CHAPTER 95 — INSTRUMENT SYSTEM

CONTENTS — MAINTENANCE PROCEDURES

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MISCELLANEOUS INSTRUMENTS

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FIGURES (CONT)

INSTRUMENT SYSTEM

95-1. INSTRUMENT SYSTEM.

The instrument system is divided into four separate categories: flight, navigation, propulsion, and miscellaneous. All indicators are installed in the hinged instrument panel (figures 95-1 through 95-4) except the pilot standby magnetic compass, hourmeter, and free air temperature indicator. The pilot standby magnetic compass is mounted in a support attached to the right side of the cabin structure, slightly forward of the instrument panel. The hourmeter is mounted in the nose compartment, and free air temperature indicator is mounted in upper left corner of the pilot windshield.

95-2. INSTRUMENTS.

1. The flight instrument system includes the pitot-static system and the following instruments:

a. Airspeed indicator

b. Altimeter

c. Inclinometer.

2. The navigation instrument system consists of the pilot standby magnetic compass.

3. The propulsion instrument system includes the following instruments:

a. Dual tachometer indicator

b. Gas producer tachometer indicator

c. Engine oil temperature/pressure indicator

d. Transmission oil temperature/pressure indicator

e. Engine torquemeter

f. Turbine outlet temperature indicator.

4. The miscellaneous instrument system includes the following instruments:

a. Hourmeter

b. Eight day clock

c. Free air temperature indicator

d. DC loadmeter

e. Fuel quantity indicator

f. Fuel pressure indicator.

5. There have been significant changes to the layout of the control panel throughout the evolution of the 206A/B series as seen in figure 95-1 through 95-4. The changes in the individual instruments are as follows:

a. A B Helicopters S/N 4 through 153 are not equipped with an inclinometer (figure 95-1).

b. B B3 Helicopters S/N 154 and subsequent are equipped with an inclinometer (11, figure 95-2) (4, figure 95-3), (5, figure 95-4).

c. A B Helicopters S/N 4 through 913 are equipped with separate fuel pressure indicators and DC loadmeters (7 and 8, figure 95-1) (15 and 1, figure 95-2).

d. B B3 Helicopters S/N 914 and subsequent are equipped with a dual fuel pressure indicator/DC loadmeter. (11, figure 95-3), (12, figure 95-4).

e. A B Helicopters S/N 4 through 913 are equipped with separate engine oil temperature and engine oil pressure indicators (11 and 12, figure 91-1) (4 and 13, figure 95-2).

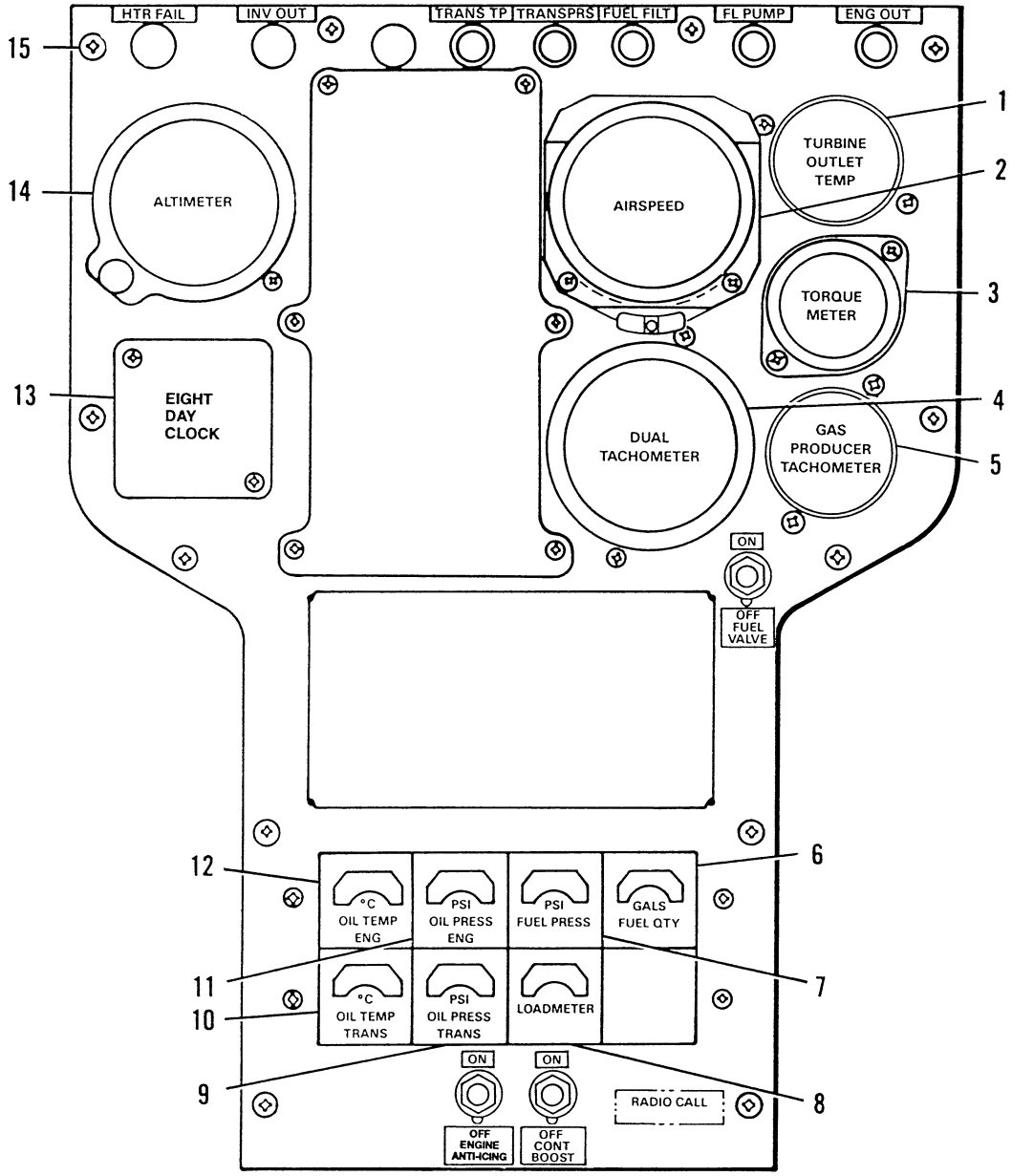
f. B B3 Helicopters S/N 914 and subsequent are equipped with dual engine oil temperature/pressure indicators (1, figure 95-3), (1, figure 95-4).

g. A B Helicopters S/N 4 through 913 are equipped with separate transmission oil temperature and transmission oil pressure indicators (9 and 10, figure 95-1) (3 and 14, figure 95-2).

h. B B3 Helicopters S/N 914 and subsequent are equipped with dual transmission oil temperature/pressure indicators (14, figure 95-3), (16, figure 95-4).

95-3. TROUBLESHOOTING.

Malfunctions pertaining to basic aircraft instruments are typical. Use figure 95-5 through 95-12 to troubleshoot instruments.



1. Turbine outlet temperature
2. Airspeed indicator
3. Torquemeter
4. Dual tachometer
5. Gas producer tachometer
6. Fuel quantity indicator
7. Fuel pressure indicator
8. DC loadmeter
9. Transmission oil pressure indicator
10. Transmission oil temperature indicator
11. Engine oil pressure indicator
12. Engine oil temperature indicator
13. Eight day clock
14. Altimeter
15. Screw

A HELICOPTERS S/N 4 THROUGH 153

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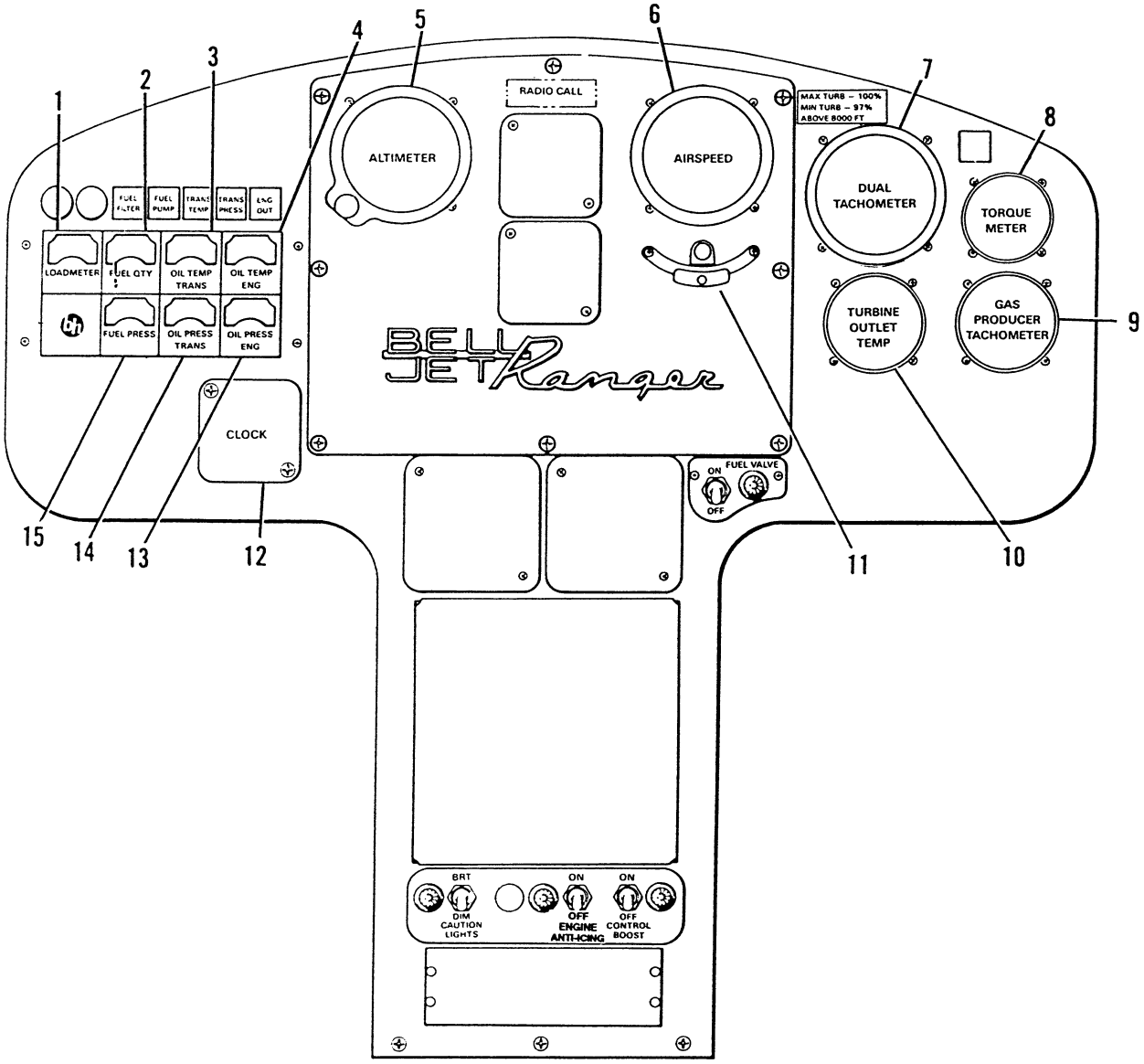
Figure 95-1. Instrument panel



1. DC loadmeter
2. Fuel quantity indicator
3. Transmission oil temperature indicator
4. Engine oil temperature indicator
5. Altimeter
6. Airspeed indicator
7. Dual tachometer
8. Torquemeter
9. Gas producer tachometer
10. Turbine outlet temperature indicator
11. Inclinometer
12. Eight day clock
13. Engine oil pressure indicator
14. Transmission oil pressure indicator
15. Fuel pressure indicator

A B HELICOPTERS S/N 154 THROUGH 913

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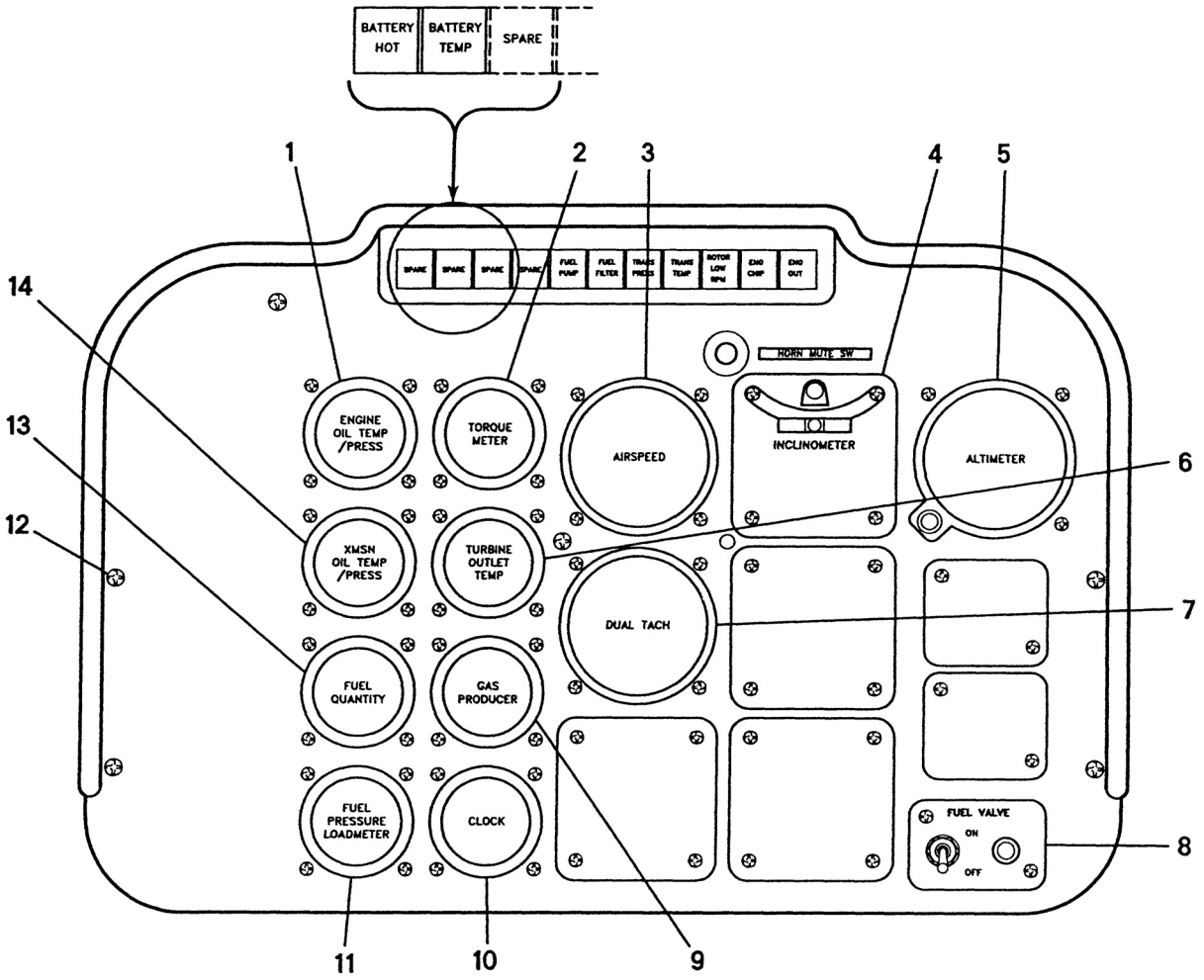
Figure 95-2. Instrument panel

