

## ELECTRICAL TORQUE INDICATING SYSTEM - MAINTENANCE PRACTICES

### 1. General

- A. Maintenance practices include torque indicator removal/installation, torque transmitter removal/installation and functional test.

### 2. Torque Indicator Removal/Installation

**NOTE:** During component removal and installation, cap all lines and fittings.

- A. Remove Torque Indicator (Refer to Figure 201).
- (1) Loosen screw (5) securing indicator (6) to mounting clamp (3) and remove indicator.
  - (2) Cut safety-wire and remove electrical connector (4) from indicator (6).
- B. Install Torque Indicator (Refer to Figure 201).
- (1) Install electrical connector (4) to indicator (6) and safety-wire.
  - (2) Slide indicator (6) through instrument panel into mounting clamp (3) and secure with screw (5).
  - (3) Start engine in accordance with Pilot's Operating Handbook and check torque indicator operation.

### 3. Torque Pressure Transmitter Removal/Installation

- A. Remove Torque Pressure Transmitter (Refer to Figure 201).
- (1) Open right upper cowling door to gain access.
  - (2) Ensure airplane electrical power is OFF.
  - (3) Cut safety wire and remove electrical connector (14).
  - (4) Loosen vent line (7) and pressure line (8) at each end of transmitter (11) and remove lines.
  - (5) Remove bolts (13) from clamps (12) securing transmitter to bracket (15) and remove transmitter.
- B. Install Torque Pressure Transmitter (Refer to Figure 201).
- (1) Secure torque pressure transmitter (11) to bracket (15) by installing bolts (13) through clamps (12).
  - (2) Connect pressure line (8) and vent line (7) to transmitter.
  - (3) Install electrical connector (14) to transmitter and safety-wire.
  - (4) Restore electrical power to airplane, start engine in accordance with Pilot's Operating Handbook and verify proper torque indicator operation.
  - (5) If torque indication is erratic, loosen pressure line connection (8) at transmitter and allow air in lines to bleed from system. Tighten line.
  - (6) Shut down engine in accordance with Pilot's Operating Handbook.

### 4. Torque Transmitter Vent Line Leak Test

- A. Leak Test Torque Transmitter Vent Line (Refer to Figure 201).

**NOTE:** Airplanes 20800001 thru 20800083, ensure torque indicator circuit breaker is in and 26 volts 400 Hz AC current is being supplied to the torque indicating system for the following tests.

**NOTE:** Airplanes 20800084 and On and 208B0001 and On, ensure torque indicator circuit breaker is engaged and 28 VDC current is being supplied to the torque indicating system for the following tests.

- (1) Disconnect vent line (4) from elbow (5).
- (2) Connect vacuum portion of pitot-static test set to line (4). Set test set altimeter to zero.
- (3) Slowly apply vacuum. Check that indicator reading does not start decreasing below zero. If this is the case, connections to transmitter are reversed and must be corrected. Continue applying vacuum until altimeter on test set reads 14,000 feet (or a pressure of 8.6 PSIA).
- (4) Shut off vacuum. Check that test altimeter or gage does not show a loss of vacuum for one minute.
- (5) If leakage is noted, disconnect vent line from transmitter and cap. Recheck test set plumbing and vent line leakage and repair as required (with vent line not connected to transmitter, positive pressure may be used to isolate leaks using bubble leak detector on fittings). Check transmitter by applying vacuum per steps (2) through (4) directly to reference port fitting of transmitter. If leakage is noted, check fitting for Teflon tape on pipe threads and proper torque. If fitting is not leakage source, replace transmitter.

- (6) Connect vent line (4) to elbow (5).

