



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: PE 04-036

Prompted By: Owner Complaints

Date Opened: 04/12/2004

Date Closed: 12/06/2004

Principal Investigator: SCOTT SHADLE

Subject: Diesel Exhaust Gas Intrusion

Manufacturer: FREIGHTLINER LLC

Products: 2003 FREIGHTLINER COLUMBIA

Population: CONFIDENTIAL

Problem Description: Diesel exhaust gas intrusion into the vehicle's cab from leaks in vehicle's exhaust system between the engine and the turbocharger and/or in the vehicle's exhaust gas recirculation system.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	1	4	4
Crashes/Fires:	0	1	1
Injury Incidents:	1	5	5
# Injuries:	2	6	6
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other*:	0	46	46

*Description of Other: Exhaust system related warranty claims for exhaust or other fumes/gases entering the vehicle's cab.

Action: This PE is closed. Both freightliner and Detroit Diesel are taking appropriate corrective actions.

Engineer: Scott Shadle

Date: 12/06/2004

Div. Chief: Richard Boyd

Date: 12/06/2004

Office Dir.: Kathleen C. DeMeter

Date: 12/06/2004

Summary:

The Preliminary Evaluation was opened based on 3 complaints from drivers of 2003 model year (MY) Freightliner Columbia truck tractors and on information provided by Freightliner indicating a known problem of exhaust leaks in certain Detroit Diesel series-60 engines equipped with a "cooled EGR" emissions control system. During the investigation, ODI requested related information on all 2000 my through the current 2005 my Freightliner truck tractors for comparison purposes. ODI's initial concern stemmed from the affects of possible carbon monoxide poisoning and whether or not this problem may constitute a safety risk. The "injury" incidents included in the failure report summary are a count of subject vehicles in which drivers reported feeling ill as a result of some kind of engine compartment fumes entering the cab of their vehicles, and the "injuries" are the number of such instances experienced by the drivers of these vehicles.

(Continued - Page 2)

MS
12/8/04

PE04-036 - CLOSING RESUME
SUMMARY (Continued)

ODI's concerns stemmed from the affects of low levels of possible carbon monoxide intrusion into the cab and whether or not this problem constitutes a safety concern. ODI examined the levels of exhaust fumes, how engine exhaust gases or fumes are being routed into the vehicle's cab, and whether the level of concentration poses a safety risk to the driver and occupants of the vehicle.

During the PE, the focus was on the likelihood that the symptoms of illness (nausea, headache, dizziness, sleepiness, severe coughing, etc.) were the result of exposure to carbon monoxide, a constituent of diesel exhaust that would result in such symptoms and that would have significant acute physical symptoms that could affect driver performance. It should also be noted that diesel engines, such as those used in the subject vehicles, normally produce low levels of carbon monoxide in their exhaust. Some literature indicates that gases and/or fumes, other than carbon monoxide, that may be present in a diesel truck's engine compartment may cause the symptoms similar to those of carbon monoxide that were reported by drivers in the various complaints received by ODI and Freightliner. These include the complex volatile hydrocarbons found in diesel exhaust, diesel fuel and engine oil fumes, and carbon dioxide.

Several of the warranty claims submitted by Freightliner and reported to ODI indicated that the discharge from the engine's crankcase breather discharge vent (blow-by tube or drip tube) was the source of the fumes entering a particular truck's cab that result in the driver feeling ill.

In October 2002, with the introduction of the Detroit Diesel engines equipped with the exhaust gas recirculation system (EGR), a problem concerning the engine exhaust system became apparent as a result of complaints. In response to the problem, Detroit Diesel published a dealer memo (No. 04TS-19) that specified an inspection procedure to determine and remedy the source of an exhaust leak. The memo makes reference to an exhaust seal joint kit (#18SP591) for the Series 60 EGR engine. Due to the increased exhaust pressure of these "EGR" engines, the exhaust manifolds would leak, along with certain other exhaust piping. In September 2004, Detroit Diesel announced an owner notification campaign to permanently correct exhaust manifold leakage problems. As of December 1, 2004, Detroit had remedied 18,000 of approximately 30,000 engines.

