Cummins

E BRAKE
by Jacobs®

For '89 - '98 Dodge Ram Trucks
Equipped with the Cummins B5.9
Mechanical Engine

Installation Manual

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Introduction

This Cummins E Brake by Jacobs kit has been specifically engineered to fit your '89 - '98 Cummins Turbo Diesel powered Dodge Ram truck without requiring any fabrication or modification.

There are slight differences for the installation on '89 - '93 vehicles and '94 - '98 vehicles. These differences are explained in the text. Watch for these differences in the instructions and make sure the directions you are following apply to your vehicle.

The procedures for installing the brake system are organized into six main sections, with each section detailing the installation of related components. We strongly recommend that you perform the procedures in the order in which they are presented. The last section lists troubleshooting procedures, in case you are experiencing problems with the E Brake.

For additional information or technical support, contact Cummins Customer Assistance Center by calling 1-800-DIESELS (1-800-343-7357).

Application Notes

1. **For those vehicles equipped with EGR valves**: The E Brake **cannot** be installed in those vehicles equipped with EGR valves. To check if your truck is equipped with an EGR valve, check the engine CPL number stamped into the Engine Data Plate attached to the left side of the engine's gear housing. Your vehicle is equipped with an EGR valve if its engine CPL number is 1863.
2. Certain 1995-1996 vehicles were not equipped with a check valve in the vacuum supply system. This check valve is required for proper operation of the E Brake and must be present on your vehicle. Not having the check valve on your vehicle can lead to problems for all systems that depend on vacuum pressure for their operation.

   Check your engine serial number (ESN) to determine whether your engine requires installation of this check valve. The ESN can be found on the Engine Data Plate, located on the left side of the gear housing next to the oil fill tube. The ESN is located to the right of the Timing TDC Specification.

   If your ESN is between 45232867 through 45360437 or 56230585 through 56293175 your engine may require installation of this check valve. If your ESN falls within this range, or if you have concerns regarding this check valve, please refer to Chrysler Technical Service Bulletin number 24-16-96, available from Chrysler dealers. The Check Valve Package (Chrysler P/N 4883793AA) is available from Chrysler and includes the check valve, hose, and required connectors. The check valve (only) is also available from Cummins distributors (P/N 3931558).
3. If your vehicle is from model year 1989 to 1993, you will need to obtain a Header Kit, P/N 3804854, to complete the installation.

Special Tools and Materials Required

You should have the following tools and materials before you begin this installation:

- Rust penetrant, such as Liquid Wrench® or Mopar® P/N 4318039
- Silicone sealer
- Anti-seize compound
- Wire stripping and crimping tool
- Battery terminal puller
- Common hand tools such as metric wrenches and screwdrivers
- Torque wrenches
- Drill with 1/4", 1/2" and #27 (0.144") bits
- Knife or other tool for cutting the rubber vacuum hose
- Clean shop towels
- Teflon® pipe sealant
- Loctite® 242 or equivalent

Safety Precautions

The following symbols in this manual signal conditions potentially dangerous to the mechanic or equipment. Read this manual carefully. Know when these conditions can exist. Then take necessary steps to protect personnel as well as equipment.

⚠WARNING THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY.

⚠CAUTION THIS SYMBOL REFERS TO POSSIBLE EQUIPMENT DAMAGE.

NOTE: INDICATES AN OPERATION, PROCEDURE OR INSTRUCTION THAT IS IMPORTANT FOR CORRECT SERVICE.

Fuels, electrical equipment, exhaust gases and moving engine parts present potential hazards that could result in personal injury. Take care when installing equipment or parts. Always wear safey glasses. Always use correct tools and follow proper procedures as outlined in this manual.

Section 1: Installing the Exhaust Valve Springs

⚠CAUTION THE HEAVY DUTY EXHAUST VALVE SPRINGS INCLUDED WITH THIS KIT MUST BE INSTALLED BEFORE THE CUMMINS E BRAKE CAN BE OPERATED SAFELY. OTHERWISE SEVERE ENGINE DAMAGE MAY RESULT.

We recommend that you bring your vehicle to a certified Cummins service facility to perform the exhaust valve spring replacement and valve adjustment. This procedure requires specialized tools and training.

If you choose to perform the exhaust valve spring installation, obtain the correct service manual for your engine from your Cummins distributor.

Section 2A: Installing the Brake Assembly

This section contains procedures for '94 - '98 vehicles only! Proceed to section 2B for '89 - '93 vehicles.

1. Preparation.

Use a battery terminal puller to disconnect the negative (–) leads from both batteries.

NOTE: WHEN YOU DISCONNECT THE BATTERIES, THE MEMORY FOR THE CLOCK AND THE STATION PRESETS ON THE RADIO WILL BE LOST. YOU MAY WANT TO RECORD THE RADIO STATION PRESETS ON PAPER BEFORE YOU DISCONNECT THE BATTERY.

2. Remove the Air Filter Box from the vehicle.

a. Use a screwdriver to loosen the clamp and disconnect the large plastic duct that connects the air filter box to the turbocharger at the turbocharger end (see Fig. 1).

b. Remove the air filter housing and duct hose as an assembly (see Fig. 2). Gently lift air filter housing from the inner fender. The plastic connectors will remain in the air filter housing and the steel mounting studs will remain in the inner fender.

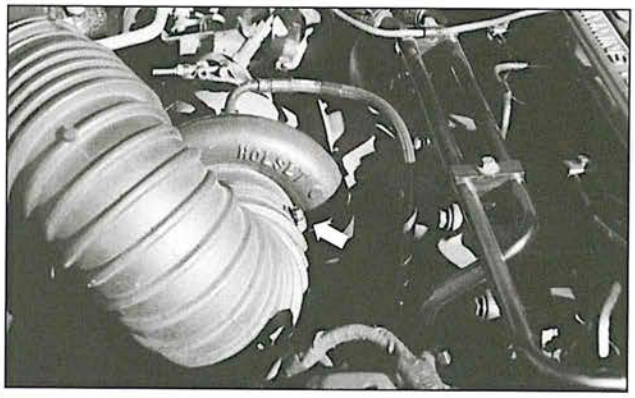


Fig. 1

Fig. 2

3. Remove the existing exhaust elbow that mounts to the rear of the turbocharger.

a. Remove the two bolts that attach the exhaust pipe to the exit side of the elbow (Fig. 3). Spray rust penetrant on bolts before loosening.

HINT: ROTATE THE CLAMP FOR THE EXHAUST PIPE SO THAT IT IS HELD IN PLACE BY THE DASH PANEL. THIS WILL KEEP THE CLAMP FROM SLIPPING DOWN UNDER THE VEHICLE.

b. Loosen and remove the "V" clamp that attaches the elbow to the exhaust side of the turbocharger (Fig. 3). This will allow you to remove the elbow from the vehicle. Also note relative position of the exhaust mounting flange. The E Brake will be mounted in the same orientation.

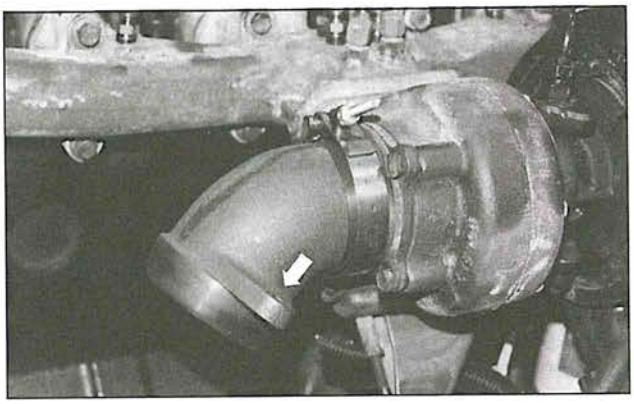


Fig. 3

4. Attach the Brake Assembly to the Turbocharger.

a. The supplied gasket is used between the turbocharger and the exhaust brake housing. This gasket is adhesive-backed to ease installation. Clean the gasket surfaces of the turbo outlet and the E Brake assembly, making sure the surfaces are free of dirt, grease, and oils. Remove the paper backing and adhere the gasket to the top of the brake housing opening.

b. Attach the brake housing to the turbocharger, using the "V" clamp supplied in the kit (Fig. 4). As you line up the two components, be careful not to knock the gasket out of place. Before you tighten the "V" clamp, rotate the brake housing so that the two holes in the mounting flange are horizontal as shown (arrow, Fig. 4).

c. Tighten the "V" clamp to 72 in.-lb. of torque.

