Ford Motor Company

FCSD

Technical Training

INTERACTIVE STUDY GUIDE

FIRTFT 7.3L DIT ENGINE DIAGNOSTIC PROCESS OVERVIEW

FCS-13887-DL

Ford Customer Service Division
Technical Training

SEPTEMBER 4, 2003

COURSE CODE: 51G03F0

IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind your head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time by an increase in underhood temperatures, even though the ignition is in the OFF position. Therefore, care should be taken to ensure that the electric cooling fan is completely disconnected when working under the hood.

The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual, and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures, and specifications in this handbook were in effect at the time the handbook was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design, or testing procedures without notice and without incurring obligation. Any reference to brand names in this manual is intended merely as an example of the types of tools, lubricants, materials, etc. recommended for use. Equivalents, if available, may be used. The right is reserved to make changes at any time without notice.

WARNING: MANY BRAKE LININGS CONTAIN ASBESTOS FIBERS. WHEN WORKING ON BRAKE COMPONENTS, AVOID BREATHING THE DUST. BREATHING THE ASBESTOS DUST CAN CAUSE ASBESTOSIS AND CANCER.

Breathing asbestos dust is harmful to your health.

Dust and dirt present on car wheel brake and clutch assemblies may contain asbestos fibers that are hazardous to your health when made airborne by cleaning with compressed air or by dry brushing.

Wheel brake assemblies and clutch facings should be cleaned using a vacuum cleaner recommended for use with asbestos fibers. Dust and dirt should be disposed of in a manner that prevents dust exposure, such as sealed bags. The bag must be labeled per OSHA instructions and the trash hauler notified as to the contents of the bag.

If a vacuum bag suitable for asbestos is not available, cleaning should be done wet. If dust generation is still possible, technicians should wear government approved toxic dust purifying respirators.

OSHA requires areas where asbestos dust generation is possible to be isolated and posted with warning signs. Only technicians concerned with performing brake or clutch service should be present in the area.

Produced and Coordinated by
Technical Support Operations
Ford Customer Service Division

August, 2000

Ford Motor Company

CUSTOMER EXPECTATIONS

Customer Expectations: Service

1. Make it convenient to have my vehicle serviced at your dealership.
2. The Service Advisor should demonstrate a genuine concern for my service needs.
3. Fix it right the first time.
4. Complete servicing my vehicle in a timely and professional manner.
5. Provide me with a clear and thorough explanation of the service performed.
6. Call me within a reasonable amount of time after my service visit to ensure that I'm completly satisfied.
7. Be responsive to questions or concerns I bring to your attention.

Expectation 3

"Fix It Right The First Time, On Time."

Both service advisors and technicians are important players when it comes to Expectation #3.

Why

Customers tell us "Fixing It Right The First Time, On Time" is one of the reasons they would decide to return to a dealer to buy a vehicle and get their vehicles serviced.

Technician Training

It is our goal to help the technician acquire all of the skills and knowledge necessary to "Fix It Right The First Time, On Time." We refer to this as "competency."

Technician's Role

Acquire the skills and knowledge for competency in your specialty via:

STST

- Self Study
- FORDSTAR Broadcasts
- Ford Multimedia Training (FMT)
- Instructor Led

New Model

- Self Study
- FORDSTAR Broadcasts
- Instructor Led

The Benefits

The successful implementation of expectations means:

- Satisfied customers
- Repeat vehicle sales
- Repeat service sales
- Recognition that Ford and Lincoln/Mercury technicians are "the Best in the Business"

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LESSON 5: DIAGNOSTIC PROCEDURES

APPENDIX

Ford Motor Company

FCSD

Technical Training

This distance learning course you are about to take is intended to give you new knowledge and information about diagnosing and servicing Ford vehicles. We hope you apply this knowledge and information to "Fix It Right The First Time" as part of our effort to satisfy our customers, the owners of Ford, Lincoln and Mercury products.

Ground Rules for Successful Completion

This course includes a Posttest.

Successful completion of this course requires you to correctly answer a minimum of 80% of the Posttest questions.

Other questions (warm-up and eval) asked during class are NOT counted toward you successful completion of this course.

LOGGING ON

Your response keypad transmits data and voice between you and the host site via telephone lines and satellite.

It is your “lifeline,” connecting you to the instructor as well as to other participants.

Using the keypad, you can become involved fully in the seminar, asking questions and contributing relevant comments.

To log on at the beginning of the broadcast session:

1. Enter your I.D. number (in response to the keypad prompt). If you press an incorrect key, press CLEAR and re-enter the numbers.
2. Press ENTER.
3. The system validates your I.D. number by displaying your name on the keypad. If your name does not appear on the keypad, re-enter your I.D. number.
4. If you cannot successfully log on, contact the FORDSTAR Help Desk:
   - USA dealers call 1-800-790-HELP (4357).
   - Canadian dealers call 1-800-467-8925.

KEYPAD OPERATION

CALL Key

- Press the CALL key if you have a question or comment. This places you in the call queue. The system indicates your name and location to the instructor.
- It takes approximately 60 seconds for the instructor to respond. If you change your mind about asking the question, simply press the CALL key again. As long as the instructor has not accepted your call, this takes you out of the call queue.

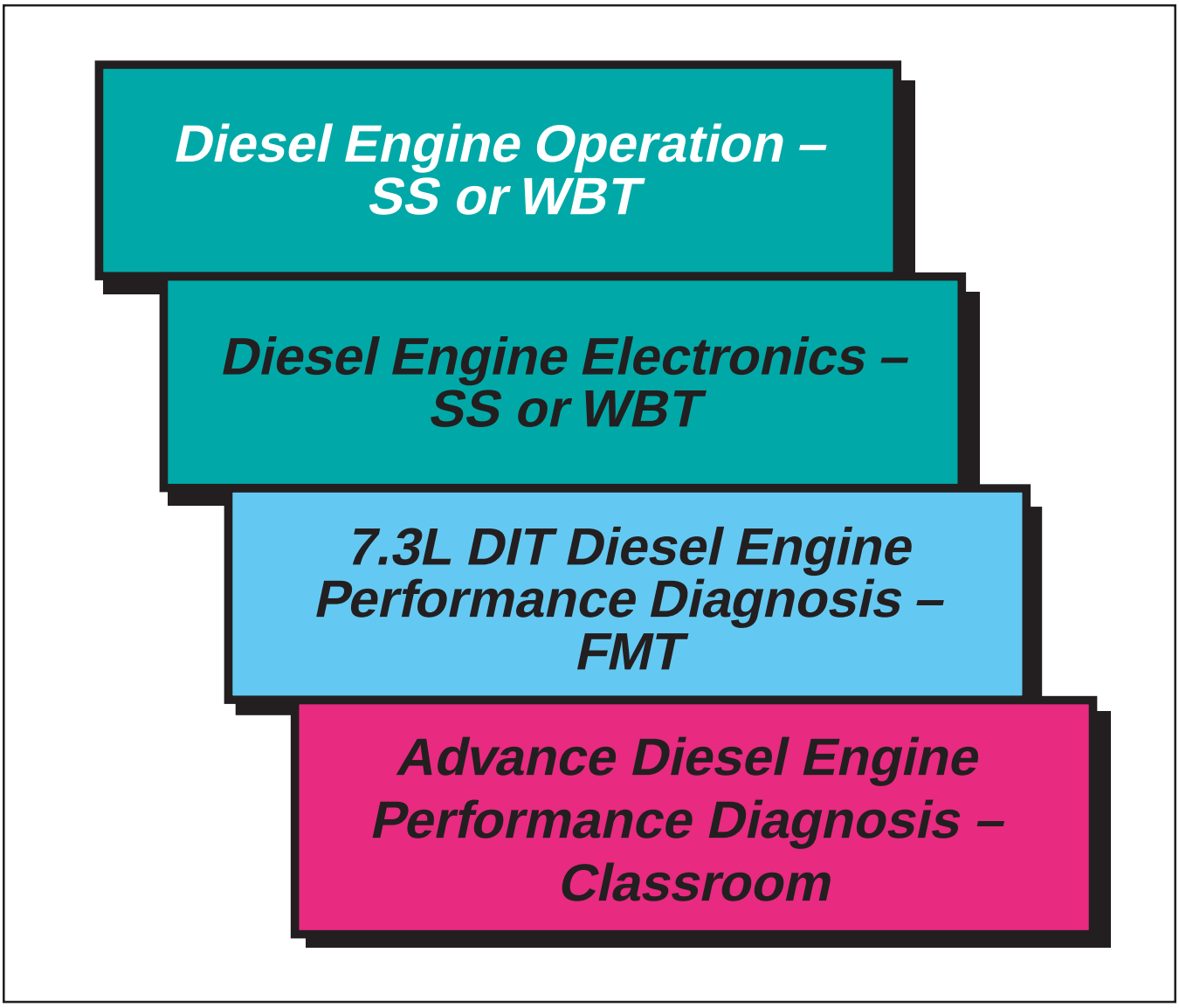
WAIT and SPEAK Lights

- The red WAIT light illuminates when your call is received and placed in the call queue.
- When the instructor calls on you, the green SPEAK light illuminates and your microphone is activated.
- The microphone is the gray dot between the SPEAK and WAIT lights. Speak in a normal tone of voice from a normal sitting position. The instructor will hear you, as will all the other students wherever they are located.

