



*Special
Instructions*

NORTH AMERICAN AVIATION • INC.



**SPECIAL INSTRUCTIONS NUMBER 1
GENERAL ELECTRIC TWO
WAY RADIO INSTALLATION**

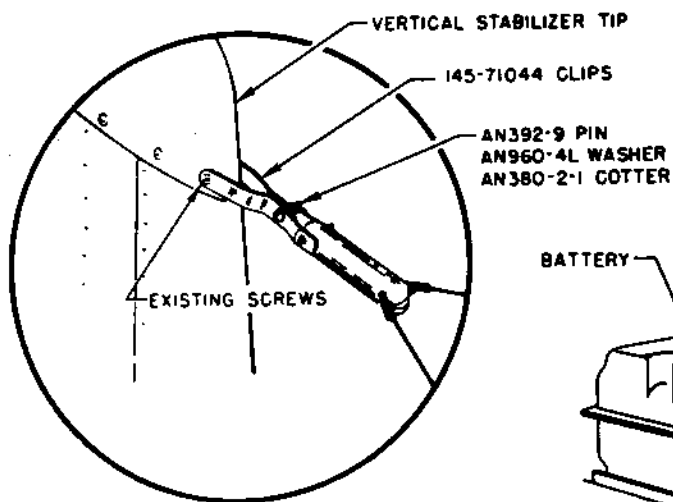
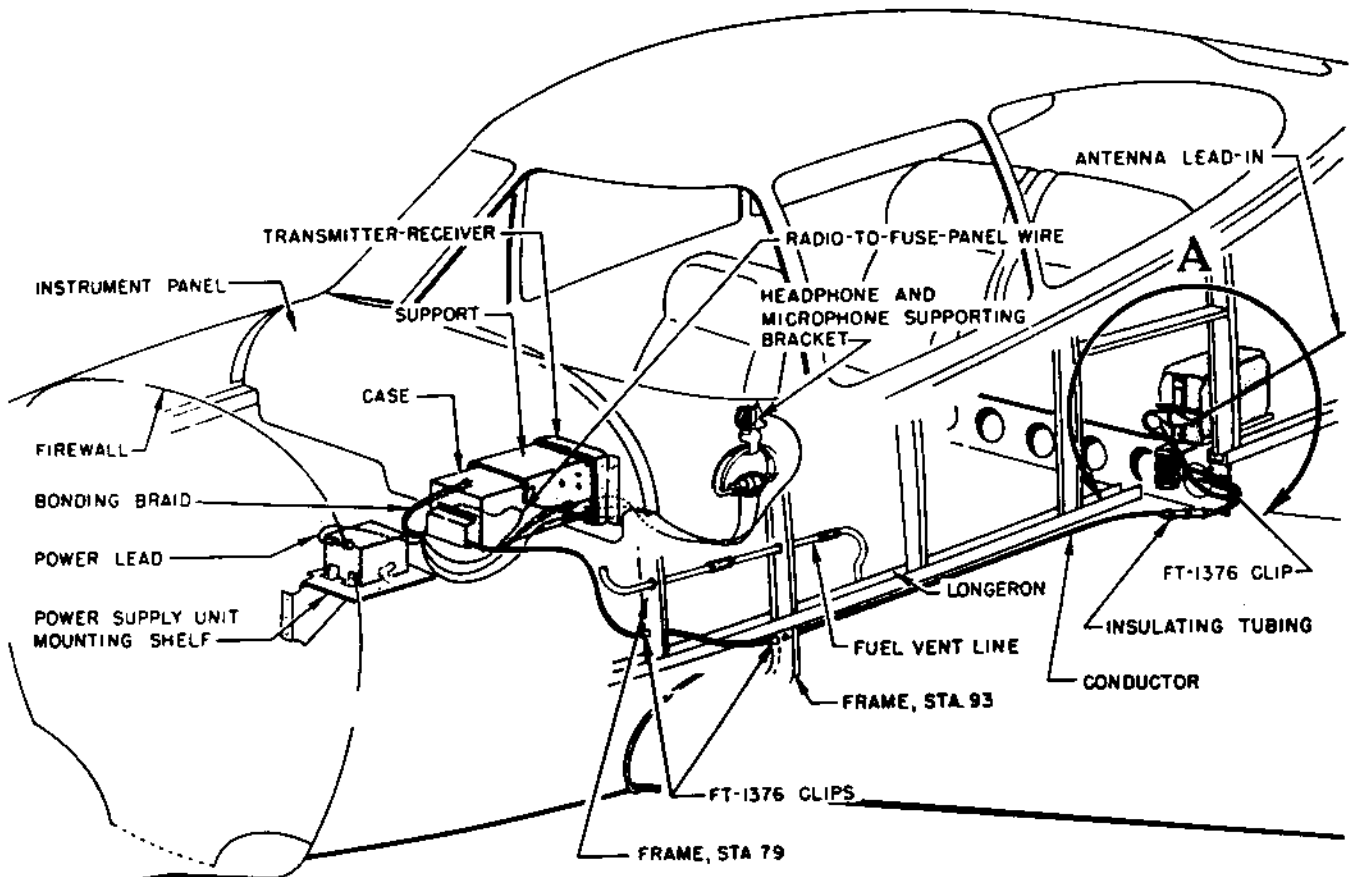
REVISED SEPTEMBER 26, 1946

NORTH AMERICAN AVIATION • INC.

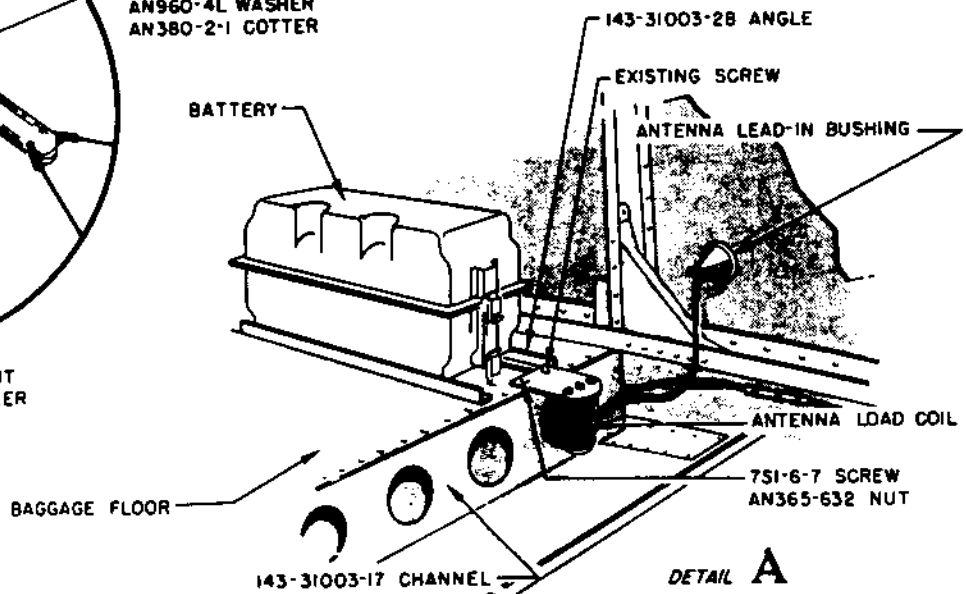
Install General Electric two-way radio (consisting of AS-1B transmitter - receiver with 145-71041 support, 4APIA1 power supply unit, 145-71045 antenna assembly) in NAVion as follows:

1. Remove front seats. Remove screws that attach 143-53003-31 phenolic rear seat back cover to baggage floor, and remove rear seat.
2. Install power supply unit with case on mounting shelf attached to back of firewall. Secure with four screws and nuts supplied with case.
3. Remove coverplate from left side of instrument panel. Place transmitter-receiver case in 145-71041 support, and secure with six 7S1-8-7 screws and AN365-832 nuts. (Screw heads must be on inside of case.) Attach bonding braid from rear of case, to right side of support, using one of the support attaching screws.
4. Mount case and support on back of panel, using screws removed with coverplate. Reinstall landing gear warning light dimming resistor with lower right screw. Insert transmitter-receiver set in case. Secure with lock screw on dial panel.
5. Plug power lead, from set, into socket on power supply unit.
6. Remove "MIC" and "PHONE" plugs from instrument panel. Install two-wire conductor jack fitting from set in "MIC" hole, and one-wire fitting in "PHONE" hole.
7. Connect power lead from set to "RADIO" fuse retainer. (Circuit must be protected with 20-amp fuse.)
8. Pry loose the two trim strips from the top of the left side upholstered panels. Remove all screws attaching panels to floor and wing top skin. Pry loose the two fasteners in forward end of rear panel, and the two in aft end and one in forward end of forward panel. Remove panels by pulling down and inboard.
9. Install antenna load coil on baggage floor just forward of battery, using forward screw in 143-31003-28 outboard battery support angle, and a 7S1-6-7 screw and AN355-632 nut in adjacent existing hole.
10. Route conductor from set to load coil, outboard of fuel vent line, between lower longeron and wing top skin. Connect to No. 214 lead from load coil. Cover connection with insulating tubing and tie tubing to prevent slipping. Install three FT-1376 clips, one on frame at station 79, one on frame at station 93, and one on 143-31003-17 baggage floor channel at left outboard lightening hole. Tie conductor to clips with cord.
11. Remove plug from hole in fuselage left side and install 1050-01 antenna lead-in bushing. Connect No. 200 lead from load coil to bushing.
12. Attach the two 145-71044 clips to vertical stabilizer tip, using the forward tip attaching screws (one on each side). Attach antenna to clips with AN392-9 pin, AN960-4L washer, and AN380-2-1 cotter. Attach antenna to top of each wing tip, using the fourth tip attaching screw from the leading edge. Connect antenna lead-in to bushing in fuselage side.
13. Remove check list holder from 145-53011-300 upholstered panel located beneath left side windshield panel. Pull lower edge of panel out from longeron, unsnapping the two fasteners which secure its aft end to fuselage skin. Pull out far enough only to reach beneath upholstery and remove the two nuts from the screws through fuselage skin. Remove screws.
14. Punch two holes through the upholstery to match the holes in fuselage from which screws were removed. Insert two AN515-8-12 screws through fuselage and upholstery, with one AN960-D8 washer on each screw between fuselage and upholstery. Install 145-71040 headphone supporting bracket on the screws with 4S4-06-15 spacers between upholstery and bracket and using 22K1-82 nuts.
15. Reinstall upholstery, check list holder, and seats. Place headphone and microphone on bracket and plug leads into jacks in dash panel. Place Radio Frequency Measurement Card in pocket in Aircraft Log Book.

Refer to NAVion Operation Manual and General Electric Manual for operating instructions.



ANTENNA ATTACHMENT TO VERTICAL STABILIZER



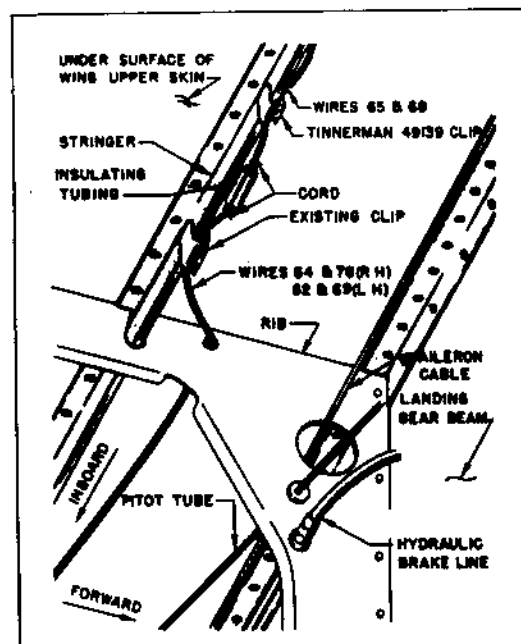
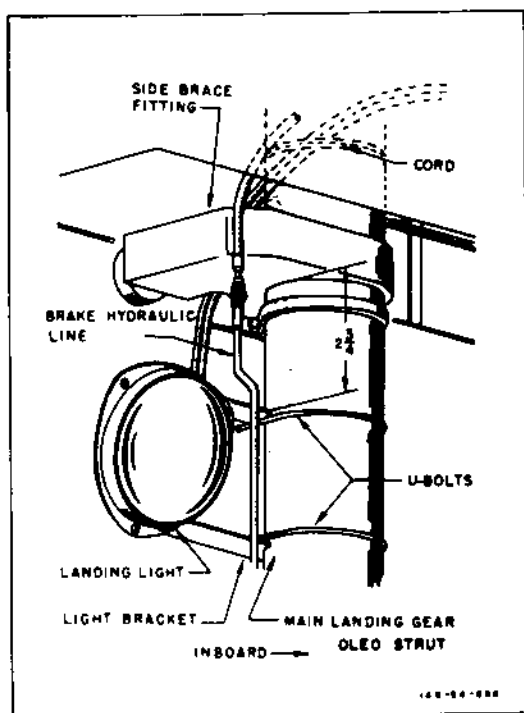
DETAIL A

REVISED AUGUST 1, 194

LANDING LIGHT INSTALLATION

Install two 145-54007 landing light assemblies on NAVion as follows:
 (right-hand landing light installation shown; left-hand opposite)

1. Install light on strut with two U-bolts, four AN960-10 washers, and four AN365-1032 nuts. Top edge of light bracket should be 2-3/4 inches below lower surface of side brace fitting, measured along aft side of strut. With landing gear handle in "UP," raise gear by hand to see that light and bracket clear wheel well structure.
2. Tie wires to strut above side brace fitting.



3. On right installation, connect wire 65 from light to wire 64, and wire 68 from light to wire 76. On left installation, connect wire 65 to wire 62, and wire 68 to wire 69. Cover each disconnect splice with insulating tubing, and tie wires together with cord adjacent to tubing.
4. Clip wires 65 and 68 to stringer with Tinnerman 49139 clip.
5. Install 30-amp fuse in "LAND. LGTS." retainer and in spare retainer.

6. Adjust lights as follows:

- (a) Position airplane on level ground, facing a vertical wall with propeller 30 feet from wall.
- (b) Level airplane by jacking tail skid. Consult NAVion dealer for leveling information.
- (c) Make a vertical mark on wall on projected centerline of airplane. (Sight over nose wheel strut and tail skid jack to establish centerline.) At 52 inches on each side of the mark, make two additional vertical marks. On each of these two marks, make two horizontal marks 12 and 18 inches from ground.
- (d) Cover one light, and loosen U-bolts of other light bracket. Rotate light around strut until beam is on vertical mark on same side of centerline as the light being adjusted. Tighten U-bolts. Loosen the two screws that hold the lamp housing to the bracket. Rotate lamp up or down until top edge of beam (not the center) strikes wall between the horizontal marks. Tighten housing screws.
- (e) Repeat (d) to adjust other light.

CAUTION: Do not operate lights longer than necessary to avoid excessive drain on battery.

SPECIAL INSTRUCTIONS NUMBER — 3

SENSITIVE ALTIMETER INSTALLATION

Install Kollsman No. 987-10-031 or No. 205BK-10-031 sensitive altimeter in NAVION as follows:

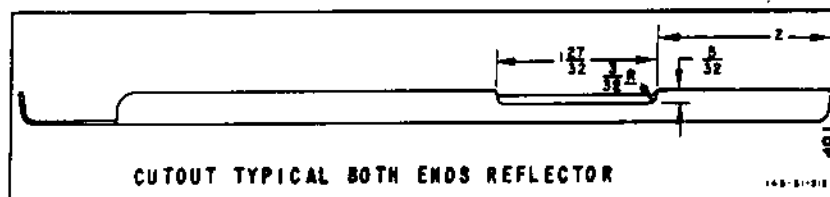
1. Remove instrument panel reflector.
2. Disconnect static pressure line from non-sensitive altimeter and remove altimeter.
3. Remove elbow fitting from old altimeter and install in new sensitive altimeter.
4. Install new altimeter in panel using mounting screws previously removed.
5. Connect static pressure line to new altimeter.
6. Test static line for leaks. Reinstall reflector.

SPECIAL INSTRUCTIONS NUMBER — 4

INSTRUMENT-FLYING PANEL INSTALLATION

Install Instrument Flying Kit (consisting of Kollsman No. 997-10-031 or No. 205 BK-10-031 sensitive altimeter, Schwinn No. MS27200 bank-and-turn indicator, and Elgin No. 1792 clock) in NAVION as follows:

1. Remove instrument panel reflector.
2. Disconnect wires from ammeter, static pressure line from altimeter, and shaft from tachometer.
3. Remove ammeter and adapter plate. Remove ammeter from adapter plate and install ammeter in cutout in upper right corner of instrument panel.
4. Remove tachometer and install in space formerly occupied by ammeter adapter, using existing screws and nuts.
5. Remove altimeter. Remove elbow fitting from altimeter and install in new sensitive altimeter. Install new altimeter in space from which old altimeter was removed, using existing screws.
6. Install bank-and-turn indicator in space from which tachometer was removed, using four NAS 202-632-B12 screws and 6939-632-875 Tinnerman nuts.
7. Install clock in cutout in upper left corner of instrument panel, using two NAS 202-632-B12 screws.
8. Reconnect wires to ammeter, static pressure line to altimeter, and shaft to tachometer. Remove loose wires 85 and 86 from their stowed position at back of instrument panel and connect them to bank-and-turn indicator. Connect wire 85 to terminal marked "+" and wire 86 to terminal marked "-."
9. Install 1-amp fuse in "BANK TURN" retainer.
10. On airplanes Serial Numbers MAY-4-251 and subsequent, cut out 145-51045 reflector ends to clear dash panel trim.



11. Install reflector, using screws, spacers, and nuts previously removed. Test static line for leaks.
12. Re-compensate compass. Fill out new compass correction card and insert in holder on reflector.

SPECIAL INSTRUCTIONS NUMBER - 1

CABIN HEATER INSTALLATION

*REVISED April 14, 1947

Install Cabin Heater Kit (consisting of 145-53315 heater, 145-53304 thermostat, 145-54035-3 switch, 145-53331 adapter, 145-53305 control rod, K2250 fuel strainer) in NAVion as follows:

SECTION A - FUEL STRAINER INSTALLATION AND RELOCATION OF FUEL OVERBOARD VENT LINE TO LEFT SIDE

(This section is required on airplanes NAV-4-2 through NAV-4-250 only)

See Figure 1

1. Remove the 75692 and 75694 hoses from fuel pumps and the 752 x 6 inverted tee and AN914-2 elbow from the fuel shut-off valve. Remove retaining nut from shut-off valve, forward side of firewall.
2. Disconnect operating cable and the fuel lines from fuel shut-off valve, aft of firewall. Remove shut-off valve.
3. Remove the 143-31005-16 doubler from forward side of firewall at fuel shut-off valve location by drilling out the attaching rivets. Remove the screw that attaches fuel shut-off cable to aft side firewall.
4. Place new 143-31005-16 doubler in same location as the old doubler, aligning pilot holes in doubler with old doubler attaching holes, and elongate the 1.145 diameter hole in firewall to match hole in doubler.
5. Drill ten No. 30 (.128) holes through doubler to match holes in firewall. Drill No. 10 (.193) hole through doubler to match the top inboard hole from which screw was previously removed. Attach doubler with ten AN442AD4-6 rivets and the removed screw.
6. Install 3325-4 nipple in shut-off valve. Attach 145-48051 bracket to K2250 strainer with two AN4-13A bolts, AN960-416 washers and AN365-428 nuts. Hold strainer in position on forward side of firewall and reinstall shut-off valve by spinning shut-off valve into strainer. Install 752 x 6 inverted tee in fuel strainer.

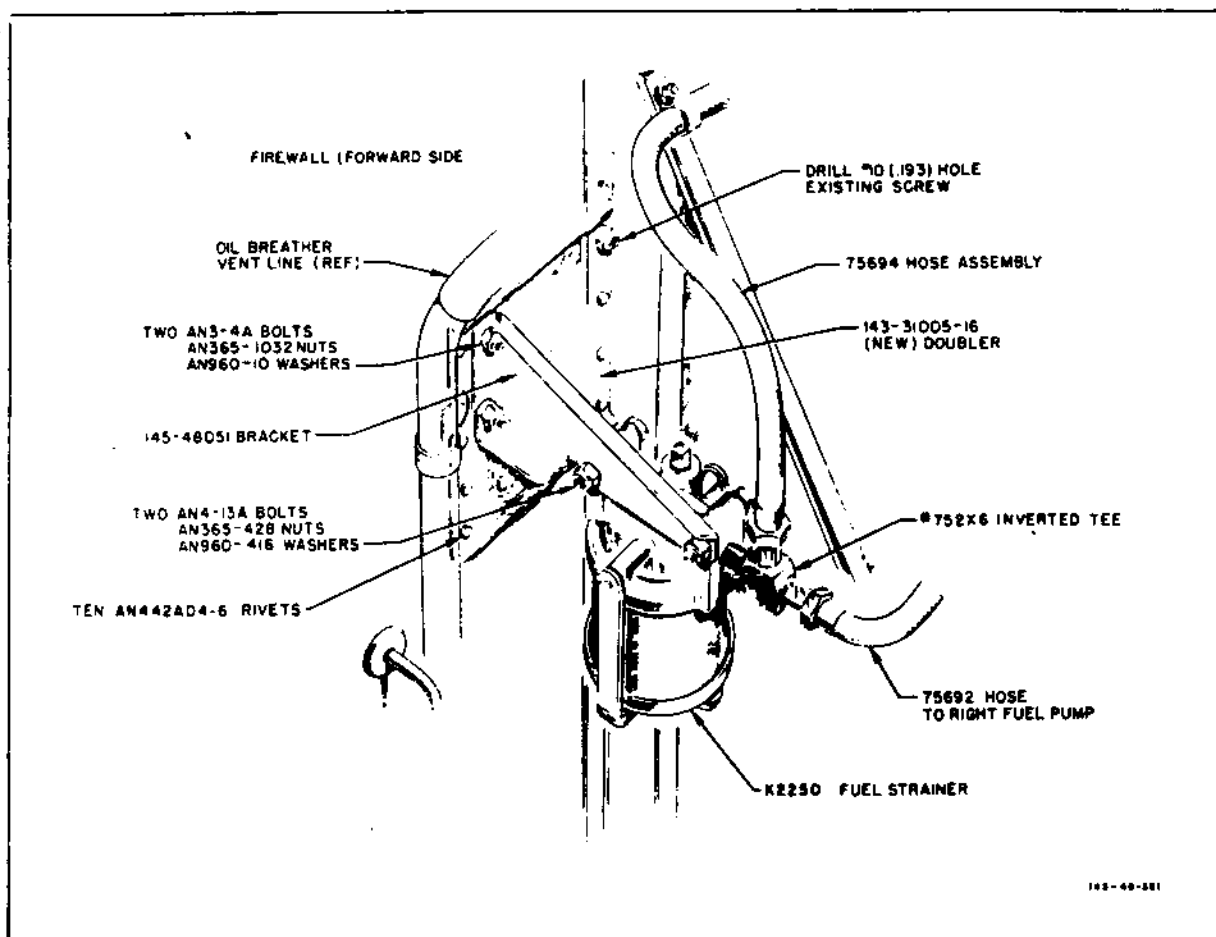


Figure 1. Strainer Installation

7. Remove 45° elbow from right fuel pump and install 400 x 6 inverted male 90° elbow.
8. With 145-48051 bracket on K2250 strainer as a template drill two No. 10 (.193) holes through firewall and attach with two AN3-4A bolts and AN960-10 washers and AN365-1032 nuts.
9. Reconnect fuel lines and operating cable to shut-off valve. Reinstall 75692 hose and 75694 hose to right and left fuel pumps.
10. Remove the forward upholstered panels, right and left side of cabin.
11. Disconnect and remove the 145-48001-28 and 145-48001-31 section of the fuel overboard vent lines.
12. Locate and drill a 13/16 inch dia. hole in cockpit floor, left side, and through the fuselage skin, in the same relative position as the existing vent line hole on the right side.

13. Install 145-48003 line, connecting to 145-48001-9 vent line with existing hose and clamps. Connect 145-48001-31 line to 145-48003 tube and route along the fuel return line. Install 145-48001-28 line, through floor and fuselage skin, using existing rubber grommets, and connect to 145-48001-31 line with new AN884-8-13 hose and two A3122-14-59 clamps.
14. Attach the overboard vent line to fuel return line with existing clip. Place 48164 snap button in previous vent line hole in fuselage skin, and replace the forward side panels.

SECTION B - HEATER INSTALLATION

See Figure 2

1. Remove right seat.
2. Note cable tension for reinstallation. Loosen turnbuckle in cable from ventilating control drum in control panel.
3. Loosen front section air vent tube and slide forward. Remove aft section air vent tube just forward of firewall. Loosen right aft sections of engine baffle.
4. Remove the vent tube adapter and gasket from forward side of firewall. Remove screws holding air vent valve, ring, and gasket to the aft side. Remove defroster tubes from valve.
5. Install a new 145-53301-26 ring on the valve, with a new 145-53301-27 gasket, four new AN515-8R8 screws, existing washers and new AN365-832 nuts.
6. Locate and drill one 1-1/2 inch diameter hole in right bottom engine cowling. Place 145-53314 adapter in the hole and drill four No. 30 (.128) holes through adapter pilot holes and cowling. Install adapter, using four 2R1AD-4-4 rivets. Connect 2-inch I.D. 9AX flex duct to adapter with one AN735-32 clamp, AN520-10R8 screw, AN960-10 washer and AN365-1032 nut.

NOTE: It is important that the combustion air inlet be installed as shown, in order to ensure pressures and airflow required to burn the fuel in heater.

7. Install a new 145-53301-27 gasket and the vent tube adapter on front of 145-53315 heater, using six AN515-8R8 screws, twelve AN960-8 washers, and six AN365-832 nuts.
8. Place a 145-53301-27 gasket on heater aft end, and install heater in firewall, using four AN515-8R8 screws, AN960-8 washers, and AN365-832 nuts. Attach the 145-53308 support to the adapter, using two AN515-8R12 screws, 483-8-4 spacers, AN960-8 washers, and AN365-832 nuts. (Nuts should be forward.)
9. Attach the valve to the heater, using four NAS 220-30 screws, AN960-8 washers, and AN365-832 nuts. (Nuts should be aft.)

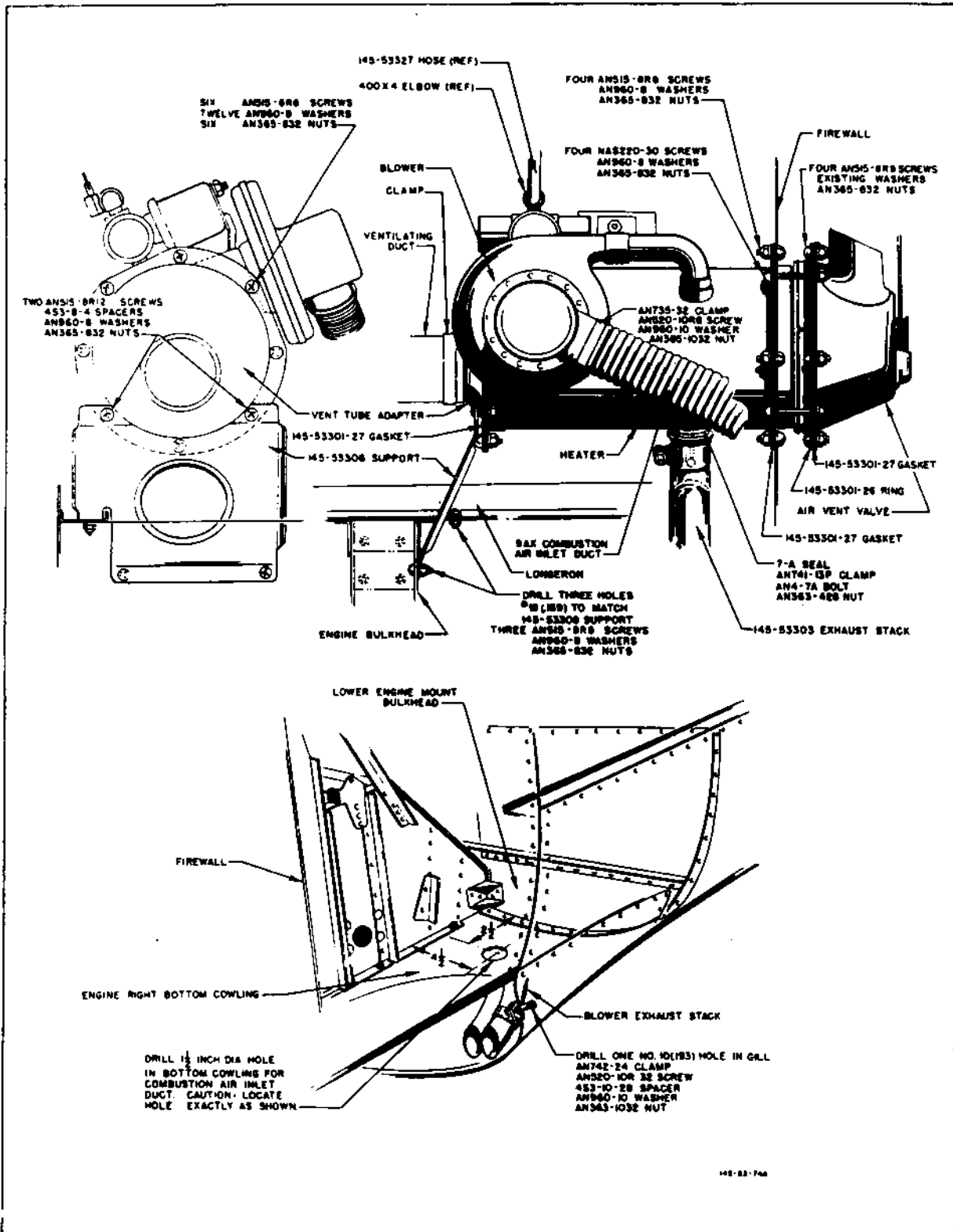


Figure 2. Heater Installation

10. Drill one No. 18 (.169) hole in longeron and two in engine bulkhead to match holes in 145-53308 support. Attach the support to the longeron and bulkhead, using three AN515-8R8 screws, AN960-8 washers, and AN365-832 nuts.
11. Attach forward section ventilating inlet duct to adapter on front of heater. Reattach engine baffles.
12. Place 7-A seal over heater exhaust port and connect 145-53303 exhaust stack to port, using one AN741-13P clamp, AN4-7A bolt, and AN363-428 nut, facing stack directly aft.
13. Slide AN742-24 clamp on outboard exhaust stack. With 483-10-28 spacer and AN520-10R32 screw held on clamp, rotate clamp near lower end of stack until spacer is satisfactorily located; then locate and drill one No. 10 (.193) hole in engine cooling outlet gill. Attach the clamp and spacer to the gill, using the screw, an AN960-10 washer, and an AN363-1032 nut.

NOTE: For proper operation of heater, end of stack must be flush with edge of gill.

14. Connect the flex duct on the 145-53314 adapter to the heater blower, using one AN735-32 clamp, AN520-10R8 screw, AN960-10 washer, and AN365-1032 nut.

See Figure 3

15. Remove cotter from ventilating control drum pin, and remove pin through glove compartment. Remove control drum.
16. Install the 145-54035-4 switch and 145-53328 actuator on the control drum lower support bracket, using screws supplied with switch, at existing holes in bracket.
17. Install the 145-53309 stop loosely in the 1/4-inch hole in the control drum, using one AN515-6R6 screw, AN960-6L washer, and AN365-632 nut.
18. Loosen the cable lock screw on the air valve pulley. If the two pulleys on the 145-53321 bracket are in the forward holes, move them to the aft holes of the bracket.
19. Check tightness of control drum pulley cable setscrew. Reinstall the control drum, using removed pin and AN380-2-2 cotter. Tighten cable to original tension.
20. Turn air valve pulley counterclockwise as far as possible to fully closed position. Turn control to "OFF." Tighten cable lock screw in air valve pulley.
21. Turn control drum to "HALF" cabin heat; then turn drum to the left, one-fourth the distance between "HALF" and "OFF." Holding the control securely in this position, locate and tighten

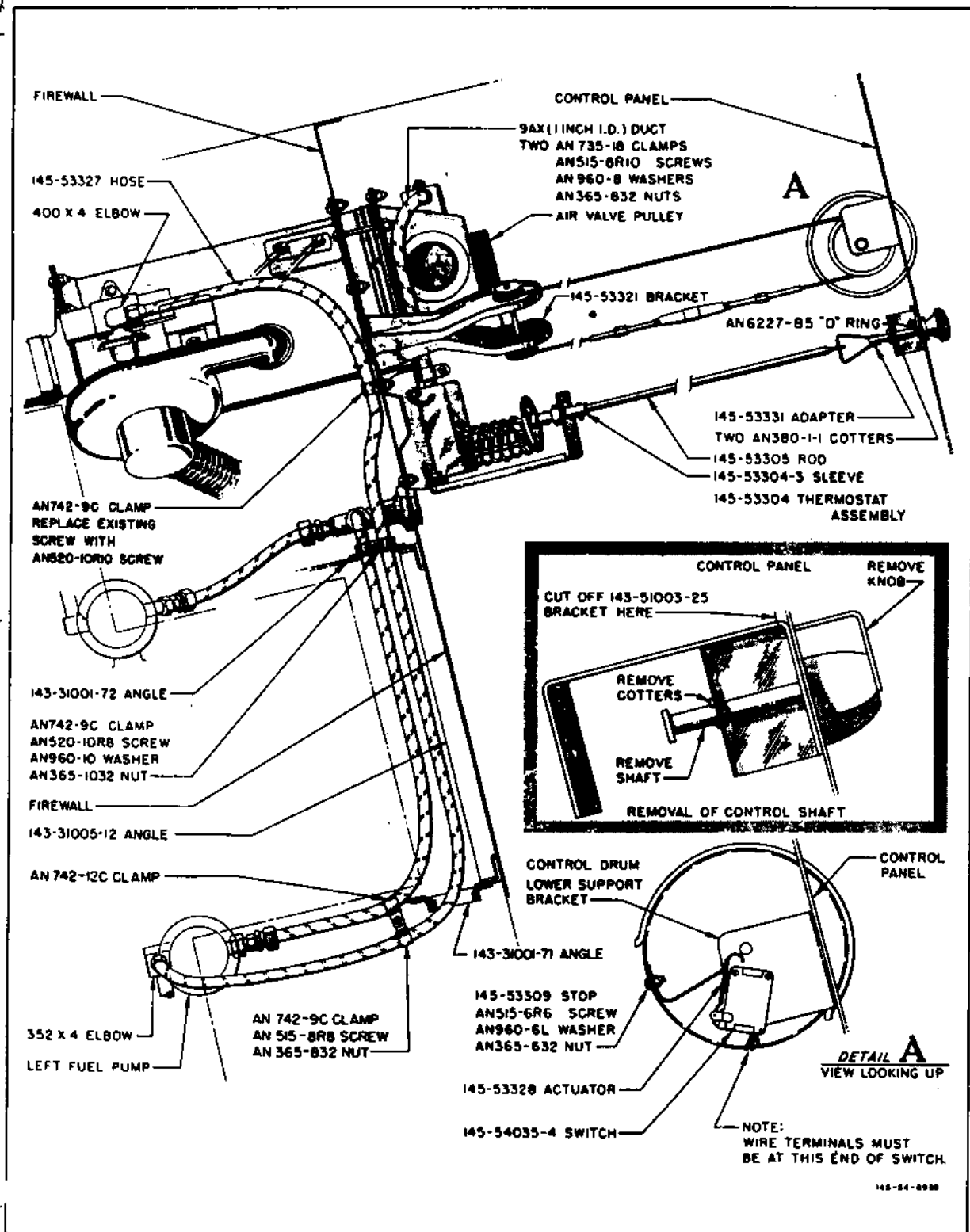


Figure 3. Thermostat Installation

the 145-53309 stop so it holds the 145-54035-4 switch open.

22. On Airplanes NAV-4-2 through NAV-4-250, remove the plastic heater switch control knob from shaft in control panel, and remove the shaft by removing the two cotters holding it to the 143-51003-25 bracket at back of panel. Cut off the long flange of the 143-51003-25 bracket as close to the control panel as possible. On Airplanes NAV-4-251 and subsequent, remove the snap button from the panel at the heater switch control location.
 23. Install 145-53331 adapter by inserting its shaft through the bracket and control panel and securing to the bracket with two AN380-1-1 cotters.
 24. Remove the three screws from firewall located just inboard from heater. Attach 145-53304 thermostat to firewall with these screws, replacing the outboard screw with an AN520-10R10 screw. Place end of 145-53305 control rod into slot of 145-53331 adapter. Insert other end of rod into 145-53304-3 sleeve of thermostat, and secure with screw and nut provided on thermostat sleeve.
 25. Turn 145-53305 rod counterclockwise to the stop. Install AN6227-5 "0" ring over end of 145-53331 adapter shaft extending through instrument panel. Install existing plastic or 145-51061-5 aluminum knob on shaft against "0" ring; install two AN565-D6-3 setscrews (aluminum knob only); turn knob to "OFF" and tighten setscrews.
- NOTE: "0" ring seal is used to provide friction on control knob. Adjustment can be made by pressing on end of knob before tightening setscrews.
26. Install the one-inch I.D. 9AX duct between air valve and the thermostat, using two AN735-18 clamps, AN515-8R10 screws, AN960-8 washers, and AN365-832 nuts.
 27. Remove plug from top of solenoid on top of heater and install 400x4 elbow. Remove plug from top of fitting on forward side of left fuel pump and install 352x4 elbow. Connect 145-53327 hose to these elbows.
 - * 28. Drill No. 10 (.193) hole one inch from top of 143-31001-72 angle. Attach heater fuel hose to angle with AN742-9C clamp, AN520-10R8 screw, AN960-10 washer, and AN365-1032 nut. (Later airplanes will have the left-hand fuel pump line clamped at this point. Remove the fuel line clamp screw, and attach the heater fuel hose with the AN742-9C clamp and the removed screw.) Attach heater fuel hose to left fuel pump inlet hose, just forward of 143-31001-71 angle using AN742-9C clamp, AN742-12C clamp, AN515-8R8 screw and AN365-832 nut. Attach heater fuel hose to firewall at outboard thermostat attaching screw with AN742-9C clamp, AN520-10R10 screw and existing nut.

NOTE: When gyro instrument panel is installed, attach the 145-53327 heater fuel hose to the 145-51052 vacuum relief valve bracket with 766-9 Adel clamp.

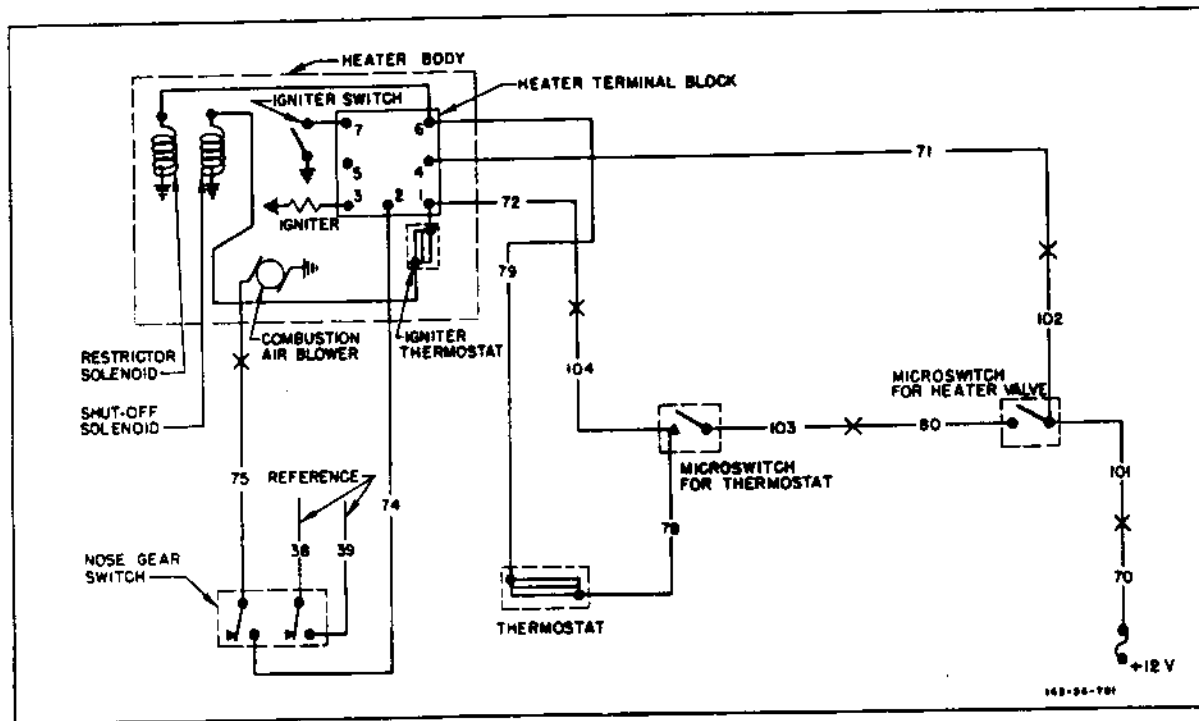


Figure 4. Wiring Diagram

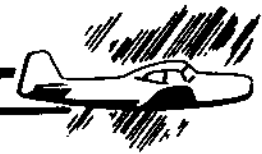
29. Untie wires stowed on 143-31001-72 angle and connect in accordance with wiring diagram. (See figure 4.) Clip these wires to 143-31001-72 angle with one 49138 wire clip. Attach these wires to firewall with AN742-6C clamp, using outboard thermostat mounting screw. Loosen wires stowed on back of instrument panel, and connect to thermostat and microswitch in accordance with wiring diagram. Clip these wires to lower edge of instrument panel with three 49138 clips.
30. Install one 3AG20 fuse in "HEATER" retainer in fuse panel and one in spare retainer if a 20-amp fuse is not present.
31. Reinstall seat.

Effective NAV-4-1111 and subsequent, and all North American manufactured NAVIONS equipped with the Adel Electric Fuel Pump System.

1. Cabin heater fuel supply line Part No. 145-53327 should be routed down to carburetor instead of to the fuel pump as directed in instructions. Remove 1/8 inch pipe plug from special fitting installed in carburetor and connect fuel supply line.
2. NAVIONS equipped with Adel electric - Carter engine driven fuel pump combination, Carter fuel pump drain should be relocated to drain out the opposite side of fuselage from the cabin heater exhaust outlet.



REVISED DECEMBER 26, 1946

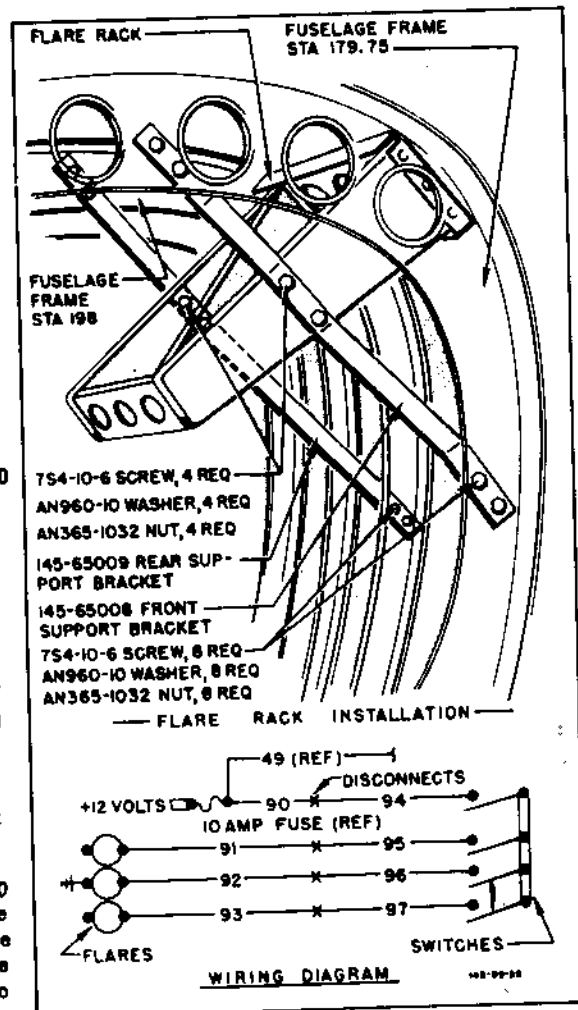


SPECIAL INSTRUCTIONS NUMBER - 6

FLARE INSTALLATION

Install Flare Kit, consisting of three Kilgore, Type B-3, parachute flares, 145-54040 switch panel, 145-65008 and 145-65009 support brackets, 145-65010 rack, in NAvion, as follows:

1. Remove cover from upper left side of fuselage just aft of cockpit enclosure, and reinstall the screws removed.
2. Attach the 145-65008 front and 145-65009 rear support brackets to the flare rack, using four 7S4-10-6 screws, AN960-10 washers, and AN365-1032 nuts.
3. Place rack on inside fuselage against doubler in skin cutout. Insert the three flare supporting cups through holes in doubler and rack, and drill eighteen No. 18 (.169) holes through doubler and rack to match holes in cups. Attach cups and rack to doubler, using eighteen NAS 220-13 screws, 4S3-D5-8 spacers, AN960-D8 washers, and AN365-832 nuts, placing spacers between rack and washers. POSITIVE ELECTRICAL CONTACT MUST BE ESTABLISHED BETWEEN CUPS AND RACK BY MEANS OF THESE SCREWS.
4. Drill No. 10 (.193) holes in fuselage frames at stations 179.75 and 198 to match holes in ends of front and rear rack support brackets. Attach brackets to frames, using eight 7S4-10-6 screws, AN960-10 washers, and AN365-1032 nuts.
5. Remove upholstery cutout at left of pilot's seat, and install flare switch panel in cutout space, using screws provided.
6. Connect the four wires from switch panel to the existing wires from flares and power source per wiring diagram. Cover each disconnect splice with insulating tubing provided, and tie tubing to prevent slipping.
7. BEFORE INSERTING ANY FLARES IN RACK, test switches and wiring.
8. BE SURE ALL FLARE SWITCHES ARE OFF AND LOCKED. Insert flares in cups and secure with clamps provided on cups. Be sure rubber gaskets are against bead of flare tubes. Connect wires from switches to flare posts.





*REVISED April 14, 1947



SPECIAL INSTRUCTIONS NUMBER -

GYRO INSTRUMENT PANEL INSTALLATION

Install Gyro Instrument Panel kit (consisting of Elgin 1792 clock, Kollsman 991-10-01 vertical speed indicator, Kollsman 205BK-10-031 or 987-10-031 sensitive altimeter, L.N. Schwien NS27200 bank-and-turn indicator, U.S. Gage AW-1 7/8-21L suction gage, Sperry 661961 attitude gyro, Sperry 649742 directional gyro, AN6121-1 oil separator, AN6110-1 vacuum pump, AN6119-1 vacuum relief valve, 40722-AL accessory drive gears, piping, and supports) in NAVION as follows:

1. Disconnect battery. Remove instrument panel reflector. Uncouple oil temperature capillary tube from oil cooler, and install a 5/8-18 threaded plug in cooler; remove all clips from capillary line; remove line and indicator. Remove the six light sockets from instrument panel. Disconnect all lines and wires from instruments. Remove the four pins from the instrument panel mounting brackets, and remove panel.

See Figure 1.

2. Remove the two vibration isolators from the upper mounting flanges of dash panel, and insert in upper mounting brackets of 145-51055 instrument panel, with body of isolator beneath bracket. Leave isolators in bottom flanges of dash panel.
3. Remove the instruments from old panel. Remove elbow from old altimeter and install in vertical speed indicator. Install 752x4 tee in new sensitive altimeter. Install 10-1146-75 union in suction gage, and 234x4 connector and 352x6 elbow in directional gyro.
4. Remove shipping plugs from air filter on attitude gyro. Remove air filter cover from directional gyro (four screws). Mount sensitive altimeter, tachometer, ammeter, and oil pressure, oil temperature, fuel pressure, fuel level, and airspeed indicators in new panel with existing screws. Mount clock with two AN515B6R12 screws. Mount suction gage, and vertical speed, attitude gyro, and bank-and-turn indicators with four AN515B6R12 screws each, using 6939-632-375 nuts for bank-and-turn and vertical speed indicators. Mount directional gyro with four AN520B10R16 screws.

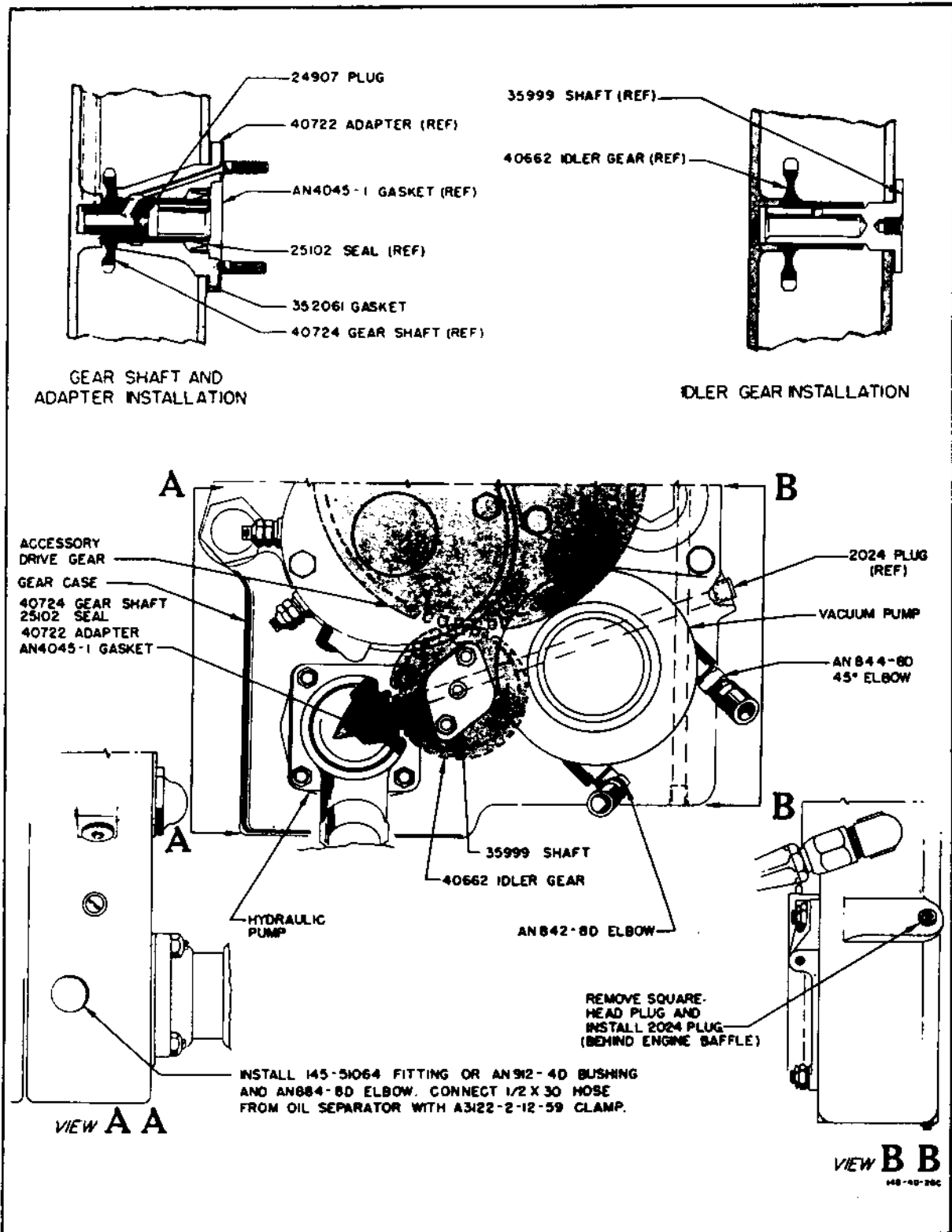


Figure 3 - Hydraulic Pump Drive Installation

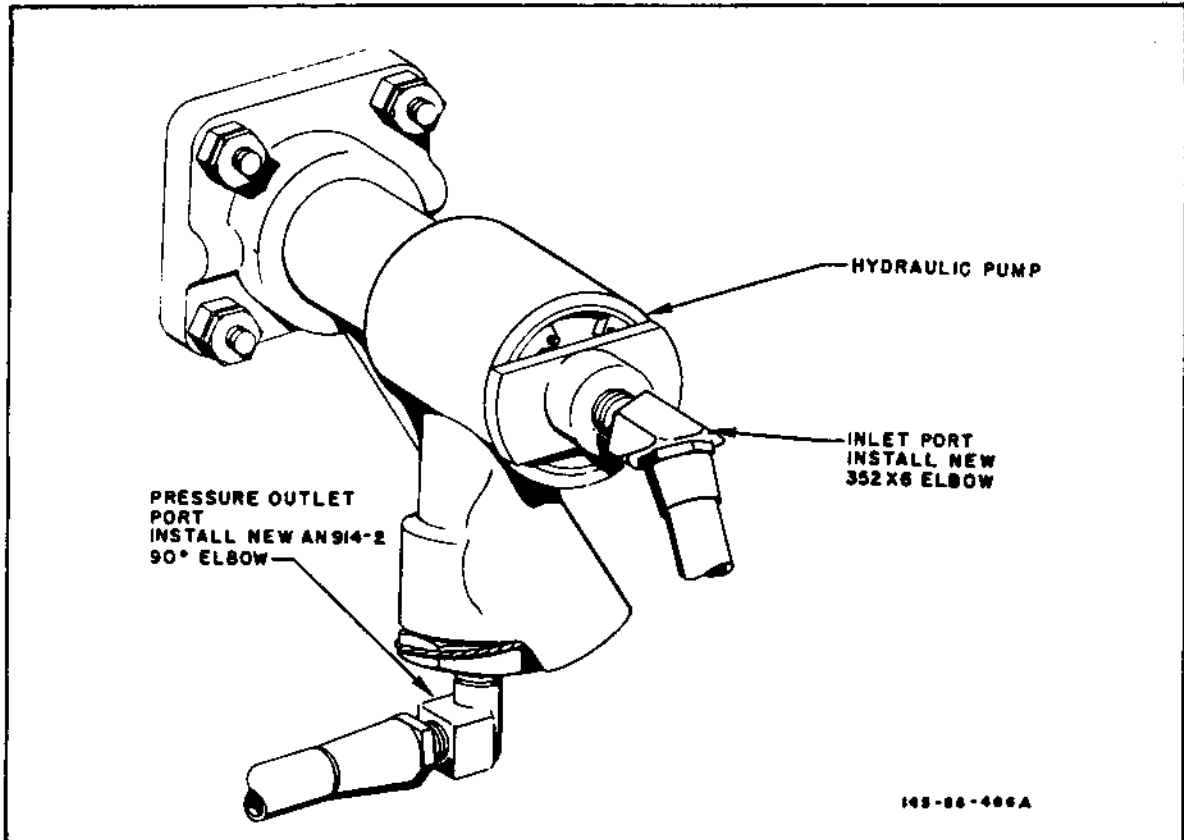


Figure 4 - Hydraulic Pump Connections

12. Install AN844-8D 45-degree elbow in vacuum pump port marked "IN" for clockwise rotation. Install AN842-8D 90-degree elbow in opposite port. Install pump on pad with gasket provided, using existing nuts.

Note: When Romec vacuum pump is used, it is necessary to rotate the generator 120° on the mount, in a counterclockwise direction. Electrical terminals will then be on upper side.

13. Install 24907 plug in shaft of 40724 gear. Insert 25102 oil seal in 40722 adapter, and place adapter on 40724 gear. (Use extreme care not to damage seal during assembly of gear and adapter. Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter in crankcase.

See Figure 4.

14. Remove the existing fitting from the pressure port on the hydraulic pump, and install the new AN914-2 90° elbow. Some airplanes are equipped with a hydraulic pressure hose incorporating 1/8-inch instead of 1/4-inch pipe threads. In that case, there will be an AN912-1 bushing installed in the pump pressure outlet. Remove this bushing, install it in the AN914-2 elbow, and connect the pressure hose. Remove the existing fitting from the inlet

port of the hydraulic pump, and install the new 352x6 fitting. Install the hydraulic pump and coupling on 40722 adapter, with AN4045-1 gasket, using existing nuts.

See Figure 3.

15. Remove the square-head plug from right side of accessory case, and install 2024 plug.
16. If the Hartzell propeller oil return line is routed to the accessory gear case, remove the existing fitting and install the 145-51064 fitting. If Aeromatic propeller is installed, remove plug from left side of case, and install AN912-4D bushing and AN844-8D elbow.

See Figure 1.

17. Drill two No. 10 (.193) holes in firewall; install AN6121-1 oil separator, with two 4S3-10-12 spacers, between oil separator and firewall, using two AN520-10R32 screws and AN365-1032 nuts, with one AN960-10L washer under each screw head and one under each nut. (Nuts should be aft of firewall.)
- *18. Connect 1/2 x 18 hose to bottom fitting in oil separator and to 145-51064 fitting or to AN844-8D elbow in gear case, using two A3122-12-59 clamps.
19. Connect 1/2x3-1/2 hose to separator, using A3122-12-59 clamp. Connect 145-51801-7 air vent line to hose, using A3122-12-59 clamp. Drill two No. 18 (.169) holes in firewall, and attach vent line to firewall with two A2980-8 clamps, AN515-8R8 screws, and AN365-832 nuts.
- *20. Drill one #18 (.169) hole in 143-31005-5 firewall channel and install AN794-12 clamp, using AN515-8R7 screw and AN365-832 nut. Connect 1/2 x 40 hose to oil separator and to AN842-8D elbow in vacuum pump using two A3122-12-59 clamps. Secure hose in AN794-12 clamp with AN515-8R7 screw and AN365-832 nut. Drill #18 (.169) hole in 143-3100-72 angle and attach hose to inboard side of angle using AN742-12C clamp, AN515-8R7 screw, and AN365-832 nut.
21. Drill (from aft side) a 7/8-inch hole in firewall. Remove existing AN3 bolt attaching angle to 143-31005-6 channel. Install 145-51052 bracket, using removed bolt and nut. Drill one No. 10 (.193) hole through 143-31005-6 channel and pilot hole in 145-51052 bracket. Install AN3-4A bolt, AN365-1032 nut, and AN960-10L washer.
- *22. Insert 145-51801-5 line through 7/8-inch hole in firewall. (AN931-8-13 grommet must be assembled on line prior to installation.) Install 200x8 connector and AN842-8D elbow in AN6119-1 vacuum relief valve. Connect 1/2 x 18 hose to AN842-8D elbow of relief valve, using A3122-12-59 clamp. Attach relief valve to 145-51052 bracket, using one AN742-14 clamp, AN530-8R8 screw, and A1778-8Z-1 nut. Connect 1/2 x 18 hose to AN844-8D elbow in vacuum pump, using A3122-12-59 clamp. Connect 145-51801-5 line to 200 x 8 connector in relief valve. Be sure line clears starter control.

NOTE: When cabin heater is installed, clamp heater fuel line to 145-51052 bracket with Adel 766-9 clamp, AN515-8R8 screw, and AN365-832 nut.

23. Install 234x8 connector in 802x6 tee, and connect tee to 145-51801-5 line. Connect 75683 hose to tee and to attitude gyro, using one A3122-10-59 clamp. Connect 75682 hose to tee and to 234x4 connector in directional gyro.
24. Attach 145-51801-5 line to existing holes in 143-51007-4 dash panel beam with two A2980-8 clamps, AN530-8R8 screws, and A1778-82-1 nuts.
25. Replace 145-51031-12 oil pressure line with 145-51801-9 line, and 145-51031-10 fuel pressure line with 145-51801-11 line.
26. Reconnect pitot and static pressure lines to airspeed indicator. Test lines for leaks. (Refer to NAVion Service Manual.) Reinstall oil temperature indicator and capillary.
27. Replace the panel light rheostat with 145-54043 rheostat. Plug the light sockets with lamps into the eleven holes in instrument panel.
28. Remove loose wires 85 and 86 from their stowed position at back of instrument panel. Connect wire 85 to bank-and-turn indicator terminal marked "+" and wire 86 to "-" terminal. Reconnect all wires to remounted instruments. Install a one-amp fuse in "BANK TURN" retainer and one in spare retainer.

See Figure 5.

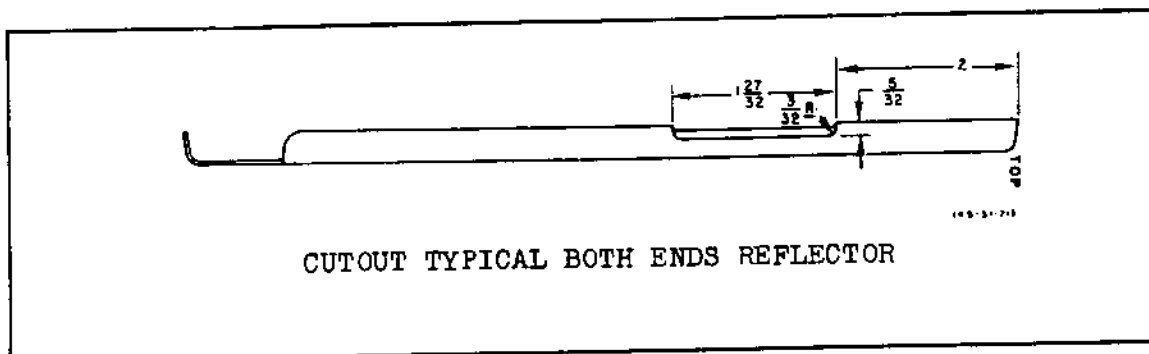


Figure 5 - Reflector Cutout

29. On Airplanes NAV-4-251 and subsequent, cut out end flanges of 145-51056 reflector to clear dash panel trim strips. Install new reflector, using six 7S8-6-10 screws, four previously removed spacers, two new 4S4-D5-12 spacers, and six 6939-632-062 nuts.
30. Re-compensate compass. Fill out new compass correction card, and insert in holder on reflector.
31. Loosen locknut on top of relief valve and, with engine running at 1000 rpm, turn adjusting screw until suction gage indicates 3.75 in. Hg. With engine running at 2300 rpm, suction gage should not exceed 4.75 in. Hg.

SPECIAL INSTRUCTIONS

Navion



RYAN AERONAUTICAL COMPANY, LINDBERGH FIELD, SAN DIEGO 12, CALIFORNIA

SPECIAL INSTRUCTIONS NO. 8

Page 1 of 7

MARCH 8, 1948

AUXILIARY FUEL TANK INSTALLATION FOR NAVION

Install 20-Gallon Auxiliary Fuel Tank, Kit No. 8 Ref. 145-48201, as follows. These installation instructions are divided into (3) three parts. Part A is the Tank Compartment Vent System installation, Part B is the installation of Fuel Shut-off Valve, Control Linkage and Fuel Gauge Electric Wiring and Part C is the Tank Lines and Bag installation.

Read Instructions completely before attempting to make this installation.

PART A

1. Remove rear seat back rest, right side cabin upholstery panels and right hand wing to fuselage fairing.
2. Lay out and drill the three one inch (1") vent holes in the airplane baggage compartment floor. The sump drain hole is 17-1/2" to the right of centerline and 4" aft of floor leading edge. For the forward vent hole measure 14-1/2" in from centerline and 3-3/4" aft of floor leading edge, the rear vent is 6-1/2" in-board from longeron and 1-3/4" forward of floor aft end. (See Figure.)
3. Lay out and drill the two one and three eighths inch (1-3/8") diameter holes and one 7/16" hole in the right hand wing to fuselage fairing, part number 145-10006-2. For the forward hole, measure out-board from inside edge of underside of fairing 18 inches, measure aft from forward edge 12" at intersection, drill 1-3/8" hole. Measure aft four (4) additional inches and drill 7/16" hole. For the aft hole, measure out-board from inside edge of underside of fairing 12" and from rear edge forward 3 inches, drill hole.
4. Properly locate and install the 145-48226-2 and -3 Weld Assemblies as follows: Place the -3 Weld Assembly over the forward vent hole on the lower side of the airplane baggage compartment floor. (See Figure.) Using the holes in the assembly mounting flange as a template, mark the

- baggage compartment floor for drilling. Using a No. 19 drill, drill the three (3) holes marked as above. Install weld assembly to lower side of baggage compartment floor, using three (3) each AN520-8-7 Screws, AN364-832 Nuts. Using procedure outlined above, install the 145-48226-2 Weld Assembly at the aft vent hole.
5. Install AN931-16-22 Grommets in the two 1-3/8" holes, drilled in the right hand wing to fuselage fairing, as described in Step 3, and install the AN-H-35-1" I.D. x 10" Hose and 145-48226-25 Tube on the 145-48226-3 (Front) Weld Assembly, using the two (2) each AN748-46 Hose Clamps. (See Figure.)
 6. Install the AN-H-35-1" I.D. x 6-1/2" Hose and 145-48226-24 Tube on the 145-48226-2 (Aft) Weld Assembly, using two (2) each AN748-46 Hose Clamps. (See Figure.)
 7. Using a 1/4" drill, drill three (3) drain holes in the fuselage bottom skin on the airplane centerline just aft of the fuselage formers at fuselage Stations 157.06 and 179.79 and just forward of the former at fuselage Station 198. Using the holes in the mounting flange of the 145-48226-21 Drain Louvre as a marking template, hold the louvres in place over each drain hole and mark the fuselage skin and wing fillet for drilling. Using a No. 28 drill, drill holes as marked and install louvres with AN530-6-8 Screws and All81-6Z-1 Tinnerman Speed Nuts.
 8. Drill a 1/4" hole 1-1/4" from in-board edge of fairing 10006-2 and just forward of former in fairing, mount the other small louvre same as on centerline of fuselage.

PART B

1. Position the 145-48222-9 Bracket at intersection of the fuselage right hand lower longeron and Fuselage Frame, Part No. 143-31001-18, as shown in Figure. Using the pilot holes in the bracket as a marking template mark the holes to be drilled in the fuselage skin and 143-31003-17 Channel, for the bracket attaching screws. The top edge of flange should be approximately 1" forward of frame.
2. Remove bracket and using a No. 40 drill, drill pilot holes as marked above. Re-position bracket in place and attach with Cleco fasteners or P-K screws and using a No. 12 drill, drill out pilot holes for the AN520 attaching Screws. Permanently attach the 145-48222-9 Bracket in place with four (4) each AN520-10R7 Screws, AN960-10 Washers and AN365-1032 Nuts.

3. Install the 145-48222-7 Fuel Shut-off Valve on bracket as shown in Figure.
4. Install the R-09 Control Assembly as follows: Lay out a center mark on the bottom edge of the airplane instrument panel. Measure over to the right of this line 8" and make a mark on the panel. Measure up 5/8" from the bottom edge of panel and where the two lines intersect, drill a 7/16" hole. Insert the R-09 Control Assembly through this hole. Route and attach control wire and housing along side of fuselage through 1/4" tooling holes in frames, (Drilling 1/4" holes in frames as necessary.) to control valve, attaching at intervals with clips provided. Attach one clip to the bottom of forward end of glove compartment to keep loop from hanging down. Secure dash control to instrument with special nut provided with control. Place one clip just above top of fuel valve bracket on to 143-31001-18 Fuselage Frame, attaching with 145-48201 Spacer for proper alignment of control to valve.
5. On the centerline of and on lower flange of instrument panel between hydraulic hand pump and hand brake, mount 145-48201-56 Gauge Unit Bracket. Attach by drilling out holes as provided on bracket and secure with three (3) AN515-8-R7 Screws, Nuts and Washers.
6. Install 441100 Gauge Quantity Unit with Resistor attached.
7. Attach one end of shielded wire No. 150, to the instrument terminal, the wire shield ground to instrument and route over to, and down along side of fuselage, to the unit in tank. Drilling 5/16" holes in frames and inserting rubber grommets into them before running wire through them.
8. With electrical terminal on the underside install fuel gauge float assembly into tank and secure with five (5) screws. (Attach wire shield ground under one of these screws.)
9. Attach No. 150 wire to terminal on fuel tank indicator transmitter, and ground shield terminal under one of the screws securing transmitter to tank.
10. Attach No. 151 wire to existing 5 amp fuel indicator circuit breaker in panel and other end to resistor on quantity gauge.

PART C

1. Inside of right hand main gear wheel well, 2-1/4" in-board of wing Station, 12-1/4" and 1-3/8" down from wing centerline (approximately at center of lightening hole) place 145-48213 Weld Assembly, with tube parallel to wing centerline, and pointing out-board, mark six holes and drill out with No. 10 drill.

NOTE: Use caution so as not to allow any pieces of metal to fall into tank while cutting and drilling holes.

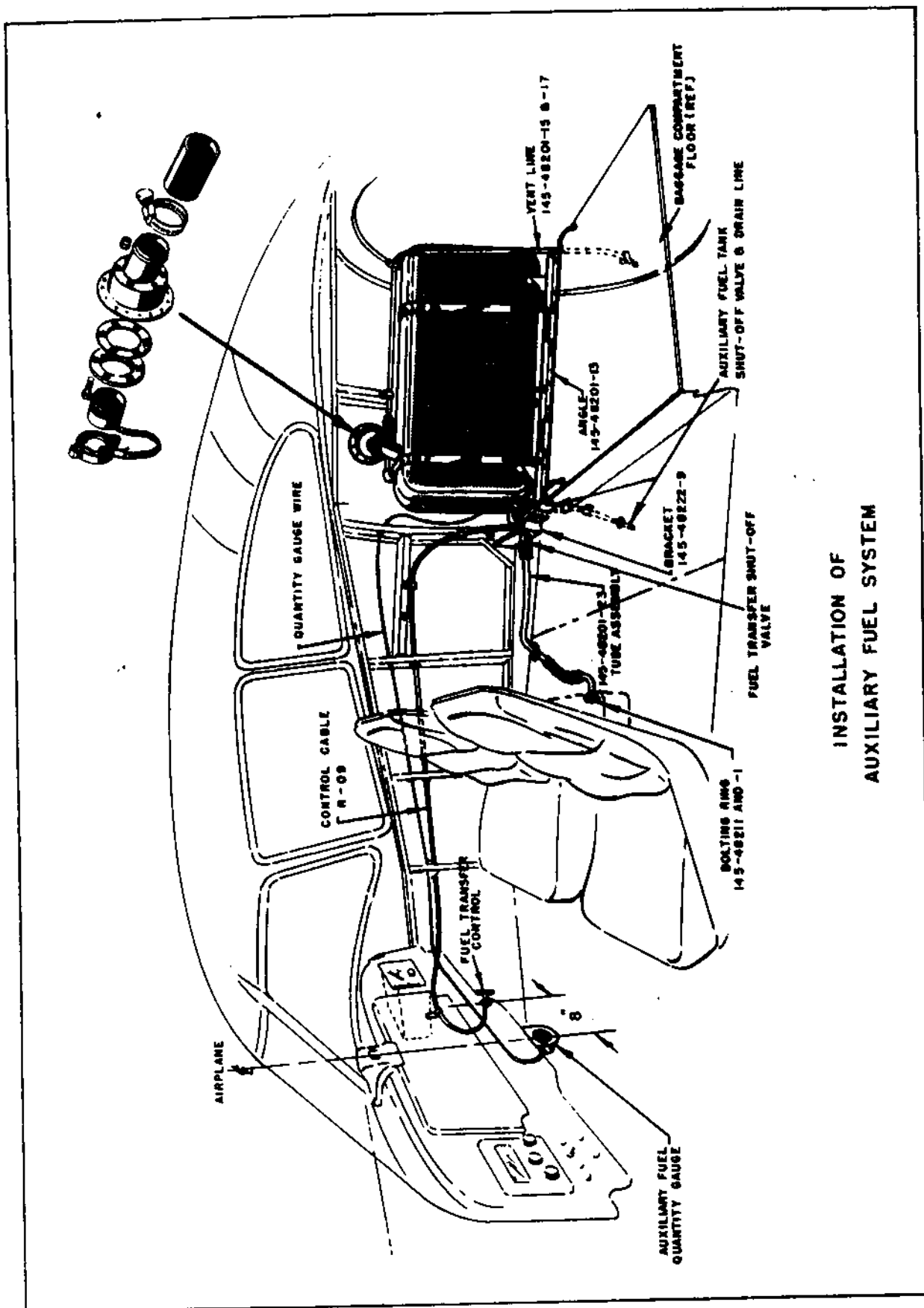
2. Cut a 7/8" diameter hole in the center of six hole circle previously drilled.
3. Place Bolting Ring 145-48211 and -1 over hole, align and mark the two rivet holes. Drill out and rivet in place on the inside of the tank. (This plate acts as nut plate.)
4. Place Flanged Tube Assembly 145-482113 with Gasket 145-48212 held in place against tank opening in line with centerline of wing, attach with six (6) AN502-10-8 Screws, using permatex or equivalent on gaskets and screws, and safety with lock wire through heads of screws.
5. Just aft of where pitot tube goes down through fuselage floor, approximately at fuselage Station 120, on right hand side measure forward of extrusion (mounted on underside) 9/16". Measure in-board from edge of longeron 3/4", drill 13/16" hole and install AN931-8-13 Rubber Grommet.
6. Install 145-48201-23 Tube Assembly from shut-off valve through hole in floor and connect to 145-48213 Weld Assembly Tube in tank with 145-48201-33 Hose and two (2) AN748-30 Clamps. (See Figure.)
7. In baggage compartment on right hand side, remove luggage strap fittings from the longeron, also the out-board bolt of the first one in-board on the forward end of baggage floor and the first fitting in-board at the aft end.
8. Place metal template provided, along side of longeron with end marked forward placed in that direction and the aft end butting against fuselage frame at the rear end of baggage compartment. Check to see if the former baggage holding strap fitting holes align with holes indicated in template for tank straps. If holes fall within 1/2" of that indicated in template, use existing holes, if they do not, then drill new ones as per template, also drill bag fastener holes indicated in template with a No. 28 drill.

NOTE: Use caution in drilling holes through longeron. This is a structural member and holes should not be over size and at no time closer than 1/2" to the nearest hole.

9. Install snap fastener studs in holes and the two tank hold down straps in the formerly indicated holes.
10. Place 145-48201-13 Angle on baggage floor. Place the 145-48205 Block Support Assembly in forward position and the 145-48207 Block Support Assembly in rear position, both against longeron. Slide 145-48201-13 Angle over and against blocks, pilot holes in angle aligning with the holes in Block Support Angle. This should align forward pilot hole of 145-48201-13 Angle with out-board hole of luggage strap fitting. Drill out pilot hole to strap fitting size (#10) and install same bolt removed, placing angle under fitting for better fit.
11. Move aft end of angle tight against block and block snug against longeron. Drill aft end hole out to 3/16" down through the center of flange of fuselage cross frame Station 179.75 and attach with AN3-3 Bolt.
12. Place fuel tank with the lugs nested in block supports, to properly align blocks, if pilot holes do not align, use pilot holes in 145-48201-13 Angle and drill new holes in block support fittings.
13. Drill out to 3/16" size hole, all block support bracket holes in forward and rear blocks, and angles attaching blocks to longeron.
14. Install AN3 Bolts in all holes drilled and provided.
15. Install turnbuckles in the two (2) holes provided in the 145-48201-13 Angle for tank strap turnbuckle attachment.
16. Directly above each cross stringer located under baggage floor, drill a 3/16" hole through 145-48201-13 Angle, floor and floor stringer, and attach with AN3-3 Bolts. On the second cross stringer from the forward end of floor attach luggage strap fitting formerly removed from longeron. Drill the other hole and attach with the same bolts. Attach aft end fitting on the second cross stringer from the aft end similar to the forward end method. (See Figure.)
17. Place luggage strap fitting removed from aft end of baggage compartment between rivets and as near as possible to the -13 Angle on the fuselage Station 179.75 cross member flange. Install same as above.
18. Install tank outlet fitting, sump finger screen, sump drain valve with 3330 x 2 Nipple, and 400 x 8 Tank Fitting on tank.
19. Place tank in supports, secure by tightening turnbuckles and safety.

20. Install 145-48201-19 Tube Assembly from tank to shut-off valve.
21. Place 145-48216 Filler Neck Assembly against skin, align tube with tube on tank, mark and drill out with No. 19 drill attaching holes.
22. From center of circle made by holes, locate and cut out to 4-9/16" diameter access hole. Smooth edges with file or emery cloth.
23. Slip 145-48201-25 Hose Assembly and Clamps over tank tube. Apply a good coating of permatex or equivalent on 145-48216 Filler Neck attaching Flange and secure to fuselage skin with eight (8) AN515-8R4 Screws.
24. Install sump drain line onto valve protruding through floor, attaching with one (1) clip on wing trailing edge flange. Extend end out through 7/16" hole with AN931-4-7 Grommet in fairing.
25. Measure 2" aft of baggage floor and at a 5" depth from fuselage skin curve to baggage floor on right hand side aft of tank, drill a 13/16" hole and insert AN931-8-13 Grommet.
26. Install tank vent line, 145-48201-15 Tube and 145-48201-17 Tube Assembly, attaching with clips at frames Station 159-1/2 and Station 179.75. Extend tube out through hole previously drilled 1 inch, 45° angle facing forward to force air into tank.
27. Install 145-48225-6 Angle on forward end of baggage floor between 145-48201-13 Angle and longeron, 1-3/4" aft of floor leading edge measure from the forward end of 145-48201-13 Angle. Place angle flange side forward at right angle to the 145-48201-13 Angle, drill out five (5) holes with 3/16" drill, and secure with AN530-10-10 Screws.
28. On the aft end of tank and baggage compartment floor, place 145-48225-4 Plate with three (3) fastener studs installed, in-board end even with 145-48201-13 Angle flange. Extend 3/4" below floor, drill out three (3) pilot holes and secure with three (3) AN530-10-10 Screws.
29. In line with 145-48225-4 Plate fasteners on Station 179.75 frame web, measure in-board from in-board side of longeron, 1-1/4 inches, drill hole with No. 28 drill and install fastener stud.
30. Install fuel tank bond, braid from bottom of tank to hole provided in 145-48201-13 Angle. (Approximately in the center of the tank.)
31. Install bag over tank, secure around lines, neck and vent by sewing and tying with cord.

32. Cut a narrow slot in the baggage compartment rear curtain for tank vent line, sew edges of slot to prevent material from fraying.
33. Re-install seat back upholstery and fairing.
34. Install small decal at fuel transfer control handle, the placard decal on instrument reflector panel in full view of pilot and the large decal below the filler neck of tank.
35. Before filling auxiliary fuel tank check quantity gage for zero setting. If on zero - fill tank with five gallons of fuel, check quantity, if indicator registers correctly continue on until full. If indicator does not indicate zero, remove indicator transmitter from tank, bend float rod until desired reading is indicated, reinstall and continue to fill in five gallon increments until tank is full, checking indicator each time five gallons are added.
36. Insert the revised pages in Airplane Operating Limitations Manual.



INSTALLATION OF
AUXILIARY FUEL SYSTEM



SPECIAL INSTRUCTIONS NUMBER - 9

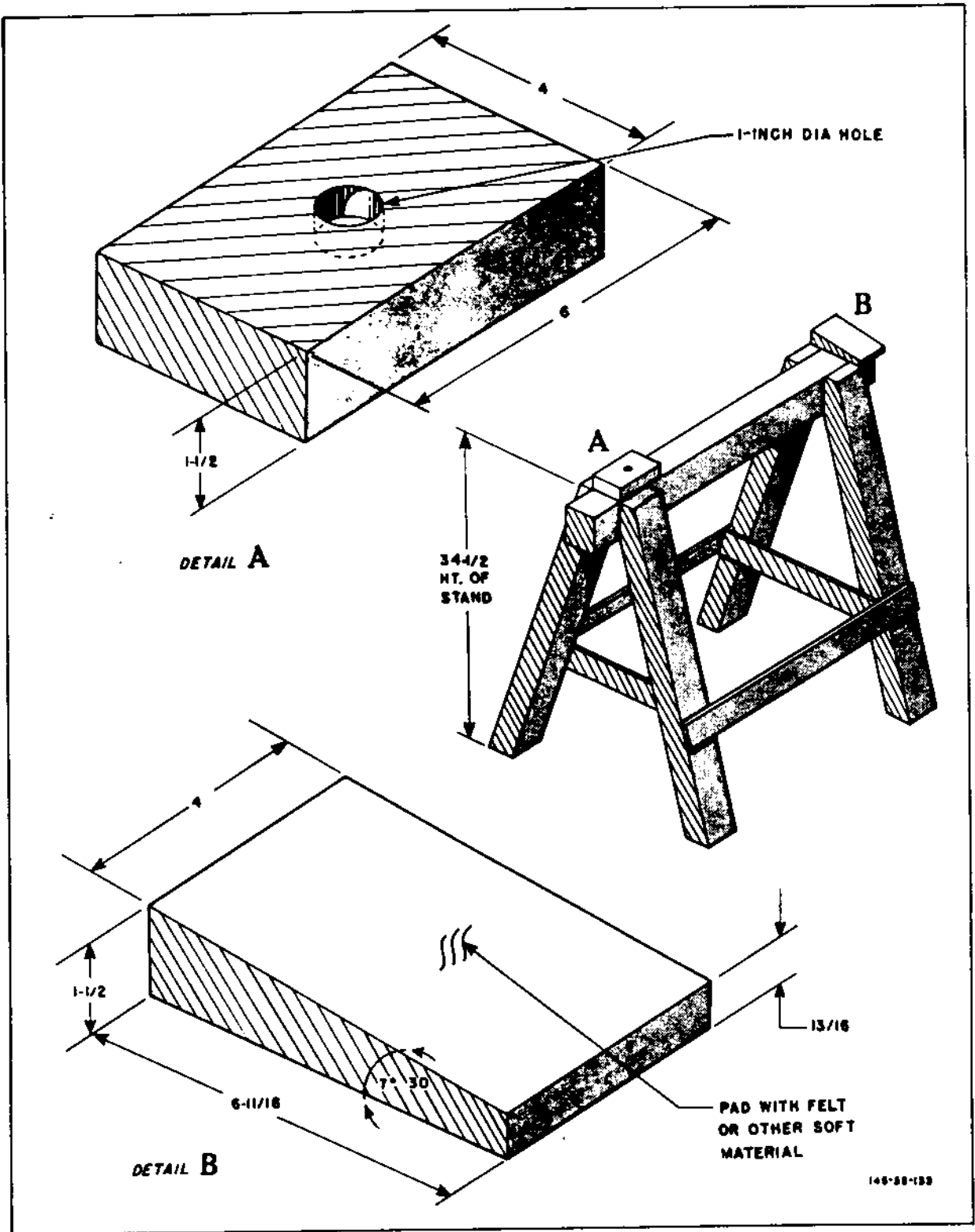
UNCRATING AND ASSEMBLY-EXPORT

Uncrate and assemble the NAVION Airplane as follows:
(Page numbers refer to the NAVION Service Manual)

1. Remove top, ends, and sides of shipping crate, in that order.
2. Manufacture four wing support blocks and attach them to a box, sawhorse, or stand as illustrated.
3. Place wings on stands (page 13) and complete the joining as explained on page 26. It may be necessary to support outboard ends of wings until several bolts can be installed through center rib bolting angle. A padded timber placed under a rib near wing tip is satisfactory for this purpose. Make certain that all lines, wires, and controls are properly connected (page 26), before proceeding.

