CHAPTER 13

INSTRUMENTS

Section	Title	Page
13.000	Instruments	13.1
13.001	Introduction	13.1
13.002	Description	13.1
13.100	Pitot-Static System	13.1
13.200	Flight Instruments	13.1
13.210	Airspeed Indicator	13.1
13.211	Pitot Line Leak Test	13.3
13.220	Altimeter	13.3
13.221	Static Line Leak Test	13.4
13.230	Vertical Speed Indicator	13.5
13.240	Outside Air Temperature (OAT)	13.5
13.300	Drive Train and Powerplant Instruments	13.5
13.310	Engine - Rotor Tachometer	13.5
13.320	Manifold Pressure Gauge	13.6
13.330	Carburetor Air Temperature	13.6
13.340	Engine Instrument Cluster	13.6
13.341	Oil Pressure Gauge	13.6
13.342	Oil Temperature Gauge	13.6
13.343	Cylinder Head Temperature Gauge	13.6
13.344	Fuel Quantity Gauge	13.6
13.345	Ammeter	13.7
13.400	Troubleshooting Guide	13.7
13.500	Optional Equipment	13.9
13.510	Aspen PFD and MFD Installations	13.9

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CHAPTER 13

INSTRUMENTS

13.000 Instruments

13.001 Introduction

This section contains a basic description of instrumentation installed in R44 Helicopters, general maintenance procedures and trouble-shooting procedures.

13.002 Description

Standard flight instruments include an airspeed indicator, dual (engine and rotor) tachometer, sensitive altimeter, manifold pressure gage, vertical speed indicator and magnetic compass. Engine cluster gages include an ammeter, oil pressure, oil temperature, cylinder head temperature and fuel quantities. Also provided are a carburetor air temperature gage (for carbureted engines), a clock, and a digital outside air temperature gage. An hourmeter actuated by engine oil pressure and collective switch is located to the right of the pilot's seat.

13.100 Pitot-Static System

The pitot-static system supplies air pressure to operate the airspeed indicator, altimeter, and vertical speed indicator. The pitot tube is located on the front of the mast fairing; a heated pitot tube is optional. Dual static ports are located aft of rear passenger doors; one on each side of cabin. Water can be drained from pitot and static lines by removing plastic drain plugs which are accessible by removing the belly aft panel; draining these lines should only be required if operation of airspeed or altimeter systems appear erratic. Openings of both pitot and static sources should be inspected frequently for bugs or other obstructions.

13.200 Flight Instruments

Refer to Section 2 of R44 Pilot's Operating Handbook for specific instrument markings.

13.210 Airspeed Indicator

The airspeed indicator displays airspeed in knots and miles per hour. The airspeed indicator operates correctly in forward flight only; backward or lateral flight will not indicate correct airspeed. The airspeed indicator will indicate forward airspeeds up to a maximum of 130 knots (Red Line).

