RESTRICTED

ERECTION AND MAINTENANCE INSTRUCTIONS

PRELIMINARY

MODEL F4U-1, FG-1, F3A-1 AIRPLANES

VOUGHT - SIKORSKY AIRCRAFT
STRATFORD, CONNECTICUT
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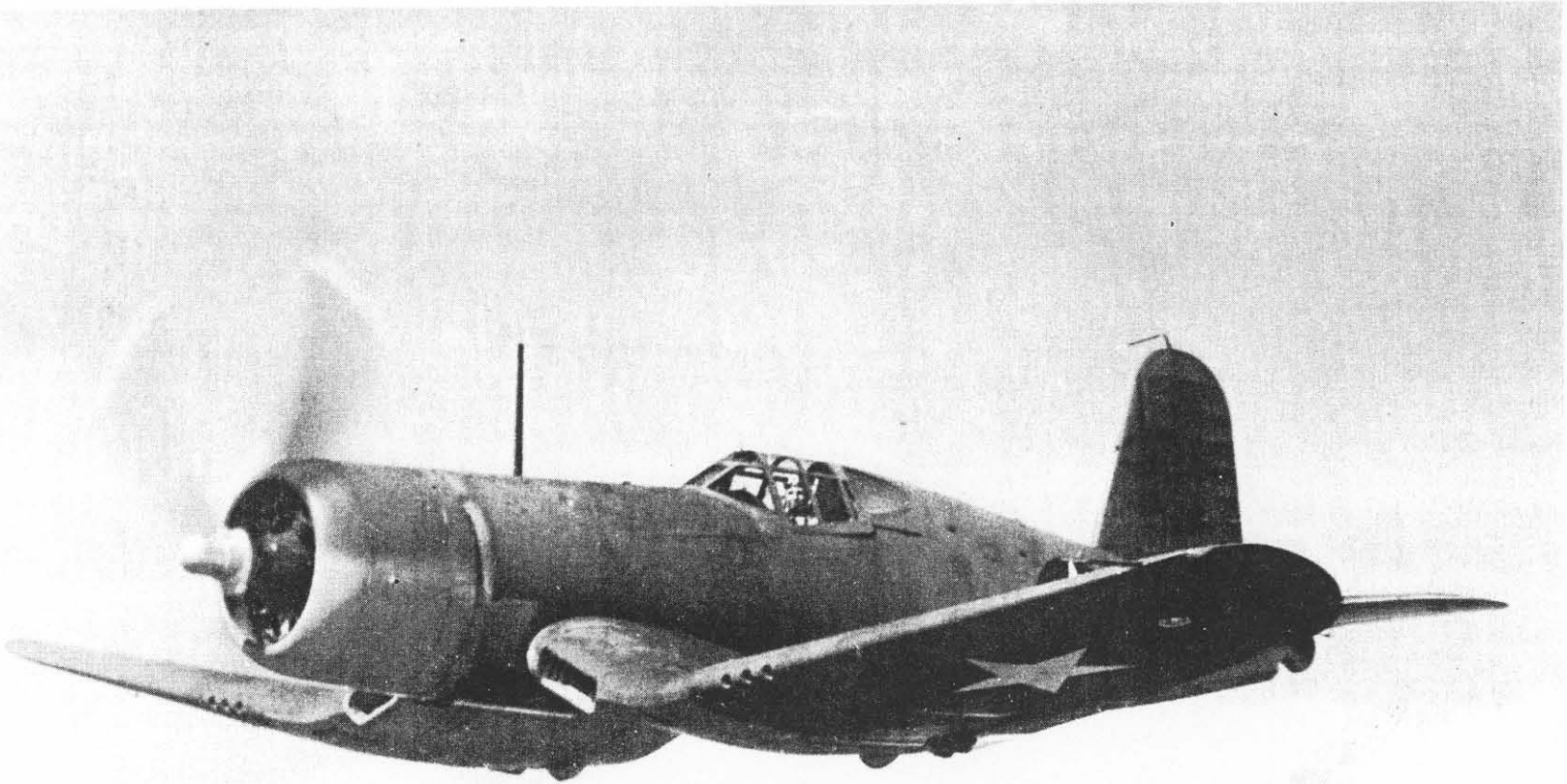

ERECTION AND MAINTENANCE INSTRUCTIONS

MODEL F4U-1, FG-1 and F3A-1 AIRPLANES

-FOREWORD-

Continued satisfactory performance of any airplane depends in a large measure upon the skill and thoroughness with which it is serviced. This compilation of erection and maintenance data is intended to augment the knowledge and training of the operating forces with specific and detailed information about the Model F4U-1, FG-1 and F3A-1 airplanes. In order to conserve time and effort in the maintenance and service of these airplanes, operating personnel are urged to familiarize themselves with the contents of this manual.

The manufacturer solicits comments and criticism of this Erection and Maintenance Manual, and invites suggestions for its improvement.

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ERECTION AND MAINTENANCE

WING GROUP

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WING GROUP

GENERAL

The full cantilever monoplane wing consists of a center section built separately from the fuselage and then riveted and bolted thereto, and hydraulically folding, tapered outer panels. The center section has an inverted gull shape, the landing gear connecting to the lowest point of the gull. The metal covered center section is essentially of box beam, single spar construction, the rear beam being incorporated between the fuselage and the end of the center section. The outer panels, of single spar construction, are metal covered from the leading edge of the wing to the rear face of the beam and fabric covered from the beam to the trailing edge except on the gun bay. An integral fuel tank is provided in each outer panel leading edge.

Incorporated in the wing group are NACA slotted type flaps and droop type ailerons for low landing speeds. Closure plates are provided for the flaps. Six .50 caliber machine guns, three in each outer panel, are installed in the wings.

The explanation of "Wing Folding" is located under "Hydraulic System" in this manual.

PROCEDURE FOR ERECTING WINGS

(Reference: VS-10000)

The center section is bolted, screwed and riveted to the fuselage as shown on VS-10225. All necessary attaching parts are called out and means of attachment are shown on this drawing. Further details concerning center section - fuselage attachment will be given in the final corrected version of this manual. The outer panels are attached to the center section at three points, the upper two points forming the hinge axis about which the outer panels fold.

Before installing the outer panels, assemble them completely as follows:

1. Raise the outer panel flap and attach at the hinge points in accordance with Views D-D and E-E and Section View H-H of drawing VS-10022. Connect the outer panel flap control rod, VS-10922, to the flap control horn, VS-10090, using a CVC-133-4-17 clevis bolt, an AN-320-4 shear nut, two AN-960-416 washers and an AN-380-2C-3 cotter pin. Connect rod assembly VS-10960 of the aileron droop linkage to the flap control horn with the attaching parts called out in View F-F of VS-10022 and connect bonding as shown in this view. See drawing VS-10953 and the discussion given under "Surface Controls".

2. With aileron tab, tab control rod and idler intact, lift the aileron and bring the hinge points into alignment, making attachment in accordance with View A-A, B-B and C-C of VS-10022. Connect the aileron push rod, VS-10944, to the VS-10048 horn and hinge fitting on the aileron. See View B-B of drawing VS-10022 for means of attachment. Connect the tab, control push rod to the VS-10977 idler as shown in View B-B of VS-10973. Connect bonding. Further details may be found under "Surface Controls".

The wing erection is completed by the following procedure (see photograph VS-6115).

1. With the airplane supported on the main wheels and at the lift tube, lift the outer panel (weight = 640 lbs. approx.) into position being careful that supporting is done against the beams and in no case against the fabric between the trailing edge ribs. Insert the top main hinge bolt, VS-13796, in accordance with View A-A of VS-10000.

Note: When attaching the outer panel to the center section, be sure that the hydraulic wing folding strut is fully compressed and that the connecting rod is completely within the outer panel, until the connection described below (paragraph 5 step h) is made. Allowing an outer panel to drop to spread position with the unattached wing folding link extended will almost certainly result in damage to the outer panel.

2. Insert a hard wood block between the lower beam flange fittings.

3. Insert and attach the VS-13795 auxiliary hinge pin assembly as shown in View B-B and Section G-G of the reference drawing.

4. The lower hinge pin is controlled hydraulically in sequence with the wing folding mechanism. The pull handle for locking the hinge pins is located on the left hand shelf in the pilot's cockpit.

5. Make the following connections between the center section and the outer panels:

(a) Electrical connections - Reference VS-10425 - Electrical System Installation.

(b) Surface control connections - Reference VS-10475 - Surface Controls - Aileron.

(c) Connect the gun charging and wing folding hydraulic lines at the swivel joints - Reference VS-14126 - Hydraulic System.

(d) Connect airspeed lines - Reference VS-14599 - Airspeed Tubing Installation.

(e) Connect the bomb control and, on the left hand side, the aileron tab control cables as shown on VS-10974. Since the clevis shackles are swaged onto the cables leading from the center section, partial disassembly of the VS-16815 clamp and loosening of the support clips is necessary, in order to allow the cable ends to pass through them.

(f) Connect fuel lines at swivel joint - Reference VS-11360 - Fuel System Installation - Outer Panel.

(g) Connect gun heater piping at swivel joint - Reference VS-10055 - Leading Edge Assembly - Outer Panel.

(h) Connect wing folding link to support on center section main beam - Reference VS-10000 - Wing Erection.

6. Attach the six gap closing doors for the center section flaps in accordance with VS-14655. (Spin the hinge pins into place by means of an electric motor or equivalent, applying oil to the pins as they enter the hinges). With the gap door actuating shafts mounted on

and held in place by the shaft bearings, VS-14777, (the bearings are bolted to the rear beam) assemble the door operating linkage with the attaching parts called out on VS-14655. Align each door with the contour of the lower center section skin by means of the adjustable torque arm in the linkage to each door. Set each door stop (Reference: Section B-B of VS-14655) to 57° door elevation. Connect the VS-15737 spring-loaded struts to the gap door actuating shaft. Typical bonding connection is illustrated in Section C-C of VS-14655.

7. Using the hinge pins called for on VS-10022, connect the outer panel flap gap closing doors. Connect the linkage between the doors and the actuating shaft using the attaching bolts, nuts, etc., called out on drawings VS-10022, VS-16027 and VS-13587. Align the doors with the contour of the outer panel lower skin by means of the adjusting arm in the linkage. Connect the gap door and indicator lock operating mechanism in accordance with VS-16027. Connect bonding.

8. Before attempting to install the center section flaps, assemble all parts necessary for a quick intermediate connection. (Reference: View D-D and Detail Z of VS-10000). Lift the inboard flap, VS-10069, into position and attach the inboard end of this flap to the flap hinge housing on the fuselage, at the same time making flap indicator connections as shown in View C-C of the reference drawing. Connect the VS-10069 flap at the outboard end by means of the VS-14417 bolt. See Section L-L of the reference drawing. Lift the outboard center section flap and slide the VS-14068 closing plate into the slot in the inboard flap. Hinge the flap in place, assemble the hinge fairing and attach the interconnecting link between the two flaps. See View F-F, Section L-L and Detail Z of drawing VS-10000 for details of these attachments. Connect the center section flap control push rod to the fitting on the outboard leading edge of flap VS-10068 using a CVC-133-4-41 clevis bolt, an AN-320-4 shear nut, two AN-960-D416 washers and an AN-380-2C-3 cotter pin.

9. Install the wing folding gap door, VS-10794, on the center section with hinge wire. Spin the hinge wire into place with an electric motor or equivalent, applying oil to the pins as they enter the hinges. Adjust the VS-16724 push rod of the gap door linkage so that the door will lie flush with the upper skin with the outer panel in the extended position. Attach the rod end to the gap door as shown on VS-10794. This drawing is located under "Surface Controls" in this manual. Refer to "Surface Controls" for further details concerning the gap door mechanism and its operation.

RIGGING

1. On an original setup no rigging is possible or necessary since all attachments of outer panel to center section are jigged with no possible means of adjustment with the following exception. The bolt on the lower inboard end of the outer panel which actuates the wing folding and pin pulling sequence valve should be adjusted so that the latter is fully compressed when the outer panel is completely spread. (Note: To compress the sequence valve plunger fully it is necessary to pass the point where the plunger depresses easily and to press it in through the hard portion of its stroke also.).

2. In the event it is believed that a wing panel has been strained or damaged, a check may be made as follows:

Level the airplane fore and aft as well as laterally by means of the leveling lugs located in the cockpit. (See photograph VS-5782).

3. Dihedral - outer panel = $8\frac{1}{2}^{o}$.
Sweepback - outer panel leading edge = 4^{o} 10'.
Wing Incidence at root section = 2^{o}.
A tolerance of plus or minus $\frac{1}{2}^{o}$ is permissable on the values given above. The difference of incidence between left and right wings should not exceed 0^{o} 15'.

WING HEAVINESS AND LATERAL TRIM

A tab, controllable from the pilot's cockpit, is provided on the left hand aileron to correct for wing heaviness and to provide lateral trim. For further information on the tab, refer to "Surface Controls".

SERVICE NOTES

1. Removal of the flaps or ailerons is accomplished by reversal of the erection procedure, first disconnecting the controls to the surface and then the hinge fittings.

2. Removal of an outer panel is accomplished by reversal of the procedure given under wing erection.

3. The entire wing tip assembly may be removed as a unit from the outer panel by disconnecting the wiring at the formation light (access provided through hand-hole in upper skin above light) and drilling out existing rivets. On reassembly, rivets the next size larger should be used.

4. Access holes for the outer panel fuel tank are provided along the outer panel beam of the tank. If the access hole covers are removed, it is important that, on reassembly, the neoprene gaskets be properly replaced to preserve gas-tightness. After replacing the screws, lock-wire the screw head with corrosion resistant steel wire.

5. The attachment of the fabric covering on the trailing edge of the wing and on the movable surfaces has been performed in accordance with Vought-Sikorsky Aircraft Process Specification No. 200 located in the Finish Specification at the rear of this manual. Drawing VS-10013 clearly illustrates the method of attachment. Some of the fabric strips are fastened by Dill Lok-Skru. Refer to Vought-Sikorsky Aircraft Process Specification No. 85, located in the Finish Specification at the rear of this manual, for doping of fabric. Observe the notes on the upper right hand corner of drawing VS-10013.

WING REPAIRS

Refer to the "Repair Manual for Model F4U-1. FG-1 and F3A-1 airplanes".

CENTER SECTION ACCESS

(Reference: VS-10705)

Access to controls, wiring and hydraulic tubing in the center section is provided by a large access hole in the interbeam inboard rib. This access hole,

which is large enough so that an average-size man can crawl through it into the center section, is reached through the wheel well, and is closed by a cloth cover provided with zipper fasteners.

In order to enter the access hole after the cover has been opened, it is necessary to remove the two VS-15032 trusses by taking out the AN-386-4-8A taper pins, etc., as called out on detail section E-E of the reference drawing, and also to remove the VS-15093 stiffener by taking out the AN4-30 and AN4-31 bolts, etc., as called out on details C-C and D-D of the reference drawing.

WARNING: It is imperative that the above mentioned stiffener and trusses be replaced before the airplane is again flown, since failure to do so might result in collapse of the interbeam inboard rib.

NOTES ON INTEGRAL FUEL TANKS

(Reference: VS-11360, VS-16657)

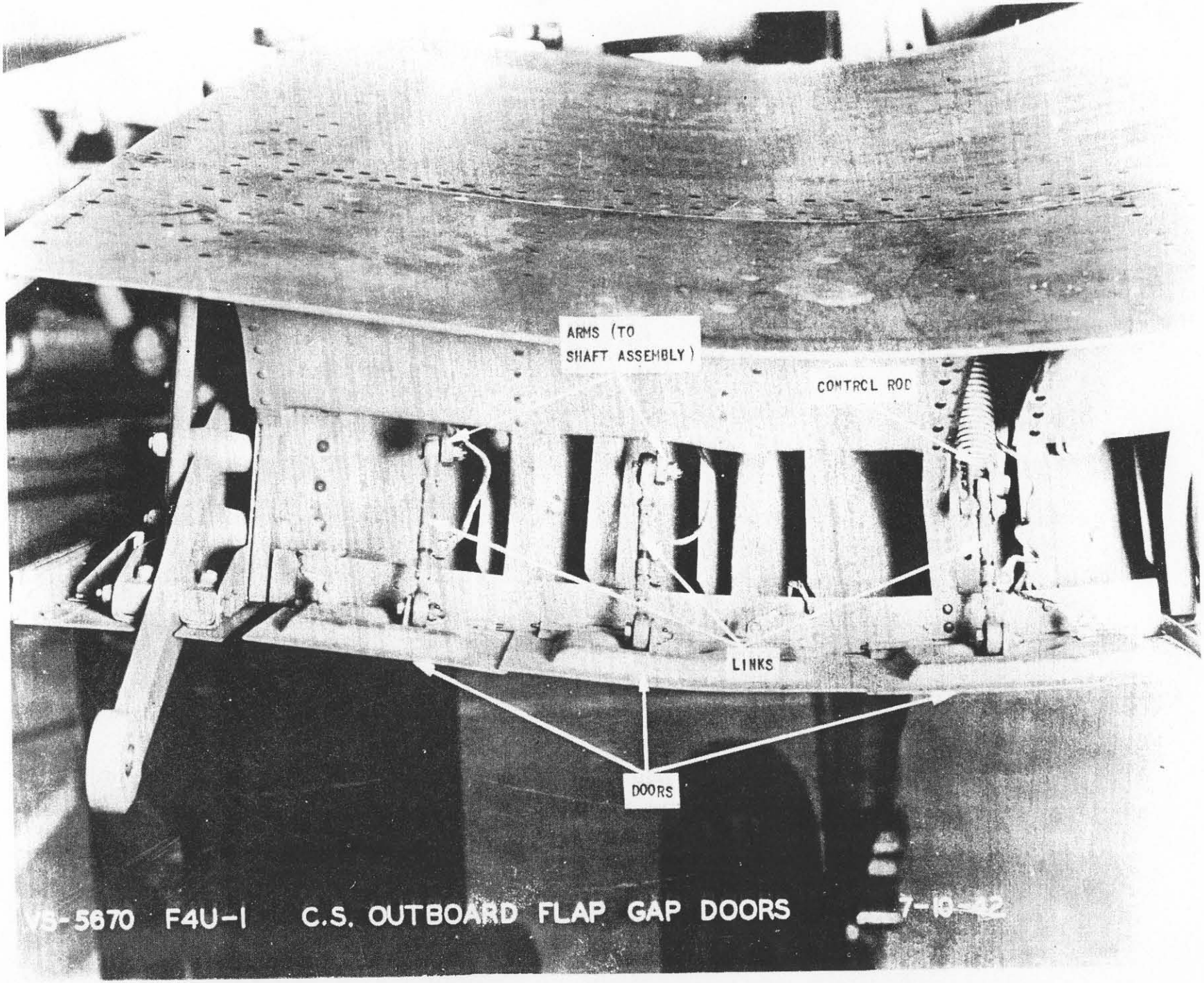
The auxiliary fuel supply is carried in the leading edge of each outer panel (Reference VS-11360), the boundaries of each tank being the front face of the outer panel beam, the ribs No. 29 3/4 and No. 86, and the leading edge skin. The assembly is of riveted aluminum alloy construction. See the Materials Specification included at the rear of this manual.

The beam consists of a riveted and bolted assembly of extruded flanges, web plates, reinforcements and vertical stiffeners.

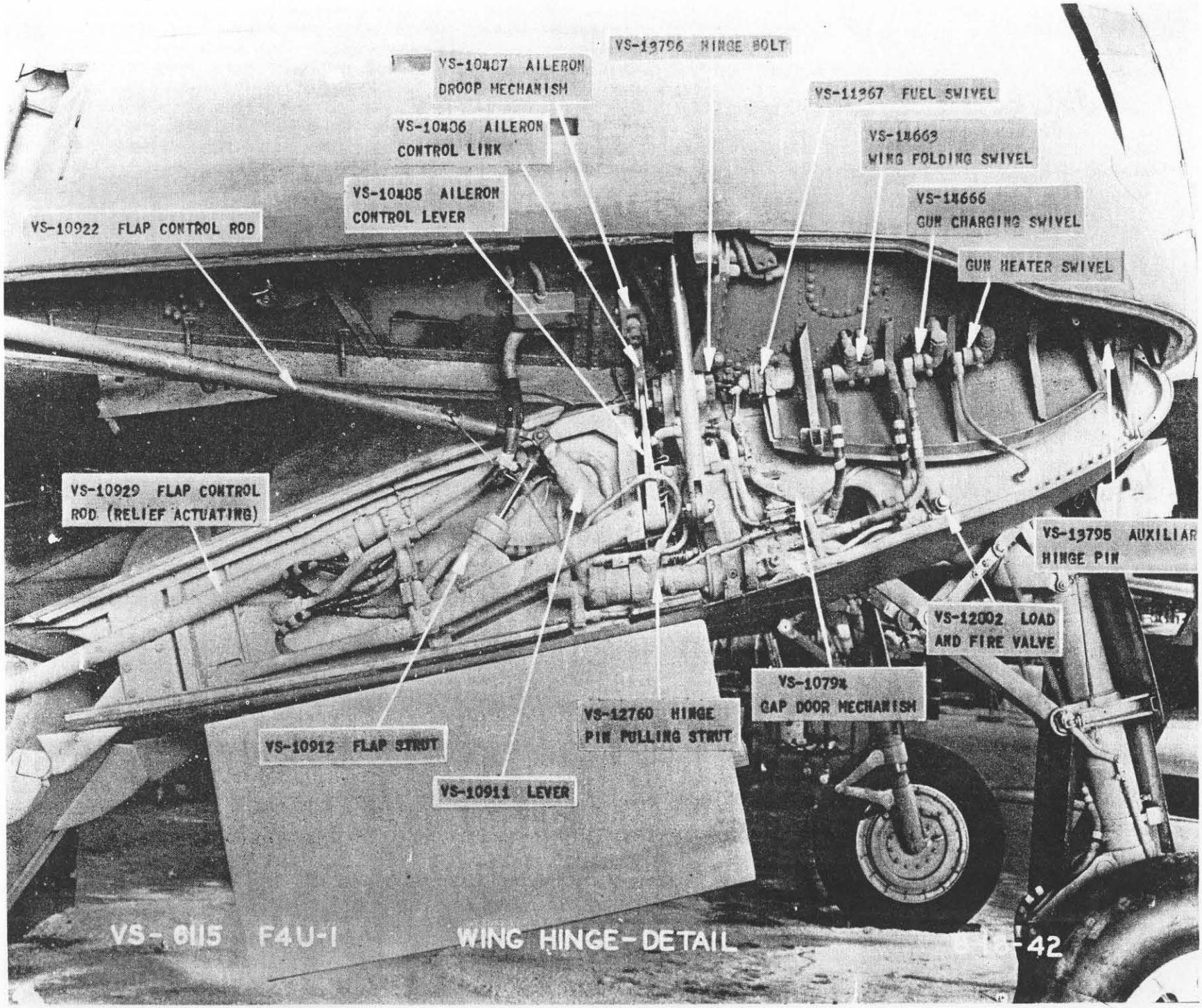
The skin surface consists of a single sheet of metal reinforced internally by ribs and spanwise stringers riveted to the skin.

Stiffeners are riveted to the integral fuel tank end ribs, No. 29 3/4 and No. 86.

The fuel tight procedure may best be understood by referring to drawing VS-16657 included in this manual. This drawing illustrates the methods used in constructing the integral fuel tanks on Model F4U-1, FG-1 and F3A-1 airplanes. In the event of damage to an integral tank, repairs should be made in strict accordance with Finish Specification No. 102 and the pertinent notes and illustrations on the aforementioned drawing.



VS-5670 F4U-1 C.S. OUTBOARD FLAP GAP DOORS 7-10-42


VS-13796 HINGE BOLT
VS-10407 AILERON DROOP MECHANISM
VS-11367 FUEL SWIVEL
VS-10406 AILERON CONTROL LINK
VS-14663 WING FOLDING SWIVEL
VS-10405 AILERON CONTROL LEVER
VS-14666 GUN CHARGING SWIVEL
VS-10922 FLAP CONTROL ROD
GUN HEATER SWIVEL
VS-10929 FLAP CONTROL ROD (RELIEF ACTUATING)
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VS-12002 LOAD AND FIRE VALVE
VS-10794 GAP DOOR MECHANISM
VS-12760 HINGE PIN PULLING STRUT
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VS-10911 LEVER
VS- 6115 F4U-1 WING HINGE-DETAIL
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TAIL GROUP

REFERENCE DRAWINGS

VS-10100	Tail Erection
VS-10102	Elevator Assembly - Skeleton
VS-10103	Stabilizer Assembly
VS-10104	Rudder Assembly - Skeleton
VS-10105	Fin Assembly
VS-10107	Rudder Assembly - Covered
VS-10109	Elevator Assembly - Covered
VS-10404	Surface Controls Installation - Fuselage - "Included in Surface Controls Section".
VS-10430	Elevator Control Installation - "Included in Surface Controls Section".
VS-10600	Inboard Profile - Fuselage - "Included in Body Section".

TAIL GROUP

GENERAL

The full cantilever tail surfaces consist of metal covered fixed surfaces and fabric covered movable surfaces. Tabs are provided on the trailing edges of the elevators and rudder for longitudinal and directional trim. The elevators are also provided with linked balancing tabs. An aero-dynamic balance is provided on the leading edges of the movable surfaces. The construction of the tail group requires no external bracing whatsoever. The internal bracing is fixed and requires no adjustment.

The stabilizer is rigidly attached to the top of the fuselage and has a fixed setting of plus $1\frac{1}{4}^{o}$ to the thrust line (fuselage level line). The fin is also rigidly attached to the top of the fuselage, the leading edge having a 2^{o} setting to the left of the centerline of the airplane to offset engine torque. The stabilizer and elevators are of two part construction and are interchangeable right and left.

PROCEDURE FOR ERECTING

(Reference: VS-10100)

1. Lift the VS-10103 stabilizer into position and line up the fore and aft stabilizer fittings with the fittings on the fuselage. For forward attachment, insert the special Dzus bolt, VS-13126, complete with the VS-13127 spring as shown in Section C-C of the reference drawing. In fastening the Dzus bolt, press down hard and screw in a clockwise direction. (The attachment is the same as any Dzus fastener). An inspection hole is provided to see that the bolt has properly engaged the spring lock. For main beam (aft) attachment to the fuselage use the tapered

bolts, AN-386-4-16, and VS-13113 bushings as shown in View B-B of the reference drawing. Be sure that the cotter pins are installed on the AN-320-5 nuts. These are quick disconnect fittings to provide for ease of disassembly. Attach the fuselage-stabilizer fairing with the seventy-eight screws (CVC-145-C8-10) provided as shown on the reference drawing.

2. Raise the fin into position and set the fin lugs in the pedestals provided in the fuselage structure. Fasten the fin lugs to the fuselage with the two AN-310-10 castle nuts, washers and cotters as shown in View A-A of the tail erection drawing, VS-10100. Attach the fin to the fuselage-fin fairing with the twenty-nine CVC-145-C8-10 screws called out on the reference drawing.

3. Assemble the rudder tab on the rudder in accordance with rudder assembly drawing VS-10107. Connect bonding as shown in View C-C of this drawing.

4. Connect the VS-12198 balance arm to the rudder bracket, VS-15882, and to the rudder horn with the AN-5-21 bolt etc., as called out on the reference drawing. Set the rudder on top of the fuselage with the torque tube projecting down through the hole in the fuselage skin and attach the rudder to the fin at the hinge with the necessary attaching parts called out on the reference drawing. Connect the torque tube to the rudder horn with the four AN-5-24 bolts, etc., as shown on the reference drawing. See View A-A of VS-10100. Connect bonding, rudder controls and rudder tab controls. See discussion under "Surface Controls", and drawing VS-10404 referenced under "Surface Controls."

5. Remove the fuselage fairing, VS-13128. Assemble two elevators on the bench as a unit, lift into position and attach at the points shown on the reference drawing. The necessary attaching parts used at each point are called out on this drawing. Line up the elevator torque shaft and, inserting the elevator horn and balance arm in place as shown, connect the torque shaft with the attaching parts called out in the side view of View B-B of the reference drawing. Connect bonding, elevator push rod to horn, and elevator tab control chain to sprocket as shown on drawings VS-10404 and VS-10340. These drawings are located under "Surface Controls" in this manual.

RIGGING

1. Control movements are described under "Surface Controls".

2. No rigging of tail surfaces is required due to their fixed cantilever type of construction. The controllable trim tabs correct for directional and longitudinal trim.

SERVICE NOTES

Refer to the "Repair Manual for F4U-1, FG-1 and F3A-1 Airplanes".

SURFACE CONTROLS

REFERENCE DRAWINGS

VS-10404	Surface Controls Installation - Fuselage
VS-10430	Elevator Control Installation
VS-10475	Aileron Control Installation
VS-10901	Aileron Controls Installation - Outer Panel
VS-10910	Rod Installation - Flap Actuating
VS-10794	Outer Panel and Center Section Hinge Gap Door Installation
VS-10953	Linkage Installation - Aileron Droop
VS-10973	Control Installation - Aileron Tab
VS-10974	Cables Installation - Aileron Tab and Bomb Control
VS-13587	Mechanism Installation - Flap Gap Closing
VS-14655	Flap Gap Doors Installation
VS-15412	Locking Device Assembly - Surface Controls
VS-16027	Mechanism Installation - Flap Door Operating and Latch
VS-10912	Strut Assembly - Wing Flap Control Hydraulic Operating

SURFACE CONTROLS

GENERAL

The primary control surfaces consist of the ailerons, the elevators and the rudder, all being provided with aerodynamic balances to reduce stick and rudder pedal loads. The secondary control surfaces consist of the landing flaps, the controllable tabs (aileron, elevator and rudder), the flap gap closing doors and the drooped ailerons.

The primary surface controls are of the conventional stick and pedal type. The secondary surface controls consist of wheel controls for the aileron, rudder and elevator tabs, and hydraulic control for the flaps. The aileron droop and flap gap door mechanisms work directly off the flap control and simultaneously with lowering of the flaps.

PRIMARY SURFACE CONTROLS

AILERONS

(Reference VS-10475, VS-10901)

Except for aileron droop, covered under secondary controls, the ailerons are operated by a series of push rods and bell cranks running from the VS-10437 lever on the control stick torque shaft to the aileron horn and hinge fittings, VS-10048, Wing heaviness is overcome by means of a controllable tab on the left hand aileron. See "Aileron Tab".

AILERON RIGGING

1. Clamp the control stick in neutral and batten the ailerons flush with the wings. (Note: Dimensions are given from bolt hole centerlines).

2. Adjust the VS-10491 aileron droop screw so that 3-7/16 inches obtains between the bolt hole centers at opposite ends of the screw with flaps up.

3. Adjust the center section aileron control rod, VS-10938, so that bell crank VS-10483 is at an angle of 90° to the centerline of the front beam as shown on drawing VS-10375. Adjust Control Rod VS-10940

so that the upper bolt hole in lever VS-10485 is 1/2" inboard of the wing hinge centerline.

4. Adjust the aileron control rods in the outer panel so that the bolt holes of bell crank VS-10493 are 2-1/8 inches from station No. 100. See drawing VS-10901.

5. Perform all bonding connections, but set up nuts only finger tight until the aileron travel has been checked.

6. After the aileron travel has been checked and the necessary adjustments made (see below), tighten and cotter all nuts.

CHECKING AILERON RIGGING

1 (a) Unclamp the control stick and remove the battens from the ailerons.

(b) Adjust stop screw VS-14872 at the aileron lever (stop installed on fuselage bulkhead No. 138.6) so that the stick travel is 14-3/4° to the right or left from neutral.

(c) Adjust the stop screws in stop VS-17364 so that bell crank VS-10503 is hard against the stop, when the aileron is up and the control stick over a full 14 3/4°, following the adjustment given in 1 (b) above. See outer panel surface controls drawing VS-10901.

2. With the stops thus adjusted and with rigging set up as outlined under "Aileron Rigging", the aileron travel in the undrooped condition should be 19° (+1° - 0°) up and 14° (+1° - 0°) down. In the event that this aileron travel is not obtained, the rod ends at the outboard bell crank should be readjusted until this travel is obtained. In this event, readjust the outboard stops also (as in 1 (c) above.

INSPECTION OF AILERON CONTROL SYSTEM

1. Since the system contains no pulleys or cables, inspection shall be concerned chiefly with bell cranks, ball bearings, check nuts, safetying and bonding. Refer to drawings VS-10475 and VS-10901

(A) Check the bearings for binding, looseness and end play, particularly self-aligning bearings. All bearings are low temperature, grease-packed bearings and need no further lubricating.

(b) Inspect check nuts at push rod ends for tightness.

(c) Inspect all attaching bolts for cotter pins.

(d) Make sure that all bonding jumpers are connected, that finish has been removed under bonding tab ends, and that jumpers do not restrict aileron motion.

(e) Make certain that no levers, push rods or bell cranks foul any structural parts when the aileron system is finally set up as described above.

AILERON DROOP

(Reference VS-10953, VSK-4404)

These airplanes are provided with an aileron droop mechanisms which works automatically in conjunction with operation of the landing flaps. The VS-10960 droop push rod drives from the outer panel flap horn and is connected to a crank extending through the inboard rib. This crank operates a sprocket and chain assembly which drives a screw in the aileron control linkage just outboard of the wing hinge, thus affecting the angular setting of the aileron. The mechanism is easily reached by folding the wings and opening the gun bay doors.

This mechanism is installed, adjusted, and tested in flight, but disconnected before delivery of these airplanes. To re-connect, proceed as follows:

1. Remove the stops on the chain leads by taking out the attaching bolts. See detail "B" on VSK-4404.

2. Fold the wings and attach the VS-10960 push rod as shown on VS-10953. These push rods, which are included in the special equipment accompanying each airplane, are tagged with the number of the airplane to which they belong, and also designated as to right or left hand side. If, in re-connecting the mechanism,

the rods are installed as indicated, further adjustment should be unnecessary

Adjustment of the system, when necessary is made at the drive screw. The following dimensions should obtain between the bolt hole centers at opposite ends of the screw:

Normal settings (flaps up) --- 3-7/16 inches
Drooped (flaps down) --- 4-19/32 inches

With the flaps full down (50°), the ailerons will droop 9½°. The drooped ailerons are operative for lateral control, having a range of 13° up and 24½ down. As stated above, no adjustment should be necessary in the droop mechanism; however, if the correct angle of droop, 9½°, is not obtained the 3-7/16 inch setting may be changed by disconnecting the screw at the outboard end and rotating it one-half turn in or out. Also, fine adjustments may be made at the end fitting of the VS-10960 push rod.

Note: Connection or disconnection of the droop mechanism does not affect the normal aileron rigging. When disconnecting the mechanism, see the notes on VSK-4404.

ELEVATORS

(Reference: VS-10430)

1. The elevators, which are reversible, are actuated by the control stick and a series of push rods and bell cranks. No cables, pulleys or chains are used in the system.

2. The push rods and bell cranks are supported on the lower fuselage interior. The control system is accessible for servicing and inspection from both the interior and exterior of the fuselage. An adjustment is provided in the system at the attachment of the extreme aft push rod, VS-10474, to the VS-12187 elevator horn. Stick adjustment is accomplished by means of two stop nuts on the VS-10436 elevator torque shaft.

ELEVATOR RIGGING

1. Clamp the control stick in neutral. The neutral position of the control stick is 33-5/16 inches forward of bulkhead No. 186 just aft of the pilot's seat. The neutral position and forward and aft extremities of stick motion are clearly illustrated on VS-10430.

2. Adjust push rod VS-10474 to line up with the elevator horn and make attachment of these units in accordance with VS-10430.

3. Connect bonding jumpers, set nuts tightly and safety.

CHECKING ELEVATOR RIGGING

1. (a) Unclamp the control stick.

   (b) Adjust the stick stops on the elevator torque shaft until the stick motion is 6-1/2 inches forward and 11-1/4 inches aft of neutral.

2. With the stops thus adjusted, the elevator travel should be $24^{\circ} \pm 1^{\circ}$ up and $16^{\circ} \pm 1^{\circ}$ down.

3. If the correct travel is not obtained, readjust the control stick stops accordingly.

INSPECTION OF ELEVATOR CONTROL SYSTEM

1. The system is similar to that described under "Ailerons", containing no cables or pulleys. Therefore, inspection shall be concerned chiefly with bell cranks, ball bearings, check nuts, safetying and bonding. See VS-10430.

(a) Check the bearings for binding, looseness and end play, particularly self-aligning bearings. All bearings are low temperature, grease packed bearings and need no further lubrication.

(b) Inspect check nuts for tightness.

(c) Check all attaching bolts for cotter pins.

(d) Make sure that all bonding jumpers have been connected and finish removed under bonding tab ends, and that jumpers do not obstruct elevator control motion.

RUDDER

(Reference: VS-10404)

1. The rudder is controlled by a cable and pulley arrangement running from the foot pedals in the cockpit to the rudder horn. A return cable assembly runs forward from the foot pedals around pulleys so that a continuous linkage is set up between the foot pedals and the rudder horn.

2. The position of the pedals is adjustable to suit the comfort of the pilot by pressing forward and inboard with the heel on the lever located on the aft side of the pedal arm while the toe rests on the pedal. The lever withdraws a spring-loaded pin, thereby allowing the pedals to be shifted fore or aft as desired. A total adjustment of 6 inches is provided. (See photograph VS-5679).

3. The foot pedals also carry the brake pedals, the installation and service of which is located under "Hydraulic System" in this manual.

RUDDER RIGGING

1. Set rudder ~~pedals~~ in mid-adjustment position and clamp in neutral. (7-1/2" from the centerline of the foot bar to bulkhead No. 134 as shown on VS-10404).

2. Clamp rudder in neutral and connect cables to rudder horn.

3. Connect rudder cables to pedals, make sure that cables are on pulleys properly, that cable guards are on pulley brackets and that fairleads are installed, tighten turnbuckles and safety.

CHECKING RUDDER RIGGING

1. Unclamp rudder and rudder pedals.

2. Adjust the rudder stop screw, VS-14872, on the rudder pedal such that the rudder will swing $25^{\circ} \pm 1^{\circ}$ to either side of neutral.

INSPECTION OF RUDDER CONTROLS

(Reference: VS-10404)

1. Inspect the cables, especially near the pulleys and near swaged on terminals, for frayed strands.

2. Check the pulleys for wear and the ball bearings for binding and looseness.

3. Cables should not rub excessively on pulley fairleads.

4. Inspect cables for tautness and see that they do not rub on foreign parts.

5. Check bonding and safetying of bolts and turnbuckles.

6. Check that cable guards are installed on pulley brackets and that fairleads are installed.

7. The bolts at the cable ends must not be drawn up tight or the swaged terminal will not rotate, thus causing the cables to bend sharply at the points of exit from the terminal.

LOCKING SURFACE CONTROLS

WHEN THE AIRPLANE IS IDLE

For the installation of the surface control locking device, see VS-15412 included herein. With the rudder pedal in neutral position, central adjustment, snap the locking device in place between the VS-11993 cap on the rudder bar and the holes provided for the locking pins on the left and right hand foot troughs. Bring the control stick into place and insert the locking pin.

SECONDARY SURFACE CONTROLS

The secondary surface controls consist of the landing flaps, the controllable trim tabs (aileron, elevator and rudder), the drooped ailerons and the flap gap closing doors. Note that all tab drive screws are irreversible, i.e., the position of the tab cannot be changed by force applied directly to the tab itself.

AILERON TRIM TAB

(Reference: VS-10974)

The trim tab on the left hand aileron is controlled by a chain and cable drive running from the sprocket at the inclined hand wheel on top of the pilot's left hand shelf to the drive unit at station No. 100 in the left hand outer panel. (See photograph VS-5680).

OPERATION

Rotating the aileron hand wheel to the right winds the chain on the hand wheel and drive unit sprockets, thereby turning the irreversible drive screw and transmitting up motion to the tab push rods and thence to the aileron tab. Rotating the hand wheel to the left lowers the tab.

Raising the aileron tab causes the left wing to ride high, thereby eliminating heaviness in that wing. Lowering the aileron tab eliminates wing heaviness in the right hand wing.

AILERON TAB RIGGING

(Reference: VS-10974)

1. With the hand wheel set in mid-position install the chains and cables. Locate the chains on the sprockets so that the chain ends line up.

2. Tighten and safety the turnbuckles located just inside the outboard center section rib.

3. Rotate the shaft between the drive unit and the tab until the tab is in neutral position and connect the shaft to the drive unit.

CHECKING AILERON TAB RIGGING

Tab full up -- $15^{\circ} \pm 1^{\circ}$

Tab full down -- $15^{\circ} \pm 1^{\circ}$

The hand wheel rotates 5-1/2 turns for a total of 30° of tab movement. The drive screw which travels .786 inches for full tab throw (30°) has a maximum obtainable travel of one inch.

INSPECTION OF AILERON TAB CONTROLS

(Reference: VS-10974)

1. Inspect the cables, especially near pulleys and fairleads and adjacent to swaged on terminals for frayed strands, and otherwise in accordance with NAF Specification T-46.

2. Check the pulleys for wear and bearings and cable guards for looseness. Also, check shafts for abrasion and interference with the aileron.

3. Inspect the chains and sprockets for wear and excessive accumulation of dust.

4. Check bolts and turnbuckles for cotter pins and safetying.

5. Inspect the system for tautness and see that the cables do not rub against any foreign parts.

6. Inspect the drive screw in the outer panel for looseness or end play. The drive screw unit may be removed through access door VS-14073 at station No. 100, approximately, on the left hand outer panel lower skin if inspection requires it. Disconnect the unit at the forward push rod and remove the four unit attaching bolts. The unit may then be withdrawn through the access door in the outer panel. Lubricate the drive screw units in the outer panel, elevator and rudder with light, low temperature oil. Zerk fittings are provided on each unit.

ELEVATOR TRIM TABS

(Reference: VS-10404)

The elevator trim tabs are controlled from the tab hand wheel (large vertical wheel on side of left hand shelf, shown on photograph VS-5680). The system is similar to that described above for aileron trim.

OPERATION

Rotating the elevator hand wheel forward winds the chains on the sprockets and causes rotation of the drive screws inside the elevator shaft which, in turn, operates a linkage arrangement to the tab and, in so doing, raises the tab. Aft rotation of the hand wheel lowers the tab.

With the tab up, the elevator rides low, thereby causing the nose of the airplane to lower. With the tab down, the effect is the opposite.

All parts of the elevator tab controls are installed within the fuselage except the drive screws and drive shafts which are inside the elevator torque shaft, and the linkage to the tabs which is inside the elevator. Note that the drive screws are irreversible.

ELEVATOR TAB RIGGING

(Reference: VS-10404)

1. Turn the sprocket at the inboard end of the elevator torque shaft by hand until the tabs are 5° down.

2. Set the hand wheel in mid-position (5° nose up) and install chains and cables. Locate the chains on the sprockets so that the chain ends line up.

3. The only turnbuckle in the system is located at Station No. 260, approximately. Tighten and safety.

CHECKING ELEVATOR TAB RIGGING

Airplane Nose Up- Tab Down -- $20^{\circ} \pm 1^{\circ}$

Airplane Nose Down - Tab Up-- $10^{\circ} \pm 1^{\circ}$

The elevator tab wheel rotates 4.66 turns for 30° of tab movement. The stop in the elevator tab control system is in the tab hand wheel in the pilot's cockpit.

INSPECTION OF ELEVATOR TAB CONTROLS

(Reference: VS-10404)

1. Inspection of the elevator tab controls shall be the same as that given under "Inspection of Aileron Tab Controls" with the exception of item No.6.

2. If inspection requires disassembly of the drive unit, make sure, on reassembly, that the nut at the inboard end of the drive screw is adjusted so that the drive screw will turn freely without end play, then wire the set screws together.

RUDDER TRIM TAB

(Reference: VS-10404)

The rudder tab hand wheel (horizontal hand wheel on left hand shelf, see photograph VS-5680) is so installed that a clockwise rotation by the pilot causes the tab to move to the left, the rudder to the right and the airplane to turn right. Likewise, a reverse motion of the handwheel causes the airplane to turn left.

All parts of the rudder tab control are installed within the fuselage except the drive screw and drive shaft which are inside the rudder torque shaft, and the linkage to the tab which is inside the rudder.

RUDDER TAB RIGGING

(Reference: VS-10404)

1. Turn the sprocket at the lower end of the rudder torque shaft by hand until the tab is in neutral.

2. Set the hand wheel to zero on the dial and install the chains and cables. Locate the chain s on the sprockets so that the chain ends line up.

3. The only turnbuckle in the system is located at Station No. 245, approximately. Tighten and safety.

CHECKING RUDDER TAB RIGGING

Check the angular travel of the rudder tab for a movement right and left of $18^{\circ} \pm 1^{\circ}$ to each side of neutral (7-1/2 turns for a 36 degree tab movement).

INSPECTION OF RUDDER TAB CONTROLS

(Reference: VS-10404)

Since the rudder tab controls consist of the same items as apply to elevator tab controls, inspection procedure shall be the same. Refer to "Inspection of Elevator Tab Controls" above.

SERVICE NOTES

AILERON, ELEVATOR AND RUDDER TAB CONTROL SYSTEM

1. For cable terminals, if swaging is not available, a standard thimble and a conventional splice in accordance with NAF Spec. PS-2-2, may be used if no interference is encountered with fairleads guards or pulleys.

2. All tab drive screws have right hand threads and are the same pitch and size.

3. Note the lubrication diagram, VS-10950, for points of lubrication and the proper lubricant to be applied.

LANDING FLAPS, GAP CLOSING DOORS AND AILERON DROOP

GENERAL

The airplane is provided with a lateral control system which is designed to permit the use of the ailerons drooped as a high lift device in addition to the wing flaps. Closing doors are provided to close the gap between the wing and the flap when the flaps are up. Both the aileron droop mechanism, when connected, and the closing plates are set in operation automatically with raising or lowering of the flaps.

FLAPS

(Reference: VS-10910)

1. The hydraulically actuated flap controls are shown on VS-10910. The center section and outer panel flap push rods are linked at the hinge line such that the hydraulic operating strut, VS-10912, actuates both center section and outer panel flaps simultaneously. (See photograph VS-6115). The right hand center section flap push rod is spring-loaded and operates a by-pass valve. When the air pressure against the flap becomes too great, i.e., when the airspeed exceeds 108 m.p.h. - power on, or 128 m.p.h. - power off, the spring compresses and, in so doing, actuates a by-pass valve which permits the flaps to elevate until such time as the speed is decreased sufficiently so that the spring can force the flap back to its original pre-set position, thereby closing the by-pass valve.

2. The only adjustment points in the system are the rod ends on the actuating strut pistons and on the forward ends of the outer panel flap push rods. Adjustment shall be such that the following holds true:

Adjust the actuating strut rod ends so that the inboard center section flaps are up snugly against the fuselage angles with the struts fully extended. Adjust the outer panel flap push rod ends so that the outer panel flaps line up with the center section flaps, with the flaps up (struts fully extended). The flap travel should then be $50^{\circ} \pm 1^{\circ}$. No adjustment is provided to increase or decrease maximum flap travel since none is deemed necessary.

3. The flap valve control handle is above and forward of the left hand shelf in the pilot's cockpit. Additional information concerning flap operation may be found under "Hydraulic System".

NOTE: Refer to "Useful Load" for instructions concerning quick disconnect of the flap pushrod. This quick disconnect assembly is furnished so that the outer panel flaps can be lowered to 90° and locked in this position, thus affording easy access for removal of the guns in the outer panel.

FLAP GAP CLOSING DOORS

(Reference: VS-14655, VS-13587, VS-16027)

1. The center section gap closing doors are made in six individual sections due to the curvature of the center section. In order to provide access for removal or service of the outboard gun, a gap of 7-13/16 inches (approx.) is left between the two outer panel gap closing doors. However, the two outer panel doors operate off the same shaft. Two shafts are used for center section door operation, each shaft operating three doors. The installation and adjustment procedure for the doors is described under "Wing Group".