FLAG Key

- Use the FLAG key when requested by the instructor. The FLAG key is usually used to alert the instructor that you have completed a test or exercise.

DIESEL CURRICULUM PATH



PURPOSE

This course is intended for experienced technicians who have successfully completed the Diesel Certification Curriculum.

The purpose is to increase technician awareness of the latest diagnostic resources (documentation) and procedures available to address Hard Start/No Start and Performance concerns on the 7.3L DIT Diesel engine.

BENEFITS

Successful completion of this course will result in the following benefits:

- Improved diagnostic performance
- More cost-effective repairs
- Improved Fix-It-Right-the-First Time (FIRTFT) performance

AGENDA

Following this introduction, information is arranged in the following order:

- Lesson 1 – Diesel Engine Operating Characteristics
- Lesson 2 – Identifying and Categorizing Concerns
- Lesson 3 – Diagnostic Resources
- Lesson 4 – Layout and Use of the PC/ED Manual
- Lesson 5 – Diagnostic Procedures

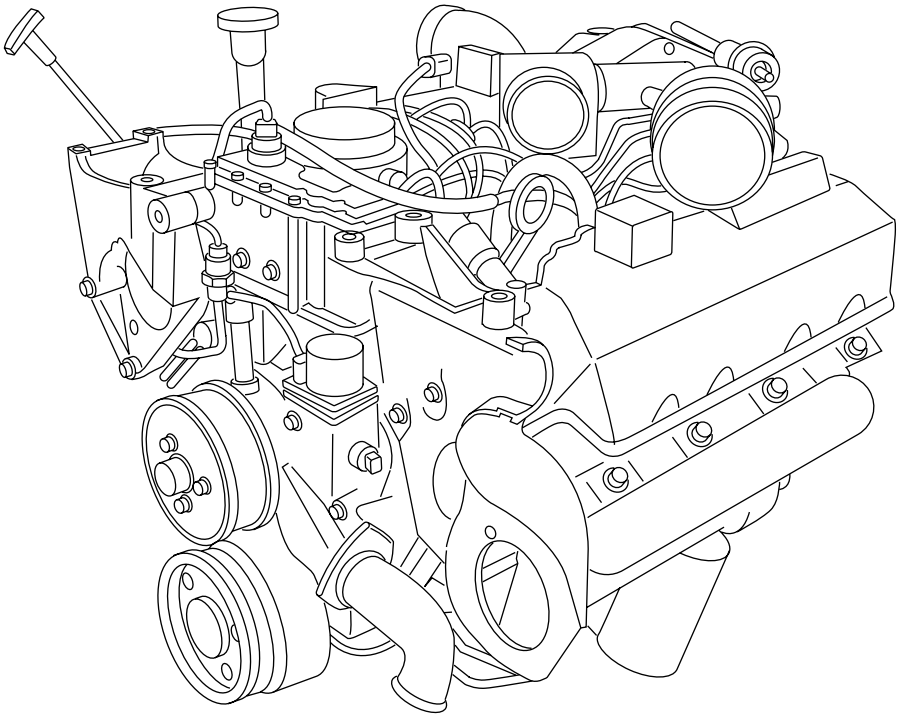
NOTES

LESSON 1: DIESEL ENGINE OPERATING CHARACTERISTICS

OBJECTIVES

- Describe the advantages of diesel engines
- Describe the operating characteristics of diesel engines
- Describe diesel maintenance highlights

ADVANTAGES OF DIESEL ENGINES



DEO004-A

7.3L DIT Engine

Diesel engines offer several advantages compared to gasoline.

Improved Fuel Economy

Converting Chemical Energy in the Fuel to Useful Mechanical Energy

- Diesel engines convert up to 55% of the energy available in diesel fuel to mechanical energy (power at the flywheel).
- Gasoline engines convert about 35% of the energy available in gasoline.

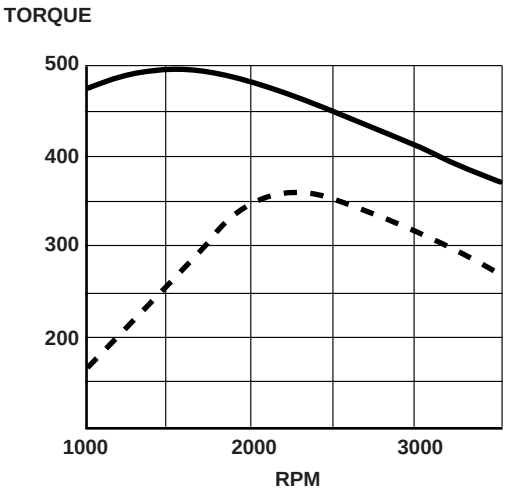
Diesel fuel to gasoline comparison

Fuel	Average Weight per Gallon (lbs)	Average BTU per Gallon
Diesel	3.2 kg (7.1 lbs)	(138,000 btu)
Gasoline	2.72 kg (6.0 lbs)	(124,000 btu)

- Diesel fuel contains more energy per unit volume (gallon or liter) than gasoline.

These characteristics (better combustion efficiency and higher energy content of fuel) combine to produce 35% to 40% better fuel economy in diesel engines compared to gasoline.

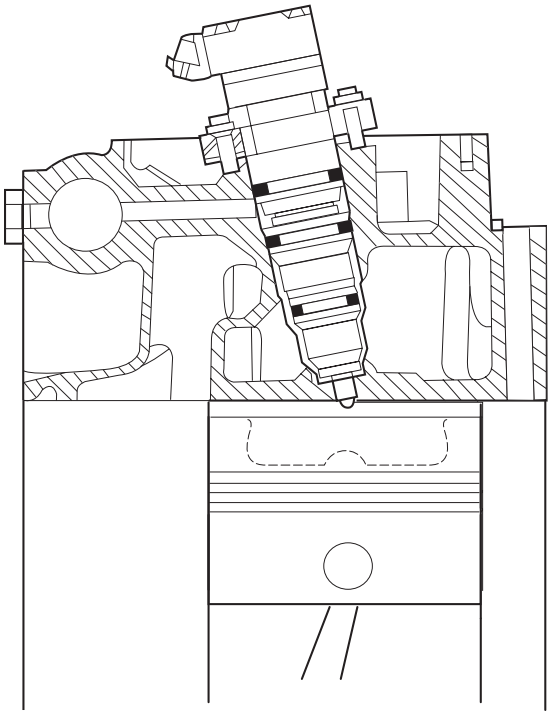
Higher Torque at Lower Engine Speed



Comparison of Diesel and Gasoline Engine Torque

Diesel engines produce greater torque at lower RPM than gasoline engines. This characteristic is important in vehicles such as trucks that are required to haul heavy loads and/or pull trailers.

UNIQUE DIESEL ENGINE OPERATING CHARACTERISTICS



DEO012-C

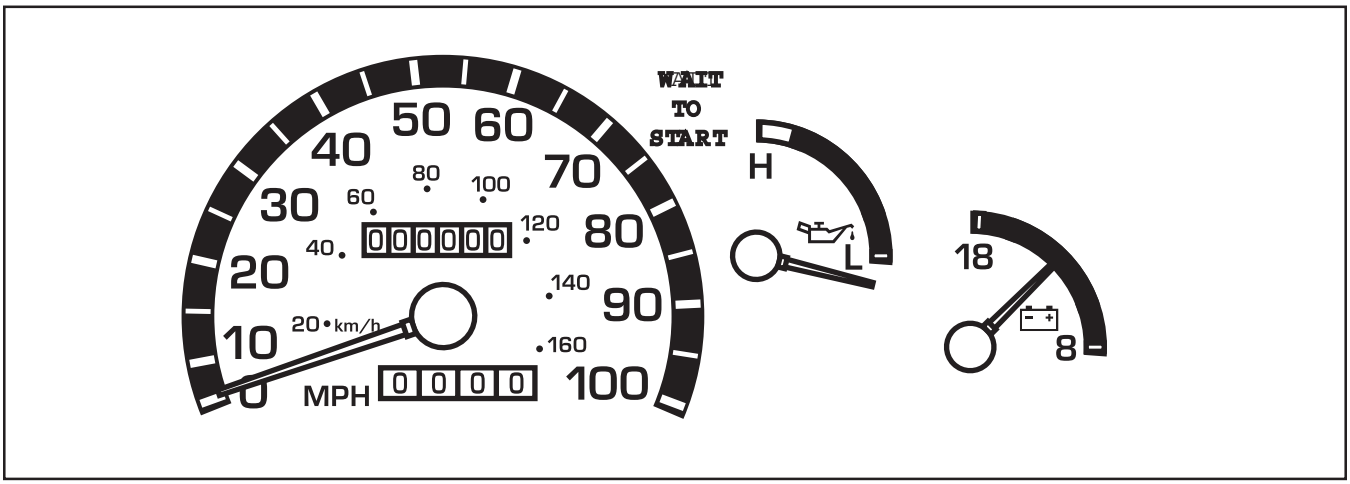
7.3L DIT Combustion Chamber

Diesel engines have some unique operating characteristics that may raise questions from some customers.

