

**CHAPTER 13  
INSTRUMENTS**

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## CHAPTER 13

### INSTRUMENTS

#### 13.000 Description

Standard primary instruments include an airspeed indicator, engine and rotor dual tachometer, altimeter, manifold pressure gage, and magnetic compass. Engine gages include an ammeter, oil pressure, oil temperature, cylinder head temperature, and fuel quantity for main and aux (if installed) tanks. Also standard are a clock, a carburetor air temperature gage, and a digital outside air temperature gage. An hourmeter actuated by engine oil pressure is located on the ledge just forward of the pilot's seat.

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 edge of the mast fairing. The static source is located inside the aft cowling inboard of the cowl door hinge.

Water can be drained from pitot-static lines by removing the plastic drain plugs which are accessible through the inspection panel on the underside of the cabin. Draining lines should only be required if the airspeed indicator or altimeter appears erratic.

Pitot and static sources should be inspected frequently for bugs or other obstructions.

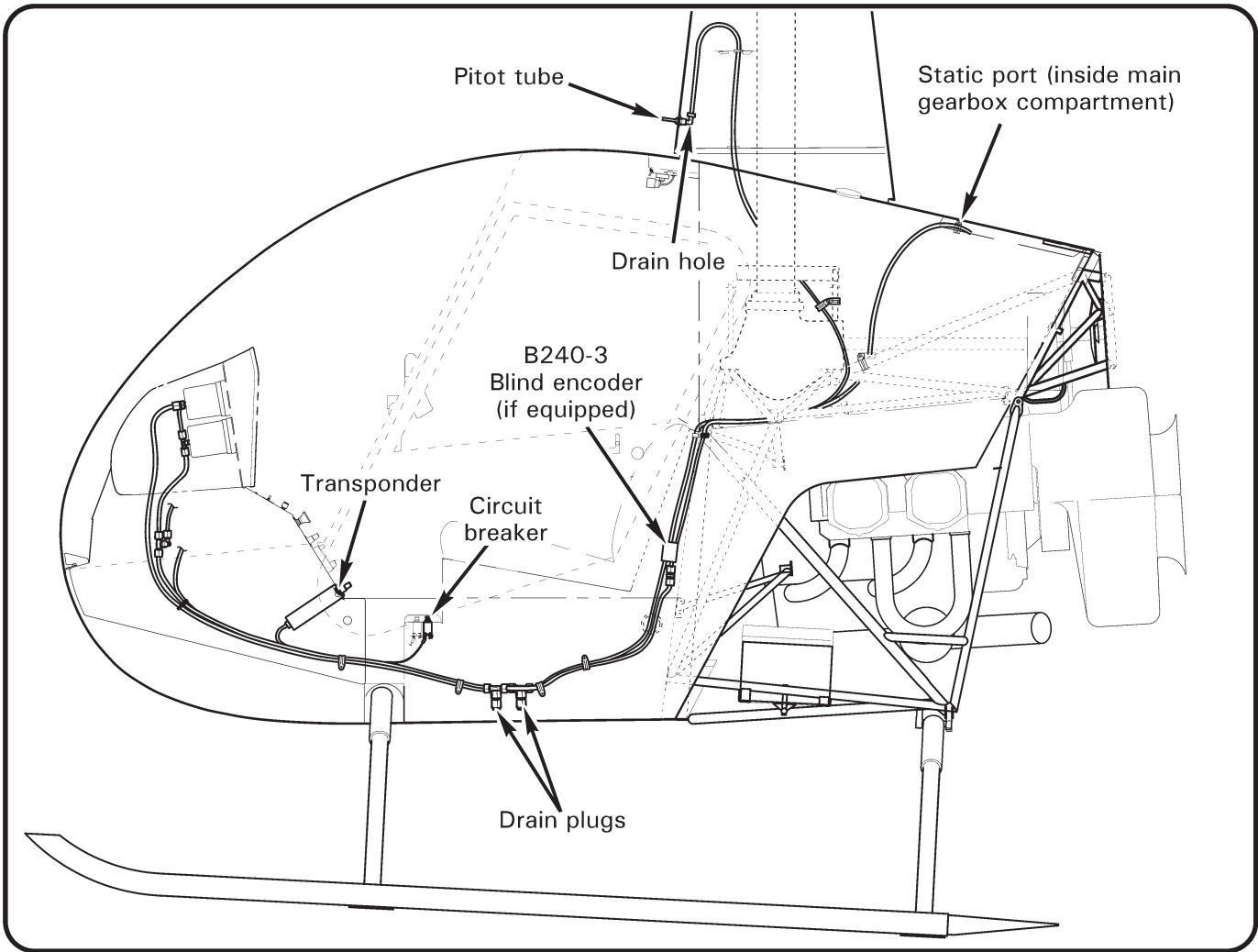
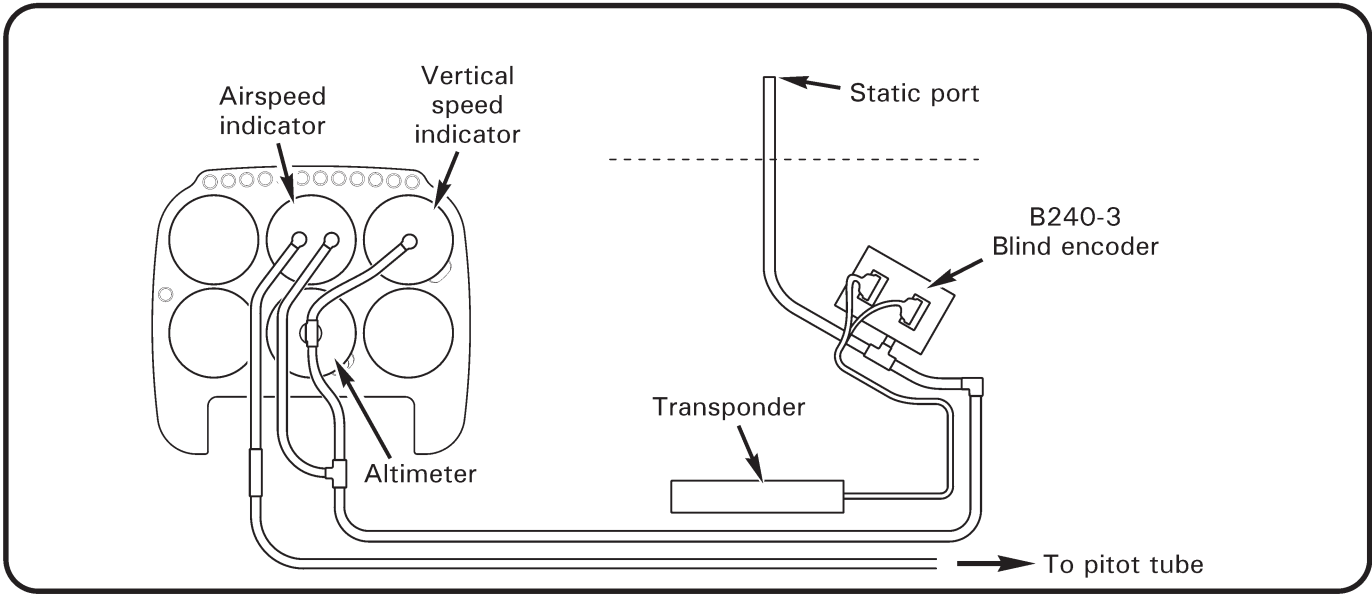


