

FUEL PRESSURE REGULATOR

4.8

REMOVAL

⚠ WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

1. Remove top plate. See [4.6 FUEL TANK TOP PLATE](#).
2. See [Figure 4-14](#). Remove ground wire spade terminal from slot of fuel filter shell.
3. Remove spring clip from fuel pressure regulator. For best results, free one side first and then the other.
4. See [Figure 4-15](#). Remove fuel pressure regulator, regulator seat, large O-ring, screen and small O-ring.

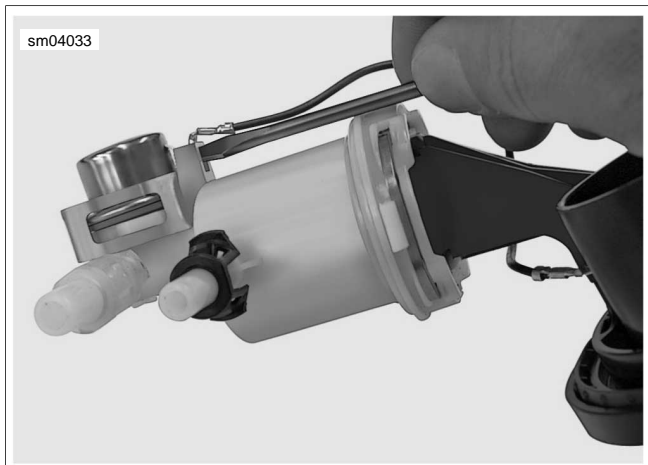


Figure 4-14. Remove Ground Wire Spade Terminal From Fuel Filter Shell



1. Spring clip
2. Fuel pressure regulator
3. Regulator seat
4. Large O-ring
5. Screen
6. Small O-ring

Figure 4-15. Fuel Pressure Regulator Assembly

INSTALLATION

1. Insert small O-ring at top of pressure port bore.
2. Install screen at top of pressure regulator bore, so that sleeve on ID faces small O-ring. Install regulator seat to evenly press screen into bore. Remove regulator seat.
3. Install large O-ring at top of screen.
4. Install regulator seat and fuel pressure regulator.
5. Install spring clip, so that indented sides engage top of center rib on fuel pressure regulator, while rounded side engages bottom of tabs on housing.
6. Route ground wire around index pin side of end cap and install spade terminal into slot in fuel filter shell.
7. Install top plate. See [4.6 FUEL TANK TOP PLATE](#).

FUEL LEVEL SENDER

REMOVAL

⚠ WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

1. Remove top plate. See [4.6 FUEL TANK TOP PLATE](#).
2. Disconnect 2-place connector to release fuel level sender from wire harness.

NOTE

Looking into fuel tank at bracketry at top of tunnel, note that finger on front bracket points forward, while finger on rear bracket points rearward. See [Figure 4-16](#).

3. Reaching into fuel tank, pull up on front finger and slide fuel level sender bracket rearward until four ears on bracket are free of catches at top of tunnel.
4. Remove fuel level sender from left side of fuel tank. See [Figure 4-17](#).

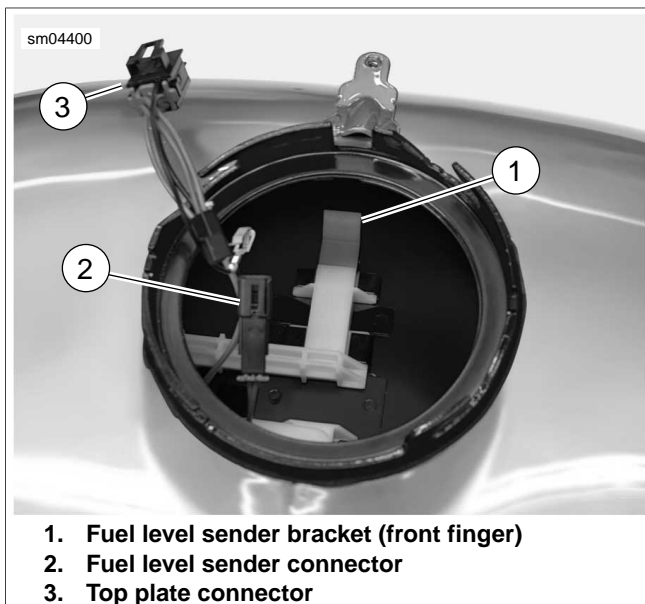


Figure 4-16. Front Finger (Fuel Level Sender Bracket)

