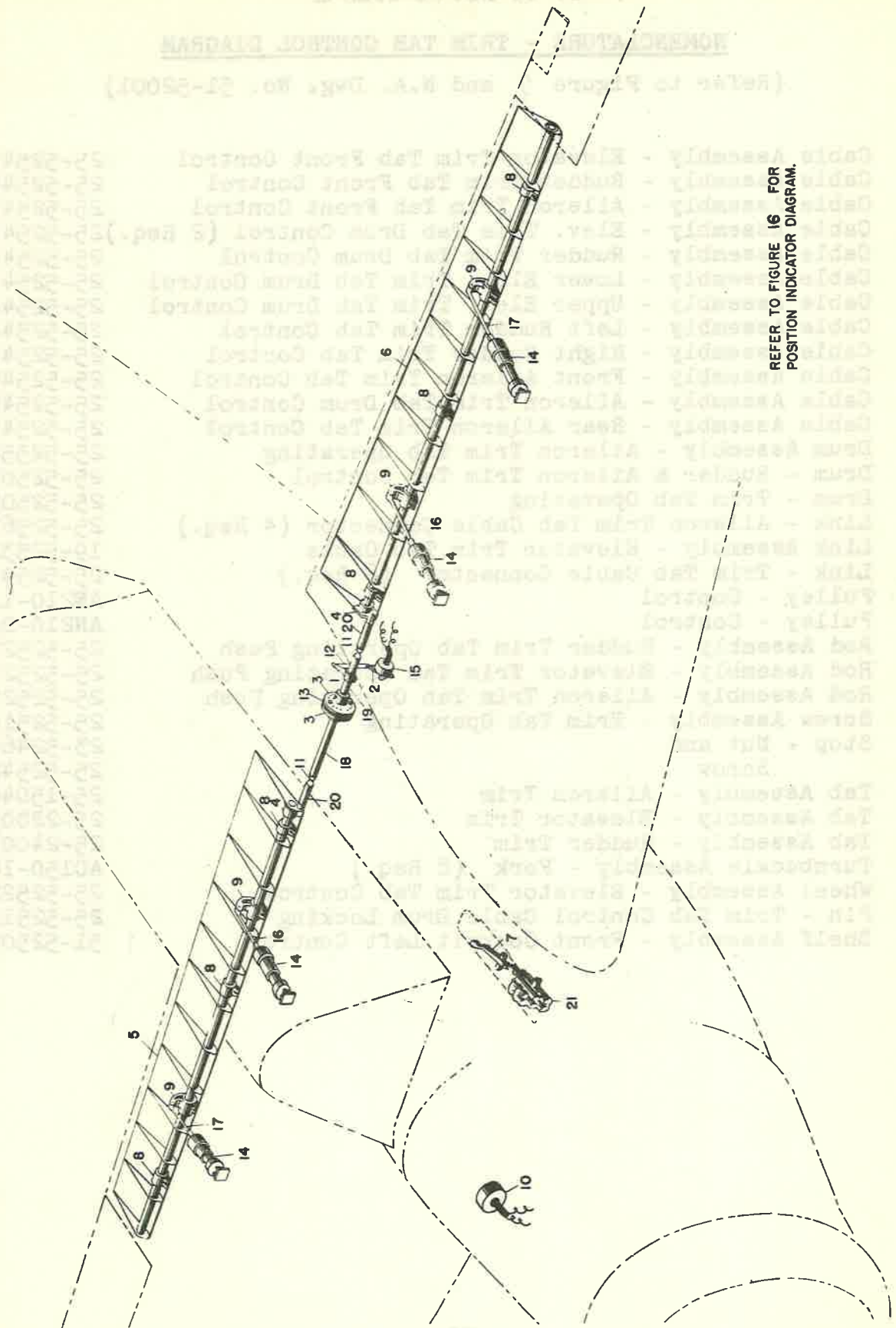
3. Empennage Installation

a. Horizontal Stabilizer: - The horizontal stabilizer assembly consists of two interchangeable sections which are bolted together with four AN6-14 bolts, through fittings provided on the upper and lower edges at inboard ends of rear spar halves. The stabilizer sections may be installed individually, or prior to installing rudder,

NOMENCLATURE - FLAP CONTROL DIAGRAM

(Refer to Fig. 8 and N.A. Dwg. No. 51-10001)

1. Arm - Flap Position Indicator Torque Tube	51-54069
2. Arm - Flap Position Indicator Transmitter	51-54067
3. Collar - Flap Equalizer Torque Tube Adjusting	51-18024
4. Fitting - Flap Synchronizing Shaft Attaching	25-18005
5. Flap Assembly - Wing R.H.	25-18001-1
6. Flap Assembly - Wing L.H.	25-18001
7. Handle Assembly - Flap Operating	25-52614
8. Hinge - Wing Flap	25-18006
9. Horn - Wing Flap Control	25-18007
10. Indicator - L.G. and Flap Position (Gen. Electric)	Type DJ-3
11. Joint - Wing Flap Synchronizing Universal	51-18039
12. Link - Flap Position Indicator Transmitter	51-54066
13. Shim - Flap Equalizer Torque Tube Adjusting	51-10022
14. Strut Assembly - Hydraulic Wing Flap Operating	51-58032
15. Transmitter - Flap Position (General Electric)	Type TJ-9
16. Tube Assembly - Flap Control Inboard	25-52611-3
17. Tube Assembly - Flap Control Outboard	25-52611-2
18. Tube Assembly - Wing Flap Center Connecting	51-18026-3
19. Tube Assembly - Wing Flap Center Connecting	51-18026-2
20. Tube Assembly - Wing Flap Synchronizing	51-18032
21. Valve Assembly - Landing Gear & Flap Selector	51-58011



REFER TO FIGURE 16 FOR
POSITION INDICATOR DIAGRAM.

FIGURE 8 - FLAP CONTROL DIAGRAM

NOMENCLATURE - TRIM TAB CONTROL DIAGRAM

(Refer to Figure 9 and N.A. Dwg. No. 51-52001)

1.	Cable Assembly - Elevator Trim Tab Front Control	25-52543-2
2.	Cable Assembly - Rudder Trim Tab Front Control	25-52543-4
3.	Cable Assembly - Aileron Trim Tab Front Control	25-52543-6
4.	Cable Assembly - Elev. Trim Tab Drum Control (2 Req.)	25-52544-2
5.	Cable Assembly - Rudder Trim Tab Drum Control	25-52544-6
6.	Cable Assembly - Lower Elev. Trim Tab Drum Control	25-52544-8
7.	Cable Assembly - Upper Elev. Trim Tab Drum Control	25-52544-10
8.	Cable Assembly - Left Rudder Trim Tab Control	25-52544-12
9.	Cable Assembly - Right Rudder Trim Tab Control	25-52544-14
10.	Cable Assembly - Front Aileron Trim Tab Control	25-52545-2
11.	Cable Assembly - Aileron Trim Tab Drum Control	25-52545-4
12.	Cable Assembly - Rear Aileron Trim Tab Control	25-52545-6
13.	Drum Assembly - Aileron Trim Tab Operating	25-52558
14.	Drum - Rudder & Aileron Trim Tab Control	25-52508
15.	Drum - Trim Tab Operating	25-52509
16.	Link - Aileron Trim Tab Cable Connector (4 Req.)	25-52567
17.	Link Assembly - Elevator Trim Tab Cable	19-52532
18.	Link - Trim Tab Cable Connector (8 Req.)	25-52541
19.	Pulley - Control	AN210-1A
20.	Pulley - Control	AN210-2A
21.	Rod Assembly - Rudder Trim Tab Operating Push	25-52527-2
22.	Rod Assembly - Elevator Trim Tab Operating Push	25-52527-3
23.	Rod Assembly - Aileron Trim Tab Operating Push	25-52527-4
24.	Screw Assembly - Trim Tab Operating	25-52510
25.	Stop - Nut and Screw	23-52464
26.	Tab Assembly - Aileron Trim	25-52542
27.	Tab Assembly - Elevator Trim	25-15040
28.	Tab Assembly - Rudder Trim	25-22003
29.	Turnbuckle Assembly - Fork (8 Req.)	25-24003
30.	Wheel Assembly - Elevator Trim Tab Control	AC150-16S
31.	Pin - Trim Tab Control Cable Drum Locking	25-52522
32.	Shelf Assembly - Front Cockpit Left Control	25-52512-2
		51-52506

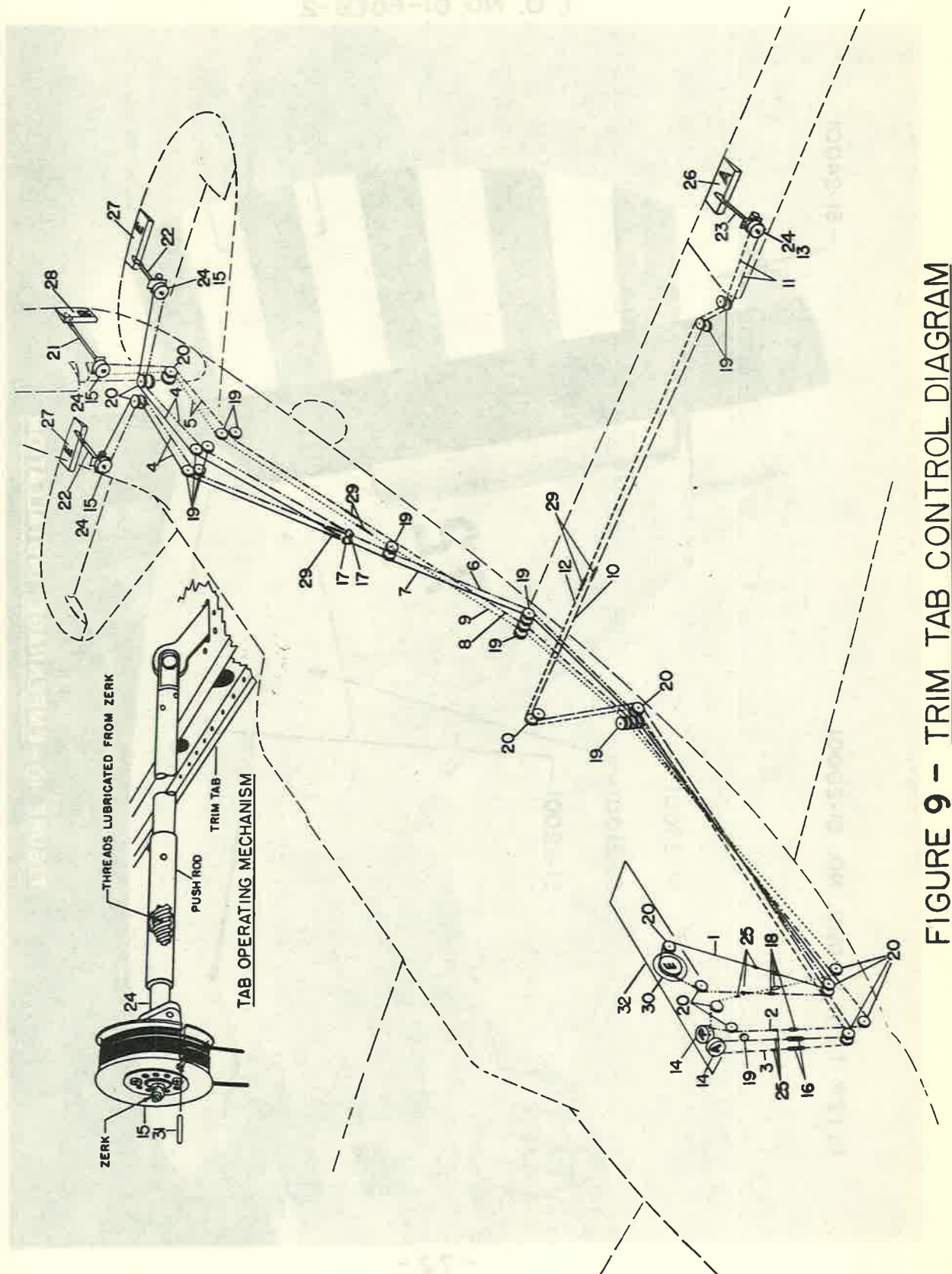


FIGURE 9 - TRIM TAB CONTROL DIAGRAM

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FIGURE 10 - EMPENNAGE INSTALLATION

REFER TO N.A. DWG. NO. 51-20001

51-24001

51-23001

51-21001

51-22001

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FIGURE 10 - EMPENNAGE INSTALLATION

as a complete assembly; either with or without the elevator halves attached. To install, place stabilizer in position on fuselage tail and secure upper and lower edges of stabilizer rear spar to fuselage, using eight AN4-15 bolts; two on each side of spar connecting points. Attach inboard ends of stabilizer front spar to each side of fuselage tail, using an AN4-17 bolt, a B100-9R4-48 spacer, two AN960-416 washers, a nut, and a cotter, at each connecting hinge center.

b. Elevator: - The two elevator sections are interchangeable. After interchanging the elevator sections or installing a spare section, make certain that drain holes on upper surface are covered and that new drain holes are added to the lower surface. The elevator sections may be installed individually, or prior to installing rudder, as a complete assembly. The torque tube on each elevator section is bolted to an elevator horn tube by means of three AN4-11 bolts through holes provided in tube flanges. The two elevator horn tubes are bolted together by means of two 25-22041 stud bolts at forward side of horn tube flanges, and an AN4-11 bolt at aft side of flanges. Prior to installation, if any of the hinge brackets have been replaced, a new section is being installed, or sections are being interchanged, check for proper alignment of hinge point centers. When certain hinge centers are in correct alignment, place elevator assembly in position, inserting the four 5/16 inch ball bearing eye-bolts, B1074, into hinge castings on elevator torque tube. Secure each eye-bolt with nut, washer, and cotter. The eye-bolts are attached to hinge brackets on rear spar of horizontal stabilizer with AN4-12 bolts. Insert an AN4-13 bolt through hinge point on each elevator control horn assembly and secure with nuts, washers, and cotters. Attach elevator control cables to elevator control horns with AN4-11 bolts, nuts, and cotters. Cables and control horn ends are identified for convenience of assembly and, at disassembly, cable ends should have been attached to prevent them from slipping into the fuselage. Thread trim tab drum cable around pulleys and through holes provided in rear spar of horizontal stabilizer. Connect cable ends to respective trim tab control cable turnbuckles, which are accessible through access door on left side of fuselage, forward of tail surfaces. For cable rigging loads, and elevator and trim tab adjustment instructions, refer to Section III, Column 36, paragraphs a, d, and e., respectively, of this Handbook.

c. Vertical Stabilizer: - To install vertical stabilizer, place stabilizer on base at upper rear deck of fuselage. Secure rear portion of stabilizer to rear fuselage bulkhead with three AC526-836-8 screws and four AC525-416-11 screws, as required. Attach the lower rear edge of stabilizer sides to the rear fuselage bulkhead with six AC525-416-8 screws, using six AN960-416 washers. Attach lower forward portion of stabilizer sides to forward bulkhead with eight AC525-416-11 screws, using eight AN960-416 washers. Secure lower edge of stabilizer sides to fuselage, using thirty-four AN526-836-6 and four AN526-836-8 screws, as required. Connect running light wires and conduit at junction box located in leading edge of stabilizer base. Attach antenna wires to mast provided on top of vertical stabilizer, connecting liaison set antenna wire to top of mast and radio compass wire to bottom.

d. Rudder: - The rudder assembly is hinged at three points by means of fittings riveted to the rudder torque tube and hinge brackets bolted to the rear fuselage bulkhead. Prior to installation, if any of the hinge brackets have been replaced, or a new rudder is being installed, check for proper alignment of hinge point centers. When certain hinge centers are in correct alignment, place rudder in position, inserting the two N.A. Std. B1074, 5/16 inch ball bearing eye-bolts in holes provided in torque tube fittings. Secure eye-bolts with nuts, washers, and cotters through the small apertures located in left side of rudder at hinge point centers. The eye-bolts are pinned to the upper hinge brackets by means of AN4-12 bolts. Secure lower hinge point with an AN4-13 bolt, washer, nut, and cotter. Attach rudder control cables to rudder horn with AN4-11 bolts, nuts, and cotters. Thread trim tab drum cables around pulleys located on lower hinge bracket and through hole in rear fuselage bulkhead, attaching cable ends to tab control cable turnbuckles which are accessible through a door on left side of fuselage, forward of tail surfaces. For cable rigging loads, and rudder and rudder trim tab adjustment instructions, refer to Section III, Column 36, paragraphs a, c, and e., respectively, of this Handbook.

e. Fairing: - Secure door to leading edge of stabilizer base at running light junction box, and install all fairing assemblies with AN526-836-6 and AN526-836-8 screws, as required. B985AL-11-20-32 washers are required for all horizontal stabilizer to fuselage fairing screws. Check fairing installation to make certain rubber chafing strips on stabilizer to fuselage fairing are well inserted between the metals. Chafing strips should be cemented to fairing with rubber to metal cement, Spec. No. 26544.

4. Fuselage

a. General: - The fuselage structure is a semi-monocoque construction of aluminum alloy. The structure consists of longerons, frames, and stringers, covered with aluminum alloy sheets. The short span center wing is an integral part of the fuselage, the front and rear spars forming the major part of the structure. A chrome-molybdenum steel tubing structure extends from the fuselage to the top of the enclosure, immediately aft of the pilot's cockpit, forming an emergency nose-over gear for protection of the crew. The firewall is of stainless steel construction and is riveted to the forward end of the fuselage. A jacking point is installed in the lower surface of each center wing stub on the front spar and at the rear of the fuselage bottom, just forward of the tail wheel. Numerous access doors are provided for inspecting and servicing the fuselage and installed equipment.

b. Hoisting: - The complete fuselage assembly, including installed equipment, may be hoisted by attaching cables to a bar passed through the lift tube aperture at rear of fuselage and to hoisting sling assembly, 25-55002, which may be installed in the hoist tube located in the upper portion of the nose-over structure. The hoisting sling eye-bolt may be installed with the pilot's

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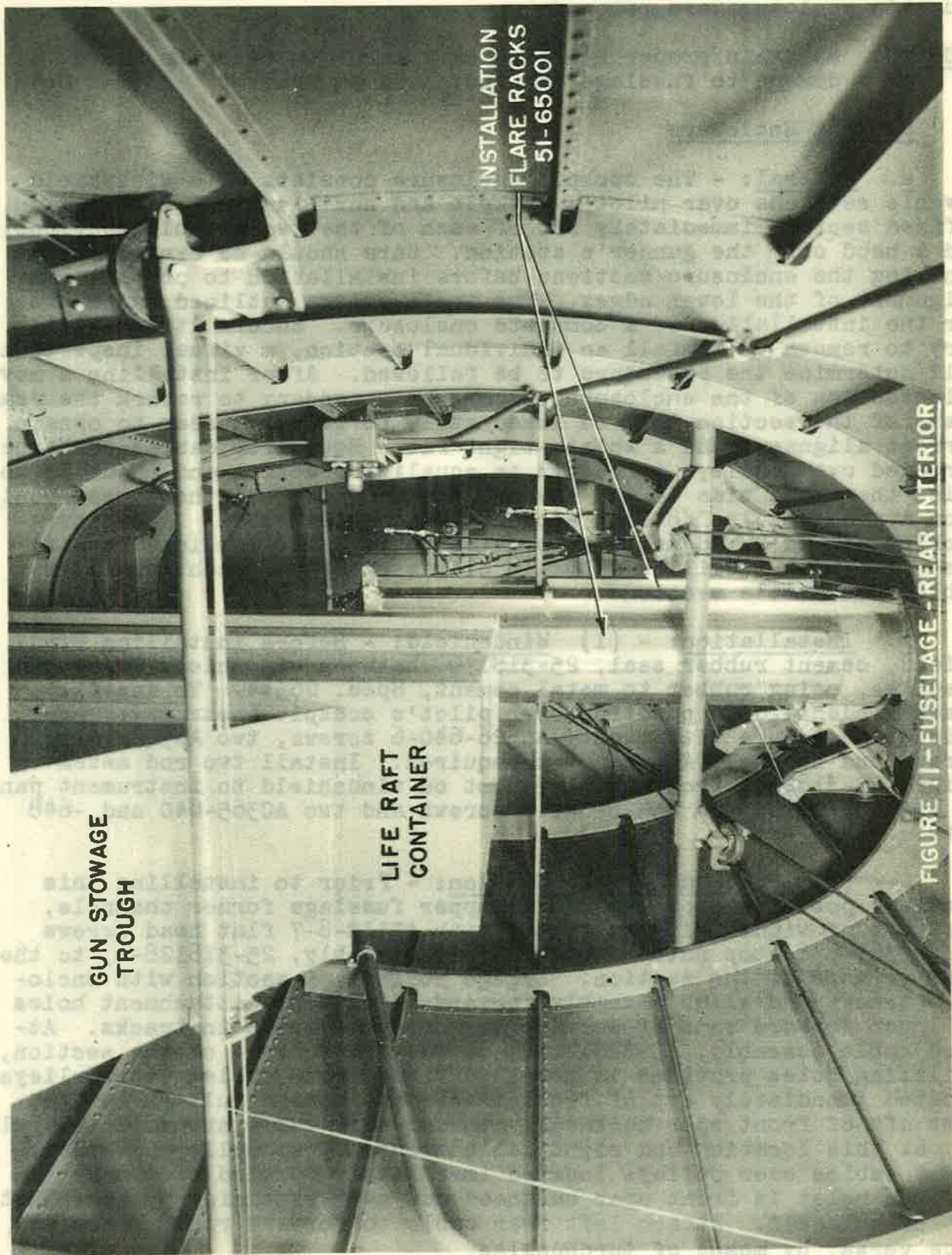


FIGURE 11 - FUSELAGE - REAR INTERIOR

enclosure in either the open or closed position, after the rubber plugs in enclosure are removed.

CAUTION: Maintain proper hoisting clearances in order to avoid damage to fuselage and installed equipment.

5. Cockpit Enclosure

a. General: - The cockpit enclosure consists of a windshield, movable sections over pilot's cockpit and auxiliary pilot's station, a fixed section immediately aft of each of the two movable sections, and a hood over the gunner's station. Care should be exercised in handling the enclosure sections before installation to prevent misalignment of the lower edges. The instructions outlined below are for the installation of a complete enclosure. Should it be necessary to remove or install an individual section, a visual inspection will determine the procedure to be followed. After installing a movable section of the enclosure, it may be necessary to rework the rear frame of the section located immediately forward in order to obtain correct alignment and a splash-tight fit. Equalizer cables shall be threaded over pulleys to obtain an equalizing action and adjusted to allow the right side of the movable section to reach the closed position approximately 1/8 inch sooner than the left side. Cable turnbuckles should be adjusted to provide equal cable tension and safetied with wire. Utilize AN392-13 clevis pins to attach equalizer cables to movable sections.

b. Installation: - (1) Windshield: - Before installing windshield, cement rubber seal, 25-318179, between windshield frame and fuselage, using rubber to metal cement, Spec. 26544. To install, place windshield in position over pilot's cockpit instrument panel shield and secure with twenty AN526-640-6 screws, two AN526-1032-9 screws and two AN3-4A bolts, as required. Install two rod assemblies, 25-318220, from small bracket on windshield to instrument panel shield, using two AN526-640-8 screws and two AC365-640 and -648 nuts.

(2) Forward Movable Section: - Prior to installing this section, position front tracks on upper fuselage former channels, just aft of windshield and fasten with AN510-8-7 flat head screws and AC365-836 stop nuts. Attach cable assembly, 25-318128-4, to the rear corners of the section. Engage rollers of section with enclosure tracks and slide assembly forward until cable attachment holes at lower forward ends of section are opposite holes in tracks. Attach cable assembly, 25-318128-2, to forward corners of the section, utilizing holes provided in tracks. Thread rear cables over pulleys located immediately aft of front tracks and around pulleys located just aft of front spar bulkhead; thread left cable around lower pulley at this location and right cable around upper pulley. Thread front cables over pulleys located immediately forward of tracks, through holes in front spar bulkhead and over remaining pulleys just aft of bulkhead. Attach left rear cable to forward right cable and vice versa, by means of turnbuckles.

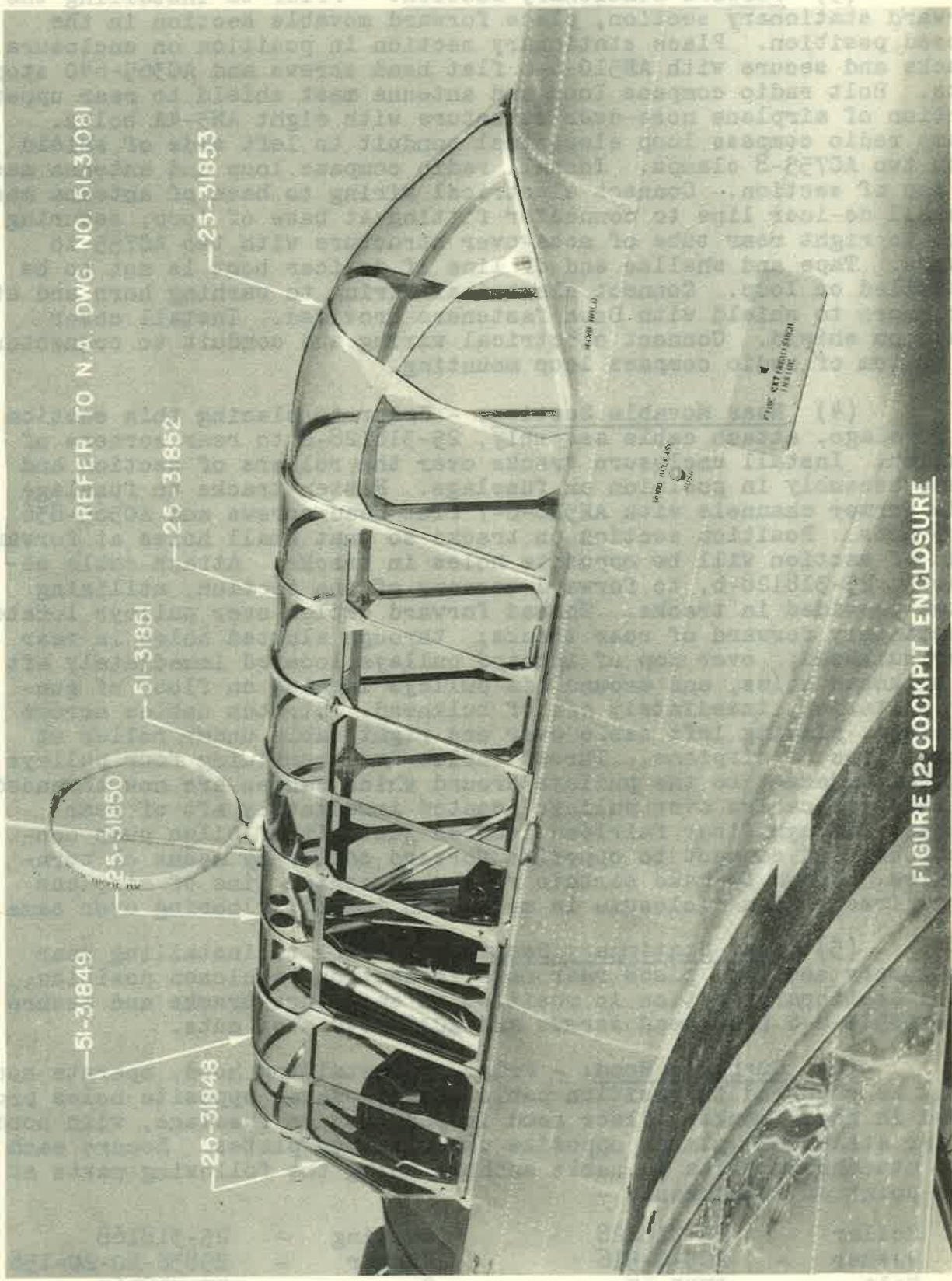


FIGURE 12-COCKPIT ENCLOSURE

77-
Bushing - 25-31852
Bolt - 25-31851
Screw - 25-31850
Nut - 25-31849
Washer - 25-31848

(3) Forward Stationary Section: - Prior to installing the forward stationary section, place forward movable section in the closed position. Place stationary section in position on enclosure tracks and secure with AN510-6-6 flat head screws and AC365-640 stop nuts. Bolt radio compass loop and antenna mast shield to rear upper portion of airplane nose-over structure with eight AN3-4A bolts. Clamp radio compass loop electrical conduit to left side of shield with two AC755-8 clamps. Install radio compass loop and antenna mast to top of section. Connect electrical wiring to base of antenna mast. Install de-icer line to connector fitting at base of loop, securing line to right rear tube of nose-over structure with two AC755-10 clamps. Tape and shellac end of line if de-icer boot is not to be installed on loop. Connect electrical wiring to warning horn and attach horn to shield with Dzus fasteners provided. Install cover plate on shield. Connect electrical wiring and conduit to connector at bottom of radio compass loop mounting.

(4) Rear Movable Section: - Prior to placing this section on fuselage, attach cable assembly, 25-318128-8 to rear corners of section. Install enclosure tracks over the rollers of section and place assembly in position on fuselage. Fasten tracks to fuselage side former channels with AN510-8-7 flat head screws and AC365-836 stop nuts. Position section on tracks so that small holes at forward ends of section will be opposite holes in tracks. Attach cable assembly, 25-318128-6, to forward corners of the section, utilizing holes provided in tracks. Thread forward cables over pulleys located immediately forward of rear tracks; through slotted holes in rear spar bulkhead; over top of inboard pulleys located immediately aft of bulkhead holes, and around aft pulleys located on floor of gunner's station, immediately aft of bulkhead. Stretch cables across fuselage, placing left cable over and right cable under roller at center line of airplane. Thread cables over remaining four pulleys located adjacent to the pulleys around which cables are now threaded. Thread rear cables over pulleys located immediately aft of rear tracks, through fiber fairlead located just aft of bilge pump connections, and connect to opposite forward cables by means of turnbuckles. Check to make certain roller at center line of airplane turns freely when enclosure is moved and install flooring over same.

(5) Rear Stationary Section: - Prior to installing rear stationary section, place rear movable section in closed position. Place stationary section in position on enclosure tracks and secure with AN510-6-6 flat head screws and AC365-640 stop nuts.

(6) Gunner's Hood: - Prior to installing hood, operate hood crank as required to position cable anchor plates opposite holes provided in hood tracks. Place hood in position on fuselage, with hood roller attachment plates opposite cable anchor plates. Secure each hood attachment plate to cable anchor, using the following parts at each point of attachment: -

Roller	-	25-318228	Bushing	-	25-318168
Washer	-	AC940-516	Washer	-	B9838-20-20-156
Bolt	-	AN25-27	Spacer	-	25-318167
Bushing	-	25-318229	Nut	-	AN315-5R

The nut should be tightened as required and staked to the bolt in three places. Connect pivot arms to fittings on lower rear corners of hood, using an AN526-428-14 screw, a 25-318231 bushing, and an AC365-428 nut at each point of attachment. Cement rubber strip over gunner's hood tracks with rubber to metal cement, Spec. 26544, allowing rubber to extend inboard from edge of tracks approximately 5/8 inches. Install fairing over hood tracks. Check operation of hood from inside and outside fuselage and from auxiliary pilot's station to ascertain hood operating mechanism and clutch release function correctly. Make certain a splash-tight fit is obtained between the hood bow and rubber sealing strips when hood is in locked position. See that metal hasp on hood is correctly aligned with fuselage hasp.

c. Panel Replacement:

(1) General: - The lower center windshield panel is of 1/4 inch laminated shatterproof glass and the windshield side panels, observer's side panels, and side panels of the fixed and movable sections, are of 3/16 inch laminated shatterproof glass. Panels of gunner's hood, upper center windshield panel, and camera door windows are of 3/16 inch transparent sheet. The upper curved panels of the fixed and movable sections are of 1/8 inch transparent sheet. Laminated shatterproof glass panels conform to Spec. AN-DD-G-551 and transparent sheet panels conform to A.C. Spec. 94-12014. Landing light doors are of 9/64 inch transparent sheet. The enclosure panels are made leak-proof by use of rubber extrusions between the panels and their frames. When replacing the panels, the same rubber sealing strips may be utilized if they are in good condition. In addition to sealing strips, "Hunt's Black Mastic Compound" should be applied to all panels where sizeable joints or crevices occur. When caulking windshield frames, special effort should be made to obtain positive leak-proof joints.

(2) Glass Panels: - To replace a glass side panel in a fixed section, it is desirable to remove section from airplane. Drill out a total of ten tubular rivets, positioned vertically at lower ends of front and rear bows and center frame. Removal of these rivets will allow lower frame and corner castings to be removed in one unit, after which panel replacements may be accomplished. Removal of a glass panel in a movable section is accomplished by pulling downward on emergency panel release latch, located between side panels, after which panels may be pushed outward. After sliding new panels in place, check to make certain emergency release pins are properly installed. Refer to ensuing paragraph (4) for replacement of glass panels in windshield. Visual inspection of observer's side windows will readily determine procedure for replacement.

(3) Transparent Sheet Panels: - The only transparent sheet panels in the entire enclosure that may be replaced without removing the section affected are the upper forward panels in each movable section and the upper rear panels in the rear fixed section. The

above mentioned panels and the other transparent sheet panels in the fixed and movable sections are removed by drilling out all the tubular rivets positioned vertically on the outer bow, adjacent to the panel effected. To replace a damaged transparent sheet panel in gunner's hood, remove assembly from airplane and remove section of outer frame located adjacent to damaged panel.

(4) Windshield Panels: - When necessary to replace a windshield panel, remove assembly from airplane. To replace the upper curved transparent sheet panel, remove the four screws at lower ends of rear frame. Then remove the two lower screws located on inner side of rear frame. Rear frame and transparent sheet panels may then be removed in one unit and disassembled. No further disassembly of windshield is necessary, as the three remaining glass panels will slide free.

6. Landing Gear Installation

a. General: - Prior to installing the landing gear, set landing gear controls and connecting linkage for the down position of the landing gear and proceed as follows: -

(1) Place landing gear in position, engaging hinge fitting on top of oleo strut with universal joint supported on the front spar of the center wing.

(2) When proper alignment of the hinge center is obtained, insert bolt, 25-33119, from inboard side of hinge assembly and secure with AN310-16 nut, washer, and cotter.

(3) Adjust landing gear rear strut assembly to obtain 57-15/16 inches between hinge centers. Connect non-adjustable end of strut to inboard side of hinge fitting located at lower end of oleo sleeve, and connect adjustable end of strut to hinge fitting located on rear spar of center wing, just outboard of fuselage, securing with AN30-23 bolts, nuts, and cotters as required.

(4) Check alignment of landing gear strut locking roller with up position hook, located in wheel well, by coating roller with graphite grease, retracting gear and observing hook mark on roller. Readjustment of landing gear rear strut assembly or shifting washers from one side of hook to the other will correct any misalignment.

(5) Check alignment of landing gear down position lock pin with its socket by manually holding gear in the down position and pushing lock pin in place. Pin should travel in and out of its socket freely. Should pin fail to do so, adjustment of the center wing brace assembly will correct the faulty condition.

(6) When certain correct adjustment of both up and down position lock mechanisms has been obtained, connect clevis end of lock pin operating link assembly to rear of landing gear lock pin with an AN5-14 bolt, and secure with nut and cotter.