OPERATION

The gap closing doors work automatically with operation of the flaps so that as the flaps are deflected, the doors open and create a smooth passage for the air to flow over the top surface of the flap. In the center section, two struts (one for each shaft) directly connected to the flap leading edges transmit rotation to the

shafts which, in turn, transmit elevating or lowering motion to the doors as the flaps are raised or lowered. The aforementioned struts are spring-loaded which permits overtravel in the mechanism since the doors close before the flaps reach their full down position. Refer to VS-14655.

In the outer panels, the flap motion is transmitted to the outboard gap closing door though the VS-16027 mechanism installation. Since both inboard and outboard gap closing doors work off the same control shaft, the elevating or lowering motion conveyed to the outboard door through the VS-16027 mechanism will be conveyed in equal proportion to the inboard door by means of the control shaft.

WING FOLDING GAP DOOR

(Reference VS-10794)

A wing folding gap door, which also serves as an indicator as to whether the wing folding hinge pin is fully inserted, is provided in the outboard upper leading edge skin of the center section. The purpose of the door is to provide a space in the outboard upper leading edge of the center section into which the inboard upper leading edge of the outer panel may enter in folding, and to present a smooth camber on the center section when the wings are spread.

The gap door is operated automatically with insertion and/or removal of the hydraulically actuated wing folding hinge pin. When the wings are in the spread condition, the hinge pin butts against an actuator, thus overcoming a spring-load in the linkage to the gap door and holding the door closed. As the hinge pin is unlocked and the wing folding control handle in the cockpit is pulled aft to "fold", the hinge pin is removed and pressure taken off the actuator, thereby permitting the spring-loaded linkage to elevate the door.

The gap door actuating linkage is shown clearly on the door installation drawing, VS-10794.

HYDRAULIC SYSTEM AND HYDRAULICALLY ACTUATED PARTS

REFERENCE DRAWINGS

VS-10205	Oleo Strut Assembly - Tail Wheel
VS-10226	Tail Wheel Installation
VS-10270	Hydraulic System - Fuselage
VS-10274	Oleo Strut Assembly - Landing Gear
VS-10275	Landing Gear Assembly
VS-102777	Brake Installation - Landing Gear
VS-10420	Arresting Gear Installation
VS-10822	Bolt Assembly - Lifting Device
VS-10870	Actuating Struts - Landing Gear
VS-10882	Links Assembly - Landing Gear Main Drag
VS-10912	Strut Assembly - Wing Flap Control Hydraulic Operating
VS-11645	Strut - Accessory Compartment Flap
VS-11817	Wing Folding Mechanism - Hydraulic
VS-11904	Dashpot Assembly - Arresting Gear
VS-11937	Retracting Strut - Arresting Gear
VS-12290	Hydraulic System - Outer Panel
VS-12760	Strut - Wing Hinge Pin Pulling
VS-12777	Strut - Landing Gear Doors Actuating - Inboard
VS-12778	Strut - Landing Gear Doors Actuating - Outboard
VS-12850	Tail Wheel Door Operating Mechanism

VS-12982	Bottle Installation - Emergency Release
VS-13487	Hinge Pin Locking Installation
VS-13779	Strut - Wing Folding
VS-13853	Strut - Tail Wheel Actuating
VS-14126	Hydraulic System Installation - Center Section
VS-15153	Strut - Oil Cooler Flap
VS-15199	Schematic Diagram - Hydraulic System

HYDRAULIC SYSTEM AND HYDRAULICALLY ACTUATED PARTS

GENERAL

(Reference: VS-10270, VS-14126, VS-12290, VS-15199)

A constant pressure hydraulic system is used on Model F4U-1, FG-1 and F3A-1 airplanes for operating the landing gear and doors, wing folding and pin pulling mechanism, landing flaps, tail wheel, arresting gear, gun charging, cowl flaps, accessory compartment air exit flap, and oil cooler flaps. A pressure regulator, VS-12287, is used to maintain a constant pressure in the system of 950 to 1125 pounds per square inch. The pressure regulator cuts in when the pressure drops below 1000 pounds per square inch. The regulator cuts out when the pressure builds up to 1075 pounds per square inch. (Explanation: As soon as the pressure drops below 1000 pounds per square inch (approx.), the regulator cuts in and the engine pump, VS-12285, builds the pressure up to 1075 pounds per square inch (approx.) somewhere between which point and 1125 pounds per square inch, the regulator cuts out and by-passes the oil directly from the pump through the regulator and to the hydraulic oil tank). A small accumulator, VS-12281, is used in the system to eliminate the constant operation of the regulator due to small leakages. Refer to VS-15199, Hydraulic System Diagram.

HAND PUMP

A hand pump, located to the left of the pilot's seat, is incorporated in the hydraulic system (see photograph VS-5187). This pump may be used to operate any hydraulically actuated part of the airplane, and is also used when draining the system.

A manual check valve is located in the left hand forward part of the cockpit, and may be seen on photograph 5187. This valve should be closed when using the hand pump, thus making it unnecessary to pump up the accumulator, and should also be closed in combat, to prevent hydraulic system failure in case the accumulator is shot away.

WING FOLDING AND PIN PULLING

(See Photograph VS-6115)

In folding, the hydraulic pressure is first applied to the VS-12760 pin pulling strut. When the pin is removed, the strut piston opens a sequence valve in the strut, permitting the hydraulic oil to flow to the VS-13799 wing folding strut and thus folding the wings.

In spreading the wings, the flow of oil from the selector valve is reversed, being sent first to the wing folding strut. After the wings are folded, a load and fire valve, VS-12802, is opened, permitting the oil to flow to the pin pulling strut and thus inserting the pin.

The load and fire valve also permits escape of the oil in the pin pulling strut as the piston is compressed and the pin removed, and prevents the return flow of oil to the pin pulling strut before the wings are spread.

LANDING GEAR

(See Photograph VS-5317)

With the landing gear down and valve handle in "up", the pressure is applied to the landing gear retracting strut, and, as soon as the landing gear has reached its retracted position, the oleo strut opens a sequence valve, VS-12806, which supplies the pressure to close the landing gear doors. High pressure then remains in both the door struts and the landing gear retracting strut, the high pressure acting in a direction to keep the gear up and the doors closed. It is to be noted, however, that the landing gear lock, unassisted by hydraulic pressure in the strut, is sufficient to keep the gear in the retracted position.

With the gear up and the doors closed, but with the valve handle in "down", the pressure is transmitted to the door and landing gear struts simultaneously. After the initial pressure has been applied to the doors and

landing gear, the gear falls almost to extended position under its own weight. When hydraulic pressure "catches up", the gear is forced to its full extension, and locks down. The gear will remain mechanically locked even if the pressure subsequently fails.

EMERGENCY LANDING GEAR EXTENSION

(Reference: VS-12982)

In the event of failure of the hydraulic system, extension of the landing gear is made possible by a CO_2 emergency pressure system and an unloading valve assembly, all operated simultaneously by pulling the emergency landing gear release handle located on the left side of the cockpit.

The VS-13457 emergency CO_2 bottle is located on the lower left hand side of the cockpit. The procedure for removing the bottle is as follows:

1. Break the union in the bonnet by loosening the large nut. The upper part of the bonnet, including the pulley assembly and the line leading to the hydraulic system, may be left intact.

2. Detach the discharge line from the upper part of the bottle by loosening the nut at the union.

3. Take off the AN3-4A bolts which clamp the straps around the cylinder, open the VS-13457 belt at the top of the cylinder, and remove the cylinder by working it down towards the bottom of the fuselage.

In operation, pressure is released from the CO_2 bottle to actuate the landing gear struts. At the same time, the VS-12803 unloading valves release the pressure from the bottoms of the landing gear struts, the landing gear door struts and the tail wheel strut. The landing gear is then extended by the CO_2 pressure, the landing gear doors being pushed open by the landing gear itself. The tail wheel is extended by the spring on the tail wheel actuating strut.

When the landing gear has been extended by the emergency system, it cannot be retracted. Besides correcting the fault in the hydraulic system which made

the use of the emergency system necessary, the following steps must be taken before the landing gear will function normally.

1. Remove the lockwire and open the VS-17298 needle valve located in the lower left hand side of the cockpit. This releases the positive CO_2 pressure in the landing gear struts. Close the valve and replace the lockwire. If this valve is not closed the emergency system will not function.

2. Before proceeding further, make certain that the landing gear operating handle is in "down" position.

3. Remove the CO_2 bottle, as explained above, and replace with a recharged bottle. Restore the unloading valves to their original position, with the levers and the links all the way forward.

The landing gear will now function normally, and the emergency system is again ready for use.

BRAKE INSTALLATION

(Reference VS-10277)

The brake installation is of the seven disc type, actuated by two independent hydraulic systems, right and left. The brake pedals are mounted on the rudder pedals, and are connected to master cylinders. The hydraulic fluid is conveyed from the master cylinder through aluminum alloy tubing to the fitting above the oleo strut knuckle fitting, and then through flexible hose down to the brake unit in the wheel.

DRAINING THE SYSTEM

To drain the system, loosen the drain plug located on the inside of the wheel, locate a can just below the drain, and pump the foot pedal fore and aft until the entire system is free of fluid. See photograph VS-5644.

FILLING THE SYSTEM

The hydraulic fluid to be used in this system is Navy Specification M-339 mineral oil.

The only satisfactory method of filling the system is through the bleeder valve at the wheel. To fill at this point, brake fluid may be pumped into the system or, if located above the level of the master cylinder, a filling can may be used. In the latter method, a rubber hose may be used from the filling can to the drain plug at the wheel. Locate an overflow can at the master cylinder with a rubber hose running from the master cylinder into the overflow can, keeping the end of the tube below the surface of the oil. Fill the system until a smooth flow of fluid with no air bubbles is obtained at the overflow can; at this time, turn the drain valve on the wheel back to "off".

If it is desired to add small quantities of brake fluid to the system, this may be done as follows:

Remove the filler plug at the master cylinder and fill with fluid to the plug level. Open the bleeder valve on the wheel and allow the oil to flow through the system until no air bubbles appear at the bleeder. Before plugging the master cylinder, work the pedals several times and watch for air bubbles at the plug hole. Refill the reservoir and insert the filler plug. Operate the brake pedals, checking for braking effect and for leakage in the system.

The filler plug is so located that sufficient foaming space is provided in the reservoir.

BRAKE PEDAL ADJUSTMENT

This adjustment does not in any way affect the brake adjustment but is merely a pedal locating device. The adjustment knob is located on the brake pedal, fore and aft adjustment being obtained by turning the adjustment knob.

BRAKE ADJUSTMENT

Directions for adjusting the brakes of these airplanes will be found in the Goodyear "Instructions for Airplane Wheels and Brakes" located at the back of this manual.

NOTE: The normal disc clearance on these brakes should be .042". When a new brake is installed, however, it should be adjusted to a clearance of .038". After the brake has been "worn in", the disc clearance should be maintained at .042". If, in checking the clearance between the adjusting nut and the discs, a total variation (from normal setting) of more than .015" is found between the clearance at one point and at another point diametrically opposite, rotate the discs individually until this variation becomes less than .015". Feeler gages should be used to measure clearances.

TAIL WHEEL AND ARRESTING GEAR

The hydraulic control for the tail wheel merely consists of a two way flow to the tail wheel strut, the direction of flow being determined by the selector valve. The hydraulic arrangement for the arresting gear is similar to that of the tail wheel; however, the tail wheel and arresting gear struts are controlled from different selector valves.

LANDING FLAPS

The hydraulic control for the flaps consists of a VS-15183 selector valve, a VS-12299 by-pass valve, a VS-12233 restrictor which can be adjusted so as to lessen or increase the blow on the VS-12790-3 flap strut piston, thereby determining the speed at which the flaps elevate and lower, a flow equalizer, VS-12292, which distributes the oil equally to each strut, and two VS-10912 actuating struts, one for the left and one for the right hand flaps. A thermal relief valve is provided on the equalizer to release any overload pressure which might result from overheating of the closed system between the flap selector valve and the flap strut. The by-pass valve is equipped

with a spring-loaded pin which is compressed by the flaps as they elevate. Thus, when the pressure on the flaps overcomes the spring load in the strut, the pin, compressed by the rising flaps, opens a port in the by-pass valve and furnishes an escape for the hydraulic oil.

The hydraulic system for gun charging, cowl flaps, accessory compartment flap, and oil cooler flaps is of the usual type consisting of a valve and strut.

Relief valves and check valves are provided throughout the hydraulic system where necessary. Refer to VS-15199.

A hand pump is provided to the left of the pilot's seat to build up hydraulic pressure in the event of failure of the engine driven pump.

FILLING THE HYDRAULIC SYSTEM

To fill the system completely, hoist the airplane to sufficient height, i.e., such that the landing gear may be readily extended or retracted. Insert an electric pump in the lines at the disconnect fitting in the firewall, fill the tank and successively actuate all the hydraulic parts, each time filling the tank to the required level. EXAMPLE: Retract the landing gear under hydraulic pressure. (Retracton must come first because damage will result if the gear is extended with empty struts). Extend the gear and refill the tank. Fold the wings hydraulically, taking great care not to allow the panels to fall free over to the folded position until the struts are properly filled with oil. Spread the wings. Refill the tank. Continue this action for all hydraulically actuated parts until the entire system is filled with hydraulic fluid. NOTE: The hydraulic fluid used in this system is a mineral oil, NAVY SPECIFICATION M-339.

DRAINAGE

To drain the system it is necessary to open one flexible line at the engine accessory compartment flap strut and, using the hand pump in the cockpit, pump the fluid into a can. For servicing a single hydraulic cylinder, break the lines at the cylinder and plug the lines.

LANDING GEAR

(Reference: VS-10275)

The main landing gear is hydraulically retractable, rotating 87° in retraction to a position completely within the wing. Hydraulically operated doors close over the wheel well opening when the landing gear is retracted, so that the under surface of the wing is not broken by any openings or projections that would disturb the air flow.

The landing gear assembly on each side of the airplane comprises a 32 x 8 Goodyear wheel with tire, tube, and multiple disc hydraulic brake, a VS-10274 oleo strut, a VS-10882 drag link assembly, a retracting link assembly, and a VS-10870 hydraulic retracting strut. A toggle on the retracting links keeps the landing gear mechanically locked when either fully extended or fully retracted, hydraulic pressure not being necessary to hold it so.

The position of the component parts of the extended landing gear is shown on the reference drawing. When fully extended, the retracting links, which have toggle joints, are held in "locked" position by the pressure of the hydraulic strut and also by the VS-10852 spring, so that the landing gear cannot retract in the event of failure of hydraulic system. The drag links cannot break upward until the retracting links have broken first. This cannot possibly be effected by any shock load on the wheels, since any such load would be transmitted directly to the wing through the oleo strut and the drag links.

In retracting, the hydraulic strut, acting through links and connecting rods, causes the retracting links to break upward allowing the drag links to break, and the landing gear to be pulled up. As the gear is raised the pivot screw to which the upper end of the oleo strut is attached is forced to rotate 87°, turning the oleo strut and the wheel assembly so that the latter will lie flat in the wing. Concurrently, the retracting links become almost completely buckled by the action of the hydraulic strut and the drag links, then, as retraction progresses they straighten out, attaining an "in line" position when the wheel is completely within the wing. As this point is reached the toggle on the retracting links locks the landing gear in raised position.

As the landing gear is retracted, the lifting device exerts force on the axle stub and the oleo strut piston, compressing the oleo strut approximately four inches and allowing the wheel to clear the after side of the wheel well.

In lowering the landing gear, the process described above is reversed, force exerted by the hydraulic strut causing the retracting links to break and allowing the gear to be extended.

The main landing gear position indicator is located in the cockpit at the forward end of the left hand shelf, (see photograph VS-5697) and has two pointers, one for the right and one for the left hand wheel. These pointers are actuated by cables running through the fuselage and center section on pulleys, and attaching to brackets on the drag link shafts. Adjusting turnbuckles are located under the left hand shelf.

The micro switch for the warning howler is operated through a lever by the upper retracting link on the outboard side. When the throttle is nearly closed and the check off switch is turned to "Land," the signal will sound until the landing gear is down and locked. The adjustment nut in the lever which actuates the micro switch should be so set that the howler goes on or off as the lock toggles are broken one inch off a straight line at their center pivot.

Since the hydraulic mechanism is able to extend the landing gear at speeds up to 200 knots, the landing gear may be used as a dive brake. A dive break control on the left hand sub-instrument panel extends the main landing gear, the tail wheel remaining retracted. Further description of the use of the landing gear as a dive brake will be found in the Pilot's Handbook.

DISASSEMBLY OF THE LANDING GEAR

(Reference: VS-10275, VS-10822)

The procedure for dismantling the landing gear, should this be necessary for replacement or repair of its parts, is given below. (NOTE: Remove the bonding before disassembling the joints. Consult the reference drawing for details and for outboard and inboard positions of bolt heads).

Remove the wheel by removing the locking ring and the hub cap and removing the axle nut. The bearing and the wheel may now be slipped off the axle.

Disconnect the lower part of the VS-10894 lifting device by detaching the rod from the fitting on the axle and disconnecting the cable and rod from the lever by removing the attaching bolts.

Detach the lower end of the drag links by removing the VS-10822 attaching bolt. This is a compound bolt and must be removed as follows: Remove the small AN310-4 nut on the outboard end and take off the fairing support bracket. Remove the AN380-C2-3 cotter pin on the inboard end of the bolt; remove the AN4-6 bolt and the fairing support. Now remove the cotter pin from the VS-10889 nut, take off the nut and remove the VS-10884 bolt. In reassembling the bolt, note that the VS-12837 bolt retaining pin must be sealed in with wax to hold it in place while assembling the bolt into the collar. Refer to drawing VS-10822 for details.

Detach the forward end of the hydraulic strut and the retracting links connecting rods by removing the CV-18221-2 attaching bolts, etc., as called out on VS-10275. Detach the forward end of the retracting links assembly by removing the bolts from the brackets on the knuckle fitting.

Detach the oleo strut by swinging it inboard and aft and unscrewing the pivot screw until the CV-18299 oleo strut attaching pivot is clear of the knuckle fitting and can be removed.

To detach the upper ends of the drag link, remove the bonding clamp from the drag link shaft, detach the upper ends of the support rods, take off the VS-10890 indicator cable bracket and remove the four AN26-40A bolts securing the shaft into the ends of the drag link. The shaft may now be removed by passing it inboard through the aperture leading to the oil cooler compartment, access to which is had by removing the panel abaft the oil cooler flap. The drag link, with retracting links connected to it, may now be removed and further disassembled. It will be found convenient to reassemble these parts before installing them in the airplane.

To detach the upper end of the hydraulic strut, detach the hydraulic connections and remove the CV-18221-1 bolt attaching the strut to the bracket on the main beam.

ADJUSTING THE LANDING GEAR

(Reference: VS-10275, VS-10882)

(Reference Photograph, VS-6370)

The landing gear is properly adjusted if the oleo strut is snug against the pad on the lower side of the beam when the gear is in locked-up position.

Means for adjustment are provided by the VS-10804 threaded collar on the oleo strut and by the eccentric bushings between the drag link shaft and the shaft support brackets on the center section beam. Instructions for making the necessary adjustments are given on the reference drawing. Additional information which may be useful is as follows:

Each full turn of the threaded collar on the oleo strut makes a difference of approximately one half of an inch in the position of the oleo strut when the gear is up.

Because of its accessibility, adjustment at the oleo strut collar is an easier operation than adjustment at the eccentric bushings. Consequently, time may be saved by always making the first adjustment at the oleo strut collar (unless only a very slight adjustment is required in the first place). Then, if further adjustment is required, rotate the eccentric bushings. See detail "A-A" on VS-10882.

For rotating the eccentric bushings, use the VS-10596 wrench provided in the tool kit.

When adjusting the eccentric bushings, be sure that both the outboard and inboard bushings are rotated the same distance. If they are not the shaft may bind and damage may result. To facilitate equal adjustment, the cogs on these bushings are numbered.

Adjustment of the landing gear lifting device is made by means of the turnbuckle in the cable. The lifting device should be so adjusted that, while the landing gear is retracting, there is a clearance of 5/8" ± 1/8" between the bottom of the wheel and the pad on the after side of the wheel well, just as the wheel enters the well. Refer to VS-10275.

ADJUSTMENT OF LANDING GEAR CONTROL

The landing gear control linkage should be adjusted so that the landing gear valve is operated before the control handle reaches the extent of its motion at either end of the quadrant.

Means for adjustment is provided in the connecting rod, located behind the auxiliary control panel at the left hand side of the cockpit. This rod is joined in the middle by a threaded barrel secured by jam nuts. Loosen the nuts and turn the barrel to lengthen or shorten the rod until the correct point of adjustment is attained. Adjustment such that the valve is not operated until the control handle reaches its full up or down position is to be avoided, since a slight subsequent change of length of the linkage, due to vibration or other causes, might make it impossible for the pilot to extend or retract the landing gear.

LANDING GEAR OLEO STRUT

(Reference: VS-10274)

The shock absorbing strut is of the oleo pneumatic type. A scissors link between the strut cylinder and the axle stub maintains the wheel alignment.

To prime the oleo strut, release the pressure at the CV-44213 valve, and remove the valve. Remove the NAF-213768-1 plug or the VS-19528 valve (the strut may be equipped with one or the other), located about $4\frac{1}{2}$" from the top of the strut. With the strut fully compressed, airplane in three-point attitude, fill the strut to the plug levels with Navy Specification M-339 mineral oil. Replace the plug and the valves, and inflate with air at the CV-44213 valve until the distance between the centers of the scissors bosses is 5 3/4" ± 1/2". In order to relieve friction, oscillate the airplane while inflating the strut.

WARNING: It is very important that the NAF-213768-1 plug or the VS-19528 valve be removed at frequent intervals to make sure that there is no air leakage from the high-pressure side of the strut. If there is noticeable pressure when the above-mentioned plug or valve is removed, disassemble the strut as explained on page 46, replace the VS-10826-1 gasket if there is evidence of failure, and check for air-tightness the weld at the top of the VS-10827 inner cylinder. Repair by soldering over the weld if there is leakage at this point.

OLEO STRUT DISASSEMBLY

(Reference: VS-10274)

1. Release the air pressure in the strut at the VS-19528 air valve, and remove the valve.

2. Remove the VS-10858 bolt, etc., connecting the upper and lower halves of the VS-10803 scissors.

3. Take off the AS-995-47-6 lockwire and remove the VS-16409 sleeve retainer nut from the lower end of the cylinder. Remove the VS-10483 split brass sleeves as the VS-10840 piston assembly is carefully withdrawn.

4. Loosen the AN-502-10-12 set screw at the upper part of the strut and, using the VS-16412 wrench provided with the tool kit, unscrew and withdraw the inner cylinder assembly from the outer cylinder. This picks up the VS-15158 plunger.

5. To remove the plunger from the inner cylinder, remove the AS-995-41-12 lockwire and the two AN-502-10-4 fillister head screws at the lower end of the cylinder and unscrew the head assembly. Remove the AS-995-41-12 lockwire and the two VS-10827-3 screws from the collar on the cylinder, remove the ring from the collar, pick out the four VS-10859 pins and slide the collar and the plunger off the cylinder. This makes accessible the CVC-954-4-1.227 packings within the bore of the plunger.

6. With the disassembly completed to this point, the oleo strut may readily be serviced. Packings and gaskets are called out on VS-10274.

7. Reassembly is accomplished by reversing the above procedure. Note; The inner cylinder must be reassembled into the strut in a vertical position to assure that packing VS-10826-1 remains centered and does not become damaged during reassembly.

LANDING GEAR DOORS INSTALLATION

(Reference: VS-13593)

The landing gear doors are hydraulically actuated, and their operation is automatic, the doors being opened as the landing gear starts to extend, and closed by a sequence valve at the oleo pad on the lower surface of the beam, operated by contact with the oleo strut when the gear is retracted. The doors may be removed by removing the bonding and by taking out the AN4-13 bolts from the aft hinges and the AN5-16 bolts from the forward hinges, thus detaching the door hinge brackets from the fittings on the ribs. A door actuating hydraulic strut is located at the forward end of each door, attached at the forward hinge and to a bracket on the beam. The hydraulic struts may be detached by disconnecting the hydraulic leads and removing the attaching bolts. See photograph VS-5317.

TAIL WHEEL INSTALLATION

(Reference: VS-10226)

The retractable tail wheel installation comprises a wheel and yoke assembly, an oleo strut, a compression strut, a scissors assembly and a hydraulic actuating strut. The installation of these principal components is clearly shown, with details, on the reference drawing, and on photograph VS-5192.

The tail wheel installation attaches to the fuselage at three points, as follows: the hydraulic actuating strut attaches to a bracket on the centerline in the bottom of the fuselage aft of the mid section access hatch; the compression strut attaches to a bracket on the upper part of the tail wheel bulkhead, and the scissors assembly as well as the forward part of the tail wheel yoke attach to a bracket (detail "A" on reference drawing) on the lower part of the tail wheel bulkhead. The other ends of the compression strut and the scissors assembly are joined together with the upper end of the oleo strut (detail "B" on reference drawing), and the after end of the hydraulic actuating strut attaches to the upper part of the scissors assembly. The lower end of the oleo strut attaches at the after end of the wheel yoke assembly (detail "C" on reference drawing).

In operation, the hydraulic actuating strut extends and applies force to the bracket at the upper end of the scissors assembly, pushing the compression strut, oleo strut and scissors assembly joint (detail "B" on reference drawing) aft from retracted position and extending the tail wheel assembly. When the "down" position is reached, the scissors assembly is completely straightened against its knee joint, providing rigid suspension for the upper part of the oleo strut. In retracting the wheel, the hydraulic actuating strut pulls forward on the scissors assembly bracket, reversing the above operation.

The tail wheel position indicator is operated by a cable connecting near the upper end of the compression strut and running over pulleys and through fairleads to the indicator at the forward end of the left hand cockpit shelf. A turnbuckle for adjustment of cable tension is located below the left hand shelf.

The tail wheel locking control handle is located on the left hand cockpit shelf and is connected with the wheel yoke by cable and pulleys. When the control handle is pulled out the tail wheel is free to castor. Turning the control handle to the right after pulling it out locks it in that position.

TAIL WHEEL DOORS

(Reference: VS-12850)

The tail wheel doors are automatically opened and closed by a mechanism linked to the upper end of the compression strut and consisting of cranks, connecting links, chains and sprockets. The mechanism is a dual one, a similar system running down each side of the fuselage to the right and left doors. Means of adjustment is provided on the VS-16351 and VS-16338 links, and on the turnbuckles on the VS-15182 chain. When slight adjustment is required, the VS-15659-7 link can be disconnected and adjusted. The two VS-15659-7 links (one on each door) and the four turnbuckles should be sufficient for adjustment purposes.

IMPORTANT: Should it be necessary to adjust the VS-16351 and 16338 links, the dimensions between bolt hole centerlines, when adjustment is complete, should be the same for corresponding links on opposite sides.

TAIL WHEEL REMOVAL

To remove the tail wheel, break the safety wire from the safety screw on the axle bolt head and remove the safety screw. The axle bolt may now be unscrewed and withdrawn. To replace, reverse the above procedure, inserting the axle bolt with the head at the right hand side of the wheel housing.

TAIL WHEEL MICRO SWITCH

The tail wheel micro switch (VS-3974-1) is mounted in the upper part of the fuselage, on the center-line, and is actuated by contact with the VS-11872 tail wheel compression strut. The switch is connected with the warning howler, so that, when the check-off switch is set to "Land" the howler will sound until the tail wheel is extended.

Adjustment is made by turning the VS-11473-1 bolt to a point where the switch is opened when the compression strut is in "wheel down" position. The bolt is then locked by tightening the AN-345-C10 nut. Warning: Do not make this adjustment too "fine". Adjust the switch so that it is opened shortly before the tail wheel is fully extended. Otherwise, after a few flights the too-finely-adjusted switch may not open, the warning howler will not cut off, and the pilot will be led to believe that some part of the landing gear is not completely extended.

Access to the tail wheel micro switch is through the tail wheel access doors, located on either side of the fuselage.

ARRESTING HOOK INSTALLATION

The arresting hook is attached to an arm assembly moving in the joint at the after part of the tail wheel yoke assembly (detail "C" on VS-10266). This arm is connected by an adjustable link to a rocker arm attached at its lower end to the tail wheel yoke forward joint (detail "A" on VS-10226), and at its upper end connecting with the arresting hook dashpot assembly and the arresting hook retracting strut. The fixed ends of the dashpot and the retracting strut attach to a bracket on the channel assembly, abaft the tail wheel hydraulic strut bracket.

In operation, a selector valve allows the hydraulic fluid in the retracting strut to flow into the return line as the spring-loaded dashpot pushes the rocker arm aft, lowering the arresting hook through

the linkage described above. In raising the hook, fluid is admitted to the retracting strut, which pulls the rocker arm forward.

Adjustment is provided in the after end of the arresting hook link assembly, which should be lengthened or shortened so that, with the hook in retracted position, the hook head exerts a pressure of fifty pounds against the bumper when the wheel is extended.

ARRESTING HOOK REMOVAL

The arresting hook is spring-loaded to hold it in fore and aft position. Before removing, push the hook to one side and tighten the red-headed bolt at the forward end of the hook, thus locking the spring in compressed position. The hook may now be detached by removing the cottered nut and bolt that attach the hook to the snubber arm, disconnecting the bonding.

WARNING: The arresting hook spring is preloaded to 855 pounds. When the hook is removed from the airplane, do not loosen the red-headed bolt at the forward end of the hook, since a sudden release of the interior mechanism might cause injury to personnel. See the warning plate attached to the arresting hook.

DISASSEMBLY OF TAIL WHEEL AND ARRESTING HOOK INSTALLATION

(Reference: VS-10226)

(Reference Photograph VS-5192)

The procedure for removing any or all of the parts of the tail wheel and arresting hook assemblies is as follows:

Hoist the tail of the airplane at the lift tube, applying counterweights as directed.

Detach bonding before removing bolts from joints. (Note: All principal bolts have cottered nuts, and are to be installed with bolt heads on the left hand side of the airplane unless otherwise noted).

Remove the arresting hook as described above.

Remove the VS-11878 bolt from the joint at the after part of the wheel yoke assembly (detail "C" on reference drawing), allowing the wheel assembly to swing from its forward joint. Detach the VS-11902 arresting hook link from the VS-11901 arm and the VS-11903 rocker arm.

Detach the VS-13853 tail wheel hydraulic strut from the bracket on the upper end of the VS-11229 scissors assembly. Detach the VS-11904 arresting hook dashpot and VS-11937 retracting strut from the rocker arm. If removal of any of these parts is desired, they may now be detached at their forward ends and removed from the airplane. Access to their forward points of attachment is through the lower fuselage mid section access door.

Detach the wheel locking control cable from the lever on the forward side of the wheel pivot.

Remove the VS-11879 bolt from the joint at the bottom of the tail wheel bulkhead. (Detail "A" on reference drawing). In order to do this, it will be necessary to disconnect the door closing link on the right hand side, so that the door may be opened wide enough to allow clearance for the bolt.
NOTE: This bolt is installed with the bolt head on the right hand side of the airplane.

Detach the lower ends of the door closing mechanism links from the crank levers on the upper part of the tail wheel bulkhead.

Remove the AN28-48 bolt attaching the tail wheel compression strut to the bracket on the tail wheel bulkhead.

The compression strut, the scissors assembly and the oleo strut may now be removed from the airplane and the bolt connecting them removed (detail "B" on reference drawing). These three parts should be reconnected before reinstallation in the airplane.

Assembly and installation of the tail wheel and arresting hook mechanism is accomplished by reversing the above procedure.

NOTE: On all moving parts of the tail wheel retracting mechanism, do not draw up nuts more than finger tight, or the tail wheel emergency extension will not operate.

Also note that the springs on the tail wheel actuating strut and on the arresting gear dashpot are preloaded; consequently, care should be exercised when disassembling these mechanisms.

TAIL WHEEL OLEO STRUT

(Reference: VS-10205)

Complete and detailed instructions for priming and servicing the tail wheel oleo strut are given on the reference drawing.

WING FOLDING

(Reference: VS-11717)

The hydraulic mechanism for folding the wings consists of a VS-13779 hydraulic strut in the outer panel, attached at one end through a VS-15034 universal joint to a bracket bolted to the beam, and at the other end connected by a link assembly to the VS-10719 support which extends from the center section beam at the hinge line.

In operation, the wing folding mechanism works in conjunction with the wing hinge pin pulling mechanism.

WARNING: Do not fold the wings unless the hydraulic system has been bled.

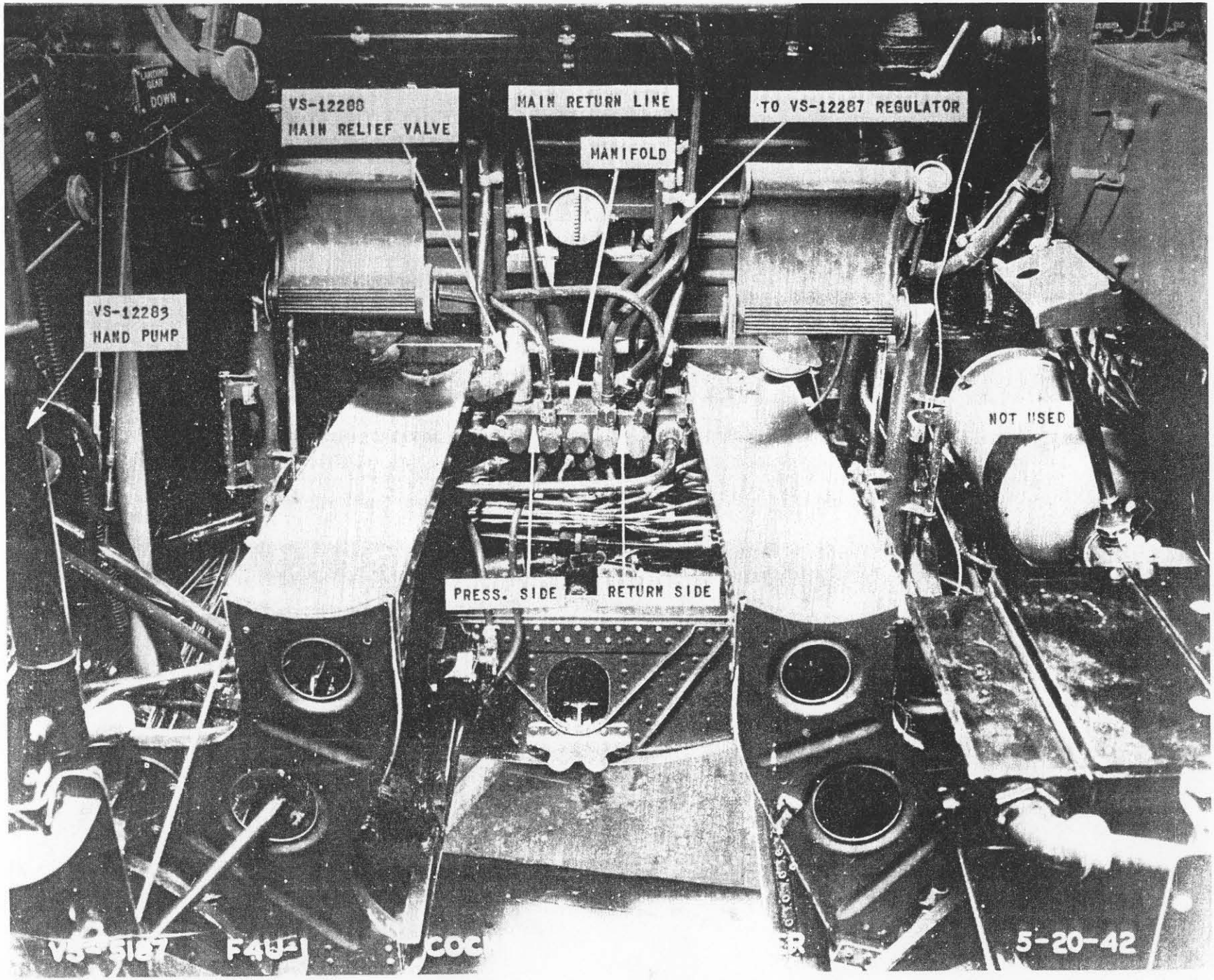
To fold the wings, the hinge pin locking handle on the left hand cockpit shelf must be released from "pulled out" or locked position. If the battery switch is on, the howler will then go on as the control is lowered. Then the hydraulic wing folding control, also on the left hand shelf, must be pulled back. As the wing panels start to fold the howler will go off.

For spreading the wings, the cockpit control lever must be pushed forward and then, when the wings

are completely spread and the hinge pins engaged as indicated by the hinge gap doors, the hinge pin locking handle should be pulled out and given a quarter turn to the locked position. Again, if the battery switch is on, the howler will go on as the wings spread; however, raising the locking handle will turn it off. This locking handle connects by cables and pulleys to locking mechanisms on the hinge pin pulling struts, the purpose being to prevent accidental folding of the wings.

WING HINGE PIN PULLING STRUT

The wing hinge pin pulling installation consists of a hydraulically actuated strut bolted to the lower wing hinge on the center section end rib. The operation of this assembly, which is coordinated with that of the wing folding mechanism, is explained under "Hydraulic System-General".


LANDING GEAR DOWN
VS-12288
MAIN RELIEF VALVE
MAIN RETURN LINE
MANIFOLD
TO VS-12287 REGULATOR
VS-12283
HAND PUMP
NOT USED
PRESS. SIDE
RETURN SIDE
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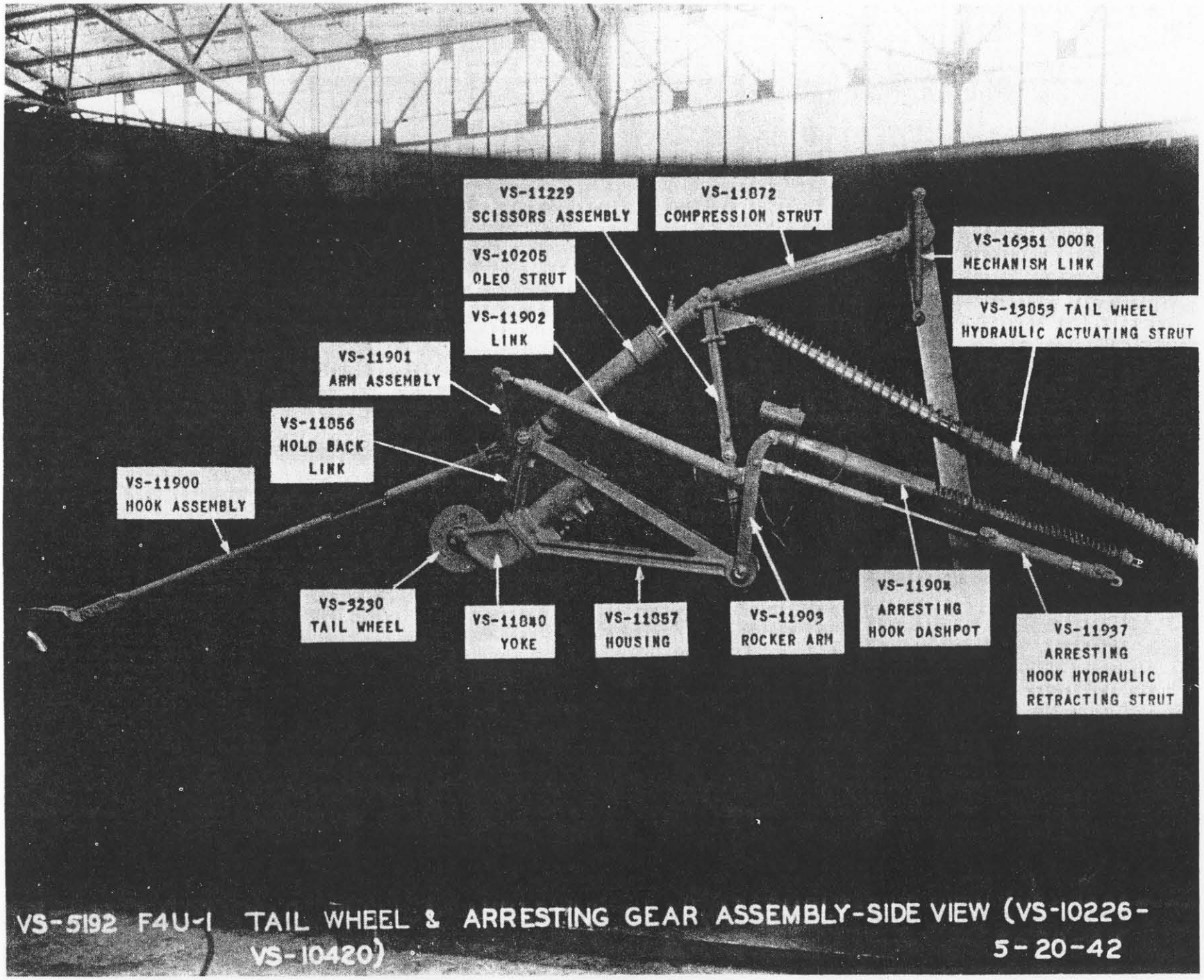

VS-5192 F4U-1 TAIL WHEEL & ARRESTING GEAR ASSEMBLY-SIDE VIEW (VS-10226-VS-10420)

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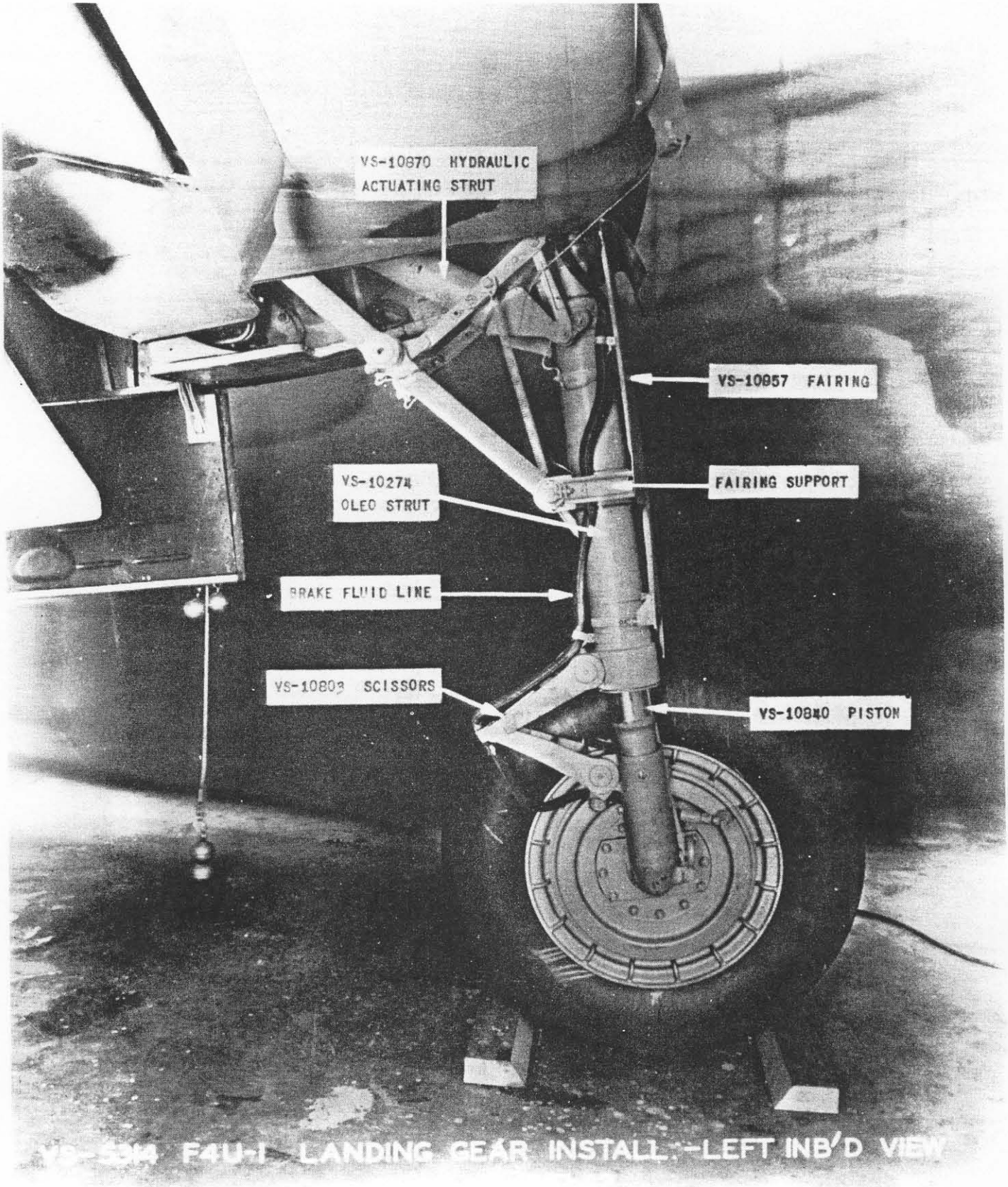
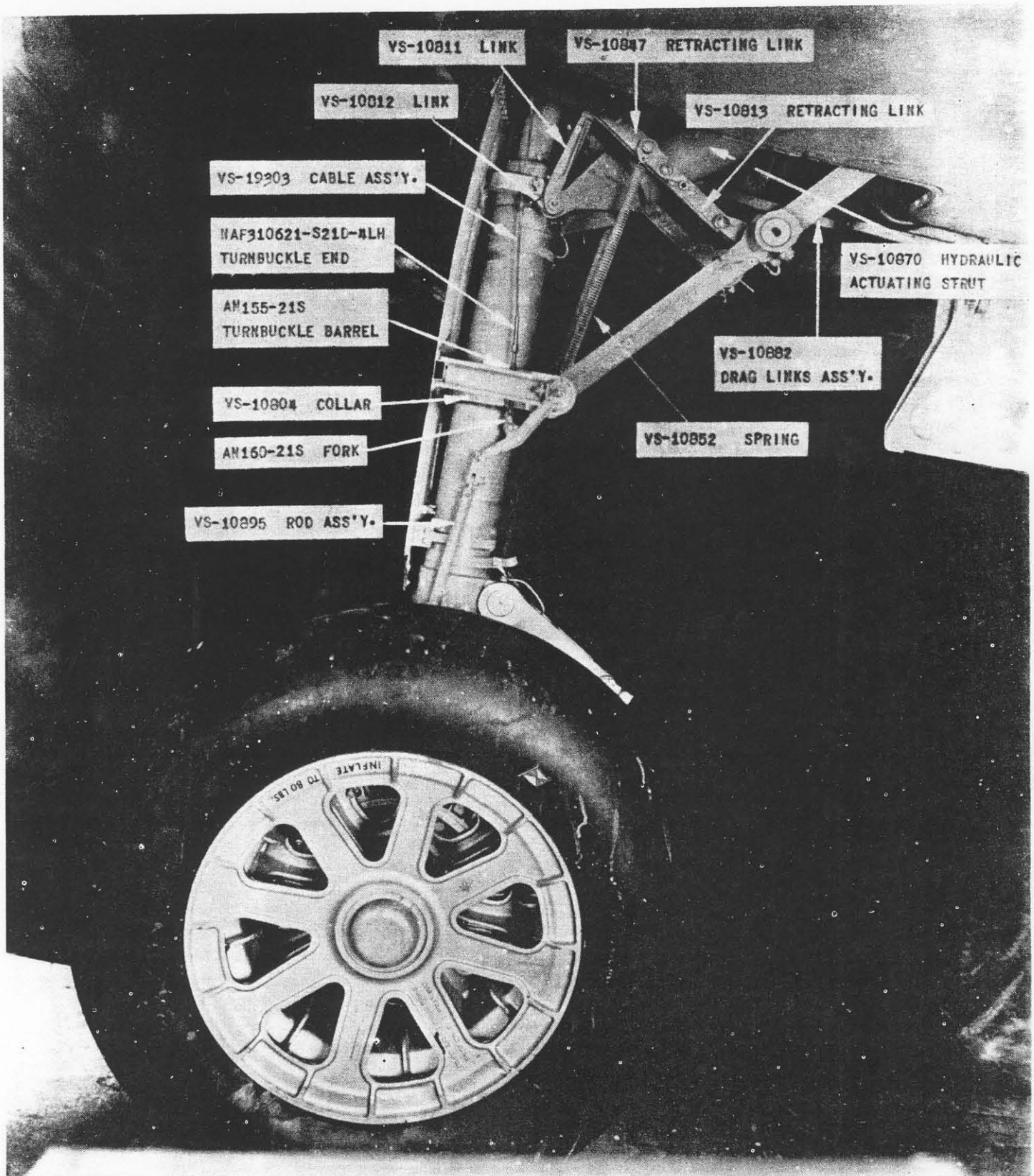
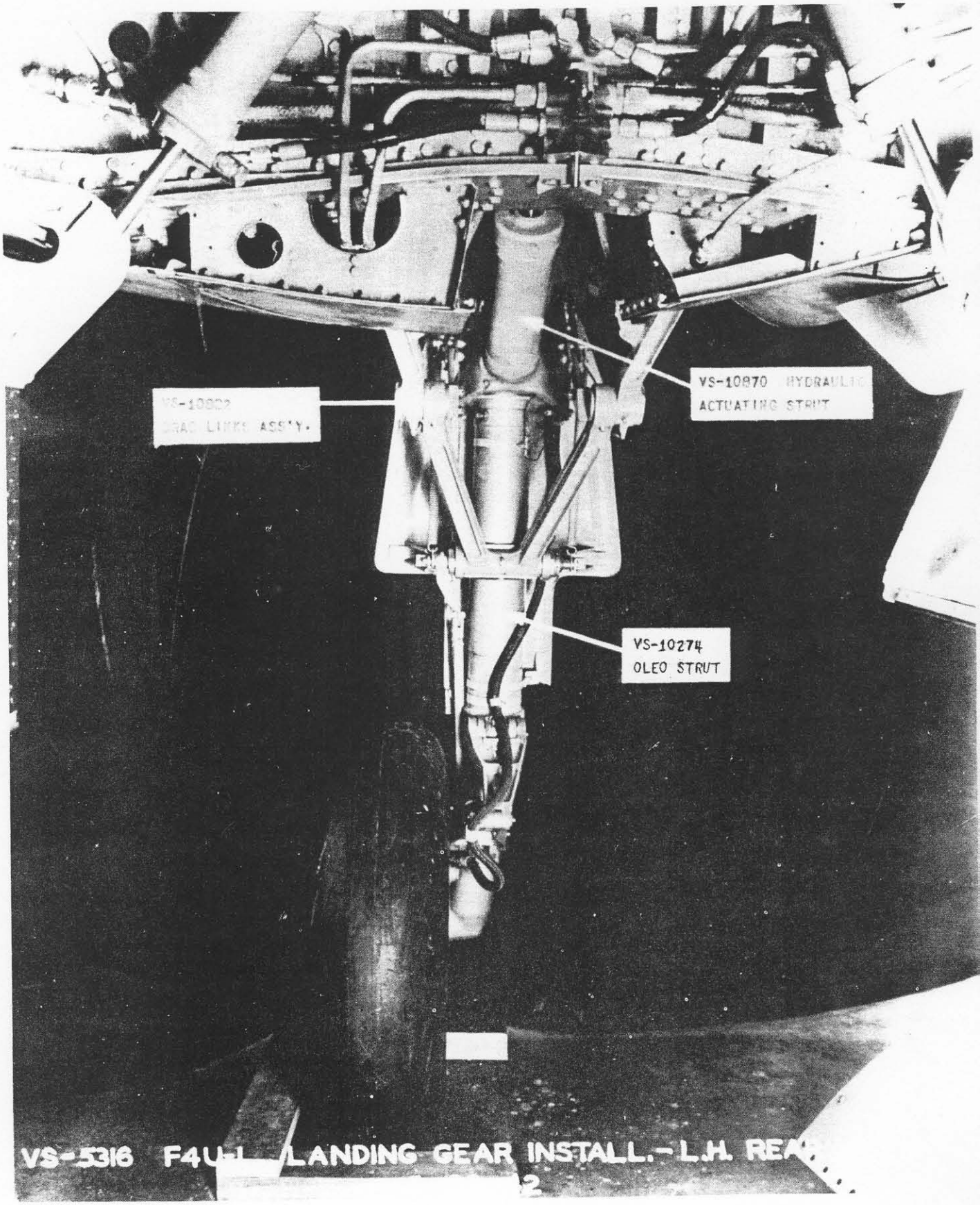


