

OWNERS MANUAL

**WITH INSTALLATION
INSTRUCTIONS**

banks[®] STINGER[™] SYSTEM

**250-325 HP CUMMINS POWERED (C8.3L)
CLASS-A PUSHER MOTORHOME
(CPL's 1406, 2102 and 2103)**

THIS MANUAL IS FOR USE WITH SYSTEM **49290**

banks[®]

GALE BANKS ENGINEERING

546 DUGGAN AVENUE • AZUSA, CA 91702

(626) 969-9600 • FAX (626) 334-1743

www.bankspower.com

PREPARATION AND PRECAUTIONS

- 1.** For ease of installation of your Banks Stinger system, familiarize yourself with the procedure by reading the entire manual before starting work. This instruction manual contains 12 pages of text, illustrations and parts listing. If any pages are missing, please call GALE BANKS ENGINEERING for a replacement.
- 2.** Throughout this manual, the left-side of the vehicle refers to the driver's side, and the right-side to the passenger's side.
- 3.** This Banks system is designed to fit Class-A Cummins powered pusher motorhomes equipped with the C8.3L engine with a factory horsepower rating of 250, 275, 300 or 325. For further identification, check the CPL number on the engine information tag located on the timing cover. This manual applies to CPL's 1406, 2102 and 2103.
- 4.** Disconnect the ground cable from the battery before beginning work. If there are two batteries, disconnect both.

- 5.** Route and tie wires and hoses a minimum of 6 inches away from exhaust heat, moving parts and sharp edges. Clearance of 8 inches or more is recommended where possible.
- 6.** During installation, keep the work area clean. If foreign debris is transferred to any Banks PowerPack component, clean it thoroughly before installing. Cleanliness is also important on and around the engine. Because diesel pushers tend to gather a large amount of grease and dirt in the engine compartment, steam cleaning the engine prior to the Stinger installation is recommended.

INSTALLATION PROCEDURE

TURBOCHARGER REMOVAL

- 1.** Position vehicle on a flat level surface.
- 2.** Disconnect the air inlet elbow or inlet hose from the compressor inlet of the turbocharger. Disconnect the exhaust pipe from the rear of the turbocharger.
- 3.** Remove the two oil drain tube bolts from the turbocharger.
- 4.** Disconnect the oil supply hose at the turbocharger.
- 5.** Note the orientation of the compressor housing in the vehicle. When the new assembly is installed the orientation of the compressor outlet should remain the same. Remove the boost pressure hose from the nipple of the wastegate actuator. Remove the turbocharger mounting nuts and the turbocharger from the exhaust manifold.

CAUTION: Anytime the turbocharger is removed from the engine, take care that no foreign objects enter any of the turbocharger connections on the

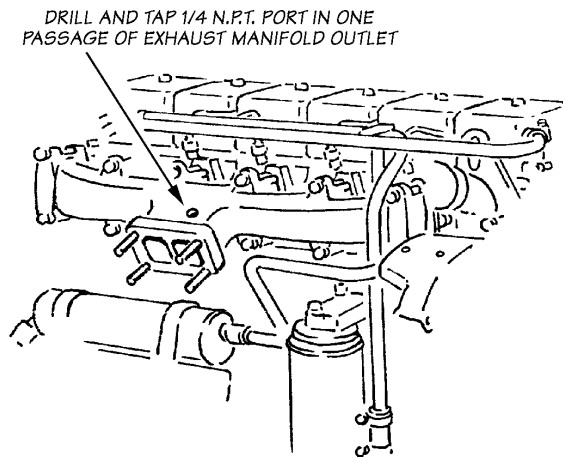
engine or the turbocharger. Foreign objects entering air, exhaust, or oil connections may cause major damage to the engine and/or turbocharger and is not covered under any warranty. Cover the open end of the intercooler pipe with a rag, as this pipe is very susceptible to foreign object entry.

- 6.** Clean and inspect the exhaust flange mounting surfaces on the exhaust manifold. Remove any remaining gasket material from the turbocharger oil drain flange surface. Make sure the surface is clean and dry.

PYROMETER (EXHAUST TEMP.) GAUGE

- 7.** The exhaust gas pyrometer monitors the temperature of the exhaust entering the turbocharger turbine housing. Installation requires that the exhaust manifold be drilled adjacent to the temperature probe near the outlet of the manifold adjacent to the turbine housing. For this reason it is essential that the turbocharger be removed from the engine in order to clean out any metal chips from drilling that could cause turbine blade damage.

Figure 1



The Cummins C8.3L engine uses a divided exhaust manifold and turbocharger. The pyrometer probe must be installed to sample exhaust temperature in one of the two exhaust passages. Typically the exhaust temperature will not differ appreciably between the two passages. We recommend installing the probe in the rear manifold passage to simplify routing the probe wiring.

8. Stuff a small shop towel or rag 4 to 5 inches into the rear exhaust manifold passage through the turbocharger mounting flange. This is to prevent chips from entering the manifold while drilling and tapping.

9. Drill through the exhaust manifold into the rear passage at the location shown in **Figure 1**. Use a $\frac{7}{16}$ inch drill, keeping the drill perpendicular to the manifold surface.

10. Tap the drilled hole with a $\frac{1}{4}$ NPT pipe tap. Check the thread depth as you tap by periodically removing the tap and screwing the probe fitting (supplied in pyrometer kit) into the tapped hole. The probe should thread in 3 to $3\frac{1}{2}$ turns hand tight. Do not install the probe in place at this time.