EFFECTIVE HELICOPTERS 1164 THROUGH 1657



1. Engine oil temperature/pressure indicator
2. Torquemeter
3. Airspeed indicator
4. Inclinometer
5. Altimeter
6. Turbine outlet temperature
7. Dual tachometer
8. Fuel valve switch
9. Gas producer tachometer
10. Eight day clock
11. Fuel pressure indicator/DC loadmeter
12. Screw
13. Fuel quantity indicator
14. Transmission oil temperature/pressure indicator

B HELICOPTERS S/N 914 THROUGH 1657

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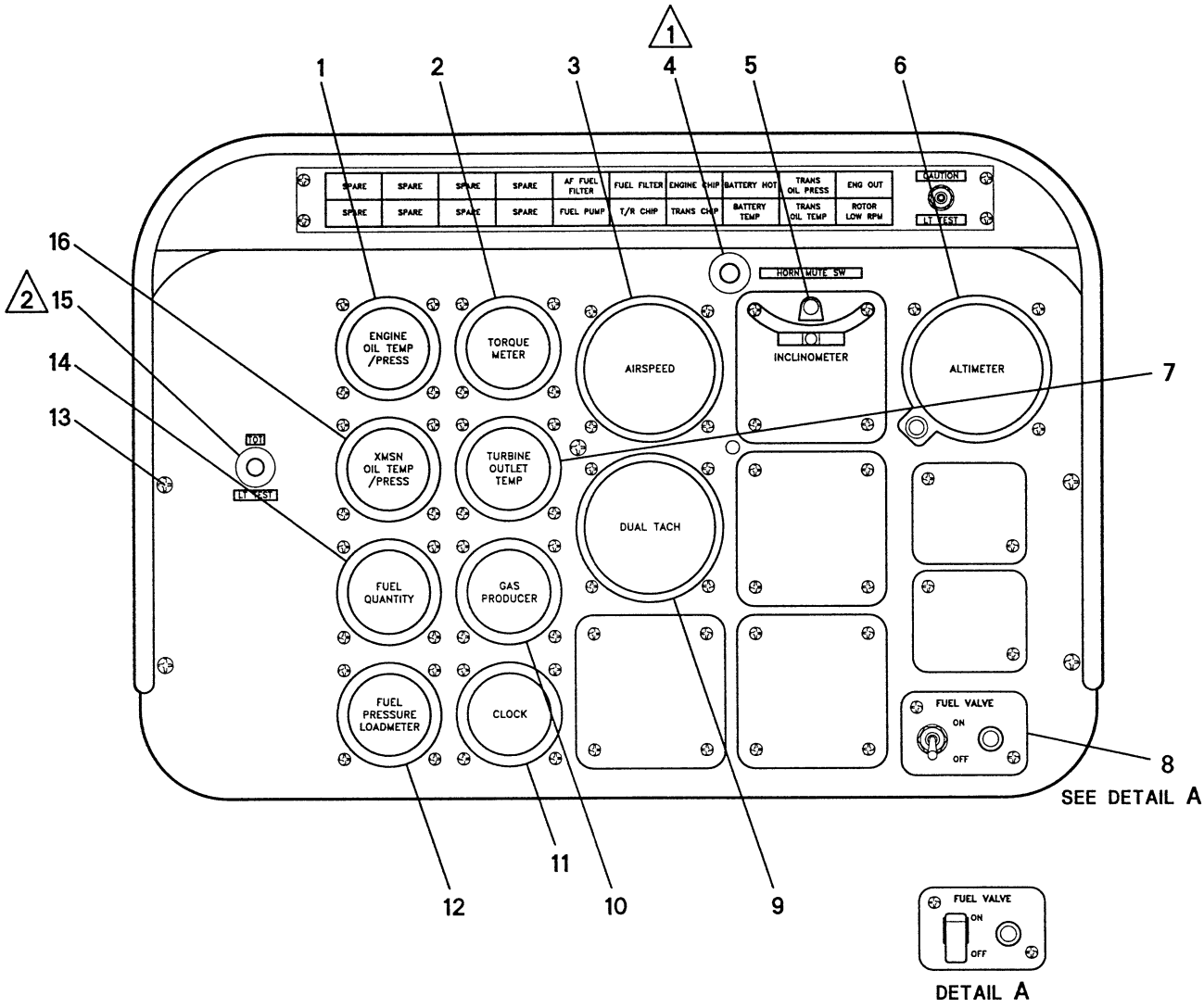
Figure 95-3. Instrument Panel



1 HELICOPTERS S/N 4075 AND SUBSEQUENT

2 HELICOPTERS S/N 3567 THRU 4074

1. Engine oil temperature/pressure indicator
2. Torquemeter
3. Airspeed indicator
4. Horn mute switch
5. Inclinometer
6. Altimeter
7. Turbine outlet temperature indicator
8. Fuel valve switch
9. Dual tachometer
10. Gas producer tachometer
11. Eight day clock
12. Fuel pressure indicator/DC loadmeter
13. Screw
14. Fuel quantity indicator
15. TOT light test
16. Transmission oil temperature/pressure indicator

B B3 HELICOPTERS S/N 1658 AND SUBSEQUENT

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Figure 95-4. Instrument panel

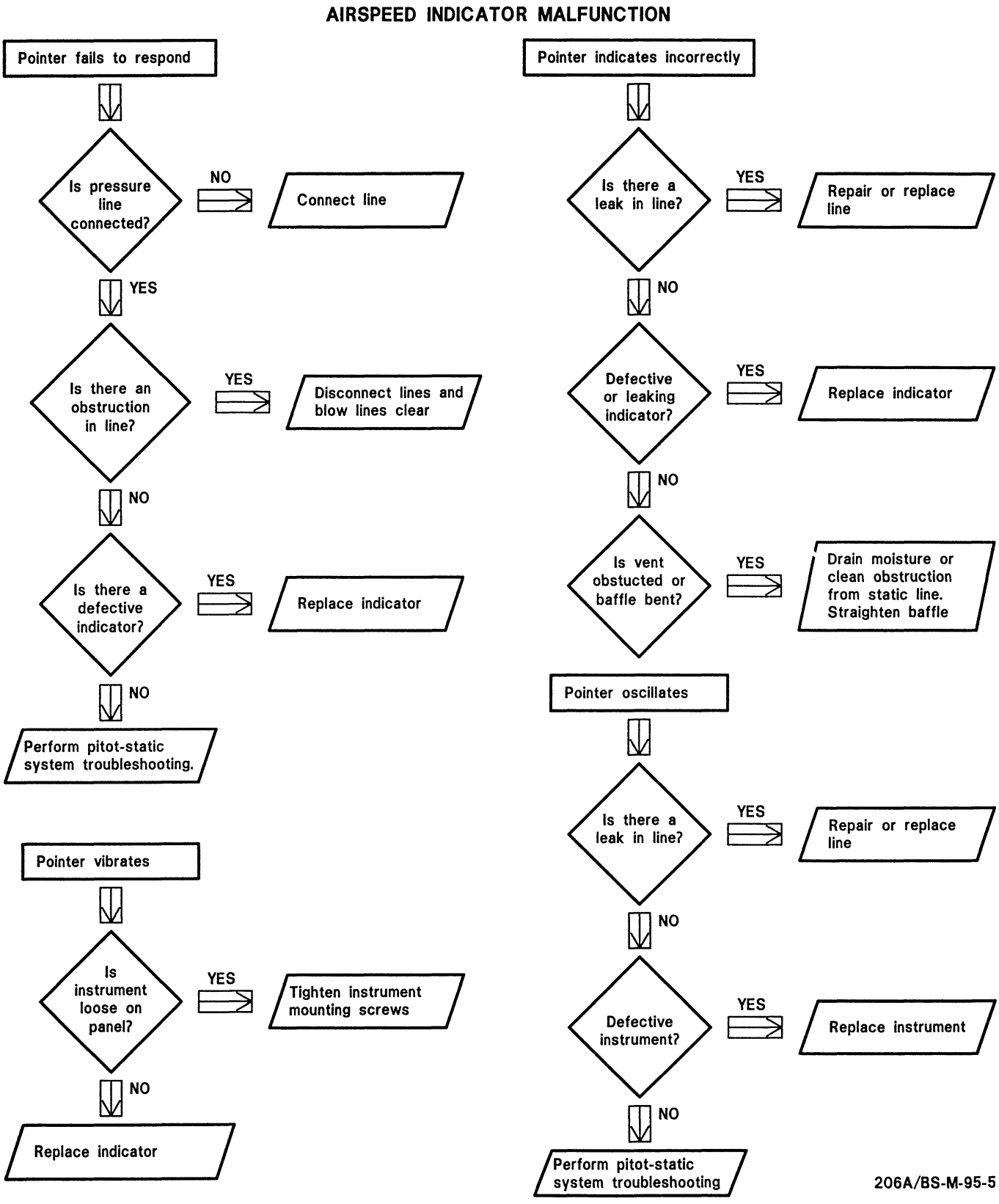

Figure 95-5. Airspeed indicator troubleshooting flow chart

ALTIMETER INDICATOR MALFUNCTION

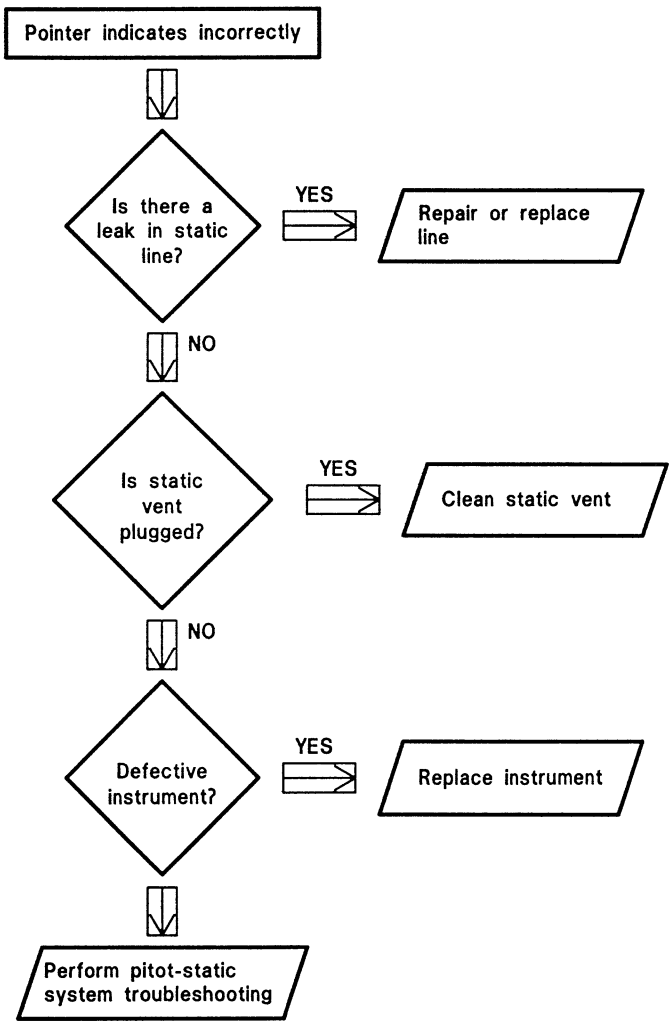

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Figure 95-6. Altimeter indicator troubleshooting flow chart