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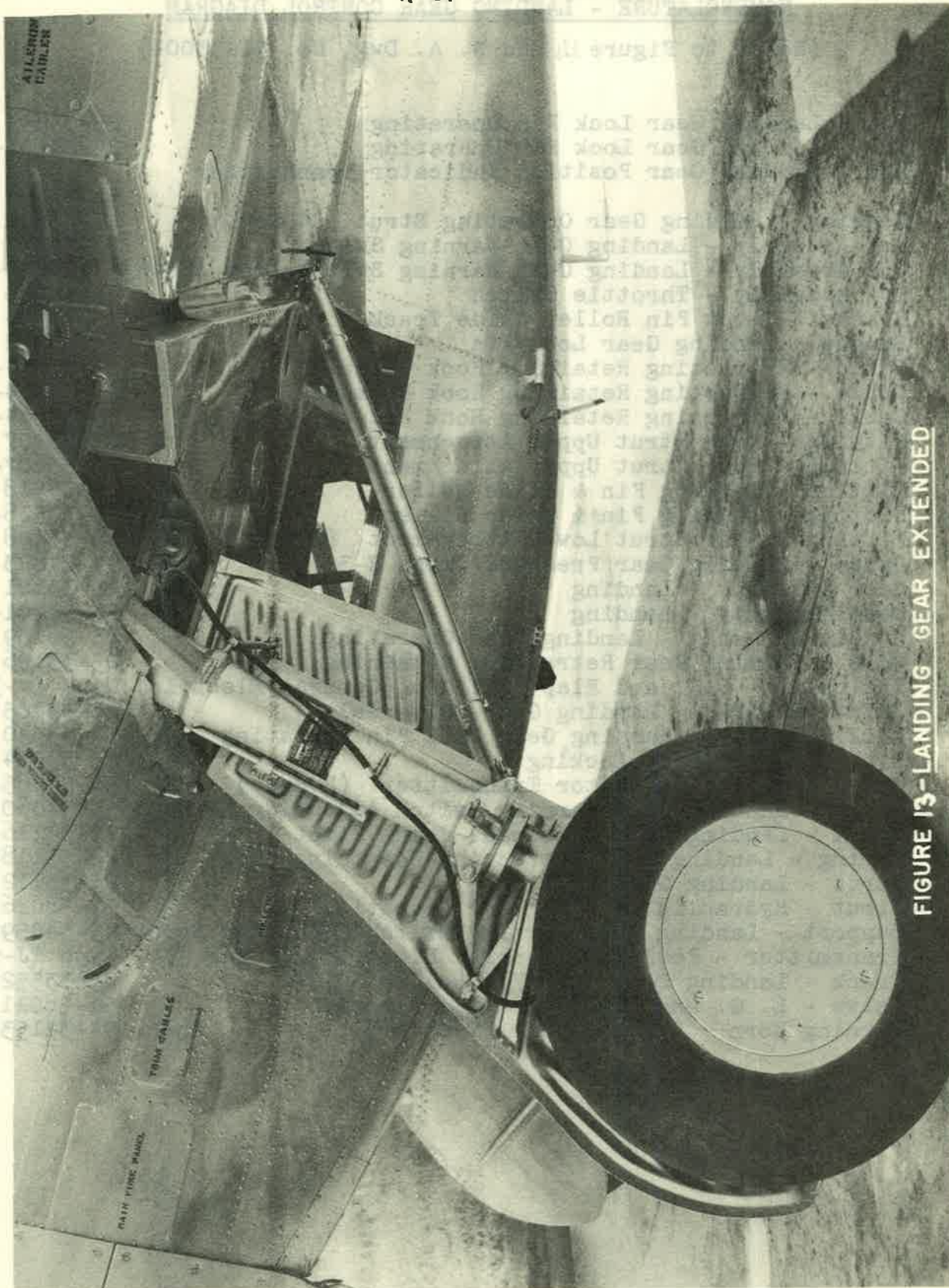
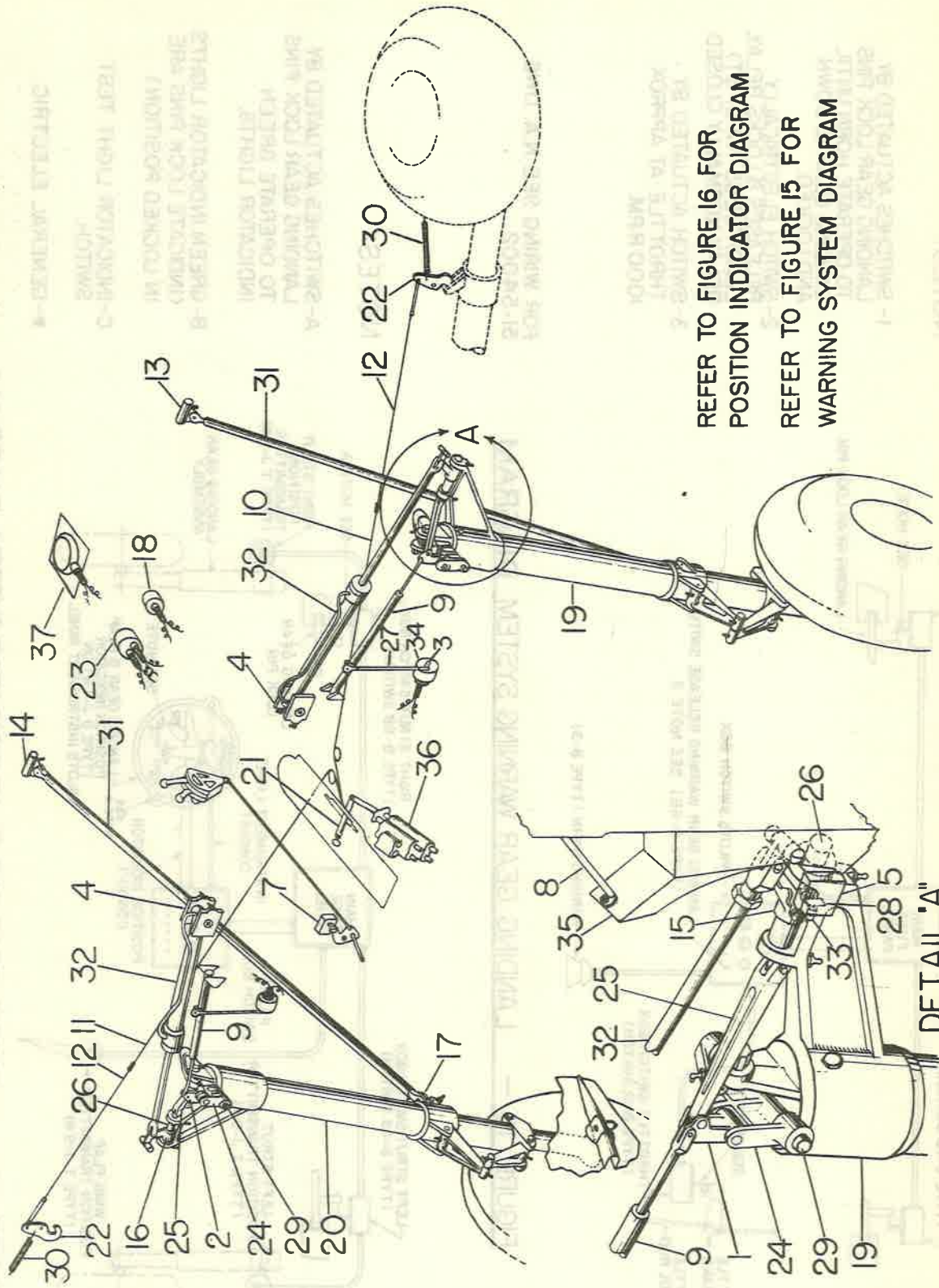


FIGURE 13-LANDING GEAR EXTENDED

NOMENCLATURE - LANDING GEAR CONTROL DIAGRAM

(Refer to Figure 14 and N. A. Dwg. No. 51-33001)

1. Arm - Landing Gear Lock Pin Operating	25-33541
2. Arm - Landing Gear Lock Pin Operating	25-33541-1
3. Arm - Landing Gear Position Indicator Transmitter (2 Req.)	51-54068
4. Bearing - Landing Gear Operating Strut (4 Req.)	25-33506
5. Box Assembly - Landing Gear Warning Switch	51-54057
6. Box Assembly - Landing Gear Warning Switch (not shown)	51-54057-1
7. Box Assembly - Throttle Switch	25-54063
8. Bracket - Lock Pin Roller Guide Track	25-33554
9. Bungee - Landing Gear Lock Pin	25-33542
10. Cable - Retracting Retaining Hook Release	25-33564-2
11. Cable - Retracting Retaining Hook Release	25-33564-3
12. Cable - Retracting Retaining Hook Release (2 Req.)	25-33564-4
13. Fitting - Rear Strut Upper Attachment	25-33107
14. Fitting - Rear Strut Upper Attachment	25-33107-1
15. Fitting - Locking Pin & Guide Roller	25-33518
16. Fitting - Locking Pin & Guide Roller	25-33518-1
17. Fitting - Rear Strut Lower Attachment (2 Req.)	25-33108
18. Gauge - Landing Gear Pressure (Type E-3)	Spec. 94-27823
19. Gear Assembly - Landing	25-33101
20. Gear Assembly - Landing	25-33101-1
21. Handle Assembly - Landing Gear Operating	25-58139
22. Hook - Landing Gear Retracting Retaining	25-33106
23. Indicator - L.G. and Flap Position (General Electric)	Type DJ-3
24. Joint Assembly - Landing Gear Universal	25-33105
25. Link Assembly - Landing Gear Lock Pin Operating	51-33540
26. Pin - Landing Gear Locking	25-33514
27. Rod - Position Indicator Transmitter (2 Req.)	51-54065
28. Screw - Landing Gear Warning Switch Adjusting (2 Req.)	51-54060
29. Shaft - Landing Gear Universal Joint Pivot	25-33116
30. Spring - Landing Gear Retracting Retaining Hook	25-33118
31. Strut - Landing Gear Rear	25-33112
32. Strut - Hydraulic Landing Gear Operating	51-58026
33. Support - Landing Gear Warning Switch Adjusting Screw	25-54059
34. Transmitter - Position (General Electric) (2 Req.)	Type TJ-9
35. Track - Landing Gear Lock Pin Roller Guide	25-33552
36. Valve - L. G. and Flap Hydraulic Selector	51-58011
37. Warning Horn - Landing Gear (Type B-3)	Spec. 94-32153



REFER TO FIGURE 16 FOR
POSITION INDICATOR DIAGRAM
REFER TO FIGURE 15 FOR
WARNING SYSTEM DIAGRAM

DETAIL "A"

FIGURE 14 - LANDING GEAR CONTROL DIAGRAM

NOTES:

- 1-SWITCHES ACTUATED BY LANDING GEAR LOCK PINS TO OPERATE HORN UNTIL LANDING GEAR IS DOWN AND LOCKED.
- 2-SWITCH ELECTRICALLY RELEASES & LOCKS RELAY, "LEACH" (1265-NA-DPST), RELAY NORMALLY CLOSED.
- 3-SWITCH ACTUATED BY THROTTLE AT APPROX. 1000 R.P.M.

FOR WIRING SEE N.A. DWG. 51-54002.

NOTES:

- A-SWITCHES ACTUATED BY LANDING GEAR LOCK PINS TO OPERATE GREEN INDICATOR LIGHTS.
- B-GREEN INDICATOR LIGHTS (INDICATE LOCK PINS ARE IN LOCKED POSITION)
- C-INDICATOR LIGHT TEST SWITCH.
- *-GENERAL ELECTRIC.

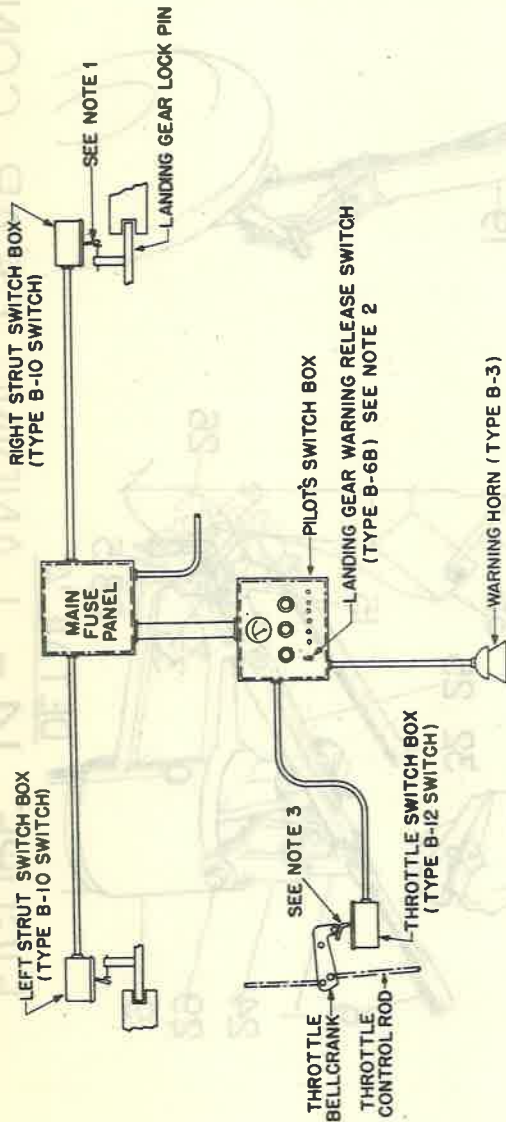


FIGURE 15 - LANDING GEAR WARNING SYSTEM DIAGRAM

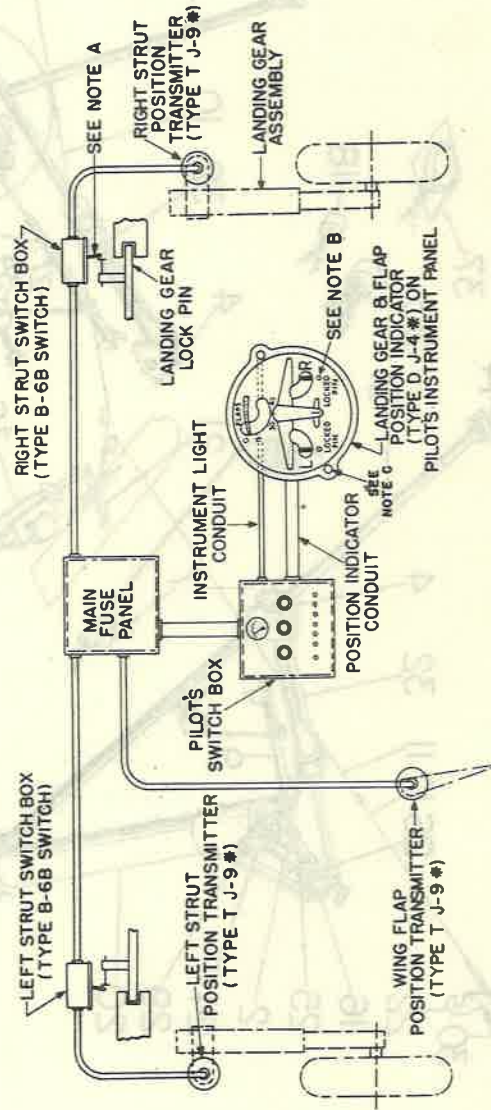


FIGURE 16 - LANDING GEAR AND FLAP INDICATOR SYSTEM DIAGRAM

(7) Prior to connecting landing gear operating strut, make certain down position lock pin is completely inserted in its socket and that operating strut is completely retracted. Adjust clevis at end of operating strut piston as required to allow bolt to pass freely through clevis and guide roller fitting on lock pin. Remove bolt, unscrew clevis 1/2 turn and connect to guide roller fitting with an AN26-24 bolt, a 25-33557 spacer, a nut, and a cotter.

(8) Lower and raise landing gear to check for proper operation of gear and correct position indication on instrument in pilot's cockpit. If necessary, adjust transmitter operating arm clamp on landing gear lock pin bungee strut, or clamp on transmitter shaft, as required to obtain correct indication.

(9) For landing gear warning horn and down position lock pin position indicator light adjustment, refer to Section III, Column 43, paragraph a. For lubrication requirements and landing gear shock strut service instructions, refer to Section III, Column 43, paragraphs b. and c., of this Handbook.

b. Brake Line: - Connect flexible brake line to brake assembly. Then, with oleo strut in the fully extended position, attach flexible line to lug located on forward side of oleo strut, just below torque arm. Attach brake line to outboard side of torque arm knee joint, to outboard side of lower collar attached to oleo strut, and to rear side of upper collar attached to oleo strut. Install safety wire through heads of wheel fairing actuating link strut bolt and upper rear brake line clamp bolt. The additional length shall be taken up between the latter point of attachment and the upper brake line attachment fitting. Insert line through retainer loop, located on wing rib just aft of landing gear universal joint and attach flexible brake line to rigid brake line.

c. Fairing: - Attach landing gear rear strut fairing to inboard side of strut assembly, and secure with four B1084-24 clamps. Maintain approximately 1-1/2 inches between upper end of fairing and center of strut attachment point to wing. Connect actuating link located on inboard side at top of oleo strut to landing gear fairing door assembly with an AN4-14 bolt, and secure with nut and cotter as required. To install landing gear wheel fairing, fasten landing gear fairing attaching angle, 25-33311, to inboard side of oleo strut, utilizing lower forward torque arm attaching bolt and an AN5-11A bolt, a 25-33318 spacer, a stop nut and a washer at rear of torque arm attachment bolt. Place fairing in position on landing gear and bolt to attaching angle with five AC525-10-8 bolts. Attach lower portion of fairing to bolt provided at bottom of oleo strut. Attach upper portion of fairing to attachment fittings on landing gear fairing retainer tube assemblies with eight AC525-10-9 bolts. Install reinforcing channel, 25-33326 L.H. or 25-33327 R.H., from outboard side of lower torque arm attachment bolt to forward end of fairing, utilizing torque arm attachment bolt and two AN526-1032-8 screws. Care should be exercised in retracting the landing gear until final

adjustment of the landing gear fairing has been made. Utilizing the emergency hand hydraulic pump, slowly raise and lower the gear to check for misalignment of the fairing. It is desirable to maintain a clearance of 1/32 inch between the landing gear fairing edges and the lower surface of the wing. In order to obtain proper functioning and clearance, it may be necessary to file or reform edges of fairing where interference occurs.

7. Tail Wheel Installation

a. General: - Place the tail wheel assembly in position, and bolt the fitting located at top of shock strut to the universal joint block assembly with an AN28-28 bolt, and secure with nut and cotter, as required. The universal joint assembly is bolted to the fuselage frame with an AN28-56 bolt. Bolt upper and lower link assemblies to the four eye-bolts located on fuselage bulkhead with AN25-27 bolts, utilizing a 25-34014 sleeve, nut and cotter at each attachment point. Each of the four eye-bolts, 25-34009, are secured to the bulkhead with an AC365-820 nut, an AC945-8 and an AN960-816 washer. Bolt shackle at end of tail wheel control cables to tail wheel control horn with AN24-12 bolts, and secure with nuts and cotters. Thread cables around pulleys provided and through holes in fuselage bulkhead. Connect end of each cable to its respective spring, using an AC150-21S turnbuckle, AN23-11 bolts, and cotters. For cable rigging loads, refer to Section III, Column 36, paragraph a., of this Handbook.

b. Fairing: - Secure tail wheel spindle housing fairing to tail wheel with two AN4-54A bolts. Attach housing strap, 25-31581, to forward end of housing with two AC526-836-6 screws and stop nuts. Attach tail wheel link fairing to the lower tail wheel link assembly with two AN526-836-14 screws and stop nuts. Install fuselage fairing around tail wheel gear well, attaching with Dzus fasteners provided.

8. Ski Installation

Provisions are made for the installation of the Type J-1 ski, AC537G643, which should be installed with reference to N.A. Dwg. No. 25-33901. One (1) Type B-1 ski retainer, AC33B866, one (1) AC34A5-3 axle extension, one (1) AC34B783 ski fitting, four (4) AC34A774-4 pins, and attaching bolts, nuts and cotters are required for installation of each ski. Prior to installing the ski, remove landing gear fairing and attaching parts. The landing gear strut and wheel wells may be covered by the landing gear fairing, to be held in place by machine screws. Screw holes for attaching fairing are to be located and drilled at ski installation.

WARNING: Landing gear control handle in pilot's cockpit should be safetied in the locked down position to prevent unintentional retraction of the gear with skis installed.

REFER TO N.A. DWG.
NO. 51-34001

9. Hydraulic System

a. General: - (1) A visual inspection of some units of the hydraulic system will readily determine the procedure for their removal, disassembly and installation; therefore, instructions for these units are omitted. A special valve wrench, 25-58178, is provided to facilitate the disassembly of various units of the system. Hydraulic lines are identified by a band of blue-yellow-blue.

(2) When disconnecting hydraulic lines, plug ends to prevent loss of fluid and entrance of foreign matter.

(3) As each of the hydraulic units is removed and disassembled, the component parts should be thoroughly cleaned.

(4) Bushings, springs, washers, packing cups, gaskets, etc., should be thoroughly inspected for deterioration, wear, and damage. Replacement of parts is not necessary unless they are in poor condition.

(5) Prior to reassembly of a unit, thoroughly flush all lines.

(6) It is also important, prior to the reassembly of a unit in the main hydraulic system, that the component parts be thoroughly cleaned with white gasoline and coated with mineral oil as used in the system. The master brake cylinder should be cleaned with diacetone alcohol and coated with Lockheed No. 5 Brake Fluid, or the equivalent.

(7) During assembly, make certain that all parts are correctly installed and locked as required.

(8) Whenever a hydraulic unit has been disassembled, regardless of the repairs or replacements accomplished, the unit must be pressure tested for leaks, tested for proper functioning and certain units shall be readjusted. Some units will, in addition to the adjustment after disassembly, require readjustments while they are in service on the airplane. For information pertinent to pressure testing, adjustment after disassembly, and readjustment while in service, refer to Section III, Column 43, paragraph e., of this Handbook.

(9) It is of prime importance, when replacing a hydraulic line, to ascertain that it does not leak.

(10) All tube fittings for the hydraulic systems are of the Parker Appliance Company, Triple Compression Type, which utilizes a sleeve under the tubing nut. Before assembling threaded parts, coat male threads with "Parker Thread Lube" or an equivalent compound. Care should be taken when reinstalling lines to avoid excessive tightening of the line connections, inasmuch as this will deform the cone of the connections, allowing leakage. Refer to T.O. 06-10-3.

(11) When flaring new tubing, the proper Parker Appliance Company flaring tool should be used and care exercised so that no burrs are left on end of tubing.

(12) Extreme care should be exercised in the handling of hydraulic fluid to keep it free from foreign substances. Clean containers should be used when it is necessary to bleed or drain any part of the system, and as a further precaution, such fluids should be put through a suitable filter before being returned to the system.

(13) The hydraulic units outlined in the ensuing paragraphs c. (1) to (7), inclusive, require moulded Neoprene parts. Information pertinent to part requirements is provided within these paragraphs.

b. Installation

(1) Landing Gear Operating Cylinder: - The landing gear operating cylinder must be installed from within the fuselage, either from the pilot's cockpit or observer's station, depending upon the items removed from airplane to facilitate removal of cylinder. To install, place landing gear retracting cylinder in space provided in wing stub, just aft of front spar bulkhead, with hydraulic line located at bottom. Prior to placing bearings on strut swivel head, insert an AN510-10-16 screw through hole in face of cylinder support bracket at each side of cylinder. Place swivel bearings in position on strut swivel head and insert four AN5-33A bolts through the bearing support angles and through bearings. Place bearing brace straps, 25-33512, over ends of bolts and secure assembly with four AC365-524 nuts. With cylinder piston fully extended, carefully check alignment of piston clevis with guide roller fitting located on lock pin. Should misalignment occur, correction can be obtained by placing 25-33567-2 and -3 shims between bearing and support bracket as required. When proper alignment is obtained, place bearing bolt retainers, 25-33511, over bolt heads and secure with AC365-1032 nuts. Attach lug on swivel head pin to rear bearing with an AN502-10-14 screw and secure with lock wire. Bolt bearing support reinforcement zee to cylinder support brackets with two AN3-4A-6 bolts, and secure with nuts. Connect hydraulic lines to fittings provided at ends of swivel head pins. Position zerk fitting on each bearing to provide accessibility. Refer to foregoing paragraph 6. a, (7), of this Section, for adjustment and attachment of piston rod end fitting. Reinstall equipment removed to facilitate installation of cylinder.

(2) Flap Operating Cylinders: - Install inboard flap operating cylinder in lower rear wing joint gap, and outboard cylinder in place provided in trailing edge of outer panel. Place cylinder in position, with hydraulic line connecting fittings on bottom, and bolt lug on rear of cylinder to attaching bracket with an AN4-13A bolt. Attach cylinder body to clamp fitting base with a "U" bolt, 25-11249. Connect hydraulic lines to fittings on bottom of cylinder. With reference to flap and position indicator adjustment, in Section III, Column 36, paragraph f., bolt flap push-pull rods to cylinder pistons and check for proper operation of flaps and indicator.

NOMENCLATURE - HYDRAULIC SYSTEM DIAGRAM

(Refer to Figure 18, and N.A. Dwg. No. 51-58001)

1.	Block - Engine Pump Lines Disconnect	51-58145
2.	Gauge - Hydraulic Pressure (Type E-3)	Spec. 94-27812
3.	Handle Assembly - Flap Operating	25-52614
4.	Handle Assembly - Landing Gear Operating	25-58139
5.	Line - Firewall to Engine Pump (Suction)	51-58511
6.	Line - Bulkhead to Firewall (Engine Pump Suction)	51-58512
7.	Line - Rib to Bulkhead (Engine Pump Suction)	51-58513
8.	Line - Reservoir to Rib (Engine Pump Suction)	51-58514
9.	Line - Fluid Filler	51-58515
10.	Line - Reservoir to Rib (Hand Pump Suction)	51-58516
11.	Line - Rib to Hand Pump (Suction)	51-58517
12.	Line - Pressure Control Valve to Tee (Return)	51-58518
13.	Line - Selector Valve to Tee (Return)	51-58519
14.	Line - Selector Valve Tee to Tee (Return)	51-58520
15.	Line - Pressure Relief Valve to Tee (Return)	51-58521
16.	Line - Filler Tee to Tee (Return)	51-58522
17.	Line - Tee to Reservoir (Return)	51-58523
18.	Line - Firewall to Bulkhead Fitting (Engine Pump Pressure)	51-58524
19.	Line - Bulkhead Fitting to Pressure Control Valve (Engine Pump Pressure)	51-58525
20.	Line - Pressure Control Valve to Cross (Engine Pump Pressure)	51-58526
21.	Line - Selector Valve to Cross (Pressure)	51-58527
22.	Line - Pressure Relief Valve Tee to Cross (Pressure)	51-58528
23.	Line - Hand Pump to Pressure Relief Valve Tee (Pressure)	51-58529
24.	Line - Selector Valve to Restrictor (Landing Gear Up)	51-58530
25.	Line - Restrictor to Tee (Landing Gear Up)	51-58532
26.	Line - Tee to Rear Port Left Strut (Landing Gear Down)	51-58533
27.	Line - Tee to Thermal Expansion Relief Valve (Landing Gear Up)	51-58534
28.	Line - Thermal Expansion Relief Valve to Rear Port Right Strut (Landing Gear Up)	51-58535
29.	Line - Selector Valve to Tee (Landing Gear Down)	51-58536
30.	Line - Tee to Front Port Left Strut (Landing Gear Up)	51-58537
31.	Line - Tee to Thermal Expansion Relief Valve (Landing Gear Down)	51-58538
32.	Line - Thermal Expansion Relief Valve to Front Port Right Strut (Landing Gear Down)	51-58539
33.	Line - Reservoir Vent	51-58540
34.	Line - Selector Valve to Elbow (Flap Up)	51-58541
35.	Line - Elbow to Tee (Flap Up)	51-58542
36.	Line - Tee to Left Inboard Strut (Flap Up)	51-58543
37.	Line - Union to Right Inboard Strut (Flap Up)	51-58544
38.	Line - Inboard to Outboard Strut (Flap Up)	51-58545
39.	Line - Tee to Thermal Expansion Relief Valve (Flap Up)	51-58546

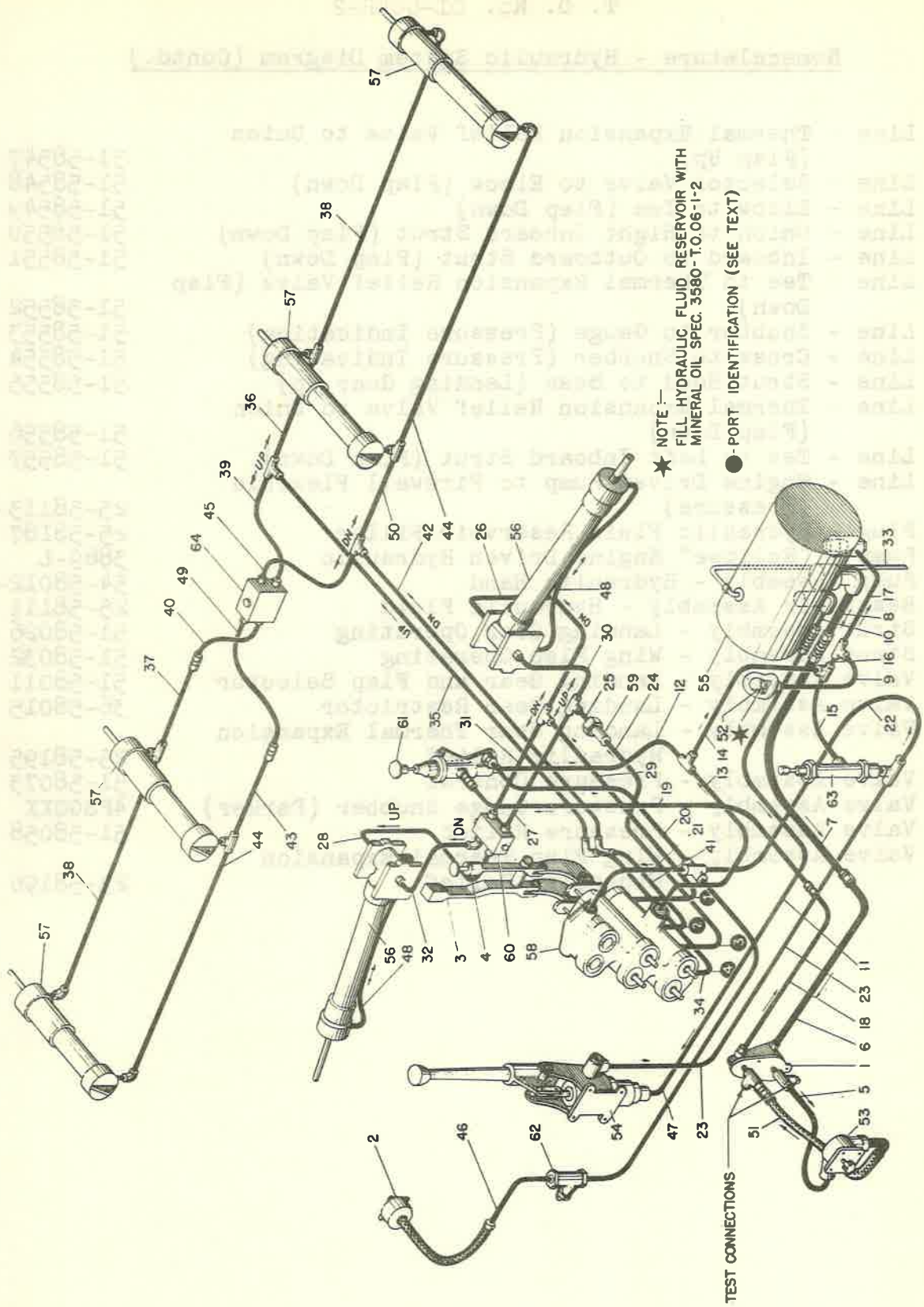


FIGURE 18 - HYDRAULIC SYSTEM DIAGRAM

Nomenclature - Hydraulic System Diagram (Contd.)

40.	Line - Thermal Expansion Relief Valve to Union (Flap Up)	51-58547
41.	Line - Selector Valve to Elbow (Flap Down)	51-58548
42.	Line - Elbow to Tee (Flap Down)	51-58549
43.	Line - Union to Right Inboard Strut (Flap Down)	51-58550
44.	Line - Inboard to Outboard Strut (Flap Down)	51-58551
45.	Line - Tee to Thermal Expansion Relief Valve (Flap Down)	51-58552
46.	Line - Snubber to Gauge (Pressure Indicating)	51-58553
47.	Line - Cross to Snubber (Pressure Indicating)	51-58554
48.	Line - Strut Head to Base (Landing Gear Up)	51-58555
49.	Line - Thermal Expansion Relief Valve to Union (Flap Down)	51-58556
50.	Line - Tee to Left Inboard Strut (Flap Down)	51-58557
51.	Line - Engine Driven Pump to Firewall Flexible (Pressure)	25-58113-2
52.	Plug - Hydraulic Fluid Reservoir Filler	25-58187
53.	Pump - "Eclipse" Engine Driven Hydraulic	3869-L
54.	Pump Assembly - Hydraulic Hand	54-58012-3
55.	Reservoir Assembly - Hydraulic Fluid	25-58111
56.	Strut Assembly - Landing Gear Operating	51-58026
57.	Strut Assembly - Wing Flap Operating	51-58032
58.	Valve Assembly - Landing Gear and Flap Selector	51-58011
59.	Valve Assembly - Landing Gear Restrictor	36-58015
60.	Valve Assembly - Landing Gear Thermal Expansion Hydraulic Relief	25-58195
61.	Valve Assembly - Pressure Control	51-58073
62.	Valve Assembly - Pressure Gauge Snubber (Parker)	4PSGGXX
63.	Valve Assembly - Pressure Relief	51-58058
64.	Valve Assembly - Wing Flap Thermal Expansion Hydraulic Relief	25-58196

(3) Selector Valve: - Place landing gear and flap selector valve in position under control shelf, just forward of flap and landing gear control handles. Line connecting fittings should be located at bottom and control handle attaching arms should face aft. Bolt cylinder to forward bracket on control shelf with an AN3-22A bolt and secure with an AC365-1032 stop nut. Place an AN210-2A elevator trim tab control pulley on an AN3-34 bolt and bolt cylinder to rear bracket on control shelf, securing with an AN310-3 nut, washer, and cotter. Both bolts are to be inserted from inboard side of brackets. Install links, 25-58157, between control handles and valve, using AN23-13 bolts, AN320-3 nuts, AN960-10 washers, and cotters. Connect hydraulic lines to valve.

c. Replacement of Hydraulic System Sealing Mediums

(1) General: - Three types of moulded Neoprene parts are used as sealing mediums in the hydraulic system; cups for sealing parts having relative motion, rings for gaskets between fixed parts, and discs for certain valve seats. CAUTION: DO NOT use rubber parts as packing glands in the units of the landing gear and flap hydraulic system. Copper gaskets are also used where certain fixed seals are required. Neoprene parts are identified by the basic part number, followed by the letter "N" moulded on the base. Ring gaskets of Neoprene are identified by a red stripe. The valve stem assemblies used in several units of the system are composed of a sealing disc and a small metal housing. Since the disc, B1134N, is enclosed in the housing, the disc itself cannot be replaced. When necessary, the entire valve stem assembly must be replaced. Service replacement of sealing mediums is necessary in the event excessive leakage occurs. Leakage of internal sealing parts is usually indicated by slow action or complete malfunctioning. Parts to be replaced may be determined by location of leakage. A visual inspection of the location where leakage is occurring, and of attaching and surrounding parts, will readily determine to what extent disassembly is necessary in order to accomplish replacement. If replacement is accomplished without removal of the unit, care should be taken to see that mechanism is kept clean and free of foreign substances. Refer to paragraph 9.a., of this Section, for general instructions on servicing the hydraulic system.

(2) Pressure Control Valve: - The pressure control valve assembly requires one B1113N cup for upper and one (1) B1232N cup for lower end of the control plunger. One (1) 51-58101-11 gasket is required between the upper bearing and the valve body. One (1) B985K-41-28-62 washer is used as a seal between the disc guide, located in bottom of valve, and the valve body. For testing and adjusting pressure control, refer to Section III, Column 43, paragraph e (1) and (3), of this Handbook.

(3) Pressure Relief Valve: - The hydraulic pressure relief valve requires the following gaskets: one (1) B985K-20-16-064, one (1) B985K-57-36-064 and one (1) B985K-40-29-064. For testing and adjusting relief valve, refer to Section III, Column 43, paragraph e (1) and (4), of this Handbook.

(4) Hydraulic Hand Pump: - The hydraulic hand pump requires one (1) B1116N cup for the piston head and one (1) B1206N cup for the piston bearing. One (1) 51-58101-6 gasket is required between the body head and the one-way valve retainer. One (1) 54-58013 stem assembly is required for the pump body head. Test the pump assembly for proper operation and leakage as specified in Section III, Column 43, paragraph e, (1) and (5), of this Handbook.