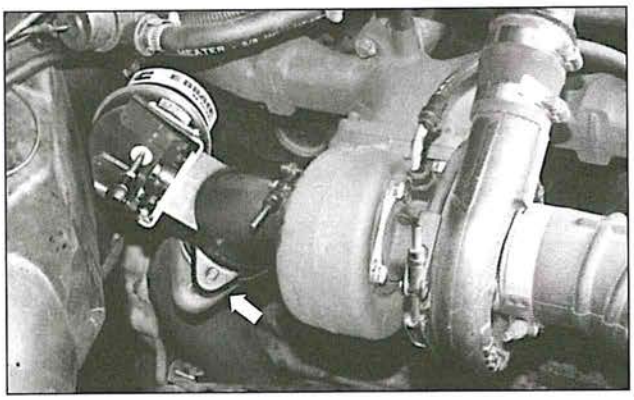


Fig. 4

5. Attach the exhaust pipe to the bottom of the exhaust brake housing.

Apply an anti-seize compound to the original two bolts that held the original elbow in place and tighten them to 19 ft- lb. of torque.

Section 2B- Installing the Brake Assembly

This section contains procedures for '89 - '93 vehicles only.

1. Preparation.

Use a battery terminal puller to disconnect the negative (–) leads from the battery, or both batteries if your vehicle is equipped with two.

NOTE: WHEN YOU DISCONNECT THE BATTERIES, THE MEMORY FOR THE CLOCK AND THE STATION PRESETS ON THE RADIO WILL BE LOST. YOU MAY WANT TO RECORD THE RADIO STATION PRESETS ON PAPER BEFORE YOU DISCONNECT THE BATTERY.

2. Replace the existing header pipe.

a. Remove the "V" clamp that connects the header pipe to the turbocharger and discard.

b. From under the chassis, remove the clamps from the header pipe and disconnect the header pipe from the rest of the exhaust system. You may need to use a torch to heat the pipes to make them easier to separate.

c. Slide the replacement header pipe from the kit into the exhaust system. You may notice that it does not reach the turbocharger as the original one did. This is to make room for the brake housing. Do not clamp the pipe in place at this time.

3. Attach the brake housing to the turbocharger.

a. The supplied gasket is used between the turbocharger and the exhaust brake housing. This gasket is adhesive-backed to ease installation. Clean the gasket surfaces of the turbo outlet and the E Brake assembly, making sure the surfaces are free of dirt, grease, and oils. Remove the paper backing and adhere the gasket to the top of the brake housing opening.

b. Attach the brake housing to the turbocharger, using the "V" clamp supplied in the kit (Fig. 4). As you line up the two components, be careful not to knock the gasket out of place. Before you tighten the "V" clamp, rotate the brake housing so that the two holes in the mounting flange are horizontal as shown (arrow, Fig 4.).

c. Tighten the "V" clamp to 72 in.-lb. of torque.

4. Attach the header pipe flange to the bottom of the exhaust brake housing.

a. Apply an anti-seize compound to the two supplied 10 MM x 1.5 x 50 bolts that will hold the replacement header pipe in place and tighten them to 19 lb.-ft. torque.

b. Tighten the header pipe clamps.

Section 3 - Installing the Pneumatic Group

⚠WARNING BE CERTAIN TO TORQUE ALL VACUUM FITTING HOSE CLAMPS TO 72 IN.- LB. PROPER CONNECTIONS ARE ESSENTIAL TO MAINTAIN THE INTEGRITY OF THE VACUUM SYSTEM, WHICH IS REQUIRED TO PROVIDE FULL USE OF THE VEHICLE'S SERVICE BRAKES.

1. Drill Mounting Holes.

a. In the engine compartment, cut away about 8" of insulation from the upper right (passenger) side of the plenum (Fig. 5).

NOTE: THERE MAY BE A PLUGGED HOLE ON THE PLENUM IN THE AREA EXPOSED WHERE THE INSULATION WAS REMOVED. IF THIS IS TRUE FOR YOUR VEHICLE, REMOVE THE PLUG AND COVER THE HOLE WITH A SILICONE SEALER TO CLOSE THE HOLE. THE PLUG MUST BE REMOVED AS IT MAY INTERFERE WITH INSTALLING THE SOLENOID MOUNTING PLATE.

b. Find the correct template in Appendix 1 of this manual. There is one template for 89-93 model vehicles and another template for 1994 and later model vehicles. Cut out the required template along the solid lines.

c. Orient the template on the plenum, using the guidelines indicated on the template: for '89–'93 vehicles, place the template so that the cutout area fits over the bump on the plenum (refer to Figure 6). For '94 and later model years, place the template so that the upper part of the template fits against the corresponding contour of the plenum.

d. Drill holes as indicated on the template. For the Relay Mounting Base, drill with a #27 drill (the relay base will be attached later in Section 4). For the Solenoid Mounting Plate, drill a pilot hole with a #27 drill and drill to final size with a 1/2" drill.

2. Attach Pneumatic Controls.

a. Insert the four supplied well nuts into the 1/2" holes you drilled into the plenum.

b. Attach the Pressure Switch and hose fittings and adapters to the solenoid (see Fig. 7).

NOTE: USE PIPE SEALANT ON ALL NPT (PIPE THREAD) CONNECTIONS.

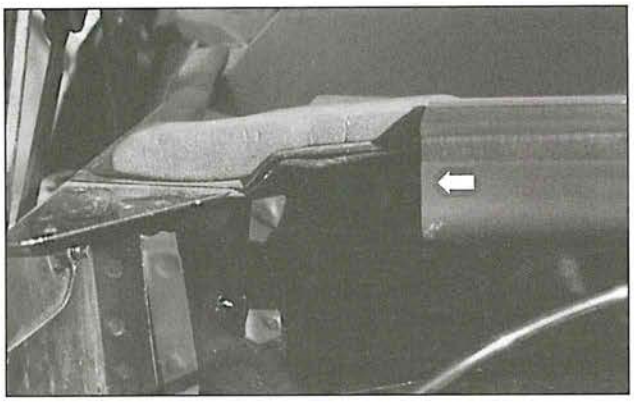


Fig. 5

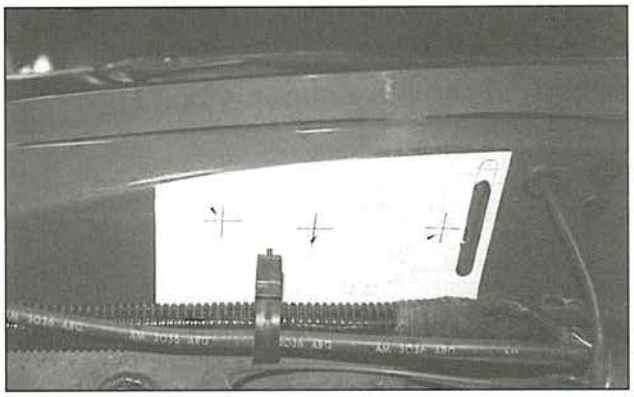


Fig. 6

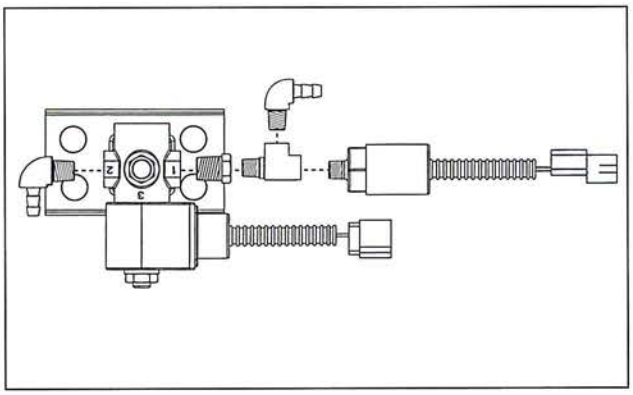


Fig. 7

c. Insert the isolator grommets into the large holes in the Solenoid Mounting Plate as indicated in Figure 8.

d. Note the orientation of the mounting plate in Figure 8. The distance from the end of the plate to the raised area in the center of the plate is greater on one side than the other. The side with the greater distance is the left side of the plate when the raised portion is facing toward you (when installed, this side points toward the passenger side of the vehicle). Holding the plate in this orientation, insert one M6 x 40 mm screw, washer, and lockwasher into the isolator grommet in the lower left corner of the plate. See Figure 8 for correct orientation of these attaching parts.