FIGURE 13-1 PITOT-STATIC SYSTEM

### 13.100 Pitot-Static System

**CAUTION**

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

**A. Pitot System Leak Test**

1. Open mast fairing.
2. Refer to Figure 13-1. Seal drain hole in elbow aft of pitot tube with pressure-sensitive tape. Connect a medical syringe, with plunger withdrawn, to pitot tube via flexible tubing.
3. Slowly apply pressure to pitot line by depressing syringe plunger until airspeed indicator reads 70 knots (plunger will remain in place).
4. Gently tap airspeed indicator glass to remove friction effects.
5. If airspeed indication drops more than 10 knots in one minute, an unacceptable leak is indicated. Slowly release pressure. Locate and repair any leak(s). Retest after any repairs.
6. Remove tape from pitot tube drain hole and verify airspeed indicator has returned to zero.
7. Remove test equipment. Close mast fairing.

**B. Static System Leak Test****CAUTION**

Airspeed indicator, altimeter, and vertical speed indicator may be damaged if suction to static line is applied or removed rapidly.

1. Refer to Figure 13-1. Set altimeter to location elevation.
2. Connect a medical syringe, with plunger depressed, to static port tube via flexible tubing.
3. Slowly apply suction to static port by withdrawing syringe plunger until altimeter indicates 500 feet greater than location elevation (plunger will remain in place).
4. If altimeter indication drops more than 100 feet in one minute, an unacceptable leak is indicated. Slowly release suction. Locate and repair leak(s). Retest after any repairs.
5. Remove test equipment.