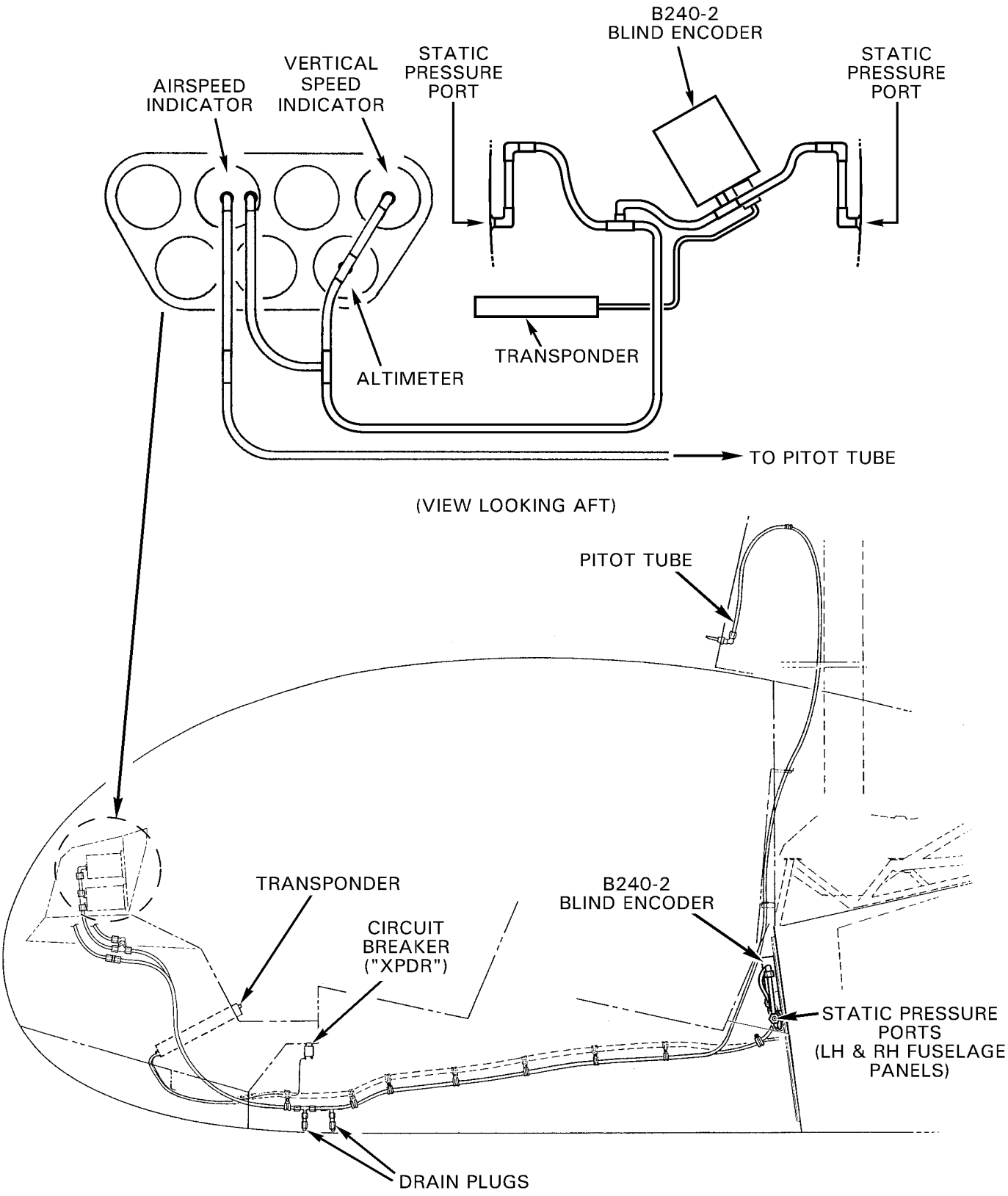

FIGURE 13-1 PITOT AND STATIC SYSTEM INSTALLATION

13.211 Pitot line leak test

CAUTION

Do not apply suction to pitot system or pressure to static system

1. **Method 1**: Using hand pump

   a. Seal pitot tube drain hole with pressure sensitive tape. Attach flexible tubing and hand pump unit (60 ml syringe) to pitot tube with pump plunger at top of cylinder.

   b. SLOWLY apply pressure to pitot line by depressing pump plunger until airspeed indicator reads 80 mph (70 knots). Pump plunger will remain in place without need to pinch off flexible tubing.

   c. Gently tap airspeed indicator glass to remove friction effects.

   d. If indicator pointer drops more than 10 mph (8-9 knots) in one minute, an unacceptable leak is indicated. After leak has been repaired, retest per sections (a) thru (d).

   e. Remove tape from pitot tube drain hole and verify airspeed indicator goes to zero.

   f. Remove test apparatus from pitot tube after acceptable test results are obtained.

2. **Method 2** : Using flexible tubing

   a. Seal pitot tube drain hole with pressure sensitive tape. Attach flexible tubing to pitot tube.

   b. SLOWLY apply pressure to pitot line by rolling flexible tubing around roller until airspeed indicator reads 80 mph (70 knots). Pinch off pressure supply at flexible tube.

   c. Gently tap airspeed indicator glass to remove friction effects.

   d. If indicator pointer drops more than 10 mph (8-9 knots) in one minute, an unacceptable leak is indicated. After the leak has been repaired, retest per sections (a) thru (d).

   e. Remove tape from pitot tube drain hole and verify airspeed indicator goes to zero.

   f. Remove test apparatus from pitot tube after acceptable test results are obtained.