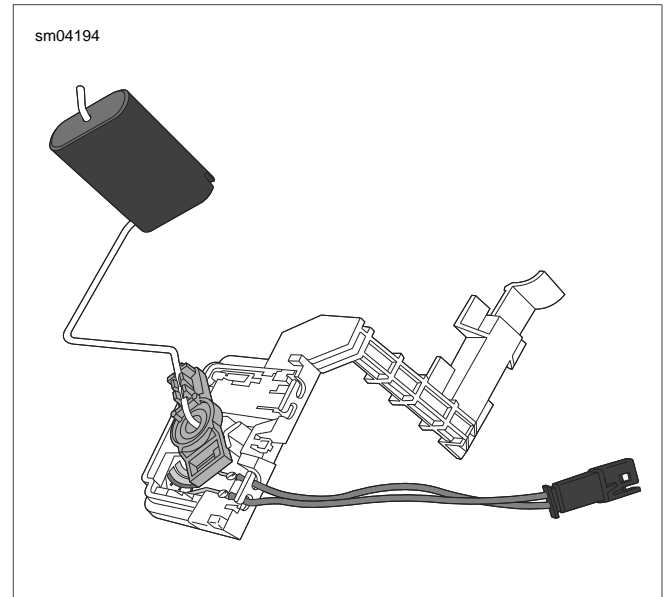


Figure 4-17. Fuel Level Sender

INSTALLATION

1. With the finger on the fuel level sender bracket pointing forward, install fuel level sender into left side of fuel tank.
2. Engage four ears on fuel level sender bracket with front set of catches at top of tunnel. Push fuel level sender bracket forward until ears are fully engaged.
3. Connect 2-place connector to attach fuel level sender to wire harness.
4. Install top plate. See [4.6 FUEL TANK TOP PLATE](#).

TWIST GRIP SENSOR

4.10

REMOVAL

1. Remove left side saddlebag. See [2.29 SADDLEBAGS](#).
2. Remove left side cover.
3. Remove main fuse.

NOTE

Do not remove the switch housing assembly without first placing the 5/32 inch (4.0 mm) cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the front stoplight switch. Use the eyelet of an ordinary cable strap if the cardboard insert is not available.

4. Place the cardboard insert between the brake lever and lever bracket.
5. Remove the upper and lower switch housing screws.
6. Loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.
7. Separate the upper and lower switch housings and remove the throttle grip from the end of the handlebar.

NOTE

To remove the throttle grip, a slight tug may be necessary to release index pins in grip from receptacle in seal cap of twist grip sensor.

8. If present, pull two cable clips on right side handlebar switch conduit from holes in handlebar.
9. **FLHR/C:** See [Figure 4-18](#). Remove headlamp and handlebar clamp shroud. See [2.47 HEADLAMP NACELLE: FLHR/C](#). Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud on fork stem nut lock plate (right side) and disconnect.
10. **FLHX, FLHT/C/U:** See [Figure 4-19](#). Remove outer fairing. See [2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U](#). Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud at top of right fairing support brace (inboard side) and disconnect.
11. **FLTR:** Remove outer fairing and bezel. See [2.41 UPPER FAIRING AND WINDSHIELD: FLTR](#) and [2.42 INSTRUMENT BEZEL: FLTR](#), respectively. Disconnect twist grip sensor jumper harness connector [204], 6-place Molex (black).

NOTE

The external latch on the pin housing of the twist grip sensor connector will break if the twist grip sensor is pulled too hard. A damaged latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.

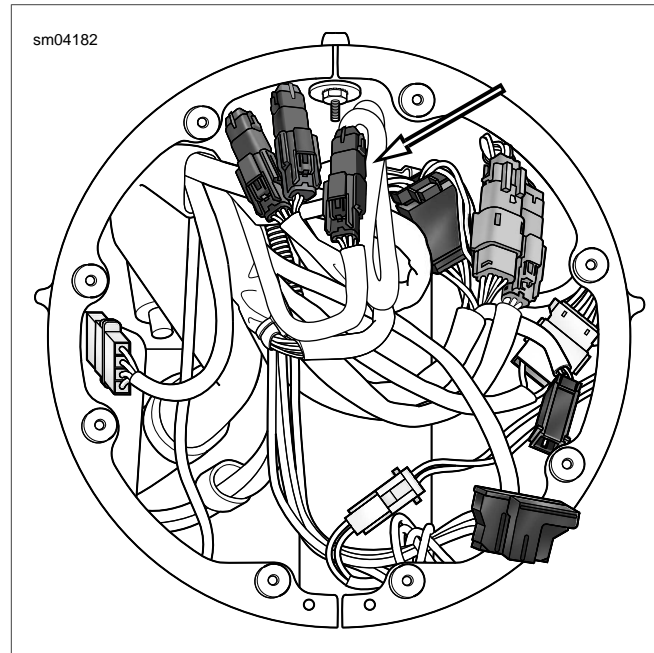


Figure 4-18. Twist Grip Sensor Jumper Harness Connector (FLHR/C)