NOTE: Rust preventative on external parts may be removed with any petroleum solvent.

4. The 145-55001 fuselage hoisting sling may be used to lower the fuselage onto the assembled wing (page 13).
5. Bolt fuselage to wing assembly and connect all controls, wires, and lines (page 23).
6. Place a suitable stand (page 13) under tail skid.
7. Install empennage (page 28) and nose wheel (page 47). Install foot step at left hand exit gill.
8. Place landing gear in down and locked position. Because of the height of wing stands, it will be necessary to deflate and compress the nose and main gear shock struts. The airplane can then be raised clear of wing stands by inflating struts or by hoisting with 145-55001 sling.
9. Adjust aileron, rudder, elevator, and elevator trim tab controls (pages 31 to 34).
10. Check elevator trim tabs for being in the down position (relative to the elevator) when cockpit control is in full "NOSE UP" position.
11. Carefully check all control surfaces for freedom of operation, full travel, and proper direction of throw.



12. If airplane is equipped with radio, install the radio antenna as explained in NAVion Special Instructions No. 1, attached.
13. Fill the dry charged battery with electrolyte of 1.285 specific gravity.
14. Install battery (page 82).
15. Thoroughly bleed brakes (page 5).
16. Jack airplane and perform a complete operational check of landing gear system including up-locks, warning horn, warning lights, and emergency release system.
17. Install propeller (pages 62 to 67).
18. Prepare engine for service after extended storage (page 20).
19. Make initial run-up of engine (page 52).
20. Perform a complete visual inspection (50-hour, page 112) of airplane and engine. Check for proper condition, installation, and operation of all parts of airplane.
21. Install seats (page 98), all inspection plates, and center floor housing.
22. Perform a thorough preflight inspection (page 112) before flying the airplane.

SPECIAL INSTRUCTIONS NO. 10

JANUARY 25, 1947

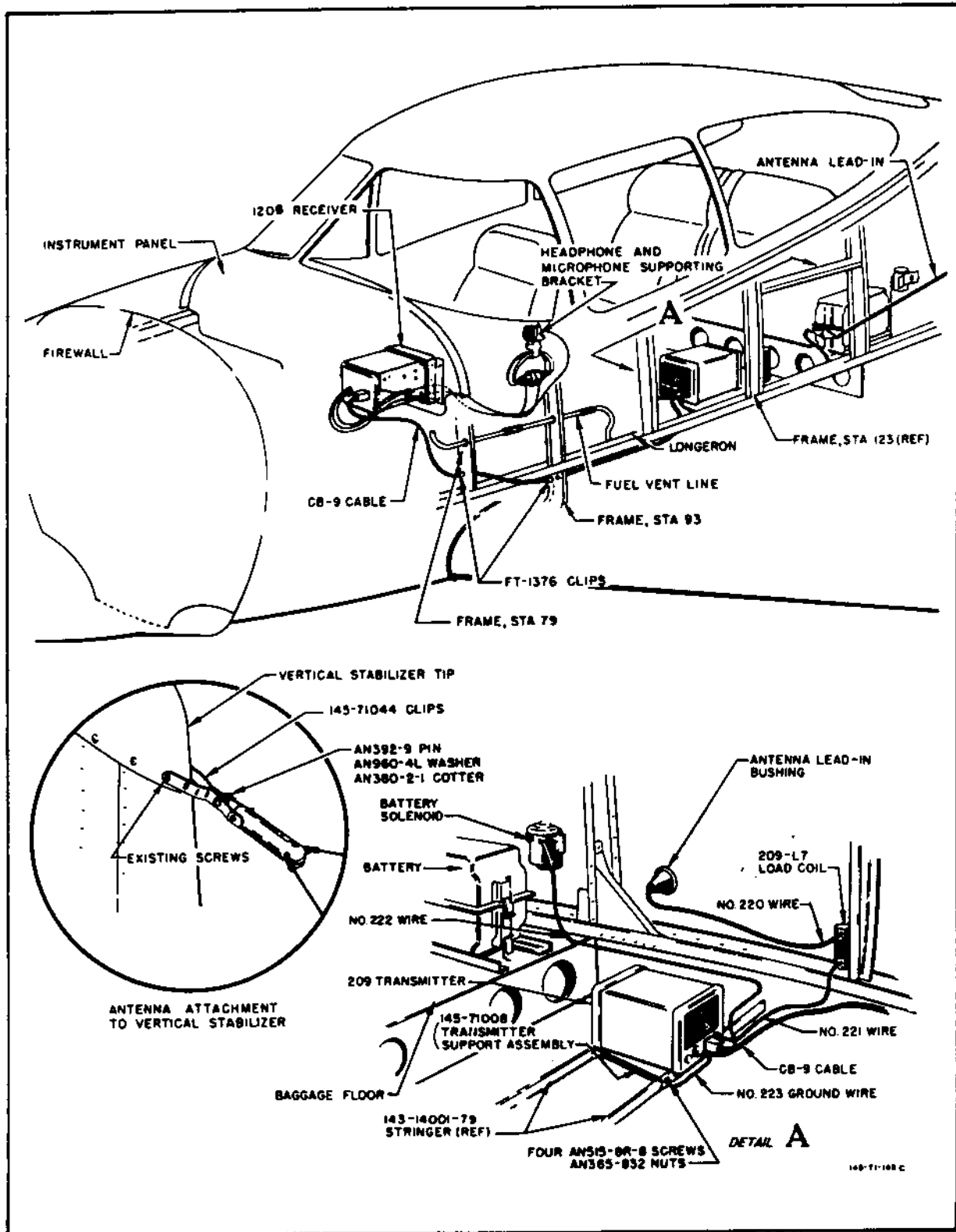
RANGER TWO-WAY RADIO INSTALLATION

Install the Ranger two-way radio (consisting of 209 transmitter with 145-71108 support, 120 B receiver, 209-L7 load coil, 145-71045 antenna assembly) in NAVION as follows:

1. Remove the left front seat and the rear seat.
2. Pry loose the two trim strips from the top of left side upholstered panels. Remove all screws attaching panels to floor and wing top skin. Pry loose the two fasteners in forward end of rear panel, the two in aft end, and the one in forward end of upholstered panel. Remove panels by pulling down and inboard.
3. Remove coverplate from left side of control panel.
4. Remove the four screws from 120 receiver cover.
5. Install 145-51040-20 coverplate on receiver, using previously removed screws. Install receiver in control panel. Connect No. 229 wire (from receiver dial light) to existing 110 rheostat wire.

NOTE: If loud speaker not installed, tape the end of No. 228 speaker wire to prevent wire from shorting.

6. Remove "MIC" and "PHONE" plugs from control panel. Install two-wire conductor jack fitting from set in "MIC" hole, and one-wire fitting in "PHONE" hole.
7. Install 209-L7 load coil on frame at station 123 just forward of battery, locating it so that bottom of load coil is one inch above lower longeron. Drill two No. 30 (.128) holes in frame, using load coil mounting brackets as template, and attach with two AN515-6R7 screws and AN365-632 nuts.
8. Remove plug from hole in fuselage left side, and install 1060-01 antenna lead-in bushing, using a 2WIV-52-40-40 washer. Connect No. 220 lead from load coil to bushing.



SPECIAL INSTRUCTIONS NO. 10

JANUARY 25, 1947

9. Attach the two 145-71044 clips to vertical stabilizer tip, using the forward tip attaching screws (one on each side). Attach antenna to clips with AN392-9 pin, AN96C-4L washer, and AN380-2-1 cotter. Attach antenna to top of each wing tip, using the fourth tip attaching screw from the leading edge. Connect antenna lead-in to bushing in fuselage side.
10. Drill a No. 10 (.193) hole in each of the 143-14001-79 left wing stringers, locating the holes 8-1/2 inches from the airplane centerline, and 7/16 inch from the top of stringer. Install 145-71008 transmitter support on stringers, and drill two No. 10 (.193) holes in stringers to match the two outboard holes in the support. Attach the transmitter support on stringers with four AN515-8R8 screws and AN365-832 nuts. (Transmitter support should be mounted level.)
11. Attach the 209 Ranger transmitter to transmitter support, with face of transmitter forward, using two AN515-8R-8 screws, two AN515-8R-10 screws, and four AN365-832 nuts.
12. Connect CB-9 cable to 209 transmitter and route, between lower longeron and top wing skin, to the control panel fuselage frame. Connect CB-9 cable to 120 receiver, and ground No. 227 wire to existing screw in receiver case. Clip cable to the first and second fuselage frames aft of control panel, using two FT-1376 clips and tying cable to clips with waxed cord.
13. Connect 221 load coil wire to transmitter, and ground the 223 transmitter ground cable to one of the transmitter support screws. Connect No. 222 wire to airplane side of battery solenoid.
14. Remove check list holder from 145-53011-300 upholstered panel located beneath left side windshield panel. Pull lower edge of panel out from longeron, unsnapping the two fasteners which secure its aft end to fuselage skin. Pull out far enough only to reach beneath upholstery and remove the two nuts from the screws through fuselage skin. Remove screws.
15. Punch two holes through the upholstery to match the holes in the fuselage from which screws were previously removed.

SPECIAL INSTRUCTIONS NO. 10

JANUARY 25, 1947

Insert two AN515-8-12 screws through fuselage and upholstery, with one AN960-D8 washer on each screw between fuselage and upholstery. Using 22K1-82 nuts, install 145-71040 headphone supporting bracket on the screws with 454-D6-15 spacers between upholstery and bracket.

16. Reinstall upholstery, check list holder, and seats. Place headphone and microphone on bracket, and plug leads into jacks in control panel. Tune the receiver to a known station frequency, and check the dial setting. Place 145-71007 Radio Frequency Measurement Card in pocket in aircraft log book.

Refer to NAVION Operation Manual and Ranger Operating and Maintenance Handbook for Operating Instructions.

SPECIAL INSTRUCTIONS NO. 11

REVISED DECEMBER 1, 1948

KOPPERS (AEROMATIC) PROPELLER INSTALLATION

These instructions contain material pertinent to the installation of the Koppers (Aeromatic) propeller assembly, following removal of the Hartzell -1, -5, or -7 propeller installation. Before starting this installation, check the following index to note which sections of these instructions affect the subject airplane.

SECTION I. Removal of Hartzell -1 or -5 Propeller Installation
SECTION II. Removal of Hartzell -7, -7A or -7B Propeller Installation
SECTION III. Installation of Aeromatic Propeller
SECTION IV. Adjustment of Aeromatic Propeller

SECTION I. Removal of Hartzell -1 or -5 Propeller Assemblies

1. Make certain that the ignition switch is off and magneto ground wires are connected.
2. Remove propeller hub nut safety pin, and hub nut.
3. Remove wirelocks and linkscrews (-1 installation only).
4. After disconnecting the piston links replace the linkscrews in the same clamps from which they were removed.
5. On -5 propellers the push rods and forks may be disconnected, after removal of the hub nut, by pulling forward on the propeller and spreading the propeller counterweights.
6. Remove the propeller from the hub.
7. Remove the 145-44013 and 145-44012 retainer plates, and the 145-44018 cover.

SPECIAL INSTRUCTIONS NO. 11
REVISED DECEMBER 1, 1948

8. Disconnect the linkage and hose connection to the servo valve.
9. Pull the actuating piston from the cylinder. Have a drip pan ready to catch any oil that may drain from the cylinder.
10. Remove the four (4) stud nuts and pull the cylinder from the engine.

NOTE: On those airplanes (Serial No's. 2 through 1110) which have the cylinder secured to brackets (rather than bolted directly to the engine) it will be necessary to remove the two (2) 145-44014 brackets from the engine. The bolts which are taken out during the process of removing these brackets, should be reinstalled with an additional 1/16 washer under the head of each bolt. Torque these bolts to 300 inch pounds.

11. Remove 145-44003 servo lever stop bracket attached to forward end of the crankcase. Install two new AN4-11A bolts, using removed nuts, palnuts, and washers. Torque nuts to 75 inch-pounds.
12. Remove clips attaching copper oil return line to engine. Disconnect line at left-hand side of oil sump. Remove line from airplane. Install and safety AN913-2 pipe plug in the oil sump from which the line was disconnected. On airplanes not using the copper line, remove the flex hose return line and 90-degree elbow at upper forward end of crankcase. Install and safety AN913-2 pipe plug in case.
13. Disconnect the oil pressure hose from left front side of engine crankcase. Install the safety and AN913-2 pipe plug in the case.
14. Remove two 145-43023 brackets securing propeller control to engine crankcase. Install four new AN4-11A bolts, using removed nuts, palnuts, and washers. Torque nuts to 75 inch-pounds.
15. Remove two clamps securing propeller control to dash panel beam aft of firewall. Remove jam nut on propeller control housing forward of dash panel, and pull control out through dash panel.
16. Plug hole in dash panel with 48152 plug button.
17. Plug hole in firewall for propeller control with AN520-10-8 screw, two AN970-3 washers, and AN365-1032 nut. (Place one washer on each side of firewall.)
18. Remove the rubber seals and retainer on forward side of engine nose cowl.

SPECIAL INSTRUCTIONS NO. 11
REVISED DECEMBER 1, 1948

SECTION II. Removal of Hartzell -7, -7A or -7B Propeller Installation

1. Make certain that the ignition is "OFF" and that the magneto ground wires are connected.
2. Remove the clevis pin from the propeller retainer nut.
3. Unscrew the propeller retainer nut.
4. Spread the counterweights by hand, until it is possible to rotate the jack plate clockwise and disengage the blade actuating links from the blade shanks.
5. Remove the propeller from the propeller shaft.
6. The rear cone may be removed at this time or subsequently, as desired.
7. Remove the bolt holding the servo neutralizing linkage to the jack plate stud.
8. Remove the jack plate.
9. Disconnect the servo valve control cable from the servo control link, and disengage the servo valve oil lines.
10. Remove the engine grill.
11. Remove the engine cowl propeller air seal. Save the nine (9) screws removed, for use later.
12. Remove the screws holding the outer diaphragm retainer ring in place, then remove the outer retainer ring.
13. Fold the diaphragm back and remove the four Allen head screws which mount the jack cylinder to the engine.
14. Remove the jack cylinder assembly from the engine.
15. If a propeller is not to be reinstalled immediately, wrap the propeller shaft with an oil soaked rag and install a thread protector on the end of the shaft.
16. Remove the five (5) clamps securing the propeller control to the guide brackets.

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17. Remove the two clamps securing propeller control to the dash panel beam. Remove jam nut on propeller control housing forward of dash panel, and pull the control out through dash panel.
18. Plug the hole in the dash panel with the 48152 plug button.
19. Remove the three (3) propeller control guide brackets. Reinstall the bolts taken out with a 1/16 inch washer under the head of each screw, to compensate for the removal of the brackets.
20. Remove the four screws and nuts securing the baffle seals to the aft side of the nose cowl.
21. Remove the two flexible oil lines (pressure and drain) from the engine. Install and safety one (1) AN913-2 pipe plug in the engine at the connection point of each oil line.
22. Plug the hole in the firewall left by removal of the propeller control. Use one (1) AN520-10-8 screw, one (1) AN365-1032 nut, and two (2) AN970-3 washers. Place one washer on each side of the firewall, and secure in place with the screw and nut.

SECTION III. Installation of Aeromatic Propeller

1. On airplanes from which the Hartzell -7 propeller was removed, place the 145-44063 seal assembly on the cowl, and drill eleven (11) 7/32 holes in the seal to match the existing mounting holes in the cowl. Mount the seal assembly on the cowl using the nine (9) screws removed in step 11 of Section II preceding.
2. On airplanes from which the Hartzell -1 or -5 propeller was removed, install the 145-44010 seal assembly on the cowl with seven (7) NAS221-8 screws.
3. Install new 145-31506 and 145-31507 baffle seals on right and left sides of baffle, inside nose cowl, using two (2) NAS221-8 screws and two (2) AN365-1032 nuts to mount each seal. SEE PAGE 70 OF NAVION SERVICE MANUAL.
4. Install the engine grill.
5. Install 2542 spacer and AN5008-20 rear cone, clean and dry, on propeller shaft. Coat outer face of rear cone and shaft splines with a thin coat of engine oil. Apply a thin coat of antisieze compound to propeller shaft threads.
6. Slide propeller on propeller shaft, aligning the wide hub spline with the blind spline (if used) on the shaft.

SPECIAL INSTRUCTIONS NO. 11
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7. Install 2400 front cone and 2756 retaining nut on shaft. Tighten nut with a force of 180 pounds at the end of a 3 foot bar.
8. Install AN5009-20 snap ring in hub groove. Safety retainer nut with AN394-19 pin, 2W-18-18-42 washer, and AN380C-2-3 cotter pin.
9. Check propeller lubricant level by turning propeller so that 1/8-inch filler plug is on the bottom. While propeller is in this position, remove No. 1 high-pitch stop bolts (stamped "1H"). Remove the filler plug, and apply Aeromatic lubricant 7F until grease comes out of the high-pitch stop bolt hole. This method completely fills propeller hub and avoids creating air pockets. For the first few hours of engine running, white or grey streaks may appear on the propeller blade shanks. This condition does not indicate grease leakage, but is caused by assembly lubricant which is applied to the blade ferrules.

NOTE: Do not service propeller with a substitute grease, as serious damage may occur to the oil seals or bearings.
Do not lose shims under high-pitch stop bolt.

SECTION IV. Adjustment of Aeromatic Propeller

The Aeromatic propeller has been regulated, at sea level, with a standard propeller airplane combination. However, prior to continued flying, the propeller must be regulated to suit each individual combination as follows:

1. A ground (static) rpm of 2225-2275 must be obtained for best take-off. Static rpm is regulated as follows.
 - a. Remove all counterweights from counterweight arms.
 - b. Check ground (static) rpm, full throttle. If static rpm is not within range of 2250-2275 rpm, correction can be made by use of the low pitch stop bolts. These bolts are marked 1L and 2L to correspond with blades No. 1 and No. 2. Add shims to increase or remove shims to decrease static rpm. If, for instance, the propeller turns 2175 rpm, addition of a laminated stop bolt shim .030 inch thick will increase the rpm approximately 100. Conversely, removal of a .030 shim will decrease rpm the same amount.

NOTE: Be certain to add or remove equal shim thickness at each stop bolt.

SPECIAL INSTRUCTIONS NO. 11
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- c. After reinstalling the counterweights, in their original position, a slight decrease in static rpm will be noted. This is a natural sequence; therefore do not make any other static adjustments.
2. At sea level, engine speed during level flight with full throttle should be 2300 rpm. Tests to check or correct the engine speed should be conducted as close as practicable to the ground. Adjust full throttle flight rpm as follows:
 - a. Add or remove counterweights, as necessary, to change rpm. Addition of one (1) 2965-2 counterweight, to each arm, will reduce rpm by approximately 50. Addition of one (1) 2965-1 counterweight, to each arm, will reduce rpm by approximately 25.

NOTE: Be certain to add or remove equal counterweights at each arm.
 - b. In order to compensate for horsepower losses at field altitudes above sea level, on full throttle regulation test, reduce rated engine speed 20 rpm for each 1000 ft. altitude above sea level, by addition of counterweights. For example, a propeller regulated at 3000 ft. above sea level should be adjusted so that full throttle level flight is 2240 rpm.

SECTION V. Operation of Aeromatic Propeller

With the static and full throttle rpm's correctly set, recommended cruising power will be delivered by the propeller. Generally, best performance and economy may be obtained, by throttle selection, between a low cruise of 2000 rpm and a high of 2100 rpm.

The attached sheet relating to operation and servicing of the Aeromatic propeller is to be inserted as page 54A in the black-covered NAVION Operation Manual.

RANGE CHART
KOPPERS (AEROMATIC) PROPELLER

ALTITUDE FEET	1800 RPM				1950 RPM Full throttle above 7500 ft				2180 RPM Full throttle above 3500 ft			
	IAS mph	TAS mph	FUEL FLOW gph	RANGE miles	IAS mph	TAS mph	FUEL FLOW gph	RANGE miles	IAS mph	TAS mph	FUEL FLOW gph	RANGE miles
Sea Level	105	105	7.0	500	125	125	9.0	470	140	141	11.5	420
2000	105	109	7.0	500	125	129	9.0	480	140	145	11.5	425
4000	105	112	7.5	500	125	133	9.0	480	139	147	11.5	425
6000	107	118	7.5	500	125	136	9.0	475	130	143	10.0	450
8000	109	124	8.0	500	120	136	9.0	480	—	—	—	—

INSTRUCTIONS FOR USE OF CHART

1. Ranges shown include take-off and climb allowances and a 5-gal reserve after landing. For each additional 5-gal reserve desired, reduce range by 75 mi. Make allowance for wind as required.
2. For maximum cruising speed, 150 TAS, fly at 3500 feet using full throttle. Range will be same as shown for 4000 feet, 2180 RPM.

CAUTION

For maximum engine life, do not exceed 2180 RPM for cruise.

3. LEANING PROCEDURE:

- a. Set up RPM for IAS slightly higher than desired.
- b. Lean mixture until point of engine roughness; then enrich slightly.
- c. RPM and IAS should be values selected on chart.

WARNING

If mixture is not leaned properly, ranges may decrease considerably.

SPECIAL INSTRUCTIONS NO. 12

*REVISED FEBRUARY 17, 1947

WARNING HORN REPLACEMENT

*When an E. A. Laboratories landing gear warning horn is replaced with an Electric Autolite No. HDP-17 horn, install the HDP-17 horn in new location as follows:

1. Remove 143-31001-49 left gill baffle cover, located on the lower left side of the fuselage just aft of the engine compartment.
2. Measure 2 inches outboard on the centerline of the "U" channel, from the existing jig hole on the vertical side, and center punch a mark. The "U" channel is located just inside the gill cover at fuselage station 65 and is riveted to the bottom fuselage skin.
3. Punch a second mark 1-3/8 inches outboard from the first center punch mark.
4. Drill two number F (.257) holes in the channel at the center punch marks.
- *5. Install the horn, facing forward, of the forward side of the channel, using two AN4-4 bolts and two 960-416 washers.
- *6. Cut the cord securing the coverings over the cable knife disconnects of the horn wires at the left gill. Slide the coverings off the knife disconnects on wires 24 and 87, and 25 and 27, and break the knife disconnects. Install the "H" knife disconnect between wires 25 and 27.
- *7. Connect one new wire extension to the "H" knife disconnect and connect the other new wire extension to wire 24.
- *8. Connect the new extended wire from 25 and 27 to the upper horn terminal, and connect the extended wire 24 to the other horn terminal.

SPECIAL INSTRUCTIONS NO. 12

*REVISED FEBRUARY 17, 1947

9. Slide coverings back over knife disconnects, and tie securely with waxed cord. Cut the terminal end off wire 87 and remove from system.
10. Disconnect the wires from the old warning horn. Bolt together the terminal ends of wires 27, 28, and 29, using an AN520-8-8 screw and AN365-832 nut. Tape connection, tie with waxed cord, and shellac.
11. Remove bracket that secures old horn, and remove horn. Check horn operation by jacking airplane and retracting landing gear.
12. The horn should blow when engine rpm is 1250 or lower (battery switch on).

SPECIAL INSTRUCTIONS

NO. 13
JAN. 10, 1947

GENERAL ELECTRIC RADIO SPEAKER INSTALLATION

Install speaker kit (consisting of 145-71009 speaker, speaker brackets and speaker housing) in Navion as follows:

1. Mount 145-71009 speaker on 145-71010 and 145-71012 speaker brackets with four AN507-632-8 screws, AN960 6 washers and AN365-632 nuts as shown.
2. Locate and drill two No. 18 (.169) holes in 145-31801 center windshield stiffener.
3. Attach speaker brackets to center windshield stiffener with two AN515-8-11 screws and AN365-832 nuts. Ground the short speaker wire to one of these screws.
4. Unsnap the rear edge of the upper left upholstery, and route No. 221 speaker wire between the upholstery and canopy skin; snap upholstery back in place.
5. Route the wire down 145-31801-71 left side windshield frame, and secure the frame by inserting two 145-71014 metal clips under windshield rubber molding; unsnap the left forward upholstered side panel along the top edge and route the wire behind upholstered side panel and forward of the control panel.
6. Connect No. 221 wire to No. 212 speaker receiver wire with quick disconnect attached to 221 wire, and cover connection with a 3-inch piece of XTE30 No. 4 IRV-O-LITE tubing and secure at both ends with waxed cord.
7. Install 145-71013 housing assembly to speaker by firmly pressing housing snaps into speaker bracket.

NOTE: If 145-53329 cabin air deflectors are installed, it is necessary to trim the air deflectors to the dimensions given in the illustration, to ensure clearance for 145-71013 speaker housing.

SPECIAL INSTRUCTIONS NO. 14

*REVISED MARCH 6, 1947

RADIO LOOP INSTALLATION

Install General Electric Radio Loop Kit (consisting of 7769236P1 loop, 145-71046 bracket, and loop wiring) in NAVION as follows:

1. Remove the first and third bolts (forward end) from wing center bolting angle. Install 145-71046 bracket on bolting angle, using two AN5-12A bolts, existing washers and nuts.
 2. Attach loop to 145-71046 bracket, using screws furnished with the loop. Install loop at right angle to centerline of the airplane; if loop is out of alignment, place a bar through 145-71046 bracket and twist to correct alignment.
 - *3. Remove canvas close-out curtains from the rear of nose wheel well. Locate and drill a 3/4-inch hole in lower wing skin, aft of nose wheel well, just forward of wing bolting angle end, and 1 1/2 inches to the right of bolting angle. Install AN931-5-12 grommet, and pass loop lead through grommet.
 - *4. Remove control cable guard box from cockpit floor, and the small coverplate aft of nose wheel blister. Drill a 3/4-inch hole in cockpit floor, two inches to the right of airplane center line, and two inches aft of nose wheel blister. Trim coverplate so the 3/4-inch hole in floor is uncovered.
- NOTE: In early airplanes the 3/4-inch holes in lower wing skin and cockpit floor are existent.
- *5. Install AN931-5-12 grommet in the 3/4-inch hole, and pass loop lead through grommet.
 6. Route loop lead forward over the top of wheel well blister, and secure to forward and aft flange of wheel well blister with two AN742-4C clamps, using existing bolts.

SPECIAL INSTRUCTIONS NO. 14

*REVISED MARCH 6, 1947

7. Route lead under control column and rudder torque tubes, diagonally, so that lead contacts the firewall to the left of starter pedal bracket.
8. Route cable up the firewall, to upper left-hand corner, and aft to the radio receiver, following radio wires. Secure cable to firewall with an AN742-4C clamp, using the existing screw located approximately 8 inches above cockpit floor, to the left of airplane centerline.
- *9. Solder the bare end of cable to terminal No. 11 of the receiver. Ground the shield of the cable to one of the existing screws in the receiver case. Couple the cable from the receiver, to cable from loop, with quick disconnect fitting provided.
10. Reinstall coverplate, control guard box, and close-out curtains.

NO. 15

*Revised April 15, 1947

GYRO INSTRUMENT PANEL (MODIFIED) INSTALLATION

Install 145-89025 Gyro Instrument Panel Kit (consisting of Kollsman 991-10-01 vertical speed indicator, U.S. Gage AW-1 7/8-21L suction gage, Sperry 661961 attitude gyro, Sperry 649742 directional gyro, AN6121-1 oil separator, AN6110-1 vacuum pump, AN6119-1 vacuum relief valve, 40722-AL accessory drive gears, piping, and supports) in Navion as follows:

1. Disconnect battery. Remove instrument panel reflector. Uncouple oil temperature capillary tube from oil cooler, and install a 5/8-18 threaded plug in cooler; remove all clips from capillary line; remove line and indicator. Remove the six light sockets from instrument panel. Disconnect all lines and wires from instruments. Remove the four pins from the instrument panel mounting brackets, and remove panel.

See Figure 1.

2. Remove the two vibration isolators from the upper mounting flanges of dash panel, and insert in upper mounting brackets of 145-51055 instrument panel, with body of isolator beneath bracket. Leave isolators in bottom flanges of dash panel.
3. Remove the instruments from old panel. Remove elbow from old altimeter and install in vertical speed indicator. Install 752x4 tee in sensitive altimeter. Install 10-1146-75 union in suction gage, and 234x4 connector and 352x6 elbow in directional gyro.
4. Remove shipping plugs from air filter on attitude gyro. Remove air filter cover from directional gyro (four screws). Mount sensitive altimeter, tachometer, ammeter, clock, and oil pressure, fuel pressure, fuel level, airspeed and bank-and-turn indicators in new panel with existing screws. Mount suction gage, vertical speed indicator, and attitude gyro with four AN515-B6R12 screws each, using 6939-632-375 nuts for vertical speed indicator. Mount directional gyro with four AN520-B10R16 screws.

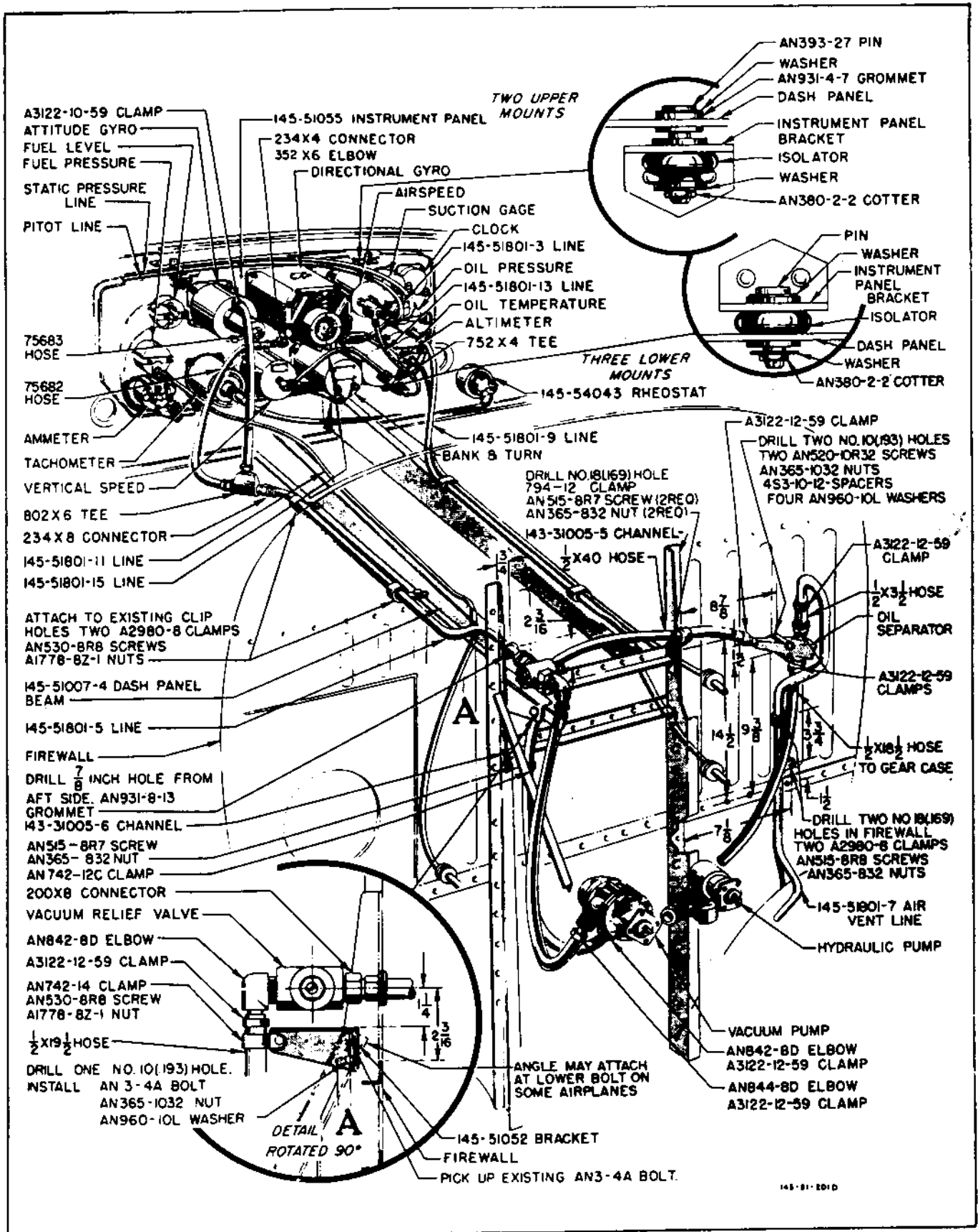


Figure 1 - Gyro Instrument Panel Installation

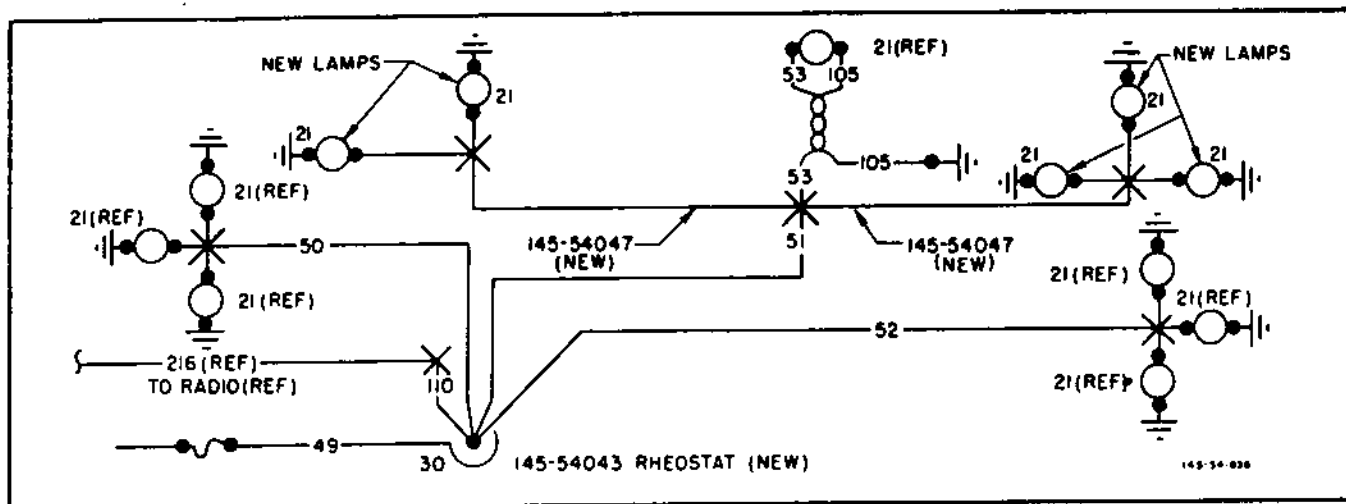


Figure 2 - Wiring Diagram

5. Connect 145-51801-3 line to directional gyro and to suction gage. Connect 145-51801-13 line to tee in airspeed indicator and to 752x4 tee in altimeter. Connect 145-51801-15 line to, 752x4 tee in altimeter and to vertical speed indicator.

See Figure 2.

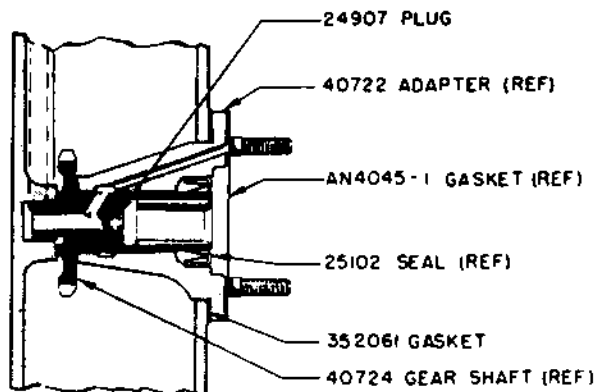
6. Connect five 145-54044 panel light sockets and lamps, and two 145-54047 wires to existing wiring.

See Figure 1.

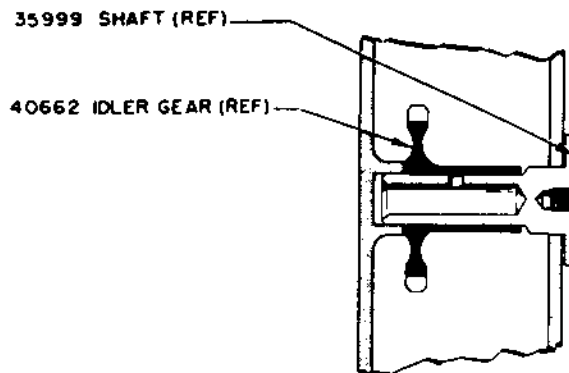
7. Insert two AN931-4-7 grommets in the upper instrument panel mounting flanges of the dash panel. Install 145-51055 instrument panel, using two AN393-27 pins, four existing washers, and two AN380-2-2 cotters in upper mounts. Use one new 275-5 isolator, existing pin, two AN960A10L washers, and AN380-2-2 cotter in lower center mount. Use two existing pins, four existing washers, and AN380-2-2 cotters in the other two lower mounts.

See Figure 3.

8. Remove hydraulic pump and coupling. Remove adapter pad on which hydraulic pump was mounted. Leave gasket on case. (If gear becomes separated from adapter pad on removal, use extreme care not to damage seal during re-assembly of gear and adapter pad.)
9. Remove the two coverplates from aft end of engine accessory gear case. Leave gaskets on case. Insert 40662 idler gear through large opening in case; position under small opening in mesh with main drive gear, and secure by installing 35999 shaft in small opening. Use the two screws removed with the small coverplate to secure shaft to case.
10. Check oil passage just inside case at hydraulic pump former location to see that it is open. Remove plug if one is present. (Vacuum pump receives oil supply from this passage.)
11. Install pad on case from where it was removed.



GEAR SHAFT AND ADAPTER INSTALLATION



IDLER GEAR INSTALLATION

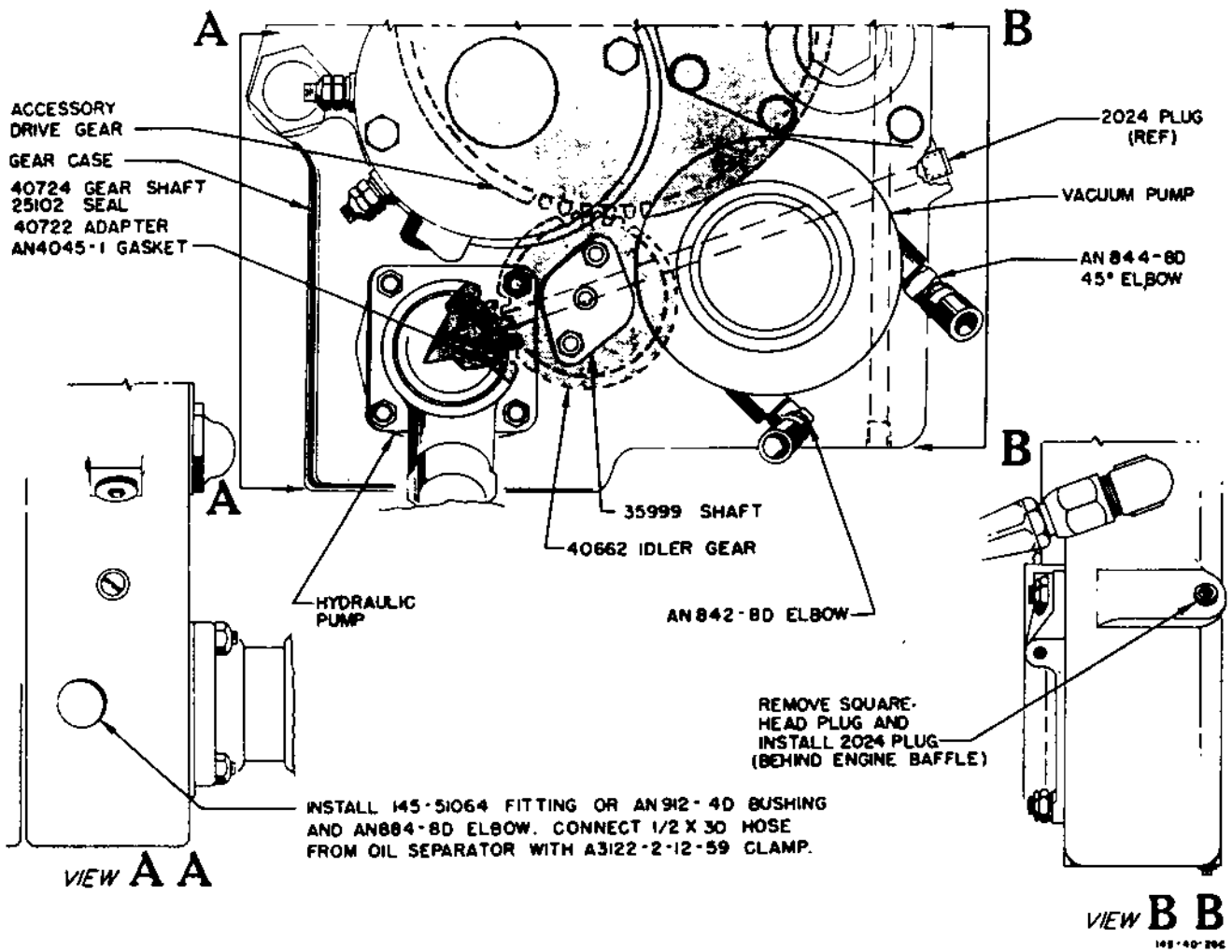


Figure 3 - Hydraulic Pump Drive Installation

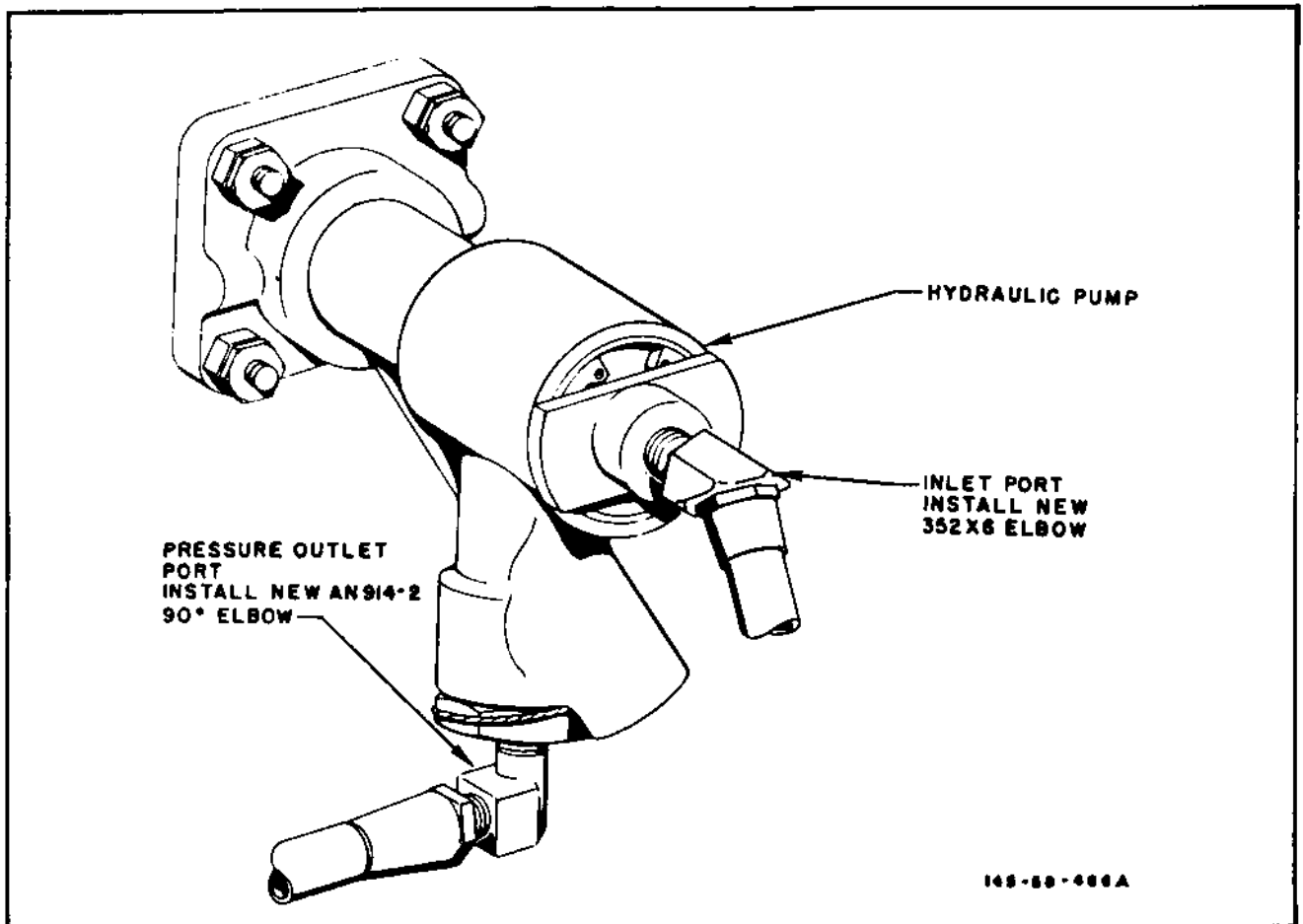


Figure 4 - Hydraulic Pump Connections

12. Install AN844-8D 45-degree elbow in vacuum pump port marked "IN" for clockwise rotation. Install AN842-8D 90-degree elbow in opposite port. Install pump on pad with gasket provided, using existing nuts.

Note: When Romec vacuum pump is used, it is necessary to rotate the generator 120° on the mount, in a counterclockwise direction. Electrical terminals will then be on upper side.

13. Install 24907 plug in shaft of 40724 gear. Insert 25102 oil seal in 40722 adapter, and place adapter on 40724 gear. (Use extreme care not to damage seal during assembly of gear and adapter. Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter in crankcase.

See Figure 4.

14. Remove the existing fitting from the pressure port on the hydraulic pump, and install the new AN914-2 90° elbow. Some airplanes are equipped with a hydraulic pressure hose incorporating 1/8-inch instead of 1/4-inch pipe threads. In that case, there will be an AN912-1 bushing installed in the pump pressure outlet. Remove this bushing, install it in the AN914-2 elbow, and connect the pressure hose. Remove the existing fitting from the inlet

port of the hydraulic pump, and install the new 352x6 fitting. Install the hydraulic pump and coupling on 40722 adapter, with AN4045-1 gasket, using existing nuts.

See Figure 3.

15. Remove the square-head plug from right side of accessory case, and install 2024 plug.
16. If the Hartzell propeller oil return line is routed to the accessory gear case, remove the existing fitting and install the 145-51064 fitting. If Aeromatic propeller is installed, remove plug from left side of case, and install AN912-4D bushing and AN844-8D elbow.

See Figure 1.

17. Drill two No. 10 (.193) holes in firewall; install AN6121-1 oil separator, with two 4S3-10-12 spacers, between oil separator and firewall, using two AN520-10R32 screws and AN365-1032 nuts, with one AN960-10L washer under each screw head and one under each nut. (Nuts should be aft of firewall.)
- *18. Connect 1/2 x 18 hose to bottom fitting in oil separator and to 145-51064 fitting or to AN844-8D elbow in gear case, using two A3122-12-59 clamps.
19. Connect 1/2x3-1/2 hose to separator, using A3122-12-59 clamp. Connect 145-51801-7 air vent line to hose, using A3122-12-59 clamp. Drill two No. 18 (.169) holes in firewall, and attach vent line to firewall with two A2980-8 clamps, AN515-8R8 screws, and AN365-832 nuts.
- *20. Drill one #18 (.169) hole in 143-31005-5 firewall channel and install AN794-12 clamp, using AN515-8R7 screw and AN365-832 nut. Connect 1/2 x 40 hose to oil separator and to AN842-8D elbow in vacuum pump using two A3122-12-59 clamps. Secure hose in AN794-12 clamp with AN515-8R7 screw and AN365-832 nut. Drill #18 (.169) hole in 143-3100-72 angle and attach hose to inboard side of angle using AN742-12C clamp, AN515-8R7 screw, and AN365-832 nut.
21. Drill (from aft side) a 7/8-inch hole in firewall. Remove existing AN3 bolt attaching angle to 143-31005-6 channel. Install 145-51052 bracket, using removed bolt and nut. Drill one No. 10 (.193) hole through 143-31005-6 channel and pilot hole in 145-51052 bracket. Install AN3-4A bolt, AN365-1032 nut, and AN960-10L washer.
- *22. Insert 145-51801-5 line through 7/8-inch hole in firewall. (AN931-8-13 grommet must be assembled on line prior to installation.) Install 200x8 connector and AN842-8D elbow in AN6119-1 vacuum relief valve. Connect 1/2 x 18 hose to AN842-8D elbow of relief valve, using A3122-12-59 clamp. Attach relief valve to 145-51052 bracket, using one AN742-14 clamp, AN530-8R8 screw, and A1778-8Z-1 nut. Connect 1/2 x 18 hose to AN844-8D elbow in vacuum pump, using A3122-12-59 clamp. Connect 145-51801-5 line to 200 x 8 connector in relief valve. Be sure line clears starter control.

NOTE: When cabin heater is installed, clamp heater fuel line to 145-51052 bracket with Adel 766-9 clamp, AN515-8R8 screw, and AN365-832 nut.

23. Install 234x8 connector in 802x6 tee, and connect tee to 145-51801-5 line. Connect 75683 hose to tee and to attitude gyro, using one A3122-10-59 clamp. Connect 75682 hose to tee and to 234x4 connector in directional gyro.
24. Attach 145-51801-5 line to existing holes in 143-51007-4 dash panel beam with two A2980-8 clamps, AN530-8R8 screws, and A1778-8Z-1 nuts.
25. Replace 145-51031-12 oil pressure line with 145-51801-9 line, and 145-51031-10 fuel pressure line with 145-51801-11 line.
26. Reconnect pitot and static pressure lines to airspeed indicator. Test lines for leaks. (Refer to NAVION Service Manual.) Reinstall oil temperature indicator and capillary.
27. Replace the panel light rheostat with 145-54043 rheostat. Plug the light sockets with lamps into the eleven holes in instrument panel.
28. Remove loose wires 85 and 86 from their stowed position at back of instrument panel. Connect wire 85 to bank-and-turn indicator terminal marked "+" and wire 86 to "-" terminal. Reconnect all wires to remounted instruments. Install a one-amp fuse in "BANK TURN" retainer and one in spare retainer.

See Figure 5.

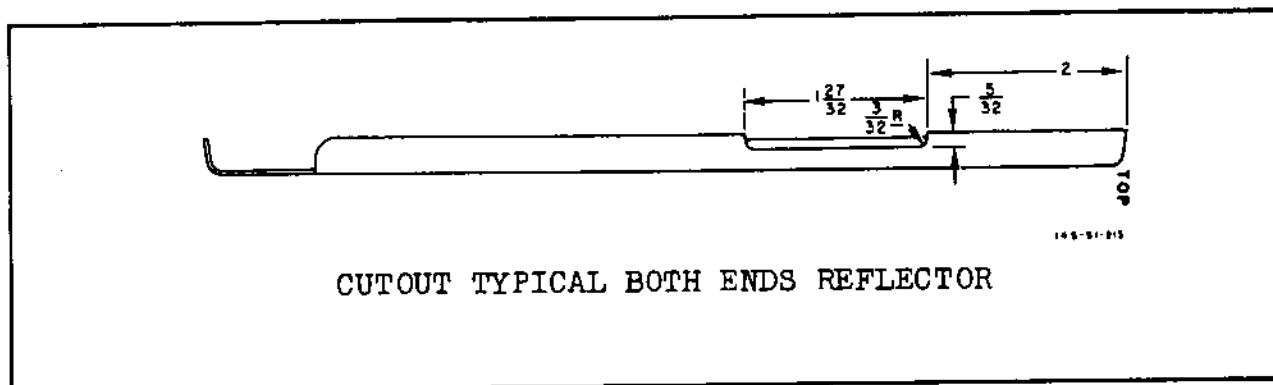


Figure 5 - Reflector Cutout

29. On Airplanes NAV-4-251 and subsequent, cut out end flanges of 145-51056 reflector to clear dash panel trim strips. Install new reflector, using six 7S8-6-10 screws, four previously removed spacers, two new 4S4-D5-12 spacers, and six 6939-632-062 nuts.
30. Re-compensate compass. Fill out new compass correction card, and insert in holder on reflector.
31. Loosen locknut on top of relief valve and, with engine running at 1000 rpm, turn adjusting screw until suction gage indicates 3.75 in. Hg. With engine running at 2300 rpm, suction gage should not exceed 4.75 in. Hg.

NO. 16

*Revised April 15, 1947

VACUUM INSTRUMENT PROVISIONS INSTALLATION

Install 145-89026 Vacuum Pump Accessory Kit (consisting of AN6110-1 vacuum pump, AN6119-1 vacuum relief valve, AN6121-1 oil separator, 40722 AL accessory drive gears, piping, and supports) in NAVION as follows:

1. Disconnect battery. Remove instrument panel reflector. Uncouple oil temperature capillary tube from oil cooler, and install a 5/8-18 threaded plug in cooler; remove all clips from capillary line; remove line and indicator. Remove the six light sockets from instrument panel. Disconnect all lines and wires from instruments. Remove the four pins from the instrument panel mounting brackets, and remove panel.

See Figure 1.

2. Remove the two vibration isolators from the upper mounting flanges of dash panel, and insert in upper mounting brackets of 145-51055 instrument panel, with body of isolator beneath bracket. Leave isolators in bottom flanges of dash panel.
3. Remove the instruments from old panel. Remove elbow from old altimeter and install in vertical speed indicator. Install 752x4 tee in sensitive altimeter. Install 10-1146-75 union in suction gage, and 234x4 connector and 352x6 elbow in directional gyro.
4. Remove air filter cover from directional gyro (four screws). Mount instruments in new 145-51055 panel. Approved locations are shown in Figure 1.

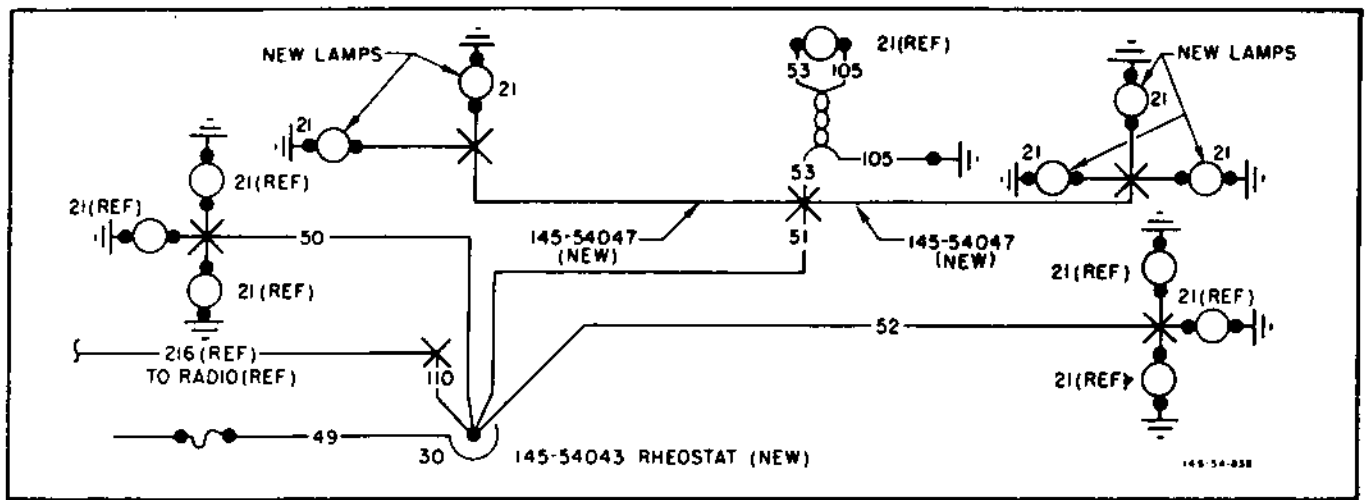


Figure 2 - Wiring Diagram

5. Connect 145-51801-3 line to directional gyro and to suction gage. Connect 145-51801-13 line to tee in airspeed indicator and to 752x4 tee in altimeter. Connect 145-51801-15 line to 752x4 tee in altimeter and to vertical speed indicator.

See Figure 2.

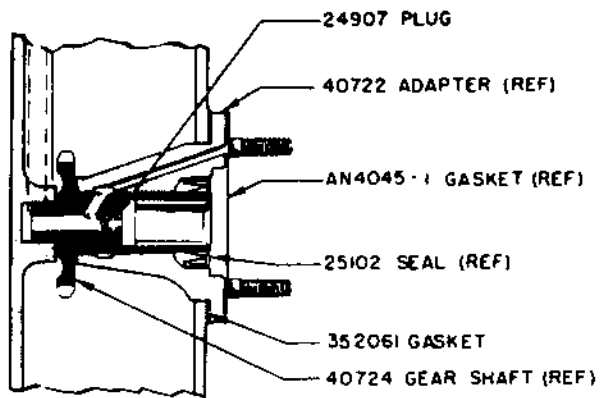
6. Connect five 145-54044 panel light sockets and lamps, and two 145-54047 wires to existing wiring.

See Figure 1.

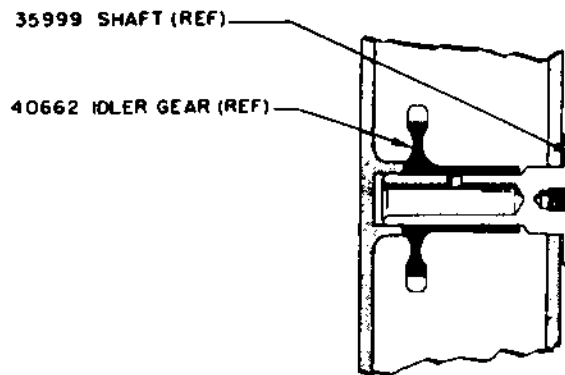
7. Insert two AN931-4-7 grommets in the upper instrument panel mounting flanges of the dash panel. Install 145-51055 instrument panel, using two AN393-27 pins, four existing washers, and two AN380-2-2 cotters in upper mounts. Use one new 275-5 isolator, existing pin, two AN960A10L washers, and AN380-2-2 cotter in lower center mount. Use two existing pins, four existing washers, and AN380-2-2 cotters in the other two lower mounts.

See Figure 3.

8. Remove hydraulic pump and coupling. Remove adapter pad on which hydraulic pump was mounted. Leave gasket on case. (If gear becomes separated from adapter pad on removal, use extreme care not to damage seal during re-assembly of gear and adapter pad.)
9. Remove the two coverplates from aft end of engine accessory gear case. Leave gaskets on case. Insert 40662 idler gear through large opening in case; position under small opening in mesh with main drive gear, and secure by installing 35999 shaft in small opening. Use the two screws removed with the small coverplate to secure shaft to case.
10. Check oil passage just inside case at hydraulic pump former location to see that it is open. Remove plug if one is present. (Vacuum pump receives oil supply from this passage.)
11. Install pad on case from where it was removed.



GEAR SHAFT AND ADAPTER INSTALLATION



IDLER GEAR INSTALLATION

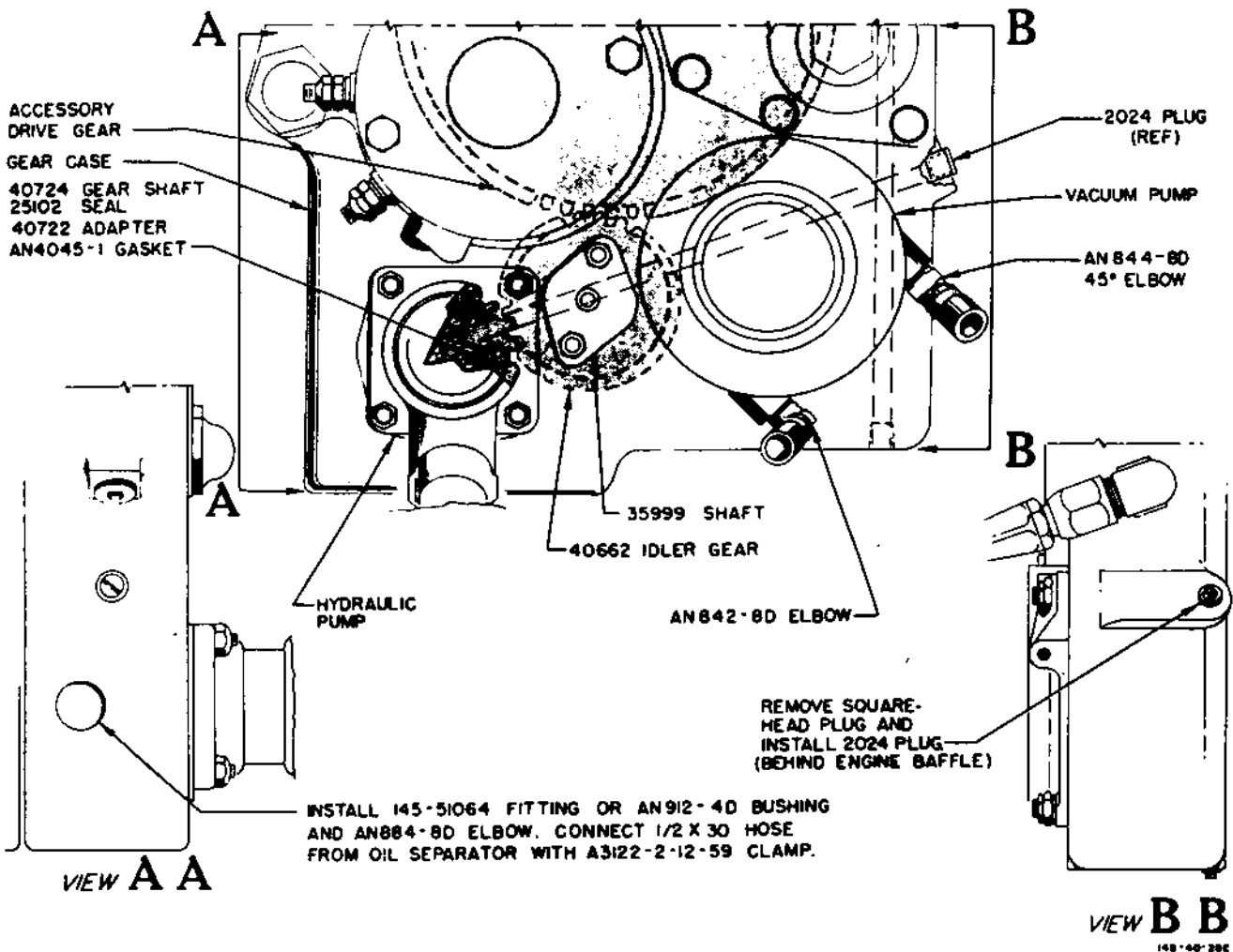


Figure 3 - Hydraulic Pump Drive Installation

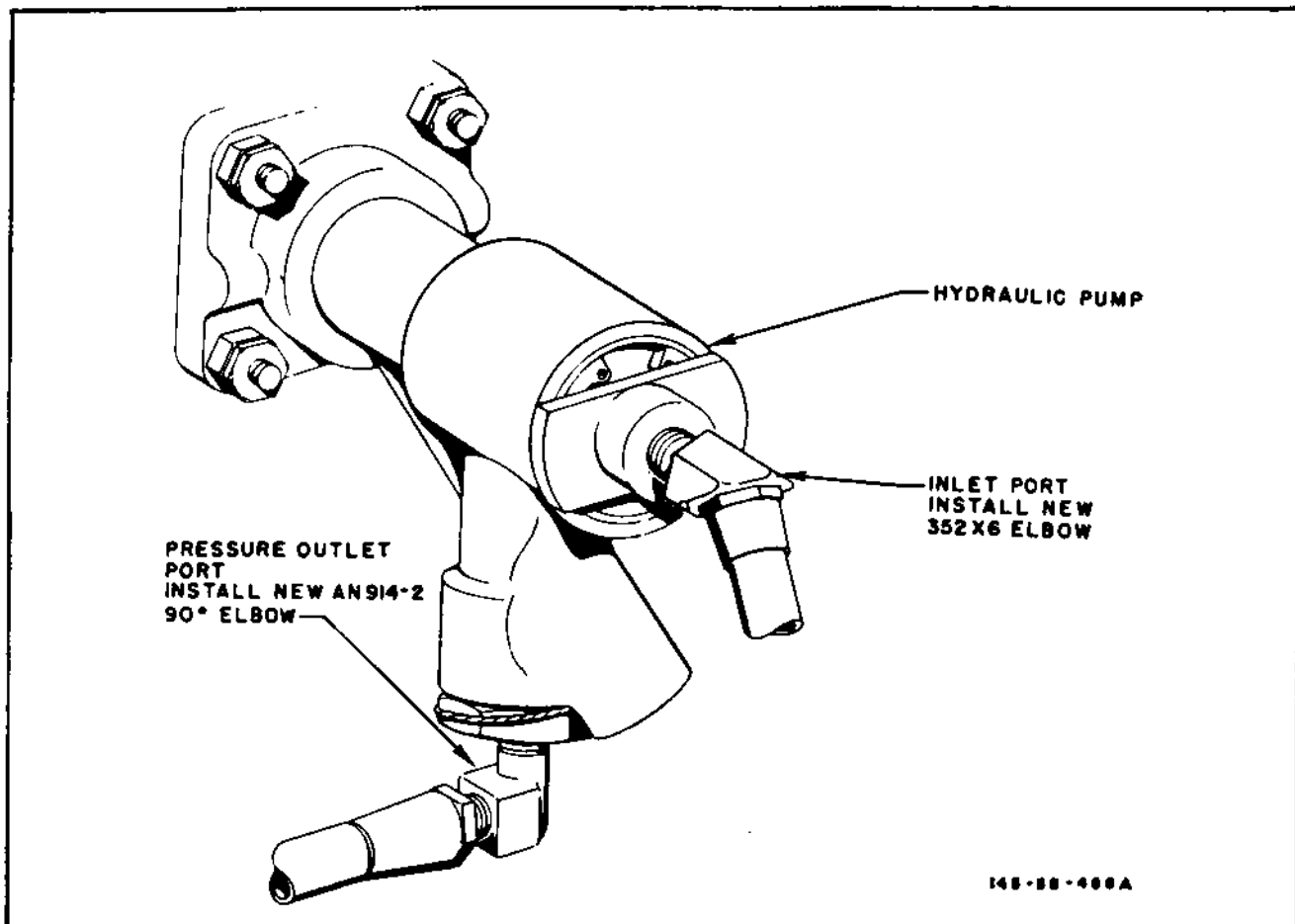


Figure 4 - Hydraulic Pump Connections

12. Install AN844-8D 45-degree elbow in vacuum pump port marked "IN" for clockwise rotation. Install AN842-8D 90-degree elbow in opposite port. Install pump on pad with gasket provided, using existing nuts.

Note: When Romec vacuum pump is used, it is necessary to rotate the generator 120° on the mount, in a counterclockwise direction. Electrical terminals will then be on upper side.

13. Install 24907 plug in shaft of 40724 gear. Insert 25102 oil seal in 40722 adapter, and place adapter on 40724 gear. (Use extreme care not to damage seal during assembly of gear and adapter. Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter in crankcase.

See Figure 4.

14. Remove the existing fitting from the pressure port on the hydraulic pump, and install the new AN914-2 90° elbow. Some air-planes are equipped with a hydraulic pressure hose incorporating 1/8-inch instead of 1/4-inch pipe threads. In that case, there will be an AN912-1 bushing installed in the pump pressure outlet. Remove this bushing, install it in the AN914-2 elbow, and connect the pressure hose. Remove the existing fitting from the inlet

port of the hydraulic pump, and install the new 352x6 fitting. Install the hydraulic pump and coupling on 40722 adapter, with AN4045-1 gasket, using existing nuts.

See Figure 3.

15. Remove the square-head plug from right side of accessory case, and install 2024 plug.
16. If the Hartzell propeller oil return line is routed to the accessory gear case, remove the existing fitting and install the 145-51064 fitting. If Aeromatic propeller is installed, remove plug from left side of case, and install AN912-4D bushing and AN844-8D elbow.

See Figure 1.

17. Drill two No. 10 (.193) holes in firewall; install AN6121-1 oil separator, with two 4S3-10-12 spacers, between oil separator and firewall, using two AN520-10R32 screws and AN365-1032 nuts, with one AN960-10L washer under each screw head and one under each nut. (Nuts should be aft of firewall.)
- *18. Connect 1/2 x 18 hose to bottom fitting in oil separator and to 145-51064 fitting or to AN844-8D elbow in gear case, using two A3122-12-59 clamps.
19. Connect 1/2x3-1/2 hose to separator, using A3122-12-59 clamp. Connect 145-51801-7 air vent line to hose, using A3122-12-59 clamp. Drill two No. 18 (.169) holes in firewall, and attach vent line to firewall with two A2980-8 clamps, AN515-8R8 screws, and AN365-832 nuts.
- *20. Drill one #18 (.169) hole in 143-31005-5 firewall channel and install AN794-12 clamp, using AN515-8R7 screw and AN365-832 nut. Connect 1/2 x 40 hose to oil separator and to AN842-8D elbow in vacuum pump using two A3122-12-59 clamps. Secure hose in AN794-12 clamp with AN515-8R7 screw and AN365-832 nut. Drill #18 (.169) hole in 143-3100-72 angle and attach hose to inboard side of angle using AN742-12C clamp, AN515-8R7 screw, and AN365-832 nut.
21. Drill (from aft side) a 7/8-inch hole in firewall. Remove existing AN3 bolt attaching angle to 143-31005-6 channel. Install 145-51052 bracket, using removed bolt and nut. Drill one No. 10 (.193) hole through 143-31005-6 channel and pilot hole in 145-51052 bracket. Install AN3-4A bolt, AN365-1032 nut, and AN960-10L washer.
- *22. Insert 145-51801-5 line through 7/8-inch hole in firewall. (AN931-8-13 grommet must be assembled on line prior to installation.) Install 200x8 connector and AN842-8D elbow in AN6119-1 vacuum relief valve. Connect 1/2 x 18 hose to AN842-8D elbow of relief valve, using A3122-12-59 clamp. Attach relief valve to 145-51052 bracket, using one AN742-14 clamp, AN530-8R8 screw, and A1778-8Z-1 nut. Connect 1/2 x 18 hose to AN844-8D elbow in vacuum pump, using A3122-12-59 clamp. Connect 145-51801-5 line to 200 x 8 connector in relief valve. Be sure line clears starter control.

NOTE: When cabin heater is installed, clamp heater fuel line to 145-51052 bracket with Adel 766-9 clamp, AN515-8R8 screw, and AN365-832 nut.

23. Install 234x8 connector in 802x6 tee, and connect tee to 145-51801-5 line. Connect 75683 hose to tee and to attitude gyro, using one A3122-10-59 clamp. Connect 75682 hose to tee and to 234x4 connector in directional gyro.
24. Attach 145-51801-5 line to existing holes in 143-51007-4 dash panel beam with two A2980-8 clamps, AN530-8R8 screws, and A1778-8Z-1 nuts.
25. Replace 145-51031-12 oil pressure line with 145-51801-9 line, and 145-51031-10 fuel pressure line with 145-51801-11 line.
26. Reconnect pitot and static pressure lines to airspeed indicator. Test lines for leaks. (Refer to NAVion Service Manual.) Reinstall oil temperature indicator and capillary.
27. Replace the panel light rheostat with 145-54043 rheostat. Plug the light sockets with lamps into the eleven holes in instrument panel.
28. Remove loose wires 85 and 86 from their stowed position at back of instrument panel. Connect wire 85 to bank-and-turn indicator terminal marked "+" and wire 86 to "-" terminal. Reconnect all wires to remounted instruments. Install a one-amp fuse in "BANK TURN" retainer and one in spare retainer.

See Figure 5.

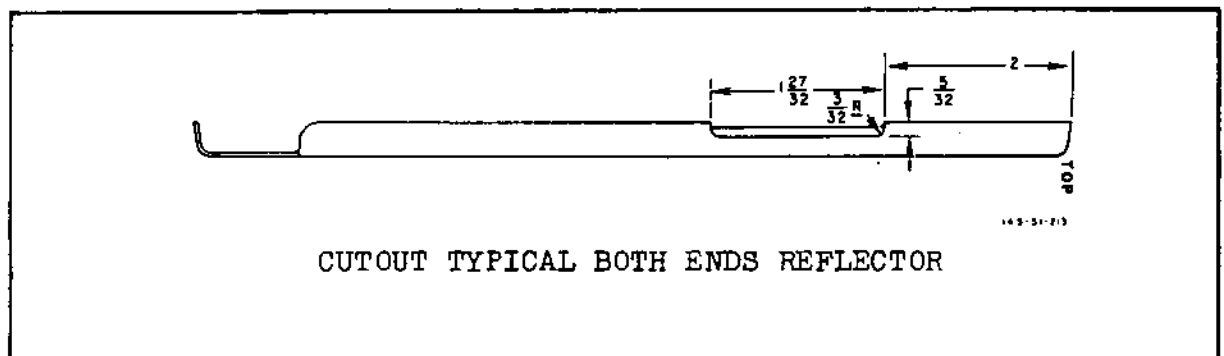


Figure 5 - Reflector Cutout

29. On Airplanes NAV-4-251 and subsequent, cut out end flanges of 145-51056 reflector to clear dash panel trim strips. Install new reflector, using six 7S8-6-10 screws, four previously removed spacers, two new 4S4-D5-12 spacers, and six 6939-632-062 nuts.
30. Recompensate compass. Fill out new compass correction card, and insert in holder on reflector.
31. Loosen locknut on top of relief valve and, with engine running at 1000 rpm, turn adjusting screw until suction gage indicates 3.75 in. Hg. With engine running at 2300 rpm, suction gage should not exceed 4.75 in. Hg.

NO. 17
MARCH 16, 1947

SPECIAL INSTRUCTIONS

INSPECTION AND REWORK OF REPLACEMENT WING ACCUMULATOR TANK BRACKETS

Navion airplanes prior to factory Serial Number NAV-4-1251 have the fuel accumulator tank supported by two 145-48008 brackets riveted to the 143-14010-20 center rib. Airplanes subsequent to NAV-4-1251 have the fuel accumulator tank supported by one 145-48007 bracket, riveted to the bolting angle of the left wing. Inspect and rework replacement 143-14001-1 left wing, before installation, as follows:

SEE FIGURE 1

A. Airplanes NAV-4-2 through NAV-4-1250

1. Inspect inside the root section of replacement 143-14001-1 left wing, to see if fuel accumulator tank bracket 145-48007 is installed. If the bracket is not present, install the wing, using the original accumulator tank installation with the bracket on the center rib. If the 145-48007 bracket is installed, remove it from the wing as follows:
 - a. Drill out the three AN442AD5-9 rivets which attach one end of 145-48007 bracket to the wing bolting angle. This is the 12th row of rivets aft of forward edge of the wing.
 - b. Drill out one 2R1AD4-4 rivet attaching the outboard end of the 145-48007 bracket, and remove bracket from wing.
 - c. Replace the first three removed rivets with AN442AD5-8 rivets. Replace the removed outboard rivet with one 2R1AD4-3 rivet.

B. Airplanes NAV-4-1251 and subsequent

1. Inspect the inside root section of replacement 143-14001-1 left wing to see if the 145-48007 fuel accumulator tank bracket is installed. If bracket is present, install wing on airplane. If bracket is not present, install the new 145-48007 bracket, received as a loose part with the replacement wing, as follows:

SPECIAL INSTRUCTIONS #17 - CONT'D

- a. Drill out three AN442AD5-6 rivets which run spanwise in the bolting angle. This is the 12th row of rivets aft of the forward edge of wing.
- b. Clamp 145-48007 bracket in the wing with the flange of bracket over holes just drilled. Drill through bolting angle holes and bracket flange with a No. 21 (.159) drill.

CAUTION: Do not elongate holes in bolting angle.

- c. Attach bracket to bolt angle with three AN442AD5-9 rivets.
- d. Drill through rib, wing skin, and pilot hole on outboard flange of bracket with No. 30 (.128) drill, and install one 2R1AD4-4 rivet.

SPECIAL INSTRUCTIONS

INSTRUCTIONS NO. 19
REVISED JULY 22, 1947

RANGER TWO-WAY RADIO INSTALLATION (L17A AIRPLANES)

Install the 154-89001 Ranger two-way radio kit (consisting of 209-C transmitter and 120-C receiver) in NAVION airplanes as follows:

1. Remove the left front seat.
2. Pry loose the two trim strips from the top of left side upholstered panels, Remove all screws attaching panels to floor and wing top skin. Remove panels by pulling down and inboard.
3. Remove existing General Electric Transmitter - Receiver power pack, load coil and antenna conductor.
4. Remove "MIC" and "PHONE" plugs from control panel. Install three-wire conductor jack fitting from set in "MIC" hole, and two-wire fitting in "PHONE" hole.
5. Drill 3/8 inch ole at left of hydraulic power indicator light and install CB-12 frequency selector switch assembly, and 154-71004 name plate. Attach wire No. 234 to wire No. 235. Slip surco tubing over connectors and tie with waxed cord.
6. Remove the four screws from 120-C receiver cover.
7. Install 145-51040-20 coverplate on receiver, using previously removed screws. Install receiver in control panel. Connect No. 229 wire (from receiver dial light) to existing 110 rheostat wire.
8. Locate and drill four No. 18 (.169) holes in floor of baggage compartment for transmitter mounting and three No. 18 (.169) holes for antenna lead in insulators.

INSTRUCTIONS NO. 19
REVISED JULY 22, 1947

9. Mount transmitter on floor using four AN515-8R8 screws and AN365-832 nuts. Ground the 223 transmitter ground cable to one of the transmitter mounting screws. Mount IN-88 antenna conductor insulators on floor. Route conductor through insulators to antenna lead in bushing. Tie conductor to insulator with waxed cord. Connect wire No. 222 to airplane side of battery solenoid.
10. Connect wire No. 231 to wire No. 232. Slip surco tubing over connectors and tie with waxed cord.
11. Connect CB-9 cable to 209-C transmitter and route, with wire No. 232, between lower longeron and top wing skin, to the control panel fuselage frame. Clip cable to the first and second fuselage frames aft of control panel, using two FT-1376 clips. Tie cable to clips with waxed cord. Connect CB-9 cable to 120-C receiver. Connect wire No. 232 to wire No. 233, slip surco tubing over connectors and tie with waxed cord.
12. Install 154-71003 wire guard over cables at aft end of transmitter. Drill through pilot holes in guard and through floor with a No. 30 (.128) drill. Attach guard with eight AN530-8R6 screws.
13. Reinstall upholstery and seat. Place headphone and microphone on bracket, and plug leads into jacks in control panel. Tune the receiver to a known station frequency and check the dial setting.
14. Change placarding on baggage compartment canvas close out to read 165 pounds instead of 180 pounds.

Refer to NAVION Operation Manual and Ranger Operating and Maintenance Handbook for Operating Instructions.

JOHN W. CASEY
FIELD SERVICE MANAGER

SPECIAL INSTRUCTIONS

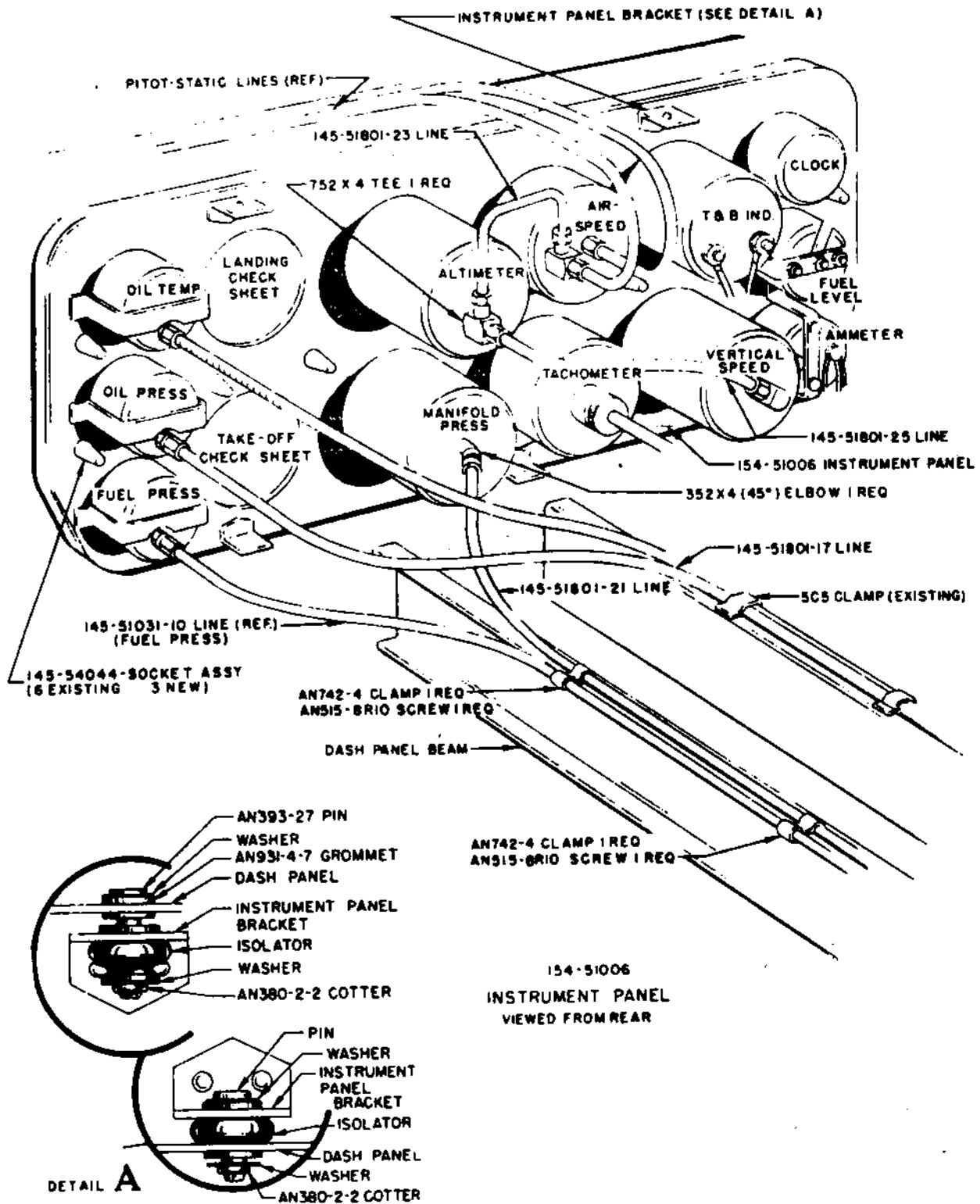
INSTRUCTIONS NO. 20
JULY 11, 1947

INSTRUMENT PANEL INSTALLATION - L17A AIRPLANES

Install 154-89002 Instrument Kit (consisting of standard panel instruments with luminous dials and pointers, a manifold pressure gauge and vertical speed indicator). The new panel also includes two new check lists, additional lights, wiring and lines.