13.220 Altimeter

The altimeter provides altitude information relative to sea level when barometric pressure correction scale is properly set. Check altimeter calibration by setting correction scale to present altimeter setting and checking altimeter reading against field elevation. They must agree within 70 feet.

13.221 Static line leak test

CAUTION

When applying suction to static line, airspeed, altimeter and vertical speed indicators may be damaged if suction is applied or removed rapidly.

1. **Method 1**: Using hand pump

   a. Set altimeter to field elevation.

   b. Seal static opening with pressure sensitive tape. Attach flexible tubing and hand pump unit to static line at drain with pump plunger depressed.

   c. SLOWLY apply suction to static line with hand pump until altimeter reaches 500 ft. greater than field elevation. Pump plunger will remain in that position.

   d. Gently tap glass on altimeter until rate-of-climb indicator has stabilized. After stabilization, altimeter should be adjusted to the next higher 100 foot mark and then timed for one minute. Change of less than 100 feet in elevation in one minute is acceptable.

   e. SLOWLY remove suction from static line.

   f. After leak has been repaired, retest per sections a thru e.

   g. Remove test equipment.

2. **Method 2:** Using flexible tubing

   a. Set altimeter to field elevation.

   b. Seal static opening with pressure sensitive tape. Preroll flexible tubing around roller so that suction may be produced by unrolling. Attach flexible tubing to static line at drain.

   c. SLOWLY apply suction to static line with hand pump until altimeter reaches 500 ft. greater than field elevation. Pump plunger will remain in that position.

   d. Gently tap glass on altimeter until rate-of-climb indicator has stabilized. After stabilization, altimeter should be adjusted to next higher 100 foot mark and then timed for one minute. Change of less than 100 feet in elevation in one minute is acceptable.

   e. SLOWLY remove suction from static line

   f. After leak has been repaired, retest per sections a thru e.

   g. Remove test equipment.

13.230 Vertical Speed Indicator

The vertical speed indicator provides rate of ascent or descent. Check vertical speed indicator for a zero rate needle indication when rotorcraft is stationary.

13.240 Outside Air Temperature (OAT)

The outside air temperature indicator has a stainless steel probe protruding from chin of rotorcraft and is connected to gauge by a calibrated length of cable.

> NOTE
>
> No cutting or splicing of OAT probe wires is permitted.

13.300 DRIVE TRAIN AND POWERPLANT INSTRUMENTS

13.310 Engine - Rotor Tachometer

The R44 is equipped with one electronic dual (engine and rotor) tachometer. The sensor for engine tachometer is breaker points in engine right magneto. Sensor for rotor tachometer is an electronic Hall Effect device which senses passage of two magnets attached to main rotor gearbox input yoke assembly. Each tachometer circuit has a separate circuit breaker and is completely independent from the other. They can be powered by either alternator or battery even if "MASTER BAT" switch is turned off. With alternator, battery and electrical circuits functioning normally tachometer power will be interrupted only if "MASTER BAT" and "ALT" switches are turned off and "CLUTCH ENGAGE" switch is disengaged.

> **CAUTION**
>
> Installation of electrical devices can affect accuracy and reliability of electronic tachometers. Therefore, no electrical equipment may be installed in the R44 helicopter unless installation is specifically approved by RHC. At 100% RPM of engine, engine and rotor tachometer needles must indicate 100% ± 1%. For adjustment of rotor tachometer, see Section 14.100 Dual Tachometer Adjustment.

13.320 Manifold Pressure Gauge

The manifold pressure gauge provides an indication of absolute air pressure in engine intake manifold. Red line on gauge indicates maximum manifold pressure for which rotorcraft is type certificated at 104% rotor RPM. Manifold pressure gauge should indicate within 0.3 inches Hg of ambient barometric pressure when engine is not running.

13.330 Carburetor Air Temperature

A carburetor air temperature gauge on panel is used to determine when carburetor heat is required during possible carburetor icing conditions, such as high humidity. Apply heat as required to keep needle out of yellow band. Carburetor air temperature gauge should read approximately the same as OAT gauge when engine is cold.