VS-394 F4U-1 LANDING GEAR INSTALL.-LEFT INB'D VIEW

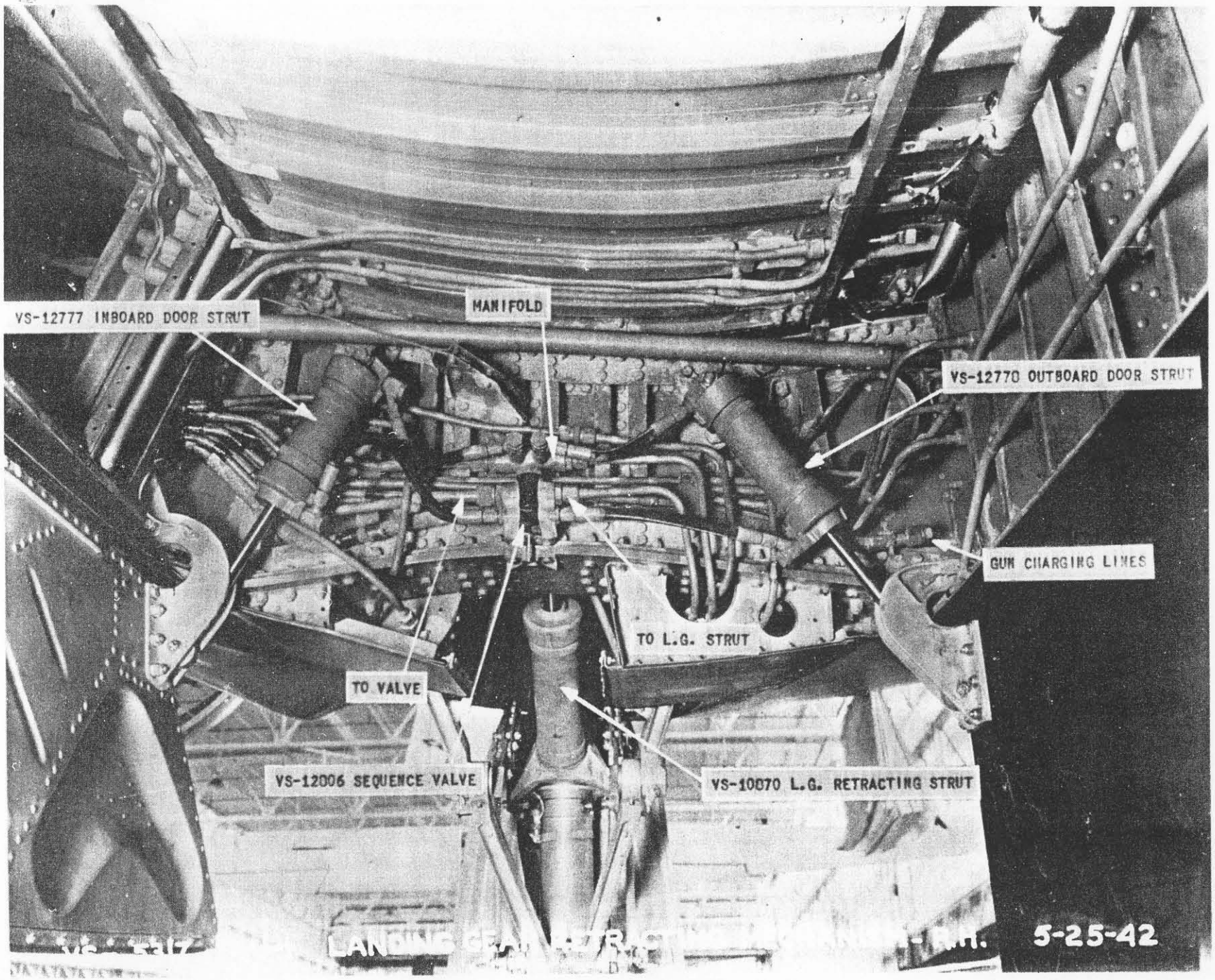


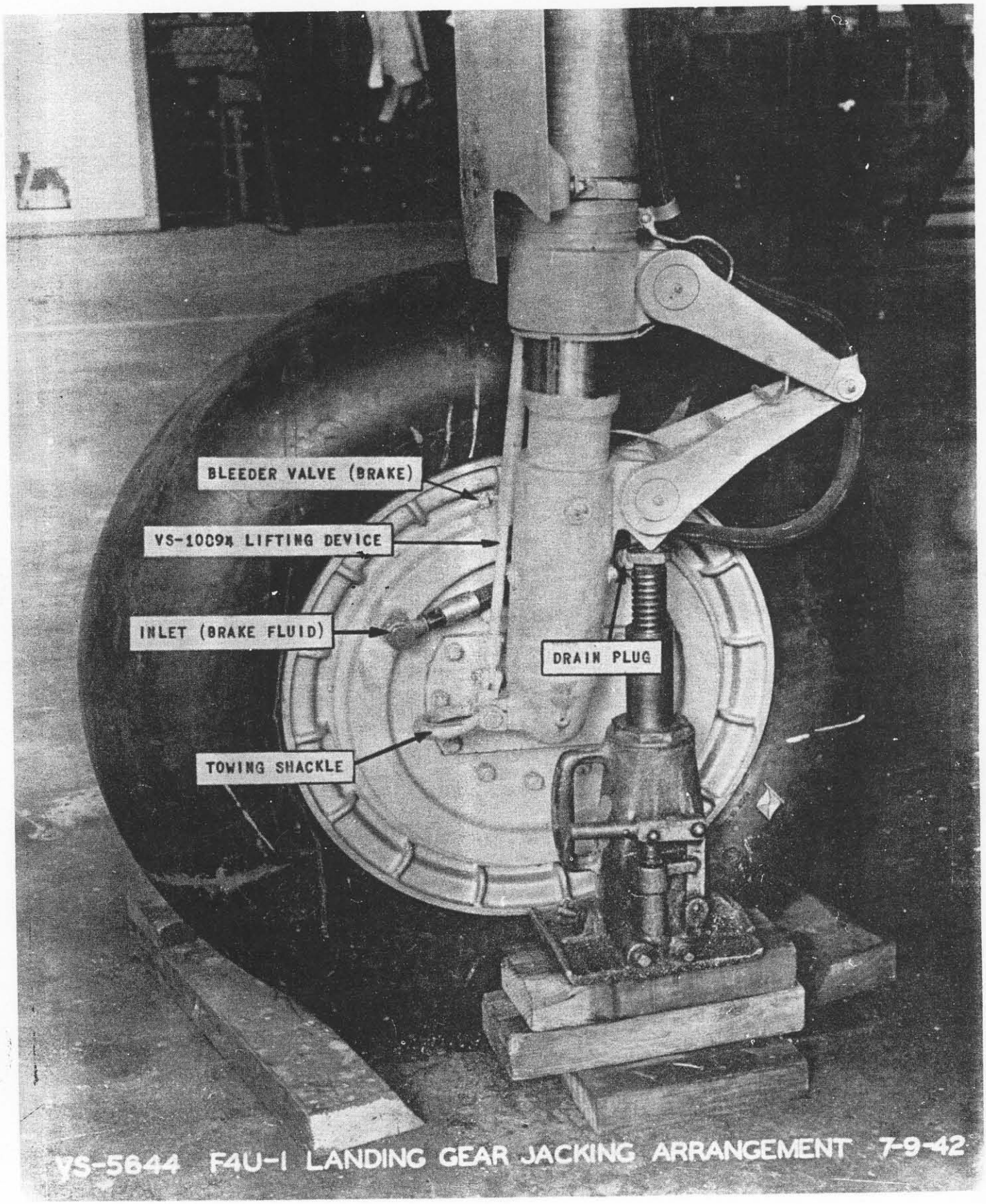
VS-5315 F4U-1 LANDING GEAR INSTALL-L.H. OUTB'D VIEW

5-25-42

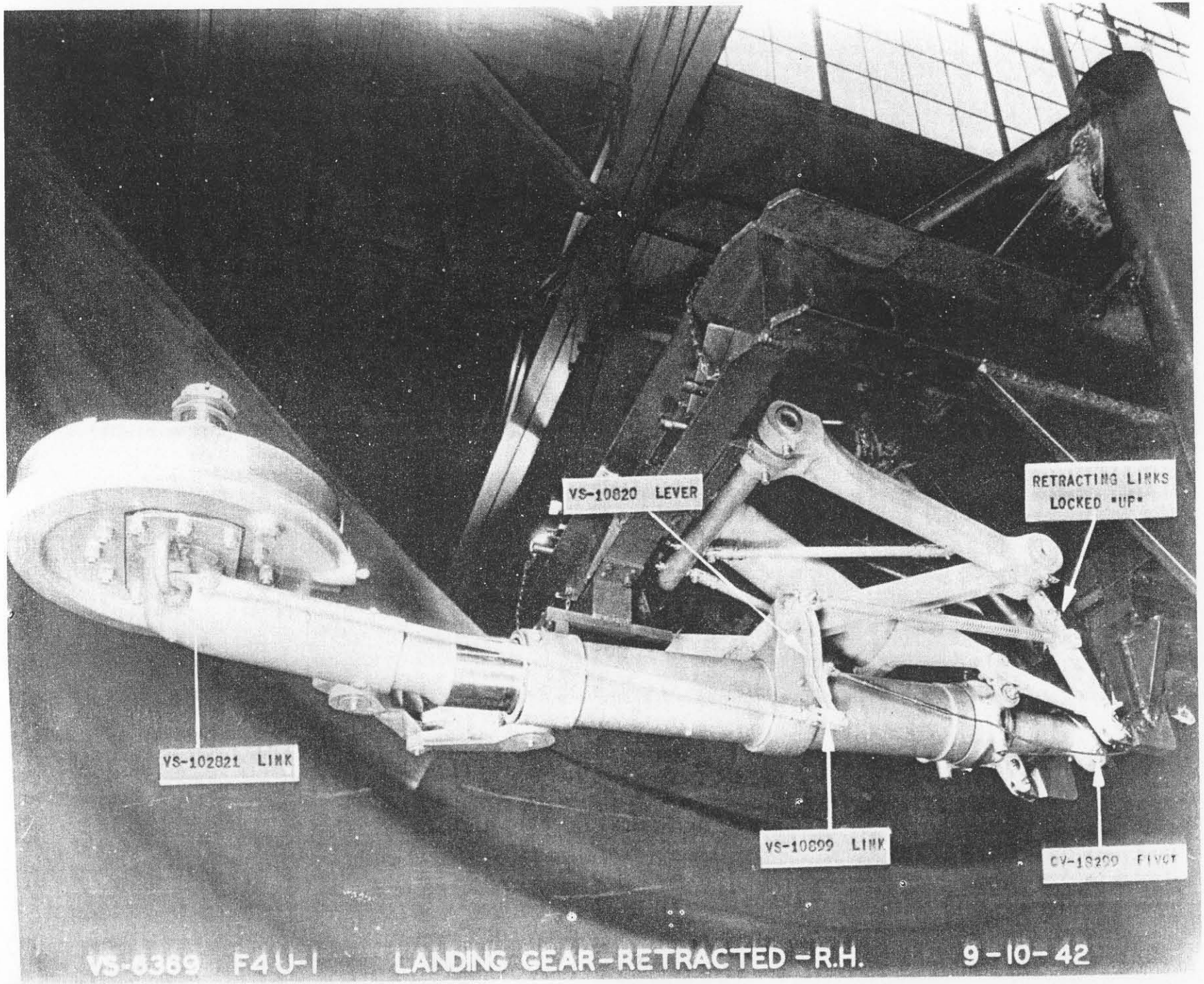


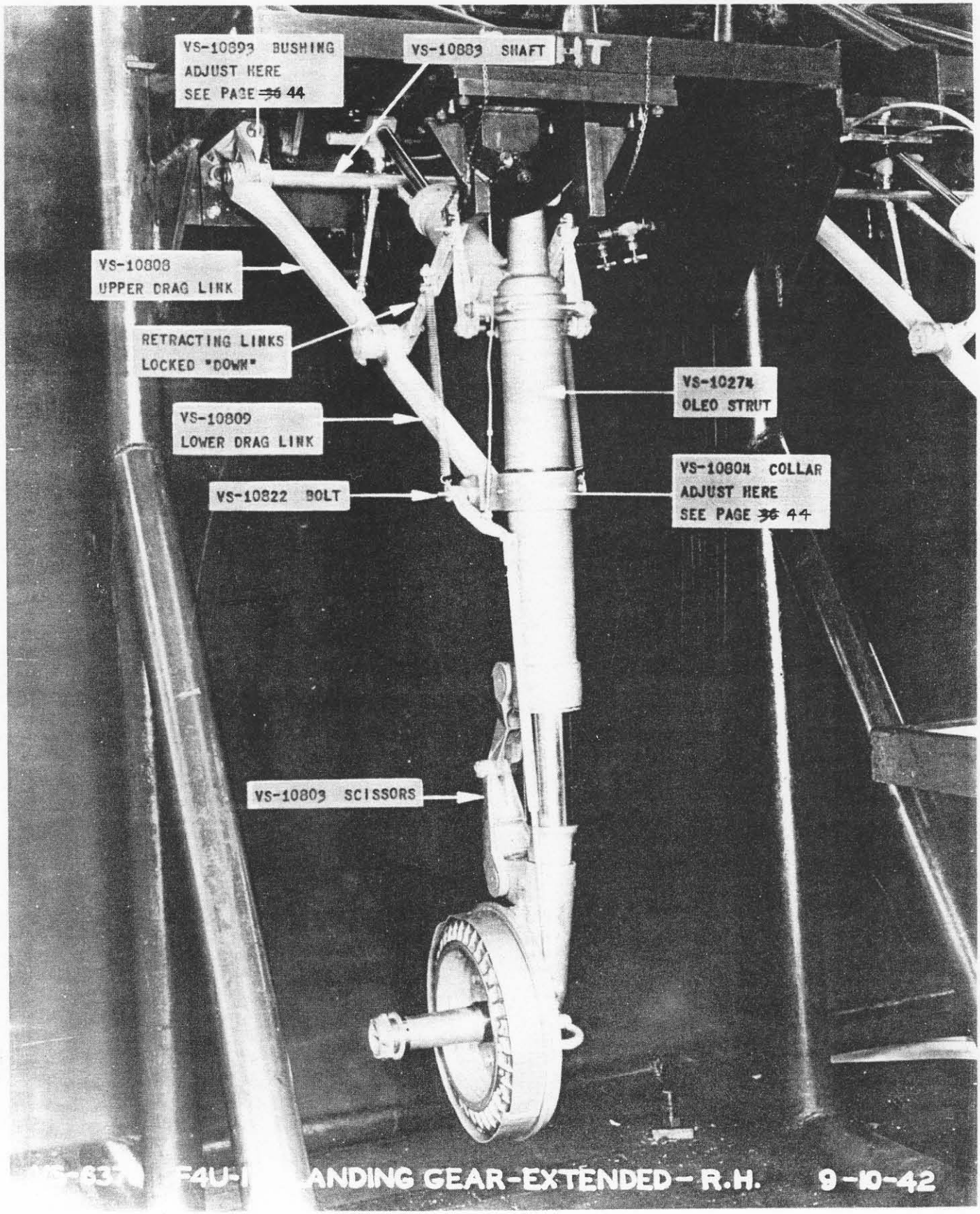
VS-5316 F4U-1 LANDING GEAR INSTALL.- L.H. REA...

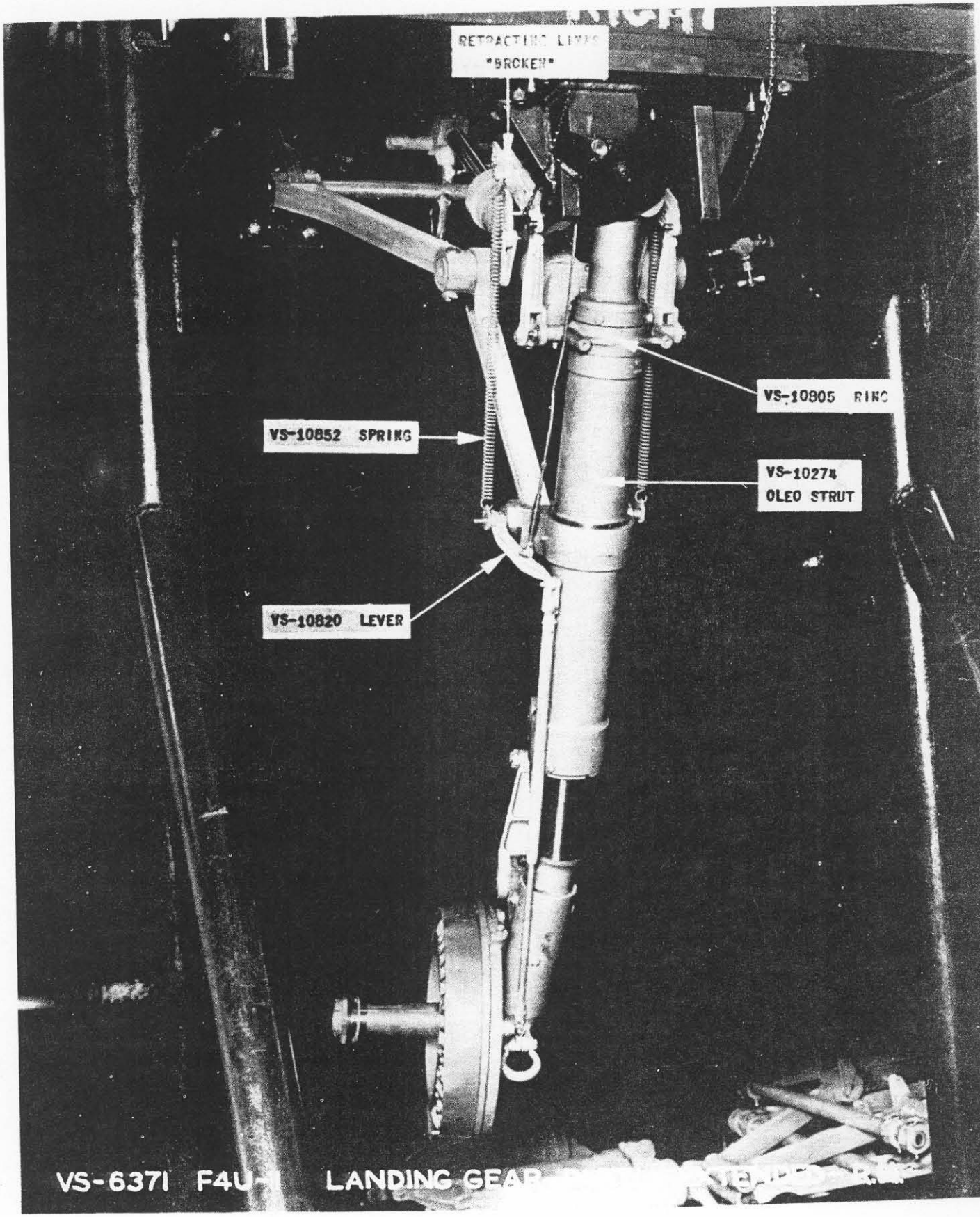

VS-12777 INBOARD DOOR STRUT
MANIFOLD
VS-12770 OUTBOARD DOOR STRUT
GUN CHARGING LINES
TO L.G. STRUT
TO VALVE
VS-12006 SEQUENCE VALVE
VS-10070 L.G. RETRACTING STRUT
5-25-42



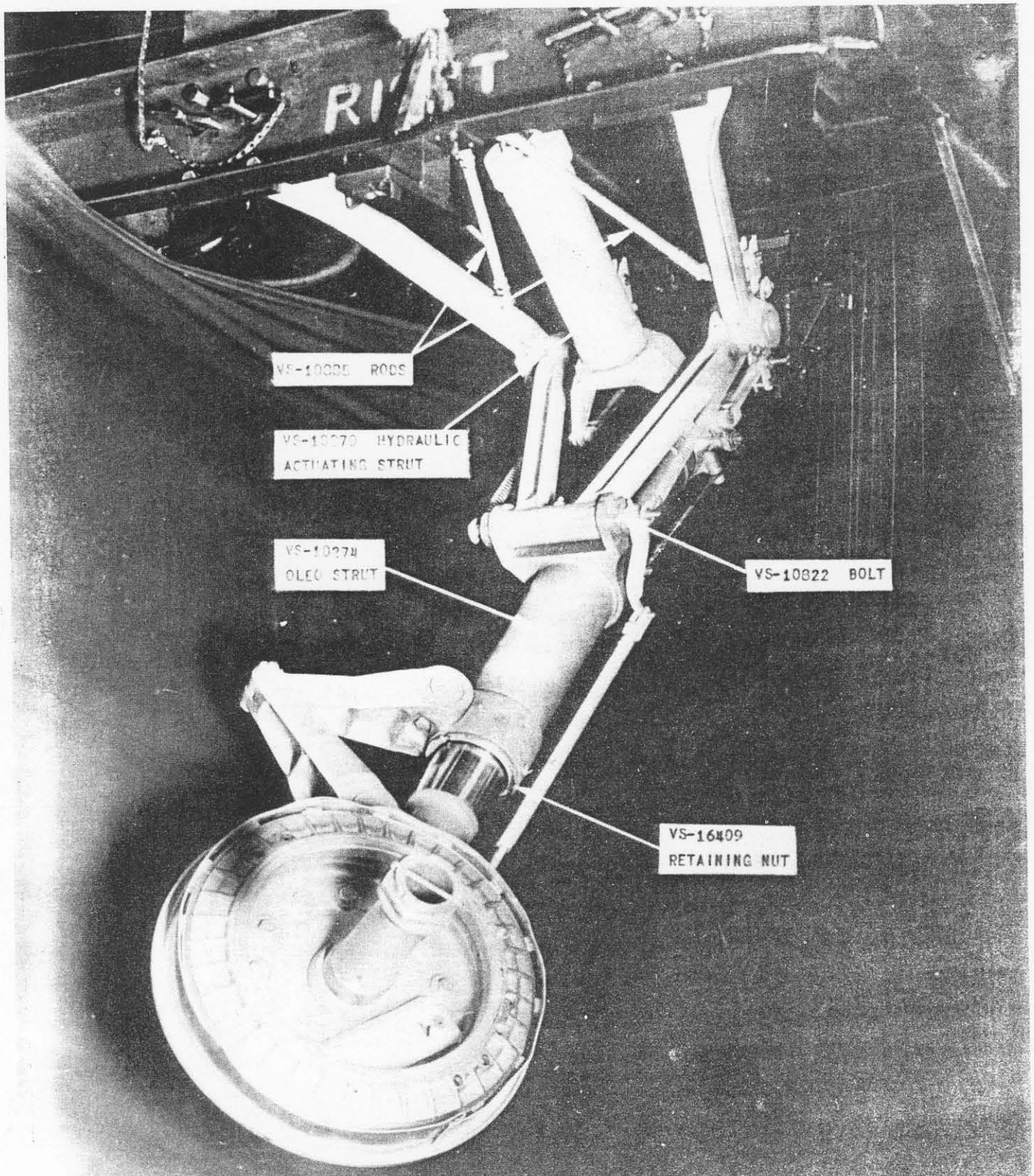
VS-5644 F4U-1 LANDING GEAR JACKING ARRANGEMENT 7-9-42


VS-10820 LEVER
RETRACTING LINKS LOCKED "UP"
VS-102821 LINK
VS-10899 LINK
CV-18299 PIVOT
VS-6389 F4U-1 LANDING GEAR-RETRACTED -R.H. 9-10-42


VS-10893 BUSHING
ADJUST HERE
SEE PAGE ~~36~~ 44
VS-10883 SHAFT
VS-10808
UPPER DRAG LINK
RETRACTING LINKS
LOCKED "DOWN"
VS-10809
LOWER DRAG LINK
VS-10822 BOLT
VS-10274
OLEO STRUT
VS-10804 COLLAR
ADJUST HERE
SEE PAGE ~~36~~ 44
VS-10803 SCISSORS
F4U-1 LANDING GEAR-EXTENDED-R.H. 9-10-42



VS-6371 F4U-1 LANDING GEAR



-8572 F4U-1 LANDING GEAR-PARTLY EXTENDED-R.H.
9-10-42

BODY GROUP

REFERENCE DRAWINGS

VS-10225	Unit Assembly - Front Section Fuselage and Center Section
VS-10227	Front Section - Fuselage
VS-10228	Mid Section - Fuselage
VS-10229	Aft Section - Fuselage
VS-10248	Cockpit Cabin Installation - Sliding Section
VS-10250	Fuselage Assembly
VS-10600	Inboard Profile - Fuselage
VS-11204	Windshield Assembly
VS-10404	Surface Controls Installation - Fuselage - "Included in Surface Controls Section".
VS-10430	Elevator Control Installation - "Included in Surface Controls Section".
VS-10226	Tail Wheel Installation - "Included in Hydraulics Section".
VS-10270	Hydraulic System - Fuselage - "Included in Hydraulics Section".
VS-12982	Bottle Installation - Emergency Release - "Included in Hydraulics Section".
VS-10326	Main Fuel Tank Installation - "Included in Power Plant Section".
VS-12343	Engine Control Unit - "Included in Power Plant Section".
VS-10408	Pilot's Seat Installation - "Included in Fixed Equipment Section".
VS-10427	Electrical Installation - Fuselage and Center Section - "Included in Fixed Equipment Section".
VS-10470	Instrument Installation - "Included in Fixed Equipment Section".
VS-10525	Radio Installation - "Included in Fixed Equipment Section".

BODY GROUP

FUSELAGE

(Reference: VS-10250)

The fuselage is of aluminum alloy, semimonocoque construction and composed of three main sections, i.e., front, mid and aft.

1. The mid and aft sections are joined by a splice plate (.051 alclad, 24ST-47A8) which is fastened to the interior of the skins by means of four rows of rivets, one row of CVC-1362AD4-6 rivets on the mid section skin and three rows of CVC-1362AD4-4 rivets on the aft section skin. (See photographs VS-4699 and VS-5193). Interior reinforcement consists of trusses and upper and lower longerons. The lower longerons are riveted to fittings which are bolted to the tail wheel bulkhead, No. 288. The fittings on the aft section and mid section trusses are bolted together through holes provided in the tail wheel bulkhead. The upper longerons run from the stabilizer bulkhead forward to the firewall. Fittings are riveted to the longerons at the connecting points, i.e., the tail wheel and seat bulkheads. The longeron fittings are then bolted together. Attaching parts for the longeron and truss fittings are called out on VS-10250.

2. Removal of the aft section may be accomplished by disconnecting surface control, hydraulic and electric lines, removing the bolts called out on the reference drawing which attach the truss and longeron fittings at the tail wheel bulkhead, No. 288, and drilling out the existing rivets in the skin and splice plates. On reassembly, rivets the next size larger must be used.

ATTACHMENT OF THE FRONT AND MID SECTIONS OF THE FUSELAGE

(Reference: VS-10250)

Section A-A of VS-10250 and the section views referenced therein show clearly the attachment points of the front and mid sections at the seat bulkhead

(consisting entirely of bolted connections), the attaching parts to be used, and the manner in which they are to be inserted.

The following procedure is recommended in attaching the front and mid sections of the F4U-1, FG-1 and F3A-1 airplanes, and should be followed as closely as possible:

(a) Mount the front and mid sections on separate cradles of corresponding height, the cradles preferably being equipped with rollers at the base.

(b) Bring the two sections together so that all bolt holes align.

(c) Insert the longeron bolts from the forward side, tighten with AN-310-7 nuts and cotter.

(d) Insert the remaining attaching bolts through the bolt holes in the attaching angles on the two fuselage sections. These bolts, called out in Section A-A of VS-10250, are to be inserted from the aft side. Other necessary attaching parts are called out on this drawing.

(e) Make all surface control, hydraulic and electrical connections. Refer to drawings VS-10404, VS-10270 and VS-10427 included within this manual.

(f) With the front and mid sections mounted on cradles, follow a procedure opposite to that given above, for diasassembly of the two sections.

WINDSHIELD AND COCKPIT CABIN

(Reference: VS-11204, VS-10248)

The windshield is located just aft of station No. 134 and covers the forward portion of the cockpit. The cockpit cabin extends from the windshield to the seat bulkhead, a sliding section housing the cockpit.

The transparent panes of the windshield are of 9/32" laminated, non - shattering plate glass. The top or dome of the windshield is of 1/4" plexiglas. The cockpit cabin sliding section panes are of 0.150 plexiglas. The panes in the rear vision tunnel are of 1/8" plexiglas.

All the plexiglas panels are fitted under retaining strips and are allowed to expand or contract without buckling by the use of a clamping extrusion through which the machine screws are fitted .

The sliding section is controlled internally by a pull handle, and externally by a push button, either of which operates a cable arrangement which releases a locking pin on the lower right hand side of the sliding section. Turnbuckles are provided on the control cable for adjustment. Refer to drawing VS-10248.

In case of emergency, the sliding section may be released from its tracks and thrown clear of the airplane by pulling on the release pins and then on the emergency throw-off handle and pushing forward as noted on drawing VS-10248. In the event of an inverted landing, a knockout panel for emergency exit is provided on the right hand side of the sliding section. This panel may be released by pulling downward on the control handle and thrusting outward.

The 1½" bullet proof glass directly behind the windshield may be readily disassembled and removed by removing the windshield dome, the periscope, the illuminated gunsight from its mounting bracket, and the attaching bolts at each upper corner and at each lower corner of the bullet proof glass.

An observation window is provided in the fuselage bottom in the cockpit. The window is held in place by retaining strips and screws.

The windshield assembly, including part of the top deck fuselage cowling, is replaceable as a unit.

FLOORING

The only flooring in the cockpit consists of foot troughs aligned with the rudder pedals, the troughs acting as foot rests for the pilot. The troughs are fabricated of alclad sheet and riveted to the supports on the fuselage.

TAIL CONE

(Reference: VS-10250)

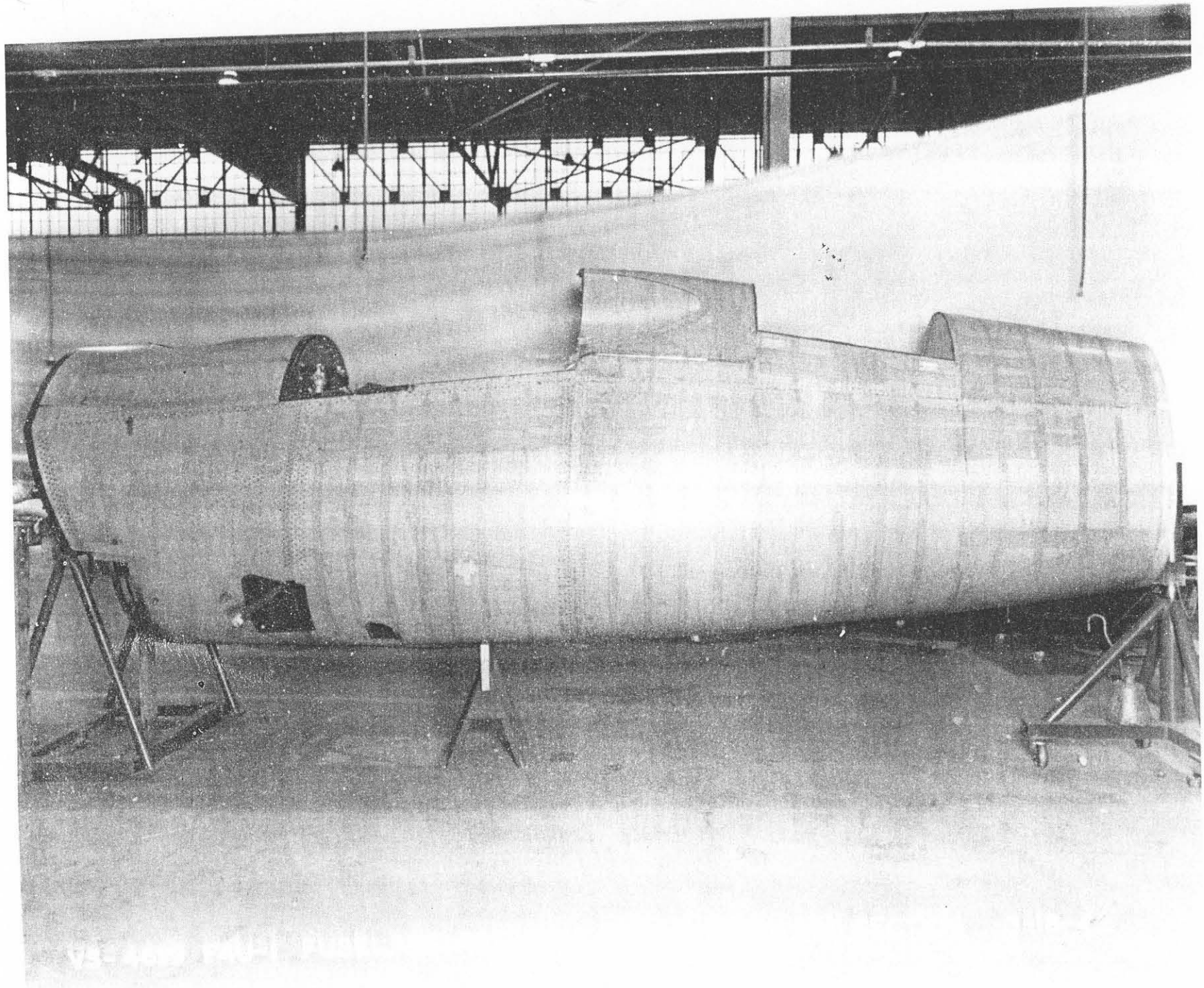
The metal (.032 alclad sheet) tail cone is attached to the aft section fuselage skin by twelve (12) No. 8 flat head machine screws. The fuselage tail fairing, .032 alclad sheet, is attached to the base of the tail cone by four (4) No. 6 countersunk head machine screws.

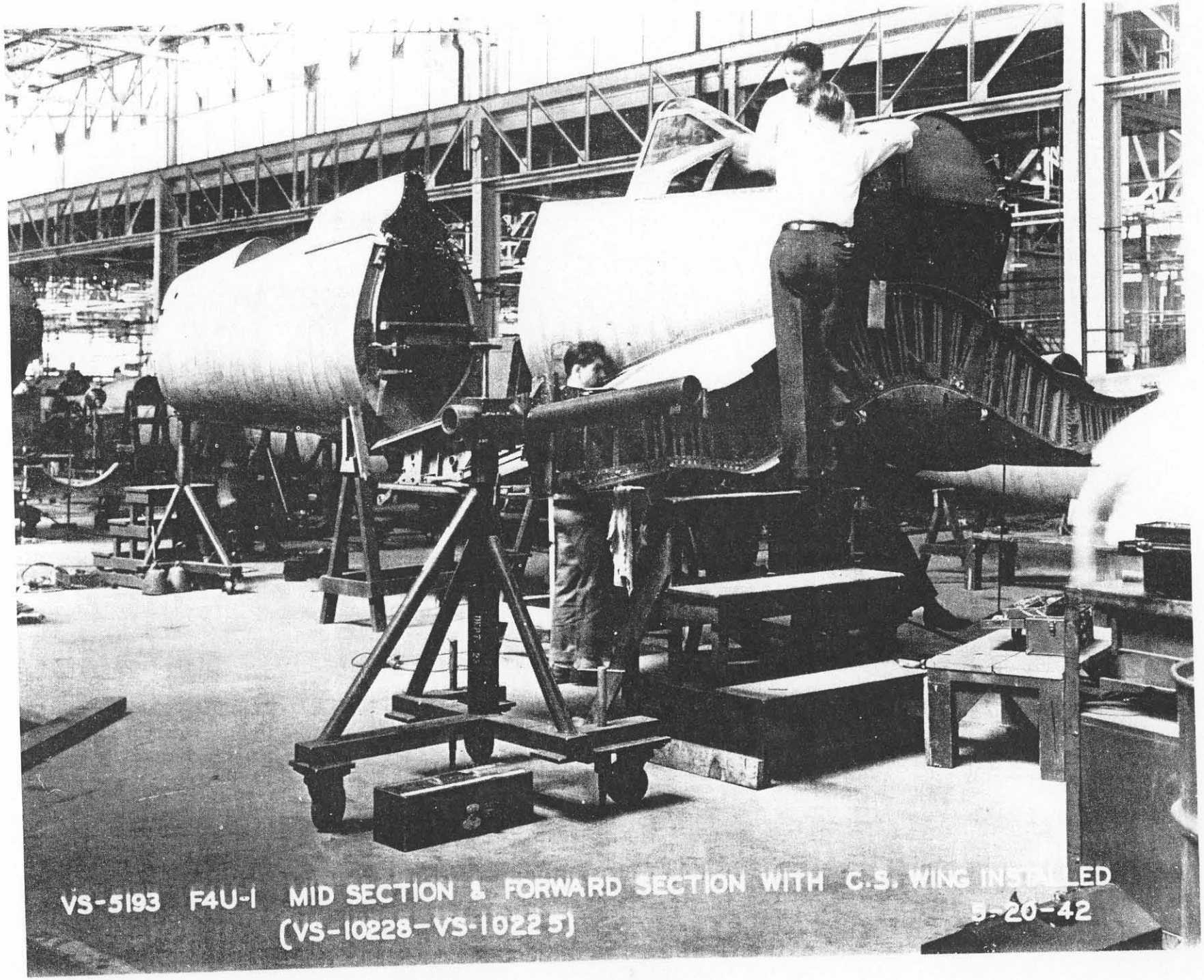
STEPS

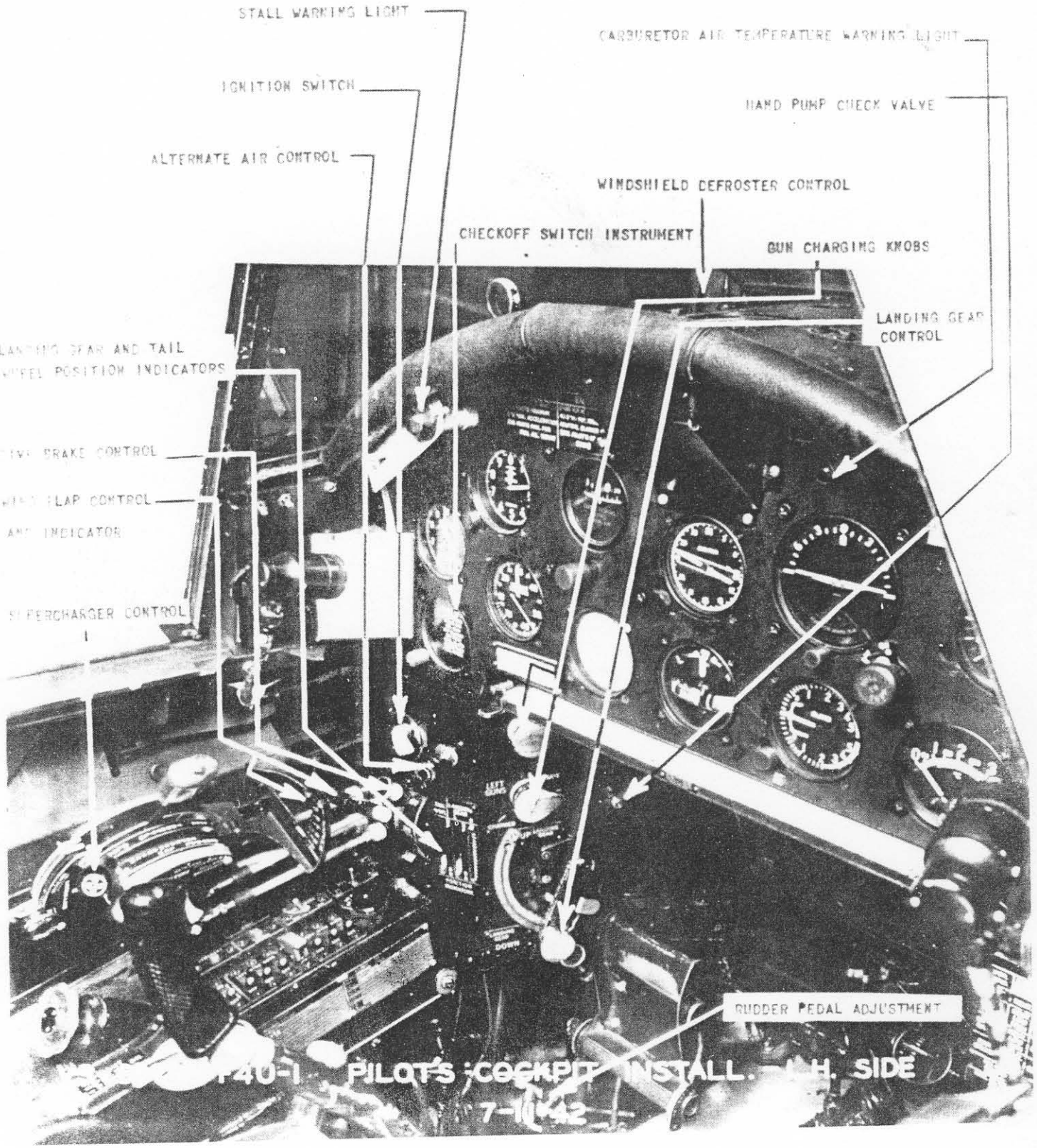
Steps and hand grips are located on the center section to afford access to the cockpit cabin. An additional double step is provided on the right hand side of the fuselage to facilitate entrance to the cockpit and servicing of the cockpit. The steps and hand grips are of the collapsible door type which gives a smooth surface to the skin on the outside.

REPAIR

For complete details on the repair procedure for the Body Group refer to the "Repair Manual for F4U-1, FG-1 and F3A-1 airplanes".