### 13.200 Primary Instruments

#### 13.210 Vertical Speed Indicator

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

#### 13.220 Airspeed Indicator

The airspeed indicator displays airspeed in knots and miles per hour. The airspeed indicator operates properly in forward flight only; backward or lateral flight will not indicate correct airspeed. The airspeed indicator will indicate airspeeds up to a maximum of 102 knots (red line).

#### 13.230 Engine and Rotor Dual Tachometer

##### **CAUTION**

Installation of electrical devices can affect accuracy and reliability of electronic tachometers.

An electronic engine and rotor dual tachometer is standard. Engine tachometer signal is provided by magneto breaker points. Rotor tachometer signal is provided by two magnetic senders at the main gearbox drive yoke. Each tachometer is on a separate circuit with its own circuit breaker. With battery and alternator switches off, the tachometers continue to receive power from the battery through a bypass circuit as long as the clutch actuator switch is in the engage position.

#### **A. Adjustment**

##### **NOTE**

Adjust rotor tachometer if engine and rotor tachometer needles are not within 1% of each other at 104% RPM.

1. Remove screws securing instrument face panel to upper console and carefully pull panel aft.
2. Run-up helicopter per R22 Pilot's Operating Handbook (POH) Section 6 at 104% engine tachometer indication.
3. Turn adjustment screw on back of tachometer (apply 1/8 turns) clockwise to increase and counterclockwise to decrease rotor tachometer indication. Adjust rotor tachometer to indicate 104%.
4. Shutdown helicopter per POH Section 6. Tighten screws securing instrument panel to upper console.

#### 13.240 Altimeter

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

### 13.250 Manifold Pressure Gage

The manifold pressure gage provides an indicator of absolute air pressure in the engine intake manifold. The red line on the gage indicates the maximum manifold pressure that the rotorcraft is type certificated for at 104% rotor RPM. The manifold pressure gage should indicate within 0.3 inches Hg of ambient barometric pressure when engine is not running.

#### **A. Manifold Pressure System Leak Check**

1. Disconnect A740-1 line assembly from engine fitting.
2. Connect a medical syringe, with plunger depressed, to line assembly fitting via flexible tubing.
3. Slowly apply suction to system by withdrawing syringe plunger until manifold pressure gage indicates 10 inches Hg (plunger will remain in place).
4. If manifold pressure gage indication rises more than one inch in one minute, an unacceptable leak is indicated. Slowly release suction. Locate and repair leak(s). Retest after any repairs.
5. Remove test equipment.

### 13.260 Magnetic Compass

An internally illuminated, wet-type compass is attached to the center bow between the windshields above the instrument panel. A compass correction card is aft of the windshield above the pilot's seat.

## 13.300 Engine Gages

### 13.310 Ammeter

The ammeter indicates electrical system loads. System load is measured at the shunt located on the lower-left side of the vertical firewall in the engine compartment.

### 13.320 Engine Oil Pressure Gage

The engine oil pressure gage 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.

### 13.330 Engine Oil Temperature Gage

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

### 13.340 Cylinder Head Temperature Gage

The cylinder head temperature gage indicates the temperature of the #4 cylinder and receives its signal from a thermocouple installed in the #4 cylinder head.

### 13.350 Fuel Quantity Gages

The fuel quantity gages indicate the fuel level of main and aux (if installed) fuel tanks and receive signals from variable resistance type senders mounted on the bottom of each tank.

### 13.360 Carburetor Air Temperature Gage

The carburetor air temperature gage 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. The carburetor air temperature gage should read approximately the same as the OAT gage when engine is cold.

## 13.400 Additional Standard Indicating Equipment

### 13.410 Clock

A manually set electric analog clock is standard equipment.

### 13.420 Outside Air Temperature (OAT) Gage/Voltmeter

**NOTE**

No cutting or splicing of OAT probe wires is permitted.

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

### 13.430 Hourmeter

An hourmeter actuated by engine oil pressure is located on the ledge just forward of the pilot's seat.