13.340 Engine Instrument Cluster

13.341 Oil Pressure Gauge

The oil pressure gauge indicates engine oil pressure and receives its signal from a variable-resistor-type sender located in left-hand forward corner of engine compartment next to hourmeter pressure switch.

13.342 Oil Temperature Gauge

The oil temperature gauge indicates engine oil temperature and receives its electrical signal from a probe mounted in engine oil pressure screen housing or oil filter adapter.

13.343 Cylinder Head Temperature Gauge

The cylinder head temperature gauge indicates temperature of cylinder #2 (O-540), cylinder #1 or #5 (IO-540) and receives its signal from a probe installed in bottom of cylinder head.

13.344 Fuel Quantity Gauge

The fuel quantity gauge indicates fuel level and receives its signal from a variable-resistor-type float indicator (see Section 12.000 for adjustment).

13.345 Ammeter

The ammeter indicates loads in electrical system. The system loads are measured at shunt located on lower right-hand side of vertical firewall in the engine compartment.

13.400 Troubleshooting Guide

INSTRUMENT	PROBLEM	PROBABLE CAUSE
Airspeed Indicator	No Indication	1. Blockage of pitot tube. 2. Disconnected pitot tube. 3. Kinks (bends) in pitot line under upper console. 4. Defective indicator.
	Erratic Indication	1. Loose pitot or static line connection. 2. Broken pitot line. 3. Water in pitot-static system. 4. Defective instrument.
Altimeter	No Indication	1. Blockage in static line. 2. Defective instrument.
	Erratic Indication	1. Water in static line.
Vertical Speed Indicator	Climb indication with no return to zero in level flight.	1. Blockage in the static line.
	Erratic Indication	1. Water in static system. 2. Defective indicator.
	No Indication	1. Defective indicator.

NOTE

For troubleshooting procedures for electrical-powered instruments, see Section 14.000.