(5) Selector Valve: - The landing gear and flap selector valve assembly requires eight (8) B1111N cups for plunger external seals and eight (8) B1188N cups for plunger internal seals. When reassembling selector valve, it should be noted that all the cups used in the valve are similar, but not identical. The eight B1111N cups have lips of equal length and the eight B1188N cups have inner lips shorter than the outer lips. Care should be taken to assemble cups with equal lips at all external sealing points and cups with shorter inner lips at internal sealing points. Four (4) 25-58101-5 gaskets and two (2) 51-58104 stem assemblies are also required, the latter being used in one-way ports of the valve. Test the valve for leaks as specified in Section III, Column 43, paragraph e, (1) and (6), of this Handbook.

(6) Landing Gear Operating Cylinder: - Each cylinder for retracting and lowering the landing gear requires six (6) B1105N cups for sealing the swivel head. Four (4) B1167N cups are required for the piston, two sealing the piston head and two sealing the piston rod inner bearing. One (1) 51-58101-7 gasket is required between the piston rod inner bearing and the cylinder wall. For testing instructions, refer to Section III, Column 43, paragraph e, (1) and (7), of this Handbook.

(7) Flap Operating Cylinders: - Each of the four (4) flap operating cylinders requires four (4) B1167N cups; two cups sealing each piston head and two cups sealing each piston rod bearing. One (1) 51-58101-7 gasket is required between the piston rod inner bearing and the cylinder wall. For testing instructions, refer to Section III, Column 43, paragraph e, (1) and (8), of this Handbook.

10. Brake System

a. Installation of Master Brake Cylinder: - Place cylinder in position on forward side of firewall, directly below center of battery shelf, engaging the lower attaching holes in cylinder body with the two AN4-40A bolts extending through the firewall. These bolts are prevented from slipping into the fuselage by a cotter pin inserted through a hat-shaped channel at rear of each bolt. Place an AN960-416 washer and a 51-33435 support bracket on an AN4-23A bolt and secure upper portion of cylinder body to firewall. Secure remaining end of support bracket, utilizing the AN23-12 pulley support bracket bolt located directly above cylinder. Place cylinder spring guide assembly in position, parallel to cylinder piston and secure to lower attaching bolts with two AC365-428 nuts and AN960-416 washers. Connect the two hydraulic fluid lines to fittings at cylinder

★ NOTE: FILL BRAKE
CYLINDER RESERVOIR
WITH FLUID (SPEC.3586)
T.O. 06-1-2

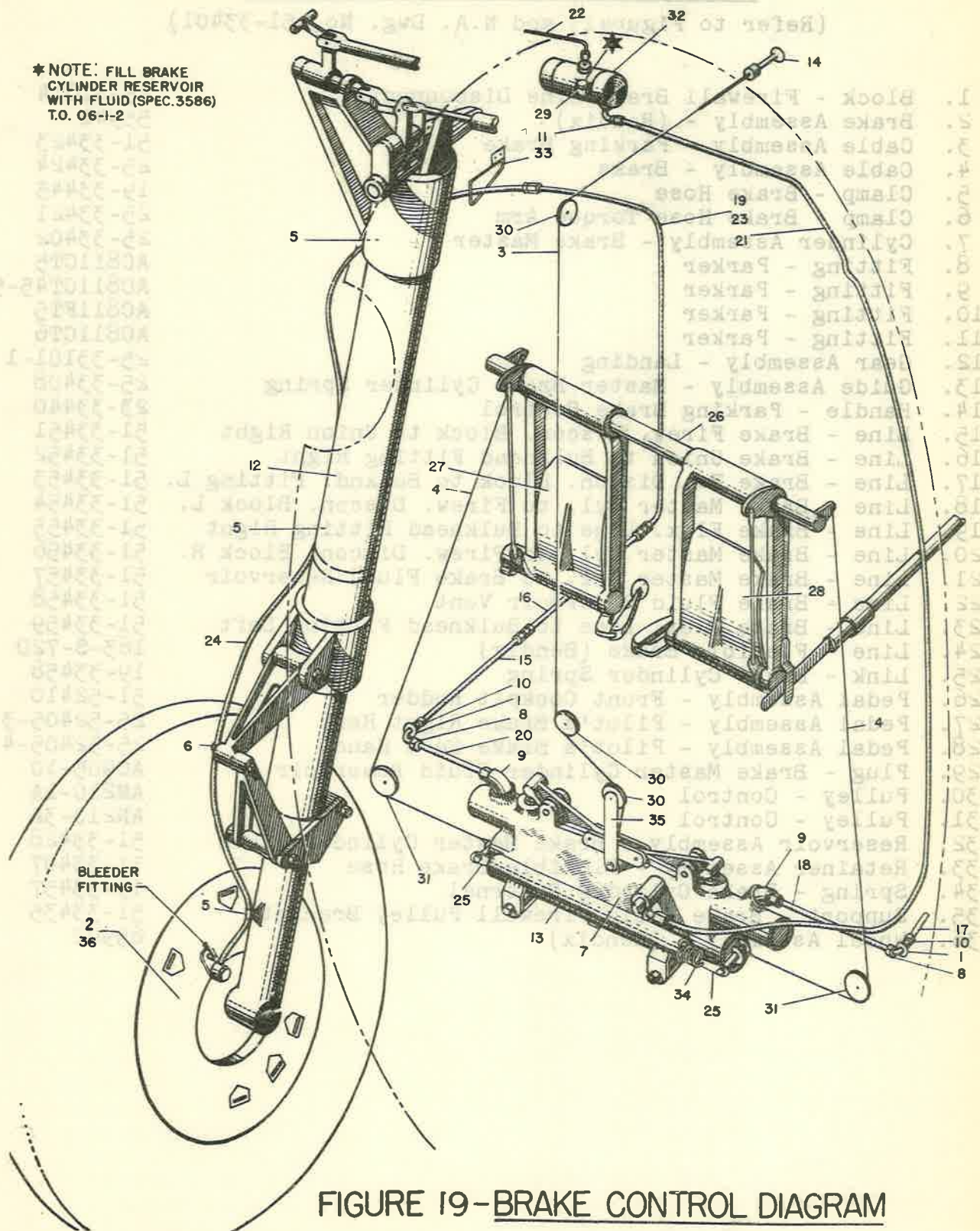
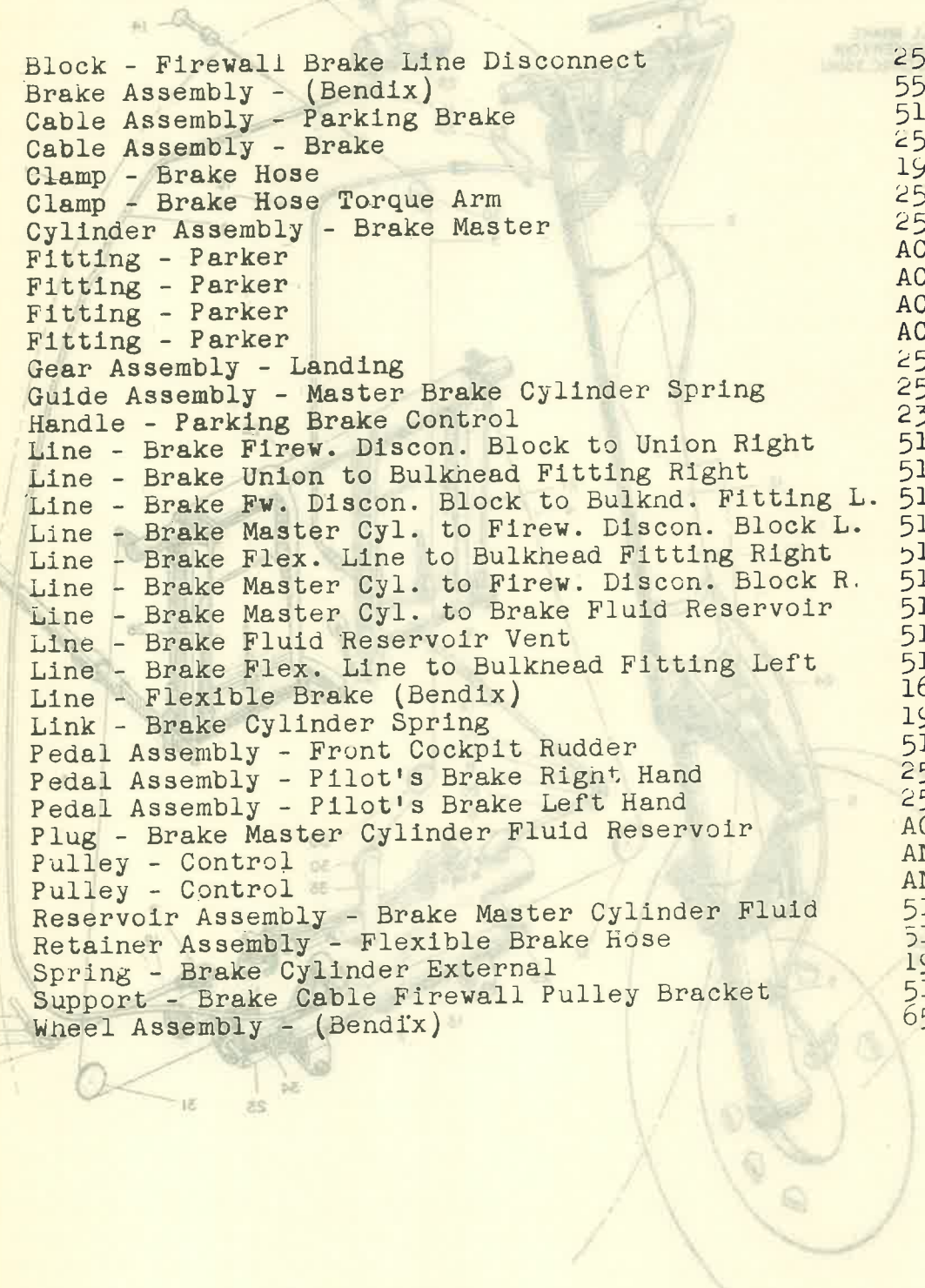


FIGURE 19-BRAKE CONTROL DIAGRAM

NOMENCLATURE - BRAKE CONTROL DIAGRAM

(Refer to Figure 19 and N.A. Dwg. No. 51-33401)



1. Block - Firewall Brake Line Disconnect	25-31614
2. Brake Assembly - (Bendix)	55941
3. Cable Assembly - Parking Brake	51-33423
4. Cable Assembly - Brake	25-33424
5. Clamp - Brake Hose	19-33445
6. Clamp - Brake Hose Torque Arm	25-33421
7. Cylinder Assembly - Brake Master	25-33402
8. Fitting - Parker	AC811CT5
9. Fitting - Parker	AC811CT45-5
10. Fitting - Parker	AC811FT5
11. Fitting - Parker	AC811CT6
12. Gear Assembly - Landing	25-33101-1
13. Guide Assembly - Master Brake Cylinder Spring	25-33408
14. Handle - Parking Brake Control	23-33440
15. Line - Brake Firew. Discon. Block to Union Right	51-33451
16. Line - Brake Union to Bulkhead Fitting Right	51-33452
17. Line - Brake Fw. Discon. Block to Bulknd. Fitting L.	51-33453
18. Line - Brake Master Cyl. to Firew. Discon. Block L.	51-33454
19. Line - Brake Flex. Line to Bulkhead Fitting Right	51-33455
20. Line - Brake Master Cyl. to Firew. Discon. Block R.	51-33456
21. Line - Brake Master Cyl. to Brake Fluid Reservoir	51-33457
22. Line - Brake Fluid Reservoir Vent	51-33458
23. Line - Brake Flex. Line to Bulkhead Fitting Left	51-33459
24. Line - Flexible Brake (Bendix)	163-S-720
25. Link - Brake Cylinder Spring	19-33458
26. Pedal Assembly - Front Cockpit Rudder	51-52410
27. Pedal Assembly - Pilot's Brake Right Hand	25-52405-3
28. Pedal Assembly - Pilot's Brake Left Hand	25-52405-4
29. Plug - Brake Master Cylinder Fluid Reservoir	AC905-10
30. Pulley - Control	AN210-1A
31. Pulley - Control	AN210-3A
32. Reservoir Assembly - Brake Master Cylinder Fluid	51-33428
33. Retainer Assembly - Flexible Brake Hose	51-33407
34. Spring - Brake Cylinder External	19-33457
35. Support - Brake Cable Firewall Pulley Bracket	51-33435
36. Wheel Assembly - (Bendix)	65902

FIGURE 19 - BRAKE CONTROL DIAGRAM

ends and at firewall. Connect reservoir line to brake cylinder, taping line at upper left engine mount attachment fitting to prevent possible chafing of line at this point. Attach brake cables to piston ends at hole in end of cylinder spring links and at connecting points on cylinder units, using an AN3-20 bolt, a B1071-6-39 spacer (between link and piston end), an AN310-3 nut, and a cotter at each attachment point. Adjust brake pedal connecting rods to obtain a slight tension on brake cables. Attach parking brake cable to linkage at center of cylinder assembly with an AN23-10 clevis bolt, a nut, a washer, and a cotter.

b. Replacement of Hydraulic Sealing Mediums: - Refer to paragraph 9.a. and c., of this Section, for general instructions pertinent to the replacement of hydraulic sealing mediums. A special wrench, 19-33447, is provided for disassembly of the master cylinder. The hydraulic master brake cylinder requires eight (8) packing cups; two (2) B1121 cups for each of the two pistons located in lower portion of cylinder; one (1) B1117 cup behind each of the two brake compensator units located in upper portion of cylinder ends; and one (1) B1117 cup for each of the two parking brake valve stems located below operating arms at upper side of cylinder. Two (2) gaskets and two (2) feed valve stem assemblies are required, one (1) each in the head of each piston assembly; use 25-58071-9 gaskets (when stock is exhausted use 51-58101-9), and 25-33412 feed valve stem assemblies. Two (2) 19-33408 brake compensator spools are required, one (1) in each parking brake compensator chamber. Two (2) 19-33430 parking brake stem assemblies are also required for the master cylinder. Test cylinder as specified in Section III, Column 44, paragraph d., of this Handbook.

11. Surface Controls

All control cables are of extra-flexible, corrosion resistant steel (pre-formed type) conforming to Spec. 48-36, and are wrapped and soldered in accordance with Spec. 98-25513. Control surface cables are 5/32 inch diameter; tail wheel cables are 1/8 inch diameter; and trim tab cables are 1/16 inch diameter. For cable rigging loads and control surface adjustment instructions, refer to Section III, Column 36, of this Handbook.

12. De-Icer System

a. General: - To complete the de-icer system installation on the O-47B Airplane, it is necessary to install de-icer shoes and non-kink hose between provided air lines and the de-icer shoes. "Rivnuts", which are essentially hollow threaded rivets, are provided for installation of the de-icer shoes on the leading edges of the wing, horizontal stabilizer, and vertical stabilizer. Temporary plugs are installed in the air line holes of the wing leading edge, and the open ends of all tubes have been taped and shellacked, pending installation of the de-icer shoes. The de-icer tubes are inflated by means of air from the exhaust (pressure) side of the

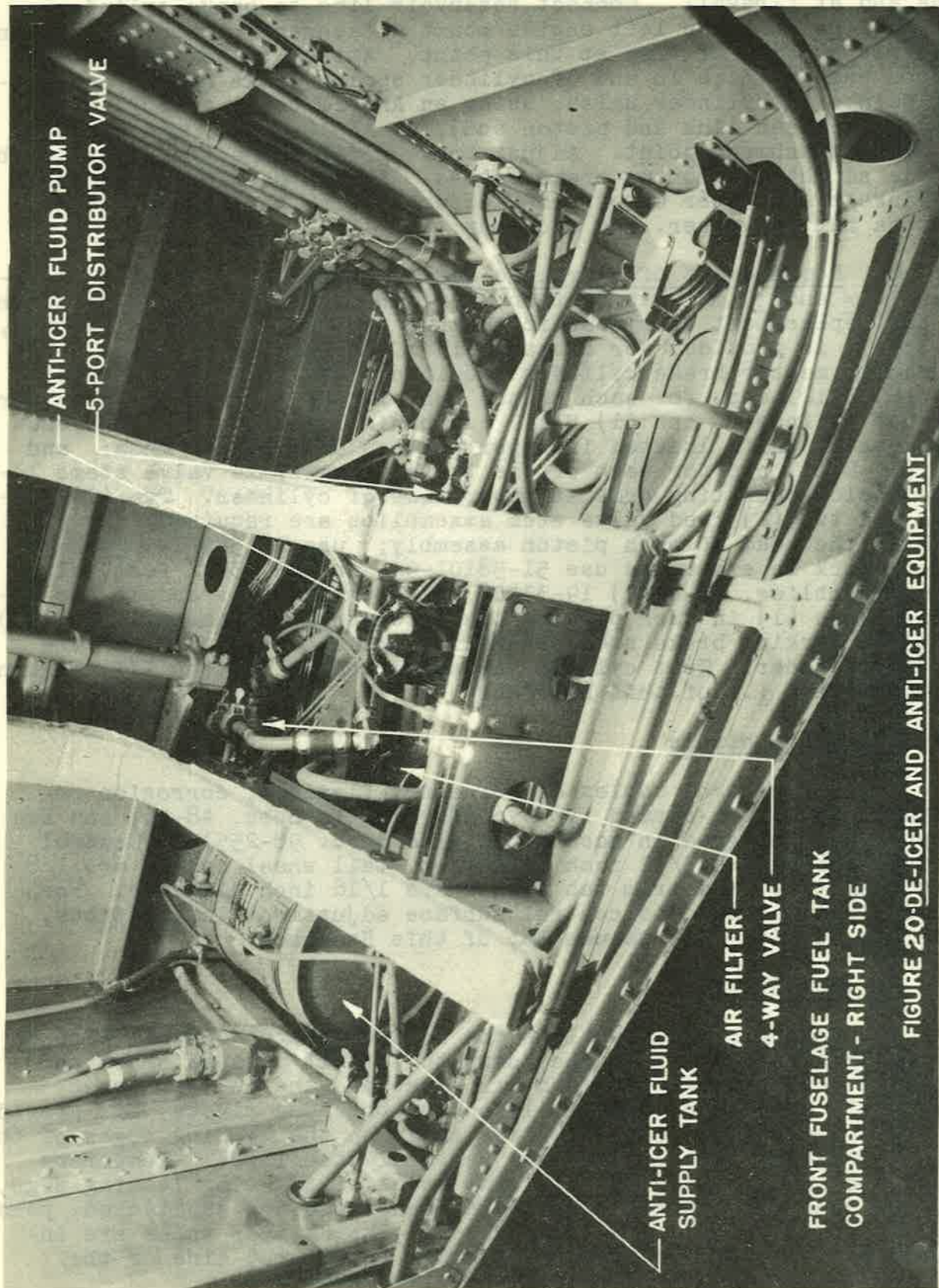


FIGURE 20-DE-ICER AND ANTI-ICER EQUIPMENT

vacuum pump. This discharged air is conducted by means of lines, through a conventional Type B-3 oil separator and to a Parker 4-way valve, the latter being controlled by a dial located on the control shelf at right side of pilot's cockpit. When the dial is set for "ON", the air is directed from the valve through an Eclipse pressure type air filter and to an Eclipse 5-port distributor valve. An integral relief valve, adjusted to operate at a pressure of 7 lbs./sq.in., is incorporated in the air filter. The distributor valve consists essentially of a constant speed electric motor, connecting ports, and rotary distributor valve. The distributor valve is automatically turned on and off by a cam on the control shaft of the 4-way valve. The rotor of the distributor valve routes the air, with proper timing, through the ports to inflate the tubes of the de-icer shoes according to the sequence of the inflation cycle; see following paragraph b. Deflation of the tubes in the de-icer shoes returns the air to the distributor valve from which it escapes into a drain line. In the event that the rotor is positioned over a port when the de-icer control is turned off, the air from the respective de-icer tubes returns through the rotor of the distributor valve, through the air filter and through the 4-way valve, escaping through a line into the distributor valve drain line. When the de-icer control dial is turned "OFF", the discharged air from the vacuum pump passes through the 4-way valve and is routed into the air filter drain line by-passing the air filter.

b. Inflation Cycle: - The de-icer system executes one complete cycle of inflation and deflation approximately every 40 seconds. The symmetrical sequence of tube inflation is as follows: (also refer to Figure 21, page 101, of this Handbook.

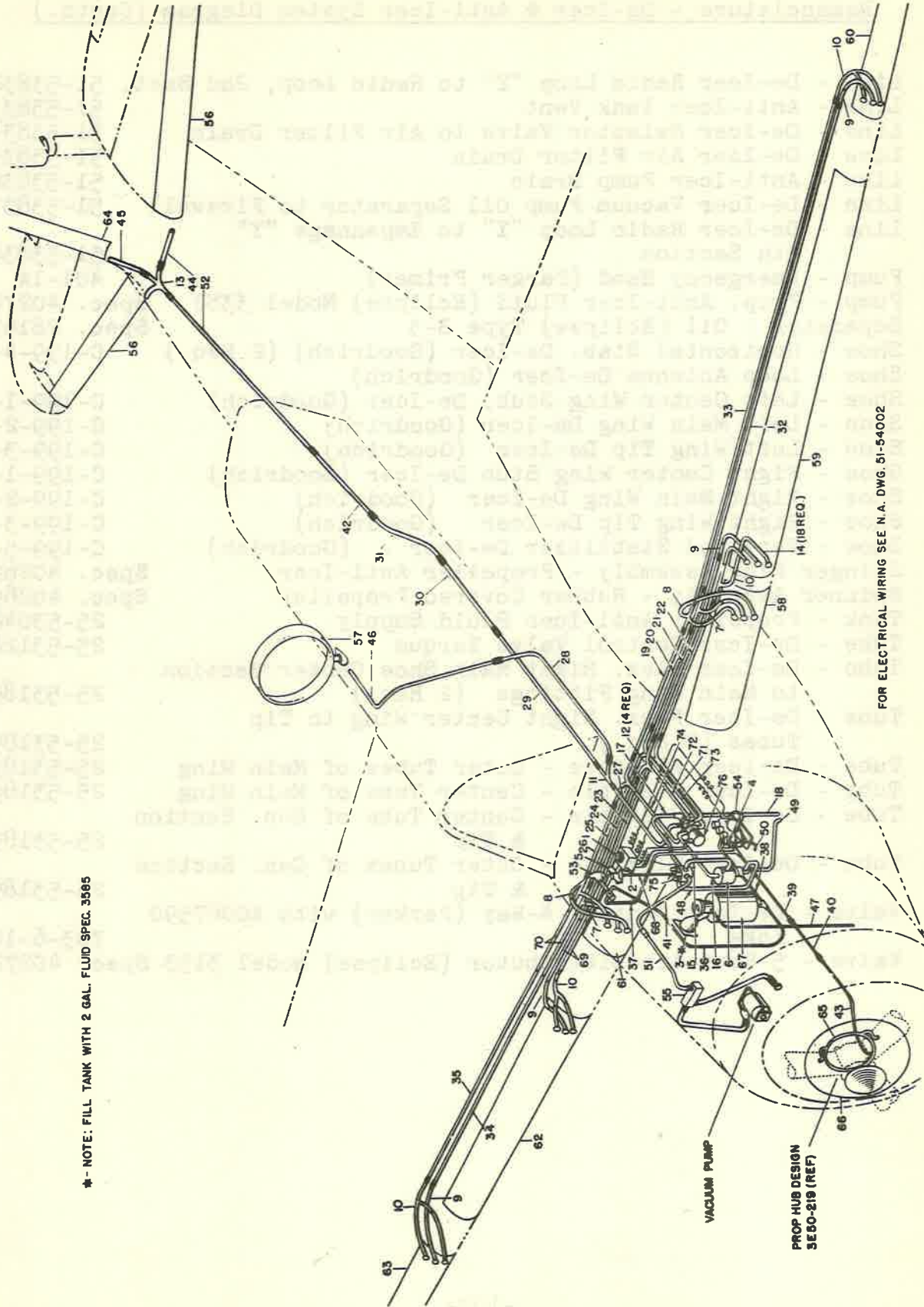
- (1) Center tube of inboard shoe on each outer wing panel.
- (2) Outer tubes of inboard shoe on each outer wing panel.
- (3) Center tube of outboard shoe on each outer wing panel, and center tube of shoe on each center wing stub.
- (4) Outer tubes of outboard shoe on each outer wing panel, and outer tubes of shoe on each center wing stub.
- (5) Tube of shoe on radio compass loop, vertical stabilizer and horizontal stabilizer.

c. De-Icer Shoe Installation: - Prior to installing de-icer shoes on wing, it is necessary to remove rubber plugs from air line holes in leading edge of wing, and to remove access doors, hand-hole cover plates, landing light doors, etc., as required to gain access to de-icer line fittings. Prior to installing de-icer shoes on empennage, it will be necessary to remove leading edge abrasion shoes from stabilizers, navigation light box cover plate at base of vertical stabilizer, and horizontal stabilizer to fuselage fairing. Remove tape from open ends of all de-icer line fittings, and remove

NOMENCLATURE - DE-ICER & ANTI-ICER SYSTEM DIAGRAM

(Refer to Figure 21, and N. A. Dwg. No. 51-53003)

1.	Box - Anti-Icer Pump & De-Icer Distributing Valve Cont.	51-54035
2.	Cam - De-Icer Torque Tube Switch	25-53129
3.	Cap - (Filler) Propel. Anti-Icer Tank	25-53194
4.	Cock - Anti-Icer Tank & Pump Drain or Parker	AC765-1 702-FG-4D
5.	Dial - Surface De-Icer Control Handle (Rework)	25-53061
6.	Filter Air - (Eclipse) Model 2915-B	Spec. 40271
7.	Fitting - Center Wing De-Icer Line Lower (2 Req.)	25-53172
8.	Fitting - Center Wing De-Icer Line Upper (2 Req.)	25-53169
9.	Fitting - Outer Wing De-Icer Line (4 Req.)	25-53176
10.	Fitting - Outer Wing De-Icer Line "Y" (4 Req.)	25-53168
11.	Fitting - Radio Compass Loop De-Icer Line "Y"	25-53177
12.	Fitting - Surface De-Icer Line "Y" (4 Req.)	25-53147
13.	Fitting - Tail Surface De-Icer Line	25-53174
14.	Hose - Non-Kink De-Icer (Goodrich) 3/8 I.D. x 7/64 wall x 18 Long (18 Req.)	
15.	Line - De-Icer Selector Valve to Air Filter	51-53801
16.	Line - De-Icer Air Filter to Distributor	51-53802
17.	Line - De-Icer Selector Valve to Distributor Drain	51-53803
18.	Line - De-Icer Distributor Valve Drain	51-53804
19.	Line - De-Icer Left Tip Shoe, Outside Tubes, Inboard	51-53805
20.	Line - De-Icer Left Tip Shoe, Inside Tube, Inboard	51-53806
21.	Line - De-Icer Left Main Shoe, Center Tube	51-53807
22.	Line - De-Icer Left Main Shoe, Outside Tubes	51-53808
23.	Line - De-Icer Right Main Shoe, Outside Tubes	51-53809
24.	Line - De-Icer Right Main Shoe, Inside Tube	51-53810
25.	Line - De-Icer Right Tip Shoe, Center Tube, Inboard	51-53811
26.	Line - De-Icer Right Tip Shoe, Outside Tubes, Inboard	51-53812
27.	Line - De-Icer Distributor to Radio Loop "Y"	51-53813
28.	Line - De-Icer Radio Loop "Y" to Radio Loop, 1st Sect.	51-53814
29.	Line - De-Icer Radio Loop "Y" to Empen. "Y", 1st Sect.	51-53815
30.	Line - De-Icer Radio Loop "Y" to Empen. "Y", 2nd Sect.	51-53816
31.	Line - De-Icer Radio Loop "Y" to Empen. "Y", 3rd Sect.	51-53817
32.	Line - De-Icer Left Tip Shoe, Center Tube, Outboard	51-53818
33.	Line - De-Icer Left Tip Shoe, Outside Tubes, Outboard	51-53819
34.	Line - De-Icer Right Tip Shoe, Center Tube, Outboard	51-53820
35.	Line - De-Icer Right Tip Shoe, Outside Tubes, Outboard	51-53821
36.	Line - Anti-Icer Tank to Emergency Hand Pump	51-53822
37.	Line - Anti-Icer Primer to Pump	51-53823
38.	Line - Anti-Icer Tank to Pump	51-53824
39.	Line - Anti-Icer Pump to Propeller, 1st Section	51-53825
40.	Line - Anti-Icer Pump to Propeller, 2nd Section	51-53826
41.	Line - De-Icer Selector Valve to Firewall	51-53827
42.	Line - De-Icer Radio Loop "Y" to Empennage, 4th Sect.	51-53828
43.	Line - Anti-Icer Pump to Propeller, 3rd Section	51-53829
44.	Line - De-Icer Empennage "Y" to Left Horizontal Stab.	51-53830
45.	Line - De-Icer Empennage "Y" to Vertical Stabilizer	51-53831



FOR ELECTRICAL WIRING SEE N.A. DWG. 51-54002

* NOTE: FILL TANK WITH 2 GAL. FLUID SPEC. 3585

FIGURE 21- DE-ICER AND ANTI-ICER SYSTEM DIAGRAM

Nomenclature - De-Icer & Anti-Icer System Diagram (Contd.)

46.	Line - De-Icer Radio Loop "Y" to Radio Loop, 2nd Sect.	51-53832
47.	Line - Anti-Icer Tank Vent	51-53833
48.	Line - De-Icer Selector Valve to Air Filter Drain	51-53834
49.	Line - De-Icer Air Filter Drain	51-53835
50.	Line - Anti-Icer Pump Drain	51-53836
51.	Line - De-Icer Vacuum Pump Oil Separator to Firewall	51-53837
52.	Line - De-Icer Radio Loop "Y" to Empennage "Y" 5th Section	51-53838 401-1A
53.	Pump - Emergency Hand (Parker Primer)	
54.	Pump - Prop. Anti-Icer Fluid (Eclipse) Model 3382	Spec. 40270
55.	Separator - Oil (Eclipse) Type B-3	Spec. 28167
56.	Shoe - Horizontal Stab. De-Icer (Goodrich) (2 Req.)	C-199-4-1
57.	Shoe - Loop Antenna De-Icer (Goodrich)	
58.	Shoe - Left Center Wing Stub, De-Icer (Goodrich)	C-199-1-1
59.	Shoe - Left Main Wing De-Icer (Goodrich)	C-199-2-1
60.	Shoe - Left Wing Tip De-Icer (Goodrich)	C-199-3-1
61.	Shoe - Right Center Wing Stub De-Icer (Goodrich)	C-199-1-2
62.	Shoe - Right Main Wing De-Icer (Goodrich)	C-199-2-2
63.	Shoe - Right Wing Tip De-Icer (Goodrich)	C-199-3-2
64.	Shoe - Vertical Stabilizer De-Icer (Goodrich)	C-199-5-1
65.	Slinger Ring Assembly - Propeller Anti-Icer	Spec. 40269
66.	Spinner Assembly - Rubber Covered Propeller	Spec. 40269
67.	Tank - Propeller Anti-Icer Fluid Supply	25-53048
68.	Tube - De-Icer Control Valve Torque	25-53128
69.	Tube - De-Icer Flex. Right Main Shoe Center Section to Main Wing Fittings (2 Req.)	25-53189-2
70.	Tube - De-Icer Flex. Right Center Wing to Tip Tubes (2 Req.)	25-53189-3
71.	Tube - De-Icer Flexible - Outer Tubes of Main Wing	25-53189-4
72.	Tube - De-Icer Flexible - Center Tube of Main Wing	25-53189-5
73.	Tube - De-Icer Flexible - Center Tube of Cen. Section & Tip	25-53189-6
74.	Tube - De-Icer Flexible - Outer Tubes of Cen. Section & Tip	25-53189-7
75.	Valve - De-Icer Control 4-Way (Parker) with AC067590 Yoke	703-6-10
76.	Valve - 5-Port Air Distributor (Eclipse) Model 3153	Spec. 40272

rivnut plug screws. The respective de-icer shoes and fairing strips should then be punched and drilled. In punching the rubber de-icer shoes, care must be taken to stretch the middle, or tube zone, lengthwise to cause metal beads in edges of shoes to lie flat. Allowance must also be made for "end pull up" or longitudinal contraction of the shoes in the installed position in order to prevent shoes from pulling loose. Care should be taken in punching to keep the holes exactly at edge of metal bead. During all handling operations, care should be exercised not to damage the rubber. Punctures in the de-icer shoes shall be repaired as specified in T.O. 03-35B-1. It is necessary to jig drill and countersink the fairing strips for No. 6-32 flat head screws. Attach Goodrich non-kink de-icer hose to lines, the hose to be of sufficient length (approx. 18 inches) to permit attachment to connector fittings in de-icer shoes. To install de-icer shoes on wing, temporarily insert No. 6-32 by 1-1/4 inch headless bolts in rivnuts at intervals of three or four feet on upper surface of wing leading edge. The shoes should then be slipped on the studs. Place the correct fairing strip over studs and insert 1/2 inch No. 6-32 cadmium plated flat head machine screws in the remaining holes between the studs. Tighten screws only enough to hold the shoe in place. Replace temporary studs with flat head machine screws. Fold rubber back over wing and thoroughly dust inside of shoes with talcum powder, Spec. 4-33. Connect non-kink air supply lines to their respective connecting fittings on de-icer shoes and secure with brass safety wire. To attach de-icer shoes to lower surface of wing, it is necessary to insert a temporary stud in every other rivnut, due to the tension of the shoe in the installed position. The shoe should then be attached, using one man to pull the rubber down over the entering edge with his open hands against the surface of the rubber, and a second man to grasp the bead and hook it over the studs and flat against the wing skin. Place the fairing strip over the studs, insert the screws in intervening rivnuts, and replace temporary studs with screws. Tighten the screws to imbed front edge of fairing strip in the rubber. The tension of the shoes prevents screws from loosening, therefore excessive tightening is not necessary. If the trailing edge of the fairing strip is flat against the wing surface, chafing of the wing skin should not occur. However, as a safeguard a strip of common masking tape can be placed on the wing skin under the trailing edge of the fairing strip. When fairing strip is omitted, the de-icer shoes may be attached by utilizing 1/2 inch washers under screw heads.

To install the de-icer shoes on the leading edge of the stabilizers, follow the same general procedure outlined above. A visual inspection of the radio compass antenna loop and of the shoe for same will readily determine the procedure for installation. Prior to operating the de-icer, make certain the system is correctly adjusted; refer to Section III, Column 36, of this Handbook.

13. Anti-Icer System

a. General: - An anti-icer system is provided for the prevention and elimination of ice formation on the propeller blades and hub. The system consists of an anti-icer fluid supply tank, an Eclipse, electrically driven anti-icer pump, a Parker emergency hand pump, a slinger ring, a rubber covered spinner cap and the necessary lines and fittings. The anti-icer lines are identified by a band of red-white. The fluid supply tank is installed in the lower forward portion of the pilot's cockpit, just below and outboard of the right floor trough. The tank filler neck is accessible through a door in right side of fuselage, just forward and above wing leading edge. A quantity gauge is installed on top of the tank. A light is provided for the gauge and is controlled from the pilot's electrical control panel. Access to a line incorporating a drain cock for pump and tank is gained through door on right side of fuselage, immediately forward and below wing leading edge. The anti-icer pump is controlled by a rheostat located on control shelf at right side of pilot's cockpit. When rheostat is "ON", the fluid is fed by the pump through a tube from which it is spilled into the slinger ring mounted on rear of propeller hub. The fluid should be supplied at the rate of approximately two quarts per hour. The fluid supply tank has a capacity of two gallons, which is adequate for four hours' operation. The propeller anti-icer hand pump, for emergency use only, is mounted on a vertical panel at forward end of control shelf located at right side of pilot's cockpit.

b. Installation: - Remove propeller and install slinger ring at rear of propeller hub, utilizing propeller barrel bolts. Reinstall propeller and install rubber covered spinner cap over propeller counterweights, again utilizing propeller barrel bolts. Remove anti-icer fluid supply line from stowed position at lower portion of engine nose section. Cut off pinched end of supply line and install a delivery tube assembly to end of supply line. Check to make certain length of supply line between engine cylinders No. 4 and No. 5 is taped and shellacked as required, utilizing lower stud in engine nose section. Secure delivery tube assembly in position in such a manner as to spill the anti-icer fluid into slinger ring. Ascertain that installation of spinner, slinger ring, and delivery tube is such that the propeller balance is not affected. Check for correct position of propeller blade feeding tubes, with reference to Section III, Column 47, paragraph b., of this Handbook.

c. Anti-Icer Pump: - Should it be necessary to replace the Eclipse propeller anti-icer pump, remove spring and ball from inlet and outlet valve on plugged port side of new pump. The Eclipse numbers of the pump parts to be removed before installation are as follows: Two (2) balls, A-29876, one (1) inlet spring (light), B-54534, one (1) outlet spring (heavy) B-54533. Prior to operating the system for the first time, a check should be made to see that the anti-icer pump is filled with light machine oil, Spec. 2-27 ("3 in 1" oil

may be substituted), to level of filler plug. No further lubrication should be required until overhaul. For additional information, refer to T. O. 03-35A-1.