NOTE: THIS BOLT MUST BE INSERTED BEFORE ATTACHING THE SOLENOID, SINCE THERE WILL NOT BE SUFFICIENT CLEARANCE TO INSERT THE BOLT AFTER THE SOLENOID ASSEMBLY IS MOUNTED TO THE PLATE.

e. Attach the Vacuum Solenoid to the mounting bracket using the two #8-32 screws supplied in the kit, using Loctite® 242 on the screw threads. Refer to Fig. 7 for proper orientation of the solenoid on the bracket.

f. Attach the mounting bracket to the plenum using the three remaining M6 x 40 screws, washers and lock washers.

3. Connect the Vacuum Actuator on the exhaust brake assembly to the "2" side of the solenoid.

a. Atttach one end of the 30" length of 1/4" I.D. hose to the fitting on the E Brake vacuum actuator (see Fig. 9). Use a hose clamp on this connection.

b. Route the hose over the heating/air conditioning lines, keeping the hose away from the exhaust manifold and header pipe. Attach the other end of the hose to the 90° elbow connected to the solenoid port marked "2" (see Fig. 7).

c. Use the P-clip provided to secure the hose to the dash panel (see Fig. 10). Use the M6 locknut provided to fasten the P-clip to an existing dash panel stud.

4. Connecting the Vaccuum Supply to the Solenoid

Connect one end of the 6" length of 1/4" vacuum hose supplied in the kit to the barb connector on the solenoid port marked "1" (See Fig. 7). This hose will attach to the polytube on the wire harness when the harness is installed in Section 4.

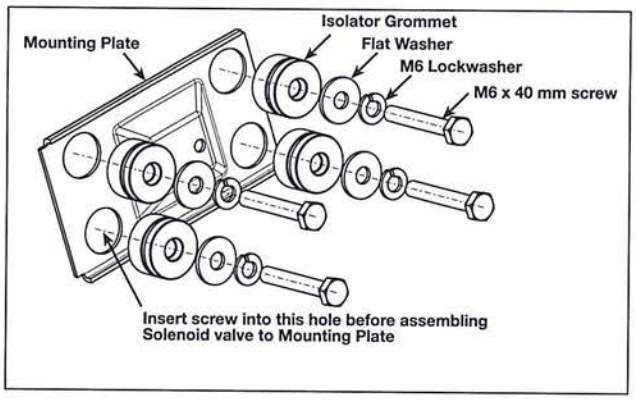


Fig. 8

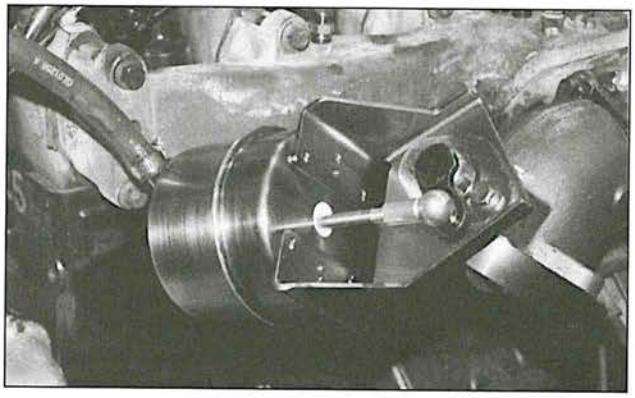


Fig. 9

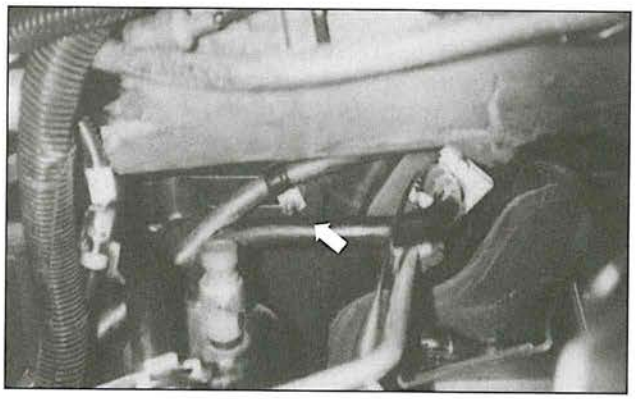


Fig. 10

5. Connecting to the Vehicle Vacuum Supply.

If your vehicle is '89 - '93 model year, perform step 5A. If your vehicle is '94- '96 model year, perform step 5B only. f your vehicle is '97- '98 model year, perform step 5C only.

5A. Vacuum supply – '89-93 vehicles (refer to Figure 11)

a. Cut the vehicle's vacuum supply hose at a point where the hose is routed near the brake master cylinder (Fig 11.)

b. Insert one 3/8" side of the of the 3/8" x 3/8" x 1/4" plastic T-fitting into the pump end of the vacuum hose, attaching with a hose clamp.

c. Attach the other end of the existing hose into the second 3/8" side of the T-fitting, using a hose clamp.

d. Attach the 30" section of 1/4" I.D. hose supplied with the kit to the third (1/4") side of the T-fitting, using a hose clamp.

e. Check all hose connections, and tighten hose clamps to 72 in.-lb. of torque.

Proceed to Section 4.

5B. Vacuum supply – '94 - '96 vehicles (refer to Figure 12).

a. Locate the existing "T" in the vacuum harness (see Fig. 12). Remove the existing tube from the "T". Attach the supplied 1 1/2" length of 1/4" I.D. hose to the "T".

b. Attach the "Y" connector supplied in the kit to the end of the 1/4" I.D. hose on the "T". Attach the original hose to one side of the "Y" connector, and the supplied 30" length of 1/4" I.D. hose to the other side of the connector.

NOTE: END OF THE HOSE WILL BE CONNECTED TO POLY TUBE ON THE WIRE HARNESS IN SECTION 4.

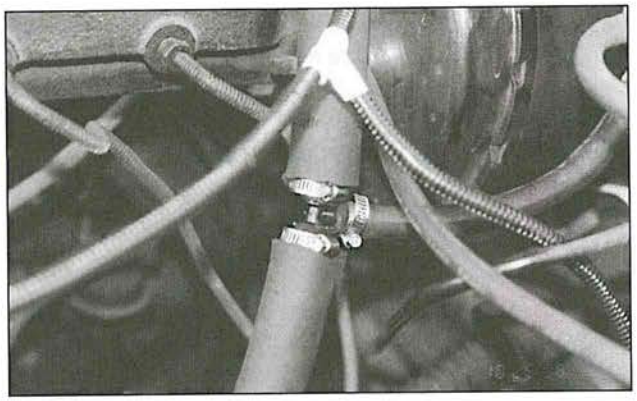


Fig. 11

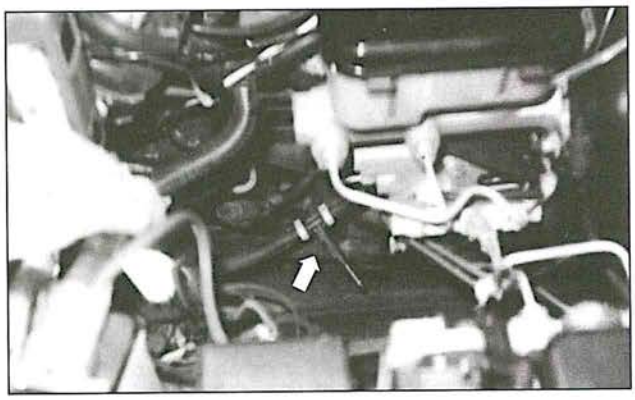


Fig. 12

5C. Vacuum supply – '97 - '98 vehicles (refer to Figure 13).

a. Locate the 1/4" plastic vacuum line from the vacuum pump to the vacuum harness (see Fig. 13).

b. Disconnect the vacuum line from the vacuum harness below the check valve (arrow, Fig. 13). Attach the supplied 1/4" x 1 1/2" hose to the check valve. Insert the supplied "Y" connector into the 1/4" x 1 1/2" hose (arrow, Fig.14). Attach the Y connector to the vehicle vacuum harness. Attach the supplied hose to the remaining end of the Y connector (Fig. 14)

NOTE: END OF THE 6" HOSE WILL BE CONNECTED TO POLY TUBE ON THE WIRE HARNESS IN SECTION 4.

