

## 4. REMOVAL & INSTALLATION

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## **Section 4. Removal & Installation GFI Natural Gas Service Manual**

### **GENERAL NOTES:**

- The Removal & Installation section of this manual is intended to give specific directions for the service, removal and replacement of the GFI Natural Gas components. Procedures for new installations are not covered. Contact the Customer Service Department at GFI Control Systems, Inc. at 1-800-667-4275 for installation information.
- Part numbers are given in the Illustrated Parts List in Section 6. Parts may be ordered from GFI Control Systems, Inc.
- Torque attaching hardware to the proper specification given with the procedures.
- All attaching hardware is rated as grade 8 unless otherwise noted.
- For fittings with O-rings, always inspect O-ring and replace as required when seal is loosened or removed.
- Lightly coat O-rings with O-ring lubricant before installing, do not use a silicone based grease. This prevents binding and damage during tightening.
- When disassembly requires removing locking hardware, always discard lockwashers and or lock nuts and replace with new hardware.
- Tighten Gyrolock fittings according to the instructions given on page 4-9.

### **WORKING WITH THE NATURAL GAS SYSTEM**

- Always work in a well ventilated area.
- Extinguish all smoking material.
- Cover exposed open tubes and ports while vehicle is in service.
- Always bleed or vent system as required before attempting to remove or detach a fitting. This applies to the high and low pressure components.
- Tank must be vented and emptied before being removed from vehicle.
- Always replace the copper sealing washer if the low pressure hoses fittings are loosened or removed. **NEVER REUSE THE COPPER WASHER.**
- **DO NOT** repair, patch or splice hoses and/or lines. These parts must be replaced in whole.
- **DO NOT** disassemble or remove fittings on the low pressure hoses. The fittings have special crimped fittings to ensure proper seals.
- Always leak check any fittings after repairs have been done.

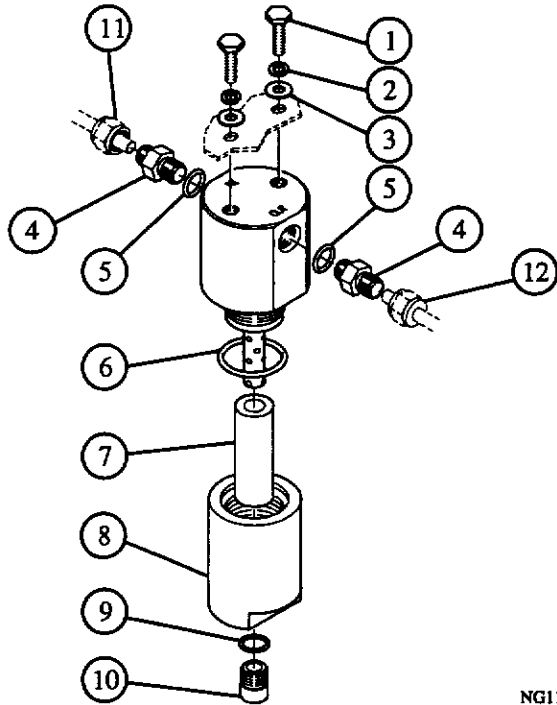
### **WORKING WITH THE ELECTRICAL SYSTEM**

- Always disconnect both battery terminals, starting with the negative (-) post.

*NOTE: When the battery power is disconnected, the gasoline PCM adaptive learn functions are reset for gasoline operation. The vehicle may exhibit poor performance in gasoline mode after battery is reconnected and engine started. Drive the vehicle approximately 5 to 10 minutes in gasoline mode under varying conditions from idle to acceleration. This will reestablish the adaptive learn settings. Disconnecting the battery power does not affect the natural gas computer.*

- **DO NOT CUT WIRES** to remove components from vehicle. Disassemble connectors and remove component harness assembly.
- **DO NOT CUT GROUND WIRES.** Remove ground wires from conduit and ground points. When replacing, always reroute and attach to the original ground points.

**4.1 COALESCENT FILTER**



NG117

INDEX	DESCRIPTION	TORQUE
1	Bolt, 5/16-18 UNC x 1 1/4"	12-18 ft-lbs
2	Lock Washer, 5/16"	
3	Flat Washer, 5/16"	
4	Fitting, Filter	
5	O-Ring, Filter Fitting	
6	O-Ring, Filter Bowl	
7	Filter Element	
8	Filter Bowl	
9	O-Ring, Drain Plug	
10	Drain Plug	
11	Fitting Nut, Hardline to Regulator	Gyrolok
12	Fitting Nut, Hardline to Quarter turn	Gyrolok

**NOTE:** After all repairs, fittings must be leak tested. (Refer to Section 5).

**CAUTION:** The system must be bled prior to beginning service or repair. (Refer to Section 5). Components under high pressure can become a projectile.

**4.1.1 COALESCENT FILTER SERVICING**

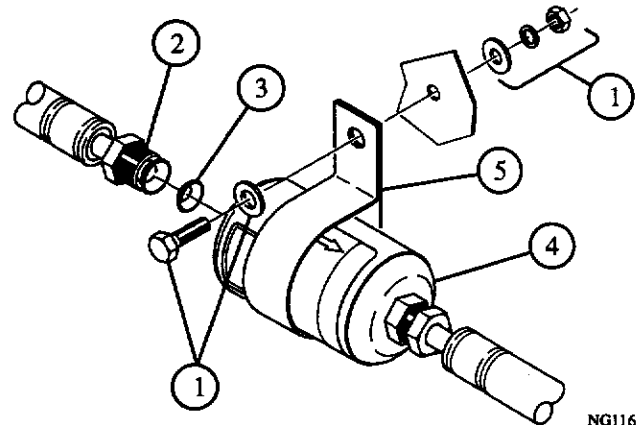
1. Close quarter-turn valve and bleed system.
2. Slowly crack open fitting (11 or 12) on filter and allow any trapped gas to escape.
3. Remove the drain plug (10) with a 1/4" allen wrench and drain until liquid is removed. Replace drain plug when completed.
4. Using bottom flats on bowl (8), unscrew bowl.
5. Clean bowl and clean or replace filter element (7) as required.
6. Reassemble, replace O-rings (6, 9).

**4.1.2 FILTER ASSEMBLY REPLACEMENT**

1. Close quarter-turn valve and bleed system.
2. Remove hardline (11, 12) from filter assembly.
3. Remove bolts (1) and washers (2, 3).
4. For installation, follow removal procedures in reverse order. Tighten fasteners to specifications.

**NOTE:** Fittings (4) are not included with assembly. Existing fittings may be reused. Replace O-rings as required.

**4.2 IN LINE FILTER**



NG116

INDEX	DESCRIPTION	TORQUE
1	Attaching Hardware	
2	Fitting Nut	25-30 ft-lbs
3	Copper Washer	
4	In Line Fuel Filter	
5	Filter Clamp	