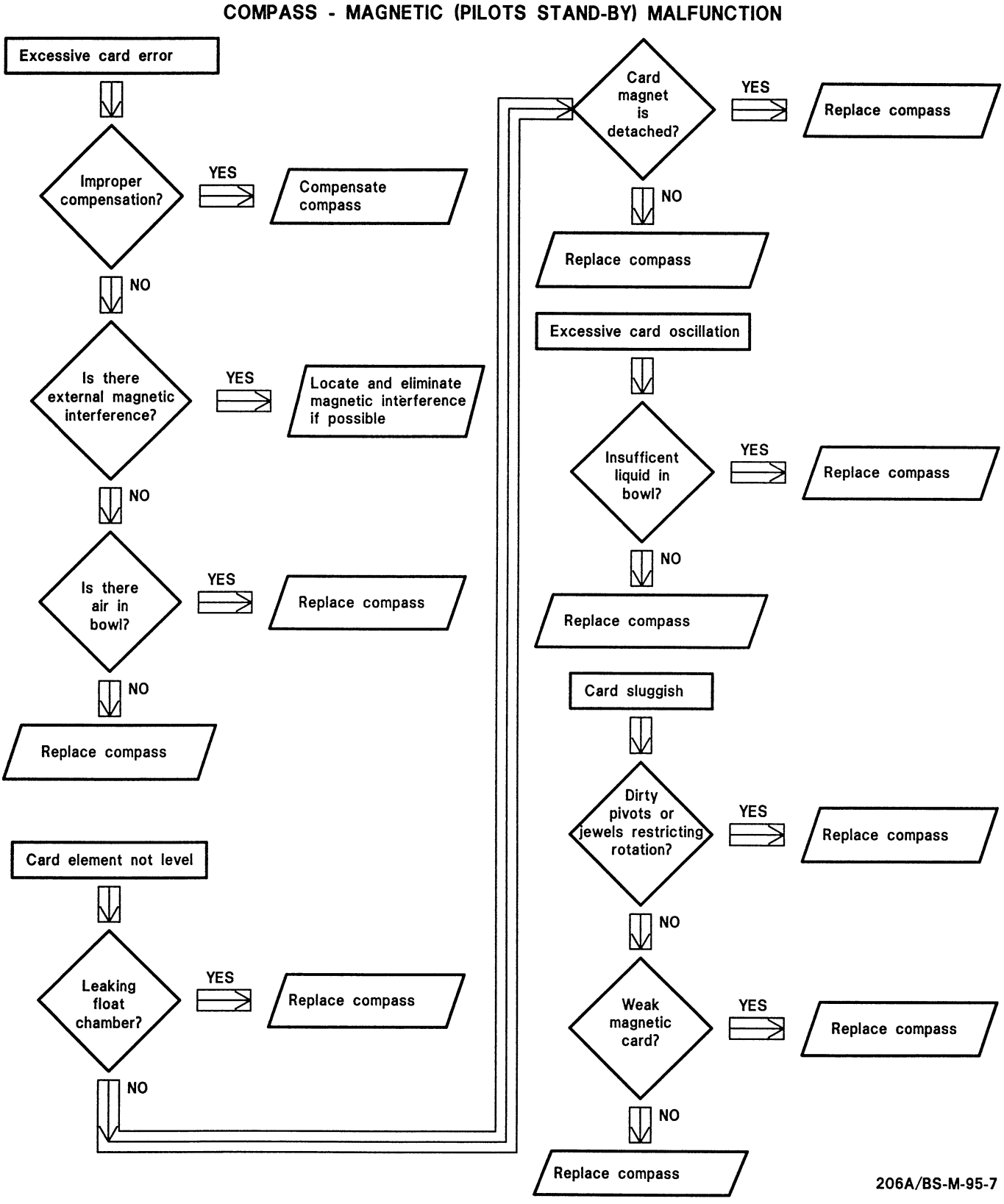
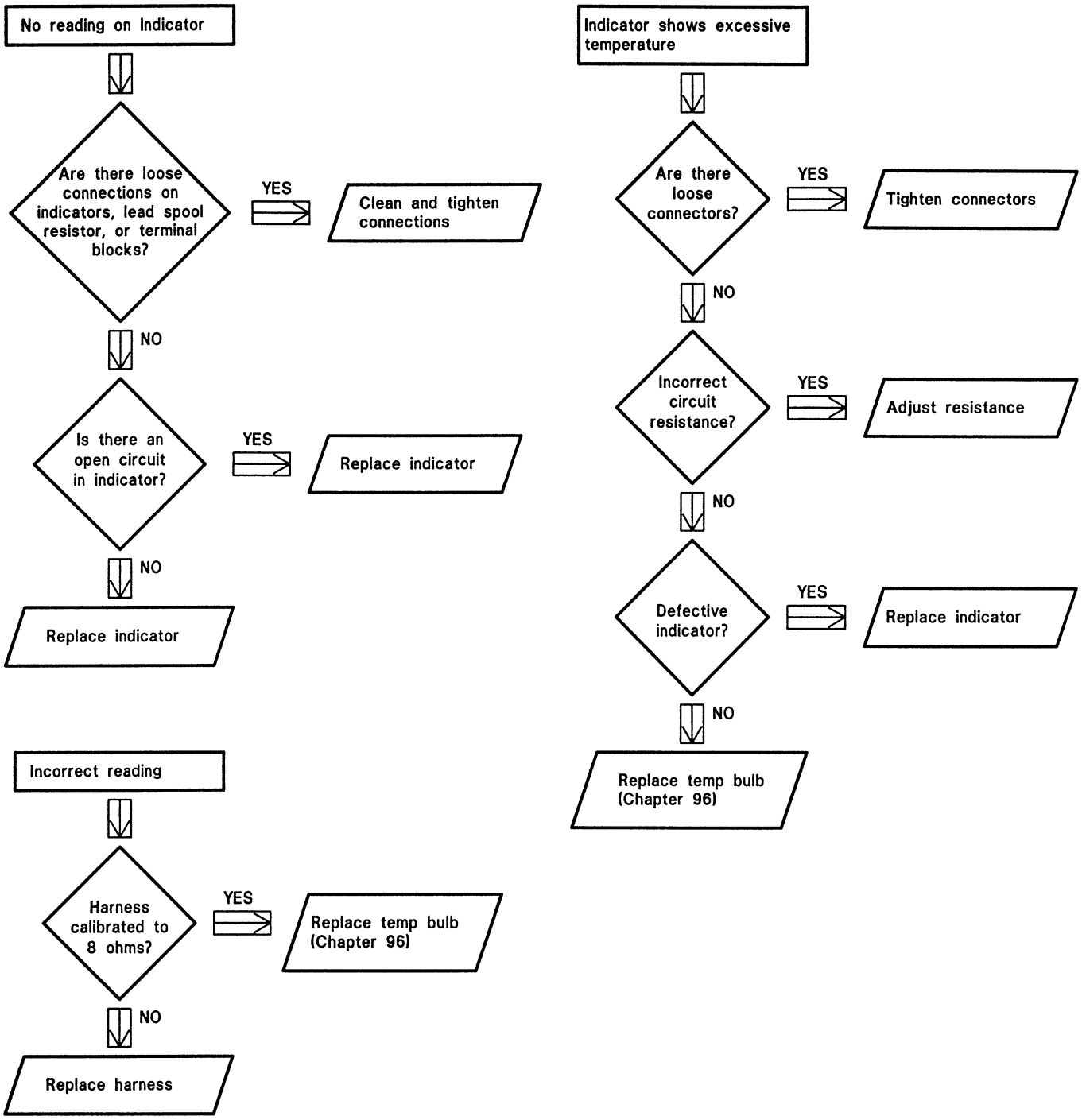


Figure 95-7. Pilot standby compass troubleshooting flow chart

TURBINE OUTLET TEMPERATURE - INDICATOR (HELICOPTERS PRIOR TO 914) MALFUNCTION



HELICOPTERS S/N 4 THROUGH 913

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Figure 95-8. Turbine outlet temperature indicator troubleshooting flow chart

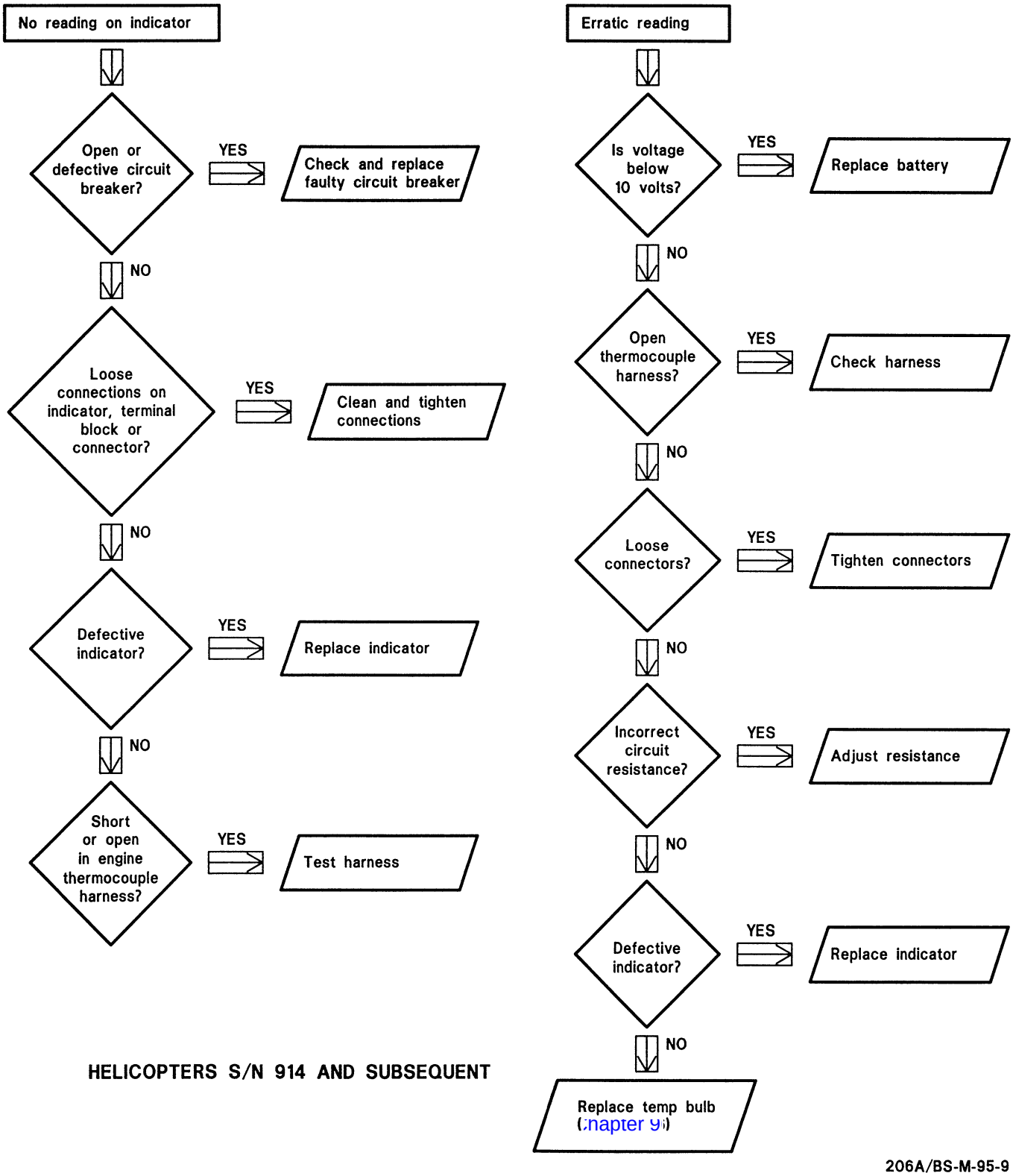

Figure 95-9. Turbine outlet temperature indicator troubleshooting flow chart

DC LOADMETER MALFUNCTION

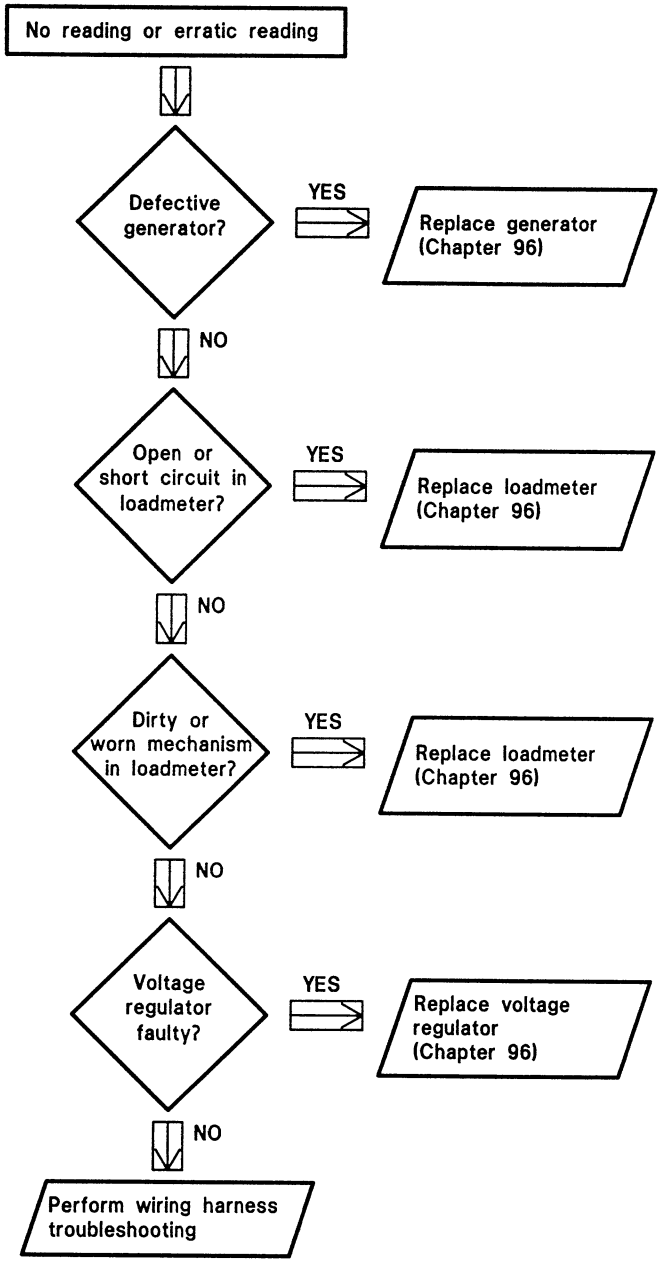

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Figure 95-10. DC loadmeter troubleshooting flow chart