As for carbon dioxide intrusion into the cab, Freightliner provided the results of tests performed on one vehicle for which the driver reported having been found with elevated levels of carboxyhemoglobin in her blood. The truck was tested both parked and while being driven, and the results indicated near zero levels of carbon monoxide, but indicated higher than normal levels of carbon dioxide. The average levels were 711 parts per million (PPM) while parked and 1061 PPM while driving. Maximum levels were 1916 PPM while parked and 1609 while driving. These carbon dioxide levels are substantially below the Permissible Exposure Levels (PEL) in the Occupational Safety and Health

Administration's (OSHA) regulatory limit of 5000 parts per-million (PPM) of carbon dioxide.

During the investigation, ODI inspected several Freightliner vehicles to understand the avenue(s) that could allow engine exhaust fumes to enter the vehicle's cab or interior. The frontal section of the cab has various seals and gaskets related to the mounting of the vehicle's heating, ventilation, and air conditioning (HVAC) system, the access door to the HVAC system's filter, and the HVAC system's water drain vent. ODI's field inspection revealed that these seals could potentially slip from the intended position and possibly compromise the integrity of the seal. This would be consistent with reports indicating that replacing these seals or the vent resolved the fumes problem for several vehicles included in either warranty claims or in reports to ODI. Some of the trucks were equipped with Caterpillar, Mercedes-Benz, or Cummins engines. This confirms to ODI that although the Detroit Diesel engine had exhaust leaks, more importantly the cab itself allowed fumes to enter the cab. To address concerns related to the gaskets and seals of the HVAC system, Freightliner has agreed to release a service bulletin instructing the dealers, when confronted with a report of fumes in the cab, on the proper inspection procedures and to replace the seals and gaskets, if needed. This TSB will be applicable for 2000-2005 model year Freightliner Columbia, Century, FLD, and FLN model trucks. Further, Freightliner has agreed to formalize a service notification, which discusses the checking, and replacement (if necessary) of the exhaust system flex pipe, which also may be a source of exhaust leaks.

Based upon the above information, the actions taken by Detroit Diesel and Freightliner are sufficient to resolve the issues raised by this investigation. A copy of the Detroit Diesel memo and the Freightliner service bulletin is attached. Accordingly, this investigation is closed. The Agency will continue to monitor this issue and will take further action if warranted by the circumstances. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist in the subject vehicles.

#

**NO.: 04 TS - 19**

April 14, 2004

TO: All Distributors, Distributor Branches & FLLC Dealers - NAFTA

ATTN: Service Manager and Parts Managers

FROM: Andrew Plant

SUBJECT: Nuisance Exhaust Odors In the Truck Cab

Note: This TS letter supercedes 03 TS-57 Issued 11-21-2003. All copies of 03 TS-57 should be discarded.

Under certain conditions, some drivers have noticed an odor in the cab and believe it to be engine fumes entering through the vehicle ventilation system.

Contributing factors include but are not limited to:

- ☐ Vehicles that are stationary, with the engine idling
- ☐ Prevailing wind speed and direction
- ☐ Vehicle HVAC settings
- ☐ The position of the cab windows and vents (open or closed)

Possibilities include:

- ☐ Exhaust leaks
- ☐ Breather discharge
- ☐ Accumulated oil mist/water vapor in the exhaust system due to excessive idling.
- ☐ Proximity to other vehicles or equipment operating an internal combustion engine

Crankcase breather discharge is normal and is made up of mostly water vapor and oil mist. Some amount of exhaust gas leakage is also normal. Leaks can occur at a number of places in the exhaust system, typically at clamp joints. If the joint becomes loose, the leak may reach a higher than normal level. Excessive idling may result in small amounts of unburned oil mist and water vapor collecting in the lower points of the exhaust system. Once the vehicle is brought up to normal operating temperatures and is in a loaded condition, such as operating at highway speed, this accumulated oil/water may burn off and create an odor.