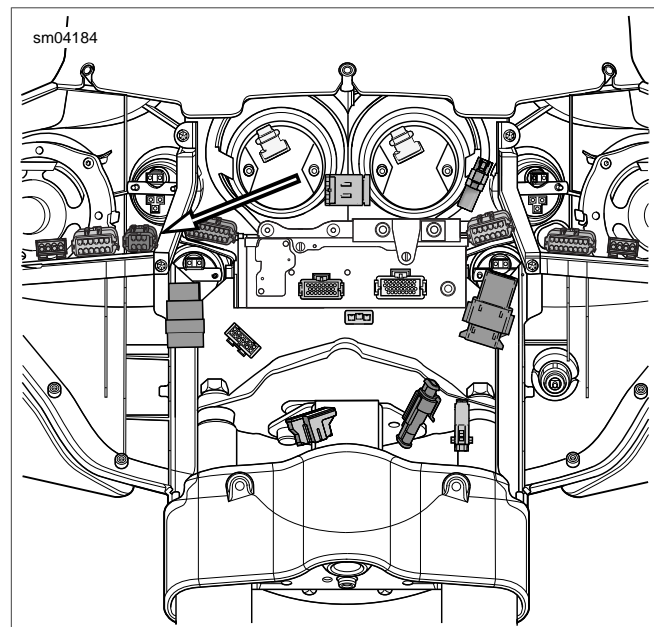


Figure 4-19. Twist Grip Sensor Jumper Harness Connector (FLHX, FLHT/C/U)

12. Gently pull twist grip sensor out of handlebar only as far as necessary to access green twist grip sensor connector. For best results, proceed as follows:
 - a. Straighten conduit on Molex connector end of jumper harness and feed through slot at front of handlebar while pulling.
 - b. If harness sticks inside handlebar while pulling twist grip sensor, pull Molex connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.

NOTE

The external latch on the pin housing of the twist grip sensor connector will break if pried. A damaged latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.

13. Gently insert a small flat blade screwdriver between pin and socket housings as shown in [Figure 4-20](#). Once bottom edge of latch is engaged, separate housings. Do not pivot or rotate screwdriver after insertion or damage to pin housing will occur.
14. See [Figure 4-21](#). Remove twist grip sensor.

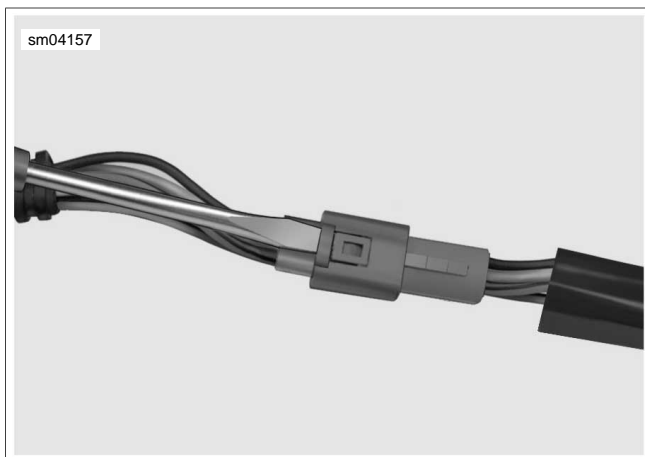


Figure 4-20. Gently Insert Screwdriver to Disconnect Twist Grip Sensor Connector



Figure 4-21. Twist Grip Sensor

INSTALLATION

NOTE

Each twist grip sensor contains the terminals for installation of a heated throttle grip available through P&A. While the seal cap protects the terminals from dirt and moisture, it also serves as a retention device for installation of the throttle grip.

1. Verify that seal cap is installed at end of twist grip sensor. If seal cap is not present, proceed as follows:
 - a. See if seal cap is engaged on index pins inside throttle grip. If found, use a stiff piece of mechanics wire to lasso seal cap and pull free of index pins. Obtain **new** seal cap if damaged or missing.
 - b. Check condition of O-ring on seal cap. As O-ring is not sold separately, install **new** seal cap if O-ring replacement is necessary.
 - c. See [Figure 4-22](#). Install seal cap engaging legs in slots at end of twist grip sensor. For best results, install one leg first. Depressing second leg slightly with a small flat blade screwdriver, push down on seal cap until fully installed.
2. Connect green twist grip sensor connector.
3. See [Figure 4-23](#). Gently pull Molex connector end of jumper harness to draw twist grip sensor into handlebar. Fit index tabs on twist grip sensor into slots in handlebar. One index tab and slot are smaller than the others to prevent improper assembly.
4. Slide the throttle grip over the end of the handlebar. Rotate the grip to verify that internal splines are engaged with those on the twist grip sensor.

NOTE

It is not necessary to hold the throttle grip onto the handlebar. Index pins in grip engage receptacle in seal cap of twist grip sensor to prevent grip from sliding off.

5. Position the lower switch housing beneath the throttle grip, so that ribs at end of throttle grip engage slot in lower switch housing.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Start the upper and lower switch housing screws, but do not tighten. Verify that the wire harness conduit runs in depression at bottom of handlebar.
8. Position the brake lever/master cylinder assembly inboard of the switch housing engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.
9. Align the holes in the handlebar clamp with those in the master cylinder housing and start the lower screw (with flat washer). Position for rider comfort.