It is important for you to be aware of these characteristics in order to help customers understand that what they might perceive as a concern is in fact a normal diesel operating characteristic.

The same diesel combustion process that produces the desirable torque characteristics also contributes to the distinct combustion sound.

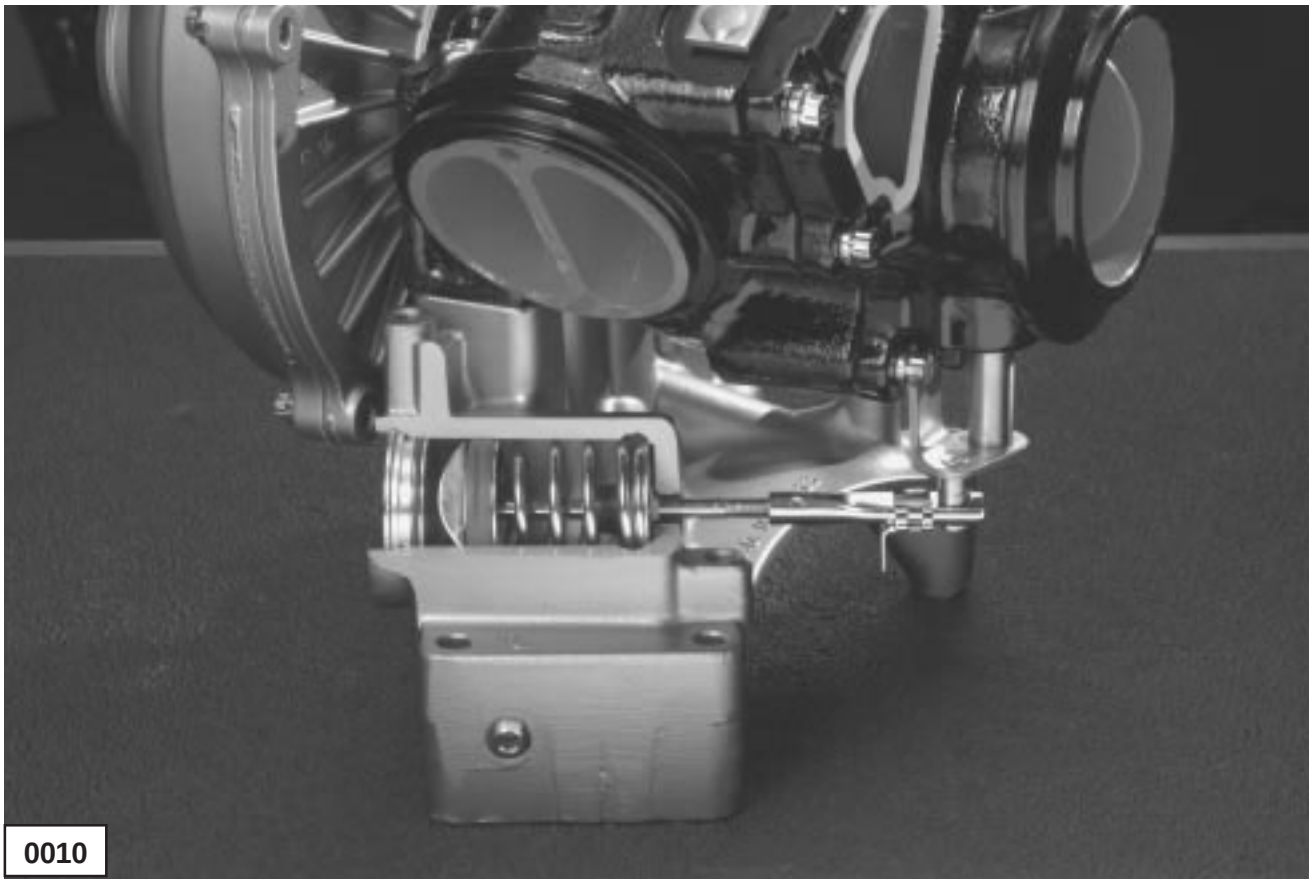
Design of modern diesel engines, including the Power Stroke, has produced much quieter engines, but the combustion noise is still more pronounced than on a gasoline engine.



Wait-To-Start Lamp

Some characteristics and items unique to diesels include:

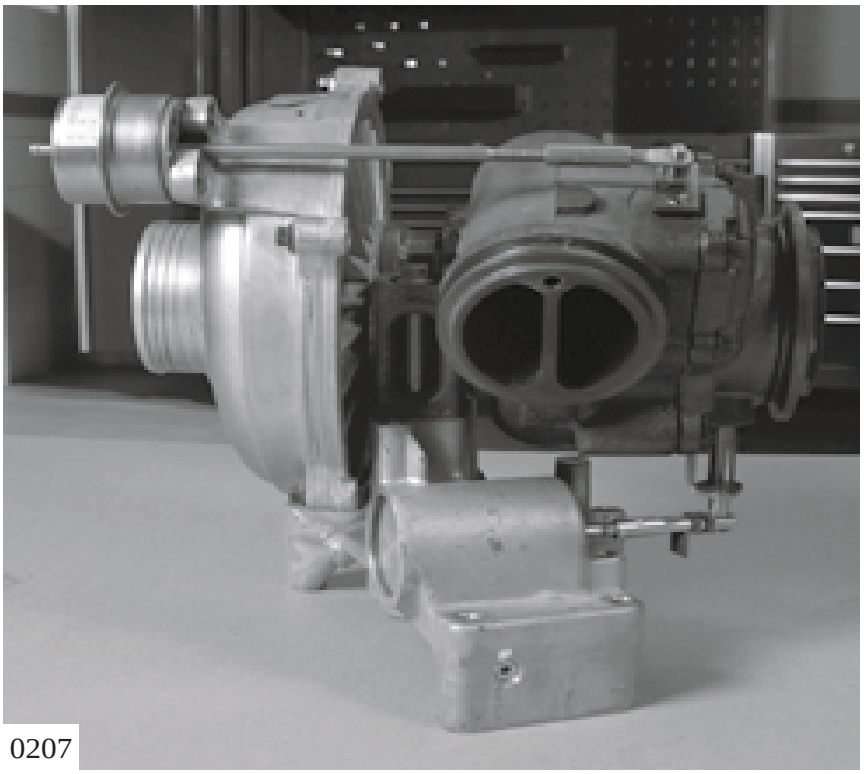
- Diesels require starting assistance, such as glow plugs, especially in cold ambient temperatures.
- Diesels produce a slight amount of smoke during a cold start.



EBP Valve

In order to bring the engine temperature up as quickly as possible, as well as to help keep the engine warm under very light loads in cold ambient temperatures, an Exhaust Back Pressure (EBP) valve is used in most applications.

- An activated EBP valve produces a "whooshing" sound.