SECTION I -- INSTRUMENT CHANGEOVER

1. Disconnect battery. Remove instrument panel reflectors. Uncouple oil temperature capillary tube from oil cooler, and install a 5/8-18 threaded plug in cooler; remove all clips from capillary line; remove line and indicator. Remove the six light sockets from instrument panel. Disconnect all lines and wires from instruments. Remove the four pins from the instrument panel mounting brackets and remove panel.
2. Remove the two vibration isolators from the upper mounting flanges of dash panel, and insert in upper mounting brackets of 154-51006 instrument panel, with body of isolator beneath bracket. Leave isolators in bottom flanges of dash panel.
3. Install new 352 x 4 (45°) elbow in the manifold pressure gauge.
4. Remove the 352 x 4 elbow from the old altimeter and install in the new rate of climb indicator.
5. Install new 752 x 4 tee in the new altimeter.
6. Remove the 752 x 4 tee and 200 x 4 connector from the old airspeed and install in the new airspeed indicator. Install the tee at the "S" port and the connector at the "P" port.
7. Remove the 250 x 4 connectors from the old oil pressure and fuel pressure gauges and reinstall on the new gauges.
8. Remove minimum oil temperature marking from face of oil temperature gauge and install new red marking at 70° F.



154-51-249 (REV)

SPECIAL INSTRUCTIONS NO. 20
July 11, 1947

9. Remove the four 6939-632-062 nuts from old panel and install on new panel, adding the two new 6939-632-062 nuts to the new panel.
10. Mount sensitive altimeter, tachometer, ammeter, clock, oil pressure, fuel pressure, fuel level, airspeed and turn and bank indicator in new 154-51006 panel as shown in Figure 1, using existing screws and nuts.
11. Install manifold pressure gauge and rate of climb indicator using eight AN515B6R12 screws and four 6939-632-375 nuts.
12. Use four AN515B6R7 screws and four 6939-632-062 nuts for mounting of the two new check lists.
13. Connect 145-51801-23 line to tee in altimeter and tee in airspeed indicator. Connect 145-51801-25 line to tee in altimeter and elbow in rate of climb indicator.

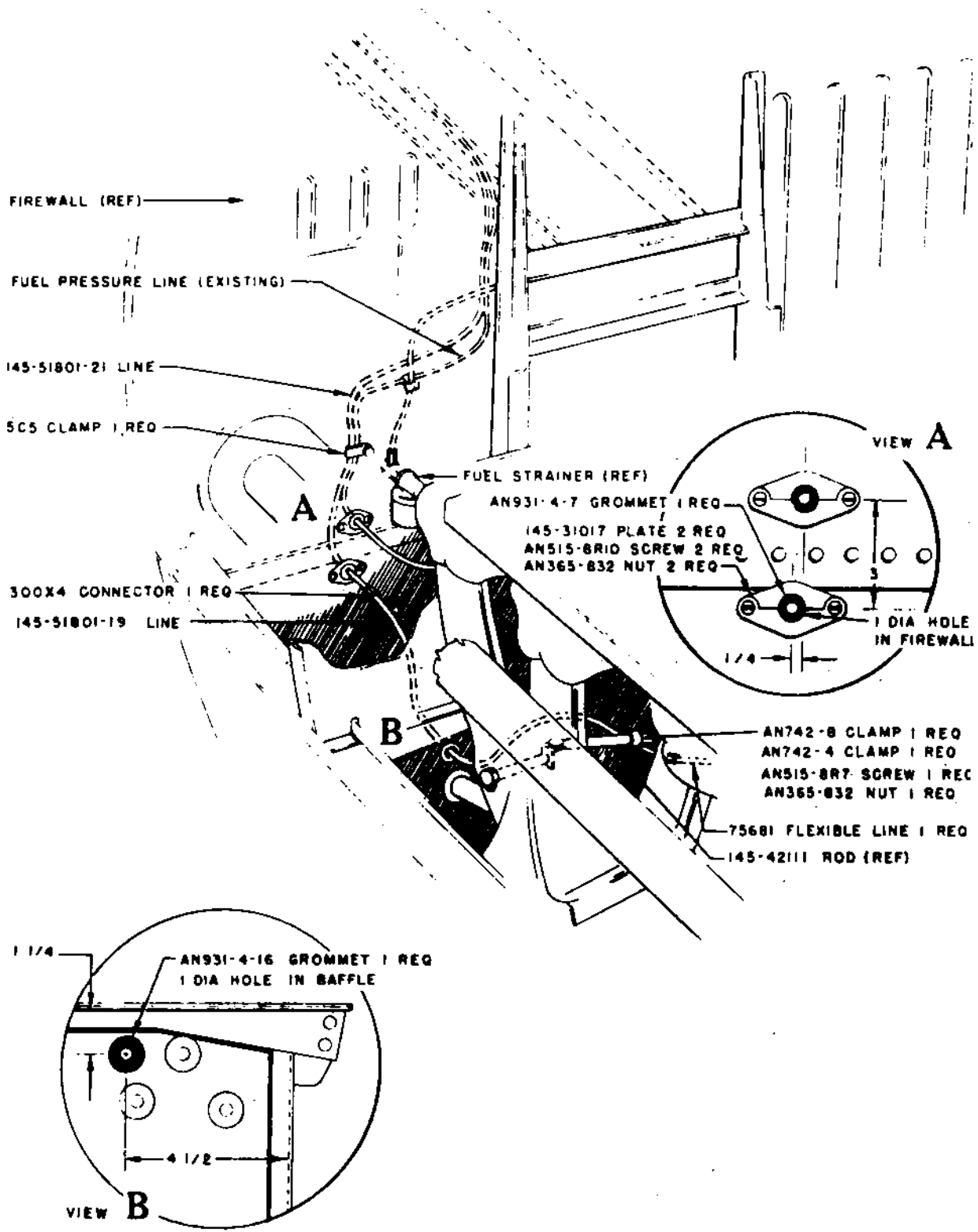
SECTION II -- ELECTRICAL REWORK

After original instrument panel is removed, make the following electrical changes:

1. Cut cord securing wire groups.
2. Cut 11 inches from turn and bank indicator wire #85 and 17 inches from wire #86. Stake on two 31889 terminals to the shortened wires.
3. Cut 15 inches from the four ammeter wires numbers 4, 6, 35 and 100. Stake on four 32544 terminals to the shortened wires.
4. Cut 10 inches from the fuel level indicator wire number 13 and 7 inches from wire #14. Stake on two 31889 terminals to the shortened wires.
5. Stake on a 31889 terminal and an #AA (Sta-Kon) connector on the 6-inch length of 18 gauge wire. Cut the terminals from the compass light wire #105 and splice to new 6-inch length of wire. Install insulating tubing over connector and tie in place with waxed cord.
6. Remove existing PW-25-35 instrument light rheostat and its connected wires from left lower side of dash panel.
7. Install new 145-54043 rheostat assembly consisting of a PW25D-4-15 rheostat and wires numbers 49, 50, 51, 52 and 110.
8. Route wires 4, 6, 35, 100, 13, 14, 85, 86, 52 and metal shielded magneto wires to the left hand side of the panel.
9. Route wires numbers 70, 71, 72, 79, and 52 to the right hand side of panel.

SECTION III -- LINE REWORK

1. Remove existing oil pressure gauge line, between the 300 x 4 union forward the firewall and the gauge.
2. Remove 1/4 inch pipe plug from upper front right side of intake spider casting located on the bottom of the engine.
3. Install new 400 x 4 elbow in spider casting.
4. Drill 1-inch holes in the 145-42301-70 right rear engine baffle plate and lower right firewall. See Figure 2 for location.
5. Drill two #18 (.169) holes in firewall at the 1" hole. See Figure 2.
6. Reform existing fuel pressure line to connect into new fuel pressure gauge location.
7. Route new 154-51801-21 manifold pressure line down right hand dash panel beam (inboard of fuel pressure line) and through new 1" hole in firewall.
8. Install the two new 145-31017 plates on the firewall using AN515-8R10 screws, AN365-832 nuts and AN931-4-7 grommet.
9. Connect 145-51801-21 manifold pressure line to 145-81801-19 manifold pressure line which passes through 145-42301-70 engine baffle with a new 300 x 4 connector.
10. Install an AN931-4-16 grommet in engine baffle.
11. Connect the 75681 flexible line to the 400 x 4 elbow in spider casting and route forward and under #5 intake pipe.
12. Connect 145-51801-19 line to 75681 flexible line.
13. Secure 145-51801-19 metal line to the 145-42111 exhaust stack support rod with AN742-8 and AN742-4 clamp, using AN515-8R7 screw and AN365-832 nut.
14. Secure existing fuel pressure line and 154-51801-21 manifold pressure line to right dash panel beam using two new AN742-4 clamps, two new AN515-8R10 screws and existing nuts.
15. Install a 505 clamp in place of existing AN742-4 clamp at aft side of firewall where fuel pressure line clamps to firewall. Connect manifold pressure and fuel pressure line to firewall line with this clamp, using existing screw and nut.
16. Route new 145-51801-17 oil pressure line down the left hand dash panel beam and through firewall connecting it to the existing 300 x 4 union forward of the firewall. (Use existing firewall grommet and plates).



100-51-100 (REV)

SECTION IV -- PANEL INSTALLATION

1. Remove dash panel ash trays and two screws securing the tray frames. Remove frames. Enlarge holes in dash panel to fit the new tray frames. Install frames and secure with existing screws or by bending over frame lugs.
2. Insert two AN931-4-7 grommets in the upper instrument panel mounting flanges of the dash panel. Install 154-51006 instrument panel using two new AN393-27 pins, four existing washers, and two AN380-2-2 cotters in upper mount. Use one new 275-5 isolator, existing pin, two AN960A10L washers and AN380-2-2 cotter in lower center mount. Use two existing pins, four existing washers, and AN380-2-2 cotters in the other two lower mounts. See Figure 1.
3. Connect three new 145-54044 panel light sockets and lamps and the six existing sockets and bulbs and one 145-54047 wire assembly to existing wiring. See Figure 3.
4. Connect up electrical wires as shown on Figure 3.
5. When electrical wires are all connected, tie in bundles with waxed cord.
6. Install existing FT-1376 clip at center dash panel mounting flange, to support electrical wiring.
7. Mount oil temperature gauge, and route capillary tube down left dash panel beam along side the oil pressure line. Secure the oil temperature and oil pressure lines to dash panel beam using two existing 505 clamps, screws, and nuts. (Oil temperature line passes through existing firewall hole. Recouple temperature bulb into oil cooler.
8. Connect pitot and static pressure lines to airspeed indicator.

NOTE: It will be necessary to bow these lines slightly due to new airspeed location.
9. Connect oil pressure, fuel pressure and manifold pressure gauge lines to gauges.

NOTE: Check all instrument lines for leaks. (Refer to NAVion Service Manual.)
10. Connect tachometer shaft to tachometer.
11. On the front face of the reflector panel, measure in from the left edge $7 \frac{3}{32}$ inches and from the bottom edge of the panel measure up $4 \frac{7}{16}$ inches. These two points constitute the left and bottom edges of the radio call plate. Position the call plate on the panel and drill four No. 48 (.076) holes using the name plate as a template for the hole location. Install four type Z ($\frac{3}{16}$ inch long) sheet metal screws.

SPECIAL INSTRUCTIONS NO. 20
JULY 11, 1947

12. Remove compass card holder from old reflector panel and reinstall on top center of new reflector.
13. Install new 154-51010 reflector, using six 758-6-10 screws, four previously removed spacer, two new 454-D5-12 spacers, and six new 6939-632-062 nuts.
14. Recompensate compass. Fill out new compass correction card, and insert in holder on reflector.
15. On lower right hand corner of dash panel, measure down $\frac{3}{8}$ inch from bottom edge of glove compartment cut out and $\frac{3}{4}$ inch inboard from right hand edge of glove compartment cut out. These two points constitute the top and right hand edges of the new 109-53026 name plate. Position the name plate on the dash panel and drill four #48 (.076) holes using the name plate as a template for the hole location. Install plate with four type Z ($\frac{1}{4}$ inch long) sheet metal screws.

SPECIAL INSTRUCTIONS

INSTRUCTIONS NO. 21
JULY 1, 1947

SURFACE CONTROL LOCK INSTALLATION

Install Surface Control Lock Kit 154-89003 in NAVION airplanes as follows:

1. Unsnap two cabin upholstery trim strips left hand of pilot's seat.
2. Remove screws attaching upholstery panel to upper longeron forward of canopy rail. Pull back upholstery panel to expose upper longeron.
See Figure 1.
3. Locate and drill holes in longeron for 154-52027 plate. Install plate on longeron using two AN426-AD5-6 rivets.
4. Remove two bolts attaching each wooden reinforcement block to the two rails for pilot's seat.
5. Attach one 2C15 stowage clip to each wooden block using one AN545-6R4 screw for each clip.
6. Reinstall wood blocks using removed bolts.

SPECIAL INSTRUCTIONS

INSTRUCTIONS NO. 22
* REVISED JULY 14, 1947

FUEL VENT LINE DRAIN INSTALLATION

If it is impossible to completely fill the left fuel tank, due to fuel becoming trapped in the left tank vent line, these instructions may be accomplished.

This condition can be corrected on early airplanes by installing a drain line from the low portion of the left vent line to the carburetor vapor return line. On late airplanes, the drain line is routed directly to the accumulator tank.

AIRPLANES AFFECTED:

NAV-4-2 through NAV-4-850 require Kit Number 145-69038
NAV-4-851 and subsequent require Kit Number 145-89038-10.

INSTALLATION INSTRUCTIONS:

Section A. Airplanes NAV-4-2 through NAV-4-850.

1. Drain fuel from airplane.
2. Remove the left hand front seat.
3. Unsnap the left side panel trim strips and loosen the side panel at left of pilot's seat (station 93) for approximately 18 inches. (Station 93 is 3 inches forward of canopy rail).
4. Remove the inspection plate on the top side of the left wing just outboard of the fuselage.
5. Disconnect 3/8 inch diameter fuel vent line at the hose located just inside the wing inspection plate and inside the fuselage at the hose connection just aft of Sta. 93. Remove this section of vent line.
6. Enlarge the hole in the cabin floor (upper wing skin) as shown in Figure 1. detail A, using a rotary file.

SPECIAL INSTRUCTIONS NO. 22
* REVISED JULY 14, 1947

7. Remove the canvas close-out cover from the aft end of the nose wheel well.
8. Route a wire from the hole in the floor just forward of the vent line cut out to the area near the wing center rib and front spar.

NOTE: The wire cannot be routed over the top side of the tank due to tank supporting structure. It must pass along the forward side of the tank.

- * 9. Slip transparent surco covering over the 1/4" flexible hose.
10. Fasten one end of the hose to the cabin end of the wire and draw the hose into the nose wheel well through the opening in the left wing spar.
11. Route the upper end of the hose between the forward hole in the cabin floor and the vent line hole.
- * 12. Install the new 145-48004 vent line section in same position as removed 145-48801-33 line and attach hose to the vent line using an AN748-22 nose clamp.
13. Remove the existing 300 x 4 union in the carburetor vapor return line at the aft section of the nose wheel well and install a 052 x 4 tee fitting.
- * 14. Install AN842-4 elbow in the tee fitting and connect hose to the elbow with AN748-22 clamp.
15. Clamp the flexible line in the nose wheel well as shown in Figure 1, using one AN742-D12C clamp, AN742-D6C clamp, AN515-8R7 screw and AN365-832 nut.
16. Reinstall canvas close-out cover, wing inspection plate, upholstery side panel and pilot's seat.

Section B. Airplanes TAV-4-851 and subsequent.

1. Complete steps 1 to 11 in Section A.
2. Remove the AN913-1 plug in the top rear side of the 145-48004 accumulator tank and install a 200 x 4 connector.

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* REVISED JULY 14, 1947

- * 3. Install a new 145-48602-21 metal line between the 145-48004 accumulator tank and the drain hose installed in step 2 of Section A.

NOTE: Route this line through the right front spar and the lightening hole in the center rib to the accumulator tank.

- * 4. Connect hose to end of metal line with AN745-22 clamp.

NOTE: Route hose and metal line with a downward gradient to avoid low spots. Shorten flexible hose if necessary.

- 5. Clamp hose to hydraulic lines using AN742-D12C clamp, AN742-D6C clamp, AN515-6R7 screw and AN365-832 nut.

SPECIAL INSTRUCTIONS

INSTRUCTIONS NO. 23
JULY 21, 1947

ENGINE BREATHER LINE REPLACEMENT - L17A AIRPLANES

To prevent oil from dripping on right hand engine gill exit, the engine breather line may be extended by replacing the existing 145-47001-8 line with a new 145-48802-12 line contained in Kit 154-89042.

INSTALLATION INSTRUCTIONS:

1. Remove the two AN742-D10 clamps from the right hand forward side of the firewall and disconnect the A3122-16-59 hose clamp and remove 145-47001-8 line.
2. Install 145-48802-12 line in the same location as the removed line, using the existing parts.

SPECIAL INSTRUCTIONS NO. 24

JUNE 24, 1948

MANIFOLD PRESSURE GAUGE INSTALLATION

Effective NAVIONS that do not have a Gyro Panel installed.

Install Type 9901-10-01 Scout Manifold Pressure Gauge, Dwg. No. 145-89062 consisting of the following parts.

145-89062-6	Reflector Assem.	1 req.	AN426AD3	Rivet	2 req.
145-89062-4	Tube	1 req.	AN366F-632	Nut Plate	1 req.
145-89062-2	Tube	1 req.	AN365-832	Nut	6 req.
145-44017	Flextube	1 req.	AN515-8-14	Screw	7 req.
200 x 4	Connector	1 req.	AN742-4C	Clamp	2 req.
300 x 4	Union	1 req.	AN931-4-12	Grommet	2 req.
250 x 4	Connector	1 req.	105 x 4	Nut	4 req.
400 x 4	Elbow	1 req.			

Install as follows:

1. Remove reflector panel from floating instrument board.
2. Draw a parallel line 2-3/8 inches above lower flange of 145-51006 floating panel, right hand side. This line should be directly on centerline with the three lower instruments.
3. Measure to the right of centerline of panel on parallel line, 9-7/16 inches, at this point cut a 2-3/32 dia. hole.
4. Measure to the right of centerline on parallel line 3-7/8 inches. This will fall just to the right of fuel pressure indicator centerline. Place a piece of tape on glass and mark dimension intersection on tape. Using a pair of dividers, set for radius required to make a 3-9/64 dia. circle, mark hole.
5. Remove fuel pressure indicator from its present location and install in hole cut out according to Item 3.

6. In the hole previously used by fuel pressure gauge, cut out as marked per Item 4. Place manifold pressure gauge in the hole, face forward parallel to centerline, mark screw attaching holes and drill out with No. 18 drill.
7. Install 200 x 4 connector fitting on manifold pressure gauge and install gauge with four (4) AN515-8-14 screws and four (4) AN 365-832 nuts.
8. On the firewall to the right of centerline 5-5/8 inches and 1-3/4 inches above the 143-51007 instrument panel beam support attaching screw, drill 3/4 inch hole in firewall and install AN931-4-12 grommet.
9. On aft engine mount cross frame station 40.5, measure down 4-1/2 inches and to the right of centerline 9-1/4 inches, drill 3/4 inch hole in webb and install AN931-4-12 grommet.
10. On the forward and upper side of the in-take manifold on engine, remove existing 1/8 inch pipe plug and install 400 x 4 elbow.
11. Install 145-44017 flextube, with 145-89062-2 line attached by 250 x 4 connector and 105 x 4 nut, through grommet previously placed in engine mount cross frame station 40.5, and attach flex end to fitting on engine manifold.
12. Install 145-89062-4 tube to gauge unit, route down on the 143-51007-4 instrument panel support beam and through grommet on firewall down to -2 tube. Attach with one (1) 145-89062-12 clip and AN742-4C clamp to beam 4-1/2 inches aft of firewall, and another approximately 1 inch above lower bend of tube onto firewall with AN742-4C clamp.
13. Connect -2 and -4 tubes with 300 x 4 union.
14. Install 145-89062-6 reflector panel.

NOTE: For installation of small type manifold pressure gauge, (U.S. Gauge AW-1-7/8-31A) replacing type 990-10-01 Scout manifold pressure gauge, Item 4 and that portion of Item 6 that calls for cutting out hole as marked in Item 4 will not apply, since present hole size matches gauge.

SPECIAL INSTRUCTIONS NO. 25

JANUARY 20, 1948

OUTSIDE AIR TEMPERATURE THERMOMETER INSTALLATION

Install outside air temperature thermometer gauge kit, Dwg. No. 145-89048, in NAVION, as follows:

1. On the center line of the airplane in the dome area above windshield, measure 6 inches to left. Then from rear edge of windshield frame, measure forward 5 inches.
2. At intersection, drill a 3/8 inch hole.
3. Install free air temperature gauge.

SPECIAL INSTRUCTIONS NO. 26

DECEMBER 30, 1947

DUAL PHONE JACK INSTALLATION

Install dual phone jack kit, consisting of Dwg. No. 145-89050 phone jack, wire and decal, as follows:

1. From center line of instrument panel, measure to right 18 inches. Then measure up from bottom of panel 2-1/2 inches. At intersection, drill a 3/8 inch hole.
2. Remove paint from area around hole on forward side of instrument panel for a good electrical ground.
3. Install phone jack with wire attached.
4. Attach wire in parallel with existing phone jack on left side of panel.
5. Install decal under phone jack, similar to left side.

SPECIAL INSTRUCTIONS NO. 28

Page 1 of 3

MARCH 29, 1948

SOUNDPROOFING FOR NORTH AMERICAN-BUILT NAVIONS

To decrease the sound level in the cabin of the NAVION, panels of fiberglass soundproofing material, Kit Part No. 145-89046, are to be installed as described below. All Ryan NAVIONS have the soundproofing installed at the factory before delivery.

NCTE: Read all of these instructions through carefully and understand them thoroughly before starting work.

PART A. SOUNDPROOFING OF FIREWALL

1. Pull control wheels to full aft position and wrap several layers of tape around one of the wheel shafts to prevent controls from moving forward. This will provide more working space for mechanic forward of instrument panel.

2. Disconnect the three flexible tubing air ducts, part numbers 145-53301-37, -38, -57, from the cabin ventilating air control valve on the firewall.

3. Disconnect the fuel shut-off valve control wire, part number 145-43007, from the Fuel Shut-off Valve Assembly, part number 145-48001-11.

4. Remove the two micarta chafing strips, part number 143-31005-26, located forward of each control wheel shaft on the present firewall panel. Retain strips and attaching screws for reinstallation.

5. Cut firewall panel as shown in Figure No. 1. Place one section of the redi-cut fiberglass firewall soundproofing panel, part number 145-53101-10, in proper position on the firewall with silver colored coating aft. While holding panel in place, fold back its corners and edges and apply a medium thick coating of cement to the original firewall soundproofing panel, the cabin floor forward of the rudder pedal guards and the sides of Cable Guard, part number 145-52402, in a manner that will provide as near 100% coverage of these surfaces as possible. Press new fiberglass panel firmly against firewall and floor so as to insure contact over entire cement covered surface. Repeat the above process with other half of firewall soundproofing panel. (See Figure No. 1.)

6. Using the 2" cloth tape, supplied with kit, tape edges of all cut-outs in the new fiberglass panel.

7. Install the aluminum alloy disc, part number 145-53101-4 around the 145-48001-11 Fuel Shut-off Valve Assembly as follows: Position disc in place around valve and, using a No. 19 drill, drill two holes through disc, panel and firewall, one above the valve and one below. Attach plate with two AN 530-8R-8 screws and A 177-82-3 Tinnerman Nuts, provided with kit. (See Figure No. 1)

8. Reconnect Fuel Shut-off Valve control wire and the three flexible tubing air ducts to the cabin air control assembly.

9. Reinstall the two 145-31005-26 Micarta chafing strips removed in Step 4 by piercing the 145-53101 soundproofing panel with a sharp instrument inserted through the original mounting holes for the strips in the air-plane firewall. Attach micarta strips with original screws.

10. Remove tape put on control wheel shaft in Step 1 to hold wheels aft.

PART B. SOUNDPROOFING OF CABIN SIDES

1. Remove front section of cabin upholstery side panels from both sides of fuselage.

2. Trim 145-53097-14 panel, as shown in Figure No. 2, to provide operating clearance for elevator trim tab mechanism.

3. Place fiberglass soundproofing panels, part numbers 145-53097-3, -5, -6, -7, -9, -11, -13, -14 and -15, in position between stations 54 and 93.43 on right and left sides of fuselage. (See Figure No. 2.)

CAUTION: The V-film cellophane-like covered surface of all panels should face inboard on the airplane. The side not having the cellophane covering should face the fuselage skin. (See Figure No. 2.)

4. While holding panels in place, fold back the edges and apply a medium thick coating of cement to the fuselage skin so as to coat as near 100% of the area as possible. Press panels firmly against cement covered surfaces.

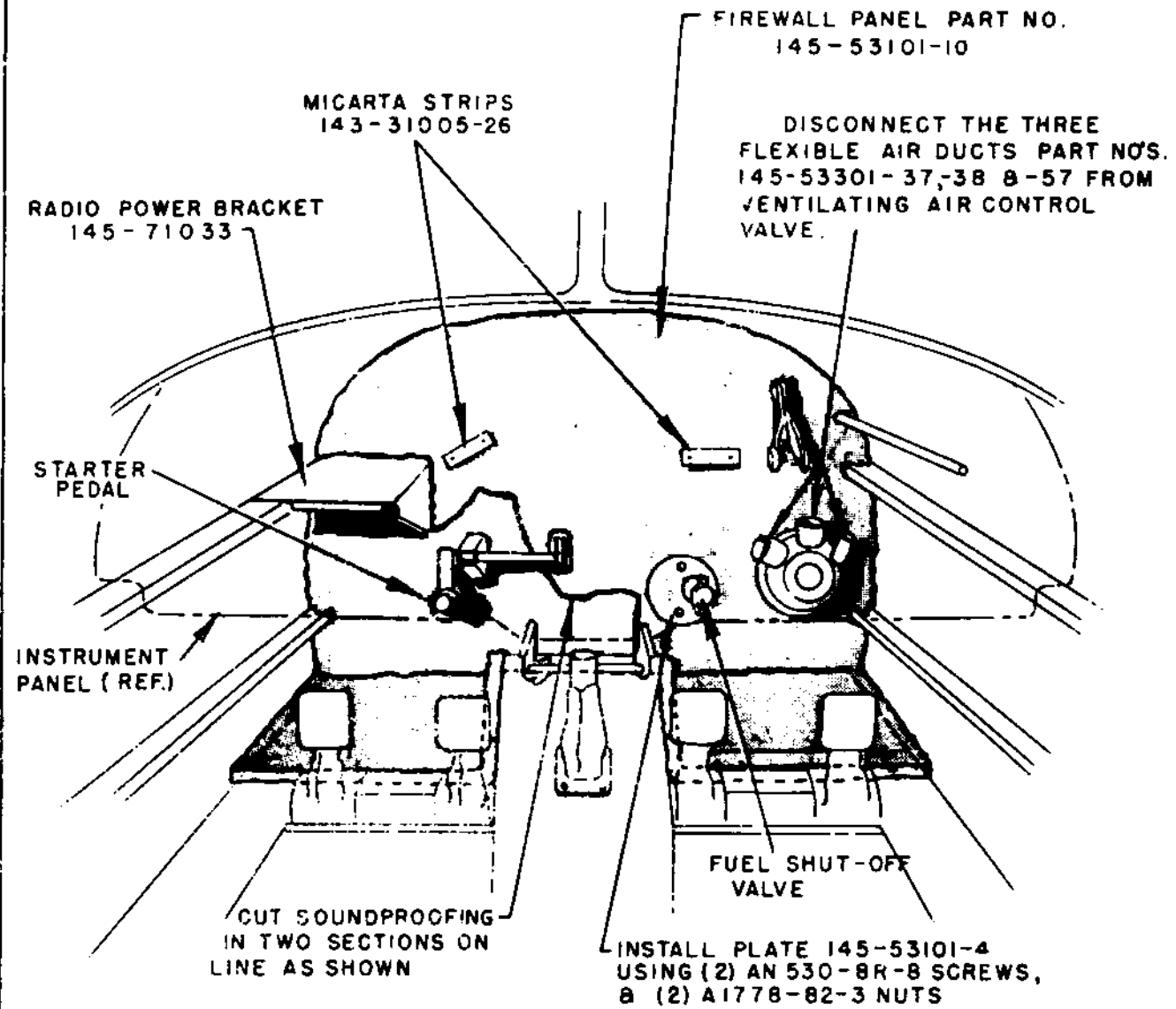
5. Slit the 145-53097-13 panel to facilitate tying electric wiring to fuselage stiffener.

6. Re-install front sections of cabin side panel upholstery.

PART C. INSTALLATION OF CANOPY AIR SEALS

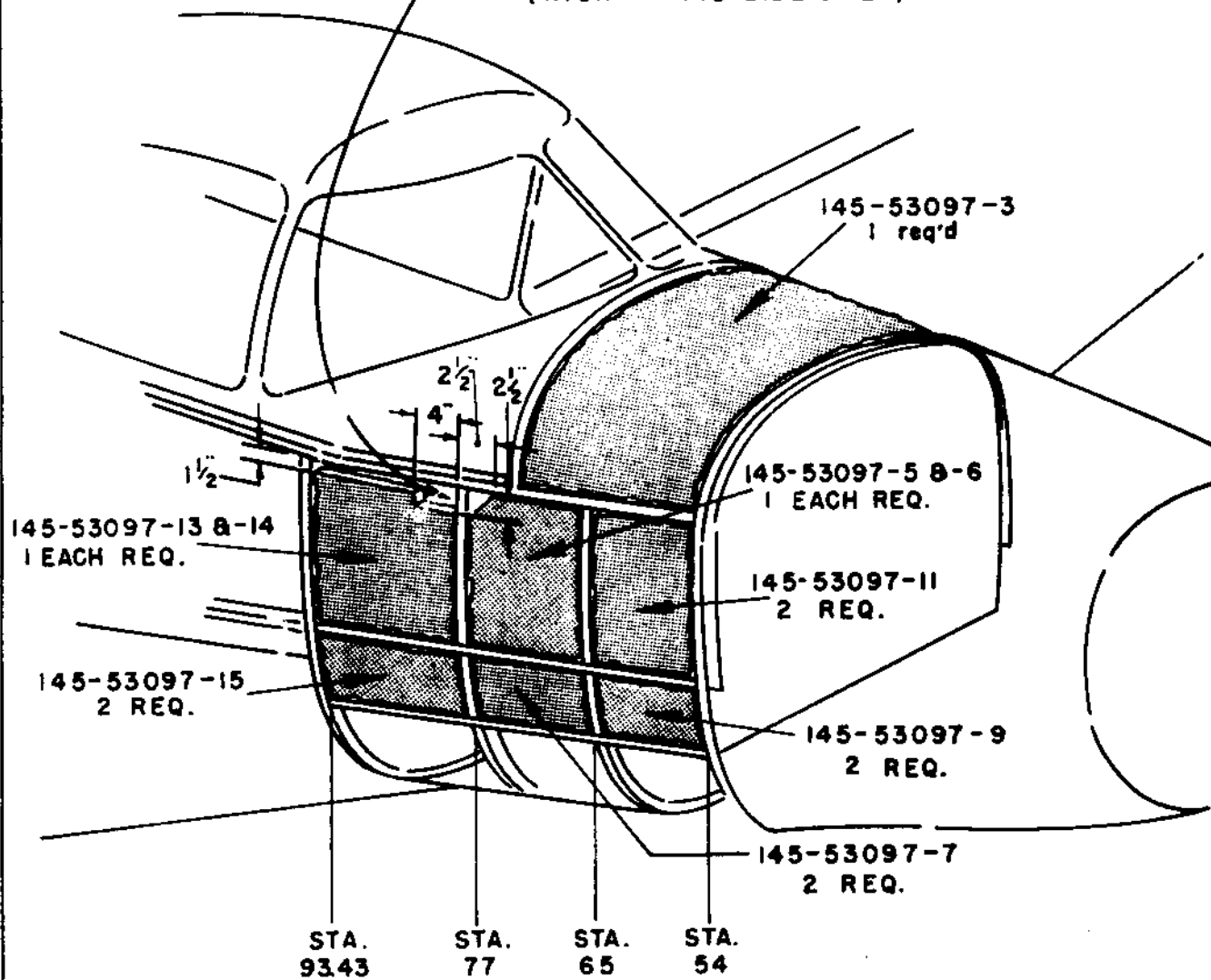
1. Remove canopy from aircraft. (See Figure No. 11 on Page 24 of NAVION Service Manual for procedure.)

2. Apply a medium thick coating of cement to an area 27 inches long in valley of canopy track channel aft of canopy roller bracket - both sides of canopy and on one side of the 145-31801-108 felt strips. (See Figure No. 3.)
3. Allow cement to dry for approximately 10 minutes and then press felt pad, part number 145-31801-108 to cement covered area - both sides of canopy.
4. Using a No. 30 drill, drill two rivet holes through felt and channel at each end of felt seal strip - holes to be 1/2" from end of felt and 1/4" in from edge. (See Figure No. 3.)
5. Rivet ends of felt strip in place with (4) four A4-2R1 rivets and (4) four AN960-D4L washers per strip. (See Figure No. 3.)
6. Apply a medium thick coating of cement to an area in the forward lower corner of the canopy, approximately 4-1/2" long, around canopy roller bracket. (See Figure No. 3.)
7. Notch felt strip number 145-31801-106 to clear canopy roller bracket and press firmly in place on cement covered area with lower edge of strip flush with lower edge of canopy and square corner of felt extending out beyond rounded corner of canopy. Do not trim corner of felt.
8. Using a No. 30 drill, drill three equi-spaced holes, approximately 1-1/2" apart and 1/2" up from lower edge of canopy. The aft hole to be 1/2" from aft edge of felt strip. (See Figure No. 3.)
9. Rivet felt strips in place with (3) three A4-2R1 rivets and (3) three AN960-D4L washers per strip. (See Figure No. 3.)
10. Reinstall canopy on airplane, using a procedure the reverse of that used for removal.

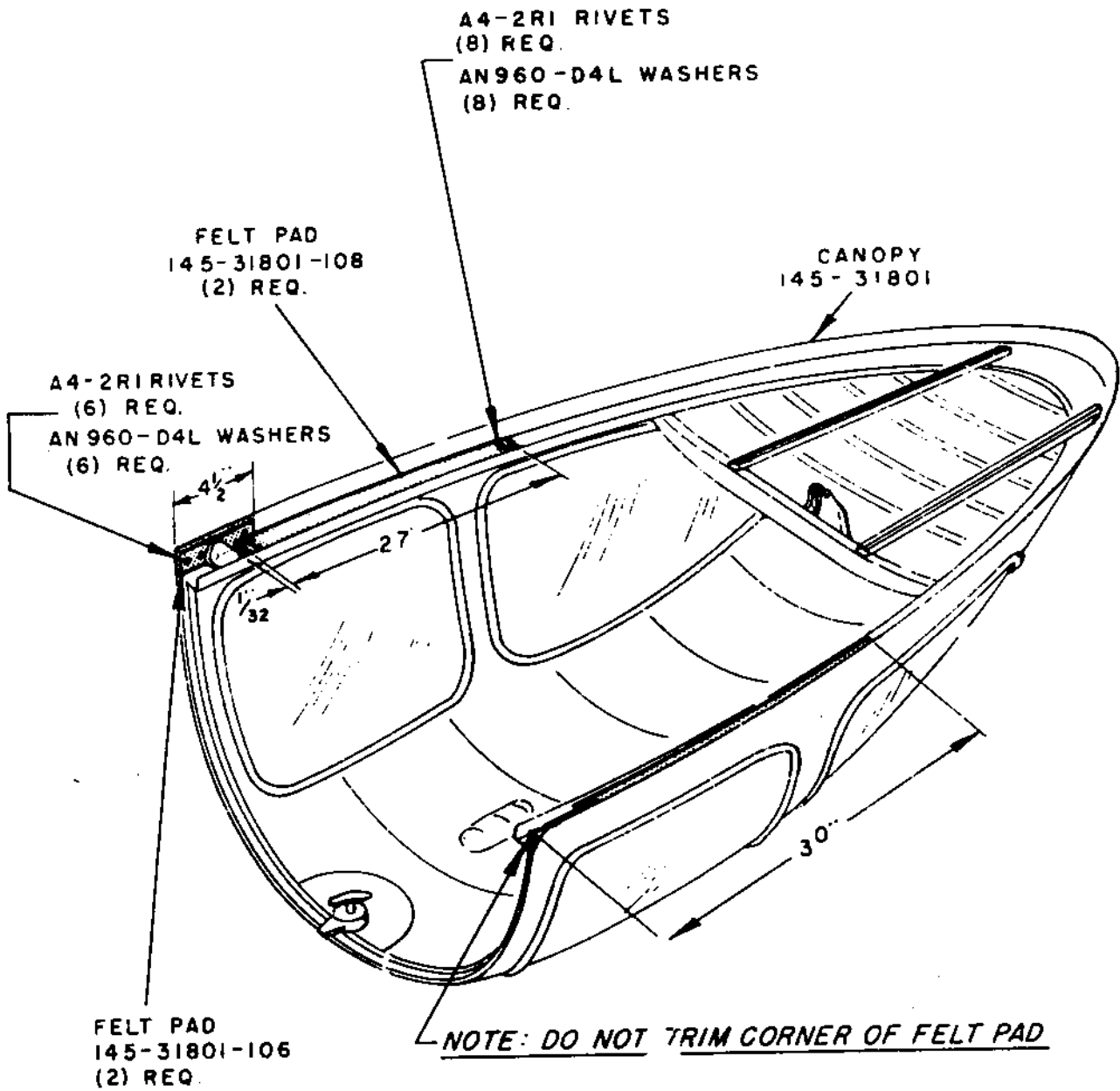


FIREWALL SOUNDPROOFING
FIGURE 1

TRIM PANELS AS SHOWN TO PROVIDE
CLEARANCE FOR ELEVATOR TRIM TAB MECHANISM
(RIGHT HAND SIDE ONLY)



CABIN SIDE SOUNDPROOFING
FIGURE 2



CANOPY SOUNDPROOFING
FIGURE 3

SPECIAL INSTRUCTIONS

SPECIAL INSTRUCTIONS NO. 29
FEBRUARY 10, 1948

Page 1 of 11

ELECTRIC FUEL PUMP KIT

Install Electric Fuel Pump Kit as follows and as shown in Figures 1 through 7. These installation instructions are divided into (3) three parts. Part A is the relocation of Fuel Strainer Part No. K22508, Part B is the installation of the Adco Electric Fuel Pump and Part C is the Electrical installation.

Airplanes affected: NAV-4-2 through 250 will require Item No. 751 Kit, unless cabin heater kit, SPECIAL INSTRUCTIONS NO. 5 has been installed. NAV-4-251 and subsequent and NAV-4-2 through 250 with heater kits installed will use Item No. 750 kit.

PART A

1. Drain fuel tanks.
2. In engine compartment on fire wall disconnect outlet fuel lines, remove strainer and bracket.
3. Remove No. 75692 hose assembly to right hand engine pump. Replace with No. 75688 hose assembly and connect to fuel shut-off valve.
4. Remove tee fitting from carburetor and replace with special fitting, or elbow, which should be removed from left hand fuel pump.

NOTE: Aircraft with cabin heater installation should have heater fuel line transferred with special fitting from left hand fuel pump, to the carburetor.

5. Connect right hand pump outlet hose assembly to special fitting or elbow on carburetor.
6. Remove left hand engine fuel pump and hose assemblies. Cover engine fuel pump mounting pad with Plate Part No. 145-48057, using existing gasket.

NOTE: It will be necessary to use several AN-960-416 washers on studs in order to properly tighten plate to pad.

7. Install AN-931-4-16 grommet in hole left by left hand pump outlet hose assembly in engine mount frame.
8. Install No. 145-48056 fitting and over-board drain line Part No. 145-48001-51 on right hand pump, see Figure No. 1.
9. In rear section of nose wheel well remove curtain and snap fasteners on lower skin and nose wheel trunnion spar web (right hand side only).
10. Remove Part No. 145-52203-9 cable guard. Trim to clear new strainer bracket as shown in Figure No. 2.
11. Re-route hydraulic line so it will be above and clearing strainer installation.
12. Remove fuel lines from sump outlet to shut-off valve under instrument panel.
13. To locate new fuel line hole on nose wheel well spar web, measure down 4-7/8" from underside of cabin floor and 4-3/16" forward from Station 93.43. Drill 1" dia. hole and insert rubber grommet. See Figure No. 2.
14. To locate 145-48055 strainer bracket assembly, measure down 3-7/8" from underside of cabin floor, on aft end of nose wheel well spar web (right hand side). Draw a straight line parallel with floor. Place top side of bracket on line and aft side even with aft side of spar. Drill out two existing rivets, to match holes on aft side of bracket, to 3/16" dia. Add 143-31007-38 angle after strainer bracket has been located so as to fasten strainer bracket to spar web with (2) two of the (6) six bolts used to install angle. See Figure No. 2.
15. On underside of fuselage (right hand side) measure 4-1/4" out-board from airplane centerline and 3" forward of Station 93.43. At this point, which will be directly under fuel strainer drain, drill a 1" dia. hole in skin as shown in Figures 2 and 4.
16. Mount bracket Part No. 145-48055 to spar web using (4) four AN 3-4A bolts, (4) four AN 365 nuts and (4) AN 960 washers. See Figure No. 2.
17. Remove old bracket from strainer. Install Parker shut-off valve, 90° inverted male elbow and line assembly Part No. 145-48001-54 on strainer.
18. Mount strainer on bracket as shown in Figure No. 2, and connect aft end of 145-48001-54 line to accumulator tank.
19. Reinstall cable guard and add two sheet metal screws as shown in Figure No. 2.
20. Locate strainer guard plate, Part No. 145-31019, as shown in Figure No. 3, with dzus fastener clips attached to plate, rivet clips to floor and skin, using (2) two rivets per clip.

PART B

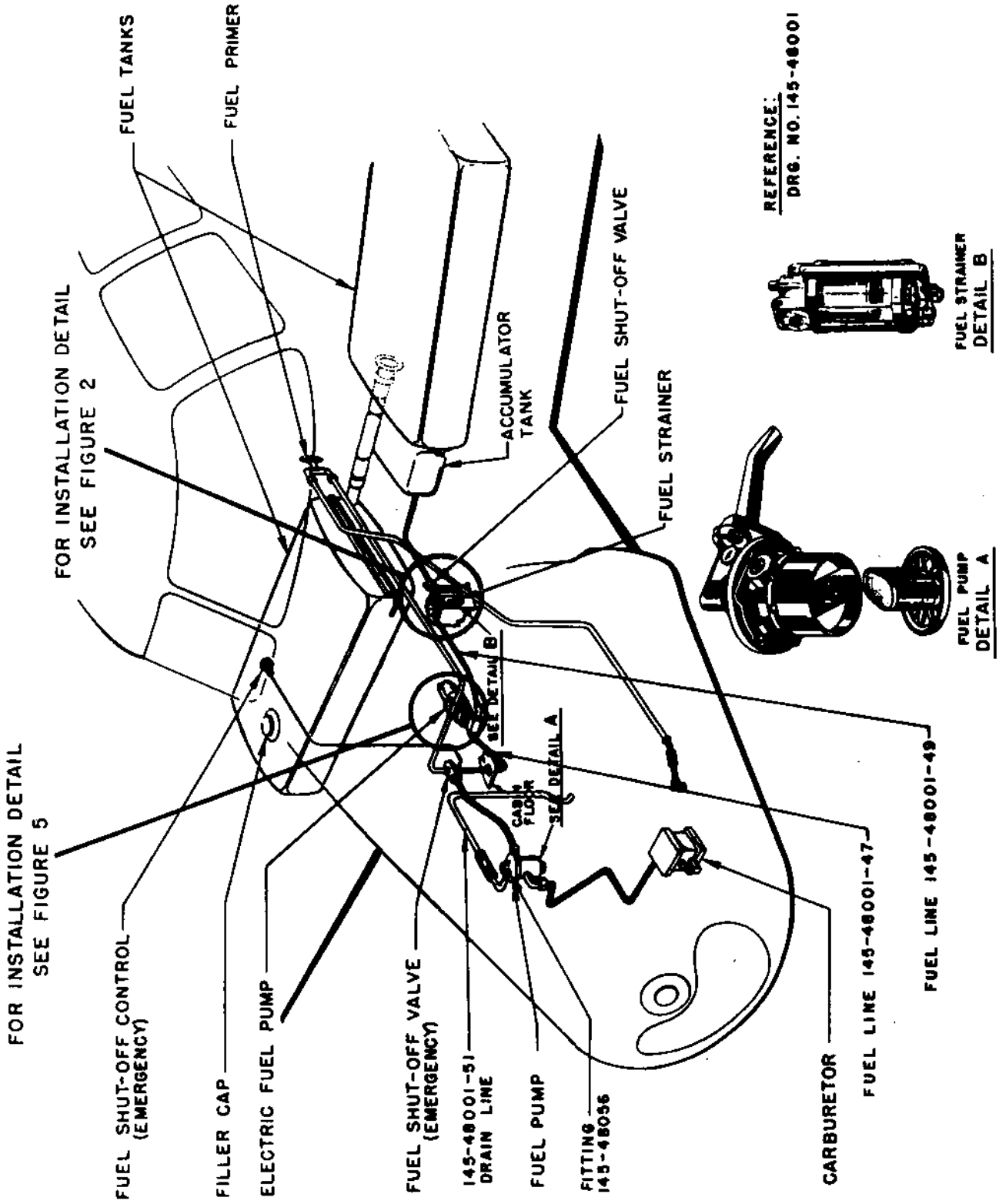
1. Remove lower right hand fire wall baffle Part No. 143-31001-50 from airplane fuselage. Rivet asbestos insulation Part No. 143-31001-100 to the inside of baffle using (10) ten AD4-2R1 rivets and (10) ten AN960-AD4 washers as shown in Figure No. 4.
2. Under cabin floor between Station 65 and 77, measure to the right of airplane centerline 13-5/16". Mark a line parallel to the center line at this point. Locate Angle Part No. 143-31002-63 on line as shown in Figure No. 5. With a No. 30 drill, drill (12) twelve holes through angle and floor and rivet in place with AN 4-2R1 rivets.
3. Drill (4) four 1/4" holes through angle and floor as shown in Figure No. 5.
4. Locate Baffle Part No. 143-31002-62 against Station 77 frame. Drill (6) six holes through frame and baffle and attach with sheet metal screws. See Figure No. 6.
5. Insert rubber grommet AN 931-6-16 in Baffle Part No. 143-31002 and install fuel line assembly Part No. 145-48001-49, from strainer to electric pump.
6. On Adel electric pump, outlet side, install 90° inverted male elbow and on inlet side, install 45° inverted male elbow.
7. Install electric pump on underside of floor at location shown in Figure No. 5, using (4) four machine screws AN 515-416R7, (2) two washers AN 960-146L (shim under floor), and (4) four lock washers AN 935-416. Install 145-48001-63 cover over screws on top side. See Figure No. 5.

NOTE: Remove paint where pump contacts floor for good electrical bond.
8. Directly under electric pump drain, drill 7/16" hole in skin. Install rubber grommet. Attach drain line 145-31002-52 to pump, cut off excess line, leaving 1/4" extend through skin. Location shown in Figure No. 4.
9. Measure 1" forward of pump line and drill 3/4" hole in skin for air vent.
10. Locate Louvre Part No. 145-48058 on outside of skin over vent hole and drain line with open end aft as shown in Figure No. 4. Rivet in place using (5) five AD4-2R1 rivets.
11. Install fuel line assemblies Part No. 145-48001-47 (From electric pump to fuel shut-off valve in cockpit.), and Part No. 145-48001-49 (From fuel strainer to electric fuel pump.) See Figure No. 1.
12. Drill a 3/8" drain hole in skin 1/2" forward of frame Station 77 and 1/2" out-board of nose gear beam, as shown in Figure No. 4.

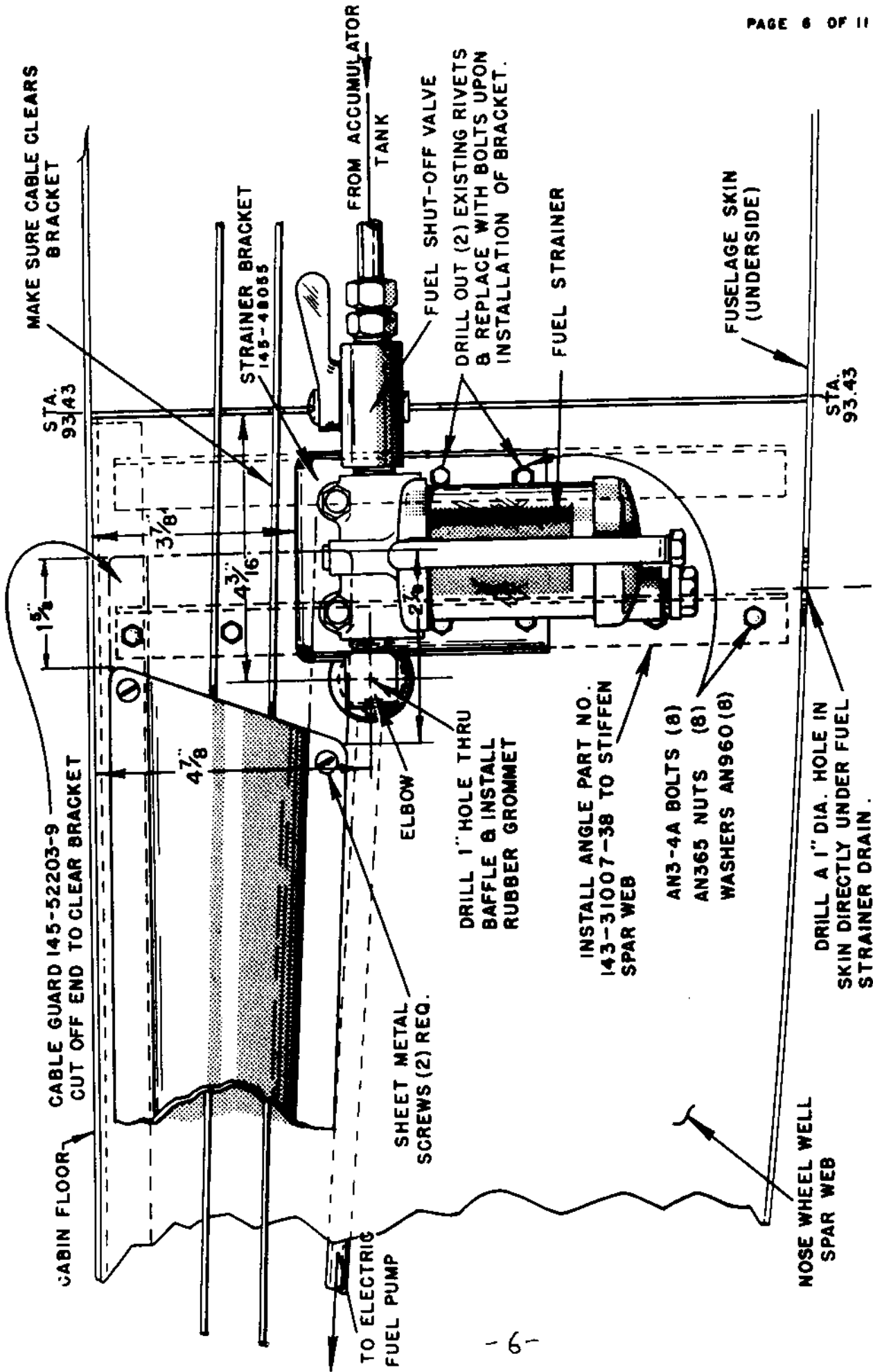
PART C

1. On left side of control panel, 1-3/8" in-board of landing gear indicator dimmer switch, drill 1/2" hole and install switch with wires attached. See Detail A, Figure No. 7.
2. Disconnect wire from instrument light circuit breaker and attach with wire on position light circuit breaker. See Detail B, Figure No. 7.
3. Connect fuel pump wire No. 127 from switch Part No. 8801K7 to 5 amp. circuit breaker, formerly used for instrument lights. See Detail B, Figure No. 7.
4. Install identification decal on instrument panel directly over fuel pump switch.
5. Route No. 128 wire along with other instrument wires through fire wall and over to the right.
6. Connect wire No. 129 with plug attached to Adel fuel pump. Route wire over to and with nose gear indicator position switch wires, through fire wall up to and connect to wire No. 128 with quick disconnect provided. Slip vinylite tube over disconnect and tie on each end to keep from shifting. For wiring diagram see Figure No. 7.

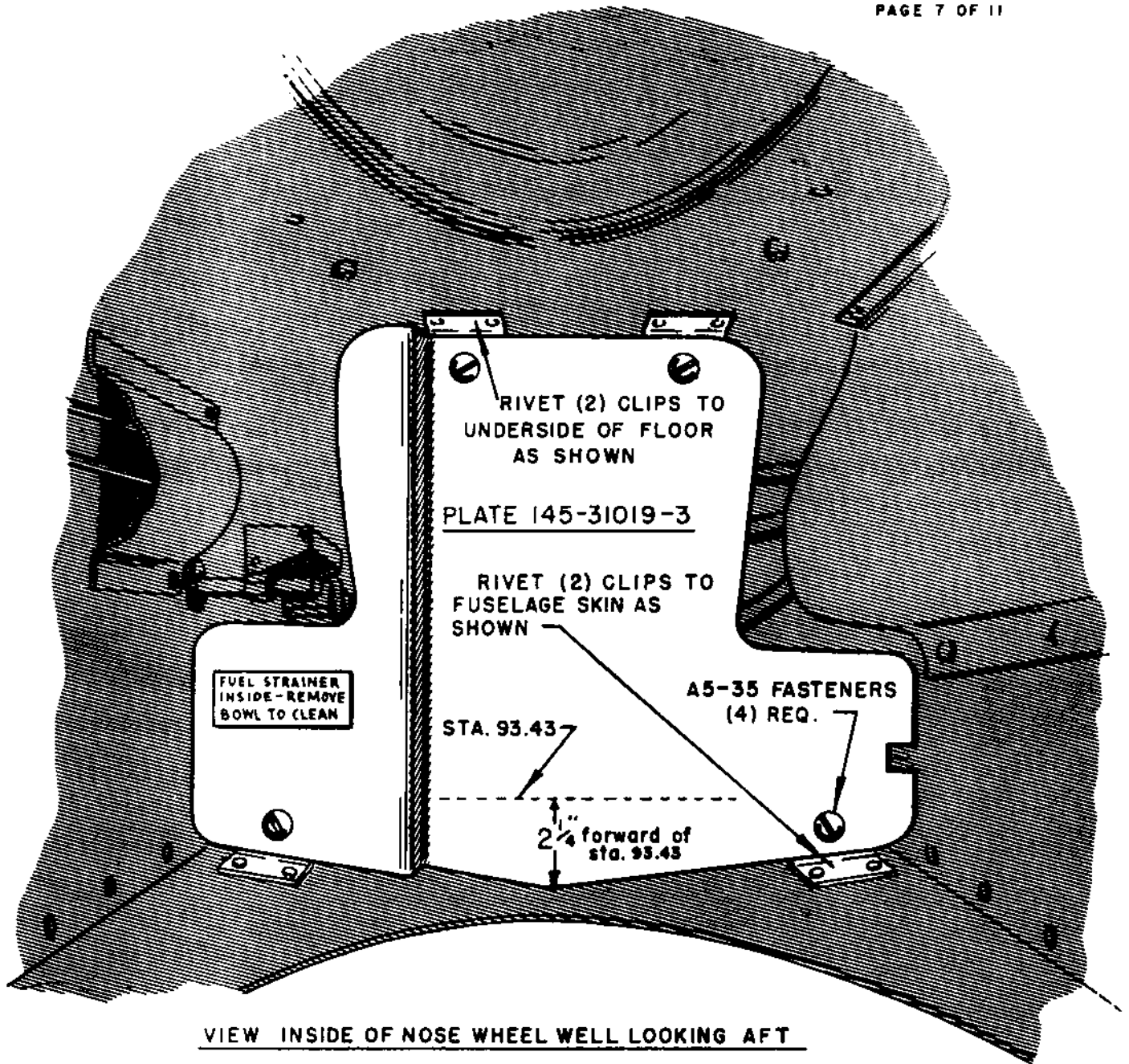
When installing electric fuel pump kit on any NAVION having a cabin heater installed, Carter Fuel Pump Drain Line Assembly, Part No. 145-48001-51 (Part A, Item 8 of Special Instructions No. 29), should be routed over to the left side of the firewall and down and out of engine compartment air exit on that side.



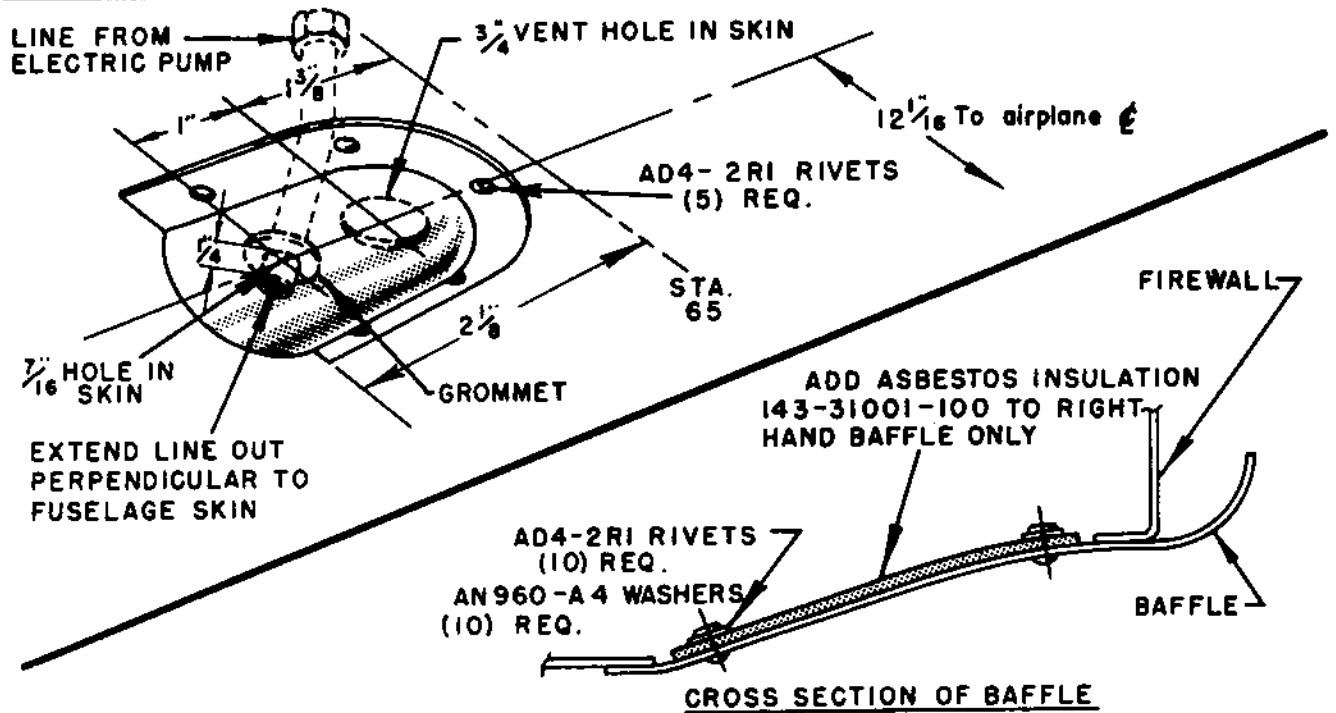
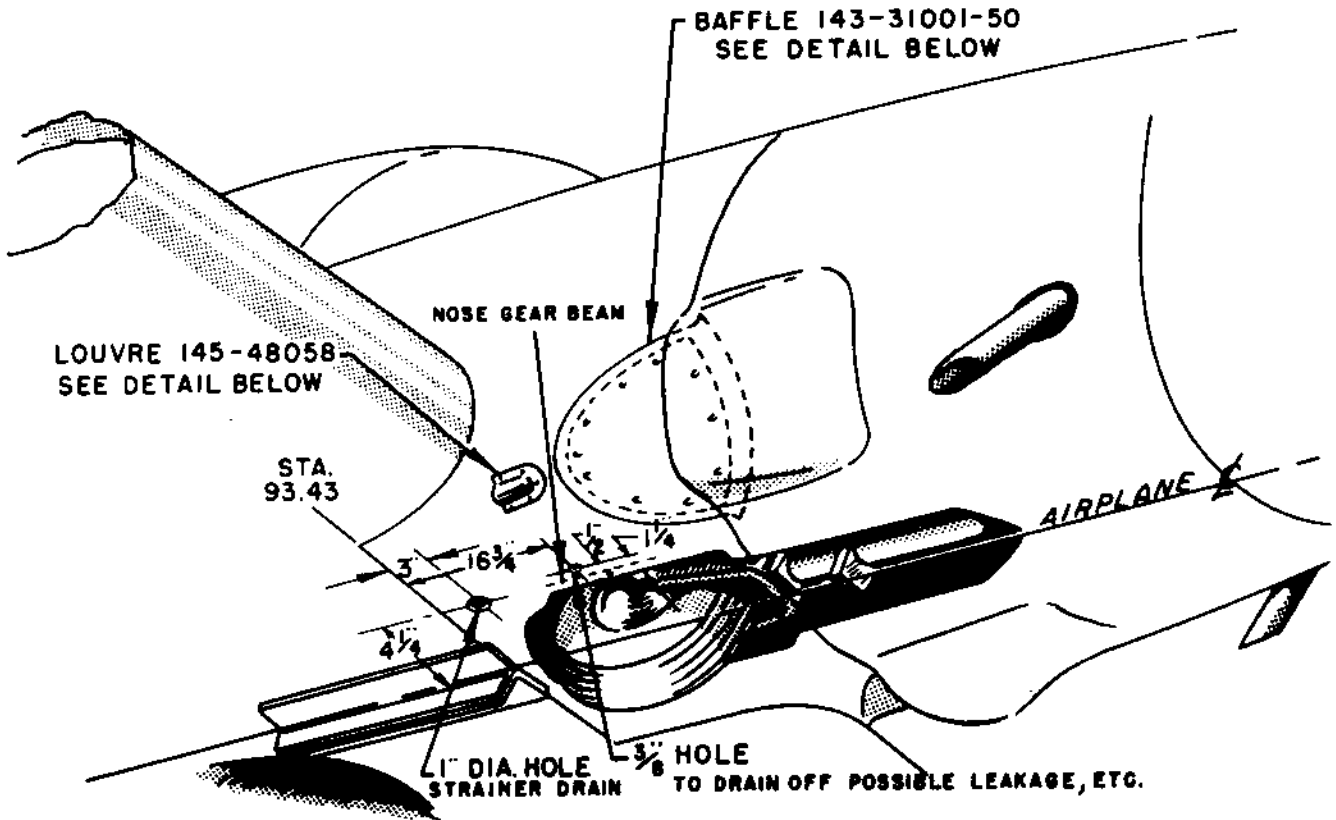
FUEL SYSTEM
FIGURE 1



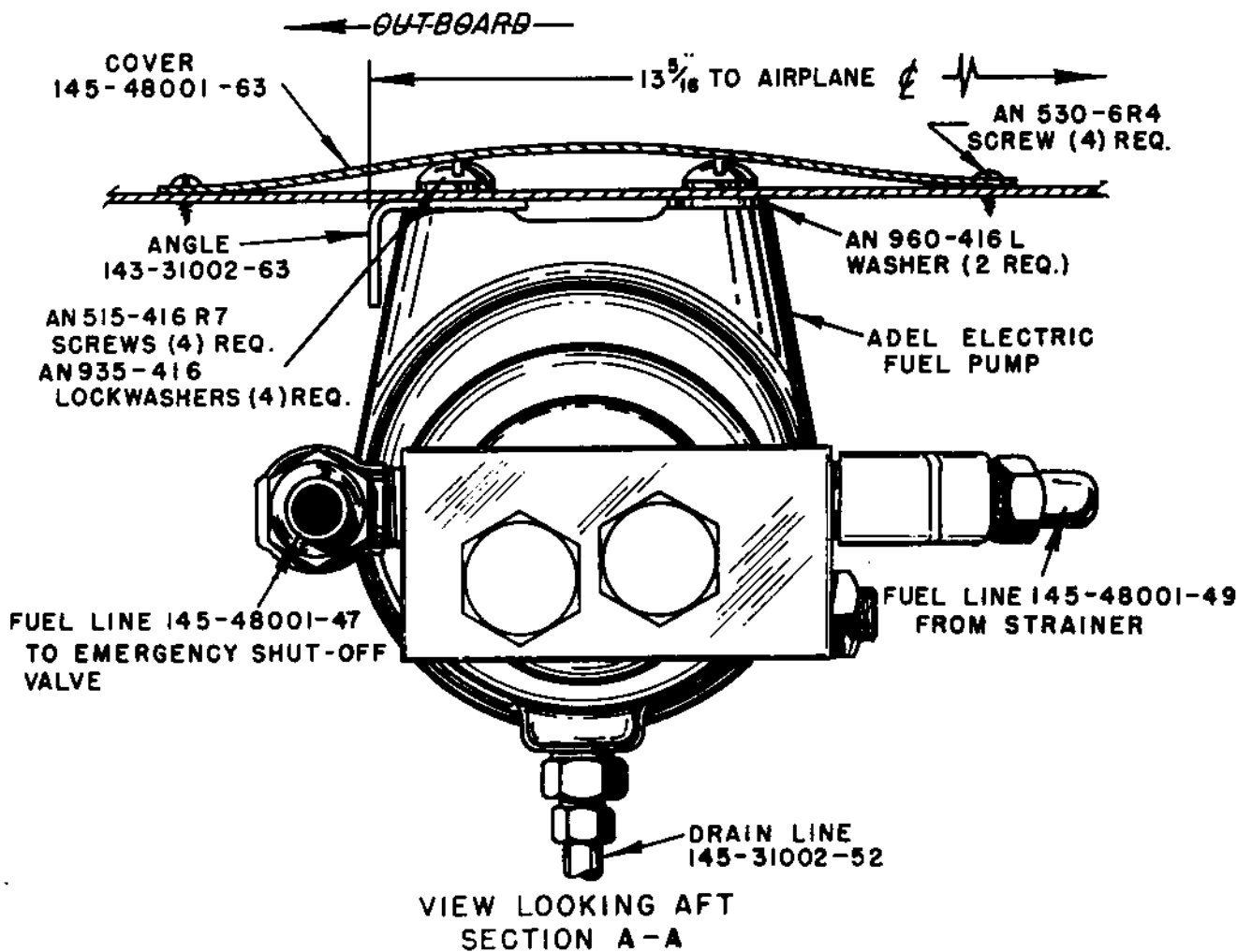
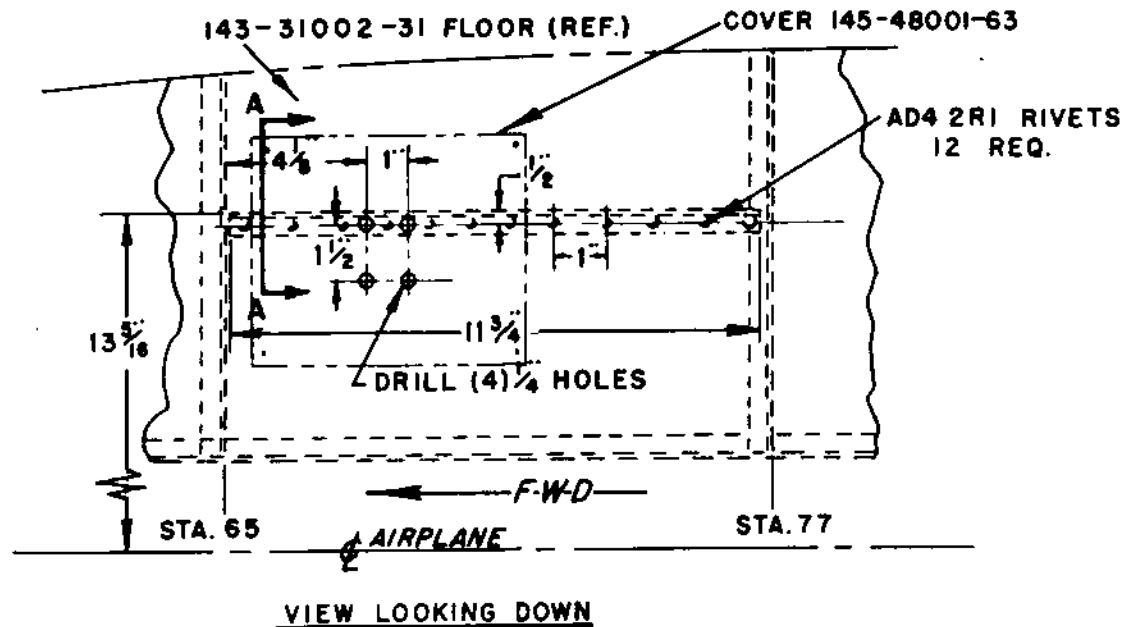
VIEW IN NOSE WHEEL WELL
 (LOOKING OUTBOARD - RIGHT HAND SIDE)
 FUEL STRAINER INSTALLATION



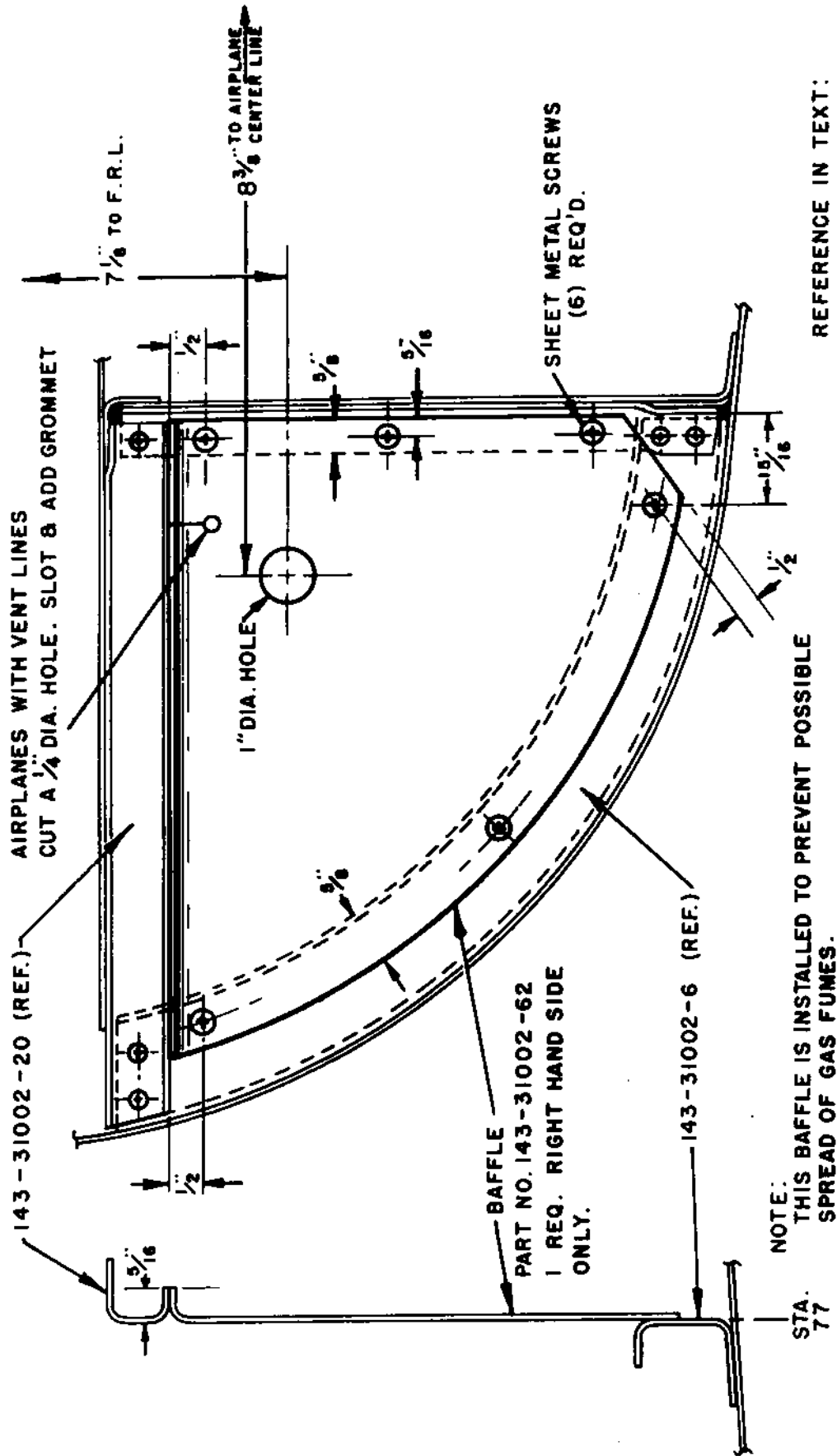
INSTALLATION OF
STRAINER GUARD PLATE
FIGURE 3



LOCATION OF DRAIN HOLES
AND
BAFFLE INSULATION
FIGURE 4



INSTALLATION OF ELECTRIC FUEL PUMP
FIGURE 5

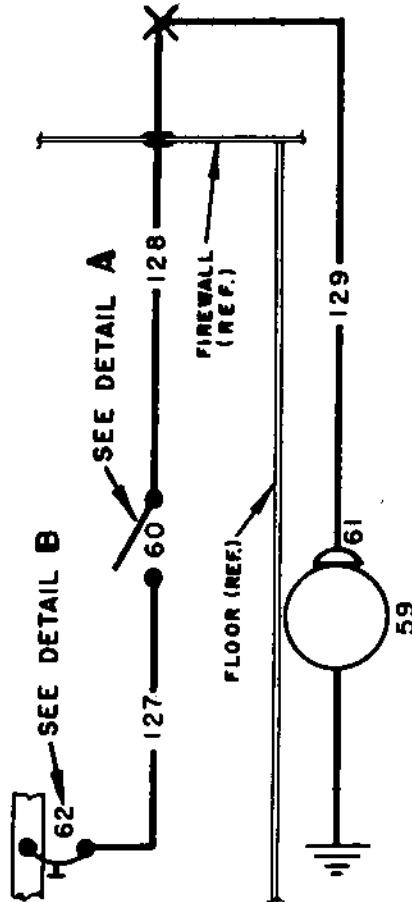
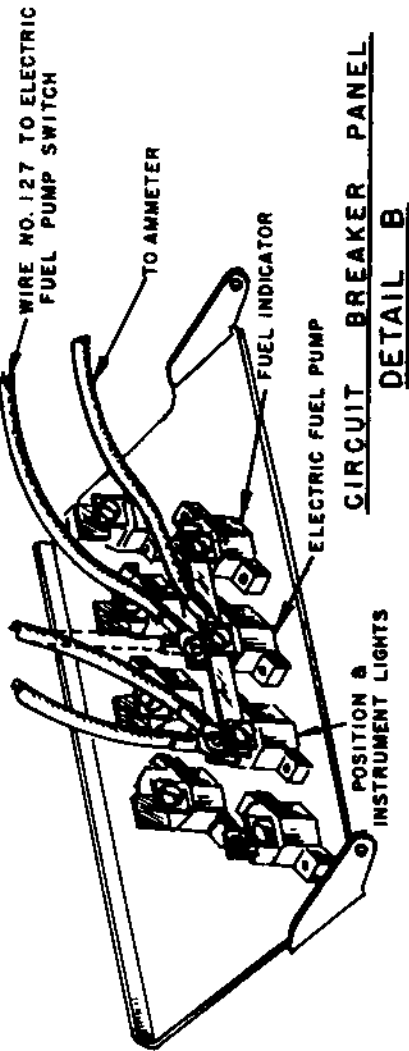


REFERENCE IN TEXT:
 PART B PARAGRAPHS
 4 AND 5.

NOTE:
 THIS BAFFLE IS INSTALLED TO PREVENT POSSIBLE
 SPREAD OF GAS FUMES.

STA.
 77

INSTALLATION OF BAFFLE STA. 77
 FIGURE 6



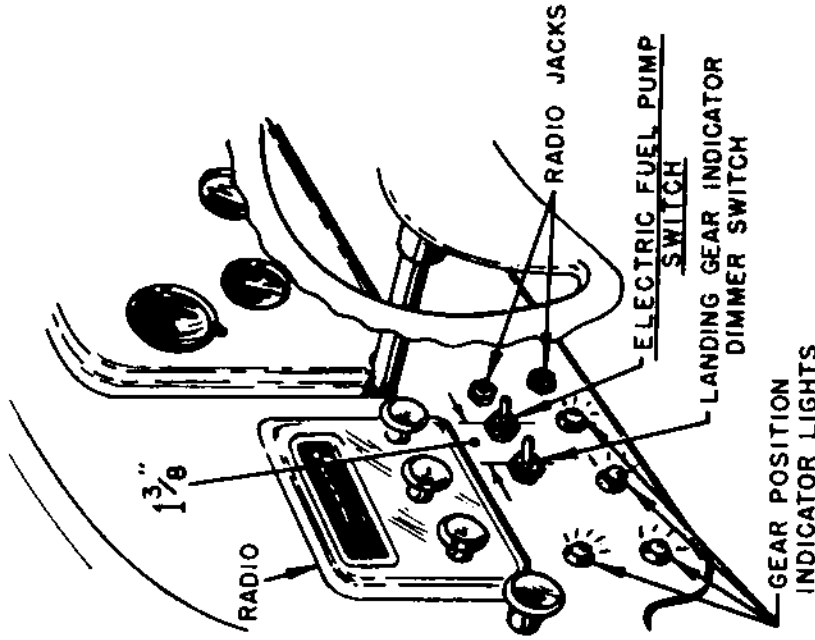
WIRE CHART

WIRE NO.	GAUGE	LENGTH
127	18	25"
128	18	40"
129	18	54"

ITEM CHART

ITEM NO.	DESCRIPTION	PART NO.
59	PUMP, ELECTRIC FUEL	ADEL
60	SWITCH, ELECTRIC FUEL PUMP	6396-K7
61	PLUG DISCONNECT	AN-3108 JOS-25
62	SA. CIRCUIT-BREAKER	CM--5

WIRING DIAGRAM



LOCATION OF
ELECTRIC FUEL PUMP SWITCH
DETAIL A

ELECTRICAL INSTALLATIONS
FIGURE 7

SPECIAL INSTRUCTIONS NO. 30

MARCH 8, 1948

ADDITIONAL CABIN AIR EXIT VENTILATION INSTALLATION

Install Cabin Air Ventilation Kit, Ref. Drawing No. 145-89055, consisting of the following:

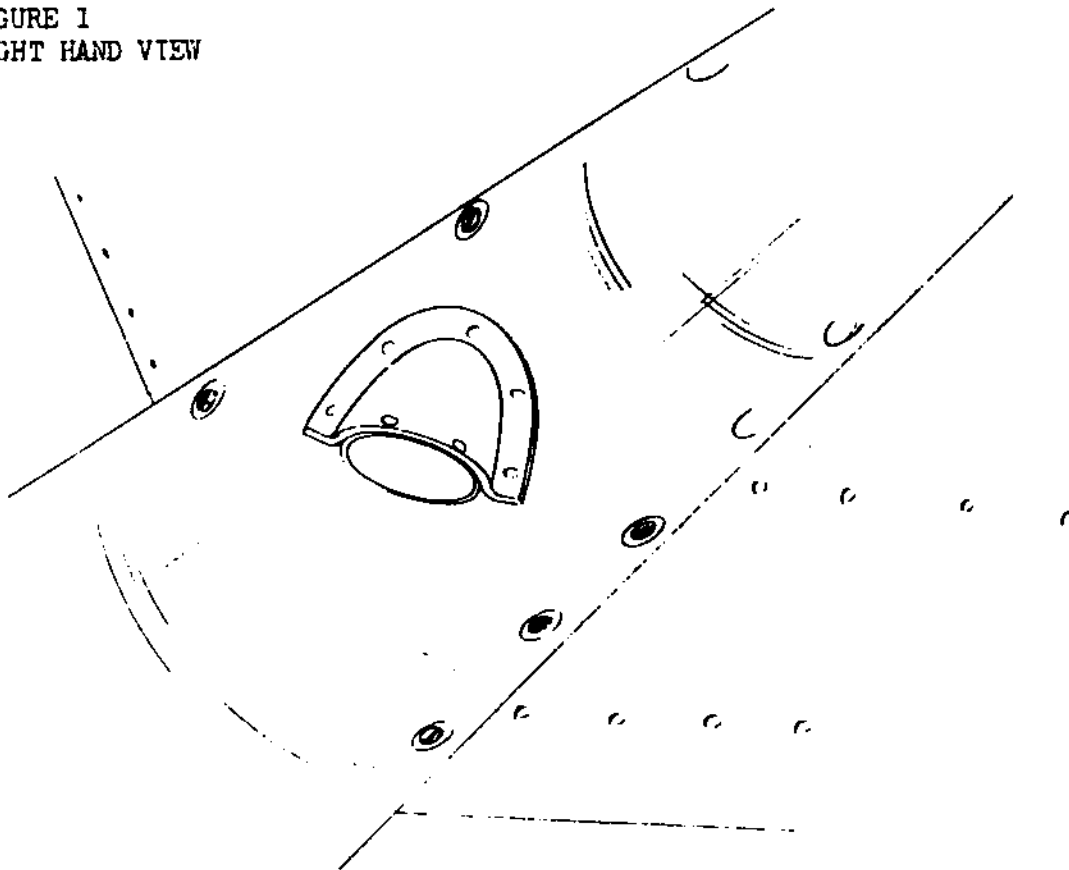
<u>Quan.</u>	<u>Part No.</u>	<u>Description</u>	<u>Quan.</u>	<u>Part No.</u>	<u>Description</u>
2	143-53003-48	Vent	2	PK 88xA-8-10	Screw
2	2T4830-18	Washer	2	AN530-8-10	Screw
12	A1778-82-3	Nut	2	145-10006-18	Tube
8	AN430-AD3	Rivet	2	143-53001-2	Hose
8	AN530-8-8	Screw	8	AN960-8	Washer
8	AN960-416	Washer	2	AN735-D32	Clamp
2	NAS-221-9	Screw	2	AN365-1032	Nut
1	145-1006-19	Louvre	1	145-1006-20	Louvre

Install Cabin Ventilation as follows:

1. Remove 143-53003-36 Heel Cover Rear Seat.
2. Measure out-board on each side of centerline of above cover, 12-13/16 inches and down 3/4" from top edge. At this point, down and out-board cut a 2-3/8" x 1-5/8" hole, (long part parallel to top edge) to permit 143-53003-48 Vent to be inserted.
3. Attach 143-53003-48 Vents with AN530-8-10 Screws in out-board holes and PK 88 x A-8-10 Screws in the in-board holes.
4. Install 143-53001-2 Hose over 143-53003-48 Vents, wrap securely with cord provided and cement or shellac to further secure Hose.
5. Install exit adjusting covers, bend up small metal tab, which acts as a stop to keep cover from being pulled off.
6. Re-install 143-53003-56 Cover under seat.
7. Remove 145-10006 Wing Fairings.