A normal concern with motor vehicle exhaust gas is carbon monoxide exposure. However, diesel engines inherently produce very low levels of carbon monoxide. Recent DDC test results show very low levels of carbon monoxide in cabs tested, even with the exhaust pipe disconnected from the turbocharger to simulate a leak. The OSHA workplace standard for permissible exposure level is 50 parts per million (ppm) as an average for healthy adults in any eight hour period. DDC testing has found CO levels in the cab to be approximately 3 ppm, even when simulating an exhaust leak. For further information, see OSHA's website at http://www.osha.gov/OshDoc/data/General_Facts/carbonmonoxide-factsheet.pdf

The following questions have come up from time to time regarding this issue

I think I have this problem. What should I do?

First, have your engine inspected by an authorized DDC or Freightliner outlet. Minimize the amount of time idling the truck and make sure the cab is well ventilated with fresh air. Do not operate the vehicle if you are drowsy or feel ill for any reason, or if you smell any unusual odor. Contact your authorized DDC or Freightliner service outlet for more information. You can also contact the DDC Customer Support Center at 313-592-8004.

Should I install a CO detector in the cab of the truck?

Although you should make a decision based on your own sense of safety, at this time DDC does not recommend the use of a CO detector. Initial testing has shown that cab CO levels are very low and well below OSHA workplace exposure limits. Cab-mounted CO detectors can be triggered by a number of other substances and may become more of a nuisance than a helpful monitoring device. For instance, cigarette smoke and gasoline engine fumes from other traffic may trigger the detector. Many commercially available CO monitors are triggered at levels beginning at approximately 70 ppm and can easily be triggered by cigarette smoke (which can emit CO at several hundred ppm).

In the event a driver complains of odors in the cab, DDC will cover the inspection and engine repairs to address this condition under the vehicle warranty. Perform the following:

Inspection:

Inspect the vehicle for any visible exhaust leaks. The most likely location for a leak is at the mating surfaces of the following:

Engine components:

- ☐ Exhaust manifold
- ☐ Turbocharger
- ☐ EGR Valve
- NOTE: An engineered vent is designed for slight leakage at the shaft plug location**
- ☐ S-Pipe
- ☐ EGR Cooler
- ☐ EGR Delivery pipe
- ☐ Delta P Sensor Lines
- ☐ Intake Manifold

Complete vehicle exhaust system, including:

- ☐ Turbocharger to Exhaust System flange
- ☐ Flex Pipe
- ☐ Muffler
- ☐ Tail Pipe

Repair Action:

1. If exhaust leaks are detected in the vehicle exhaust system.
 - Repair as necessary following OEM guidelines and parts.
2. If exhaust leaks are detected from DDC engine components.
 - Make a notation on the repair order
 - Install kit 23534792 following instructions on 18SP591
 - Ensure that any leaks are repaired after completing this procedure.
3. If no exhaust leaks were detected with the vehicle exhaust system or the engine components **and** it is apparent that the exhaust manifold slip joint seal kits have been installed:
 - **STOP!**
 - Call Detroit Diesel Customer Support Center at 313-592-8004 for instructions.
4. If no exhaust leaks are detected and the exhaust slip joint seal kit has not been installed:
 - Install kit 23534792 following instructions on 18SP591

DDC recommends all repair facilities procure this kit and place in inventory to aid in quick turn around time for customers with concerns.

Submit for reimbursement through the DDC warranty system.

Labor operation 06.10-11 - 4.0 hours. This labor operation was created for this activity and includes the complete procedure.

Primary Failed Part: 23533277

The narrative must include any noted leaks found during the inspection process.

Andrew Plant
Senior Service Engineer

Enclosure: 18SP591

DETROIT DIESEL



Installation Instructions

18SP591 – Exhaust Seal Joint Kit for Series 60® EGR Engine

Introduction

To check for leaks, perform the following:

1. If exhaust leaks are detected in the vehicle exhaust system, repair as necessary following OEM guidelines using OEM parts.
2. If exhaust leaks are detected from DDC engine components, make a notation in the repair order. Ensure that any leaks are repaired after completing this procedure. Proceed to disassembly.
3. If no exhaust leaks were detected with the vehicle exhaust system or the engine components and it is apparent that the exhaust slip joint seal kits have been installed, stop and call the Detroit Diesel Customer Support Center at 313-582-8004 for instructions.
4. If no exhaust leaks are detected and the exhaust slip joint seal kit has not been installed, perform the disassembly procedures in this 18SP.