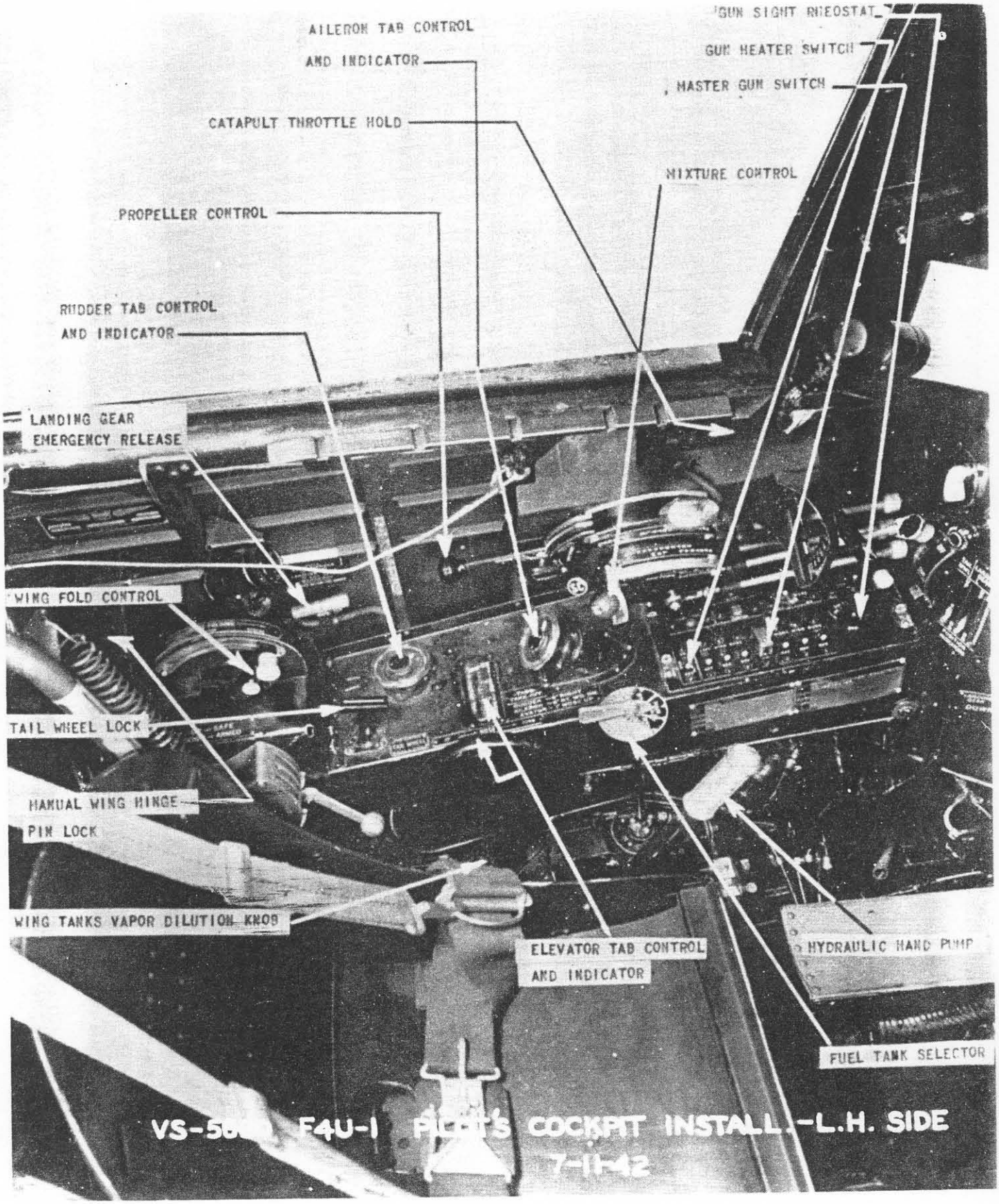


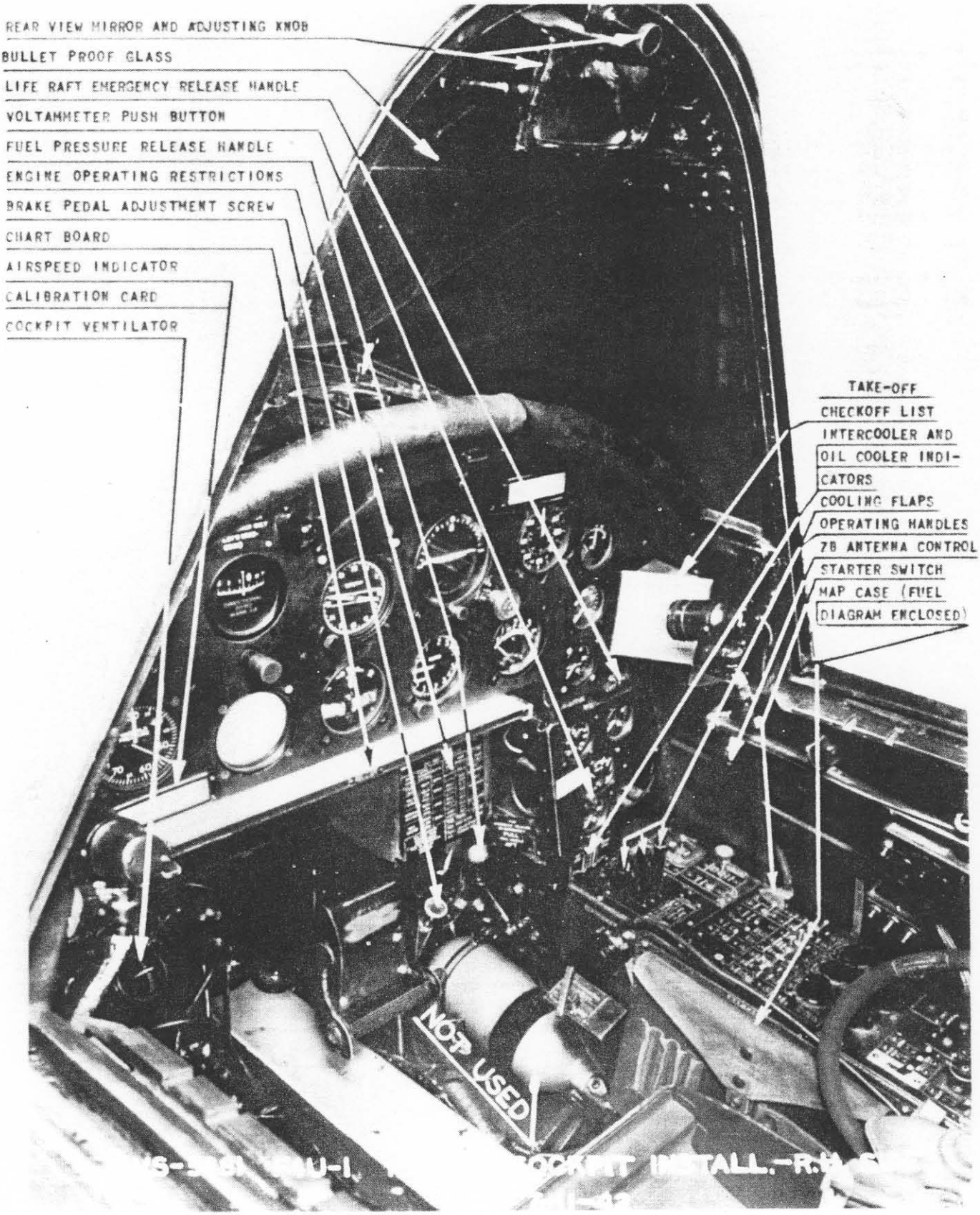

VS-5193 F4U-1 MID SECTION & FORWARD SECTION WITH C.S. WING INSTALLED
(VS-10228-VS-10225)
5-20-42

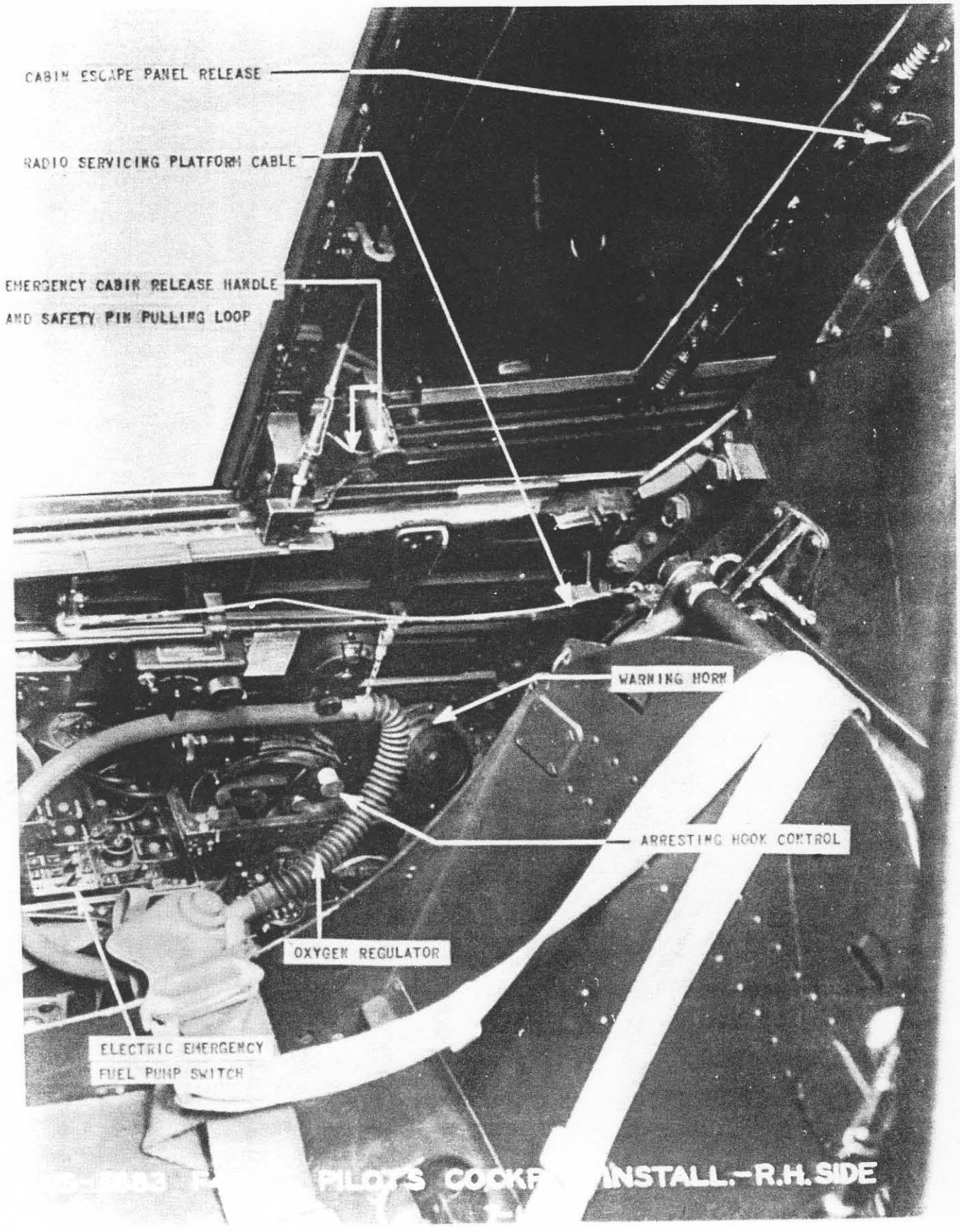


P40-1 PILOT'S COCKPIT INSTALL. - L.H. SIDE

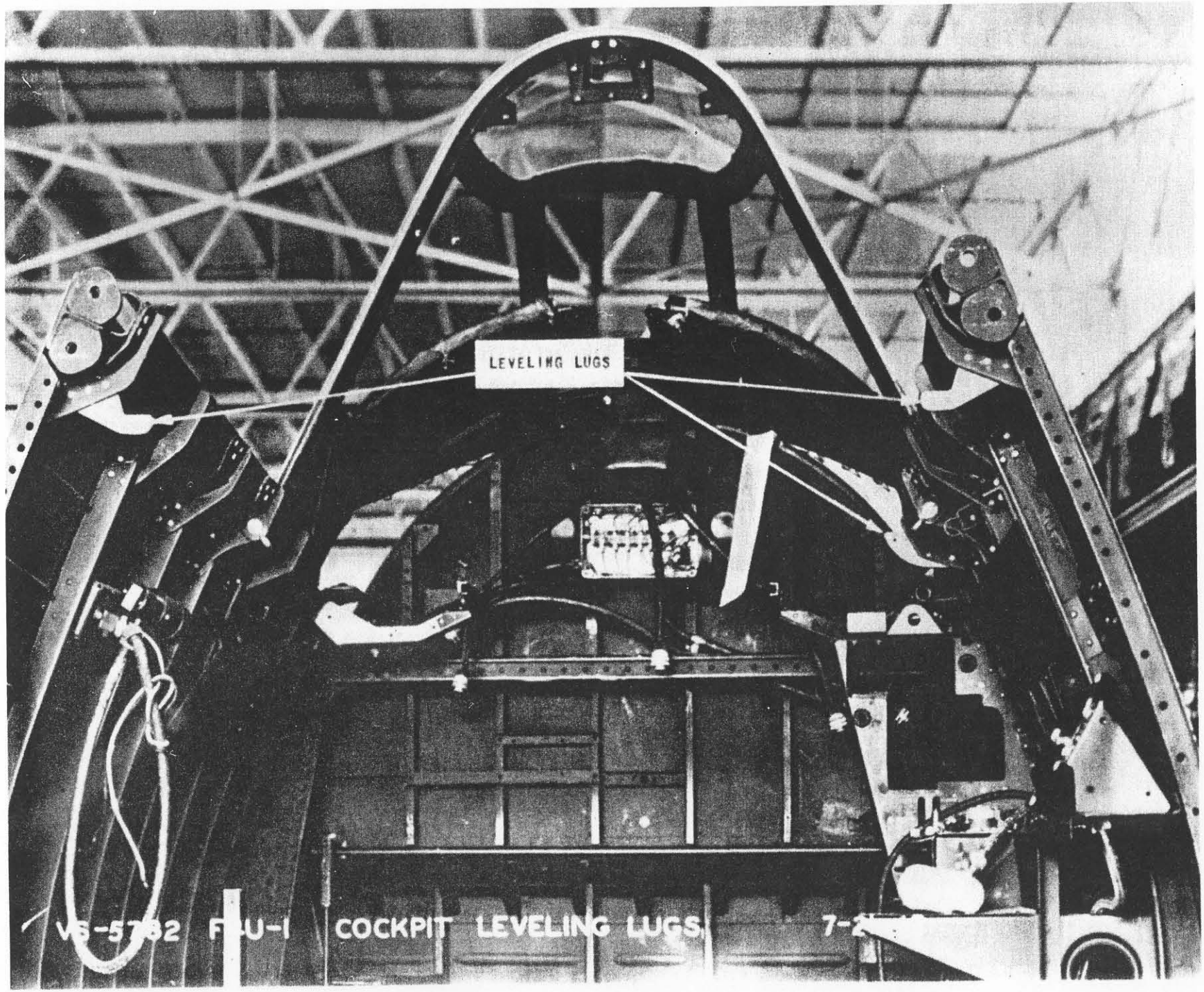
7-11-42


GUN SIGHT RHEOSTAT
GUN HEATER SWITCH
MASTER GUN SWITCH
AILERON TAB CONTROL
AND INDICATOR
CATAPULT THROTTLE HOLD
MIXTURE CONTROL
PROPELLER CONTROL
RUDDER TAB CONTROL
AND INDICATOR
LANDING GEAR
EMERGENCY RELEASE
WING FOLD CONTROL
TAIL WHEEL LOCK
MANUAL WING HINGE
PIN LOCK
WING TANKS VAPOR DILUTION KNOB
ELEVATOR TAB CONTROL
AND INDICATOR
HYDRAULIC HAND PUMP
FUEL TANK SELECTOR
VS-5[illegible] F4U-1 PILOT'S COCKPIT INSTALL.-L.H. SIDE
7-11-42


REAR VIEW MIRROR AND ADJUSTING KNOB
BULLET PROOF GLASS
LIFE RAFT EMERGENCY RELEASE HANDLE
VOLTAMMETER PUSH BUTTON
FUEL PRESSURE RELEASE HANDLE
ENGINE OPERATING RESTRICTIONS
BRAKE PEDAL ADJUSTMENT SCREW
CHART BOARD
AIRSPEED INDICATOR
CALIBRATION CARD
COCKPIT VENTILATOR
TAKE-OFF CHECKOFF LIST
INTERCOOLER AND OIL COOLER INDICATORS
COOLING FLAPS OPERATING HANDLES
ZB ANTENNA CONTROL
STARTER SWITCH
MAP CASE (FUEL DIAGRAM ENCLOSED)
NOT USED



PILOT'S COCKP[illegible] INSTALL.–R.H. SIDE


LEVELING LUGS
VS-5782 F4U-1 COCKPIT LEVELING LUGS 7-2

POWER PLANT GROUP

REFERENCE DRAWINGS

VS-10300	Power Plant Installation
VS-10301	Engine Controls Installation
VS-10302	Engine Accessories Installation
VS-10305	Starting System Installation
VS-10306	Oil Tank Assembly
VS-10307	Lubrication System Installation
VS-10315	Exhaust Collector Installation
VS-10325	Fuel System Installation
VS-10326	Main Fuel Tank Installation
VS-10350	Power Plant - Removable Section
VS-10601	Side Panel Assembly - Engine Section
VS-10620	Cowl Assembly - Nose - Engine Section
VS-10645	Cowling Installation - Engine Section
VS-10650	Engine Section Group
VS-10655	Flaps Installation - Engine Cowl
VS-10950	Lubricating Diagram
VS-11360	Fuel System Installation - Outer Panel
VS-12343	Engine Control Unit
VS-13380	Diagram - Fuel System
VS-13382	Vapor Dilution System
VS-16657	Fuel Tight Procedure - Tank - Outer Panel - "Included in Wing Section".

POWER PLANT

(Reference: VS-10300)

ENGINE

The airplane is powered with a Pratt and Whitney Double Wasp Model R-2800-8 engine (2 stage, 2 speed) rated at 1675 horsepower at 2550 RPM from sea level to 5500 feet, 1625 horsepower at 2550 RPM at 15,000 feet, and 1550 horsepower at 2550 RPM at 21,500 feet. For take-off the engine is rated at 2000 horsepower at 2700 RPM. The gear ratio is 2:1.

The military rating for the Pratt and Whitney Model R-2800-8 engine (2 stage, 2 speed), based on five minute operation, is as follows: 2000 horsepower at 2700 RPM at 1000 feet; 1800 horsepower at 2700 RPM at 13,500 feet; and 1650 horsepower at 2700 RPM at 22,500 feet. Rated over-speed for thirty seconds is 3060 RPM.

ENGINE OPERATING INSTRUCTIONS

(See Pilot's Handbook)

Reference: Bu Aer Technical Orders: 35-38, 21-39, 39-41, 55-41, 5-40, 18-42, 43-42.

Bu. Aer. Technical Orders: 27-39, 16-42, 37-41, 2-42.

PROPELLER

The airplane is fitted with a Hamilton-Standard three-bladed, constant speed, hydromatic propeller. The blade design is No. 6443A-21; the hub design is No. 23E-50-21; the governor design is No. 4G10-G5C. The total range of the blade angle control is 44°. The nomi-

nal diameter of the propeller is 13 feet 3 inches. The normal low pitch stop setting is 12°. The normal high pitch stop setting is 54°. These angles are measured at the 72 inch station.

The propeller control is discussed under "Power Plant Controls".

Reference: Bu Aer Technical Orders: 5-38, 5-40.

POWER PLANT REMOVAL

(Reference: VS-10350)

Note: Refer to VS-10350 for items to be removed before attaching the power plant hoisting sling and proceeding with removal of the power plant section. A detailed listing of items to be removed is given on this drawing.

1. The following items must be disconnected or detached at the firewall when removing the power plant unit. See VS-10350.

Right Hand Side:

(a) Vapor Return Line

(b) Oil Pressure Line

(c) Manifold Pressure Line

(d) Vacuum Line

(e) Hydraulic Line to Engine Cowl Flap Strut

(f) Hydraulic Line from Engine Cowl Flap Strut

(g) Jack Plug - Generator, Starter Switch, Tachometer, Oil Inlet Thermometer, Carburetor Air Thermometer.

(h) Thermocouple

(i) Heater Line

Left Hand Side:

(a) Engine Controls Connections

(b) Fuel Pressure Vent Line

(c) Fuel Pressure Line

(d) Hydraulic Line from Regulator to Reservoir

(e) Ignition Conduit

(f) Hydraulic Line - Suction to Hand Pump

(g) Hydraulic Line - Pump to Regulator

2. Insert the lifting links on the VS-11392 engine sling in the engine lifting eyes. (NOTE: The airplane must be in the thrust line level position in order to use this sling). Insert the hoisting hook through the proper hole in the VS-11392-2 bar. The proper hole in the bar shall be determined on the following considerations:

(a) Extreme forward hole: - Bare engine - power plant unit with propeller but without intercoolers.

(b) Center-forward hole: - Power plant unit complete with propeller and intercoolers.

(c) Center - Aft hole: - Power plant unit without propellers or intercoolers.

(d) Extreme aft hole: - Power plant unit with intercoolers but without propeller.

3. Apply sufficient hoisting force to the sling to relieve the mount bolts of the engine weight.

4. Remove the upper engine mount attaching bolts at the firewall. Caution: Care should be exercised to insure that the engine is not allowed to swing so as to impose binding loads on the mount, the firewall, the center section main beam or the upper longeron fittings after the upper bolts are loosened.

5. Remove the lower engine mount bolts and swing the power plant clear, steadying it to keep the thrust axis in a substantially horizontal position so that the lifting sling does not damage the engine or other parts.

The power plant unit is installed by reversing the above procedure.

ENGINE MOUNT

(Reference: VS-10650)

The engine mount is built of torch welded, chrome-molybdenum steel tube (44T18), sheet (47S14), and bar (46S23 and 46S28). The engine is supported on six (6) flexible mounting brackets attached to the mount as shown on drawing VS-10650. Attachment of the upper mount fittings to the longerons (through the firewall), and the lower mount fittings to the center section beam is shown on this drawing also. (See Photograph VS-5247). If removal of the engine mount is necessary, the attaching bolts should be tightened on re-installation, in strict accordance with the torque wrench values given on VS-10650.

WARNING: In case of sudden engine stoppage, caused by obstruction of propeller rotation, remove the engine mount and check the mount attachment fittings by proof loads. Failure of the fittings is most likely to occur in the lower fittings, especially the lower left fitting.

POWER PLANT CONTROLS

1. PROPELLER GOVERNOR

The constant speed control unit, Hamilton Standard Model 4G10, is mounted on the engine nose. It is manually operated from the engine control unit, VS-12343, on the left hand side of the pilot's cockpit by means of a sliding control.

THE MAXIMUM GOVERNING SPEED SHOULD BE SET FOR 2700 RPM

(a) To adjust the propeller governor control for maximum RPM, break the lockwire and loosen the four screws which clamp the ring to the disc on the governor. When these screws are loose, the torque shaft may be rotated independently of the lever. See photograph VS-5180.

(b) Pull the control lever in the cockpit back to minimum RPM position.

(c) Rotate the governor shaft as far as it will go in a clockwise direction when viewed from the left side of the airplane. While held in this position, tighten and lockwire the four screws, re-clamping the ring, disc and lever.

(d) Set the stop screw on the governor head to give 90° total motion to the torque shaft. This will give approximately 2700 RPM for take-off.

(e) For final setting of the stop screw for maximum RPM, set the control lever forward to 2700 RPM in flight, then land, and, without changing the setting of the governor control from the position which gives this speed, screw in the stop screw until it just touches the lever.

(f) Tighten the jam nut.

2. THROTTLE AND MIXTURE CONTROLS

The throttle and mixture controls consist of an engine control unit, VS-12343, mounted on the left hand side of the cockpit, with Simmonds controls running forward through the firewall to jackshafts which transmit the push-pull motion from the control levers to push rods, thence to bell cranks and finally to the appropriate levers on the carburetor. The jackshafts are mounted on supports clamped to the engine mount. The bell cranks are mounted on an idler attached to a support clamped to the engine mount, and further restrained by an engine-to idler supporting rod. This arrangement eliminates the transmission of any engine motion which might affect throttle or mixture operation.

ADJUSTMENTS

All rod ends in the throttle and mixture linkages are threaded and fitted with Fafnir self-aligning ball-bearing rod ends. Adjustments may be made at the rod ends connected to the jackshafts, the rod ends connected to the bell cranks, or the rod ends connected to the levers on the carburetor.

THROTTLE AND MIXTURE CONTROL RIGGING

The basic requirement in rigging the control linkages is that the movement of the controls be limited by the stops on the carburetor and not by stops or interference elsewhere in the linkage. All adjustment should be performed on the push rods between the carburetor and bell cranks; however, if the total adjustment provided is apparently too long or too short, adjustment may be made on the rods between the jackshafts and bell cranks. Other adjustment points are provided in order to insure the non-interference of the throttle and mixture controls with foreign structure.

3. SUPERCHARGER CONTROL

The supercharger is controlled from the same units as the throttle and mixture. The control is a Simmonds running from the VS-12343 unit through the firewall and to the lever on the supercharger. Adjustment in the control is provided on the self-aligning, ball-bearing rod ends at the supercharger. Adjust so that the full travel of the control is governed by the stops on the supercharger.

4. ALTERNATE AIR CONTROL

The alternate air control, an Arens controlled from the left hand auxiliary control panel, runs forward from a push-pull control knob through the firewall to a jackshaft mounted on a support attached to the front face of the firewall; the jackshaft then transmits the push-pull motion through a push rod to a bell crank assembly attached to the valve on the carburetor air entrance duct.

Adjustments may be made at the forward end of the Arens control and at the lower end of the push rod. Adjust so that the valve is flush with the upper surface of the duct when the control knob is pushed forward to the closed position.

PROPELLER ACCUMULATOR

The propeller accumulator (Simmonds-Olaer H101, Simmonds Aerocessories, Inc., New York, N.Y.) is mounted on the left hand side of the airplane forward of the oil tank armor plate. Its purpose is to supply oil under pressure to the governor at times when, during aerobatics or combat, the normal flow of engine oil to the governor might be temporarily interrupted. The procedure for disassembly of the accumulator for inspection or repairs is as follows:

1. Release the pressure in the accumulator at the tire-type air valve, and remove the valve core.

2. Remove the accumulator from the airplane by detaching the hose connection and removing the clamp bolts.

3. Remove the solder slug from the spanner wrench hole in the closure cap, and take off the cap, using a spanner wrench or a strap wrench. Pull out the plug and the sealing gasket.

4. Remove the two nuts and the washer over the valve stem shoulder.

5. To remove the separator bag from the accumulator shell, a special disassembly tool, which is procured from the manufacturer, must be used. This tool consists of a short rod which engages the valve stem, connected by a length of swaged-on cable to a long, thin rod. Attach the short rod to the valve stem and push the stem and the rod into the shell. Insert the long rod into the shell, work it around the bag and push it out through the hole in the opposite end of the shell. Turn the bag over in the shell by pulling on the attaching cable. Grease the mouth of the shell and gently withdraw the bag.

Clean the inside of the shell and inspect for sharp edges, pits, and protrusions. Inflate the bag to twice normal size and examine for flaws, breaks and leaks. In case of bag failure a new one must be installed.

To reassemble the accumulator:

1. Remove the valve core. Place a small quantity of oil in the bag, wash it around to wet the inside thoroughly. Eject the excess oil, squeeze out all air, and attach the special pull-through rod to the valve stem. Insert the rod in the mouth of the shell and through the valve hole in the opposite end, grease the shell mouth and gently pull the bag into the shell. Remove the pull-through rod and replace the washer and the nuts, holding the valve stem with the wrench flat provided, to keep it from turning as the nuts are drawn up tight.

2. Replace the valve core and the valve cap.

3. Place the sealing gasket against the shoulder of the plug, insert the plug in the mouth of the shell, replace the cap and tighten with a spanner wrench or a strap wrench.

After the accumulator has been reassembled, test under pressure for leaks in the valve, separator bag, and around the gasket, then reinstall in the airplane.

NOTE: The accumulator is to be preloaded with air to a pressure of 300 p.s.i., not more than 24 hours before engine run in. Accumulator pressure should be checked daily when the airplane is in service.

Reference: Bu Aer Technical Order: 49-42

STARTING SYSTEM

(Reference: VS-10305)

These airplanes are equipped with an Eclipse, Type III, Cartridge Starter, the breech of which is attached to a tripod mounted on the engine. The breech is readily accessible through a door hinged to the right hand side panel of the accessory compartment. The door is locked by two Dzus fasteners. The ammunition magazine, capacity 8 cartridges, is fastened to the inside of the right hand side panel and is accessible through the cartridge starter breech access door.

The contacting switch for this starter is located on the main switch panel on the right hand shelf in the pilot's cockpit. The electric primer unit (reference

VS-10427) is mounted on the carburetor, the primer switch being located beside the starter switch.

The booster coil, furnished with this starter, is supported from the engine mount. The booster coil is accessible upon removal of the right hand side panel of the accessory compartment.

NOTE: The cartridge ordinarily used with this starter contains 35 grams of powder. A 40 gram cartridge may be used with this starter in cold weather.

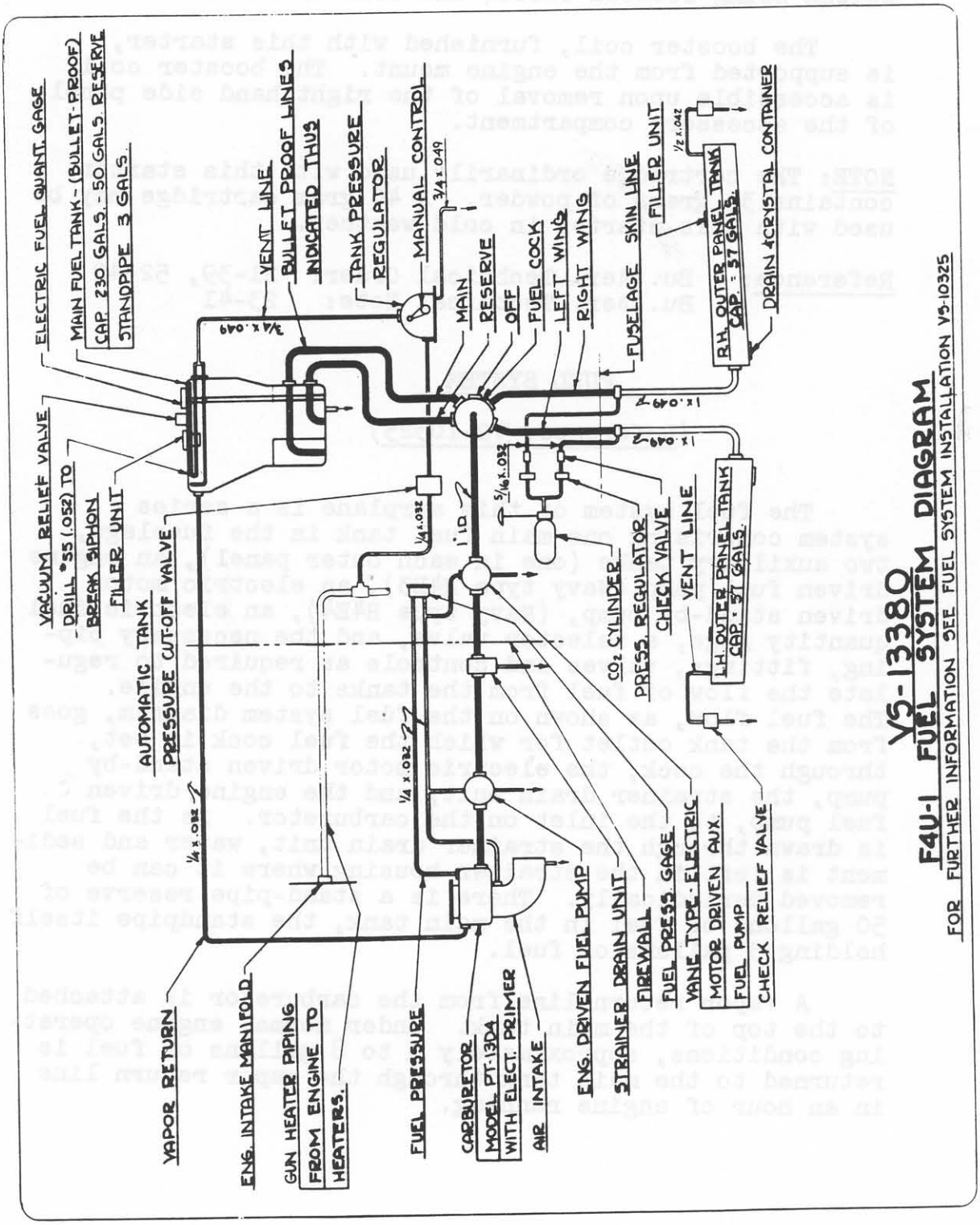
Reference: Bu. Aer. Technical Order: 21-39, 52-42
Bu. Aer. Technical Note: 23-41

FUEL SYSTEM

(Reference: VS-10325)

The fuel system of this airplane is a series system comprising one main fuel tank in the fuselage, two auxiliary tanks (one in each outer panel), an engine driven fuel pump (Navy type H4E3), an electric motor driven stand-by pump, (Navy type H4E4), an electric fuel quantity gage, a selector valve, and the necessary piping, fittings, valves and controls as required to regulate the flow of fuel from the tanks to the engine. The fuel flow, as shown on the fuel system diagram, goes from the tank outlet for which the fuel cock is set, through the cock, the electric motor driven stand-by pump, the strainer drain unit, and the engine driven fuel pump, to the inlet on the carburetor. As the fuel is drawn through the strainer drain unit, water and sediment is left in the strainer housing where it can be removed periodically. There is a stand-pipe reserve of 50 gallons of fuel in the main tank, the standpipe itself holding 3 gallons of fuel.

A vapor return line from the carburetor is attached to the top of the main tank. Under normal engine operating conditions, approximately 5 to 8 gallons of fuel is returned to the main tank through the vapor return line in an hour of engine running.



F4U-1 FUEL SYSTEM DIAGRAM

VS-13380

FOR FURTHER INFORMATION SEE FUEL SYSTEM INSTALLATION VS-10325

NOTE: At any time the airplane is operated with a full main tank (230 gallons of fuel) and an additional quantity of fuel in the outer panel wing tanks, it is imperative that sufficient fuel be used from the main tank first to allow space for the vapor return. If this directive is not adhered to, the returned fuel will overflow through the main tank vent lines. Starting and warming up with the selector valve control on "Main" will remove a sufficient quantity of fuel from the main tank so that no further attention need be given to vapor return). The fuel selector control should be turned to "Reserve" on take-offs and landings only, and as otherwise directed in the Pilot's Handbook. After take-off, fuel carried in the wing tanks should be used first, main tank last.

A vapor dilution system is provided in the left and right wing tanks in order to furnish protection against fire or explosion under gunfire. The control, which is located just below the elevator tab control and operated by turning counterclockwise (see photograph VS-5680), releases carbon dioxide from a high pressure cylinder to the wing tank fuel lines, thereby providing an inert atmosphere within the fuel tank. The vapor dilution system has been designed to prevent an accumulation of pressure within the wing tanks in excess of that for which the tanks were designed. Two check valves are incorporated in the lines of the vapor dilution system in order to prevent a return flow of the carbon dioxide once the CO_2 is released to the wing tanks. The carbon dioxide should be released immediately prior to combat. Warning: The outer panel tanks must not be purged when operating on fuel from these tanks. Injection of CO_2 would result in interruption of fuel flow through these lines.

Reference: Bu. Aer. Technical Order: 55-41

MAIN FUEL TANK

(Reference: VS-10326)

The self-sealing, aromatic resistant main fuel tank is suspended from six hangers in the tank compartment just forward of the pilot's cockpit. The tank is braced internally by means of cables as shown in Section D-D of the reference drawing.

The direct-lift, float-type electric fuel quantity gage, vacuum relief valve and vent lines are installed as a unit, the fuel quantity gage being attached between the base and top of the tank. See Section D-D of VS-10326. The venting arrangement is such as to permit rapid refueling with high duty equipment and to prevent loss of fuel during catapulting, arresting and acrobatics. Pressure differential relative to atmospheric pressure within the tank and external atmospheric pressure is relieved by a vacuum relief valve. (Note: on reattaching the cowl deck above the tank, the VS-13379 sponge rubber pad should be fitted snugly between the cowl deck and the fuel gage, as shown in Section D-D of the reference drawing, in order to eliminate possibility of damaging the gage).

The capacity of the main fuel tank is 230 U.S. gallons. The last 50 gallons is kept in reserve by the use of a standpipe.

The filler cap, gasoline tight under ten pounds pressure, is on the upper surface of the tank.

The fuel tank gage is located on the main instrument board in the cockpit. With the airplane in the thrust line level attitude, the gage is marked to indicate the fuel quantity in the main tank in 10 gallon increments from 10 to 200 gallons.

Strainers of ten mesh monel screen are provided at the top of the standpipe and at the "Reserve" outlet.

The drain plug is located at the bottom of the main tank. The plug may be opened by inserting the VS-17519 wrench provided in the tool kit and turning counterclockwise. When the drain has been closed, lockwire the plug to the VS-13388 nut on the drain fitting. Access to the drain plug is obtained by removing the fourteen (14) screws in the cover plate attached to the fuselage skin beneath the fuel tank.

The main tank cover, VS-17228, may be removed for inspection of the tank interior or for disconnection of attachment fittings prior to removal of the tank. Removal of the cover is accomplished by removing the forty six (46) AN-510-C10-14 screws which attach the cover to the cowl deck, VS-11835, above the fuel tank.

Removal of the main fuel tank shall be performed as follows:

1. Remove the tank cover, VS-17228.

2. Disconnect all tank-to-structure attachments from the interior of the tank. (The hole provided by removal of the cover is large enough to permit access to a man of average proportions).

3. Disconnect the two fuel lines, "Main" and "Reserve", at the fittings on the lower left hand side of the fuel tank. (Lockwire the nuts on the fittings on reassembly).

4. Disconnect the Camloc fasteners around the edge of the cowl deck.

5. Insert and "open" the hoisting saddle. Withdraw the fuel tank from the tank compartment.

WARNING: It is imperative that personnel working inside of the self-sealing fuel tank wear shoes or"sneakers" with rubber bottoms (without heels), to avoid damaging the self-sealing cell.

Reference: Bu. Aer. Technical Order: 46-41

FUEL MEASURING GAGE

The drawing on the following page shows a fuel measuring gage for checking the quantity of fuel in the main tank in cases when the fuel quantity gage is damaged or its accuracy questioned. To use the gage, insert it in the fuel filler neck opening until it rests on the crossbar, which should point fore and aft. The airplane should be in the three-point attitude when using this gage.

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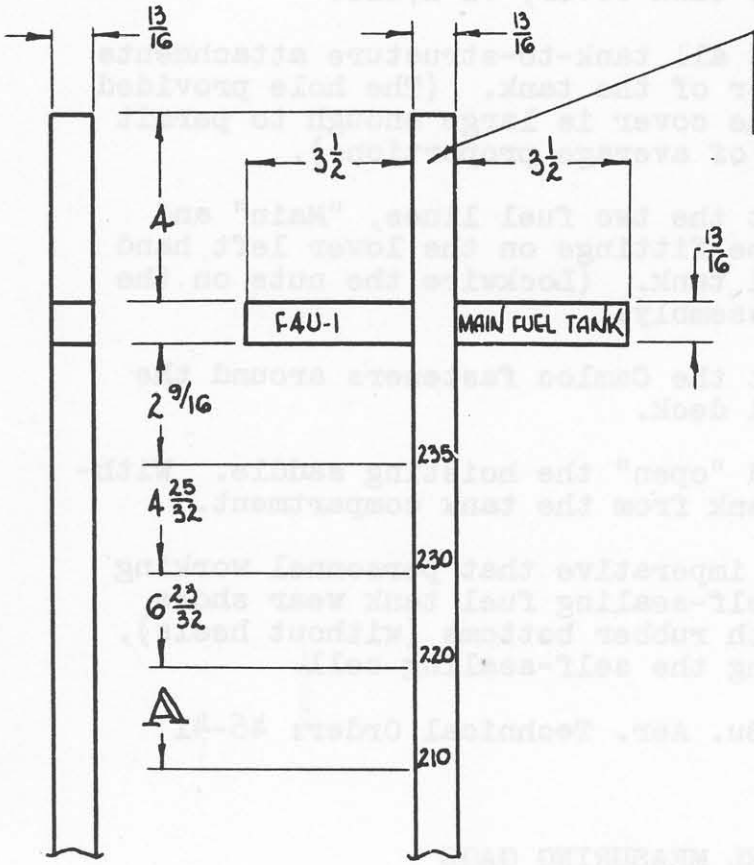
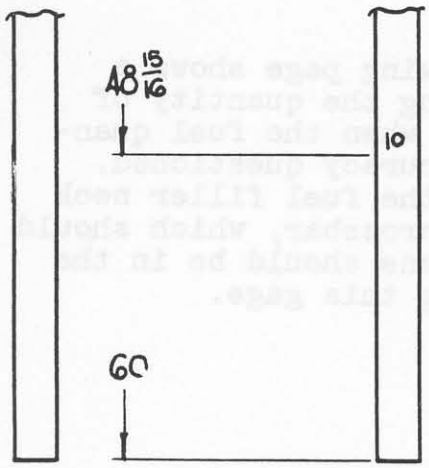
F4U-1, F3A-1, FG-1, FUEL MEASURING GAGE

MAIN FUEL TANK





PLACE FOLLOWING NOTE HERE:
"THIS GAGE IS APPROXIMATE AS FUEL TANK IS FLEXIBLE."

NO. OF GALLONS	A
235	2 9/16
230	4 25/32
220	6 23/32
210	8 7/8
200	10 11/16
190	12 5/16
180	13 3/4
170	15 3/8
160	17 3/16
150	18 11/16
140	20 11/32
130	22 3/32
120	23 3/4
110	25 11/16
100	27 23/32
90	30 9/16
80	33 1/2
70	34 5/16
60	36 11/32
50	37 5/8
40	40 7/16
30	43 3/16
20	45 1/2
10	48 15/16

MATERIAL: WOOD

INSTRUCTIONS FOR REPAIR OF

SELF-SEALING FUEL CELLS

1. This procedure produces a permanent repair. The size and degree of repair is not limited. However, the degree of effective repair of self-sealing fuel cells will depend upon the facilities available, experience, and the amount and seriousness of the damage, Cells that are considered beyond repair should be scrapped in such a manner as to save flat areas that can be used in the repair of less severly damaged cells, and the fittings to replace damaged fittings of cells otherwise usable.

2. The following equipment is required to effect repairs by the following method:

1/4" Steel Hand Roller
3/32" Steel Plain Hand Roller
Shears
Mirror
1" Paint Brush
#40-80 Emery Cloth
Sharp Shoe Knife
Spatula
Clean Lintless Rags

3. The following Materials are required to effect repairs by this method:

1 can Acetone Solvent No.1
1 can Ethylene Dichloride Solvent No. 2
1 can Synthetic Rubber Dough 3 M, Ex. 55257*
1 can of accelerator for Dough
1 can Solvent resisting cement, Thiokol E.C. 570*
1 roll .060" solvent resisting synthetic sheet cured Chemigum or Ameripol**

*From Minnesota Mining & Mfg. Co.
**From Goodyear Tire & Rubber Co., or B.F. Goodrich Co. similar to FTL-1 ON or 411B liner without nylon

4. The accelerator and dough are to be prepared in the following manner.

Mix the accelerator thoroughly so that the liquid and sediment are a homogeneous paste. Add slowly 10 parts of mixed accelerator to 100 parts of dough by weight and stir continuously until homogeneous. (Caution: Mix only enough dough and accelerator for immediate use. Dough older than two hours, or in a tough or non-tacky condition should not be used.)

5. Preparation

Drain all gasoline from the cell and allow it to become thoroughly dry. In case there is evidence of water close to the injury, swab with acetone (Solvent No. 1) to aid removal of water before drying. Drying may be hastened by using rapid air circulation and heat. The temperature of tank should not go higher than 120°F. (49°C). When the sealing gum has resumed its normal appearance and is no longer swollen, repairs may be begun.

6. Repairs

Buff or dissolve with acetone all sloshing compound, if present, from inner layer surface for a distance of three inches (3") in all directions from edge of injury. (Important: Poor adhesion of patch to inner layer material will result if the sloshing compound is not completely removed).

7. Buff the inner layer thoroughly three inches in each direction from the injury. If the cell exterior is accessible, buff three inches in each direction until thefabric cords are exposed.

8. Open and aligr the injury. Swab lightly with solvent No. 2 and fill injury with mixed dough. On the exterior, place dough over the injury and extending three (3") in each direction from the injury and to a depth of one quarter inch (1/4"). Place dough on interior over injury and extending one half inch (1/2") in all directions and one-eighth inch (1/8") deep over the injury and tapering off to form a smooth mound. Use a blunt spatula and work the dough like putty. If the exterior is not accessible, the dough will have to be extruded through the injury to the proper dimensions.

9. Cover dough on cell interior with a patch large enough to extend three inches (3") in all directions from injury. Buff patch to remove all gloss. Clean buffed patch and cell surface with solvent No. 2. Apply one medium coat of cement to liner and patch. Allow to dry for 10 to 15 minutes.

Swab lightly with solvent No. 2 to make surfaces tacky. Clean patch over injury and roll down.

10. Roll down patch in the following manner. Stick one end of patch first. Then gradually roll down to other end of patch, moving roller perpendicular to long dimensions of patch and perpendicular to direction of advance of rolled down area. During each movement of roller, part of roller must overlap previously rolled down area to avoid trapped air. Do not let any part of the patch touch until rolled down in prescribed manner or trapped air will result. After rolling down, the edges should be rerolled to insure good adhesion.

11. After patch has been applied and had about 1/2 hours drying time, place one coat of cement on patch and the area from which the sloshing compound was removed.

12. Allow tank to dry for 24 hours at 100°F. before filling with fuel. Circulate air to aid the removal of solvent.

13. Repair cell exterior, whenever accessible, either with dough as described above, or by the following method:

> Cut a patch large enough to extend two and one-half inches (2-1/2") in all directions from the edge of the damaged area. Buff patch to remove all gloss and buff exterior cell surface as noted above, clean patch and exterior surface with solvent No. 2. Apply two coats of cement to cell surface and one coat to the buffed patch. Allow 10 to 15 minutes drying time between coats. Swab surfaces lightly with solvent No. 2 before applying patch. Roll down as noted above. Allow to dry for one-half hour and paint over patch and buffed area with one coat of cement. Allow patch to dry 24 hours at 100° F. before using cell.

14. Corner Repairs

Prepare patch stock and cell surface as noted above. Avoid wrinkling or stretching by cutting a single slit radially from the edge of the patch to the center, which will form the apex of the corner. Fit the patch, trim to size, and cut the slit so that the lap, it will form will be on a flat side as far from the injury as possible. Outline patch on the cell surface while the patch is in the correct position so it can be returned so that position after cementing.

15. Apply cement as noted and place patch over outline. (Caution: Be sure to place patch so that the outline on the cell and the edge of the patch coincide and so that the inner end of the slit falls directly in the corner).

16. Stick down one edge of slit with finger and roll down patch starting from stuck-down edge and proceeding around patch. Carefully observe the prescribed procedure to avoid wrinkles and trapped air.

17. Apply cement to the surfaces that form the lap. Be careful to coat the inner end of the slit in the patch. Roll down. Paint edges with cement, being careful to cover well the inner end of the slit in the patch.

18. Cover slit with a narrow strip of patch stock and roll down securely.

19. If edges of patch do not stick down well, wipe loose places with a clean, lintless rag dampened with solvent, let dry a short time and reroll. If adhesion is still poor, apply one more thin coat of cement, let dry, and roll down. If patch is still loose at any point, remove and scrap clean surfaces of cement, and apply a new patch.

20. A second patch is put on in the same manner over the first patch and extending beyond the first gum patch at least 1/2". Place slit on a different plane surface if possible.

21. Outside Repair

Outside corner repairs are made in the same manner as the inside repair, but following the specified outside repair procedure. Use only one patch and cover lap with a strip of repair sheet in such a manner that the strip will extend one inch on each side of outside edge of lap and from apex or corner to outer edge of patch.

22. Loose Laps

Repair loose lap seams by using the prescribed procedure of buffing, washing, cementing rolling down and painting of the loose lap without the use of additional patches.

23. Loose Patches

Treat in the same manner as a loose lap unless it is obviously better to replace the patch with a new one using the prescribed procedure.

24. General

All repaired tanks must dry at least 24 hours at 100°F. (38°C.) after last repair is completed before being filled with gasoline. Repairs are improved by a longer drying time. The temperature should not be above 120°F. (49°C.)

Always wash cement out of brush with solvent immediately after use.

25. Caution:

Solvent and cement vapors are somewhat toxic if inhaled over a long period of time. A respirator designed for organic vapors should be worn if operator is exposed to high vapor concentrations (working inside liners). If practicable air should be circulated through the cell to prevent high concentrations of vapors.

26. Danger

Vapors are highly inflammable and should not be allowed to accumulate. No sparks, smoking or open flames should be allowed near place where cementing is being done.

PRESSURE SYSTEM - MAIN FUEL TANK

(Reference: VS-10325, VS-10270, VS-13380)

In order to prevent loss of fuel pressure and to guard against the possibility of vapor lock developing at high altitudes, a pressure system is installed whereby, above 12,000 feet altitude, approximately, a constant pressure of 3½ pounds per square inch, with respect to external atmosphere is maintained above the gasoline surface in the main fuel tank.