**5. Torque Transmitter Pressure Line Leak Test**

A. Leak Test Torque Transmitter Pressure Line (Refer to Figure 201).

- (1) Disconnect pressure line (6) from adapter (7).
- (2) Connect air pressure source to pressure line.
- (3) Apply 2.0 PSIG pressure and check that torque indicator reading increases. If reading decreases, line to torque transmitter is reversed and must be corrected.
- (4) Apply 40 PSIG pressure and shut off pressure source. Record data as follows:
  - (a) Allow system to set for ten minutes to stabilize. Tap test gage and record exact test pressure (PSIG). Record ambient temperature in (°F) and true ambient pressure ("Hg) by reading the window of an altimeter set to zero altitude.
  - (b) Allow system to set for one hour. Record test pressure, ambient temperature and ambient pressure in same manner as step (a) above.
  - (c) Correct for ambient temperature and pressure differences as follows:
    - 1 Ambient Temperature Correction (PSIG) = Final Reading (°F) - Initial Reading (°F) x 0.1.
    - 2 Ambient Pressure Correction (PSIG) = Final Reading ("Hg) - Initial Reading ("Hg) x -0.49.
    - 3 Corrected Test Pressure = Initial Test Pressure + Ambient Temperature + Ambient Pressure Correction.
    - 4 Leakage = Corrected Test Pressure - Observed Final Test Pressure.
- (5) Leakage per Step 3. shall not exceed 0.5 PSIG. Isolate and repair any leaks by using bubble leak detector solution on fittings.

**NOTE:** Allowable leakage of 0.5 PSIG is due to tolerances in pressure gage and correction procedures. Goal is zero leakage. If there is any doubt as to whether leakage exists, check all fittings with bubble leak detector fluid.

- (6) Relieve pressure and disconnect test equipment. Reconnect pressure line to adapter.

**6. Torque Transmitter Functional Test**

A. Functional Test Torque Transmitter (Refer to Table 201).

**CAUTION:** Improper connection will damage the transmitter.

- (1) Connect pressure source and gage (or deadweight tester) to pressure port of the transmitter. Leave reference port (marked "VENT") of the transmitter open to atmosphere.
- (2) Apply pressures in increasing direction. Check indicator reading tolerance after tapping transmitter to overcome friction. Repeat with decreasing pressure except at the 2500 foot-pound point.
- (3) Failure of transmitter to comply with above shall result in rejection of unit.
- (4) Apply 8.6 PSIA pressure (14,000-foot altimeter reading with altimeter originally set to zero) to reference port (marked "VENT") of transmitter. Shut off vacuum and check that no discernible leakage occurs in one minute.

**Table 201. Scale Error**

INPUT PSI (1)	INPUT PSI (2) (REF)	TOLERANCE PSI (REF)	TORQUE (FT-LBS)	TOLERANCE (FT-LBS)
-0.71	0	+1.38 or -1.38	0	+50 or -50
13.49	14.20	+1.38 or -1.38	500	+50 or -50
27.68	28.39	+1.02 or -1.02	1000	+35 or -35
41.87	42.59	+0.78 or -0.78	1500	+28 or -28
46.36	47.08	+0.56 or -0.56	1658	+20 or -20
55.22	55.93	+0.56 or -0.56	1970	+20 or -20
70.26	70.98	+1.18 or -1.18	2500	+40 or -40

**NOTE 1:** To be used when transmitter and pressure source are at same level.

**NOTE 2:** To be used when transmitter is 20 inches higher than pressure source.

1. Constant = 35.22 Ft-Lbs/PSI.
2. Zero PSI at the gage = 25 Ft-Lbs. Difference will disappear when gage is installed and operating.
3. Pressures listed in column 1 are with reference port open to ambient pressure and no fluid head difference between source and indicator.
4. Values listed in column 1 are for calibration of indicator only and are not applicable to installed system.

## 7. Torque System Functional Test

### A. Functional Test Torque System (Refer to Figure 201).

- (1) Disconnect plumbing between torque transducer and engine.
- (2) Connect the torque system calibration tester to the pressure port of the transducer.
- (3) Close the torque indicator circuit breaker.
- (4) Using dry Nitrogen source, apply 28.39 PSI, +1.02 or -1.02 PSI, to the transducer. The indicator shall read 1000 Ft-Lbs, +35 or -35 Ft-Lbs.
- (5) Increase pressure to 42.59 PSI, +.78 or -.78 PSI. The torque indicator shall read 1500 Ft-Lbs, +28 or -28 Ft-Lbs.
- (6) Increase pressure to 47.08 PSI, +.56 or -.56 PSI. The torque indicator shall read 1658 Ft-Lbs, +20 or -20 Ft-Lbs.
- (7) Increase pressure to 55.93 PSI, +.56 or -.56 PSI. The torque indicator shall read 1970 Ft-Lbs, +20 or -20 Ft-Lbs.
- (8) Slowly remove pressure from the torque transducer.
- (9) Remove torque system calibration tester and restore the system to original condition.
- (10) If indicator readings are out of tolerance, then perform torque system calibration. Refer to Torque System Calibration.