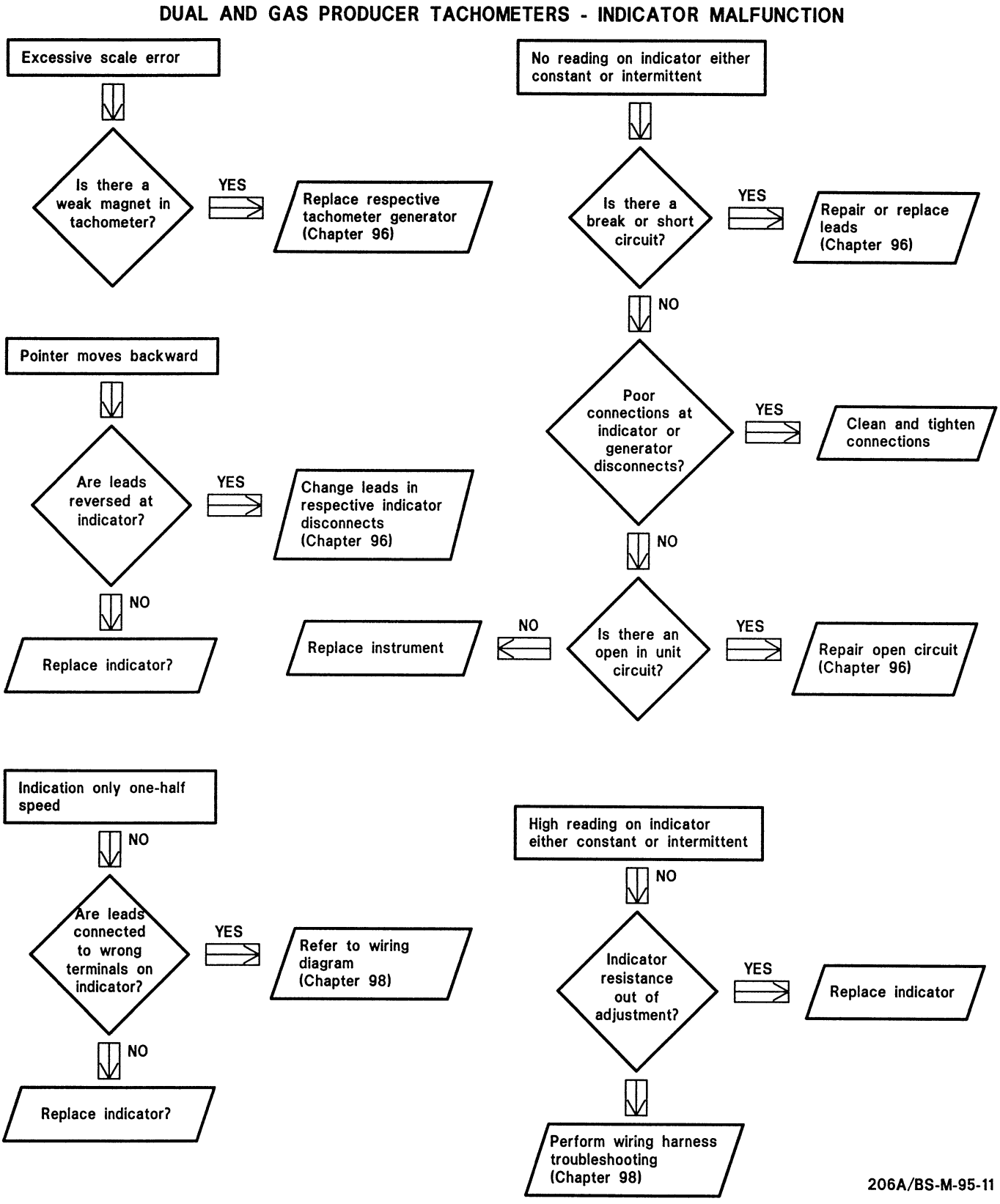
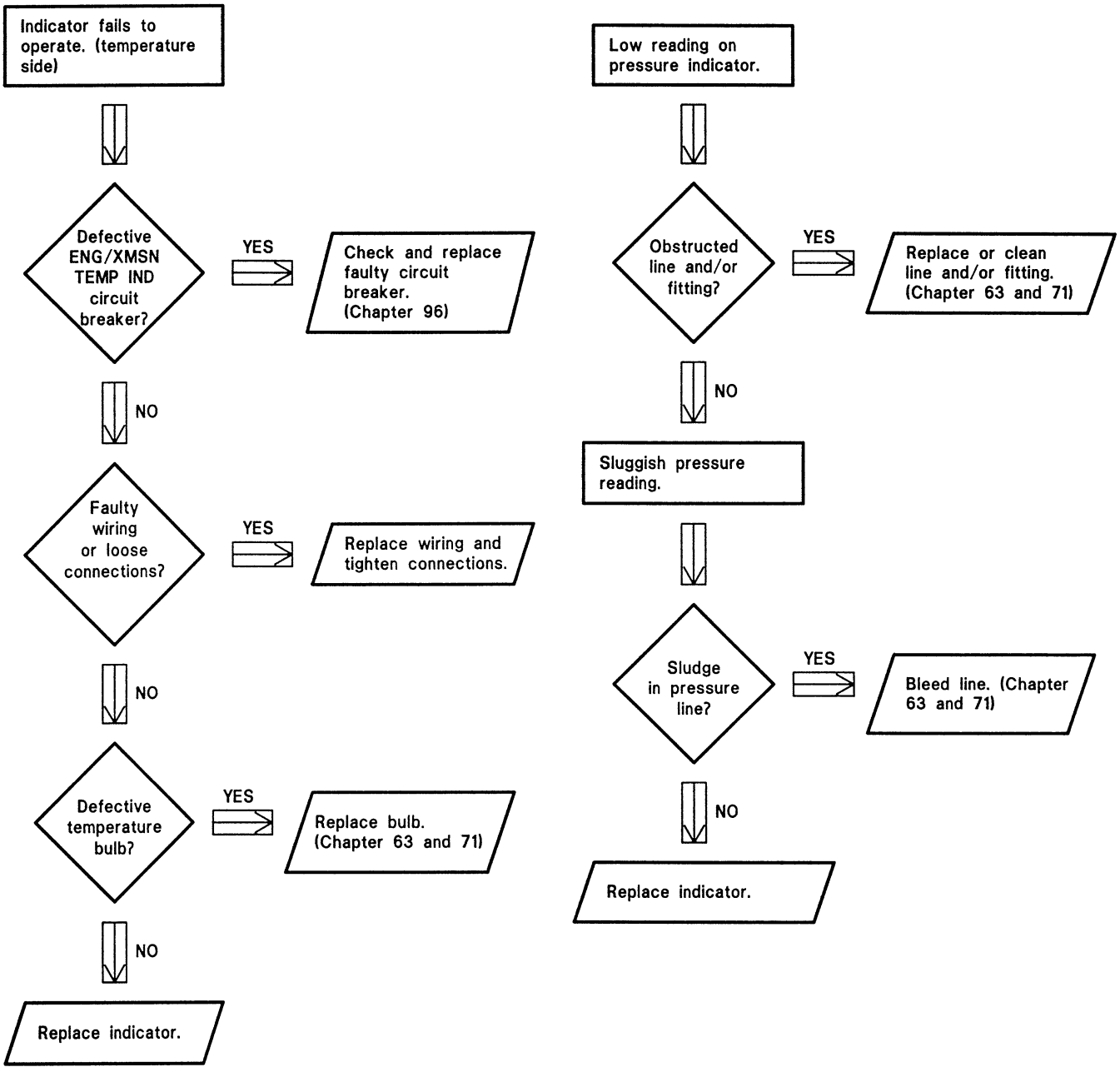


Figure 95-11. Dual and gas producer tachometers troubleshooting flow chart

ENGINE/TRANSMISSION OIL TEMPERATURE/PRESSURE INDICATOR MALFUNCTION



206A/BS-M-95-12

Figure 95-12. Engine/transmission oil temperature and oil pressure indicators troubleshooting flow chart

95-4. MAINTENANCE.

NOTE

Instruments must be tested and repaired at an authorized repair station. Disassembly of an instrument is not recommended.

The removal, cleaning, inspection, and installation procedures for most instruments are basically the same. Therefore a single procedure may be used for most instruments with the exception of the hourmeter, free air temperature indicator, and the pilot standby magnetic compass.

95-5. REMOVAL.

1. Ensure battery switch is in OFF position.

2. A B On helicopters S/N 4 through 913, remove screws (15, figure 95-1) around edge of instrument panel.

3. B On helicopters S/N 914 through 1657, remove screw (12, figure 95-3) attaching console shroud to instrument panel.

4. B B3 On helicopters S/N 1658 and subsequent, remove mounting screws (13, figure 95-4) attaching instrument panel to console.

5. Tilt instrument panel aft.

6. Disconnect electrical connectors and/or tubes from the back of the instrument. Place protective tape or caps on connectors piping and instrument openings.

7. Remove screws attaching instruments to instrument panel.

8. Remove instrument from helicopter.

95-6. INSPECTION.

Inspect instruments for the following:

1. Loose or cracked glass.

2. Legibility of range markings (figure 95-15).

3. Security in instrument panel.

95-7. REPLACEMENT.

1. Replace instrument if glass is loose, broken, or missing.

2. Replace illegible range markings (Chapter 11).

NOTE

For proper instrument ranges refer to applicable JetRanger Flight Manual.

95-8. INSTALLATION.

1. Ensure that battery switch is OFF.

2. Position instrument in panel and secure with mounting screws.

3. Remove protective tape or caps and connect electrical connectors and/or tubes to instruments.

4. Tilt instrument panel forward.

5. A B On helicopters S/N 4 through 913, install mounting screws (15, figure 95-1) attaching instrument panel to console.

6. B On helicopters S/N 914 through 1657, install screws (12, figure 95-3) attaching console shroud to instrument panel.

7. B B3 On helicopters S/N 1658 and subsequent, install screws (13, figure 95-4) around edge of instrument panel.

FLIGHT INSTRUMENTS

95-9. FLIGHT INSTRUMENTS.

The flight instrument system consists of the pitot-static system, airspeed indicator, altimeter, and inclinometer.

95-10. PITOT-STATIC SYSTEM.

The pitot tube (1, figure 95-13) is mounted on a support (2), located on the most forward part of the cabin nose structure just right of the helicopter centerline. This tube supplies impact air to the airspeed indicator. Static air pressure for instrument operation is obtained from two static vents which are located immediately forward of the crew doors and just below the windshields.

95-11. REMOVAL.

1. Ensure electrical power is OFF.

2. Disconnect pitot tube (1, figure 95-13) from support assembly (2).

3. Disconnect support assembly (2). Cap exposed opening of static line (5) to prevent entrance of foreign particles.

4. Disconnect all associated electrical wiring and cover wire ends with tape (Chapter 96). Remove pitot tube from helicopter.

5. Disconnect static line (5) from tee assembly (4), and union assembly (7).

6. Disconnect static line (5) from union at static vent (3).

7. Disconnect static vent from baffle assembly (6). Remove vent and baffle from helicopter.

95-12. CLEANING AND INSPECTION.

1. Clean pitot tube (1, figure 95-13) with lint free cloth and an approved cleaning solvent.

2. Drain moisture from static line (5) and associated hardware.

3. Inspect all lines and fittings for tightness.

4. Visually check lines for chafing, security, and damage.

5. Inspect pitot tube and static vents (3) for obstruction and damage.

95-13. INSTALLATION.

1. Install and connect static vent (3, figure 95-13) and baffle assembly (6).

2. Connect static line (5) to union at static vent.

3. Connect static line to tee assembly (4) and union assembly (7).

4. Remove tape from associated wiring. Install pitot tube (1) and electrical wiring. (Chapter 96).

5. Remove cap from static line. Connect static line to support (2).

6. Connect pitot tube and support.

95-14. TESTING.

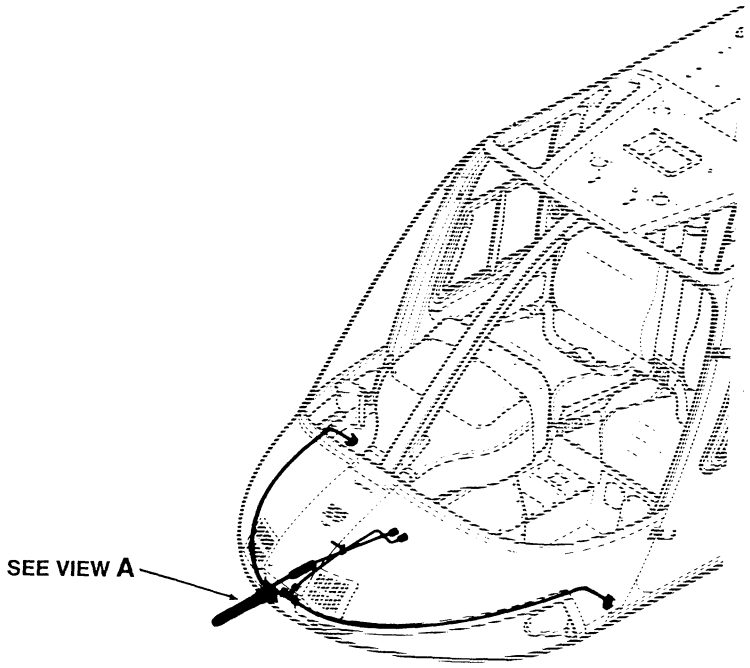
CAUTION

APPLYING SUCTION TO PITOT TUBE MAY DAMAGE INSTRUMENT.

1. With system completely installed, apply carefully regulated air pressure to pitot tube. Use a piece of flexible tubing which will fit tightly over the end of the pitot tube. While observing the airspeed indicator, have an assistant fold the free end of the tubing over and roll tubing slowly to create pressure. When desired reading has been reached, (50 to 100 mph) (81 to 62 kph), hold rolled end tightly for one minute to hold pressure constant.

2. Tap the instrument panel lightly, near the airspeed indicator to overcome friction that might affect the pointer; watch for a drop in the reading which would indicate leakage. If reading drops more than 5 mph (8 kph) in 1 minute and no blockage is present in static line perform troubleshooting procedures on airspeed indicator.