The pressure system consists of a line from the intake manifold to the pressure regulator, the main tank vent line continuing from the regulator to the main tank. The system contains two valves in series, one valve on the line on the intake manifold and the other on the pressure regulator. Pressure can be transmitted only with both valves in the "on" position. The cut-off valve on the line from the intake manifold is automatic in its action, being operated by a bellows, and will be in the "on" position above 12,000 feet and in the "off" position below 12,000 feet. The second valve is controlled manually by means of an ON-OFF control on the pressure regulator located on the right side of the cockpit beneath the main instrument panel.

Refer to the pilot's handbook for further details concerning the pressure system and its operation.

Reference: Bu. Aer. Technical Orders:
5-40, 55-41

Bu. Aer. Technical Note:
18-42, 28-41

The fuel pressure gage is located on the lower, right hand corner of the instrument board and is marked to indicate the fuel pressure in the system in 1 pound per square inch increments from 0 pounds per square inch to 25 pounds per square inch.

OUTER PANEL TANKS

(Reference: VS-10325, VS-11360, VS-13382)

The integral fuel tanks in the outer panels are assembled with zinc chromate compound between surfaces with flush type rivets, and with bolts, nuts and washers dipped in zinc chromate compound before assembly, as required to make the tanks gasoline tight. For further details concerning tank construction, refer to "Wing Group" and to Finish Specification No. 102 at the back of this manual.

Access for repairs and cleaning is provided through hand holes located at the rear and sides of each tank.

A fuel strainer of ten mesh monel screen is provided at each tank outlet at the inboard end of the tank. A perforated container of potassium dichromate crystals is provided, located near the fuel outlet at the inboard end of each tank, for removing water in the fuel tank.

The fuel is transmitted from the outer panel fuel line to the center section fuel line by means of a swivel joint as shown on reference drawing VS-11360.

Each outer tank has a 57 gallon capacity or a total of 114 gallons for both auxiliary tanks.

The filler cap is on the outboard upper surface of the tank.

No fuel quantity gages are provided on the outer panel tanks.

Refer to "Fuel System" and to the Pilot's Handbook for details of the Vapor Dilution System. Also, see drawings VS-10325 and VS-13382 referenced above.

FUEL LINES

(Reference VS-10325, VS-13380)

The main fuel lines of these airplanes are of bullet proof or self-sealing construction, the fuel lines in the wings being fabricated of aluminum alloy (52S0-44T32) as shown on drawing VS-10325.

SELECTOR VALVE

The fuel selector valve, VS-12397, is secured to a bracket at the bottom of the pilot's cockpit on the left hand side. The control handle and dial are mounted on the auxiliary control board and have five "on" settings, one for each fuel tank (including droppable tank), and one "off" setting. A single shaft, actuated by the control handle, determines the flow of fuel through the desired valve port; i.e., a roller attached to the lower end of the shaft, inside the valve, presses against one of the poppets, thereby opening a port and allowing fuel from the selected tank to flow through the valve into the fuel lines to the carburetor.

Reference: Bu Aer Technical Note: 19-39

ENGINE DRIVEN FUEL PUMP

The engine driven fuel pump, Navy type H4E3 (see photograph VS-4936), is equipped with integral by-pass and diaphragm relief valves. The pressure relief valve should be adjusted to hold 15 to 17 pounds per square inch at all engine speeds above 1840 RPM (Note: After adjustment is made, be sure that the diaphragm vent screen is free from oil and dirt).

AUXILIARY FUEL PUMP

The electric motor driven, auxiliary fuel pump, Navy type H4E4, which replaces the conventional AEL-2

Unit or wobble pump, is mounted on a support which is riveted to bulkheads No. 154½ and No. 138 3/5. The auxiliary fuel pump is provided for emergency use only and as otherwise prescribed in the Pilot's Handbook. The pressure relief valve on this pump should be adjusted to hold 15 to 17 pounds per square inch.

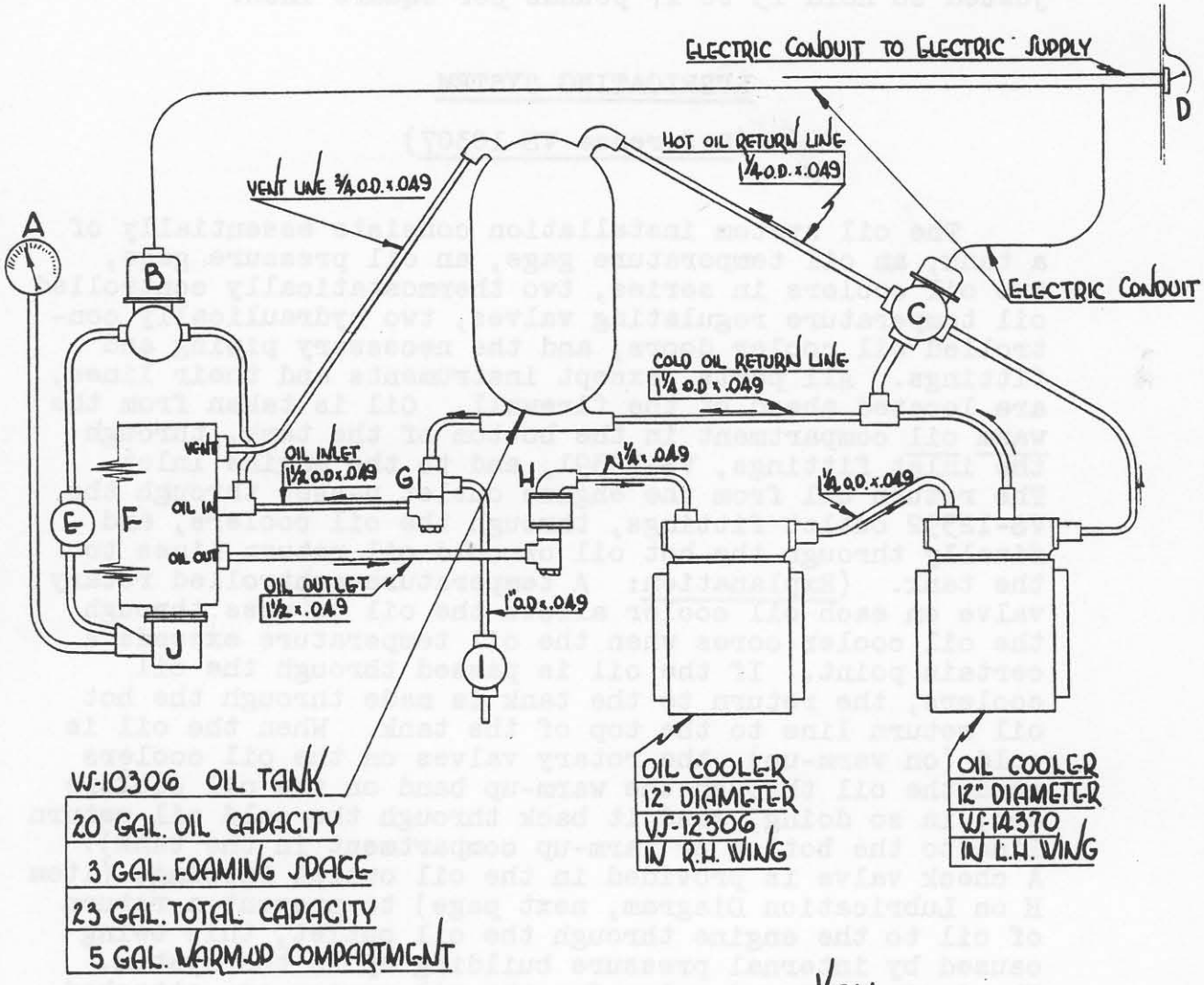
LUBRICATING SYSTEM

(Reference VS-10307)

The oil system installation consists essentially of a tank, an oil temperature gage, an oil pressure gage, two oil coolers in series, two thermostatically controlled oil temperature regulating valves, two hydraulically controlled oil cooler doors, and the necessary piping and fittings. All parts, except instruments and their lines, are located ahead of the firewall. Oil is taken from the warm oil compartment in the bottom of the tank, through the inlet fittings, VS-12391, and to the engine inlet. The return oil from the engine outlet passes through the VS-12392 outlet fittings, through the oil coolers, and finally through the hot oil or cold oil return lines to the tank. (Explanation: A temperature-controlled rotary valve on each oil cooler allows the oil to pass through the oil cooler cores when the oil temperature exceeds a certain point. If the oil is passed through the oil coolers, the return to the tank is made through the hot oil return line to the top of the tank. When the oil is cold (on warm-up), the rotary valves on the oil coolers send the oil through the warm-up band on the oil coolers and, in so doing, send it back through the cold oil return line to the bottom or warm-up compartment in the tank). A check valve is provided in the oil outlet fittings (item H on Lubrication Diagram, next page) to prevent a return of oil to the engine through the oil outlet, this being caused by internal pressure building up in the system. The drain line and valve for the oil system are attached to the inlet fittings. Both the inlet and outlet fittings are of the quick disconnect type and are clamped to the front face of the beam. An oil vent line is provided between the top of the tank and the engine. The handle for controlling the oil cooler doors is located on the right hand side of the cockpit. Details of the oil dilution system will be included in the final corrected version of this manual.

F4U-1 LUBRICATION SYSTEM DIAGRAM

REFERENCE VS-10307 - DIAGRAM INCLUDES OIL DILUTION SYSTEM
ALL LINES ARE 52SO ALUM. ALLOY TUBING - SPEC. 44T32



VS-10306 OIL TANK
20 GAL. OIL CAPACITY
3 GAL. FOAMING SPACE
23 GAL. TOTAL CAPACITY
5 GAL. WARM-UP COMPARTMENT

~ KEY ~

A - FUEL PRESSURE GAGE
B - VS-19626 OIL DILUTION VALVE
C - VS-19625 BY-PASS VALVE
D - VS-11400 BOX INSTALL.
E - VALVE - PLUG - 2 WAY
F - R-2800-8 ENGINE
G - VS-12391 - FITTING ASSEM - OIL INLET
H - VS-12392 - FITTING ASSEM - OIL OUTLET
I - VS-11339 OIL DRAIN VALVE
J - PT-13D4 CARBURETOR

TIMING ARRANGEMENT

By-Pass open	0°F.
By-Pass closed	105°F.
Cooler inlet (starts to open)	70°F.
Cooler inlet (full open)	105°F.
Warm-up (starts to open)	70°F.
Warm-up (full open)	105°F.
Warm-up (starts to close)	140°F.
Warm-up (full closed)	175°F.
Cooler outlet (starts to open)	140°F.
Cooler outlet (full open)	175°F.

OIL TANK

(Reference: VS-10306)

The oil tank is a torch welded assembly of alclad sheet with welded on bosses for fitting attachment, and welded on outlet and dirt sumps. Internal structure consists of a riveted baffle assembly, VS-11357. A plug is provided at the bottom of the oil tank dirt sump for periodically draining the sludge accumulated in the sump. The drainage may be accomplished by removing plug CV-54317 as shown in section C-C of the reference drawing. Be sure that the gasket and lockwire are replaced when the plug is restored.

The capacity of the tank is 20 U.S. gallons of oil plus 3 gallons of foaming space. The filler unit is in the right end plate of the tank and is accessible through a door in the right accessory compartment panel, VS-11602.

The cap is of the NAF type and is fitted with a graduated sounding rod.

A ten mesh brass screen is carried in the filler unit and can be removed from the tank for cleaning or repair by removing the six screws around the filler neck.

Reference: BuAer Technical Note: 39-42

INSTALLATION

(Reference: VS-10650)

The oil tank is supported on brackets mounted on the firewall as shown on the reference drawing. To install the tank, bolt the straps to the lower support brackets and swing the straps forward to clear the tank. Attach the fork and turnbuckle to the firewall stud as shown. Lower the tank through the engine mount until it rests on the lower support brackets, then swing the top aft so that the tank seats snugly in the upper and lower support brackets. Bring the straps around the tank and secure the upper ends to the fork. Adjust the tension in the straps with the turnbuckle. When adjustment is complete, lockwire the turnbuckle.

To remove, detach the straps and reverse the procedure described above.

OIL COOLER DOOR CONTROL

The quantity of cooling air to be admitted to the oil coolers is regulated by two doors, or valves, controlled from the right hand side of the cockpit. The two doors may be placed in any position between "open" and "closed" as required to by-pass the appropriate quantity of cooling air through the airduct openings to the coolers. Refer to "Hydraulic System".

OIL COOLERS

The two oil coolers are supported on brackets just aft of the airduct openings in the center section. The two coolers are mounted in series with the oil from the engine going through the right hand cooler first, then through the left hand cooler, and finally returned to the tank. The two oil coolers are purchased complete with rotary valves from the Harrison Radiator Division.

Reference: Bu Aer Technical Note: 44-42

PIPING AND DRAIN VALVE

(Reference: VS-10307)

All piping is aluminum alloy tubing (52S0-44T32). Connections are made with standard synthetic rubber hose and hose clamps.

The drain valve is a quarter turn, plug valve, supported on the firewall shoulder just below the main beam and attached to the shoulder by four screws. To drain the system completely, remove the lockwire and turn the drain valve.

INDICATOR INSTALLATION

Indicators are provided on the right hand sub-instrument panel in the cockpit which show the positon

of the accessory compartment air exit flap and the oil cooler doors at all positions between "open" and "closed".

The indicator installations consist essentially of spring-loaded cables running forward from the sub-instrument panel through 3/16" brass tubing to the right oil cooler door and to a scissors arm on the accessory compartment air exit flap strut. Refer to VS-10302 for further details.

CARBURETOR AND INDUCTION SYSTEM

CARBURETOR

These airplanes are equipped with Bendix-Stromberg PD-13D4 injection carburetors. A carburetor instruction booklet is included at the rear of this manual.

AIR INTAKE BOX

The air intake box, an aluminum alloy casting attached to the carburetor bottom flange, is equipped with three backfire valves built into the bottom of the box. A boss is provided on the top side of the entrance opening for the carburetor warning light. For information concerning the warning light refer to the "Pilot's Handbook".

Cold air, taken through the openings in both wings, passes through ducts to the auxiliary stage supercharger. The compressed air leaves the engine through openings on both sides of the engine and passes through ducts to the two intercoolers. After passing through the intercoolers the air in combined in a "Y" duct and passes into the carburetor air box and then into the carburetor. No hot air is required for this type of carburetor, but an alternate air intake valve, controllable from the left hand sub-instrument board, is provided.

A floating take-off door is provided in the duct just aft of the intercooler. This door will open when the engine is operating as a single stage engine. When operating as a two stage engine, pressure will keep the door closed.

Reference: BuAer Technical Orders: 44-40, 39-40
BuAer Technical Note: 32-40

EXHAUST SYSTEM

(Reference: VS-10315, VS-10302)

The thrust type exhaust collector is made of .0375 stainless steel sheet (AN-QQS-757) welded in accordance with Bureau of Aeronautics Specification SR-43 using a columbium bearing 18-8 type welding rod (Navy Department Specification 46R2). The exhaust collector is finished in accordance with Bureau of Aeronautics Specification SR-39.

An extension or stack is provided between each front cylinder port and the ports on the collector.

All sections of the exhaust collector are joined by slip joints which permit expansion or contraction due to temperature changes.

The exhaust collector is restrained by two VS-10383 supports which are fastened to the engine by screws as shown on the reference drawing.

Caution should be taken to avoid overtightening of the bolts attaching the collector to the engine as the heat will either cause the overtight bolts to fail or it will restrain other parts so that they fail.

INSPECTION AND REPAIR

The exhaust collector is subject to extreme temperature changes and excessive vibration in service and to high loads during flight. (Note: It should be inspected frequently for cracks, dents, chafing and burning. This is especially important on this "Thrust Type" exhaust collector. Repairs can be made by welding.

ENGINE COWLING

(Reference: VS-10645, VS-10650)

The engine cowl is of the NACA type and consists of three main units, a nose cowl, cowl panels, and

controllable cowl flaps. The flow of cooling air through the engine is controlled by adjusting the gap between the hydraulically controlled cowl flaps and the engine diaphragm shoulder.

NOSE COWL

(Reference: VS-10645, VS-10620)

The nose cowl is a riveted and spot welded assembly of alclad sheet (24ST-47A8) riveted to a trailing edge channel of alclad sheet (24S0-47A8).

The nose cowl is secured to the cylinders by means of eighteen (18) links, the forward end of the links engaging the attachment plates on the nose cowl channel as shown in Section B-B of VS-10620. Raise the nose cowl into position and attach the after end of the links to the cylinder head plates, using the attaching parts called out in Section B-B of VS-10620. (Note: An eccentric bushing is provided in the latter attachment to allow for possible manufacturing variations in the nose cowl and the engine. Those links which do not fit can be made longer or shorter by inserting a screw driver in the bushing end slot and turning the bushing in the link).

COWL FLAPS

(Reference: VS-10645, VS-10655)

The eighteen (18) cowl flaps are made of alclad sheet (24S0-47A8), and slide on eighteen levers. These levers, which are aluminum alloy impact extrusions, are actuated by eighteen (18) hydraulic struts connected in parallel, the struts being inter-connected by 3/16 diameter tubing (52S0-44T32) with aluminum alloy AN type fittings. The levers are hinged to an elliptical shaped channel of alclad sheet which is mounted on the rear cowl mounting lugs on the engine. See photograph VS-4936.

The flaps are held in place by spring clips. A safety attachment is also provided in the form of a 1/16" steel cable with a lift-the-dot fastener at the end, which fastens on the center of each flap and also serves as a bonding attachment. The flaps may be readily removed and replaced to provide access to the rear spark plugs and to the exhaust collector. To remove a flap, open the flaps just enough to provide access to the fastener and clip, disconnect the lift-the-dot fastener, lift up on the spring clip with one hand and slide the flap aft with the other hand.

ACCESSORY COMPARTMENT PANELS

(Reference: VS-10650)

The four accessory compartment panels are spot welded and riveted assemblies of alclad sheet (24ST-47A8) and heat treated alclad stiffeners (24S0-47A8- H.T. to 56,000 P.S.I. After Forming). Repairs should be made by riveting; failed spot welds should be drilled out and replaced by 1/8" aluminum alloy rivets.

A hydraulically controlled accessory compartment and intercooler air exit flap is hinged to the bottom panel. The flap is removable with the bottom panel as a unit. A snap-on fitting at the lower end of the flap strut piston provides for quick disconnect at that point. The control handle for the flap is located just beneath the sub-instrument board on the right hand side of the cockpit.

An upper and lower compartment wing gap cover (Upper Cover -24S0-47A8; Lower Cover - 24ST-47A8) fabricated from alclad sheet is attached to the center section leading edge on each side of the fuselage as shown in Section A-A of the reference drawing. A splice plate joins the upper and lower gap covers.

In the wake of the exhaust outlet stacks, .062 asbestos sheet and .017 stainless steel sheet (AN-QQS-757) are riveted over the skin of the VS-11607 bottom panel and the VS-11606 lower wing gap cover.

All panels, including the wing gap cover panels, are attached to channel members by means of Dzus and Camloc fasteners.

ENGINE COWL PANELS

(Reference: VS-10645)

The four engine cowl panels are spot welded and riveted assemblies of alclad skin (24ST-47A8) reinforced by alclad stiffeners (24SO-47A8). All repairs should be made by riveting. Failed spot welds should be drilled out and replaced with 1/8" aluminum alloy rivets.

The panels are secured by Dzus fasteners along their leading edges to the nose cowl channel and along their trailing edges to the cowl flap channel. Straps and channels of alclad sheet are used to join the edges of the panels. The hoop tension loads in the panels are taken through the strap studs which project through holes in the edges of the panel and the channels.

To remove the engine cowl panels, disconnect the Dzus fasteners on the straps and along the leading and trailing edges of the cowling.

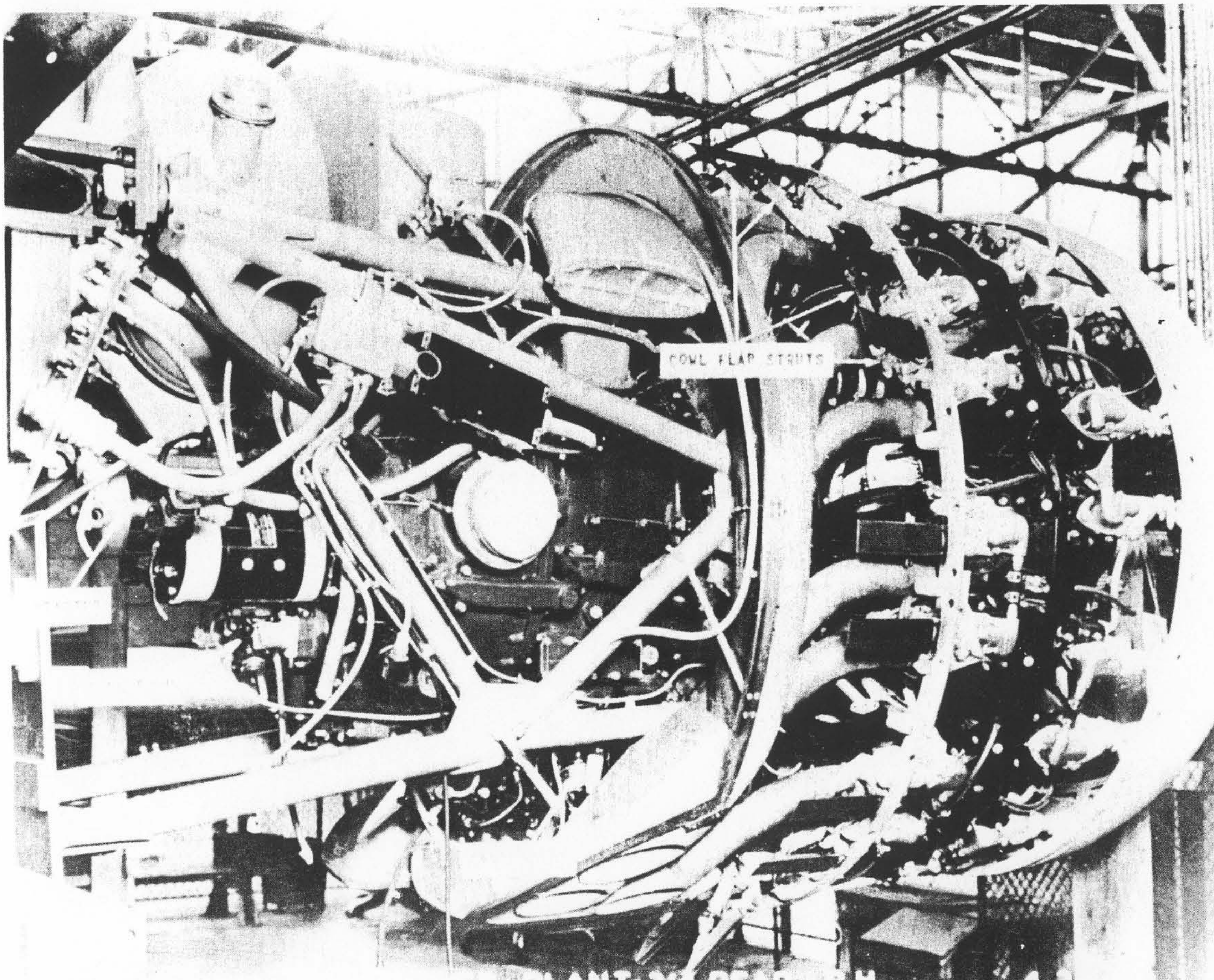
FIREWALL

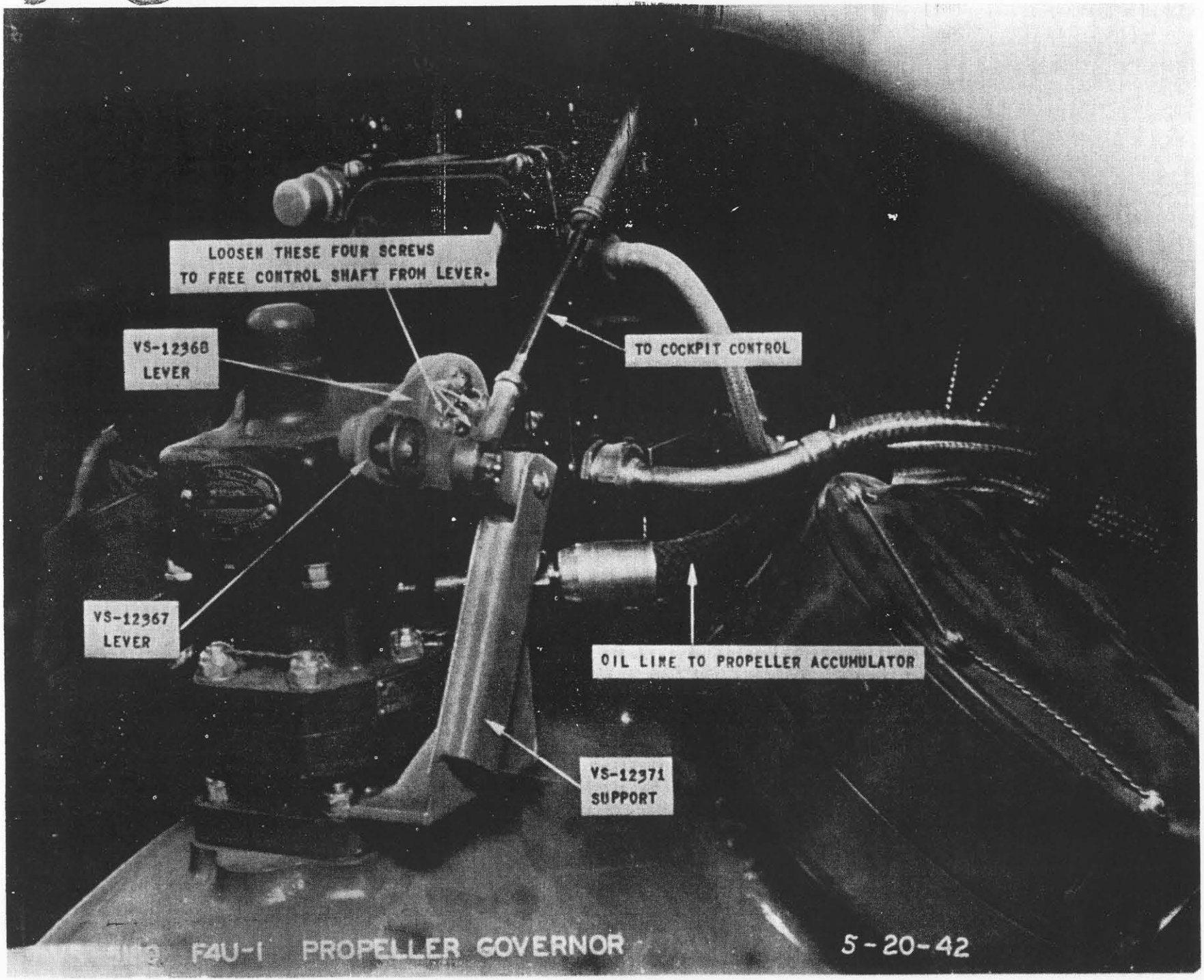
The firewall is fabricated of alclad sheet with stiffeners of aluminum alloy. The firewall serves, in addition, as the forward bulkhead of the fuselage.

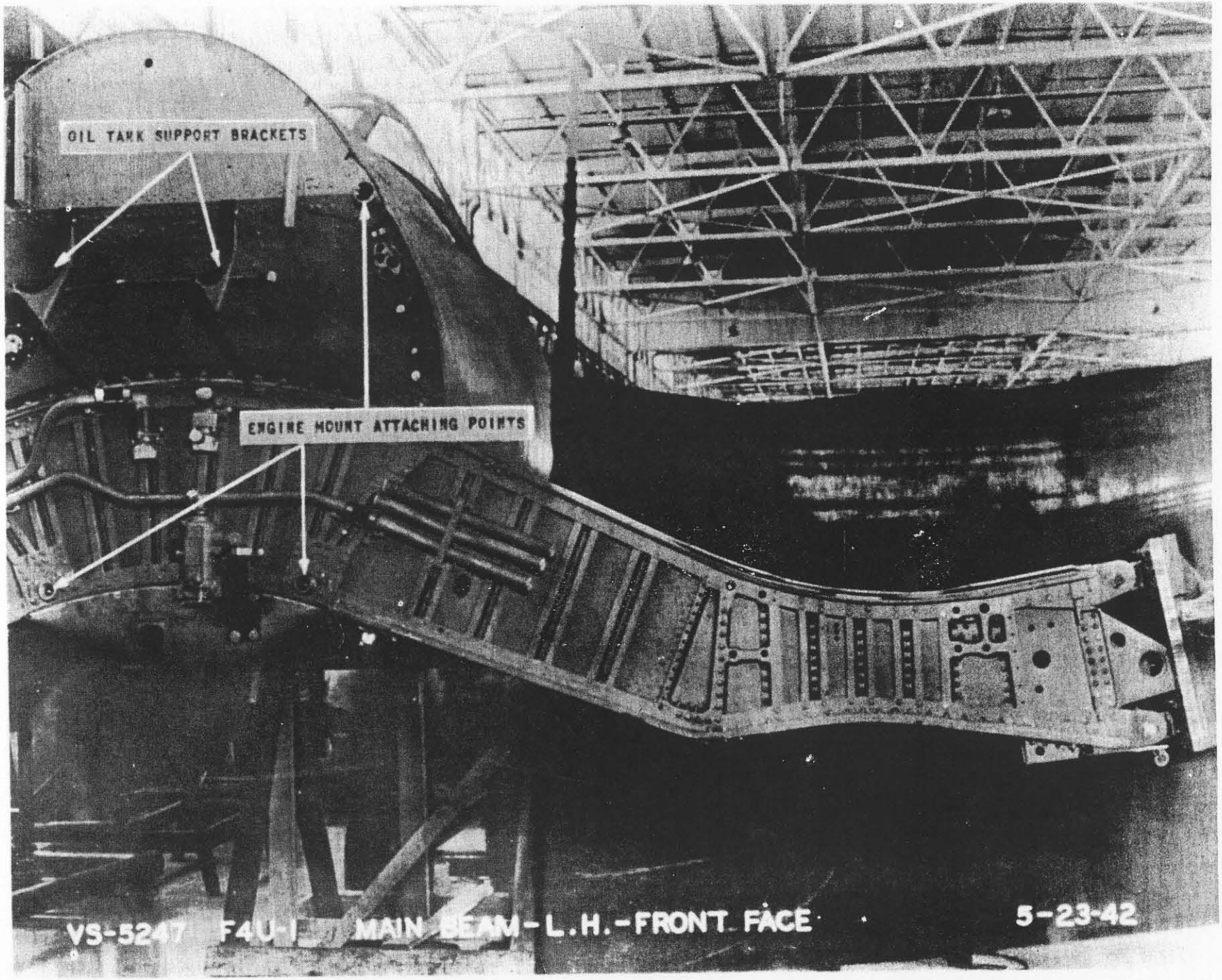
INSTRUMENTS

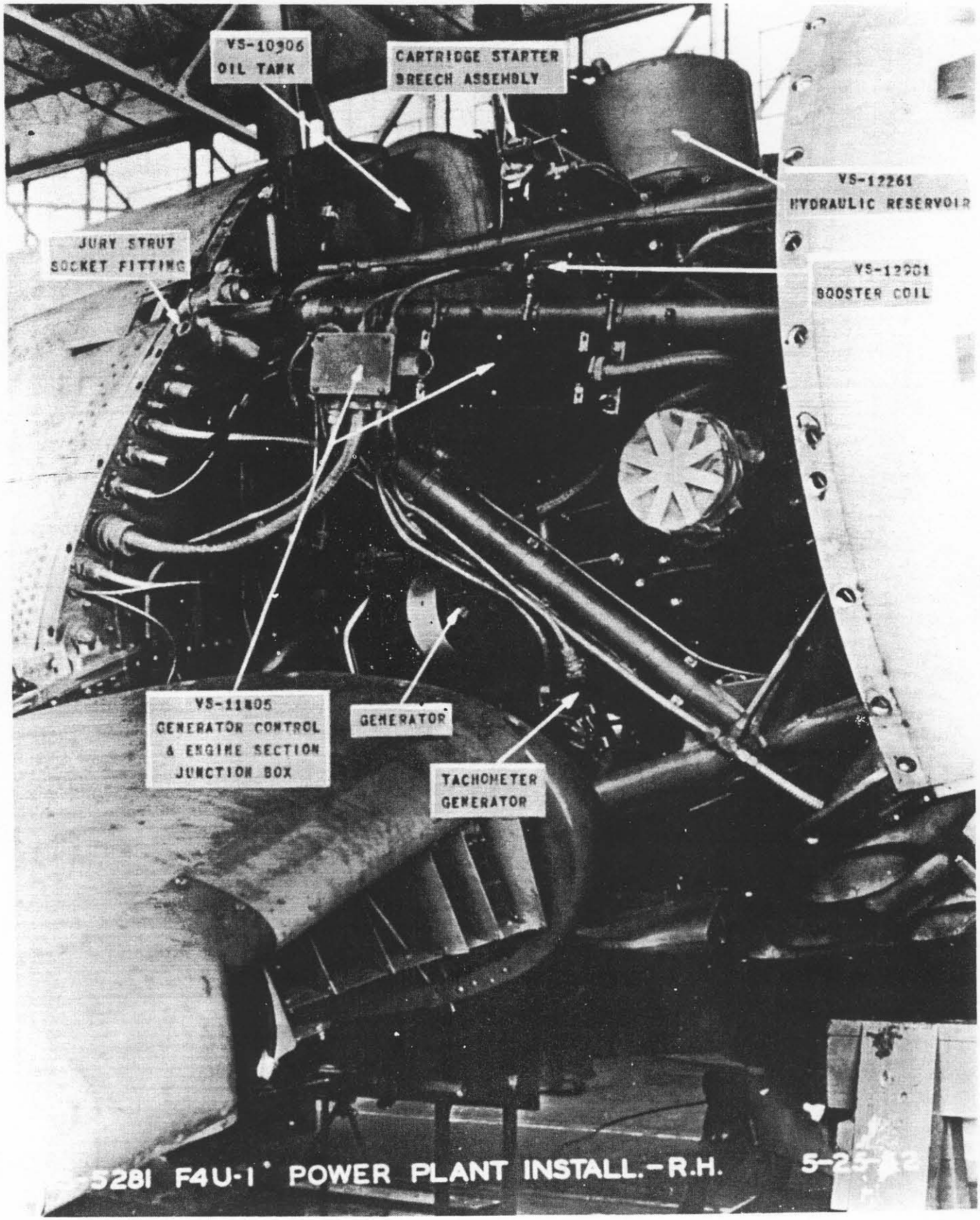
The engine instruments listed below are mounted on the pilot's instrument panel.

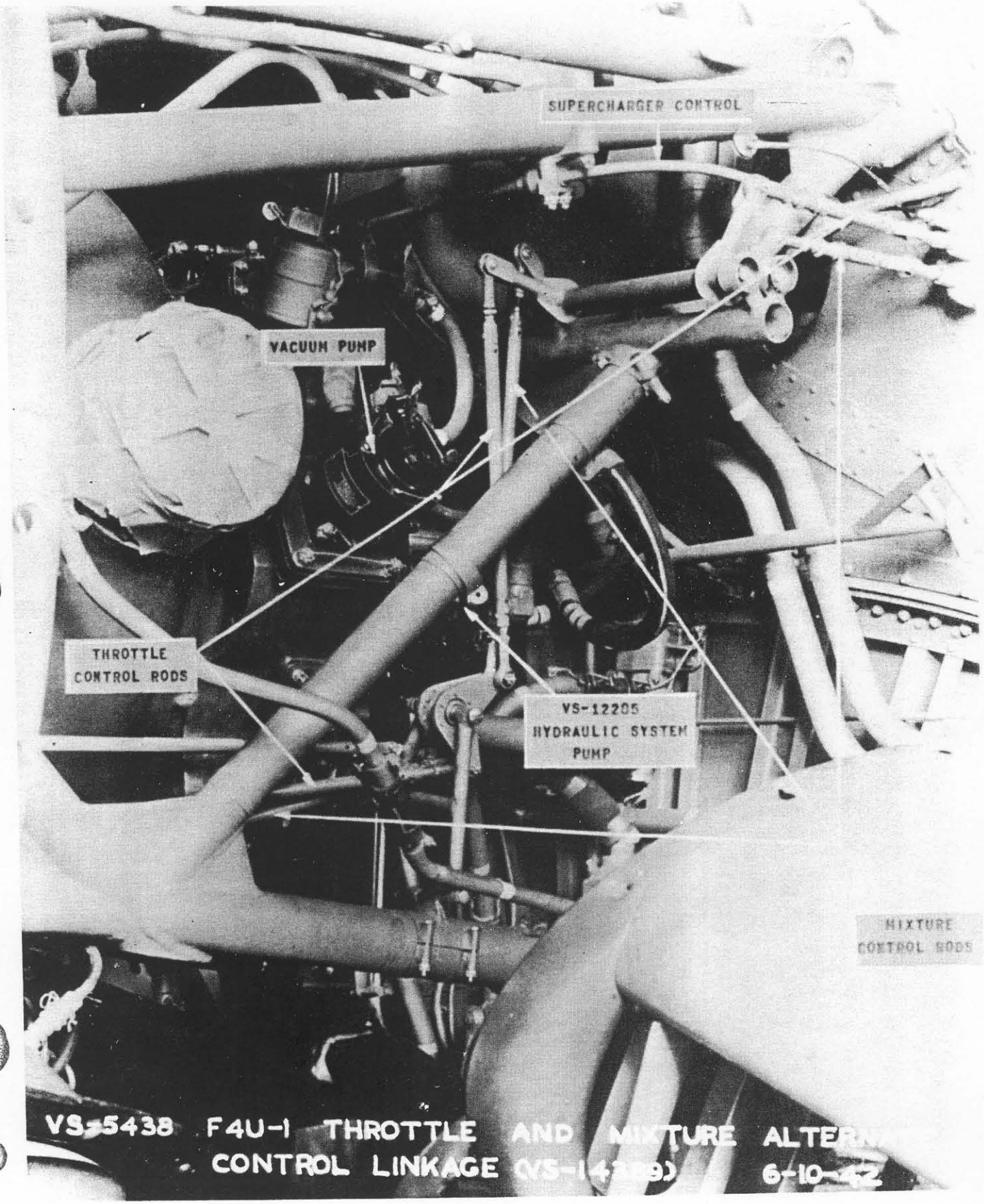
Tachometer - FSSC-88-1-2500
Check-off Switch - FSSC-88-S-1400
Manifold Pressure Gage - FSSC-88-G-773
Cylinder Temperature Indicator - FSSC-88-I-2650
Oil Temperature Indicator - FSSC-88-I-2815
Oil Pressure Gage - FSSC-88-G-860
Fuel Pressure Gage - FSSC-88-G-565
Fuel Quantity Gage - VS-12495


COWL FLAP STRUTS
PLANT-3/4 REAR R.H.
4-2

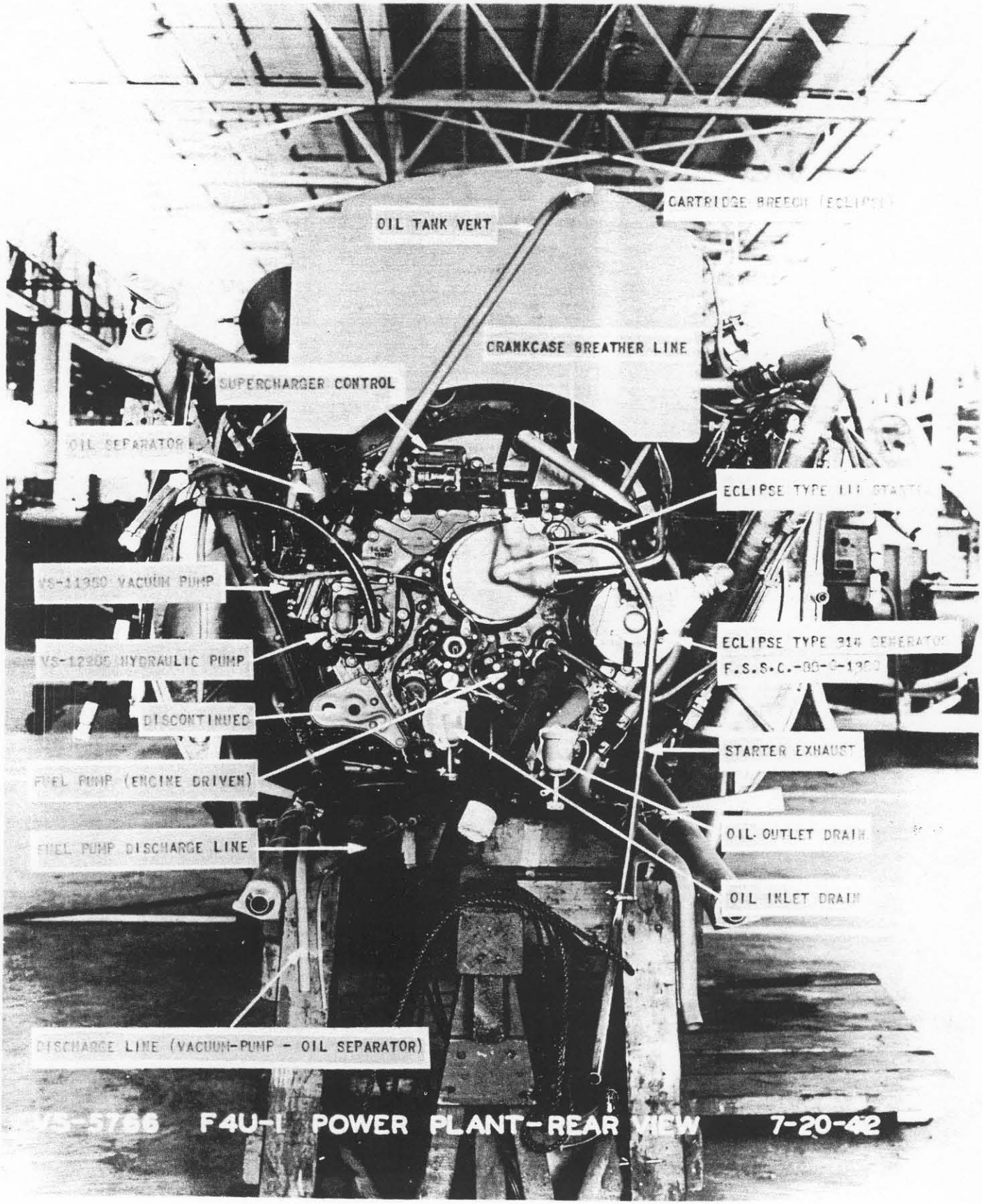

LOOSEN THESE FOUR SCREWS
TO FREE CONTROL SHAFT FROM LEVER.
VS-12368
LEVER
TO COCKPIT CONTROL
VS-12367
LEVER
OIL LINE TO PROPELLER ACCUMULATOR
VS-12371
SUPPORT
F4U-1 PROPELLER GOVERNOR
5-20-42

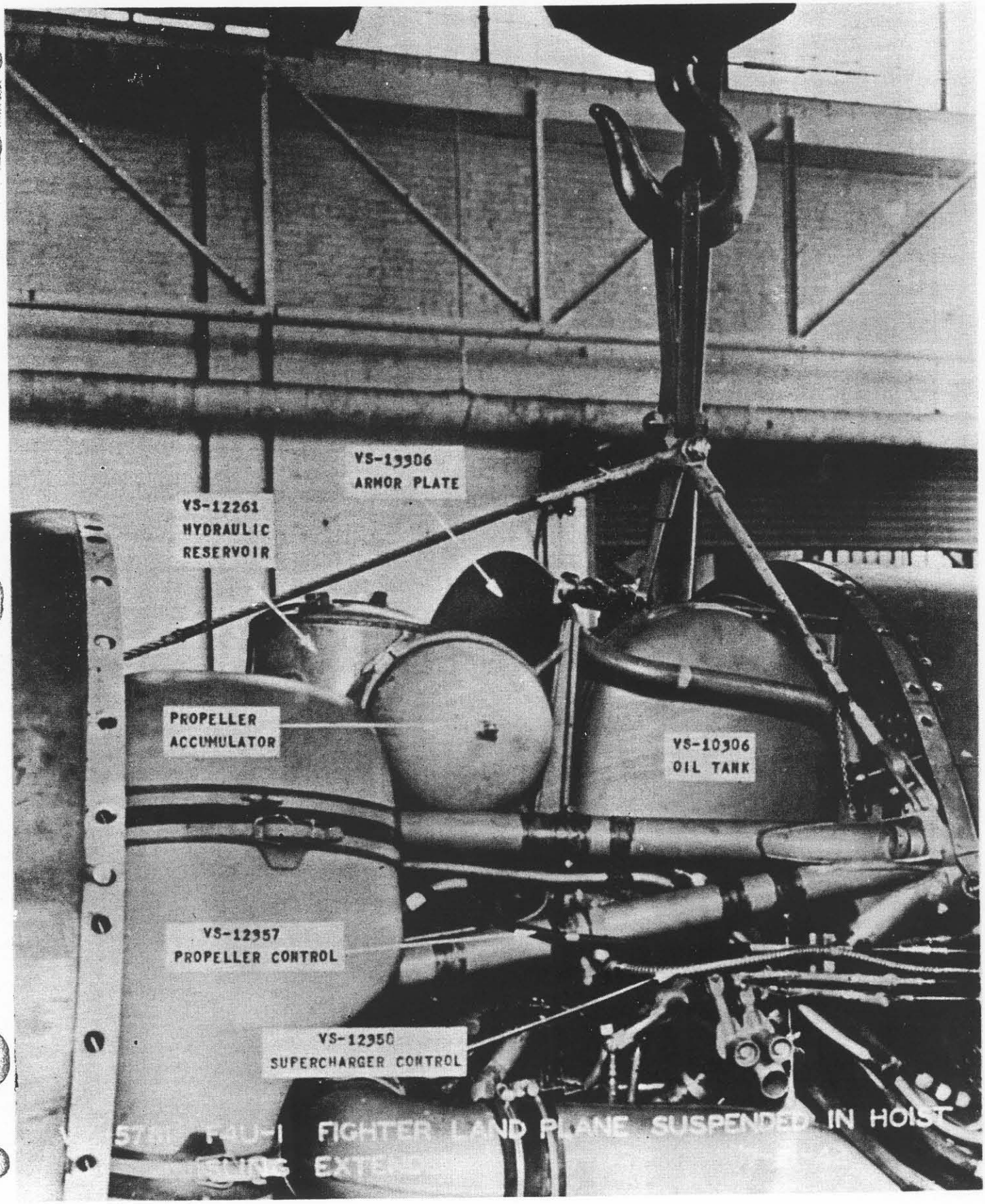

OIL TANK SUPPORT BRACKETS
ENGINE MOUNT ATTACHING POINTS
VS-5247 F4U-1 MAIN BEAM-L.H.-FRONT FACE
5-23-42


VS-10906
OIL TANK
CARTRIDGE STARTER
BREECH ASSEMBLY
VS-12261
HYDRAULIC RESERVOIR
JURY STRUT
SOCKET FITTING
VS-12001
BOOSTER COIL
VS-11805
GENERATOR CONTROL
& ENGINE SECTION
JUNCTION BOX
GENERATOR
TACHOMETER
GENERATOR
5281 F4U-1 POWER PLANT INSTALL.-R.H.
5-25-42

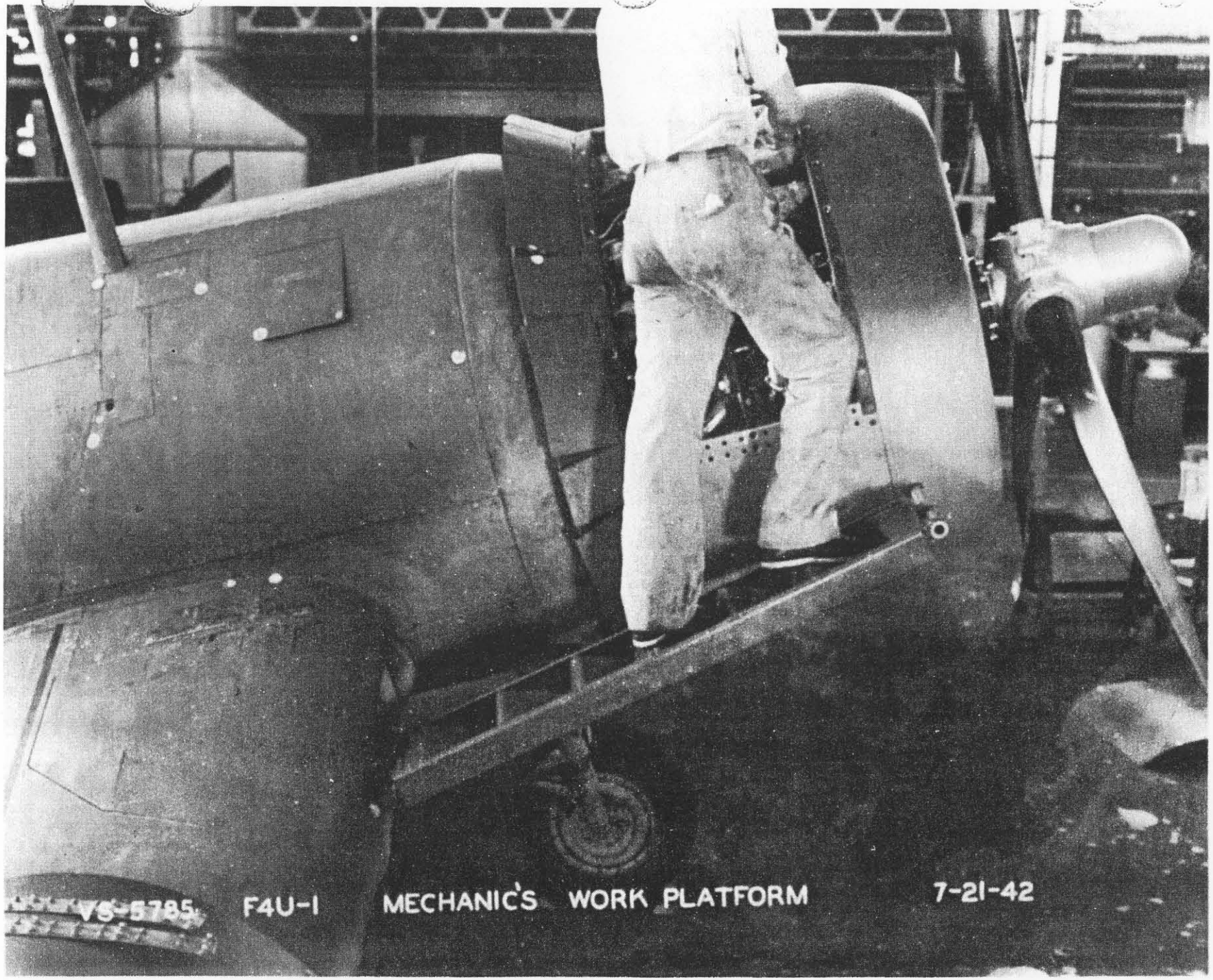


VS-5438 F4U-1 THROTTLE AND MIXTURE ALTERN
CONTROL LINKAGE (VS-14289) 6-10-42


OIL TANK VENT
CRANKCASE BREATHER LINE
SUPERCHARGER CONTROL
OIL SEPARATOR
VS-11350 VACUUM PUMP
VS-12205 HYDRAULIC PUMP
DISCONTINUED
FUEL PUMP (ENGINE DRIVEN)
FUEL PUMP DISCHARGE LINE
DISCHARGE LINE (VACUUM-PUMP - OIL SEPARATOR)
ECLIPSE TYPE 11 STARTER
ECLIPSE TYPE 314 GENERATOR
F.S.S.C.-80-3-1362
STARTER EXHAUST
OIL OUTLET DRAIN
OIL INLET DRAIN
VS-5766 F4U-1 POWER PLANT-REAR VIEW 7-20-42



57[illegible] F4U-1 FIGHTER LAND PLANE SUSPENDED IN HOIST
[illegible] EXTENDED


VS-5785
F4U-1
MECHANIC'S WORK PLATFORM
7-21-42

FIXED EQUIPMENT GROUP

REFERENCE DRAWINGS

VS-10408	Pilot's Seat Installation
VS-10425	Electrical System Installation
VS-10426	Wiring Diagram - Electrical System
VS-10427	Electrical Installation - Fuselage and Center Section
VS-10428	Electrical Installation - Outer Panel
VS-10460	Diagram - Towing, Tie-Down
VS-10470	Instrument Installation
VS-13976	Heating System Installation
VS-14567	Airspeed Installation - Outer Panel
VS-14599	Airspeed Tubing Installation - Center Section

PILOT'S SEAT

(Reference - VS-10408)

The VS-10407 pilot's seat is of the AN standard bucket type, fabricated from 24ST Alclad sheet and assembled by spot-welding and riveting. A vertical adjustment of 6 inches is provided, controlled by a lever on the right-hand side of the seat. A Sutton-type harness attachment is installed on the back of the seat, the release lever being located on the left hand side of the seat.