## 8. Electrical Torque System Calibration

### A. Aircraft System Calibration (AMETEK).

- (1) Disconnect plumbing between torque transducer and engine.
- (2) Connect torque system calibration tester to pressure port of the transducer.

**CAUTION:** The pressure source to transducer connection must have absolutely zero leakage before calibration is attempted.

- (3) Close torque indicator circuit breaker.

**NOTE:** The following steps are to be performed with both indicator and transducer at ambient temperature.

- (4) Apply pressure  $P_1$  (as stamped on the torque transducer), and observe the torque indicator reading.
- (5) Calculate  $D_1$  where  $D_1 = \text{indicator reading} - 1000$ .
- (6) Supply pressure  $P_2$  (as stamped on the torque transducer) and observe the torque indicator reading.
- (7) Calculate  $D_2$  where  $D_2 = \text{indicator reading} - 2000$ .
- (8) Calculate slope adjustment, direction and magnitude ( $D_3$ ).
- (9) The following calibration is an algebraic sum,  $D_3 = D_1 - D_2$ .
  - (a) A negative result means a downscale adjustment.
  - (b) A positive result means an upscale adjustment.
- (10) Loosen screw securing indicator to mounting clamp, draw it from the panel far enough to access the adjustments in the rear portion of the indicator cover.
- (11) Remove both cap screws (slope and offset), to gain access to the adjustments.
- (12) Turn the slope adjustment to change the indicator in the amount and direction of  $D_3$ .
- (13) Apply pressure  $P_1$  (as stamped on the torque transducer).
- (14) Turn the offset adjustment to center the torque indicator pointer on the 1000 Ft-Lb graduation.
- (15) Repeat steps 4 through 14 until  $D_1$  and  $D_2$  are both zero.
- (16) Using the following formula, calculate the value of the slope for pressure versus torque system indication.

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$$M = \text{Slope} \quad M = \frac{P_2 - P_1}{1000}$$

- (17) Using the following formula, calculate the pressure for the red wedge indicator (1658 Lbs torque) for the PT6A-114 engine and (1865 Lbs torque) for the PT6A-114A engine, and for the red radial indication (1970 Lbs torque) for both PT6A-114 and PT6A-114A engines.

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$$\begin{aligned} P_R &= \text{Pressure Required} \\ T_I &= \text{Torque Indicated} \end{aligned} \quad P_R = [(M[2000 - T_I]) - P_2]$$

- (18) Using the following formula, calculate the possible overall system error.

(a) °C = Ambient temperature in degrees centigrade.

(b) ± Error (Ft-Lbs) = [ ([50-°C] 0.03714) + 1.4 ] 25

**NOTE:** °C should be current ambient temperature.

- (19) Verify that red wedge indication corresponds to the respective applied pressure within the overall error allowed as calculated in Step 18.
- (20) Verify that red radial indication corresponds to the respective applied pressure within the overall error allowed as calculated in Step 18.
- (21) Remove pressure from the torque transducer.
- (22) Verify the torque indicator shows (0) zero ft-lbs torque within the overall error as calculated in Step 18.
- (23) Replace both cap screws covering the slope and offset adjustments. Reinstall the torque indicator.
- (24) Remove the torque calibration tester and restore the system to original condition.
- (25) Pull the torque indicator circuit breaker.
- (26) Verify the torque indicator needle is in the OFF or below zero area.

#### B. Aircraft System Calibration (KULITE).

- (1) Disconnect the plumbing between the torque transducer and the engine.
- (2) Connect the torque system calibration tester to the pressure port of the transducer.

**CAUTION:** The pressure source to transducer connection must have absolutely zero leakage before calibration is attempted.

- (3) Close the torque indicator circuit breaker.