14. Power Plant Installation

a. General: - The entire power plant, from the firewall forward, may be assembled and installed on the airplane as a complete unit, or the nine-cylinder, Wright R-1820-57 engine may be installed on the mount after the mount and other power plant units have been installed on the airplane. Engine mount fittings, electrical wiring and conduit, lines and control rods are conveniently located and easily connected. Care should be exercised when installing the power plant to prevent damage to lines, conduit, clamps, engine accessory units, etc. Coat male thread fittings of lines with lubricant specified in T. O. 06-10-3, prior to installation. Also see T.O.08-5-1.

b. Power Plant Complete: - The sequence of operations necessary to install the complete assembled power plant, including all units forward of the firewall is as follows: (Refer to Figures 24 and 25 for letters designating points of attachment.)

(1) Due to the snug fit, it is recommended that the four engine mount fuselage attachment fittings, (HH), (F), (V) and (Y), respective fuselage engine mount attachment fittings, attachment bolts, AN8-15 and bolt retainers, 25-31144, be cleaned and coated with graphite cup grease, prior to assembly.

(2) Remove nut from rocker arm pin bolt, located at exhaust side of No. 2 and at intake side of No. 9 engine cylinders. Place ends of Wright Company hoisting sling, No. 83297, (JJ), over ends of pin bolts and reinstall nuts, castellation first.

(3) Attach hoist (KK), and raise power plant into position. Rear of mount must be supported by personnel, and the two lower points of attachment to fuselage, (Y) and (V), engaged and loosely held by nuts prior to the engagement of the two upper points of attachment, (HH) and (F).

(4) Secure each engine mount attachment fitting to its respective fuselage attachment bolt with an AN960-816 washer, an AN310-8 nut, and an AN380-3-3 cotter. Tighten these four bolts to a tension of from 300 to 500 inch pounds.

(5) Remove engine hoisting sling, reinstall nuts and cotteners on rocker arm pin bolts, and make the following connections: -

(a) Instrument vacuum line (M), (suction), from relief valve to fitting at upper right side of firewall, just above de-icer (vacuum pressure) line fitting, using rubber hose and clamps.

(b) De-icer vacuum line (N), (pressure), from top of oil separator to fitting at upper right side of firewall, just below instrument vacuum line, using rubber hose and clamps.

T. O. NO. 01-60EB-2

REFER TO N.A. DWG.
NO. 51-40001

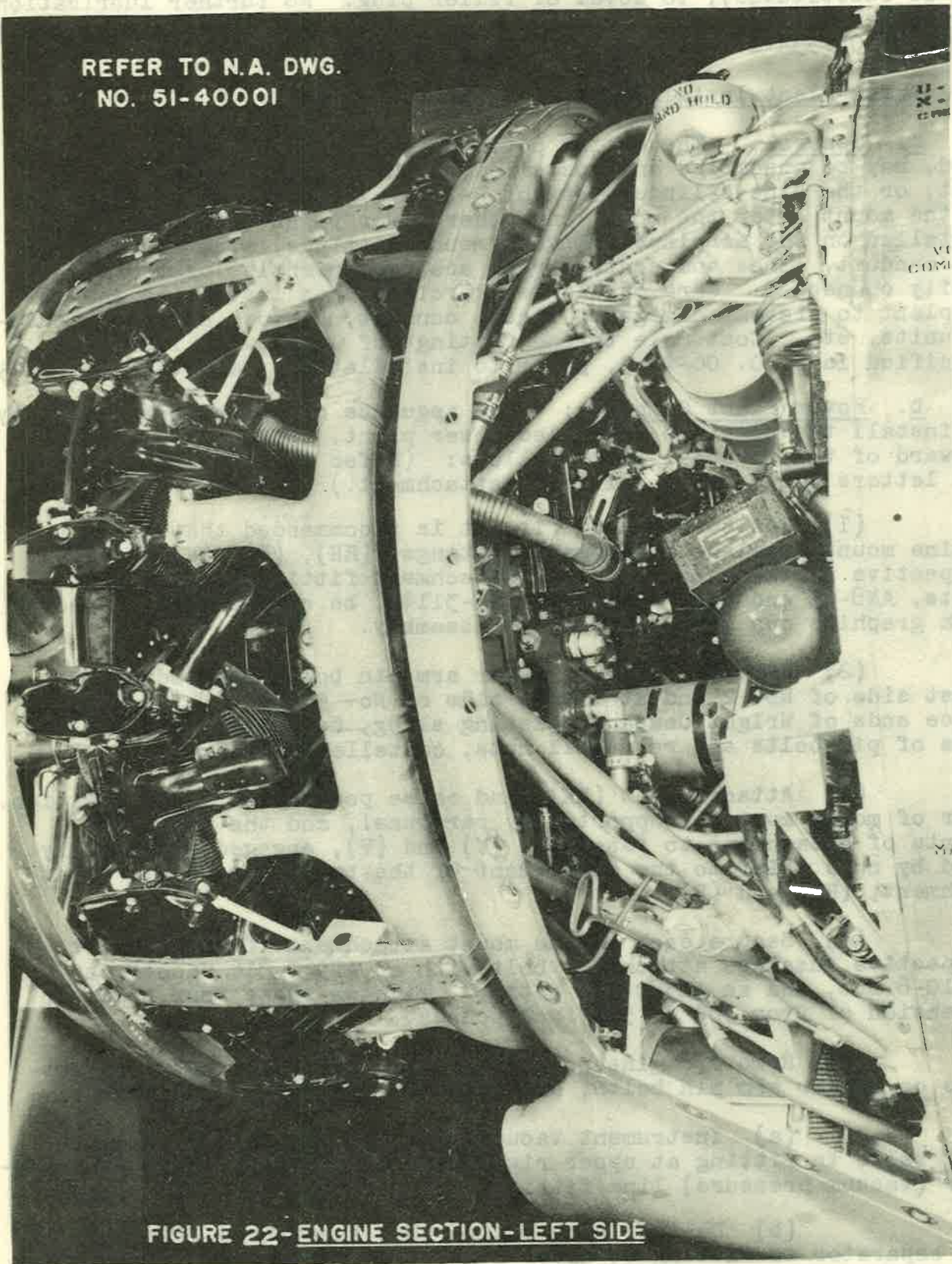


FIGURE 22-ENGINE SECTION-LEFT SIDE

T. O. NO. 01-60EB-2

REFER TO N.A. DWG.
NO. 51-40001

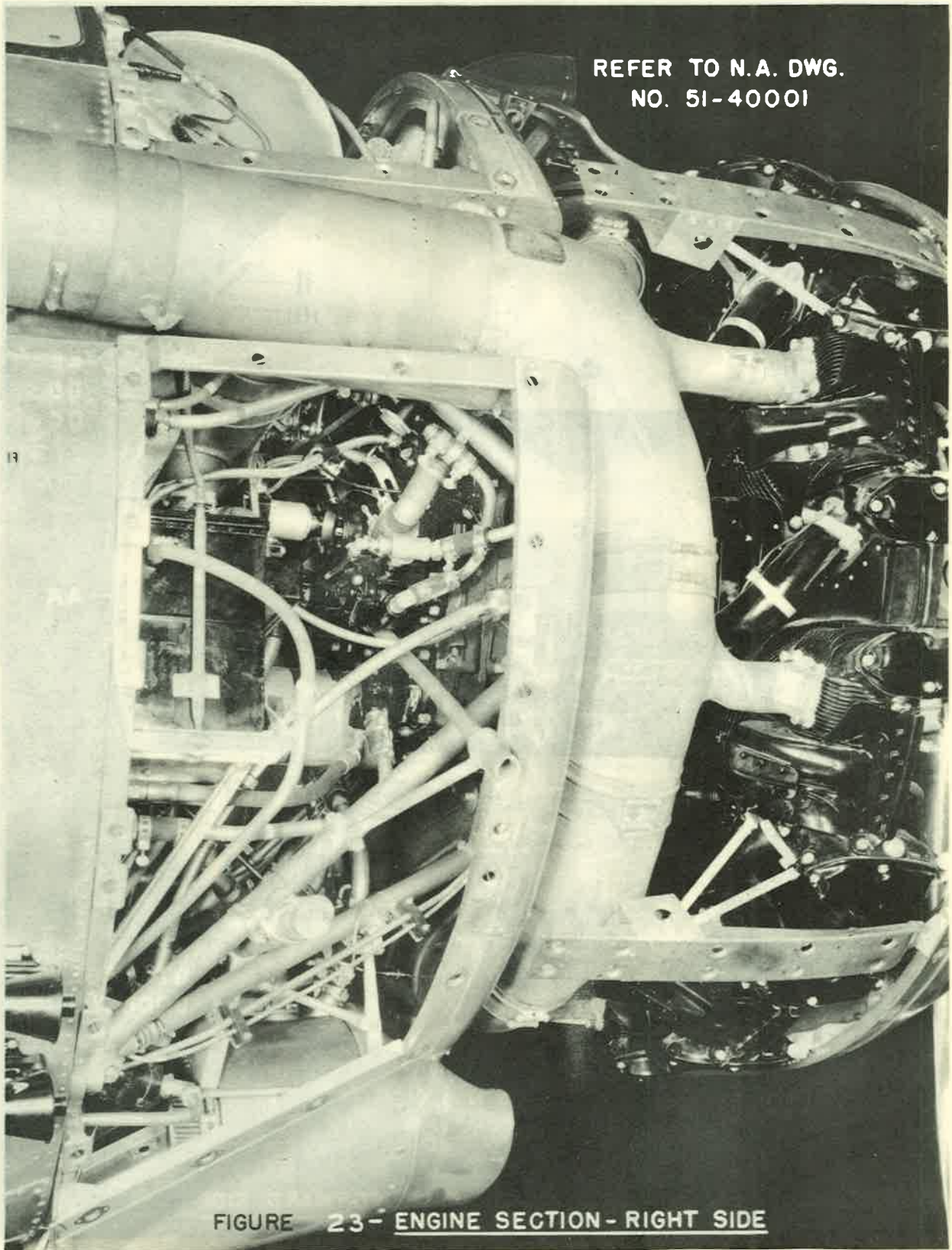


FIGURE 23- ENGINE SECTION - RIGHT SIDE

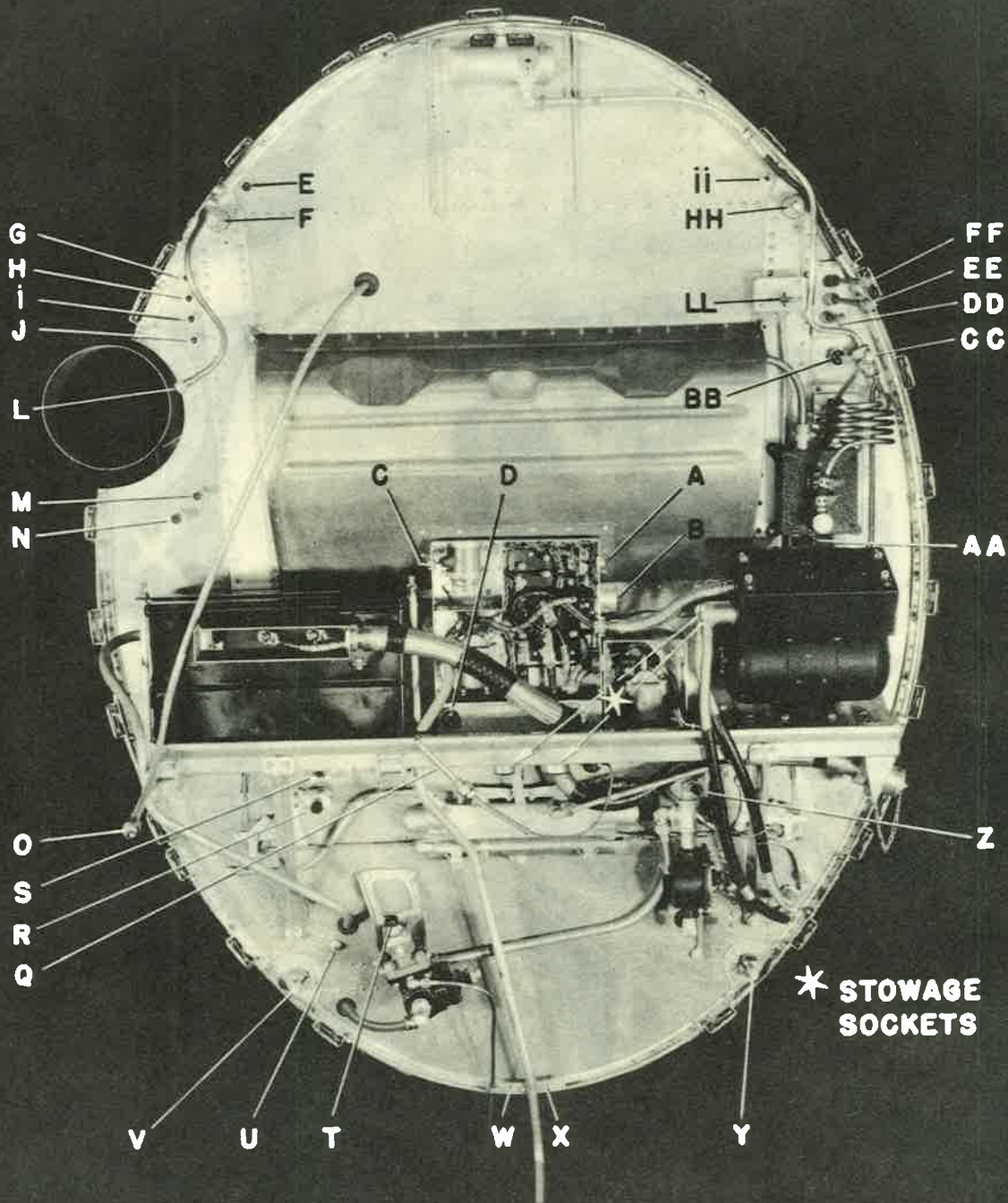


FIGURE 24- FIREWALL FORWARD SIDE

T. O. NO. 01-60EB-2

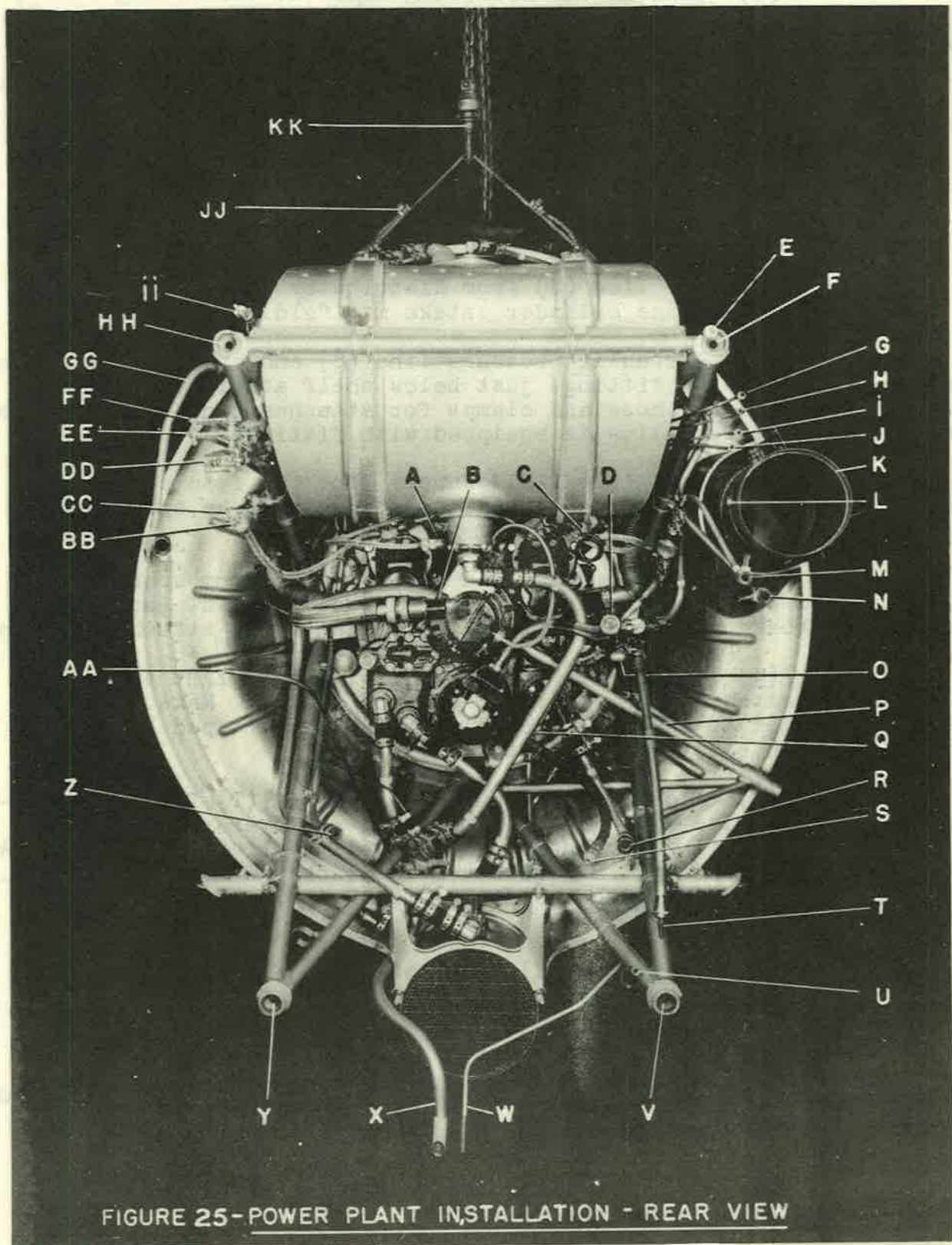


FIGURE 25-POWER PLANT INSTALLATION - REAR VIEW

(c) Connect the following lines to connecting block, (G), (H), (I), (J), at upper right side of firewall, starting with the upper fitting and working downward: -

Fuel pressure line (G) from left side of carburetor;

Manifold pressure line (H) from upper engine case fitting between magnetos;

Oil pressure line (I) from lower engine case fitting between magnetos;

Engine primer line (J) from distributor cross, supported on No. 1 engine cylinder intake manifold.

(d) Hydraulic pressure line (S) and hydraulic suction line (R) from pump to fittings just below shelf at right side of firewall. Use rubber hose and clamps for attachment of suction line. The flexible pressure line is equipped with fittings.

(e) Anti-icer fluid supply line (U) from engine nose section to firewall fitting, located immediately above and inboard of lower right engine mount attachment point.

(f) Thermocouple lead assembly (E) from spark plug of master rod engine cylinder No. 1 to firewall socket, located immediately inboard and above upper right engine mount attachment point.

(g) Tachometer shaft (O) from upper right side of firewall to drive assembly at right side of engine. Make certain shaft is clamped to edge of firewall foot well and taped at point of contact with oil tank and foot well.

(h) Flexible fuel pump drive shaft (T) from drive assembly at right side of engine to fuel pump at lower right side of firewall. Secure line to bracket on firewall shelf with an AC755-14 clamp, using an N.A. Std. B1208N40-4-24-38 rubber sheet under clamp. Safety wire fitting at each end of shaft. Refer to Figure 2, page 20, for lubrication requirements.

(i) Fuel line (Z) from left rear side of carburetor to top of hand fuel pump, located on lower left side of firewall, using rubber hose and clamps.

(j) Oil dilution line (II) from oil drain and dilution cock to firewall fitting, located immediately above and inboard of upper left engine mount attachment point, using rubber hose and clamps.

(k) Overflow line (GG) to fitting on oil tank filler flange, using rubber hose and clamps.

(l) Left magneto wiring and conduit (BB) to ignition disconnect plug, located at upper left side of firewall just above exhaust gas analyzer. Clamp conduit and conduit bonding strap to attachment plate on carburetor air heat bellcrank support mounted on upper left engine mount tube. Tape line at point of contact with engine mount.

WARNING: When ignition plug is disconnected, engine ignition is "ON". DO NOT rotate engine.

(m) Right magneto wiring and conduit (C) to main power panel connector, located on center of firewall. Clamp conduit and conduit bonding strap to firewall foot well. Tape line at point of contact with right magneto scintilla junction box, and tank to drain cock oil line.

(n) Generator electrical wiring and conduit (D) to main power panel connector located on center of firewall. Conduit shall be positioned under battery conduit and taped at point of contact with firewall shelf and tank to drain cock oil line.

(o) Starter electrical wiring and conduit (B) to main power panel connector located on center of firewall.

(p) Carburetor air temperature resistance bulb electrical wiring and conduit (A) to main power panel connector, located on center of firewall.

(q) Clamp starter conduit to firewall foot well, using tape between conduit and clamp. Utilize clamp screw to secure starter conduit and temperature conduit bonding straps. Clamp temperature conduit to starter conduit with two clamps. Use tape under the starter conduit clamp. Tape temperature conduit at points of contact with starter conduit.

(6) Install oil temperature capillary bulb (Q) in well located in tank to drain cock oil line. Make certain tube is clamped to bottom of firewall shelf.

(7) Insert starter crank extension through support at right side of engine mount and connect to starter drive with a bolt, nut, and cotter.

(8) Prior to connecting the engine control rods, (FF), (EE), (DD), and (CC), to their respective bellcranks mounted on upper left engine mount tube, set engine controls in pilot's cockpit as follows: -

Throttle - "Closed" (extreme aft) position
Mixture - "Idle Cut-Off" (extreme aft) position
Propeller - "Take-Off" (extreme forward) position
Carburetor Air Heat - "Icing Conditions" (extreme aft) position

Set levers on engine accessories as follows: -

Carburetor throttle lever - "Closed" (lever down) position

Mixture lever - "Idle Cut-Off" (lever up) position

Propeller governor bellcrank - "Take-Off" (Take-off position is approximately 51° (degrees) in a counter-clockwise direction from vertical center line of unit when viewing unit from bellcrank side.) If stop on governor has been previously adjusted correctly, place bellcrank against same.

WARNING: When power plant installation is complete, test engine to be sure take-off R.P.M. (2350) is obtainable. If take-off R.P.M. is not obtainable, further adjustments of the governor stop will be necessary.

Carburetor air heat bellcrank - "Icing Conditions" (lever up) position

Adjust control rods as required and connect to respective bellcranks, mounted on upper left engine mount tube.

(9) Install exhaust tail pipe trough cowl between engine fixed cowl and firewall, using bolts and No. 1032 Bendix set nuts.

(10) Complete engine exhaust collector installation by installing discharge section, 51-42005-10. Be sure to bolt section to support bracket located at rear of engine cylinders No. 2 and 3.

(11) Install engine exhaust front stack (K) between exhaust collector and exhaust tail pipe. (Refer to Figure 25) Attachment to collector requires a 51-42005-19 sleeve, and attachment to tail pipe requires a 25-42022 sleeve. Attach each sleeve, using three AN23-10 bolts, three B310-3 nuts (AN320-3 nuts may be used for replacements), three AN380-2-2 cotters, and one 25-42035 link. The link shall be installed at the top of each sleeve. The sleeve nuts shall be cotted so as to allow approximately 3/32 inch expansion space. Do not tighten bolts.

(12) Connect exhaust gas analyzer inlet line (L) from analyzer at left side of firewall to connecting boss on inner side of engine exhaust front stack, just forward of firewall. Safety wire connecting fitting.

Connect exhaust gas analyzer outlet line (AA) from fitting on aft side of collector ring at rear of No. 6 engine cylinder to outboard fitting on bottom of analyzer unit, using rubber hose and clamps.

NOTE: Sampling nipples not used at inlet or outlet connections to exhaust collector - USE FLUSH FITTINGS.

(13) Clamp dynamotor unit, electrical wiring, and conduit to lower left tube of engine mount, just below step support clamp, using two clamps. Tape lines at points of contact with each other and secure bonding strap of each line to "U" bolt of step support bracket by means of a screw.

(14) Clamp end of drain line (X) from oil cock, and end of supercharger drain line (W) from right side of engine case, to angle at bottom of firewall.

(15) Make certain that all control rods are properly adjusted and safetied as required; that all line connections are properly tightened; and that all lines, conduit, controls, etc., are properly supported by means of clamps and protected against chafing. Also make certain power plant assembly is properly bonded. Check for proper operation of controls while running engine. Ascertain take-off R.P.M. (2350) is obtainable. Also make certain fitting on throttle control bellcrank will operate toggle switch (LL), located on firewall at a throttle position of approximately 1000 R.P.M.

(16) Install engine nose ring cowl, engine ring removable cowl, and engine compartment removable cowl. Refer to following paragraph d., and Figure 26, of this Handbook.

(17) Install propeller. A special hub nut wrench, No. 81402, is provided. Refer to T. O. 03-20CB-2.

c. Engine to Engine Mount Ring: - The sequence of operations necessary to install the Wright R-1820-57 engine to the engine mount ring is as follows: -

(1) If the following accessories are installed on the engine, they must be removed in order to allow the engine accessory section to pass through the engine mounting ring: Carburetor, carburetor adapter, vacuum pump, tachometer and fuel pump drive assembly, hydraulic pump line connecting fittings, and Cuno oil strainer. It is also necessary to turn "IN" and "OUT" engine oil line connecting fittings towards center of engine; to loosen Breeze shielding nut and remove coil housing and distributor block from each magneto.

(2) It is recommended that the installation of the following be accomplished prior to installing engine on mounting ring: Spark plugs, thermocouple, generator, starter, propeller governor, primer distributor lines from distributor cross to engine cylinders Nos. 1, 2, 3, 8, and 9, magneto ignition manifold assembly, cylinder baffles, and so forth.

(3) Install two B1144-4 rubber vibration absorber cushions and one 25-31912 spacer in each of the nine engine mount cushion lugs, except in the rear side of the cushion lug behind cylinder No. 3, which requires one 25-31914 cushion instead of a B1144-4 cushion. The lubrication and replacement instructions for vibration cushions, contained in T. O. 01-1-58, shall be adhered to.

(4) Assemble the three sections of the engine fixed baffle around rear of engine. Refer to following paragraph d. (1), of this Handbook.

(5) Remove nut from rocker arm pin bolt, located at exhaust side of No. 2, and at intake side of No. 9 engine cylinders. Place ends of Wright Company hoisting sling, No. 83297, over ends of pin bolts and reinstall nuts, castellation first.

(6) Attach hoist to sling and raise engine into position opposite mounting ring.

(7) Carefully guide engine through mounting ring so as to prevent damage to magnetos and other engine accessory units.

(8) Fasten engine to mounting ring, using an AN7-57 bolt, two B1102 washers, two AN960-716 washers, an AN310-7 nut and an AN380-3-3 cotter at each of the nine points of attachment, except for the rear side of cushion lug behind cylinder No. 3, which requires a 25-31913 washer and an AN7-65 bolt. The cushion lug behind cylinder No. 2 also requires an AN7-65 bolt. An engine bonding strap, 19-54079, must be installed on two of the engine to mount bolts prior to their installation, and these bolts used on opposite sides of the engine.

NOTE: These bolts, securing the bonding straps, require only one AN960-716 washer and it should be used beneath the bolt head. Prior to placing nuts and washers on bolts located behind No. 2 and No. 3 engine cylinders, install exhaust collector support bracket, 25-42031.

CAUTION: Tighten all bolts evenly to obtain maximum absorbing characteristics and to assure proper alignment of engine with mounting ring. Be familiar with instructions contained in T. O. 00-20A, Column 33, 40 Hour, and T. O. 01-1-58 before tightening bolts.

(9) Lower hoist, remove engine sling, and reinstall nuts and cotters on rocker arm pin bolts.

(10) Attach end of each engine bonding strap to nearest bolt, securing engine fixed cowl to engine mount.

(11) Install carburetor adapter, carburetor, vacuum pump, tachometer and fuel pump drive assembly, hydraulic pump line connecting fittings, and Cuno oil strainer. Reinstall distributor block, coil housing and Breeze shielding nut in each magneto. Safety turn-buckle on coil housing strap.

(12) Install top portion of engine fixed cowling, or, if at engine removal power plant was completely disconnected, install the three sections of the fixed cowling. Refer to following paragraph d(2) for installation instructions.

(13) Secure oil separator and cowling support bracket to top portion of engine fixed cowling, using four bolts, washers, and No. 1032 Bendix set nuts. First ascertain that cowling fits properly.

(14) Install carburetor air mixing chamber. Use screen and two gaskets between mounting flanges, and secure with elastic stop nuts and washers.

(15) Prior to connecting the engine control rods to their respective engine accessory units, set engine controls in pilot's cockpit as follows: -

Throttle - "Closed" (extreme aft) position
Mixture - "Idle Cut-Off" (extreme aft) position
Propeller - "Take-Off" (extreme forward) position
Carburetor Air Heat - "Icing Conditions" (extreme aft) position

Set levers on engine accessories as follows: -

Carburetor throttle lever - "Closed" (lever down) position

Mixture lever - "Idle Cut-Off" (lever up) position

Propeller governor bellcrank - "Take-Off" (Take-off position is approximately 51° (degrees) in a counter-clockwise direction from vertical center line of unit when viewing unit from bellcrank side). If stop on governor has been previously adjusted correctly, place bellcrank against same.

WARNING: When power plant installation is complete, test engine to be sure take-off R.P.M. (2350) is obtainable. If take-off R.P.M. is not obtainable, further adjustments of the governor stop will be necessary.

Carburetor air heat bellcrank - "Icing Conditions" (lever up) position

Adjust throttle, mixture, and carburetor air heat forward vertical control rods if required and connect to respective levers of engine accessory units. Connect control rod between propeller governor bellcrank and bellcrank mounted on forward side of engine fixed cowling. Install propeller control center rod through hole in fixed engine cowling and connect to bellcrank mounted on forward side of cowling. Adjust rod if required and connect to bellcrank mounted on upper left engine mount tube.

(16) Install oil tank vent line from forward fitting on tank flange to fitting on left side of engine section. Use rubber hose and clamps to make each connection.

(17) Install fuel lines from fitting on top of hand fuel pump to fitting on left rear side of carburetor, using rubber hose and clamps to make the three connections. Position first section of line on inner side of lower left engine mount tube and clamp to same in two places.

(18) Position engine oil fitting "OUT" as required and connect line from forward end of oil cooler to same. A rubber hose and four clamps are required for each connection.

(19) Position engine oil fitting "IN" as required and connect line from oil drain and dilution cock to same. Use rubber hose and clamps to make each connection.

(20) Attach exhaust tail pipe trough cowl to engine fixed cowl, using bolts and No. 1032 Bendix set nuts.

(21) Install engine exhaust collector assembly as required. Make certain discharge section of collector is bolted to support bracket at rear of engine cylinders No. 2 and 3.

(22) Connect engine exhaust front stack to exhaust collector. Refer to foregoing paragraph b.(11).

(23) Connect exhaust gas analyzer outlet line from outboard fitting on bottom of analyzer unit, located on upper left side of firewall, to fitting on exhaust collector ring at rear of engine cylinder No. 6. Safety wire connecting fitting.

NOTE: Sampling nipples not used at inlet or outlet connections to exhaust collector - USE FLUSH FITTINGS.

(24) Install left and right magneto blast tubes through their respective support bracket assemblies in engine fixed cowl and through support brackets located in pressure baffles between engine cylinders No. 8 and 9, and No. 2 and 3. Use asbestos sheet between blast tubes and engine fixed cowl support bracket clamps. Position intake end of each tube approximately 3-1/2 inches forward of pressure baffle support. Connect end of each blast tube to flange on magneto housing with rubber hose and clamps. Tighten clamps provided on cowl and baffle support brackets.

(25) Connect the following lines from connecting block at upper right side of firewall, using rubber hose and clamps to make each connection.

- (a) Manifold pressure line to upper engine case fitting between magnetos.
- (b) Oil pressure line to lower engine case fitting between magnetos.
- (c) Fuel pressure line to left side of carburetor.

- (d) Primer line to distributor cross, supported on No. 1 engine cylinder intake manifold. Use rubber grommet where line passes through engine fixed cowling. Lines (a), (b), and (c) must be clamped together just above right magneto, using four clamps. Use rubber strips between clamps. All four lines should be secured with clamp and fairlead assembly on upper left engine mount tube, just forward of oil tank.
- (26) Connect left magneto wiring and conduit to ignition disconnect plug located at upper left side of firewall, just above exhaust gas analyzer. Clamp conduit and conduit bonding strap to attachment plate on carburetor air heat bellcrank support, supported on upper left engine mount tube. Tape line at point of contact with engine mount tube.
- WARNING:** When ignition plug is disconnected, engine ignition is "ON"; DO NOT rotate engine.
- (27) Connect right magneto wiring and conduit to main power panel connector located on center of firewall. Clamp conduit and conduit bonding strap to firewall foot well. Tape line at point of contact with right magneto scintilla junction box and tank to drain cock oil line.
- (28) Connect generator electrical wiring and conduit to main power panel connector, located on center of firewall. Conduit shall be positioned under battery conduit, and taped at point of contact with firewall shelf and tank to drain cock oil line.
- (29) Connect starter electrical wiring and conduit to main power panel connector located on center of firewall.
- (30) Connect forward end of carburetor air temperature resistance bulb electrical wiring and conduit to bulb installed in rear of carburetor adapter. Connect aft end of conduit to main power panel connector located on center of firewall. Conduit should be taped and clamped at point of contact with conduit interconnecting the two magnetos. Make certain resistance bulb nut is safetied to adapter casting.
- (31) Clamp starter conduit to firewall foot well, using tape between conduit and clamp. Utilize clamp screw to secure starter conduit and temperature conduit bonding straps. Clamp temperature conduit to starter conduit with two clamps. Use tape under the starter conduit clamp. Tape temperature conduit at points of contact with starter conduit.
- (32) Thread thermocouple lead wires through hole in engine fixed baffle, immediately below right magneto ignition manifold conduit. Connect lead wires to No. 1 engine cylinder spark plug gasket

attachment wires. Tape and shellac connections. Lead wires should also be protected with tape for a distance of six inches on either side of engine fixed baffle.

(33) Connect oil tank vent line from aft fitting on oil tank flange to fitting on right side of engine case, using rubber hose and clamps.

(34) Connect hydraulic pressure line and hydraulic suction line from fittings just below shelf at right side of firewall to pump at right side of engine. Use rubber hose and clamps to secure suction line. The flexible pressure line is equipped with fittings.

(35) Connect instrument vacuum line (suction) from relief valve to lower fitting on right side of vacuum pump, using rubber hose and clamps.

(36) Connect de-icer vacuum line (pressure) from outboard side of oil separator to upper fitting on right side of vacuum pump, using rubber hose and clamps.

(37) Connect oil line (drain) from oil separator to fitting located on engine case between the magnetos, using rubber hose and clamps.

(38) Insert starter crank extension through support at right side of engine mount and connect to starter drive with a bolt, nut, and cotter.

(39) Connect tachometer shaft from upper right side of firewall to drive assembly at right side of engine. Shaft should be clamped to edge of firewall foot well and taped at point of contact with oil tank and foot well.

(40) Connect flexible fuel pump drive shaft from pump at lower right side of firewall to drive assembly at right side of engine. Safety wire connecting fittings and make certain shaft is clamped to bracket on firewall shelf.