REMOVAL OF PILOT'S SEAT

(Reference VS-10408)

The seat assembly is supported at four points, and may be easily and quickly removed to provide accessibility to controls, fuel piping, etc. (Note: Before removing or replacing the seat, be sure that it is in the full up position, to avoid accidental release and possible personal injury due to tension of seat-raising springs). The only seat attachments are the two quick-release bolts inserted through the VS-13819 fittings on the upper, after side of the seat (See photograph VS-4690). Withdraw the bolts, then rotate and raise the entire seat assembly to free the hooks at the ends of the VS-11482 support struts from the VS-13894 brackets extending through the lower section of the lower armor plating attached to the seat bulkhead. The entire seat assembly may now be lifted from the cockpit. To replace, reverse the above procedure. Note: For normal servicing, place the seat in the bottom of the cockpit and fold the armor plate down to serve as a servicing platform (See "Radio Installation", "Useful Load").

ARMOR INSTALLATION AND REMOVAL

Armor protection forward of the pilot consists of VS-13386 armor plate forward of the oil tank, VS-16487 and VS-16488 armor plate on the bulkhead forward of the cockpit, a heavy gage dural plate on the main fuel tank cover and a VS-13941 bullet-proof glass auxiliary shield behind the windshield. Armor protection abaft the cockpit is furnished by armor plate in two sections, attached at the seat bulkhead. The upper section, VS-13888, which protects the pilot's head and shoulders, is built into the fuselage structure, while the VS-15277 lower section, shielding the pilot's back, is attached at the lower part of the seat bulkhead by hinges, allowing it to be tilted forward, providing a working platform for access to the radio compartment. (See photographs VS-4690, VS-5681, and VS-5783.)

All the armor installation may be removed, if necessary, by taking out the attaching bolts or, in the case of the bullet-proof glass, by removing the bolts attaching the support brackets to the forward instrument deck and to the upper windshield support. Procedure and time required for the removal of various units of the armor installation are as follows:

1. To remove the armor plate forward of the oil tank (VS-13386) it is first necessary to remove the top and both side panels of the engine accessory compartment, then remove the four bolts attaching the armor plate to its support brackets. Two men working together removed the top and side accessory compartment panels in four minutes, removed the bolts and the armor plate in seven minutes and replaced the top and side panels in four minutes. The total elapsed time was fifteen minutes for two men.

2. To remove the VS-15277 pilot's aft armor plate, lower section, the pilot's seat must first be removed. See instructions under "Pilot's Seat Removal". Tilt the armor plate forward as explained under "Radio Installation", "Useful Load". Remove hinge bolts and detach support cables, leaving the armor plate free to be lifted from the airplane. Two men working together removed the pilot's seat in 1 minute, removed the hinge bolts and the armor plate in 9 minutes and replaced the seat in 1 minute. The total elapsed time for the two men was 11 minutes.

3. To remove the bullet-proof glass (VS-13941) it is necessary to remove the cockpit cabin deck cowl access doors, located on the fuselage just below and forward of the sides of the windshield, and the illuminated Mark 8 gun sight and sun visor. (This subject is further explained in the chapter on useful load). From below the cowl deck, remove the bolts attaching the bullet-proof glass support bracket to the deck. Remove bolts attaching the glass supports to the top of the windshield frame. The bullet-proof glass may now be removed. Working together, two men removed the access doors in 1 minute. One man entered the cockpit cabin while the other worked from the center section. Removal of the gun sight and visor required 10 minutes. Removal of bullet-proof glass took 8 minutes, after which the gun sight and visor were replaced in 10 minutes and the access doors in 1 minute. The gun sight, however, was not re-boresighted. Total elapsed time for two men was 30 minutes.

After performance of the above operation, realignment of the illuminated gun sight is necessary. It is estimated that two men will require 90 minutes to make this adjustment.

4. Information and statistics concerning the removal of the cockpit forward bulkhead armor plate, VS-10487, VS-10488, and the seat bulkhead upper panel, VS-13888, are not available at the time of preparation of this preliminary erection book. Complete information will be given in the final version of this manual.

ELECTRICAL SYSTEM

(Reference - VS-10425, VS-10426, VS-10427, VS-10428)

The electrical system is a standard single wire system with ground return. The main distribution panel is located on the right hand side of the cockpit and contains switches for all electrical equipment with the exception of armament items, the armament switch panel being located on the left hand side.

The electrical power supply consists of a 24 volt, 11 ampere-hour storage battery (type NAF-1062-11) connected in conventional fashion to a 28.5 volt, 50 ampere engine driven generator (type NM-1B).

An electrically operated, "sealed beam", retractable landing light is located in the left outer panel.

LANDING GEAR AND WING FOLDING HOWLER

The howler is so connected to the electrical system and to the power plant that it sets up a warning signal for the pilot when the landing gear is not fully down and locked, and the engine throttle is in a range between closed and one-quarter open.

The howler is also connected to the wing folding and locking mechanism and gives warning to the pilot when the wings are not fully spread or properly locked at any time, provided the Battery Switch is on.

TOWING, TIE-DOWN, SUPPORTING

(Reference - VS-10460)

Points of attachment and methods of rigging for towing, tie down and supporting are clearly shown on the reference drawing. (See also photographs VS-5404 and VS-5644.)

HOISTING

(Reference VS-10460)

The clevis ends of the sling cables are attached by snap-in pins to fittings on the upper engine mount ring.

Eye bars of the after part of the sling assembly attach by pins to straps on the upper engine mount just forward of the firewall (Reference VS-10650). (See photographs VS-5779 and VS-5781).

No provision has been made for stowing the hoisting sling in the airplane.

TRICING

(Reference VS-10460)

Methods of tricing are shown on the reference drawing. For location of the bays in which these airplanes may be triced, see typical installation No. 1, Newport News Shipbuilding and Drydock Company drawing No. 53-382.

JACKING

Jack pads are provided on the landing gear axles at the attaching points of the lower scissors links. (See photograph VS-5644.)

CATAPULTING

The two hooks for catapulting the airplane are located on the center section main beam, bottom side, just outboard of the fuselage. A hold-back shackle is provided on the tail wheel assembly. Refer to VS-10226 and to photograph VS-5192.

For dimensions and location of bridle, see drawing VS-10481.

TOW TARGET INSTALLATION

Provision has been made for towing targets with this airplane. Points of attachment of the equipment are indicated on drawing VS-10544.

HEATING SYSTEM

(Reference VS-13976)

The heating system is shown clearly on the reference drawing. Vaporized fuel is taken from the blower crankcase section of the engine, passed through AN-856-8 hose and .032 aluminum alloy tubing assemblies to the master solenoid valve,

through the valve, thence through tubing to the header which distributes the mixture through individual solenoid valves to the defroster and to each gun bay heater. For additional information on gun bay heaters, see "Useful Load".

Between the master solenoid valve and the header are incorporated a pressure switch - this switch being so calibrated that for a difference between manifold pressure and atmospheric pressure of less than one inch, the current drain to the heaters will be cut out and their solenoid valves closed - and a check valve to prevent any reverse flow in the event that the pressure switch should fail to operate.

The master solenoid valve is mounted ahead of the fire-wall, close to the engine and is controlled by a master switch which is located on the right hand shelf of the cockpit. For landing and take-off this switch should be turned off, preventing the flow of fuel mixture to the pressure regulator and heating system. This eliminates the hazard of a mixture outlet to the cockpit in the event of a crash on take-off or landing.

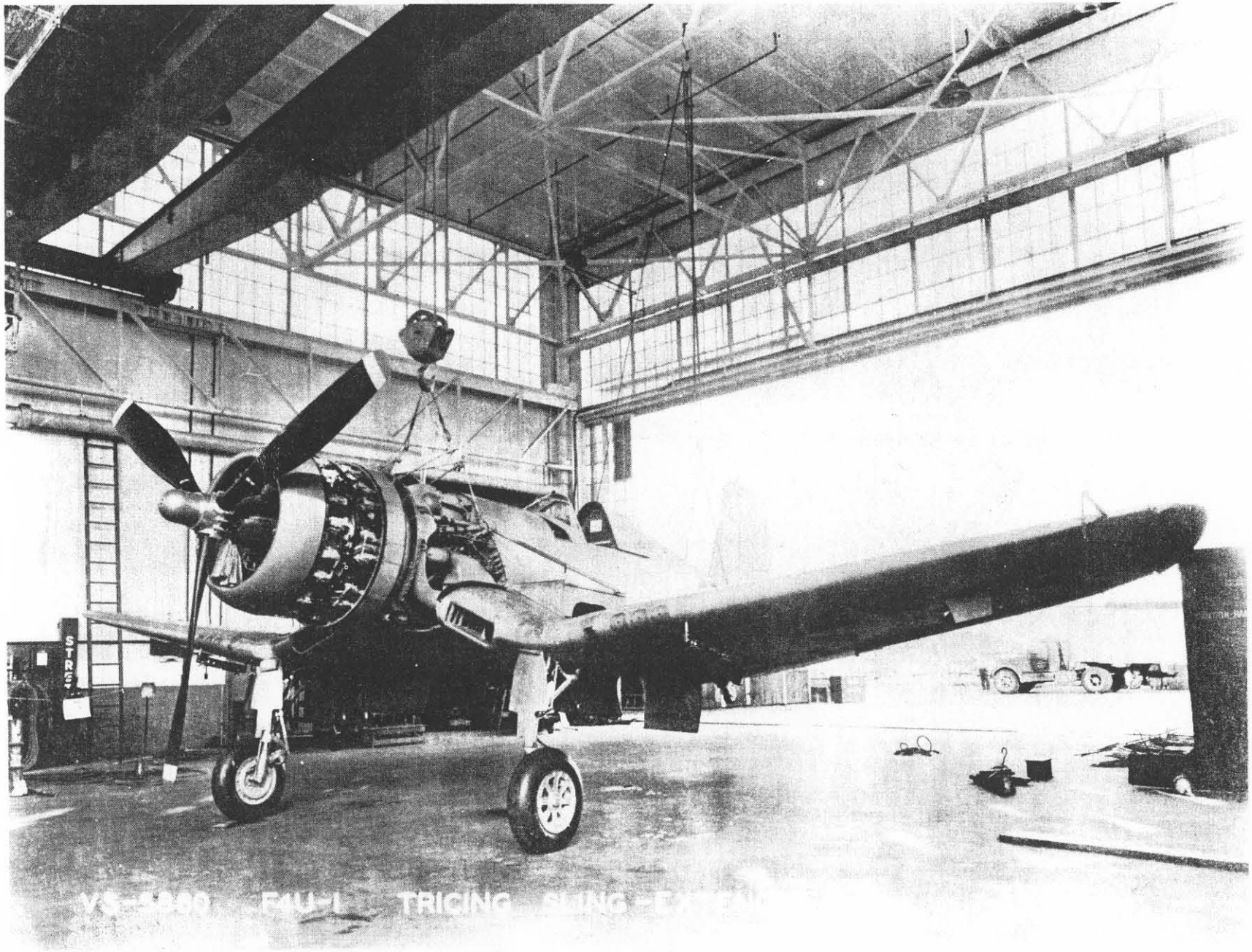
COCKPIT VENTILATING SYSTEM

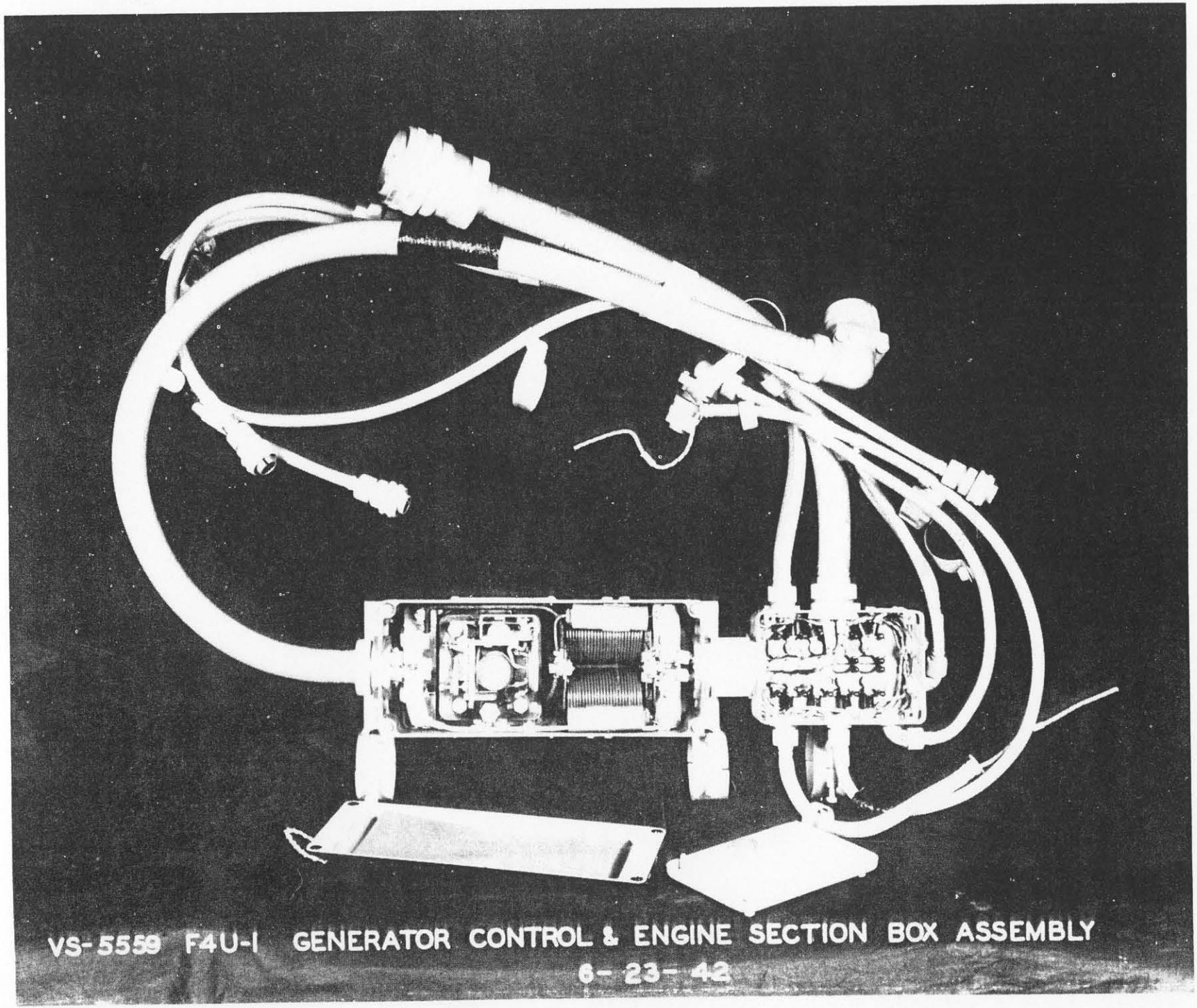
Fresh air is admitted to the cockpit through 1-1/2 inch alclad flexible tubing. This tubing, which is held in position by clamps, leads from the airduct in the left hand center section through the center section and into the fuselage, terminating in a butterfly valve located between the rudder pedals, the valve being constructed to permit its operation by the pilot's feet.

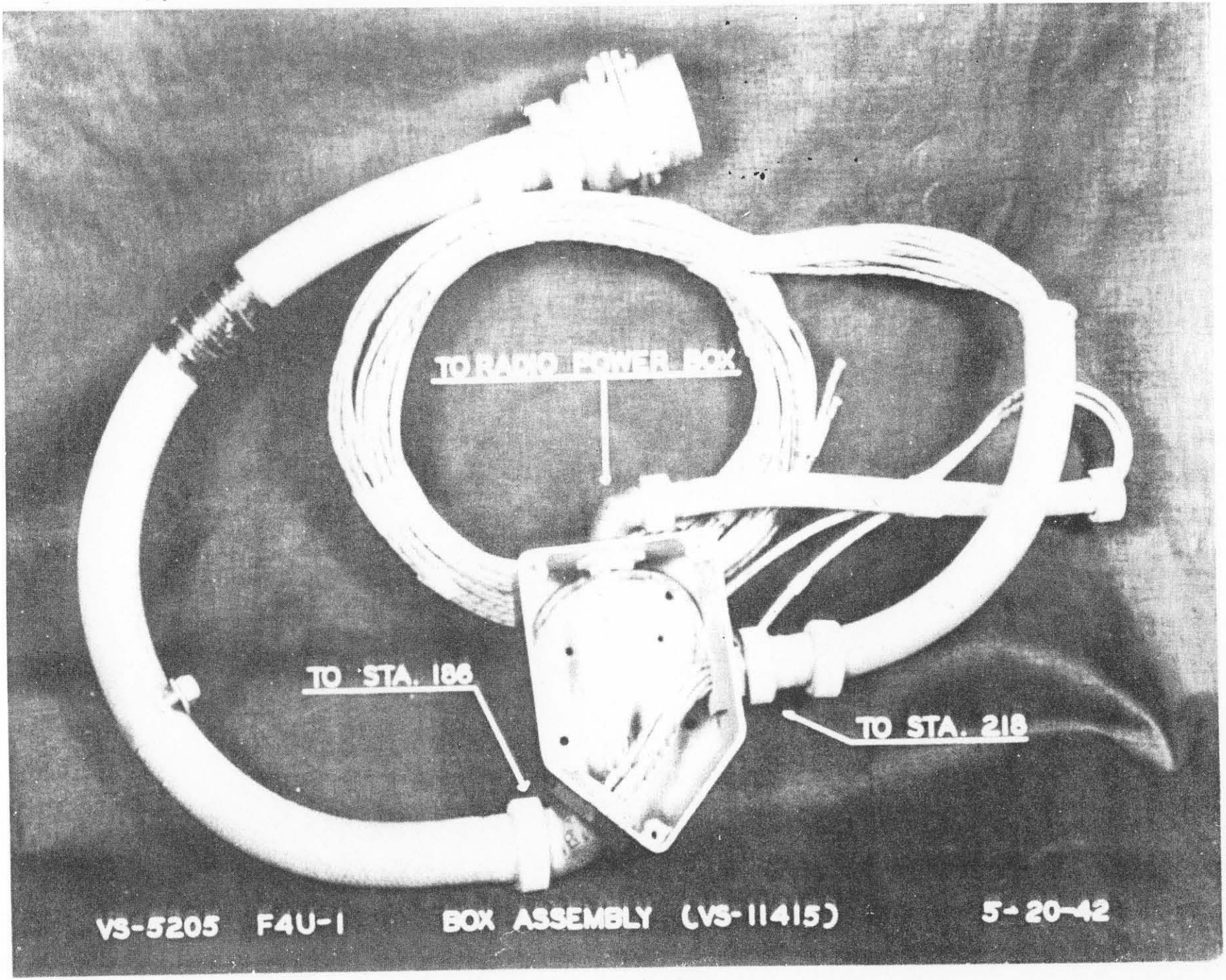
USEFUL LOAD GROUP

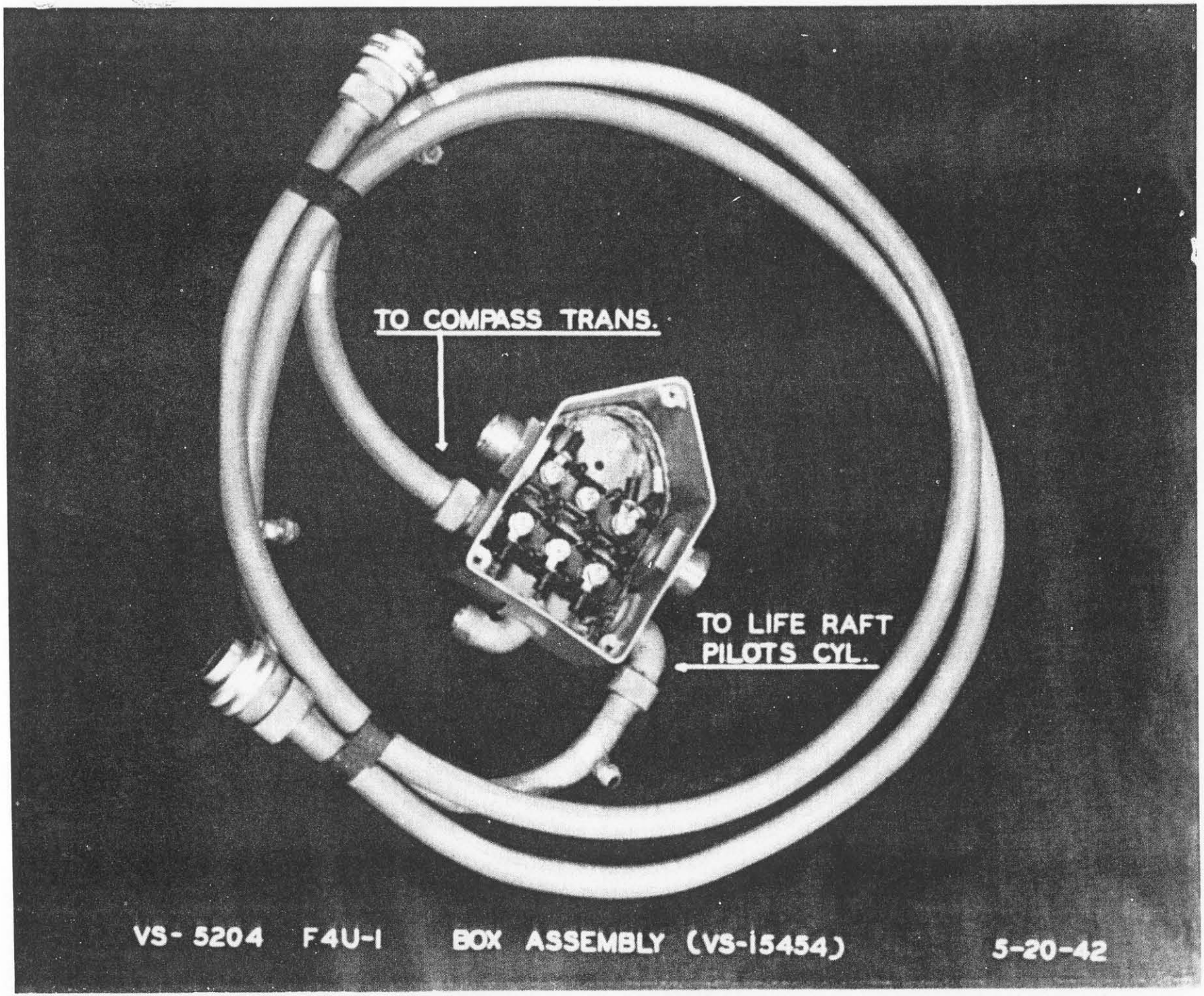
REFERENCE DRAWINGS

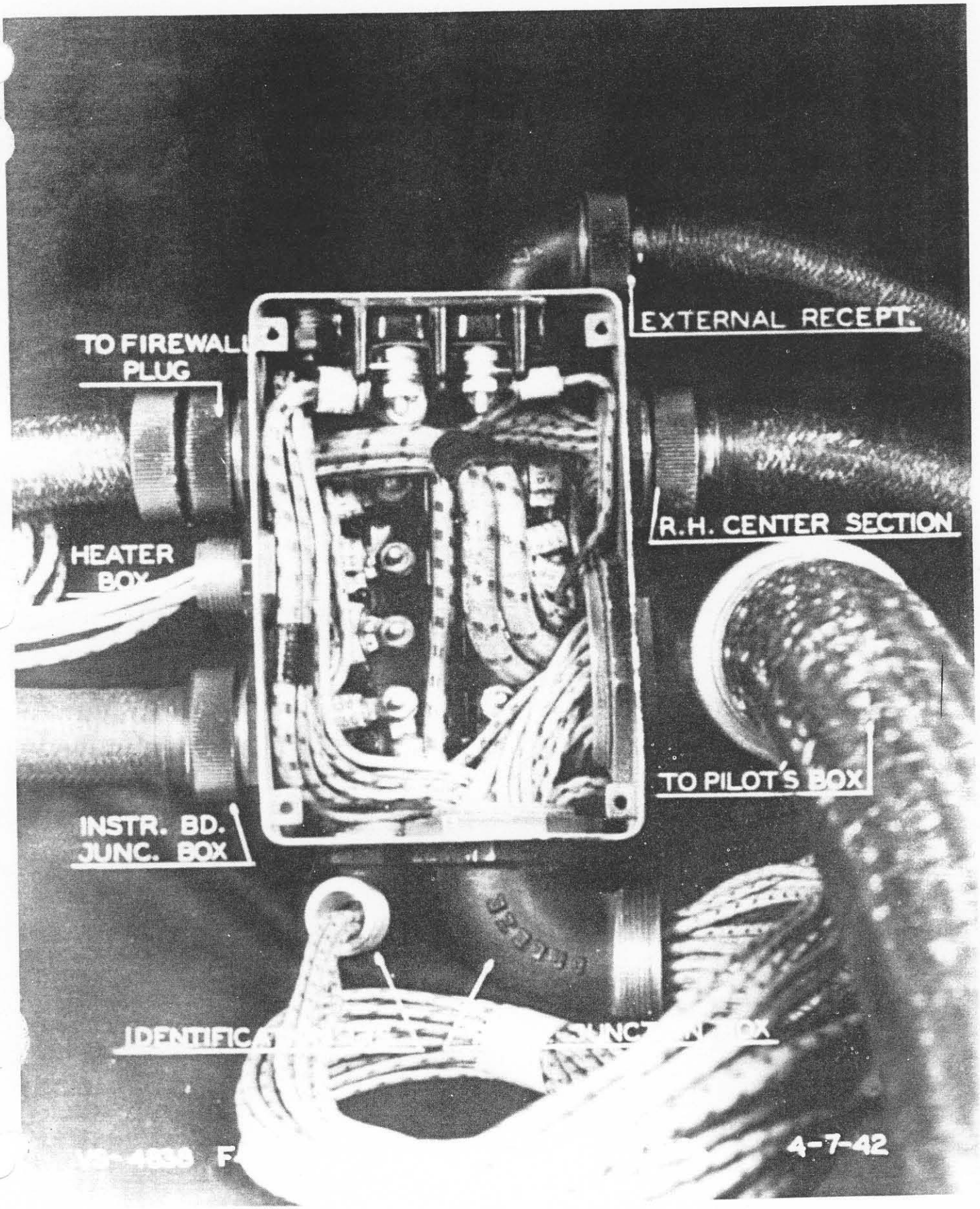
VS-10435	Sighting Installation - Gun Bore
VS-10519	Gun Installation - Outer Panel
VS-10520	Gun Installation - Fixed
VS-10525	Radio Installation
VS-10542	Bomb Rack Installation - Outer Panel
VS-10575	Gun Camera Installation -
VS-12528	Heater - Fixed Gun Installation