**NOTE:** The following steps are to be performed with both the indicator and the transducer at ambient temperature.

- (4) Apply 28.39 psi and observe the torque indicator ( $T_1$ ) reading.
- (5) Calculate  $D_1$  where  $D_1 = T_1 - 1000$ .
- (6) Apply 55.93 psi and observe the torque indicator ( $T_2$ ) reading.
- (7) Calculate  $D_2$  where  $D_2 = T_2 - 1970$ .
- (8) Calculate the direction and the magnitude ( $D_3$ ) where  $D_3 = D_1 - D_2$
- (a) A negative result means a downscale adjustment.
- (b) A positive result means an upscale adjustment.
- (9) Loosen the screw securing the indicator to the mounting clamp, draw it from the panel far enough to access the adjustments in the rear portion of the indicator cover.
- (10) Remove both of the cap screws covering the slope and offset adjustments, to gain access to the adjustments.
- (11) Turn the slope adjustment to change the indicator in the amount and direction of  $D_3$ .
- (12) Apply 28.39 psi.
- (13) Turn the offset adjustment to center the torque indicator pointer on the 1000 ft-lb graduation.
- (14) Repeat steps 4 through 13 until  $D_1$  &  $D_2$  are both zero.

- (15) Verify the red wedge indicator by applying 53.04 psi (PT6A-114A engine) or 47.34 psi (PT6A-114 engine). Note the difference between 1865 Ft-Lbs or 1658 Ft-lbs (respectively).
- (16) Using the following formula, calculate the possible overall system error.
- (a) °C = Ambient temperature in degrees centigrade.
- (b)  $\pm \text{Error} = 25 (((50 - \text{°C}) \cdot 0.03714) + 1.4)$

**NOTE: °C should be current ambient temperature.**

- (17) Verify that the red wedge indication noted in step 15 corresponds to the respective applied pressure within the overall error allowed as calculated in Step 16.
- (18) Remove the pressure from the torque transducer.
- (19) Verify that the torque indicator shows (0) zero Ft-lbs torque within the overall error as calculated in Step 16.
- (20) Replace both of the cap screws covering the slope and offset adjustments. Reinstall the torque indicator.
- (21) Remove the torque calibration tester and restore the system to original condition.
- (22) Open the torque indicator circuit breaker.
- (23) Verify that the torque indicator needle is in the OFF or below zero area.
- (24) Reset the circuit breaker.