NOTE

Do not pull the switch housings so far inboard as to cause the throttle grip to bind or drag on the handlebar. Rotate the throttle grip to verify that it freely returns to the idle position.



Figure 4-22. Install Seal Cap If Removed



Figure 4-23. Install Twist Grip Sensor

- Beginning with the top screw, tighten the handlebar clamp screws to 72-80 **in-lbs** (8-9 Nm).

NOTE

Always tighten the lower switch housing screw first, so that any gap between the upper and lower housings is at the front of the switch assembly.

- Tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).
- Remove the cardboard insert between the brake lever and lever bracket.
- FLHR/C:** Connect twist grip sensor jumper harness connector and install on T-stud on fork stem nut lock plate (right side). Install handlebar clamp shroud and headlamp. See [2.47 HEADLAMP NACELLE: FLHR/C](#).
- FLHX, FLHT/C/U:** Draw twist grip sensor jumper harness connector and conduit forward to front of upper fork bracket, and then route under right radio support bracket to area behind fairing support brace. Connect connector

and install on T-stud at top of fairing support brace (inboard side). Install outer fairing. See [2.37 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U](#).

- FLTR:** Connect twist grip sensor jumper harness connector. Install outer fairing and bezel. See [2.41 UPPER FAIRING AND WINDSHIELD: FLTR](#) and [2.42 INSTRUMENT BEZEL: FLTR](#), respectively.
- If present, install two cable clips on right side handlebar switch conduit into holes in handlebar.
- Install main fuse.
- Install left side cover.
- Install left side saddlebag. See [2.29 SADDLEBAGS](#).

NOTE

*Whenever a **new** twist grip sensor (or ECM) is installed, place the engine run/stop switch in the RUN position and turn the ignition/light keyswitch to IGNITION and then back to OFF four times (without starting engine). Allow at least three seconds to elapse between ignition cycles. As the ECM uses the first four ignition cycles to establish the optimum idle speed, there may be initial performance problems if the procedure is not performed, such as high idle or hesitation when the throttle is opened.*

- Turn the ignition/light key switch to IGNITION and apply brake lever to test operation of brake lamp.

TWIST GRIP SENSOR JUMPER HARNESS

Removal

- Remove twist grip sensor.
- Obtain length of strong flexible mechanics wire.

NOTE

Be sure that mechanics wire is of sufficient strength to pull conduit and connector through handlebar without breaking. Wire length must also be long enough, so that free end is not lost in handlebar when pulled.

- See [Figure 4-24](#). Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled.
- Gently pull Molex connector end of jumper harness to draw conduit, connector and mechanics wire out through slot at front of handlebar. If harness sticks inside handlebar, pull on twist grip sensor connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until free. Remove mechanics wire from jumper harness.

Installation

- Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled.

2. Gently draw connector and conduit back through handlebar. For best results, proceed as follows:
 - a. Guide leading edge of connector and conduit through slot at front of handlebar. Keep harness straight and feed through slot while pulling.
 - b. If harness sticks inside handlebar, pull Molex connector end to retract it slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.
3. Remove mechanics wire from jumper harness.
4. Install twist grip sensor.

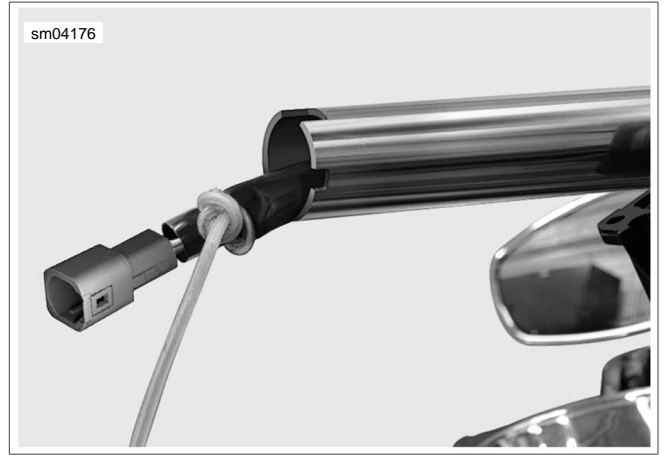


Figure 4-24. Fix Mechanics Wire to Twist Grip Sensor Jumper Harness

THROTTLE CONTROL ACTUATOR (TCA)

4.11

GENERAL

NOTE

See [Figure 4-25](#). The TCA is not sold separately. Damage or failure requires complete replacement of the induction module. Also note that tampering or removing TCA cover voids warranty.

Refer to the electrical diagnostic manual for information on the function and testing of the TCA.