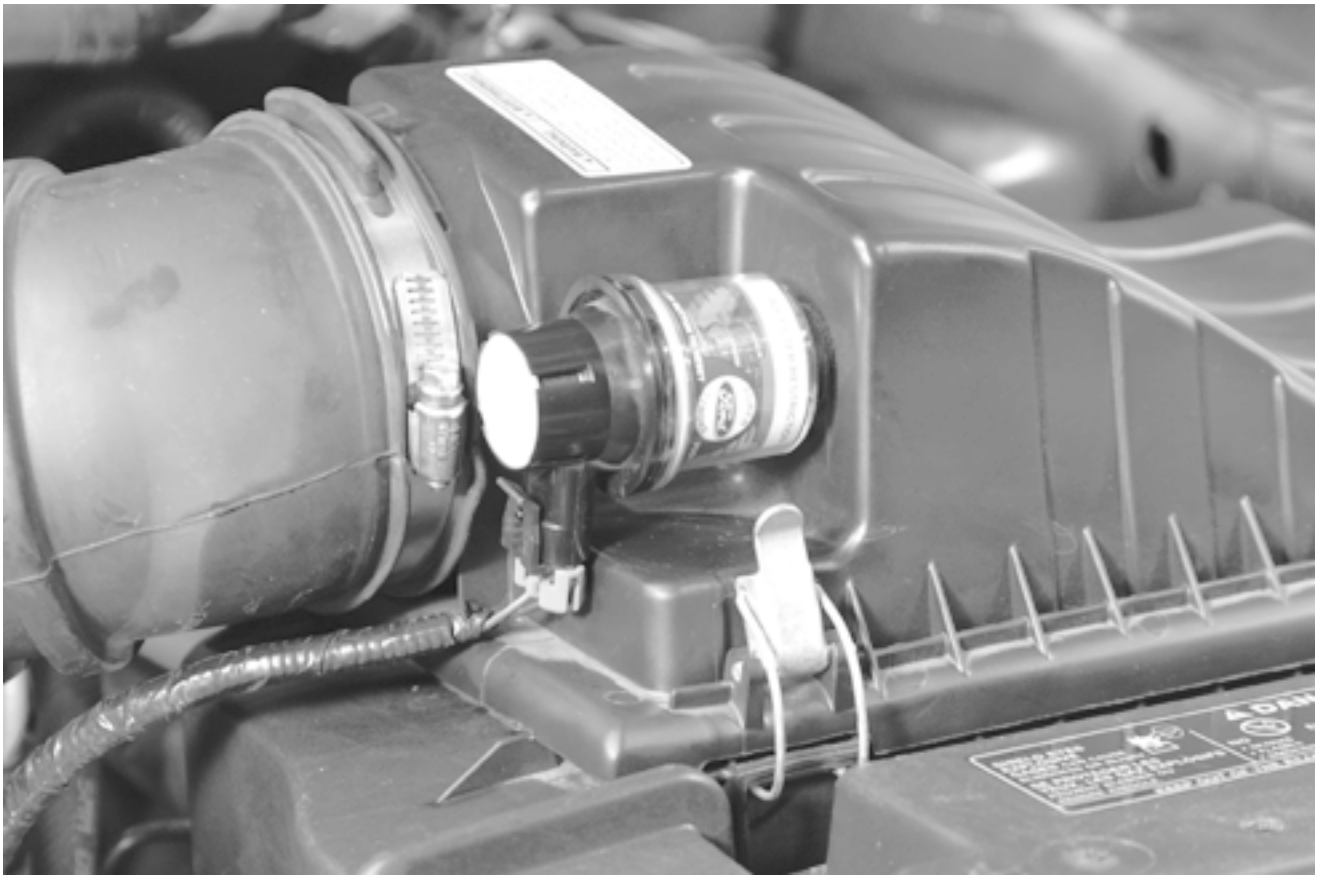


0207

Turbocharger

With the engine under load, turbocharger "whine" can be heard. While normal turbo whine may cause concern for some customers, the "enthusiast" segment often finds the characteristic whine of all turbocharged diesel engines to be pleasing!

SPECIAL MAINTENANCE TOPICS



Filter Minder

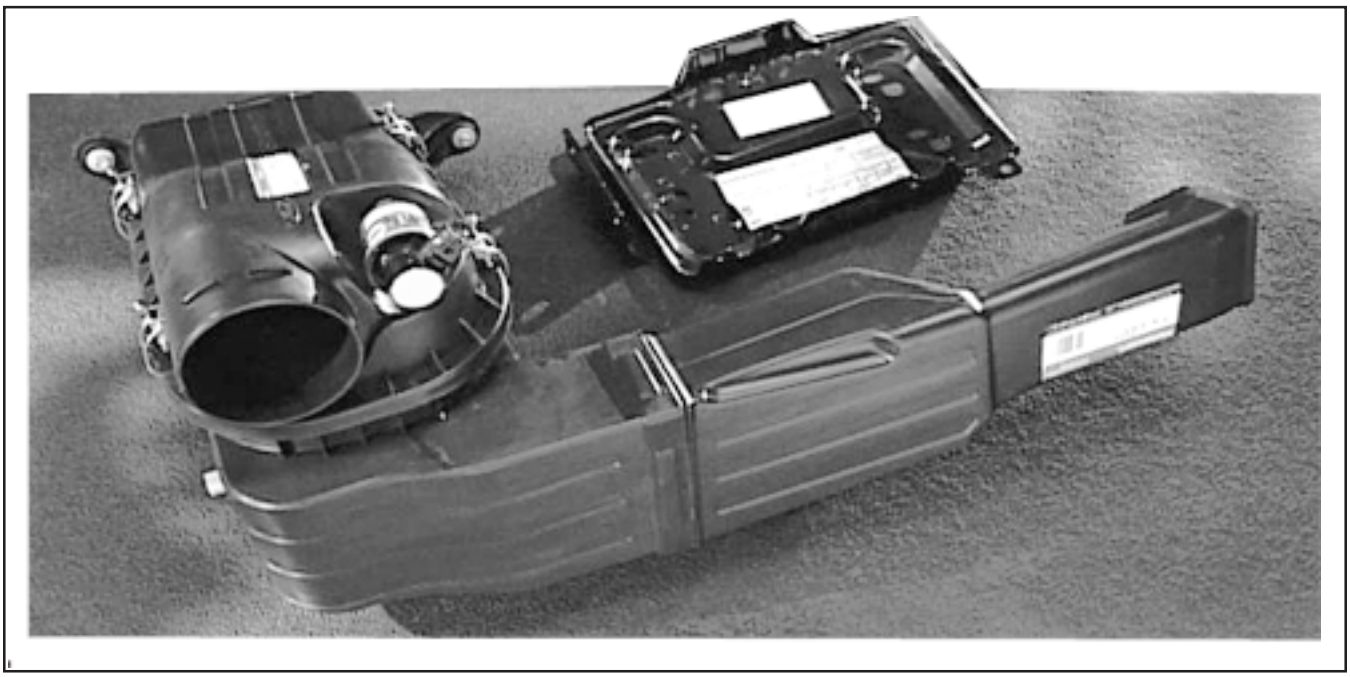
Despite the well-deserved reputation for toughness, diesels can be susceptible to dirt and water contamination.

Air Inlet System

Monitor and maintain the air filter.

Since diesel engine speed and power is not regulated by a throttle plate as in gasoline engines, airflow is directly proportional to engine speed. Without the restriction created by the throttle plate, the airflow into a diesel engine, over the same operating period, is greater than on a gasoline engine of similar displacement.

Severe Duty Air Inlet System Filter Kit



Severe Duty Air Inlet System Filter Kit

For vehicles operating in particularly dusty conditions, a new high-capacity air filter kit is now available for customer purchase.

The new Servere Duty Filter Kit:

- Is designed and approved by Ford Motor Company
- Installs within 30-45 minutes
- Fits any 1999-2003 F250-550 or Excursion with a 7.3L Power Stroke Diesel Engine
- Contains new air box and initial filter element

The new filter allows operation of the truck in the most severe conditions for much longer than with the conventional filter.

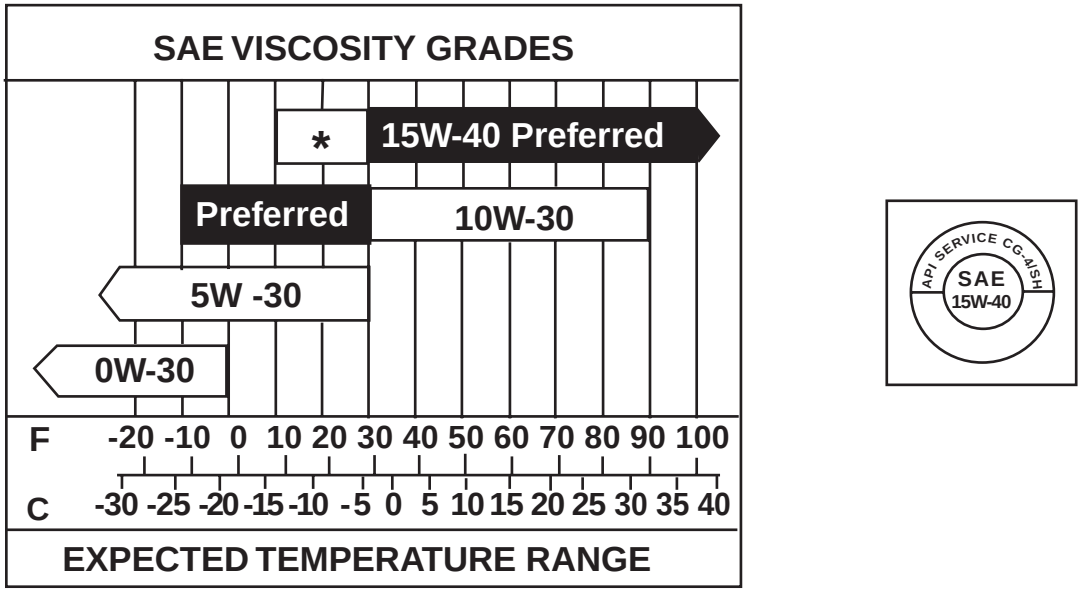
The Severe Duty filter contains:

- Sixteen times (16x) as much media surface area as washable filters.
- Three times (3x) as much media surface area as the conventional filter.