**CAUTION:** The fuel filter used with the GFI system is not interchangeable with gasoline filters.

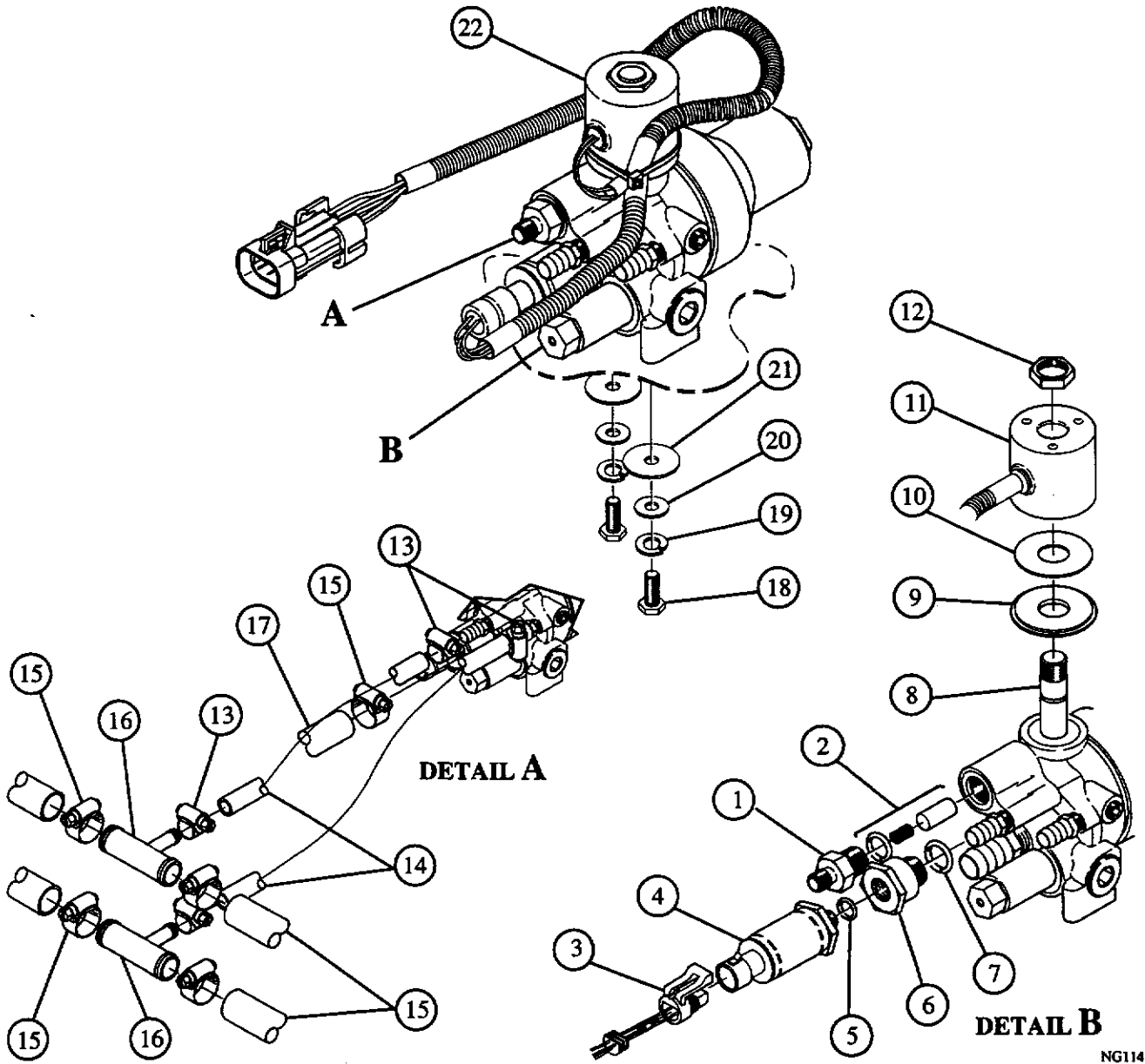
1. Bleed system. See section 5.
2. Slowly crack open low pressure fitting (2) on filter and allow any trapped gas to escape. Remove fittings and DISCARD COPPER WASHER SEALS (3).
3. Remove attaching hardware (1), clamp (5) and filter (4).
4. For installation, follow removal procedures in reverse order.

**NOTE:** NEVER REUSE COPPER WASHERS. If a fitting is removed or loosened, ALWAYS replace existing washer with a new washer to ensure a good seal. Always use flats on filter to tighten fittings, never use filter body.

**CAUTION:** The fuel flow through the filter is directional. Ensure that mounting allows that IN is from the regulator and OUT is to the comp valve.

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## 4.3 REGULATOR ASSEMBLY



NG114

INDEX	DESCRIPTION	TORQUE	INDEX	DESCRIPTION	TORQUE
1	Fuel Inlet Fitting	15 ft-lbs	12	Nut, Coil	72-88 in-lbs
2	Filter Replacement Kit		13	Clamp, M6	
3	Connector		14	Coolant Hose	
4	FSP Sensor	15 ± 2 ft-lbs	15	Clamp, M10	
5	O-Ring		16	Tee	
6	FSP Sensor Adapter	15 ± 2 ft-lbs	17	Vent Hose	
7	O-Ring		18	1/4-20 UNC Bolt	10-15 ft-lbs
8	Core, Tube		19	Lock Washer	
9	Washer, Steel		20	Flat Washer	
10	Washer, Rubber		21	Fender Washer	
11	Harness, HSP Coil		22	Regulator Assembly	

**4.3.1 REGULATOR REPLACEMENT**

1. Close quarter-turn valve and bleed system. (Refer to Section 5).
2. Slowly crack open line fitting on coalescent filter and allow any trapped gas to escape.
3. Remove low pressure fuel line. DISCARD COPPER WASHER.
4. Clamp off coolant lines (14) and remove from regulator.
5. Disconnect connector P38 from FSP Sensor.
6. Remove bolts (18), washers (19, 20 & 21) and regulator assembly (22).
7. For installation, follow removal procedures in reverse order. Torque hardware to specification.

**NOTES:**

1. Use only NEW copper washers.
2. Coolant lines may be attached to either coolant fitting of regulator. There is no preferred coolant flow direction.
3. Ensure that all coolant hoses are routed to avoid contact with engine mount bolts or other components.

**4.3.2 FUEL INLET FITTING AND FILTER**

A special fuel inlet fitting for 1/4" tubing is installed as standard on the regulator. When more than 3000 PSI is stored on board or applications where there is a long distance between the cylinder(s) to the regulator, a special fitting for 3/8" tubing is available separately. The following steps are for the replacement of the inlet fitting and/or filter.

**NOTE:** The Heavy Duty "Large Body" regulator is supplied with the 3/8" tube fitting as standard.

1. Close the quarter-turn valve and bleed system (refer to Section 5-2).
2. Slowly crack open the fuel inlet fitting and allow any trapped gas to escape.
3. Remove hardline from fitting assembly.
4. Remove fitting (1).
5. Remove and discard existing spring, filter and O-ring (2).
6. Clean debris from filter cavity and threads.
7. Clean threads of fitting as required.
8. Replace existing filter if required then locate filter inside regulator filter boss.
9. Lubricate new O-ring and install on fitting gland.
10. Insert fitting and spring into regulator and hand tighten fitting.
11. Torque fitting to 15 ft-lbs. DO NOT OVER TIGHTEN.
12. Check for and eliminate external leaks.

**4.3.3 FSP SENSOR REPLACEMENT**

1. Close quarter-turn valve and bleed system. (Refer to Section 5).
2. Slowly crack open hardline fitting on regulator and allow any trapped gas to escape. Remove hardline from regulator if required.
3. Clamp off coolant lines (14), remove from regulator.
4. Remove low pressure fuel line. DISCARD COPPER WASHER.
5. Remove connector from end of FSP sensor (4).