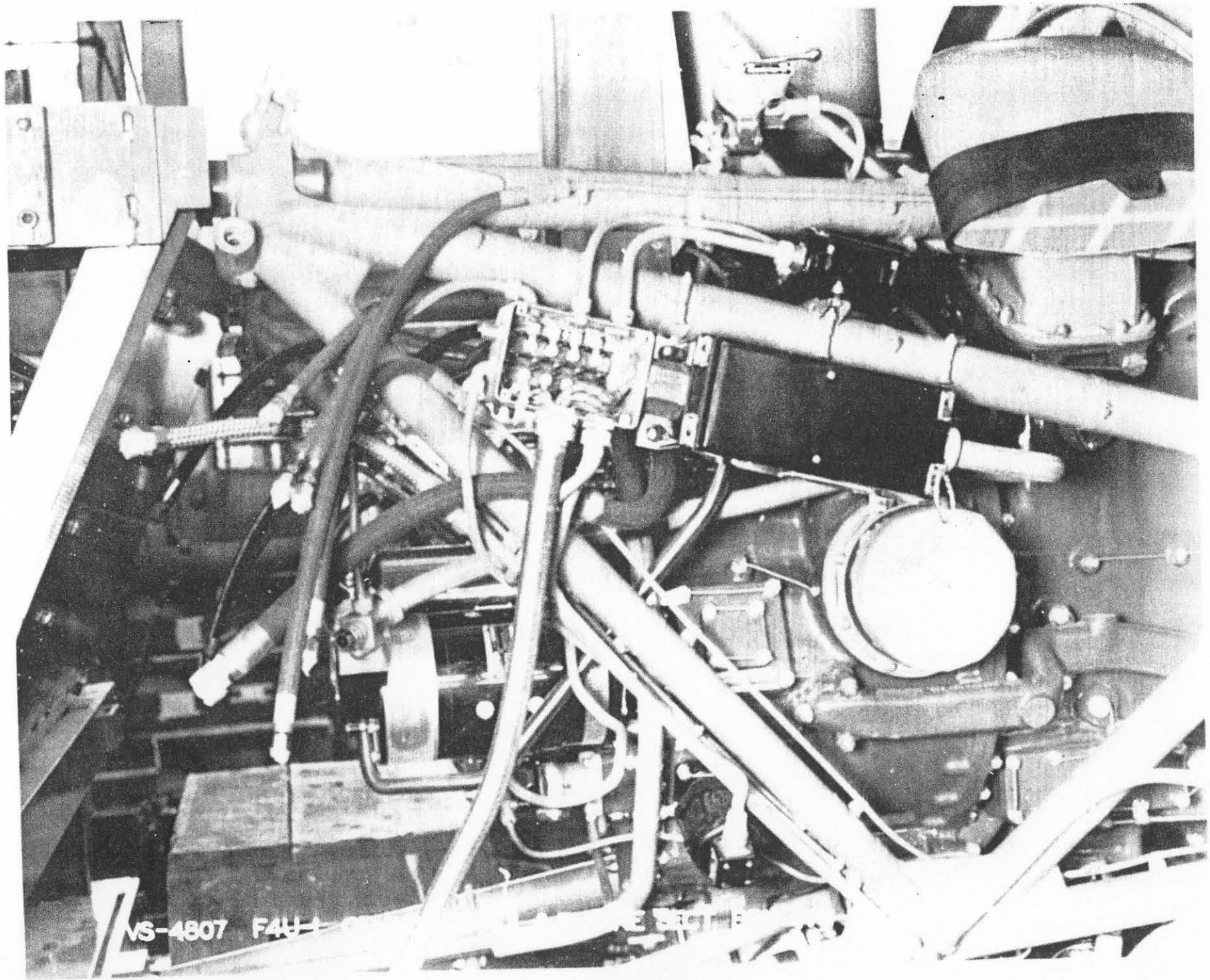

STRUT

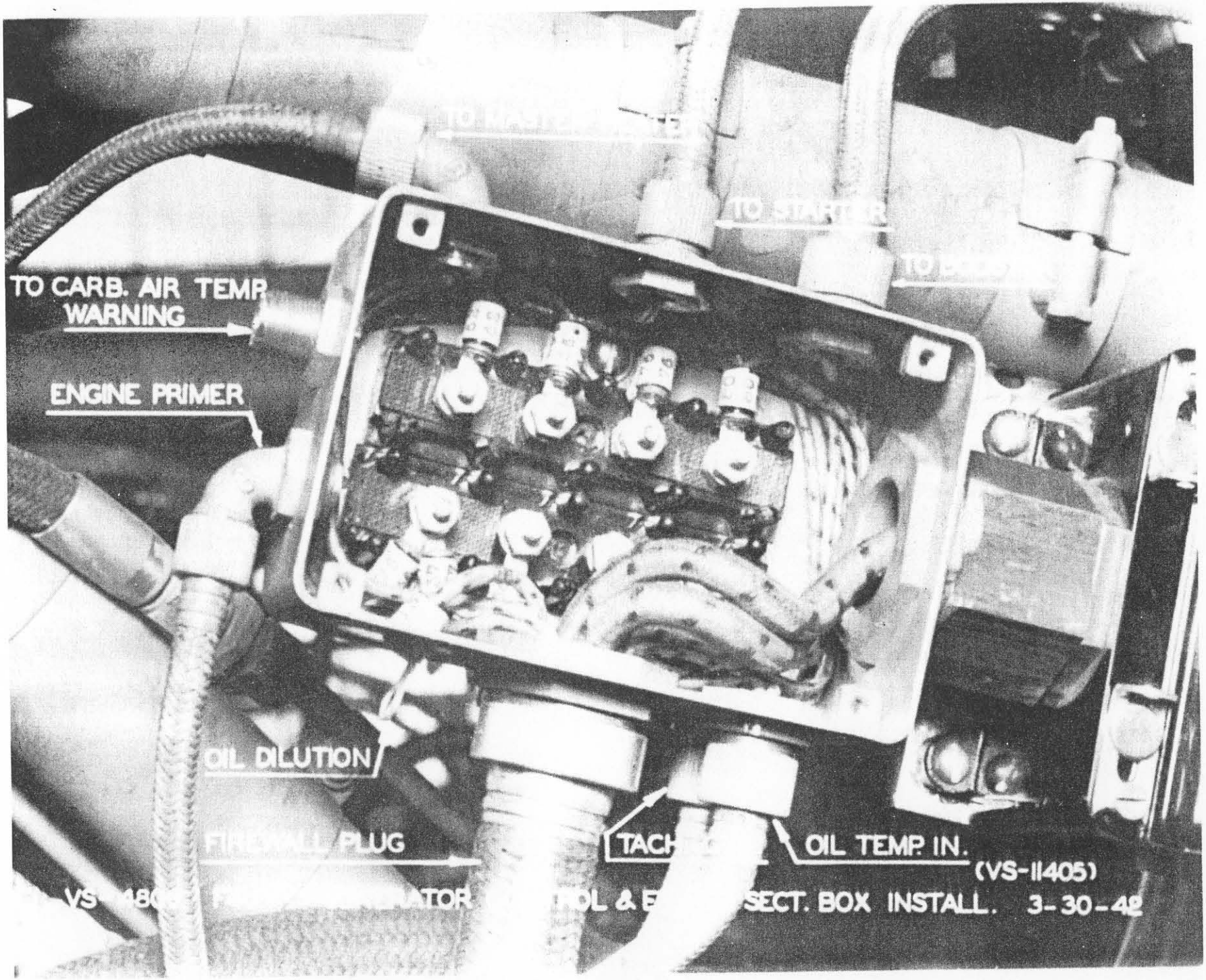

VS-5559 F4U-1 GENERATOR CONTROL & ENGINE SECTION BOX ASSEMBLY
6-23-42

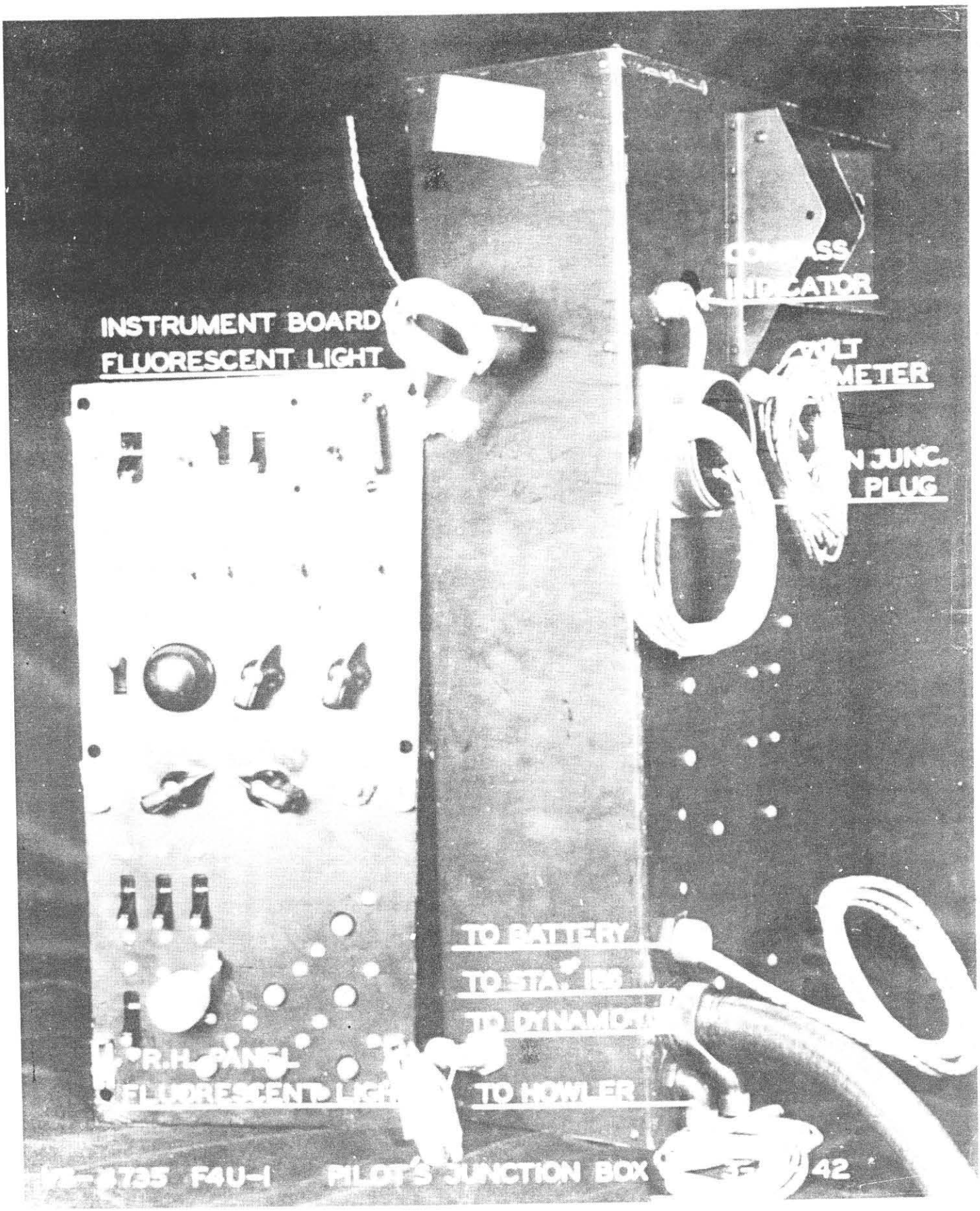

TO RADIO POWER BOX
TO STA. 186
TO STA. 218
VS-5205 F4U-1 BOX ASSEMBLY (VS-11415) 5-20-42

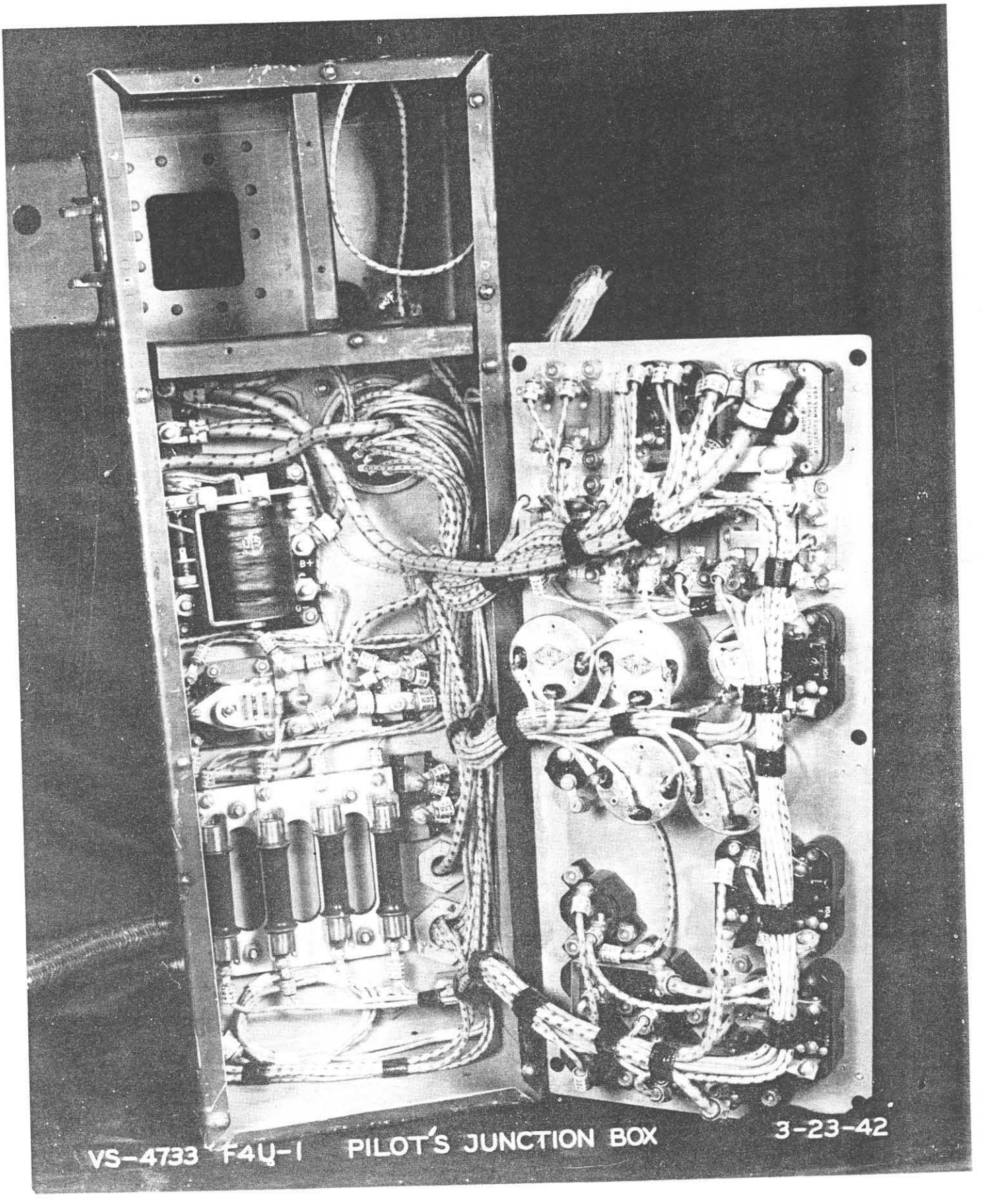

TO COMPASS TRANS.
TO LIFE RAFT
PILOTS CYL.
VS- 5204 F4U-1 BOX ASSEMBLY (VS-15454) 5-20-42


TO FIREWALL PLUG
EXTERNAL RECEPT.
R.H. CENTER SECTION
HEATER BOX
TO PILOT'S BOX
INSTR. BD. JUNC. BOX
4-7-42

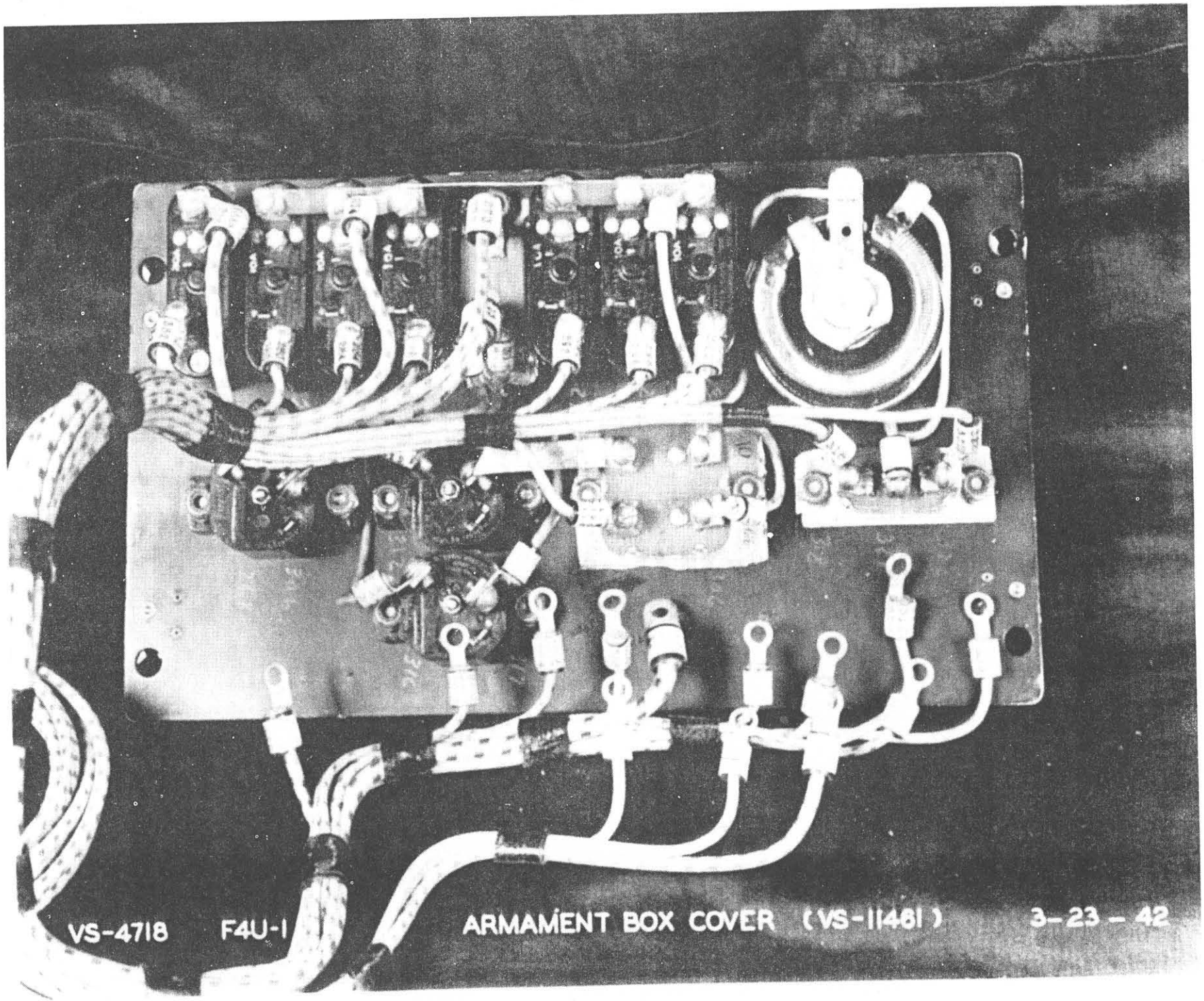

VS-4807 F4U-1

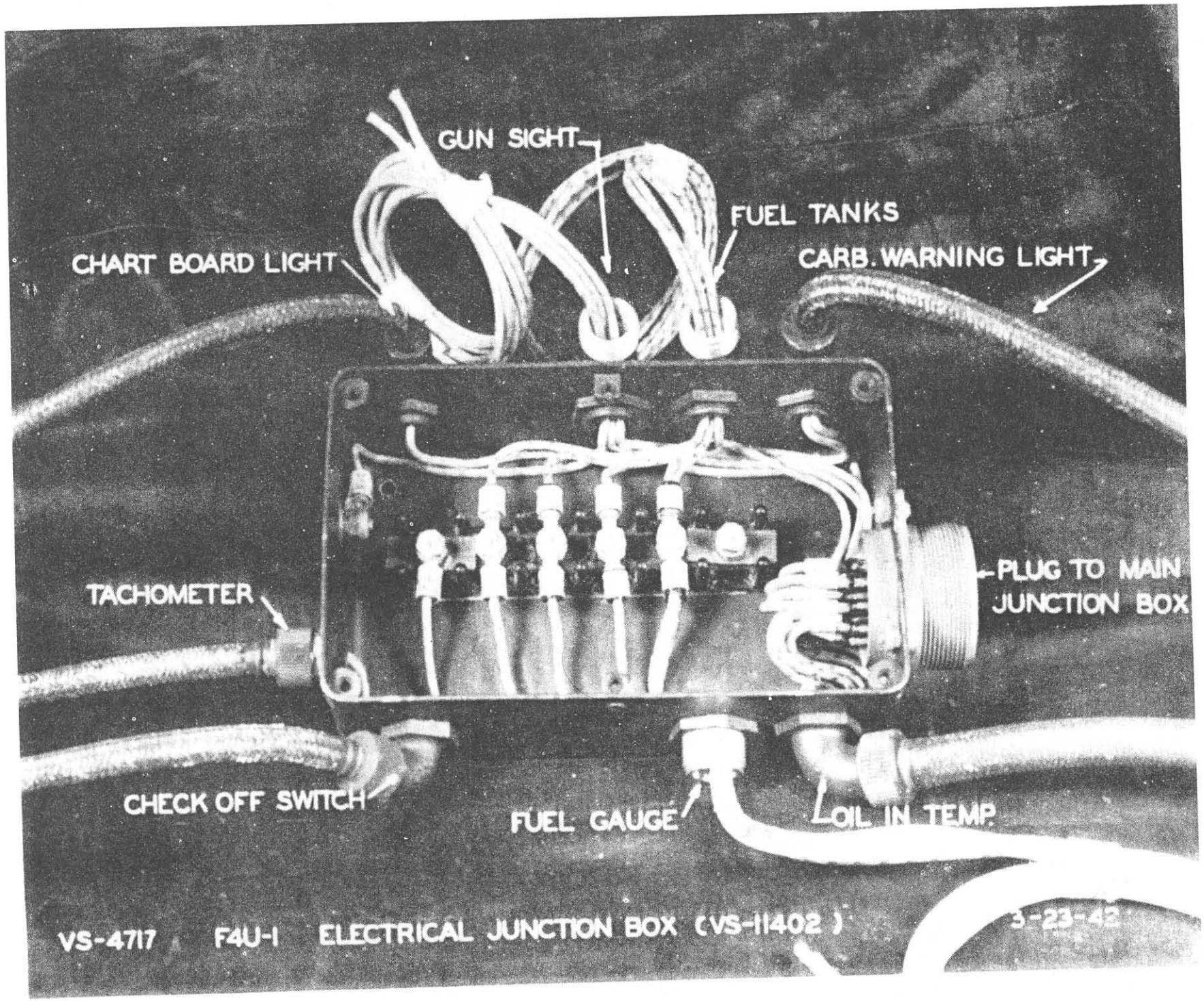

TO CARB. AIR TEMP. WARNING
ENGINE PRIMER
OIL DILUTION
TACH
OIL TEMP. IN.
(VS-11405)
SECT. BOX INSTALL. 3-30-42

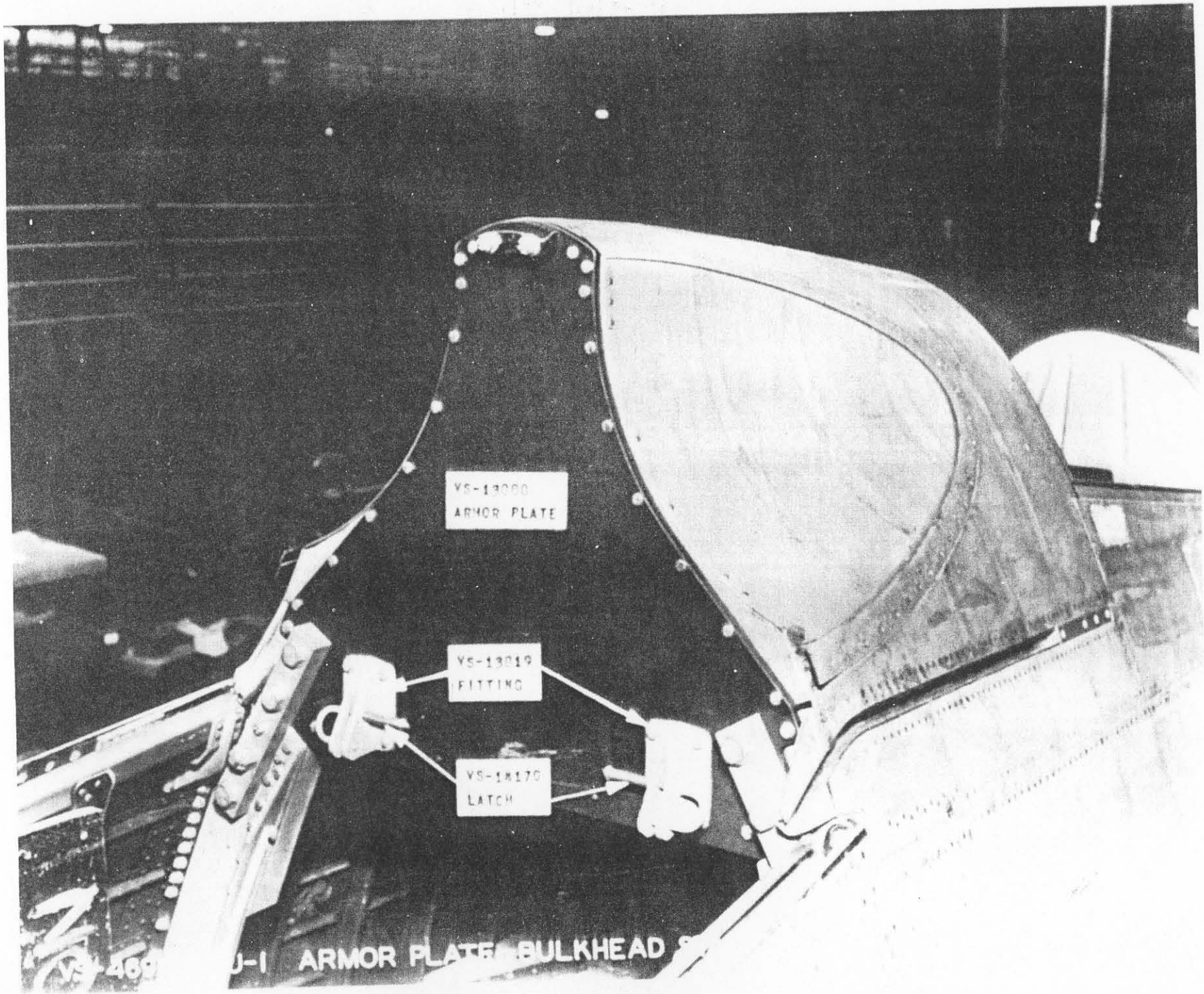

INSTRUMENT BOARD
FLUORESCENT LIGHT
TO BATTERY
TO STA. 198
TO HOWLER
R.H. PANEL
PILOT'S JUNCTION BOX
42



VS-4733 "F4U-1 PILOT'S JUNCTION BOX 3-23-42


VS-4718 F4U-1 ARMAMENT BOX COVER (VS-11461) 3-23-42


GUN SIGHT
FUEL TANKS
CHART BOARD LIGHT
CARB. WARNING LIGHT
TACHOMETER
PLUG TO MAIN JUNCTION BOX
CHECK OFF SWITCH
FUEL GAUGE
OIL IN TEMP.
VS-4717 F4U-1 ELECTRICAL JUNCTION BOX (VS-11402)
3-23-42


VS-13000
ARMOR PLATE
VS-13019
FITTING
VS-18170
LATCH
ARMOR PLATE - BULKHEAD

USEFUL LOAD

The useful load consists of crew, fuel, oil, armament, radio equipment, navigating equipment, and oxygen equipment.

ARMAMENT

The armament installation comprises six .50 calibre Browning non-synchronized fixed aircraft machine guns, type M-2, in the outer panels, one Mark 8 illuminated gun sight and an auxiliary open sight mounted on the cowl deck, a type N-4 gun camera in the right hand outer panel, two Mark 41 Mod. 2 bomb racks, each to carry one 100 lb. bomb on each outer panel, and one Mark 2 Molin signal discharger.

GUN INSTALLATION

(Reference VS-10519, VS-10520)

The guns are located in the inboard end of the outer panel trailing edge, aft of the wing beam, with the barrels projecting into blast tubes, the muzzles of which are fastened to the leading edge. The guns are mounted on trunnion posts, permitting a minimum horizontal adjustment from parallel to the centerline of airplane to convergence at 250 yards, and a vertical adjustment of plus or minus 1/8 degree from the line of flight. Ejected cases and links fall directly into the airstream through chutes attached to and below the guns. For each gun the link and case chutes meet in a common opening to the outside air stream. The position of the guns is shown clearly on the reference drawing. The ammunition is fed from the boxes to the guns across phenolic rollers. For location refer to VS-10519 and VS-10520.

Access to the guns for service or removal is provided by large gun bay doors in the upper surface of the outer panel, extending from the after edge of the main beam to the lower trailing edge. (See photograph VS-5405) The forward sections of the doors are hinged and fold forward, being held in this position by support struts. The after section, however, must be removed from the airplane. To open: release the fastenings on the forward outboard door edge by turning the latch locking screw one-quarter turn and raising the latch. This disengages a locking strip from a row of studs on the rib. Other latches are released by opening Dzus fasteners, raising the latches and turning clockwise on right hand side and counterclockwise on left hand side, thus withdrawing the locking pins at the door edges.

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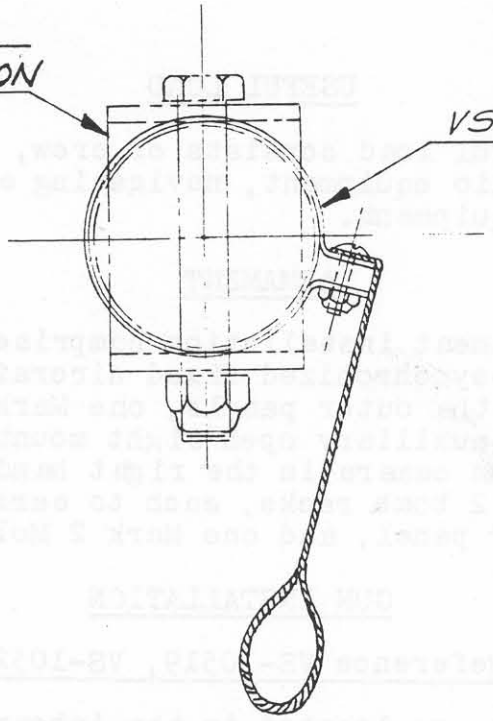
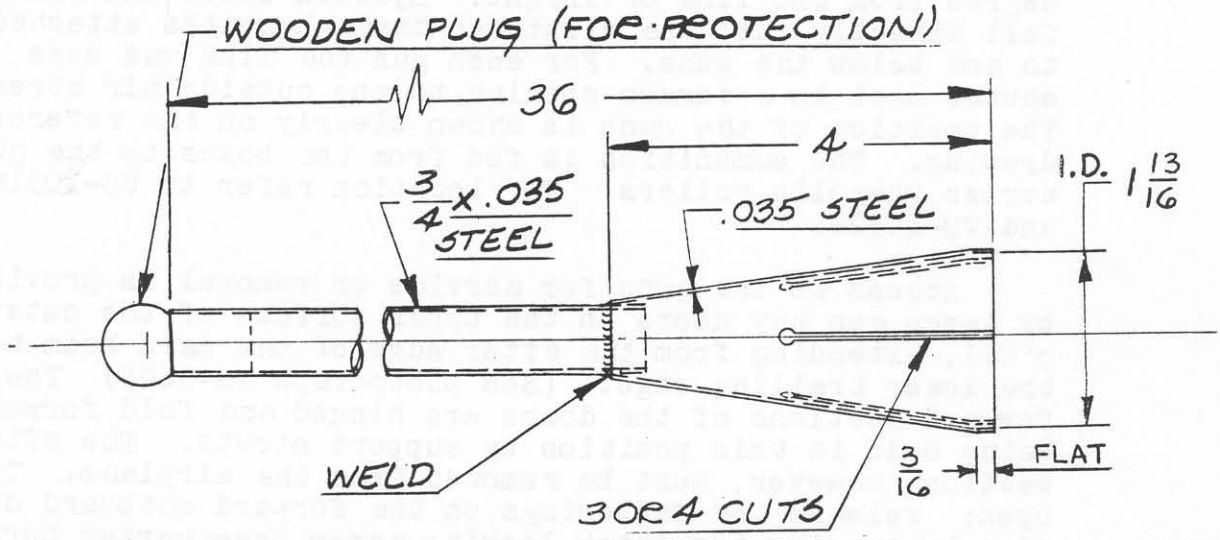
Date 9-7-42

Page-100

B.O. 179008
FRONT GUN TRUNNION



A CABLE AS SHOWN ABOVE MAY BE USED ON FRONT GUN TRUNNION TO FACILITATE INSTALLATION AND REMOVAL OF GUNS.



A FUNNEL AS SHOWN ABOVE SHOULD BE USED TO FACILITATE INSTALLATION OF GUN BARREL JACKET INTO FABRIC BOOT IN MAIN BEAM.

OUTER PANEL FLAP DISCONNECT

In order to remove the guns, the outer panel flaps must be dropped to a position approximately perpendicular to the thrust line. This is accomplished by means of the outer panel flap disconnect assembly, located at the inboard end of the flap. To lower flaps, open the small access door, which is equipped with a Camloc fastener, and raise the disconnect lever (see drawing VS-10022) thus detaching one end of the flap horn fitting from the flap and allowing flap to drop about 90°, in which position it automatically locks. To unlock the flap, push down the plunger on outer panel upper surface (this plunger projects only when flap is locked in lowered position) and raise the flap to its normal position, at which point the flap horn fitting is automatically re-connected.

REMOVAL OF GUNS AND GUN FITTINGS

Before the guns can be removed it is necessary to remove the feed chutes, link ejection chutes and hydraulic gun chargers, and to detach the electrical connections at the trigger controls.

The feed chute for each gun is attached to the outboard side of the breech by the VS-12568 hanger assembly, the detaching of which may be readily accomplished by pulling out the crank-shaped spring-loaded tube until the locking pins disengage. Release the outboard end of the chute by pressing out on the spring clips attaching the chute to the rib, thus freeing the feed chute completely, so that it may be lifted out. The forward feed chute is jointed in the middle to allow its removal from below the door support strut. Remove the hinge pins to open the joint.

The link ejection chute for each gun is attached to the inboard side of the gun and may be removed by pulling out the snap-in pin, pulling the chute away from the gun and lifting the chute clear of its connection to the case ejection chute below the gun.

The hydraulic gun chargers are secured to the inboard sides of the guns by linked throw-off clamps. Loosening the wing nuts on the clamp links releases the clamps and detaches the gun chargers. The hydraulic lead-ins are of flexible hose which allows the disconnected chargers to be stowed in the spring-clip holders on the adjacent ribs without disconnecting the hoses.

The electric trigger control solenoids, Mark 5 Mod. 1, Mark 4 Mod. 1 or Mark 3 Mod. 3, are attached to the outboard sides of the guns. Electrical connections are readily detached by pulling the pins from the sockets.

The guns are mounted on trunnions, equipped with knurled, spring-loaded locking rings which must be backed off one-quarter turn and held thus while the guns are lifted from the trunnion posts. Guns may now be withdrawn aft until the barrels are clear of blast tubes. Replacement of the guns is accomplished by a reversal of the above procedure.

DIRECTIONAL ADJUSTMENT OF GUNS

Provision for horizontal and vertical adjustment of each gun is made on the after trunnion post. Access to the adjusting nuts is had through the gun bay door itself, through the hand holes in the under surface of the outer panel below the after trunnions of the inboard and intermediate guns, and through the small Dzus-fastener-equipped access door below the after end of the outboard gun.

Horizontal adjustment is obtained by loosening the nut on the transverse bolt in the lug at top of the after trunnion, loosening the set screw in the gun, and turning the bolt until the correct position is reached; then tighten the set screw and nut. Means for vertical adjustment is provided on the after trunnion post which is threaded into a clamp support. Lift the rear of the gun from the trunnion post, loosen the nut on the clamp support, turn the trunnion post until the desired elevation is attained, then tighten the nut on the clamp.

GUN HEATERS

(Reference VS-12574)

The gun heaters, which are of the internal combustion "South Wind" type, are located in the outer panel trailing edges, outboard of the guns, one heater being installed in each outer panel. Access to the heaters is provided by doors just outboard of the aft gun bay doors. (See photograph VS-5399). The heater doors are equipped with Dzus fasteners. The heaters rest on pads across the ribs, being secured aft to the VS-15674 and VS-15675 brackets by means of seven screws, and held down forward by two long bolts that pass through the VS-12571 channels riveted across the tops of the heaters.

The heater is installed as described above, using the screws, bolts, etc., as called out on VS-12574. After installation, the following connections must be made (See Wiring Diagram, VS-10426).

1. Remove the tape from the gun heater end of wire No. 343 in the left outer panel and wire No. 347 in the right outer panel, and connect the wires to the heaters

2. Remove the AN-815-D6 union and the AN-820-6 cap from the end of the VS-16100-39 tube assembly in the outer panels. Connect the VS-16100-39 tube to the heater by means of the AN-819-6D and AN-818-6D tube fittings.

To remove the heaters, take out the attaching screws and bolts, disconnect and plug the fuel supply tubes, disconnect the electric wiring and lift the heaters from the wing.

Should it be found necessary to replace a gun heater, it is to be noted that new heaters are supplied assembled for installation in the left hand outer panel. Instructions for reversing the assembly, for right hand installation, will be found on drawing VS-12528.

GUN BLAST TUBES

The blast tube muzzles are attached at the tube openings in the outer panel leading edge with flush screws. If necessary, the blast tubes may be removed by taking out the attaching screws and pulling the tubes forward, out of the leading edge.

AMMUNITION BOXES

There are six ammunition boxes, two per gun, in each outer panel, lying across the ribs outboard of the guns. Each holds 200 rounds with the exception of the after outboard boxes which, in order to fit into the wing contour, are less deep than the others and hold 175 rounds each. Consequently the maximum magazine capacity for the inboard and intermediate guns is 400 rounds each, and 375 rounds for each of the outboard guns. The 200 round boxes are interchangeable on the left hand outer panel and on the right hand outer panel, but not from left to right.

To remove the ammunition boxes, open the gun bay access doors and raise the ammunition box retaining strips. The latter are located over the outboard ends of the outboard boxes and over the gap between the outboard and inboard boxes. Near the forward end of each retaining strip is a latch, opened by turning the latch locking screw one-quarter turn. Raising the latch unlocks the retaining strip which may now be swung open on the hinge at its forward end. Grasp the ammunition box handles which extend across the box at the ends of the cover, pull them in a direction away from the center of the cover, then pull up. Handles will then extend about two inches above the box, and the ammunition box may be lifted clear of the wing.

The ammunition box covers are hinged on the forward side and secured on the after side by hinge pins. To open the covers, withdraw the after pins. When closing, be sure

that the covers are all the way down and aligned with the sides of the boxes before replacing the pins.

ILLUMINATED GUN SIGHT

The Mark 8 illuminated gun sight is located on the center line of the airplane and is mounted in an adapter which is bolted to a bracket on the cowl deck above the instrument board.

To remove the illuminated gun sight, press in the buttons at the sides of the lamp housing at the bottom of the sight. The lamp housing may then be removed by detaching the electric conduit connection forward of the housing. Remove the two bolts attaching the sight adapter to the sight bracket.

To remove the sun filter, take out the four bolts attaching the sun filter post to the cowl deck. To replace the sun filter and the illuminated sight, reverse the above procedures.

To adjust the illuminated sight, loosen the clamp bolts in the adapter supporting ring just enough to permit movement of the sight; align the sight, then tighten the clamp bolts.

AUXILIARY OPEN SIGHT

The auxiliary open sight is of the ring and bead type, and is mounted on the cowl deck, left hand side. Vertical and horizontal adjustment is provided in the forward, or bead, part of the sight. Loosen the nut on the lower part of the bead shaft, then adjust the upper nut until the desired elevation of the bead is obtained. Adjust horizontally by moving the bead shaft to the right or left in the slotted adapter blocks. When the correct horizontal position is attained, hold the sight in place and tighten the lower nut.

GUN CAMERA

(Reference VS-10575)

The type N-4 gun camera is installed in the inboard leading edge of the right hand outer panel. The camera window is made of curved laminated plate glass. For horizontal adjustment, loosen the AN-310-3 nut on the bolt at the top of the VS-10021 trunnion and turn the VS-13738 bolt until the correct horizontal position is reached, then tighten the nut and replace the safety wire. For vertical adjustment, loosen the lower AN-316-4L nut at the bottom of the trunnion shaft, adjust the upper AN-316-4L nut until the desired elevation is attained, then tighten the lower nut.

Access to the camera is provided through a small door located just below the camera. The door is equipped with Dzus fasteners.

BORESIGHTING

(Reference VS-10435)

The following instructions are given for aligning the gun sights, gun camera, and guns as follows: Horizontally - for firing parallel to plan-view thrust line of the airplane and for convergence at 250 yards, vertically - parallel to the line of flight at estimated full speed of the airplane with normal load less one half fuel and at best performance altitude.

Level the airplane to approximate flight position by hoisting the tail on the lift tube. Exact levelling is not necessary for boresighting. Apply counterweights as noted in order to prevent the airplane from nosing over.

Place the boresighting tees in position. The forward boresighting tee has an aperture with cross wires, and has relatively wide arms; the after tee has a peep sight and much shorter arms. The socket for the aft boresighting tee (reference VS-17569) is on the airplane centerline lower fuselage surface, just below the seat bulkhead. The forward boresighting tee socket is on the centerline fuselage lower surface approximately below the main fuel tank bulkhead. Remove the VS-12591-2 rubber plugs from the sockets and insert each tee rod in its socket so that the slot in the rod engages the cross pin in the socket. Slide the retaining nut up the rod into the socket and tighten.

BORESIGHTING FOR PARALLEL FIRE

(Reference VS-10435)

To boresight the guns, camera, and sights for parallel alignment, proceed as follows. Construct a target screen of some suitable material, minimum size about 7 by 20. (a target of this size is not to be placed more than 100 feet ahead of the leading edge of the center section. If distance is greater, the 20 foot length of the target must be increased). Extend a horizontal line the full width of the screen, near the lower edge. At the approximate midpoint of this line, erect a perpendicular to it. Now, working from these lines and using the measurements given on the diagram for parallel fire on VS-10435, establish on the target screen aiming points for the illuminated sight, the auxiliary sight, the gun camera and the guns. (Note: The diagram on the reference drawing is to be followed only for measurements and not as a pattern. In laying out aiming points on the target screen, be sure that the point for the gun camera is above the horizontal and to the right of the

centerline and that the point for the auxiliary sight is above the horizontal and to the left of the centerline).

Place the target screen in a vertical position at a convenient distance from the airplane, and approximately perpendicular to its centerline. Sighting through the peep and crosswires of the tees, adjust the target so that the peepsight and crosswires coincide with the intersection of the target's centerline and horizontal line. Sight across the points at the end of the tees' arms, and adjust the target further so that these points line up with points on the horizontal line on the target. Fix the target securely in the position of its final adjustment.

Adjust the illuminated sight so that the dot in the center of the circle of vision coincides with the aiming point for the illuminated sight.

Adjust the bead of the auxiliary open sight so that the bead and the center of the ring line up with the corresponding aiming point on the target screen.

Adjust the gun camera so that its aiming point on the target screen is centered in the camera field of vision.

Guns are adjusted by means of adjusting nuts on the after trunnions, as explained above. Open the gun breeches and sight through the barrels, adjusting each gun so that its aiming point coincides with the center of the field of vision through the barrel.

BORESIGHTING FOR CONVERGING FIRE

(Reference VS-10435)

The procedure for boresighting the guns, the gun sights, and the gun camera for convergence at 250 yards is essentially the same as that for parallel fire, explained above, with the following exceptions.

1. The distance of the target screen from the airplane must be known.

2. The aiming points for parallel fire on the target screen must be moved toward the target centerline, the extent of movement being determined by the distance of the target screen from the airplane.

The necessary data for boresighting for converging fire is given on drawing VS-10435. In setting up the target screen, the following facts are to be noted.

1. The distance from the target screen to the airplane is measured from a point on the outer panel leading edge, mid-

way between the inboard and intermediate blast tube muzzles, to the target screen on a line approximately parallel to the plan view centerline of the airplane.

2. The necessary figures for establishing the positions of the aiming points on the target screen, with the screen at several specified distances from the airplane, are given on drawing VS-10435. If it is impossible to place the screen at any of the given distances from the airplane, the positions of the aiming points, with the target screen at any distance from the airplane can be calculated by the formulae given on the reference drawing.

After the target screen has been set up, and the aiming points established on it as determined by its distance from the airplane, proceed with boresighting as noted above under "Boresighting for Parallel Fire".

BOMB INSTALLATION

(Reference VS-10542, VS-10974)

The two Mark 41 Mod. 2 bomb racks are installed on the outer panel lower surface, each rack holding one 100 lb. class bomb (Mark 41 or Mark 43.) The bomb racks are connected with the bomb controls in the cockpit by cables, the turnbuckles to adjust cable tension being located at the bottom of the cockpit, left hand side. To install the bomb racks, remove the VS-12591 and VS-12592 rubber plugs from the rack support holes and screw in the VS-10541 support tubes as far as they will go, then back off the supports just enough to align the holes in the support tubes with the holes in the bomb racks. Attach the racks to the support tubes with bolts, washers and cottered nuts as called out on VS-10542. Remove the plugs from the bomb release and arming cables outlet holes. Provide slack in the cables by opening the clevis shackle located in the forward part of the gun bay. Connect the eye splices of the bomb-rack cables to the clevis shackles in the cable ends. These shackles, as well as those in the gun bay, are opened by pushing up the spring-loaded retaining sleeves, which snap down into locking position when the shackles are closed. With the cables pulled taut, adjust the turnbuckles in the cockpit until the dimension from the wing surface to the center of the pin in the cable end shackles are:

Bomb Arming Cable (forward) -7/8"
Bomb Release Cable (aft) -13/16"
(See detail "A-A: on VS-10974)

Removal of the bomb racks is accomplished by reversing the above procedure. Spring stops maintain tension in the cables so that their free ends may be pushed into the outlet holes and the holes plugged, without danger of the cables slipping off their sheaves in the outer panels and center section.

MOLIN SIGNAL DISCHARGER

The Mark 2 Molin signal discharger is installed on brackets on the left hand side of the fuselage just abaft the radio compartment and is connected with a remote cockpit control handle by a cable and pulley assembly. The discharger holds six cartridges which are fired automatically by pulling the control handle. The cockpit control is located to the right of the pilot's seat. A turnbuckle for cable adjustment is provided in the lower part of cockpit right hand side, forward of the seat bulkhead.

OXYGEN EQUIPMENT

The oxygen equipment is located in the right hand after part of cockpit (See photograph VS-5683) and is of the "Demand type," with Model 3 pressure regulator manufactured by the Mine Safety Appliance Company. The oxygen cylinder and valve assembly may be removed by loosening the wing nut on the cradle straps, opening the friction buckle on the hold-down belt and disconnecting the oxygen tube by removing the coupling nut at the top of the cylinder. Be sure that the tubing is grounded to the fuselage.

Reference: Bu. Aer. Technical Note: 18-39

NAVIGATING EQUIPMENT

The navigating equipment consists of a chart board, resting in slides below the instrument panel, and a case for maps and pencils at the right hand side of cockpit. A lock is provided on the chart board to keep it from sliding out when not in use.

RADIO INSTALLATION

(Reference VS-10525)

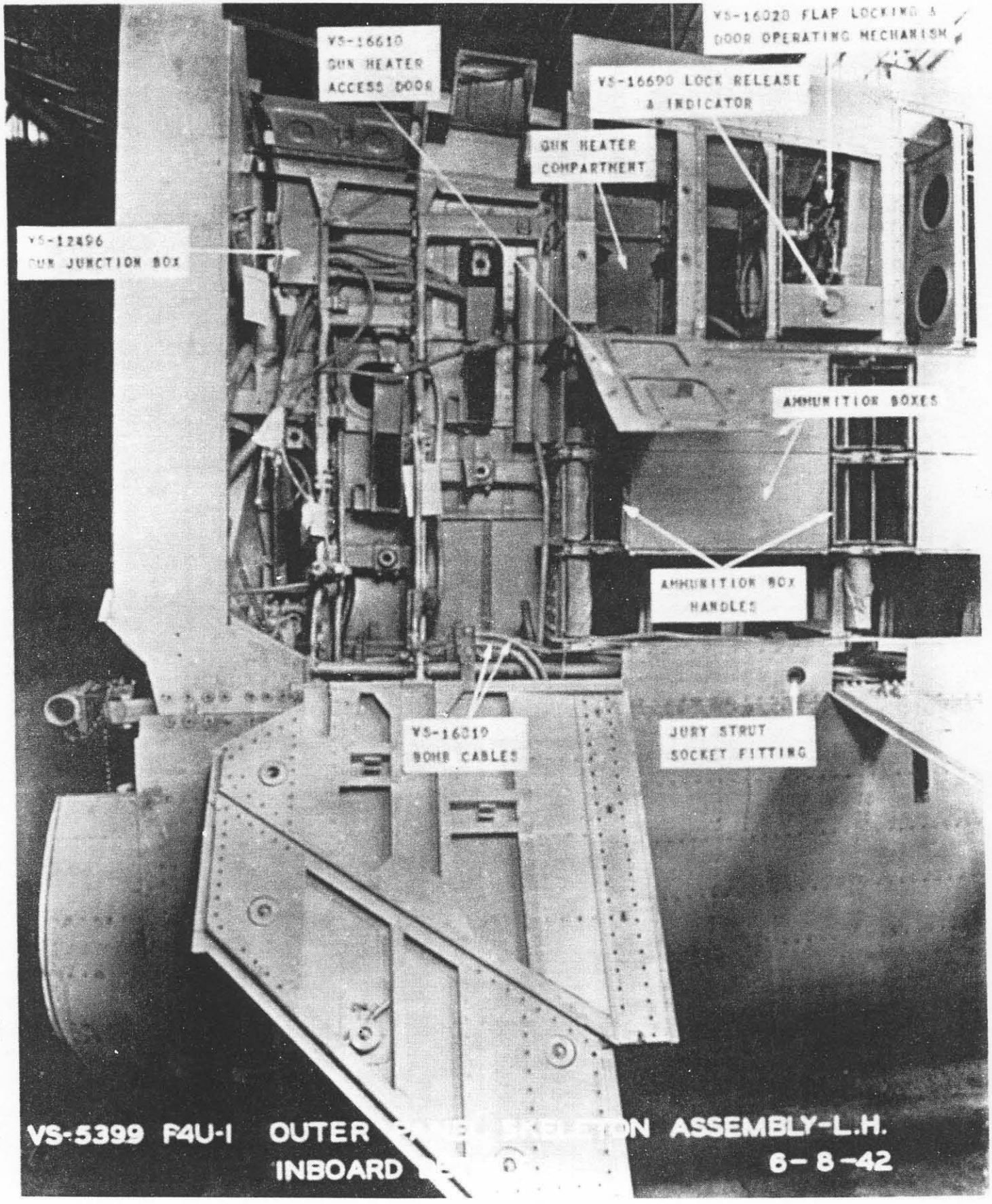
The GF-12, ZB, ABA, IFF radio installation is clearly shown on the reference drawings. Bases for the various units of the installation are bolted to the floor of the radio compartment, abaft the pilot's seat. These bases are provided with rubber shock supports, on which the radio equipment units rest, being held in place by snap-slide fasteners.

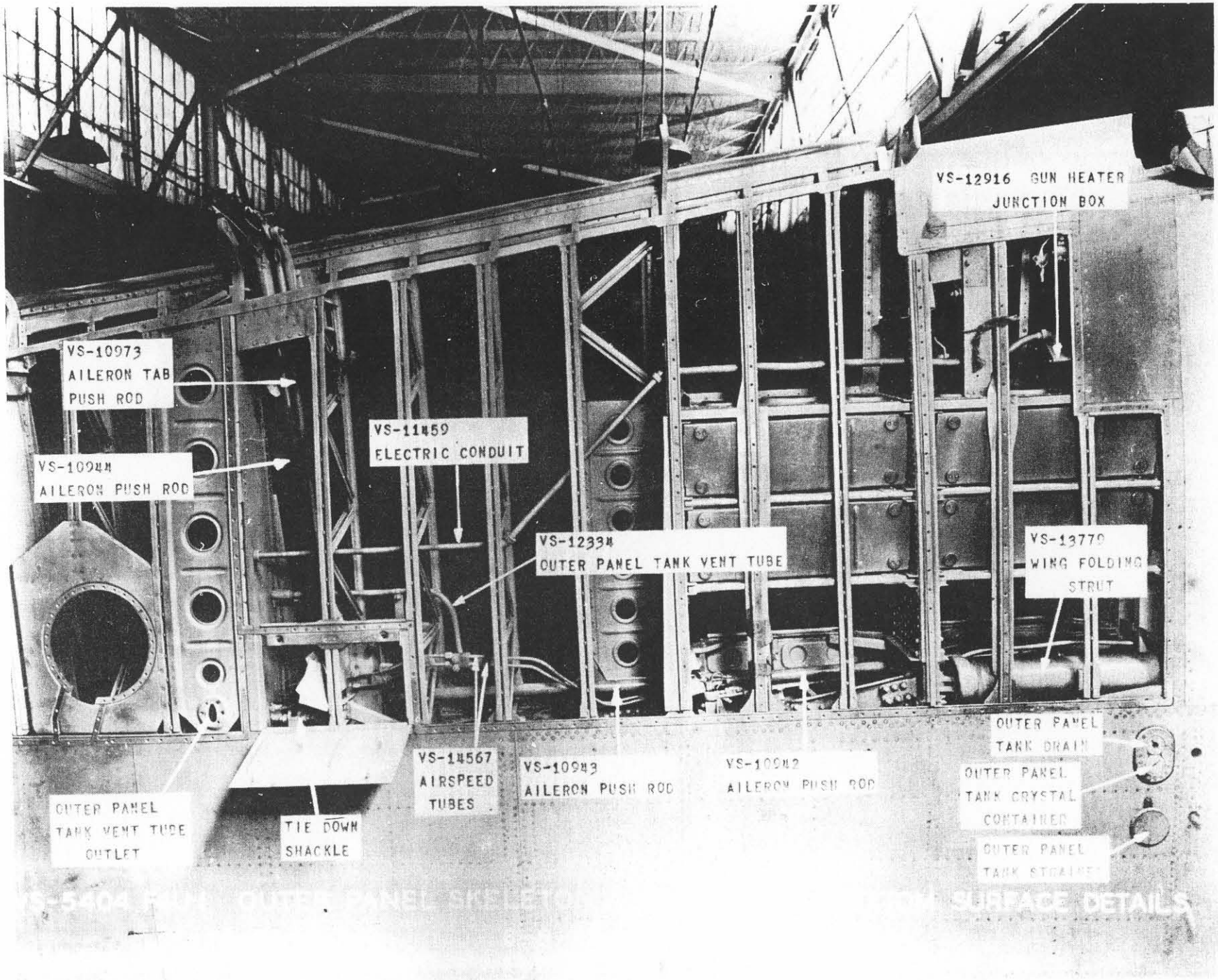
The forward antenna mast may be detached by first relieving tension on the antenna by breaking open the ball and socket clip in the forward part of the antenna, then removing the screw through the base of the mast. The mast may then be lifted from the base.

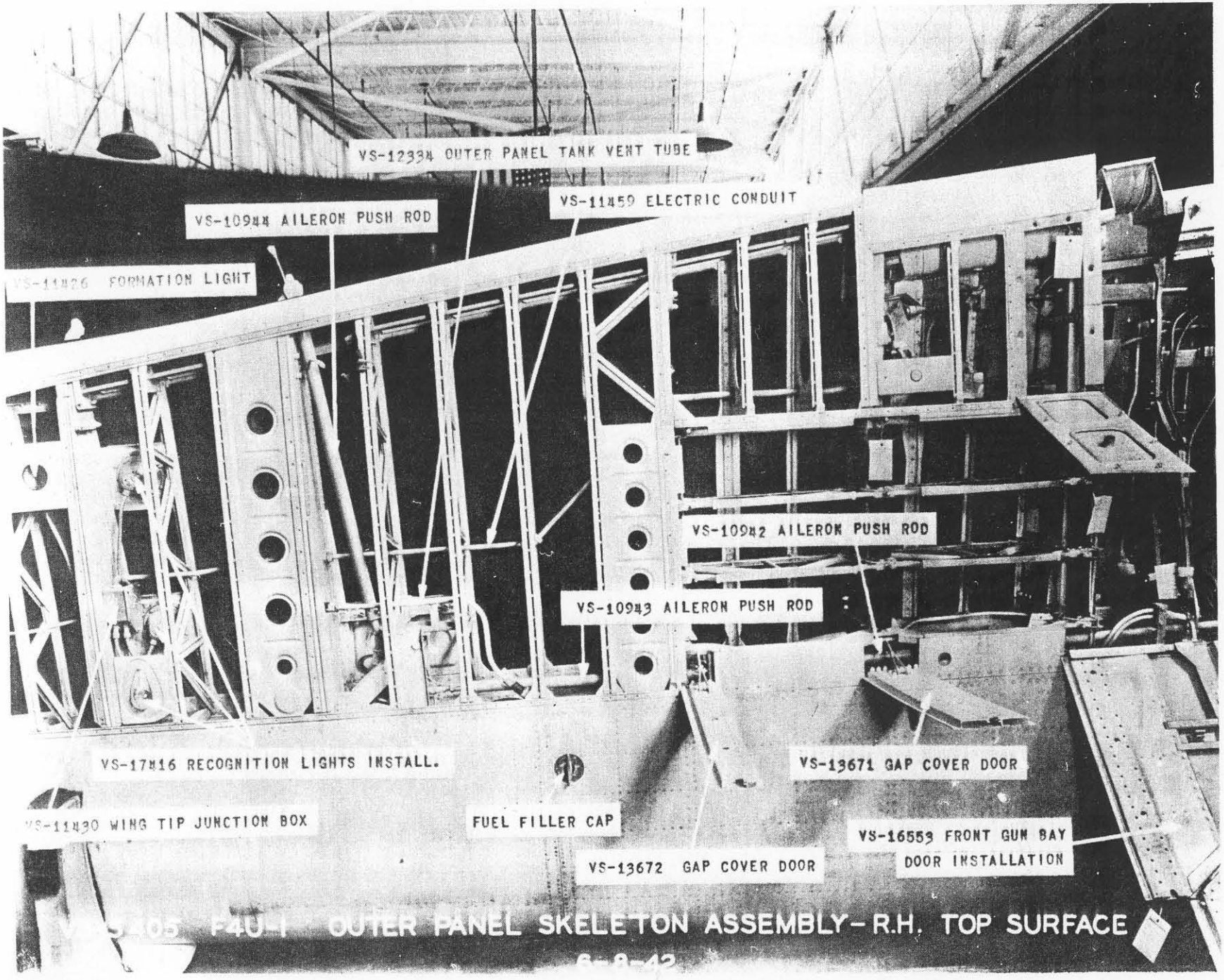
The after antenna mast is built into the top of the rudder and is not removable.

The antenna lead-in connection is on the right hand side of the fuselage, abaft of the cockpit, and is attached by ten screws.

Access to the radio compartment is provided by tilting forward on its hinges the lower section of armor plate abaft the pilot's seat. To accomplish this, remove the pilot's seat, as explained in "Fixed Equipment." Remove the armor plate support cables from the stowing hook and attach the cable snap-hooks to the rings just below the sides of the cockpit cowling. Open the quick-release bolts at the top of the armor plate, and tilt the armor forward on its hinges. The support cables allow the armor plate to swing down to a horizontal position, where it may be conveniently used as a platform for working in the cockpit and the radio compartment.


VS-16020 FLAP LOCKING &
DOOR OPERATING MECHANISM
VS-16610
GUN HEATER
ACCESS DOOR
VS-16690 LOCK RELEASE
& INDICATOR
GUN HEATER
COMPARTMENT
VS-12496
GUN JUNCTION BOX
AMMUNITION BOXES
AMMUNITION BOX
HANDLES
VS-16010
BOWD CABLES
JURY STRUT
SOCKET FITTING
VS-5399 F4U-1 OUTER
INBOARD
ASSEMBLY-L.H.
6-8-42


VS-12916 GUN HEATER JUNCTION BOX
VS-10973 AILERON TAB PUSH ROD
VS-11459 ELECTRIC CONDUIT
VS-10944 AILERON PUSH ROD
VS-12334 OUTER PANEL TANK VENT TUBE
VS-13779 WING FOLDING STRUT
OUTER PANEL TANK VENT TUBE OUTLET
TIE DOWN SHACKLE
VS-14567 AIRSPEED TUBES
VS-10943 AILERON PUSH ROD
VS-10942 AILERON PUSH ROD
OUTER PANEL TANK DRAIN
OUTER PANEL TANK CRYSTAL CONTAINER
OUTER PANEL TANK STRAINER


VS-12334 OUTER PANEL TANK VENT TUBE
VS-11459 ELECTRIC CONDUIT
VS-10944 AILERON PUSH ROD
VS-11426 FORMATION LIGHT
VS-10942 AILERON PUSH ROD
VS-10943 AILERON PUSH ROD
VS-17416 RECOGNITION LIGHTS INSTALL.
VS-13671 GAP COVER DOOR
VS-11430 WING TIP JUNCTION BOX
FUEL FILLER CAP
VS-16553 FRONT GUN BAY DOOR INSTALLATION
VS-13672 GAP COVER DOOR
P40-1 OUTER PANEL SKELETON ASSEMBLY-R.H. TOP SURFACE

CLOSE TOLERANCE BOLTS

The following close tolerance bolts are used on these airplanes, and are listed with the drawings on which they are called out, and the number of each required.

DWG. NO.	SIZE	QUANTITY
VS-10000	CVC-133-4-14	4
	CVC-133-5-18	2
VS-10022	CVC-133-3-9	1
	CVC-133-4-15	4
	CVC-133-4-16	2
	CVC-133-5-18	2
	CVC-133-5-19	2
	CVC-133-6-11	2
	CVC-133-4-17	2
	CVC-133-4-14	2
VS-10100	CVC-133-4-38	2
	CVC-133-4-61	1
	CVC-133-4-53	2
	CVC-133-4-49	2
VS-10103	CVC-133-4-15	2
VS-10105	CVC-133-4-15	1
VS-10109	CVC-133-4-16	2
VS-10404	CVC-133-4-12	2
	CVC-133-4-14	2
VS-10430	CVC-133-4-58	1
	CVC-133-5-25	5
	CVC-133-5-17	1
	CVC-133-8-66	1
VS-10475	CVC-133-4-13	3
	CVC-133-4-15	1
	CVC-133-6-33	1
	CVC-133-8-36	2
VS-10794	CVC-133-3-10	7
VS-10901	CVC-133-4-14	4
	CVC-133-4-15	1
	CVC-133-5-17	1
	CVC-133-8-37	1
VS-10910	CVC-133-4-27	2
	CVC-133-4-67	2
	CVC-133-4-71	2
	CVC-133-4-72	2
VS-10973	CVC-133-3-10	1
	CVC-133-4-8	1
	CVC-133-4-21	1
VS-12850	CVC-133-3-14	6
	CVC-133-5-19	6

The following close tolerance bolts are listed below as to location on the airplanes. The quantity is given in parenthesis after the bolt size.