1. Pitot tube
2. Support
3. Static vent
4. Tee assembly
5. Static line
6. Baffle assembly
7. Union assembly



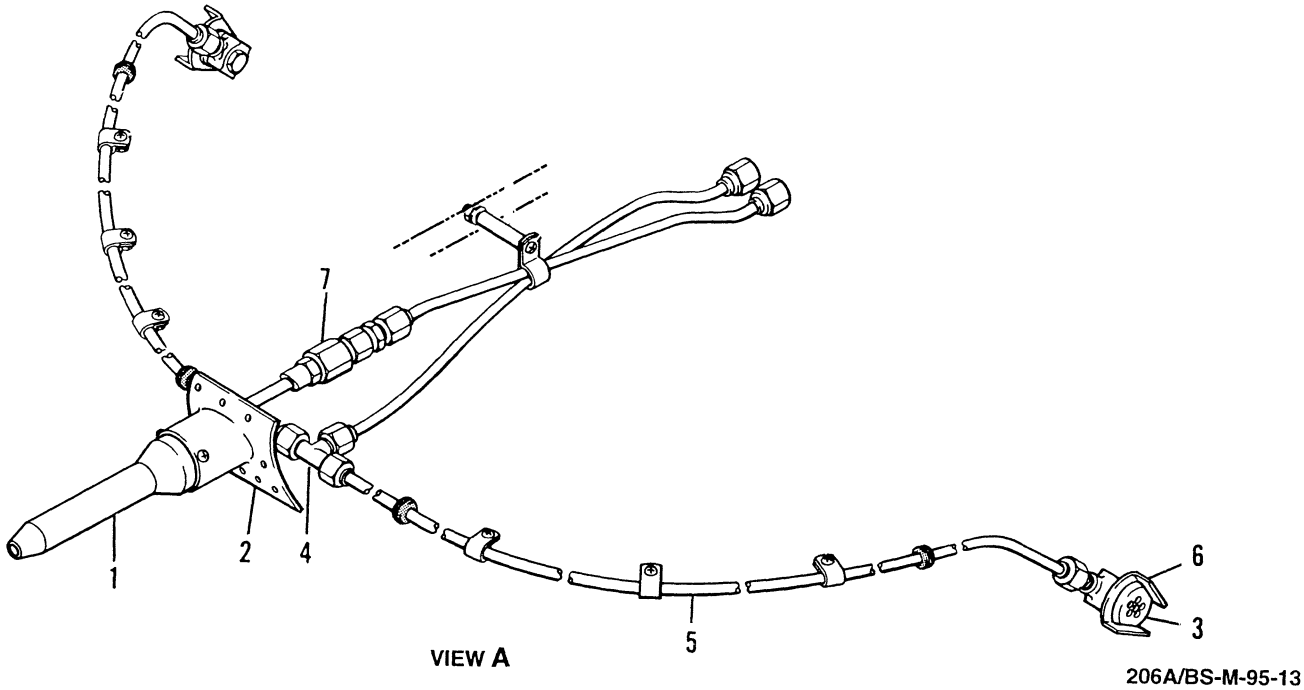


Figure 95-13. Pitot-static system

95-15. AIRSPEED INDICATOR

The airspeed indicator (2, Figure 95-1, 6, Figure 95-2, 3, Figure 95-3 and 3, Figure 95-4) is a standard pitot-static instrument. This single scale indicator provides an airspeed reading in miles per hour, and knots by measuring the difference between impact air pressure from the pitot tube and the static air pressure from the static vents.

NOTE

Maintenance on the pitot-static system (paragraph 95-10 through paragraph 95-14) is the only recommended maintenance for the airspeed indicator. If the indicator itself is suspected of malfunction it must be replaced.

95-16. ALTIMETER

The altimeter (14, Figure 95-1, 5, Figure 95-2, 5, Figure 95-3, and 6, Figure 95-4) provides a direct reading of helicopter height in feet above sea level. This indicator is connected to the static air system to sense atmospheric pressure. An external knob is provided to make compensation for variations of prevailing barometric pressure.

95-17. ADJUSTMENT

Limited adjustments may be accomplished without removal from the helicopter. This adjustment is applicable to instruments manufactured by United Instruments, P/N 5932 and 5934. Altimeter adjustments will be accomplished as follows:

1. Rotate the altimeter pointer set knob to obtain desired information, tapping the instrument lightly to remove any possible friction error.

2. Loosen knob lockscrew, and hold screw or lockbar away from the knob without turning.

3. Rotate knob to set the desired barometric indication at the index mark.

4. Push knob inward, to original position, and secure lockbar by tightening lockscrew until snug.

5. Apply light outward pressure to knob and rotate to ensure altitude pointer and barometric indicator are properly locked.

95-18. INCLINOMETER

The inclinometer (11, Figure 95-2, 4, Figure 95-3 and 5, Figure 95-4) is a simple instrument consisting of a covered glass tube, ball, and damping fluid. The ball indicates when the helicopter is in directional balance, either in a turn or straight and level flight. If the helicopter is yawing or slipping, the ball will move off of center.

NAVIGATION INSTRUMENT

95-19. NAVIGATION INSTRUMENT.

The sole navigation instrument installed is the pilot standby magnetic compass (figure 95-14).

95-20. PILOT STANDBY MAGNETIC COMPASS.

The pilot standby magnetic compass (1, figure 95-14) is a standard, nonstabilized, magnetic type instrument mounted on a support which is attached to the forward cabin right side. The compass is used in conjunction with a compass correction card located below the compass.

95-21. CALIBRATION.

1. Check compass for excessive card oscillation, card element not level, and sluggish card before positioning helicopter on compass rose.

2. Position helicopter on compass rose. Observe the following precautions prior to start of compass compensation test procedures.

a. Ensure that all magnetic material and equipment in helicopter is secured in normal flight position.

b. Ensure controls and levers are in normal flight position.

c. Ensure personnel near or in helicopter have no magnetic material on their persons or in their possession.

d. Ensure all magnetic objects, such as trucks, automobiles, or other aircraft, are removed from compass rose area to where there will be no magnetic effect on compass.

3. Secure helicopter right skid to compass rose holding fixture. Use helicopter ground handling wheels or equivalent to support helicopter when rotating to different headings.

4. Start helicopter engine. Refer to applicable JetRanger Flight Manual.

5. Turn power on to all equipment, except the landing lights. Allow approximately three minutes for equipment functions to stabilize.

NOTE

Use a non-ferrous screwdriver, preferably brass, for compass adjustments.

6. Set E-W and N-S adjustment screws on compass to zero position. Zero position is when dot of screw is aligned with dot of frame.

NOTE

Make every effort to place helicopter in simulated flight condition while swinging compass.

7. Swing helicopter to magnetic north heading. Adjust N-S adjustment screw until compass indicates exactly north.

8. Swing helicopter to magnetic east heading. Adjust E-W adjustment screw until compass indicates exactly east.

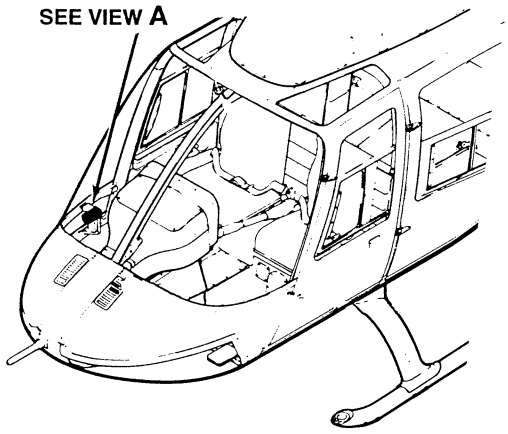
9. Swing helicopter to magnetic south heading and note resulting error. Adjust N-S adjustment screw to remove one-half of error.

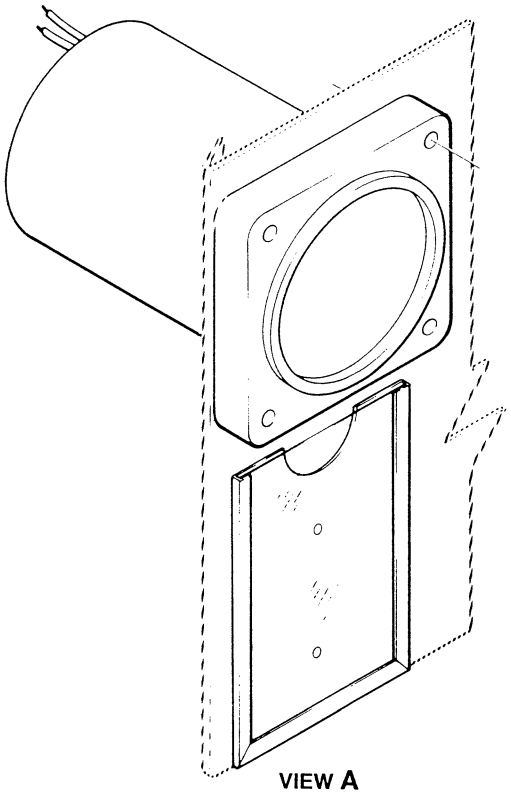
10 Swing helicopter to magnetic west heading and note resulting error. Adjust E-W adjustment screw to remove one-half of error.

NOTE

Maximum deviation on cardinal headings shall not exceed 2 degrees. Maximum deviation on all other headings shall not exceed 10 degrees.

11. Swing helicopter in successive magnetic 30 degree headings and record all errors on the compass correction card.





206A/BS-M-95-14

Figure 95-14. Pilot standby magnetic compass

PROPULSION INSTRUMENTS

95-22. PROPULSION INSTRUMENTS.

The propulsion instruments consist of the dual tachometer, gas producer tachometer, engine oil temperature, engine oil pressure, transmission oil temperature, transmission oil pressure, engine torquemeter, and turbine outlet temperature indicators.

NOTE

For instrument removal, inspection, and installation procedures, refer to paragraphs 95-5 through 95-8.

95-23. DUAL TACHOMETER.

The dual tachometer (figure 95-15), indicating in percent, furnishes both rotor rpm and power turbine rpm information. This instrument is powered by the rotor tachometer and power turbine tachometer generators. The generators are self-generating and are not connected to the electrical system. Normal operation of the helicopter is when rotor rpm and power turbine rpm needles are synchronized and in the green arc. Refer to figure 95-15 and Chapter 11 for instrument placards and markings.

95-24. OPERATIONAL CHECK.

SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
H337	Howell Engine Test Set or Alternate

NOTE

Refer to Chapter 96 for pin and plug locations for instruments.

1. Disconnect plug (P6) from rotor tachometer generator and connect to matching receptacle on test set or equivalent. Energize tachometer generator in test set. Verify rotor rpm pointer on the tachometer indicates upscale at approximate speed of tachometer generator on test set.

2. Disconnect plug (P6) from test set and connect to rotor tachometer generator on engine. Ensure connector is properly mated and is tight and secure.

3. Disconnect plug (P7) from turbine tachometer generator and connect to matching receptacle on test set. Energize tachometer generator on test set. Verify turbine rpm pointer on tachometer reads upscale at approximate rpm at which tachometer generator is turning.

4. Disconnect plug (P7) from test set and connect to matching receptacle on turbine tachometer generator on engine. Ensure connector is properly mated and is tight and secure.

5. Prior to installing tachometer generator to engine, apply a light coat of antiseize compound (C-452) to shaft spline.

95-25. GAS PRODUCER TACHOMETER.

The gas producer tachometer (figure 95-15), indicating in percent, furnishes gas producer rpm information. This instrument is powered by the gas producer tachometer generator. This generator is a self generating component. Refer to figure 95-15 and Chapter 11 for instrument placards and markings.

95-26. OPERATIONAL CHECK.

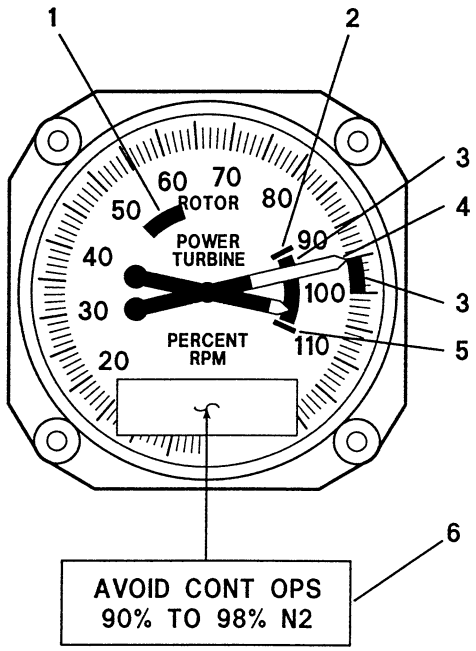
SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
H337 or Equivalent	Howell Engine Test Set

1. Disconnect plug (P10) from gas producer tachometer generator and connect to matching receptacle on test set. Verify gas producer tachometer indicates approximate rpm at which tachometer generator is turning.

2. Disconnect plug (P10) from test set and connect to gas producer tachometer generator on engine (Chapter 71). Ensure connector is properly mated and is tight and secure.

3. Prior to installing tachometer generator to engine, apply a light coat of antiseize compound (C-452) to shaft spline.



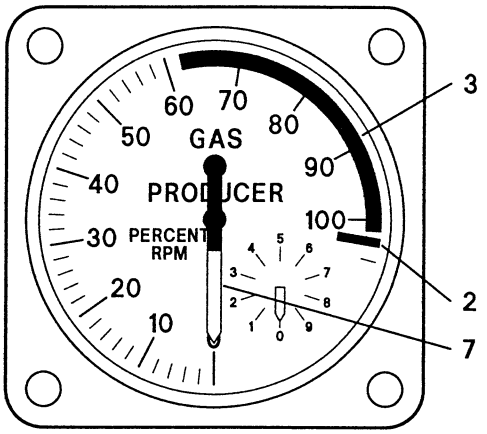
DUAL TACHOMETER

POWER TURBINE INDICATOR

R	98% Minimum operation
G	98% to 100% Continuous operation
R	100% Maximum

ROTOR INDICATOR

R	90.0% Minimum operation
G	90.0 to 107.0% Normal operation
R	107.0% Maximum
Y	50.0 to 60.0% Accelerate through this range



GAS PRODUCER

G	60.0 to 104.0% Continuous operation
R	104.0% Maximum

GAS PRODUCER

G	60.0 to 105.0% Normal Operation
R	105.0% Maximum

1. Yellow arc
2. Red line
3. Green arc
4. Power turbine pointer
5. Rotor pointer
6. Limits placard
7. Gas producer pointer

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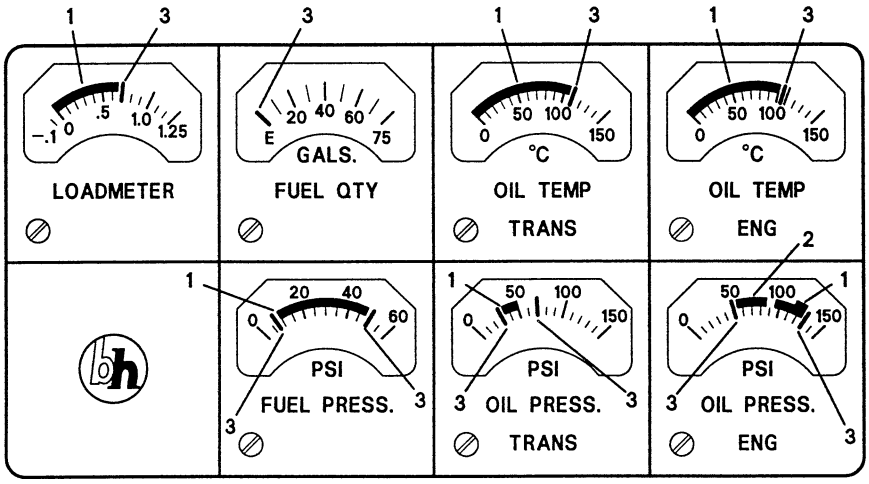
Figure 95-15. Propulsion instruments (Sheet 1 of 5)