11. Remove as many loose chips as possible from the exhaust manifold. A shop vacuum, small brush, or fingers will help. Now remove the rag using a welding rod or coat hanger bent into a hook.

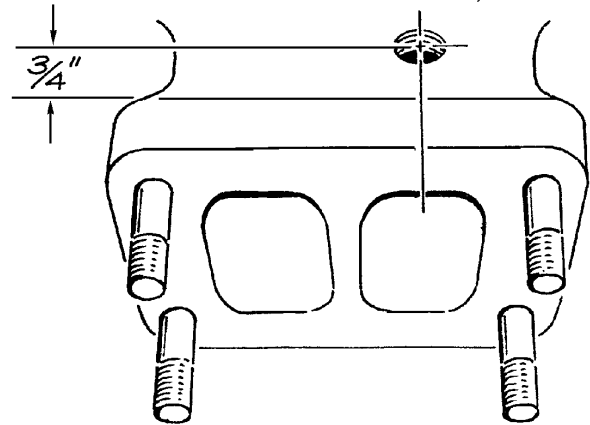
CAUTION! Make sure rags are removed from exhaust manifold prior to reinstalling turbine housing!

12. Install the probe in the manifold. Anti-seize on the threads is recommended.

TURBOCHARGER DISASSEMBLY AND REASSEMBLY:

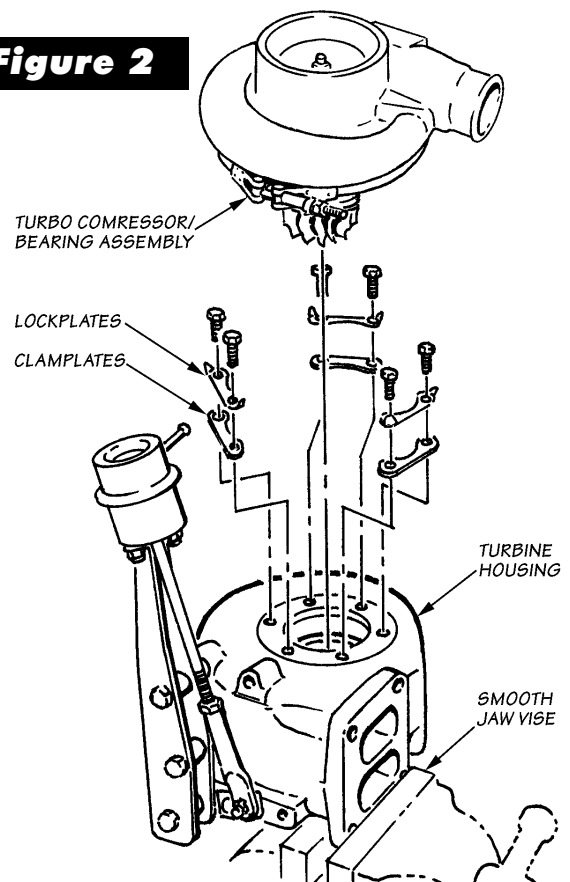
13. Clamp the turbine inlet flange of the turbocharger in a bench vise. Loosen the six bolts, attaching the turbine housing to the center bearing section of the turbocharger. (See **Figure 2**)

LOCATE PORT $\frac{3}{4}$ INCH BEHIND FLANGE, CENTERED OVER RIGHT EXHAUST MANIFOLD PASSAGE, AS VIEWED



14. Remove the bolts, lockplates, and clamp plates. Carefully remove the center bearing and compressor assembly from the cast iron turbine housing. If the turbocharger has been in service for some time, rust and carbon may prevent the center bearing and compressor assembly from easily separating from the turbine housing. If light hammer blows, penetrating oil or heat will not free the compressor assembly from the turbine housing, the clamp bolt adjacent to the turbo oil inlet connection may be backed out so as to push against the bearing casting and separate the two components. Remove any loose rust or carbon from the bearing housing that might prevent proper engagement into the new turbine housing.

Figure 2



15. Install the center bearing and compressor assembly into the new turbine housing supplied. Apply a dab of anti-seize compound to the bolts, then install bolts, clamp plates, and lock plates finger tight to allow for final positioning.

16. Remove the exhaust outlet adapter from the rear of the original turbine housing. Clamp the exhaust inlet flange of the new turbine housing in a bench vise. Using the new gasket provided install the turbo exhaust outlet adapter casting to the new turbine housing with five 8mm x 20mm metric hex bolts. Apply a dab of anti-seize compound to the bolts, then torque the bolts to 11.3N-m (100 in-lbs.). Make sure the turbine inlet flange does not rotate in the vise while torquing.

TURBOCHARGER INSTALLATION

17. Install a new turbo exhaust inlet gasket provided and apply a dab of anti-seize compound to the four turbo mounting studs. Install the turbocharger on the exhaust manifold. Tighten the turbocharger mounting nuts to 32N-m (24 ft.lbs.) torque.

18. Align the compressor outlet with the intercooler hose adapter and tighten the clamp. Tighten the turbine housing clamp plate bolts to 11.3N-m (100 in-lb.) torque.

19. Spin the turbocharger shaft to make sure it turns freely. If not, loosen the turbine clamp plate bolts and check for misalignment between the turbine housing and turbocharger center section. Retighten bolts and check again.