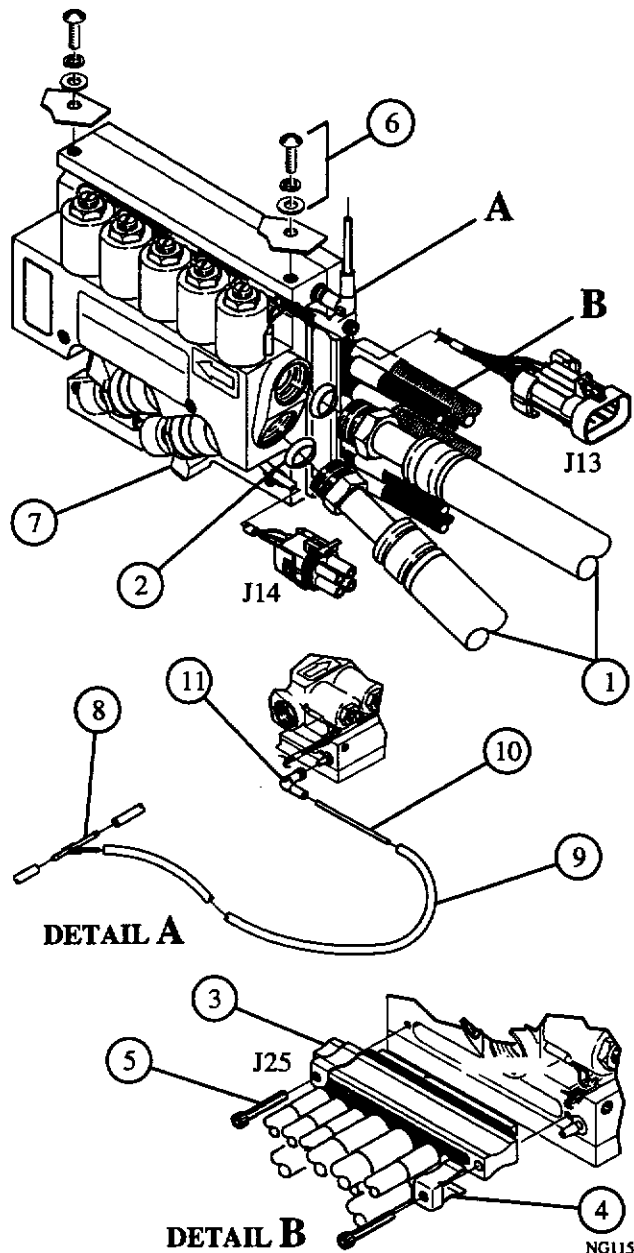
**NOTE:** Some older model regulators require a 1 1/16" thin wall socket, new models require a 1" thin wall socket. Refer to Illustrated Parts Catalog for appropriate socket part numbers.

6. Remove FSP sensor and discard.
7. If the FSP sensor adapter (6) comes loose, remove the adapter using a 7/8" socket. Clean cavity and adapter threads. Lubricate new O-ring (7) and install on adapter gland. Install adapter and hand tighten. Torque adapter to 15± 2 ft-lbs.
8. Lubricate FSP sensor O-ring (5) and thread sensor into adapter. Hand tighten sensor.
9. Torque FSP sensor (4) to 15 ± 2 ft-lbs.
10. Reconnect lines and hoses previously removed. ALWAYS USE NEW COPPER WASHERS.
11. Remove clamps from coolant lines and check coolant level.
12. Check for and eliminate any leaks.

**4.3.4 HIGH PRESSURE SOLENOID (HPS) COIL**

1. Close quarter-turn valve and bleed system.
2. Disconnect J3/P3 and connector (3) to FSP sensor (4).
3. Loosen and remove nut (12) from coil.
4. Remove coil harness (11) and washers (9 & 10).
5. Clean off old Loctite from threads of core tube (8) using a wire brush.
6. Position new washers (9 & 10) with coil (11) on core tube (8) as shown. Position harness away from spring tower.
7. Place 2 drops of Loctite 242 on thread of core tube and install retaining nut (12). Torque between 72-88 in-lbs. Reattach connectors.

**4.4 COMPUVALVE ASSEMBLY**



**4.4.1 REMOVAL**

1. Bleed system. See section 5.
2. Disconnect battery.
3. Slowly crack open low pressure fittings - allow any trapped gas to escape. Remove fittings and DISCARD COPPER WASHER SEALS.
4. Disconnect MAP Takeoff from compuvalve.
5. Disconnect J/P 13 and J/P 14 (connectors from main wire harness to compuvalve injectors).
6. Remove screws (5) and disconnect electrical connector J25 from compuvalve. Retain hardware.
7. Remove attaching hardware (6) that attaches compuvalve assembly.
8. Remove compuvalve (7) from vehicle.

**NOTE:** If system is to be disconnected for an extended period of time, cover all open hose fittings and electrical connections to avoid contamination.

**4.4.2 INSTALLATION**

1. For installation, follow removal procedures in reverse order. Tighten fasteners to specifications.

**NOTES:**

1. NEVER reuse copper washers in low pressure fittings. ALWAYS USE NEW WASHERS.
2. When reinstalling connector J25:
  - Coat outside of connector with a standard dielectric grease.
  - Press ENDS and CENTER of connector into the compuvalve fully. DO NOT use the attaching screws to seat the connector in position. The screws are for retention only.
  - Attach connector using existing saddle brackets and 8-32 screws. Do not over tighten.

**4.4.3 MAP TAKEOFF**

**4.4.3.1 RUBBER HOSE REPLACEMENT**

1. Remove ties and hose to be replaced.
2. Cut replacement hose to proper length for routing from tee to compuvalve.
3. Push hoses on connecting parts and tie as required.

**4.4.3.2 DAMPER TUBE REPLACEMENT**

1. Remove damper tube (10).
2. Cut replacement damper tube to the length specified in the specific vehicle supplement. Inspect ends of tube for roughly cut ends. Ends should be smooth and clean. Passage must be free and clean of obstructions.
3. Insert tube into rubber elbow (11) as far as possible. Do not use lubricant to assemble elbow & tube.
4. Insert other end of tube approximately 1" into hose (9). Do not use lubricant to assemble hose & tube.

INDEX	DESCRIPTION	TORQUE
1	Hose, Low Pressure	25-30 ft-lbs
2	Copper Washer	
3	Main Wire Harness	
4	Saddle, Bulkhead Connector	
5	8-32 Screw	15-20 in-lbs
6	Attaching Hardware	10-15 ft-lbs
7	Compuvalve Assembly	
8	Tee, Vacuum	
9	Hose, Vacuum	
10	Tube, Vacuum Dumper	
11	Elbow, Vacuum	

**4.5 HOSE ASSEMBLY**

**4.5.1 COOLANT HOSE**

**NOTE:** When replacing base vehicle coolant hoses DO NOT move regulator coolant tees (16). These must be on different hoses for proper coolant circulation. DO NOT INSERT TEES INTO THE SAME HOSE. Otherwise, icing on hoses and regulator may occur and will cause system malfunction. Clamp heater hoses closed or drain coolant system.

1. Remove clamp (13) and hose (14) from regulator port and tee (16). Hose will have coolant inside, allow to drain (See Section 4.3, page 4-4).
2. Cut hose to proper length for routing from tee to regulator.
3. Push hose onto tee and coolant fitting of regulator.
4. Secure all coolant hoses to fittings and tees with worm gear clamps (13). Ensure that clamp is positioned over the tube portion of the fitting and does not clamp over the fitting barb. Do not over tighten clamps.
5. Refill coolant system or unclamp hoses. Check and eliminate any coolant leaks, fill as required.

**4.5.2 FUEL HOSE**

**CAUTION:** NEVER attempt to repair hose assemblies. These hoses have special crimped fittings and must be replaced as an assembly.

1. Close quarter turn valve and bleed system. (Refer to Section 5).
2. Slowly crack open and disconnect fitting of fuel hose (1). DISCARD COPPER WASHERS.
3. Assemble hose (1) as required. See section 4.5.2.1.