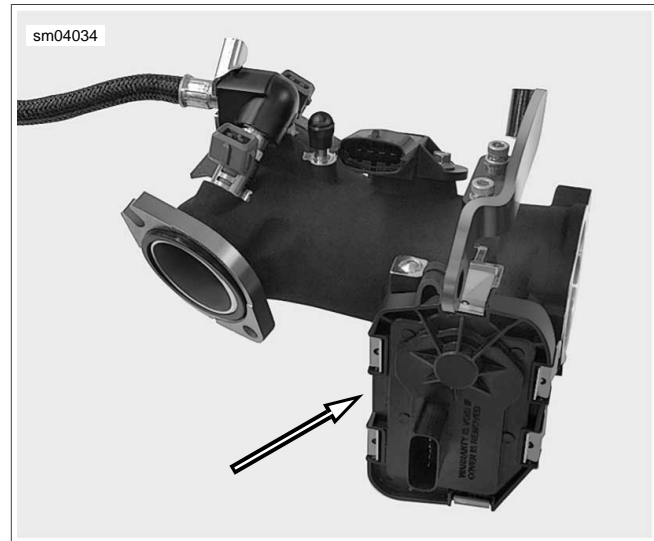


Figure 4-25. TCA

ENGINE TEMPERATURE SENSOR (ET)

4.12

REMOVAL

1. Remove main fuse. See [7.6 SYSTEM FUSES AND RELAYS](#).
2. Loosen horn bracket bolt to front cylinder head. Remove horn bracket bolt (with flat washer) from rear cylinder head and swing horn bracket forward.
3. Pull back boot at back of front cylinder and remove ET sensor connector [90].
4. See [Figure 4-26](#). Remove sensor.

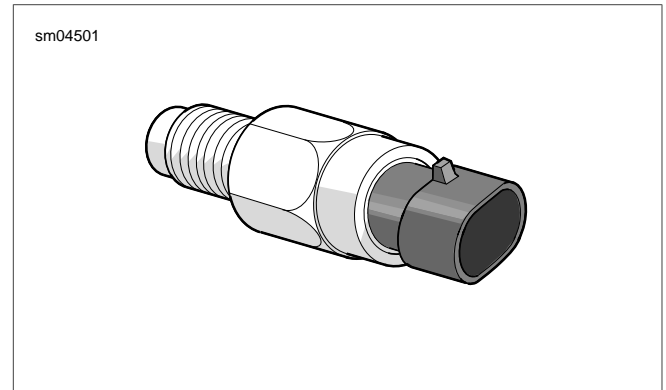


Figure 4-26. ET Sensor

INSTALLATION

1. Hand start **new** ET sensor into bore at back of front cylinder.
2. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
3. Install ET sensor connector [90]. Pull boot over connector.
4. Install main fuse. See [7.6 SYSTEM FUSES AND RELAYS](#).

INDUCTION MODULE

4.13

REMOVAL

| PART NUMBER | TOOL NAME |
|-------------|------------------------|
| HD-47250 | INTAKE MANIFOLD WRENCH |

1. Remove fuel tank. See [4.5 FUEL TANK](#).
2. Remove air cleaner and backplate. See [4.4 AIR CLEANER ASSEMBLY](#).
3. See [Figure 4-27](#). Pull purge tube from fitting (2) at top of induction module (California models only).
4. Remove TMAP sensor connector (5).
5. Remove front fuel injector connector (1) and rear fuel injector connector (6).
6. Remove TCA connector (4). Cut anchored cable strap to release connector conduit from front right side of induction module.
7. Remove right side screws from front and rear cylinder head flange adapters. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250). See [Figure 4-28](#).
8. Loosen left side screws from flange adapters. Slots in flanges make removal of screws unnecessary. For best access, proceed as follows:
 - a. Loosen horn bracket screw to front cylinder head. Remove horn bracket screw (with flat washer) from rear cylinder head and swing horn bracket forward.
 - b. Disconnect terminals from horn spade contacts and release harness conduit from J-clamp.
 - c. Remove ET sensor connector [90].
9. Slide induction module out right side of motorcycle.
10. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.