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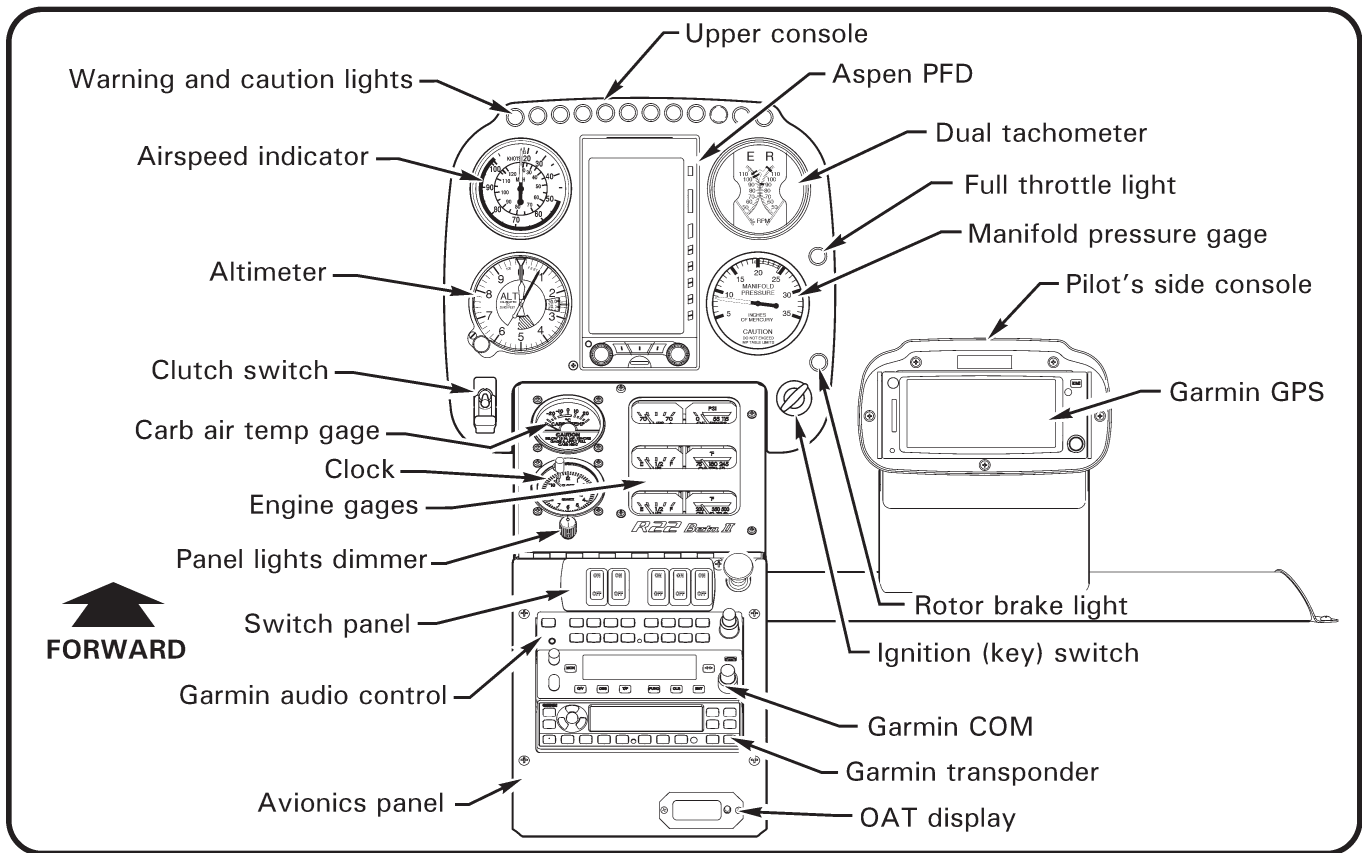