8. Measure aft from leading edge of fairing 20 inches, draw a line at right angle to in-board edge of fairing.
9. For the left hand side place paper template with 20 inch line thereon even with 20 inch line marked on fairing and side marked fuselage even with fuselage edge of fairing. Mark and cut out hole. Bend down lower edge slightly to provide more clearance and allow tube to be placed at the proper angle.
10. For right hand side turn paper template over and repeat method used for left hand side.
11. Insert 145-10006-18 Tube in hole and rivet 145-1006-19 and -20 louvres on to wing fairing with five (5) rivets. Rivet tube to louvre with two (2) rivets. See Figure 1.
12. Re-install wing fairings.
13. Under the rear seat (accessible from baggage compartment) attach flex hose to the tubes on fairing and secure with clamps.

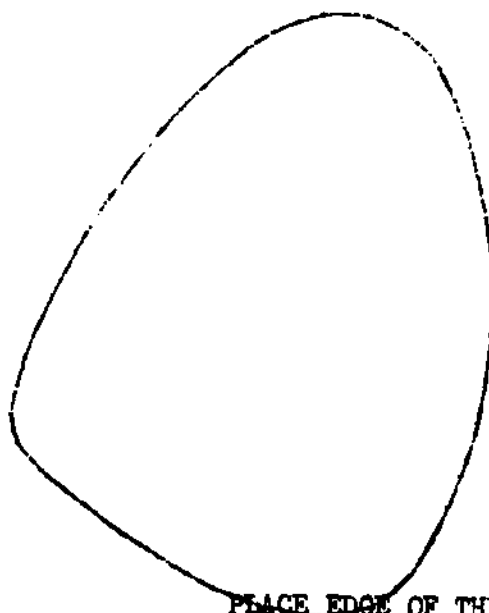
FIGURE 1
RIGHT HAND VIEW



TEMPLATE FOR HOLE CUT-OUT IN FAIRING

THIS VIEW LEFT HAND

NOTE: FOR THE RIGHT HAND SIDE TURN
PAPER TEMPLATE OVER.



20" FROM FORWARD END OF FAIRING



PLACE EDGE OF THIS PAPER TEMPLATE
EVEN WITH FAIRING EDGE ON FUSELAGE
SIDE. >

SPECIAL INSTRUCTIONS NO. 31

MARCH 15, 1948

BENDIX DOME SPEAKER INSTALLATION

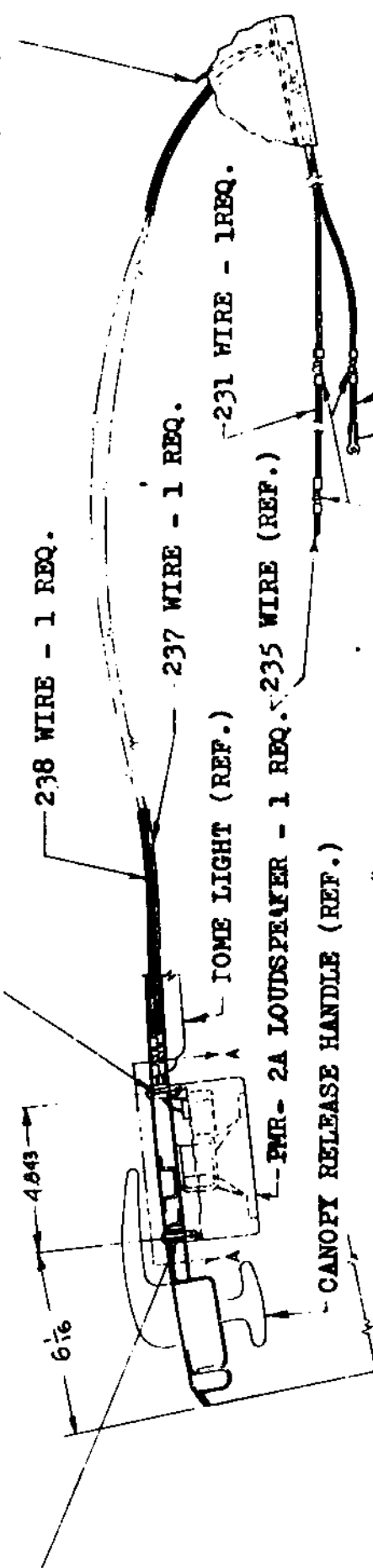
Install dome speaker kit (consisting of 145-71019 speaker and speaker housing) in NAVION as follows:

1. On center line of canopy, measure aft 6-1/16 inches and 4-7/8 inches additional. See sketch.
2. Drill two holes with #18 drill.
3. Remove dome light guard and open canopy headliner in area under speaker.
4. Mount speaker with two NAS-220-16 screws, placing one NAS-43-3-40 spacer on each screw between canopy and speaker.
5. Route No. -238 and No. -237 wires down to aft end of canopy with the existing dome light wire. See sketch.
6. Ground -238-232 wire to frame with 8-32 screw. Route -237-231 wire forward to receiver, using existing clips for dome light.

CAUTION: Leave sufficient loose wire to allow opening and closing canopy.

7. Route -237-231 wire forward with other existing wires to short No. 212 speaker receiver wire attached to radio terminal block. With quick disconnect attach to -237-231 wire and cover connection with 3-inch piece of XTE30 No. 4 IRV-O-LITE tubing and secure at both ends with waxed cord.
8. Reinstall dome light guard.

--- DRILL 5/16 (.312) HOLE
THRU CANOPY LATCH PLATE



SECTION OF FWD END OF CANOPY AT
AIRPLANE HALF SCALE

VIEW OF L H SIDE OF CANOPY APPROX.
1 1/2" TO 2" FROM AFT END OF CANOPY

WIRE CHART

WIRE		TERMINALS	
NUMBER	GAUGE	LENGTH	TYPE TYPE
237	18	10"	#31770 #31770
238	18	10"	#31770 #31770
231	18	11"	#31770 #31770
232	18	6"	#31770 #31889

SPECIAL INSTRUCTIONS NO. 32

Page 1 of 3

MARCH 16, 1948

INSTALLATION BENDIX PMN-1A LOOP ANTENNA
FOR DIRECTION FINDING

Install Bendix Loop Kit, Ref. Drawing No. 145-89061 consisting of:

**145-71047	Cover Assembly	AN960D416	Washer	1 Req.
*145-71047-10	Cover Assembly	AN365-632	Nut	3 "
145-71048	Spacer Block	AN515-6R5	Screw	3 "
145-71049	Plate	AN515-8R12	Screw	1 "
PMN-1A	Loop Assembly	AN515-8R28	Screw	1 "

PART A

145-89061-10 Assembly effective NAV-2 through 1050.

Install as follows:

1. Above windshield and 1/4 inch to the right of centerline, measure forward 5-3/8 inches. Drill 5/16 inch hole.
 NOTE: Use caution when drilling through to avoid damaging upholstery.
2. Measure 3/4 inch aft of 5/16 inch hole and 9/16 inch to the right of centerline of windshield, mark and drill 5/16 inch antenna lead-in hole.
3. Place Spacer Block No. 145-71048 over holes and with streamline pointing directly aft, mark and drill out with size #18 drill, the two holes on each end which are used to secure loop and block to the windshield dome.

* Used on NAV-2 through 1050 only.

** Used on NAV-1051 and subsequent.

4. Remove lock assembly from loop shaft and place Spacer Block 145-71048 on shaft under 145-71049 Plate attached to loop.
5. Thread antenna lead through hole in spacer and through holes previously drilled over windshield, attach loop, 145-71049 Plate and 145-71048 Spacer Block with two AN515-8 Screws.
6. Mount Azimuth plate on No. 145-71047-10 Cover Assembly.
7. Make necessary cutouts to fit cover snug to fabric.
8. Cut off excess shaft. (Leave sufficient to secure knob properly.)
9. Install lock on shaft. Place spacer under lock. Install box cover assembly over both shafts. Place AN365-8 Washer on drive shaft. Press cover assembly firmly against fabric and install control and lock knobs.
10. On centerline of instrument cowl just forward of Compass fairing, drill $1/4$ inch hole.
11. Run antenna lead down along side channel through hole and over to radio lead box. Secure to channel by means of two clips provided.
12. Solder the bare end of cable to terminal No. 11 of receiver. Ground the shield of the cable to one of the existing screws in the receiver case. Couple the cable from the receiver to cable from loop with quick disconnect fitting provided. Slip vinylite tube over disconnect and secure on each end by tying with cord to prevent shifting.

PART B

145-89061 Assembly effective NAV-1051 and subsequent.

Install as follows:

1. Above windshield and on the centerline measure forward $5-3/8$ inches. Drill $5/16$ inch hole.
2. Measure $3/4$ inch aft of $5/16$ inch hole and $5/16$ inch to the right of centerline of windshield, mark and drill $5/16$ inch antenna lead-in hole.
3. Place Spacer Block No. 145-71048 over holes and with streamline pointing directly aft, mark and drill out with size #18 drill, the two holes on each end which are used to secure loop and block to the windshield dome.

NOTE: It will be necessary to enlarge to 1/4 inch, the mounting holes on the underside of 145-31801-73 windshield former bow. This is necessary so screwdriver can be inserted and screws tightened directly against skin.

4. Remove lock assembly from loop shaft and place Spacer Block 145-71048 on shaft under 145-71049 Plate attached to loop.
5. Thread antenna lead through hole in spacer and through holes previously drilled over windshield, attach loop, 145-71049 Plate and 145-71048 Spacer Block with two AN515-8 Screws.
6. Mount Azimuth plate on No. 145-71047 Cover Assembly.
7. Make necessary cutouts to fit cover snug to fabric.
8. Cut off excess shaft. (Leave sufficient to secure knob properly.)
9. Install lock on shaft. Place spacer under lock. Install box cover assembly over both shafts. Place AN365-8 Washer on drive shaft. Press cover assembly firmly against fabric and install control and lock knobs.
10. On centerline of instrument cowl just forward of Compass fairing, drill 1/4 inch hole.
11. Run antenna lead down along side channel through hole and over to radio lead box. Secure to channel by means of two clips provided.
12. Solder the bare end of cable to terminal No. 11 of receiver. Ground the shield of the cable to one of the existing screws in the receiver case. Couple the cable from the receiver to cable from loop with quick disconnect fitting provided. Slip vinylite tube over disconnect and secure on each end by tying with cord to prevent shifting.

SPECIAL INSTRUCTIONS NO. 33

DECEMBER 22, 1947

GENERAL ELECTRIC DOME SPEAKER INSTALLATION

Install dome speaker kit (consisting of 145-71018 speaker and speaker housing) in NAVION as follows:

1. On center line of canopy, measure aft 5-7/8 inches and 5-7/32 inches additional. See sketch.
2. Drill two holes with #18 drill.
3. Remove dome light guard and open canopy headliner in area under speaker.
4. Mount speaker with two NAS-220-16 screws, placing one NAS-43-3-40 spacer on each screw between canopy and speaker.
5. Route No. 12 and No. 14 wires down to aft end of canopy with the existing dome light wire. See sketch.
6. Ground -12 wire to frame with 8-32 screw. Route -14 wire forward to receiver, using existing clips for dome light.

CAUTION: Leave sufficient loose wire to allow opening and closing canopy.

7. Route -14 wire forward with other existing wires to short No. 212 speaker receiver wire attached to radio terminal block. With quick disconnect attach to -14 wire and cover connection with 3-inch piece of XTE30 No. 4 IRV-O-LITE tubing and secure at both ends with waxed cord.
8. Reinstall dome light guard.

SPECIAL INSTRUCTIONS NO. 34

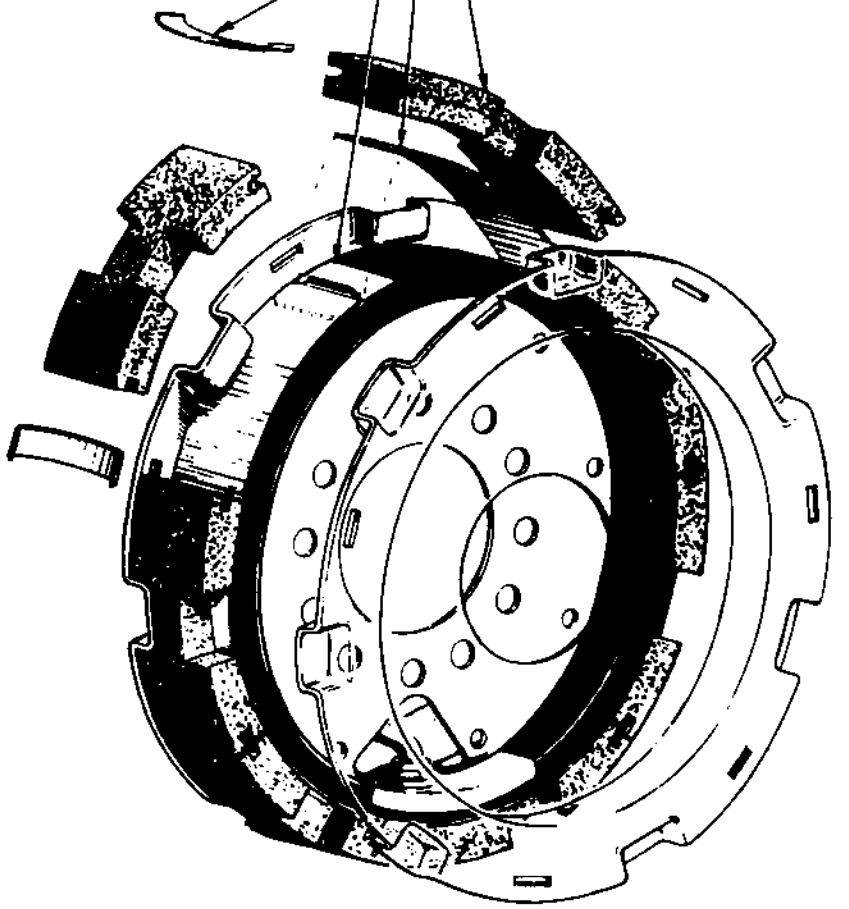
DECEMBER 12, 1947

INSTALLATION INSTRUCTIONS FOR
HAYES GOODRICH BRAKE REINFORCEMENTS

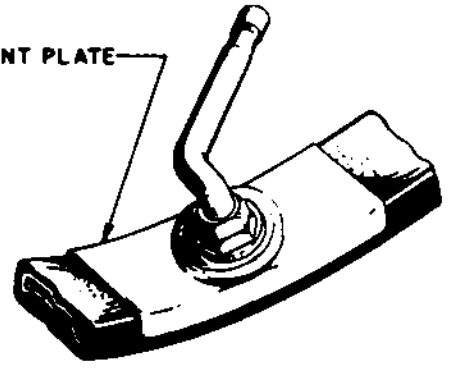
IN CASES WHERE THE HAYES GOODRICH BRAKES ARE LEAKING DUE TO RUPTURE OF THE EXPANDER TUBE WITHIN THE BRAKE ASSEMBLY, THE 145-89024 KIT (CONSISTING OF 145-33215) REINFORCEMENT PLATES AND 145-33214 VALVE SECTION REINFORCEMENT PLATES) MAY BE INSTALLED AS FOLLOWS AT TIME EXPANDER TUBE REPLACEMENT IS MADE:

1. JACK THE AIRPLANE IN THE MANNER PRESCRIBED, AND REMOVE THE MAIN WHEELS.
2. REMOVE THE BRAKE ASSEMBLY FROM THE LANDING GEAR AND DIS-ASSEMBLE THE BRAKE UNIT AND LINING AS PRESCRIBED ON PAGE 48, FIGURE 34, OF THE NAVION SERVICE MANUAL.
3. REMOVE THE EXPANDER TUBE FROM THE BRAKE ASSEMBLY BY SEPARATING THE HALVES OF THE ASSEMBLY.
4. REMOVE THE NUTS, NUT CAP, AND WASHER FROM THE EXPANDER TUBE VALVE, AND INSTALL 145-33214 FLANGED REINFORCEMENT PLATE OVER THE VALVE; REPLACE THE PREVIOUSLY REMOVED WASHER AND RETAINING NUT.
5. INSTALL THE EXPANDER TUBE, AND REASSEMBLE THE BRAKE HALVES. INSTALL THE NUT CAP AND RETAINING NUT ON THE VALVE.
6. INSTALL THE SEVEN 145-33215 REINFORCEMENT PLATES WITH ENDS OVER SPACERS IN SUCH MANNER AS TO FORM A STEEL BAND AROUND THE EXPANDER TUBE. INSTALL BRAKE LINING AND RETAINING SPRINGS.
7. INSTALL BRAKE ASSEMBLY ON LANDING GEAR STRUT, AND BLEED THE BRAKE SYSTEM IN THE MANNER PRESCRIBED ON PAGE 5 OF THE NAVION SERVICE MANUAL.
8. MARK REWORKED BRAKE WITH BLACK STRIPE 1/2 INCH WIDE ON OUTSIDE HOUSING, TO AID IN IDENTIFICATION OF BRAKE ASSEMBLIES HAVING REINFORCEMENTS INSTALLED.

- ① PLACE EXISTING BRAKE LINING SPACER ON EXPANDER TUBE.
- ② INSTALL 145-33215 REINFORCEMENT PLATE WITH ENDS OVER SPACERS.
- ③ INSTALL BRAKE LINING.
- ④ BRAKE LINING RETAINING SPRING



145-33214 FLANGED REINFORCEMENT PLATE



145-34-88

FIG. 1

SPECIAL INSTRUCTIONS NO. 35

JUNE 21, 1948

VENTURI VACUUM GYRO INSTRUMENT PANEL INSTALLATION

Effectivity: NAVIONS that do not have vacuum pump drive pad available on engine accessory case.

Install Venturi Vacuum Gyro Instrument Panel Kit No. 145-89025-10 (consisting of Kollsman 991-10-01 vertical speed indicator, U.S. Gage AW-1-7/8-216 suction gage, Sperry 661961 attitude gyro, Sperry 649742 directional gyro, two (2) AN5807-1 venturi tubes, AN6119-1 vacuum relief valve, piping and supports) on NAVIONS as follows.

See Figure 1.

1. Disconnect battery. Remove instrument panel reflector. Uncouple oil temperature capillary tube from oil cooler, and install a 5/8-18 threaded plug in cooler; remove all clips from capillary line; remove line and indicator. Remove the six light sockets from instrument panel. Disconnect all lines and wires from instruments. Remove the four (4) pins from the instrument panel mounting brackets, and remove panel.
2. Remove the two (2) vibration isolators from the upper mounting flanges of dash panel, and insert in upper mounting brackets of 145-51055 instrument panel, with body of isolator beneath bracket. Leave isolators in bottom flanges of dash panel.
3. Remove the instruments from old panel. Remove elbow from altimeter and install in vertical speed indicator. Install 752 x 4 tee in sensitive altimeter. Install 10-1146-75 union in suction, gage, and 234 x 4 connector and 352 x 6 elbow in directional gyro.
4. Remove shipping plugs from air filter on attitude gyro. Remove air filter cover from directional gyro (four screws). Mount sensitive altimeter, tachometer, ammeter, clock, and oil pressure, fuel pressure, fuel level, airspeed and bank-and-turn indicators in new panel with existing screws. Mount suction gage, vertical speed indicator, and attitude gyro with four (4) AN515-B6R12 screws each, using 6939-632-375 nuts for vertical speed indicator. Mount directional gyro with four (4) AN520-B10R16 screws.

5. Connect 145-51801-3 line to directional gyro and to suction gage. Connect 145-51801-13 line to tee in airspeed indicator and to 752 x 4 tee in altimeter. Connect 145-51801-15 line to 752 x 4 tee in altimeter and to vertical speed indicator.

See Figure 1.

6. Connect five (5) 145-54044 panel light sockets and lamps, and two (2) 145-54047 wires to existing wiring.

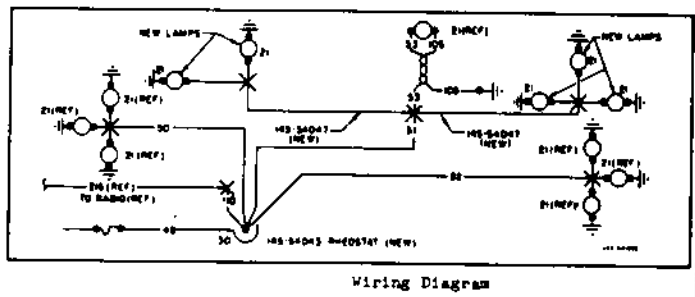
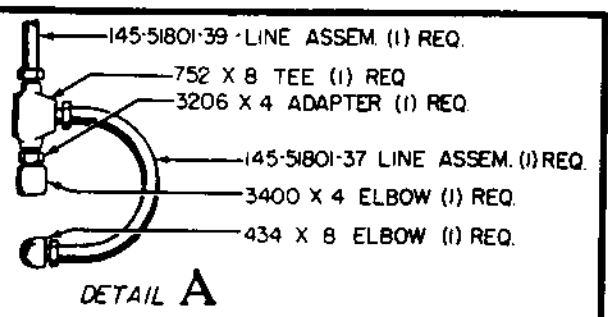
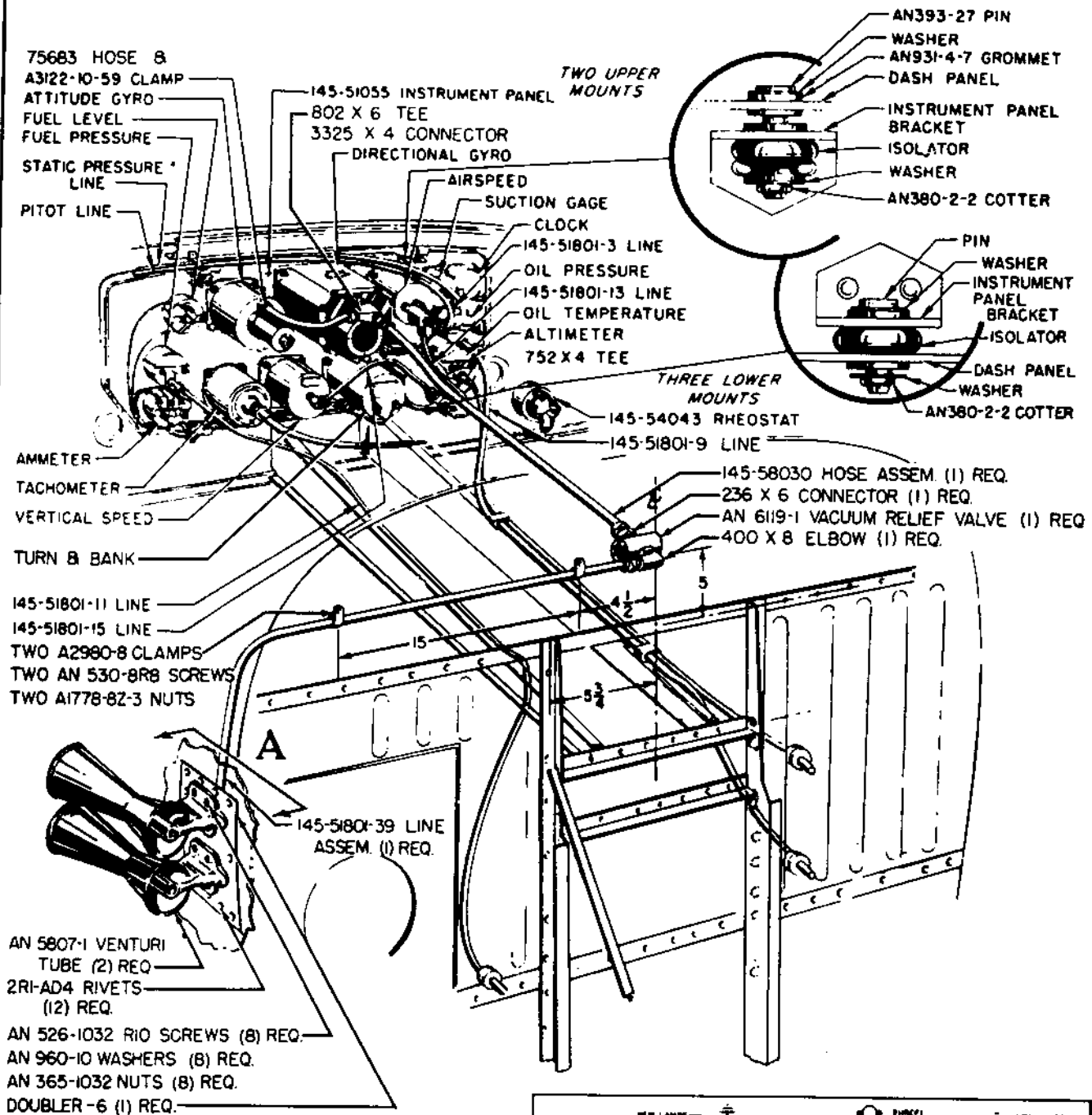
See Figure 1.

7. Insert two (2) AN931-4-7 grommets in the upper instrument panel mounting flanges of the dash panel. Install 145-51055 instrument panel, using two (2) AN393-27 pins, four (4) existing washers, and two (2) AN380-2-2 cotters in upper mounts. Use one (1) new 275-5 isolator, existing pin, two (2) AN960A10L washers, and AN380-2-2 cotter in lower center mount. Use two (2) existing pins, four (4) existing washers, and AN380-2-2 cotters in the other two lower mounts.

See Figure.

8. Place Part No. 145-89066-6 doubler with the 5/8" holes pointing forward, on the outside of right hand forward fuselage, with the upper 5/8" hole 8" above level point and the forward 3/16" venturi attaching holes 2-9/16" aft of firewall, mark and drill out holes.
9. Place doubler on the inside of skin and rivet into place with twelve (12) 2R1-AD4-5 rivets.
10. Attach venturi tubes with eight (8) AN526-1032-R10 screws, AN960-10 washers and AN365-1032 nuts.
11. Install 3400 x 4 elbow in upper venturi, install 3206 x 4 adapter in 752 x 8 tee and attach to 3400 x 4 elbow. Install 434 x 8 elbow in lower venturi, connect venturi tubes together with Part No. 145-51801-37 line assembly. Connect Part No. 145-51801-39 line assembly to tee and attach to firewall two places with two (2) A2980-8 clamps, two (2) AN530-8R8 screws and two (2) A1778-8Z-3 nuts.
12. Attach AN6119-1 vacuum relief valve with 400 x 8 elbow installed in inlet port to -39 line assembly, install 236 x 6 connector in opposite port on relief valve.
13. Remove the top rear-most vacuum entrance plug from directional gyro and install 3325 x 4 connector. Remove the 75682 hose and fitting from gyro and install plug previously removed. (This hose and fitting is replaced

- with 3325 x 4 connector and 145-58030 line assembly.) Disconnect 75683 hose from tee and install tee onto 3325 x 4 connector on back of gyro instrument. Reinstall 75683 line on tee and connect Part No. 145-58030 line to tee and vacuum relief.
14. Replace 145-51031-12 oil pressure line with 145-51801-9 line, and 145-51031-10 fuel pressure line with 145-51801-11 line.
 15. Reconnect pitot and static pressure lines to airspeed indicator. Test lines for leaks. (Refer to NAVION Service Manual.) Reinstall oil temperature indicator and capillary.
 16. Replace the panel light rheostat with 145-54043 rheostat. Plug the light sockets with lamps into the eleven (11) holes in instrument panel.
 17. Remove loose wires 85 and 86 from their stowed position at back of instrument panel. Connect wire 85 to bank-and-turn indicator terminal marked "+" and wire 86 to "-" terminal. Reconnect all wires to remounted instruments. Install a one-amp fuse in "BANK TURN" retainer and one in spare retainer.
 18. Re-compensate compass. Fill out new compass correction card, and insert in holder on reflector.
 19. Loosen lock nut on top of relief valve, adjust valve by turning adjusting screw (counter-clock-wise to increase suction, clock-wise to decrease) to indicate 3.75 inches on suction gage at an airspeed of 100 m.p.h. Gage should not exceed 4.75 inches at 190 m.p.h.



SPECIAL INSTRUCTIONS NO. 36

Page 1 of 4

AUGUST 23, 1948

ROMEK FUEL PUMP SYSTEM INSTALLATION

Install Romek Fuel Pump System Kit No. 145-89068 and -30 as follows:

These instructions are provided for the installation of the Romek Vane-type Engine Driven Fuel Pump for all Ryan manufactured NAVIONS, 1111 through 1270, and including all North American manufactured NAVIONS, having the Adel Electric Fuel Pump Kit installed.

For airplanes having Gyro Instrument Panel with engine driven vacuum pump installed, see Note 2 at the end of these instructions. Read instructions completely before attempting installation.

See Figure 2.

1. Inside of nose wheel well, remove Part No. 145-31019-3 strainer guard.
2. Remove Parker fuel shut-off valve located just aft of strainer, replace operating handle with Part Nos. 145-48069 and 145-48067 stop and yoke, secure to valve with Part No. AN500A10-6 cap screw, safety and reinstall valve.
3. Place Part No. 145-48073 lower rudder cable fairlead onto the top aft end of strainer bracket, flange side aft. Drill out the two (2) No. 10 holes through bracket and attach with two (2) AN526-1032 screws and two (2) AN365-1032 nuts.
4. Directly above the centerline of valve just forward of floor angle, drill a 1/2 inch hole in floor. Cut a 1-1/2" x 3/4" corner out of Part No. 145-52402-9 floor cable guard for control shaft clearance. Place Part No. 145-48074 control shaft through 1/2 inch hole and secure to valve yoke with two (2) AN380-2-4 cotter pins. Remove lower 3/16 inch bolt from in-board seat track wood block attachment. Drill a No. 10 hole in opposite side above 3/16 inch hole and install an AN545B8-4 wood screw. Place Part No. 145-48070 fuel selector support adapter over control shaft, attach with

NAS220-13 bolt, AN960 washer and AN365-832 nut. Secure Part No. 145-48065 support assembly to floor over carpet and on the side of seat track with two (2) screws and two (2) bolts. Install handle and secure with 26NKM-02 nut, making sure the "ON" and "OFF" position of valve corresponds with handle.

NOTE. It will be necessary to rework handle before installing, this can be accomplished by cutting off former stop lug with a file or saw.

5. Remove right hand cooling access gill cover, remove Part No. 145-48001-49 line, (strainer to Adel pump) and install 145-48001-87 tube assembly to strainer.

See Figure 1.

6. Remove Adel electric pump with relief and by-pass valve manifold. This can be accomplished by removing the cover plate and the four attaching screws in cockpit floor. Reinstall Part No. 20610 Adel electric pump with manifold assembly and valves attached. Tighten and safety, similar to method previously used.
7. Connect 75685 hose assembly to Adel pump manifold and attach to -87 line from strainer with 200 x 6 connector.
8. Remove Part No. 145-48001-47 fuel line (Adel pump to Deutsch valve). Remove Deutsch valve from firewall. Remove connector fittings from Deutsch valve and install in Part No. 145-48232 fitting. Remove control from instrument panel and insert hole plug in hole left by control in panel. Install Part No. 145-48232 fitting in the former Deutsch valve location, using same method of attachment.
9. Connect primer line and Part No. 145-48001-83 tube assembly from Adel pump to Part No. 145-48232 fitting.
10. Drill a 1/2" hole in firewall at lower right hand corner in curved exit area, 1-1/4" below cockpit floor and 6" out-board of nose wheel spar. Install AN837-4D elbow, AN960-816 washer and AN924-4D nut.
11. Attach Part No. 145-48401-70 tube assembly to 40448 relief valve mounted on underside of pump manifold. Connect opposite end of -70 tube assembly to AN837-4D elbow installed in firewall.
12. Remove Part No. 145-48061 line from Carter pump. Connect opposite end to fitting Part No. 145-48232, replacing Deutsch valve.
13. Remove Carter fuel pump and install Part No. 145-48057 cover plate, using existing gasket and adding sufficient washers under nuts to tighten pad properly.

See Figure 4.

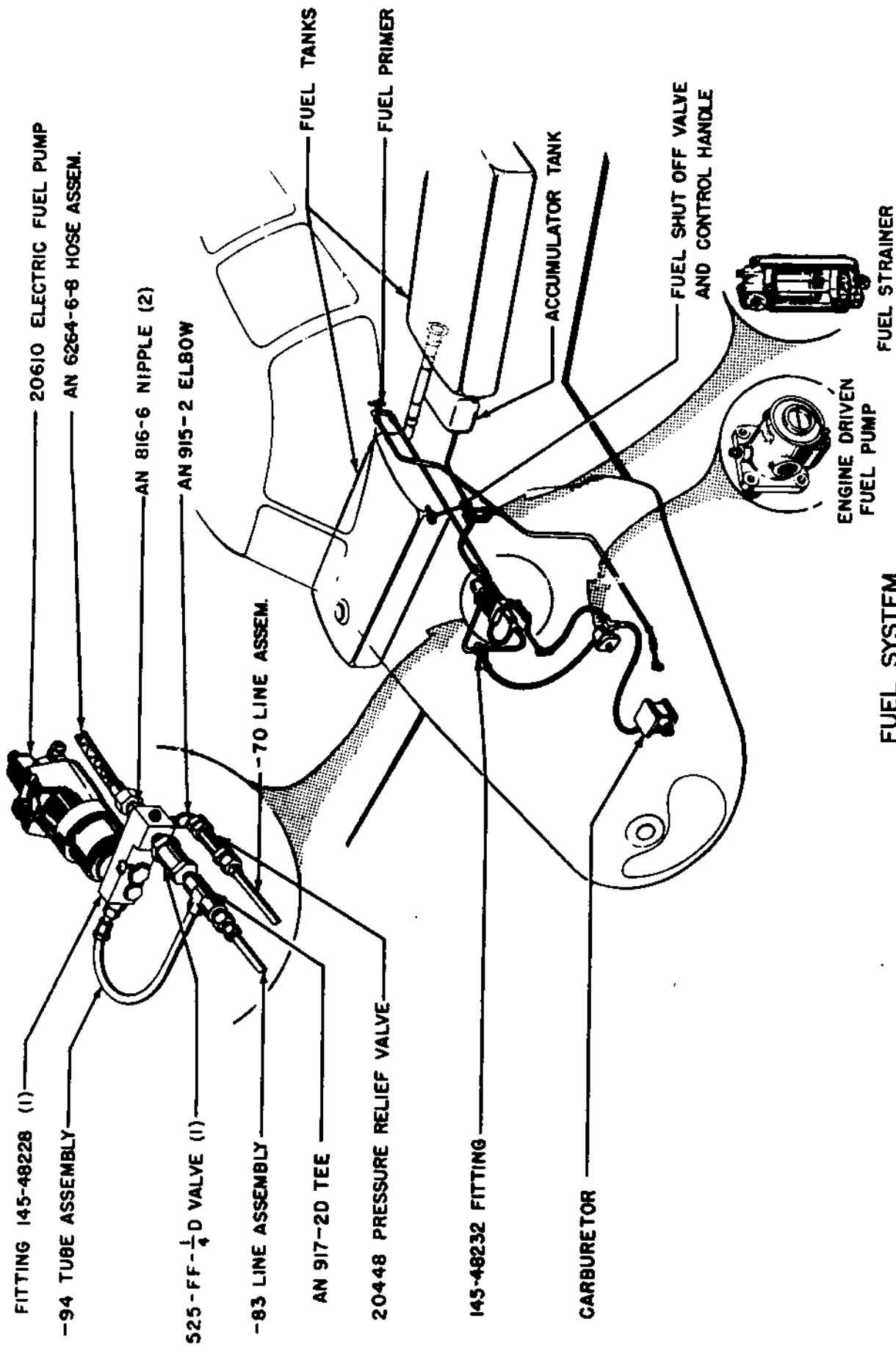
14. Remove adapter pad on which hydraulic pump is mounted, leave gasket on case. (If gear becomes separated from adapter pad on removal, use extreme care not to damage seal during reassembly of gear and adapter pad.)
15. Remove the two (2) cover plates from aft end of engine accessory gear case, leave gaskets on case. Insert 40662 idler gear through large opening in case, position under small opening in mesh with main drive gear, and secure by installing 35999 shaft in small opening. Use the two (2) screws removed with the small cover plate to secure shaft to case, and safety with lock wire.
16. Check oil passage just inside case at hydraulic pump location to see that it is open. Remove square plug, if one is present, and install 2024 plug. (Romec fuel pump receives oil supply from this passage.)
17. Reinstall hydraulic pump and adapter pad from where it was removed, using existing gasket, nuts and washers.

NOTE: Be sure gasket is located properly over small oil port, or it will seal opening and close off oil supply line.
18. Install one (1) 3350 x 4 street ell and one (1) 352 x 6 elbow in Romec fuel pump port marked "in". Install 350 x 6 elbow and 250 x 4 elbow in Part No. 145-53307-10 special fitting stamped "S", and install in opposite port. Install 200 x 4 connector and Part No. 145-48001-78 tube assembly into drain port at bottom of pump.
19. Remove the four (4) studs on accessory pad on which Romec fuel pump will be mounted. Install the 530479-03 longer studs.
20. Install 24907 plug in shaft of 40724 gear. Insert 25102 oil seal in 40722 adapter and place adapter on 40724 gear. (Use extreme care not to damage seal during assembly of gear and adapter. Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter into crank case. Place AN4045-1 gasket on adapter and place Part No. 530371 insulator plate on adapter. Place another AN4045-1 gasket on insulator plate and install Romec fuel pump, using existing nuts and washers.
21. Re-route Part No. 145-48062 existing line from carburetor to the right hand side of engine and connect to 145-53307-10 "S" fitting. Attach Part No. 145-44017 line with 300 x 4 union and 145-48001-74 line assembly onto -10 "S" fitting and -74 end to AN837-4D elbow installed in firewall, securing with one (1) AN742-D6C clamp on nose gear firewall support channel. Attach Part No. 145-48061 line from 145-48232 fitting on firewall to 352 x 6 elbow on inlet port of Romec fuel pump. Install 145-48001-80 tube with hose connection and A3122-10-59 clamps onto -78 drain line and secure in two (2) places with AN742D6C clamps.

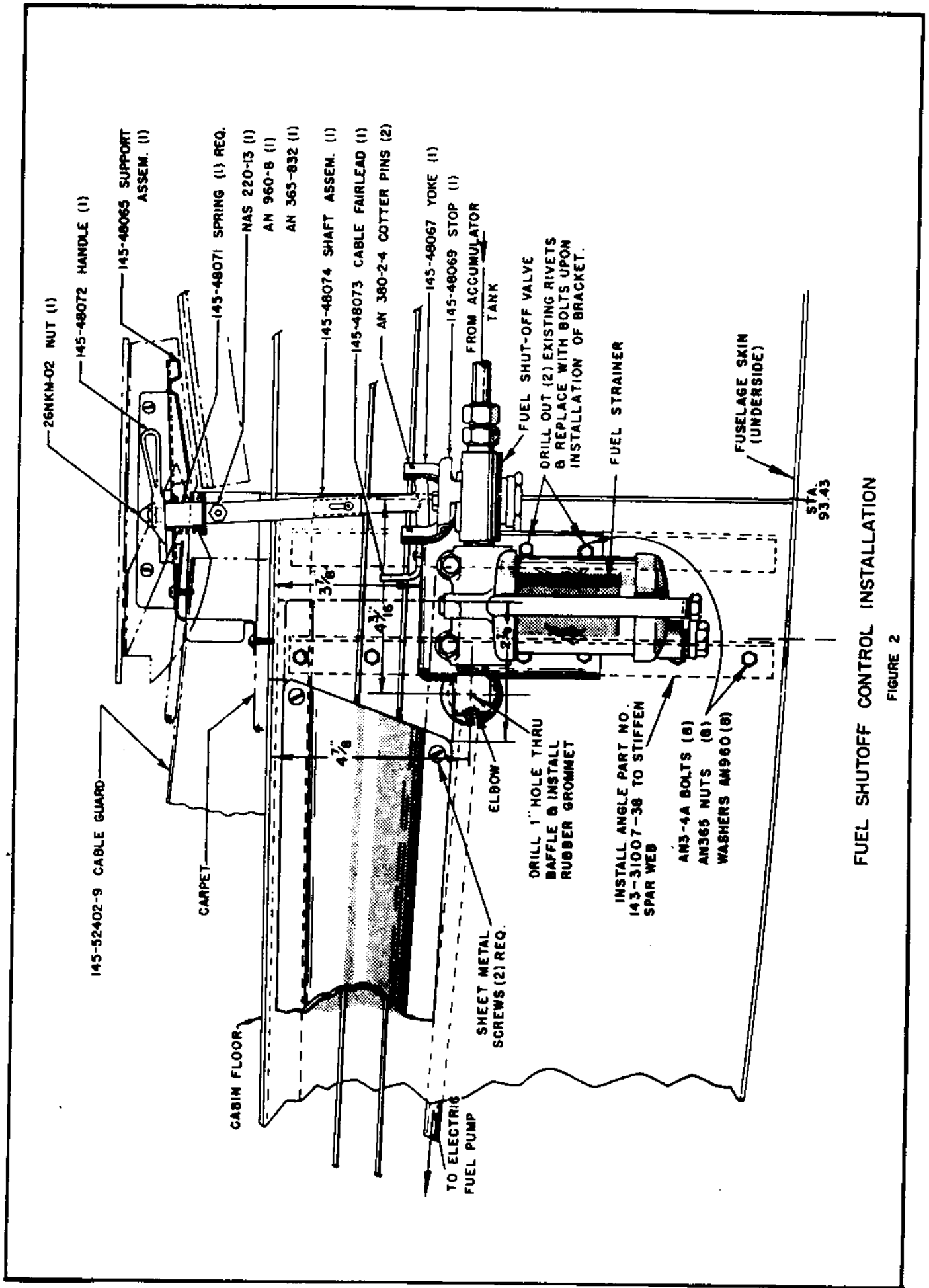
NOTES:

1. Upon completion of installation, each fuel pump should be checked individually, and with both operating. Adjust fuel pressure of Adel electric pump first, this is accomplished by loosening jam nut on 20448 Adel pressure relief valve, screwing "in" to increase and "out" to decrease. Desired pressure for Adel pump only is 14-1/2 pounds. Adjust pressure of the Romec pump by screwing adjustment screw on back of Romec pump "in" to increase and "out" to decrease, desired pressure for Romec pump only with the engine turning up to 1500 r.p.m. is 12-1/2 pounds, with both pumps operating this will be about 13-1/2 pounds pressure which is normal.
2. It is essential to eliminate all air leaks of the entire fuel system, in order to achieve proper operation of the Romec fuel pump.
3. On airplanes having Gyro instrument panel with engine driven vacuum pump installed, it will be necessary to move hydraulic pump from its present location to the location of the vacuum pump. Remove the vacuum pump, and install venturi tubes as provided in supplement instructions; also, the installation of the idler gear, shaft, adapter and adapter gear of these instructions will not apply as they had previously been installed with the vacuum pump kit.

Insert revised pages in Operation Manual.

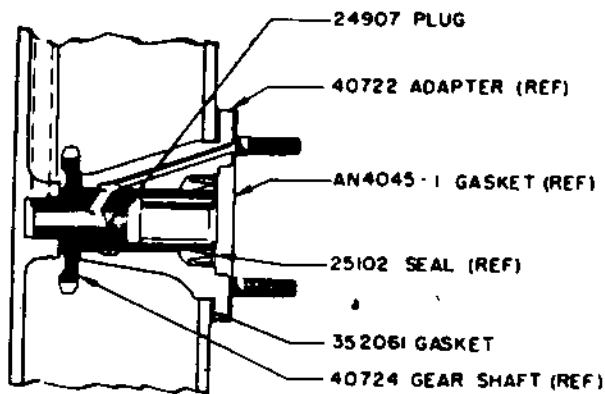


FUEL SYSTEM
FIGURE 1

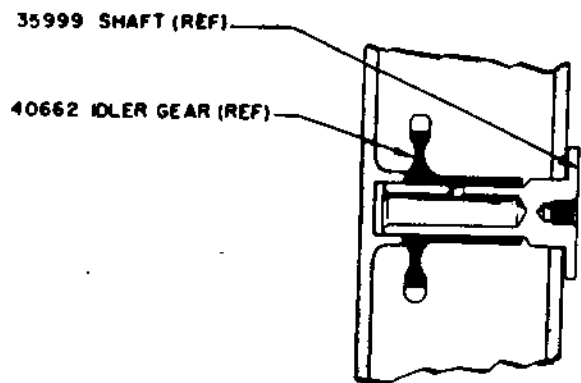


26NKM-02 NUT (1)
 145-52402-9 CABLE GUARD
 145-48072 HANDLE (1)
 145-48065 SUPPORT ASSEM. (1)
 145-48071 SPRING (1) REQ.
 NAS 220-13 (1)
 AN 960-8 (1)
 AN 365-832 (1)
 145-48074 SHAFT ASSEM. (1)
 145-48073 CABLE FAIRLEAD (1)
 AN 380-2-4 CUTTER PINS (2)
 145-48067 YOKE (1)
 145-48069 STOP (1)
 FROM ACCUMULATOR TANK
 FUEL SHUT-OFF VALVE
 DRILL OUT (2) EXISTING RIVETS & REPLACE WITH BOLTS UPON INSTALLATION OF BRACKET.
 FUEL STRAINER
 FUSELAGE SKIN (UNDERSIDE)
 STA. 93.43
 4 7/8
 3 1/8
 4 3/16
 3 1/8
 CARPET
 CABIN FLOOR
 TO ELECTRIC FUEL PUMP
 SHEET METAL SCREWS (2) REQ.
 ELBOW
 ORILL 1" HOLE THRU BAFFLE & INSTALL RUBBER GROMMET
 INSTALL ANGLE PART NO. 143-31007-38 TO STIFFEN SPAR WEB
 AN3-4A BOLTS (8)
 AN365 NUTS (8)
 WASHERS AN960 (8)

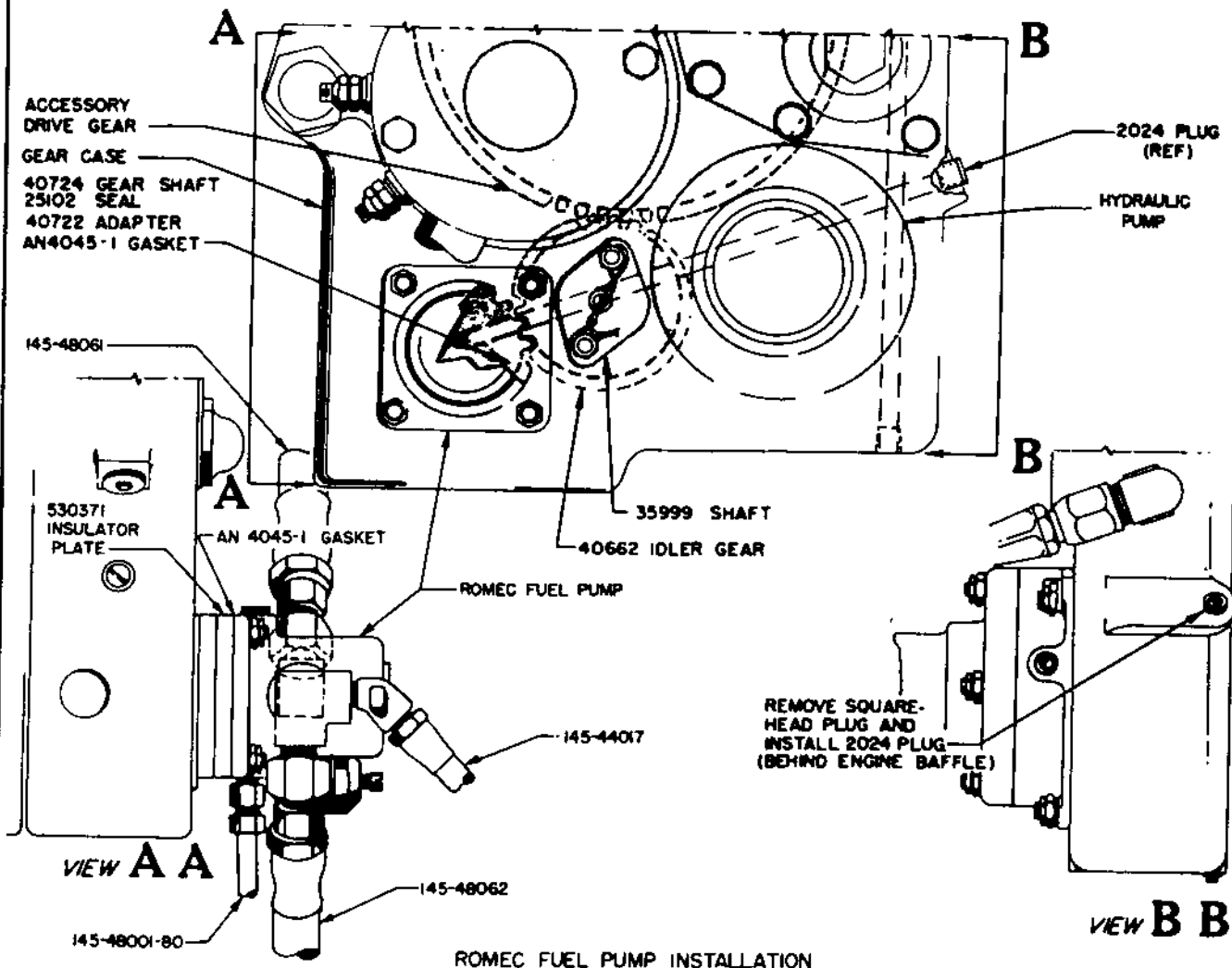
FUEL SHUTOFF CONTROL INSTALLATION
FIGURE 2



GEAR SHAFT AND ADAPTER INSTALLATION



IDLER GEAR INSTALLATION



ROMEc FUEL PUMP INSTALLATION

FIGURE 4

SPECIAL INSTRUCTIONS NO. 36 - REVISION A
DECEMBER 1, 1949

Page 1 of 5

ROMECC FUEL PUMP SYSTEM INSTALLATION

These instructions are provided for the installation of the Romecc Vane-type Engine Driven Fuel Pump, and Fuel Filter Screen for all Ryan manufactured Navions, serial number 1111 through 1270, and including all North American manufactured Navions, having the Adel Electric Fuel Pump Kit installed.

For airplanes having Gyro Instrument Panel with engine driven vacuum pump installed, see Note 3 at the end of these instructions.

Install Romecc Fuel Pump System Kit No. 145-89068 with Fuel Filter Screen, part No. 145-48080, as follows:

NOTES

READ THESE INSTRUCTIONS THROUGH CAREFULLY BEFORE STARTING INSTALLATION

EXTREME CARE must be exercised to prevent any foreign material from entering fuel system when making this installation.

See Figure 2 for paragraphs 1 through 5.

1. Drain airplane fuel system.
2. Inside of nose wheel well, remove 145-31019-3 strainer guard.
3. Remove Parker fuel shut-off valve located just aft of strainer, replace operating handle with 145-48069 and 145-48067 stop and yoke, secure to valve with AN500A10-6 cap screw, safety and reinstall valve in original position.
4. Place 145-48073 lower rudder cable fairlead onto top aft end of strainer bracket, flange side aft. Drill out two (2) No. 10 holes through bracket and attach with two (2) AN526-1032 screws and two (2) AN365-1032 nuts.
5. Directly above the centerline of valve just forward of floor angle, drill a 1/2 inch hole in floor. Cut a 1-1/2 inch x 3/4 inch corner out of 145-52402-9 floor cable guard for control shaft clearance. Place 145-48074 control shaft through 1/2 inch hole and secure to

valve yoke with two (2) AN380-2-4 cotter pins. Remove lower 3/16 inch bolt from in-board seat track wood block attachment. Drill a No. 10 hole in opposite side above 3/16 inch hole and install an AN545B8-4 wood screw. Place 145-48070 fuel selector support adapter over control shaft, attach with NAS220-13 bolt, AN960 washer and AN365-832 nut. Secure 145-48065 support assembly to floor over carpet and on side of seat track with two (2) screws and two (2) bolts. Install handle which was removed in paragraph No. 3 (see Note below) and secure with 26NKM-02 nut, making sure the "ON" and "OFF" position of valve corresponds with handle.

NOTE

It will be necessary to rework handle before installing, this can be accomplished by cutting off former stop lug with file or saw.

6. Remove right hand cooling access gill cover, remove 145-48001-49 line, (strainer to Adel pump) and install 145-48001-87 tube assembly to strainer.

See Figure 1 for paragraphs 7 through 11.

7. Remove manifold from Adel pump. This can be accomplished by removing two (2) cap bolts on the forward end of pump. Install new 145-48228 manifold assembly onto pump using new AN6227-B7 seals and original cap bolts. Tighten and safety.
8. Connect 75685 hose assembly to Adel pump manifold and attach to -87 line from strainer with 200 x 6 connector.
9. Install 200 x 6 connector, 145-48001-81 line assembly, 525FF1/4D valve and AN917-2D tee fitting in 145-48228 manifold assembly, as shown in Figure 1, Detail "A".
10. Remove 145-48001-47 fuel line (Adel pump to Deutsch valve). Remove Deutsch valve from firewall. Remove connector fittings from Deutsch valve and install in new 145-48232 fitting. Remove control from instrument panel and insert hole plug in hole left in panel. Install 145-48232 fitting in the former Deutsch valve location, using similar method of attachment.
11. Connect primer line and 145-48001-83 tube assembly from Adel pump to 145-48232 fitting.

See Figure 3 for paragraphs 12 through 17.

12. Locate and drill a 15/16 inch diameter hole in firewall 5-1/2 inches up from bottom, measuring adjacent to nose wheel torque box and 3-1/2 inches outboard from box side.

13. Install AN915-2 45 degree elbow in 1/4 inch hole in bottom of 145-48228 Adel pump manifold assembly.
14. Install pressure relief valve with flow arrow pointing aft into AN915-2 elbow.
15. Install filter assembly, part No. 145-48080, to firewall with aft port pointing down using an AN960-1616L washer and AN924-10D nut. Install an AN823-4 45 degree elbow in both ports of filter. (See Figure 3.)
16. Connect -114 tube assembly to AN823-4 fitting on filter screen.
17. Remove 145-48061 line from Carter pump. Connect opposite end to 145-48232 fitting, that replaced Deutsch valve.
18. Remove Carter fuel pump and install 145-48057 cover plate, using existing gasket, adding sufficient washers under nuts to properly tighten pad.

See Figure 4 for paragraphs 20 through 28.

19. Remove adapter pad on which hydraulic pump is mounted to engine, leaving gasket on case. (If gear becomes separated from adapter pad on removal, use extreme care not to damage seal during re-assembly of gear and adapter pad.)
20. Remove two (2) cover plates from aft end of engine accessory gear case, leaving gasket on case. Insert 352014 idler gear through large opening in case, position under small opening in mesh with main drive gear, and secure by installing 35999 shaft and 520004 gasket in small opening. Use two (2) screws removed with small cover plate to secure shaft to case, and safety with lock wire.
21. Remove square plug from oil passage galley on right side of engine accessory case and install 2024 plug in its place. (Romec fuel pump receives oil supply from this passage.) See View BB of Figure 4.
22. Reinstall hydraulic pump and adapter pad on original pad, using existing gasket, nuts and washers.

NOTE

Be sure gasket is located properly over small oil port, or it will seal opening and close off oil supply line.

23. Install two (2) 3350 x 4 elbows in Romec fuel pump port marked "in". Install 352 x 6 elbow and AN915-1 street elbow in 145-53307-10 special fitting stamped "S", and install in outlet port. Install 200 x 4

connector and 145-48001-78 tube assembly in drain hole at bottom of pump.

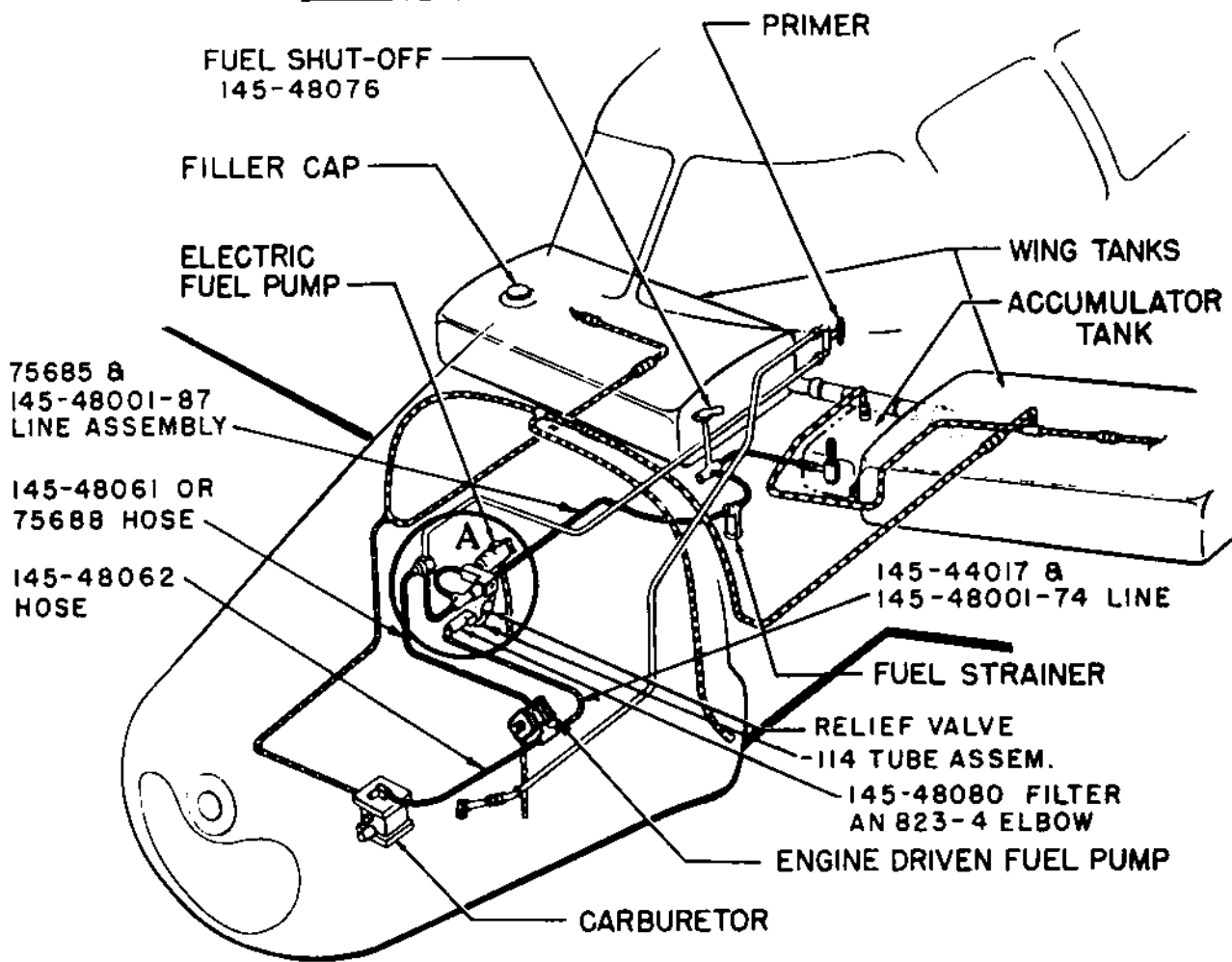
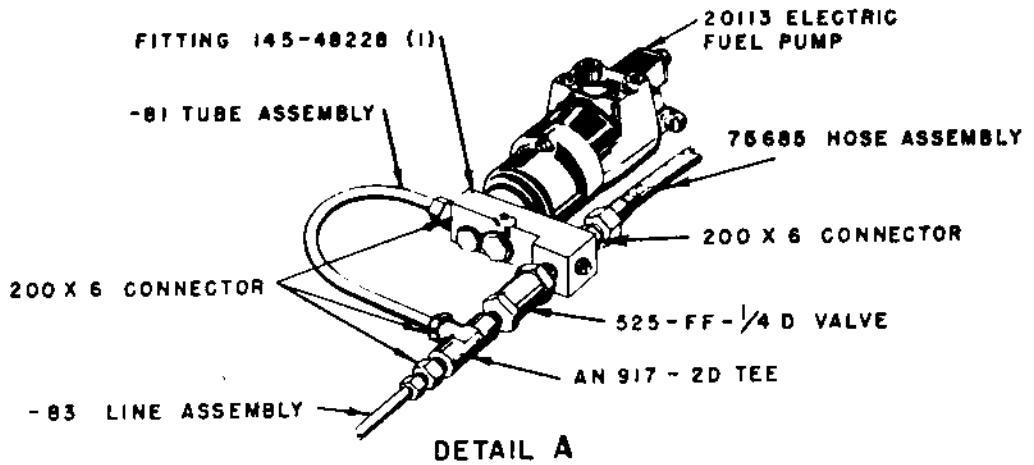
24. Remove four (4) studs from accessory pad on which Romec fuel pump will be mounted and install 530479-03 longer studs.
25. Install 24907 plug in shaft of 352018 gear. Insert 25102 oil seal in 530443 adapter and place adapter on 352018 gear. (Use extreme care not to damage seal during assembly of gear and adapter. (Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter into crank case. Place AN4045-1 gasket on adapter and place 530371 plate on adapter. Place another AN4045-1 gasket on spacer plate and install Romec fuel pump, using existing nuts and washers.
26. Route 145-48062 existing line from carburetor along right side of engine and connect to 350 x 6 elbow in 145-53307-10 "S" fitting in Romec pump. Attach 145-44017 line with 300 x 4 union and 145-48001-74 line assembly to -10 "S" fitting and -74 end to AN823-4 elbow installed forward of firewall in end of 145-48080 filter assembly, secure line with one (1) AN742-D6C clamp on nose gear firewall support channel. Attach 145-48061 line from fitting on firewall to 3350 x 4 elbow at inlet port of Romec fuel pump. Install 145-48001-80 tube with hose connection and A3122-10-59 clamps on -78 drain line in bottom of Romec pump and secure line in two (2) places with AN742D6C clamps.
27. Flush system thoroughly then connect -114 line to pressure relief valve, as shown in Figure No. 3.

IMPORTANT NOTES

1. Upon completion of this installation, adjust system fuel pressure by adjusting the 20448A pressure relief valve to relieve at 13-1/2 psi. This adjustment is accomplished as follows:
 - (a). Place carburetor mixture control in "idle cut-off" position and turn Adel electric fuel pump "on". Observe fuel pressure as indicated by fuel pressure gauge.
 - (b). If observed fuel pressure is too high, turn Adel pump "off" and loosen -114 line B nut at pressure relief valve inlet; also loosen jam nut on aft end of valve body and turn body of valve to the left so that inner part of valve turns out of outer body. This adjustment is fairly sensitive with

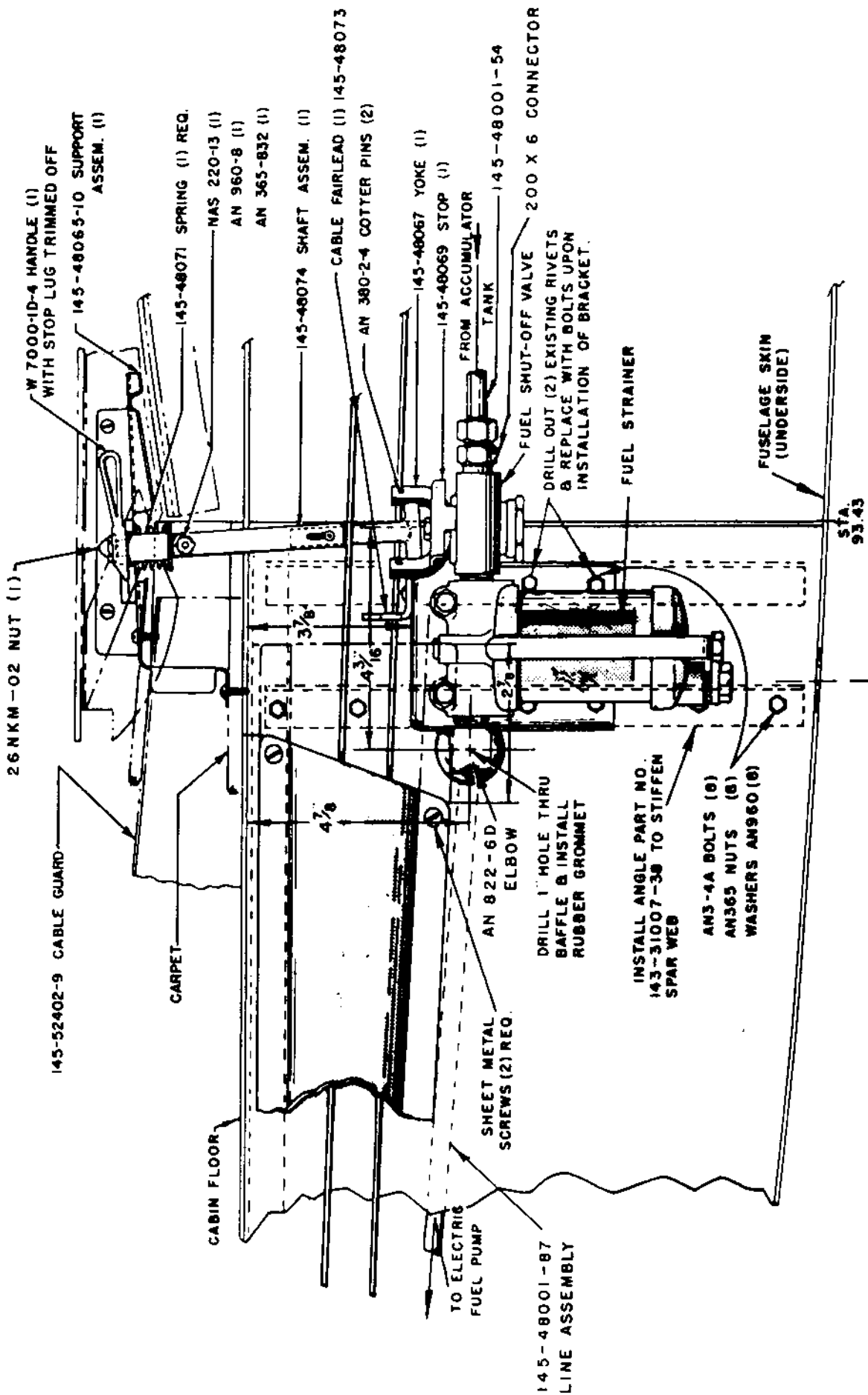
one half turn of the valve body changing fuel pressure approximately one pound.

- (c). If observed fuel pressure is too low, turn valve body to the right which screws inner part of valve further into body, which will increase fuel pressure.
 - (d). Tighten 20448A valve jam nut and -114 line B nut, loosened to facilitate adjustment, after each adjustment to prevent fuel leakage during test periods. Recheck the line B nut and valve jam nut for proper tightness after final adjustment. Fuel pressure should be the same regardless of whether one or both pumps are running.
2. The elimination of all suction air leaks is essential if the fuel system is to work satisfactorily. Fluctuating fuel pressure or a sudden lowering of fuel pressure may be caused by air leaks or presence of foreign material in the system.
 3. On airplanes having Gyro instrument panel with engine driven vacuum pump installed, it will be necessary to move hydraulic pump from its present location to the location of the vacuum pump. Remove the vacuum pump, and install venturi tubes as provided in supplemental instructions; also, the installation of the idler gear, shaft, adapter and adapter gear of these instructions will not apply as they have been previously installed with the vacuum pump kit.
 4. Insert revised pages in CAA Approved Operations and Limitations Manual.
 5. Form "ACA337" for Repairs and Alteration must be completed for this change.



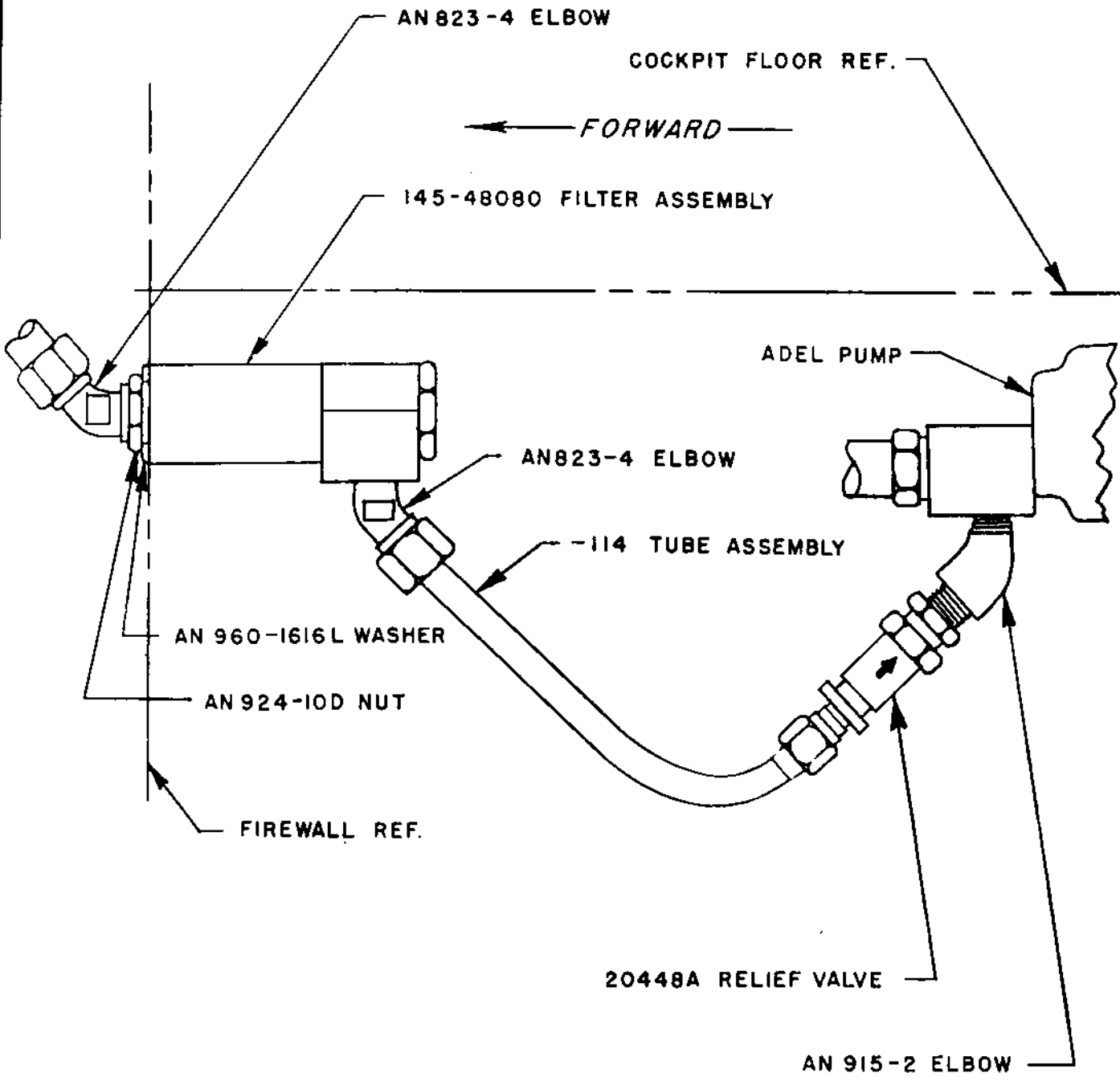
- FUEL
- PRIMER
- VAPOR RETURN
- VENT
- FUEL RELIEF

FUEL SYSTEM
FIGURE 1

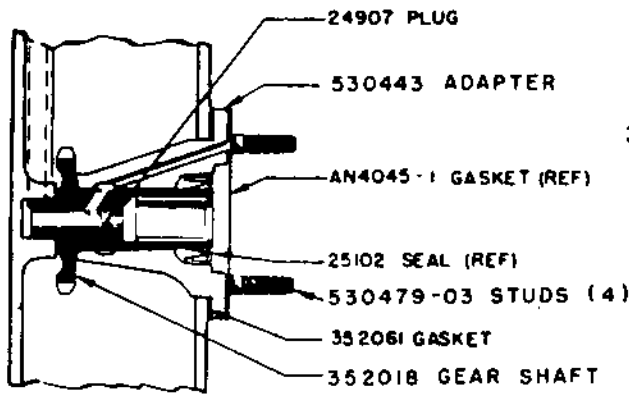


FUEL SHUTOFF CONTROL INSTALLATION

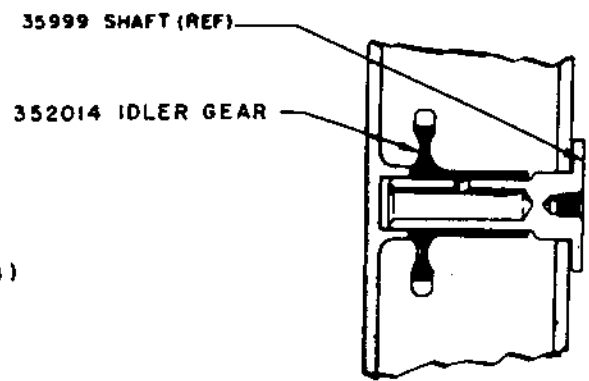
FIGURE 2



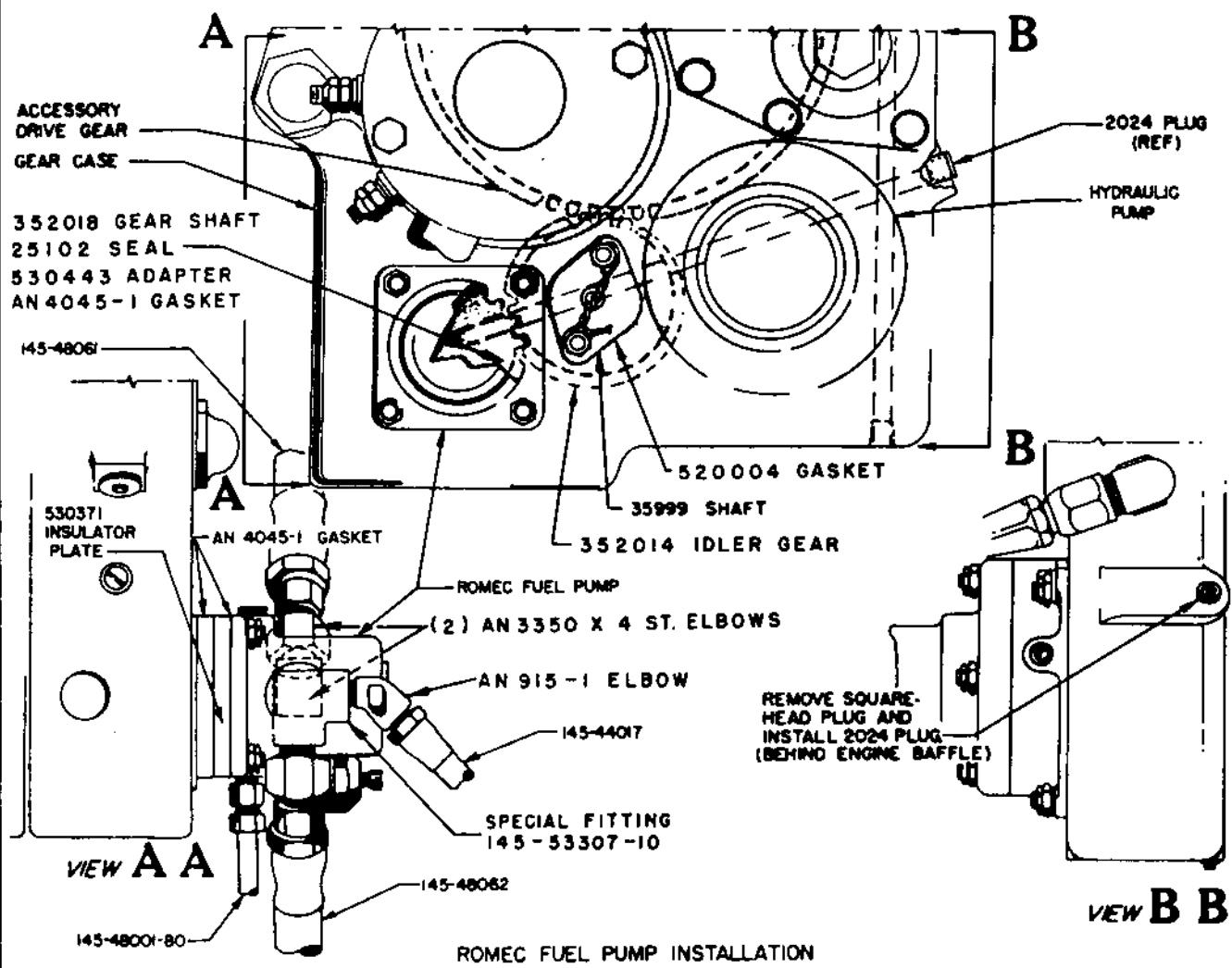
PRESSURE RELIEF VALVE AND FILTER INSTALLATION
 FIGURE 3



GEAR SHAFT AND ADAPTER INSTALLATION



IDLER GEAR INSTALLATION



ROME C FUEL PUMP INSTALLATION

FIGURE 4

SPECIAL INSTRUCTIONS NO. 37 - REVISION A
REVISED NOVEMBER 15, 1949

Page 1 of 8

ROMEC AND ADEL FUEL PUMP KIT

These instructions describe the installation of a Navion fuel system utilizing a Romec, vane type, engine driven fuel pump, and Adel, electrically driven, emergency fuel booster pump for Navions, factory serial No. NAV4-2 thru 1110 that do not already have an Adel emergency fuel pump installed.

NOTE

READ THESE INSTRUCTIONS THROUGH CAREFULLY BEFORE STARTING INSTALLATION

Install Romec-Adel Fuel Pump Kit, Dwg. No. 145-89068-10-20-40-50 according to the following instructions and as illustrated in Figures 1 through 9. These instructions are divided into four (4) parts. Part A covers relocation of the K2250B Fuel strainer and installation of the new 145-48076 Whittaker Fuel Shut-Off Valve Assembly. Part B describes installation of the 20113 Adel Electric Fuel Pump. Part C covers installation of the Romec Engine Driven Fuel Pump. Part D describes modifications necessary to the airplane electrical system.

PART A

1. Drain airplane fuel system.
2. Disconnect all fuel lines on engine compartment side of firewall and remove existing fuel strainer assembly.
3. Remove Deutsch D-51 fuel shut-off valve from firewall and remove primer line and fuel supply line connector fittings from valve and reinstall connectors in new bulkhead fitting, part No. 145-48232. Install one of the 200 x 6 connectors furnished with kit in end of bulkhead fitting which extends through firewall. Remove Deutsch D-51 valve control from instrument panel and insert hole plug in hole left in panel as a result of control removal. Install new bulkhead fitting, part No. 145-48232, in firewall opening formerly occupied by Deutsch valve and connect engine primer line to fitting.
4. Remove baffle, right hand, part No. 143-31001-202 and disconnect fuel lines running from accumulator tank outlet to fuel shut-off valve removed in step 3 above.

5. Remove curtain and snap fasteners in rear section of nose wheel well.
6. Remove cable guard, part No. 145-52203-9 and trim same to clear new strainer bracket as shown in Figure 2, also remove two anchor nuts formerly used to secure rear end of cable guard.
7. Reroute existing hydraulic line on right wall of wheel well so it will be above and clear of strainer installation described below.
8. To locate new 145-48055 strainer bracket assembly, measure down 3-7/8 inches from underside of cabin floor on aft end of nose wheel well right wall and draw a straight line parallel with floor. Place top edge of bracket on line and aft side even with aft edge of nose wheel well wall. (See Figure 2.) Drill out to 3/16 inch the two existing rivets that match holes on aft edge of strainer bracket, and add angle, part No. 143-31007-38 after strainer bracket has been located so that the two mounting bolts through forward edge of bracket will go thru angle flange. Make temporary installation of strainer bracket with four (4) 3/16 inch diameter bolts as shown in Figure 2.
9. To locate new fuel line hole in right wall of nose wheel wall, remove old bracket from strainer and install AN822-6D elbow in strainer outlet. Place strainer in position on new bracket and mark center of 1 inch fuel line hole to be drilled in nose wheel well wall. Remove strainer and bracket to facilitate drilling the 1 inch hole as shown in Figure 2.
10. On underside of fuselage (right hand side) measure 4-1/4" out-board from airplane centerline and 3" forward of station 93.43. At this point, which is directly under fuel strainer drain, drill a 1" diameter hole in skin as shown in Figure 8.
11. Mount bracket, part No. 145-48055, to nose wheel well wall, using four (4) AN3-4A bolts, four (4) AN365 nuts and four (4) AN960 washers. See Figure 2.
12. Install Whittaker fuel shut-off valve assembly, part No. 145-48076 in fuel strainer, part No. K2250B and install 200 x 6 inverted male connector in inlet port of valve.
13. Connect aft end of tube assembly, part No. 145-48001-54 to accumulator tank outlet, then mount fuel strainer assembly on new bracket and connect forward end of 145-48001-54 tube assembly to Whittaker fuel shut-off valve inlet.
14. To install Whittaker fuel shut-off valve control and mounting, directly above the centerline of valve, just forward of floor angle, drill a 1/2" hole in floor. Cut a 1-1/2" x 3/4" corner out of floor cable guard, part No. 145-52402-9 for control shaft clearance. Place control shaft,

part No. 145-48074, through 1/2" hole and secure to valve yoke with two (2) AN380-2-4 cotter pins. Remove lower 3/16" bolt from in-board seat track wood block attachment. Drill a No. 10 hole in opposite side above 3/16" hole and install AN545-B8-4 wood screw. Place fuel selector adapter, part No. 145-48070, over control shaft, attach with NAS220-13 bolt, AN960 washer and AN365-832 nut. Secure support assembly, part No. 145-48065, to floor over carpet and on the side of seat track with two (2) screws and two (2) bolts. Install handle, part No. 145-48072, and secure with 26NKM-02 nut. (See Figure 2.)