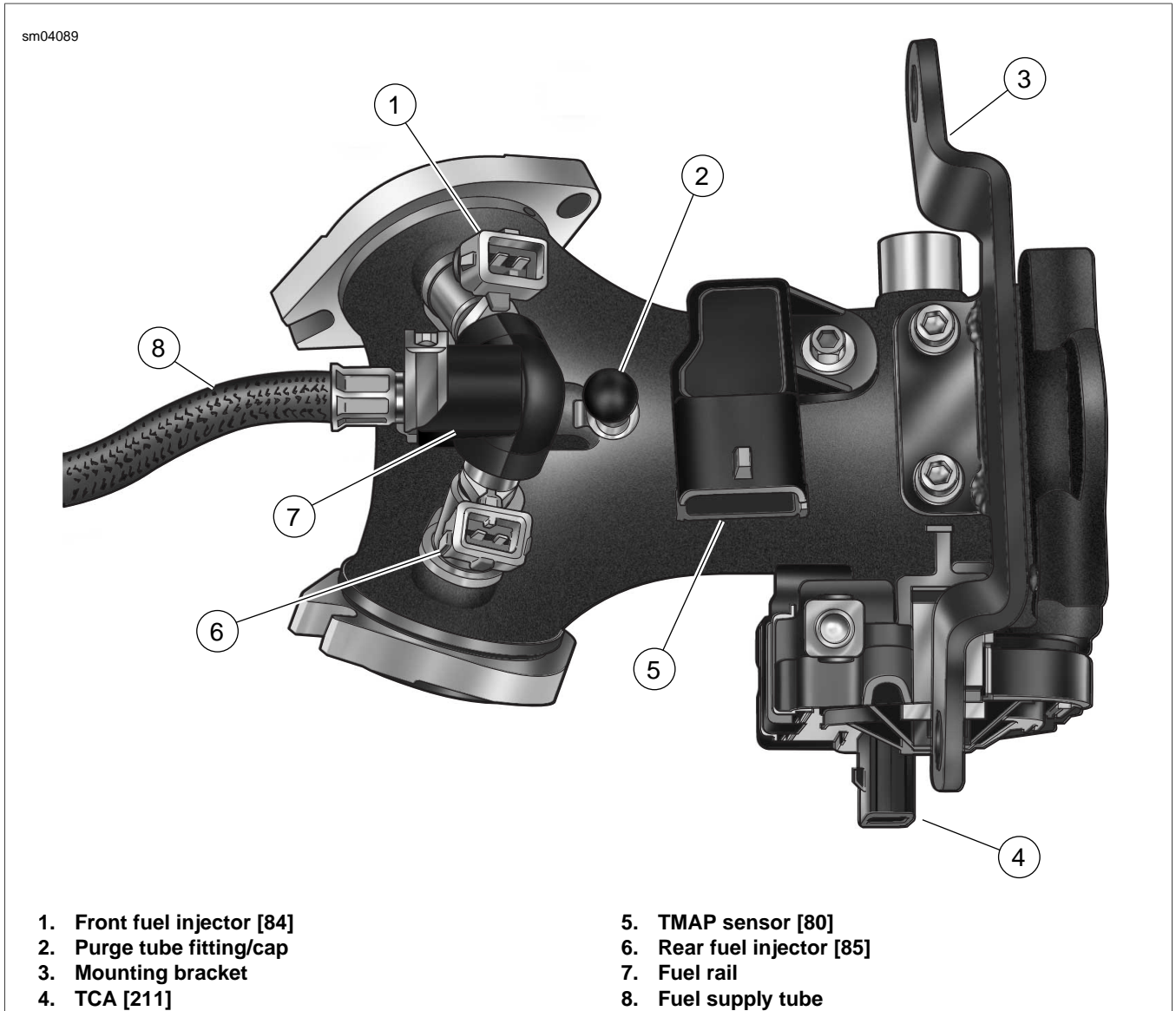


Figure 4-27. Induction Module Assembly

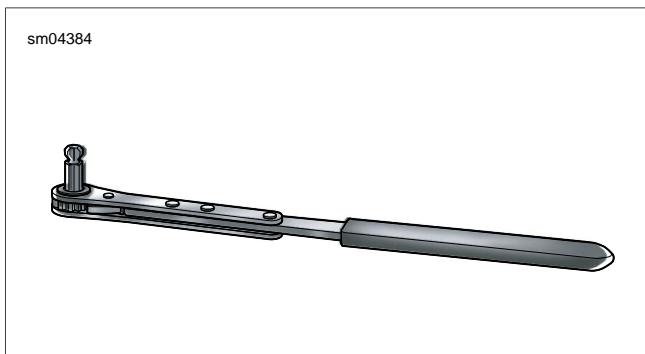


Figure 4-28. Intake Manifold Wrench

INSTALLATION

| PART NUMBER | TOOL NAME |
|-------------|------------------------|
| HD-47250 | INTAKE MANIFOLD WRENCH |

1. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module.
2. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.
3. Orient the induction module as shown in [Figure 4-27](#). Slide induction into position so that open-ended slots on flange adapters engage socket screws on left side.
4. Start right side screws. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250).
5. Use mounting bracket to properly locate induction module. Start two breather bolts to fasten mounting bracket to front and rear cylinder heads.

6. Tighten right side flange adapter screws until snug. Tighten left side screws to 96-144 **in-lbs** (10.9-16.3 Nm).
7. Tighten right side screws to 96-144 **in-lbs** (10.9-16.3 Nm).
8. If parts were removed for access to left side flange adapter screws, proceed as follows:
 - a. Install ET sensor connector [90] at back of front cylinder. Pull boot over sensor.
 - b. Install terminals onto horn spade contacts. Capture harness conduit in J-clamp.
 - c. Fasten horn bracket to rear cylinder head. Tighten front and rear horn bracket screws to 35-40 ft-lbs (48-54 Nm).
9. Remove breather bolts to release mounting bracket from front and rear cylinder heads.
10. See [Figure 4-27](#). Install rear fuel injector connector (6) and front fuel injector connector (1).
11. Install TMAP sensor connector (5).
12. Route TCA connector and conduit straight down between induction module and front cylinder staying inboard of mounting bracket. Install **new** anchored cable strap in hole at front right side of induction module and loosely capture TCA conduit.
13. Route conduit rearward under induction module and install TCA connector (4). Tighten cable strap and cut any excess cable strap material.
14. Connect purge tube to fitting (2) (California models only). On non-California models, inspect rubber cap for tears, cracks or signs of deterioration. Replace cap if damaged or missing.
15. Install fuel tank. See [4.5 FUEL TANK](#).
16. Install backplate and air cleaner. See [4.4 AIR CLEANER ASSEMBLY](#).