Part Numbers associated with he new AIS kit are as follows:

Description	Ford P/N	Motorcraft P/N
7.3L Severe Duty Filter Kit	2U2Z-9K635-AA	FA-1759
Replacement Filter	2U2Z-9601-BA	FA-1757

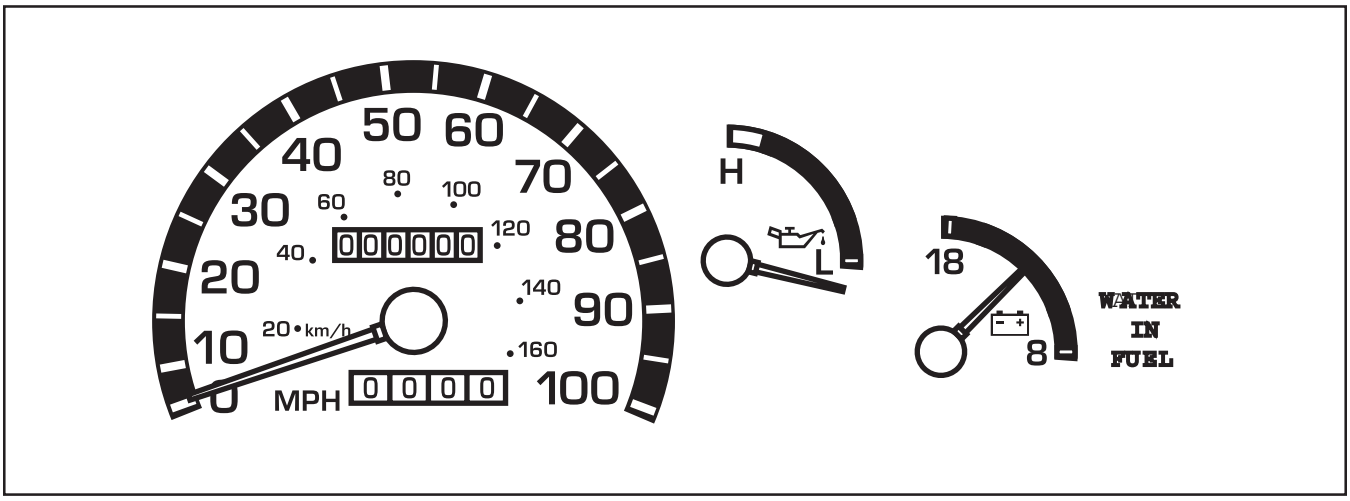
Lubrication System



Oil Classification and Viscosity

Change the engine oil and filter at recommended intervals. Always use the correct specification and viscosity, as recommended in the Owner's Guide.

Fuel System



Water-In-Fuel Indicator Lamp

Remind customers to monitor the "Water in Fuel" indicator lamp, and drain the fuel filter/water separator whenever the lamp illuminates during vehicle operation.

Quality and Characteristics of Diesel Fuel

Diesel fuel quality can have a marked effect on engine operation, especially cold-start characteristics and to a somewhat lesser effect engine power output.

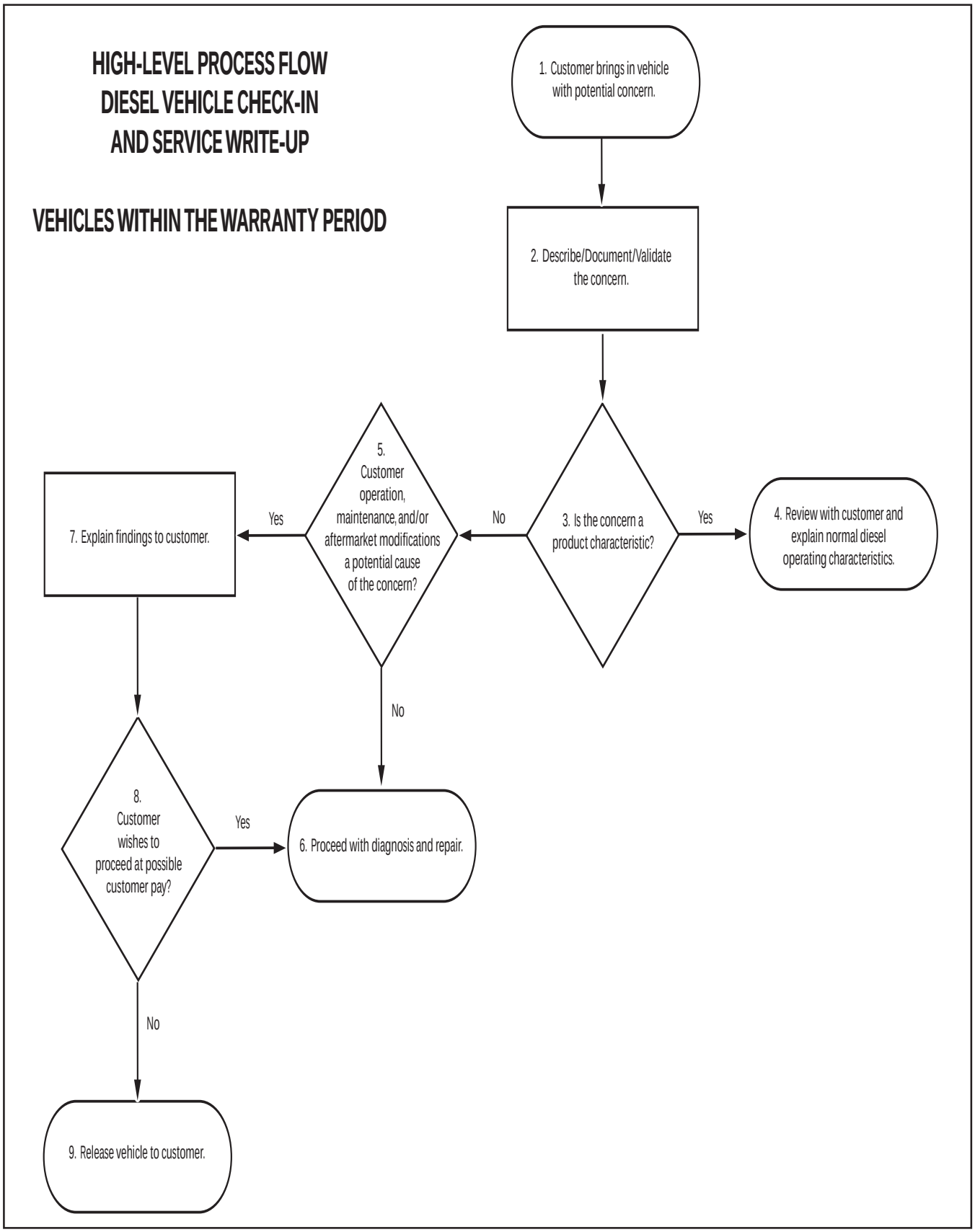
Purchasing diesel fuel from a supplier with a reputation for quality product will usually eliminate the need for you or your customer to become involved with the intricacies of diesel fuel characteristics.

A detailed discussion of quality and characteristics of diesel fuel can be found in the "Diesel Engine Operation Fundamentals" course, Code 51S01S0.

OBJECTIVES

- Describe the process flow for vehicle service write-up
- Differentiate between vehicle concerns that should be addressed and normal diesel operating characteristics
- Describe resources for customer handling

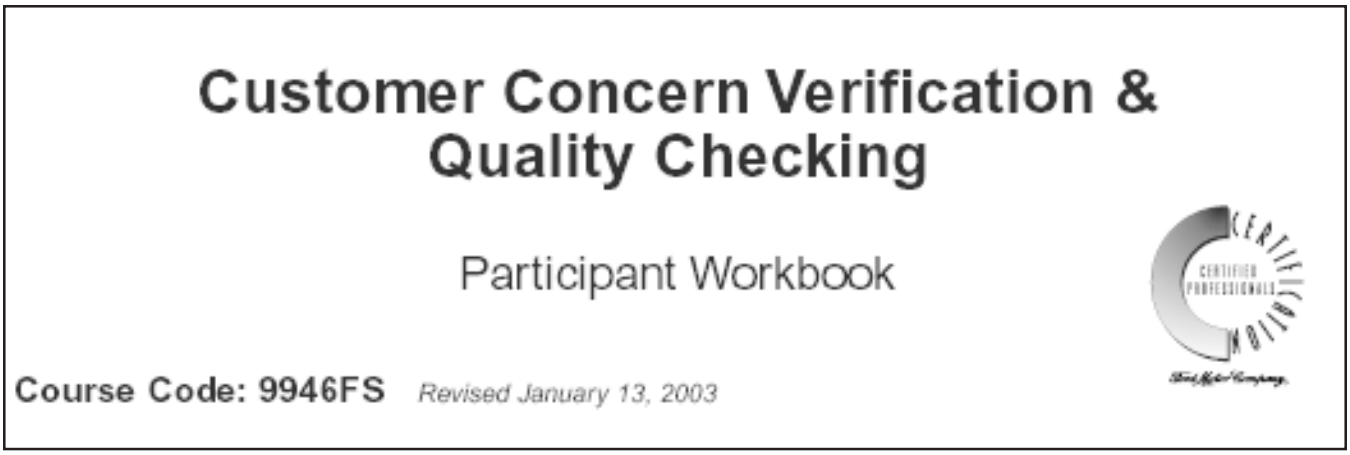
PROCESS FLOW



Identifying and Categorizing Concerns

The graphic on the facing page illustrates a high-level service activity process flow, from the time the vehicle is checked-in until it is returned to the customer.