**NOTE:** If hose is connected to spray bar or disk, spray bar or disk must be replaced with hose. Assemble spray bar and disk according to instructions in figure 4.6 & 4.7.

4. Thoroughly clean any dirt and debris from threads of fitting and sealing surface.
5. Insert NEW copper washer (2) in fitting ports.
6. Engage fitting nut of hose assembly into port threads and position hose as required for routing. Hand tighten then torque nut to specification.

**NOTE:** When tightening nut, fitting and hose may "travel" clockwise. Position hose and fitting a few degrees counter clockwise from desired position. If fitting is loosened or removed, always REPLACE copper washer. This is to ensure a good seal.

7. Check for and eliminate external leaks. DO NOT tighten fittings to stop leaks. Use a proper torque, clean threads and a new copper washer.

**4.5.2.1 HOSE PREPARATION**

The following steps apply to hoses fitted with the GFI fittings and ferrules:

(For the following steps, the term fitting applies to fittings, splitters and spray nozzle fittings.)

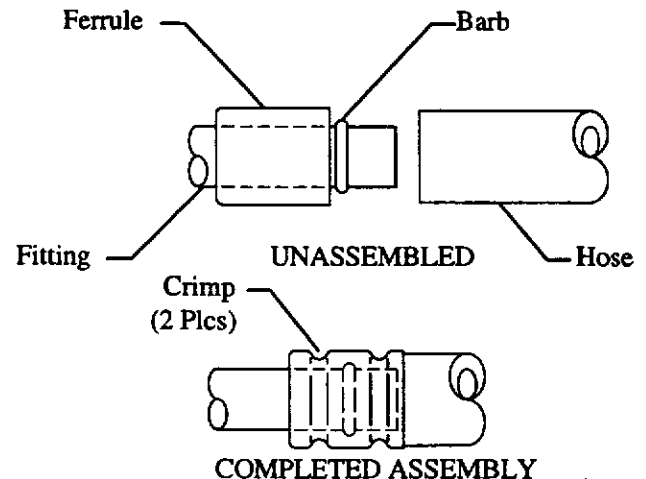
1. Cut hose to length required to provide proper routing.

**NOTE:** Hose lengths, for hoses from compuvalve to discharge nozzle, are given in specific vehicle supplements. Factory calibrations use this measurement.

2. Slide ferrule onto selected fitting and mark fitting with the position of the ferrule that will put the barb centered in the ferrule.
3. Slide hose onto selected fitting.
4. Slide ferrule completely onto hose.
5. Position hose and ferrule over barb on fitting by aligning ferrule with mark made in step 2 and crimp ferrule on each side of barb. Do not put crimp on top of barb.

**CAUTION:** When using crimping tool listed in the parts catalog, apply crimp then rotate fitting and hose 90° and crimp a second time to create the proper crimp for good sealing.

6. Repeat steps 2 through 5 for other end of hose.

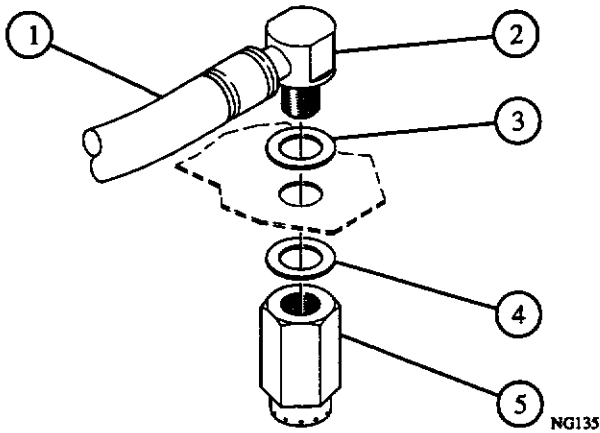


**Hose End Preparation.**

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**Section 4. Removal & Installation GFI Natural Gas Service Manual**

**4.6 SPRAY DISK**



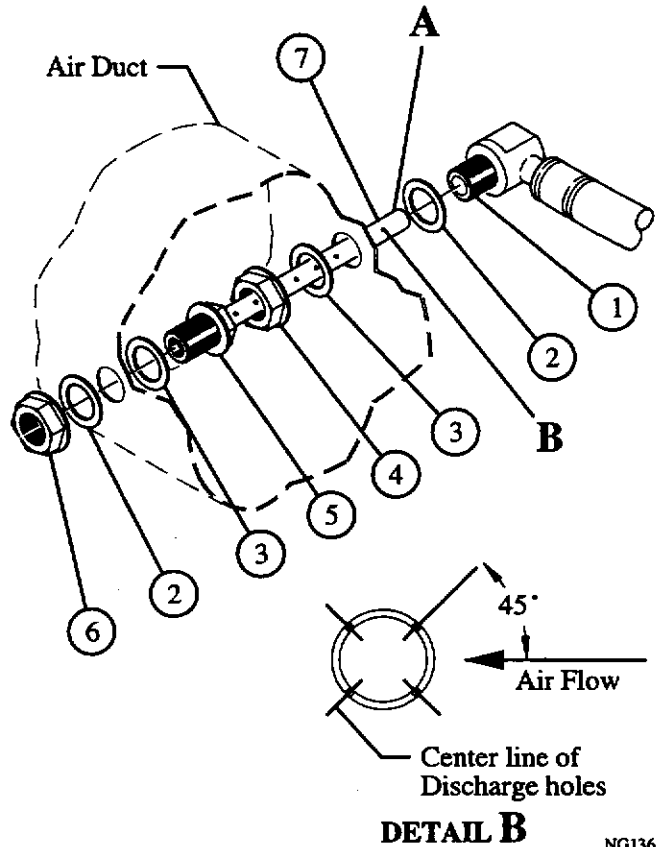
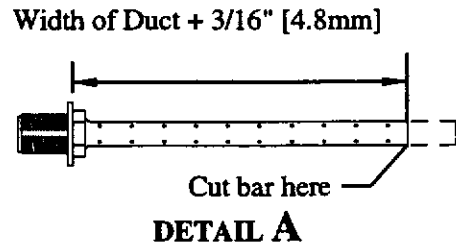
INDEX	DESCRIPTION	TORQUE
1	Hose, Low Pressure	5 ft-lbs
2	Nozzle Fitting	
3	Rubber Washer	
4	Steel Washer	
5	Spray Nozzle	

**NOTE:** If only removing nozzle for service, it is not necessary to replace assembly. If it is necessary to replace hose attached to spray nozzle fitting, the nozzle must be replaced.

1. Detach spray nozzle (5) from nozzle fitting (2).
2. Trim replaced nozzle to the length of the nozzle being removed. Cut and finish surface squarely for good sealing. THOROUGHLY CLEAN filings and debris from nozzle (inside and out).
3. Prepare hose (1) from compulvalve to spray nozzle as previously described.
4. Place rubber washer (3) over threaded portion of nozzle fitting (2) and insert threaded portion into hole.
5. Place steel washer (4) over threaded portion of fitting and apply Loctite 242 onto bottom 2 threads. Then thread nozzle onto fitting. Loosely hand tighten nozzle.
6. Position hose and nozzle in desired orientation and torque nozzle to 5 ft-lbs. Do not over tighten.

**CAUTION:** Use only the wrench flats to tighten fitting and nozzle. Always use the proper tools. Always ensure an air tight fitting around washers to avoid dirt and unmixed air from entering.

**4.7 SPRAY BAR**



INDEX	DESCRIPTION	TORQUE
1	Nozzle Fitting	5 ft-lbs
2	Rubber Washer	
3	Steel Washer	
4	Nut	
5	Spray Bar	
6	Nut	
7	Tube	

**NOTE:** If only removing nozzle for service, it is not necessary to replace assembly. If it is necessary to replace hose attached to spray nozzle fitting, the nozzle must be replaced.