20. Use the new gasket provided to connect the turbocharger oil drain tube to the turbocharger. Make sure the turbocharger oil drain flange is clean and free of any old gasket material. Tighten the drain flange bolts to 24N-m (18 ft.lbs.) torque. *NOTE: If the bolts encounter excessive resistance prior to seating against the flange, check for paint build up in the threads of the turbo bearing housing. The threads may need to be chased with an 8mm x 1.25 metric tap.*

21. Reconnect and tighten the turbo oil supply hose.

BOOST GAUGE INSTALLATION

22. Choose a suitable location under the lower edge of the dash panel for mounting the instrument panel provided where it can be conveniently viewed by the driver.

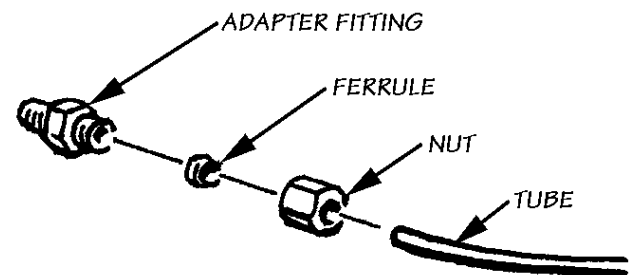
NOTE: Molded instrument consoles for top-of-dash mounting and additional gauges are available through Gale Banks Engineering.

23. Using the panel as a template, drill two $\frac{3}{16}$ " diameter holes in the dash and mount the panel with two no. 10 x $\frac{1}{2}$ " machine screws, nuts and star washers provided.

24. If the intake manifold has an $\frac{1}{8}$ " NPT plug, remove it and install the $\frac{1}{8}$ " NPT male x $\frac{1}{8}$ " compression tube adapter at this location. Otherwise use the $\frac{1}{2}$ x $\frac{1}{8}$ " NPT bushing and install the bushing and adapter in the intake manifold in place of an existing $\frac{1}{2}$ " pipe plug.

25. Install one end of the $\frac{1}{8}$ " diameter plastic tube provided in the nut and ferrule adapter fitting and tighten the nut. Check that the plastic tube cannot be pulled out of the ferrule, but do not over-tighten the nut. See **Figure 3**.

FIGURE 3



26. Install the boost gauge in the gauge panel using the clamps and thumb nuts provided. Install the $\frac{1}{8}$ " NPT female x $\frac{1}{8}$ " compression tube adapter fitting onto the connection at the back of the gauge. Use Teflon tape or sealant on the male threads of the gauge nipple. Use sealant sparingly, and do not allow any sealant to cover the small pin-sized hole in the end of the gauge nipple.

27. Route the plastic tube along one framerail of the coach. Find an opening in the forward bulkhead to route the tube into the driver's compartment. It may be necessary to drill a $\frac{3}{8}$ " hole. Route the tube to the gauge then cut the tube to length. Insert the tube into the nut and ferrule on the adapter fitting at the gauge, then tighten the nut against the tube and ferrule. Do not overtighten.

28. Uncoil the leadwire cable provided with the pyrometer gauge kit. As a precaution to improper gauge function, re-crimp the ring terminals on the wires at the probe, after sliding an insulating sleeve onto each of the wires at this end of the cable. Check that the two red wires are connected together, and likewise the yellow wires, and that screws are tight. Slide the insulating sleeves over each connection and check that connections cannot short together. Wrap electrical tape over the sleeves for additional insulation.

29. Route the leadwire along the same path as the boost hose. Coil any excess length and secure it with tie wraps. **DO NOT** cut the leadwire to shorten it. The pyrometer is calibrated to operate with the predetermined length provided.

30. Remove the short piece of bare wire from across the stud terminals on the back of the pyrometer gauge. Remove the U-clamp from the studs, then install the gauge through the panel using the U-clamp and two 10-32 hex nuts provided with the gauge. **DO NOT** remove the nuts on the studs closest to the gauge body.

31. Slip the ring terminals on the end of the leadwire cable over the studs on the pyrometer. Connect the yellow wire to the + terminal and the red wire to the other terminal. If the leadwires are accidentally reversed, the gauge will read backwards. Install one flat washer, one lock washer, and one 10-32 hex nut on each stud and tighten.

GAUGE LIGHTING

32. Snap the light sockets into the back of each gauge if not already installed. Connect one wire from each light to a good ground location under the dash, such as metal dash support brackets where other wires may already be grounded. Connect the remaining light wires together, then to an 18-ga. or larger wire connected to the headlight circuit, or to the factory instrument light circuit. Wiring and terminals for gauge lighting are not supplied with the system.

33. Install the air inlet tube (from the air cleaner housing) and the turbo exhaust pipe onto the turbocharger. Reattach the wastegate actuator boost line using a crimp lock clamp provided.

OTTOMIND INSTALLATION

To realize power gains made available by the increased airflow through the Banks components, the fuel delivery of the injection pump must also be increased. This procedure will provide the additional fuel flow required.

The injection pump is located on the upper left side of the engine, and can be identified by the row of six injector pressure tube connections on top of the pump body.