FIGURE 13-2 SIX-INSTRUMENT CONSOLE WITH ASPEN PFD – TYPICAL

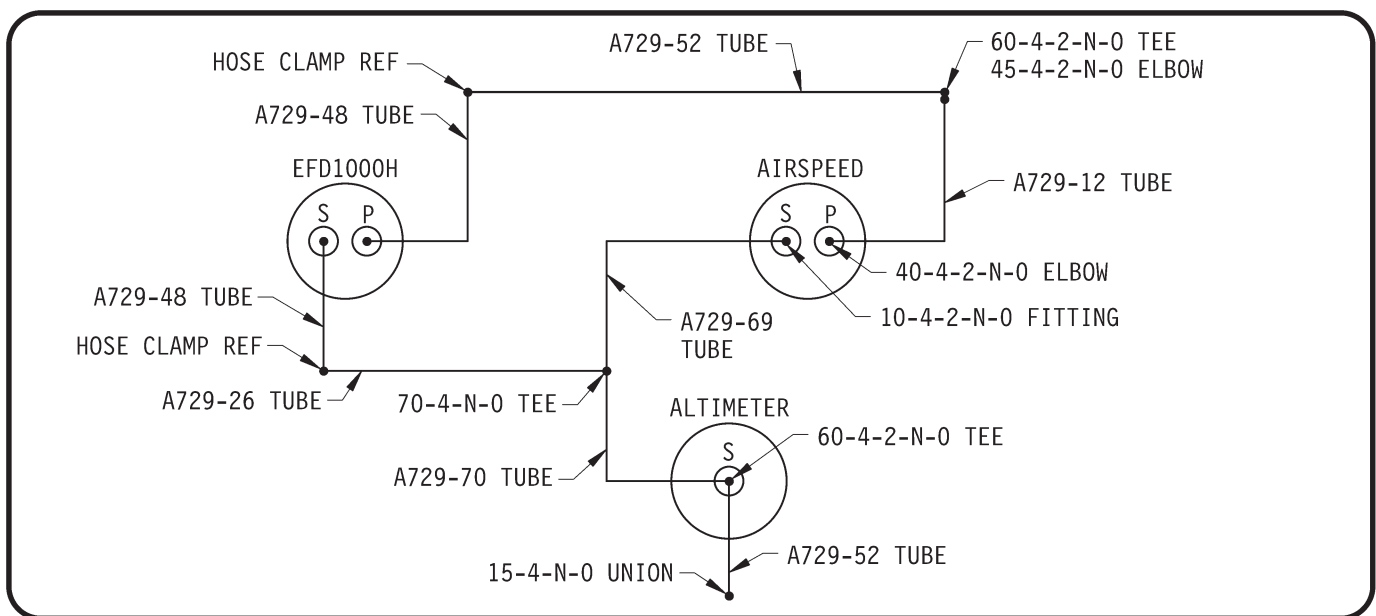


FIGURE 13-3 ASPEN PFD PITOT-STATIC SCHEMATIC

### 13.500 Optional Equipment

#### 13.510 Aspen PFD Installation

Refer to R22 Illustrated Parts Catalog Figures 13-47 and 13-49.

##### **A. Description**

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).

##### **B. Schematic**

Refer to Figure 14-42 for C800-1 Aspen PFD electrical schematic.

##### **C. Removal**

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Gently depress blue tab at top of Aspen PFD to release display from mounting bracket.
3. 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 to display, unplug connector, and remove display.

##### **D. Installation**

1. Turn battery switch off and pull-out EFIS circuit breaker (7.5 amp) at panel.
2. Plug airframe wiring harness connector into Aspen PFD display and tighten screws. Verify security.
3. Remove temporary fitting caps and connect pitot and static lines to display using quick-disconnect couplers.
4. Insert display into mounting bracket until blue tab snaps 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 Pilot's Guide. Turn battery and avionics switches off.
7. Perform pitot-static leak check.

13.510 Aspen PFD Installation (continued)**E. Antenna**

Refer to Section 14.700 for antenna locations and R22 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. Cut and discard ty-raps as required and disconnect antenna cable at connectors (secured to frame). 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 and 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 at connectors; secure to frame using ty-raps. Verify security.
6. Perform ground checks per Part D steps 5 and 6.

**F. Scheduled Maintenance and Inspections**

The internal 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](http://www.aspenavionics.com) for instructions for continued airworthiness.

13.510 Aspen PFD Installation (continued)

**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.

13.600 Instrument Markings

See R22 Pilot’s Operating Handbook (POH) Section 2 for instrument markings.

13.700 Troubleshooting

**Vertical Speed Indicator**

No Indication

- Defective indicator.

Erratic Indication

- Water in static system.
- Defective indicator.

Climb indication with no return to zero in level flight.

- Blockage in the static line.

**Airspeed Indicator**

No Indication

- Blockage of pitot tube.
- Disconnected pitot tube.
- Kinks (bends) in pitot line under upper console.
- Defective indicator.

Erratic Indication

- Loose pitot or static line connection.
- Broken pitot line.
- Water in pitot-static system.
- Defective instrument.

**Altimeter**

No Indication

- Blockage in static line.
- Defective instrument.

Erratic Indication

- Water in static line.

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