This 18SP addresses Series 60 EGR exhaust leak. The Seal Joint kit, P/N 23534782, listed in Table 1, is required and includes the following items:

Part No.	Qty.	Description
23533543	2	Seal Kit
23533983	3	Gaskets, Exhaust Manifold-to-Head
08929529	1	Gasket, Exhaust Manifold-to-Turbo
08020285	1	Gasket, Turbo Oil Drain
18SP591	1	Installation Instructions

Table 1 Seal Joint Kit P/N: 23534782

Additional Parts Required

The following additional parts are required to complete the installation and are available from Freightliner® dealers:

- BOA 91560 or BOA 91559 Filter
- 01-14598, Turbo-to-Exhaust Pipe Clamp (may be required if current one is not reusable.)

Inspection

Inspect the vehicle for any visible exhaust leaks. The inspection will include the following engine components:

- Exhaust Manifold
- Intake Manifold
- Turbocharger Connections
- EGR Valve
- S-Pipe
- EGR Cooler
- EGR Delivery Pipe
- Delta P Sensor Lines

Inspect the vehicle exhaust system including:

- Turbo-to-Exhaust System Flange
- Flex Pipe
- Muffler
- Tail pipe



WARNING: PERSONAL INJURY

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Always start and operate an engine in a well-ventilated area.

If operating an engine in an enclosed area, vent the exhaust to the outside.

Do not modify or tamper with the exhaust system or emission control system.



CAUTION: EXHAUST FUMES

To avoid injury or injury to bystanders from fumes, engine or vehicle fuel system service operations should be performed in a well-ventilated area.

Disassembly

Disassemble as follows:

1. Remove the air filter housing.
2. Remove the turbocharger-to-charge air cooler piping.
3. Remove the turbocharger heat shield.
4. Remove the turbocharger oil drain.

NOTICE

Do not distort the turbo oil drain during removal. Distorted drain tubes will result in improper oil flow and will damage the turbocharger.

5. Remove the turbocharger and gasket.

NOTE:

Discard the turbocharger gasket.

6. Remove the mixer delivery pipe and inspect the flanges for damage:
 - a) If the delivery pipe flanges are damaged, replace the pipe.
 - b) If the delivery pipe flanges are not damaged, reuse the pipe.
7. Remove the air line or oil lines connected to the EGR valve.
8. Loosen the EGR valve and the S-pipe clamps.
9. Remove the S-pipe.
10. Remove the EGR valve and inspect the mating surfaces for pitting or chatter.
 - a) If the EGR valve is damaged, replace the EGR valve.
 - b) If the EGR valve is not damaged, reuse the EGR valve.
11. Remove the exhaust manifold and inspect for cracks, pitting on the mounting surfaces, or chatter or pitting on the S-pipe seat and joints.

NOTE:

Discard the used exhaust manifold gaskets.

12. Inspect the S-pipe clamp and ensure that the spherical washer has not been removed.
13. Clean the threads with a wire brush, if necessary, to remove carbon build-up and to ensure a proper torque during installation.
14. Clean gasket surfaces thoroughly.

Reassembly

Reassemble as follows:

1. With the manifold on the bench, wrap the seals around the slip joint.
2. Position the split of the seal so it is to the top of the manifold when mounted to the engine.
3. Position the shells around the seal so the split of the shells will be horizontal to the floor when the manifold is mounted to the engine.

NOTE:

If positioned properly, the seal split will be 90 degrees from the shell split lines. The large, full lip of the shells always faces toward the turbocharger, and the area where the lip is removed must face toward the cylinder head.

4. Use large slip joint pliers to compress the shells around the seal. This will allow the bolt to protrude enough to start the clamp nut. See Figure 1.



Figure 1 Using Slip Joint Pliers to Compress Shells

5. Position the bolt so the nut will face away from the engine and toward the bottom of the manifold. Do not fully tighten clamps to allow for adjustment after manifold and heat shield installation. See Figure 2.