Several training courses address this process flow in much greater detail.



Course Code 9946FS

For example, a course titled "Customer Concern Verification and Quality Checking" is one of a number of courses included in the Service Advisor Certification curriculum. A complete listing of courses pertaining to customer handling and communications can be found at My Training, Service Advisor Certification on the FMCDealer website.

While training on Service Department process flow, and managing customer relationships, is usually directed at Service Advisors, it also is important that technicians are aware of these concepts.

Service Advisors, Service Managers, and customers often depend on the knowledge and expertise of the technician to verify if a concern exists, and to identify and correct the root cause if a concern with the vehicle is found.

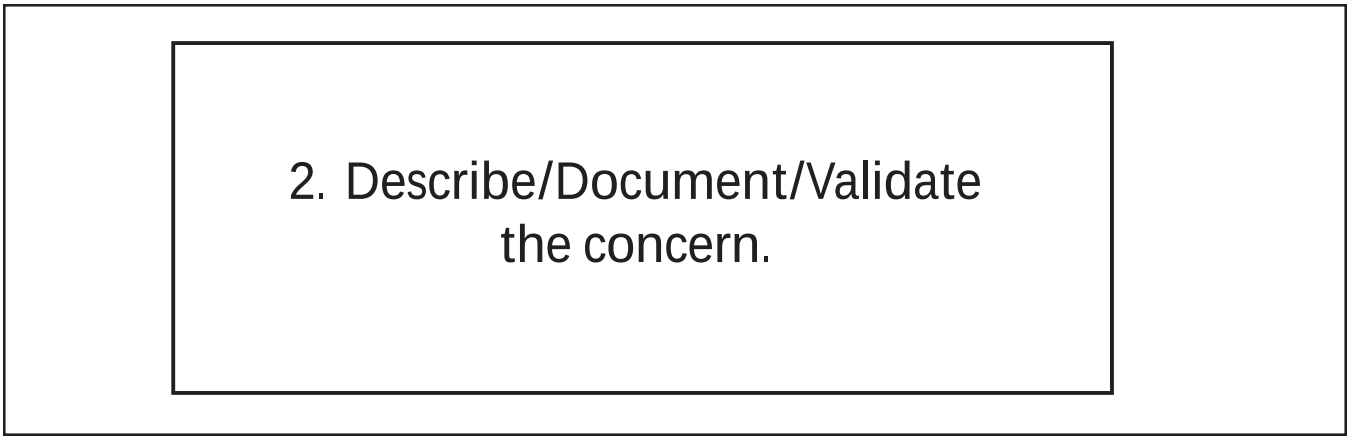
Your knowledge and expertise also are valuable in addressing concerns that are ultimately determined to be either customer perception of a normal vehicle operating characteristic, or a genuine concern with the vehicle that turns out to be the responsibility of the customer. Customer-caused concerns often involve insufficient routine maintenance or aftermarket modifications.

Most customers take pride in ownership and want their vehicles to perform well for a long period of time. Proactive customer communication and education can often prevent conflicts and increase the level of satisfaction.

On the following pages several steps in the high-level process will be examined as they pertain to potential concerns with diesel engines.

Remember once again that this is high-level review. A more-detailed process flow addresses subjects such as dealing with intermittent concerns, and the need to possibly road test the vehicle with the customer in order to thoroughly document and verify the concern.

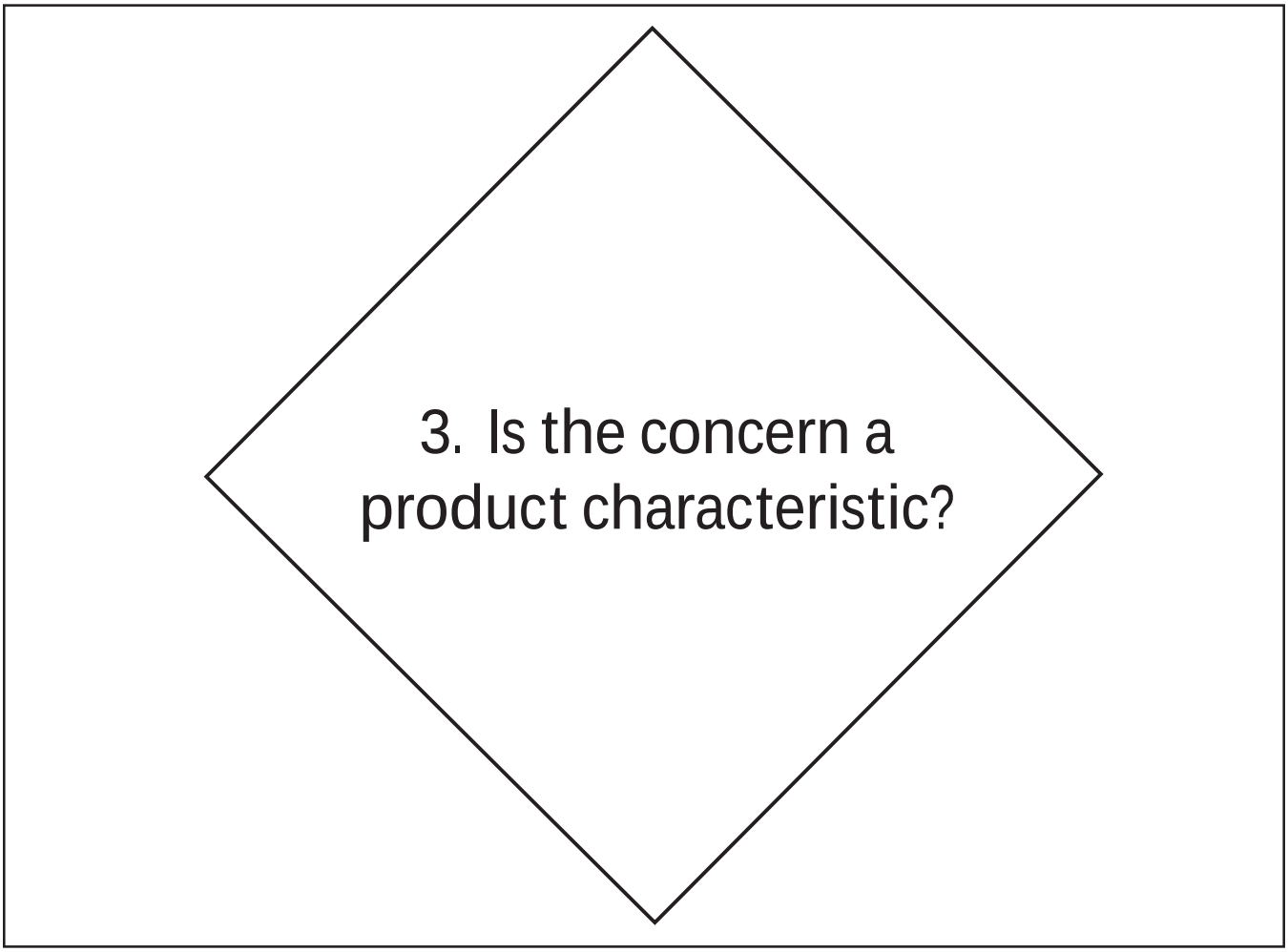
Step 2



Step 2

Step 2 is a collaborative effort between customer, Service Advisor, and technician to accurately document and verify the concern. Unfortunately, conditions under which the symptoms occur are not always present when the vehicle is parked in the check-in area.