TEMPERATURE MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP)

4.14

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the temperature/manifold absolute pressure (TMAP) sensor.

REMOVAL

1. Remove fuel tank. See [4.5 FUEL TANK](#).
2. Remove hex screw to release TMAP sensor bracket from induction module. Discard screw.
3. See [Figure 4-29](#). While rotating TMAP sensor slightly, pull straight up to release pressure port from hole in induction module.

INSTALLATION

1. Inspect O-ring on pressure port for cuts, tears or signs of deterioration. Install **new** O-ring if necessary.
2. With the electrical connector facing toward the rear of the induction module, insert pressure port on TMAP sensor into hole in induction module.
3. Align hole in TMAP sensor bracket with threaded hole in induction module.
4. Install **new** hex screw and tighten to 84-108 **in-lbs** (9.5-12.2 Nm).
5. Install fuel tank. See [4.5 FUEL TANK](#).

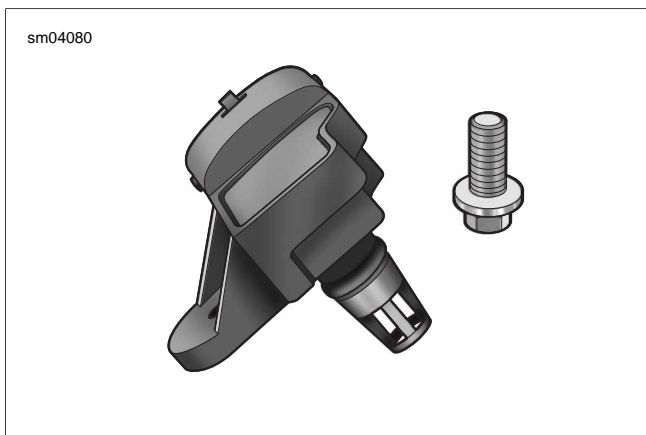


Figure 4-29. TMAP Sensor

OXYGEN SENSORS (O2)

4.15

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the oxygen sensor (O2).

REMOVAL

| PART NUMBER | TOOL NAME |
|-------------|------------------|
| HD-48262 | O2 SENSOR SOCKET |

1. Remove main fuse. See [7.6 SYSTEM FUSES AND RELAYS](#).
2. **Front Exhaust Header:** Cut cable straps and disconnect front O2 sensor connector [138], 2-place Amp (Tyco), behind cross brace between front frame downtubes.
3. **Rear Exhaust Header:** Disconnect rear O2 sensor connector [137], 2-place Amp (Tyco), under starter.
4. See [Figure 4-31](#). Remove O2 sensor using O2 SENSOR SOCKET (Part No. HD-48262) with drive extension.

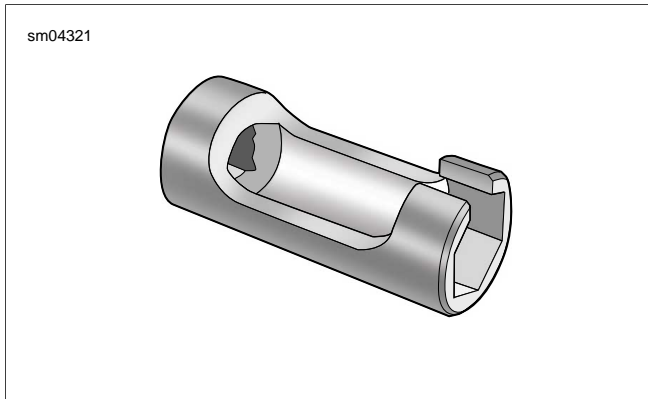


Figure 4-30. O2 Sensor Socket (HD-48262)



Figure 4-31. Remove/Install Front O2 Sensor

INSTALLATION

| PART NUMBER | TOOL NAME |
|-------------|------------------|
| HD-48262 | O2 SENSOR SOCKET |

NOTES

- Do not install sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred.
 - Replacement sensors have anti-seize pre-applied to the threads. Apply a thin coat of anti-seize lubricant to the threads of sensors that are to be reused. Never use any other lubricant or sealant.
1. If reusing O2 sensor, install **new** seal washer and apply a light coating of anti-seize lubricant to threads.
 2. Start O2 sensor into threaded boss on exhaust header.
 3. Using O2 SENSOR SOCKET (Part No. HD-48262), tighten to 30-44 ft-lbs (40.7-59.7 Nm).