34. Locate the cam plate cover on the injection pump. See Figure 4. The cover is just to the rear of the area where the six injector pressure tubes connect to the pump body, and is retained by four screws. Clean any dirt, grease, or foreign material from the cam plate cover, especially in the area where the cam plate cover flange contacts the main pump body, to prevent contaminants from entering into the pump upon disassembly.

Use a sharp scribe to scribe a line in the injector pump body along the outside edge of the cam plate cover where the cover attaches to the pump (along the upper edge of the

FIGURE 4

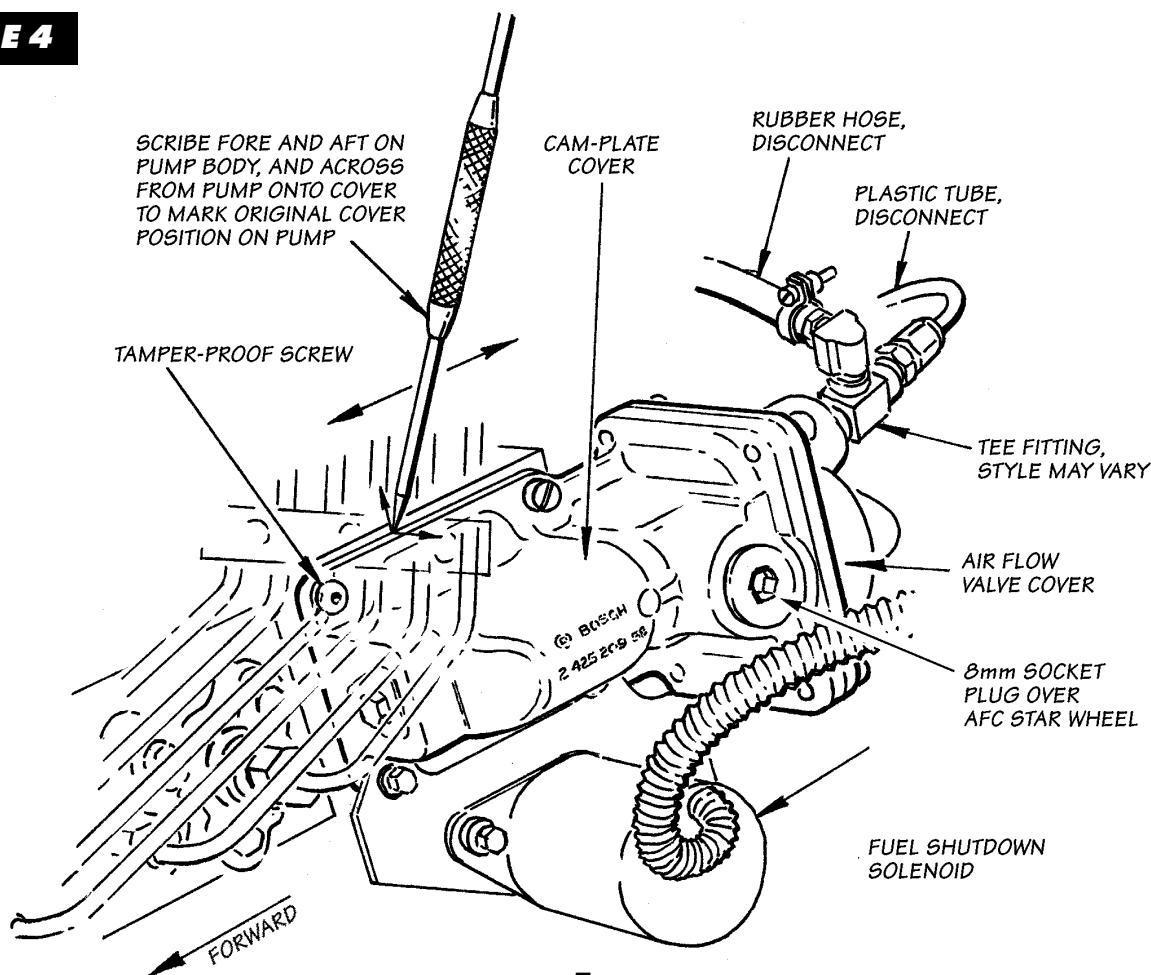


FIGURE 5

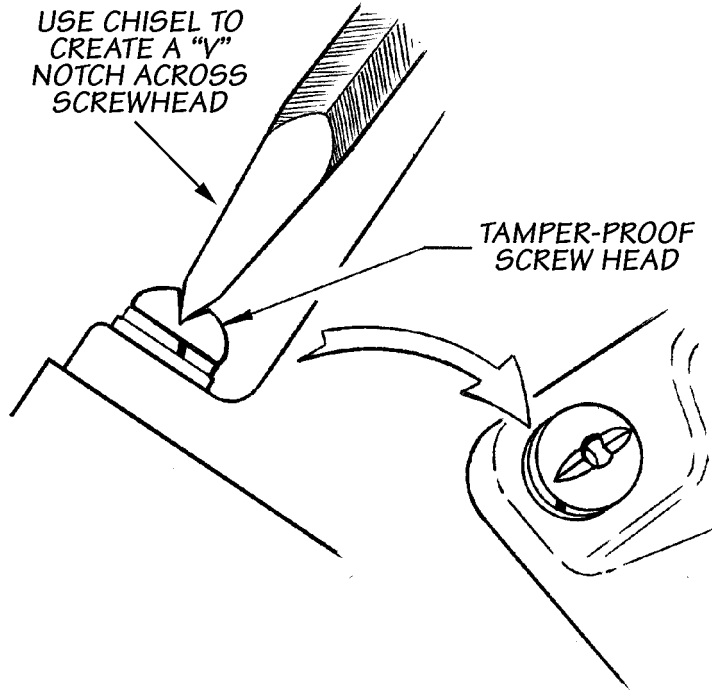
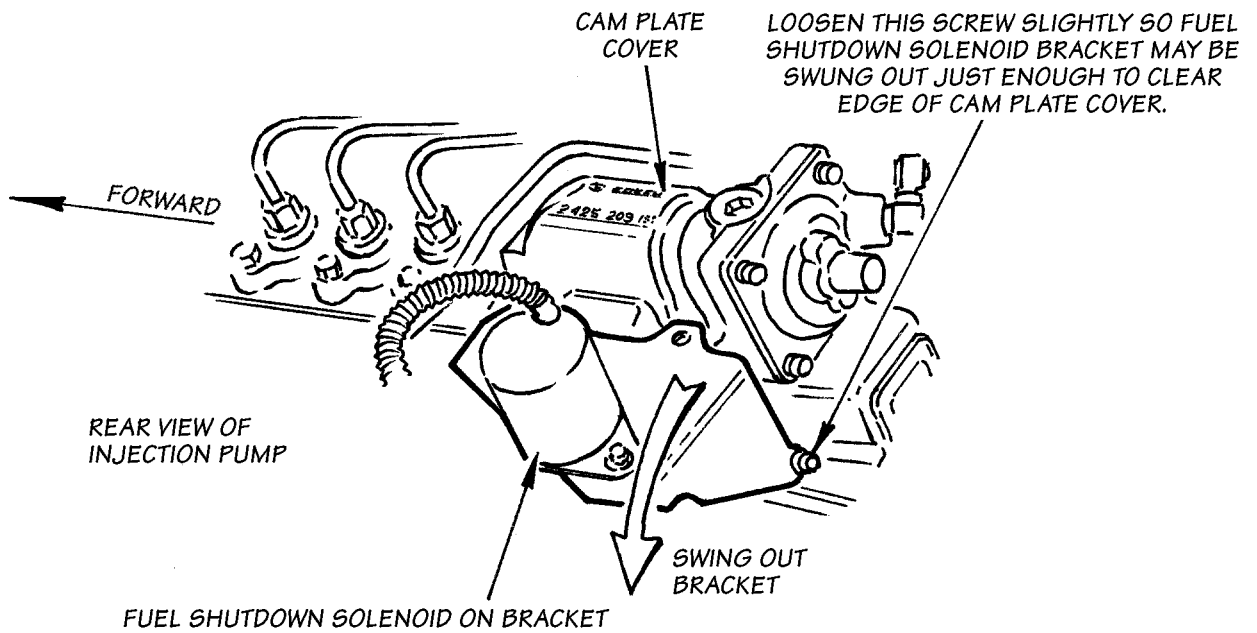


FIGURE 6



cover, on the side facing the engine). Then scribe another line at a right angle across the first, from the pump body onto the cover. These scribe lines are to enable you to reinstall the cam plate cover in exactly the same position. You may make any additional scribe lines if you feel it may be helpful.

35. Loosen and disconnect a rubber hose and a plastic tube from a "tee" fitting located in the air flow valve cover. This is a smaller cover attached to the rear of the cam plate cover, with four screws facing the rear of the engine.

36. The upper forward screw attaching the cam plate cover to the fuel pump body has a factory break-off tamper proof head. This screw head must be modified to provide some means of removal. A sharp chisel with an approximately $\frac{3}{8}$ " wide blade may be used to chisel a screwdriver "slot" across the screw head. Pass the chisel between the injector tubes and strike