1. Green
2. Yellow
3. Red
4. Torque pointer

LOADMETER

R	0.7 Maximum
G	0.0 to 0.7 Normal

TRANSMISSION OIL TEMPERATURE

G	15 to 110°C Continuous operation
R	110°C Maximum

FUEL PRESSURE

R	8.0 Minimum
G	8.0 50.0 Psi Continuous operation
R	50.0 Psi Maximum

Optional per Technical Bulletin No. 206-08-74-1

FUEL PRESSURE

R	4.0 Psi Minimum
G	4.0 to 50.0 Psi Continuous operation
R	50.0 Psi Maximum

ENGINE OIL PRESSURE

R	50 Psi Minimum
Y	50 to 90 Psi Below 78.5% N_1
G	90 to 115 Psi from 78.5 to 94.2 % N_1
G	115 to 130 Psi above 94.2% N_1
R	130 Psi Maximum

FUEL QUANTITY

R	On empty

ENGINE OIL TEMPERATURE

G	0 C to 107°C Continuous operation
R	107°C Maximum

TRANSMISSION OIL PRESSURE
ALL S/N HELICOPTERS

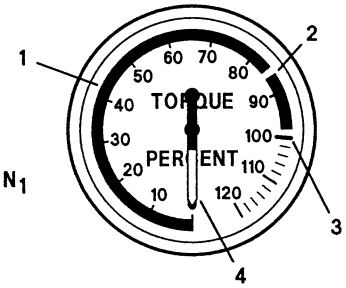
R	30 Psi Minimum
G	30 to 50 Psi Continuous operation
R	70 Psi Maximum

TRANSMISSION OIL PRESSURE
OPTIONAL S/N THRU 153

R	30 Psi Minimum
G	50 to 60 Psi Continuous operation
Y	60 to 80 Psi
R	80 Psi Maximum

TORQUEMETER

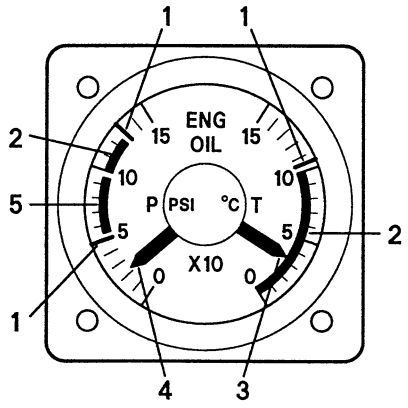
G	0 to 85.0% Continuous power
Y	85% to 100%
R	100% Maximum



206ABS-M-95-15-2

HELICOPTERS S/N 913 AND PRIOR

Figure 95-15. Propulsion instruments (Sheet 2)



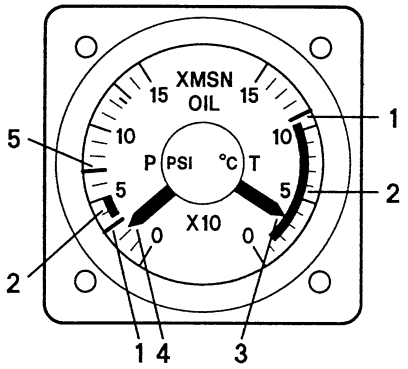
ENGINE OIL TEMPERATURE

G	0 to 107°C Continuous operation
R	107°C Maximum

ENGINE OIL PRESSURE

Y	50 to 90 PSI below 78.5% N_1
G	90 to 115 PSI from 78.5 to 94.2% N_1
G	115 to 130 PSI above 94.2% N_1
R	50 PSI Minimum, 130 PSI Maximum

ENGINE OIL TEMPERATURE/PRESSURE INDICATOR
HELICOPTERS S/N 914 AND SUBSEQUENT



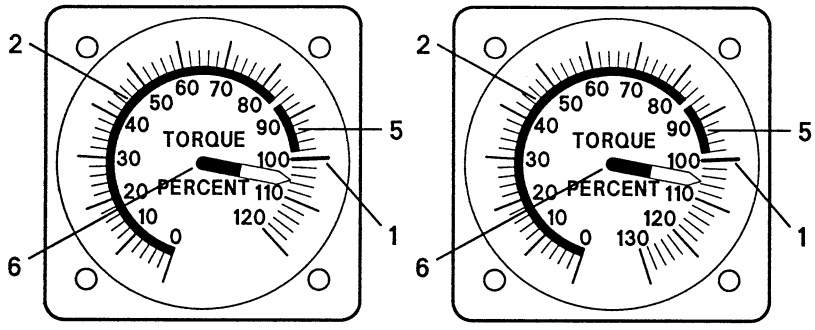
TRANSMISSION OIL PRESSURE

G	30 to 50 PSI Continuous operation
R	30 PSI Minimum, 70 PSI Maximum

TRANSMISSION OIL TEMPERATURE

G	15 to 110°C Continuous operation
R	110°C Maximum

TRANSMISSION OIL TEMPERATURE INDICATOR



A B B3

B3

TORQUEMETER

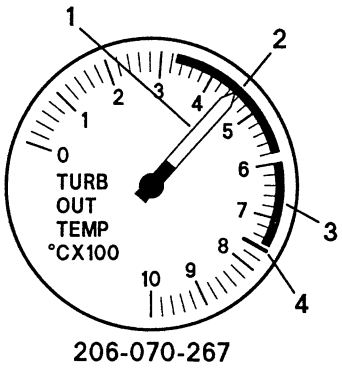
G	0 to 85.0% Continuous operation
Y	85.0 to 100.0% Takeoff power range
R	100.0% Maximum (5 Minute Limit)

TORQUEMETER INDICATOR

1. Red mark
2. Green arc
3. Pointer (temperature)
4. Pointer (pressure)
5. Yellow arc
6. Pointer (torque)

206ABS-M-95-15-3

Figure 95-15. Propulsion instruments (Sheet 3)



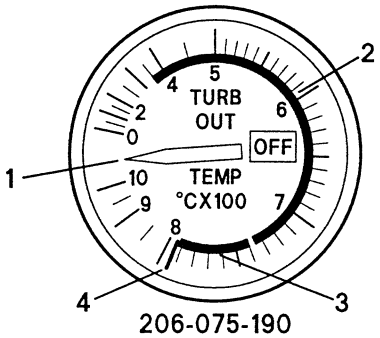
206-070-267

A TURBINE OUTLET TEMPERATURE INDICATOR

G	330 to 693°C Continuous power range
Y	693 to 749°C Takeoff power range
R	749°C Maximum

(Do not exceed 10 seconds above 749°C or 1 second at 927°C)

HELICOPTERS S/N 914 AND PRIOR

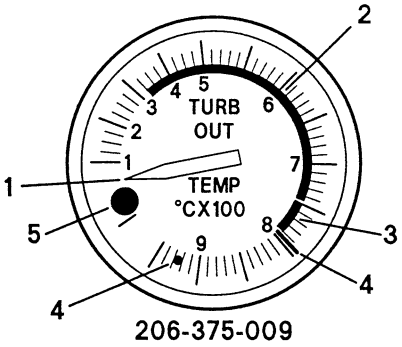


206-075-190

B TURBINE OUTLET TEMPERATURE INDICATOR

G	330 to 737°C Continuous operation
Y	737 to 793°C Takeoff power range
R	793°C Maximum (5 minute limit)

HELICOPTERS S/N 914 AND PRIOR
(Prior to T.B. 206-82-61)



206-375-009

B TURBINE OUTLET TEMPERATURE INDICATOR

G	330 to 737°C Continuous power range
Y	737 to 793°C Takeoff power range
R	793°C Maximum (5 minute limit)
(R)	927°C Maximum for starting (Not to exceed 1 second)
(R)	Red warning light TOT 793 to 927°C for 10 seconds or TOT above 927°C

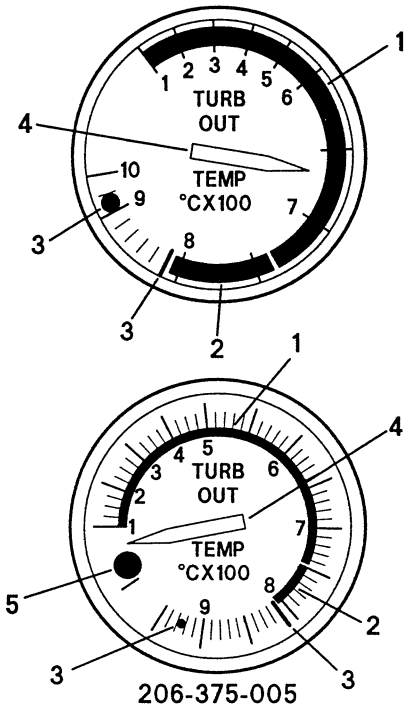
NOTE
Range mark just below warning light is 999°C.

HELICOPTERS S/N 914 THRU 3366
(Post T.B. 206-82-61)

1. Pointer
2. Green arc
3. Yellow arc
4. Red
5. Warning light

206ABS-M-95-15-4

Figure 95-15. Propulsion instruments (Sheet 4)



TURBINE OUTLET TEMPERATURE

G	100 to 738°C Continuous operation
Y	738 to 810°C Takeoff power range
R	810°C Maximum (5 minute limit)
(R)	927°C Maximum during starting and shutdown (10 seconds maximum)

TURBINE OUTLET TEMPERATURE

G	100 to 738°C Continuous power range
Y	738 to 810°C Takeoff power range
R	810°C Maximum (5 minute limit)
(R)	927°C Maximum during starting and shutdown (10 seconds maximum)
R	Red warning light The light illuminates when either of the following conditions are exceeded: 812 to 927°C for 10 seconds 927°C or higher for 1.0 seconds

NOTE

Any one of the two turbine outlet temperature gages may be installed in the helicopter

HELICOPTERS S/N 3367 AND SUBSEQUENT

1. Green arc
2. Yellow arc
3. Red
4. Pointer
5. Warning light

206ABS-M-95-15-5

Figure 95-15. Propulsion instruments (Sheet 5)

95-27. A B ENGINE OIL TEMPERATURE INDICATOR (HELICOPTERS S/N 4 THRU 913).

The engine oil temperature indicator (figure 95-15) indicates the engine oil temperature in degrees Celsius. This instrument is included in a bridge circuit with a resistor element and temperature bulb located in the engine oil tank. The indicator and bulb are matched electrically in the bridge circuit and require no calibration. Refer to figure 95-15 and Chapter 11 for instrument placards and markings.

95-28. OPERATIONAL CHECK.

1. Close ENG/XMSN TEMP IND circuit breaker.

2. Check that indicator reads approximate ambient temperature.

95-29. A B ENGINE OIL PRESSURE INDICATOR (HELICOPTERS S/N 4 THRU 913).

NOTE

Helicopters S/N 254 through 913 are equipped with electrically operated engine oil pressure indicators with a transducer mounted in the piping circuit adjacent to the oil pressure switch.

On helicopters S/N 4 through 913, the engine oil pressure indicator (11, figure 95-1 and 13, figure 95-2) provides indications of engine oil pressure in pounds per square inch (psi). The indicator reading is supplied by the transducer in the piping circuit. Refer to figure 95-15 and Chapter 11 for instrument placards and markings.

NOTE

For maintenance on the engine oil pressure indicator refer to paragraphs 95-4 through 95-8.

CAUTION

ANY TIME THE ENGINE OIL PRESSURE OR TRANSMISSION OIL PRESSURE INDICATORS ARE REMOVED, OR DISCONNECTED FROM PRESSURE GAGE LINE, PRESSURE GAGE LINE BLEEDING PROCEDURE IS REQUIRED. REFER TO CHAPTER 71 FOR ENGINE OIL PRESSURE GAGE LINE BLEEDING PROCEDURE. REFER TO CHAPTER 63 FOR TRANSMISSION OIL PRESSURE GAGE LINE BLEEDING PROCEDURE.

95-30. OPERATIONAL CHECK.

SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
Barfield Model 2311F or Equivalent	Pressure Tester 0 – 150 psi (0 – 1034 kPa)

1. Disconnect engine oil pressure line at engine compartment firewall, and block source line connected to engine.

2. Connect 2311F pressure tester or equivalent piping connected to indicator.

3. Slowly increase source pressure from 0 psig to 100 psig (0 kPa to 689 kPa).

4. Engine oil pressure indications shall track through full range of externally applied pressure, ± 10 psig (68.95 kPa) at high end.

5. Return pressure to zero, disconnect 2311F pressure tester, and reconnect engine oil pressure piping.

95-31. A B TRANSMISSION OIL TEMPERATURE INDICATOR (HELICOPTERS S/N 4 THRU 913 AND PRIOR).

The transmission oil temperature indicator (12, figure 95-1 and 3, figure 95-2) provides transmission oil temperature reading in degrees Celsius. The indicator is used in the 28 vdc bridge circuit with a temperature bulb which is located in the left side of the transmission. Refer to figure 96-15 and Chapter 11 for instrument placards and markings.

95-32. OPERATIONAL CHECK.

1. Close ENG/XMSN TEMP IND circuit breaker.

2. Check that indicator reads approximate ambient temperature.

95-33. A B TRANSMISSION OIL PRESSURE INDICATOR (HELICOPTERS S/N 913 AND PRIOR).

The transmission oil pressure indicator (9, figure 95-1 and 14, figure 95-2) is included in the piping circuit to the transmission oil pressure disconnect at the lower firewall. This indicator indicates transmission oil pressure in pounds per square inch and is precalibrated (bench) against a standard. Refer to figure 96-15 for instrument placards and markings.

95-34. B B3 ENGINE OIL TEMPERATURE/ PRESSURE INDICATION (HELICOPTERS S/N 914 AND SUBSEQUENT).

Engine oil temperature/pressure indication (figure 95-15) is a dual instrument providing both temperature and pressure indications. Temperature side of instrument is part of bridge circuit with resistor element of temperature bulb located in engine oil tank; it indicates engine oil temperature in degrees Celsius. Indicator and temperature bulb are matched electrically in bridge circuit and do not require calibration. Pressure side of instrument is precalibrated in pounds per square inch and is part of piping installation which provides direct (wet line) readings from engine to indicator. Calibration of system is not required. Bleeding of pressure gage lines is required if air is allowed to enter pressure lines. Refer to figure 96-15 for instrument placards and markings.

95-35. OPERATIONAL CHECK.

SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
Barfield Model 2311F or Equivalent	Pressure Tester 0 – 150 psi (0 – 1034 kPa)

1. Close ENG/XMSN TEMP IND circuit breaker.

2. Check temperature indicator reads approximate ambient temperature.

3. Disconnect engine oil pressure line at engine compartment firewall, and block source line connected to engine.

4. Connect 2311F pressure tester to piping connected to indicator.

5. Slowly increase source pressure from 0 psig to 100 psig (0 kPa to 689 kPa).

6. Engine oil pressure indications shall track through full range of externally applied pressure, ± 10 psig (68.95 kPa) at high end.

7. Return pressure to zero, 2311F pressure tester, and reconnect engine oil pressure piping.

95-36. TROUBLESHOOTING.

Refer to figure 95-12 for troubleshooting flow chart.

95-37. TRANSMISSION OIL TEMPERATURE/ PRESSURE INDICATOR.

Transmission oil temperature/pressure indicator (figure 95-15) is a dual instrument providing both temperature and pressure indications. Temperature side of instrument is part of a bridge circuit with resistor element of temperature bulk located in oil filter head, which indicates transmission oil temperature in degrees Celsius. Indicator and temperature bulbs are matched electrically in bridge circuit and do not require calibration. Pressure side of instrument is precalibrated in pounds per square inch against a standard. Calibration of system is not required. Bleeding of pressure lines is required if air is allowed to enter pressure lines (Chapter 63). Refer to figure 96-15 and Chapter 11 for instrument placards and markings.

95-38. OPERATIONAL CHECK.

SPECIAL TEST EQUIPMENT

TYPE OR MODEL	NOMENCLATURE
Barfield Model 2311F or Equivalent	Pressure Tester 0 – 150 psi (0 – 1034 kPa)

1. Close ENG/XMSN TEMP IND circuit breaker.

2. Check indicator reads approximate ambient temperature.

3. Disconnect transmission oil pressure line at engine compartment firewall, and block source line connected to transmission.

4. Connect calibrated pressure source to piping connected to indicator.

5. Slowly increase source pressure from 0 to 70 PSIG (0 kPa to 483 kPa).

6. Transmission oil pressure indications shall track through full range of externally applied pressure, ±7 PSIG (±48.27 kPa) at high end.

7. Return pressure to zero, disconnect pressure source, and reconnect transmission oil pressure line.

95-39. TRANSMISSION OIL TEMPERATURE/ PRESSURE INDICATOR — TROUBLESHOOTING

Refer to Figure 95-12 and perform checks as necessary to isolate trouble.

95-40. ENGINE TORQUEMETER

A **B** On helicopters S/N 4 through 913, the engine torquemeter (3, Figure 95-1 and 8, Figure 95-2) is precalibrated in percent and is included in the piping circuit to the lower firewall disconnect and gives indication in percent.

B **B3** On helicopters S/N 914 and subsequent, the engine torquemeter (2, Figure 95-3) operates identically to the previous model with the exception that it indicates in pounds per square inch.

NOTE

A **B** Helicopters S/N 254 through 913 have electrically operated engine torquemeters with a transducer mounted in the piping circuit.

A **B** **B3** All other ship numbers are equipped with direct (wet-line) indicators.

A **B** On helicopters S/N 254 through 913, helicopter torquemeters that have not been converted to direct (wet-line) indicators may not contain the proper calibration information stamped on the identification plate. For "hands on" calibration checks, the following will apply:

For torquemeter 206-070-399-001 used with the 250-C-18 engine installation, 114 PSIG equals 120% and 95 PSIG equals 100%.

For torquemeter 206-070-399-003 used with the 250 C-20 engine installation, 91.8 PSIG equals 120% and 76.5 PSIG equals 100%.

For both torquemeters the color range markings are the same as follows (Figure 96-15 and Chapter 11):

0 to 85%	Green arc
85 to 100%	Yellow arc
100%	Redline

95-41. ENGINE TORQUEMETER — TESTING

1. Disconnect engine torque pressure line from transducer (Chapter 71).

2. **A** Apply 95 PSI oil pressure from outside source. **B** **B3**. Apply 76.5 PSI oil pressure from outside source.

3. Torquemeter indicator should read 100% (±2.0).

95-42. ENGINE TORQUEMETER — OPERATIONAL CHECK

1. **A** **B** **B3** Disconnect engine pressure line from the transmitter and attach pressure hand gun to the transmitter (Chapter 63).

2. Apply 76 PSI (524 kPa) pressure. Check that torquemeter reads 100% (±2).

3. Bleed engine pressure line and connect (Chapter 63).

95-42A. ENGINE TORQUEMETER — BLEEDING

NOTE

Bleeding of the torquemeter system should be accomplished any time that the lines have been loosened or disconnected.

1. Bleed the torque indicator system by bleeding the instrument lines as follows:

a. Gain access and disconnect the torquemeter line at engine.

b. Connect a low-pressure filler gun filled with approved engine oil.

c. Gain access and place a suitable container under the torque indicator line at the instrument or at the transducer as applicable.

d. Loosen the torque indicator line at the torque indicator or at the transducer as applicable, while slowly applying pressure with the filler gun. Continue to force oil into the line until a steady flow is established at the torque indicator or transducer and a bubble free flow has been established.

e. When bleeding has been satisfactorily completed, tighten the line to the torque indicator or transducer.

f. Remove the low-pressure filler gun and connect aft end of line at engine, taking precaution to hold fluid loss to a minimum during installation.

95-43. TURBINE OUTLET TEMPERATURE (TOT) INDICATOR

Turbine Outlet Temperature (TOT) system consists of indicator (Figure 95-15), related wiring, and engine thermocouples. Indicator is graduated in degrees Celsius and receives temperature indications from thermocouples mounted in turbine exhaust outlet. A B On helicopter S/N 913 and prior, electrical power for the indicator is generated by thermocouples and external or battery power is not required for indications. B B3 On helicopters S/N 914 and subsequent electrical power for the indicator is supplied from the 28 VDC bus through the TOT circuit breaker. Refer to Figure 96-15 and Chapter 11 for instrument placards and markings.

CAUTION

TOT INDICATION ON S/N 914 AND SUBSEQUENT MAY NOT BE ACCURATE ON BATTERY STARTS WHEN BATTERY POWER IS LOW OR DROPS TO 10 VOLTS.

B B3 Helicopters S/N 914 through 3366 (Post TB 206-82-61) and S/N 3367 and subsequent are equipped with a red warning light on face of TOT indicator, which will illuminate if temperature of 812°F (+3, -0) is exceeded for more than 10 seconds (+2, -0). This light will remain illuminated until circuit is reset with TOT OVERTEMP LIGHT reset switch. The reset switch is a lockswitch that requires a key to actuate. It is located adjacent to engine hourmeter in nose of helicopter. If circuit is not reset, light will illuminate any time power is applied to indicator.

95-44. TURBINE OUTLET TEMPERATURE (TOT) INDICATOR — OPERATIONAL CHECK

SPECIAL TOOLS REQUIRED

NUMBER	NOMENCLATURE
2312G or Equivalent	Turbine Temperature Test Set

1. A B Helicopters S/N 4 through 913.

a. Remove Turbine Outlet Temperature (TOT) indicator (Figure 95-15) from instrument panel (paragraph 95-5) and functionally check turbine temperature test set at 700°C (±5°) and 750°C (±5°).

b. If indicator operates within specified limits, proceed with step c. If indicator does not operate within specified limits, replace indicator.

NOTE

To maintain proper accuracy, use only a whetstone bridge when performing resistance adjustments in the following procedures.

c. Check total circuit lead resistance (Figure 95-16). Resistance should be 8 ohms (±0.05). Resistance may be adjusted by adding or removing turns of wire from resistance spool.

d. If resistance is within limits set in step a, install indicator (paragraph 95-8) and proceed.

NOTE

The following procedures are performed using Figure 95-16 as reference.

e. With TOT indicator installed, disengage circuitry from engine supplied harness at nacelle terminal block and attach helicopter harness leads to thermocouple test rig.

NOTE

During course of troubleshooting, calibrated adjustments of indicators should be accomplished by qualified personnel only.

f. Attach jetcal analyzer probes to test rig thermocouples and perform system checkout in accordance with analyzer operating instructions. This will validate instrument circuitry, isolating the difficulty to the engine and/or associated components. However, if proper system function is not attained through jetcal operation, step a through step f were not properly performed and shall be repeated.

2. B B3 Helicopters 914 through 3567 (Pre TB 206-82-61).

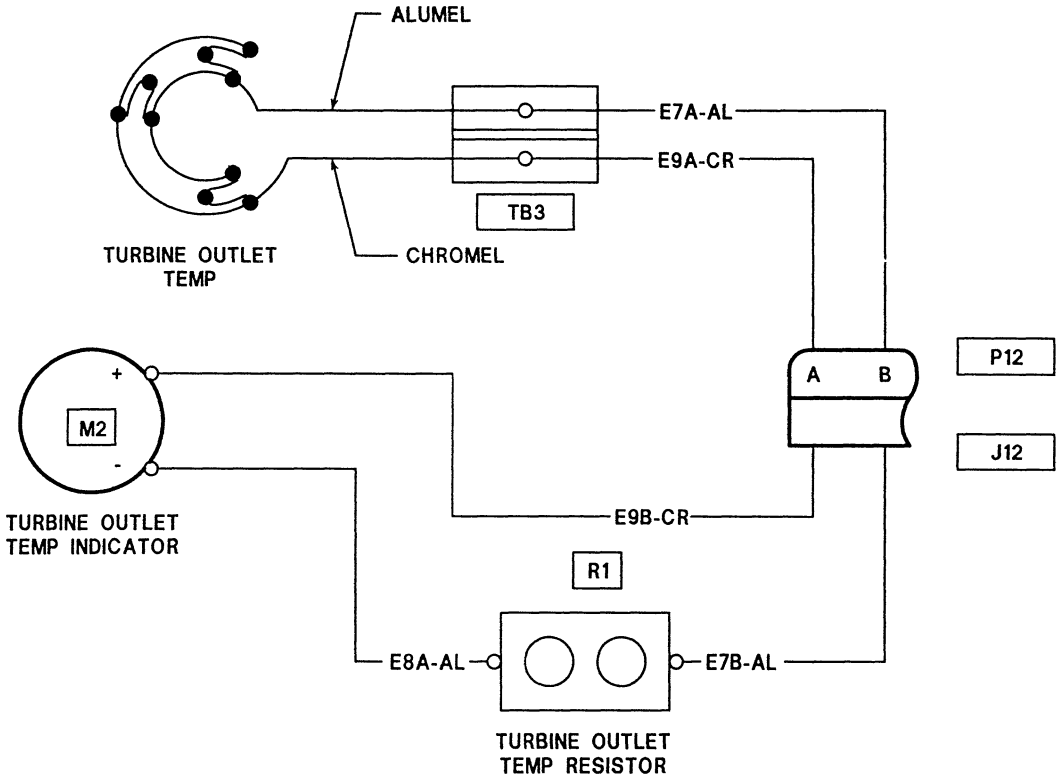
NOTE

If electrical power is removed from the TOT indicator (Figure 95-15), the OFF flag will appear and the pointer will remain at its last reading. For example, if the last reading was 500°C when electrical power was removed, the pointer will continue to read 500°C until electrical power is reapplied. If in the meantime, the temperature has dropped to 30°C, the pointer will motor down to read 30°C when power is reapplied. This is normal indicator operation. If the thermocouple leads are opened while electrical power is applied, the indicator pointer will spin or motor. This is also normal indicator operation.

NOTE

It may be necessary to remove TOT indicator from instrument panel to accomplish the following step. Refer to Figure 95-16 to accomplish following steps.

a. Disconnect electrical connector from TOT indicator and install TOT test adapter cable in accordance with Figure 95-11.



HELICOPTERS S/N 4 THRU 913

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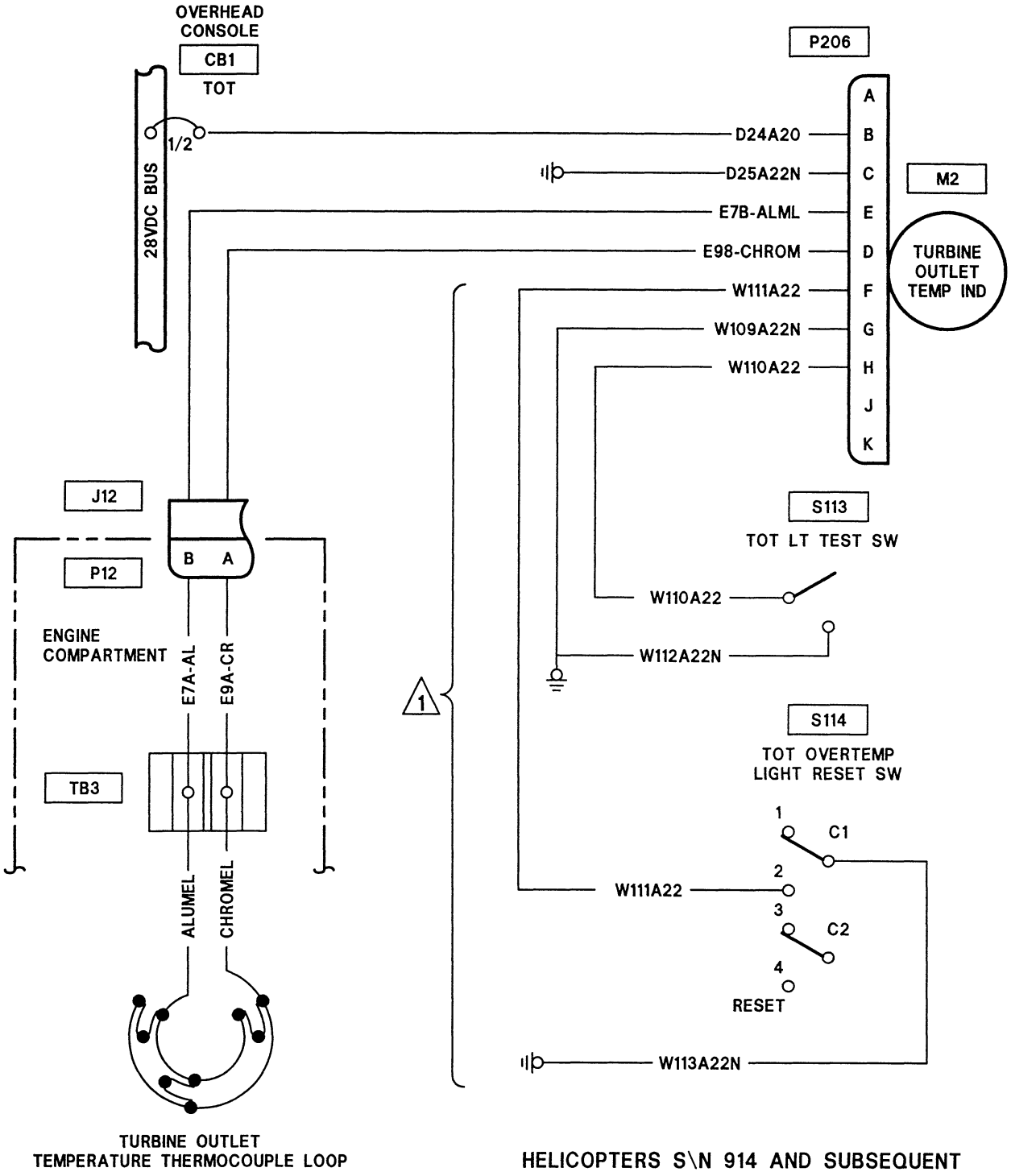
Figure 95-16. Turbine outlet temperature indicator circuit (Sheet 1 of 2)



NOTE

1 TOT overtemp light circuit, 206B helicopters with T.B. 206-82-61 incorporated and helicopters S\N 3367 and subsequent.

206A/BS-M-95-16-2

Figure 95-16. Turbine outlet temperature indicator circuit (Sheet 2)

b. Place BAT switch to ON.

c. Close TOT IND circuit breaker. Check that power OFF flag on indicator disappears within one second after circuit breaker is closed. If power OFF flag operates normally, proceed with step e.

d. If power OFF flag does not disappear, check for 28 Vdc at pin B and ground at pin C of TOT test adapter cable and/or P206.