15. Reinstall cable guard, part No. 145-52203-9, and add two sheet metal screws as shown in Figure 2.
16. Locate strainer guard plate, part No. 145-31019-3, in rear of nose wheel well, 2-1/4 inches forward of station 93.43 as shown in Figure 3. With Dzus fastener clips attached to plate, rivet clips to floor and skin, using two (2) rivets per clip.

PART B

1. Rivet asbestos insulation, part No. 143-31001-100, to inside of baffle, part No. 143-31001-50, previously removed, using ten (10) AD4-2R1 rivets and ten (10) AN960-AD4 washers as shown in Figure 8.
2. On underside of cabin floor, between station 65 and 77, measure to the right of airplane centerline 13-5/16 inches and mark a line parallel to the centerline at this point. Locate angle, part No. 143-31002-63, on line as shown in Figure 5. With a No. 30 drill, drill out the twelve (12) holes through angle and floor and rivet angle in place with AN4-2R1 rivets.
3. Drill out to 1/4 inch through the cabin floor the two (2) pilot holes indicated in the 145-31002-63 angle as shown in Figure 5. Also locate and drill two additional 1/4 inch Adel pump mounting bolt holes parallel with the two 1/4 inch holes through 145-31002-63 angle. (See Figure 5 for hole layout.)
4. Locate baffle, part No. 143-31002-62, against station 77 frame. Drill six (6) holes through frame and baffle and attach with sheet metal screws. (See Figure 6.)
5. Insert rubber grommet, part No. AN931-6-16, in baffle, part No. 143-31002-62, and install fuel line assembly comprised of 75685 hose assembly and tube, part No. 145-48001-87, through baffle to fuel strainer outlet port.
6. Install Adel electric fuel pump, part No. 20113, with manifold and valve assembly attached. (See detail on Figure 1.) Secure pump to underside of cabin floor with four (4) AN515-416R7 machine screws, two (2) AN960-416L washers for shims under floor and four (4) AN935-416 lock washers. Install cover, part No. 145-48001-63, over screw heads on top surface of cabin floor. (See Figure 5.)

NOTE

Remove paint where pump body contacts floor for good electrical bond.

7. Directly under electric pump drain, drill 7/16" hole in skin. Install rubber grommet. Attach drain line 145-48001-52 to pump, cut off excess line, so as to leave 1/4" extending through skin. Location shown in Figure 8.
8. Measure 1" forward of pump drain line and drill 3/4" hole in skin for air vent.
9. Locate louvre, part No. 145-48058, on outside of skin over vent hole and drain line with open end aft as shown in Figure 8. Rivet louvre in place using five (5) AD4-2R1 rivets.
10. Install fuel line assembly, part No. 145-48001-83, to AN917-2D tee on Adel fuel pump manifold and to firewall fitting, part No. 145-48232. Connect 75685 hose assembly, on line from fuel strainer, to Adel fuel pump manifold, inlet port. (See detail on Figure 1.)
11. Install filter assembly, part No. 145-48080, on firewall by drilling a 15/16" diameter hole in firewall 5-1/2 inches up from bottom of fuselage and 3-1/2 inches out-board from right nose wheel well wall in Adel pump compartment. Make all measurements adjacent to outer side of nose wheel well wall.
12. Install filter assembly, part No. 145-48080, to firewall with aft port pointing down using an AN960-1616L washer and AN924-10D nut. Install an AN823-4 45 degree elbow in both ports of filter. (See Figure 9.)
13. Install AN915-2 elbow in bottom port of Adel pump manifold and connect relief valve, part No. 20448A to elbow with arrow on valve body pointing aft or toward Adel pump.
14. Connect tube assembly, part No. 154-48001-114, between aft port of filter assembly and pressure relief valve as shown in Figure 9.
15. Drill a 3/8 inch diameter drain hole in fuselage skin 1/2 inch forward of frame at station 77 and 1/2 inch outboard of nose wheel well wall as shown in Figure 8.

PART C

1. Remove tee fitting from carburetor and replace with existing fitting, part No. 145-53307, removed from left hand Carter fuel pump.

NOTE

Aircraft with cabin heater installation should have heater fuel line transferred with special fitting from left hand fuel pump to carburetor.

2. Reconnect to carburetor the existing 75695 hose assembly, formerly used between right hand Carter fuel pump and carburetor.
3. Remove left and right hand engine fuel pumps and hose assemblies. Cover engine fuel pump mounting pads with plate, part No. 145-48057, using existing gaskets.

NOTE

It will be necessary to use several AN960-416 washers on studs in order to properly tighten plate to pad.

4. Install AN931-4-16 grommet in hole left by left hand pump outlet hose assembly in engine mount frame.

See Figures 1 and 4 for clarification of following steps.

5. Remove adapter pad on which hydraulic pump is mounted to engine, leaving gasket on case. (If gear becomes separated from adapter pad on removal, use extreme care not to damage seal during re-assembly of gear and adapter pad.)
6. Remove the two (2) cover plates from aft end of engine accessory gear case, leave gaskets on case. Insert 352014 idler gear through large opening in case, position under small opening in mesh with main drive gear, and secure by installing 35999 shaft and 520004 gasket in small opening. Use the two (2) screws removed with the small cover plate to secure shaft to case, and safety with lock wire.
7. Remove square head plug from oil passage galley on right side of engine accessory case and install plug, part No. 2024, in its place. (See view BB of Figure 4.)
8. Reinstall hydraulic pump and adapter pad from where it was removed, using existing gasket, nuts and washers.

NOTE

Be sure gasket is located properly over small oil port or it will seal opening, and close off oil supply line.

9. Install two (2) elbows, part No. 3350 x 4 in Romec fuel pump port marked "in". Install one elbow, part No. 352 x 6, and one street elbow, part No. AN915-1, in special fitting, part No. 145-53307-10 stamped "S", and install this assembly in "outlet" port of Romec fuel pump. Install connector, part No. 200 x 4, and tube assembly, part No. 145-48001-78, into drain port at bottom of Romec pump.
10. Remove the four studs on accessory pad on which Romec fuel pump will be mounted, install the 530479-03 longer studs.
11. Install 24907 plug in shaft of 352018 gear. Insert 25102 oil seal in 530443 adapter, and place adapter on 352018 gear. (Use extreme care not to damage seal during assembly of gear and adapter. Open side of seal should face gear.) Place 352061 gasket on adapter and insert adapter into crank case. Place AN4045-1 gasket on adapter and place part No. 530371 insulator plate on adapter. Place another AN4045-1 gasket on insulator plate and install Romec fuel pump, using existing nuts and washers. (See Figure 4.)
12. Reroute existing line, part No. 145-48062, from carburetor along right side of engine and connect to 350 x 6 elbow in special fitting, part No. 145-53307-10 "S", on Romec pump.
13. Connect hose assembly, part No. 145-44017, to line assembly, part No. 145-48001-74, with a 300 x 4 union and install this line assembly to the AN915-1 elbow in special fitting on Romec pump and to the AN823-4 elbow in forward end of filter assembly, part No. 145-48080, on firewall. Secure line with one (1) AN742-D6C clamp to nose gear firewall support channel.
14. Attach line, part No. 145-48061, to 200 x 6 connector in bulkhead fitting on firewall, part No. 145-48232, and to 3350 x 4 street elbow in "inlet" port of Romec pump.
15. Install tube assembly, part No. 145-48001-80, onto Romec pump drain tube assembly, part No. 145-48001-78, with hose connection and two A3122-10-59 hose clamps. Secure line in two places with AN742D6C clamps and route line so that outlet end terminates at aft edge of left side engine cooling air exit duct.

PART D

See Figure No. 7.

1. On left side of control panel, 1-3/8" in-board of landing gear indicator dimmer switch, drill a 1/2" hole and install switch, part No. 8396K7, with wires attached.
2. Disconnect wire from instrument light circuit breaker and attach it to position light circuit breaker.

3. Connect fuel pump wire No. 127 from switch, part No. 8396K7 to 5 amp. circuit breaker, formerly used for instrument lights.
4. Install identification decal on instrument panel directly over fuel pump switch.
5. Route No. 128 wire along with other wiring harness wires through fire-wall and over to the right.
6. Connect wire No. 129 with plug attached to Adel fuel pump. Route wire over to nose gear indicator position switch wires, through fire-wall, up to and connect to wire No. 128 with quick disconnect provided. Slip vinylite tube over disconnect and tie on each end to keep from shifting. For wiring diagram, see Figure 7.
7. Apply appropriate decals, furnished with kit, to air deflector, circuit breaker panel and instrument panel.

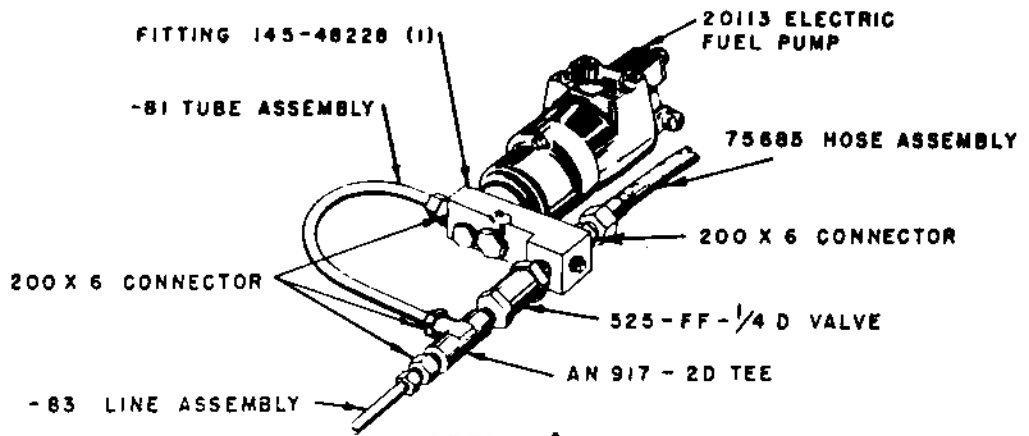
IMPORTANT NOTES

1. Extreme care must be exercised to keep all lines and fittings free from dirt and chips during the installation of this kit, as foreign material in circulation is the one thing most apt to cause malfunction of any modern aircraft fuel system.
2. Upon completion of the installation, adjust system fuel pressure by adjusting the 20448A pressure relief valve to relieve at 13-1/2 psi. This adjustment is accomplished as follows:
 - (a). Place carburetor mixture control in "idle cut-off" position and turn "on" Adel electric fuel pump. Observe fuel pressure as indicated on fuel pressure gauge.
 - (b). If observed fuel pressure is too high, turn Adel pump off and loosen line B nut at pressure relief valve inlet; also loosen jam nut on aft end of valve body and turn body of valve to the left or so that inner part of valve turn out of outer body. This adjustment is fairly sensitive with one half turn of the valve body changing the pressure approximately one pound.
 - (c). If observed fuel pressure is too low, turn valve body to the right so as to screw inner part of valve further into body, which will increase fuel pressure.

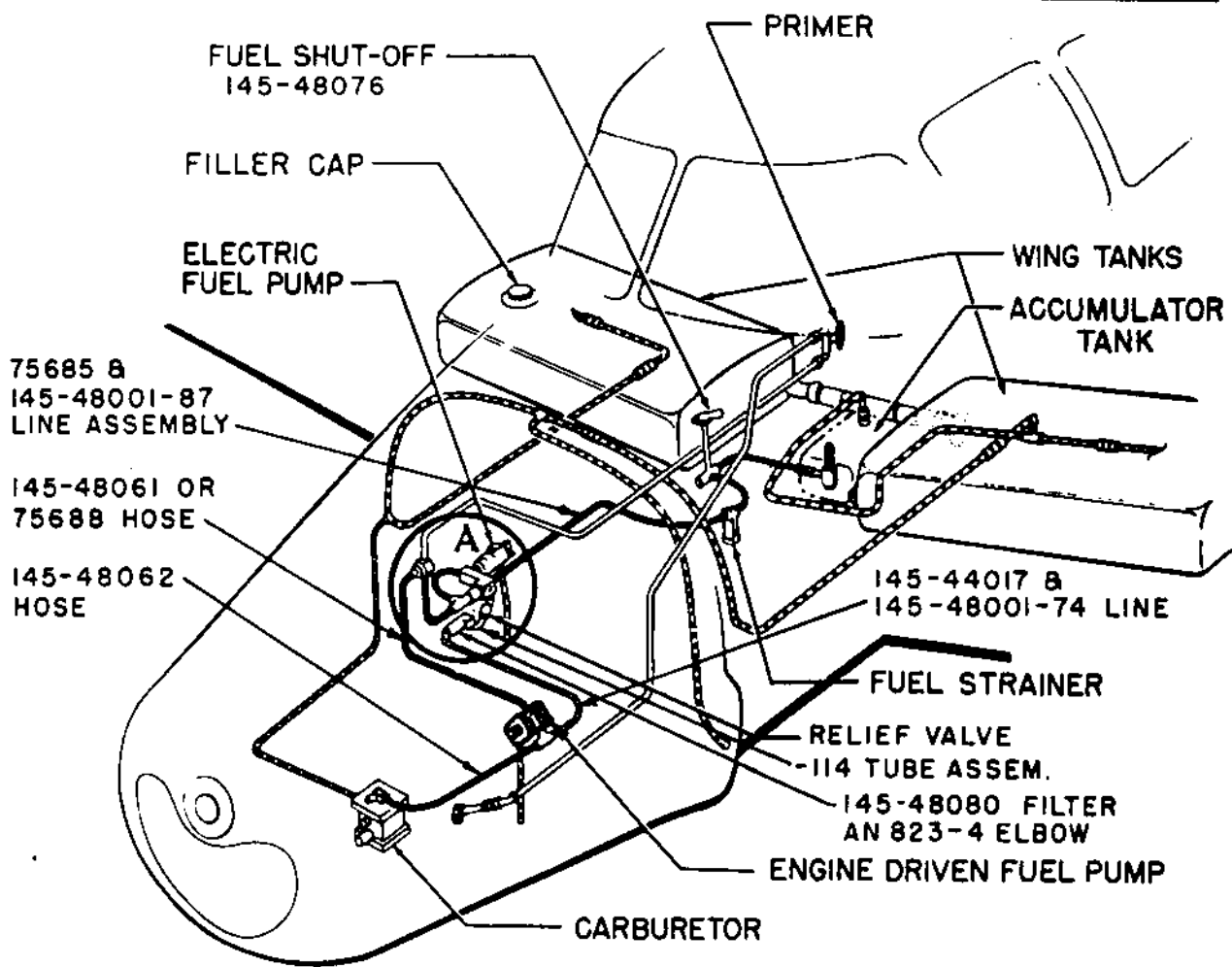
- (d). Tighten valve jam nut and line B nut, loosened to facilitate adjustment, after each adjustment to prevent fuel leakage during test periods. Recheck the line B nut and valve jam nut for proper tightness after final adjustment. Fuel pressure should be the same regardless of whether or not one or both pumps are running.
3. The elimination of all suction air leaks is essential if the system is to work satisfactorily. Fluctuating fuel pressure or a sudden lowering of fuel pressure may be caused by air leaks or the presence of foreign material in the system.
4. On airplanes having Gyro instrument panel with engine driven vacuum pump installed, it will be necessary to move hydraulic pump from its present location to the location of the vacuum pump. Remove the vacuum pump, and install venturi tubes as provided in supplemental instructions; also, the installation of the idler gear, shaft, adapter and adapter gear of these instructions will not apply as they had previously been installed with the vacuum pump kit.

Insert revised pages in Operation Manual.

Form "ACA337" for Repairs and Alteration must be completed for this change.

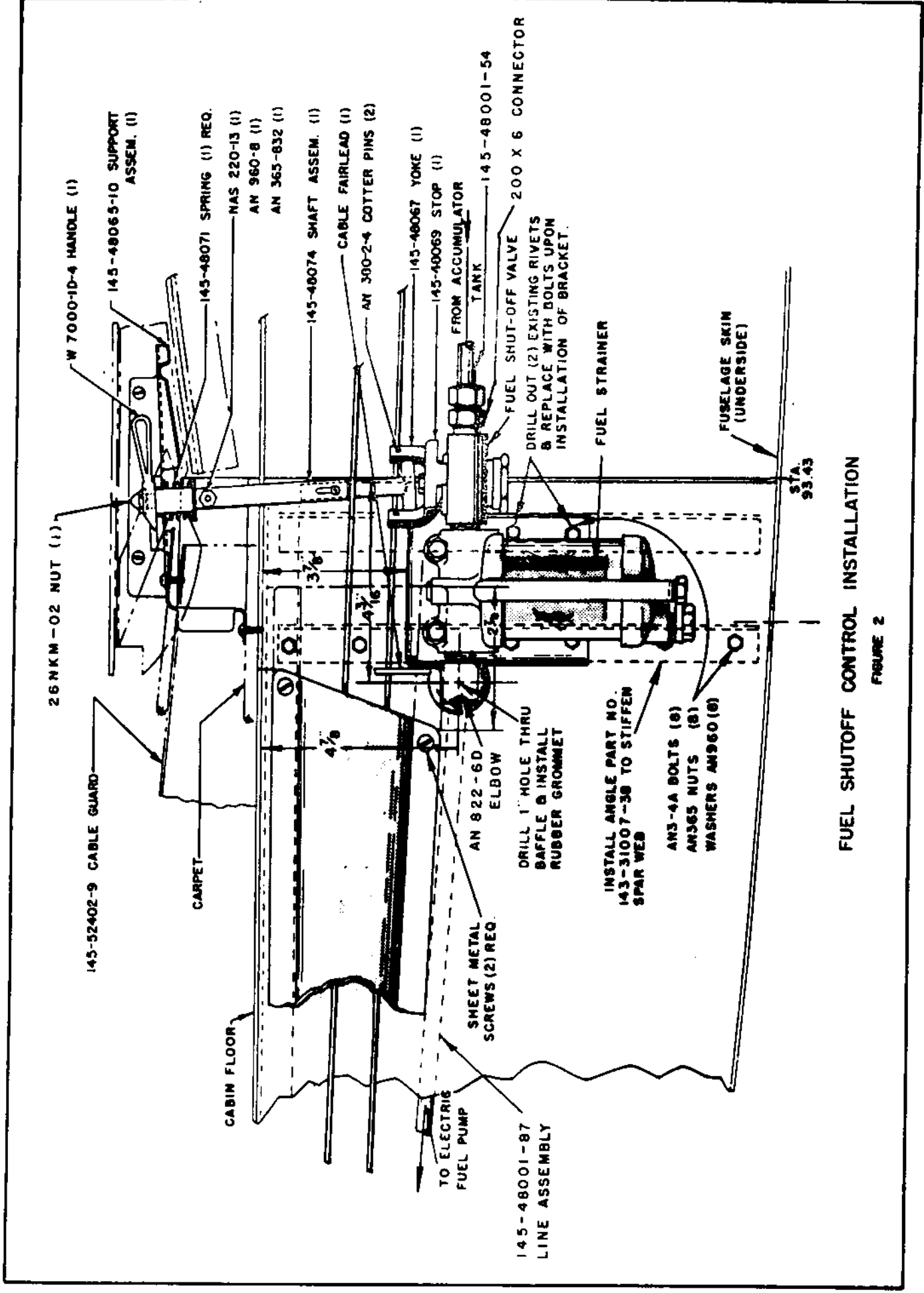


DETAIL A

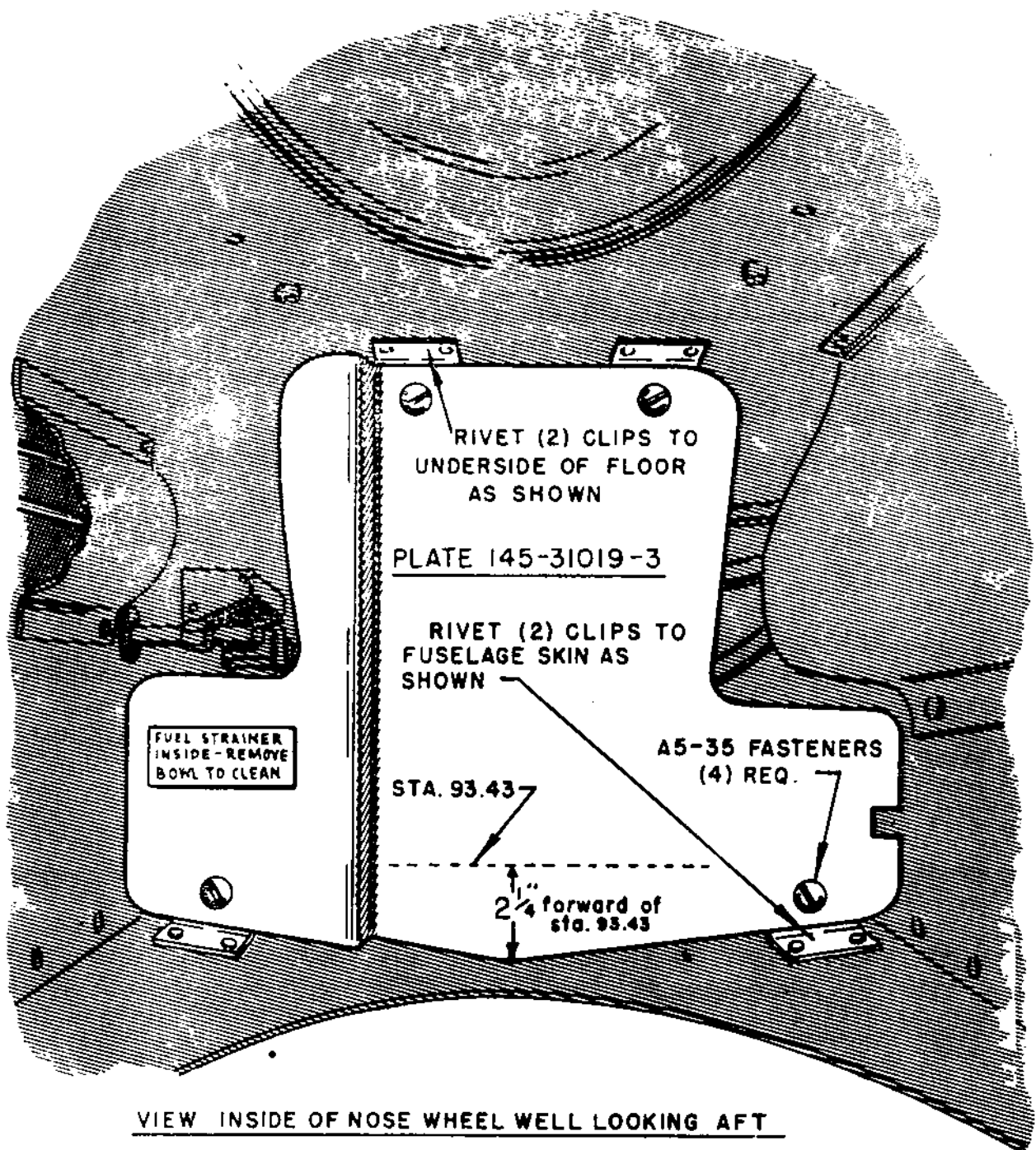


- FUEL
- PRIMER
- VAPOR RETURN
- VENT
- FUEL RELIEF

FUEL SYSTEM .
FIGURE 1

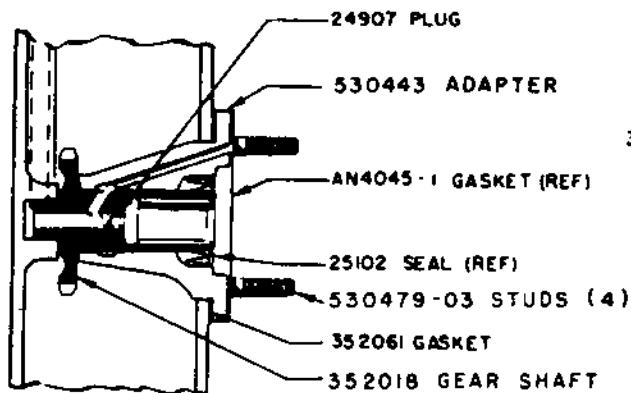


FUEL SHUTOFF CONTROL INSTALLATION
 FIGURE 2

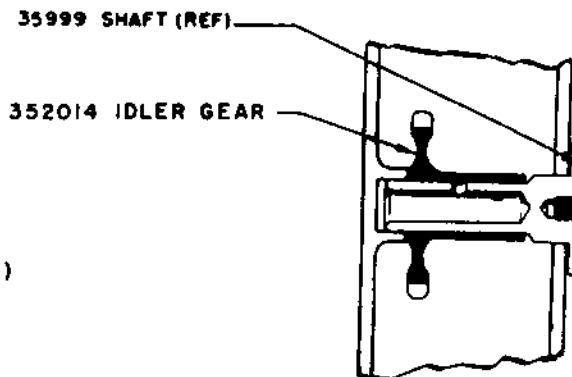


VIEW INSIDE OF NOSE WHEEL WELL LOOKING AFT

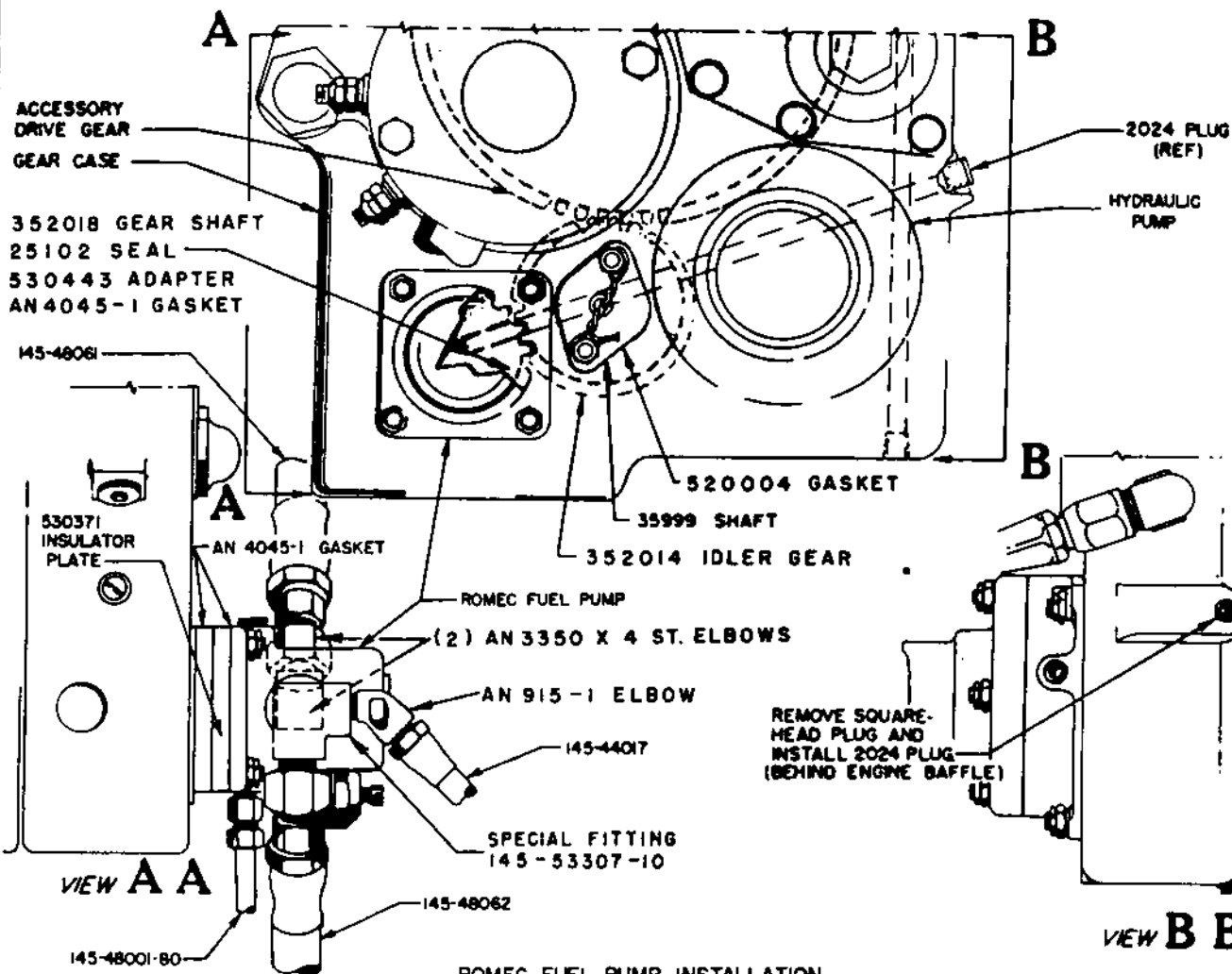
INSTALLATION OF
 STRAINER GUARD PLATE
 FIGURE 3



GEAR SHAFT AND ADAPTER INSTALLATION

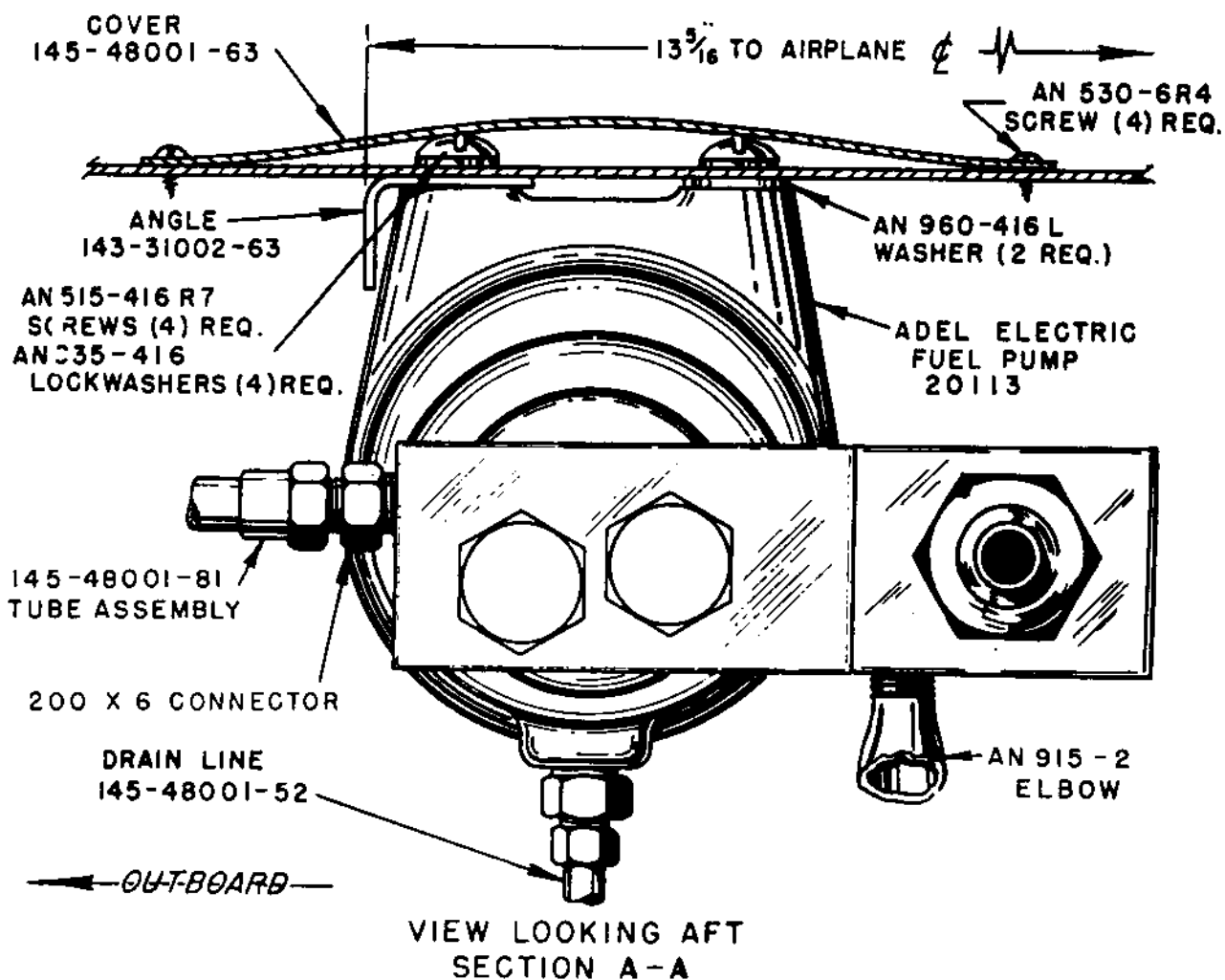
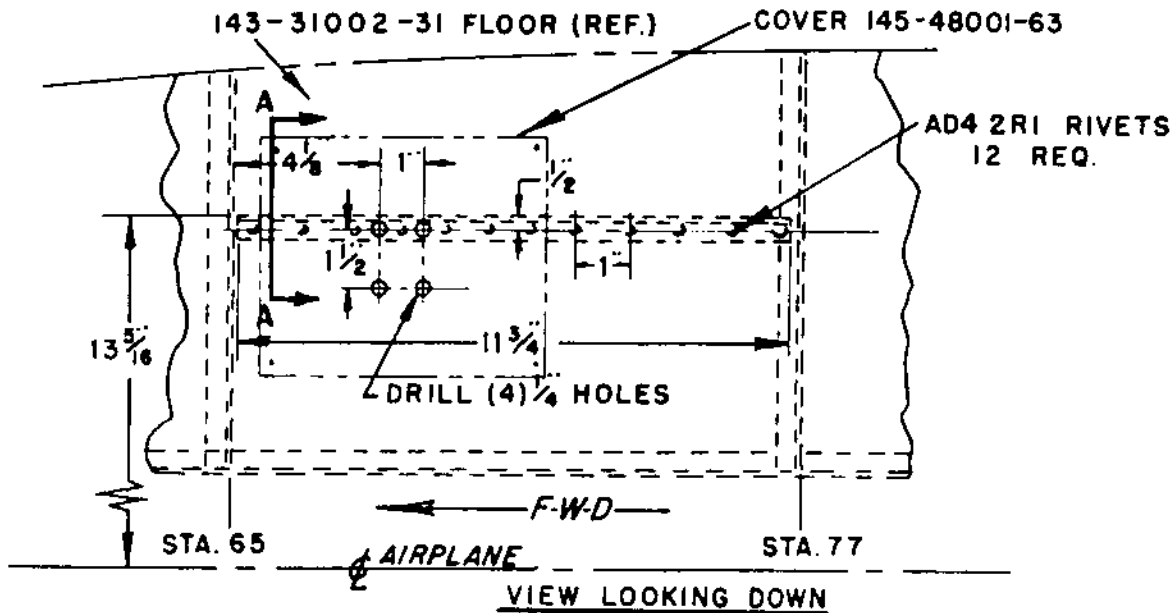


IDLER GEAR INSTALLATION

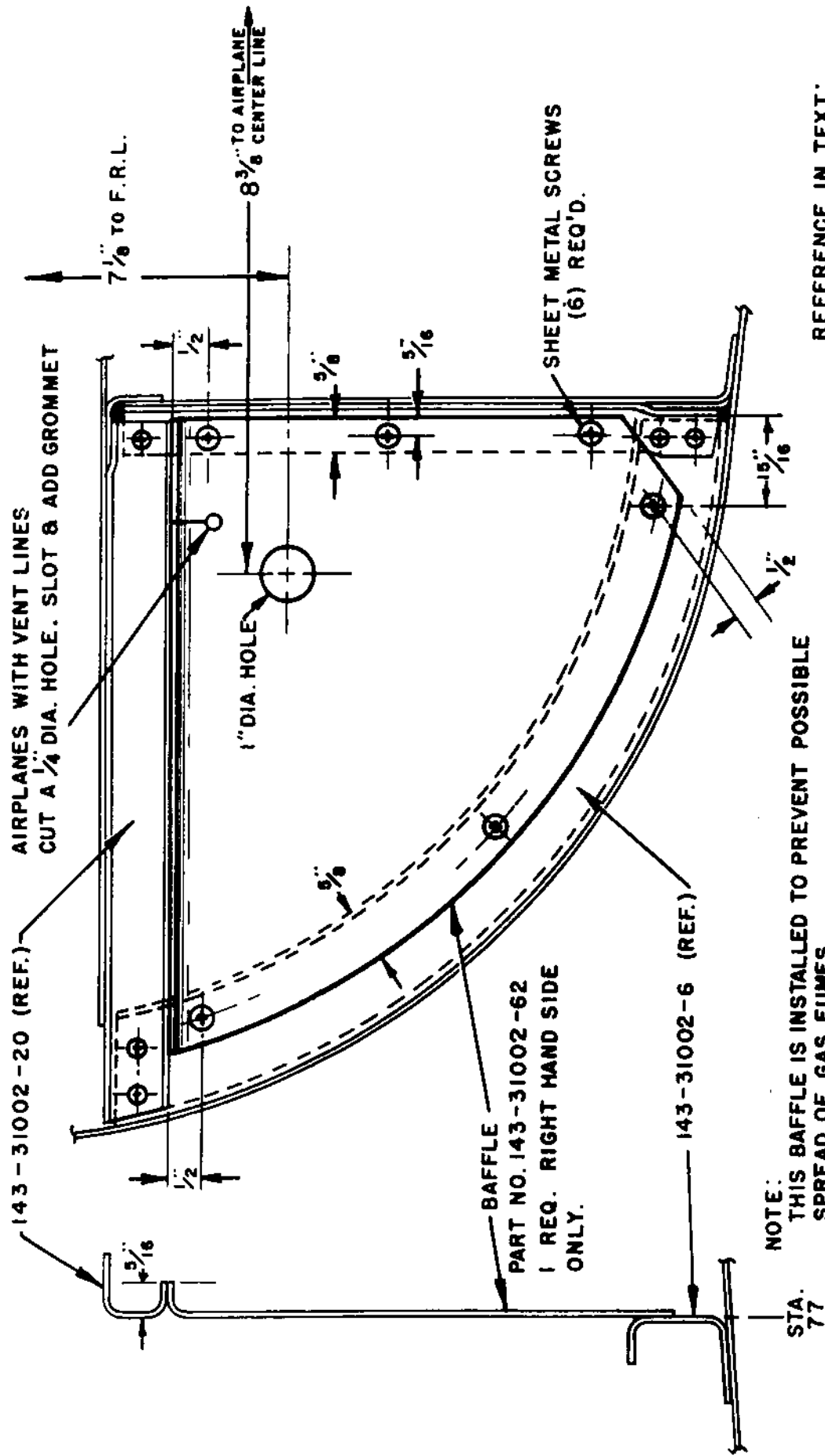


ROMEc FUEL PUMP INSTALLATION

FIGURE 4



INSTALLATION OF ELECTRIC FUEL PUMP
FIGURE 5

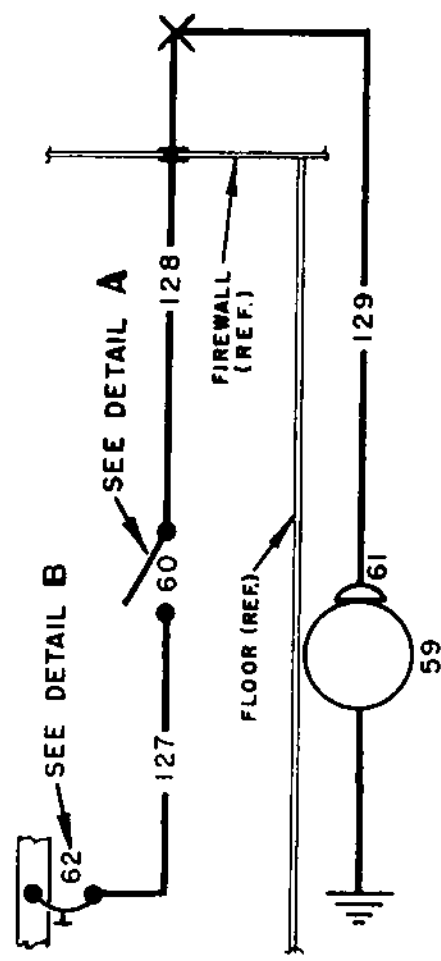
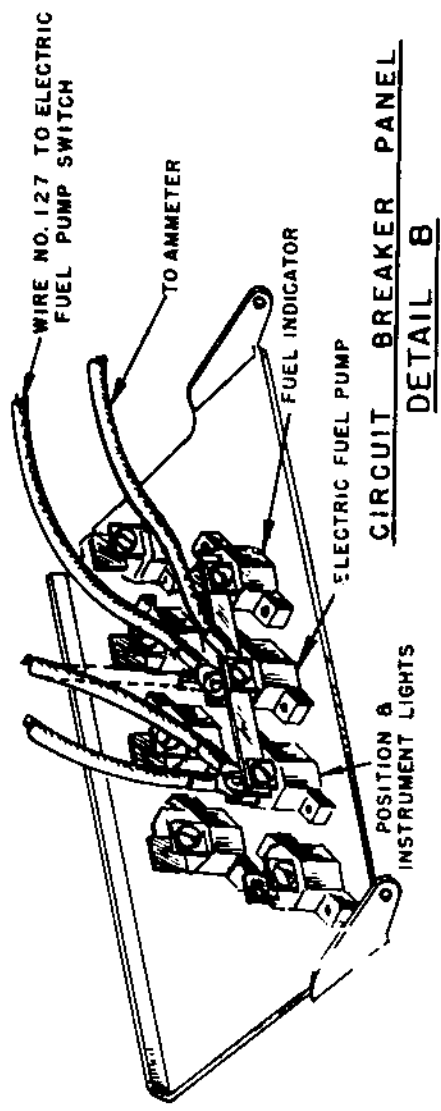


NOTE:
THIS BAFFLE IS INSTALLED TO PREVENT POSSIBLE
SPREAD OF GAS FUMES.

STA.
77

REFERENCE IN TEXT:
PART B PARAGRAPHS
4 AND 5.

INSTALLATION OF BAFFLE STA. 77
FIGURE 6

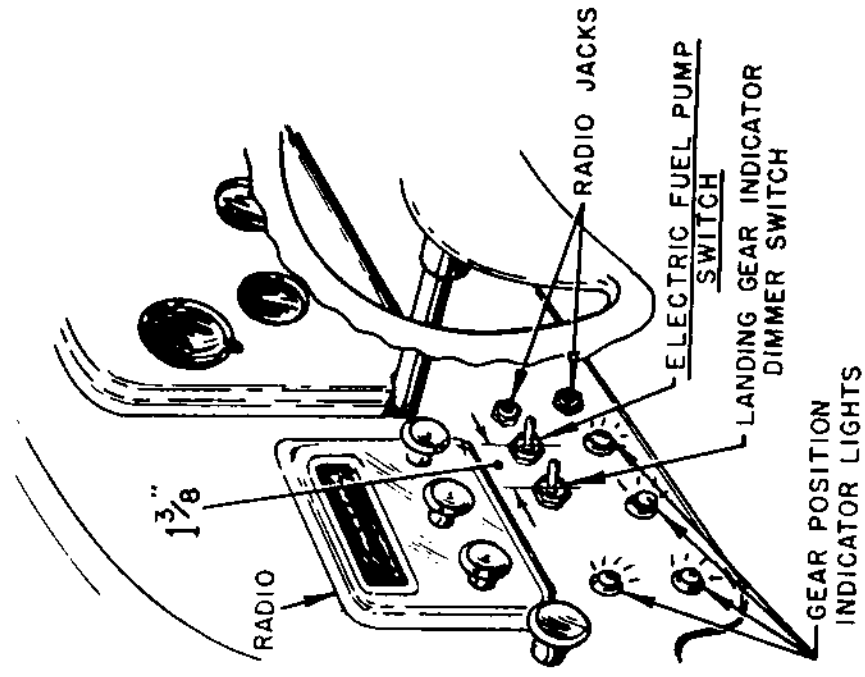


WIRE CHART

WIRE NO.	GAUGE	LENGTH
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128	18	40"
129	18	54"

ITEM CHART

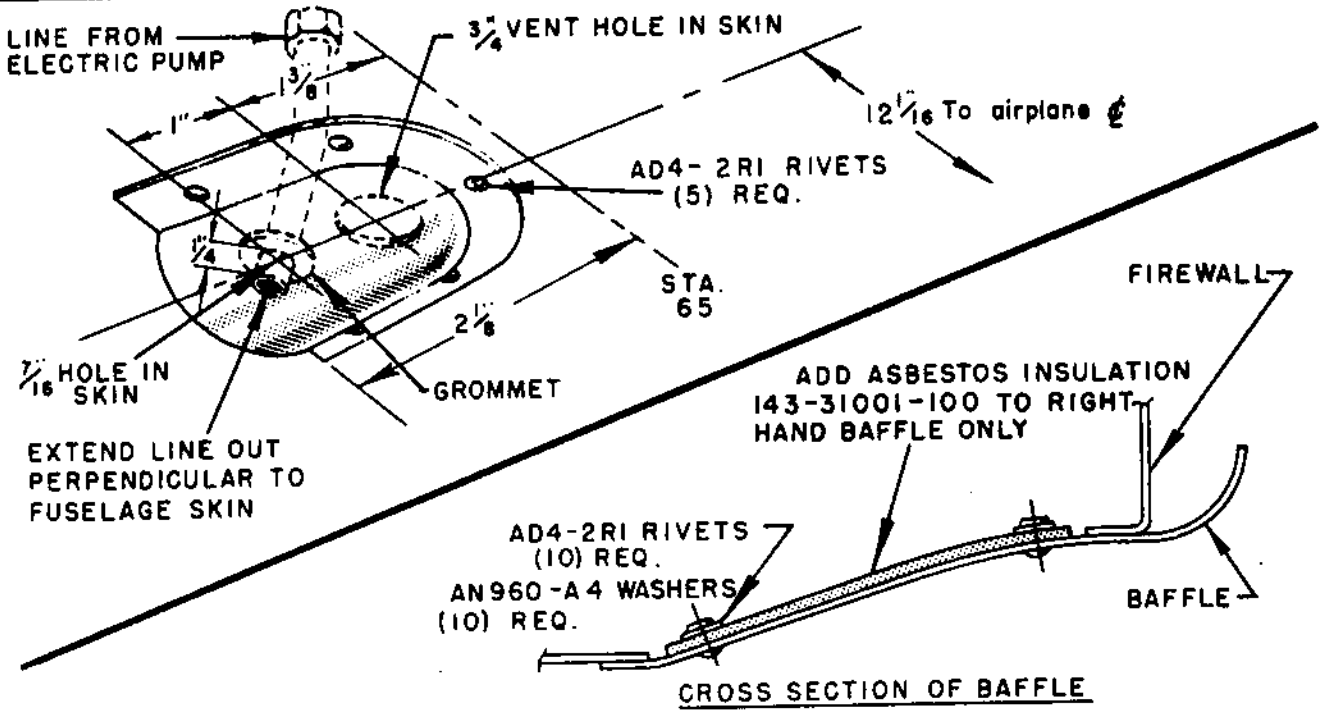
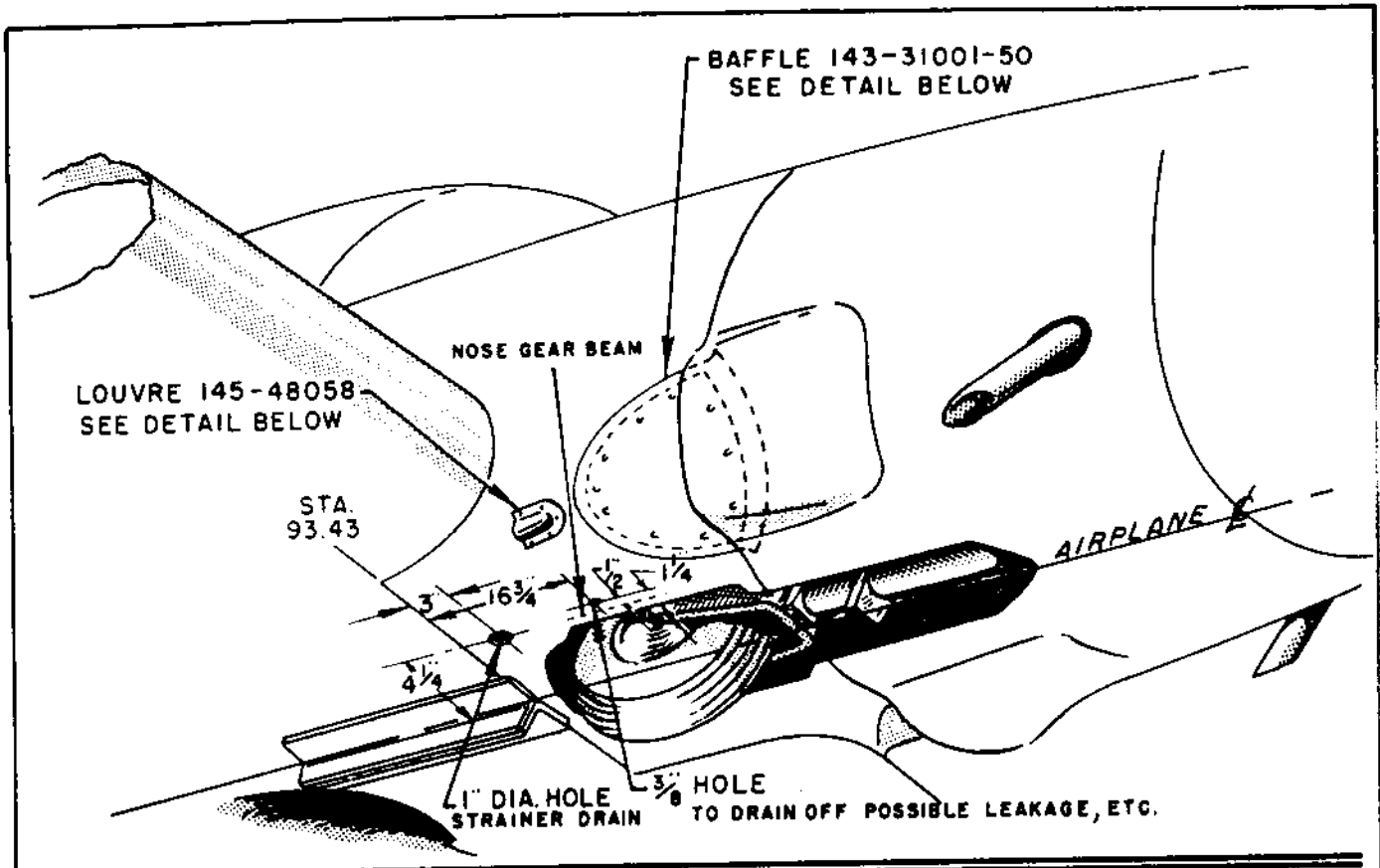
ITEM NO.	DESCRIPTION	PART NO.
59	PUMP, ELECTRIC FUEL	ADEL
60	SWITCH, ELECTRIC FUEL PUMP	8396-K7
61	PLUG DISCONNECT	AN-3106 103-25
62	5A. CIRCUIT-BREAKER	CM-5



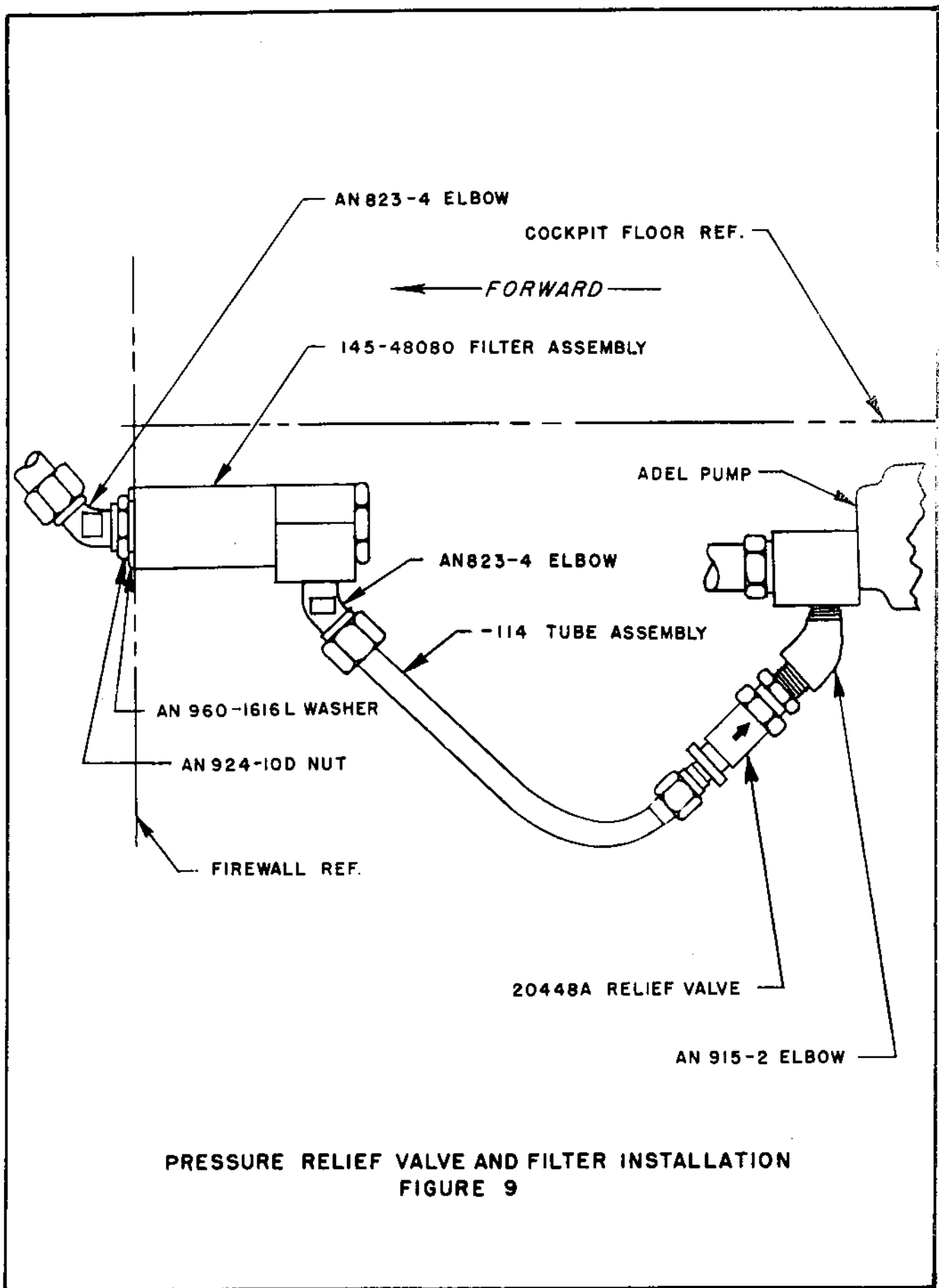
LOCATION OF
ELECTRIC FUEL PUMP SWITCH
DETAIL A

ELECTRICAL INSTALLATIONS
FIGURE 7

WIRING DIAGRAM



LOCATION OF DRAIN HOLES
AND
BAFFLE INSULATION
FIGURE 8



PRESSURE RELIEF VALVE AND FILTER INSTALLATION
 FIGURE 9

SPECIAL INSTRUCTIONS NO. 38

APRIL 1, 1949

AUXILIARY UNDER SEAT FUEL TANK

Kit Auxiliary Fuel Tank Under Seat Type, Ryan Dwg. No. 145-89067, Catalog Items Nos:

746 Applicable on NAV-4-2 through 1627 with the Adel Carter Fuel System or the Adel Romec Fuel System Installed

746-100 Applicable on NAV-4-1790 and Subsequent

Install as follows:

1. Remove rear seat, rear upholstery side panels, left hand arm rest, rear seat kick panel, 2 access cover holes in fairing and rear carpet.
2. Remove the center seat support tube from the forward baggage floor cross channel, the 143-31003-24 angle from the forward side of channel and relocate to the left hand aft side, drill out holes in channel through -24 angle and secure with five (5) AN3-3A bolts, AN960-10 washers and AN365-1032 nuts. Locate the new 143-53003-100 seat support angle on top of baggage floor centered in channel and floor bracket. Drill 1/4" hole and attach with AN4-5A bolt and AN365-428 nut. Remove the cable support angle located across the center lighting hole. Reroute cable under baggage channel and through flap drive bracket.

NOTE: On 1949 model Navions this angle, seat bracket and canopy cable has previously been relocated.

3. Bevel off the forward vertical flanges of 145-52022-5 and -6 flap operating support bracket angles, by starting at a point 6-1/2" from aft end and cutting to the flat flange at forward end.
4. Move canopy assist cable housing located on the top of the wing, to the right hand side of centerline of airplane; secure to floor with same screw and clip.

SPECIAL INSTRUCTIONS NO. 38

5. Remove antenna load coil from present location on the forward side of baggage floor channel and relocate by placing -149 bracket support against skin and station 142 $\frac{1}{2}$ frame, just above battery box. Drill out and rivet in place with five (5) $\frac{1}{8}$ " rivets, attach load coil to bracket.

NOTE: 1949 model Navions, item five (5) will not apply.

6. Install 145-53335 baffle by pressing down tight against the wing skin and back baggage floor channel, place 145-53337 canvas baffle between the top of 53335 baffle and baggage channel and secure both baffles by drilling out pilot holes with No. 28 drill, through baffle, canvas and baggage and secure with six (6) AN530-8R-8 screws across the top and four (4) across the bottom.
7. Place the 145-48240 wood cradle assembly between the flap actuating bracket angles on airplane centerline with aft end snug against baggage floor cross member. Drill out clip holes through wing skin and secure with eight (8) AN3-3A bolts and AN365-1032 nuts.
8. Locate filler neck outlet on right hand side of fuselage by removing the first two (2) fillet attaching screws and nut plates just aft of station 123 $\frac{7}{16}$. Place -58 doubler against skin and hold in place by inserting the screws removed through the skin and into nut plates on the doubler. Drill out all pilot rivet holes through skin and make cut out to match hole in doubler. Rivet -58 doubler in place with twentyone (21) 2R1-AD5 rivets.

NOTE: Do not rivet the six (6) scupper attaching holes. These holes should be drilled out with No. 10 drill. Secure scupper to skin and doubler with six (6) button head screws.

9. Locate and secure the two tank hold down straps by inserting the double hole end through the canvas baffle leather reinforced openings approximately $3\text{-}\frac{1}{4}$ " inboard from longeron on both sides of fuselage. Drill two (2) holes through baggage floor and cross channel centerline with No. 10 drill. Where possible pick up existing rivet for one hole. Insert the two (2) AN3-5A bolts into the holes in strap. Place the -5 spacer under the strap flange and over the bolts, secure with two (2) AN365-1032 nuts, and AN960-10 washers, repeat procedure for opposite side.
10. Remove masking tape from tank boss outlet, place tank in cradle assembly, centered between the safety belt bolts on fuselage sides and against cradle back, press down firmly on left hand side above tank outlet boss. This will provide a mark on skin for hole to be cut out. Remove tank and cut out hole with a $1\text{-}\frac{1}{8}$ " hole saw.

SPECIAL INSTRUCTIONS NO. 38

11. Place tank in place, centered and against cradle stop. Place -145 doubler over sump outlet, center, mark rivet and skin cutout hole.
12. Remove tank, cut out hole to doubler size, drill and rivet with seven (7) 2R1-AD4 rivets.

NOTE: Remove area of doubler that interferes with micarta plate on the wing.

13. Locate the auxiliary tank vent pipe hole in lower right hand wing by measuring to a point 7" to the right of centerline and 1-1/2" forward of rear spar. Place -44 doubler over point located, mark, drill out holes, rivet in place and install grommet. Locate and drill a 1" hole in the upper skin on the right hand side 7-3/4" from centerline of airplane and 4-1/4" forward of the forward baggage floor channel. Locate the vent tube over the upper hole in wing skin, drill out the three (3) attaching holes and secure tube to skin with three (3) AN365-832 nuts, three (3) AN515-8R6 screws and washers.
14. To locate forward tank hold down strap eye bolts, drill out with No. 10 drill the second rivet aft on outboard side of each main wheel up-lock bracket located on the underside. Install the two (2) AN42-3 eyebolts, AN365-1032 nuts and AN960-10 washers.
15. Install tank and center in area. Place straps over tank and attach turn buckles to eyebolts with AN3-5A bolts, nuts and washers. Tighten tank securely with the turn buckles and safety with lock wire.
16. Install 42B3581 tank filler neck and cap, use a thread lube to prevent siezing.
17. To install the tank vent lines on the left hand side, drill out two (2) 13/16" holes; one in frame station 142 9/16, 5-1/3" above horizontal channel junction and one in the horizontal channel 3-3/4" forward of station frame. Install rubber grommets.
18. Adjacent to the baggage floor forward channel and longeron intersection, left hand side, locate and drill a 13/16" hole 3/4" inboard of longeron and 1-3/8" aft of cross member. Directly below and slightly inboard, drill 13/16" hole in wing fillet. Install rubber grommets in each hole.
19. Install AN822-8 elbow into tank vent port. Place vinyl tubing over -12, -18 and -23 tubes, insert -23 tube through horizontal channel grommet and connect "B" nut to elbow in tank. Insert -12 tube into grommet in frame, connect -23 and -12 tube with -14 hose and two (2) AN748-30 clamps. Secure -12 tube to horizontal channel aft of frame with AN 742-D10C clamp, AN515-8R8 screw and AN364-832 nut. Insert -18 tube into hole in floor and wing fillet, connect to -12 tube with -14 hose and AN748-30 clamps.

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20. In the left hand wheel well area place -114 hose over tank outlet tube and locate upper inboard sump tank 145-48077-3 bracket on the 25 and 26 wing splice bolt. (Counting from forward end.)
21. Place sump tank onto -114 hose and against inboard bracket, slide 145-48077-4 outboard bracket under tank. Locate the two (2) rivet holes into angle on spar, locate the sump tank screen and drain plug holes in wing skin, and remove tank.
22. Rivet the 145-48077-4 clamp bracket to spar angle with two (2) AN 470-AD4 rivets.
23. Place -55 doubler on outside of wing skin over holes located for sump screen and drain outlets. Drill out rivet holes and make cutout in skin to match doubler cutouts. Rivet -55 doubler in place with AN 470-AD4 rivets spaced 1" apart, around entire doubler.
24. Install sump tank, secure hose with two (2) AN748-46 clamps. Secure sump tank to mounting brackets with two (2) 820-18 Marman clamps; neoprene cushion and safety.
25. Place -70 shield inside of wheel well flange angle, locate in front of angular section of tank. Mark and drill two (2) holes with No. 28 drill and secure with two (2) AN515-8-6 screws.
26. Remove fuel shut-off valve, strainer assembly, main fuel line from main sump tank to strainer and the control position plate from cockpit floor.

NOTE: Navions that do not have the cockpit floor type shut-off valve installed will require the removal of the Deutch shut-off valve located on the firewall, the installation of the 145-48232 fitting in place of Deutch valve and the removal of the control from instrument panel.

27. Place 145-48235 dial plate assembly on the right hand side of control cable tunnel on the front seat floor. Center the plate so the shaft hole is 2-7/16" forward of station 93 7/16 and 5" to the right of airplane centerline. Drill a 3/8" hole through rug, tunnel and cockpit floor.
28. Place the new Whittaker valve through the floor from below, with the outlet port located on the left hand side (toward the airplane centerline). Mark the two attaching holes on the floor, remove valve and drill out the two (2) holes with a No. 10 drill, place two (2) AN515-8-40 screws into the holes drilled in floor. Underneath the floor place the -51 spacer over the screws with the notched-out side down and toward the centerline of airplane. Place the Whittaker valve on next over the screws, the 145-48243-3 detent plate and the 145-48243-5 plate spring over the valve. Secure with two (2) AN960-A8L washers and two (2) AN365-832 nuts.

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29. Place 145-48235 dial plate assembly over valve control shaft, drill and secure to floor with three (3) PK88XA-9-10 screws and three (3) 2T4830-18 washers.
30. Prior to installing the control handle, line up ports, with handle in main position (straight aft). The aft port and the center side port should be open. With handle in auxiliary tank position, the forward port and center side port should be open. Secure handle with screw formerly removed.
31. Install new -137 tube assembly from main sump tank to rear valve port, connect to the AN823-6 elbow, the -141 tube assembly from auxiliary sump tank outlet to the forward valve port, connect with the AN822-6B elbow located in valve, the opposite end with the -106 hose and two (2) AN748 clamps.
32. Reinstall the strainer and connect the valve outlet to strainer line.
33. Secure auxiliary tank line in three (3) places with three (3) AN742-D8C clips.
34. Install tank bond to floor with an AN515-8R8 screw, one (1) AN366-F832 nut plate and AN960-8 washer.
35. Attach -5 MFD condenser to the screw that secures tank bond to floor. Place condenser lead on gage transmitter in tank, attach No. 150 wire assembly to transmitter, route over to left hand side of fuselage and forward with existing wires to forward side of instrument panel.
36. To locate gage on instrument panel, place 145-48201-56 bracket on the underside of panel centerline. Locate and drill the two (2) holes with No. 28 drill. Install the bracket with the 145-48201-59 plate and resistor in between panel flange and instrument bracket. Secure with two (2) AN515-8R10 screws, AN364-8-32 nuts and AN960-8 washers.
37. Install gage in mounting bracket. Connect No. 150 wire to left hand terminal on gage unit. Connect No. 240 wire from right hand gage terminal to resistor terminal with AN515-8R10 screw and AN364-832 nut to washer. Connect No. 151 wire from opposite resistor terminal to existing fuel indicator circuit breaker in breaker panel.
38. Check fuel quantity indicator by turning on master switch, waiting about 1 minute, and read indicator. If needle registers zero, transmitter is set properly. If needle does not register zero, pry off transmitter cover and rotate small gear until needle registers proper position. Place five gallons of fuel in tank, if indicator registers incorrectly, rotate gear until needle registers five gallons. No further calibration should be necessary. Replace cover on transmitter.

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39. Remove from the rear seat kick board, the two cabin vent tubes and boxes and install the new 145-89055-300 duct assembly.

NOTE: Airplanes prior to serial number 1111 that do not have cabin vent installed, install duct in kick board, 1" down and 12-3/4" from centerline on each side. Cut out holes in board and secure the boxes with two (2) AN530-8-10 screws. Locate duct outlet louvre in the fillets with the straight section facing aft and slightly outboard, the flange edge 2-1/4" from the inboard edge and the straight section 20" from leading edge, mark and drill rivet holes. Remove louvre, make cut out in fillet to match inside of louvre area. Install louvre in fillet with five (5) 1/8" rivets.

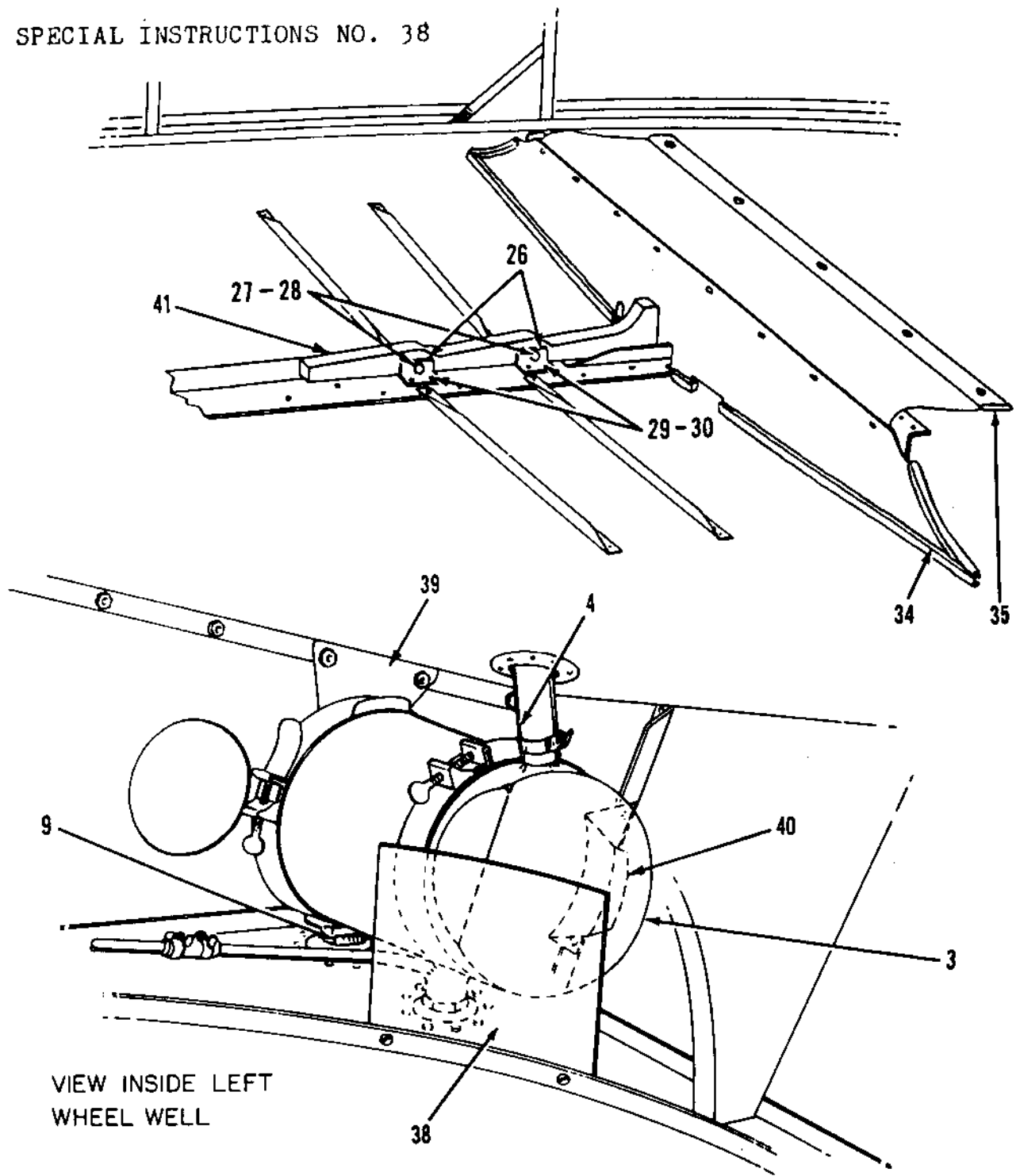
40. Install rear seat kick board and connect duct flex tubes to the louvre installed in fillet with two (2) AN515-832 screws and nuts.
41. Reinstall fuselage side panels, rear seat bottom, canvas baffle, rug and seat back.
42. Insert revised pages in Operating Limitations Manual.

NOTE: Pages are not required on Navions 1790 and subsequent as information has been incorporated in the existing 1949 manual.

The auxiliary underseat tank has been C.A.A. approved and requires only the preparation of Form 337 and submitting installation for inspection to a C.A.A. representative.

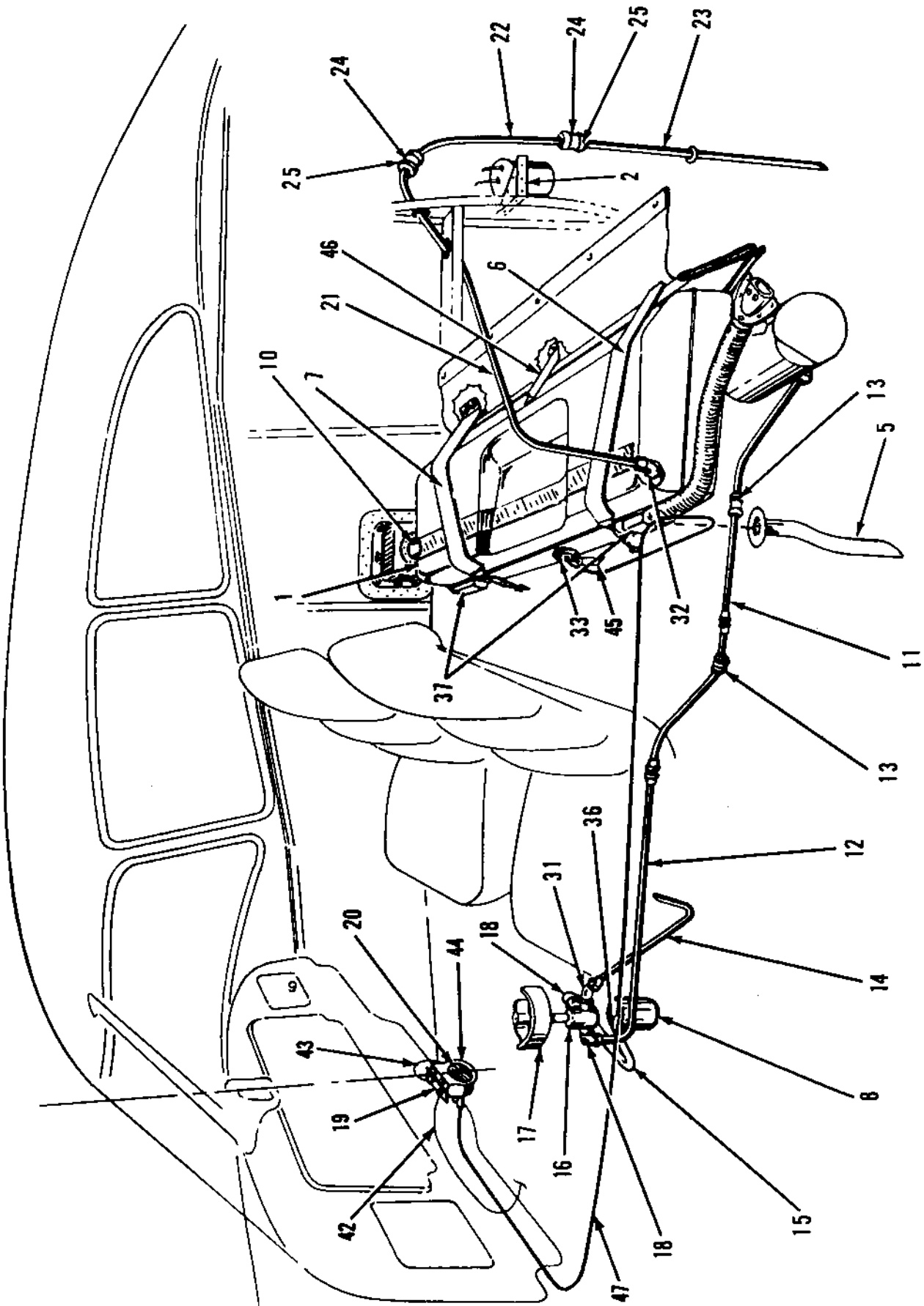
Equipment List, Item No. 110 (c) Wt. 20 Lbs. H Arm 130".

SPECIAL INSTRUCTIONS NO. 38



VIEW INSIDE LEFT
WHEEL WELL

3	145-48239	ACCUMULATOR TANK ASSY
4	145-89067-114	HOSE-FAIN TANK TO ACCUMULATOR TANK
9	W-7600-1/8	ACCUMULATOR TANK DRAINCOCK
26	145-89067-53	BRACKET
27	AN24-19A	AIRCRAFT BOLT
28	AN365-428	SELF-LOCKING NUT
29	AN3-3A	AIRCRAFT BOLT
30	AN365-1032	SELF-LOCKING NUT
34	145-53335	BAFFLE
35	145-53337	CANVAS BAFFLE
38	145-89067-70	ACCUMULATOR TANK SHIELD
39	145-48077-3	BRACKET
40	145-48077-4	BRACKET
41	145-48240	CRADLE ASSY



SPECIAL INSTRUCTIONS NO. 38

1	145-48304	TANK ASS'Y - UNDERSEAT
2	145-89067-149	ANTENNA LOAD COIL BRACKET
5	145-53336	VENT PIPE ASS'Y - UNDERSEAT TANK
6	145-48241-1	STRAP ASS'Y LH
7	145-48241-2	STRAP ASS'Y RH
8	K2250B	STRAINER - FUEL
10	42B3581	CAP AND NECK ASS'Y - UNDERSEAT TANK
11	145-89067-141	TUBE ASS'Y - ACCUMULATOR TANK TO SELECTOR VALVE AFT
12	145-89067-131	TUBE ASS'Y - ACCUMULATOR TANK TO SELECTOR VALVE FORWARD
13	145-89067-106	HOSE
14	145-89067-137	TUBE ASS'Y - SELECTOR VALVE TO MAIN SUMP TANK OUTLET
15	145-89067-133	TUBE ASS'Y - SELECTOR VALVE TO FUEL STRAINER
16	W6235-1/4D	VALVE - FUEL SELECTOR (WITH 3 INCH EXTENSION HANDLE)
17	145-48235	PLATE - FUEL SELECTOR INDICATOR
18	AN822-6B	ELBOW
19	91396	RESISTOR (SW)
20	154-48002-5	GAUGE - FUEL QUANTITY
21	145-89067-23	TUBE ASS'Y - UNDERSEAT FUEL TANK VENT
22	145-89067-12	TUBE - UNDERSEAT FUEL TANK VENT
23	145-89067-18	TUBE - UNDERSEAT FUEL TANK VENT
24	145-89067-14	HOSE
25	AN748-30	CLAMP
31	AN823-6	ELBOW
32	AN822-8	ELBOW
33	145-51071-4	TRANSMITTER - FUEL LEVEL
36	AN816-4	NIPPLE
37	145-53334	RETAINER
42	151	WIRE ASS'Y
43	240	WIRE ASS'Y
44	145-48201-56	BRACKET
45	5MFD	CONDENSER
46	143-53003-100	SUPPORT
47	150	WIRE ASS'Y

SUPPLEMENT PAGE TO SPECIAL INSTRUCTIONS NO. 38

APRIL 21, 1949

AUXILIARY UNDER SEAT FUEL TANK

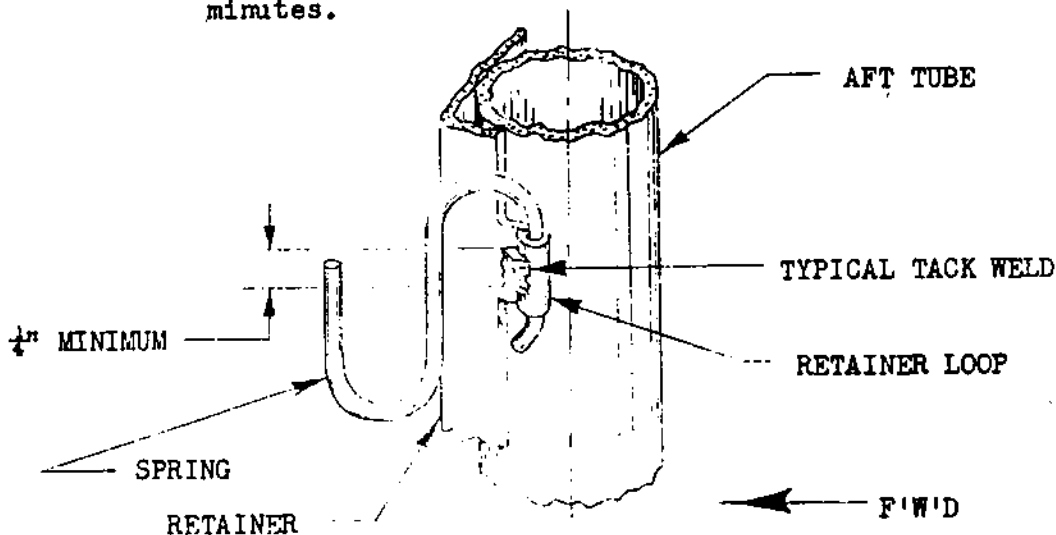
PURPOSE: TO ADD THE PLACING OF THE THREE DECALS ON THE INSTRUMENT PANEL, AND THE ADDITION OF WELDING THE REAR SEAT BOTTOM SPRING RETAINER LOOPS

1. Place the 145-51066-16 decal directly above the main fuel quantity gage.
2. Place the 145-51066-15 decal directly to the right of the main fuel quantity gage.
3. Place the 145-51066-17 decal directly above the fuel pressure gage.

Prior to reinstalling the rear seat bottom, the following seat modification must be accomplished, to prevent spring from becoming detached due to abnormal loads being applied in concentrated area of seat.

1. Check all spring retainer loops on both fore and aft tubes, bending back in place any that are found to be open.
2. Place two or more layers of asbestos sheet between spring retainer loop area and seat padding.
3. Using an arc weld set with a low carbon, mild steel or stainless steel rod, tack each loop on both the fore and aft tube. This will close loop and prevent spreading. Clean off scale and prime all welded areas.

NOTE: Arc weld only is recommended due to the close proximity of seat fabric; however, the weld is not critical so any type of arc weld set such as is used in most automobile garages should be able to accomplish the job in 15 to 20 minutes.