(41) Insert forward section of anti-icer supply line through hole in engine fixed baffle, just below cushion lug behind engine cylinder No. 4. Connect forward section to aft section. If slinger ring is not to be installed, crimp end of line, coil extra length as required, and clamp to right-hand forward bolt of mounting flange located on engine nose section. The anti-icer line should be protected with tape from engine mounting ring to ignition manifold assembly. Use rubber grommet where line passes through engine fixed baffle.

(42) Connect supercharger drain line to fitting on lower right side of engine case, using rubber hose and clamps.

(43) Make certain that all control rods are properly adjusted and safetied as required; that all line connections are properly tightened; and that all lines, conduit, controls, etc., are properly supported by means of clamps and protected against chafing. Also make certain power plant assembly is properly bonded. Test for proper operation of engine controls while running engine. Ascertain take-off R.P.M. (2350) is obtainable. Also make certain fitting on throttle control bellcrank will operate toggle switch located on firewall at a throttle position of approximately 1000 R.P.M.

(44) Install engine nose ring cowl, engine ring removable cowl, and engine compartment removable cowl. Refer to following paragraph d., and Figure 26, of this Handbook.

(45) Install propeller. A special hub nut wrench, No. 81402, is provided. Refer to T. O. 03-20CB-2.

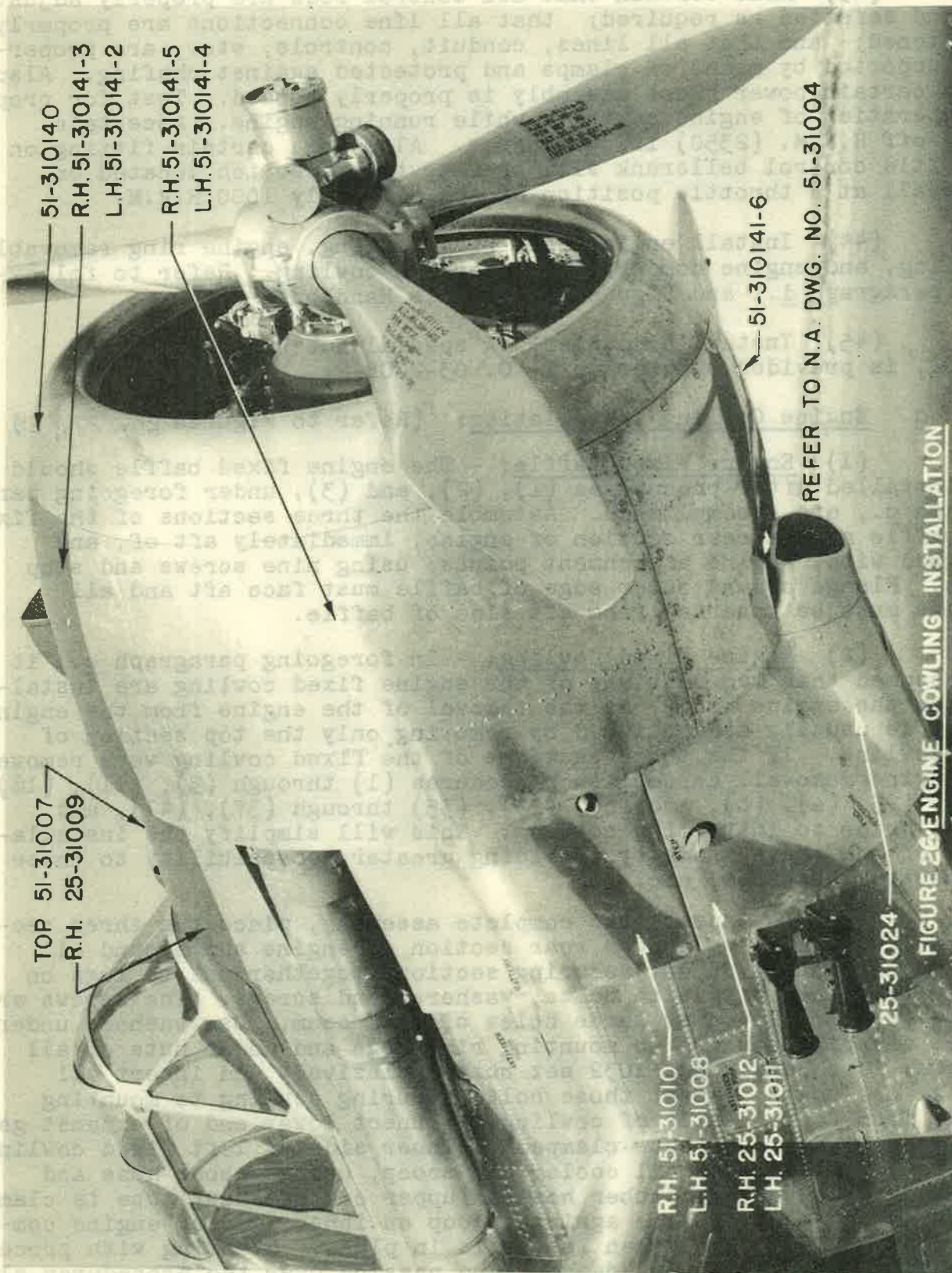
d. Engine Cowling Installation: (Refer to Figures 26, 27, 28)

(1) Engine Fixed Baffle: - The engine fixed baffle should be installed after procedures (1), (2), and (3), under foregoing paragraph c., are accomplished. Assemble the three sections of the fixed baffle around rear section of engine, immediately aft of, and aligned with, engine attachment points, using nine screws and stop nuts. Flange around outer edge of baffle must face aft and all screws must be inserted from aft side of baffle.

(2) Engine Fixed Cowling: - In foregoing paragraph c., it is assumed that two sections of the engine fixed cowling are installed on the engine mount, as the removal of the engine from the engine mount is usually accomplished by removing only the top section of the cowling. If the three sections of the fixed cowling were removed at engine removal, accomplish procedures (1) through (9), (11), (16), (17), (25) (a), (b), and (c), (33), (35) through (37), (41), and (42), prior to installing cowling. This will simplify the installation of the above items by providing greater accessibility to these connecting fittings, etc.

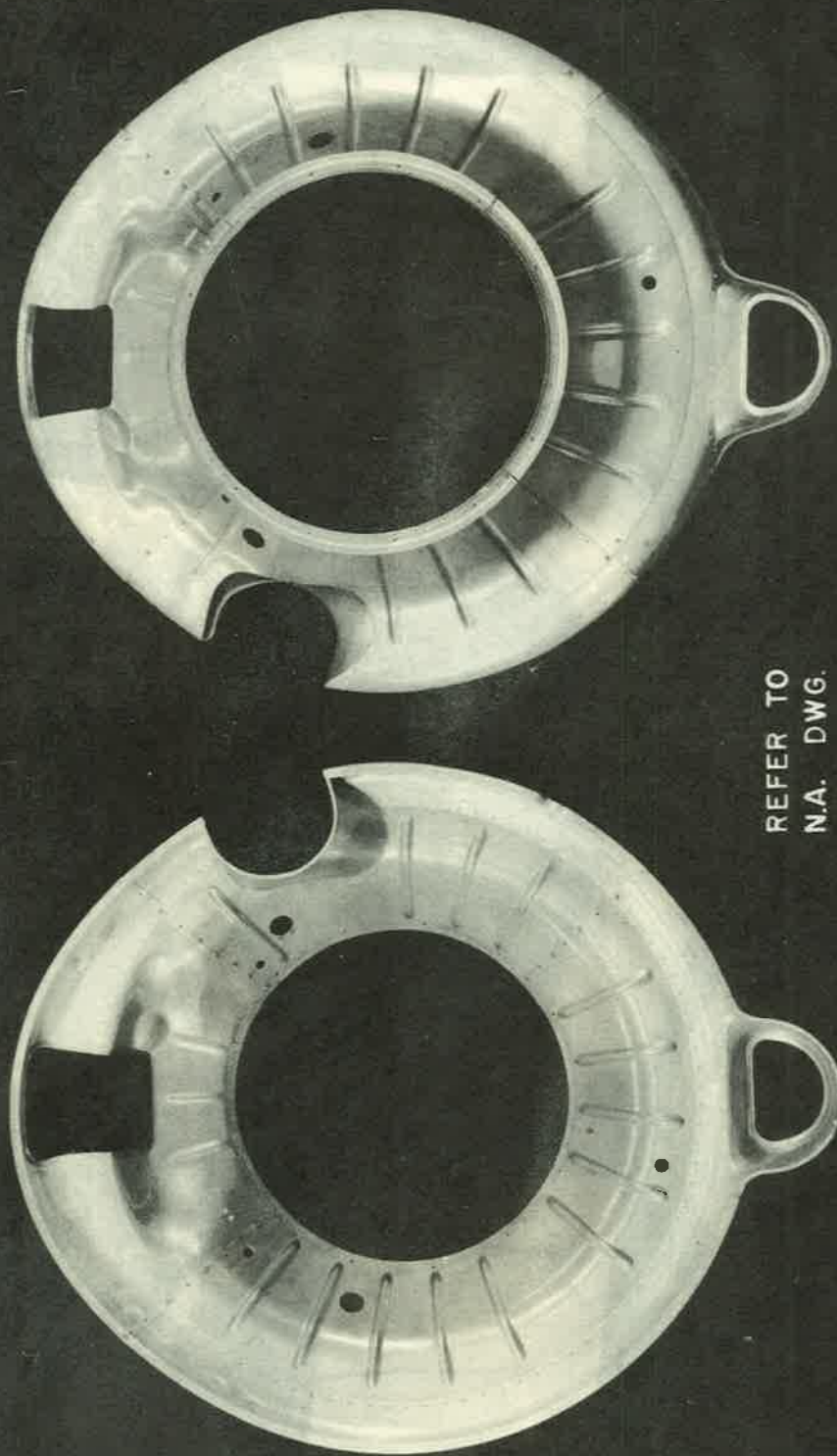
To install the complete assembly, place the three sections of the cowling around rear section of engine and around oil cooler air intake scoop, securing sections together and to lugs on engine mounting ring with bolts, washers, and screws. The screws are to be used in the outer three holes of each seam. Use washers under nuts, securing cowling to mounting ring lugs and under nuts of all screws. Use Bendix No. 1032 set nuts exclusively and insert all screws and bolts, except those bolts securing cowling to mounting ring, from forward side of cowling. Connect lower end of exhaust gas analyzer blast tube (tube clamped to inner side of left fixed cowling section) to flange on oil cooler air scoop, using rubber hose and clamps. Make certain rubber hose on upper end of blast tube is clamped so as to position same against scoop on inner side of engine compartment cowling panel when latter is in place. Starting with procedure (10), foregoing paragraph c. and passing over the procedures already accomplished, continue the installation of the engine to the engine mounting ring.

T. O. NO. 01-60EB-2



REFER TO N.A. DWG. NO. 51-31004

FIGURE 26 ENGINE COWLING INSTALLATION



REFER TO
N.A. DWG.
NO. 51-31005

FIGURE 27 - ENGINE FIXED COWLING

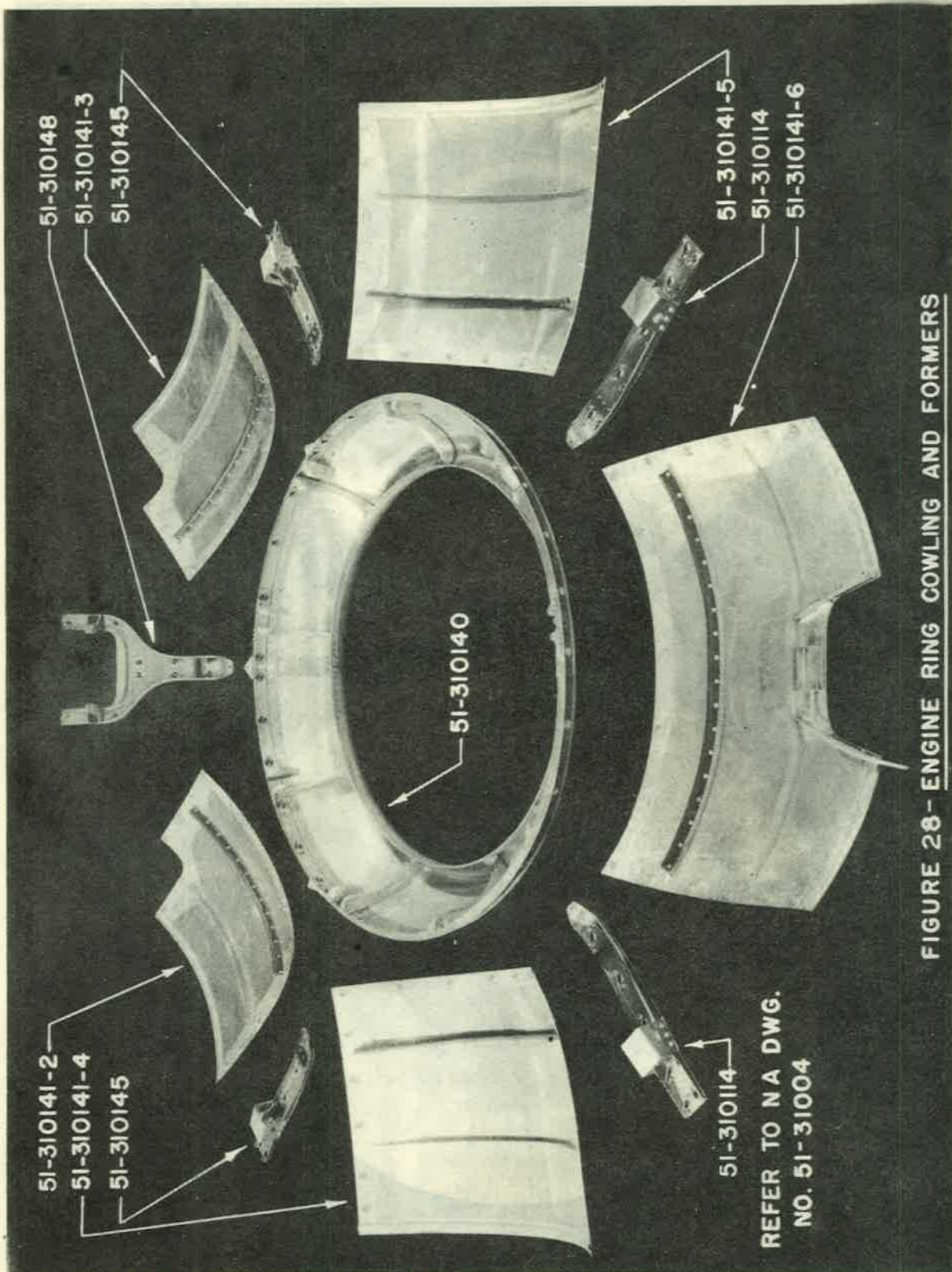


FIGURE 28 - ENGINE RING COWLING AND FORMERS

(3) Engine Nose Ring Cowling: - The nose cowling may be installed either with or without the propeller installed. In the event propeller is installed, remove bolts from angles on inner side of cowling, spring cowling and screw same over propeller blades. Place assembly over cylinders, positioning cowling bolting angle at bottom. Secure each cowling attaching bracket to its respective lug located on intake rocker arm box of each cylinder, using two (2) 51-310129 bushings, a bolt, nut, and cotter. Attach cowling together at bolting angle, using five bolts, nuts, and cotters.

(4) Engine Nose Ring Removable Cowling: - A tripod shaped tubular bracket, equipped with a "Lord" bushing, No. H-3004, and an N. A. bushing, No. 51-310166, is supported at rear of and between engine cylinders No. 2-3, 4-5, 6-7, and 8-9. The rear lugs on the adjoining intake and exhaust rocker arm boxes of the above mentioned cylinders and a 51-310188 bolt, used on the intake manifold flange of cylinder Nos. 2, 4, 6, and 8, are used to attach the brackets. These brackets support the aft end of former assemblies to which the five sections of the removable nose cowling are attached. Secure the formers to the support brackets and to lugs riveted to rim of nose cowling, using bolts, nuts, washers, and cotters as required. Install a fifth former assembly, using lug on each side of the carburetor air scoop and lug on rim of nose cowl. Secure with bolts, nuts, washers, and cotters as required. Attach the five sections of the removable ring cowling to the rim of the nose ring cowling and to the former assemblies, securing with Dzus fasteners provided.

(5) Engine Compartment Removable Cowling: - Attach lower section of engine compartment cowling to engine fixed cowling oil cooler air scoop by means of screws, stop nuts, and anchor nuts, the latter provided on inner edge of scoop. Attach castings at rear corners of section and fasten to firewall flange by means of bolts, washers, and stop nuts. Install exhaust tail pipe trough cowling between fixed engine cowling and firewall, using bolts and No. 1032 Bendix set nuts. Install the remaining sections of the removable compartment cowling, securing with Dzus fasteners provided. The oil filler cap access door, battery plug in socket door, engine step holes, etc.; will readily identify the sections of the cowling for installation.

15. Fuel System

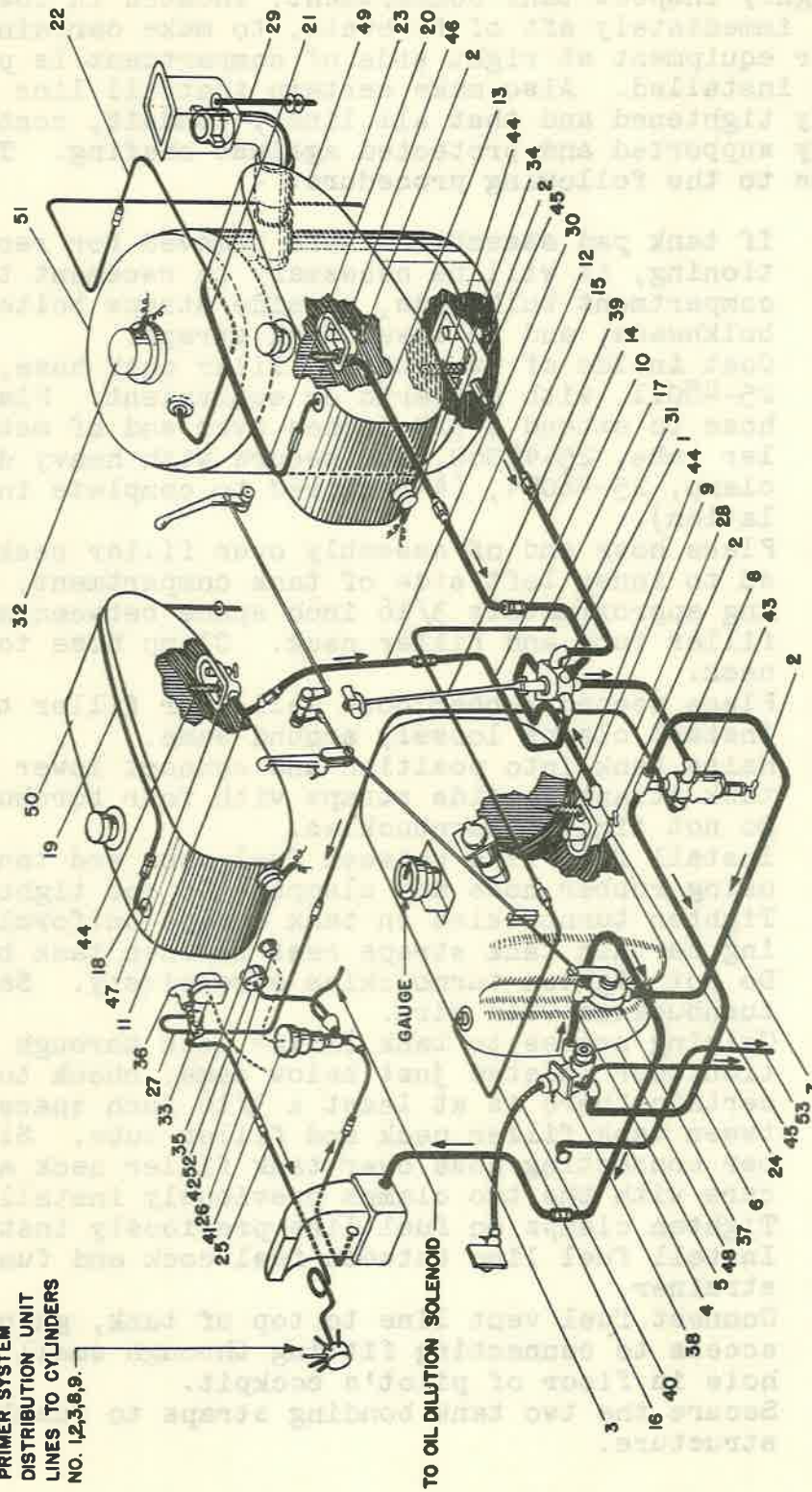
a. General: - Fuel lines are identified by means of a red band. Refer to Fuel System Diagram, Figure 29, page 125. Clean inside of all tanks and fuel system lines thoroughly, immediately prior to installation. After cleaning, keep fuel caps on and plug ends of lines and openings in tanks to prevent entrance of foreign substances. Coat male thread fittings of all fuel lines with lubricant, as specified in T. O. 06-10-3. Use Du Pont "Cavalprene" cement, or the equivalent, to secure all tank pad assemblies and allow same to dry at least 12 hours before installing tanks. Exercise care when handling fuel tanks to prevent damage to same. For adjustment of liquidometer rheostats on tanks, refer to T.O. 05-65A-1.

NOMENCLATURE - FUEL SYSTEM DIAGRAM
(Refer to Figure 29, and N.A. Dwg. No. 51-58001)

1.	Cock - Fuel (Type K-2A)		AC37B3157
2.	Cock - Drain		AN771-2
3.	Line - Hand Pump to Carburetor	2nd. Sect.	51-48803
4.	Line - Hand Pump to Carburetor	1st. Sect.	51-48804
5.	Line - Hand Pump to Engine Pump		51-48805
6.	Line - Engine Pump to Strainer		51-48806
7.	Line - Hand Pump to Strainer		51-48807
8.	Line - Selector Valve to Strainer		51-48808
9.	Line - Front Fuselage Tank to Selector Valve		51-48809
10.	Line - Right Wing Tank to Selector Valve	3rd. Sect.	51-48810
11.	Line - Right Wing Tank to Selector Valve	1st. Sect.	51-48811
12.	Line - Left Wing Tank to Selector Valve	2nd. Sect.	51-48812
13.	Line - Left Wing Tank to Selector Valve	1st. Sect.	51-48813
14.	Line - Rear Fuselage Tank to Sel. Valve	2nd. Sect.	51-48814
15.	Line - Rear Fuselage Tank to Sel. Valve	1st. Sect.	51-48815
16.	Line - Front Fuselage Tank Vent	1st. Sect.	51-48816
17.	Line - Front Fuselage Tank Vent	2nd. Sect.	51-48817
18.	Line - Right Wing Tank Vent	1st. Sect.	51-48818
19.	Line - Right Wing Tank Vent	2nd. Sect.	51-48819
20.	Line - Left Wing Tank Vent	1st. Sect.	51-48820
21.	Line - Left Wing Tank Vent	2nd. Sect.	51-48821
22.	Line - Rear Fuselage Tank Vent	1st. Sect.	51-48822
23.	Line - Rear Fuselage Tank Vent	2nd. Sect.	51-48824
24.	Line - Engine Pump Drain		51-48825
25.	Line - Primer to Engine	2nd. Sect.	51-48826
26.	Line - Primer to Engine	1st. Sect.	51-48827
27.	Line - Strainer to Primer	2nd. Sect.	51-48828
28.	Line - Strainer to Primer	1st. Sect.	51-48829
29.	Line - Rear Fu. Tank Filler Neck Overflow Drain		51-48830
30.	Line - Right Wing Tank to Selector Valve	2nd. Sect.	51-48831
31.	Line - Left Wing Tank to Selector Valve	3rd. Sect.	51-48834
32.	Liquidometer - Rear Fuselage Tank Rheostat		EA17-51-00211
33.	Liquidometer - Indicator		EA31-239-1
34.	Liquidometer - Left Wing Tank Rheostat		EA15-25-00158
35.	Liquidometer - Right Wing Tank Rheostat		EA15-25-00158
36.	Primer - Parker Appliance Company (Type E-2)		Spec. 28350
37.	Pump Assem. - Hand Fuel (Type D-2)		AN4009
38.	Pump - Engine Driven Fuel "Pesco" (Type G-9)		Spec. 28339
39.	Shaft Assem. - Fuel Cock Torque Control		51-48056
40.	Shaft Assem. - Engine Pump Flexible Drive		AC37B1683-27
41.	Signal - Fuel Pressure Warning (Type C-3)		Spec. 32215
42.	Signal - Fuel Switch-Over (Red)		Spec. 39A2822-2
43.	Strainer - Fuel (Type C-2A)		AC35D1706
44.	Standpipe Assem. - (All Tanks)		25-48044-3
45.	Sump - Front & Rear Fuselage Tanks		51-48017
46.	Sump - Left Wing Tank		51-48015
47.	Sump - Right Wing Tank		51-48015-1
48.	Tank Assembly - Front Fuselage		51-48002
49.	Tank Assembly - Left Wing		51-48003
50.	Tank Assembly - Right Wing		51-48003-1
51.	Tank Assembly - Rear Fuselage		51-48006
52.	Unit - Engine Gauge (Type B-2)		Spec. 27824
53.	Line - Engine Supercharger Drain		51-48833

FOR ELECTRICAL WIRING SEE N.A. DWG. 51-54002

PRIMER SYSTEM
DISTRIBUTION UNIT
LINES TO CYLINDERS
NO. 1,2,3,8,9.



	FUEL CAPACITY	
	NORMAL	OVERLOAD
FRONT FUSELAGE TANK	34 GAL.	60 GAL.
REAR FUSELAGE TANK	60 "	60 "
LEFT WING TANK	40 "	40 "
RIGHT WING TANK	40 "	40 "
TOTAL FUEL CAPACITY	134 GAL.	200 GAL.

NOTE:- SODIUM CHROMATE CAPSULE
IN EACH TANK

INTEGRAL RELIEF VALVE IN
ENGINE FUEL PUMP

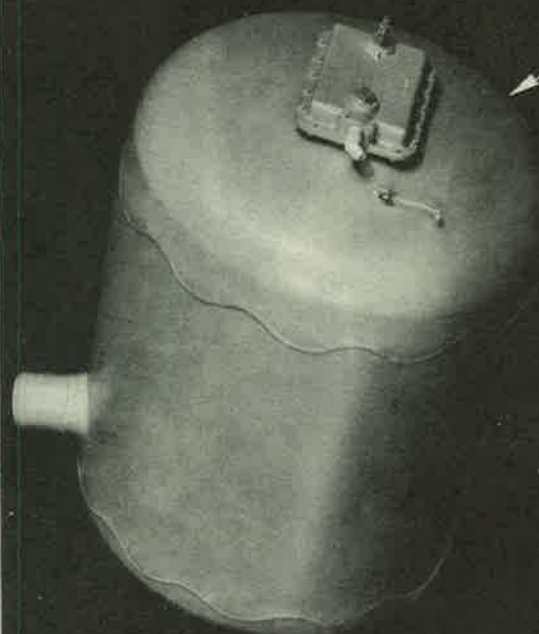
FIGURE 29 - FUEL SYSTEM DIAGRAM

b. Fuel Tank Installation:

(1) Front Fuselage Tank: - Before installing front fuselage fuel tank, thoroughly inspect tank compartment, located in lower portion of fuselage, immediately aft of firewall, to make certain de-icer and anti-icer equipment at right side of compartment is properly and completely installed. Also make certain that all line connections are properly tightened and that all lines, conduit, controls, etc., are properly supported and protected against chafing. To install tank, adhere to the following procedure: -

- (a) If tank pad assemblies were removed for reconditioning, it will be necessary to recement them to compartment bulkheads, to side straps bolted to bulkheads, and to lower tank straps.
- (b) Coat inside of two rubber filler neck hose, 25-48011, with glycerin or equivalent. Place one hose to extend 1-3/4 inches over end of metal filler tube, 25-48060, and secure with heavy duty clamp, 25-48064, (4 required to complete installation).
- (c) Place hose end of assembly over filler neck, riveted to inner left side of tank compartment, allowing approximately 3/16 inch space between metal filler tube and filler neck. Clamp hose to filler neck.
- (d) Place second rubber hose well over filler tube and install clamps loosely around same.
- (e) Raise tank into position and connect lower padded tank straps to side straps with four turnbuckles. Do not tighten turnbuckles.
- (f) Install fuel line between fuel cock and tank sump, using rubber hose and clamps. Do not tighten clamps.
- (g) Tighten turnbuckles on tank straps uniformly, making certain tank straps rest between tank beads. Do not tighten turnbuckles excessively. Safety turnbuckles with wire.
- (h) Gaining access to tank filler neck through inspection door located just below same, check to make certain there is at least a 3/16 inch space between tank filler neck and filler tube. Slip rubber connecting hose over tank filler neck and secure with the two clamps previously installed.
- (i) Tighten clamps on fuel line previously installed.
- (j) Install fuel line between fuel cock and fuel strainer.
- (k) Connect fuel vent line to top of tank, gaining access to connecting fitting through small access hole in floor of pilot's cockpit.
- (l) Secure the two tank bonding straps to fuselage structure.

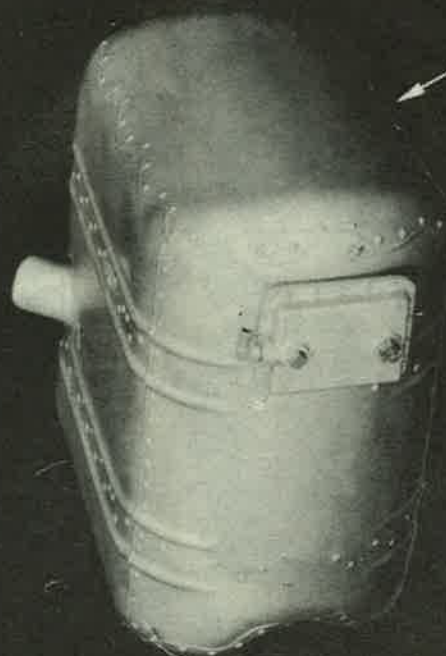
REFER TO N.A. DWG.
NO. 51-48001



51-480061



51-48003



51-48002



51-48003-1

FIGURE 30-FUEL TANKS

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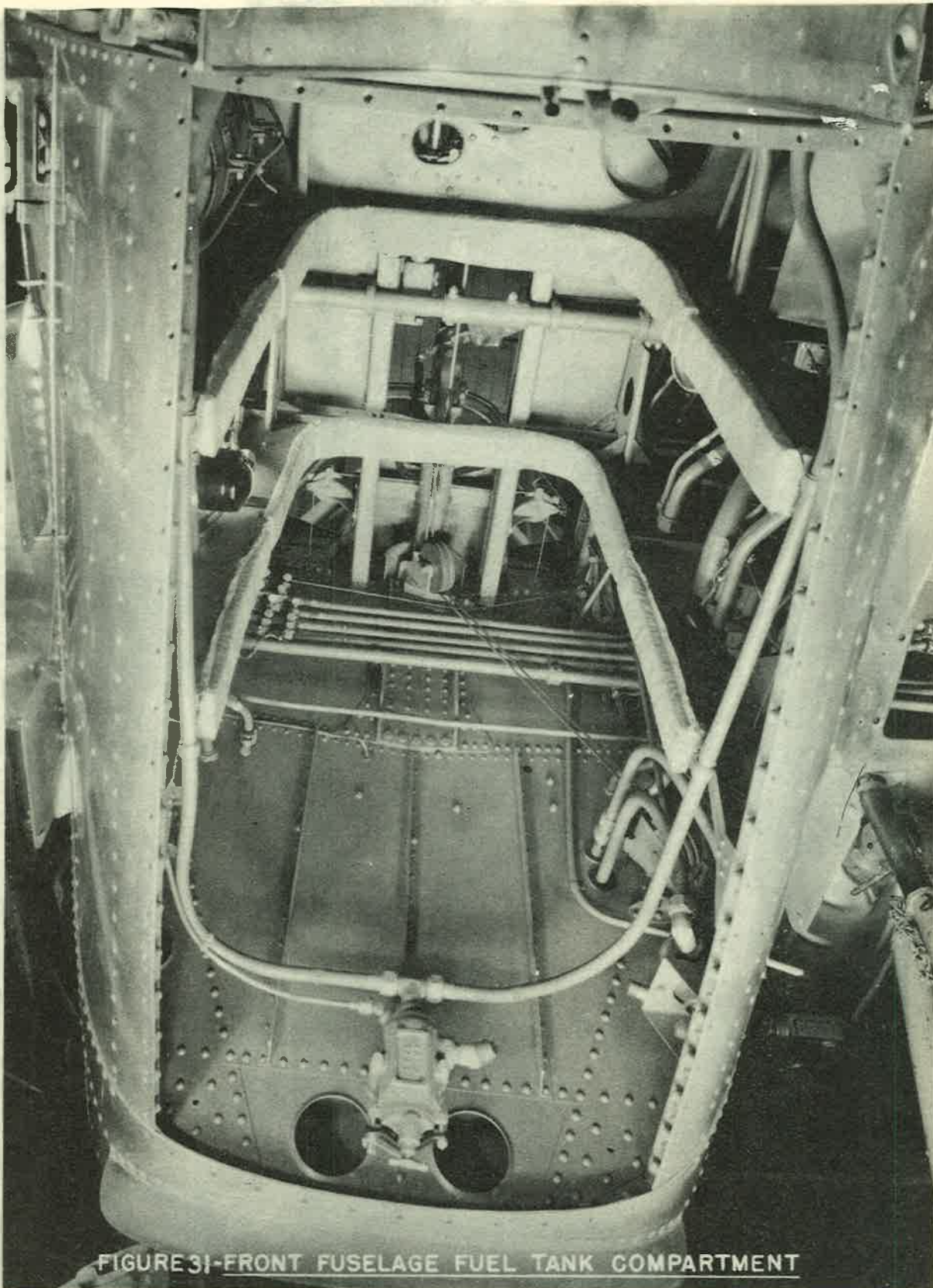


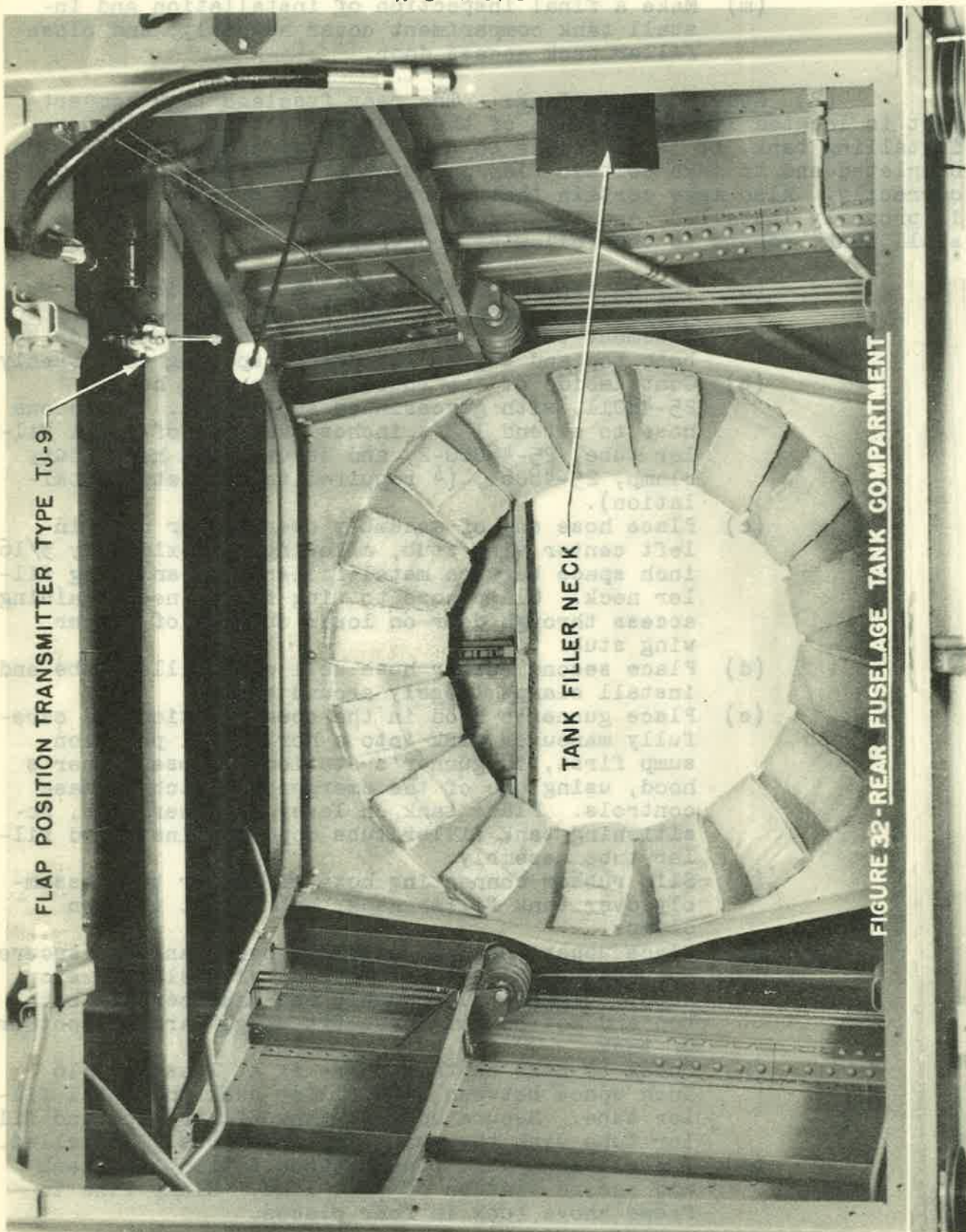
FIGURE 31-FRONT FUSELAGE FUEL TANK COMPARTMENT

- (m) Make a final inspection of installation and install tank compartment cover assembly, and close filler neck access door.