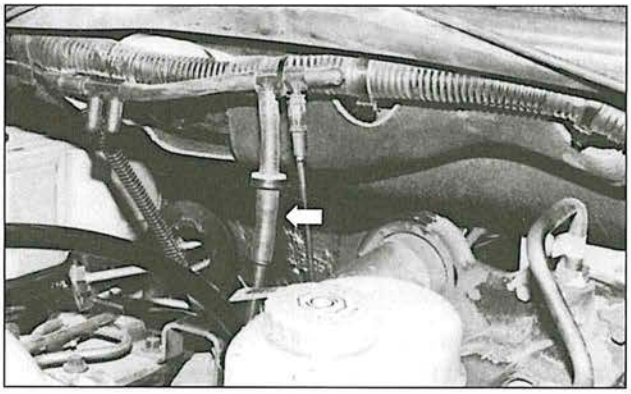


Fig. 13

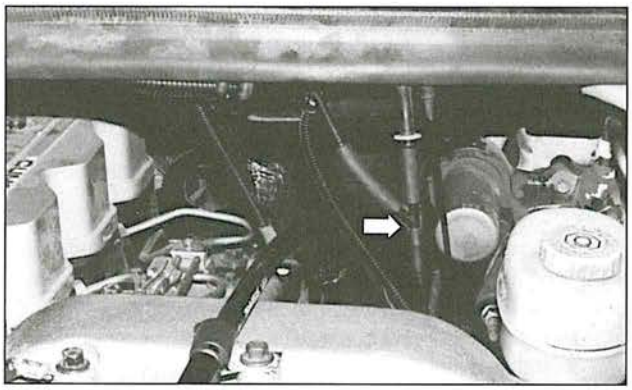


Fig. 14

Section 4 - Installing the Engine Controls and Wiring Harnesses

1. Fuel Pump Switch.
For '94 - '98 vehicles, perform step 1A. For '89 - '93 vehicles, perform step 1B.

1A. Fuel Pump Switch ('94-'98 vehicles only).

a. **For '94 - '96 vehicles:** Add a second fuel pump return spring to the existing spring as shown in Fig. 15. The new spring fits in the center of the existing spring. Detach the spring from the pump and add the second spring to the center of the existing spring. Replace the two springs onto the fuel pump in the original location.

   For '97 - '98 vehicles: There are two fuel pump return springs with plastic ends. Remove one spring as shown in Figure 16 and replace it with the spring provided.

b. Remove the two bolts from the gear cover as shown in Fig. 17.

c. Attach the fuel pump switch to its mounting bracket as shown in Figure 18. Do not tighten the screws at this time. There are two pairs of slots in the fuel pump switch mounting bracket. Use the longer pair of slots, as indicated in Figure 18.

d. Mount the fuel pump switch mounting bracket to the gear cover at the location where the bolts were removed (Fig. 17). Use the original bolts to attach the bracket to the gear cover. Tighten the bolts to 18 ft-lb.

e. The fuel pump switch must be adjusted so that the switch button is pressed by the throttle return linkage when the engine is not being fueled (when the throttle pedal is released. With the throttle at idle position, insert a 0.030" feeler gage between the switch plunger and the throttle bell crank. Adjust the switch so that the plunger is compressed to its fullest extent. Hold the switch in this position and tighten the switch mounting screws.

NOTE: CHECK THE SWITCH ADJUSTMENT. THE SWITCH SHOULD BE ADJUSTED SO THAT AT NO FUEL POSITION THE SWITCH PLUNGER TRAVELS SLIGHTLY BEYOND THE POINT OF SWITCH ENGAGEMENT (WHEN YOU HEAR AN AUDIBLE "CLICK"). HOWEVER, THE FUEL PUMP SWITCH SHOULD NOT BE MOUNTED SO CLOSELY THAT THE SWITCH ACTS AS THE STOP FOR THE THROTTLE LEVER.

f. Secure the wire leads from the fuel pump switch to the existing vehicle wire harness as shown in Figure 19.

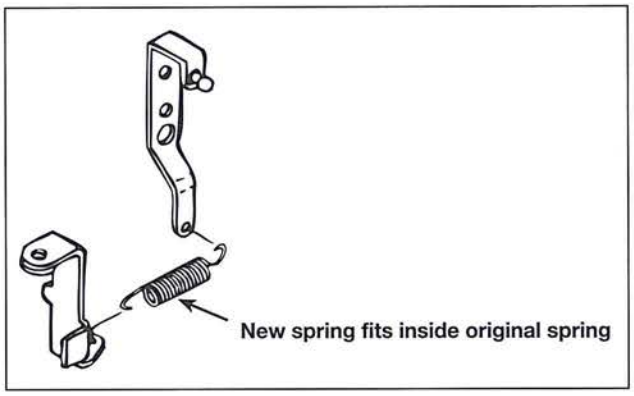


Fig. 15

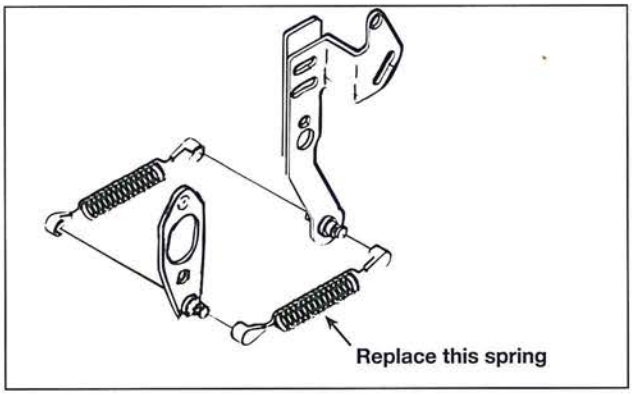


Fig. 16

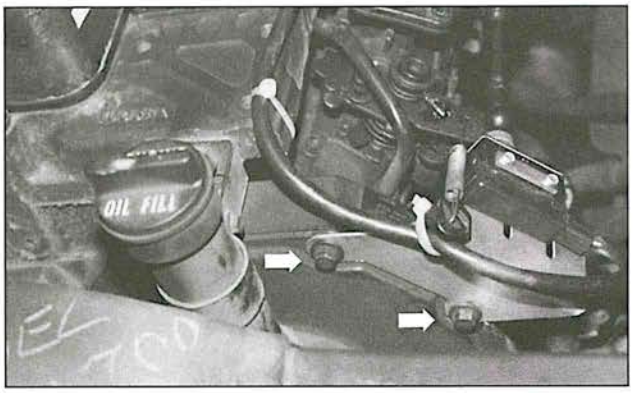


Fig. 17

1B. Fuel Pump Switch (for '89 - '93 vehicles only).

a. Remove the two gear cover bolts from the upper right corner as shown in Figure 17. One of these bolts holds the original fuel pump return spring bracket in place. Save this bracket, since you will reuse it.

b. Attach the fuel pump switch to the mounting bracket as shown in Figure 20. There are two sets of slots in the bracket. Attach the switch using the pair of shorter slots as illustrated in Figure 20. Do not tighten the mounting screws at this time.

c. Attach the fuel pump switch mounting bracket to the gear cover using the original bolts that were removed from the gear cover (see Fig. 17). Tighten the bolts to 18 ft.-lb.

d. The fuel pump switch must be adjusted so that the switch button is pressed by the throttle return linkage when the engine is not being fueled (when the throttle pedal is released. With the throttle at idle position, insert a 0.030" feeler gage between the switch plunger and the throttle bell crank. Adjust the switch so that the plunger is compressed to its fullest extent. Hold the switch in this position and tighten the switch mounting screws.

NOTE: CHECK THE SWITCH ADJUSTMENT. THE SWITCH SHOULD BE ADJUSTED SO THAT AT NO FUEL POSITION THE SWITCH PLUNGER TRAVELS SLIGHTLY BEYOND THE POINT OF SWITCH ENGAGEMENT (WHEN YOU HEAR AN AUDIBLE "CLICK"). HOWEVER, THE FUEL PUMP SWITCH SHOULD NOT BE MOUNTED SO CLOSELY THAT THE SWITCH ACTS AS THE STOP FOR THE THROTTLE LEVER.

e. Use cable ties to secure the switch's wire leads away from heat or moving objects (arrows, Fig. 19).

f. Using the 1/4-20 nut and bolt provided, attach the fuel pump return spring bracket to the top of the fuel pump switch bracket.

g. Reattach the fuel pump return spring.

2. Wire Harness Installation

a. Route the main harness along the top of the engine compartment plenum.

b. **For '89 - '93 trucks only:** connect the GREEN, BLACK and WHITE wires with the male connector from the harness to the matching female connector on the jumper harness. Connect the male connector on the jumper harness with the matching female connector on the Fuel Pump Switch.

For '94 - '98 trucks only: connect the GREEN, BLACK and WHITE wires with the male connector from the harness to the matching female connector on the Fuel Pump Switch.