straight down to create a "V" notch, then use a $\frac{5}{16}$ - $\frac{3}{8}$ " blade screwdriver with moderate downforce to turn the screw. See [Figure 5](#). An alternate method is to drive the chisel into the screw head using blows upon a hand held impact driver tool set in the "removal" position, such as a Snap-On No. PIT 160 or equivalent. Install a hex or 8-point socket on the driver that will fit over the shank on the chisel. Another method is to drive a No. T15 (or in some cases a No. T20) male TORX bit into the screw head using either a hammer or hand impact driver. A center punch may be required to provide a depression in the top of the screw. When using a hand impact driver, use light hammer taps to seat the TORX bit, and progressively harder blows to loosen the screw.

Once this screw has been removed, save the washers and discard the screw, then loosen and remove the remaining three screws and retain these for reassembly. Remove two fuel shutdown solenoid bolts and the hairpin style clip from the solenoid actuator rod. Remove the solenoid and set it aside. Loosen slightly one bolt at the rear of the injection pump that will allow the fuel shutdown solenoid and bracket to be swung outboard just enough to clear the edge of the cam plate cover so the cover can be removed from the pump. Now remove the cam plate cover and set it aside. (See [Fig. 6](#))

37. Note the position of the cam plate attached to the pump body by two screws. Mark a scribe line in the pump body at the forward edge of the cam plate where it contacts the pump body. See [Figure 7](#). This mark can be used as a reference should the original cam plate need to be reinstalled.