1. Remove nut (4) from nozzle fitting (1) and set elbow & hose assy aside.
2. Remove nut (6) from spray bar (5).
3. Remove spray bar (5) from tube (7).



4. Measure width of duct at alignment holes. Do not distort duct profile during this step (e.g. do not squeeze duct to be narrower or wider than when installed).
5. Add 3/16" [4.8 mm] to length in step 4; then, measure spray bar and mark new length.
6. Cut and deburr unthreaded end of spray bar at mark made in step 5. Thoroughly clean and remove all debris and filings from spray bar.
7. Prepare hose and fitting as described in section 4.5.2.1.
8. Place nut (4) and steel washer (3) over unthreaded end of spray bar and a steel washer over threaded portion of spray bar.
9. Slip unthreaded end of spray bar into hole in duct on side that hose and fitting will be. Slide threaded end through other hole in duct.
10. Place rubber washer over threaded end of spray bar. Apply Loctite 242 or equivalent onto threads then loosely hand tighten nut on threads.
11. Position spray bar so that discharge holes are oriented 45° to air flow (refer to detail B). Torque nut to 5 ft-lbs. A 1/4" hex key hole at the end of the threads can be used to hold bar in position while tightening.
12. Place rubber washer (2) over threads of fitting and apply Loctite 242 or equivalent to bottom two threads.
13. Place fitting over unthreaded portion of spray bar and through hole in duct.
14. Place washer and nut from step 6 onto thread of fitting and loosely hand tighten.
15. Position hose and fitting for desired routing then torque nut to 5 ft-lbs. Wrench flats are provided on fitting to hold fitting in position.
16. Securely attach duct in original position. Replace any base vehicle hardware that is damaged during removal in the preceding steps.

**4.8 MULTI-POINT MANIFOLD**

The GFI multi-point manifold is designed for vehicles with modern large volume tuned manifolds. The purpose of the multi-point manifold is to provide delivery of fuel near the intake valves in order to minimize combustible volume in the intake manifold to prevent backfiring. Responsive performance is provided with the addition of throttle position sensing (TPS). Specific installation details are provided with each kit and in the factory installation template. Compuvalves for this system must have code 2350 or higher and require the factory approved calibration for the specific installation.

**4.9 USING GYROLOK FITTINGS**

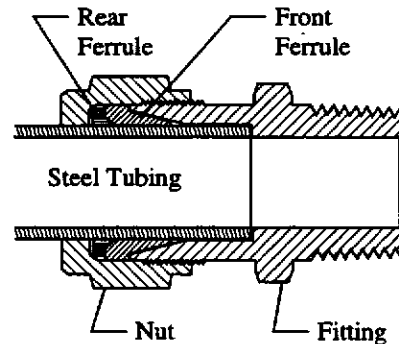
Installations that use Gyrolok fittings to attach the rigid tube (hardline) for the high pressure fuel lines are described below. The nuts and ferrules are supplied with the fittings; additional nuts and ferrules are available for spares and replacements.

These instructions include swaging the ferrules prior to actual installation.

1. Position any materials or components (e.g. grommets) on hardline before starting.
2. Secure fitting in vice or similar clamping device to immobilize fitting. Do not clamp on nuts.
3. Loosen the fitting nut, it is not necessary to remove the nut from the fitting. This will allow the tubing to be fully inserted. The ferrules will self align.
4. Insert the tubing into the fitting, resting it firmly against the internal shoulder of the fitting. (This is approximately 3/4").
5. Remove nut and slide up tubing. Ensure ferrules are correctly oriented on tubing. Correct as required.
6. Finger tighten the nut until snug. Then, with a wrench, tighten 1 full turn.
7. Remove nut and line and inspect ferrules and line for irregularities.

**ON INSTALLATION:**

8. Insert prepared line into fitting fully, so line is firmly against the internal shoulder of the fitting.
9. Finger tighten nut on fitting until snug. Then, with a wrench, tighten 1/4 turn.



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Gyrolok fittings may be assembled and disassembled repeatedly. To reassemble a fitting do the following:

- *Firmly insert the tubing end with the previously set ferrules into the fitting body and hand tighten nut.*  
*With a wrench, tighten the nut until a sharp rise in torque is felt, tighten 1/4 turn.*

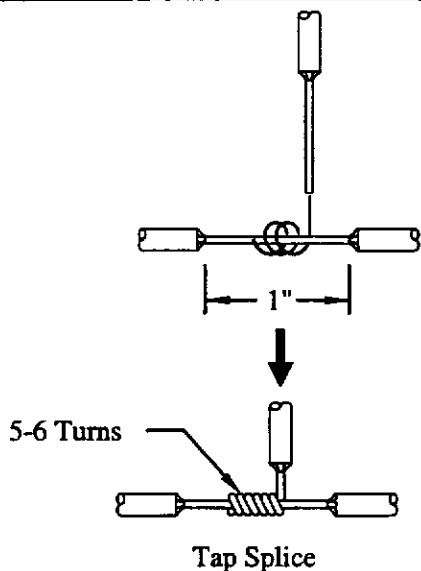
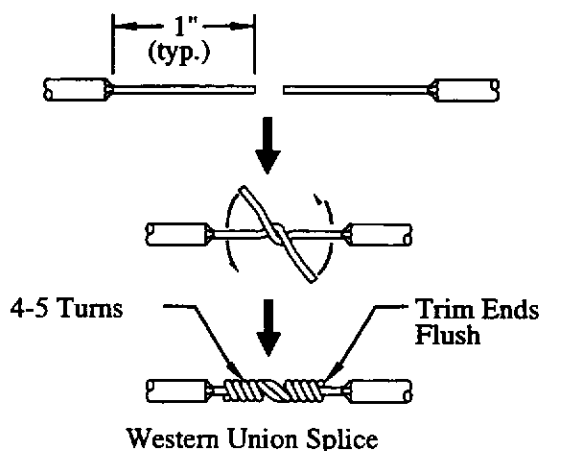
**4.10 WIRING**

The following information provides a general "how to" guide for the service and repair of the wiring for the GFI system. Specific locations and details are given in the specific vehicle supplements.

**NOTE:** During all wiring operations, reference a reputable schematic representation of the base vehicle wiring. Acceptable examples are the OEM Service and Maintenance Manuals for a specific vehicle or the MITCHELL ENGINE PERFORMANCE SERVICE & REPAIR manuals.

**4.10.1 SPLICING**

Proper splicing is required to ensure good electrical conductivity through out the electronic system. There are 3 types of splices: the "Western Union", used to join the ends of wires; the tap or branch used to join to an existing wire; and the pigtail splice that is NOT RECOMMENDED for applications with this installation.



**Wire Splices.**

NG124

1. Strip approximately 1" of insulation from wires as shown for type of splice to be used. Ensure that copper wire is not cut when removing insulation.
2. Twist wires together as shown.

**NOTE:** If using heatshrink for insulator, it is necessary to slide heatshrink onto wire prior to twisting. Ensure heatshrink is positioned away from splice so that heat from soldering in step 3 does not affect heatshrink.

3. Solder splice as described in section 4.10.2.
4. Use heatshrink or electrical tape to insulate splice. Extend insulation at least 1/4" over existing insulation. Ensure that insulation covers all bare wire.

**4.10.1.1 SPLICING WITH SPLICE CLIPS**

Using splice clips is **STRICTLY FORBIDDEN**. These connections are not as consistently conductive, provide a weaker connection that allows wires to pull apart and are susceptible to damage by moisture.