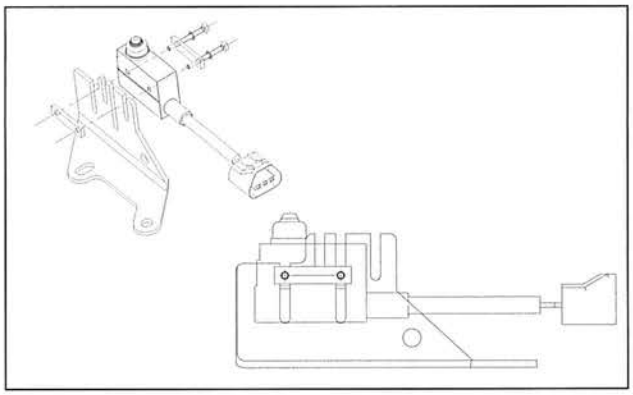


Fig. 18

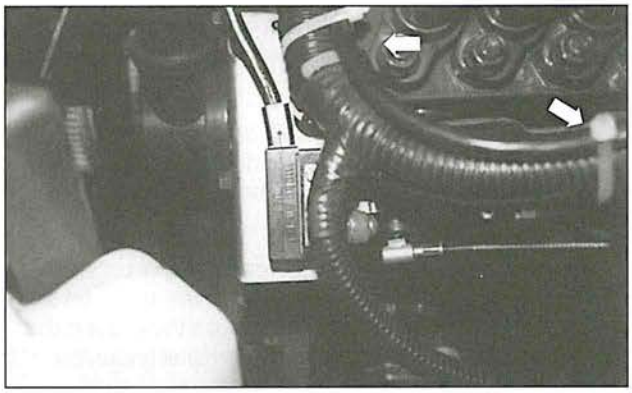


Fig. 19

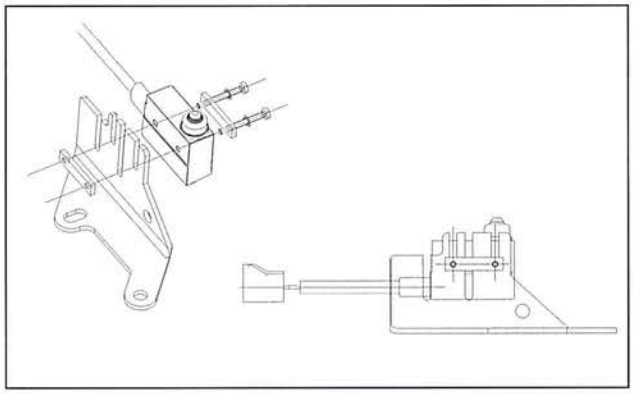


Fig. 20

c. Attach the 30" length of 1/4" I.D. vacuum line to the vacuum fitting on the main E Brake harness. Trim any extra length of hose with a sharp knife.

d. Connect the female connector with YELLOW and BLUE wires from the harness to the male connector with BLACK and RED wires on the Pressure Switch.

e. Attach the male connector with the PURPLE and GREEN wires from the harness to the female connector with the two BLACK wires on the solenoid.

f. Attach the 6" length of 1/4" I.D. vacuum tube attached to the solenoid to the polytube fitting on the main E Brake harness.

g. Mount the Relay base on the wire harness to the plenum at the hole drilled in Section 3 previously. Attach the base to the plenum using the sheet metal screw provided. Attach the Time Delay Relay to the mounting base.

h. Route the exposed red, yellow and green wires from the wire harness along the hood release cable, passing the wires through the hood release cable grommet in the dash panel.

i. Route the green wire with the ring terminal under the air box intake to an existing sheet metal screw on the passenger side inner fender. Remove the sheet metal screw and reinstall with the ring terminal under the screw (Fig. 21).

3. Attaching the Wiring Harness to the Power Supply.

If you have a '94-'98 vehicle, perform step 3A. If you have an '89-'93 vehicle, perform step 3B.

3A. Power Distribution Center/Wire Harness Connection – for '94 - '98 Vehicles.

a. Locate the power supply wire on the harness. The power supply wire is black or white with a ring terminal at its end. It also has an in-line 10A fuse to protect the system. Route this wire along the vehicle's inner fender and behind the Power Distribution Center.

b. Remove the cover from the vehicle's Power Distribution Center, and remove the nut from the positive terminal lug (see Fig. 22).

c. Mount the ring terminal from the power supply wire over the positive terminal lug (Fig. 23) and reinstall the nut and cover.

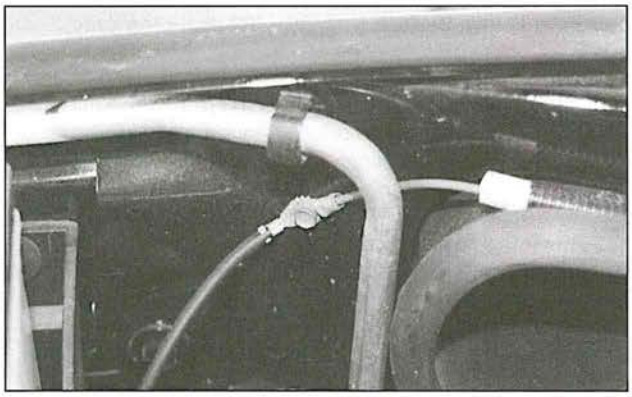


Fig. 21

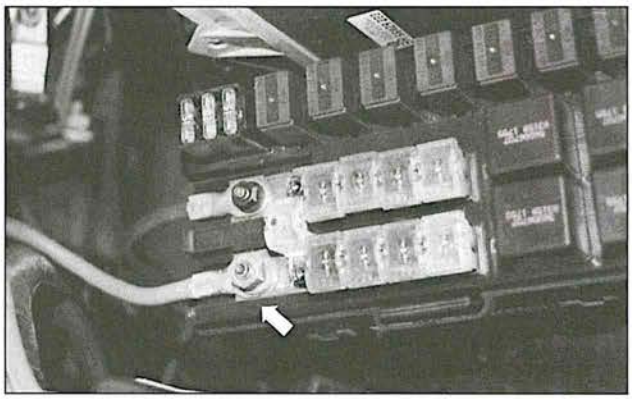


Fig. 22

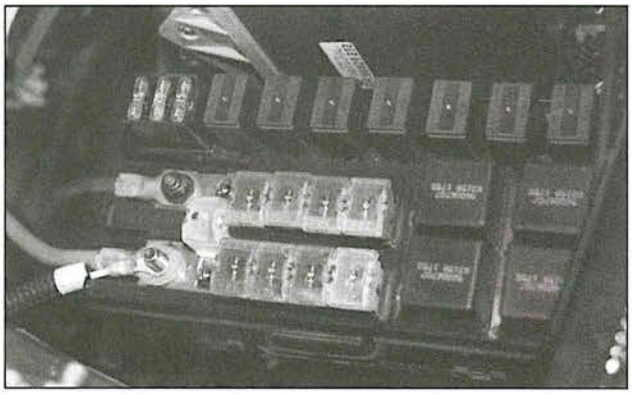


Fig. 23

3B. Power Supply/Wire Harness Connection – for '89 - '93 vehicles only.

a. Locate the power supply wire on the harness. The power supply wire is black or white with a ring terminal at its end. It also has an in-line 10A fuse to protect the system. Route this wire along the vehicle's inner fender to the battery.

b. Remove the nut from the battery clamp on the positive terminal (Fig. 24). Slip the ring from the power supply wire over the battery terminal clamp and reinstall the nut.

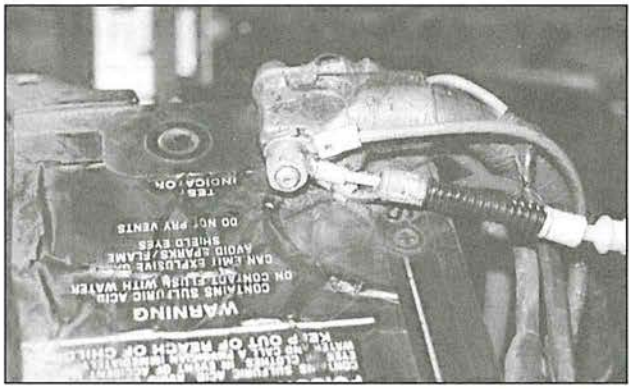


Fig. 24

4. Attach the System ON/OFF Wire.

a. Locate the two intake manifold grid heater power solenoids. The solenoids for all models are located on the left inner fender (see Fig. 25). Each solenoid has a green wire with a black stripe connected to one of its terminal posts. Remove the green/black wire from one of the solenoids (either solenoid may be used). Next remove the small hex nut from the post.

b. Slide the ring terminal attached to the RED wire on the wiring harness on the terminal post and fasten it in place with the hex nut. Finally, return the green/black wire to the terminal post.