38. Place the installation guide template provided over the stock fuel cam plate. This template will provide the position reference for the Banks OttoMind calibration cam. *Note: The guide template will only fit one way. If it appears to be misaligned or does not seem to fit, flip the plate over and try again.*

39. Using two of the cam cover screws previously removed, loosely attach the guide template to the fuel pump body. Slide the guide template toward the rear of the engine so that there is zero clearance between the front edge of the fuel cam plate and the guide template. Hand tighten the two screws so that the guide template **DOES NOT** move during the remainder of the Banks OttoMind installation.

40. Loosen and remove the two screws holding the fuel cam plate in place. Keep these for reuse. Remove the stock fuel cam plate. Keep this piece in a safe location in case it is needed for future work on your vehicle.

41. Install the Banks OttoMind fuel calibration cam in the same position as the stock fuel cam plate, with zero clearance between the front edge of the calibration cam and the guide template. Replace the two screws to retain the calibration cam and tighten. Remove the installation guide template and keep it with your stock fuel cam plate for future use.

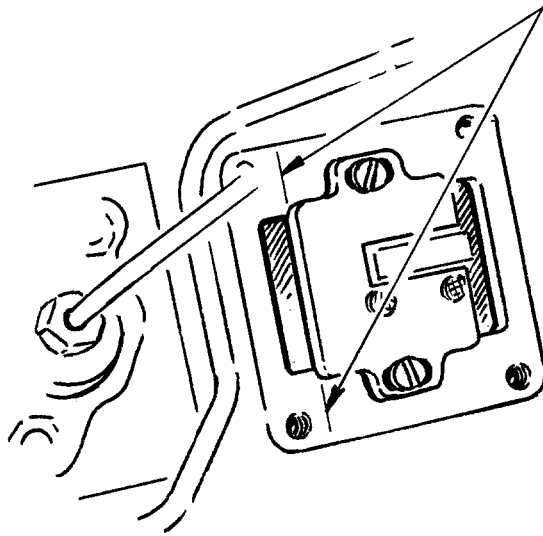
42. Once the Banks OttoMind is installed, replace the cam plate cover on the pump, swing the fuel shutdown solenoid bracket into place and reinstall the fuel shutdown solenoid. Thread the two lower cover screws into the pump finger tight. Install one original screw in the upper rear bolt hole. Install the supplied phillips head screw in the upper forward bolt hole. This is a temporary use screw to be replaced once final fuel calibration is confirmed. It is recommended that vehicle performance be verified before the final installation of the break off screw. Tighten the bolts, while positioning the cover to its exact original position, as indicated by your scribe lines on the cover and pump body. Tighten the rear fuel shutdown bracket bolt that was loosened for cover removal. After engine performance is checked, replace the phillips head screw with the break off screw provided.

43. Reconnect the rubber hose and plastic tube to the "tee" fitting on the air flow valve cover, tighten the hose clamp and tube nut.

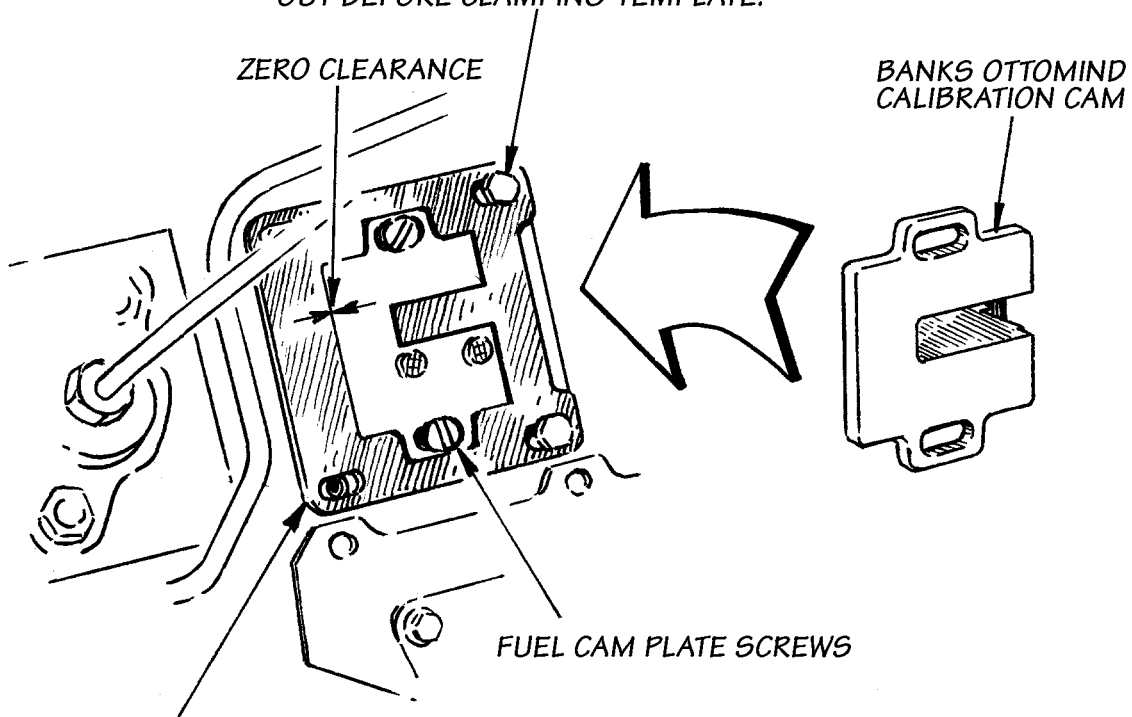
This completes the injection pump adjustment procedure. Continue to the CHECKING ENGINE PERFORMANCE section of these instructions.