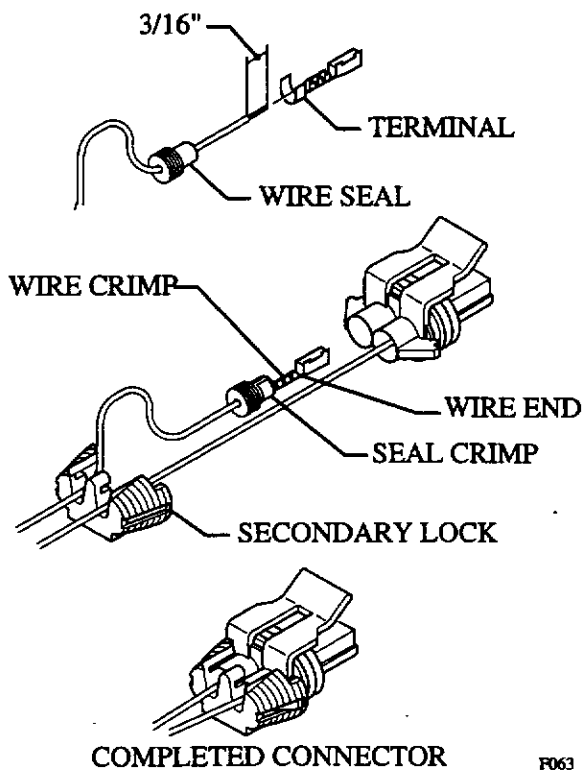
**4.10.2 SOLDERING**

When soldering a splice do the following:

1. Ensure wires are clean and twisted tightly together.
2. Use a 60/40 rosin core solder. The use of flux is not required. **DO NOT** use an acid core solder for electrical connections.
3. Using soldering tool, apply heat to wire. Apply solder under iron, apply enough solder to form a heavy film between the face of the iron and the surfaces being soldered. Move the iron slowly along work, ensuring that the applied solder melts, spreads and penetrates fully.
4. Keep splice stationary and allow to cool before moving or handling.

**4.10.3 CONNECTOR ASSEMBLIES**

Wires **MUST NOT** be cut to remove a connector or spliced together to reattach a connector. Connectors can be removed in the following manner:



**4.10.3.1 ASSEMBLY AND DISASSEMBLY**

1. Remove secondary lock from back of connector.
2. Use a pin extractor and remove terminal and seal from connector housing.

To assemble a connector:

1. Attach connector terminal to wire end:
  - Place wire seal over unstripped wire end.
  - Strip 3/16" of insulation from wire.
  - Place wire into terminal. Do not let wire fray out of or extend beyond terminal crimp area. Crimp terminal to hold wire. Do not over crimp so that terminal is deformed.
  - Slide seal to terminal and crimp large wings around seal. Do not allow seal ribs under crimp wings.
  - Solder ALL hand crimped terminals.
2. Insert wire terminal into connector housing until terminals "click" in place. Terminals are keyed to fit in one direction, do not force terminal.
3. Fill empty socket(s) with plug(s) (refer to Section 6).
4. When all wires are installed, push secondary lock over end of connector housing.

**4.10.4 GROUND LUG CONNECTOR**

CONNECT GROUND LUGS BEFORE CONNECTING POWER OR ANY OTHER CONNECTIONS. Grounds should be the **FIRST** electrical connection made when installing a system, and the **LAST** to be removed when disconnecting the system. Connect ground lug ring to a clean, bare metal surface of the engine. Roughen surface with a file or sand paper then thoroughly clean location with acetone or equivalent degreaser/solvent; remove all grease, dirt, paint etc.

To verify that the ground is solidly connected, measure voltage between battery negative terminal and the installed system ground lug. Voltage must be  $\leq 50$  mv (.05v). An alternative means of measurement is to measure the resistance between the ground lug and battery negative (-) terminal. Resistance should be  $\leq 5$  ohms.

**4.10.5 WIRE ROUTING**

Wires should be routed with the following criteria:

- Route wires to the GFI main wire harness, DO NOT extend main harness wire to intercept and tap wires.
- Avoid routing near "hot spots" where heat can damage insulation and/or wire.
- Do not route within 6" of high tension wires and devices (e.g. ignition coil).
- Do not route wire with hoses.
- Do not route in area where wire can be damaged from sharp edges or rubbing against vehicle parts.
- Allow adequate wire length to avoid straining wire from installation or vehicle operation.
- Route wire in bundles as much as possible.
- Secure wires with clips and/or ties.

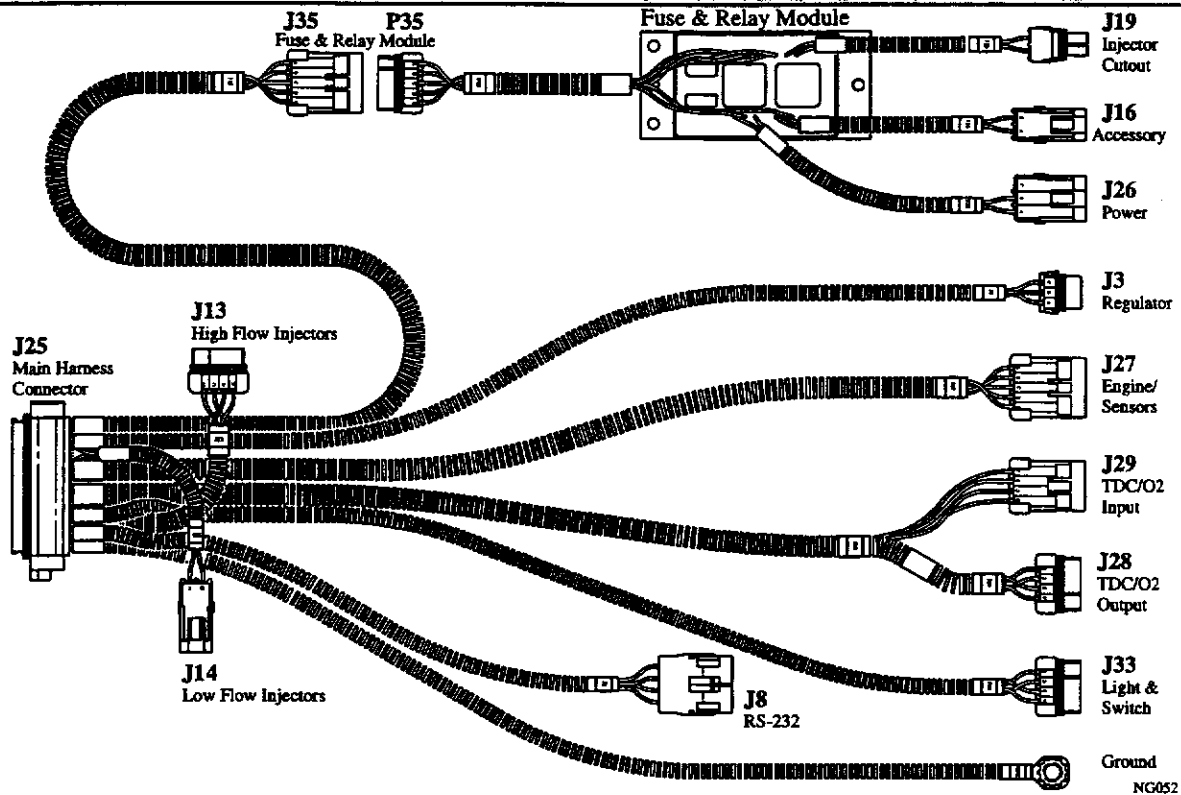
**4.10.6 REMOVING A WIRE HARNESS**

1. Disconnect battery cables, starting with the negative (-) terminal.
2. Detach connectors on harness.
3. Detach ground connections.