Figure 201 : Sheet 1 : Electrical Torque Indicating System Installation

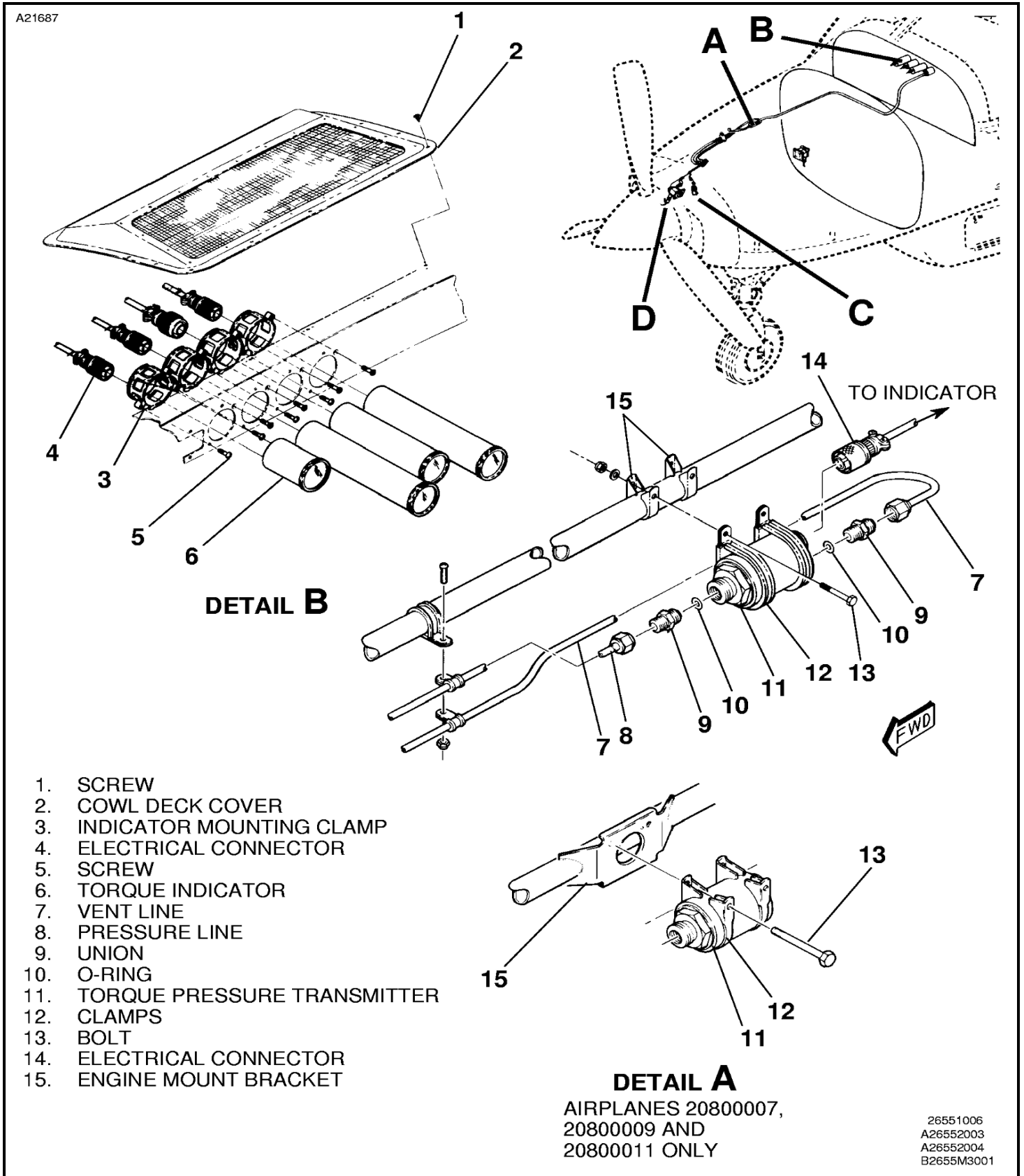
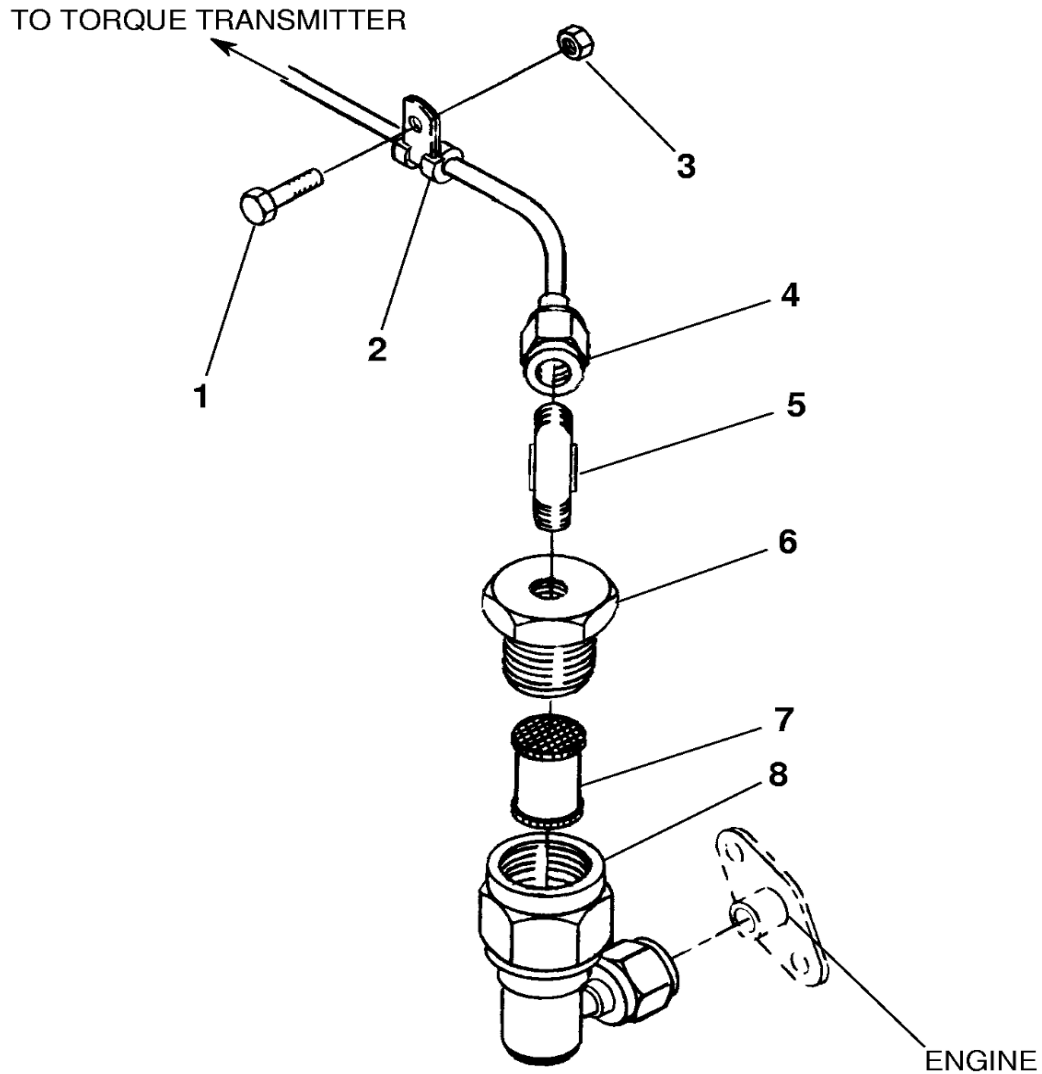