NOTE

Verify connector halves are clean and free of grease or other contaminants. NEVER apply dielectric grease, cleaning agents, or any other lubricants, sealants or fluids to O2 sensor connectors. Any such application will result in signal trouble and sensor failure.

4. **Front Exhaust Header:** Connect front O2 sensor connector [138], 2-place Amp (Tyco). Secure connector and harnesses to back of cross brace with **new** cable straps.
5. **Rear Exhaust Header:** Connect rear O2 sensor connector [137], 2-place Amp (Tyco), and tuck under starter.
6. Install main fuse. See [7.6 SYSTEM FUSES AND RELAYS](#).

FUEL INJECTORS

4.16

GENERAL

⚠ WARNING

Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

Refer to the electrical diagnostic manual for information on the function and testing of the fuel injectors.

REMOVAL

1. Remove induction module. See [4.13 INDUCTION MODULE](#).
2. Remove T25 TORX screw to release fuel supply tube clamp from fuel rail.
3. See [Figure 4-32](#). Rotate fuel supply tube clamp 90 degrees in a clockwise direction and then remove from groove in fuel supply tube fitting.
4. Pull fuel supply tube from fuel rail bore and remove two O-rings and two sealing washers. Discard O-rings and sealing washers.
5. Pull fuel injectors with attached fuel rail from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
6. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
7. Remove O-rings from fuel injectors. Discard O-rings.

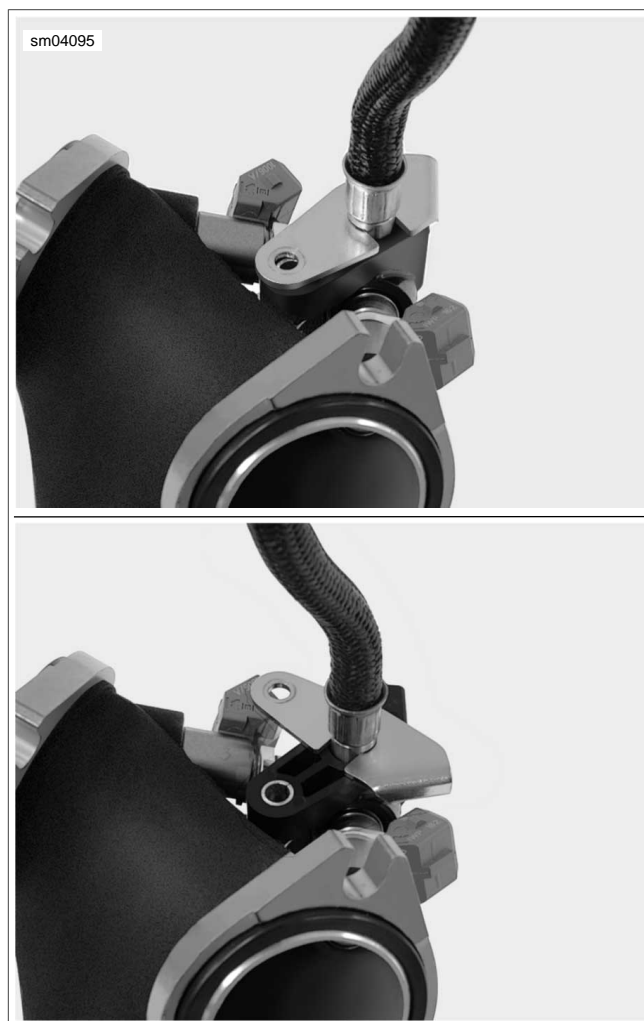


Figure 4-32. Rotate Fuel Supply Tube Clamp

INSTALLATION

1. Apply a very light film of clean engine oil to **new** O-rings. Install O-rings on fuel injectors.
2. Push open end of fuel injectors (opposite cone spray) into fuel rail.
3. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push cone spray end of fuel injectors into bores of induction module until slot at bottom of fuel rail engages machined tab at top of induction module.
4. Install **new** O-ring and sealing washer in fuel rail bore. Install second O-ring and second sealing washer.
5. Push fuel supply tube into fuel rail bore.
6. Rotate fuel supply tube in a clockwise direction until tapered end of quick connect fitting is pointing upward. Now rotate tube an additional 90°, so that fitting is pointing rearward (toward TCA on induction module).
7. Engage slot on fuel supply tube clamp in groove of fuel supply tube fitting. Rotate fuel supply tube clamp 90° in a

counter-clockwise direction until curled lip on fuel supply tube clamp engages flange on fuel rail.

8. Align thru holes in fuel rail and fuel supply tube clamp with threaded hole in induction module. Install T25 TORX screw and tighten to 66-82 **in-lbs** (7.5-9.3 Nm).
9. Install induction module. [4.13 INDUCTION MODULE](#).