**CAUTION:** DO NOT cut wire or splice wire together during reassembly. Remove and replace completely.

4. Remove ties and clamps as required.

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**Main Wire Harness**

### 4.11 MATING HARNESS

For reference, the chart below gives the mating wire color, pin number and the signal of wire connections between the base vehicle and the main wire harness.

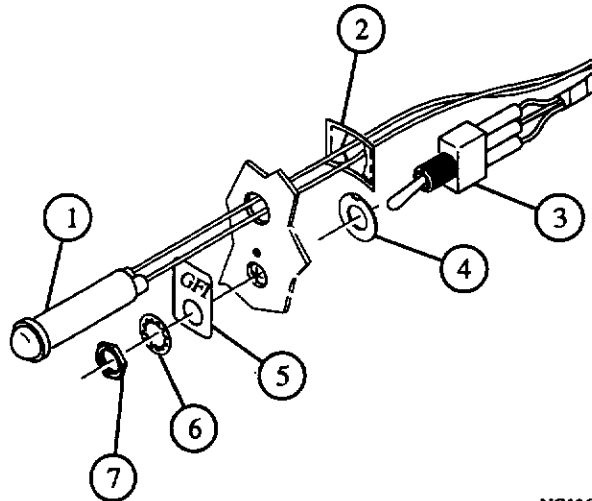
PIN ID	SIGNAL	COLOR
<b>P3</b>		
A	AGND	FROM FSP SENSOR
B	FSP	FROM FSP SENSOR
C	FSPpower	FROM FSP SENSOR
D	B+/IGNIT	FROM HPS
E	Not Used	
F	HPS	FROM HPS
<b>P19</b>		
A	INJcom1	TAN
B	INJnc1	TAN/WHITE
<b>P26</b>		
A	SW B+	RED/YELLOW
B	B+	RED
C	Not Used	
<b>P27</b>		
A	CPS	BROWN/BLACK
B	STARTER	PINK
C	AGND (IAT)	FROM IAT SENSOR
D	IAT	FROM IAT SENSOR
E	AGND (MST)	FROM MST SENSOR
F	MST	FROM MST SENSOR
G	TACH	LT BLUE
H	KNOCK	PURPLE
J	TPSgnd	BLACK/WHITE
K	TPSin	DK GREEN

PIN ID	SIGNAL	COLOR
<b>P28</b>		
A	O2out	LT GREEN
B	AGND	LT GREEN/BLACK
C	TDCout1	LT GREEN/LT BLUE
E	TDCoco1	LT GREEN/RED
F	TDCout2	LT GREEN/YELLOW
G	TDCoco2	LT GREEN/GREY
<b>P29</b>		
A	O2in	ORANGE
B	O2gnd	ORANGE/DK BLUE
C	TDCin1	ORANGE/WHITE
E	TDCin1	ORANGE/WHITE
F	TDCin2	ORANGE/BLACK
G	TDCin2	ORANGE/BLACK
H	TDCoffset	ORANGE/YELLOW
<b>P33</b>		
A	FGL	DK BLUE
B	FGM	GREY
C	GASOLINE	FROM SWITCH
D	ALT FUEL	FROM SWITCH
E	B+/IGNIT	FROM SWITCH
F	LIGHT1	WHITE *
G	LIGHT2	WHITE/BLUE *

\* White wire from Pin F of P33 goes to White wire of LED.  
White/Blue wire from Pin G of P33 goes to Red wire of LED.

**4.12 FUEL SELECTOR SWITCHES**

**4.12.1 STANDARD SWITCH AND LIGHT**



INDEX	DESCRIPTION	TORQUE
1	Indicator Light Assy	
2	Retainer	
3	Selector Switch Harness Assy	
4	Washer, Position	
5	Label, Dashboard Switch	
6	Washer, Lock	
7	Nut	

**4.12.1.1 REPLACING THE INDICATOR LIGHT**

1. Disconnect battery terminals starting with the negative (-) post.
2. Remove dash trim panel according to manufacturer's instructions. Remove push-on retainer (2) from light assembly (1).
3. Pull light assembly from front of panel.
4. To install replacement light, follow removal procedures in reverse.

**NOTES:** The RED wire of the LED MUST be attached to the White/Blue wire from pin G of P33. The white wire attaches to the White wire from pin F of P33.

**4.12.1.2 REMOVING THE SELECTOR SWITCH**

1. Remove dash trim panel.
2. Disconnect P33 and remove wires from cavities.
3. Remove switch harness assembly (3).

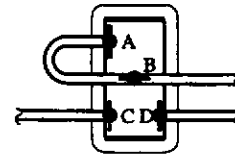
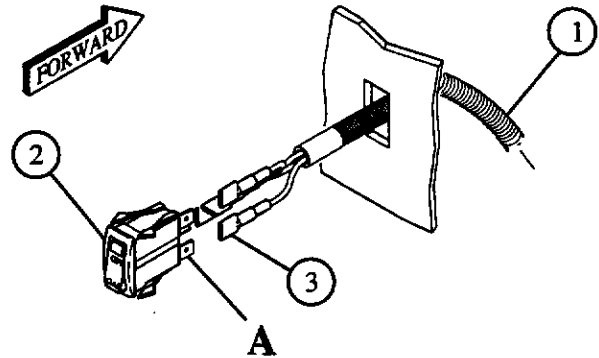
**4.12.1.3 INSTALLING THE SELECTOR SWITCH**

1. Route harness with switch through dash.
2. Push fuel selector switch through rear of bottom hole in dash trim panel.
3. Secure switch using position washer (4), lockwasher (6) and nut (7), tighten until snug.
4. Reconnect P33. Insert pins into proper cavities until they "click" in place. The pin numbers of the wires on the switch assembly are marked on the ends for proper connector assembly.

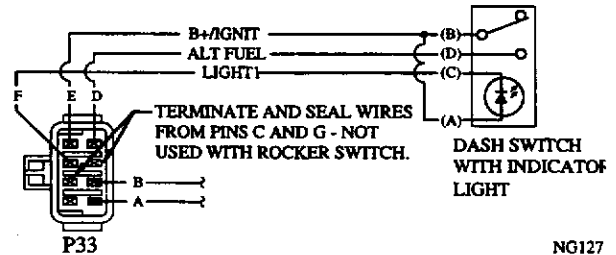
**NOTE:** The green LED indicator DOES NOT wire to the switch. The GFI computer controls the light to indicate when natural gas is being USED not when natural gas is selected with the selector switch.

5. Reinstall dash trim panel.

**4.12.2 OPTIONAL ROCKER SWITCH**



**DETAIL A**  
(View of Back of Switch)



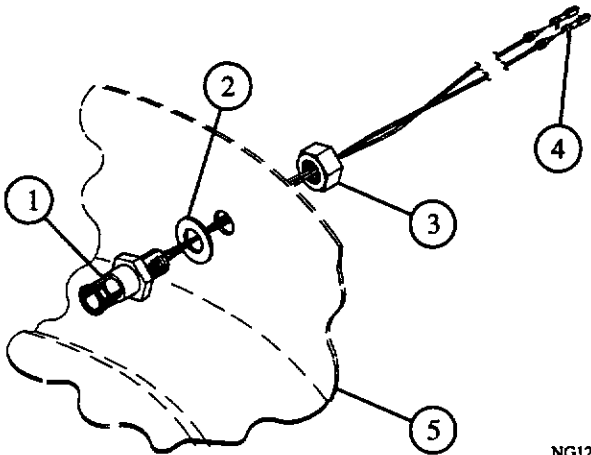
INDEX	DESCRIPTION	TORQUE
1	Switch Harness	
2	Selector Switch	
3	Terminal, Spade	

**4.12.2.1 SWITCH REPLACEMENT**

1. Disconnect battery terminals, starting with the negative (-) post.
2. Remove dash panel according to manufacturer's instructions.
3. Press in tabs on switch (2) and push switch out of dash panel.
4. Reinstall dash panel, pull switch harness (1) through rectangular hole in panel.
5. Slide spade terminals (3) onto terminals of switch (2). Ensure that wire colors and terminals agree with the illustration.
6. Firmly push fuel selector switch into hole with orientation shown.