Figure 201 : Sheet 2 : Electrical Torque Indicating System Installation

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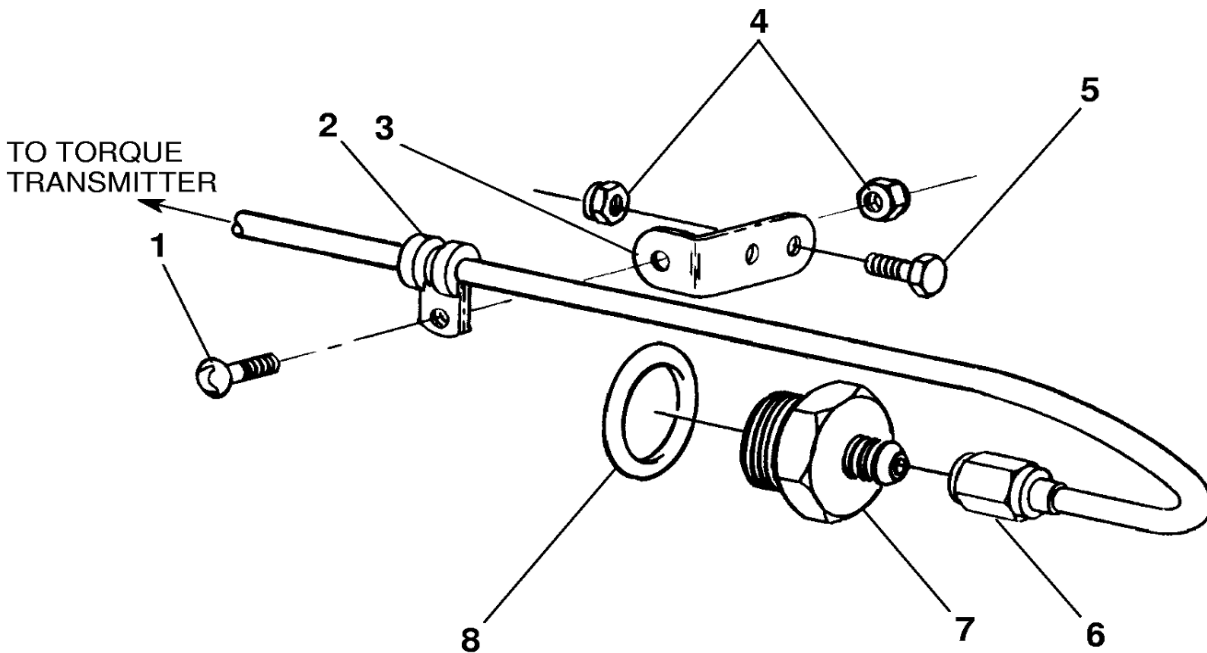
**DETAIL C**  
TORQUE TRANSMITTER VENT LINE

1. BOLT
2. CLAMP
3. NUT
4. LINE
5. ELBOW
6. ADAPTER
7. BREATHER PADS
8. OIL SEPARATOR

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Figure 201 : Sheet 3 : Electrical Torque Indicating System Installation

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**DETAIL D**  
TORQUE TRANSMITTER PRESSURE LINE

- 1. SCREW
- 2. CLAMP
- 3. BRACKET
- 4. NUT
- 5. BOLT
- 6. LINE
- 7. ADAPTER
- 8. PACKING

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