SUPPLEMENT NUMBER 2 FOR SPECIAL INSTRUCTIONS NUMBER 38

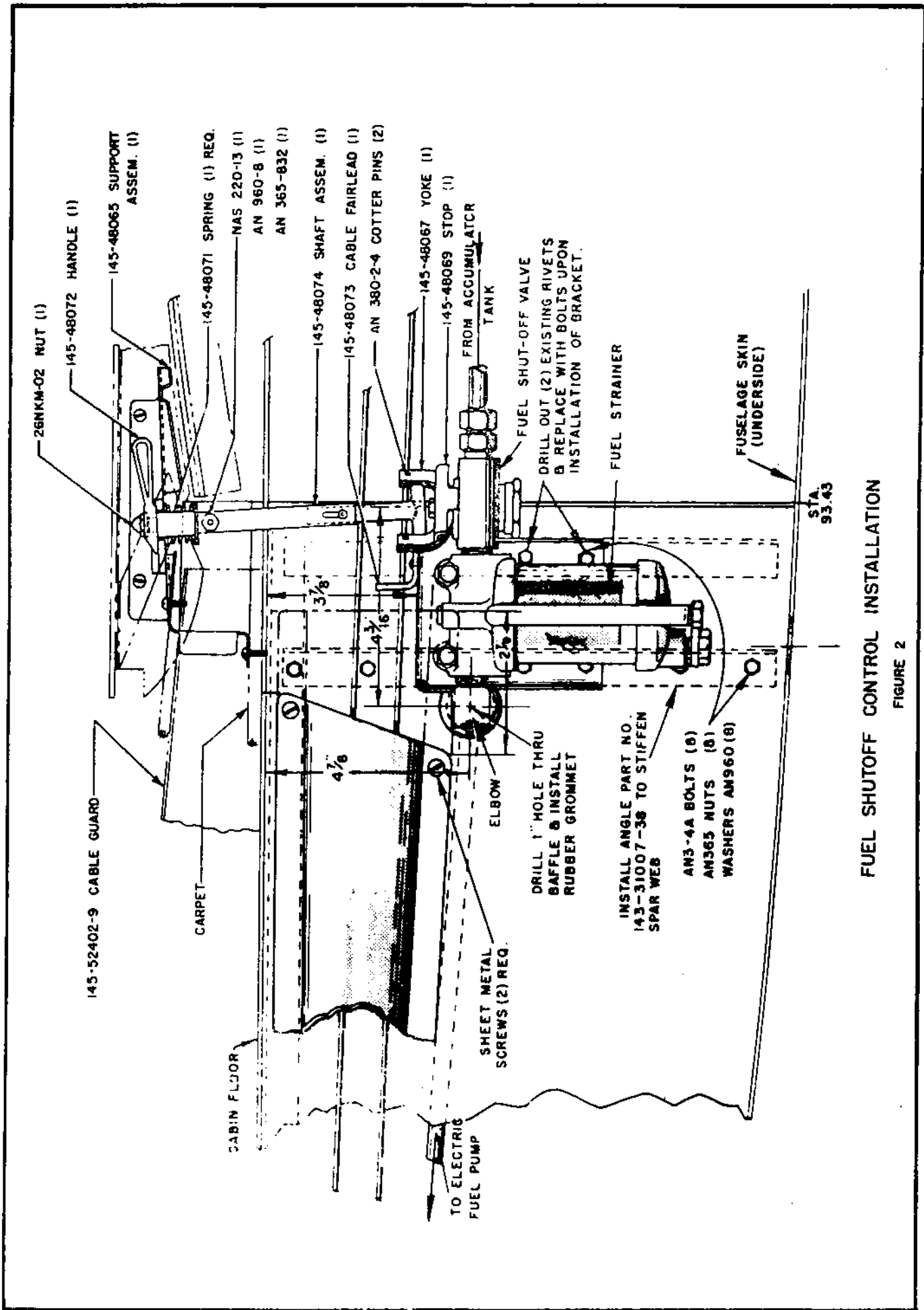
SEPTEMBER 7, 1949

On page 5 of Special Instructions No. 38, add the following note after item No. 37.

NOTE: Navions having King-Seely fuel level indicating systems (Airplane Serial Numbers 1565 and Subsequent - including 1949 model Navions.) incorporating a voltage divider DO NOT require the resistor or the No. 240 wire noted in item No. 37 above. The gauge wiring for these airplanes should be installed as follows:

- a. Connect No. 150 wire to left hand terminal on gauge unit.
- b. Connect No. 151 wire to right hand terminal on gauge unit and to main fuel tank indicator terminal on voltage divider which is mounted adjacent to glove compartment.

Item No. 37 will apply in its entirety to airplanes with Serial Numbers from NAV4-2 through 1564 which are not equipped with the King-Seely fuel indicating system.



FUEL SHUTOFF CONTROL INSTALLATION

FIGURE 2

SPECIAL INSTRUCTIONS NO. 39

JUNE 21, 1948

DUAL VENTURI TUBE INSTALLATION

Install Dual Venturi Kit No. 145-89066 consisting of the following:

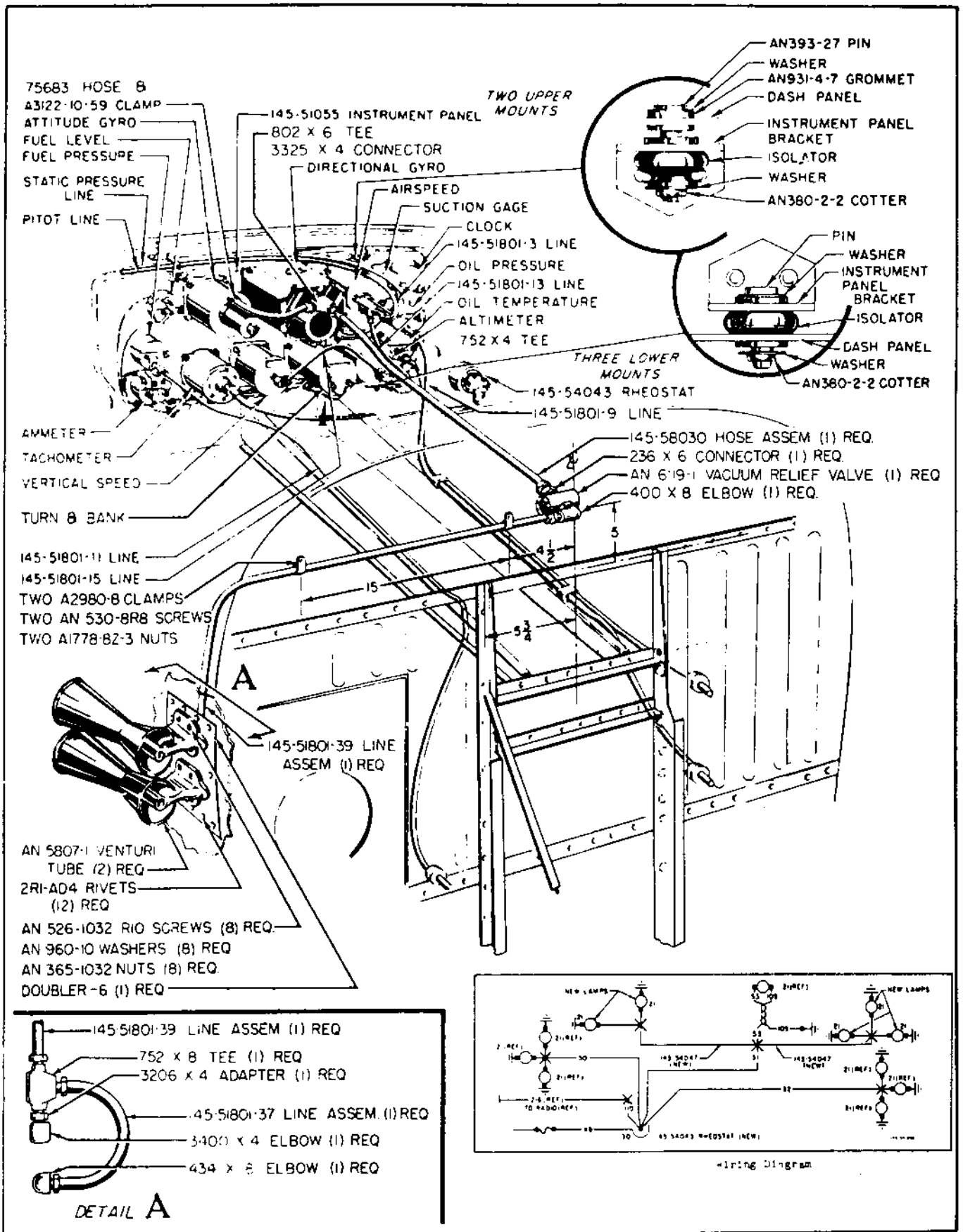
145-89066-6	Doubler	1 req.	AN5807-1	Venturi Tube	2 req.
145-51801-37	Line Assem.	1 req.	AN6119-1	Vac. Rel. Valve	1 req.
145-51801-39	Line Assem.	1 req.	AN526-1032-R10	Screw	8 req.
145-58030	Line Flex.	1 req.	AN960-10	Washer	8 req.
3206 x 4	Adapter	1 req.	AN365-1032	Nut	8 req.
752 x 8	Tee	1 req.	3325 x 4	Connector	1 req.
2R1-AD4-5	Rivet	12 req.	236 x 6	Connector	1 req.
AN530-8R8	Screw	2 req.	A2980-8	Clamp	2 req.
A1778-8Z-3	Nut	2 req.	3400 x 4	Elbow	1 req.
434 x 8	Elbow	1 req.	400 x 8	Elbow	1 req.

Install as follows and as shown in Figure 1.

1. Place Part No. 145-89066-6 doubler with the 5/8" holes pointing forward, on the outside of right hand forward fuselage, with the upper 5/8" hole 8" above level point and the forward 3/16" venturi attaching holes 2-9/16" aft of firewall, mark and drill out holes.
2. Place doubler on the inside of skin and rivet into place with twelve (12) 2R1-AD4-5 rivets.
3. Attach venturi tubes with eight (8) AN526-1032-R10 screws, AN960-10 washers and AN365-1032 nuts.
4. Install 3400 x 4 elbow into upper venturi, install 3206 x 4 adapter into elbow and connect 752 x 8 tee. Install 434 x 8 elbow in lower venturi. Connect venturi tubes together with Part No. 145-51801-37 line assembly. Connect Part. No. 145-51801-39 line assembly to tee and attach to firewall two places with two (2) A2980-8 clamps, two (2) AN530-8R8 screws, and two (2) A1778-8Z-3 nuts.

SPECIAL INSTRUCTIONS NO. 39

5. Attach AN6119-1 vacuum relief valve with 400 x 8 elbow installed in inlet port to -39 line assembly. Install 236 x 6 connector in opposite port on relief valve.
6. Remove the top rear-most vacuum entrance plug from directional Gyro and install 3325 x 4 connector. Remove the 75682 hose and fitting from Gyro and install plug previously removed. (This hose and fitting is replaced with 3325 x 4 connector and 145-58030 line assembly.) Disconnect 75683 hose from tee and install tee onto 3325 x 4 connector on back of Gyro instrument. Reinstall 75683 line to tee and connect Part No. 145-58030 line to tee and vacuum relief valve.
7. Loosen lock nut on top of relief valve, adjust valve by turning adjusting screw (counter-clockwise to increase suction, clockwise to decrease) to indicate 3.75 inches on suction gage at an air speed of 100 m.p.h. Gage should not exceed 4.75 inches at 190 m.p.h.



SPECIAL INSTRUCTIONS NO. 40

JUNE 24, 1948

DIRECT CONTROLLED FUEL SHUT-OFF VALVE

Effectivity: NAV-4-1271 through 1400.

Install Direct Controlled Parker Fuel Shut-off Valve consisting of the following parts.

145-48232	Fitting	1 req.	145-48071	Spring	1 req.
145-48067	Yoke	1 req.	NAS220-13	Bolt	1 req.
145-48069	Stop	1 req.	145-48065	Support	1 req.
145-48078	Shaft	1 req.	AN960-8	Washer	1 req.
145-48070	Adapter	1 req.	AN365-832	Nut	1 req.
AN960A816	Washer	1 req.	AN530-8R12	Wood Screw	2 req.
NAS221-17	Bolt	2 req.	AN365-1032	Nut	2 req.
AN960-106	Washer	4 req.	51076	Plug	1 req.

Install as follows:

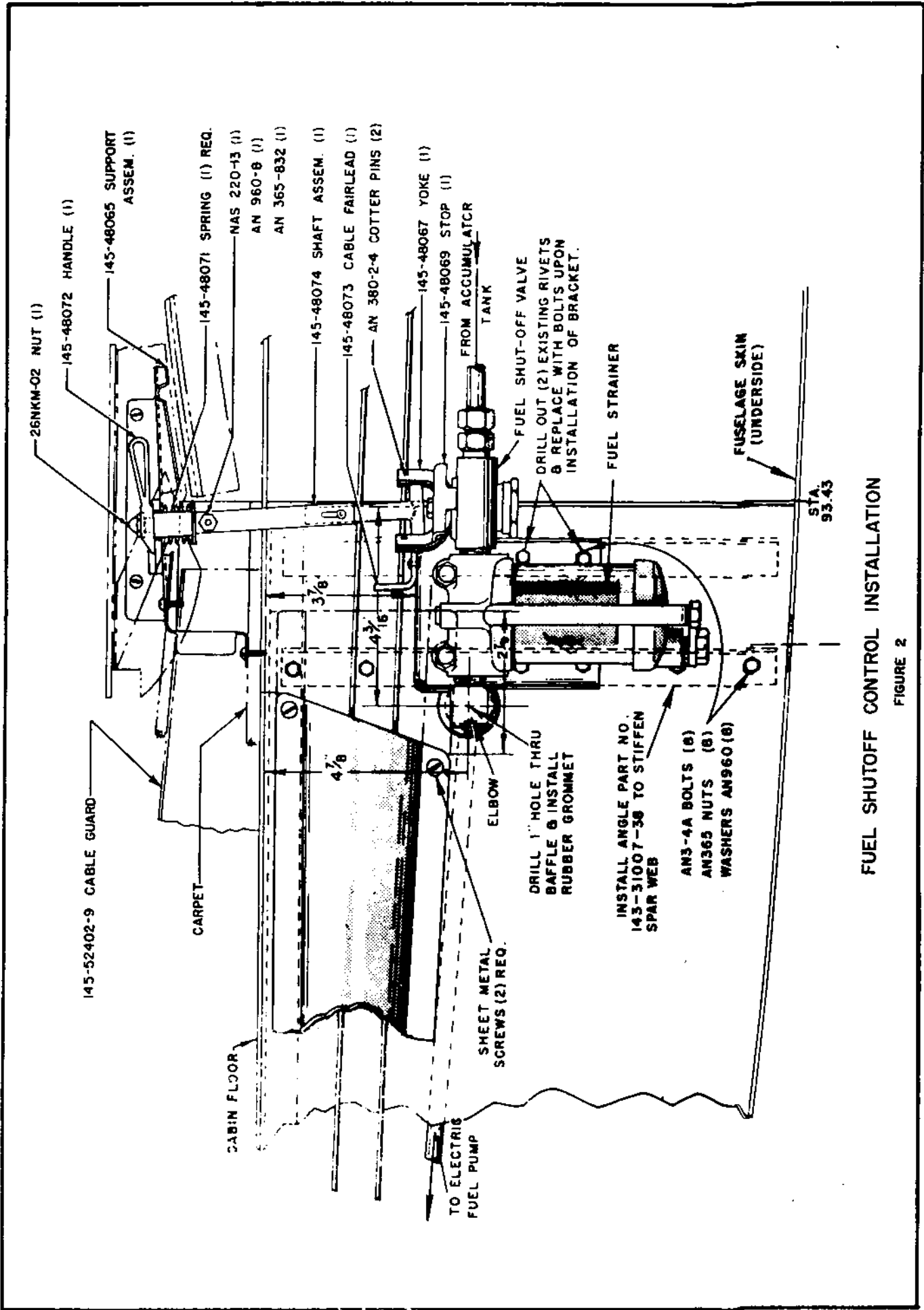
See Figure.

1. Remove Part No. 145-31019-3 strainer guard located in nose wheel well.
2. Remove Parker fuel shut-off valve located just aft of strainer, replace operating handle with Part No's. 145-48069, 145-48067 stop and yoke, secure to valve with Part No. AN500A10-6 cap screw, safety and reinstall valve.
3. Place Part No. 145-48073 lower rudder cable fairlead onto aft end of strainer bracket, flange side aft, drill two (2) No. 10 holes through bracket and attach with two (2) AN526-1032 screws, two (2) AN365-1032 nuts.
4. Through the floor, directly above centerline of valve just forward of floor angle, drill a 1/2" hole, cut a 1-1/2" x 3/4" corner out of Part No. 145-52402-9 floor cable guard for control shaft clearance. Place Part No. 145-48074 control shaft through 1/2" hole and secure to valve Yoke with two (2) AN380-2-4 cotter pins. Remove lower 3/16" bolt from

in-board seat track wood block attachment. Drill a No. 10 hole in opposite side above 3/16" hole and install an AN545B8-4 wood screw. Place Part No. 145-48070 fuel selector adapter into control shaft, attach with NAS220-13 bolt, AN960 washer and AN365-832 nut. Place Part No. 145-48071 spring and AN960A816 washer over adapter. Place Part No. 145-48065 support assembly over spring and adapter and secure support to floor over carpet and on the side of seat track with two (2) screws and two (2) bolts.

5. Rework Parker valve control handle previously removed from valve, by removing former stop lug with a file or saw and install handle on adapter with 26NKT1-02 nut, making sure the "ON" and "OFF" position of valve corresponds with handle.
6. Forward of firewall remove 145-48061 fuel line from Deutsch valve, aft of firewall remove Part No. 145-48001-47 line, connector fitting, primer line and adapter fitting. Remove Deutsch valve from firewall and valve control from instrument panel. Place hole plug in hole left by fuel shut-off control in panel. Install Part No. 145-48232 fitting in former Deutsch valve location, attach similar to method used on valve. Reinstall connector fittings, primer and fuel lines.

NOTE: Care must be exercised in installation to eliminate all air leaks in the entire fuel system, THIS IS EXTREMELY IMPORTANT.



FUEL SHUTOFF CONTROL INSTALLATION

FIGURE 2

SPECIAL INSTRUCTIONS NO. 42

JUNE 2, 1948

CARTER FUEL PUMP BREATHER DRAIN LINE

Install Part No. 145-48234 Carter Fuel Pump Breather Drain Line as follows:

1. Place Part No. 145-48234-7 synthetic rubber seal over (-3 tube left hand) (-4 tube for right hand) collar side opposite tube flare. Insert tube into hole in -5 clamp with flared end in-board. Remove fiber screen and snap ring from fuel pump breather opening. Install clamp around fuel pump, place tube flare into breather opening, position tube for best position to attach Part No. 145-48234-9 drain line and tighten clamp securely. This will press synthetic seal into large opening and create a fuel seal.
2. Install drain tube with hose connection and clamps connected to (-3 left hand) (-4 right hand) tube. Attaching -9 tube to fire-wall in two (2) places with AN742-6 clamps.

NOTE: Drain line exits must NOT be located near either heater or engine exhaust outlets.

SPECIAL INSTRUCTIONS NO. 43

AUGUST 16, 1948

CYLINDER HEAD TEMPERATURE GAUGE

Install Cylinder Head Temperature Gauge Kit, Dwg. No. 145-89071 consisting of the following parts:

17ATS3D	Cylinder Head Temperature Gauge	1 req'd.
88L-800-10	Thermocouple Lead	1 req'd.
AN515B6-12	Screw	4 req'd.
AN515-8R12	Screw	1 req'd.
AN365B632	Nut	1 req'd.
AN365-832	Nut	1 req'd.
AN960-8	Washer	1 req'd.
A2980-S-8	Clamp	1 req'd.
AN931-4-7	Grommet	1 req'd.
18 mm	Thermocouple (For 18 mm Spark Plugs on Navions NAV-4-1271 and subsequent.)	
14 mm	Thermocouple (For 14 mm Spark Plugs on Navions NAV-4-2 through 1270.)	

Install as follows:

1. Measure to the left of windshield centerline 14-1/2 inches on dash panel and up from the radio cut out in the dash panel 1-3/4 inches, at intersection of dimensions, mark and cut out 3-5/32 inch diameter hole.
2. Place instrument face forward in hole, holding the two top screw holes level laterally, mark the four attaching screw holes. Remove instrument and drill out the four (4) marked holes with No. 18 drill.
3. Attach 886-800-10 lead with the large connector ends to the poles on the back of instrument and install instrument in dash panel with the four (4) AN515B6-12 screws.
4. On the left hand side of firewall upper corner, 2-1/2 inches up from firewall support angle rivet row and two (2) inches out-board of the last out-board upper vertical bead center line, mark intersection of dimensions and drill a 7/16 inch diameter hole.

5. Insert AN931-4-7 grommet, route thermocouple lead through grommet and forward to the upper No. 2 cylinder spark plug.
6. Remove spark plug and gasket. Place 14 mm or 18 mm thermocouple on spark plug and reinstall, deleting copper gasket previously used.
7. Connect lead to thermocouple with attached connectors. Gather up excess lead in a coil at firewall just below grommet, fold together in the middle and attach to firewall with A2980-S-8 clamp, drilling out one of the firewall support angle rivets directly below grommet for attaching clamp with AN515-8R12 screw, AN960-8 washer and AN365-832 nut.

CAUTION: Do not cut thermocouple lead as lead length has been calibrated to the instrument in its present length.

SPECIAL INSTRUCTIONS NO. 44

MARCH 2, 1949

GYRO INSTRUMENT KIT - AIR FORCE TYPE PANEL

Effectivity: NAV-4-2 through 1627

Gyro Instrument Panel Kit Ryan Dwg. No. 145-89074-10 & -20 catalog items Nos.
716-300 Panel complete less vacuum power supply
716-400 Panel without instruments less vacuum power supply

Install as follows and as shown in sketch:

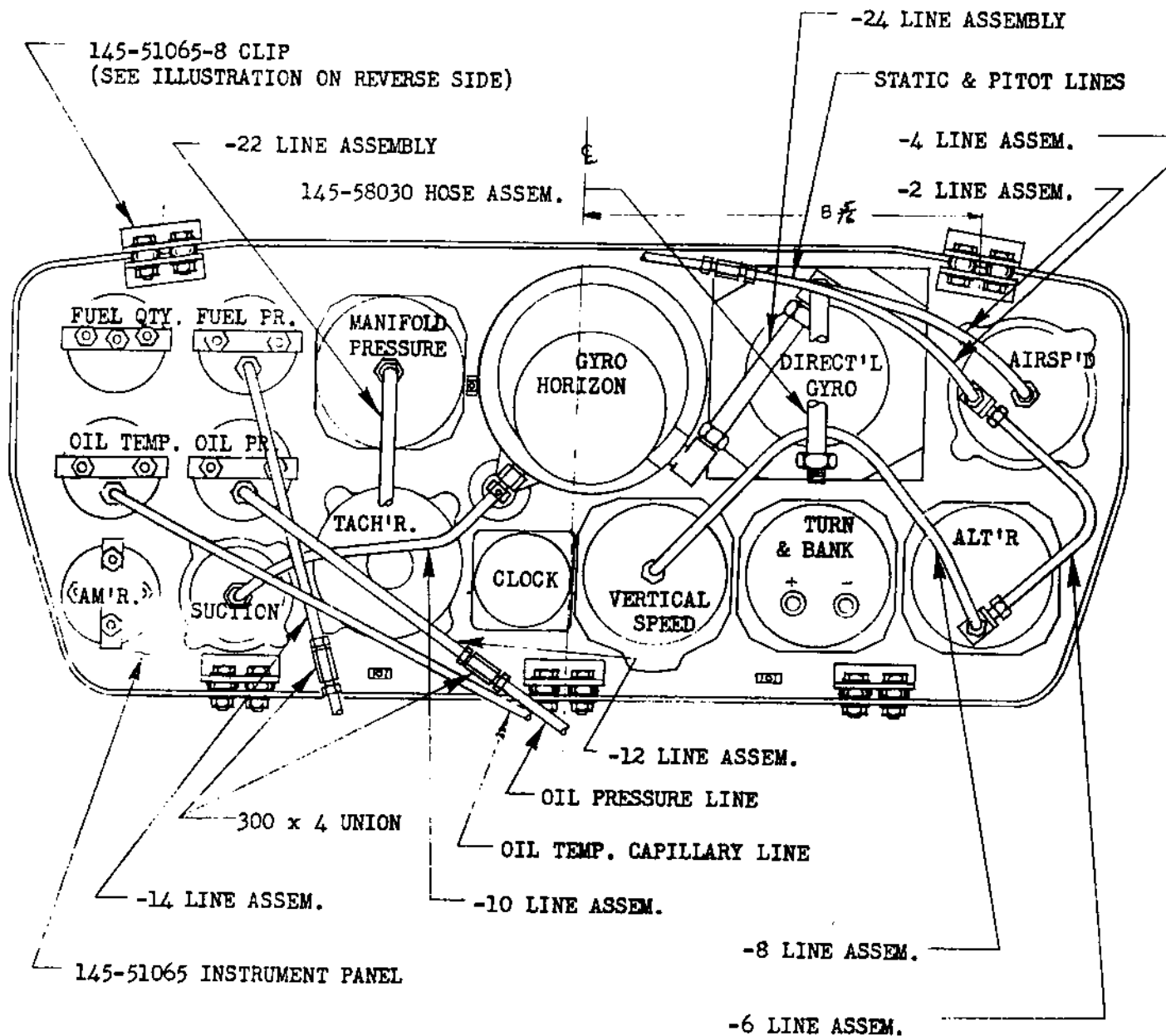
1. Remove existing instrument panel from control panel, and remove all instruments.
2. To install shock mounts on the lower side locate and drill two (2) $3/8"$ holes $13/32"$ on either side of the existing $3/8"$ diameter hole in the three (3) original shock mount positions.
3. Place an AN960-A6166 washer on lower side of 275-5 shock mount isolator and place isolator in each new hole drilled. Remove the 145-51065-8 clips from 145-57065 panel and place the -8 clip on the upper side of isolators and attach with two (2) AN3-6A bolts, AN960-A10 washers and AN365-1032 nuts in the three (3) places.
4. To locate the two (2) upper mounts, measure outboard of the centerline of the control panel on both sides $8-5/16"$ at that point reduce the width of the control panel flange by removing $3/16"$ of material for a distance of $3/4"$ on either side of $8-5/16"$ dimension.
5. Place the 145-51065-8 clip with the isolators attached, and secured similar to procedure used on the lower mounts and center in cutout area $8-5/16"$ from centerline with radius of clip nesting in radius of control panel. Mark and drill with No. 18 drill the two (2) screw attaching holes through control panel. Attach with two (2) AN515B6R6 screws and two 6939-632-062 nuts.
6. Install instruments in the new 145-51065 panel according to sketch.
7. Attach extension -12 line assembly to the oil pressure gauge and the -14 line assembly to the fuel pressure gauge.
8. Attach -2 line assembly to the pressure port on the airspeed indicator and the -4 line assembly to the tee fitting in static port of airspeed indicator.
9. Attach -6 line assembly from the tee fitting on airspeed indicator to the tee fitting in altimeter. Attach -8 line assembly from the tee fitting in altimeter to the connector in the vertical speed indicator.

SPECIAL INSTRUCTIONS NO. 44

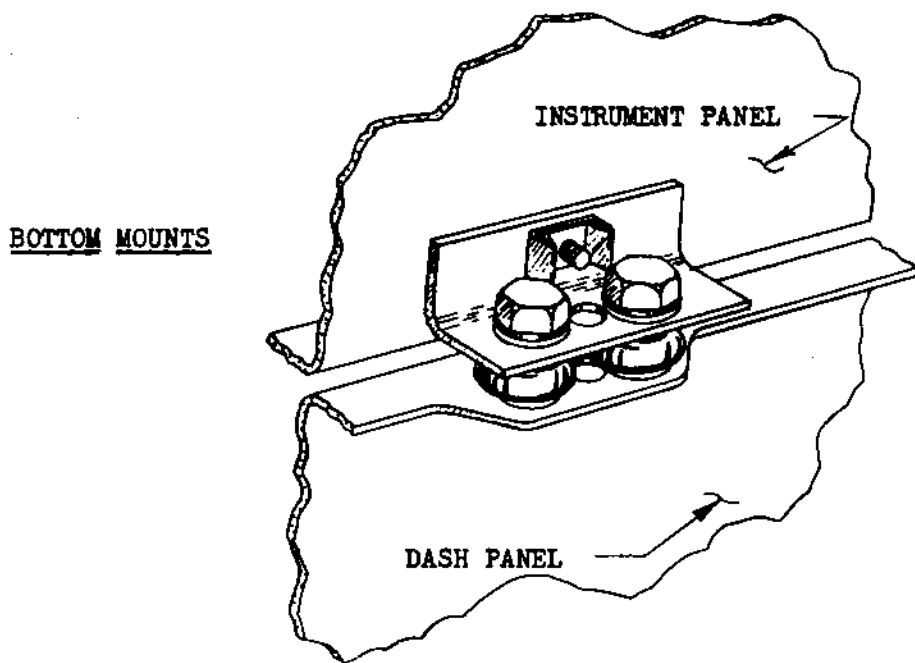
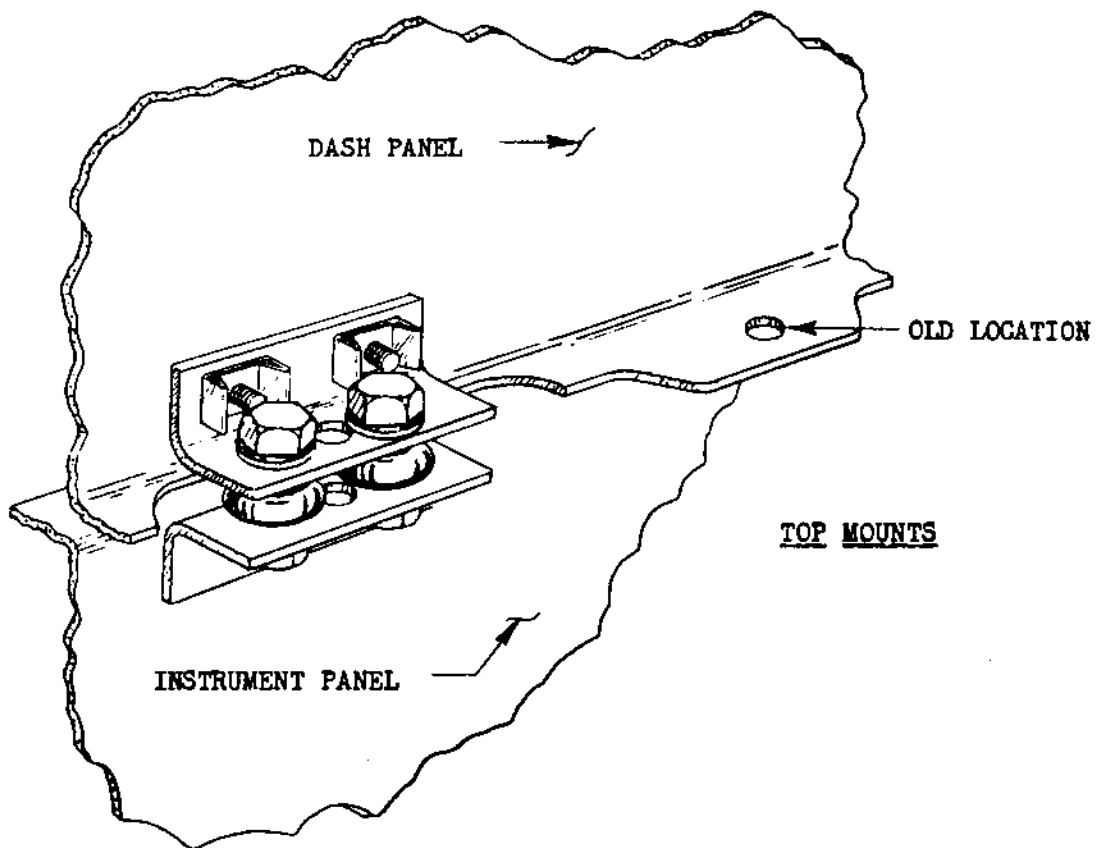
10. Install 3400 x 4 street elbow into the small port of Gyro horizon and the 400 x 6 elbow into larger port.
11. Install 3200 x 4 pipe adapter into port in directional Gyro, install 752 x 6 tee into pipe adapter and connect Gyro horizon to directional Gyro with -24 line assembly.
12. Attach 145-58030 hose assembly to the tee fitting in directional Gyro.
13. On the firewall to the right of centerline 5-5/8" and 1-3/4" above the 143-51007 instrument panel beam support attaching screw, drill 3/4" hole in firewall and install AN931-4-12 grommet.
14. On aft engine mount cross frame station 40.5, measure down 4-1/2" and to the right of centerline 9-1/4", drill 3/4" hole in webb and install AN931-4-12 grommet.
15. On the forward and upper side of the in-take manifold on engine, remove existing 1/8" pipe plug and install 400 x 4 elbow.
16. Install 145-44017 flextube, with 145-89062-14 line attached by 250 x 4 connector and 105 x 4 nut, through grommet previously placed in engine mount cross frame station 40.5, and attach flex end to fitting on engine manifold.
17. Install 6939-632-062 nuts (for securing reflector panel into holes provided (5 places)).
18. Install floating panel assembly in control panel, attach with the five (5) screws formerly removed from clips.
19. Install 145-22 tube to gauge unit, route down on the 143-51007-4 instrument panel support beam and through grommet on firewall down to -14 tube. Attach with one (1) 145-89062-12 clip and AN742-4C clamp to beam 4-1/2" aft of firewall, and another approximately 1" above lower bend of tube onto firewall with AN742-4C clamp.
20. Connect -22 and -14 tubes with 300 x 4 union.
21. Connect airspeed lines to the extension, -2 and -4 lines attached to the instrument, with 300 x 4 unions. Connect the -12 and -14 lines to the existing oil and fuel pressure lines with 300 x 4 unions.
22. Connect 145-58030 hose assembly to the vacuum supply power source at firewall.
23. Connect 145-51066 reflector light connection and install reflector on floating panel.

Gyro Kit is approved for the Navion and needs only the preparation of a Form 337 and submission to C.A.A. Inspector for inspection.

SPECIAL INSTRUCTIONS NO. 44



SPECIAL INSTRUCTIONS NO. 44



SPECIAL INSTRUCTIONS NO. 46

AUGUST 17, 1948

INSTALLATION OF REPLACEMENT HARTZELL PROPELLER MICARTA GUIDE BLOCKS

These instructions are provided to be helpful in the installation of replacement micarta blade angle adjustment guide blocks and a caution note on the most probable causes for the failure of the blocks.

Extreme care must be exercised when propeller is removed from actuating cylinder jack plate to prevent the blade from rotating too far and allowing the block to strike the hub at an angle or on the end. This usually will and does in most cases cause block to crack on one end, if this happens and propeller is reinstalled with the cracked end on the under side it cannot be seen, consequently after a few hours in flight, block may fail completely with subsequent malfunctioning of the propeller.

New blocks are usually .005 to .015 over size and will require sizing to fit fork on jack plate. This can best be accomplished by placing a piece of medium sand paper on a surface plate or equivalent. Hold block true and slide back and forth until a free fit is acquired, do not remove any more than is necessary for a free snug fit.

NOTE: Sand on the fabric sides of the block, (the beveled angle sides) also on assembly, slide blocks into forks with fabric sides next to fork sides.

SPECIAL INSTRUCTIONS NO. 47

OCTOBER 25, 1948

CONVERSION, HARTZELL -1 OR -5 PROPELLER INSTALLATION TO -7, -7A OR
-7B PROPELLER INSTALLATION

Remove Hartzell -1 or -5 propeller assembly rework airplane nose cowl, and install a Hartzell -7, -7A, or -7B propeller assembly according to the following instructions.

Effectivity: Airplanes on which it is possible to mount the propeller jack cylinder directly on the crankcase. On airplanes which mount the cylinder on brackets make certain the engine has drilled and tapped bosses at the front of the crankcase before attempting to change propeller assemblies.

SECTION I. REMOVAL OF -1 OR -5 PROPELLER ASSEMBLIES

1. Remove propeller hub nut safety pin, and hub nut.
2. Remove wirelocks and linkscrews (-1 installation only).
3. After disconnecting the piston links replace the linkscrews in the same clamps from which they were removed.
4. On -5 propellers the push rods and forks may be disconnected, after removal of the hub nut, by pulling forward on the propeller and spreading the propeller counterweights.

CAUTION: Extreme care must be exercised when propeller is removed from actuating cylinder jack plate to prevent the blade from rotating too far and allowing the mica block to strike the hub at an angle or on the end as this is apt to crack the block. If this happens and propeller is reinstalled with the cracked end on the under side it cannot be seen, consequently after a few hours flight, block may fail completely with subsequent malfunctioning of the propeller.

SPECIAL INSTRUCTIONS NO. 47

5. Remove the propeller from the hub.
6. Remove the 145-44013 and 145-44012 retainer plates, and the 145-44018 cover.
7. Disconnect the linkage and hose connections to the servo valve.
8. Pull the actuating piston from the cylinder. Have a drip pan ready to catch any oil that may drain from the cylinder.
9. Remove the four (4) stud nuts and pull the cylinder from the engine.

NOTE: On those airplanes (Serial Nos 2 through 1110) which have the cylinder secured to brackets (rather than bolted directly to the engine) it will be necessary to remove the two (2) 145-44014 brackets from the engine. The bolts which are taken out during the process of removing these brackets, should be re-installed with a 1/16 washer under the head of each bolt.

10. Remove the oil pressure and oil return hoses from the engine. Plug the holes in the block to prevent entrance of any foreign matter.
11. Remove the forward 145-43023 propeller control guide bracket and the 145-44003 propeller control guide bracket, reinstalling the bolts removed with a 1/16 washer under the head of each bolt.
12. Remove the four (4) mounting studs on the front of the engine block.

SECTION II. REWORK OF COWL

1. Rework the cut-out in 145-31501-519 cowl assembly, according to the dimensions given in figure.
2. Lay reinforcing strip 145-31501-582 on the upper nose cowl air entrance flange, and using the reinforcing strip as a template, drill five (5) (No. 30 drill) holes and secure the reinforcing strip to the flange with five (5) AD4-4-5-2R1 rivets.
3. Using 145-44061 seal as a template, drill eight (8) (No. 10 drill) holes in the cowl. Mount one AN366F-1032 nut plate at each hole, using two (2) AD3-4-2R1 rivets to each nut plate. Drill the rivet holes with a No. 40 drill.
4. Replace the nose cowl baffle seals with the new 145-31508-10 and 145-31509-10 baffle seals.

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SECTION III. INSTALLATION OF -7 PROPELLER

1. Remove forward 145-43023 propeller control guide bracket. Use removed nuts, bolts and washers to install 145-44060-2 bracket on right side of engine.
2. Attach two AN742-4 clamps to top of aft 145-43023 propeller control guide bracket. Attach clamps to the bracket in such a manner that propeller control is pointed across the engine centerline to right side of the engine. Use two each NAS221 screws and AN365-1032 nuts to secure clamps to bracket.
3. Attach the propeller control to the 145-44060-2 bracket, using two (2) each AN742-4 clamps, NAS221-8 screws, and AN365-1032 nuts.
4. Install the AN6264-4-17 $\frac{1}{2}$ hose assembly. Use an AN901-100 gasket, 145-44052 bushing, and AN816-4 nipple to attach the hose to the engine.
5. Attach the AN6264-6-11 $\frac{1}{2}$ hose assembly to the engine, using an AN822-6-2 elbow to connect the hose to the engine.
6. Install propeller on engine in accordance with the following instructions taken basically from the Supplement, Section X, of the Hartzell Propeller Manual, third printing, dated August, 1948. Exercise the utmost care in adjusting the propeller control cable before attaching it to the A-117 servo valve control lever.
 - a. Clean shaft threads and splines thoroughly, removing all nicks, burrs, and galls. Make a careful check to determine that shaft threads are not burred or pulled. Stone out burrs and use crocus cloth to remove scratches.
 - b. Wipe the shaft clean and dry with a lint free cloth.
 - c. Remove piston from cylinder by removing A-121 valve link screw and sliding piston forward off piston guide rods.
 - d. Remove diaphragm B-119 by removing outer and inner plates B-120 and A-113.
 - e. The cylinder is mounted on the engine nose with the guide pins A-122 in the horizontal plane, and the servo valve on the upper left side of the cylinder, looking aft. In order to eliminate all possibilities of oil leaks it is recommended that a paper gasket be used between cylinder C-111-7 and the face of the engine, together with gasket compound.
 - f. The cylinder C-111-7 is mounted with four (4) Allen head cap screws (5/16-18). Use 1/16 thick aluminum or copper washers under the heads of the screws. Be sure the screws do not bottom in the engine tapped hole before pulling up tight on the cylinder; otherwise oil will leak out. Safety screws with wire through drilled holes in screw head.

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- g. Install rubber diaphragm with inner and outer diaphragm rings. **IMPORTANT** - tighten all screws uniformly until the rubber squeezes out past the edges of the rings 1/16 inch. Breakage of the rings may result if only a few screws are tightened at a time.
- h. Connect hydraulic lines AN6264-4-17½ and AN6264-6-11½ to the servo valve. Use an AN823-4 elbow and an AN912-3 bushing when connecting the AN6264-4-17½ line to the valve, and an AN822-6-6 elbow to connect the AN6264-6-11½ line.
- i. Grease front face of rubber diaphragm and install piston. Connect A-118 link with piston, using A-121 screw. Safety screw with wire running to other screws on piston.
- j. Install the rear cone clean and dry; then coat the hub face of cone, and shaft threads with a thin film of antisieze compound (Specification AN-C-53, or equivalent). Coat the shaft splines with a thin coating of engine oil.
- k. Slide the jack plate into position on the cylinder guide studs.
- l. Install the engine cowl air seal, securing with nine (9) NAS221-9 screws.
- m. Remove all grease or anti-rust compound from the propeller hub and wipe dry.
- n. Raise propeller and align wide hub spline with propeller shaft blind spline. Then cautiously slide propeller on shaft, taking care not to damage splines, cone seat, or cone.
- o. Spread the propeller counter-weights apart. Turn the jack plate counter-clock-wise until the actuating links line up with the blade shank attaching blocks. Then pull the counter-weights together until the actuating links and attaching blocks are in place.

CAUTION: Extreme care must be exercised when propeller is removed from actuating cylinder jack plate to prevent the blade from rotating too far and allowing the micarta block to strike the hub.
See caution note on page 1.

- p. Coat the hub face of the front cone with antisieze compound.
 - q. Install the halves of the front cone on retainer nut shoulder, Start retainer nut and cone onto shaft, and screw up snug.
7. Check positioning of element piston to ascertain that clearance is available to allow a 3/16 inch deflection of the diaphragm to either side of neutral. By pushing or pulling the propeller counter-weights, move the

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piston forward or aft, as necessary, to bring the face of the piston flush with the face of the outer diaphragm clamping ring. With the piston in this position, there should be a minimum clearance of 1/4 inch between the jack plate collar and the propeller hub. Should there be less than 1/4 inch clearance at this point, insert spacers behind the rear cone, as necessary, to attain this clearance.

Example: With a clearance of 7/32 inch between the jack plate collar and the propeller hub, it will be necessary to place one (1) 1/32 inch spacer behind the rear cone.

8. After establishing the jack plate clearance, as described in step 7 preceding, complete the propeller installation as follows:
 - a. Block one blade and tighten retainer nut with torque of 540 foot pounds (a 180 pound load at the end of a three foot bar).
 - b. Install the retainer nut snap ring in the hub groove.
 - c. Install the propeller retaining nut locking pin, from inside of shaft through aligned shaft hole and retainer nut hole.

CAUTION: If propeller shaft and retainer nut holes do not line up, tighten retainer nut slightly until alignment can be obtained. Do not loosen retainer nut to obtain alignment for locking pin installation.

- d. Install washer and cotter pin on locking pin.

NOTE: In some cases it may be necessary to use a 3/16 inch lock pin when clearance is not available for the 1/4 inch pin.

9. Connect push-pull control wire to valve lever A-117. When connecting control to lever A-117, place piston in forward position with 1/16 inch gap between jack plate collar and propeller hub, and valve body 3/8 inch from valve plate (near mid position); also push-pull control should be pulled out from dash about 1/8 inch.
10. Run up engine and set low stop pitch control to provide proper static rpm (1975 - 2025).
11. Upon completion of the preceding installation, make an operational check of the jack plate clearance. In the full forward position of the diaphragm, (maximum rpm) with engine running, there must be a minimum of 1/8 inch clearance between the jack plate collar and propeller hub. Clearance may be observed from the side of the airplane while the engine is running.

NOTE: This clearance must be observed while the engine is running, as the propeller counter-weights will cause a change

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in the propeller pitch as the engine is stopped. It is realized that no measurement can be taken while the engine is running; however, if the clearance is obviously less than 1/2 inch the low pitch stop must be adjusted to provide clearance.

It is important that this jack plate to hub clearance be maintained to preclude any possibility of overloading engine thrust bearing with propeller.

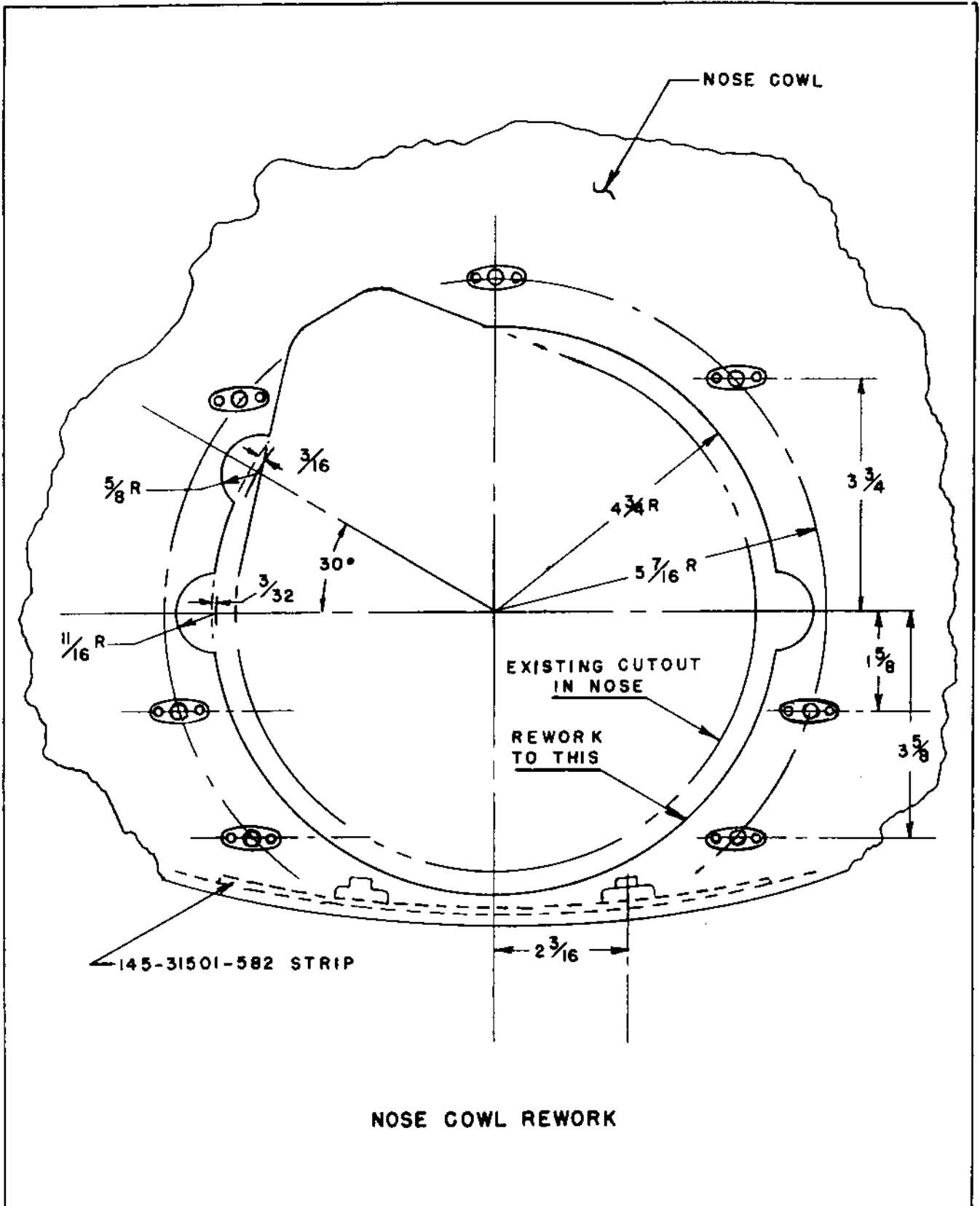
12. If the foregoing instructions are fully complied with, the maximum static rpm will be approximately 2025. This adjustment should give a maximum sea level take-off of 2300 with approximately a 400 rpm control range when the propeller control is moved from full increase to full decrease rpm.

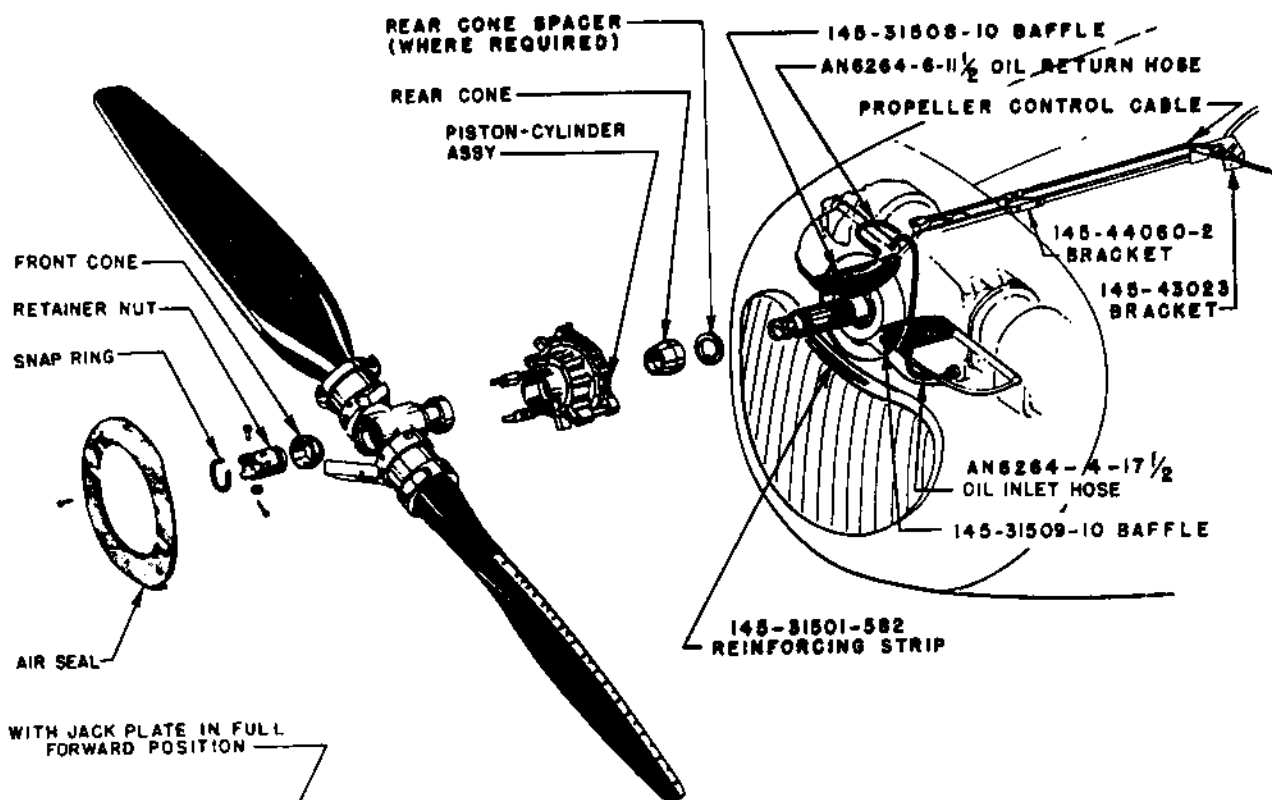
DO NOT attempt to increase this control range, if it will cause over-deflection of the diaphragm of more than 3/16 inch forward.

DO NOT attempt to increase the maximum take-off rpm above 2300 as the engine, airplane and propeller combination is not approved for any setting in excess of 2300 rpm and any attempt made to so adjust the propeller will result in a decreased clearance between the propeller hub and jack plate with subsequent possible overloading of the thrust bearings.

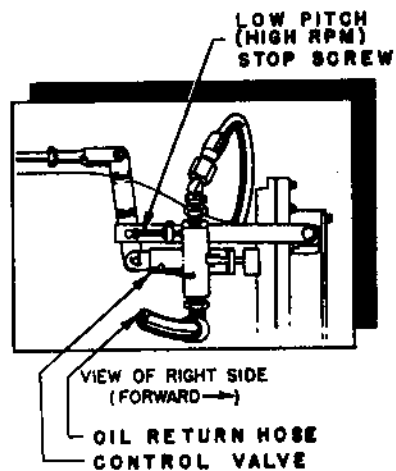
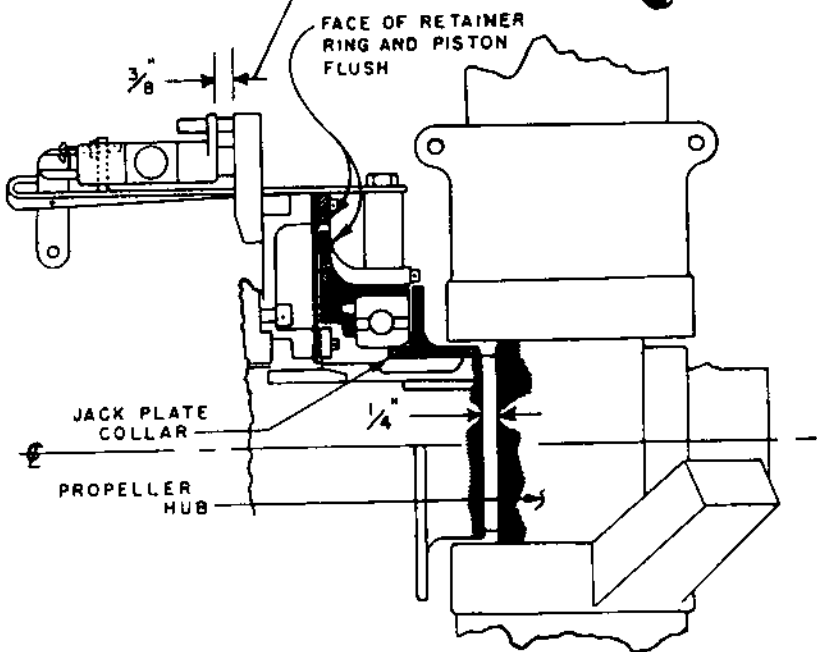
13. If the desired maximum rpm cannot be obtained, the blade settings in the hub must be changed rather than removing spacers from back of the rear cone. The blade settings may be changed by the following procedure:
- If the propeller and clamp are not already indexed, scribe a reference line from the propeller blade to the blade clamp.
 - Loosen the outboard clamp bolts.
 - Rotate the blade in the clamp as necessary to increase the maximum rpm. A movement of the blade of 1/32 inch in the clamp will effect approximately a 1° change in propeller pitch and will change the maximum rpm approximately 100 rpm. Decrease blade pitch to increase rpm.
 - Tighten the clamp bolts (torque to 20 ft. pounds) and repeat the procedure for the other blade.

CAUTION: It is essential that the pitch change of both blades is identical.





WITH JACK PLATE IN FULL FORWARD POSITION



-7 PROPELLER INSTALLATION

SPECIAL INSTRUCTIONS NO. 48

NOVEMBER 15, 1948

PROPELLER CONVERSION, KOPPERS (AEROMATIC) TO HARTZELL -7, -7A or -7B

These instructions apply only to those airplanes on which it is possible to mount the propeller jack cylinder directly on the crankcase. Make certain that the engine has drilled and tapped bosses at the front of the crankcase before attempting to change propeller assemblies.

SECTION I. REMOVAL OF KOPPERS (AEROMATIC) PROPELLER ASSEMBLIES AND REWORK OF COWL

1. Remove propeller hub nut clevis pin, and hub nut.
2. Remove the propeller from the hub.
3. Remove the 145-44010 engine cowl air seal. This seal is held in place with seven (7) screws.
4. Remove the four screws and nuts securing the 145-31506 and 145-31507 baffle seals to the aft side of the nose cowl.
5. Rework the cut out in 145-31501-519 cowl assembly, according to the dimensions given in figure.
6. Lay reinforcing strip 145-31501-582 on the upper nose cowl air entrance flange, and using the reinforcing strip as a template, drill five (5) (No. 30 drill) holes and secure the reinforcing strip to the flange with five (5) AD4-4-5-2R1 rivets.
7. Using 145-44061 seal as a template, drill eight (8) (No. 10 drill) holes in the cowl. Mount one AN366F-1032 nut plate at each hole, using two (2) AD3-4-2R1 rivets to each nut plate. Drill the rivet holes with a No. 40 drill.
8. Attach the 145-31508-10 and 145-31509-10 baffle seals to the aft side of the nose cowl, using the four (4) NAS221-8 screws and AN365-1032 nuts removed in step 4 preceding.

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SECTION II. INSTALLATION OF HARTZELL -7 PROPELLER

1. Remove the 48152 plug button located to the right of throttle in the dash panel.
2. Remove the two (2) AN970-3 washers, AN520-10-8 screw, and AN365-1032 nut, which form the firewall plug. This plug is located to the left of the carburetor air control cable. Install an AN931-4-7 grommet in the hole left by removal of the firewall plug.
3. Take the jam nut from the propeller control and place forward of the dash panel in line with the propeller control mounting hole. Pass the control through the dash panel and install jam nut. Guide the opposite end of control through the grommet in the firewall. Tighten the jam nut to secure the control to the dash panel.
4. Secure the propeller control to the 145-51007-4 dash panel support beam. At a point 6-13/16 inches aft of the firewall, remove the screw holding the hydraulic lines clamps in place. Replace the screw with an AN520-10R-14 screw, mounting the AN742-4 propeller control clip on top of a 4S3-D10-6 spacer. At a point 13-23/32 inches aft of the firewall, use the existing screw and nut (attaching the carburetor air control cable to the 145-43001-5 angle) to secure the AN742-4 propeller control clip to the -5 angle.
5. Attach the 145-43023 bracket to the engine by removing the two rear upper crankcase bolts and replace with AN4-13A bolts and eight (8) AN960-416 washers. Mount the bracket on the left side of the top crankcase mating flange. Torque the bolts to 75 inch pounds.
6. Attach the 145-44060-2 bracket to the engine, by removing upper crankcase bolts No. 6 and 7 (as counted from the rear of the engine) and replacing with AN4-13A bolts and eight (8) AN960-416 washers. Mount the bracket on the right side of the crankcase mating flange. Torque the bolts to 75 inch pounds.
7. Attach the propeller control to the brackets installed in steps 5 and 6 preceding, using four (4) each AN742-4 clamps, NAS221-8 screws, AN365-1032 nuts, and 145-43026 sleeves. The sleeves should be located in such a manner as to prevent the clamps from crushing the flex control, causing it to bind.
8. Remove the two AN913-2 pipe plugs from the forward part of the engine. See Page 55 of Navion Service Manual for exact location. Attach the AN6264-4-17-1/2 hose assembly to the left side of the engine, using an AN901-100 gasket, 145-44052 bushing, and AN816-4 nipple to secure the hose. Attach the AN6264-6-11-1/2 hose assembly to the right side of the engine with an AN822-6-2 elbow.

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9. Install propeller on engine in accordance with the following instructions taken basically from the Supplement, Section X, of the Hartzell Propeller Manual, third printing, dated August, 1948.
 - a. Clean shaft threads and splines thoroughly, removing all nicks, burrs, and galls. Make a careful check to determine that shaft threads are not burred or pulled. Stone out burrs and use crocus cloth to remove scratches.
 - b. Wipe the shaft clean and dry with a lint free cloth.
 - c. Remove piston from cylinder by removing A-121 valve link screw and sliding piston forward off piston guide rods.
 - d. Remove diaphragm B-119 by removing outer and inner plates B-120 and A-113.
 - e. The cylinder is mounted on the engine nose with the guide pins A-122 in the horizontal plane, and the servo valve on the upper left side of the cylinder, looking aft. In order to eliminate all possibilities of oil leaks it is recommended that a paper gasket be used between cylinder C-111 and the face of the engine, together with gasket compound.
 - f. The cylinder C-111-7 is mounted with four (4) Allen head cap screws (5/16-18). Use 1/16 thick aluminum or copper washers under the heads of the screws. Be sure the screws do not bottom in the engine tapped hole before pulling up tight on the cylinder; otherwise oil will leak out. Safety screws with wire through drilled holes in screw head.
 - g. Install rubber diaphragm with inner and outer diaphragm rings. **IMPORTANT** - tighten all screws uniformly until the rubber squeezes out past the edges of the rings 1/16 inch. Breakage of the rings may result if only a few screws are tightened up at a time.
 - h. Connect hydraulic lines AN6264-4-17-1/2 and AN6264-6-11-1/2 to the servo valve. Use an AN823-4 elbow and an AN912-3 bushing when connecting the AN6264-4-17-1/2 line to the valve, and an AN822-6-6 elbow to connect the AN6264-6-11-1/2 line.
 - i. Grease front face of rubber diaphragm and install piston. Connect A-118 link with piston, using A-121 screw. Safety screw with wire running to other screws on piston.
 - j. Install the rear cone clean and dry; then coat the hub face of cone, and shaft threads with a thin film of antisieze compound (Specification AN-C-53, or equivalent). Coat the shaft splines with a thin coating of engine oil.

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- k. Slide the jack plate into position on the cylinder guide studs.
- l. Install the engine cowl air seal, securing with nine (9) NAS221-9 screws.
- m. Remove all grease or anti-rust compound from the propeller hub and wipe dry.
- n. Raise propeller and align wide hub spline with propeller shaft blind spline. Then cautiously slide propeller on shaft, taking care not to damage splines, cone seat, or cone.
- o. Spread the propeller counterweights apart. Turn the jack plate counter-clock-wise until the actuating links line up with the blade shank attaching blocks. Then pull the counterweights together until the actuating links and attaching blocks are in place.

CAUTION: Extreme care must be exercised to prevent the blade from rotating too far and allowing the block to strike the hub at an angle or on the end. This will cause block to crack on one end. If this happens and propeller is reinstalled with the cracked end on the under side it cannot be seen, consequently after a few hours in flight, block may fail completely with subsequent malfunctioning of the propeller.

- p. Coat the hub face of the front cone with antisieze compound.
 - q. Install the halves of the front cone on retainer nut shoulder, start retainer nut and cone onto shaft, and screw up snug.
10. Check positioning of element piston to ascertain that clearance is available to allow a 3/16 inch deflection of the diaphragm to either side of neutral. By pushing or pulling the propeller counterweights, move the piston forward or aft, as necessary, to bring the face of the piston flush with the face of the outer diaphragm clamping ring. With the piston in this position, there should be a minimum clearance of 1/4 inches between the jack plate collar and the propeller hub. Should there be less than 1/4 inch clearance at this point, the rear cone should be shimmed up, as necessary, to attain this clearance.

Example: With a clearance of 7/32 inch between the jack plate collar and the propeller hub, it will be necessary to place one (1) 1/32 inch shim behind the rear cone.

11. After establishing the jack plate clearance, as described in step 10 preceding, complete the propeller installation as follows:

SPECIAL INSTRUCTIONS NO. 48

- a. Block one blade and tighten retainer nut with a torque of 540 pounds (a 180 pound load at the end of a three foot bar).
- b. Install the retainer nut snap ring in the hub groove.
- c. Install the propeller retaining nut locking pin, from inside of shaft through aligned shaft hole and retainer nut hole.

CAUTION: If propeller shaft and retainer nut holes do not line up, tighten retainer nut slightly until alignment can be obtained. Do not loosen retainer nut to obtain alignment for locking pin installation.

- d. Install washer and cotter pin on locking pin.

NOTE: In some cases it may be necessary to use a 3/16 inch lock pin when clearance is not available for the 1/4 inch pin.

12. Connect push-pull control wire to valve lever A-117. When connecting control to lever A-117, place piston in forward position with 1/16 inch gap between jack plate collar and propeller hub, and valve body 3/8 inch from valve plate (near mid position); also push-pull control should be pulled out from dash about 1/8 inch, to allow for spring-back cushion.
13. Run up engine and set low stop pitch control to provide proper static rpm (1975 - 2025).
14. Upon completion of the preceding installation, make an operational check of the jack plate clearance. In the full forward position of the diaphragm, (maximum rpm) with engine running, there must be a minimum of 1/8 inch clearance between the jack plate collar and propeller hub. Clearance may be observed from the side of the airplane while the engine is running.

NOTE: This clearance must be observed while the engine is running, as the propeller counter-weights will cause a change in the propeller pitch as the engine is stopped. It is realized that no measurement can be taken while the engine is running; however, if the clearance is obviously less than 1/8 inch the low pitch stop must be adjusted to provide clearance.

It is important that this jack plate to hub clearance be maintained to preclude any possibility of overloading engine thrust bearing with propeller.

15. If the foregoing instructions are fully complied with, the maximum static rpm will be approximately 2025. This adjustment should give a maximum sea level take-off of 2300 with approximately a 400 rpm control range when the propeller control is moved from full increase to full decrease rpm.

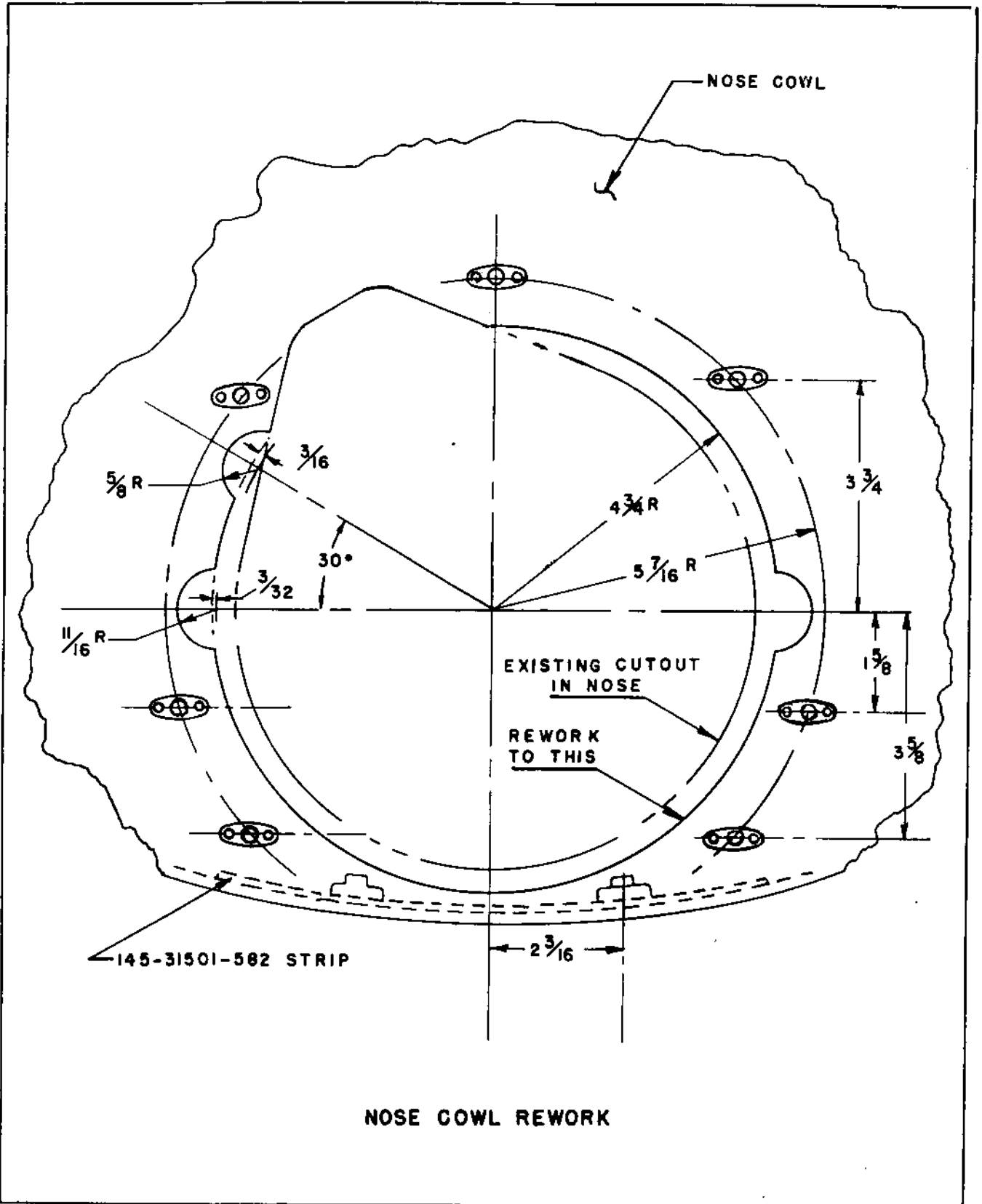
SPECIAL INSTRUCTIONS NO. 48

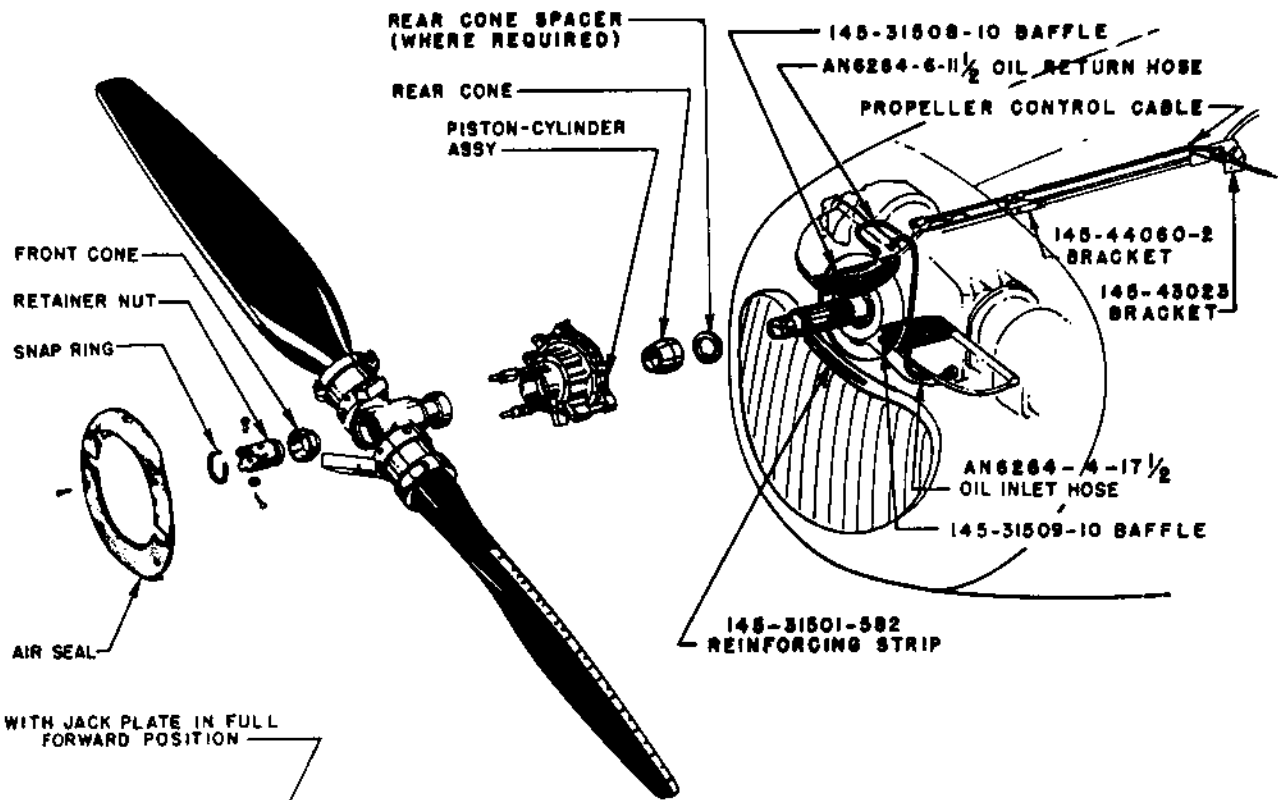
DO NOT attempt to increase this control range, if it will cause over-deflection of the diaphragm of more than 3/16 inch forward.

DO NOT attempt to increase the maximum take-off rpm above 2300 as the engine, airplane and propeller combination is not approved for any setting in excess of 2300 rpm and any attempt made to so adjust the propeller will result in a decreased clearance between the propeller hub and jack plate with subsequent possible overloading of the thrust bearings.

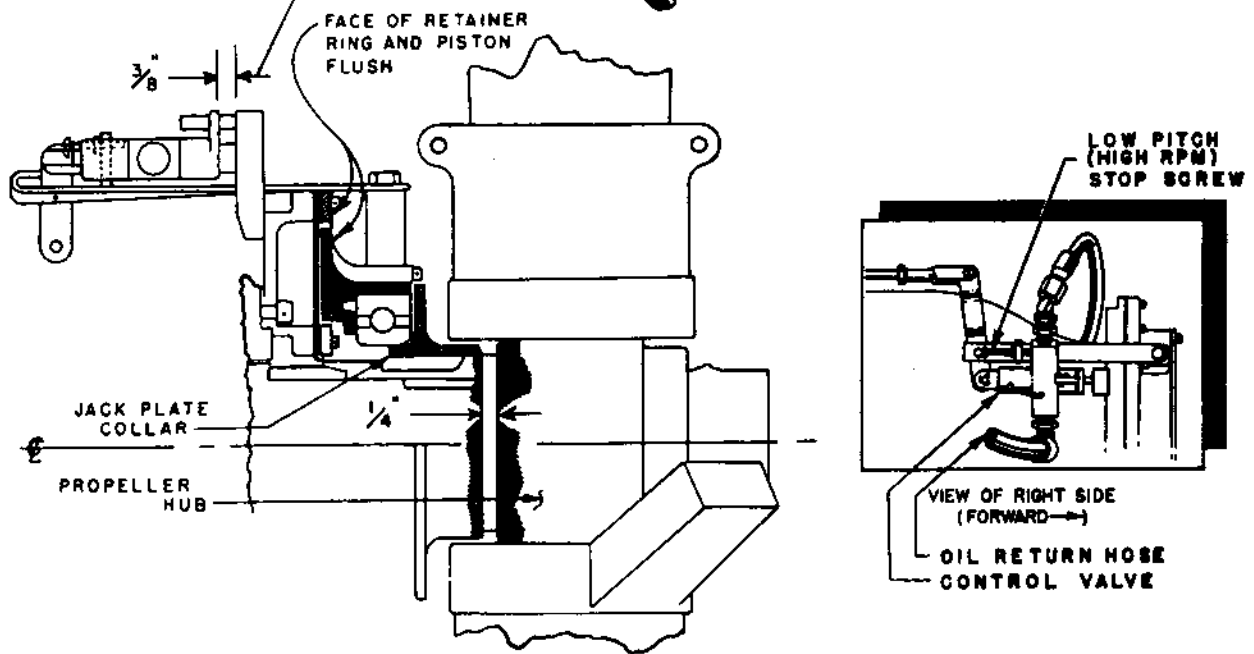
16. If the desired maximum rpm cannot be obtained, the blade settings in the hub must be changed rather than removing spacers from back of the rear cone. The blade settings may be changed by the following procedure:
 - a. If the propeller and clamp are not already indexed, scribe a reference line from the propeller blade to the blade clamp.
 - b. Loosen the outboard clamp bolts.
 - c. Rotate the blade in the clamp as necessary to increase the maximum rpm. A movement of the blade of 1/32 inch in the clamp will effect approximately a 1° change in propeller pitch and will change the maximum rpm approximately 100 rpm. Decrease blade pitch to increase rpm.
 - d. Tighten the clamp bolts (torque to 20 ft. pounds) and repeat the procedure for the other blade.

CAUTION: It is essential that the pitch change of both blades is identical.





WITH JACK PLATE IN FULL FORWARD POSITION



-7 PROPELLER INSTALLATION

SPECIAL INSTRUCTIONS NO. 49

DECEMBER 13, 1948

SHUTTER INSTALLATION - OIL COOLER

An adjustable shutter, to prevent passage of air through the oil cooler, and necessary shutter control linkage, may be installed as follows:

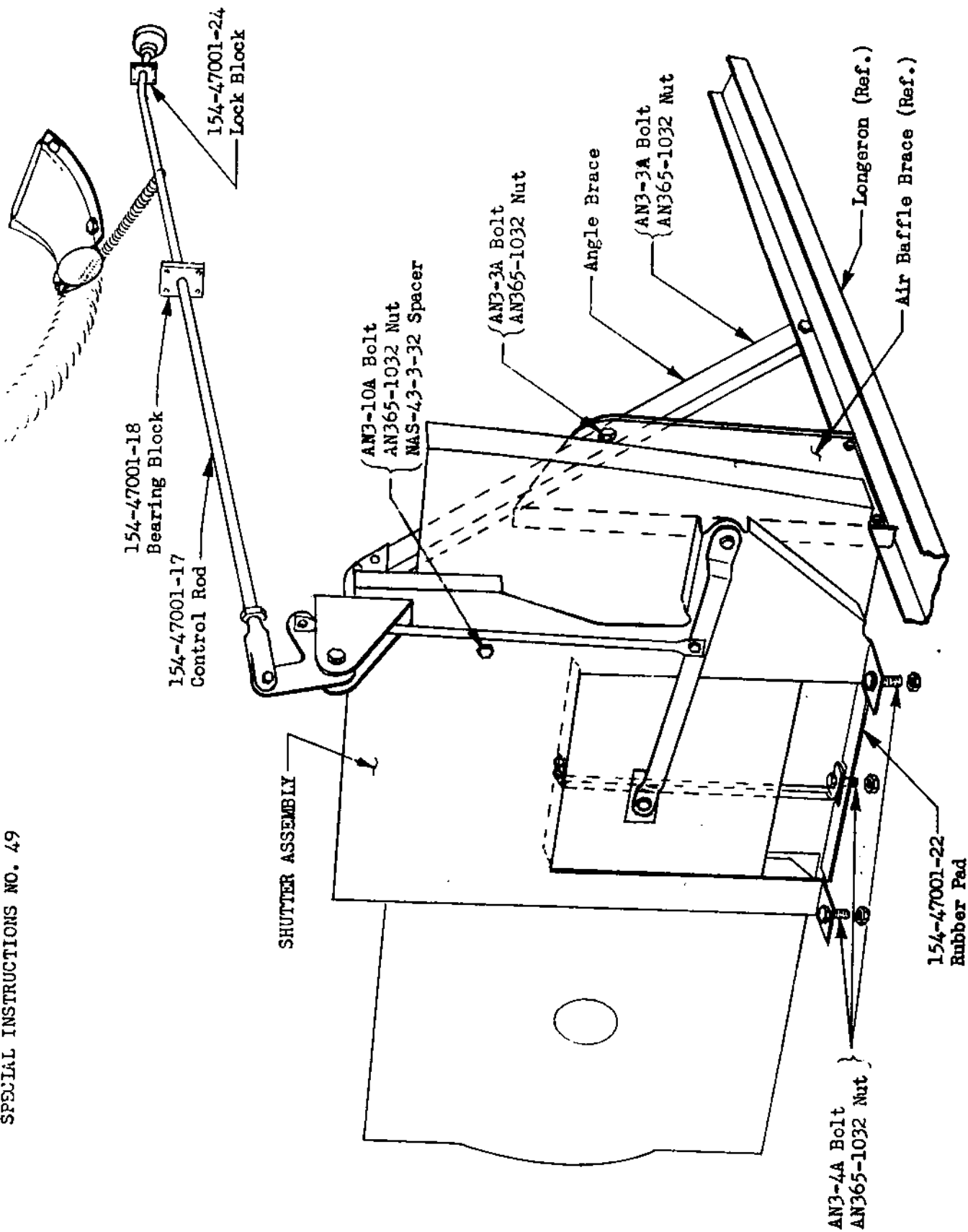
1. At a point 1-1/2 inch above the radio control panel cutout and 1-1/2 inch inboard of the left edge of the radio control panel cutout, drill a 5/16 inch hole in the dash panel. Elongate the hole horizontally to a length of approximately 3/8 inch.
2. Place the 154-47001-24 lock block over the hole in the dash panel. The block should be placed so that the flat side of the cutout is at the right and cuts the arc of the dash panel hole. Use the block as a template to mark and drill (No. 30 drill) rivet holes, four places. Secure the bearing block to the forward face of the panel with four (4) AN426-AD4-5 rivets, or four (4) 6-32 brass screws.
3. Place the 154-00010-8 decal on the dash panel, above the hole drilled in step 1.
4. Place the shutter assembly in position forward of the oil cooler. Using the assembly as a template, mark and drill three (3) mounting holes (No. 10 drill). Drill one hole for each base mounting flange, and one hole above and to the right (looking aft) of the shutter door.
5. Secure the shutter assembly to the mounting structure. Use three (3) each AN3-4A bolts and AN365-1032 nuts to secure the base mounting flanges. Secure the body of the shutter assembly to the oil cooler baffle with one (1) each NAS-43-3-32 spacer, AN365-1032 nut, and AN3-10A bolt.
6. Install the shutter assembly angle brace. Fit the brace into position, so that the upper part of the brace fits against the 154-47001-31 clip, and passes on downward and aft past the air baffle brace and the cowl longeron. Drill through the angle and clip (No. 30 drill) and secure with two (2) AN442-AD4-5 rivets. Drill through the angle and structure ("F" drill) at the junction of the angle brace and air baffle brace and at the junction of the angle brace and longeron. Secure the angle brace at each point with one (1) each AN3-3A bolt and AN365-1032 nut.

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7. At a point directly aft of the shutter bell crank, and approximately two (2) inches above the line of rivets securing the 143-31005-9 angle to the aft face of the firewall, drill a 3/8 inch hole in the firewall.
8. Place the 154-47001-18 bearing block over the hole in the firewall and use the block as a template to mark rivet locations, four places. Drill the rivet holes with a No. 30 drill. Secure the block to the forward face of the firewall with four (4) AN470-AD4-8 rivets, or four (4) 6-32 screws.
9. Pass the 154-47001-17 control rod through the instrument panel and firewall holes. Adjust the clevis end of the rod so that when the 154-47001-24 lock block is mating with the first notch in the control rod, the oil cooler shutter is in the full open position.
10. Secure the rod end clevis to the bell crank with one (1) each AN393-7 clevis pin, AN960-10L washer, and AN380-2-2 cotter.
11. Hook the 145-52320-2 spring to the -17 rod. Hook the other end of the spring to the inboard mounting nut of the left defroster duct. This spring should cause the control rod lock notches to mesh firmly with the lock block.
12. Using a good grade rubber cement, secure the 154-47001-22 rubber pad in place under the shutter door.