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### 4.13 IAT SENSOR



NG128

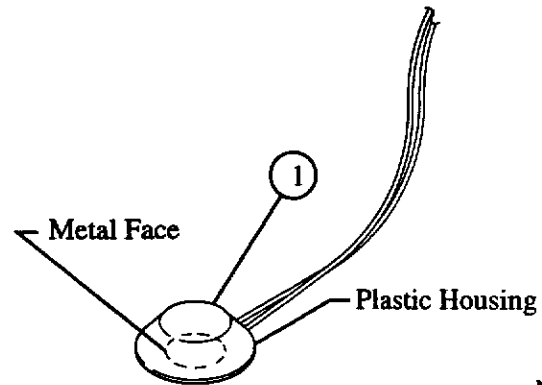
INDEX	DESCRIPTION	TORQUE
1	IAT Sensor	
2	Washer, Rubber	
3	Nut, Plastic	10 in-lbs
4	Terminal, Wire	
5	Air Cleaner Housing	

**NOTE:** The following instructions are for installing an IAT sensor. To remove, follow the procedure in reverse order.

1. Remove air cleaner housing (5).
2. Place rubber washer (2) on threaded portion of IAT sensor (1).
3. Place wire ends and threaded portion of sensor through hole.
4. Apply Loctite 262 or equivalent on threads.
5. Secure sensor with nut (3) and tighten to approximately 10 in-lbs. Do not overtighten. Ensure a tight seal to prevent dirt and external air from entering.
6. Route wires to connector and insert terminals (4) into P27 connector housing Pins C & D until terminals "click" into place. Pin designation is not important.

**NOTE:** Terminals are "keyed" and will fit into housing in one direction only. Do not force terminal.

### 4.14 MST SENSOR



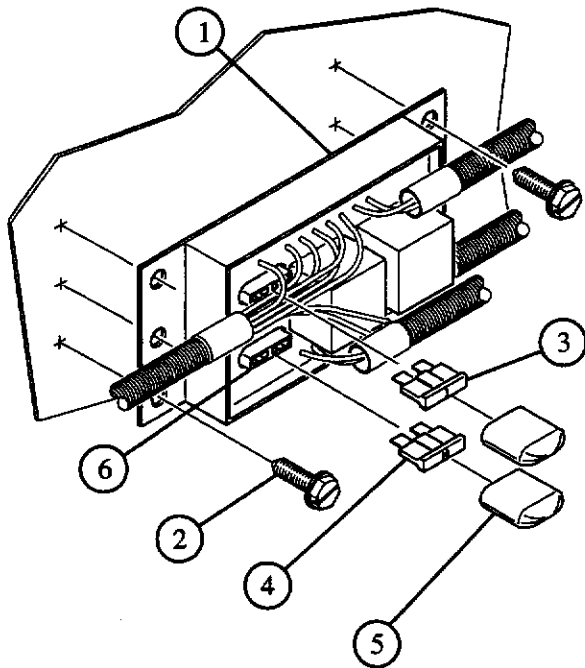
NG129

INDEX	DESCRIPTION	TORQUE
1	MST Sensor	

1. Remove existing sensor.
2. Roughen surface with a file or sand paper. Thoroughly clean location with acetone or equivalent degreaser/solvent; remove all grease, dirt, paint, etc.
3. Apply a thin covering of thermal paste (silicone thermal compound) to metal puck face of sensor (1).
4. Apply Loctite weld epoxy onto plastic perimeter of sensor.
5. Place sensor on previously prepared position and hold in position for a minimum of 3 minutes.
6. Route wires to connector and insert terminals into P27 connector housing Pins E and F until terminals "click" into place. Pin designation is not important.

**NOTE:** Terminals are "keyed" and will fit into housing in one orientation only. Do not force terminal.

4.15 FUSES & RELAYS



NG130

INDEX	DESCRIPTION	TORQUE
1	Fuse & Relay Module/Bracket	
2	Attaching Hardware	
3	Fuse, Cartridge Type, 3 Amp	
4	Fuse, Cartridge Type, 10 Amp	
5	Fuse Cover	
6	Fuse Socket	

4.15.1 FUSES

1. Disconnect J26.
2. Remove fuse cover (5) and remove fuse from fuse socket (6).
3. Place new fuse in holder and reassemble.

**CAUTION:** Do not replace fuses with a higher rated fuse. Damage to the electronic components could result. If fuses continue to fail, go to section 3 (System Diagnosis).

4. Reconnect J/P26.

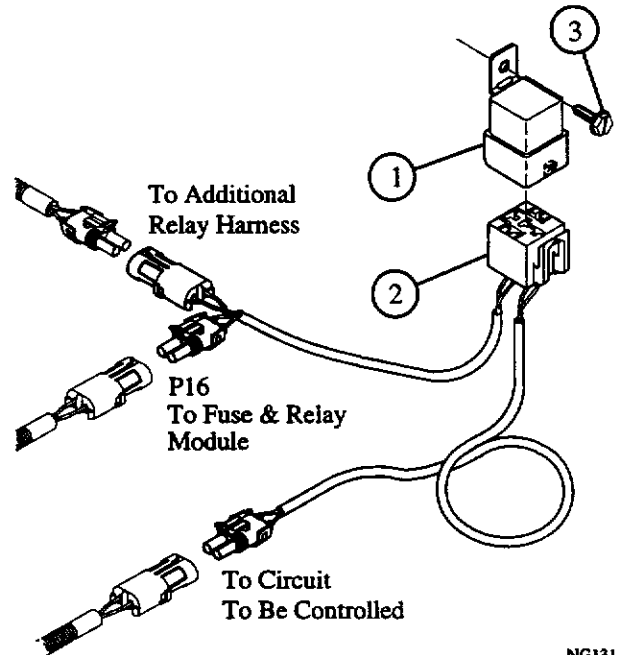
4.15.2 FUSE & RELAY MODULE

1. Disconnect J/P26.
2. Disconnect P35, J16 and J19.
3. Remove attaching hardware (2) and fuse & relay module (1).

**NOTE:** Attaching hardware can consist of self-tapping screws or bolts, washers and nuts.

4. To install, follow removal procedures in reverse order.

4.16 AUXILIARY RELAY HARNESS



NG131

INDEX	DESCRIPTION	TORQUE
1	Relay, SPDT	
2	Base, Relay	
3	Attaching Hardware	

4.16.1 RELAY REPLACEMENT

1. Disconnect power (J16) to auxiliary relay harness.
2. Remove attaching hardware (3) from relay (1).
3. Disconnect relay (1) from relay base (2).
4. Assemble using new relay.
5. Place relay in previous position and attach using hardware (3). Reconnect J/P 16.

4.16.2 HARNESS REPLACEMENT

1. Disconnect J/P26.
2. Unplug connectors J/P16 and connectors going to additional relay harness and controlled circuit.
3. Remove attaching hardware (3) from relay (1).
4. Remove auxiliary relay harness.
5. To install, follow removal procedures in reverse order.