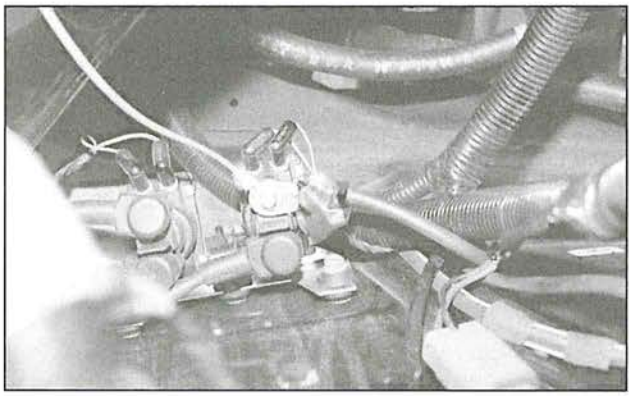


Fig. 25

5. Secure the Wire Harness

Route the wire harness under the rubber gasket at the top of the vehicle's plenum along the vehicle's existing wire harness. Use cable ties to secure the wire harness just installed to the vehicle's existing harness.

6. Reinstall the Air Filter Box.

Section 5 - Installing the Switch Groups

1. Dash Switch Installation.

If your vehicle is a '94 - '97 and **does not have** fog lights or an automatic overdrive transmission, perform Step 1A. For all other applications, perform Step 1B.

NOTE: THE KIT INCLUDES TWO DIFFERENT SWITCHES, EACH DESIGNED FOR A SPECIFIC APPLICATION. YOU WILL ONLY USE ONE SWITCH DURING INSTALLATION. THE SECOND SWITCH IS NOT REQUIRED.

1A. Dash Switch (for '94 - '97 vehicles that do not have fog lights or an automatic overdrive transmission).

For these vehicles, you will install a pushbutton switch as the main system ON/OFF switch. This switch has a factory appearance. Proceed as follows:

a. Remove the screws that hold the driver's side lower dash panel under the steering wheel, and remove the dash panel.

b. Remove the two screws that hold the ashtray in place and remove the ashtray from the dashboard (see Fig. 26).

c. Remove the two screws that hold the drink holder in place and remove the drink holder from the dashboard (see Fig. 27).

d. Gently pull the plastic cover away from the dashboard. If you have a tilt steering wheel, adjust the steering wheel to its lowest position. If you have a floor shifter, put the shift lever in a rear position (2nd or 4th gear). This will give you the most room for removing the plastic cover. If you need to, you can disconnect the cigarette lighter and the power accessory terminal to completely disconnect the cover from the dashboard.

e. Remove the three screws that attach the plastic switch block to the dashboard and pull the switch block out (see Fig. 28).

f. If your vehicle has **either** an automatic overdrive transmission or fog lights (but not both) the switch block already has two openings. A factory switch is mounted in one opening and a plug covers the second opening. Remove the plug from the existing switch block and insert the ON/OFF switch and harness assembly into the opening.

If your vehicle has **neither** an automatic overdrive transmission or fog lights, the vehicle's switch block has no openings. Insert the On/Off switch in one of the openings in the switch block supplied with the kit.

The switch will snap in as the locking tabs engage the mounting holes in the switch block.

g. Route the switch harness behind the dash panel and above the steering column to the main harness.

NOTE: DO NOT REASSEMBLE THE DASHBOARD AT THIS TIME. PROCEED TO STEP 2.

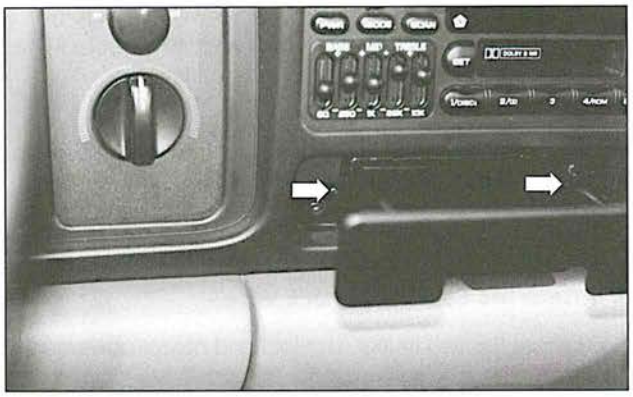


Fig. 26

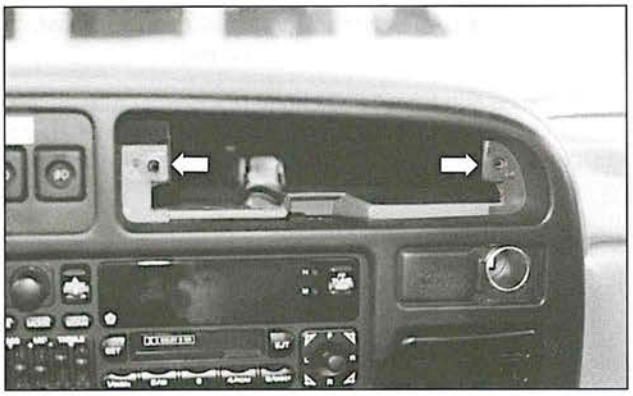


Fig. 27

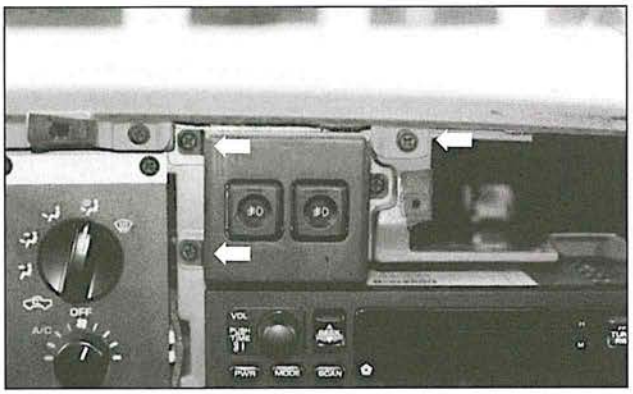


Fig. 28

1B. Dash Switch (for all other applications).

For these vehicles, you will install a rocker switch in a panel below and to the right of the dashboard to perform as the system ON/OFF switch. Proceed as follows:

a. Locate the Dashboard switch cutout template in Appendix 2. Use this template to locate and cut a rectangular hole in the dashboard for the E Brake On/Off switch. The switch should be located in the dash panel below the vehicle ashtray (Fig. 29). Drill holes in the dash panel as indicated on the template and saw or file the edges to the template dimensions.

NOTE: BE SURE TO CUT THE SWITCH HOLE TO THE TEMPLATE DIMENSIONS. IF THE HOLE IS OVERSIZE, THE SWITCH TABS WILL NOT PROPERLY LOCK IN PLACE.

b. Insert the Dashboard switch harness through the hole. Push the switch into the hole completely to engage the locking tabs on the switch body.

c. To ease harness installation and connections, remove the three screws retaining the dashboard panel below the steering wheel and remove the dashboard panel (Fig. 30).

c. Route the Dashboard switch harness behind the dash and over to the main harness. See Figure 31.

2. Switch Connection to Main Harness

a. Locate the green, yellow, and red wires routed through the plenum into the cab in Section 4. Slip the supplied 16 1/2" plastic conduit over these three wires.

b. Locate the supplied 3-cavity male connector. This connector must be attached to the green, yellow, and red wires. Insert the green wire from the main harness into the center cavity. Insert the red wire into the right cavity, and the yellow wire into the left cavity. See Figure 32.

c. Connect the Dash Switch Harness to the main harness by inserting the male connector into the female connector. Secure the wire harness to the dashboard supports with wire ties. Reattach the dash panel removed previously.

⚠ WARNING ENSURE THAT THE WIRE HARNESS IS KEPT AWAY FROM PEDAL LINKAGES TO PREVENT INTERFERENCE WITH PEDAL OPERATION OR HARNESS DAMAGE BY THE LINKAGE MECHANISMS.

Reassemble the Dashboard and reconnect the vehicle batteries. Installation is now complete.