NOTE: When installing the center base mounting flange bolt, check that the shutter door backing angle is lightly touching the aft side of the door; but is not bearing hard enough against the door to cause it to bind.

SPECIAL INSTRUCTIONS NO. 49



SPECIAL INSTRUCTIONS NO. 51

FEBRUARY 15, 1949

GYRO INSTRUMENT PANEL INSTALLATION

EFFECTIVITY: NAV4-1790 AND SUBSEQUENT

Install Gyro Instrument Panel Kit, Ryan Dwg. No. 145-89088,
Catalog Item No. 717-100 complete Gyro Panel
Catalog Item No. 717-200 Panel less Instruments
as follows:

1. Remove reflector and instrument panel from control panel.
2. Locate a point to the left of control panel center-line 13-1/2 inches (16-3/8 inches if cylinder head temperature gage is installed) and 11 inches up from the bottom of panel, mark and cut a 2-3/32 diameter hole with a 1/16 inch notch at bottom center of hole.
3. Remove fuel quantity indicator from its present position and install in the opening cut in step 2.
4. Remove clock from its present position and install in opening left by fuel quantity gage.
5. Remove airspeed indicator from its present position. Remove adapter from former clock opening and install air speed indicator.
6. Install directional Gyro in opening left by air speed indicator.

NOTE: It will be necessary to remove the light located to the right of instrument in order to provide clearance for directional Gyro.

7. Install suction gage in blank opening to the right of rate of climb indicator.
8. Remove adapter plate from opening directly below suction gage. Remove oil pressure indicator from present position and install in opening below suction gage.

SPECIAL INSTRUCTIONS NO. 51

9. Remove manifold pressure gage from present location and install in opening left by oil pressure gage.
10. Remove adapter plate from opening that was formerly used by manifold pressure gage, and install artificial horizon.

SEE SKETCH.
11. Install 400 x 6 and 434 x 4 elbows in ports of Gyro horizon.
12. Install 300 x 4 union into suction gage and connect -10 line assembly one end to suction gage, the other end to 434-4 fitting in Gyro horizon.
13. Install 3200 x 4 pipe adapter and 752 x 6 tee into directional Gyro, connect -8 line from tee to 400 x 6 fitting on Gyro horizon.
14. Reinstall floating instrument panel into control panel.
15. Attach 145-58030 hose assembly to tee and connect opposite end of hose assembly to line or regulator of suction power supply. (Reference Special Instructions Kit No. 39.)
16. Install -2 replacement line from alt. to static line fitting on airspeed indicator. Attach -4 line assembly extensions to pitot pressure and static lines with 300 x 4 unions and opposite end to fittings on airspeed indicator.
17. Re-route manifold and oil pressure lines and connect to fittings on the instruments.
18. Clip -12 light assembly to fuel quantity indicator U clamp in such a position that the light will reflect through the slots provided in the instrument sides.
19. Attach No. 328 wire of -12 light assembly to compass harness. (This is the connection left by removal of light assembly from hole now covered by directional Gyro.)
20. Attach 145-51081 light reflector to the instrument face side of the panel with the right hand top attaching screw of the directional Gyro instrument.
21. Place -14 light seal over directional Gyro shaft and install the 145-51080 reflector panel. (Seal should be stapled together.)

NOTE: This kit is C.A.A. approved and requires only the filling out of a Form 337 and submitting to C.A.A. inspector for approval.

3200 x 4 PIPE ADAPTER
752 x 6 TEE

BEND STATIC & PITOT
LINES TO ALIGNMENT

13 1/2"

145-51-081 LIGHT REFLECTOR

145-58030 HOSE ASSEM.

COMPASS WIRE HARNESS CONNECTION

-8 LINE ASSEM.

-4 LINE ASSEMS.
300 x 4 UNIONS

300 x 4 UNION

SUCTION

RATE OF CLIMB

TURN & BANK

AIR. SP'D IND.

F.L. IND.

OIL TEMP.

OIL PR.

MAN. PR.

CYRO HORIZON

CYRO

CLOCK

TACH.

ALT.

BEND TUBES & FIT TO
NEW GAUGE LOCATIONS

434 x 4 ELBOW

-12 LIGHT ASSEM.

-2 LINE ASSEM.

400 x 6 ELBOW

-10 LINE ASSEM.

SUPPLEMENT NO. 1

SPECIAL INSTRUCTIONS NO. 51

SEPTEMBER 1, 1949

On page number 2, step number 12 correct to read as follows:

Install 10-1146-75 adapter into suction gauge and connect -10 line assembly, one end to suction gauge, the other end to 434-4 fitting in Gyro horizon.

On page number 3, illustration, upper left hand corner, strike out 300 x 4 union and write in 10-1146-75 adapter.

SPECIAL INSTRUCTIONS NO. 52

SPECIAL INSTRUCTIONS

MARCH 1, 1949

FUEL FILTER SCREEN INSTALLATION

EFFECTIVE: NAV-4-1270 TO 1693 AND NAVIONS HAVING THE BOMBO ADAPTER KIT INSTALLED

Fuel Filter Screen, Ryan Fuel System Kit Drawing No. 145-48228, install as follows:

1. Remove Adel electric fuel pump access gill door.
2. Locate and drill a 15/16 inch diameter hole in firewall 6-1/2 inches up from bottom, measuring adjacent to nose wheel torque box and 4 inches outboard from box side.
3. Remove existing -74 tube assembly from pressure relief valve to firewall fitting, and disconnect flexline forward of firewall.
4. Remove the existing line assembly clamps and fittings from pressure relief valve, to boss in right hand fuel tank.
5. Install AN913-3D plug in tank boss, or tee, if auxiliary tank is installed.
6. Check 145-48228 manifold fitting on Adel electric pump and ascertain if a 1/4" pipe tap hold with plug is installed. If installed remove plug. If there is no plug or hold; locate and drill a hold with a "Z" drill (.413), countersink 90° x 9/16 diameter, ream with 1/4" pipe taper, and tap with 1/4" pipe thread on underside of fitting 1-3/16" from large end (end extending out beyond Adel pump) and 7/16" forward from the pump face side, to a depth necessary to intersect internal hold. See sketch.

NOTE: Prior to reinstalling fitting after drilling hole, thoroughly flush fitting in solvent or gasoline to eliminate all chips remaining from drill and tapping operation. Also replace "O" rings under cap screws. Replacement "O" rings should not be soluble in gasoline.

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7. Install AN915-2 45° elbow into 1/4" hole.
8. Install pressure relief valve with flow pointing aft into AN915-2 elbow.
9. Remove existing AN837 45° elbow from firewall.
10. Install 145-48080 filter screen assembly into 15/16 inch hole previously drilled in firewall, attaching with AN960-1616L washer, AN 924-10D nut installed on AN823-4 45° elbow and elbow screwed into forward end of filter screen through firewall, aft fitting hole to be located underneath.
11. Reinstall flex line to AN823-4 fitting.
12. Install AN823-4 45° elbow into lower side of aft end of filter screen (end with large hex section).
13. Connect the -114 tube assembly to the AN823-4 fitting on filter screen, flush system thoroughly by turning on Adel pump, then connect opposite end to pressure relief valve.
14. Plug 7/16 inch ole formerly used by AN837 elbow in firewall with 48152 plug button.

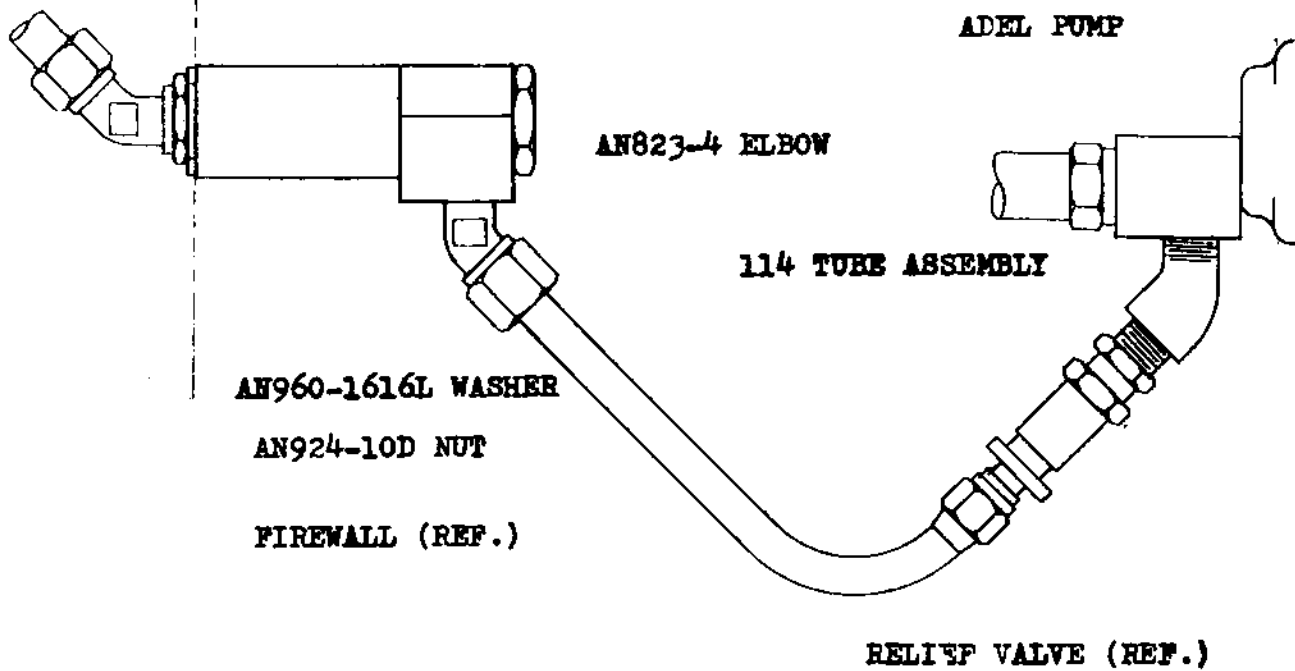
NOTE: Extreme caution must be exercised to prevent any foreign material from entering fuel lines and fittings when making this installation.

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AN823-4 ELBOW

COCKPIT FLOOR (REF.)

145-48080 FILTER ASSEMBLY



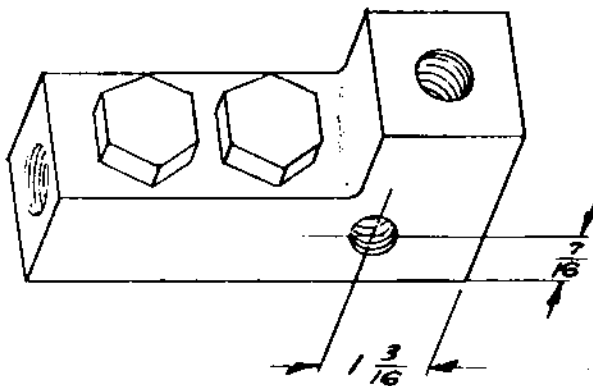
AN960-1616L WASHER

AN924-10D NUT

FIREWALL (REF.)

RELIEF VALVE (REF.)

AN915-2 ELBOW
(REF.)



REWORK MANIFOLD (WHEN NECESSARY) TO DIMENSIONS SHOWN

SPECIAL INSTRUCTIONS NO. 53

APRIL 1, 1949

NEW YORK AIR BRAKE HYDRAULIC PUMP

Kit installation New York Air Brake Hydraulic Pump Ryan Dwg. No. 145-89098
Catalog Item No. 793 Applicable NAV-4-2 through 1564
Catalog Item No. 793-100 Applicable NAV-4-1565 through 1627

Install as follows:

1. Close off hydraulic fluid supply valve with control in cockpit.
2. Remove the existing inlet and outlet hoses from hydraulic pump, the pressure relief valve and fluid supply shut-off valve.
3. Remove the 45° weatherhead fitting from the hydraulic fluid supply shut-off valve and install the AN823-6 45° ell.

NOTE: On Navions serial number 1565 and subsequent this fitting need not be changed.

4. Remove the weatherhead tee or AN tee fitting from the inlet port of the hydraulic pressure relief valve and install the 200 x 4 connector or the AN816-4 connector. Re-connect the line running from cockpit valve to connector installed.
5. Remove the 1/8" pipe plug located in pressure relief valve from the port opposite the inlet port from which tee fitting was removed and install the AN822-5 90° ell with opening pointing down.
6. Remove the existing 145-58020 hydraulic pump and install the new 145-58024 hydraulic pump assembly with the side port pointing down and to the left, looking from the rear.
7. Install the AN6260-6-20 hose assembly into the inlet port of hydraulic pump (port located on the side) and the opposite end to the fitting in hydraulic supply shut-off valve.
8. Install the AN6264-5-20 hose assembly to outlet port of pump (aft end port) and the opposite end to the AN822-5 90° ell previously installed in pressure relief valve.

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9. Remove the tee connecting the left and right landing gear down lines, located in the main wheel well. Install the 145-58021 restrictor assembly with tee attached. (Restrictor pointing forward.)

NOTE: It will be necessary to reduce the length of the 145-58801-38 line (main line from cockpit valve) by the amount of the restrictor length, reflare the tube and connect to the restrictor.

10. Place the airplane on jacks, push on hydraulic supply shut-off valve and ground check gear through several cycles before flying airplane.

This pump is C.A.A. approved and requires only the preparation of a 337 Form, and submitting to a C.A.A. representative for inspection.

Equipment Item No. _____ Engine Driven Hydraulic Pump
Model 67A025 New York Airbrake Wt. 3 lbs. H-arm 46"

SPECIAL INSTRUCTIONS NO. 54

MARCH 25, 1949

WHEEL WELL FAIRING DOORS INSTALLATION

Kit - Landing Gear Fairings, Ryan Dwg. No. 145-89097, Catalog Item No. 792

Effectivity: NAV-4's prior to 1790

SECTION A. Installation and Adjustment of Nose Wheel Doors

1. Place airplane on jacks so that the landing gear may be retracted as desired.
2. Remove the fuselage baffles of the engine cooling air exhausts.
3. Cut out the templates (see sketch) and locate as indicated on the left and right sides of the nose wheel well.
4. Drill four (4) No. 10 (.194 dia.) holes as indicated by the templates.
5. Place the bearings on the ends of the cam torque shaft and position the assembly as indicated by the alignment of the holes drilled in step 4 preceding with the bearing block mounting holes. Adjust end play in bearings to a maximum of 1/32 inch; by placing AN960-716L washers, as necessary, behind the left hand bearing. Remove any rivets located beneath the bearing blocks.
6. Secure the bearing and torque shaft assembly in place with four (4) each AN3-7A bolts and AN365-1032 nuts.
7. Retract the nose gear and place the fairing doors in position over the wheel well. Check that the doors are fully forward and do not contact the wheel or tire. Mark the location of the door hinges on the fuselage skin. The hinges should start immediately aft of the firewall.

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8. Remove the rivets which fall within the location marks of the hinge. These should be the 25 skin rivets immediately aft of the firewall on each side of the wheel well.
9. Insert the hinge plate of each door between the airplane skin and the nose beam assembly. Close doors and check fit. The doors must meet at the centerline of the airplane and must conform to the cut-out of the wheel well. If necessary, a small amount of material may be trimmed from the edges of the doors to make them fit.
10. Using the existing rivet holes as a template, drill each hinge plate (No. 30 drill) and rivet in place with AD4-2R1-5 rivets.
11. Locate the 145-33308-2 stop at the forward end of the wheel well. The stop should be located on the centerline of the airplane so that it will extend into the wheel well to contact both fairing doors when they are closed. Drill the stop and mounting flange two places (No. 40 drill) and secure with two (2) AD3-2R1-4 rivets.
12. Locate the 145-33307 bracket and spring assembly at a point 2-1/2 inches outboard of the airplane centerline, and 1-3/4 inches forward of the wheel well cutout. Drill the bracket and skin two places (No. 40 drill) and secure with two (2) AD3-2R1-4 rivets.
13. Before attaching the door actuating links, raise the gear slowly; by hand, checking that only the tip of the upper drag link enters the cam and that all other points of the drag link have 1/16 inch clearance.
14. Attach the door actuating links, adjusting the lower links to be approximately 5-3/8 inches long.
15. Retract nose gear by hand until tip of upper drag link is ready to enter slotted cam. With the actuating links in the over-center locked position, the tip of the drag link should clear the lower cam section by approximately 1/16 inch. To increase this clearance lengthen the upper actuating link. To decrease this clearance shorten the upper actuating link.
16. Measure the distance from the door link attaching bolts to the centerline of the cam torque shaft for both doors. Note this measurement for future reference.
17. Completely retract nose gear and check the fit of the doors. If doors are not fully closed, shorten the lower links only, to raise them. If doors hit stops before strut is fully retracted and locked, lengthen links only. When properly adjusted the doors will preload against stops enough to prevent movement of the doors; but will not preload enough to prevent gear from latching in the up position.

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18. Extend the gear and adjust linkage to obtain measurement noted in step 16 preceding. Lengthen or shorten the upper links only, at this time.
19. Retract gear and check cam clearance and fit of doors. Make any fine adjustments required by following preceding adjustment procedure.
20. As a final check attempt to hold doors closed while slowly extending gear. The cam must move the door links to an over center, locked, position without aid of the spring. Should cam movement fail to open the doors fully check the lower cam tip clearance in step 15 preceding. If necessary reduce this clearance slightly and repeat adjustment procedure.
21. Reinstall fuselage baffles.

SECTION B. Installation and Adjustment of Main Wheel Doors

The following procedure is for one main wheel well fairing door only, and will have to be repeated for the opposite wing.

1. Locate the two 145-83302-10 stops on the wing rib at station 24.5. The stops will be centered on the rib flange with the bottom of the stop 3/8 inch above the lower wing skin. Secure each stop to the rib with two (2) AD3-2R1-4 rivets.
2. Remove the eight (8) rivets securing the lower wing skin to the bulkhead flange at the outboard end of the wheel well.
3. Place the hinge plate, spacer, and stiffener on the upper side of the bulkhead flange; and using the existing rivet holes as a template drill eight places with a No. 19 drill (.166 dia.)
4. Secure the hinge plate, spacer and stiffener to the wing structure with eight (8) each AN526-832R10 screws and AN365-832 nuts.
5. Place the 145-83302-9 bracket on the strut, slightly below the landing light bracket.
6. Connect the 145-83303-3 link to the door and bracket. Move the bracket up or down, as necessary, to place the link in a horizontal position; and adjust the length of link to provide a 1/8 inch minimum clearance between the fairing door and landing light.
7. Retract the gear slowly checking for 1/8 inch minimum clearance as the link passes in front of landing light. Rotate the clamp, on the shock strut to increase or decrease this clearance.

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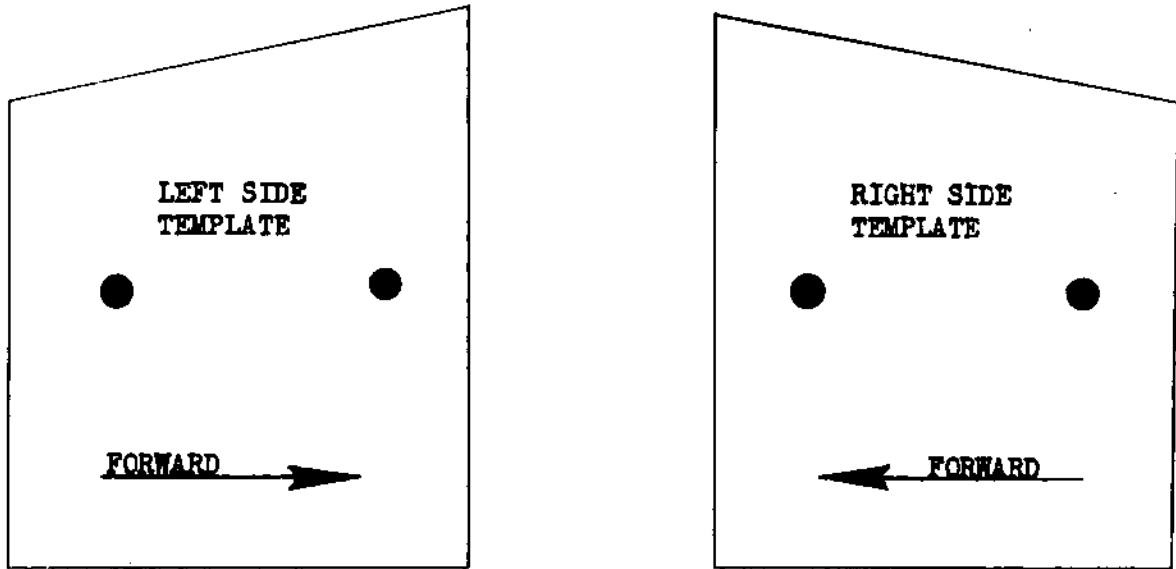
8. With gear completely retracted, the door should bear against the stops with a 2 to 3 pound load. To move the door toward the stops slide clamp, on strut, toward wheel
9. Lower gear and recheck clearance around landing light. Repeat adjustment procedure as necessary.

SECTION C. Operational Check

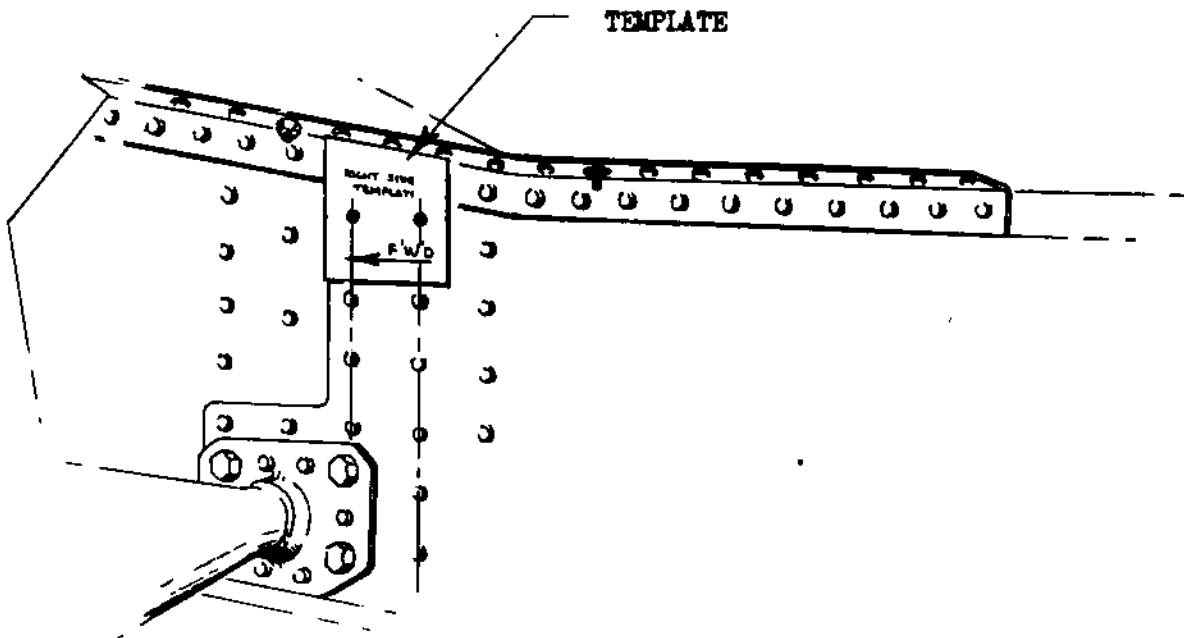
Before removing airplane from jacks, raise and lower gear a minimum of three times; carefully checking all operational clearances and fit of doors. Make certain that gear is down and locked before removing jacks.

This Kit is C.A.A. approved and requires only filling out of Form 337 and submitting to C.A.A. representative for inspection.

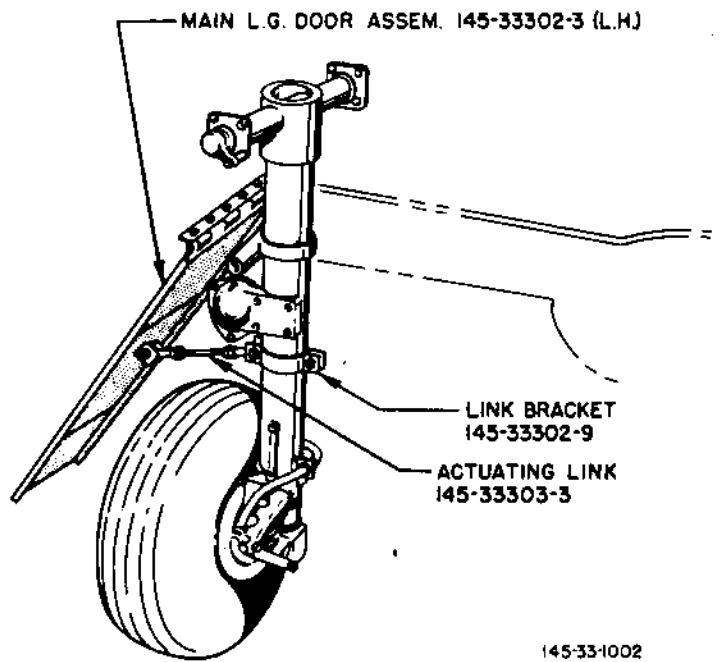
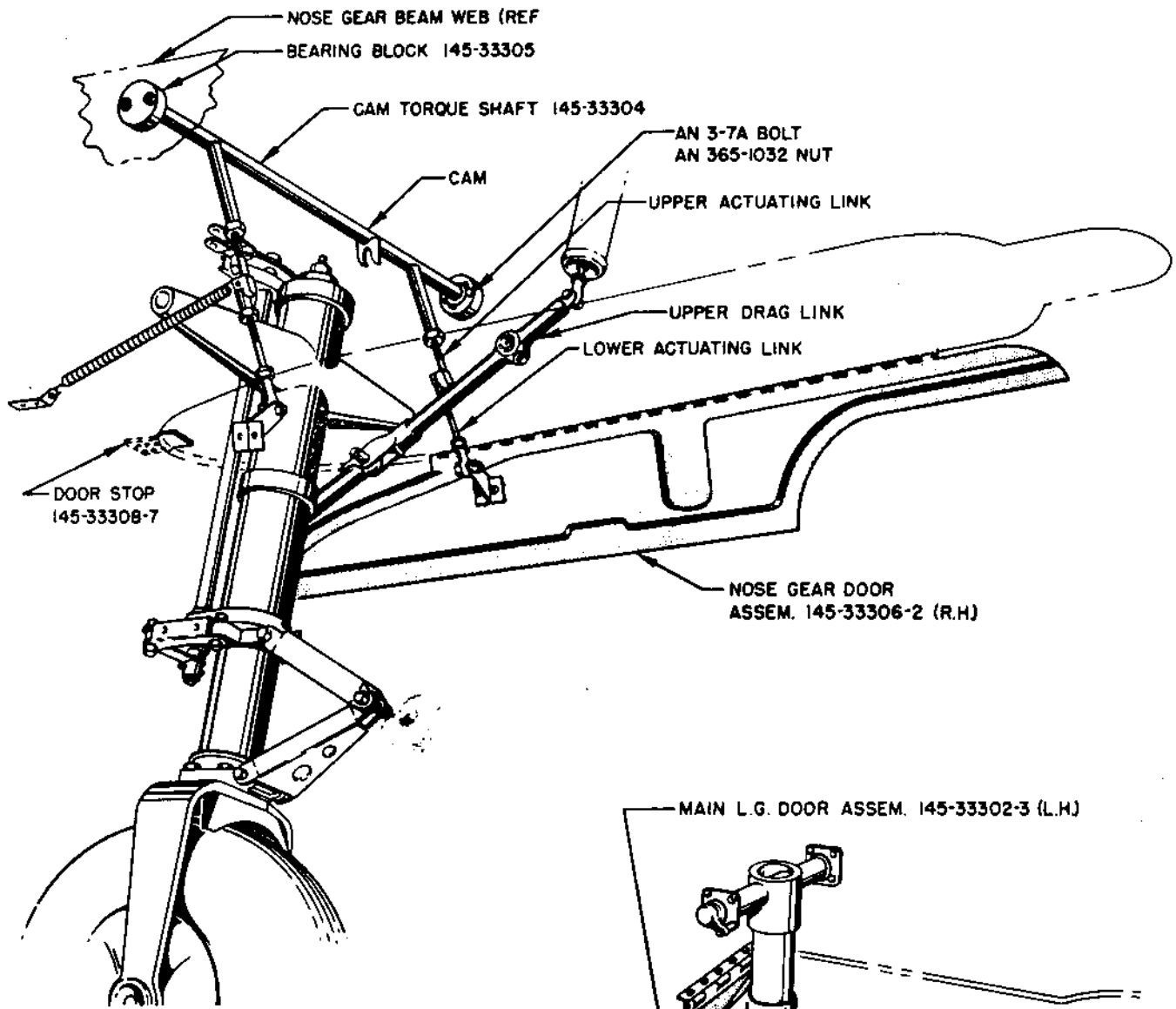
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BEFORE CUTTING, CEMENT TEMPLATES TO THIN
CARDBOARD TO MAINTAIN SHAPE AND DIMENSIONS



VIEW INSIDE NOSE WHEEL WELL SHOWING
PLACEMENT OF TEMPLATE FOR LOCATION
OF BEARING BLOCK MOUNTING HOLES



145-33-1002

SUPPLEMENT NO. 1 TO NAVION SPECIAL INSTRUCTIONS NO. 54

JUNE 5, 1949

WHEEL WELL FAIRING DOORS INSTALLATION

The following changes should be made in the fairing door installation procedure described in Special Instructions No. 54 to facilitate the installation of this equipment.

1. The following paragraph replaces paragraph 3 on page 1:

Cut out template printed on page ² of this supplement and locate as indicated on the right and left sides of the nose wheel well. (The templates furnished with original instructions have the holes located incorrectly).

2. Paragraph 5 on page 1 of the instructions should read as follows:

Place the 145-33305 bearings on the ends of the 145-33304 cam torque shaft and position the assembly in the wheel well as indicated by the alignment of the holes drilled in step 4. (Remove any rivets located beneath bearing block). Make a temporary installation of the assembly in the nose wheel well with four (4) AN3-7A bolts and AN365-1032 nuts. Line up cam on torque shaft with approximate center of upper actuating link and mark around ends of shaft at the end bearings with a pencil. Remove torque shaft assembly from airplane and drill a No. 40 cotter pin hole in each end of shaft. Locate cotter pin hole far enough inboard of the pencil marks so that an AN960-816L washer can be installed between the cotter pins and the bearings and still leave approximately 1/32 inch end play in shaft. Install cotter pins and washers and make a permanent installation of the torque tube assembly in the nose wheel well.

3. Delete present paragraph 6 on page 1 and use the following instructions for step 6 of the procedure:

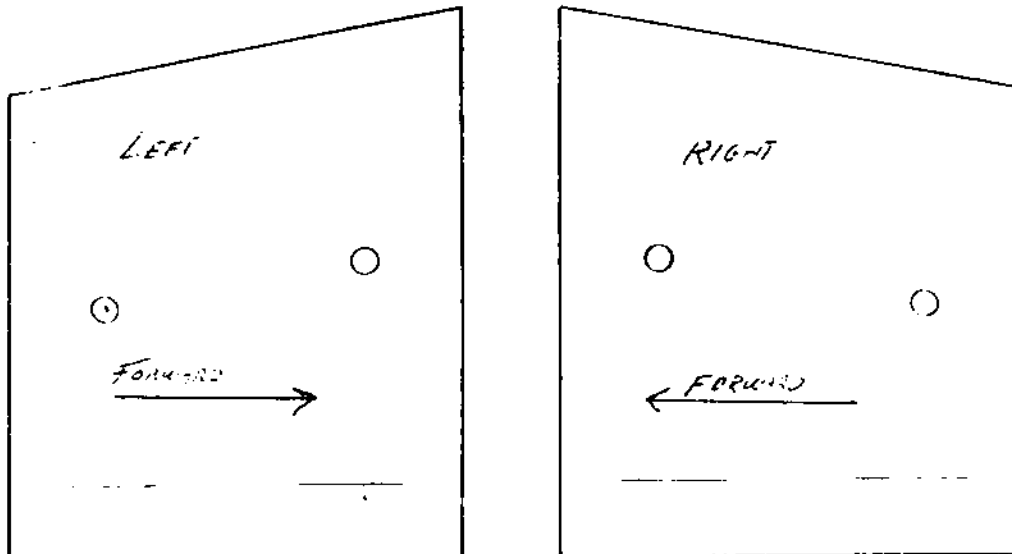
SUPPLEMENT NO. 1 TO SPECIAL INSTRUCTIONS NO. 54

Install the 145-33308-1 stop assembly on the 145-34143 dural block at top of nose gear wheel fork with two (2) AN515-8R7 screws and AN936-A8 washers. Using stop assembly bracket as a template, mark location of mounting screw holes on block with pencil and drill two (2) holes with No. 29 drill and tap with an 8/32 tap. Locate the 145-33308-1 micarta stop assembly 1/8 inch below top of dural block and centered horizontally on the block.

4. The dimensions in paragraph 12 on page 2 should read as follows:

The 2-1/2 inch measurement given in this paragraph should be 2-3/4 inches and the 1-3/4 inch measurement should read 1/4 inch.

NOTE: In cases where difficulty is encountered in getting the nose gear to lock in the up position after fairing doors have been installed, it may be necessary to widen the slot in the 145-34118 hook assembly - auxiliary landing gear uplock 1/16 inch. This may be accomplished by filing 1/16 inch off the top edge of the slot. Under no circumstances should any material be taken off the lower edge of the slot. Due to the additional load placed on the nose gear actuating mechanism, it may also be necessary to increase the length of the actuating cylinder piston shaft by screwing the end fitting out on the shaft a maximum of one full turn. Do not attempt to adjust actuating cylinder until after slot in uplock has been widened 1/16 inch.



SPECIAL INSTRUCTIONS NO. 55

APRIL 29, 1949

ENGINE EXHAUST MUFFLER HEATER INSTALLATION

Kit - Muffler and Heater Installation, Ryan Dwg. No. 145-89099

Applicable on NAV-4's prior to 1628

NOTE: This kit may be installed without removing the engine from the airplane. However, it is possible to do a faster and better job if the engine is first removed according to the instructions in the "Navion Service Manual".

SECTION A. Preparation

1. Remove engine from airplane according to instructions on page 57 of Service Manual.
2. Remove oil cooler and inboard oil cooler support bracket.
3. Remove Stewart-Warner heater, if installed and any existing wiring or lines to heater, securely capping fuel line intake port.

SECTION B. Firewall and Lower Cowling Rework

1. At a point 4-1/2 inches above and 1-7/8 inches inboard of the center of the air distributor intake plate, drill a 5/16 inch diameter hole through the firewall and insert an AN931-4-7 grommet. This hole is for ventilating air mixing valve control.
2. Drill four (4) (No. "F" drill) holes in firewall. See figure. These holes are to be used to secure the tail pipe supports.
3. Remove the mounting nut of the firewall fitting for the fuel pressure relief line. Place the 154-48001-119 shield over the

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fitting and re-install the mounting nut. Before tightening the mounting nut move the shield flange to the outboard side of the fitting.

4. Place one (1) 143-31901-500 cover plate over the inside of each exhaust stack cut-out in the lower cowl skin. Using the plates as templates, drill twenty-four (24) (No. 30 drill) holes in the cowl skin. Secure each plate to the skin with twelve (12) 2R1-AD4-4 rivets.

SECTION C. Rework of Left Bulkhead Baffle

1. Locate 143-31901-304 doubler on face of bulkhead. This doubler is to be located immediately below bulkhead upper flange, with outboard vertical edge 15-1/16 inches from airplane centerline.
2. Clamp doubler in place and using doubler as a template, drill seventeen (17) (No. 30 drill) rivet holes along the border of the doubler, two (2) (No. 10 drill) holes near the upper inboard edge of the doubler, and cut out the bulkhead web to match the center hole in the doubler.
3. Secure the doubler to the bulkhead web with seventeen (17) 442AD4-4 rivets.
4. Place the 145-42127-5 seal in place over the aft side of the bulkhead web cut-out, with the cut-in edge of the seal at the top, immediately inboard of vertical center. Using the seal as a template, drill eight (8) (No. 6 drill) holes in the web and doubler.
5. Locate one AN362-1032 nut plate over each hole drilled in step 4 preceding. Attach the nut plates to the forward side of the doubler with sixteen (16) 2R1-AD3-5 rivets.
6. Place the seal and 145-42127-6 plate over the bulkhead cut-out and secure with four (4) each AN3-5 bolts and AN960-10 washers.
7. Locate the 145-47001-12 oil line shield against the inboard flange of the doubler. The shield should be so located as to be a shield between the oil pressure and return lines and the unshrouded portion of the exhaust muffler. Using the shield flange as a template, drill two (2) (No. 10 drill) holes through the bulkhead, and secure the shield to the bulkhead with two (2) each AN3-3 bolts and AN365-1032 nuts.
8. On the aft face of the bulkhead, mount the 145-47001-11 oil cooler bracket with two (2) each AN520-10-R7 screws, AN365-1032 nuts, and AN960-10 washers. Secure the bracket to the bulkhead at the two (2) (No. 10 drill) holes drilled in step 2, preceding.

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SECTION D. Rework of Right Bulkhead Baffle

1. Locate 143-31901-301 doubler on aft face of right bulkhead baffle. The doubler should ride on the bulkhead angle flange, and the upper inboard corner of the doubler should be 3-1/8 inches outboard of the inboard edge of the bulkhead web.
2. Clamp doubler in place and use as a template to drill twenty-one (21) (No. 30 drill) rivet holes, and to cut the bulkhead web to match the cut-out holes in the doubler.
3. Secure the doubler to the bulkhead web with twenty-one (21) 442AD4-4 rivets.
4. Place the 143-31901-302 plate over the outboard doubler cut-out hole, and use as a template to drill five (5) (No. 30 drill) holes through the doubler and bulkhead web.
5. Secure the -302 plate and 143-31901-303 packing to the aft face of the doubler with five (5) 442-AD4-6 rivets.
6. Locate a point on the 145-31901-20 flange, 8-17/32 inches outboard of the airplane centerline. From this point drop a vertical line across the aft face of the bulkhead web. On this vertical line locate two points, 1-1/2 and 3-3/16 inches below the top of the -20 flange. At the point 1-1/2 inches below flange, drill a 1-1/4 inch diameter hole. At the point 3-3/16 inches below flange, drill a one (1) inch diameter hole. Two inches outboard of the 1-1/4 inch hole, drill a second one (1) inch diameter hole.
7. Place the 145-42128-5 seal over the tail pipe cut-out and use a template to locate eight (8) drill points for location of mounting bolts. Drill with a No. 6 drill.
8. Locate one AN362F-1032 nut plate over each hole drilled in step 7 preceding. Attach the nut plates to the forward side of the bulkhead with sixteen (16) 2R1-AD3-5 rivets.
9. Place the seal and 145-42128-4 plate over the tail pipe cut-out and secure with four (4) each AN3-5A bolts and AN960-10 washers.

SECTION E. Carburetor Air Mixing Chamber Modification

1. Remove the carburetor air mixing chamber from the airplane and disassemble.
2. Reassemble mixing chamber, replacing the chamber body with 145-42201-84 body.

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3. Slide the 145-42201-83 hot air dump pipe on the aft end of the hot air tee. Secure the pipe to the tee by drilling a 3/16 inch diameter hole through the dump pipe and tee and fastening with an AN3-15 bolt and AN365-1032 nut.
4. At a point four (4) inches to the left of the carburetor centerline and five (5) inches aft of the transverse carburetor centerline cut a 1-7/16 inch diameter hole in the bottom cowling.
5. Slide the 791-2E-21 clamp on the bottom of the hot air dump tube. Remove the air mixing valve assembly on the airplane.
6. Rotate and raise or lower the 791-2E-21 clamp as necessary, to locate the clamp mounting clip in a spot free of obstructions. Drill one (1) (No. 30 drill) hole to match the clip and secure the clip to skin with an ADC-4 countersunk rivet.

SECTION F. Installation, Left Exhaust Manifold, Exhaust Tail Pipe, Tail Pipe Shroud

1. Attach the 145-42118-35 tail pipe support to the tail pipe with two (2) each AN4-6A bolts, and AN363-428 nuts. Place the tail pipe support on the forward side of the support bracket, with the 145-42118-43 reinforcing plate over the support.
2. Pass the forward end of the 145-42121 tail pipe forward through the bulkhead baffle cut-out. Place the 145-42118 muffler manifold in position and connect the tail pipe to the muffler, using one (1) each AN325-11 clevis pin, AN960-10 washer and AN380-2-2 cotter to secure the attaching clips.
3. Attach the 145-42127-11 support to the 145-42127-3 shroud with one (1) each AN3-4 bolt and AN960-10 washer. Place the forward end of shroud over the bulkhead seal and attach to the bulkhead with four (4) each AN3-5A bolts and AN960-10 washers.
4. Attach the tail pipe support and the shroud support bracket to the firewall with two (2) each AN404 bolts, AN960-D416L washers and AN364-428 nuts.

SECTION G. Installation, Right Exhaust Manifold, Exhaust Tail Pipe, and Tail Pipe Shroud

1. Attach the 145-42118-35 tail pipe support to the tail pipe with two (2) each AN4-6A bolts, and AN363-428 nuts. Place the tail pipe support on the forward side of the support bracket, with the 145-42118-43 reinforcing plate over the support.

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2. Place the 145-42119 muffler manifold in position with the tail pipe extension fitting through the bulkhead cut-out.
3. Slide 145-42123 tail pipe on manifold fitting and secure in place with one (1) each AN393-11 clevis pin, AN960-10 washer and AN380-2-2 cotter.
4. On 145-42128-9 tail pipe shroud drill a (No. 10 drill) hole one inch above the inboard edge of the shroud and 5-1/4 inches aft of the bend on the shroud flange. Use this hole to mount an AN742-32 clamp with one (1) each AN515-1OR7 screw and AN365-1032 nut.
5. Attach the 145-42128-10 support to the aft shroud flange with one (1) each AN3-4 bolt and AN960-10 washer. Place the forward flange of the 145-42128-9 tail pipe shroud over the bulkhead seal, and secure the shroud in place with four (4) each AN3-5 bolts and AN960-10 washers.
6. Attach the 145-42128-10 shroud support bracket and 145-42118-35 tail pipe support bracket to firewall. Use the holes drilled in step 2, Section B, preceding, and two (2) each AN4-4 bolts, AN960-D416L washers and AN364-428 nuts.

SECTION H. Installation, Hot Air Mixing Valve

1. Using the existing clamp, mount the 145-42122 mixing valve on the firewall.
2. Insert the existing ventilating air intake duct into the forward end of the mixing valve, and secure with the existing clamp.
3. Secure the 145-42202 flex tube coming from the bottom of the valve to the heating shroud out-let pipe, with one (1) each AN735-32 clamp, AN515-1OR7 screw, and AN365-1032 nut.
4. Attach the 145-42202 flex tube to the mixing valve dump out-let with one (1) each AN735-32 clamp, AN515-1OR7 screw, and AN365-1032 nut. Attach the lower end of the flex tube to the exhaust tail pipe shroud, using the clamp attached to the shroud in step 4, Section G, preceding.
5. Secure a 795-3 clip to the windshield defroster air out-let adapter assembly. Drill a (No. 18 drill) hole 9/16 inch above the flange hole on the inboard side of the adapter, and secure the clip to the flange with one (1) each AN515-8R7 screw and AN365-832 nut.
6. At a point 17-3/4 inches outboard of the airplane centerline and 1/4 inch above the edge of the 145-51060 glove compartment bracket, drill a (No. 18 drill) hole. Secure a 795-3 clip to the bracket with one (1) each AN515-8R7 screw and AN365-832 nut.

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7. Drill a 3/8 inch hole through the control panel, in line with, and 3-1/2 inches outboard of the air distributor control. Place the "CABIN HEAT PULL HOT" decal on the panel immediately above the hole.
8. Thread the M-22-O-32B "Aren" flexible control through the panel, through the clips installed in steps 5 and 6 preceding, and through the firewall. Secure the end of the flexible shielding with the AN742-3 clip on the upper edge of the mixing valve, and attach the control wire to the pivot arm with a K-3058 swivel and AN380-2-2 cotter. Adjust the control cable so that with the mixing valve in the cold air position, the control has a 1/8 inch spring back from the control panel.

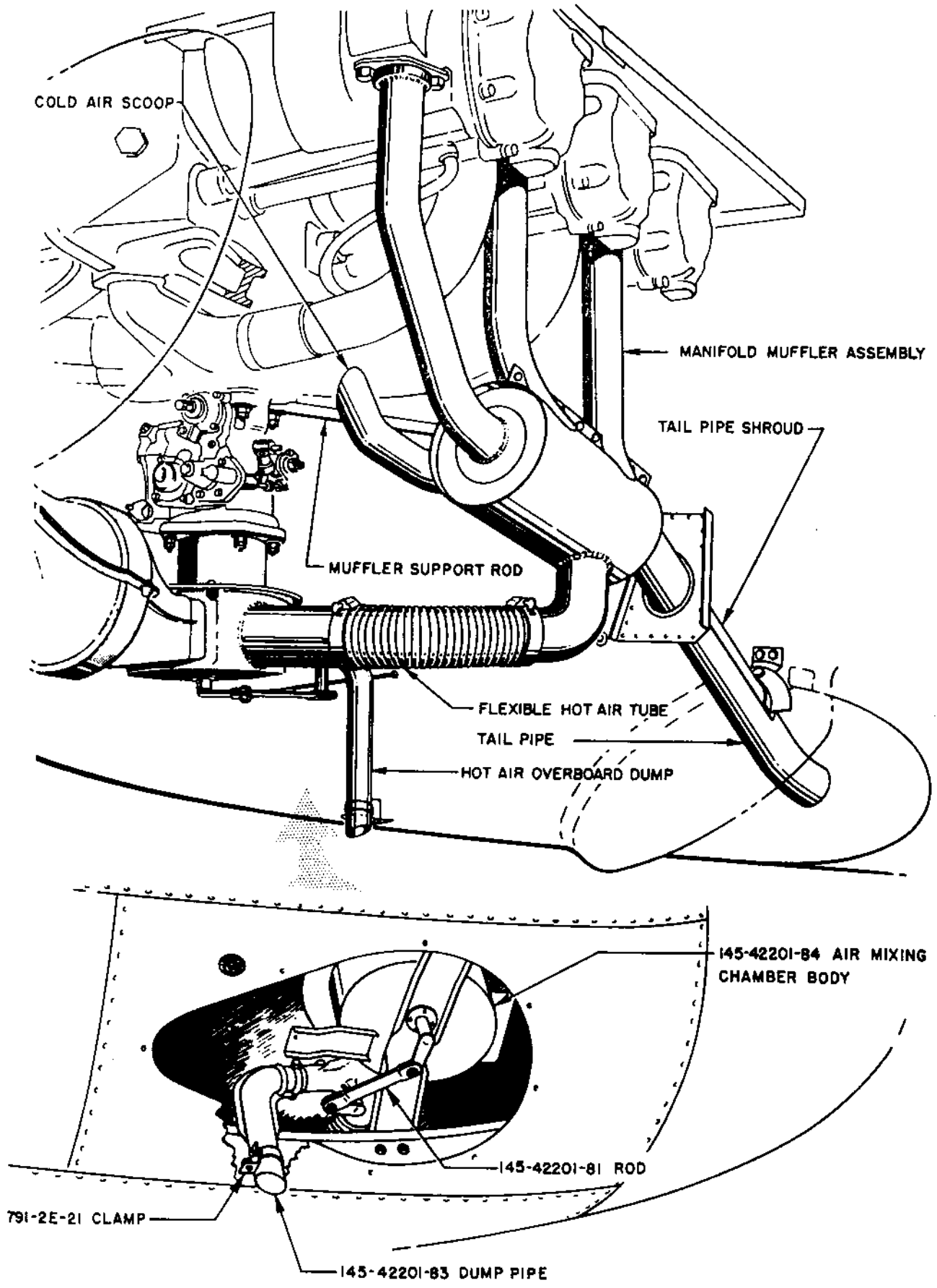
SECTION I. Engine Installation

1. Remove old exhaust stacks and shrouds from engine, saving mounting nuts for re-use.
2. Lower the engine slowly into place, checking that all attachments and controls are in the clear. Install the engine in accordance with instructions in the "Navion Service Manual".
3. Attach the manifold muffler pipes at the engine exhaust ports. Use nuts previously removed, and torque to 80-90 inch pounds.
4. Remove the oil cooler outlet fitting and replace with special 145-47031 fitting, then install oil cooler in previous position.
5. Attach 145-42125 left muffler support rod to left rear carburetor mount stud.
6. Using 145-42124 clip, attach rod to lug plate at upper aft end of muffler. Drill a ("F" drill) hole in the plate and attach the clip to the muffler with one (1) each AN4-5A bolt, AN960-416 washer and AN363-428 nut. Attach the rod to the clip with one (1) AN4-7A bolt, one (1) AN363-428 nut and four (4) AN960-416 washers.
7. Attach 145-42126 right muffler support rod to right forward carburetor mount stud.
8. Drill a ("F" drill) hole in lug plate at forward upper end of right muffler. Secure 145-42124 clip to lug plate with one (1) each AN4-5A bolt, AN960-416 washer and AN363-428 nut. Secure rod to clip with one (1) AN4-7A bolt, four (4) AN960-416 washer, and one (1) AN363-428 nut.
9. Connect right muffler heater shroud with air mixing chamber tee. Use 145-42202-2 hose and two (2) AN737-74 hose clamps to make connection.

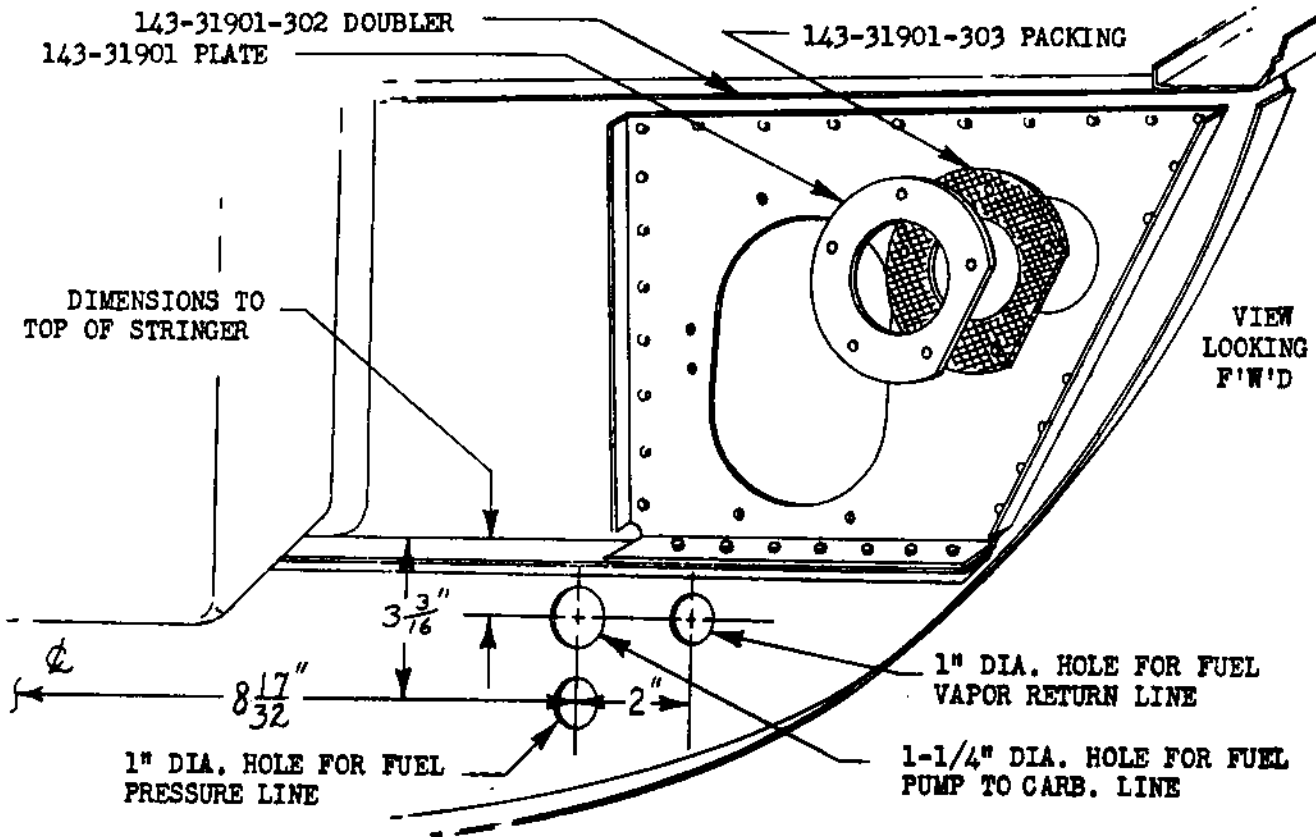
This heater kit is CAA approved and requires only the preparation of a No. 337 Form and submitting to a CAA representative for inspection.

Equipment Item No. 124 Ryan Muffler Heater
Combination

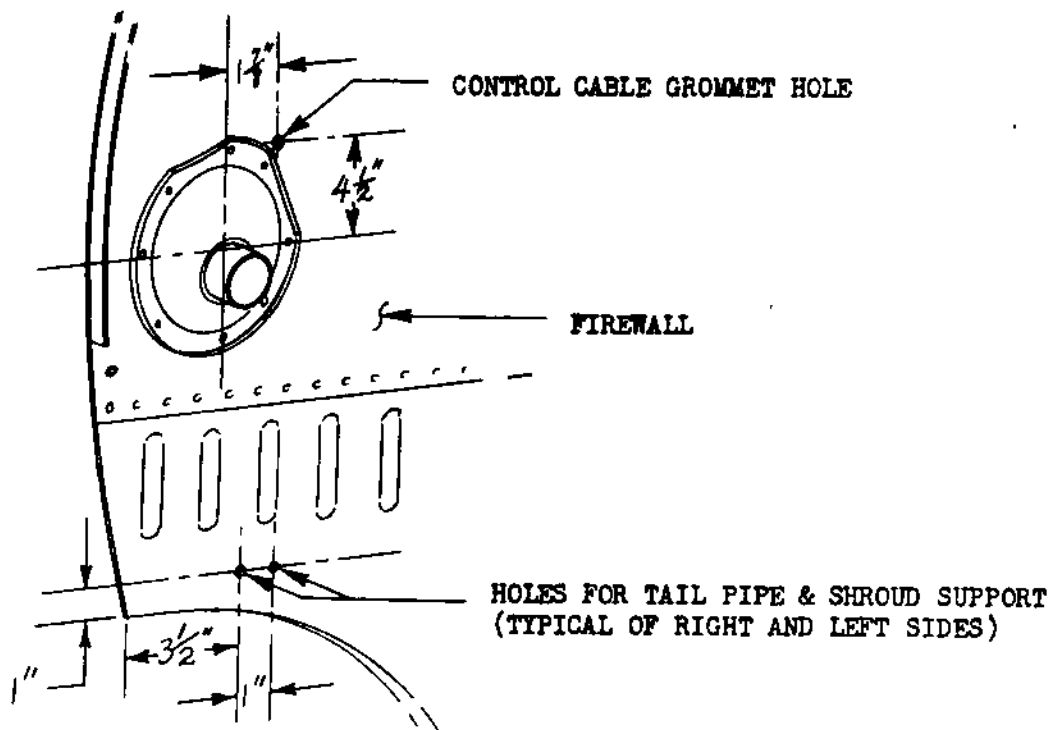
Wt. 7 lbs. H-arm 42"



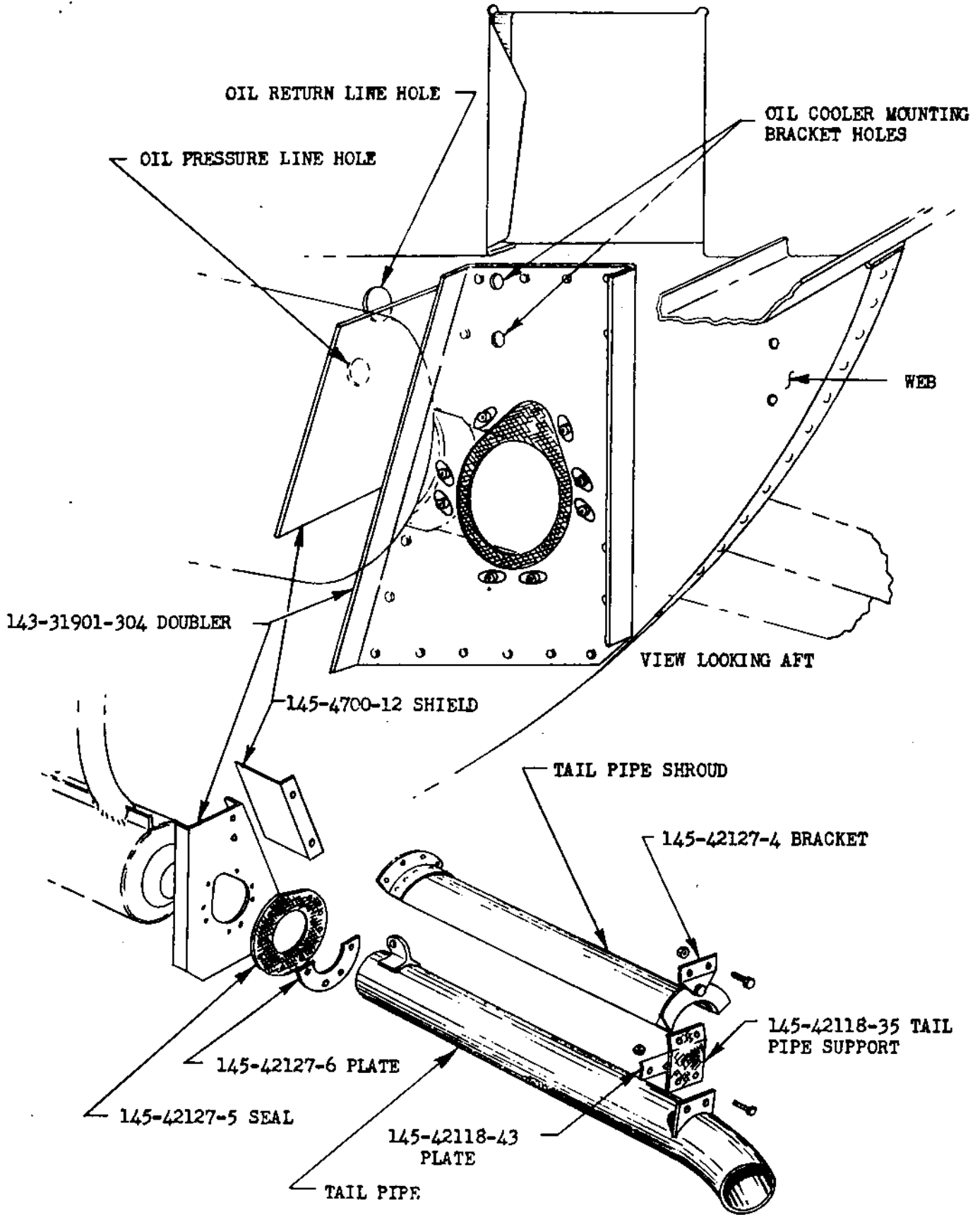
SPECIAL INSTRUCTIONS NO. 55

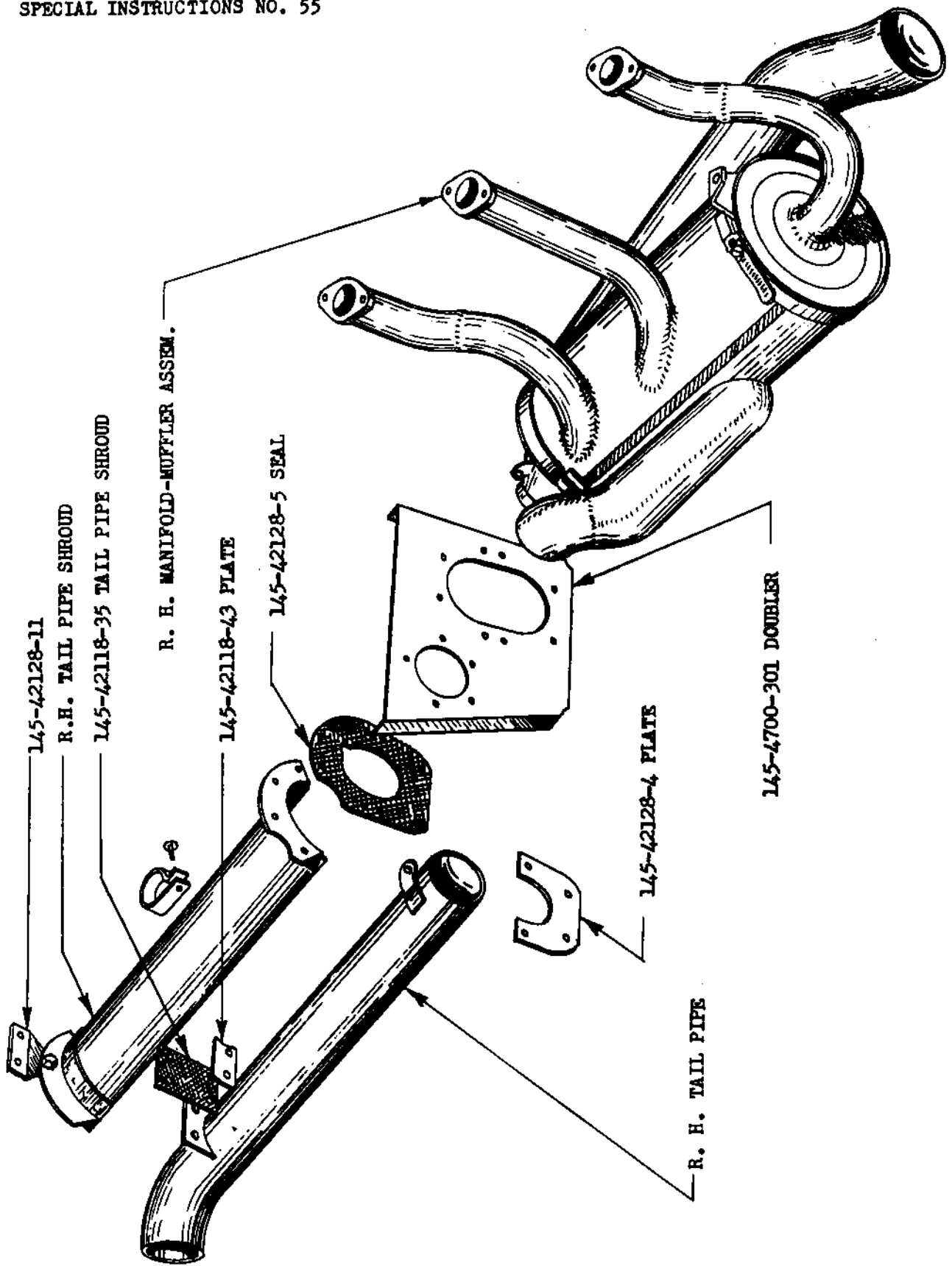


MOUNTING OF R. H. DOUBLER

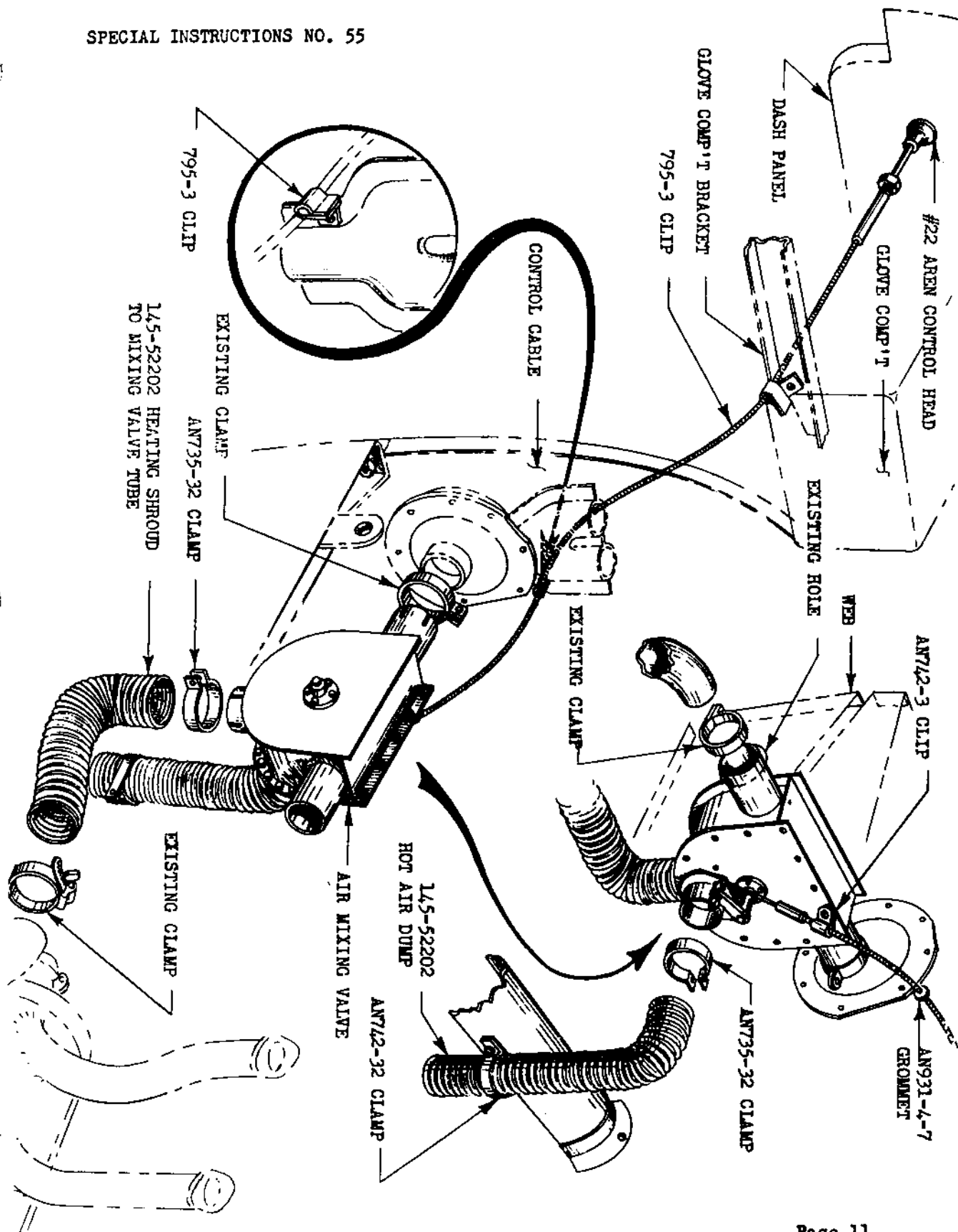


SPECIAL INSTRUCTIONS NO. 55





SPECIAL INSTRUCTIONS NO. 55



SUPPLEMENT NO. 1 TO SPECIAL INSTRUCTIONS NO. 55
DECEMBER 12, 1949

ENGINE EXHAUST MUFFLER HEATER INSTALLATION

- KIT:** Muffler and Heater Installation, Ryan Dwg. No. 145-89099
- EFFECTIVITY:** All Navions prior to factory serial No. 1790 having muffler-heater installation, or exhaust system tail pipes extending out through air exit ducts at aft edge of engine cowling.
- REASON:** Since the issuance of Navion Special Instructions No. 55, it has been decided that a relocation of the fuel system vent outlet is necessary on these Navions to eliminate any possibility of fuel vapor from the vent being ignited by engine exhaust flame.

Relocate fuel system vent outlet as follows:

1. Remove left front upholstery side panel from airplane and loosen bottom hose clamp on AN-H-35-8-13 hose, connecting present 145-48001-28 Line Assembly-Overboard Drain to 145-48001-38 Line Assembly-Overboard Vent (reference fuel system diagram in Navion Parts Catalog.)
2. Remove 143-31001-103 Baffle, L.H., located just aft of exhaust stack outlet, for access to 145-48001-28 Line Assembly and remove line from airplane.
3. On underside of fuselage at station 77, measure over 10-1/2 inches to left of airplane centerline and mark skin. On this mark, measure 1-3/8 inches forward of fuselage station 77 and mark center of new vent line hole.
4. Drill a 13/16 inch diameter hole in skin and install grommet used in original vent line hole.
5. Install new 145-48001-120 Line Assembly-Overboard Drain and reinstall left front upholstery side panel and 143-31001-103 Baffle L.H.
6. Enlarge original vent line hole to 27/32 inch diameter and install 48164 United-Carr Fastner Plug Button.

SPECIAL INSTRUCTIONS NO. 56

AUGUST 11, 1949

"Y" DRIVE VACUUM PUMP INSTALLATION

Install "Y" drive vacuum pump kit No. 145-89074-50 as follows and as shown in Figure No. 1.

1. Remove hydraulic pump and gasket.
2. Remove oil seal from engine R/H lower accessory drive shaft.
3. Remove existing fuel line running from firewall to Romec fuel pump and 45 degree hose fitting from Romec pump. Install AN816-6 nipple in Romec pump and AN823-6 elbow in firewall fitting with outlet pointing down. Install AN6264-6-17 hose between firewall fitting and Romec pump.
4. Loosen clamps holding cable housing for carburetor heat control to obtain slack in housing at firewall. Clamp above control housing to mixture control housing approximately two (2) inches forward of firewall using one (1) AN742-3 clamp, one (1) 742-4 clamp, one (1) AN515-8R7 screw and one (1) AN365-832 nut. Re-tighten all clips loosened to accomplish the above.
5. Rotate 90 degree elbow on R/H side of engine accessory case and re-route oil line which runs from this elbow to the oil cooler over the top rear of the generator.
6. Install "Y" drive unit on R/H lower accessory drive formerly occupied by hydraulic pump using new AN4045-1 gasket on pad and existing nuts and pal nuts.

NOTE: Caution, care should be exercised to prevent foreign material from entering "Y" drive unit to avoid fouling oil passage.

7. Install two (2) AN842-8D elbows in vacuum pump as shown in Figure No. 1.

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8. Install hydraulic and vacuum pumps on "Y" drive pads, using AN4045-1 gaskets, three (3) AN4-10 bolts and four (4) AN310-4 nuts per pump as shown in Figure No. 1 and secure with .030 safety wire. Reconnect hydraulic supply and pressure hoses to pump.
9. Drill two (2) No. 10 (.193) holes in firewall; install AN6121-1 oil separator, with two (2) 4S3-10-12 spacers, between oil separator and firewall, using two (2) AN520-10R32 screws and AN365-1032 nuts, with one (1) AN960-10L washer under each screw head and one (1) under each nut. (Nuts should be aft of firewall.) See Figure No. 1.
10. Remove 1/2 inch pipe plug from lower L/H side of engine accessory case (See Figure No. 1.) and install AN912-4D reducer and AN844-8D elbow.
11. Connect 1/2 x 24 hose to bottom fitting in oil separator and to 145-51064 fitting or to AN844-8D elbow in gear case, using two (2) A3122-12-59 clamps.
12. Connect 1/2 x 2-1/2 hose to separator, using A3122-12-59 clamp. Connect 145-51801-43 air vent line to hose, using A3122-12-59 clamp. Drill two (2) No. 18 (.169) holes in firewall, and attach vent line to firewall with two (2) A2980-8 clamps, AN515-8R8 screws, and AN365-832 nuts. On airplanes with exhaust heater muffler systems, locate end of vent tube to clear exhaust stack.
13. Connect 1/2 x 56 hose to oil separator and to lower AN842-8D elbow in vacuum pump, using two (2) A3122-12-59 clamps. Drill two (2) #18 (.169) holes in firewall (see Figure No. 1) and clamp hose to firewall, using two (2) AN742-16C clamps, two (2) AN515-8R8 screws, and two (2) AN365-832 nuts. Nuts to be aft of firewall. Remove upper outboard bolt attaching hydraulic reservoir to firewall and secure hose at this point with one (1) AN742-16C clamp using existing bolt.
14. Drill (from aft side) a 7/8 inch hole in firewall located as shown in Figure No. 1. Remove existing AN3 bolt attaching angle to 143-31005-6 channel and install 145-51052 bracket, using removed bolt and nut through lower hole in bracket. Drill one (1) No. 10 (.193) hole through 143-31005-6 channel and upper pilot hole in 145-51052 bracket and install AN3-4A bolt, AN365-1032 nut, and AN960-10L washer.
15. Insert 145-51801-41 line through 7/8 inch hole in firewall. (AN931-8-13 grommet must be assembled on line prior to installation.) Install 400 x 8 elbow and AN842-8D elbow in AN6119-1 vacuum relief valve. Connect 1/2 x 12-1/2 hose to AN842-8D elbow of relief valve, using A3122-12-59 clamp. Attach relief valve to 145-51052 bracket, using one (1) AN742-14C clamp, AN515-8R7 screw, and AN365-832 nut. Connect 1/2 x 12-1/2 hose to AN842-8D elbow in vacuum pump, using A3122-12-59 clamp. Connect 145-51801-41 line to 400 x 8 elbow in relief valve.

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16. Drill a No. 18 (.169) hole in firewall adjacent to grommet on -41 line as shown in Figure No. 1. Secure 145-5801-41 line using one (1) 766-8R clamp, one (1) AN515-8R7 screw and AN365-832 nut. Attach clamp to hole in firewall, using one (1) AN515-8R8 screw and AN365-832 nut. Drill a No. 18 (.169) hole in firewall adjacent to vacuum relief valve, as shown in Figure No. 1, and secure 145-5801-41 line using one (1) A2980-8 clamp, AN515-8R8 screw and AN365-832 nut.
17. On end of 145-5801-41 line assembly, install a 252 x 8 connector and 236 x 6 connector as shown in Figure No. 1 and connect gyro instrument suction line at this point.
18. After connecting gyro instruments to vacuum line at firewall, loosen locknut on top of relief valve and, with engine running at 1000 RPM, turn adjusting screw until suction gauge indicates 3.75 in. Hg. With engine running at 2300 RPM, suction gauge should not exceed 4.75 in. Hg.

NOTE: Repair and Alteration form ACA 337 must be completed when this installation is finished. Total weight increase resulting from this installation is 8.5 pounds at 46 inches aft of the datum.

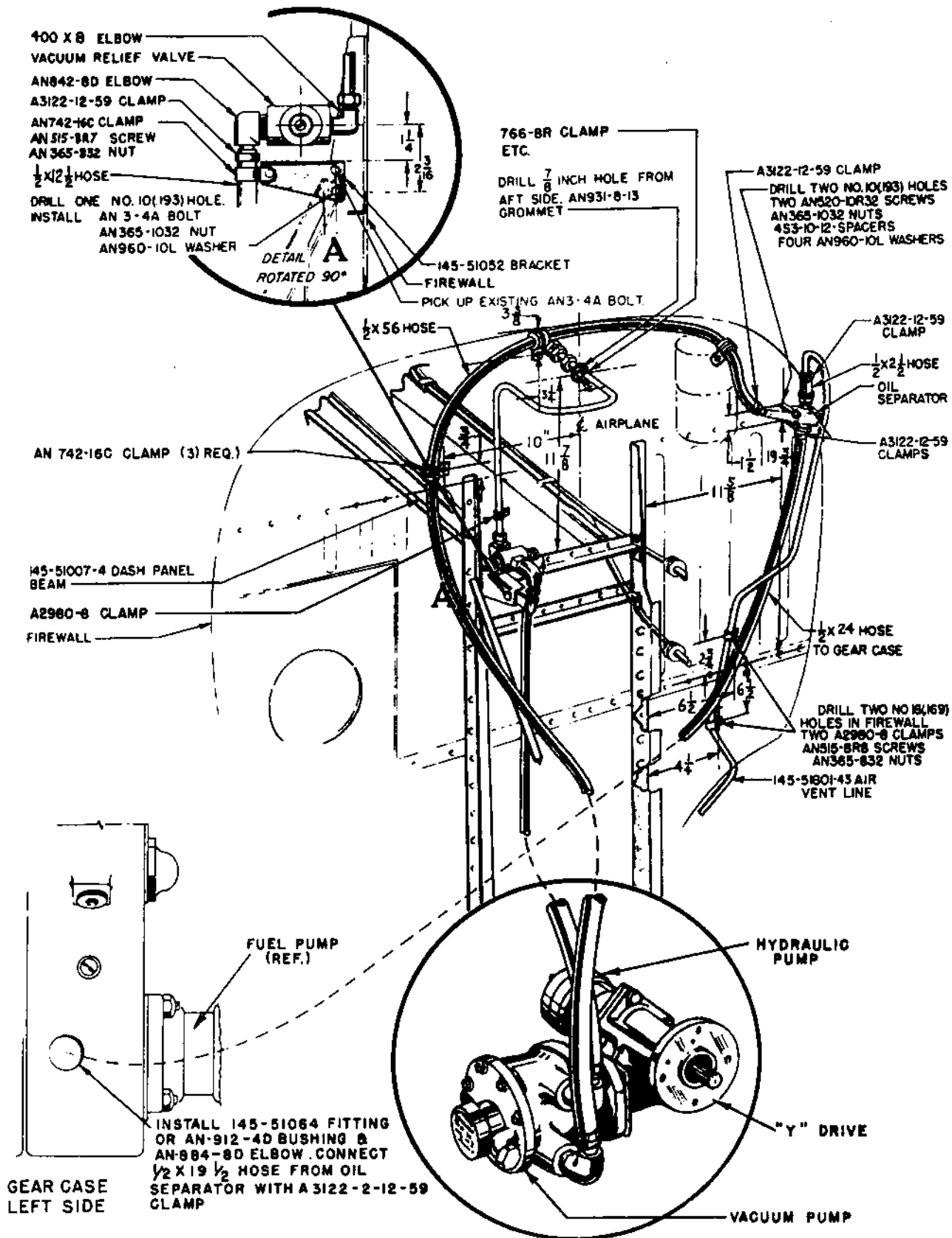


FIGURE 1

SPECIAL INSTRUCTIONS NO.57
 JULY 6, 1949

SPECIAL INSTRUCTIONS

CONVERSION, HARTZELL PLASTIC BLADE
 PROPELLER TO METAL BLADE

Hartzell HC-12x20 propellers that are equipped with plastic blades Model No. 8428 may be modified by installing aluminum alloy blades, Model No. 8433 by authorized propeller shops, as follows:

1. Remove Hartzell propeller from engine.
2. Disassemble the blade clamp assemblies and remove the 8428 blades. Clean all grease from pilot tube and bearing assemblies with a suitable solvent and re-grease with ANG-5 or equivalent grease.
3. Pack the pilot tube holes in the 8433 blades with ANG-5 or equivalent grease and assemble blades to the hub assembly, removing excess grease as necessary.
4. Reinstall the clamp assemblies using new A-47 clamp gaskets and tighten the securing bolts and nuts to a torque of approximately 20 foot pounds. The metal to metal feature of the blade clamps is no longer necessary or desirable when metal blades are installed, as clamps are tightened. It is essential that the blade clamps do not pull together at the outer corners when tightening the outer set of clamp bolts, or else the blades may rotate in the clamps when the propeller is running. If a slight clearance, say .005 inch, is not present at the outer metal-to-metal contacting surface after the clamp bolts are tightened to 20 ft. lb. torque, remove the clamps and file these lands down slightly.
5. Index the propeller at the 30 inch station - using appropriate indexing equipment - to the designated settings for the various types of propellers as indicated on the table below.

<u>PROPELLER</u>	<u>ENGINE TAKE-OFF RPM</u>	<u>BLADE INDEX ANGLE</u>	<u>SPACER THICKNESS TO BE USED BEHIND REAR CONE</u>
12x20-1 & -5	2300	14°	1/16"
12x20-7,-7A & -7B	2300	12°	1/8"
12x20-1 & -5	2600	11°	1/16"
12x20-7,-7A & -7B	2600	9°	1/8"

SPECIAL INSTRUCTIONS NO. 57

NOTE: Spacers of the required thickness may be fabricated from 24ST dural and are to be installed as indicated behind the rear propeller cone.

6. Shorten the propeller counterweight to an over-all length of 4-1/8" + 0. This must be carefully done to keep the counterweight assembly in balance.
7. Balance the propeller according to instructions in the "Hartzell Propeller Manual".
8. Install the propeller on the aircraft and rig the controls maintaining tolerances as set up in Ryan Service Bulletin No. 5 with the exception of counterweight length.
9. Run up engine and set full throttle static RPM with propeller in low pitch to 300 RPM below maximum take-off RPM.
10. Flight test aircraft to determine actual take-off RPM, which should be checked at 95 MPH indicated airspeed.

NOTE: Form "ACA337" for Repairs and Alteration must be completed for this change. Net weight change is an increase of 3 pounds at an arm of + 7 inches.