(2) Rear Fuselage Tank: - The rear fuselage tank compartment is located immediately aft of the observer's station. Before installing tank, it is desirable to have the flap panel installation completed and to make certain flap position transmitter is adjusted correctly. Also make certain that second section of tank vent lines is properly installed, and that tank compartment is clean. To install tank, adhere to the following procedure: -

- (a) If, at tank removal, tank pad assemblies were removed for reconditioning, it will be necessary to recement them in place. Cement seventeen pads on both top and bottom retainers, spacing pads evenly.
- (b) Coat inside of two rubber filler neck hose, 25-48011, with glycerin or equivalent. Place one hose to extend 1-3/4 inches over end of metal filler tube, 25-48060-2, and secure with heavy duty clamp, 25-48064, (4 required to complete installation).
- (c) Place hose end of assembly over filler neck in left center wing stub, allowing approximately 3/16 inch space between metal filler tube and wing filler neck. Clamp hose to wing filler neck, gaining access through door on lower surface of center wing stub.
- (d) Place second rubber hose well over filler tube and install clamps loosely around same.
- (e) Place gunner's hood in the open position and carefully maneuver tank into a horizontal position, sump first, in gunner's station. Close gunner's hood, using one of the emergency clutch release controls. Place tank on lower retainer pads, positioning tank filler tube opposite installed filler tube assembly.
- (f) Slip rubber connecting hose of filler tube assembly over tank filler neck, but do not tighten clamps.
- (g) Place upper retainer assembly over tank and secure to retainer adjusting fittings with elastic stop nuts. Tighten nuts evenly and make certain both top and bottom retainers fit snugly around contour of tank.
- (h) Check to make certain there is at least a 3/16 inch space between tank filler neck and metal filler tube. Secure hose to tank filler neck and filler tube with the two clamps previously installed.
- (i) Install tank vent line between fittings on tank and second section of vent line. Clamp line to frame above tank in four places.

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- (j) Connect liquidometer wiring and conduit to gauge unit on top of tank. Protect conduit with tape as required and clamp to rim of upper tank retainer.
- (k) Install fuel cock line between tank sump and second section of line. Utilize rubber grommet where line passes through hole in aft side of rear spar bulkhead.
- (l) Secure the two tank bonding straps to fuselage structure.
- (m) Make a final inspection of installation. Install door on rear wall of observer's station, flooring over top of tank compartment, gunner's seat (removed to get tank in and out of airplane), Marker Beacon receiver, inspection door assembly over tank sump and filler neck access door on lower surface of center wing.

(3) Wing Tanks: - In order to remove or install a wing tank, it is first necessary to install landing gear jury strut and to remove landing gear rear strut. Also make certain that the two sections of the tank vent lines, installed in the tank compartments, are clamped as required and protected against chafing. To install either tank, adhere to the following procedure: -

- (a) If, at tank removal, tank pad assemblies were removed for reconditioning, it will be necessary to recement them to intermediate rib at top of tank compartment, to tank straps bolted to ends of intermediate rib, and to eight reinforcing channels of wing stub ribs.
- (b) Coat both sides of moulded Duprene filler neck ring, 51-48042, with Du Pont "Cavalprene" cement, or the equivalent, and place ring around tank filler neck.
- (c) Raise tank into position engaging tank filler neck with metal retainer provided around filler hole in upper surface of wing.
- (d) Connect tank straps around lower surface of tank by means of a turnbuckle. Do not tighten turnbuckle.
- (e) Check to make certain Duprene ring around tank filler neck is positioned correctly. Tighten strap turnbuckle, making certain tank strap rests between tank beads. Safety wire turnbuckle.
- (f) From within fuselage insert fuel cock line through hole provided in inboard wing rib, and connect to tank sump and second section of fuel cock line. Protect line with rubber strip and clamp to fuselage structure, just aft of union.

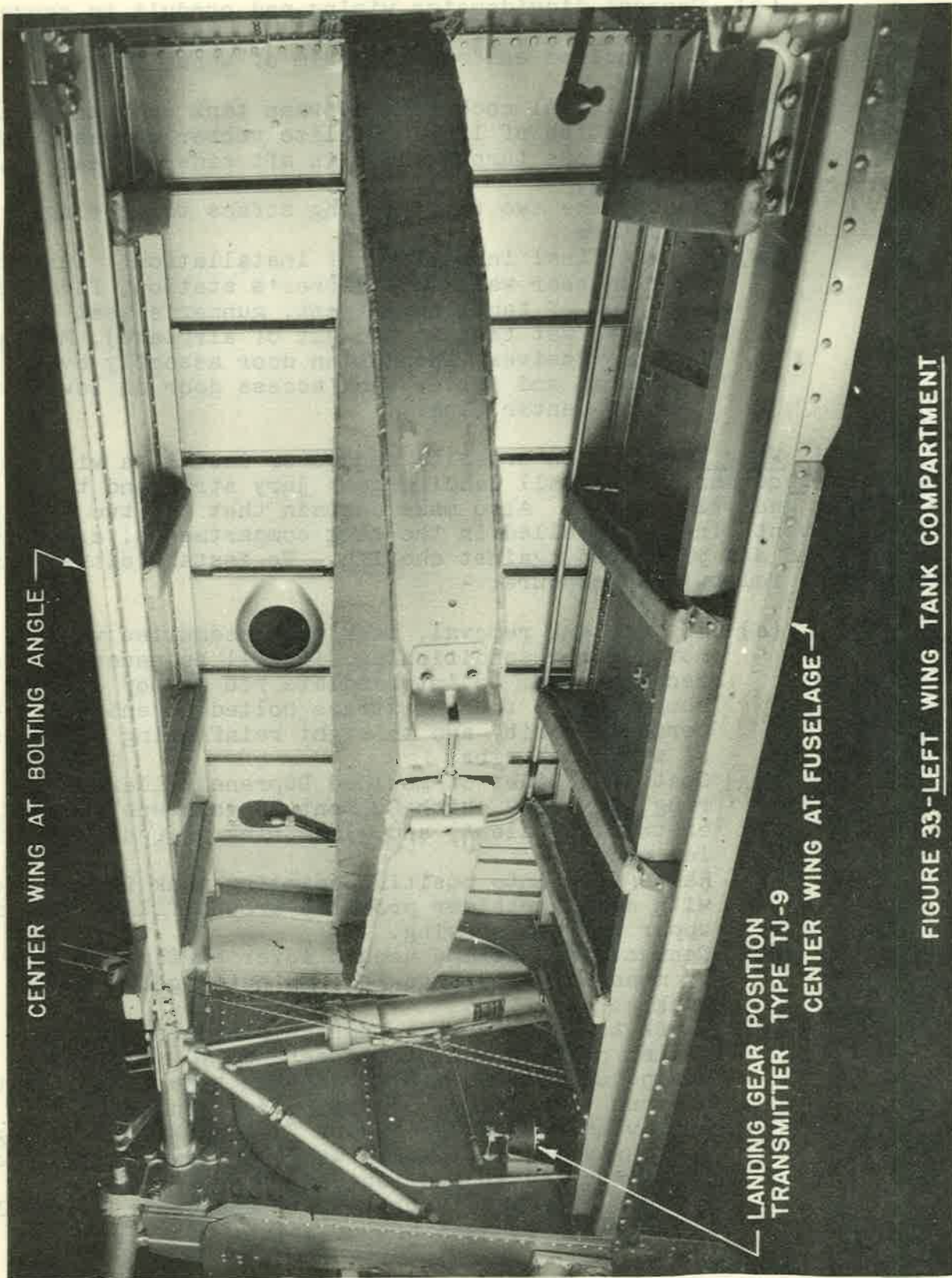


FIGURE 33-LEFT WING TANK COMPARTMENT

- (g) Connect fuel vent line to top of tank, gaining access to connecting fitting through inspection door on upper surface of wing.
- (h) Connect liquidometer electrical wiring and conduit to rheostat on forward end of tank. Clamp conduit to hydraulic brake line.
- (i) Make a final inspection of installation and install fuel tank door assembly over tank compartment. Utilize rubber grommet where vent line passes through door. Install cover plate over tank vent line connecting fitting on upper surface of center wing.
- (j) Connect landing gear fairing actuating link to in-board top side of oleo strut.
- (k) Reinstall landing gear rear strut and remove temporary jury strut.
- (l) Check for proper operation of the landing gear to make certain rear strut, fairing door link, etc., are adjusted correctly. For landing gear and fairing adjustment instructions, refer to paragraphs 9.a., and 9.c. of this Section.

16. Oil System

a. General: - Oil lines are identified by means of a yellow band. Refer to Oil System Diagram, Figure 34, page 135, of this Handbook.

b. Oil Tank Installation: - Prior to installing oil tank, make certain tachometer drive shaft is installed through hole located in firewall, just above firewall foot well. See that rubber grommet is used where shaft passes through hole and that shaft is clamped to right edge of foot well. To install oil tank, adhere to the following procedure: -

(1) If necessary, install the four tank support straps, attaching same to brackets welded to the two upper engine mount cross tubes by means of bolts and stop nuts.

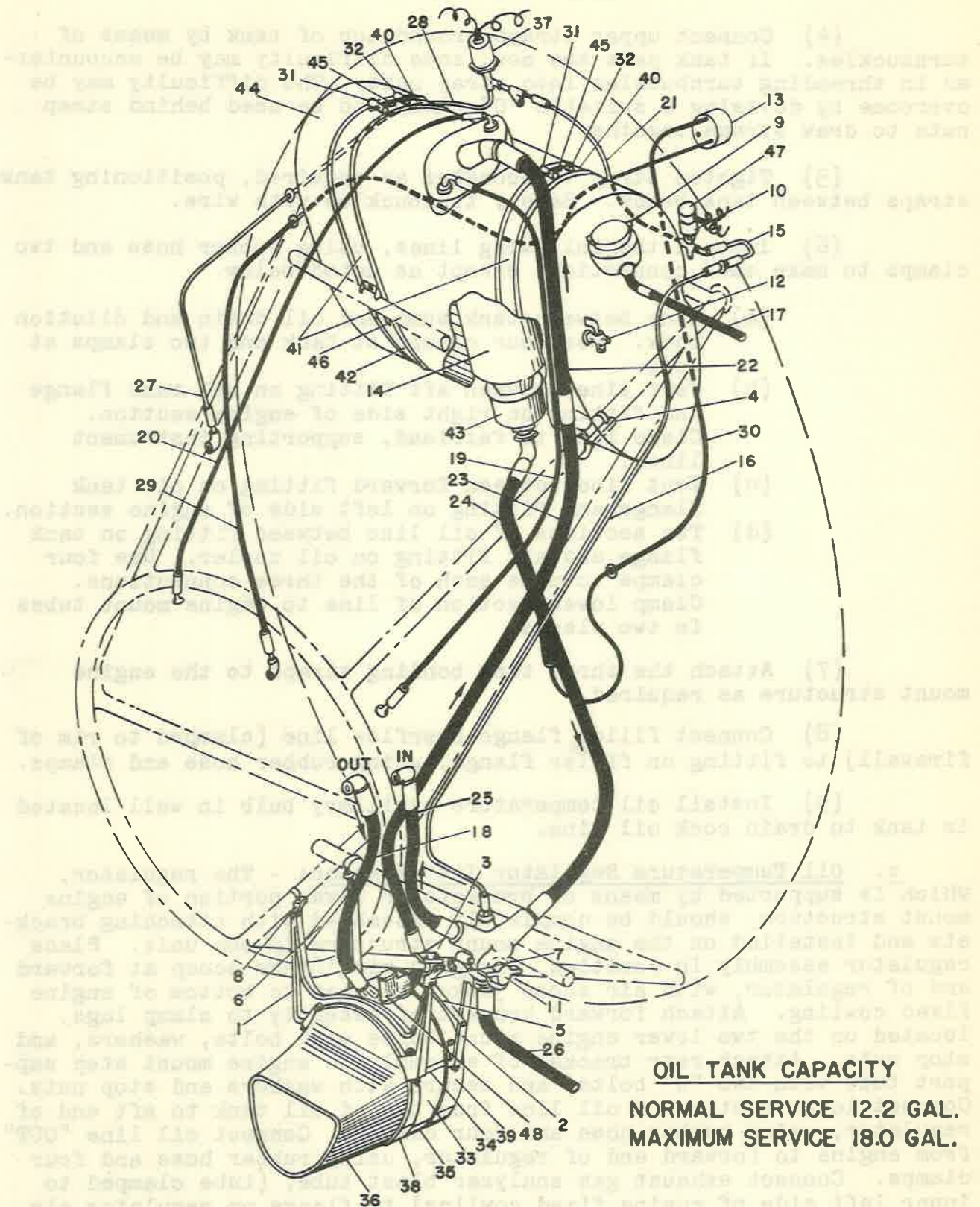
(2) Fasten tank pad assemblies to respective support straps and to forward side of upper rear engine mount cross tube, binding pads in place with two turns of waxed linen cord at intervals of approximately four inches.

(3) With tank filler flange on left side, place tank on padded straps, allowing recessed trough at rear of tank to rest on engine mount cross tube pad. If mount is installed on airplane, care must be taken to prevent damage to exhaust gas analyzer line and thermocouple lead wires.

NOMENCLATURE - OIL SYSTEM DIAGRAM

(Refer to Figure 34, and N.A. Dwg. No. 51-47001)

1. Bracket - Oil Cooler Front Support	51-47010
2. Bracket - Oil Cooler Rear Support	51-47012
3. Bracket - Oil Dilution Cock Support	51-47018
4. Bracket - Throttle, Air Mixture Bellcrank Support	51-43009
5. Brace - Oil Cooler Support Bracket Left	25-47028-2
6. Brace - Oil Cooler Support Bracket Right	25-47028-4
7. Base - Oil Cooler Front Support Left Clamp	25-47011
8. Base - Oil Cooler Front Support Right Clamp	25-47011-1
9. Cap Assembly - Oil Tank Filler (Repaint)	51-47009
10. Clamp - Oil Dilution Solenoid Valve	51-47040-2,-3
11. Cock Assembly - Oil Drain and Dilution	A.C. 37D6114-4
12. Cock - Oil Level	A.C. 770-2
13. Gauge Unit - Engine (Type B-2)	Spec. 27824
14. Hopper Assembly - Oil Tank	51-47024
15. Line - Oil Dilution Valve to Drain Cock 1st. Sect.	51-47801
16. Line - Oil Dilution Valve to Drain Cock 2nd. Sect.	51-47802
17. Line - Tank Filler Cap Overflow Drain	51-47803
18. Line - Engine to Cooler	51-47807
19. Line - Engine to Tank Vent Left	51-47805
20. Line - Engine to Tank Vent Right	51-47809
21. Line - Oil Dilu. Fuel Pres. Sig. Swt. to Sole. Valve	51-47812
22. Line - Oil Cooler to Tank 2nd. Sect.	51-47811
23. Line - Oil Cooler to Tank 1st. Sect.	51-47804
24. Line - Oil Sump to "Y" Drain	51-47006
25. Line - Drain Cock to Engine	51-47806
26. Line - Oil System Drain	51-47810
27. Line Assembly - Fuel Pressure Carb. to Firewall	51-51835
28. Line Assembly - Fuel Pressure Signal to Firewall	51-51836
29. Line Assembly - Oil Pressure Engine to Firewall	51-51837
30. Line - Oil Temperature Capillary	
31. Nut - Tank Strap Turnbuckle Right	15-48021-2
32. Nut - Tank Strap Turnbuckle Left	15-48021-3
33. Regulator - Oil Temperature (10" Diameter) (C-8)	Spec. 28388
34. Retainer - Oil Cooler Support Bracket (2 Req.)	25-47037
35. Retainer Assembly - Oil Cooler Strap	25-47034
36. Scoop Assembly - Oil Cooler Air Intake	51-47031
37. Signal Assembly - Fuel Pressure (Type C-3)	Spec. 32215
38. Strap Assembly - Oil Cooler Support Front	25-47027-2
39. Strap Assembly - Oil Cooler Support Rear	25-47027-9
40. Strap Assembly - Oil Tank Upper Rear	36-47027-16
41. Strap Assembly - Oil Tank Upper Front	36-47027-18
42. Strap Assembly - Oil Tank Lower (2 Req.)	25-47014-6
43. Sump - Oil Tank	54-47003
44. Tank Assembly - Oil	51-47002
45. Turnbuckle - Tank Strap	15-48020-2
46. Tube Assembly - Oil Tank & Bellcrank Support	51-47008
47. Valve Assembly - Oil Dilution Solenoid	A.C. 37D6210
48. Valve Assembly - Oil By-Pass Relief (Type D-5)	A.C. 38A1854



OIL TANK CAPACITY

NORMAL SERVICE 12.2 GAL.
MAXIMUM SERVICE 18.0 GAL.

FIGURE 34-OIL SYSTEM DIAGRAM

(4) Connect upper straps around top of tank by means of turnbuckles. If tank pads are new, some difficulty may be encountered in threading turnbuckles into strap nuts. The difficulty may be overcome by devising a suitable "C" clamp, to be used behind strap nuts to draw straps together.

(5) Tighten strap turnbuckles as required, positioning tank straps between tank beads. Safety turnbuckles with wire.

(6) Install the following lines, using rubber hose and two clamps to make each connection, except as noted below.

- (a) Line between tank sump and oil drain and dilution cock. Use four clamps at tank and two clamps at cock.
- (b) Vent line between aft fitting on oil tank flange and fitting on right side of engine section. Clamp line to fairlead, supporting instrument lines.
- (c) Vent line between forward fitting on oil tank flange and fitting on left side of engine section.
- (d) Two sections of oil line between fitting on tank flange and aft fitting on oil cooler. Use four clamps to make each of the three connections. Clamp lower section of line to engine mount tubes in two places.

(7) Attach the three tank bonding straps to the engine mount structure as required.

(8) Connect filler flange overflow line (clamped to rim of firewall) to fitting on filler flange, using rubber hose and clamps.

(9) Install oil temperature capillary bulb in well located in tank to drain cock oil line.

c. Oil Temperature Regulator Installation: - The regulator, which is supported by means of brackets on lower portion of engine mount structure, should be completely assembled with attaching brackets and installed on the engine mount structure in one unit. Place regulator assembly in position, engaging air intake scoop at forward end of regulator, with air scoop jacket riveted to bottom of engine fixed cowling. Attach forward bracket of assembly to clamp lugs, located on the two lower engine mount tubes with bolts, washers, and stop nuts. Attach rear bracket of assembly to engine mount step support tube with two "U" bolts, and secure with washers and stop nuts. Connect lower section of oil line from top of oil tank to aft end of regulator, using rubber hose and four clamps. Connect oil line "OUT" from engine to forward end of regulator, using rubber hose and four clamps. Connect exhaust gas analyzer blast tube, (tube clamped to inner left side of engine fixed cowling) to flange on regulator air intake scoop, using rubber hose and two clamps. Make a final inspection of installation and install sections of removable engine compartment cowling as required.

17. Fuselage Equipment

a. Installation:

(1) General: - Detailed instructions for the installation of major items of fuselage equipment are outlined below. Instructions have been omitted for other items of equipment, the locations for which are outlined in T. O. 01-60EB-1, which require only simple operations for installation.

(2) Pilot's Seat: - Prior to placing seat in pilot's cockpit, slip the chrome-plated seat support tubes through guides located on back of seat, locating adjustment holes on tubes to align with lock plungers at lower rear corners of seat. Bolt seat stops in position on each tube, just above and below adjustment holes. Place seat in position in cockpit, inserting lower ends of seat support tubes in sockets, located immediately aft of front spar bulkhead. Secure top of seat support tubes to brackets welded to forward tubes of nose-over structure, with bolts and stop nuts. With seat adjusted to the full up position, attach end of shock cord to hook, located on inner side of either lower seat support tube guide. Place shock cord over pulley and install pulley in bracket located in upper portion of nose-over structure. Attach end of shock cord to remaining hook, located on inner side of lower seat support tube guide. Stretch shock cord over pulleys located on fuselage structure, immediately aft of seat. Install life preserver cushion and seat safety belt.

(3) Auxiliary Pilot's Seat: - Insert seat support tubes through guides provided on back of seat, locating adjustment hole, near top of each tube, to align with lock plungers located at lower rear corners of seat. Place seat in position on forward side of rear spar bulkhead, inserting lower ends of seat support tubes in sockets bolted to seat support channels on bulkhead. Secure top of tubes to channel with bolts and stop nuts. Bolt each seat brace assembly to respective seat support channels with an AN4-22 bolt, utilizing two B1009-6-11, B1009-4-48, and B1009-6-17 spacers, and secure with nut and cotter. Install safety belt on seat.

(4) Observer's Seat: - Insert seat support tubes through guides provided on back of seat, locating adjustment holes to align with lock plungers located at lower rear corners of seat. Bolt seat stops in position on each tube, just below adjustment holes. Place seat in position on lower forward side of rear spar bulkhead and secure lower ends of tubes to seat support channels with bolts and stop nuts. With seat adjusted to the full down position, slide auxiliary pilot's and observer's seat support tube sockets over top of each observer's seat support tube. Place tube sockets over ends of auxiliary pilot's seat support tubes and secure sockets to seat support channels with an AN4-21A bolt, utilizing a B1070-416-9 spacer between socket and channel, and securing with stop nut. Install safety belt on seat and life preserver cushion on wall at rear of seat.