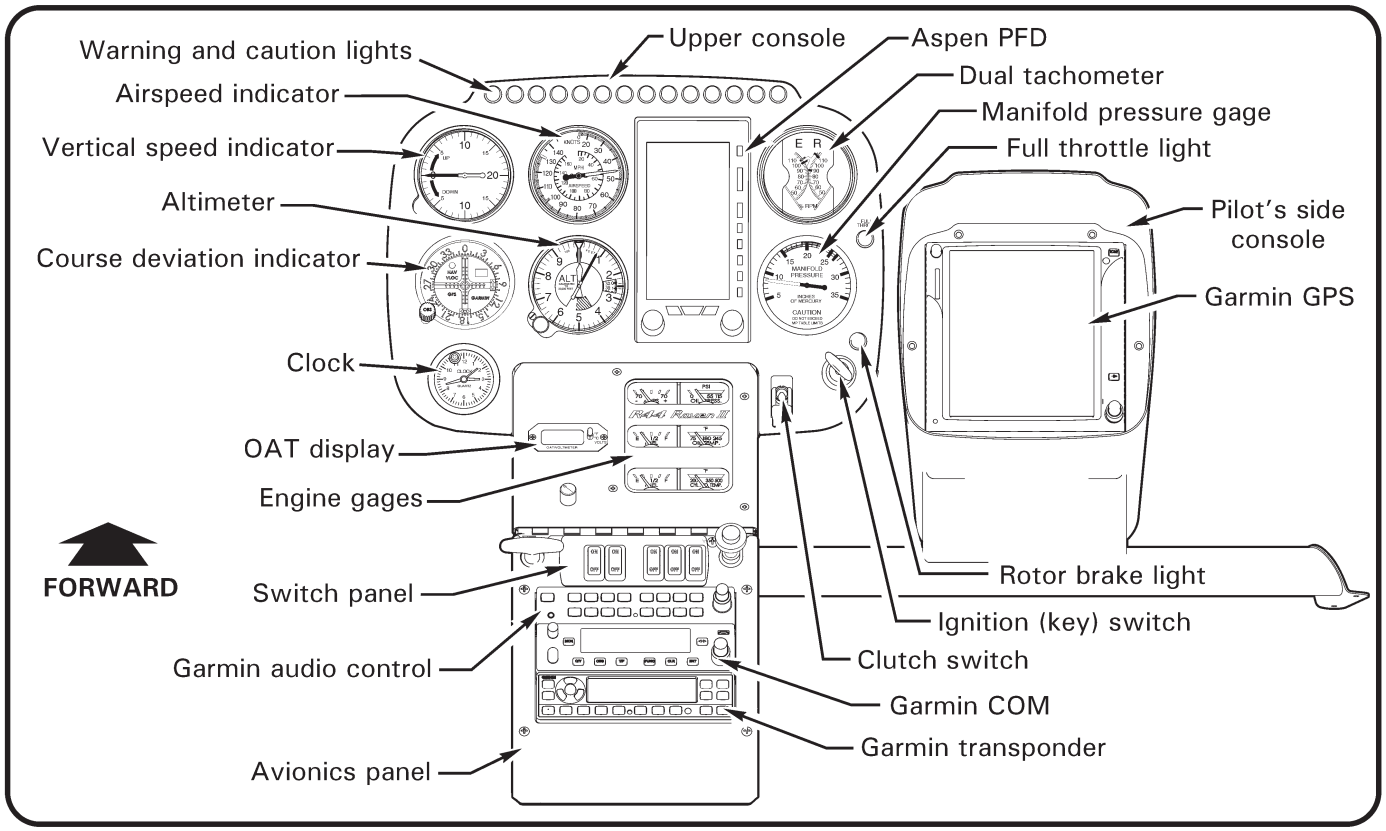

FIGURE 13-2 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD - TYPICAL (R44 II SHOWN)