(a) CVC-133-3-10 (1). Used to attach the aileron tab horn to the tab control rod end.

(b) CVC-133-3-10 (2); CVC-133-4-17 (1); CVC-133-3-12 (1) Used in the rudder tab control linkage within the rudder and rudder torque shaft.

(c) CVC-133-6-37 (1). Used to attach the tube and socket of the control stick.

(d) CVC-133-4-21 (2); CVC-133-6-30 (2); CVC-133-6-37 (2) Used in the aileron droop linkage near the aileron droop screw located at the inboard end of the outer panels. Refer to "Surface Controls" in this manual.

(e) CVC-133-4-16 (1); CVC-133-4-15 (1). Used at each end of the outer panel flap push rod.

(f) CVC-133-3-10 (2); CVC-133-3-12 (1); CVC-133-4-17 (1) Used in the elevator tab control linkage within the elevator and elevator torque shaft.

BONDING

The F4U-1, FG-1 and F3A-1 airplanes are properly bonded when they leave the factory. Should it be necessary to remove any of the bonding during major overhaul or for any repair work, the following general precautions should be observed before replacing bonds.

Preparation of Surfaces:- Points at which electrical connection is to be made shall be scraped free of any and all protective coating or finish, including anodic coating (do not remove cadmium plating), then thoroughly cleaned and dried.

Cleaning shall be accomplished by the use of carbon tetrachloride or alcohol.

The following bonding methods are used:

1. Where steel parts are bonded to steel parts, the copper bond CVC-801 shall be used.

2. Where steel parts are to be bonded to aluminum parts, the aluminum bond jumper NAF-1065, Type D, shall be attached to the aluminum part and the copper bond jumper, CVC-801 shall be attached to the steel member and their free ends joined with a No. 6 aluminum alloy screw and elastic stop nut.

As an alternative, the aluminum bond jumper can terminate at a steel adapter lug CVC-810 fastened to the steel member. Reference Fig. 1, Page 114.

3. Where an aluminum bonding jumper must be secured by a screw or bolt larger than a No. 6, an adapter lug CVC-810 made of the same material as the part to which it is fastened shall be used.

General Bonding Precautions:- Care shall be taken in the application of all bonding devices, to avoid any method of attachment likely to result in weakening of strength parts in the airplane structure.

All aluminum alloy clamps are made of Alclad material, the coating of pure aluminum eliminating the necessity of installing aluminum foil under the clamps.

For detailed requirements on bonding and testing of bonds, see Specification SR-16 and Fig. 2, Page 114.

The bonding installation should be inspected in complete detail after each 100 hours service. Inspectors should check connections for tightness of fastening, soundness of soldered joint, strength and flexibility.

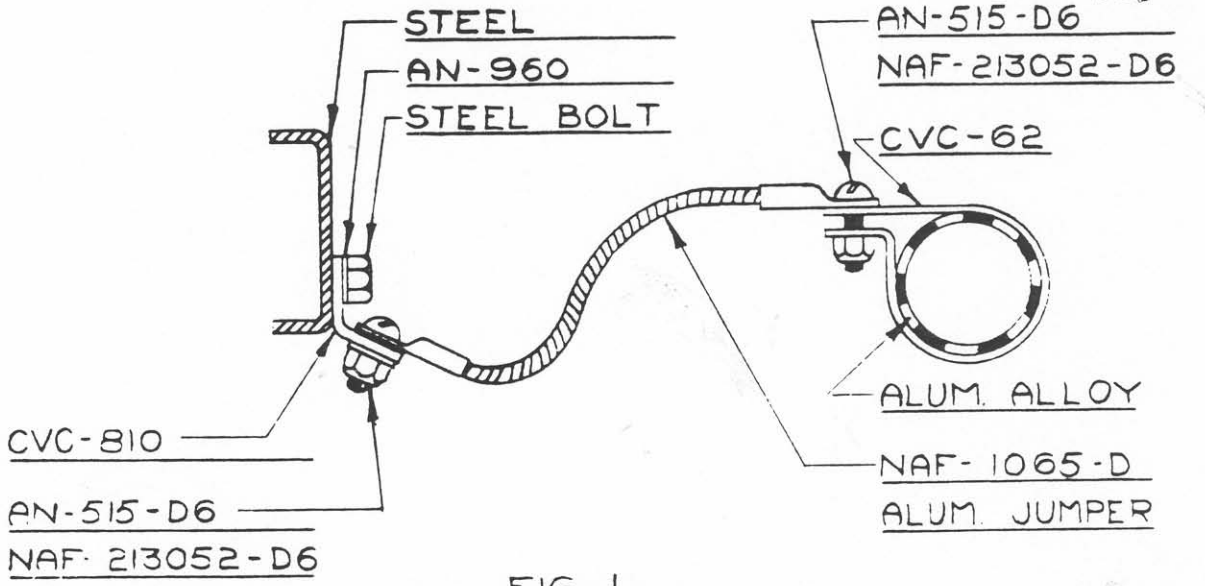
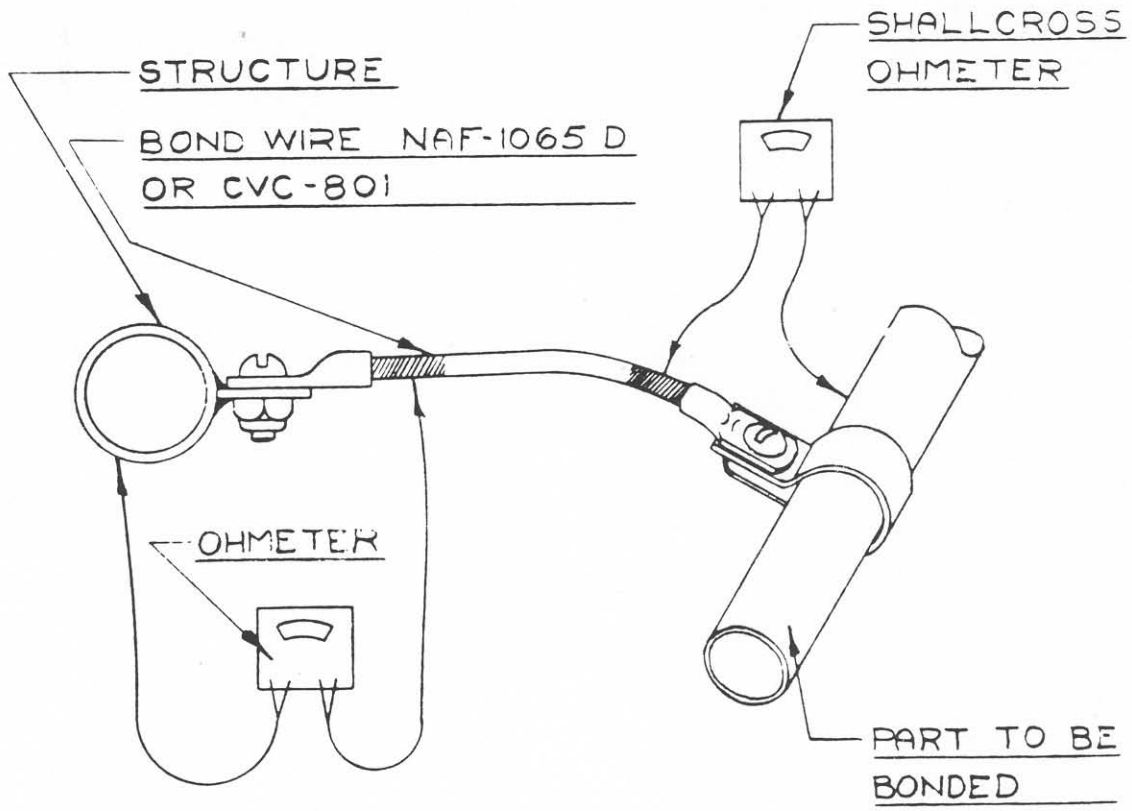


FIG. 1

TEST PROCEDURE FOR BONDING



SD-261-1A

116a. The principal dimensions of the airplane are as follows:

Span: Wings (monoplane)	40' 11-3/4"
Span: Wings folded	17' 1"
Height, over cabin thrust line level (approx.)	11' 2"
Height, over tail thrust line level (approx.)	15' 3-3/4"
Height over propeller, three-point position	15' 2-3/4"
Height to top of hoisting sling (approx.)	11' 9"
Length (maximum)	33' 4"
Length from hoisting sling to the most aft part of tail thrust line level, rudder neutral, elevator down:	24' 6-3/4"
L.E.W. to c.g. (empty) 22.8% M.A.C. (wheels down)	25.0"
L.E.W. to c.g. (Fighter) (wheels down)	31.9"
L.E.W. to c.g. (Fighter-Overload) (wheels down)	31.8"
Center of gravity, normal loading condition: (wheels down)	
Horizontal location, % M.A.C.	30.2%
Vertical location, below thrust line	7.5"
L.E.Wing to rudder hinge line	20' 7-1/2"
L.E.Wing to elevator hinge line	23' 7-3/32"
Angle of line through c.g. and point of contact of wheels with normal to thrust line (approx.)	18° 45'
Angle between lines joining c.g. and points of contact of wheels (front elevation)	83° 36'
Ground angle	14° 23'
Dihedral (outer panel)	8-1/2°
Sweepback (leading edge outer panels)	4° 10'
Chord at root section	105"
Chord at construction tip section	71.4"
Mean aerodynamic chord, inches	94.0"
Wing section and thickness; at root section (% chord)	18%
at construction tip section (% chord)	9%
average - frontal area divided by wing area	16%
Geometric aspect ratio of the following:	
Wing cellule	5.35
Horizontal tail surfaces	4.70
Vertical tail surfaces	1.24
Aileron span	7' 6"
Aileron chord, mean (aft of hinge)	14.3"
Wing incidence, at root section	2°
Clearance of wing at lowest point above ground, thrust line level	51.8"
Tail span	16' 6"
Stabilizer, incidence	+1-1/4
Wheel tread	12' 1"
Wheel size	32" x 8"
Tire and tube size (main wheels)	32" x 8"
Tail wheel tire	8-1/2" x 4"
Diameter of propeller (3 blades) (nominal dia.13'3")	13' 4"
High lift device:	
Type of wing flap	NACA Slotted
Span of wing flaps (% of wing span):	46%
Flap chord aft of hinge, average (% wing chord)	21%
Flap angle, maximum (degrees)	50°

Aileron droop, degrees	9.5°
Propeller clearance, normal loading condition:	
Thrust line level	9"
Three-point attitude	27-3/4"

117a. Angular movements for full movement of controls on each side of neutral: (as limited by the stops in the pilot's cockpit).

Rudder	25° right 25° left
Rudder pedal	4.4" aft, 4.4" forward
Elevator	24° above, 16° below
Elevator control	6-1/2" forward, 11-1/4" aft
Aileron (normal)	19° up, 14° down
Aileron (drooped 9.5°) (measured) from normal chord line)	13° up, 24.5° down
Aileron control	10-1/4" right, 10-1/4" left
Rudder tab control	7-1/2 turns for 40° of tab
Elevator tab contrcl	4.66 turns for 30° of tab
Aileron tab control	5-1/2 turns for 30° of tab
Rudder tab	20° right, 20° left
Elevator tab	10° up, 20° down
Aileron tab	15° up, 15° down
Flaps	50°
Flap control	power operated

WRENCH TORQUE FOR INSTALLING

CASTELLATED AND SELF-LOCKING STEEL NUTS ON STEEL BOLTS

Applies to medium fit, Cadmium plated, non-lubricated nut-bolt installations, heat-treated to 125,000 p.s.i. ultimate tensile strength.

Values given are for nuts (female th'd. member) tightened down onto the bolt.

Method of Using Tables:

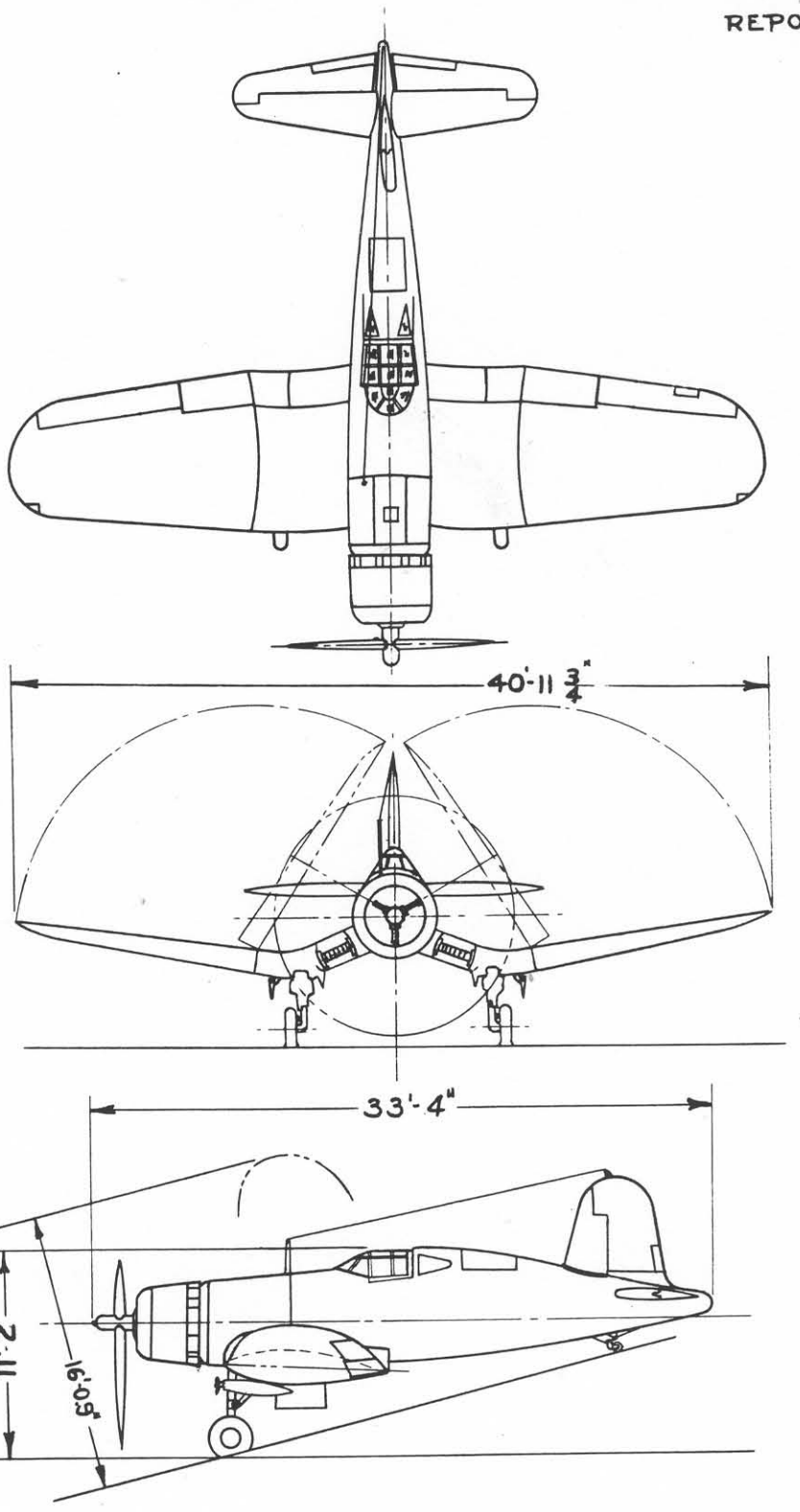
Given: Nut size and type

Find: Allowable wrench torque limits

Procedure:

1. Determine torque limits recommended for given nut (Column 2 or 3)
2. If desired initial tension stress is other than 40,000 p.s.i., multiply the allowable torque limits by $\frac{\text{limit tensile stress}}{40{,}000}$
3. When the heat treat is other than 125,000 p.s.i., multiply the allowable torque limits by $\frac{\text{actual heat treat}}{125{,}000}$

Fine Thread Series — Torque Limits Recommended (in.-lbs.)					Coarse Thread Series — Torque Limits Recommended (in.-lbs.)				
Size	Tension Type (NAF1137-AN310)		Shear Nut Type (NAF1137-AN320)		Size	Tension Type (NAF1137-AN310)		Shear Nut Type (NAF1137-AN320)	
(1)	(2)		(3)			(2)		(3)	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
8-36;	12	15	7	9	8-32	12	15	7	9
10-32	20	25	12	15	10-24	20	25	12	15
1/4-28	50	70	30	40	1/4 -20	40	50	25	30
5/16-24	100	140	60	85	5/16-18	80	90	48	55
3/8-24	160	190	95	110	3/8-16	160	185	95	100
7/16-20	450	500	270	300	7/16-14	235	255	140	155
1/2-20	480	690	290	410	1/2-13	400	480	240	290
9/16-18	800	1000	480	600	9/16-12	500	700	300	420
5/8-18	1100	1300	660	780	5/8-11	700	900	420	540
3/4-16	2300	2500	1300	1500	3/4-10	1150	1600	700	950
7/8-14	2500	3000	1500	1800	7/8-9	2200	3000	1300	1800
1-14	3700	5500	2200	3300	1-8	3700	5000	2200	3000
1 1/8-12	5000	7000	3000	4200	1 1/8-8	5500	6500	3300	3900
1 1/4-12	9000	11000	5400	6600	1 1/4-8	6500	8000	3900	4800



MODEL F4U-1

0 10 20
SCALE - FEET

FORM NO. 226 M

REPORT No. 5615

DATE 9/23/42

1V64 PLV

VOUGHT-SIKORSKY AIRCRAFT

STRATFORD, CONNECTICUT

DIVISION OF UNITED AIRCRAFT CORPORATION

TITLE

ACTUAL WEIGHT & BALANCE

(25th AIRPLANE)

SUBMITTED UNDER

FINAL CORRECTED INFORMATION

MODEL
F4U-1

CONTRACT
82811

PREP. W.E. Wheeler CH'KD. Jack Hamel APPR. J.C. Burling

REVISIONS

DATE	REV. BY	PAGES AFFECTED	REMARKS	NO. OF PAGES

MODEL F4U-1

ACTUAL WEIGHT & BALANCE

TABLE OF CONTENTS

GROUP WEIGHT STATEMENT

[redacted]—ACTUAL

(Cross out those not applicable)

Model F4U-1

Contract No. 82811

Airplane, Government No. 02177

Airplane, Contractor No. 2807

Built by Vought-Sikorsky Aircraft

Engine (model) R-2800-8

Engine Government No. 16478

Date 9/28/42

Changes incorporated in this airplane (Nos. of) A,B,C,D,F,G,H,I,J,K,L,M,N,P,Q,R,S, T,U,W,X,Y,Z,AC.

Other modifications incorporated since the first airplane under this contract See page 18.

AN-9103-B

Model F4U-1

Report 5615

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GROUP WEIGHT STATEMENT

			Landplane	Seaplane
Wing group,			1026.09	
Wings,		875.79		
Ailerons,		57.14		
Flaps,		93.16		
Struts and wires,			158.19	
Tail group,				
Stabilizer,		61.80		
Elevator,		54.82		
Fin,		13.94		
Rudder,		27.63		
Struts and wires,			2488.21	
Body group,				
Fuselage, [redacted]		1841.14		
Alighting gear—land type,		647.07		
Main landing gear,	526.77			
Retracting mechanism,	31.70			
Auxiliary landing gear,	71.00			
Retracting mechanism,	17.60			
Hull,				
Alighting gear—water type,				
Main floats,				
Main float bracing,				
Auxiliary floats (Disp. lbs.),				
Auxiliary float bracing,				
Retracting mechanism,				
Engine section or nacelle group,			325.01	
Power plant group,			3783.03	
Engine (as installed),		2467.95		
Engine accessories,		361.87		
Power plant controls,		32.31		
Propeller,		488.90		
Starting system,		60.80		
Cooling system,				
Radiator and shutters,				
Liquid,				
Piping, etc.,				
Lubricating system,		75.84		
Tanks,	21.48			
Piping, etc.	54.36			
Fuel system,		295.36		
Tanks,	206.48			
Piping, etc.	88.88			
TOTALS (To be brought forward)			7780.53	

GROUP WEIGHT STATEMENT (Cont'd.)

		LANDPLANE	SEAPLANE
Fixed equipment,		946.32	
Instruments,	49.43		
Surface controls,	137.62		
Furnishings,	362.05		
Communicating, (Army),			
Electrical,	187.62		
Anchor, towing and hoisting gear,			
Arresting hook installation,	38.86		
[redacted] Hydraulic	170.74		
TOTALS (from page 2),		7780.53	
WEIGHT EMPTY,		8726.85	

USEFUL LOAD

	FIGHTER Landplane	BOMBER [redacted]	OVERLOAD FIGHTER [redacted]	Seaplane (Actual)
Crew,	200.00	200.00	200.00	
Fuel, (gals.), 178 - 178 - 310	1068.00	1068.00	1860.00	
Oil, (gals.), 12 - 12 - 20	90.00	90.00	150.00	
Armament, 6 - .50 Cal.	776.89	1033.99	1120.69	
Fixed gun and installation,	765.39	765.39	1109.19	
Flexible gun and installation,				
Bomb and installation,		257.10		
Torpedo and installation,				
Pyrotechnics,	11.50	11.50	11.50	
Equipment,	161.36	161.36	161.36	
Communicating (Navy),	107.46	107.46	107.46	
Navigating,	3.70	3.70	3.70	
Miscellaneous,	50.20	50.20	50.20	
Trapped Fuel & Oil	88.00	88.00	88.00	
USEFUL LOAD,	2384.25	2641.35	3580.05	
WEIGHT EMPTY,	8726.85	8726.85	8726.85	
GROSS WEIGHT,	11111.10	11368.20	12306.90	

UNIT WEIGHTS

Wing group (net area = 314), lbs. per sq. ft. incl. 1067.35 of C.S.	6.66
Tail group (net area = 79.9), lbs. per sq. ft.	1.98
[Submerged displacement main float or hull ( ) / Weight of main float and bracing ( )]	
Weight of cooling system per normal H. P. (H. P.)	
Weight of lubricating system per gal. oil cap. (20 Gals. of oil)	3.79
Weight of fuel system per gal. cap. (359 Gals.)	.82

ACTUAL WEIGHT AND BALANCE SUMMARY

PAR. 20(c) of SR-5C

CONDITION		WEIGHT POUNDS	% MAC	HORIZONTAL ARM
Weight Empty	wheels up	8726.85	25.53	94.35
Weight Empty	wheels down	8726.85	23.89	92.81
Normal Fighter	wheels up	11111.10	31.84	100.28
Normal Fighter	wheels down	11111.10	30.55	99.07
Bomber	wheels up	11368.20	31.47	99.93
Bomber	wheels down	11368.20	30.20	98.74
Overload Fighter	wheels up	12306.90	31.96	100.39
Overload Fighter	wheels down	12306.90	30.80	99.30
Extreme Nose Heavy	wheels up	9939.90	29.00	97.61
Extreme Nose Heavy	wheels down	9939.90	27.55	96.25
Extreme Tail Heavy	wheels up	11896.86	32.82	101.20
Extreme Tail Heavy	wheels down	11896.86	31.62	100.07

AN-9249

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ACTUAL WEIGHT AND HORIZONTAL BALANCE

Contract No. 82811 Airplane Gov't. No. 02177 Airplane Cont'r. No. 2785

Date of weighing 9/28/42 Load Condition EMPTY Land, [redacted] Article No.

		SCALE READING	TARE	SCALE CALI-BRATION	NET WEIGHT	GUARANTEED WEIGHT
Weight on wheels	LEFT	4070.0	6.0		4064.0	
	RIGHT	3955.0	6.0		3949.0 $= W_W$	
Weight on tail wheel		944.5	125.0		819.5 $= W_T$	
TOTAL		8969.5	137.0		8832.5 $= W_W + W_T$	

Airplane Weight (after corrections for missing items, etc; have been applied) ~~8726.85~~

DIMENSIONS*	SYMBOL	CALCULATIONS*
L. E. L. W. for'd [redacted] C. L. axle 4.3125 Ins.	e	$q = \frac{W_T \times m}{W_W + W_T} = \frac{819.5 \times 245.15625}{8832.5} = 22.746$
C. L. axle to tail wheel 245.15625 Ins.	m	
C. G. aft C. L. axle 22.746 Ins.	q	
C. G. [redacted] aft L. E. L. W 27.0585 Ins.	k	$k = e + q = 4.3125 + 22.746 = 27.0585$
Limits of "k" to meet ..... Ins. to balance guarantee ..... Ins.		
Length of m. a. c. 94.0 Ins.	**	
L. E. m. a. c. [redacted] aft (—) L. E. L. W. 3.7 Ins.	**	
..... % m. a. c. Allowable balance range to ..... % m. a. c.		
Airplane balance 23.89 % m. a. c.	***	

*Refer to the Army Handbook, Section II, Parts I and II, for diagrams showing the various dimensions given above.

**m. a. c. calculated in accordance with the Handbook, Section II, Part II, (Army) or SR-7 (Navy).

***Balance after corrections for missing items, etc; have been applied.

NOTE: Guaranteed Weight shown above, is the guaranteed weight empty corrected for authorized changes and over or under weight of Government furnished material.

Approved by A. C. Rep. .....

Witnessed by I. N. A. Walter Bscott

Wright Field 10-19-38-4M

AN-9250

Model F4U-1

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ACTUAL WEIGHT AND VERTICAL BALANCE

Contract No. 82811 Airplane Gov't. No. 02177 Airplane Cont'r. No. 2785

Date of weighing 9/28/42 Load Condition EMPTY Land, Sea. Article No.

	SCALE READING	TARE	SCALE CALI-BRATION	NET WEIGHT	GUARANTEED WEIGHT
Weight on wheels RIGHT	3707.0	6.0		3701.0	
Weight on wheels LEFT	3787.0	6.0		3781.0 $= W'_w$	
Weight on tail wheel	1354.5	0.75		1353.75 $= W'_T$	
TOTAL	8848.5	12.75		8835.75 $W'_w + W'_T$	

Airplane Weight (after corrections for missing items, etc; have been applied) 8726.85

DIMENSIONS*	SYMBOL	CALCULATIONS*
C. L. axle to tail wheel ..... Ins.	m'	
C. L. axle to ref. pt. "o" ..... Ins.	n'	$\beta = \tan^{-1} \frac{a-b}{n} =$
Ref. pt. "o" above floor line ..... Ins.	a'	
C. L. axle above floor line ..... Ins.	b'	$\phi = \tan^{-1} \frac{a'-b'}{n'} =$
		$\delta = \beta - \phi =$
C. L. axle to ref. pt. "o" ..... Ins.	n**	
Ref. pt. "o" above floor line ..... Ins.	a**	$q' = \frac{W'_T \times m'}{W'w + W'_T} =$
C. L. axle above floor line ..... Ins.	b**	
Thrust line above C. L. axle ..... Ins.	r**	$i = \frac{q'}{\cos \delta} - q =$
Tail down angle ..... Degs.	δ	$f = r - p = r - \frac{i}{\tan \delta} =$
C. G. above / below thrust line ..... Ins.	f	
Corrected C. G. above / below T. L. ..... Ins.	***	

*Refer to the Army Handbook, Section II, Parts I and II, for diagrams showing the various dimensions given above.

**These dimensions shall be obtained during the thrust line level weighing.

***C. G. location after corrections for missing items, etc., have been applied.

NOTE: Guaranteed Weight shown above, is the guaranteed weight empty corrected for authorized changes and over or under weight of Government furnished material.

Approved by A. C. Rep. .....

Witnessed by I. N. A. Walter Bescott

Wright Field 10-19-38-4M

CORRECTED WEIGHT EMPTY

First Weighing	=	8832.5
Second Weighing	=	8835.75
		17668.25/2
Average as weighed	=	8834.13

Distance of C.G. aft of L.E.W. = 27.06 inches
Distance of C.G. aft of horizontal reference axis
27.06 + 66.65 = 93.71 inches

	% MAC	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT
Average as weighed		8834.13	93.71	827846
Plus missing items (page 9)		+ 42.69	95.38	+ 4068
Deductive items (page10)		-149.97	146.70	-22001
WEIGHT EMPTY, Wheels Down	23.89	8726.85	92.81	809913
Retract wheels (page 11)		0		+13484
WEIGHT EMPTY, Wheels Up	25.53	8726.85	94.35	823397

MISSING ITEMS

ITEMS	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT
Top and side engine accessory compartment cowling	23.50	74.80	1758
Feed chutes	11.78	118.10	1391
Ejection chutes	5.80	114.10	662
Emergency equipment support	.49	138.00	68
Molin signal discharger handle installation	1.12	169.00	189
	42.69	95.38	4068

DEDUCTIBLE ITEMS

USEFUL LOAD

Six rear mounting posts	6.00	127.00	762
Six front trunnion bolts	6.60	111.30	735
Trigger switch	.50	153.50	77
Gun charging valves	2.60	145.70	379
Gun charging controls	13.32	125.50	1672
Auxiliary open sight	.20	146.20	29
GF-12 transmitter	11.95	195.00	2330
" receiver	12.25	196.00	2401
" dynamotor	13.77	212.00	2919
" junction box	2.91	212.80	619
" transmitter control	.82	164.50	135
" receiver switch	.89	170.20	151
" remote tuner	.84	175.00	147
" antenna relay	.95	212.20	202
" fixed antenna & insulator	.93	200.00	186
ZB antenna switch relay	1.27	216.50	275
" remote control box	.53	163.50	87
" homing adapter	3.75	196.00	735
" homing antenna	.68	207.90	141
Radio cables & linkages	11.15	175.33	1955
Pilot's radio throttle switch	.30	160.50	48
Remote coil control	.11	168.00	18
Bomb racks	20.28	83.30	1689
Bomb rack attaching parts	4.30	83.30	358
IFF cables, antenna, etc.	8.14	187.00	1522
Chart board	2.80	142.00	398
TOTAL - DEDUCTIBLE USEFUL LOAD	127.84	156.21	19970

DEDUCTIBLE ITEMS
FLIGHT TEST EQUIPMENT

Rollers & bulkheads in ammunition boxes	2.40	115.20	276
Bungee	0.73	270.00	197
Hoist sling	19.00	82.00	1558
	22.13	91.78	2031

SUMMARY OF DEDUCTIBLE ITEMS

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT
Deductible Useful Load	127.84	156.21	19970
Deductible Flight Test Equipment	22.13	91.78	2031
DEDUCTIBLE ITEMS	149.97	146.70	22001

MOMENT CHANGE DUE TO RETRACTING LANDING GEAR

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Wheels Up:					
Oleo Struts & Collars	200.06	96.6	19326	67.0	13404
Drag Links	75.68	86.6	6554	72.3	5472
Wheels, Tires and Brakes	172.09	121.1	20840	69.7	11995
Fairing on Oleos	6.92	82.8	573	64.3	445
Oleo Compressing Linkage	2.70	101.4	274	66.1	178
Retracting Cylinders	16.90	88.8	1501	73.8	1247
Retracting Linkage	14.80	77.0	1140	69.9	1035
Doors in Wing	42.86	120.0	5143	63.0	2700
Tail Wheel and Tire	9.59	316.1	3031	97.9	939
Tail Wheel Drag Strut & Housing	15.38	304.8	4688	98.2	1510
Fork Bearing & Centering Device	12.97	310.5	4027	97.0	1258
Tail Wheel Oleo Strut	11.09	296.0	3283	108.0	1198
Tail Wheel Retracting Cylinder	10.57	268.9	2842	98.0	1036
Tail Wheel Retracting Linkage	7.03	283.4	1992	109.5	770
Tail Wheel Doors in Fuselage	13.07	320.0	4182	94.0	1229
TOTAL - WHEELS UP:	611.71		79396		44416.
Wheels Down:					
Oleo Struts & Collars	200.06	71.4	14284	46.3	9263
Drag Links	75.68	87.5	6622	63.4	4798
Wheels, Tires and Brakes	172.09	70.9	12201	24.5	4216
Fairing on Oleos	6.92	68.7	475	57.9	401
Oleo Compressing Linkage	2.70	71.3	193	39.9	108
Retracting Cylinders	16.9	84.7	1431	68.3	1154
Retracting Linkage	14.8	76.7	1135	63.7	943
Doors in Wing	42.86	120.0	5143	53.7	2302
Tail Wheel & Tire	9.59	316.6	3036	83.8	804
Tail Wheel Drag Strut & Housing	15.38	307.2	4725	89.6	1378
Fork Bearing & Centering Device	12.97	311.4	4039	85.9	1114
Tail Wheel Oleo Strut	11.09	306.5	3399	104.0	1153
Tail Wheel Retracting Cylinder	10.57	279.4	2953	99.0	1046
Tail Wheel Retracting Linkage	7.03	297.8	2094	109.5	770
Tail Wheel Doors in Fuselage	13.07	320.0	4182	96.8	1265
TOTAL - WHEELS DOWN:	611.71		65912		30715

MOMENT CHANGE DUE TO

RETRACTING LANDING GEAR (continued)

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Moment Correction to Extend Wheels	0		-13484		-13701
Moment Correction to Retract Wheels	0		+13484		+13701
NORMAL FIGHTER USEFUL LOAD					
PAR. 20(g) (1) of SR-5C					
CREW	200.00	167.3	33460	116.5	23300
Fuel & Oil					
Fuel - fuselage - 178 gals.	1068.00	116.2	124102	99.8	106586
Oil - 12 gals.	90.00	84.0	7560	114.0	10260
Trapped fuel & oil	88.00	46.1	4057	90.0	7920
TOTAL FUEL & OIL	1246.00	108.9	135719	100.1	124766
Fixed Gun Installation					
6 - .50 Cal. Guns	356.10	116.7	41557	76.0	27064
6 - Trunnion posts	6.60	111.3	735	73.5	485
6 - Rear mounting posts	6.00	127.0	762	71.5	429
1200 Rds. .50 cal. ammunition	358.80	115.2	41334	75.5	27089
1 - Trigger switch	0.50	153.5	77	114.0	57
6 - Gun charging controls	13.80	125.5	1732	77.0	1063
2 - Gun charging valves	2.30	145.7	335	114.0	262
6 - Electric trigger controls	13.20	127.1	1678	77.0	1016
1 - Illuminated sight	4.00	151.5	606	133.0	532
1 - Auxiliary open sight	0.20	146.2	29	132.0	26
1 - Gun camera & mountings	3.89	77.0	300	71.2	277
TOTAL FIXED GUN INSTALLATION	765.39	116.5	89145	76.2	58300
Pyrotechnics					
1 - Molin signal discharger	10.00	221.3	2213	116.0	1160
6 - Signal cartridges	1.50	221.3	332	116.0	174
TOTAL PYROTECHNICS	11.50	221.3	2545	116.0	1334

NORMAL FIGHTER USEFUL LOAD

PAR. 20 (g) (1) of SR-5C

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Communicating					
GF12 Radio Installation	(53.67)	196.4	(10541)	109.1	(5856)
Transmitter	11.95	195.0	2330	108.2	1293
Receiver	12.25	196.0	2401	108.2	1325
Dynamotor	13.77	212.0	2919	108.0	1487
Junction box	2.91	212.8	619	104.3	304
Transmitter control	.82	164.5	135	115.0	94
Receiver switch	.89	170.2	151	115.0	102
Remote tuner	.84	175.0	147	115.3	97
Remote coil control	.11	168.0	18	110.2	12
Antenna relay	.95	212.2	202	130.0	124
Fixed antenna & insulator	.93	200.0	186	150.0	140
Microphone	.30	152.0	46	105.0	32
Pilot's throttle switch	.30	160.5	48	118.0	35
Connecting cables & linkages	7.65	175.0	1339	106.0	811
ZB Radio Installation	(9.73)	190.5	(1854)	108.4	(1055)
Antenna switch relay	1.27	216.5	275	115.5	147
Remote control box	.53	163.5	87	110.0	58
Homing adapter	3.75	196.0	735	113.5	426
Homing antenna installation	.68	207.9	141	78.4	53
Connecting cables & linkages	3.50	176.0	616	106.0	371
IFF Radio Installation (ABK-1)	(44.06)	194.0	(8549)	108.3	(4772)
Receiver & transmitter	32.45	200.0	6490	110.0	3570
Pilot's control box	1.40	159.0	223	115.0	161
Plug holder	.10	196.5	20	104.0	10
Junction box	.32	152.0	49	108.5	35
IFF Pilot's Control Box Switch	.96	182.0	175	115.3	111
Indicator & junction box	.60	189.5	114	105.0	63
Inertia switch	1.38	190.8	263	113.5	157
Fixed rod antenna	1.00	163.5	164	68.0	68
Cables	5.85	179.6	1051	102.0	597
TOTAL COMMUNICATING	107.46	194.9	20944	108.7	11683
Navigating Equipment					
1 - Set of charts	.50	160.5	80	102.0	51
1 - Chartboard	2.20	142.0	312	119.8	264
1 Plotting board	1.00	142.0	142	119.8	120
TOTAL NAVIGATING EQUIPMENT	3.70	144.3	534	117.6	435

NORMAL FIGHTER USEFUL LOAD

PAR. 20 (g) (1) of SR-5C (continued)

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Miscellaneous Equipment					
1 - Life raft, seat type	14.00	167.30	2324	103.00	1442
Emergency equipment	8.70	139.00	1209	112.00	974
1 - Oxygen regulator,mask,etc.	3.50	174.5	611	105.9	371
1 - Oxygen cylinder	24.00	180.8	4339	94.7	2273
TOTAL MISCELLANEOUS EQUIPMENT	50.20	169.0	8483	100.8	5060
USEFUL LOAD NORMAL FIGHTER	2384.25	122.0	290830	94.3	224878

BOMBER USEFUL LOAD

PAR. 20 (g) (2) of SR-5C

Details are same as Normal Fighter except as otherwise shown.

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Crew	200.00	167.3	33460	116.5	23300
Fuel & oil	1246.00	108.9	135719	100.1	124766
Fixed gun installation	765.39	116.5	89145	76.2	58300
Bomb Installation					
Bomb racks	20.80	83.3	1733	66.0	1373
Demolition bombs	232.00	84.8	19674	61.0	14152
Bomb rack attaching parts	4.30	83.3	358	69.0	297
TOTAL BOMB INSTALLATION	257.10	84.6	21765	61.6	15822
Pyrotechnics	11.50	221.3	2545	116.00	1334
Communicating	107.46	194.9	20944	108.7	11688
Navigating	3.70	144.3	534	117.6	435
Miscellaneous	50.20	169.0	8483	100.8	5060
USEFUL LOAD BOMBER	2641.35	118.4	312595	91.1	240700

OVERLOAD FIGHTER USEFUL LOAD

PAR. 20 (g) (2) of SR-5C

Details are same as for Normal Fighter except as otherwise shown.

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	VERTICAL ARM	VERTICAL MOMENT
Crew	200.00	107.3	33460	116.5	23300
Fuel & Oil					
Fuel - fuselage, 230 gals.	1380.00	115.6	159528	104.8	144624
Fuel- outer panel tanks 80 gals.	480.00	86.4	41472	78.7	37776
Oil - 20 gals.	150.00	84.0	12600	114.0	17100
Trapped fuel & oil	88.00	46.1	4057	90.0	7920
TOTAL FUEL & OIL	2098.00	103.7	217657	98.9	207420
Fixed Gun Installation					
Fixed gun installation Normal Fighter	765.39	116.5	89145	76.2	58300
1150 rds. additional ammunition	343.80	114.5	39365	76.3	26232
TOTAL FIXED GUN INSTALLATION	1109.19	115.9	128510	76.2	84532
Pyrotechnics	11.50	221.3	2545	116.00	1334
Communicating	107.46	194.9	20944	108.7	11683
Navigating	3.70	144.3	534	117.6	435
Miscellaneous	50.20	169.0	8483	100.80	5060
TOTAL USEFUL LOAD OVERLOAD FIGHTER	3580.05	115.1	412133	93.2	333764

GROSS WEIGHTS
PAR. 20(h) (1) of SR-5C

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	% MAC
Weight Empty (wheels up)	8726.85	94.35	823397	
Normal Fighter Useful Load	2384.25	122.0	290830	
Gross Fighter (wheels up)	11111.10	100.28	1114227	31.84
Extend Wheels	0		- 13480	
Gross Fighter (wheels down)	11111.10	99.07	1100743	30.55
Weight Empty (wheels up)	8726.85	94.35	823397	
Bomber Useful Load	2641.35	118.4	312595	
Gross Bomber (wheels up)	11368.20	99.93	1135992	31.47
Extend Wheels	0		- 13484	
Gross Bomber (wheels down)	11368.20	98.74	1122508	30.20
Weight Empty (wheels up)	8726.85	94.29	823397	
Overload Fighter Useful Load	3580.05	115.1	412133	
Gross-Overload Fighter (wheels up)	12306.90	100.39	1235530	31.96
Extend Wheels	0		- 13484	
Gross-Overload Fighter(wheels down)	12306.90	99.30	1222046	30.80

NORMAL FIGHTER
%MAC = (100.28 - 70.35) ÷ 94 x 100 = 31.84

GROSS WEIGHTS LESS EXPENDIBLE ARMAMENT & FUEL

PAR. 20 (h) (2) of SR-5C

CONDITION	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	% MAC
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Less Ammunition	- 358.80	115.2	- 41334	
Normal Fighter Less Ammunition	10752.30	99.78	1072893	31.31
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Less Fuel	-1068.00	116.2	-124102	
Normal Fighter Less Fuel	10043.10	98.59	990125	30.04
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Less Ammunition	- 358.80	115.2	- 41334	
Less Fuel	-1068.00	116.2	-124102	
Normal Fighter Less Fuel & Ammunition	9684.30	97.97	948791	29.38

EXTREME NOSE-HEAVY & TAIL-HEAVY CONDITION

PAR. 20 (h) (3) of SR-5C

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	% MAC
Nose Heavy				
Gross Bomber (wheels up)	11368.20	99.93	1135992	31.47
Less Fuel	-1068.00	116.2	-124102	
Less Ammunition (1200 rds.)	- 358.80	115.2	- 41334	
Less Molin Signal Cartridges	- 1.50	221.3	- 332	
Gross-Extreme Nose Heavy(wheels up)	9939.90	97.61	970224	29.00
Extend Wheels	0		- 13484	
Gross-Extreme Nose Heavy(wheels down)	9939.90	96.25	956740	27.55
Tail Heavy				
Gross Overload Fighter (wheels up)	12306.90	100.35	1235530	31.96
Less Outer Panel Fuel 80 gals.	- 480.00	86.4	- 41472	
Less 230 gals. Fuel (fuselage)	-1380.00	115.6	-159528	
Add 237 gals. Fuel (fuselage)	1422.00	115.53	+164284	
Add Gun Heaters	18.10	132.90	2405	
Add Tow Target Equipment	2.86	198.0	566	
Add Pneumatic Tail Wheel(Est.Weight)	7.00	316.1	2213	
Gross-Extreme Tail Heavy (wheels up)	11896.86	101.20	1203998	32.82
Extend Wheels	0		- 13484	
Gross-Extreme Tail Heavy(wheels down)	11896.86	100.07	1190514	31.62

EFFECTS OF SPECIAL EQUIPMENT

PAR. 20 (h) (4) of SR-5C

ITEM	WEIGHT	HORIZONTAL ARM	HORIZONTAL MOMENT	% MAC
Change in Main Fuel Tank Cell				
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Remove Bulletproof Fuel Cell	- 152.80	115.0	- 17572	
Install "Bladder-Type" Fuel Cell	39.50	115.0	4543	
Normal Fighter Gross (wheels up)	10997.80	100.13	1101198	31.68
Installation of Tow Target Equipment				
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Install Tow Target Equipment	2.86	198.0	566	
Normal Fighter Gross (wheels up)	11113.96	100.31	1114793	31.87
Installation of Gun Heaters				
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Install Gun Heaters	18.10	132.90	2405	
Normal Fighter Gross (wheels up)	11129.20	100.33	1116632	31.89
Installation of Pneumatic Tail Wheel				
Normal Fighter Gross (wheels up)	11111.10	100.28	1114227	31.84
Install Pneumatic Tail Wheel (Est. Weight)	7.00	316.1	2213	
Normal Fighter Gross (wheels up)	11118.10	100.42	1116440	31.99

TABULATION OF AUTHORIZED AND PENDING CHANGES

PAR. (20(j) of SR-5C

REFERENCES:
(a) Bu. S&A letter Nos. 82811 SPM6 of 15 Nov. 1941.
(b) Bu. S&A letter Nos. 82811 SPM6 of 16 March 1942.
(c) VSA letter E-28465 of 21 April 1942.
(d) VSA letter E-16902 of 24 Jan. 1942.
(e) VSA Conf. letter E-20000 of 13 Feb. 1942.
(f) VSA Conf. letter E-57685 of 29 Sept. 1942.
(g) BuAer letter Nos. Aer-E-2563-TEW/8-22-C-82811(1) dated 17 August 1942 with INA 1st End. C-82811/F49 of August 1942.
(h) VSA letter E-53841 of 8 Sept. 1942.

CHANGE LETTER OR REFERENCE	ITEM	WEIGHT
	AUTHORIZED CHANGES:	
A	Strengthen Wing Folding Mechanism	11.2
B	Seven - Disc Brakes	7.0
C	Aluminum Alloy substituted for magnesium in electrical system	6.6
D	Install Booster Coil	3.0
E	Type II Starter (not applicable)	0
F	Carburetor Air Warning System	1.5
G	Electric Priming System	0
H	Pilot's Armor and Splash Protection	22.0
I	Propeller Accumulator Installation	19.0
J	Trigger Switch Revised	0
K	Install Harrison Oil Coolers	20.6
L	Changed Arresting Gear Hook Head	2.0
M	Eliminated Provision for First Aid Kit	-0.2
N	Install Remote Compass Remove MK 10 Compass	6.4
O	Install Turbo Supercharger (not applicable)	0
P	Mark 8 Illuminated Gun Sight	2.0
Q	Install Larger Hydraulic Pump and Piping	2.2
R	Change Electrical Receptacle	0
S	Lap and Shoulder Harness Provision	3.0
T	Rear Vision Mirror	0
U	Molin Signal Discharger Installation	2.4
V	Gun Camera Installation in Fin (not applicable)	0
W	Bush Aluminum Intercoolers for Copper	-49.0
X	Manually Operated Wing Hinge Pin Locking Door	6.6
Y	Fuselage Bottom Hatch	7.9
Z	Provision for Emergency Escape in Flight	4.0
AC	Vane Type Electric Fuel Pump	5.0
(a)	Stronger Main Wheels	4.0
(b)	Stronger Main Wheels	6.7
	TOTAL AUTHORIZED CHANGES	93.9

TABULATION OF AUTHORIZED AND PENDING CHANGES

PAR. 20(j) of SR-5C (continued)

CHANGE LETTER OR REFERENCE	ITEM	WEIGHT
	PENDING CHANGES:	
(c)	Recognition Lights	7.0
(d)	Sealing and Ventilating of Space around Main Fuel Tank	5.0
(e)	Gun Heating and Windshield Defrosting	-3.4
(f)	Aileron and Flap Redesign	42.3
(f)	Aileron Control Rigidity	19.0
(f)	Stiffness to Avoid Gun Resonance	45.7
(f)	Gun Access Doors Redesign	3.0
(f)	ABA-IFF Equipment Provision	2.0
(f)	Self-Sealing Tank (Aromatic Resistant)	52.8
(f)	Removal of Pressure Fire Extinguisher Provision	-3.9
(g)	Removal of Mark I Type A Life Raft	-15.4
(g)	Add Emergency Equipment Support	0.5
(h)	Sealed-Beam Landing Light	0.6
	TOTAL - PENDING CHANGES	155.2

TOTAL - AUTHORIZED CHANGES	93.9
TOTAL - PENDING CHANGES	155.2
TOTAL - AUTHORIZED AND PENDING CHANGES	249.1