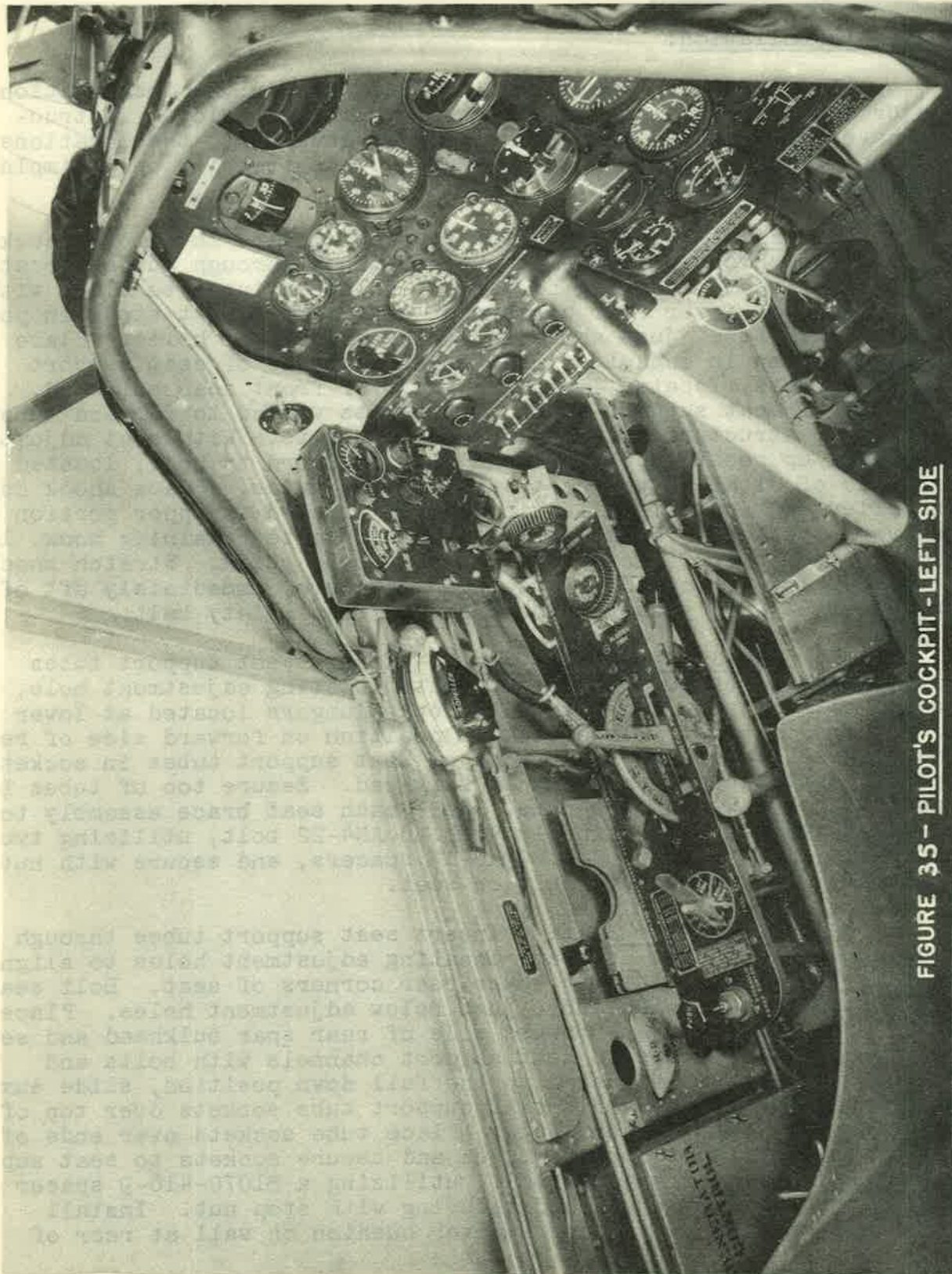


FIGURE 35 - PILOT'S COCKPIT - LEFT SIDE

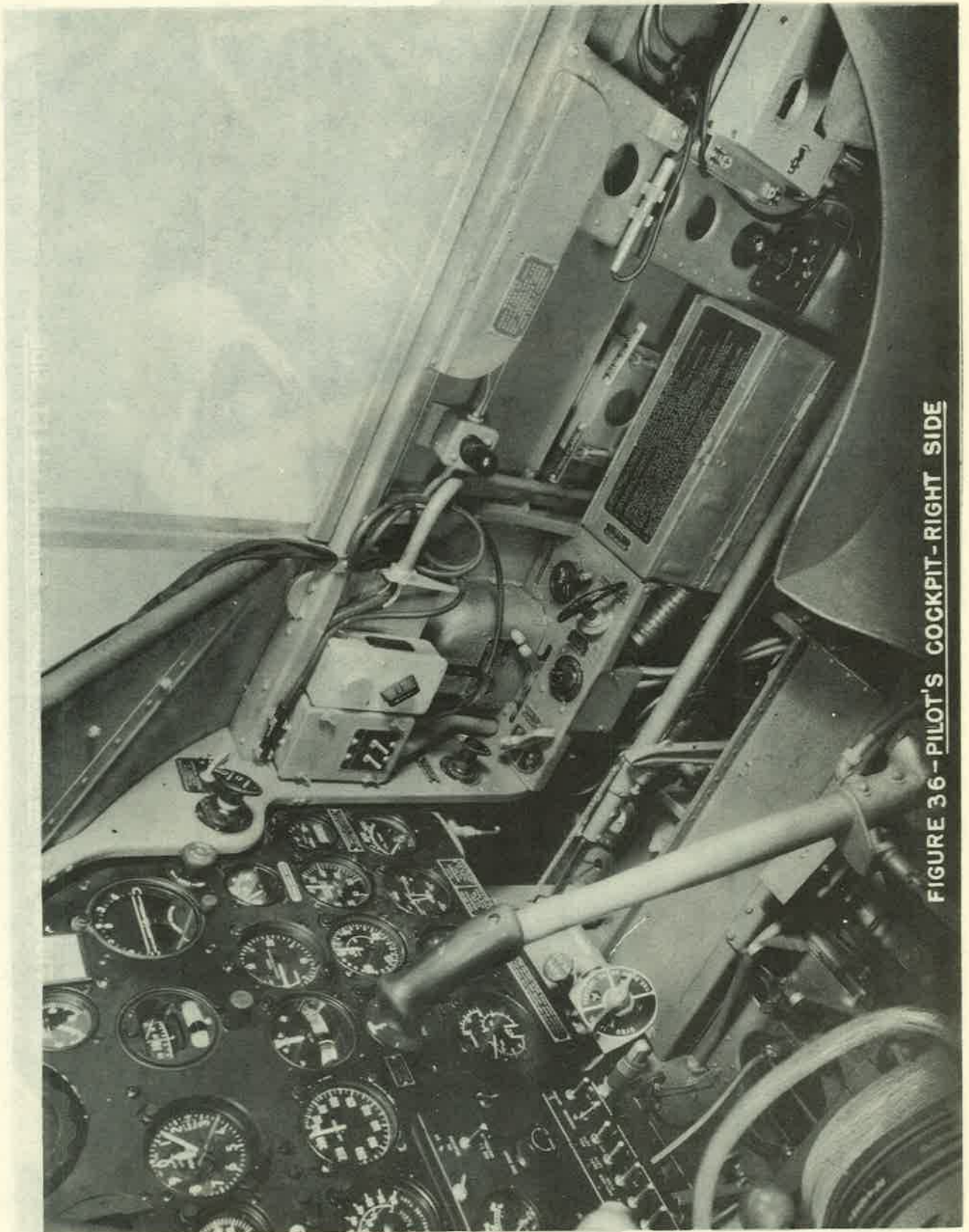


FIGURE 36 - PILOT'S COCKPIT - RIGHT SIDE

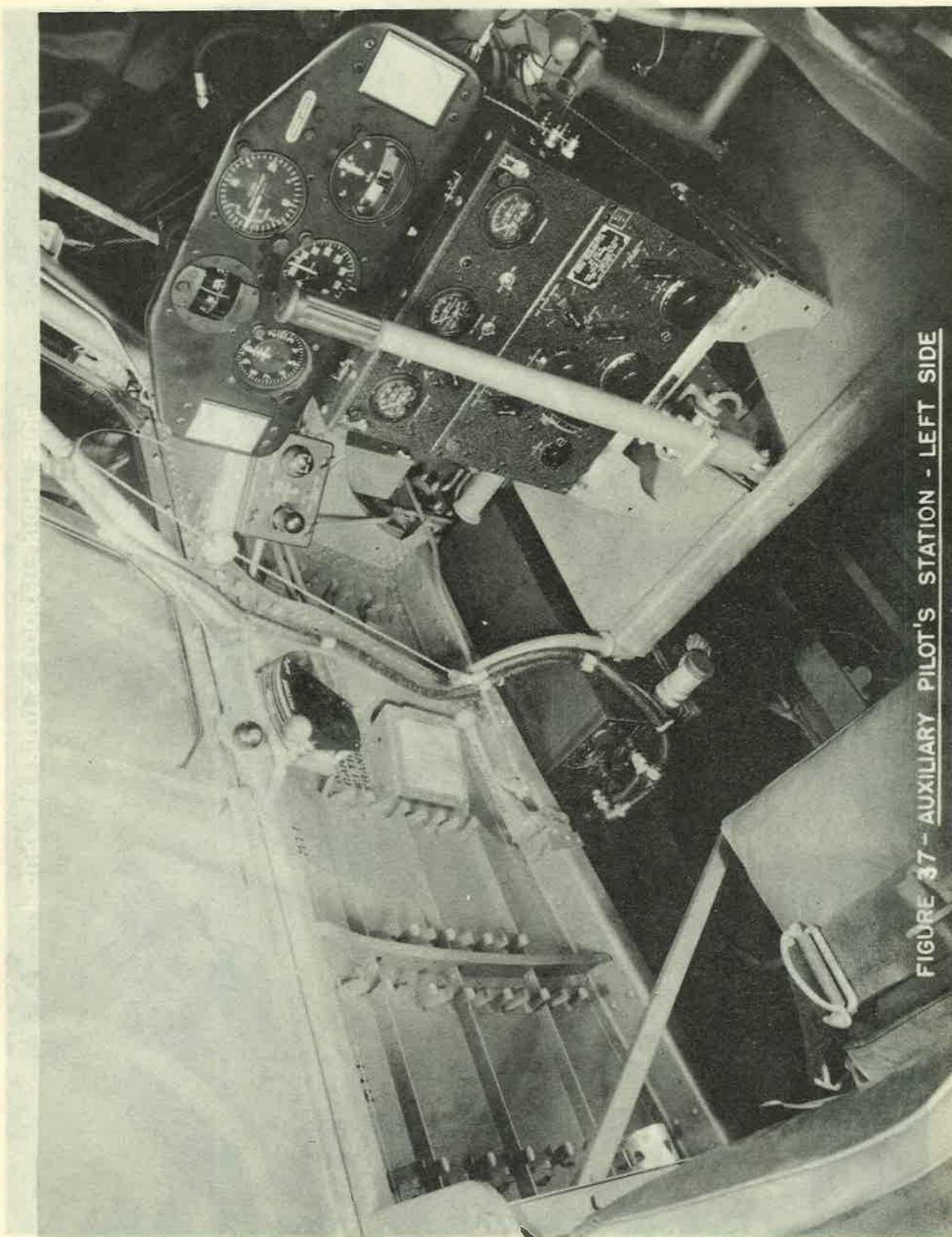


FIGURE 37 - AUXILIARY PILOT'S STATION - LEFT SIDE

T. O. NO. 01-60EB-2

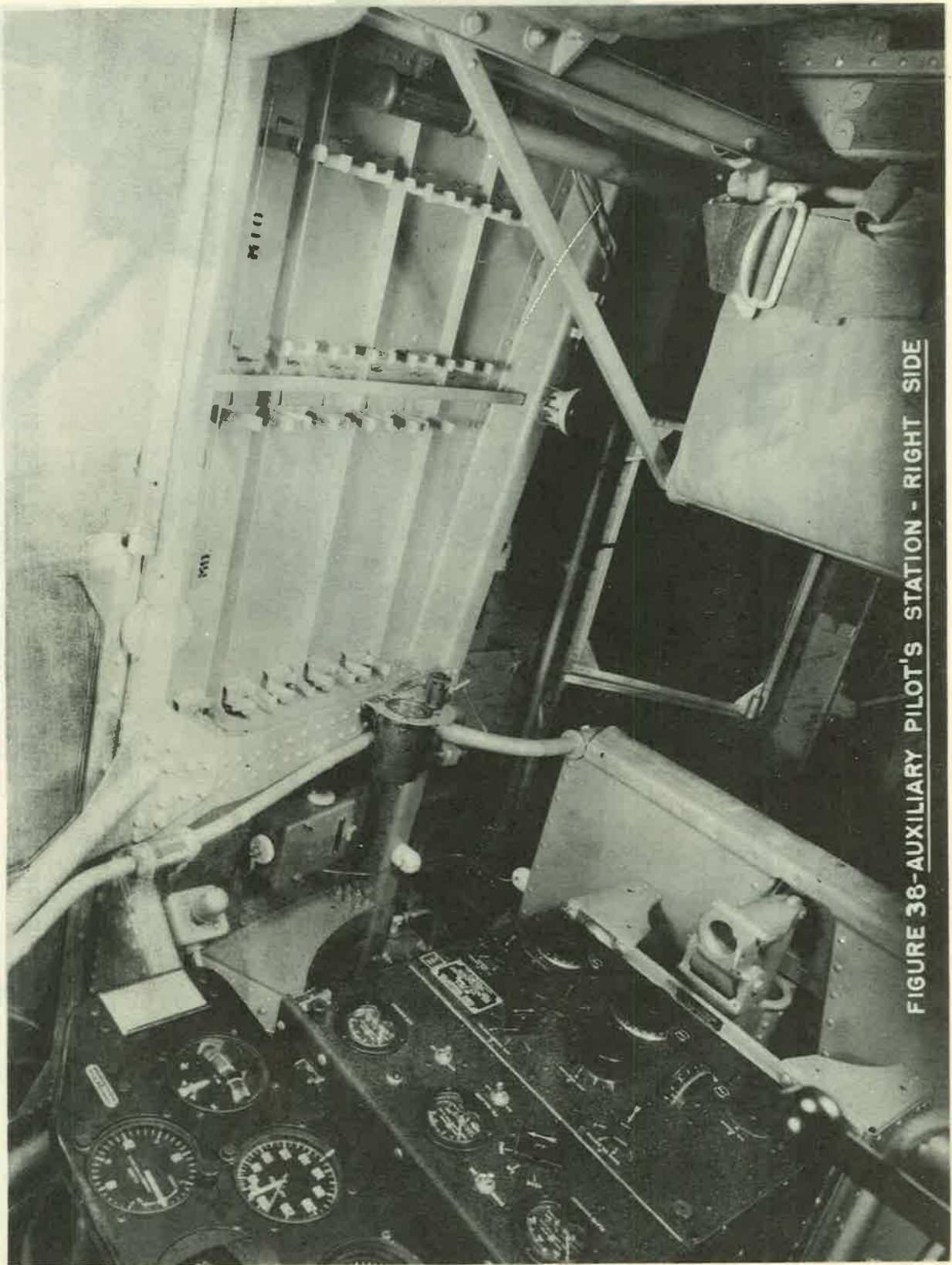


FIGURE 38-AUXILIARY PILOT'S STATION - RIGHT SIDE

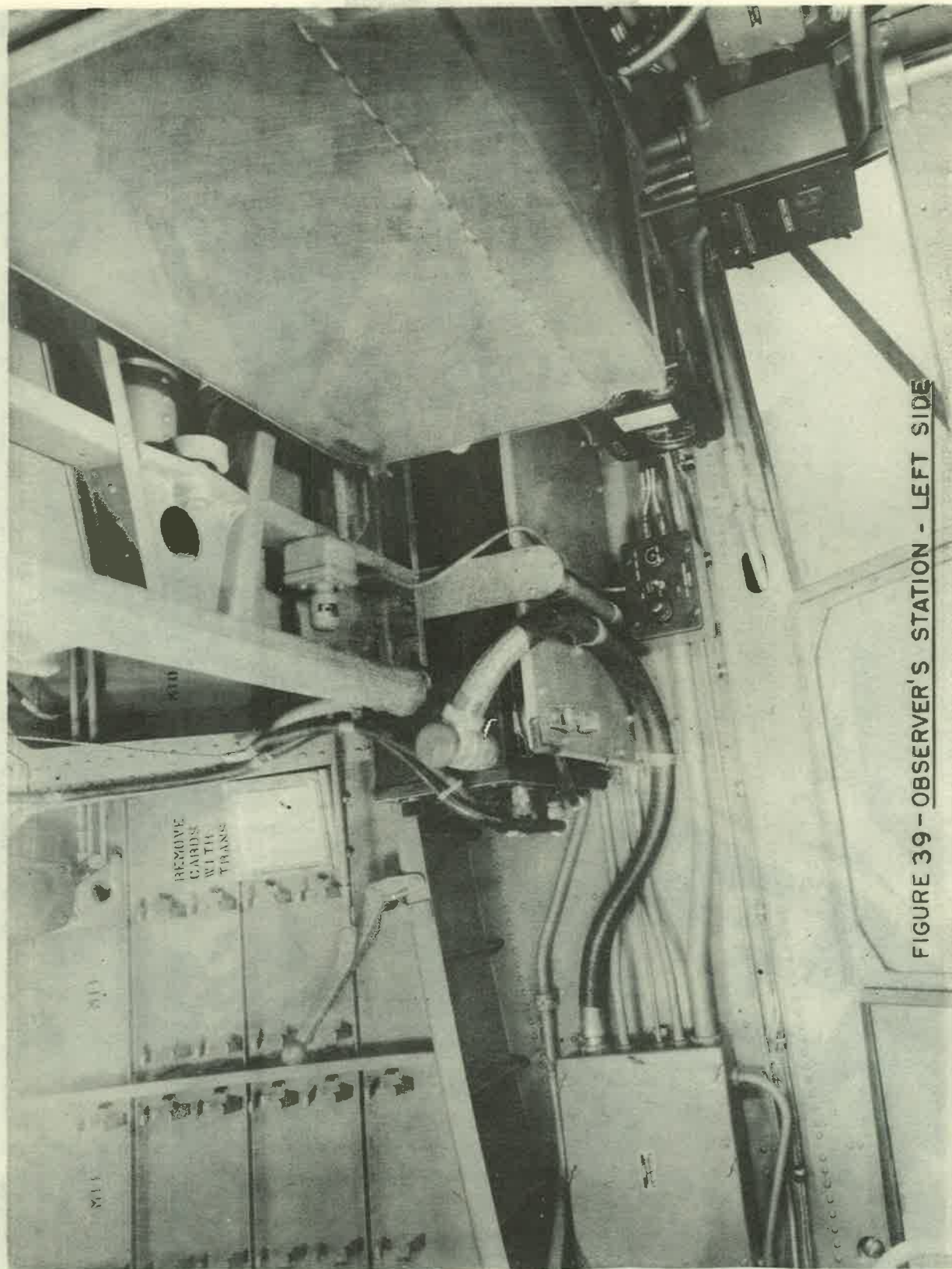


FIGURE 39 - OBSERVER'S STATION - LEFT SIDE

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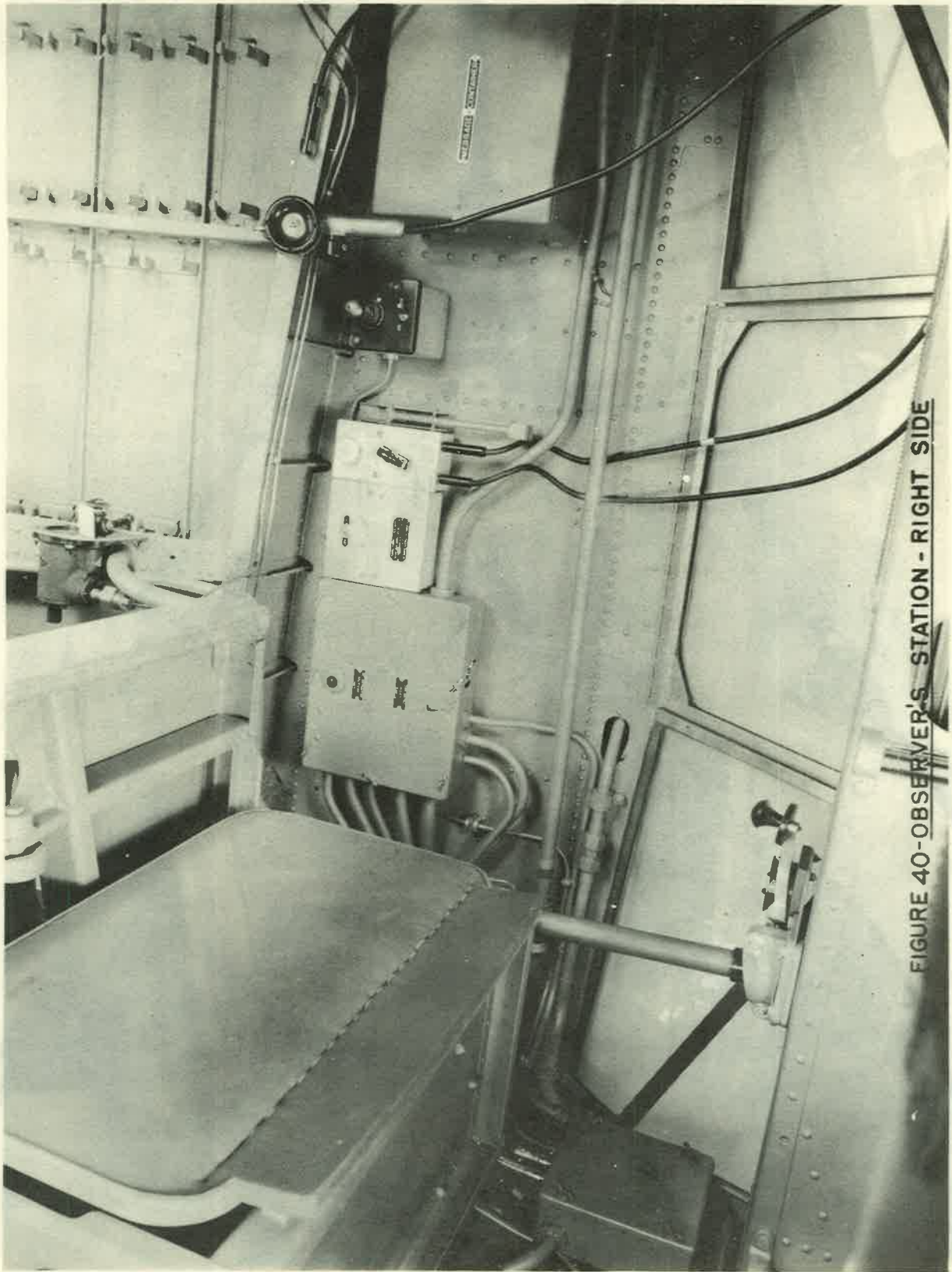


FIGURE 40-OBSERVER'S STATION - RIGHT SIDE

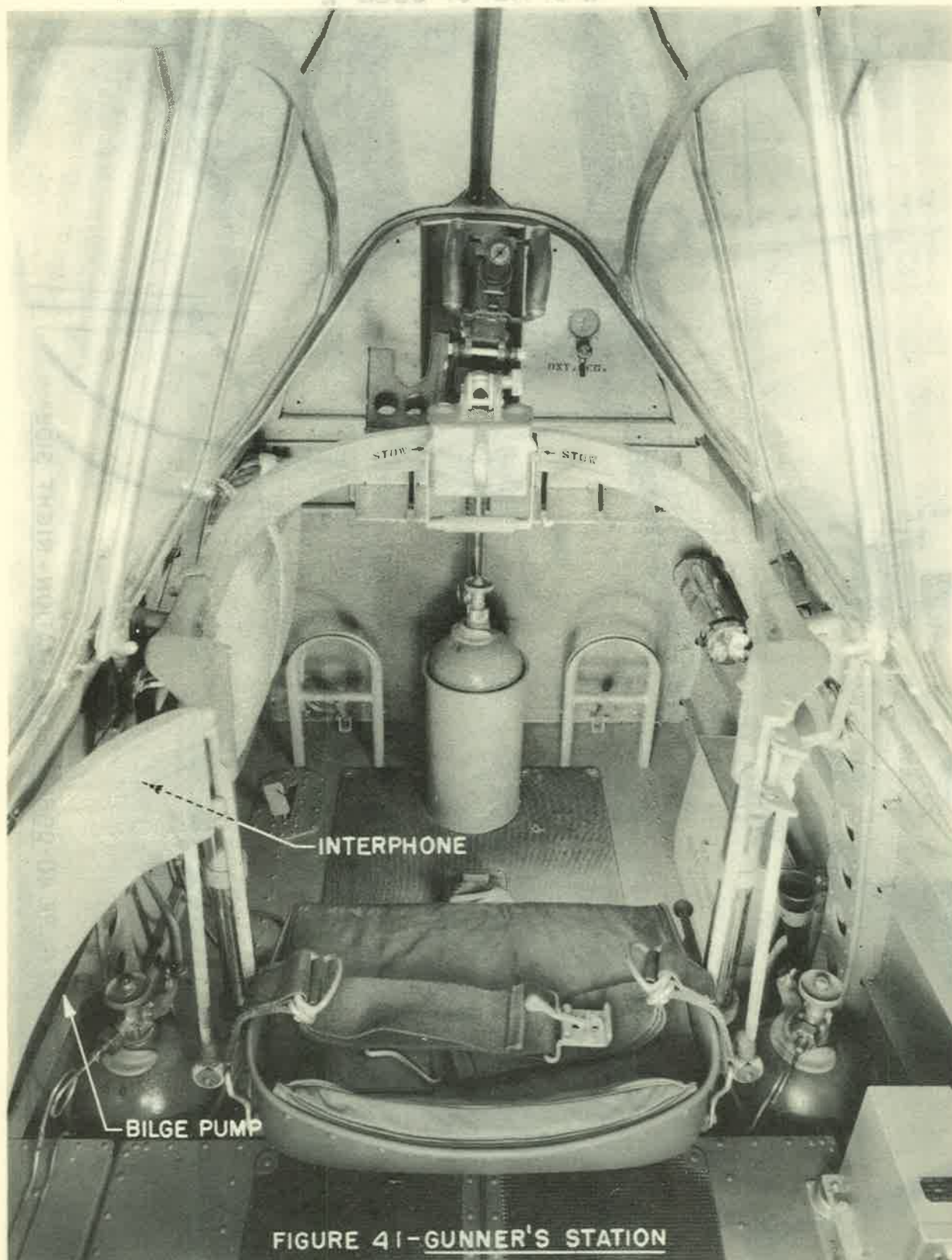


FIGURE 41-GUNNER'S STATION

(5) Gunner's Seat and Gun Track: - Place assembly in position in gunner's compartment, with seat facing aft. Secure assembly to attachment fittings on fuselage sides by inserting pivot pin, 25-62026, through track and seat support bracket at each side of assembly, bolting pins in place with AN3-13A bolts and securing with stop nuts. Lubricate pin before installing same by applying a small amount of graphite cup grease, Spec. VV-G-671. Bolt stop collar to lower portion of track adjusting tube, just above adjustment holes. Press downward on pedal mounted on the outboard side of the gunner's left foot rest and insert tube through adjusting trunnion support bracket, bolted to floor in the aft portion of the gunner's compartment. Bolt another stop collar to end of tube. Secure adjusting tube fitting on upper end of tube to bracket on gun track with a bolt, nut, and cotter.

18. Electrical System

a. General: - In general, a single and two-wire system is utilized. All circuits are individually fused with the exception of the starter motor, battery, and ignition switch. A two-wire system is used in the generator battery circuit to eliminate the effect of the magnetic field produced by the single generator conductor on the compass. All wiring terminals and equipment are completely shielded and bonded by means of suitable conduit junction boxes and bonding straps. Disconnect plugs are employed on the forward side of the firewall, to facilitate disassembly of the power plant. The main electrical power panel is centrally located on the forward side of the firewall. It is from this panel that all circuits receive energy. With the exception of a test switch on the landing gear and flap position indicator instrument, a flare rack light switch, two extension control light switches, de-icer distributor valve motor switch, propeller anti-icer pump motor switch and fuel gauge selector switch, all switches and rheostats for control of the electrical equipment are located within shielded panels, at the left sides of the pilot's cockpit, auxiliary pilot's and observer's stations. Each switch and rheostat is plainly marked to indicate its operation. When leaving airplane, or whenever disassembly affecting electrical wiring is to be accomplished, make certain battery main line switch is "OFF".

b. Electrical Bonding: - All parts are bonded according to specifications, and replacement should be made with clamps, bolts, screws, bonding straps (pig tails), etc., similar to those provided in the original installation. Refer to T. O. 08-5-1.

c. Wiring Diagrams: - Electrical and radio wiring diagrams are maintained in the data case of the gunner's station. In addition to the wiring diagrams, individual wiring charts are mounted on all box assemblies where practical.

d. Ignition: - The Type A-8 ignition switch is wired directly to the rear of the magnetos and is located at the left side of the pilot's instrument panel. A main line battery solenoid is used to safety the entire electrical system and is controlled from the pilot's electrical control panel. This panel is also provided with a generator main line switch, a voltmeter, and an ammeter.

e. Starter: - A Type C-21, hand and electric, inertia starter is provided. The starter is controlled by means of a foot pedal installed at the inboard side of the right floor trough in the pilot's cockpit. A booster coil for the starter is installed in the engine compartment in a suitable container, separately shielded to provide radio shielding. A handcrank for the starter is stowed in the baggage compartment. The handcrank extension and manual starter engaging control, the latter when and if installed, are located at the right side of the engine accessory section. An outside battery plug-in socket is located at the left side of the engine accessory section.

f. Lighting: - The pilot's cockpit, auxiliary pilot's station, observer's station, and fuselage in the vicinity of the flares, are illuminated by Type A-6 lights which provide lighting for operation of controls, reading of maps and charts, and loading of flare racks. The cockpit lights are controlled by switches located on the electrical control panels. The flare rack light is controlled by a switch on the light box located inside door at left side of fuselage, opposite the flare racks. Further illumination is obtained from a Type B-5 extension light provided at right side of front cockpit seat, and at right side of observer's station. These lights are controlled by a switch located on the light boxes. In the front cockpit, provisions are made for illuminating the radio compass, magnetic compass, and turn indicator by means of a separate rheostat control. Each instrument is indirectly lighted by an individual lamp. The intensity of instrument lighting is controlled by rheostats located on electrical control panels. Spare instrument illuminating lamps are located on the instrument panels. The anti-icer storage tank quantity gauge, located at the right forward corner of the pilot's floor, is provided with a light controllable by a switch on pilot's electrical control panel. The gun sight is controlled by a rheostat on pilot's electrical control panel. Two (2) Type A-8 landing lamp assemblies, one (1) Type B-3 running (passing) lamp assembly and a standard set of Type A-8 navigation lights are provided.

g. Fuses and Spares: - All active and spare fuses, except those outlined below, are located in main fuse panel at left side of fuselage, aft of firewall. These fuses are accessible from the ground only, through a door on side of fuselage. All junction box covers are provided with buttonhead, Dzus type fasteners which may be opened

with the fingers. The active and spare fuses not located in the main fuse panel are as follows:

- Dynamotor - Top cover of dynamotor unit on left side of shelf at forward side of firewall.
- Dynamotor - High Voltage Output - High voltage fuse box at forward left side of observer's station.
- Generator - Generator control panel at left side of pilot's cockpit.
- Radio ... - Liaison set junction box at right side of observer's station and inside bottom of liaison receiver.
- Radio Compass - Junction box at left side of observer's station.
- Marker Beacon - Junction box at left side of observer's station.

Active and spare instrument light resistors are located in each electrical control panel.

h. Generator: - A Type E-7, 12-volt, 50-ampere generator is provided. The rate of charge to the 68-ampere hour battery is controlled by means of a Type A-1 generator control panel. This panel, together with the generator fuse, is located in a shielding container at the left side of the pilot's cockpit. A generator main line switch is located on pilot's electrical control panel.

1. Battery: - The Type D-6, 12-volt, 68-ampere hour battery is mounted on a shelf at the right forward side of the firewall. A system of forced air is provided for cooling as well as ventilating.

19. Communication Equipment

a. General: - A radio wiring diagram, showing the complete radio wiring circuits of the airplane, is maintained in the data case of the gunner's station. Also refer to Technical Orders of the 08-5 and 08-10 series. Sockets are provided under firewall shelf for stowing dynamotor electrical wiring and conduit when unit is removed from airplane. The radio circuits are protected by electrical fuses placed at points of connection to the electrical circuit. Only positive 12-volt leads are fused where a grounded electrical system is utilized. The communication equipment consists of antenna installations and the following units.

	Type
Liaison Set, Short Range	SCR-238
Transmitter	BC-307-A
Receiver	BC-224-B
Key	J-5A
Dynamotor	BD-86-A
Antenna Reel	RL-30-B
Switch Box	BC-345
Filter	FL-5-A

Radio Compass	SCR-242-B
Receiver	BC-310-B
Loop	LP-15-B
Mounting	GS-7-B
Remote Control	BC-311-B (rework)
Tuning Shaft	MC-124
Indicator	I-65-B
Interphone (three place)	RC-15-A
Amplifier	BC-212-B (rework)
Microphones	T-17
Throat Microphone Amplifier	BC-216-A
Jack Boxes	BC-213-B (rework)
Marker Beacon Receptor	RC-20
Receiver	BC-301

b. Installations:

(1) Liaison Set, Short Range: - Mount radio transmitter on shelf assembly, located above auxiliary pilot's floor. Mount radio receiver on support assembly located below auxiliary pilot's floor. A door and writing shelf assembly is provided at front of receiver unit and may be folded up and fastened in front of unit. All necessary controls for the observer are located on front of the transmitter and the receiver, except for the transmitter key which is mounted below on the right shelf assembly in order to be conveniently operated by observer. Power supply for the liaison set is obtained from the airplane's 12-volt battery and dynamotor. The 12-volt input to the radio is at the liaison set junction box assembly located at the right forward side of observer's station. Mount dynamotor at the left end of shelf, located on forward side of firewall.

(2) Liaison Set Antenna: - A fixed wire and a trailing wire antenna are provided for the liaison set. A change-over switch is provided and is located at the right side of the auxiliary pilot's cockpit, above the liaison set junction box. Mount the antenna reel assembly on the right side of the receiving set support assembly. Approximately 70 feet of W106 antenna wire is required for the installation of the fixed antenna. The wire should be attached by means of an insulated shock cord assembly to the lower portion of the antenna mast, located at top of vertical stabilizer and the ends attached to fitting provided at each wing tip. An insulator must be installed approximately 39 inches from each wing tip attachment fitting. Attach lead-in wire at center of right antenna wire and to insulator fitting on right side of fuselage, located just above and wired to antenna change-over switch.

(3) Radio Compass: - Install the radio compass receiver on the plate assembly located at the left side of the observer's station. Mount the radio compass loop at the rear of the forward fixed

portion of the cockpit enclosure. The loop is of the non-rotating type, and should be mounted so that the plane of the loop is transverse to the line of flight. Install the radio compass remote control unit on the support assembly provided in the forward portion of the pilot's cockpit at the left side. The remote control shaft is interconnected mechanically with the radio compass receiver. Install the radio compass indicator instrument on the pilot's instrument panel. A junction box for radio compass and marker beacon is provided for interconnecting the radio compass circuits. The box is located at the left side of the observer's station, aft of radio compass receiver. The necessary fuses, active and spare, are plainly marked for identification and are maintained in the junction box.

(4) Radio Compass Antenna: - A wire antenna, which runs fore and aft above the fuselage, is provided for the radio compass. Approximately 20 feet of W106 antenna wire is required. Attach wire to upper portion of mast at top of vertical stabilizer by means of an insulated shock cord assembly. Attach other end of wire to the metallic mast, located immediately forward of the radio compass loop. This mast, being sufficiently capable both mechanically and electrically, serves as lead-in for radio compass antenna.

(5) Interphone: - The interphone equipment is of the three-place type, permitting communication between the pilot's cockpit, observer's or auxiliary pilot's station and the gunner's station. A mounting hook for the hand-held microphone is installed near each interphone outlet. Install a microphone and a radio headset connector cord at each jack box. The cordage length should be sufficient to permit normal movement of the crew member without disconnecting the connector cord from the wearer's headset. A clip is provided for securing the jack end of connector cord when the cord is not attached to a headset. Mount interphone amplifier at right side of observer's station, between the liaison junction box and the observer's interphone jack box. The observer has direct control of the amplifier, and a remote control switch is provided on the pilot's transmitter control box for remote operation.

(6) Marker Beacon Receiver Equipment: - Install the antenna on the under side of the fuselage with the antenna substantially parallel to the line of flight. Mount marker beacon flasher on the pilot's instrument panel. Install marker beacon receiver on left rear corner of floor, between gunner's and auxiliary pilot's stations.

20. Instruments

a. General Description: - The pilot's, auxiliary pilot's and observer's instrument panels are mounted on Lord type shock absorbers, and contain the following instruments and indicators.

b. Pilot's Instrument Panel

	Type	Spec. or Part No.	T.O. No.
Airspeed Indicator	C-7	27804	05-10-2
Altimeter	C-11	27857	05-20-10
Bank and Turn Indicator	A-5	27803	05-20-2
Carburetor Mixture Thermometer	F-2	27823	05-40-12
Clock	A-9	27879	05-1-9
Compass - Magnetic	B-16	27807	05-15-2
Engine Gauge Unit	B-2	27824	05-40-5
Flight Indicator	C-5	27802	05-20-3
Free Air Thermometer	C-6	27722	05-20-7
Fuel-Air Ratio Indicator	A-2	27845	05-3B-2
Hydraulic Pressure Gauge	E-3	94-27812	05-1-3
Indicator - Liquidometer	EA-31-239-1		05-65A-1
Lamp Assembly, Camera Signal		39A2822-3	
*Lamp Assembly, Fuel Signal		39A2822-2	
Lamp Assembly, Marker Beacon		39A2822-4	
Landing Gear & Flap Position Indicator (General Electric)	DJ-4		05-55A-2
Manifold Pressure Gauge	D-2	27811	05-40-2
Radio Compass Indicator	I-65-B	H38B6029	08-10-21
Rate of Climb Indicator	A-6	94-27782	05-20-11
Suction Gauge	F-2	27813	05-20-6
Tachometer	C-7	27816	05-5C
Cylinder Temperature Indicator	B-7	27821	05-40-3
Turn Indicator	A-3	27800	05-20-4

* - Type C-3 Signal INOPERATIVE UNTIL FURTHER NOTICE

c. Aux. Pilot's Instrument Panel

Airspeed Indicator	C-7	27804	05-10-2
Altimeter	C-11	27857	05-20-10
Bank and Turn	A-5	27803	05-20-2
Compass	B-16	27807	05-15-2
Rate of Climb	A-6	94-27782	05-20-11

d. Observer's Instrument Panel

Altimeter	C-11	27857	05-20-10
Clock	A-9	27879	05-1-9
Free Air Temperature Indicator	C-6	27822	05-20-7

e. Instrument Installation: - Instruments may be installed on the panel by attaching instrument case to panel with "Phillips" oval-head screws (brass). Where nuts are not fastened to instrument, use binding head nuts as required. All instrument lines may be readily attached to their respective instruments by means of fittings provided. CAUTION: After installing new instruments or disturbing panels in any way, check to make certain shock absorbing characteristics of panels have not been hindered. Install the electrically heated Type C-2 airspeed pitot tube, assembly No. 51-51033, in the nose section of the right outer wing panel.



21. Armament Installation

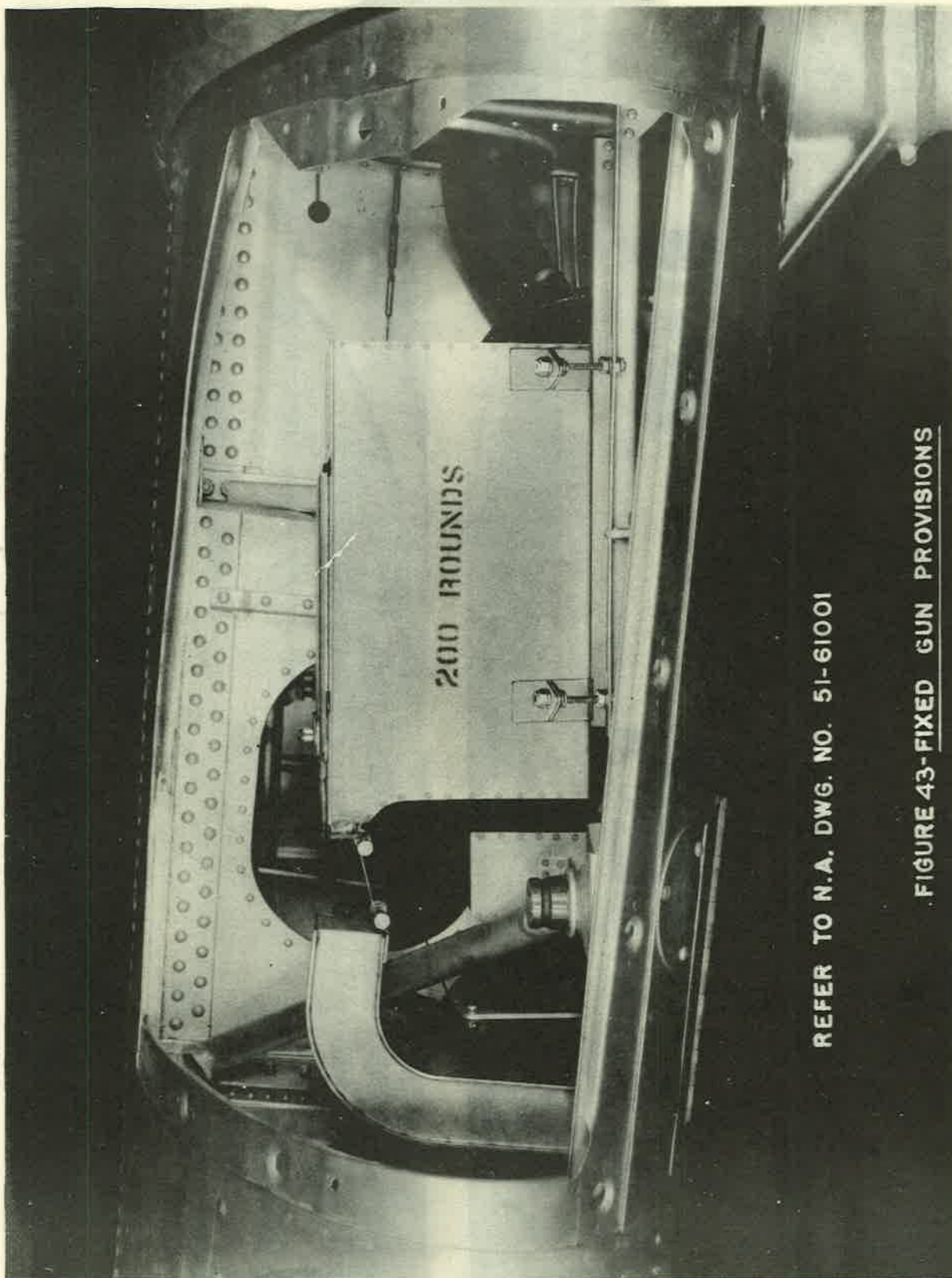
a. Fixed Gun:

(1) General: - Provisions are made for the installation of one (1) Model M-2, .30 caliber, Browning fixed machine gun in the leading edge of the right outer wing panel, just outboard of the wing attachment bolt angle. The gun is unsynchronized. A bracket and a retainer are provided on the outboard side of the second outer panel rib for stowing the gun solenoid when gun is not in use, and solenoid cable when solenoid is removed from airplane. The gun solenoid is safetied through a switch located on the pilot's electrical control panel, and is operated by a conventional type trigger located on pilot's control stick. The gun charging control handle is mounted on the control shelf at right side of pilot's cockpit. The control loads the gun after it has been armed, and releases a door on the lower surface of the wing, which covers the link and case ejection chutes. A special mounting post wrench, 19A-53417, is provided to facilitate installation and adjustment of the mounting posts. Prior to installing the fixed gun, it is necessary to remove Dzus fastened inspection doors from the leading edge of the outer panel. Refer to Section II, paragraph 5., of this Handbook, for location of airplane leveling facilities. A gun sighting chart is mounted on a plate attached to under side of gun compartment cover.

(2) Gun Mounts: - A tubular tripod assembly, extended from the front spar of the right outer wing panel, is provided to accommodate the fixed gun mounting post assemblies. A Type A-4 gun mount post is installed at the rear portion of the support. The forward portion of the support is provided with a trunnion post, 19A-31111, and a Type A-3 trunnion bolt and bracket assembly.

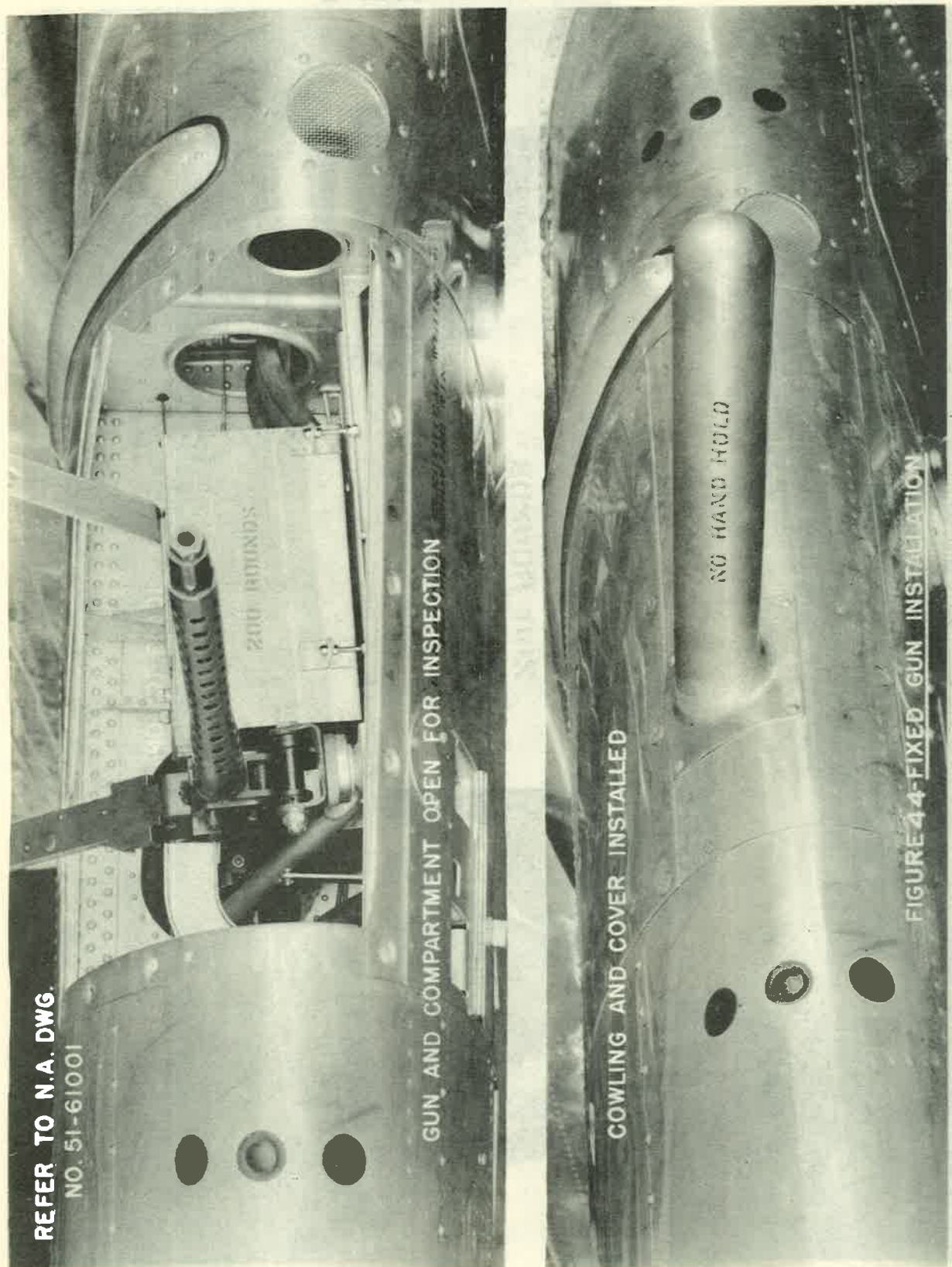
(3) Gun Sight: - A bracket is provided for the installation of a Type N-2A optical gun sight, and is located in pilot's cockpit between floor troughs, forward of control stick. The electrical wiring and conduit for the gun sight is stowed directly forward of the mounting brackets. The rheostat for control of gun sight is located on the pilot's electrical control panel. A gun sight cover is located in case at left side of pilot's cockpit. Adjustable brackets for mounting gun sight reflector glass, 38A2197, are provided on top of pilot's instrument panel shield. A 1/32 inch clearance is provided at each side of the reflector for packing with 1/4 inch strips of "Cavalprene" composition, or the equivalent. Cement the packing strips to the brackets with N.A. Neoseal, or the equivalent, and install the reflector.