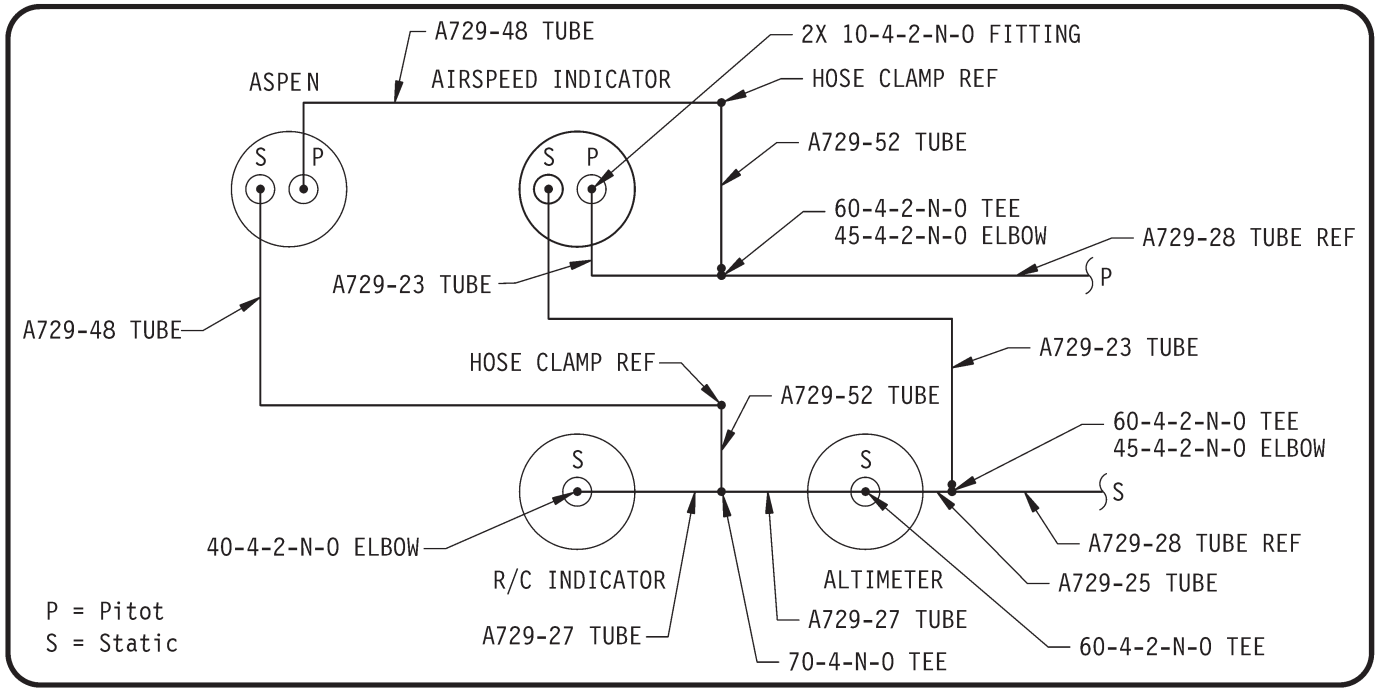

FIGURE 13-3 ASPEN PFD PITOT-STATIC SCHEMATIC

13.500 Optional Equipment

13.510 Aspen PFD and MFD Installations

Refer to R44 Illustrated Parts Catalog Figures 95-63 thru 95-71.

A. Description

R44 options include a single screen Aspen PFD or a dual screen Aspen PFD and MFD.

The Aspen PFD (Primary Flight Display) is an LCD unit with displays for attitude, altitude, airspeed, heading, and optional NAV (HSI/CDI). The Aspen PFD is a situational awareness aid, to be used in conjunction with required VFR instruments (altimeter, airspeed indicator, and magnetic compass).

The standard Aspen PFD installation configures the lower half of the display as a directional gyro. An optional installation configures the lower half of the display to a Horizontal Situation Indicator (HSI).

The Aspen MFD (Multifunction Display) is an LCD unit with displays for moving map navigation data, terrain, and traffic. Terrain and traffic may also be overlaid on moving map.

GPS position data is received from Garmin GTN series GPS for moving map and terrain displays. Aspen MFD also includes an internal terrain database.

TIS-A traffic data may be received from Garmin GTX330 transponder for moving map display; TIS-A traffic data is received from GTN series GPS for traffic display.

Heading and outside air temperature data is received from Aspen PFD. GPS position data may be received from Aspen PFD which includes a remote sensor module for backup GPS position data if primary GPS fails.

B. Schematics

Refer to Figure 14-23 for C800-1 Aspen PFD electrical schematic, and Figure 14-24 for C800-3 Aspen PFD and MFD electrical schematic.

Refer to Figures 13-1 and 13-3 for Aspen PFD pitot-static schematic, and Figures 13-1 and 13-5 for Aspen PFD and MFD pitot-static schematic.

C. Removal

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.

2. Gently depress blue tab(s) at top of Aspen PFD/MFD to release display(s) from mounting bracket(s).

3. PFD only: Disconnect pitot and static lines from display using quick-disconnect couplers. Temporarily cap pitot and static line fittings at display and in aircraft to prevent contamination.

4. Loosen screws securing airframe wiring harness connector(s) to display(s), unplug connector(s), and remove display(s).