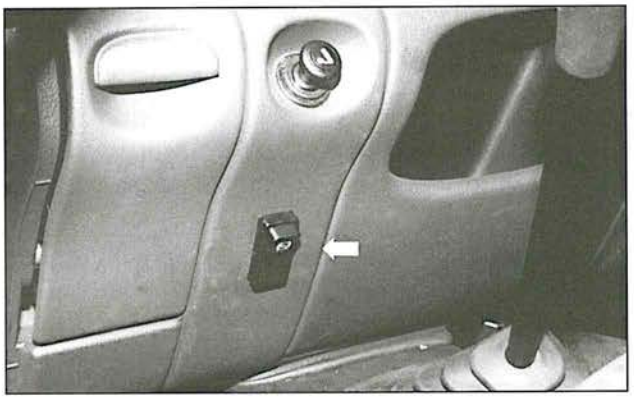


Fig. 29

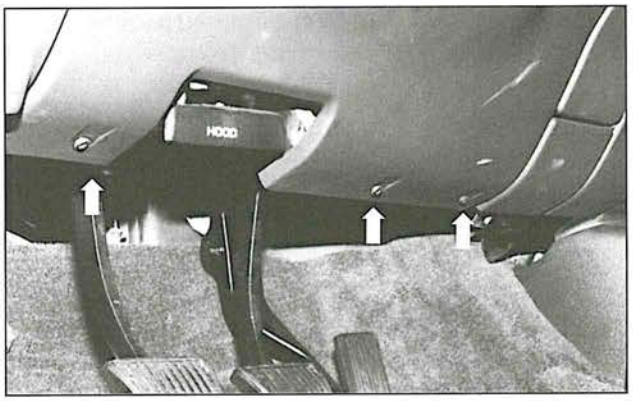


Fig. 30

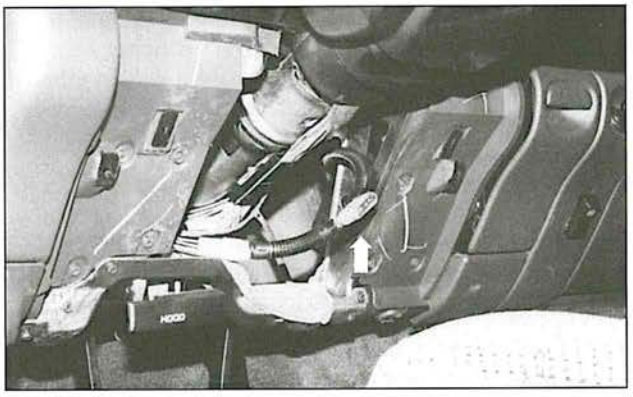


Fig. 31

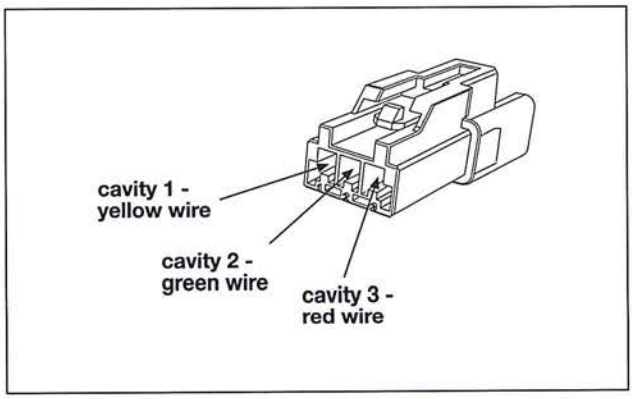


Fig. 32

Section 6 - Operational Check

Once you have completed the installation of the kit, the final step before the test drive is to check the operation of the brake.

⚠WARNING KEEP HANDS, TOOLS AND ELECTRICAL CORDS AWAY FROM THE COOLING FAN AND OTHER MOVING PARTS. INJURY COULD RESULT.

1. Start the vehicle and let it warm up.
2. Turn the dash ON/OFF switch to the "ON" position. With the hood open and the engine running at idle, the exhaust brake should be in the closed position.
3. Carefully operate the fuel pump lever to bring the engine off idle. The exhaust brake valve should open. Watch the movement of the vacuum actuator to tell if the brake is operating as it should.

   If the brake does not operate as described above, turn the switch to the "off" position and check the Troubleshooting section for details on how to proceed.

Section 7 -Troubleshooting

If the E Brake does not seem to be performing properly:

1. With the engine running at idle and the system ON/OFF switch in the ON position, check to ensure the butterfly valve is completely closing. Either bring the engine off idle or have someone manually activate the ON/OFF switch as you observe the operation of the actuator piston rod. It should move about 1.5".
2. Check for exhaust leaks at the points where the E Brake housing is attached to the turbocharger. Look for signs of exhaust residue from leaking exhaust gas. With the engine running, listen for exhaust leaks which may make a hissing or whistling sound.
3. Check for exhaust leaks at the exhaust manifold, both in the manifold itself and at the gasket surfaces where it bolts to the cylinder head. If the leaks aren't readily apparent, use a strip of paper attached to the end of a pair of pliers or a probe to locate the leaks.

   If there are leaks from the gaskets, replace them with the new triple layer stainless steel gaskets available from Cummins. These will perform better than the originals that you may need to replace. Check for leaks between the turbocharger and the exhaust manifold.
4. Test the vacuum pressure to the solenoid. Detach the 1/4" vacuum hose that is connected to solenoid port #1. Attach the hose to a vacuum gage. With the engine running, check to see that the vacuum system is operating in the range from 15 in. Hg to 29 in. Hg. If the vacuum pump is producing less than that, it may need to be replaced. Check for hose/connection leaks.
5. Test the vacuum pressure to the vacuum actuator. Detach the hose from the vacuum actuator. With the engine running at idle and the system ON/OFF switch ON, check to ensure that the vacuum system is operating in the range from 15 in. Hg to 29 in. Hg.
   - If proper vacuum pressure is present, the electrical and pneumatic connections are OK.
   - If vacuum pressure is present at the solenoid but not at the vacuum actuator, then the problem is probably electrical.

If the system doesn't appear to work at all, it is most likely an electrical problem.

NOTE: BEFORE YOU BEGIN TESTING THE ELECTRICAL PORTION OF THE SYSTEM, PERFORM THE VACUUM TEST TO ENSURE THE PNEUMATIC AND MECHANICAL COMPONENTS ARE WORKING CORRECTLY.

1. Make sure the system ON/OFF switch is turned "ON".
2. Check all connections to verify that they are correctly made and secure.
3. Use a test light or multimeter to ensure the solenoid is working when current is applied. It should make an audible clicking sound when it turns on.
4. Check the green ground wires for good continuity, that is, a good connection to the vehicle chassis.
5. Check the operation of the vacuum pressure switch. After you have checked to ensure the vacuum system is operating correctly and with the engine running, disconnect the switch from the harness and check the two ports in the connector for continuity. Plug the switch back into the harness after your test.

6. Check the connections and operation of the fuel pump switch. With the engine running at idle, use a volt meter or test light to verify there is positive (+) battery voltage at the white wire going to the fuel pump switch.

    - If there is no voltage at the white wire, check the fuse to see if it is blown or if it is not making good contact. If there is power before the fuse and not after it, the fuse is blown. If there is no power before the fuse, repair the connection to the vehicle power distribution box.

    - If there is power going to the white wire, check to verify that there is voltage at the black wire. If there is, the switch is OK. If there isn't, manually operate the switch by pressing the button. If voltage is present when you manually operate the switch, then the switch is out of adjustment on the bracket. If there is still no power coming out of the switch, then the switch is defective and must be replaced.

7. Check the connections and operation of the ON/OFF rocker switch. For those systems using a rocker ON/OFF switch, use a volt meter or test light to verify positive (+) voltage to the switch's RED wire when the ignition key switch is ON and the engine at idle.

    - If there is no power to the RED wire, check all harness connections as well as the 10 amp fuse in the harness.

    - If there is power to the RED wire, turn the rocker switch "ON" and verify there is voltage to the YELLOW wire. If voltage is not present at the YELLOW wire, the rocker switch is defective or connections are faulty and the switch harness must be replaced.

    - If there is no power to the RED wire, check the connection at the switched side of the heating/cooling system power supply solenoid.

8. Check the connections and operation of the Vacuum Pressure switch. With the engine running at idle, and the system ON/OFF switch "ON", there should be voltage at both wires going to the vacuum pressure switch.

    - If there is voltage at the YELLOW wire, but not at the BLUE wire, the vacuum pressure switch is defective and must be replaced.