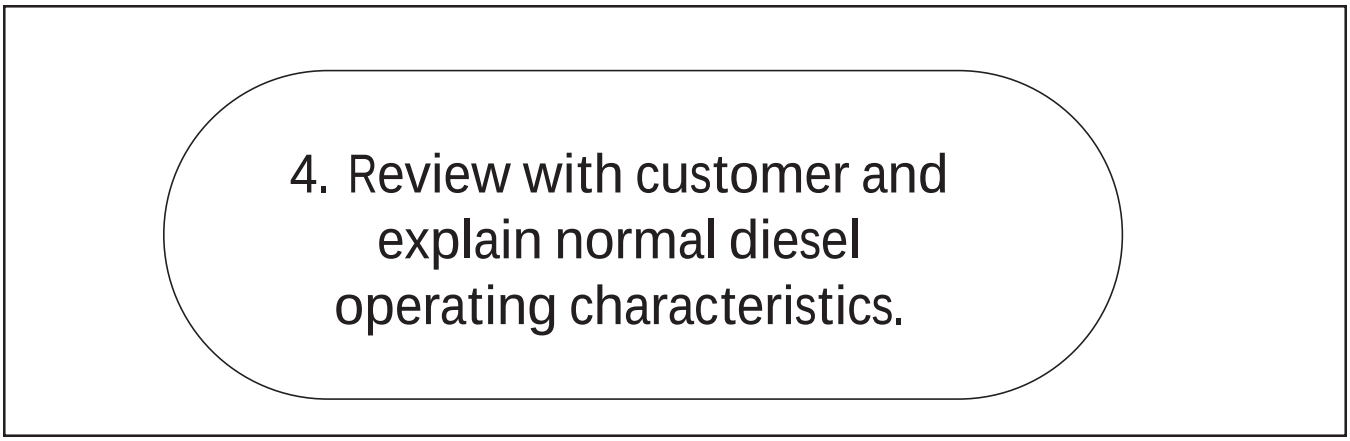
Step 3



Step 3

Step 3 can represent a significant decision point with all vehicles, and especially diesels. For example, if the customer states that the engine cranks for several seconds before it starts in cold ambient conditions, and then emits some exhaust smoke for a minute or so after it does start, there is a strong possibility that this is a normal diesel operating characteristic, and we should go to the right, toward Step 4.

Step 4

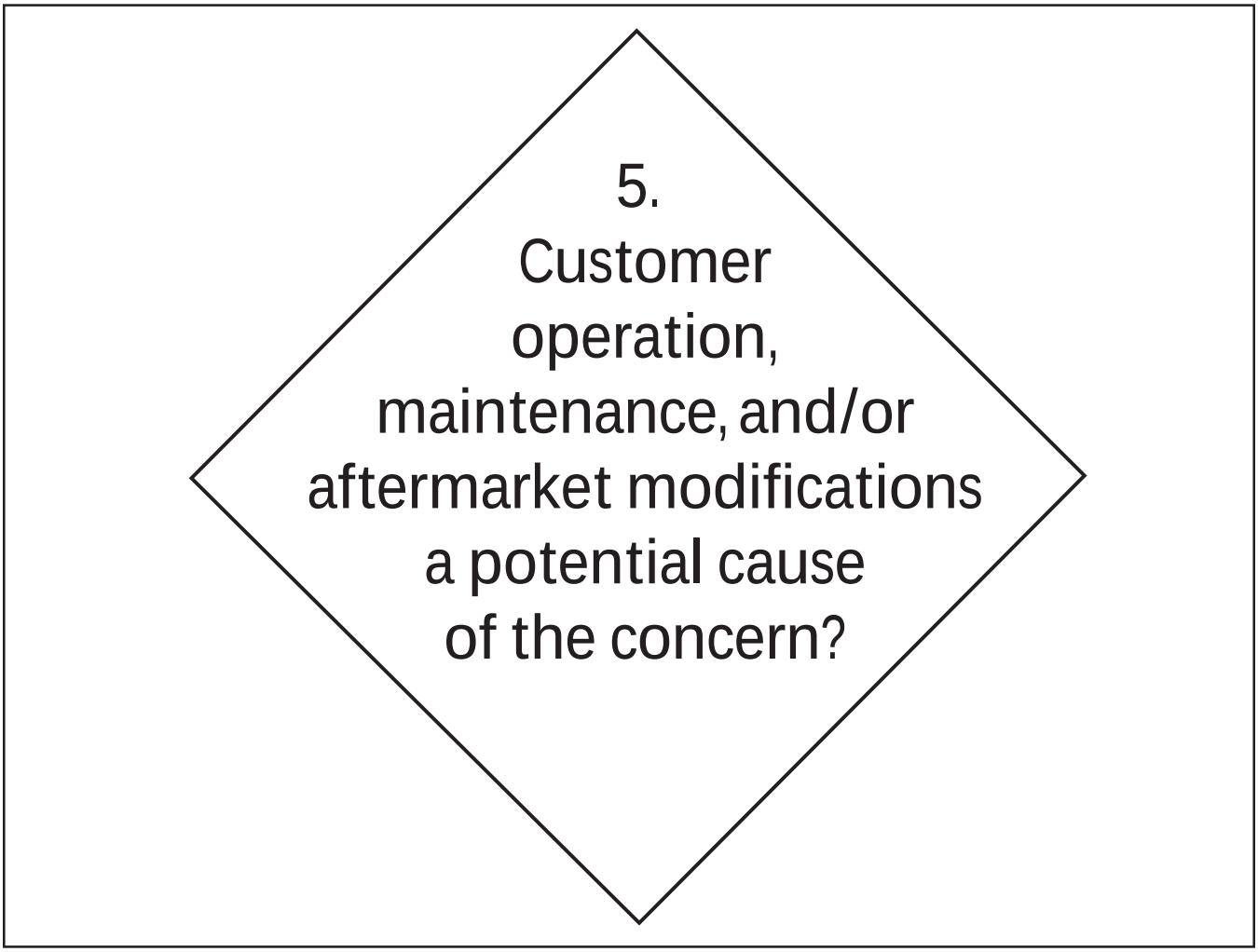


Step 4

Once it is determined with relative certainty that the concern described by the customer is actually a normal diesel operating characteristic, it is important to have a clear communication with the customer concerning your findings, rather than attempting to diagnose and repair a concern with the vehicle that probably does not exist.

Remember that when you strongly believe, backed by objective observations, that the engine is operating normally, you have a much better chance early in the process of convincing the customer that no problem exists, rather than conducting extensive tests and replacing parts to no avail, then attempting to convince the customer that there was nothing wrong in the first place!

Step 5



Step 5

Most identified concerns will flow from Step 5 to Step 6, but there will be instances where it is necessary to flow from Step 5 to Step 7. In those instances, the Service Advisor must proactively use his or her customer-handling skills to explain the findings to the customer, possibly depending on your knowledge and skills to explain the analysis.

Warranty Analysis

Wastegate Defeat Device

Warranty analysis indicates two categories where the costs can be reduced through cooperative efforts:

- High Trouble Not Indicated (TNI), where warranty return parts test good. The volume of this category may be exacerbated by changing parts in order to satisfy the customer, even though the engine is operating normally. Better and proactive customer education may reduce this category.
- Components that analysis indicates have been damaged by aftermarket modifications. Turbocharger overspeed by defeating wastegate operation is one example, as well as PCM software modification through either reflash or installation of a "chip" onto the PCM. Damage caused by aftermarket modifications is not covered by the New Vehicle Limited Warranty.

OBJECTIVES

- Identify and describe the purpose of current 7.3L DIT diagnostic resources

DIAGNOSTIC RESOURCES

In this lesson, we'll look at the many resources available to aid in diagnosing 7.3L concerns.

Some of these resources have been available for years, and others are quite new.

All of the resources, when properly used in the hands of a qualified technician, are intended to meet the goal of making 7.3L diagnostics smoother and more focused.

First, we'll take a very brief look at the S-S-C-C process, then review the available resources.

Some of the resources to be examined in this lesson include:

- OASIS Reports
  - When requested with Symptom Codes, will return applicable TSBs and SSMs.
- The Service Manual, which includes:
  - Workshop Manual
  - Powertrain Control/Emissions Diagnosis Manual
  - Wiring Diagrams
- Supporting documentation, such as:
  - Diesel Engine Diagnostic Guide Worksheets
  - Powertrain Control System Wiring Schematic and DTC Index
  - Technician Turbocharger Guide
  - Technician High Pressure Oil Pump (HPP) Guide

THE DIAGNOSTIC PROCESS

S-S-C-C

Symptom-to-system-to-component-to-cause (S-S-C-C)