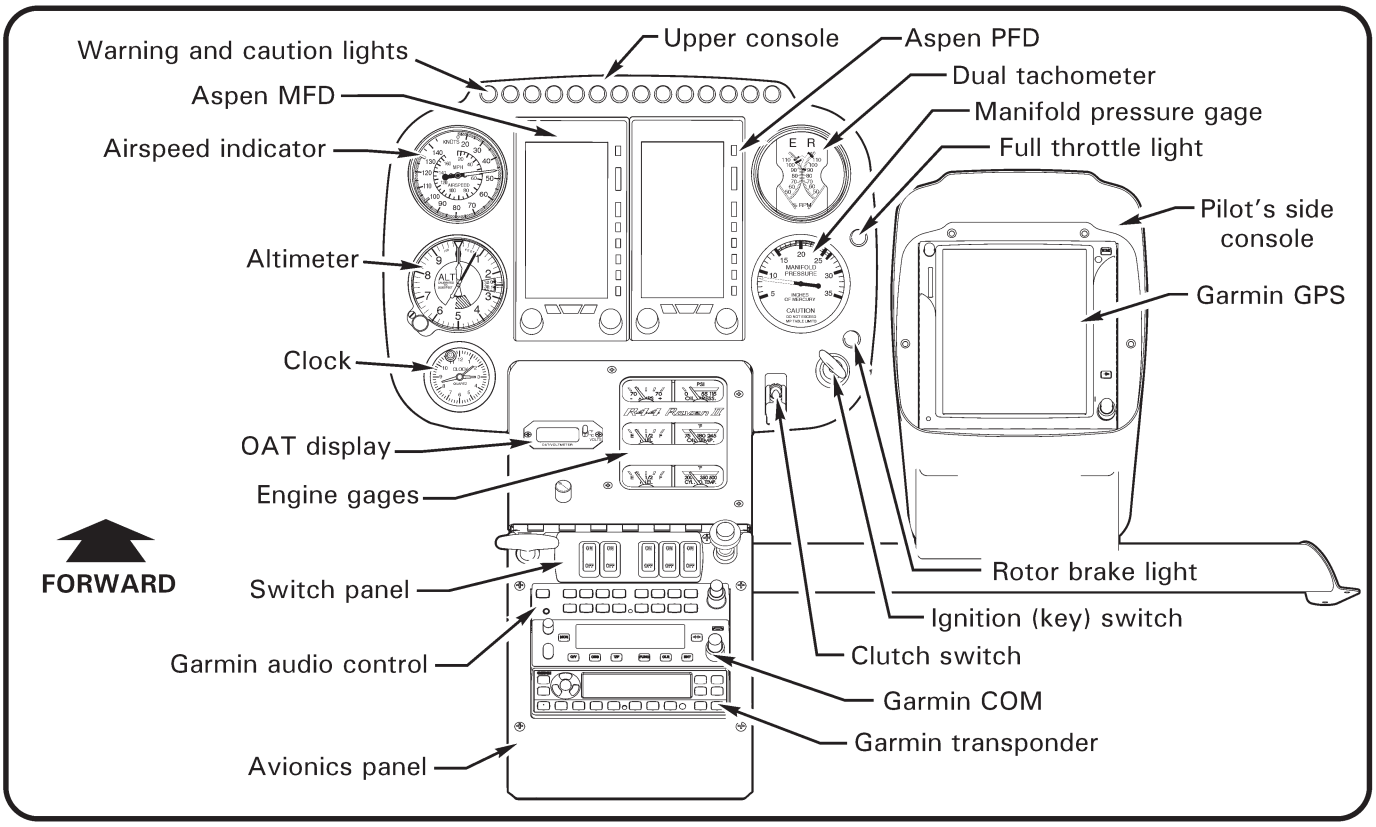

FIGURE 13-4 EIGHT-INSTRUMENT CONSOLE WITH ASPEN PFD AND MFD - TYPICAL (R44 II SHOWN)