FIGURE 7

MAKE SCRIBE LINES ACROSS
FRONT EDGE OF FACTORY
FUEL CAM PLATE ONTO
BOTH SIDES OF PUMP BODY.



COVER SCREWS TEMPORARILY INSTALLED TO HOLD TEMPLATE.
ADD WASHERS UNDER SCREW HEADS IF SCREWS BOTTOM
OUT BEFORE CLAMPING TEMPLATE.



GUIDE TEMPLATE SHOWN INSTALLED
OVER FACTORY FUEL CAM PLATE

CHECKING ENGINE PERFORMANCE

Go over the entire installation as a precautionary check to ensure that all clamps are tight, wiring and hoses are properly routed, and connections are tight. Start the engine and allow it to warm up. Drive the vehicle under light load (normal around town driving) for 20 to 30 minutes, and listen for any exhaust leaks or rattles, or intake boost leaks. Shut off the engine and re-tighten all intercooler, intake and turbocharger boost clamps. If your vehicle has an air compressor that feeds from the engine intake, check these connections as well. These connections may have loosened with time, and if leaking, will cause a drop in boost pressure with a loss in performance. Check that clamps are properly positioned on hoses, and periodically check tightness of hose clamps at regular maintenance intervals, such as when the oil is changed. Engines with high mileage may have broken or loose exhaust bolts, or blown gaskets between the cylinder head and exhaust manifold. Repair any exhaust leaks as necessary.

Observe the operation of the boost and pyrometer gauges while driving under varying conditions. Turbocharger boost pressure will increase as a function of load and engine RPM, thus the engine will produce little boost while cruising at light throttle, with maximum boost while climbing hills heavily loaded during acceleration. Note the boost level seen during hard acceleration with a given load. If performance seems to have deteriorated sometime in the future, the maximum boost figures may be compared to see if boost has dropped off. Lower boost may be caused by turbo ducting leaks, a malfunctioning wastegate or fuel injection pump, or a dirty air filter. Typical maximum boost pressure settings for the Cummins diesel will vary considerably with different transmission models, factory settings and altitude.

Use your pyrometer (exhaust gas temperature) gauge to monitor exhaust gas temperature (EGT) in the engine. At idle, exhaust gas temperature will be very low, perhaps only 300 degrees F. As the engine is accelerated for higher speeds with greater loads, the EGT will rise. The highest EGT will be seen under maximum load at full throttle, such as climbing a steep grade with a heavily laden vehicle. Use caution if your pyrometer reading approaches 1250 F, with 1300 F being the **ABSOLUTE MAXIMUM!** Exceeding these figures for more than a brief moment may cause engine damage.

If the vehicle reaches maximum EGT under these conditions, downshift the vehicle to reduce load, or back off the throttle.

TROUBLE SHOOTING CHART

SYMPTOM	CAUSE	REMEDY
HIGH EGT	• EXCESSIVE FUEL DELIVERY	• CHANGE INJECTOR PUMP SETTING
	• FAULTY INJECTOR(S)	• REPAIR INJECTOR(S)
	• RESTRICTED EXHAUST SYSTEM	• CHECK FOR OBSTRUCTIONS
EXCESSIVE FUEL SMOKE (BLACK) POOR PERFORMANCE	• FAULTY INJECTOR(S)	• REPAIR INJECTOR(S)
	• DIRTY AIR CLEANER	• CLEAN OR REPLACE
	• RESTRICTED AIR INTAKE	• CHECK FOR BLOCKED OR COLLAPSED AIR INTAKE HOSES
EXCESSIVE OIL SMOKE (BLUE)	• POOR QUALITY or DIRTY DIESEL FUEL	• REPLACE FILTERS, CLEAN LINES, INJECTORS AND TANK AS REQUIRED
	• BLOCKED OR RESTRICTED TURBO OIL DRAIN	• ELIMINATE RESTRICTIONS IN THE DRAIN LINE
LACK OF BOOST, EXCESSIVE OIL SMOKE, & POOR PERFORMANCE	• DAMAGED TURBO BEARINGS, CAUSED BY DIRTY OIL OR LACK OF LUBRICATION	• REBUILD TURBO, CHECK OIL LEVEL, CHANGE OIL AND FILTER AT REGULAR SERVICE INTERVALS
	• WORN OR DAMAGED ENGINE COMPONENTS	• CHECK COMPRESSION, REPLACE RINGS OR VALVES
LOW BOOST, POOR PERFORMANCE, SOMETIMES WITH HIGH EGT	• RESTRICTED EXHAUST SYSTEM	• ELIMINATE RESTRICTIONS, CHECK FOR OBSTRUCTIONS
LACK OF BOOST OR LOW BOOST, POOR PERFORMANCE	• INTAKE SYSTEM LEAKS	• LOCATE AND SEAL LEAKS; CHECK INTAKE CLAMPS & MANIFOLD GASKETS
	• EXHAUST SYSTEM LEAKS AHEAD OF TURBOCHARGER EXHAUST INLET	• LISTEN FOR LEAKS, REPAIR AS NECESSARY
	• BROKEN TURBOCHARGER BLADES CAUSED BY FOREIGN OBJECTS ENTERING THE INTAKE OR EXHAUST SYSTEM	• REBUILD TURBOCHARGER; ELIMINATE MEANS OF FOREIGN OBJECT ENTRY
PYROMETER NOT WORKING	• CHECK FOR REVERSED WIRES	• REVERSE WIRES
	• POOR WIRE CONNECTIONS	• CLEAN AND SECURE CONNECTIONS. IF GAUGE READING CHANGES WHILE WIGGLING CONNECTIONS, CONNECTIONS ARE FAULTY.
	• WIRING CONNECTIONS SHORTED TOGETHER	• INSULATE CONNECTIONS
BOOST GAUGE NOT WORKING	• LOOSE, BROKEN, PINCHED, CUT, OR MELTED PLASTIC PRESSURE LINE	• REPAIR OR REPLACE AS REQUIRED, RE-ROUTE LINE AWAY FROM HAZARDS
	• NEEDLE IN GAUGE STICKS	• REPLACE GAUGE
GRADUAL LOSS OF PERFORMANCE, AND POSSIBLY BOOST ("FLATTENS OUT" AT HIGH RPM)	• CLOGGED, OR PARTIALLY CLOGGED, FUEL FILTER	• REPLACE FUEL FILTER(S)