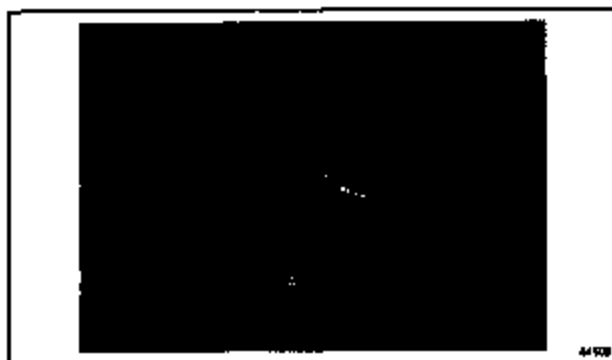


Figure 2 Exhaust Manifold Clamp Orientation

6. Install the exhaust manifold with new gaskets and adjust the clamps as necessary.

NOTE:

Use new gaskets during installation.

7. Install the EGR valve assembly and the S-pipe and ensure that the seats are aligned properly. See Figure 3 for correct torque specifications.

NOTE:

Squareness of the joints is a good indicator of proper alignment.

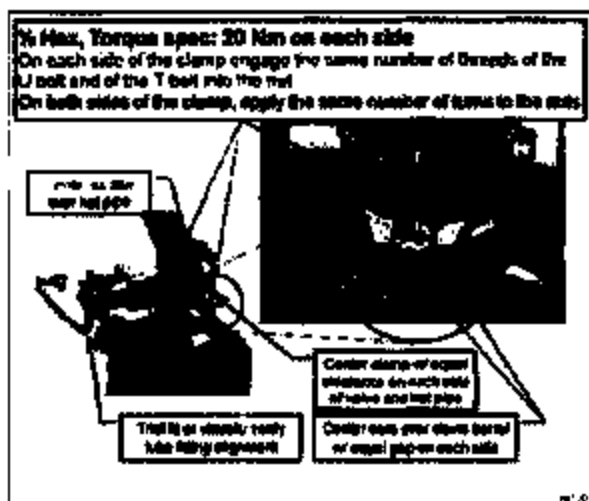


Figure 3 Alignment of Center Saddle over Hot Pipe

8. Install the turbocharger with a new gasket.
9. Install turbo oil drain.

NOTE:

Inspect O-rings for damage and replace if necessary (P/N: 23530682).

10. Install the mixer delivery pipe. Assemble flange clamps properly.
11. Attach the EGR actuator line, oil supply and drain lines.
12. Assemble the exhaust pipe to the turbocharger and ensure proper alignment. Use new turbo-to-exhaust pipe clamp if current one is damaged.
13. Assemble the turbocharger-to-charge air cooler piping.
14. Reassemble the air filter housing and heat shield.
15. Run the engine to allow the exhaust system to warm. Check the clamp torque. Torque as necessary if not to specifications.
16. Visually inspect around the joints and seats for exhaust leaks.
17. Verify that the dipstick is P/N: 23534201.

NOTE:

If part number of dipstick is not P/N: 23534201, replace with P/N: 23534201 and file a separate claim.

NOTE:

If dipstick was changed, reduce oil level to meet the full mark.

18. Inspect the breather pipe for kinks or damage. Replace components as necessary.
19. Replace the HVAC filter with P/N: BOA 91560 or BOA 91559.
20. Ensure that the HVAC access plates are properly installed. See Figure 4.



Figure 4 HVAC Access Plates

21. Ensure that the cab vents are not blocked.
See example in Figure 5.



Figure 5 Cab Vents (example)

22. Ensure that the HVAC drain flap is not missing or damaged. See Figure 6.



Figure 6 HVAC Drain Flap

DETROIT DIESEL



12400 Outer Drive West Detroit, Michigan 48228-4001
Telephone: 313-592-9000
www.detroitdiesel.com

Copyright© 2004 Detroit Diesel Corporation. Detroit Diesel®, DDC®, and the spinning arrows design are registered trademarks of Detroit Diesel Corporation. Freightliner® is a registered trademark of Freightliner Corporation. All other trademarks are the property of their respective owners.
18SP591 0404 As technical advances continue, specifications will change. All rights reserved. Printed in U.S.A.