(4) Ammunition Box: - An ammunition box is provided to accommodate 200 rounds of .30 caliber ammunition with links. Install the box on brackets located in fixed gun compartment, just inboard of gun, attaching with four adjusting screws, 40-61012, twelve AN960-10 washers, and twelve stop nuts.



REFER TO N.A. DWG. NO. 51-61001

FIGURE 43-FIXED GUN PROVISIONS



(5) Ejection Chutes: - A case and a link ejection chute are provided, both of which terminate at a door assembly on under side of wing. The door is automatically released by means of gun charging control cable to which it is interconnected. Place case ejection chute in position between front and rear mounting posts, and secure to support channels welded to mount assembly with two adjusting screws, 40-61012, six AN960-10 washers, and six stop nuts. Place link ejection chute in position on right side of gun, opposite ammunition box, and bolt lower rear portion of chute to support bracket provided with two adjusting screws, 40-61012, six AN960-10 washers, and six stop nuts. When gun is not installed, attach link, 25-61030, between fixed gun ammunition box and link ejection chute, using an AN3-21A and an AN3-22A bolt.

(6) Gun Installation: - Prior to installing fixed gun, remove link between ammunition box and link ejection chute. Loosen ammunition box adjustment screws and slide assembly inboard as far as slotted support brackets will permit. Remove gun solenoid and electrical conduit from stowed position on wing rib, and install solenoid on left side of gun. Place assembly in position on mounts and lock in place by a turn of the knurled rings. Connect electrical wiring and conduit at rear of solenoid. Connect link at end of gun charging cable to turnbuckle at rear of gun charging rod. Join cables by connecting detachable link assembly. Attach ammunition box and link ejection chute to gun, using pins provided on gun. Attachment lugs on ammunition box, ejection chutes, and their support brackets are slotted to permit directional adjustment. To adjust ammunition box and chutes vertically, screw adjustment studs up or down as required, and tighten lock nuts. When proper adjustment is obtained, replace inspection doors. A sheath assembly, 51-61026, is provided for covering gun muzzle when gun is not to be used.

b. Flexible Gun:

(1) General: - Provisions have been made at the gunner's station for installation of one (1) Model M-2, .30 caliber, Browning flexible machine gun. A Type D-4 vane sight, a Type B-8 rear ring sight, a Type A-4 case ejection container, and a Type A-4 link ejection container are required for the flexible gun.

(2) Gun Mount: - A Type G-1A gun mount is used to support the flexible gun. The mount operates on a semi-circular track supported at each side by means of a bracket which also supports the gunner's seat. The gun is attached to the mount by means of a Type C-12 adapter assembly.

(3) Ammunition Boxes and Holders: - Provisions are made for 500 rounds of ammunition with links at rear of gunner's station. An ammunition magazine holder assembly, 51-62027, is provided and accommodates five B1171 holders. Each holder accommodates one (1) Type L-4 ammunition box, or 100 rounds of ammunition.

T. O. NO. 01-60EB-2

REFER TO N.A. DWG.
NO. 51-62001

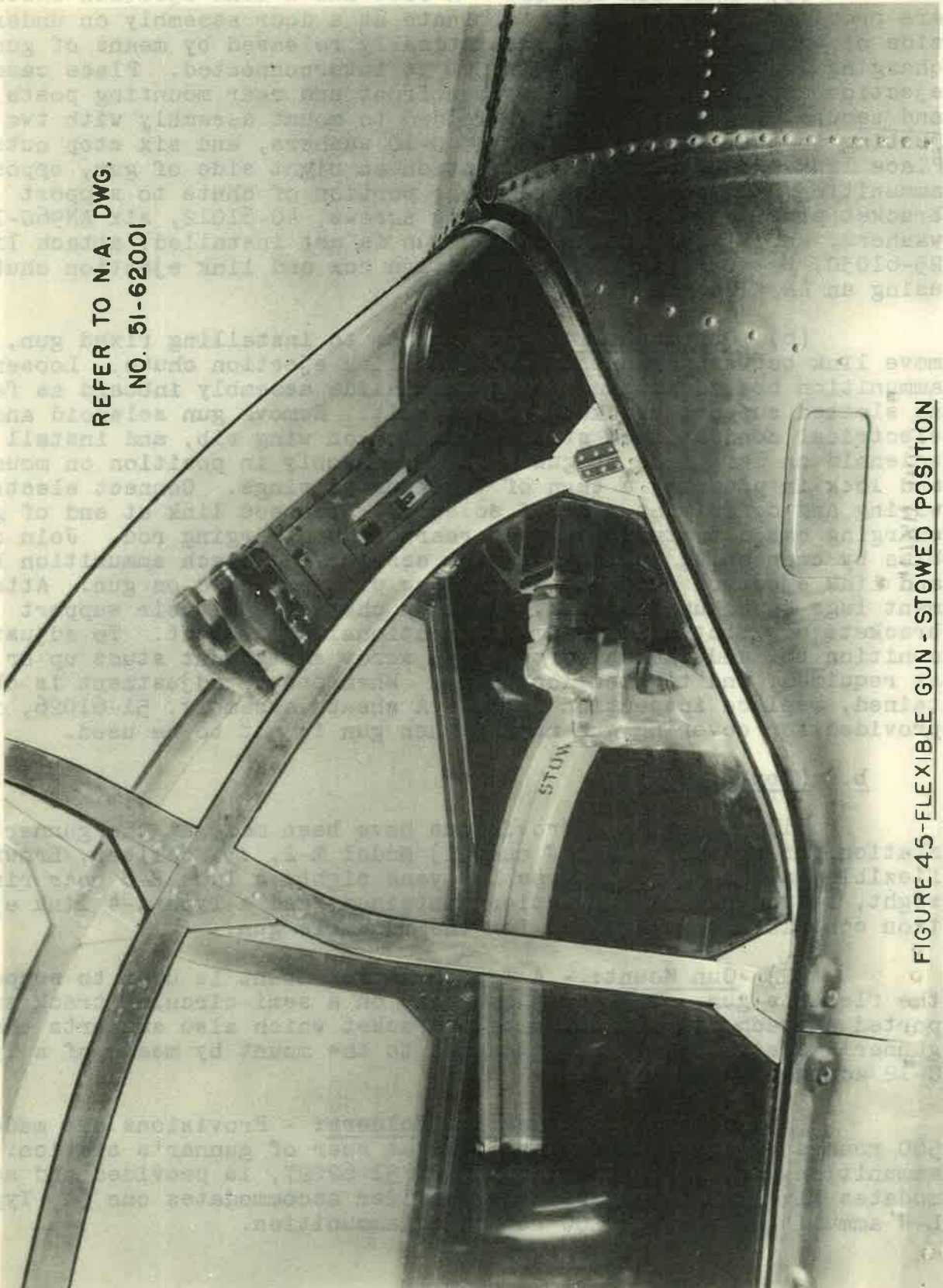


FIGURE 45-FLEXIBLE GUN - STOWED POSITION

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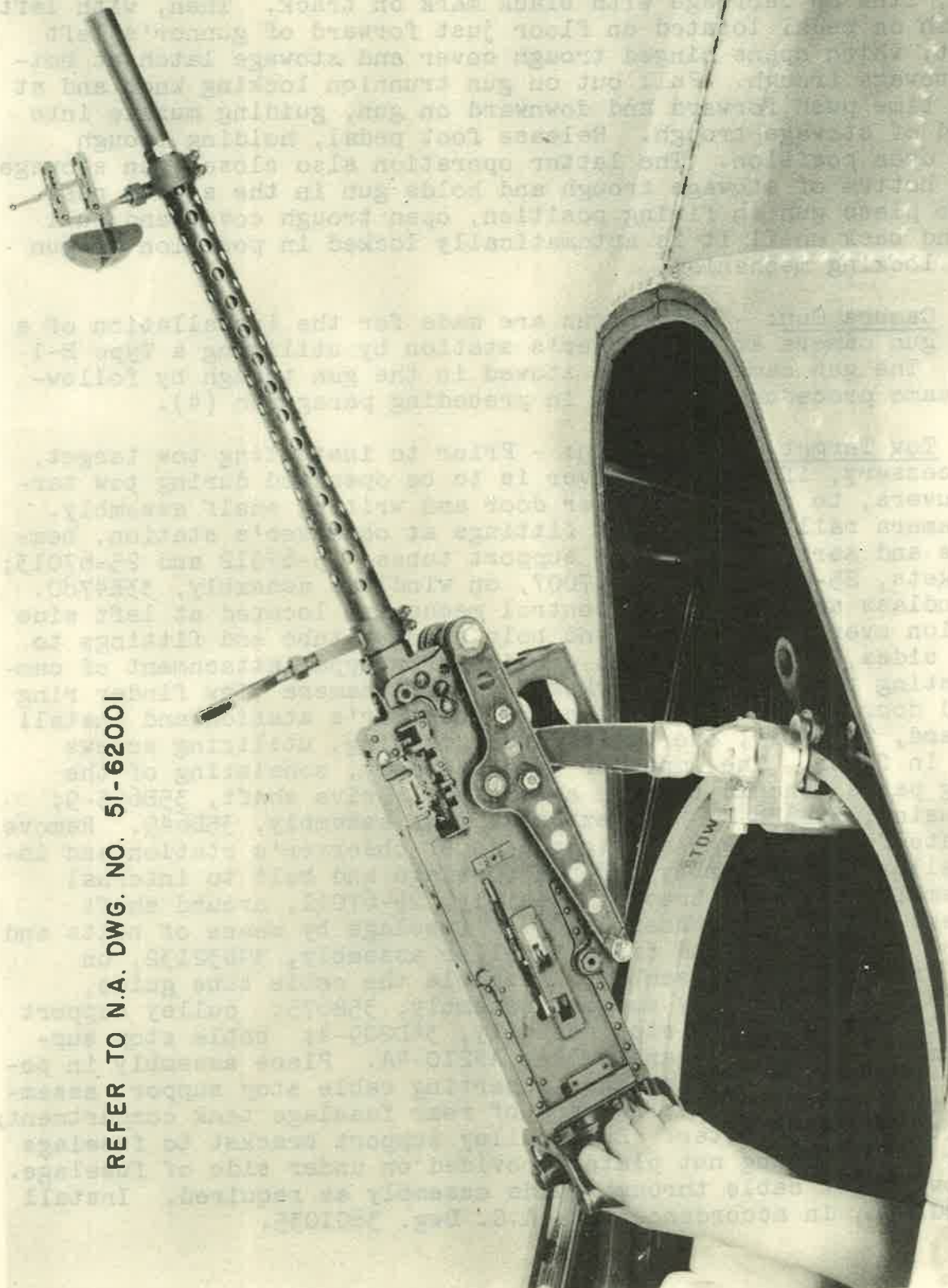


FIGURE 46-FLEXIBLE GUN - FIRING POSITION

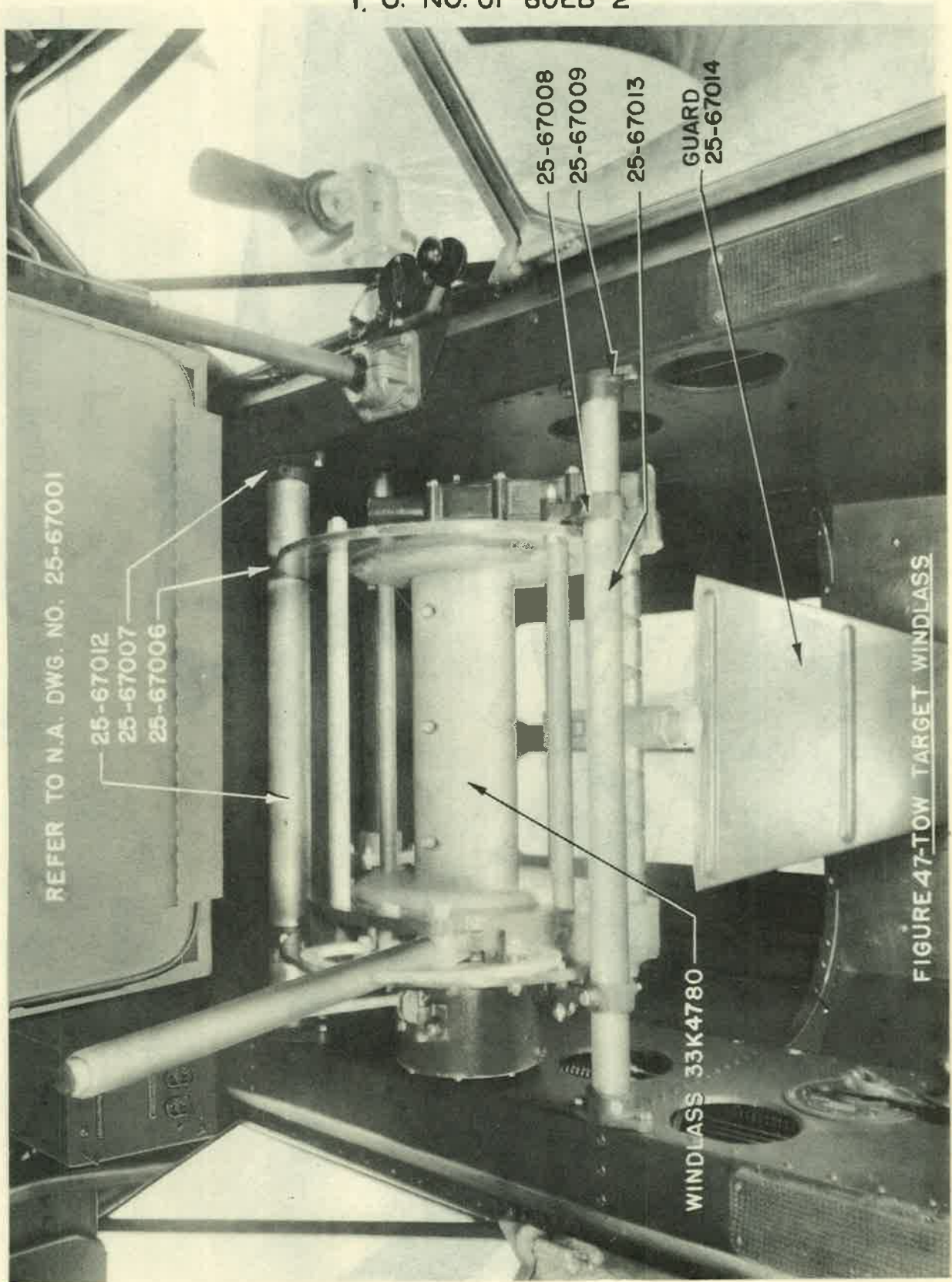
REFER TO N.A. DWG. NO. 51-62001

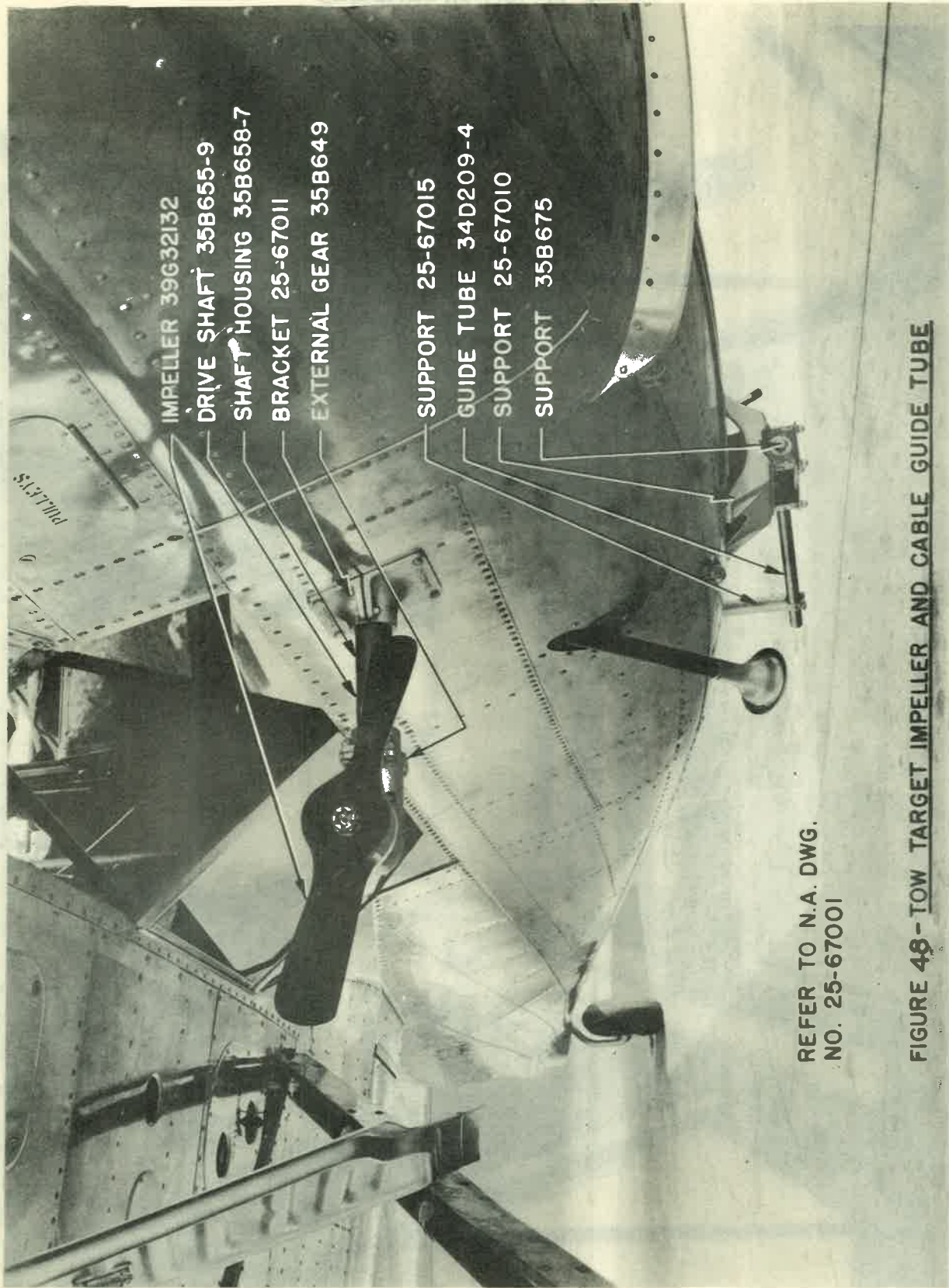
(4) Installation and Stowage: - Attach Type C-12 adapter assembly to gun mount and install gun, sights, and case and link ejection containers. Prior to stowing gun, make certain muzzle stabilizer is removed and that gun track is at the lowest position. To stow gun, line up carriage with black mark on track. Then, with left foot, push on pedal located on floor just forward of gunner's left foot rest, which opens hinged trough cover and stowage latch at bottom of stowage trough. Pull out on gun trunnion locking knob and at the same time push forward and downward on gun, guiding muzzle into lower end of stowage trough. Release foot pedal, holding trough cover in open position. The latter operation also closes gun stowage latch at bottom of stowage trough and holds gun in the stowed position. To place gun in firing position, open trough cover and pull gun up and back until it is automatically locked in position by gun trunnion locking mechanism.

c. Camera Gun: - Provisions are made for the installation of a Type H-2 gun camera at the gunner's station by utilizing a Type B-1 adapter. The gun camera may be stowed in the gun trough by following the same procedure outlined in preceding paragraph (4).

d. Tow Target Installation: - Prior to installing tow target, it is necessary, if radio receiver is to be operated during tow target maneuvers, to remove receiver door and writing shelf assembly. Remove camera rails and support fittings at observer's station, beacon masts and aerial. Assemble support tubes, 25-67012 and 25-67013; and brackets, 25-67009 and 25-67007, on windlass assembly, 33K4780. Place windlass assembly, with control mechanism located at left side in position over camera door, and bolt support tube end fittings to fuselage sides, utilizing holes provided for upper attachment of camera adjusting tube support brackets. Remove camera view finder ring cover and door assembly from floor of observer's station and install cable guard, 25-67014, over view finder opening, utilizing screws provided in floor. The impeller tube assembly, consisting of the following parts, should then be assembled: Drive shaft, 35B655-9; shaft housing, 35B658-7; and external gear assembly, 35B649. Remove cover plate from fuselage at right side of observer's station and insert impeller tube assembly through fuselage and bolt to internal gear assembly. Install bracket assembly, 25-67011, around shaft housing and attach to outboard side of fuselage by means of bolts and stop nuts. Install rewind drive impeller assembly, 39G32132, on shaft of external gear assembly. Assemble the cable tube guide, which consists of: Pulley support assembly, 35B675; pulley support bracket, 25-67010; cable stop assembly, 34D209-4; cable stop support assembly, 25-67015; and pulley, AN210-4A. Place assembly in position on under side of fuselage, inserting cable stop support assembly in socket provided just forward of rear fuselage tank compartment; secure with pin and cotter. Bolt pulley support bracket to fuselage with four bolts, using nut plates provided on under side of fuselage. Thread tow target cable through guide assembly as required. Install guard, 38G1036, in accordance with A.C. Dwg. 38G1035.

T. O. NO. 01-60EB-2





22. Pyrotechnic Installation

a. Landing Flares: - Type A-4 flare racks are installed in the fuselage, just aft of the life raft container, to accommodate two Type M-8 parachute flares. Two handles for releasing the flares are located at the right side of the pilot's cockpit. A Dzus fastened door is provided directly above the rack installation, so that flares may be lowered into the rack chutes. The hangwire swivel loops can be adjusted to the arming mechanism through a door at the left side of the fuselage. A light is provided for night loading of flares.

b. Pyrotechnic Pistol: - Provisions are made for the installation of a Type M-2 pyrotechnic pistol on the rear wall, at the left side of the auxiliary pilot's station.

c. Signals and Flares: - Clips are installed at each side of the auxiliary pilot's station for holding signals and flares. The two rows of clips on the left side at the rear accommodate ten Type M-11 Red Star Signals. The row of clips on the left side at the forward end accommodate four M-10 White Star Signals. The clips at the rear portion of the right side accommodate six Type M-10 White Star Signals, and at the forward portion of the right side there are clips that will accommodate five Type M-9 parachute flares.

23. Oxygen Installation

a. General Description: - Provisions are made for the installation of three Type C-1 oxygen cylinders and three Type A-6 oxygen regulators. Copper lines are installed from the regulators to the forward portion of the gunner's station, at which point they are provided with fittings for attachment to valve assemblies, which attach to the oxygen cylinders. When completing oxygen installation, special care must be taken to insure lines are free from oil and other foreign matter. See T.O. 03-50-2 for charging of oxygen cylinders.

b. Oxygen Cylinders: - A well at each side of the gunner's seat and in the aft end of the gunner's station is provided to accommodate the Type C-1 oxygen cylinders. The wells at the left and right sides of the gunner's seat accommodate cylinders for the pilot and observer, respectively. The well at the forward end of gunner's station accommodates the cylinder for the gunner. Each well is equipped with a large hook, with wing nut arrangement for securing the cylinders.

c. Oxygen Regulators: - Provisions are made for the installation of Type A-6 oxygen regulators in the cockpit and stations, within easy reach of and visible to the occupants. A cut-out is provided in the control shelf, at the right side of the pilot's cockpit, for installation of the pilot's regulator. A bracket is provided at the auxiliary pilot's right floor support for installing a regulator between the observer's and the auxiliary pilot's stations. The regulator at the gunner's station is mounted by means of a cut-out in the former at left rear corner of the station.

24. Photographic Installation

Provisions are made for installation of reconnaissance mission photographic equipment at the observer's station. Provisions consist of the necessary tracks, supports, brackets, clamps, etc., for installing cameras and accessories, as outlined below. A selector valve for the camera vacuum supply is installed in the lower forward portion of the observer's station at the right side. A pertinent instruction plate is located adjacent to the valve. A camera power junction box is located to the left of the vacuum selector valve. The camera power box and pilot's instrument panel are provided with a signal light which function when the camera is in operation. A camera door is provided in the fuselage bottom at the forward end of observer's station. The door, consisting of two panels, is hinged at the outboard edges, each panel opening downward. The door panels consist of 3/16 inch transparent sheets encased in aluminum alloy frame assemblies. A crank for opening and closing the camera door is located at the left side of observer's station. The crank operates a chain drive which in turn is interconnected with the door mechanism by means of cables and push rods.

Camera - Type K-3B, 8-1/4 inch and 12 inch cones

Camera Mount - Type A-8

Vertical View Finder - Type A-2

Intervalometer - Type B-2

Set Cables, Connecting (3 Required)

Filter - Type A-2A

Roll of Film, 9-1/2 inches x 75 feet

Magazine Loaded (Extra) Type A-1A

25. Drift Meter Provisions

Provisions are made for installing a pilot's Type C-1 drift meter on the rear side of the firewall. The upper portion of the pilot's instrument panel is provided with a cut-out to accommodate the upper end of the drift meter. The drift meter is supported by three felt-padded clamps. A boot and a shield are provided at the lower end of the drift sight and a cover plate is installed over opening in fuselage. Prior to installing drift sight, it is necessary to remove cockpit ventilation valve and cover duct opening in fuselage.

26. Flotation Gear

Six separate water-tight compartments are built integral with the structure of each outer wing panel, to provide flotation. The compartments are interconnected, through structural members that separate them, by means of holes, so located that all compartments are vented and drained to the lowest point. Water-tight access doors are provided on lower surface of wing for periodic inspection. Two vent tubes from the compartments in each wing terminate at each side of fuselage between auxiliary pilot's and gunner's stations. By incorporating bilge pump connections at these points, the vent lines may be used as bilge lines. It is important that vent line connections be kept open for venting when not in use. Provisions are made at right side of gunner's station for stowage of a bilge pump.

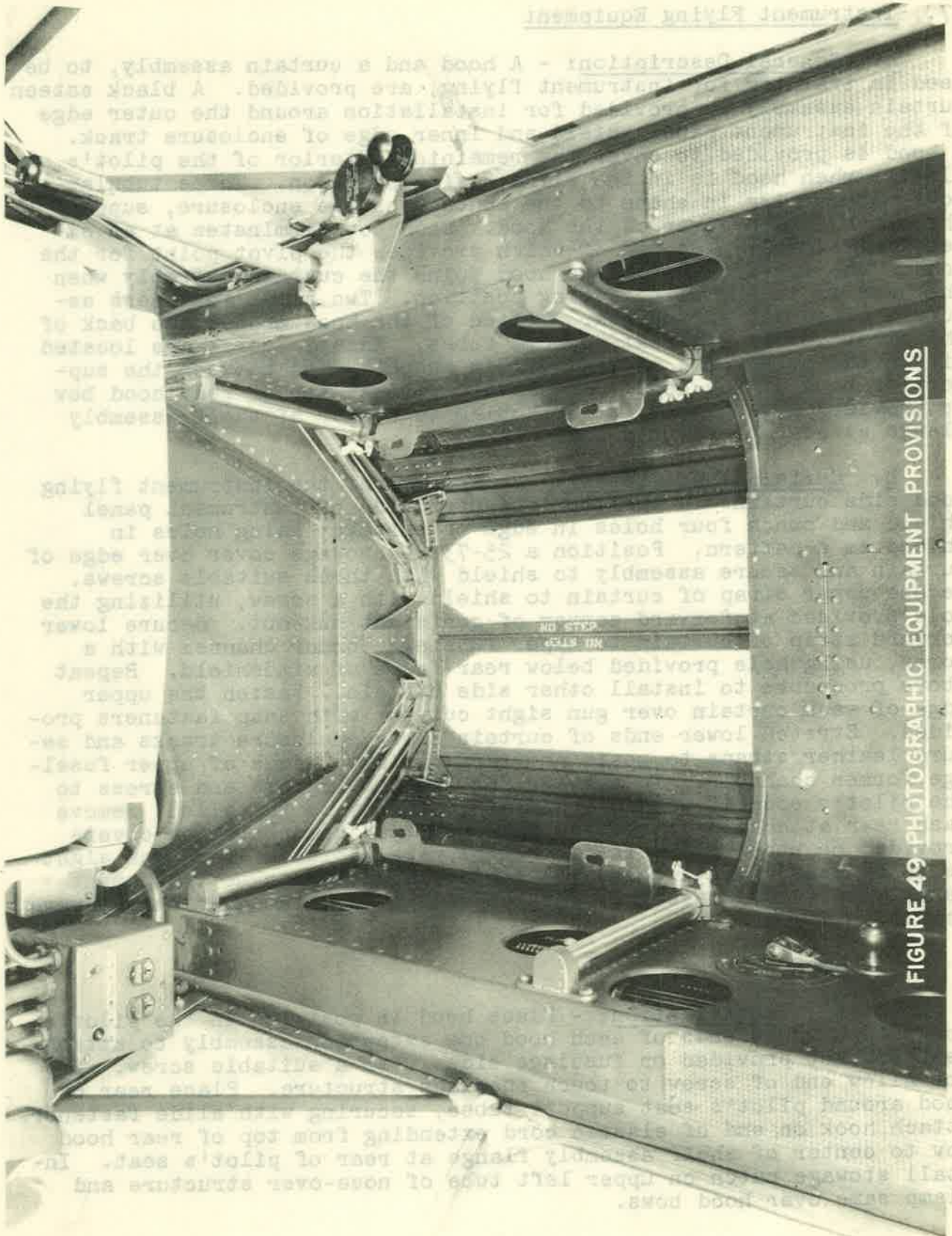


FIGURE 49-PHOTOGRAPHIC EQUIPMENT PROVISIONS

27. Instrument Flying Equipment

a. General Description: - A hood and a curtain assembly, to be used in training for instrument flying, are provided. A black sateen curtain assembly is provided for installation around the outer edge of the instrument panel shield and inner edge of enclosure track. A hood is provided to cover the remaining interior of the pilot's enclosure when hood is in the blind flying position. Three tubular bows, conforming in shape to the contour of the enclosure, support the black sateen cover of the hood. Each bow terminates at an extension assembly, the end of which provides the pivot point for the hood. The forward bow of the hood joins the curtain assembly when the hood is in the blind flying position. Two slide fasteners assure a close fit of the rear portion of the hood around the back of the pilot's seat and seat support tubes. Elastic cords are located within the outer edge of the curtain assembly and between the supporting bows of the hood. An elastic cord at top of rear hood bow is provided with a hook for attaching to center of shelf assembly flange at rear of pilot's seat.

b. Curtain Installation: - Place one of the instrument flying hood side curtains in position on upper side of instrument panel shield and punch four holes in edge of curtain, using holes in shield as a pattern. Position a 25-73029 stowage cover over edge of curtain and secure assembly to shield with three suitable screws. Secure upper strap of curtain to shield with a screw, utilizing the hole provided at forward corner of gun sight cut-out. Secure lower forward strap of curtain to upper fuselage former channel with a screw, using hole provided below rear frame of windshield. Repeat above procedure to install other side curtain. Fasten the upper edge of each curtain over gun sight cut-out with snap fasteners provided. Stretch lower ends of curtain along enclosure tracks and secure leather straps to posts provided on inner sides of upper fuselage former channels. To provide for ease of ingress and egress to the pilot's cockpit when the curtain assembly is installed, remove each rear attachment strap and place curtain under stowage covers provided on upper sides of instrument panel shield. When gun sight is to be used, remove screws attaching upper straps to instrument panel shield and place that portion of the curtain under the stowage covers.

c. Hood:

(1) Installation: - Place hood in position in the pilot's cockpit. Secure ends of each hood bow extension assembly to attachment bracket provided on fuselage sides with a suitable screw. Do not allow end of screw to touch fuselage structure. Place rear of hood around pilot's seat support tubes, securing with slide fasteners. Attach hook on end of elastic cord extending from top of rear hood bow to center of shelf assembly flange at rear of pilot's seat. Install stowage catch on upper left tube of nose-over structure and clamp same over hood bows.

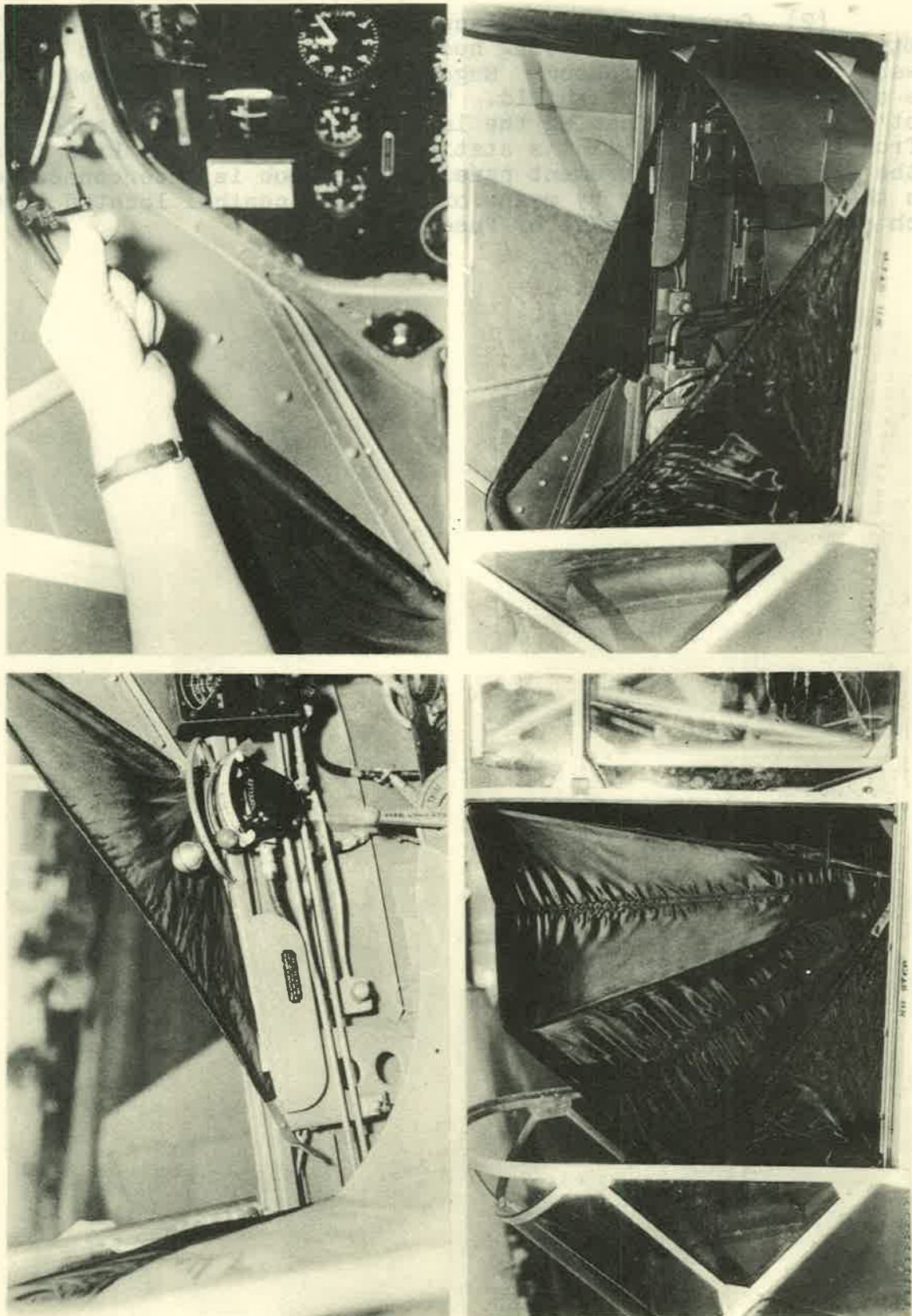


FIGURE 50-INSTRUMENT FLYING HOOD

(2) Operation: - To place the hood in the useful operating position, release clamp holding hood in the stowed position and pull forward on front bow of hood. Engage bow with latch located on under side of instrument panel shield. The hood may be released from the pilot's cockpit by releasing the latch. The hood may also be released from the auxiliary pilot's station by pulling on the knob located to the left of the instrument panel. This knob is interconnected with the catch assembly by means of a Bowden control located between catch and knob at left side of fuselage.

HOOD RELEASE LATCHING HOOD