IMPORTANT EMISSIONS INFORMATION

DIESEL SMOKE OPACITY TESTING

Several states are now imposing roadside inspections that test diesel vehicles for smoke opacity (density) and issue citations for excessively smokey vehicles. The predominate standard is a 40% maximum opacity limit, with vehicles exceeding this level either being fined or issued "fix-it" tickets. A 40% opacity level means that 40% of the light visible through the smoke as seen against a white background is blocked by the smoke. Thus a clear exhaust stream represents 0% opacity, while jet-black smoke represents 100% opacity.

The opacity test is conducted with one person depressing the accelerator pedal to the floor as quickly as possible with the engine out of gear while another person observes the opacity of the smoke. The engine is held at full throttle for approximately two seconds, then released. This is done 5-6 times, with the first 2-3 times being considered invalid, as built up carbon being blown out with the exhaust may show darker smoke. The initial burst of smoke from the next several accelerations is simultaneously compared with a tinted plastic sample while viewed against a white background under daylight conditions. This is referred to as a "snap idle" or "snap throttle" test and is often conducted at roadside inspection sites or truck weigh stations using a calibrated opacity meter placed over the smoke stream. Although comparison testing with the plastic sample will not give an actual opacity reading, and it can be interpreted differently because of light conditions and other variables, it will give you an approximate indication of whether the vehicle's smoke opacity is below the 40% level.

Included with this Banks Stinger system is a 4-inch square of acrylic plastic tinted to approximate a 40% opacity. By using this plastic in the following procedure, the vehicle's smoke opacity can be compared to the 40% test level.

1. Start the vehicle and allow the engine to warm up. You may want to drive the vehicle for 5-10 minutes to speed up the process. Park the vehicle outside so the tailpipe is not in shadow and the exhaust smoke can be viewed against a white background that is not in shadow. If a white background is not available, place a piece of white cardboard, at least one-foot square, so the exhaust smoke can be viewed in front of it.

2. With the vehicle running, set the transmission in Park or Neutral, and apply the parking brake. Have another person depress the accelerator pedal to the floor as quickly as possible and hold it there for 2-3 seconds, then release it. Repeat this procedure two more times.

3. Hold up the tinted plastic at arms length so it is directly above the path of the exhaust smoke, so both the smoke and the plastic can be viewed simultaneously against the white background while accelerating the vehicle. Have your helper repeat 2-3 more acceleration bursts while you observe the smoke and plastic sample.

Compare the tint of the initial puff of smoke during acceleration with the sample, after the initial puff the smoke will most likely be lighter. The darkest part of the acceleration burst is the level measured in the test. It may take several acceleration bursts for you to make a determination of the vehicle's opacity level.

4. If the smoke appears lighter than the sample, the opacity is less than 40%. If the smoke appears darker, the cam plate in the fuel injection pump may have been mispositioned during installation. Please refer to page 8, INJECTION PUMP ADJUSTMENT, to verify that the Banks Ottomind calibration cam is in the correct position. This test assumes that the injection pump and fuel injection system are adjusted properly and in good working order, as other factors may affect the opacity level.

NOTE: In no case should this test be considered as meeting any legal requirement where an actual opacity percentage number is required. It is a "ball-park" approximation to give the tuner a relative idea of where the vehicle's opacity level stands.

BILL OF MATERIALS

Cummins 8.3 Diesel Motorhome

COMPONENT	49290 PART#
ASSEMBLY, OttoMind	62407
ASSEMBLY, Turbine Housing, 14cm	24350
BUSHING, 1/8" NPT x 1/2" NPT	92258
CARD, Product Registration	96392
GASKET, Oil Drain	93042
GASKET, Turbo Inlet	93032
GAUGE, Opacity	91090
KIT, Boost Gauge	64054
KIT, Pyrometer	64007
LUBRICANT, Anti-seize	90045
OWNERS MANUAL	96381
PANEL, Mounting, 2 Gauge	63002
(3) PLAQUE, Banks Turbocharged	96003
TAPE, Teflon	91099
WARRANTY STATEMENT	96364