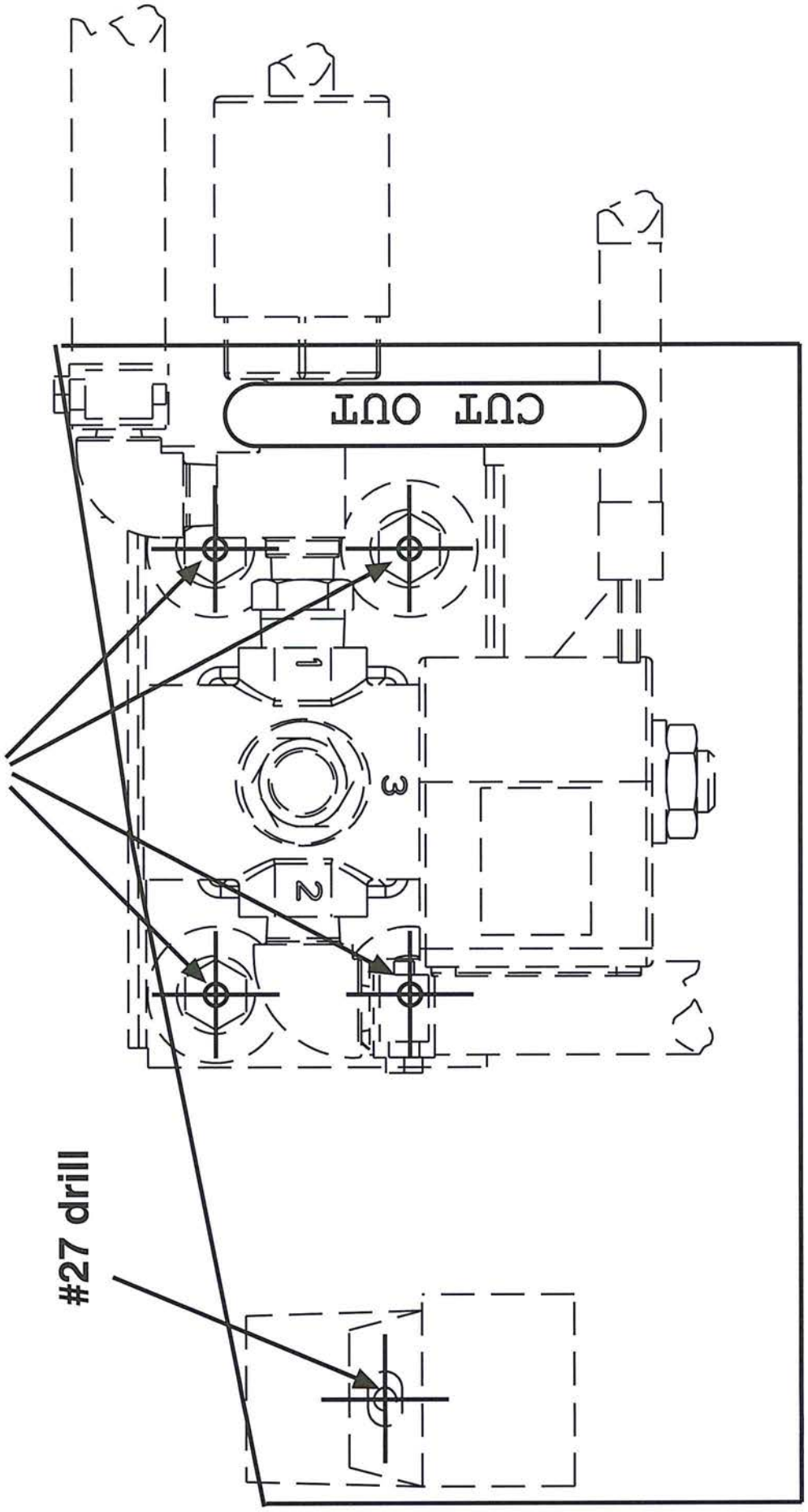
    - If there is no voltage at the YELLOW wire, check the connections and operation of the system ON/OFF switch.

REMINDER: THIS TEST ASSUMES THAT YOU HAVE ALREADY TESTED FOR SYSTEM VACUUM AND DETERMINED THAT IT IS WORKING CORRECTLY.

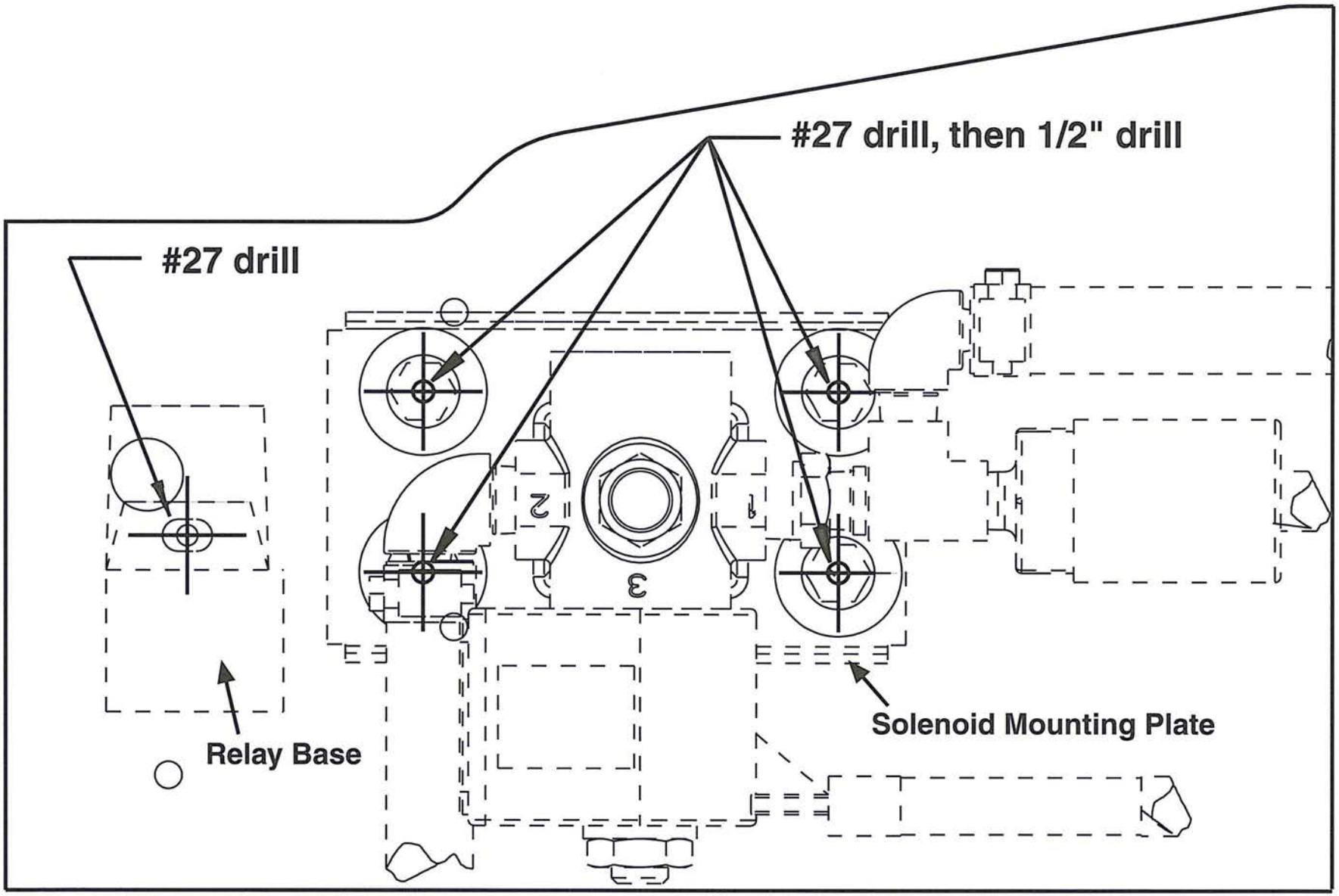
Notes

Appendix 1 - Mounting Hole Templates

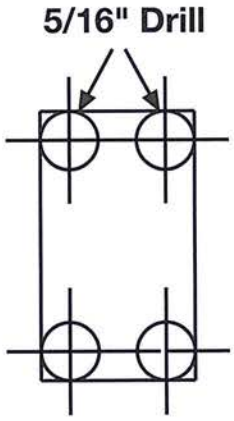
'89 - '93 Solenoid Mounting Bracket
Hole Pattern Template



'94 - 98 Solenoid Mounting Bracket
Hole Pattern Template



Appendix 2 - Dash Switch Hole Template



Notes

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