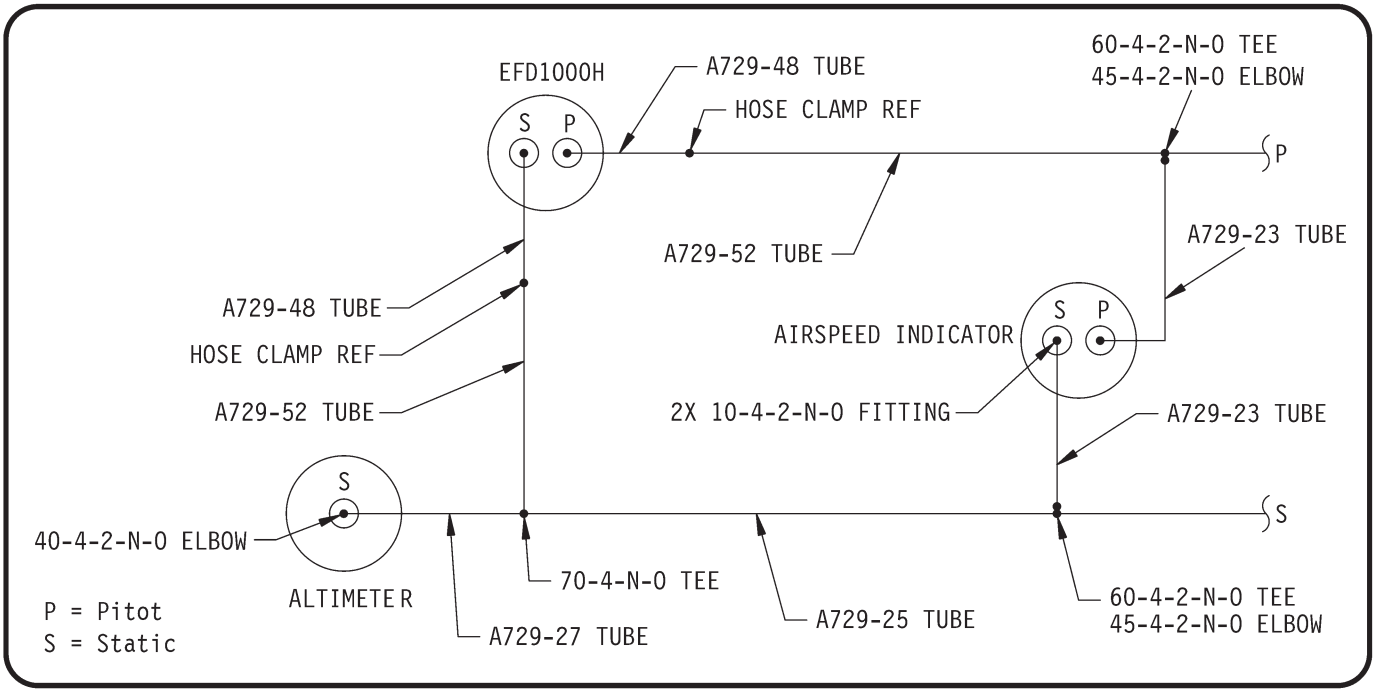

FIGURE 13-5 ASPEN PFD AND MFD PITOT-STATIC SCHEMATIC

13.510 Aspen PFD and MFD Installations (continued)

D. Installation

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Plug airframe wiring harness connector(s) into Aspen PFD/MFD display(s) and tighten screws. Verify security.
3. PFD only: Remove temporary fitting caps and connect pitot and static lines to display using quick-disconnect couplers.
4. Insert display(s) into mounting bracket(s) until blue tab(s) snap(s) into place. Verify security.
5. Push-in EFIS circuit breaker (7.5 amp) at panel. Turn battery & avionics switches on.
6. Perform appropriate functional checks per Aspen EFD1000H PFD / EFD500H MFD Pilot's Guide. Turn battery and avionics switches off.
7. Perform pitot-static leak check.

E. Antenna

Refer to Section 14.800 for antenna locations and R44 Illustrated Parts Catalog (IPC) Chapter 6.

NOTE

Do not use magnetized tools.

Removal

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Using plastic scraper, remove B270-1 sealant from around EFIS antenna at corners where it attaches to tailcone.
3. Disconnect antenna cable from antenna. Remove screws securing antenna and antenna ground wire to tailcone and remove antenna.

Installation

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Remove paint & primer from antenna and antenna ground wire mating surfaces to ensure electrical ground.
3. Install screws securing antenna and antenna ground wire to tailcone. Verify security.
4. Apply small bead B270-1 sealant (0.1 inch max in height) around antenna at corners where it attaches to tailcone and allow to dry.
5. Connect antenna cable to antenna. Verify security.
6. Perform ground checks per Part D steps 5 and 6.

13.510 Aspen PFD and MFD Installations (continued)

F. Scheduled Maintenance and Inspections

The internal and optional external battery must be tested for proper operation every 12 months. No calibration is necessary. Other maintenance is on condition. Contact Aspen Avionics at www.aspenavionics.com for instructions for continued airworthiness.

G. Special Maintenance and Inspections

1. Turn battery and avionics switches off. Open circuit breaker panel and upper console.

2. Inspect condition of and verify no obvious damage to Aspen displays, pitot-static lines, metal braiding, copper bus bars, circuit breaker, and wiring. Verify no loose, chafed, or broken wires or terminals. Verify no evidence of arcing. Verify equipment security.

3. Secure circuit breaker panel and upper console. Perform ground checks per Part D steps 5 and 6.