(1) If 28 Vdc and ground are available, replace TOT indicator and forward defective indicator to instrument test lab for condition verification.

(2) If 28 Vdc and/or ground is not available, repair TOT test adapter cable and/or helicopter wiring.

e. Functionally check TOT indicator at 737ºC and 793ºC with jetcal analyzer. Indicator shall read within 5ºC at both temperatures.

(1) If indicator reads correctly, proceed with step f.

(2) If indicator reads incorrectly, replace indicator and forward defective indicator to instrument test lab for condition verification.

f. Open TOT IND circuit breaker. Check that power OFF flag appears on face of indicator.

g. Place BAT switch to OFF.

h. Disconnect and remove TOT test adapter cable.

NOTE

To maintain proper accuracy, use only a wheatstone bridge to check resistance.

i. Measure resistance of TOT circuit between pins D and E of P206. Resistance shall not be less than 5 ohms, nor more than 200 ohms. Normally, total resistance is 7 to 20 ohms.

(1) If resistance is within limits, proceed to step j.

(2) If resistance is not within limits, ensure helicopter wiring and connections are serviceable and proceed to step j.

j. Install TOT indicator, disengage instrument circuitry from engine supplied harness at the nacelle terminal block, and attach instrument harness leads to thermocouple test rig. Attach jetcal analyzer probes to test rig thermocouples and perform system checkout in accordance with analyzer operating instructions. This will validate instruments circuitry, isolating the difficulty to the engine and/or associated components. However, if proper system function is not attained through jetcal operation, steps a. through j. were not properly performed and shall be repeated.

3. B B3 206B helicopters with T.B. 206-82-61 incorporated and S/N 3567 and subsequent.

a. TOT overtemperature LT TEST:

(1) TOT LT TEST (15, figure 95-4) switch is located on left side of instrument panel between and adjacent to oil temperature/pressure and transmission oil temperature/pressure indicators. Switch tests TOT overtemperature light circuit.

(2) Depress spring-loaded push-button switch. The OVERTEMP light in TOT indicator shall illuminate.

4. Engine thermocouple loop resistance check (figure 95-16):

a. Ensure TOT circuit breaker (CB1) is open.

b. Disconnect electrical connector (P206) from TURB OUT TEMP (TOT) indicator.

c. Measure resistance across the two terminals on thermocouple terminal board (TB3). The resistance of thermocouple loop shall be 1.0 ± 0.50 ohms.

d. Reconnect TOT electrical connector.

5. TOT system functional check:

a. Set FUNCTION switch on the tester to IND mode. Adjust test set meter for ambient temperature.

b. Remove wire E7A-AL from terminal board (TB3). Connect black lead from test set to end of E7A-AL. Connect red wire from test set to wire E9A-CR on terminal board (TB3).

c. Close TOT IND circuit breaker. Press and hold TEST switch on test set while positioning CAL ADJUST knob to 738 degrees. TOT indicator shall indicate 738 ± 5 degrees (the low end of the yellow range mark).

d. Press and hold TEST switch on test set while positioning CAL ADJUST knob to set 812 degrees. TOT pointer shall indicate 812 ± 5 degrees (high end of the yellow range mark and leading edge of red line).

NOTE

The following steps, d.(1) through d.(4), apply to helicopters S/N 3387 and subsequent.

(1) The red warning light shall illuminate when the CAL/ADJUST setting is 812 (+3, –0) degrees to 927 degrees for 10 (+2, –0) seconds. If the light did not illuminate as described in the preceding step, increase the CAL/ADJUST knob setting 3 degrees and the light shall illuminate in 10 (+2, –0) seconds and remain illuminated.

(a) Reset CAL/ADJUST knob to below 812 degrees.

(b) Reset red warning light per following step d.(4).

(c) Reset CAL/ADJUST knob to 927 (+3, –0) degrees quickly. The red warning light shall illuminate in 0 to 1.5 seconds and remain illuminated.

(2) Continue to hold TEST switch. Adjust CAL/ADJUST knob for a reading of well below 812 degrees (i.e. 600 degrees). Overtemperature warning light shall remain illuminated.

(3) Open TOT circuit breaker and then close it again. Red warning light shall extinguish when power is removed but illuminate again when power is restored.

(4) Rest TOT warning light circuit by inserting key and positioning OVERTEMP LT RESET switch to RESET. TOT warning light shall extinguish.

e. Open TOT IND circuit breaker. Disconnect test set leads and reconnect wire E7A-AL to terminal board (TB3).

MISCELLANEOUS INSTRUMENTS

95-45. MISCELLANEOUS INSTRUMENTS

The miscellaneous instruments installed consist of the DC loadmeter, free air temperature indicator, eight day clock, and the hourmeter.

95-46. FUEL PRESSURE INDICATOR

The fuel pressure indicator (7, Figure 95-1, and 15, Figure 95-2) provides indication of amount of fuel pressure in pounds per square inch. A B On helicopters S/N 913 and prior: circuitry for the indicator (Chapter 96) is located in the piping circuit to the fuel pressure disconnect. B B3 On helicopters S/N 914 and subsequent: electrical circuitry is provided from the fuel pressure transducer to the indicator (Chapter 96). The newer indicator (11, Figure 95-3) is part of a dual indicator with the DC loadmeter.

95-47. OPERATIONAL CHECK

1. Disconnect fuel pressure line from the transmitter and attach a source of air pressure to the transmitter.

2. Gradually increase air pressure while monitoring fuel pressure indicator until it reads 30 PSIG. The applied pressure shall be 30 ±3 PSIG.

95-48. DC LOADMETER

The DC loadmeter (8, Figure 95-1 and 1, Figure 95-2) measures and indicates generator output in percentage. B B3 On helicopters S/N 914 and subsequent, the DC loadmeter (11, Figure 95-3 and 12, Figure 95-4) is part of a dual indicator with the fuel pressure indicator.

95-49. FREE AIR TEMPERATURE INDICATOR

The free air temperature indicator (1, Figure 95-17) is a simple probe type thermometer inserted through a hole in the windshield and provides indication of outside ambient air temperature.

95-50. REMOVAL

Remove nut from outside of windshield and remove indicator from windshield.

95-51. INSTALLATION

Position indicator in windshield and secure with nut on outside of windshield.

95-52. FUEL QUANTITY INDICATOR

The fuel quantity indicator (6, Figure 95-1, 2, Figure 95-2, 13, Figure 95-3 and 14, Figure 95-4) provides indication of available fuel in fuel cell. It is calibrated in gallons and is part of the fuel system electrical bridge circuit.

95-53. CALIBRATION

CAUTION

OBSERVE STANDARD PRECAUTIONARY STEPS WHEN FUELING OR DEFUELING HELICOPTERS (CHAPTER 12).

NOTE

Fuel quantity calibration is accomplished with auxiliary 27.5 VDC applied to helicopter external power receptacle.

1. Perform the following procedures when it is necessary to calibrate the fuel quantity system:

a. Place helicopter at a safe distance from fire hazard areas.

b. Set BAT switch to OFF position.

c. Securely ground helicopter from static electricity.

d. Position helicopter 1 to 2° nose down for entire calibration procedure.

e. Defuel fuel cell (Chapter 12).

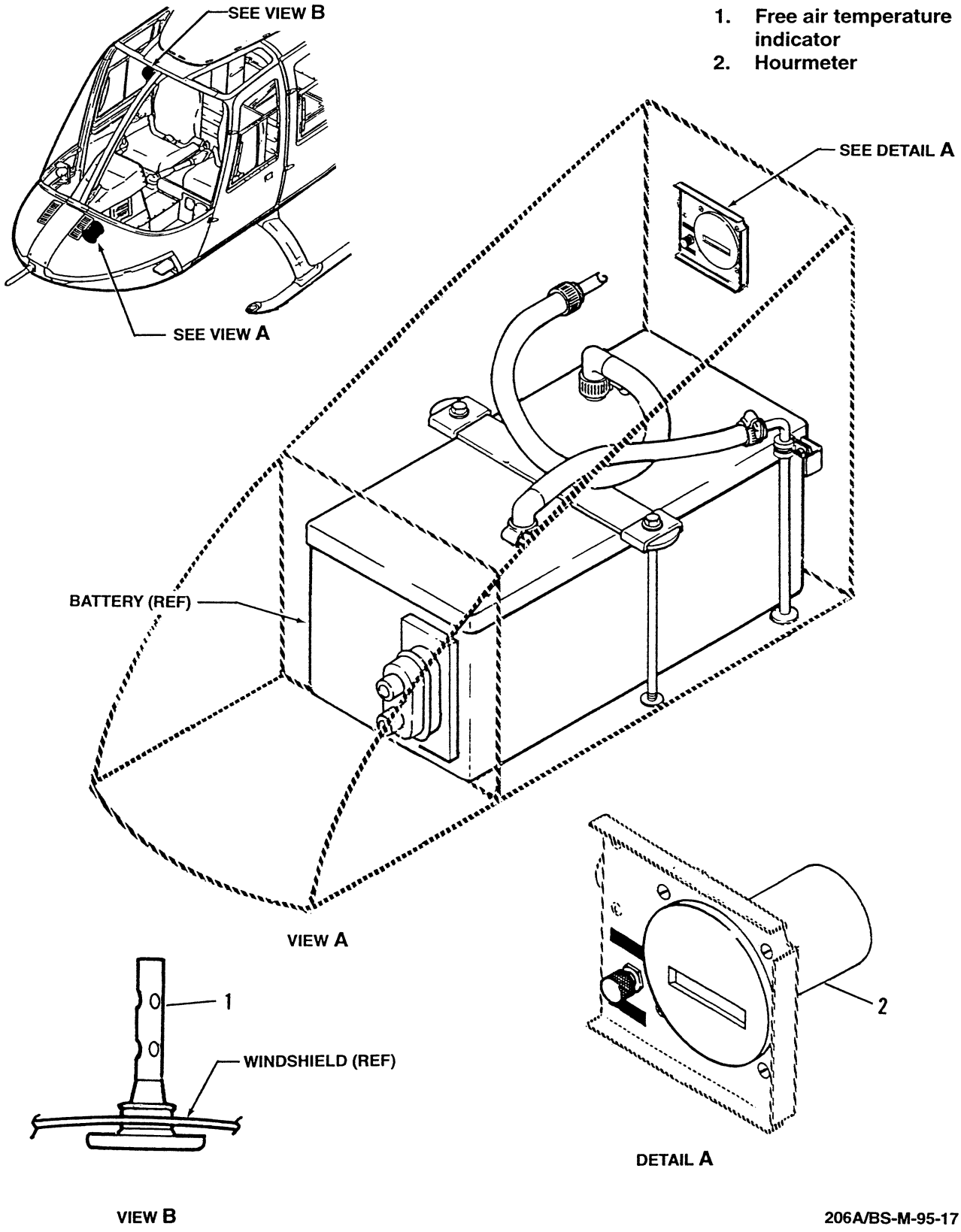


Figure 95-17. Free air temperature indicator and hourmeter

2. A B B3 On helicopters S/N 1903 and prior, close INST CLUSTER circuit breaker. B3 On helicopters S/N 1904 and subsequent, close QTY-PRESS circuit breaker (Chapter 96).

a. Remove pedestal side panels.

b. Connect an adjustable external power source and set at output level of 27.5 Vdc.

3. Observe that fuel quantity gage pointer rests at zero; if gage pointer does not indicate zero then adjust it to read zero (Chapter 96).

4. Add one gallon of fuel to fuel cell (Chapter 12). The gage pointer should still indicate zero. Check for fuel leaks.

5. Add measured quantities of fuel while observing same indications on gage until gage reads 40 gallons; check for leaks. Gage should be accurate within 3 gallons.

6. Continue filling fuel cell until spillover is reached.

7. Adjust indicator until a reading of 75 gallons is reached.

8. Defuel fuel cell (Chapter 12). Measure extracted fuel quantity. The amount should be no less than 76 gallons. Indicator should read zero gallons.

9. Replace pedestal side panels.

10. Refuel as necessary (Chapter 12).

95-54. EIGHT DAY CLOCK.

The eight day clock (13, figure 95-1, 12, figure 95-2, and 9, figure 95-3) provides accurate indication of time in hours and minutes, and has a sweep second hand pointer.

95-55. HOURMETER.

The engine hourmeter (2, figure 95-17) provides indication of engine operating hours throughout the life of the engine.