SPECIAL INSTRUCTIONS NO. 58

OCTOBER 17, 1949

R.C.A. MODEL AVA-129 LOOP ANTENNA INSTALLATION

Install R.C.A. Rotatable Loop Antenna Kit, Ryan Item No. 731-100, as follows:

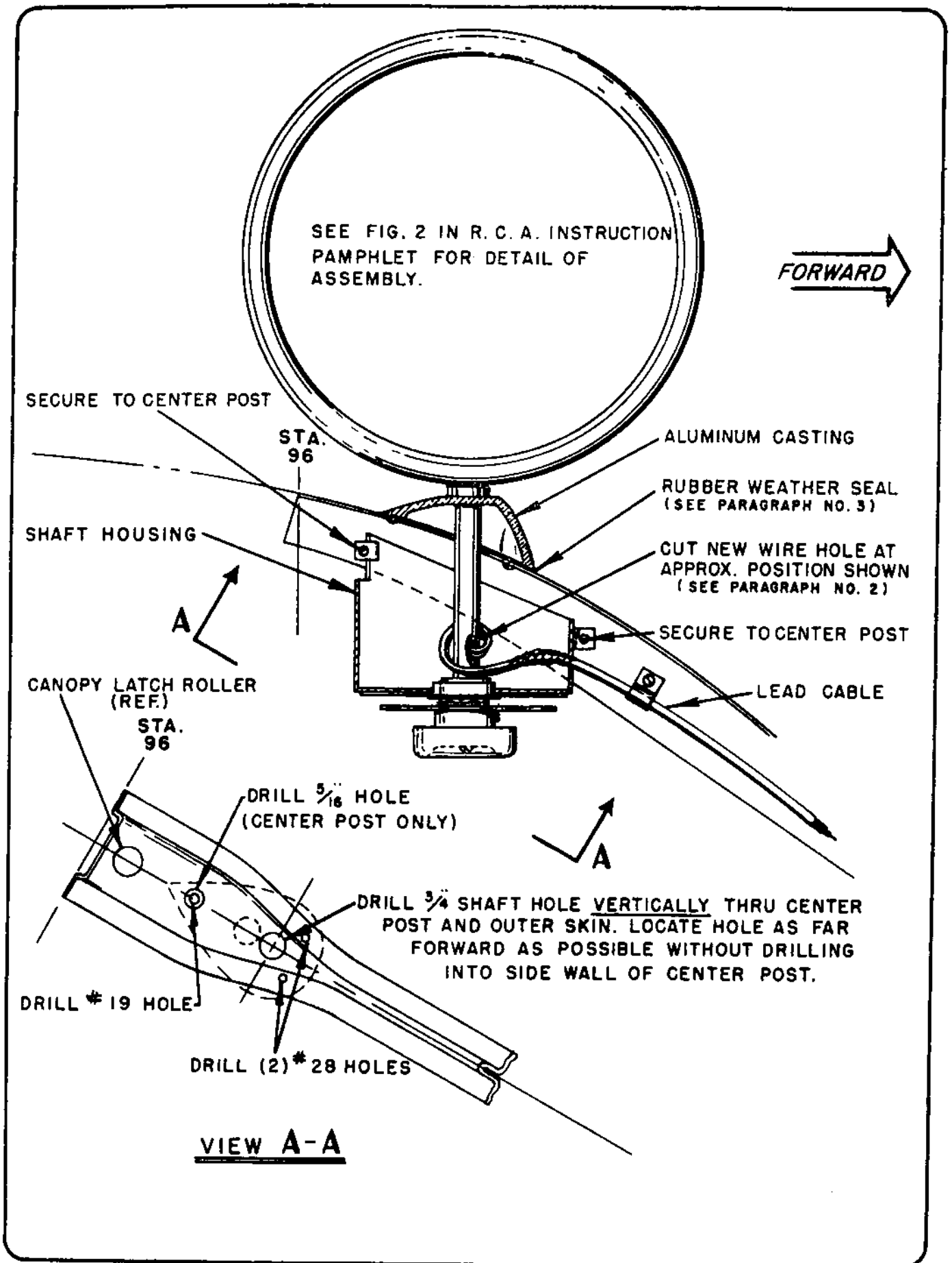
1. Locate and drill a $3/4$ inch hole in windshield center post as shown in view A-A of Figure 1. This $3/4$ inch loop shaft hole should be drilled from inside the airplane and must be drilled vertical or at 90 degrees to the airplane horizontal center line.
2. Place streamlined aluminum casting on loop shaft and apply chalk dust to area around screw holes in casting. Place loop and casting in position on windshield frame and tap casting lightly to leave chalk marks on skin indicating location of mounting screw holes. Drill holes as shown in view A-A of Figure 1.
3. Using casting as a template cut weather-seal gasket shown in Figure 1 out of $1/16$ inch rubber or Neoprene sheet.
4. Install casting and weather-seal gasket with two (2) No. 6 screws at front of casting and one (1) No. 8 screw at rear. Insert rear screw and screwdriver through $5/16$ inch access hole drilled in windshield center post. (See view A-A of Figure 1.)
5. Insert shaft bushing in indicator dial plate and secure with Allen screws. Drill two holes in indicator plate to match nut plates in housing and secure plate to housing with machine screws.
6. Install loop on ship and while holding shaft housing up in position put a mark on loop shaft $1/2$ inch out from face of indicator plate; also locate and mark position of new wire hole to be cut in loop shaft as shown in Figure 1.
7. Remove loop and cut off shaft as marked above, also cut or grind new wire hole in loop shaft.

SPECIAL INSTRUCTIONS NO. 58
R.C.A. MODEL AVA-129 LOOP ANTENNA INSTALLATION - PAGE 2

8. Reinstall loop and reroute loop wires through new hole in shaft.
9. Solder one of the two antenna lead wires to outer shielding of shielded cable and connect other one to wire through center of shielded cable. Tape soldered joint as necessary to prevent shorting. (Quick disconnects may be used here if available.)
10. Install inner shaft housing to windshield center post with sheet metal screws.
11. Install plain and spring washers on loop shaft and secure metal cap to end of shaft with Allen screws provided in cap. Secure control knob to end of shaft with one (1) machine screw in bottom of knob. (See Figure 1.)
12. Attach shielded cable to windshield center post with clips and route cable to radio set through grommet inserted in hole drilled in top of dash panel.

NOTE: Form "ACA337" for Repairs and Alterations must be completed for this change. Net weight change is an increase of 2 pounds, 7 ounces at an arm of + 91 inches.

Since the R.C.A. Loop Kit furnished under Ryan Item No. 731-100 is a universal kit there will be several parts left over after installation of the loop on a Navion. These parts are not returnable to either R.C.A. or Ryan for credit.



R. C. A. AVA-129 LOOP ANTENNA INSTALLATION
FIGURE 1

SPECIAL INSTRUCTIONS NO. 59
DECEMBER 1, 1949

Page 1 of 4

LEFT MAIN FUEL TANK REPLACEMENT

These instructions describe the wing structure and fuel quantity indicator system changes necessary on Navions, factory serial Nos. NAV4-2 thru 1564, whenever it should become necessary to replace the original left main fuel tank in one of these aircraft with the current production type tank for any reason. The reason these changes are necessary is, that left main fuel tanks adaptable to the Stewart-Warner fuel quantity indicating system used on these earlier model Navions are no longer available for replacement purposes.

NOTE

In the write-up of these instructions it is assumed the wings of the aircraft have been disassembled and the left fuel tank removed according to instructions contained in the Navion Service Manual.

PROCEDURE:

PART I

WING REWORK AND FUEL QUANTITY TRANSMITTER INSTALLATION.

1. After original left main fuel tank has been removed from left wing panel, remove the two (2) center rivets attaching angle, part No. 143-14004-19, to the wing spar web.
2. Cut a 4-3/8 inch diameter hole in spar web; locating hole according to instructions in Figure 1.
3. Install reinforcement plate, part No. 145-89069-2, over cut-out in spar web as follows:
 - (a). Place plate, part No. 145-89069-2 in position and using rivet holes in angle, part No. 143-14004-19, as a template, drill two holes (No. 20 drill) in each end of the extended side of plate. See Figure 1.

- (b). Use Cleco (or similar) sheet metal fasteners to secure plate in position so that it may be used as a template to drill out the seventeen (17) rivet holes (No. 20 drill), in the spar web.
 - (c). Remove plate from spar web and clean area of all metal chips.
 - (d). Re-position plate on spar web and rivet in place with nineteen (19) AN442AD5-6 rivets.
4. Locate angle, part No. 143-14004-33, on aft side of spar as shown in Figure 1. Drill nine (9) rivet holes (No. 20 drill) and attach angle to spar with nine (9) AN442AD5-6 rivets.
 5. Drill three (3) additional rivet holes (No. 20 drill) in top and bottom wing spar cap flanges between the two reinforcing angles and install six (6) AN442AD5-6 rivets as shown in Figure 1.
 6. Coat gasket, part No. 145-48237, with non-hardening, gasoline resistant, gasket compound and place gasket in fuel quantity transmitter mounting cup on tank.
 7. Insert King-Seeley transmitter, arm and float, part No. 154-48002-4, through mounting cup opening and align mounting screw holes in tank with those in transmitter.

CAUTION

There is only one position at which all the transmitter mounting holes and holes in tank will align. Exercise caution not to bend float arm when turning transmitter to align mounting screw holes.

- Secure transmitter to tank with six (6) AN502-10-8 screws provided in kit. Before tightening mounting screws, take up play in transmitter mounting by turning transmitter clockwise as far as possible.
8. Check transmitter float for freedom by turning tank over and back several times. The float should fall free from both top and bottom of tank. If the float binds, remove bind by loosening mounting screws and turning transmitter counter-clockwise in the mount.

NOTE

- It is sometimes necessary to slightly elongate the mounting holes of the transmitter to allow the movement necessary to free a binding float.
- Turn transmitter only the amount necessary to free float, checking carefully after each adjustment.
9. Flush tank to remove any metal particles or other foreign material that may have been introduced into tank and reinstall tank in wing panel according to instructions contained in Navion Service Manual.

10. Reassemble wings and reinstall them on fuselage according to instructions in Navion Service Manual.

PART II

MODIFICATIONS TO INSTRUMENT WIRING AND CALIBRATION OF FUEL QUANTITY TRANSMITTER.

1. Remove instrument panel reflector by taking out four (4) mounting screws.
2. Disconnect wiring from terminals on back of Stewart-Warner fuel quantity indicator and remove indicator from instrument panel.
3. Install new King-Seeley indicator, part No. 145-48002-3/4, in instrument panel hole from which Stewart-Warner indicator was removed and connect wires to back of instrument.
4. In the left wing wheel well area, replace wire No. 5 (to main tank transmitter) with longer wire No. 292 furnished with kit and connect to terminal on transmitter.
5. Reinstall instrument panel reflector.
6. Level airplane and put five (5) gallons of gasoline in wing tanks.
7. Pry access cover off back of fuel quantity transmitter and adjust so that fuel level indicator on instrument panel reads two (2) gallons. See Figure 2.

NOTE

Turn adjusting gear clockwise to increase gauge reading and counter-clockwise to decrease reading. DO NOT BEND FLOAT ROD.

8. Replace transmitter cover and allow at least three (3) minutes for temperature to stabilize and recheck two (2) gallon reading on fuel level indicator. It is very important that the transmitter access cover be securely installed during this check, as any slight air movement will affect gauge reading. If the required two (2) gallon reading is not obtained after reinstallation of the transmitter cover, remove cover, readjust transmitter and recheck as above.
9. Add thirty (30) gallons of fuel to tanks, making a total of thirty-five (35) gallons in tanks.
10. Record fuel level before draining any fuel. Remove fuel five (5) gallons at a time and record indicator reading after each five (5) gallon removal. In each instance the indicator reading should be taken after a minimum wait of three (3) minutes.

11. The indicator should indicate three (3) gallons less than the actual quantity in the tank for each reading. Tolerances on indicator readings are as follows; with five gallons in tank tolerance is \pm one (1) gallon either side of adjusted reading. This tolerance can expand linearly to a maximum tolerance of \pm three (3) gallons when there are thirty-five (35) gallons of fuel in tanks.
12. After above procedure has been completed, indicator should again read two (2) gallons \pm one (1) gallon when there is actually five (5) gallons of fuel in tanks.

NOTE

When flying in rough air, estimate fuel quantity approximately six (6) gallons less than the gauge reading.

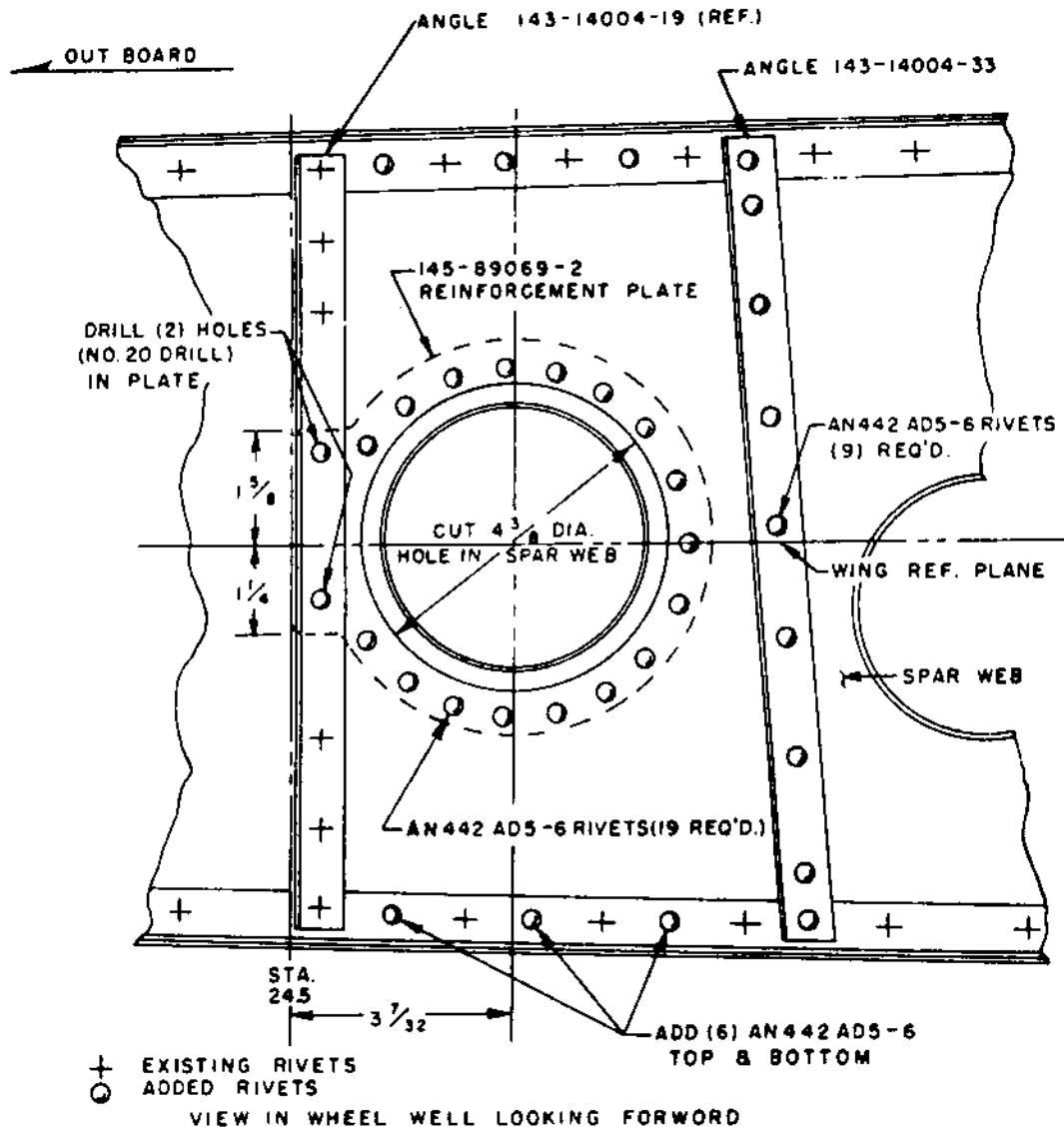


FIGURE 1

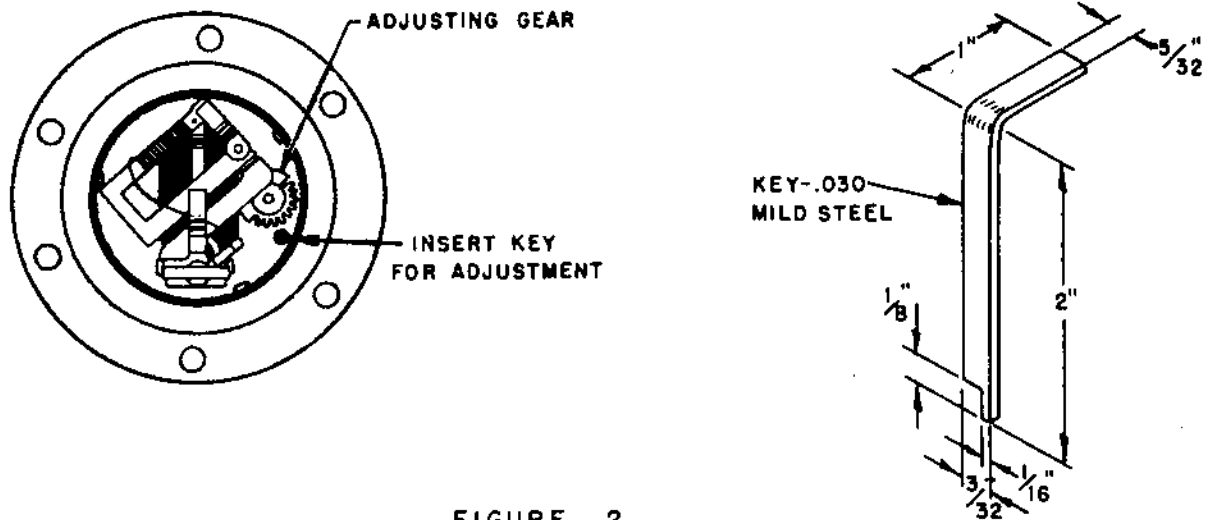


FIGURE 2

SPECIAL INSTRUCTIONS NO. 60
FEBRUARY 24, 1950

INSTALLATION - CABIN VENTILATOR KIT, RYAN DWG. NO. 146-53302

READ INSTRUCTIONS COMPLETELY BEFORE PROCEEDING WITH INSTALLATION

1. Remove cabin canopy from airplane.
2. Locate centerline of canopy by drawing a line forward from center rivet at upper edge of rear window through center rivet at station 149.
3. Locate and mark a fore and aft centerline on -7 door.
4. Place door centerline on canopy centerline with forward edge of door $3/4$ inch aft from the center aft rivet on station 149 canopy bow.
5. Using a pencil, carefully mark a line on canopy around the edge of -7 door.
6. Cut out marked section.
- NOTE: If soundproofing is installed in canopy it must be carefully removed from hole area.
7. Place -3 doubler in position on top of canopy (see figure 1) and drill sixteen (16) equally spaced holes as shown, using a No. 30 drill.

CAUTION: Do not drill through head liner.

8. Using -3 doubler as a template drill or punch corresponding holes in -5 gasket seal.
9. Cement -11 doubler seal to -5 gasket seal and -3 doubler as shown in figure 1.
10. If it interferes with door cutout, cut headliner support wire in half and carefully pull each half out.

11. Place -3 doubler, -5 and -11 seals in position (see figure 1) and secure with cleco fasteners. Use care not to tear headliner. If soundproofing interferes trim back as necessary.
12. Rivet doubler and seals in place using sixteen (16) 2R1 rivets.
13. Trim canopy headliner flush with cutout.
14. Place -7 door in position over opening and while holding door as far forward as skin cutout will permit, drill four (4) No. 28 holes in -5 seal, using door as drill template.
15. Secure -7 door to -5 seal and -9 strip using four (4) 2R1 rivets. (See figure 2.)
16. Install 146-53303 spring to -7 door as shown in figure 2, using one (1) AN526-832-7 screw, one (1) AN960-8 washer and one (1) 22K1-82 cap nut.
17. Check operation of door carefully and adjust as necessary to insure an adequate seal against moisture when closed.
18. Reinstall canopy on airplane.

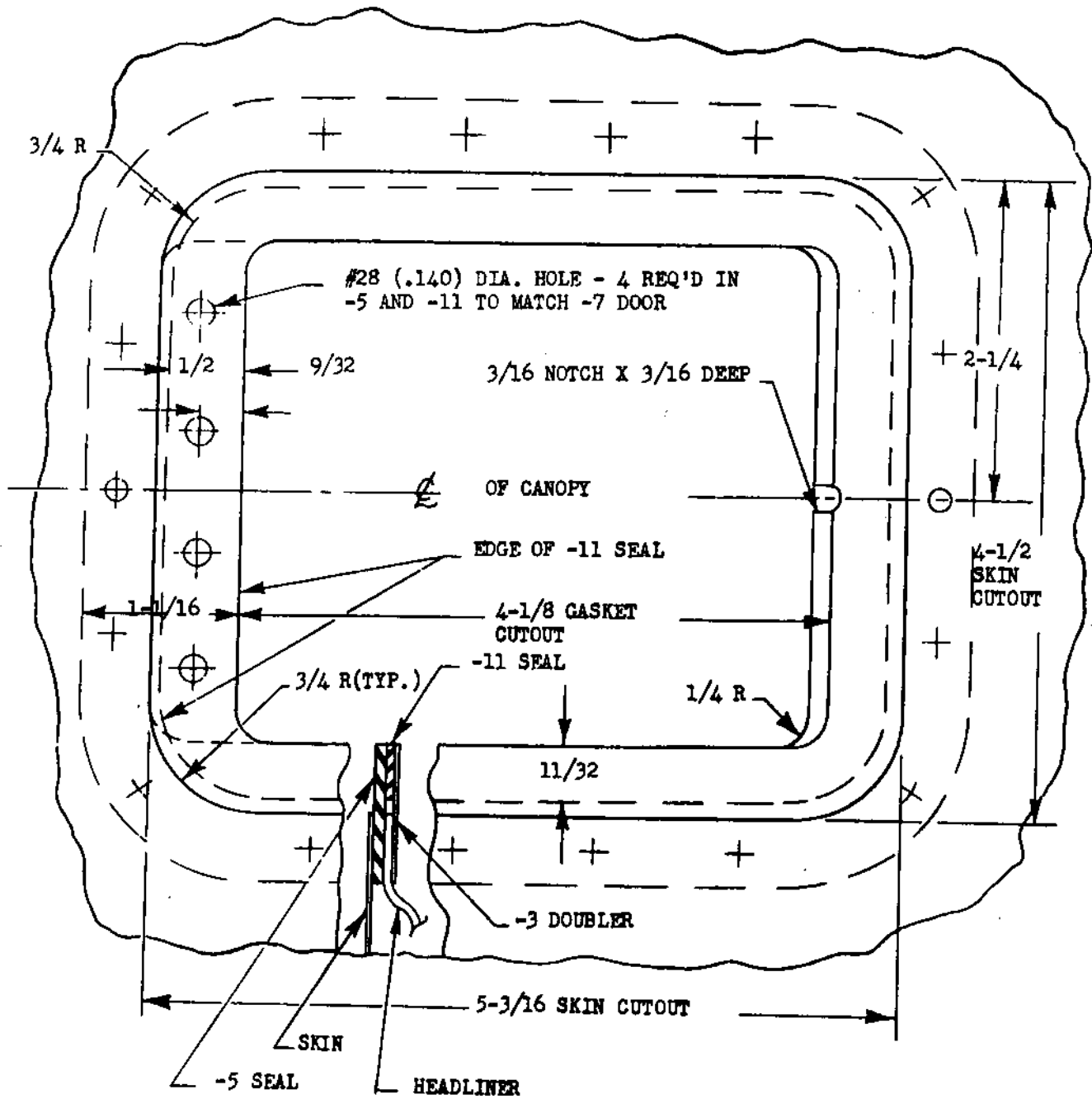


FIGURE 1

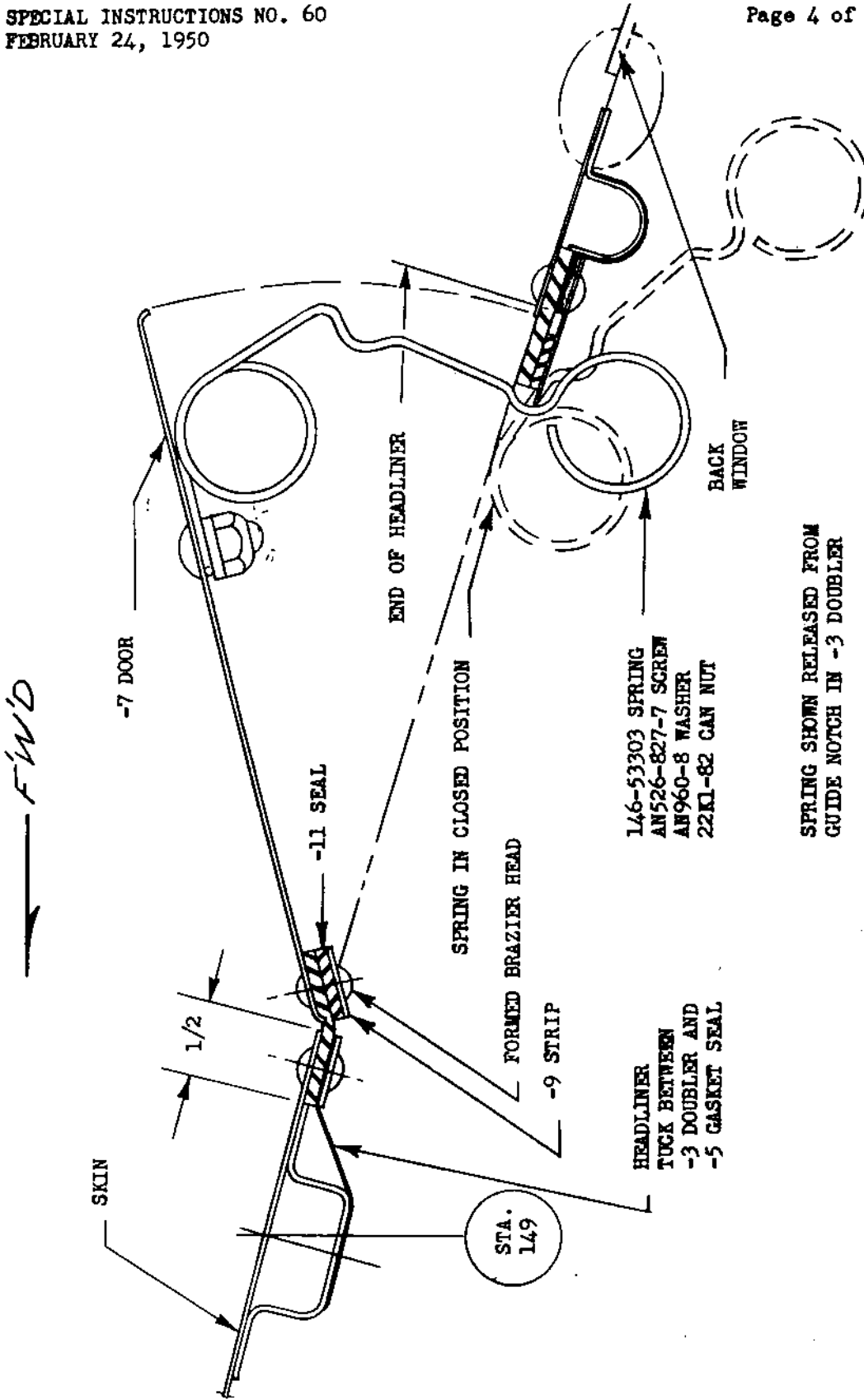


FIGURE 2

SPECIAL INSTRUCTIONS NO. 61

REVISED APRIL 28, 1950

ECLIPSE E-80 STARTER INSTALLATION

The kit for this starter installation is divided into three (3) classifications:

- A. Modification of Continental Engine, Model E-185-3 to a Model E-185-9, covering an accessory gear train change which provides for the installation of an Eclipse Model E-80 starter.
- B. Removal of the present Delco-Remy starter assembly and replacement with an Eclipse E-80, 397-13B starter assembly, which has been modified as necessary to permit installation on the -9 engine.
- C. Removal of the present Navion foot starter switch and installation of an instrument panel push button starter system including a starter relay on the firewall.

NOTE: This starter installation cannot be made on engines equipped with the dual Carter fuel pump system as the cam which actuates these fuel pumps is an integral part of the crank shaft gear which is replaced in this installation with a gear having no cam. This installation is suitable for engines equipped with a Romec-Adel or similar fuel system only.

1. Remove engine from airframe.
2. Remove sump.
3. Remove engine accessory housing.

CAUTION: Remove the four (4) cap screws installed from the front side of accessory case before attempting case removal.

4. Remove pivot; starter pinion, Continental P/N 35976 and two (2) 5/16 pivot mounting studs, Continental P/N 2390.
5. Remove cam shaft gear, Continental P/N 352012.

NOTE: The removal of this gear is necessary to permit removal of the accessory drive gear called out in the next operation (6).

6. Remove accessory drive gear, Continental P/N 40650 from rear end of crank shaft.
7. Install new replacement crank shaft gear.
8. Install new starter pinion pivot, with oil trough on top side, using the special hexagon head cap screws and elongated special lock washers furnished in kit.
9. Install new replacement starter driven gear with three (3) tooth dog, using special ground steel thrust washer and retaining circlip.

NOTE: Fill all passages with oil prior to installation.

10. Reinstall cam gear.
11. Rotate engine to check valve timing and re-time if necessary.

NOTE: Replacement gear has timing mark and standard timing procedure can be followed when necessary.

12. Reinstall accessory case using new gaskets, and new special lock washers, Continental P/N 36025, furnished with the kit.
13. Reinstall magnetos and check ignition timing.
14. Replace sump using new "O" ring seals in kit.
15. Remove three (3) starter flange mounting studs and replace with new studs furnished with kit. Install Eclipse starter using adaptor, gaskets, screws and nuts as furnished with kit.
16. Replace insulating washer with metal washer from right hand starter terminal as per directions on tag attached to starter. This will provide a single wire grounded system.
17. Remove foot actuated starter switch from firewall and plug hole with the one inch plug button, P/N 18143 furnished with kit.

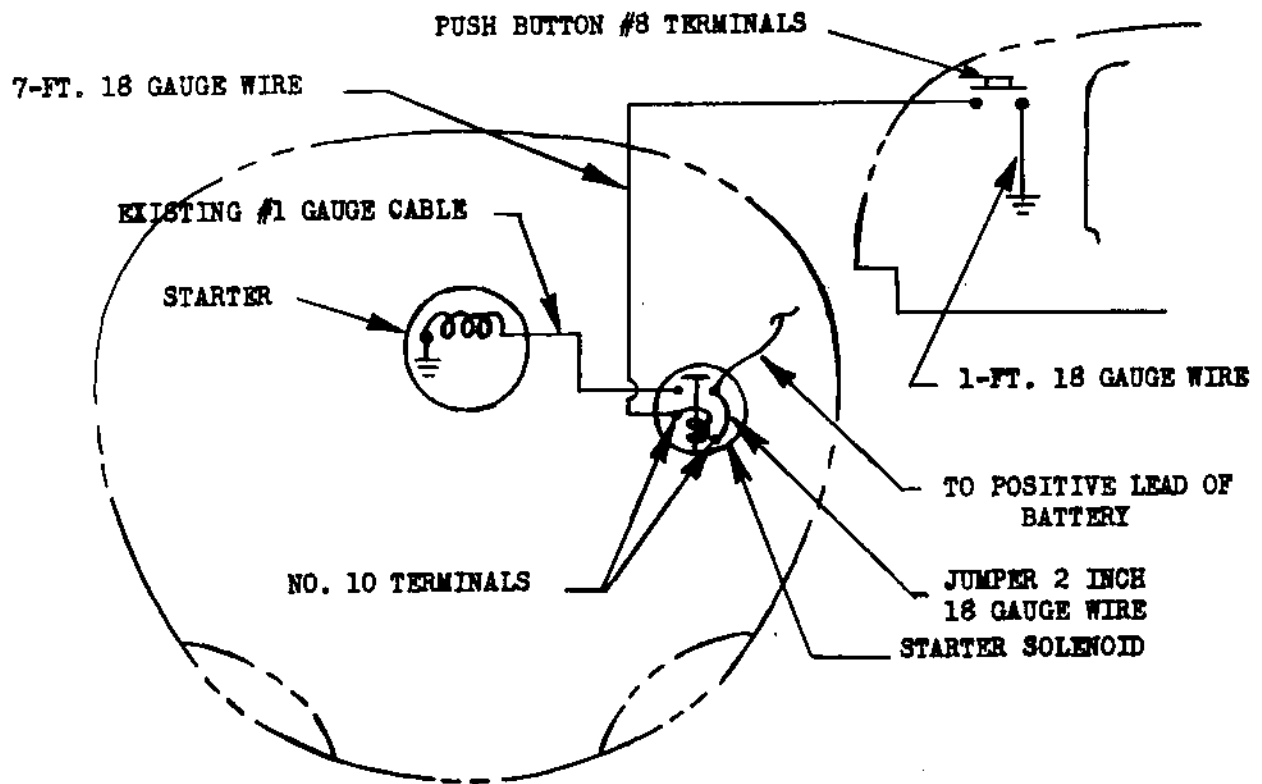
NOTE: Replace existing rubber insulating boots on all terminals.

18. Install starter relay, P/N 71-111242, with rolled cap to the top, in existing foot switch mounting position. Use mounting bolts and nuts from old foot switch.
19. Install push button starter switch.

NOTE: The location of this switch can be made as desired by the customer, but it is suggested that it be located on the left hand side of panel above the row of indicator lights.

20. Connect plus battery lead and two inch jumper to left side of relay. Connect opposite end of jumper to nearest No. 10 solenoid terminal. Connect No. 10 end of 7 foot, 18 gauge wire to the remaining No. 10 solenoid terminal, routing this cable through firewall at the existing loom to one side of starter push button terminal on dash.
21. Connect the No. 8 terminal of the one foot, 18 gauge wire to the remaining terminal on push button and ground No. 10 lug end to the ground strap behind instrument panel.
22. Use AN742-5 clamp to secure tachometer housing to rear end of Eclipse starter as a support.
23. Attach existing No. 1 cable to remaining free terminal of the relay.
24. Cut existing terminal from starter end of No. 1 cable and replace it with heavy duty terminal provided with the Eclipse starter and attach to left hand starter terminal.
25. Inspect and check entire engine installation as required after engine change and complete a routine pre-flight check.
26. Change identification on engine name plate from E-185-3 to E-185-9.
27. The change in weight and balance is + 4 lbs. at + 47. inches.
28. Execute CAA Forms 337 and make proper entries in Log Book.

NOTE: See page 4 for installation and wiring diagram.

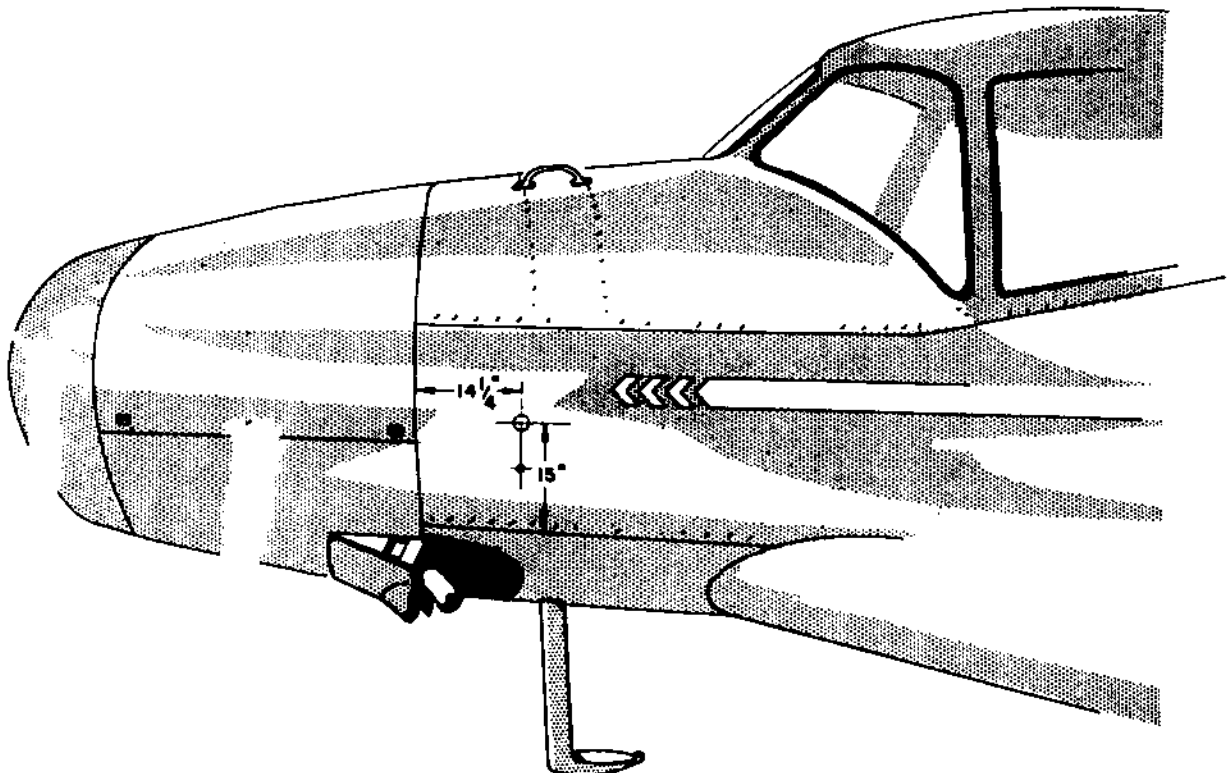


SPECIAL INSTRUCTIONS NO. 62
JULY 27, 1950

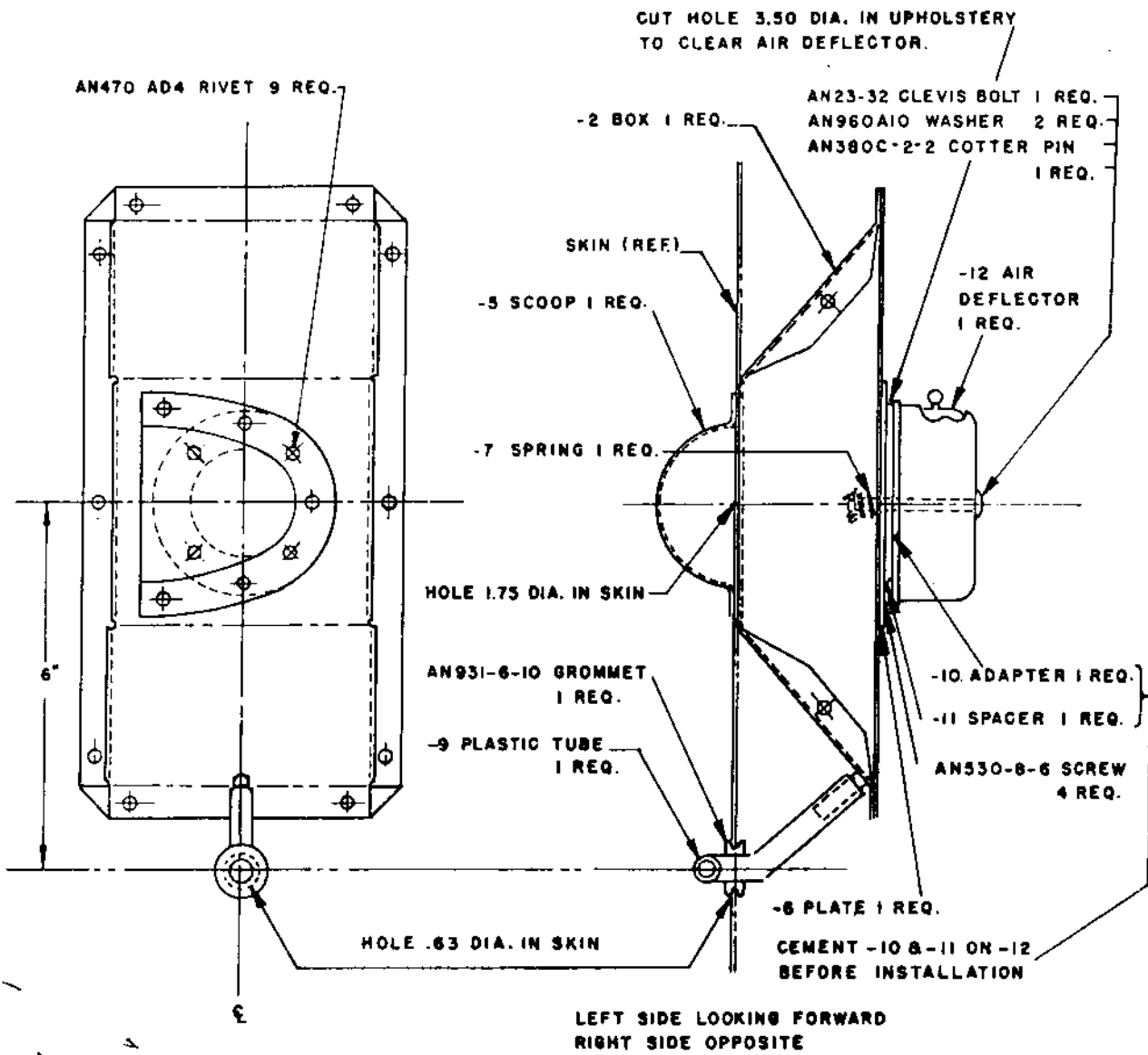
Page 1 of 2

SIDE PANEL AIR INLET VENT INSTALLATION FOR ALL NAVIONS

Install Side Panel Inlet Vent Kit, No. 145-89113 as illustrated
in installation drawing below and on page 2 of these instructions.



LOCATION OF SKIN HOLES



INSTALLATION DETAILS

SPECIAL INSTRUCTIONS NO. 64
REVISED APRIL 20, 1951

INSTALLATION OF CABIN REVERSE FLOW VENTILATION SYSTEM

SECTION I. INSTALLATION OF COCKPIT AIR VENTS 145-53341

Install 145-53341 cabin air vents as follows. See Figures 1 and 2.

1. Locate and drill a 1-3/4 inch hole in the fuselage skin in the right and left side 2.87 inches aft of stations 72.75 and 18.21 inches outboard of the fuselage centerline.

2. Locate 145-89113-5 scoops with the scoop axis parallel to windshield fuselage intersection line (as shown on Figure 1) with skin hole at closed end of scoop.

3. Drill six (6) No. 40 holes through each scoop and fuselage skin then attach scoops using AN470AD3 rivets.

NOTE

Drive aft inboard rivet attaching each scoop flush on lower surface.

4. Measure .93 inches forward of vent hole centerline and .93 inches down through centerline and drill a 9/64 inch hole through skin and scoop flange.

5. Install -3 and -4 gates using one (1) AN526-632-9 screw, one (1) -7 spring, one (1) NAS43-1-8 spacer, one (1) AN960-6 washer, and one (1) AN960-416L washer and one (1) AN365-632 nut, each side.

6. Measure ten (10) inches up from bottom of instrument panel and 1-1/8 inches from the side then drill a 5/16 inch hole. Install an AN931-3-5 grommet in hole.

7. Connect -5 rod to gate using one (1) AN365-632 nut and two (2) AN960-6 washers.

8. Insert -5 rod end through grommet in instrument panel and install one (1) AN340-6 jam nut and knob.

9. Install cabin vent control placard in position below each control.



Figure 1



Figure 2



Figure 3

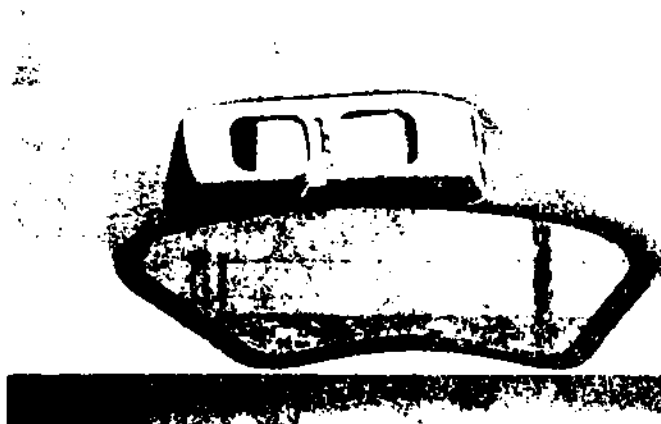


Figure 4

SECTION II. INSTALLATION OF CANOPY AIR SCOOP 145-53340

Install 145-53340 canopy air scoop as follows. See Figures 3 and 4.

1. Remove canopy from airplane.
2. Locate centerline of canopy by drawing a line forward from center rivet at upper edge of rear window through center rivet at station 149.
3. Locate and mark a fore and aft centerline on -3 canopy scoop.
4. Place scoop centerline on canopy centerline with forward edge of scoop $3/4$ inches aft from the center aft rivet on station 149 canopy bow.
5. Using a pencil, carefully mark a line on canopy around edge of -3 scoop and cut out marked section.

NOTE

If soundproofing is installed in canopy it must be carefully removed from hole area.

6. Make an X shaped cut in canopy head liner in scoop area just large enough to insert -19 frame.
7. Locate -19 frame symmetrically on canopy longitudinal centerline so that open ends of -19 frame butt against 145-31801-31 frame, which is located just forward of canopy rear window.
8. Rivet -19 frame to canopy using AN470AD4 rivets on 2 inch spacing.
9. Using the 143-53302-3 doubler as a template, drill 16 (sixteen) No. 30 holes in canopy skin around cutout.
10. Apply 3M rubber cement to outer $1/2$ inch of 146-53302-5 seal and place it in position around canopy cutout taking care to line up holes.
11. Place -3 doubler on under side of -5 seal and cleco in place.
12. Rivet -5 seal and -3 frame in place using sixteen (16) AN470AD4 rivets.
13. Attach -7 bracket to -5 scoop with AN526-1032-6 screw, AN960-10L washer and AN365-1032 nut.
14. Place scoop in position in cutout, with scoop opening pointed forward and holding scoop as far aft in cutout as possible, drill four (4) holes through the part of the -5 seal that is to act as the scoop hinge.
15. Place 146-53302-9 doubler strip in position under -5 seal (aft end) and using four (4) 2R1A4-6 rivets, secure -7 door and -9 doubler in place.

16. Trim canopy headliner and cement edges to inside edge of -19 frame using 3M rubber cement (red) and tuck edge of headliner between edge of -19 frame and canopy skin.

17. At station 160.87 measure 1-3/8 inches up from the rivet line that runs fore and aft below the L/H side windows and 1-3/16 inches aft of the rear side window rubber frame. Drill a 5/8 hole.

18. Install an AN931-6-10 grommet in the 5/8 hole.

19. Install the -25 drain tube running from the air scoop box assembly under the headliner and extending 3/4 of an inch out of the grommet. Cut off the -25 tube at a 45 degree angle facing aft and using 3M rubber cement, seal grommet opening around tube. Secure end of -25 tube to box assembly outlet with several turns of safety wire.

20. Locate and drill four (4) No. 20 holes in canopy skin to match the location of the attachment flanges for the -9 box assembly.

21. Install four (4) Tinnerman A1789-8z-1 nuts on the -9 box assembly attaching flanges and secure -9 box to canopy, using four (4) AN530-4R6 screws.

NOTE

Attach -25 drain tube to box nipple before securing box to canopy.

22. Open air scoop and place scoop control in open position. Connect -21 arm to scoop, using -23 link, two (2) AN393-11 pins, three (3) AN960-10 washers, one (1) AN960-10L washer and two (2) AN380C-2-2 cotter pins.

23. Make certain that scoop seals well in closed position.

NOTE

Change in weight and balance resulting from this installation should be computed on the basis of three (3) pounds at 160 inches aft of the datum.

KIT - CABIN REVERSE FLOW VENTILATION SYSTEM

P/N 145-89118

Item No. 709

Item No.	Qty.	Part No.	Part Name
1.	1		12" length Wax Cord
2.	1	145-31801-109	Tube - Canopy Air Scoop Drain
3.	1	145-51061-3	Knob - Instr. Panel Control
4.	1	145-53340-3	Scoop Assem. - Canopy Air
5.	1	145-53340-9	Box Assem.
6.	1	145-53340-19	Frame - Canopy Reinf.
7.	1	145-53340-21	Arm Assem. - Canopy Air Scoop Control
8.	1	145-53340-23	Link
9.	1	145-53341-3	Gate - Cockpit Air Vent L.H.
10.	1	145-53341-4	Gate - Cockpit Air Vent R.H.
11.	2	145-53341-5	Rod
12.	1	145-53341-9	Louvre L.H.
13.	1	145-53341-10	Louvre R.H.
14.	2	145-53341-11	Grommet
15.	1	145-53340-41	Seal
16.	1	145-53340-39	Doubler
17.	2	AN230WB-20	Washer
18.	1	146-53302-9	Strip
19.	2		Knob
20.	4	A1789-82-1	Speednut
21.	2	NAS43-1-8	Spacer
22.	2	AN340-6	Nut
23.	3	AN380C2-2	Pin
24.	4	AN365-632	Nut
25.	1	AN365-1032	Nut
26.	3	AN393-11	Pin
27.	12	AN470AD3	Rivet
28.	24	AN470AD4-4	Rivet
29.	20	AN470AD4-6	Rivet
30.	2	AN526-632-9	Screw
31.	1	AN526-1032-6	Screw
32.	4	AN530-4R6	Screw
33.	1	AN931-6-10	Grommet
34.	6	AN960-6	Washer
35.	5	AN960-10	Washer
36.	2	AN960-10L	Washer
37.	2	AN960-416L	Washer
38.	1	145-53340-33	Ring
39.	1	145-53340-7	Bracket

SPECIAL INSTRUCTIONS NO. 65
NOVEMBER 5, 1950

Page 1 of 2

REMOTE INDICATING COMPASS KIT INSTALLATION

Install 145-89112 remote indicating compass kit as follows:

1. Locate -6 compass transmitter support bracket on the ships center-line with the aft leg of the bracket attached to belt-frame at Station 249.5 using two (2) AN3-4A bolts, two (2) AN365-1032 nuts and two (2) AN960-10 washers. Secure forward bracket support leg to fuselage skin at Station 243 using two (2) AN526-1032 screws and two (2) AN365-1032 nuts.
2. Locate compass transmitter inverter, No. 12117-3, in third lightening hole to the right of ships centerline on fuselage Station 179.75 bulkhead.
3. Drill four (4) No. 18 holes with 2-3/8 inch spacing symmetrically located around the lightening hole and using four (4) AN515-B-8R8 screws and four (4) AN365-B-832 nuts attach the 12117-3 inverter to the bulkhead.
4. Measure 4.5 inches down on bulkhead from inverter and attach NAS45-8-3 terminal strip using two (2) AN515-4-6 screws and two (2) AN345-4 nuts.
5. Mount AN5730-3 compass transmitter in -6 support bracket using three (3) AN515-BR-8 screws, three (3) AN365-B-832 nuts and three (3) AN960-8 washers.
6. Remove standard compass and its support bracket.
7. Cut a 2.5 inch hole in the compass shroud.
8. Drill three (3) No. 18 holes in compass shroud to match existing compass indicator mounting holes, leaving lower left corner undrilled.
9. Using two (2) AN505-B-6R16 screws, one (1) AN515-B-6R14 screw and three (3) AN365-B-632 nuts, attach AN57302 indicator unit to shroud.

NOTE

Drill through existing nuts on indicator unit with a No. 28 drill before mounting indicator on shroud.

10. Install lighting shield on AN57302 indicator, using three (3) bushings furnished.
11. Mount compass shroud with indicator unit installed back on dash panel in original location.

12. Attach wiring harness and cannon plugs to the transmitter, inverters, terminal strip and CMIO position and instrument light circuit breaker. See Figure No. 2, Wiring Diagram.

13. Compensate the compass using the following method.

14. Set the compensating magnets on the transmitter to neutral.

15. Place the ship on a magnetic north heading.

16. Loosen the transmitter attaching screws and rotate transmitter until compass indicator reads north.

17. Secure transmitter.

18. Rotate ship to an east heading and remove all the error using the compensating magnets.

19. Rotate ship to a south heading and remove one-half the error.

20. Rotate to a west heading and remove one-half the error.

21. Swing airplane around 360 degrees noting deviation on each heading.

NOTE

Radio should be turned on during this operation, engine should be running and the controls must be in a neutral position.

22. The weight and balance change is seven and one-half (7.5) pounds at 200.13 inches aft of the datum.

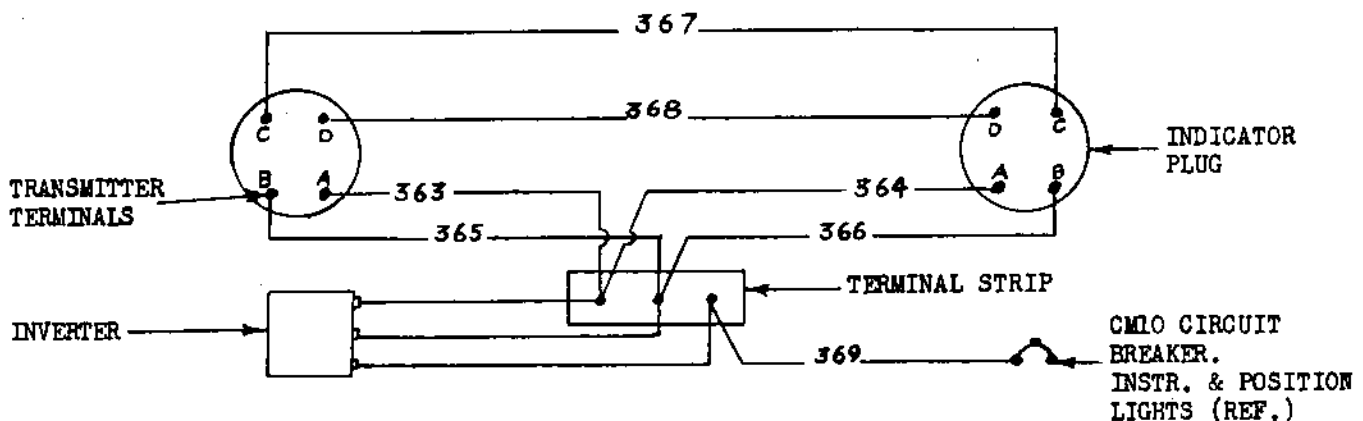


FIGURE I

SPECIAL INSTRUCTIONS NO. 66
NOVEMBER 1, 1950

POSITION LIGHT FLASHER (NARCO) INSTALLATION

Install Narco FL-1 Position Light Flasher Unit and K11178 Filter Unit according to the following instructions.

1. Measure 11.5 inches back from the firewall on the left hand lower instrument panel support beam and scribe a mark on the center line of the beam at this point.
2. Drill four (4) No. 17 holes in the beam spaced properly to match the existing mounting holes in the FL-1 flasher unit.
3. Attach flasher unit to outboard side of the beam, using screws, inserts and grommets furnished. Position unit so that the terminals will be in the lower aft corner.
4. Remove No. 168 wire from position light circuit breaker and switch.
5. Install new wire No. 358 from circuit breaker to flasher unit and wire No. 357 from flasher unit to position light switch.
6. Secure wires as necessary with waxed cord.

NOTE

On installations where excessive radio noise is encountered when using flasher unit, a Narco K11178 filter should be installed between circuit breaker and flasher unit. Mount filter on beam adjacent to flasher with screws furnished.

SPECIAL INSTRUCTIONS NO. 67
NOVEMBER 5, 1950

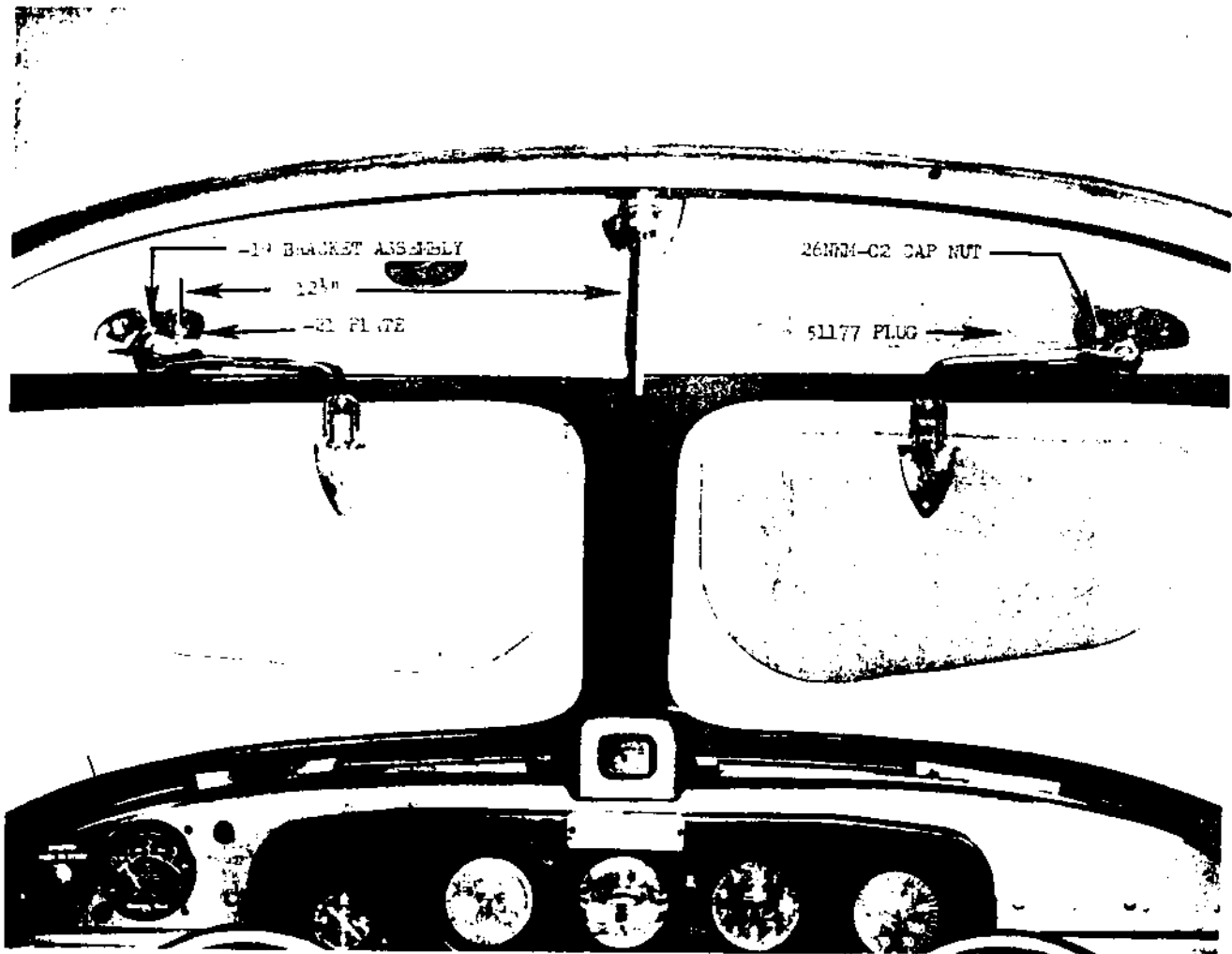
Page 1 of 2

WINDSHIELD SUN VISOR KIT INSTALLATION FOR ALL NAVIONS

Install Windshield Sun Visor, Kit 145-89116 as follows.

1. Remove R/L wind deflectors and their attaching brackets, mounted above windshields.
2. Plug holes in skin with four (4) AN470AD4 rivets.
3. Plug holes in upholstery panel with two (2) 51177 plugs.
4. Locate -19 visor support bracket according to measurements in Figure 1 and drill two (2) No. 10 holes in the skin to match holes in -19 bracket assembly.
5. Make a cutout in the upholstery panel oblong in shape 2-7/16 inches long and 1-5/8 inches wide to permit the -19 bracket to be inserted.
6. Secure -19 bracket in place with -21 plate installed over the top of the head liner using two (2) AN520C1OR-8 screws and two (2) 26NKM-02 cap nuts.
7. Install visor assembly.
8. Repeat the above for the opposite side.
9. Weight change resulting from this installation is negligible.

See other side for illustration.



SPECIAL INSTRUCTIONS NO. 68
JANUARY 2, 1951

INSTALLATION OF CANOPY WINDOW CURTAINS FOR ALL NAVIONS

Install Navion cabin window curtains according to the following instructions.

SECTION I

1. Mark position for installation of rear side window curtain fasteners as follows: Place curtain in position over window and mark accurately with a soft pencil, the point opposite the female half of the fastener attached to top forward corner of curtain. Drill a No. 32 hole and install this corner fastener and snap curtain in place with long edge of curtain on top. Locate and install other fasteners on front edge of curtain and attach curtain. Pull curtain back into position and locate position of other fasteners as shown in figure 1. (These points must be located on "hat" section frame around window.) The lower snaps are located on the canopy base rail in a horizontal position.

2. Carefully drill a No. 32 hole at each point marked and screw male section of fastener into place.

C A U T I O N

Drill through "hat" section only - do not drill through canopy skin.

SECTION II

Locate front curtain rods as follows:

1. Measure $7/8$ of an inch aft of the canopy forward bow and $1-3/8$ inches up from the canopy lower rail and drill a No. 12 hole.

2. Measure $7/8$ of an inch aft of the canopy forward bow and $18-9/16$ inches up from the canopy lower rail and drill a No. 12 hole.

3. Using one (1) 751-10-14 screw and one (1) 2W1-AL16-32-64 washer attach each curtain rod in position, utilizing the holes drilled in steps 1 and 2.

4. Hold the lower curtain rod in position so that the measurement from the aft end of the rod to the canopy lower rail is $1/4$ of an inch, and drill a No. 12 hole opposite the rod aft attachment point.

5. Slide curtain over the upper and lower rods and secure lower rod, using one (1) 751-10-14 screw and one (1) 2W1-AL16-32-64 washer.

SPECIAL INSTRUCTIONS NO. 68

PAGE 2

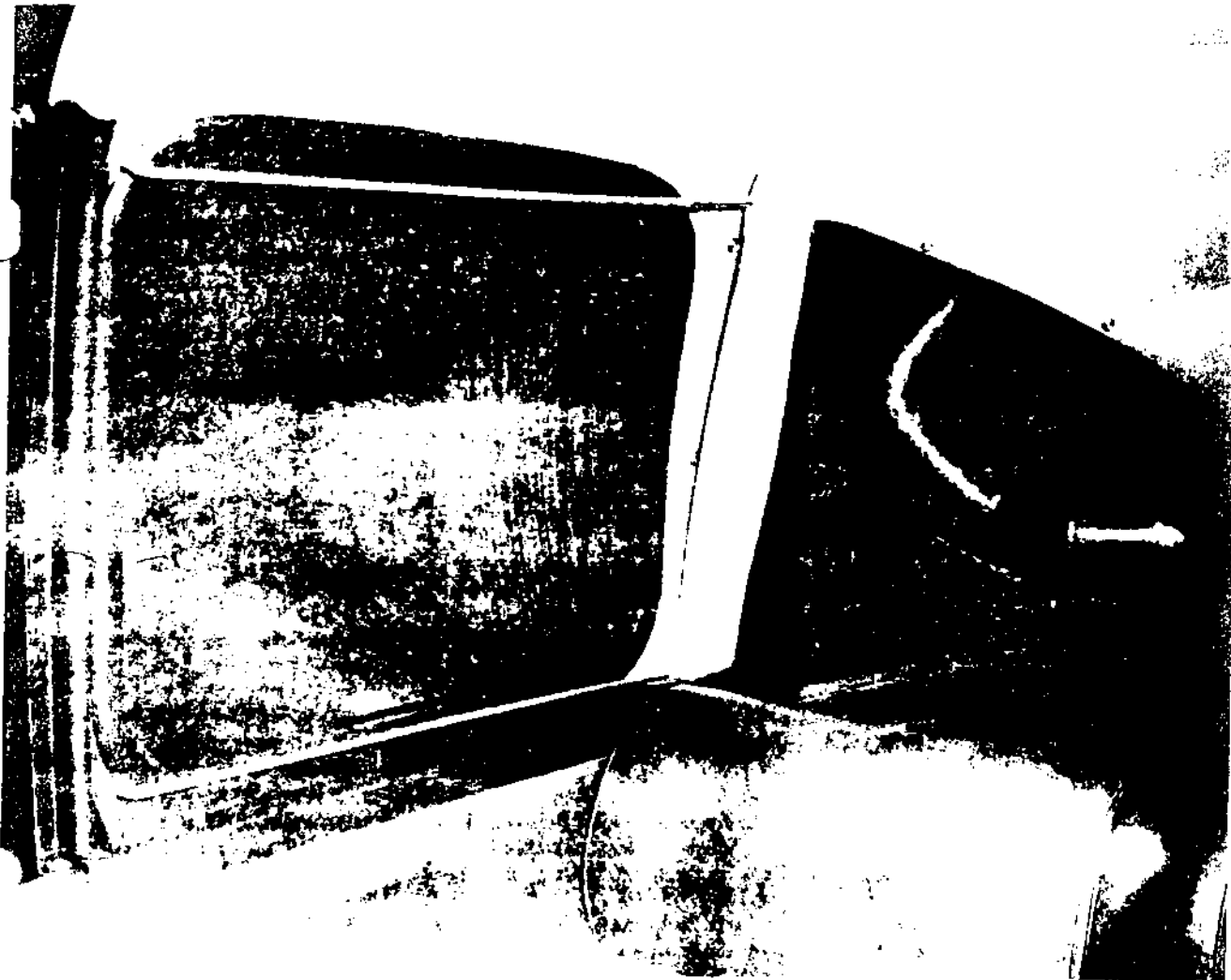
6. Hold upper rod so curtain is suspended tightly between the two rods and drill a No. 12 hole opposite the point of attachment for the aft end of the upper rod. (The approximate distance between lower canopy rail and upper rod aft attachment point is 17-1/2 inches.)

7. Secure the aft end of the rod using one (1) 781-10-14 screw, one (1) 2W1-AL16-32-64 washer and one (1) NAB75-3-015 spacer. (Spacer to be used on top rod only and is installed between headliner and canopy skin.

CAUTION

Rods must be parallel along their entire length.

Weight and balance change resulting from this installation is negligible.



STANDARD INSTRUCTIONS NO. 68
PLATE 1

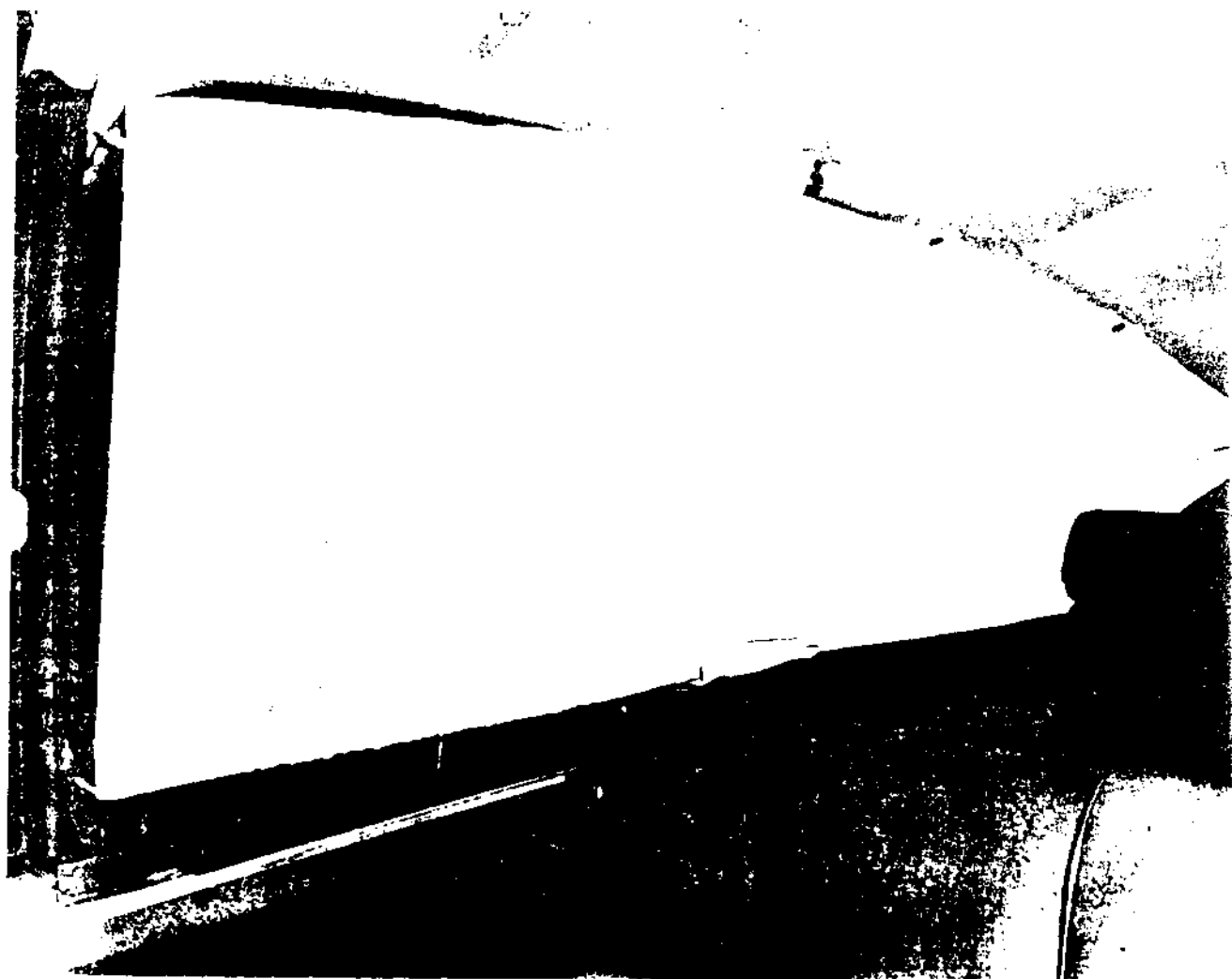


Figure No. 2

SPECIAL INSTRUCTIONS NO. 69
NOVEMBER 22, 1950

INSTALLATION "Y" DRIVE AND VACUUM PUMP ON SUPFR 260 NAVIONS.
RYAN DWG. NO. 146-89015

1. Remove hydraulic pump from Lycoming engine.
2. Install hydraulic pump on back end of "Y" Drive, with side inlet fitting on the upper left side as drive is installed on engine, using one (1) AN4045-1 gasket and three (3) AN4-10 bolts, four (4) AN960-10L washers, four (4) AN310-4 nuts and four (4) AN380-2 cotter keys.
3. Install two (2) AN842-8D elbows in vacuum pump, point elbows aft and slightly up as "Y" Drive and vacuum pump are mounted on engine.
4. Install vacuum pump on "Y", using one (1) AN4045-1 gasket, three (3) AN4-10 bolts, four (4) AN960-10L washers, four (4) AN310-4 nuts and four (4) AN380-2 cotter keys.
5. Place AN4041 gasket on engine drive pad and install "Y" Drive assembly with vacuum pump hanging slightly to the right of the straight down position. Secure "Y" Drive to engine, using four (4) AN960-10L washers, four (4) AN315-4 nuts and four (4) AN356-4 pal nuts.
6. Measure down one (1) inch from upper horizontal firewall rivet line and in $3\frac{1}{2}$ inches from L/H outer edge of firewall. Drill a No. 12 hole. Measure down $1\frac{1}{2}$ inches from hole and drill a second No. 12 hole.
7. Mount oil separator on firewall, using two (2) AN520-10R-32 screws, two (2) 453-10-12 spacers, four (4) AN960-10L washers and two (2) AN365-1032 nuts.
8. Install 24" hose on lower separator outlet, using one (1) A3122-12-59 clamp.
9. Install one (1) AN840-8D adapter nipple in place of left lower plug in rear end of engine accessory case.
10. Connect other end of 24" hose to adapter in engine rear case, using one (1) A3122-12-59 clamp.

SPECIAL INSTRUCTIONS NO. 69

PAGE 2

11. Install 40" line on end of oil separator and routing it above and behind the hydraulic reservoir, down the firewall L/H vertical channel, connect it to the aft elbow (or pressure side) of the vacuum pump, using -5A clamps.
12. Clamp 40" line at hydraulic reservoir and upper end of firewall vertical channel, using two (2) AN742-16C clamps, two (2) AN515-8R8 screws and two (2) AN365-832 nuts.
13. Install 2½" hose on oil separator upper fitting, using one (1) A3122-12-59 clamp. Attach -43 air vent line to 2½" hose with another -59 clamp and route lower end of -43 line out L/H gill. Secure line to firewall with two (2) A2980-8 clamps, two (2) AN515-8R8 screws and two (2) AN365-832 nuts.
14. Locate a point one (1) inch down from top of firewall and one (1) inch inboard from inner flange of R/H firewall vertical support channel and drill a 13/16 inch hole in firewall.
15. Install one (1) AN931-8-13 grommet in hole.
16. Measure down from upper end of R/H firewall support channel 10-1/8 inches and drill a No. 12 hole in the inboard flange of channel.
17. Install 200X8 connector and AN840-8D adapter in AN6119-1 vacuum relief valve.
18. Attach 32 inch hose to adapter in vacuum relief valve, using one (1) A3122-12-59 clamp.
19. Attach vacuum relief valve to firewall, using one (1) 453-10-12 spacer, one (1) AN742-14C clamp, one (1) AN515-8R8 screw and one (1) AN365-832 nut. Attach at hole drilled in step No. 16 with clamp around lower hose at nipple.
20. Attach lower end of 32 inch hose to suction side of vacuum pump, using one (1) A3122-12-59 clamp.
21. Attach -45 line to 200X8 connector in top of vacuum relief valve extending line through hole in firewall drilled in step No. 14.
22. Using one (1) 252X8 connector and one (1) 236X6 connector, connect -45 line assembly to instrument vacuum line.

Weight and balance changes resulting from this installation may be computed by reference to the following.

"Y" Drive Adapter	2.5 pounds at 46 inches
Vacuum Pump Kit (less "Y" Drive)	6.0 pounds at 52 inches



Figure 1

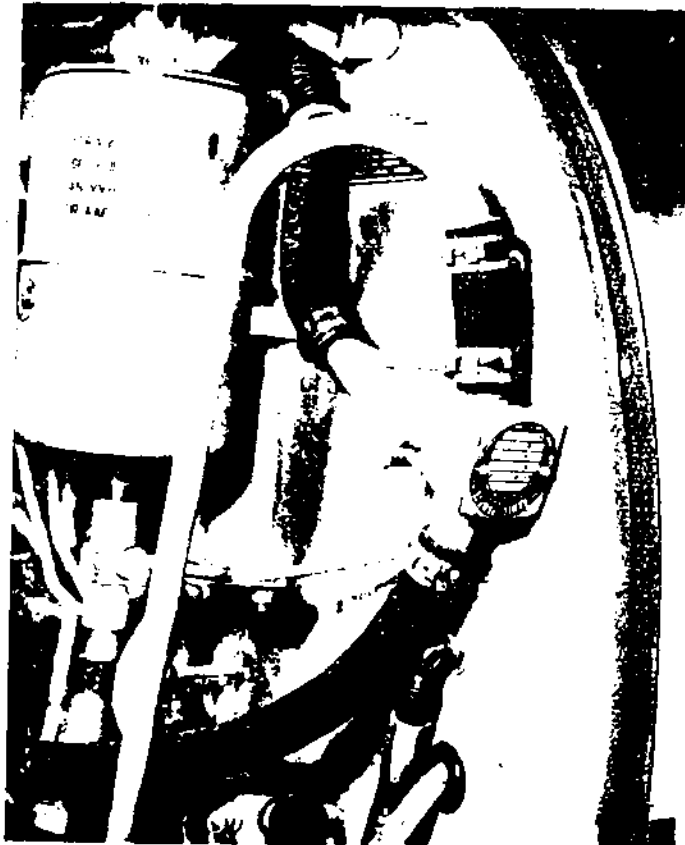


Figure 2

Refer to text for dimensions.

SPECIAL INSTRUCTIONS NO. 70
NOVEMBER 22, 1950

INSTALLATION OF ENGINE COWL FLAP KIT - RYAN DWG NO'S. 146-31510
AND 143-31901

CAUTION

This installation not recommended for Navions equipped with Stewart-Warner Heater or on Navions equipped with other than Ryan exhaust stacks.

Install cowl flap kit according to the following instructions and figures:

SECTION I.

1. Place -71 doubler in position against skin at gill opening with widest leg of the -71 doubler located at the lower side and flush with engine mount skin lower edge.
2. Using a soft pencil, mark around inside edge of -71 doubler.
3. Measure $\frac{3}{8}$ of an inch up from upper mark and draw a parallel line.
4. Measure $\frac{3}{16}$ of an inch aft from forward mark and draw a parallel line.
5. Make a cutout along lines made in steps 3 and 4. Cut along vertical line to extend down through edge of engine mount skin.
6. Place -71 doubler in position on inside of engine mount skin and secure in position with several sheet metal fastners or set up screws.
7. Drill No. 30 holes on one (1) inch spacing and secure -71 doubler to mount skin, using AN470AD4 rivets.
8. Locate the 146-31513 inboard hinge half so that the measurement from the upper edge of the lower -71 doubler leg to the hinge point is $1\frac{1}{16}$ inches and secure in place with one cleco.
9. Locate the 146-31512 outboard hinge half so that the measurement from the lower to the upper hinge points is $7\frac{1}{2}$ inches and temporarily secure with one sheet metal fastner.

10. Place the cowl flap in "closed" position and locate 146-31513-2 and 146-31512-2 hinge halves in position and secure each with one sheet metal fastener or screw.

11. Temporarily connect hinges and check movement of flap open and closed. Adjust hinges as necessary, locate and drill the necessary attaching holes for each hinge and secure hinges in position using twelve (12) NAS-221-10 screws and twelve (12) AN365-1032 nuts.

12. Attach hinge halves together using two (2) AN3-6 bolts, two (2) AN365-3 nuts and two (2) AN380-2-2 cotter pins.

13. Repeat above procedure for opposite side.

SECTION II.

1. Locate a point on the instrument panel $1\frac{1}{2}$ inches to the right of the centerline and $\frac{3}{4}$ of an inch up from the bottom of the panel. Drill a $\frac{37}{64}$ inch hole.

2. Measure $3\frac{1}{2}$ inches to the right of airplane centerline on the firewall and $8\frac{7}{8}$ inches up from firewall skin lap. Drill a $\frac{11}{16}$ inch hole.

3. Measure $8\frac{1}{8}$ inches to the right of centerline on the firewall and $8\frac{1}{2}$ inches up from firewall skin lap and drill another $\frac{11}{16}$ inch hole.

4. Install the AN931-7-11 grommet in the hole drilled in step 3.

5. Install cowl flap flexible control, using -7 spacer behind instrument panel to space attaching nut more conveniently and with the long leg of the "Y" on left side of the firewall.

6. Secure the ferrule where control splits to R/H instrument panel support beam, using one (1) AN742-6 clamp, one (1) AN520-10R14 screw, one (1) NAS432-DD-3-32 spacer, one (1) AN960-D10 washer and one (1) AN365-1032 nut.

7. Place the -2 and -6 micarta blocks with the 161701-1 seal around the L/H flap control at firewall and secure in position, using four (4) AN520-1 or 10 screws, after having pulled all possible slack to the forward side of firewall.

8. Place the -3 and -4 micarta block in position around R/H flap control at firewall and secure to firewall, using four (4) AN520-10R10 screws.

9. Install -5 bracket in position on forward side of firewall below R/H control, using two (2) AN520-10R8 screws and two (2) AN365-1032 nuts.

10. Attach R/H control to -5 bracket, using two (2) AN742-5 clamps, two (2) AN520-10R8 screws and two (2) AN365-1032 nuts.

11. Install -3 bracket under the two bolts which secure the 145-58247 hydraulic relief valve.

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12. Attach L/H control to -3 bracket, using two (2) AN742-5 clamps, two (2) AN520-10R8 screws and two (2) AN365-1032 nuts.

13. Connect control to cowl flaps, using two (2) AN4-10 bolts, two (2) AN960-416 washers, two (2) AN310-4 nuts and two (2) AN380-2-2 cotter pins.

14. Install 145-51061-6 knob on control end at instrument panel and lock in position with set screw.

15. Rig control to provide a full open position of $4 \pm 1/8$ inches as measured near upper hinge, and simultaneous closing.

16. Install control placard on instrument panel above cowl flap control.

17. Weight and balance effect resulting from this installation may be computed on the basis of 6.5 pounds at 62 inches aft of the datum.



Figure 1

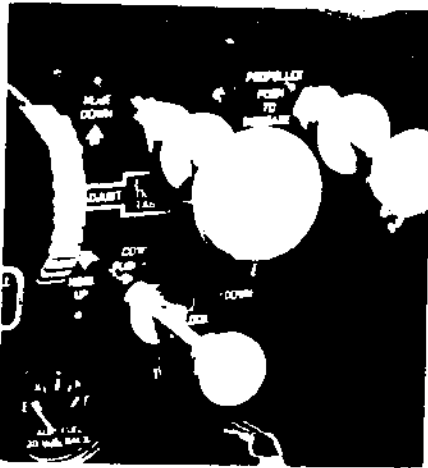


Figure 2

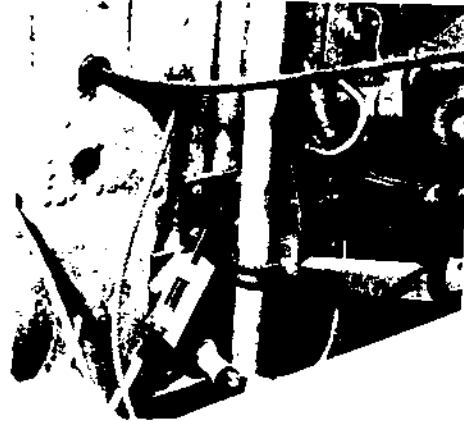


Figure 3

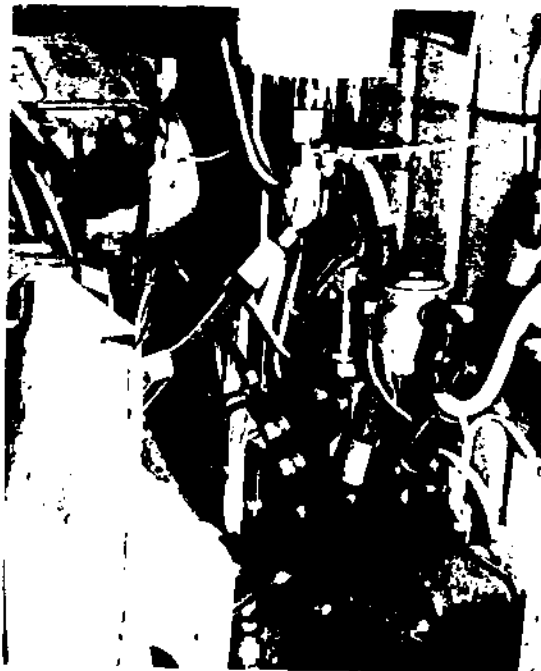


Figure 4

Refer to text for dimensions.

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INSTALLATION OF 145-48081 FUEL TANK FILLER NECK DOOR

Install 145-48081 Fuel Tank Filler Neck Hinged Door as follows.

1. Locate Dzus fastener hole 45 degrees outboard from the trailing edge of the filler neck well and centered 2.44 inches from the center of the well. Drill 5/16 inch hole.
2. Center A5-30 Dzus fastener spring under hole and rivet to filler neck well collar.
3. Place -1 door assembly in place over well and mark the two rivets on the collar which interfere with either end of door hinge. Replace these rivets with flush rivets.
4. Place door in position (with Dzus fastener secured) and drill three (3) No. 30 holes with 3/4 inch spacing in the -3 hinge half and well collar.
5. Secure -3 hinge half using three (3) AN470AD4 rivets.

Weight change resulting from this installation is negligible.