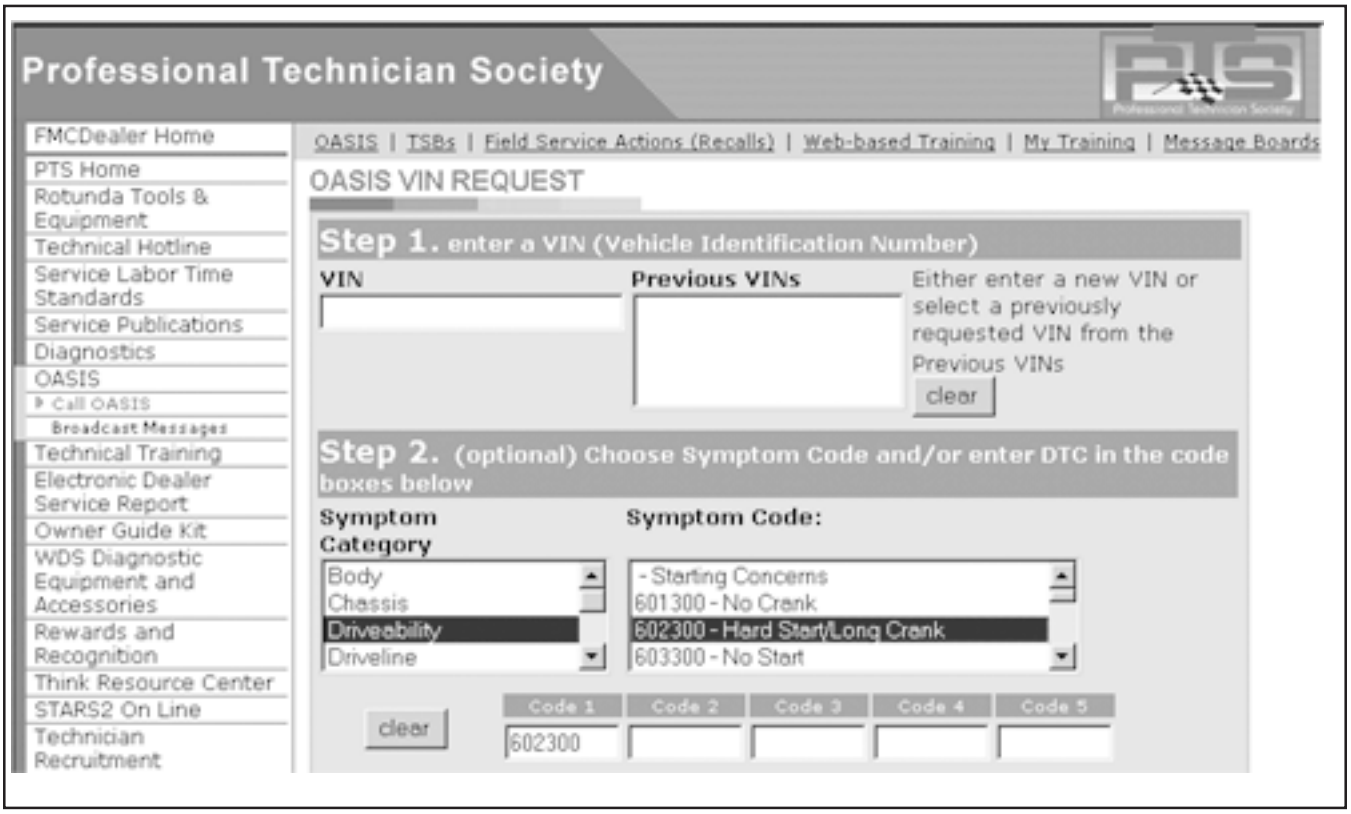
Diagnostic documentation supports the S-S-C-C process.

Symptom-to-system-to-component-to-cause (S-S-C-C) is the diagnostic process used by Ford Motor Company technicians to locate the cause of a customer concern. This process uses a systematic approach to diagnosing a concern. Following this process allows the technician to lock-step through a diagnosis and rule out possibilities to arrive at an end result, which is the system or component that is causing the customer concern. The S-S-C-C process aids the technician in his/her quest to "Fix It Right The First Time On Time."

Symptom-to-System-to-Component-to-Cause (S-S-C-C) Diagnostic Process

1. Understand the repair order
2. Verify the customer concern
    - Road test
        - Safety check (visual) vehicle before road test.
        - May be necessary to have customer ride along to help point out concern.
    - Visual/Audible inspection
3. Check TSBs, OASIS, and vehicle history
    - Follow instructions in TSB or OASIS.
4. Carry out vehicle preliminary checks
    - Part of the symptom/index chart
        - Look for obviously failed components or systems.
5. Diagnostic tests
    - Diagnostic routines
6. Carry out Repairs
    - Carry out the cause of the concern.
7. Verify the repair.
    - Make sure that the original concern is gone and no new concerns have been created.

OASIS REPORTS



OASIS VIN Request

When a vehicle comes in for service be certain to run an OASIS report with Symptom Codes.

When Symptom Codes are used, the OASIS report will contain applicable TSBs and Special Service Messages (SSMs) in addition to the vehicle warranty history.

- SSMs are text messages produced by Engineering, and contain the latest information on emerging concerns and known fixes.
  - SSMs are often replaced by more comprehensive TSBs as fixes are validated and the concern closed.

SERVICE MANUAL

PC/ED Manual

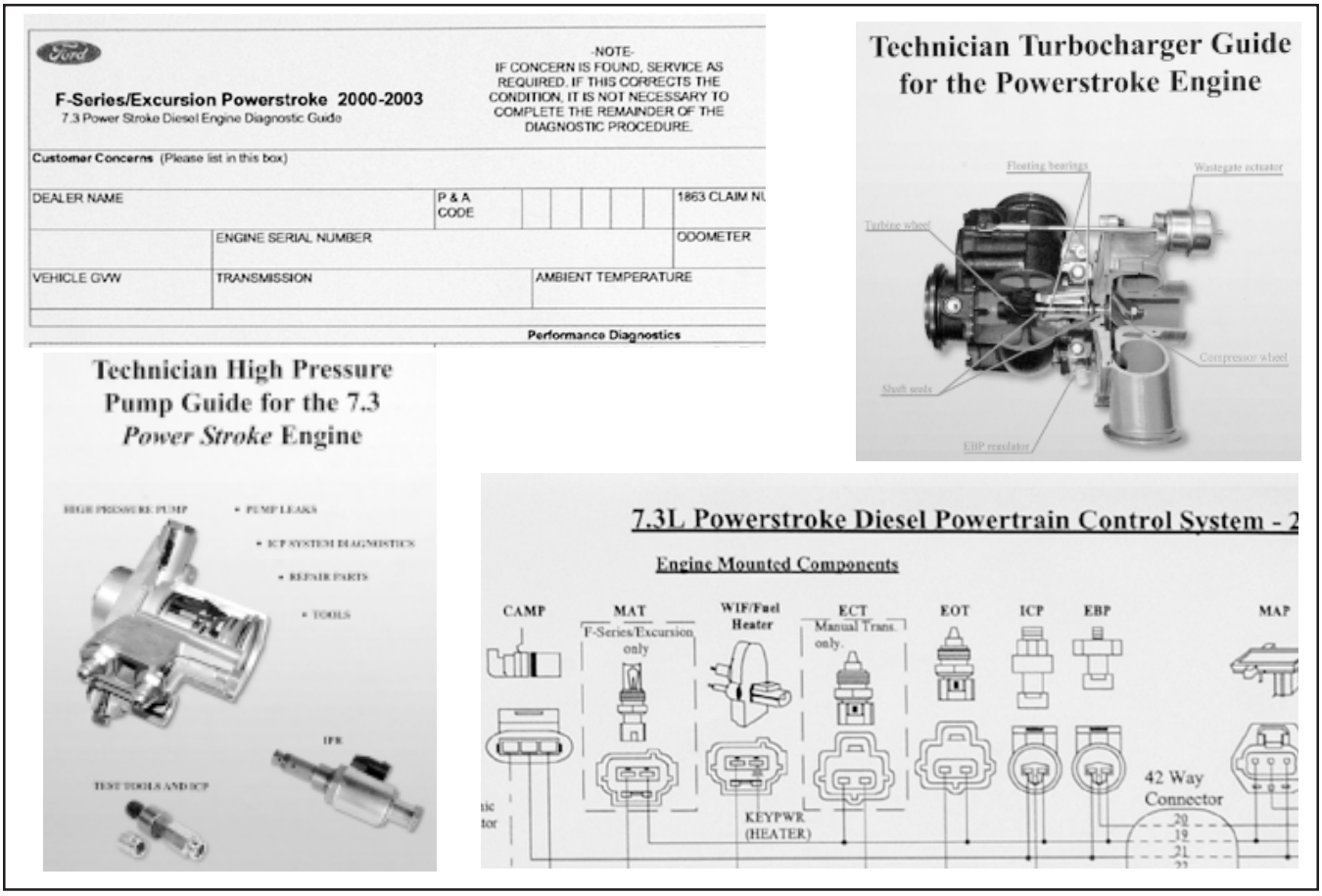
The traditional "Service Manual" consists of three publications.

- Workshop Manual
- Powertrain Control/Emissions Diagnosis (PC/ED) Manual
- Wiring Diagrams

This course will focus on using the PC/ED Manual along with additional supporting documentation.

Contents of the PC/ED Manual will be covered in Lesson Four.

SUPPORTING DOCUMENTATION



Supporting Documentation

Documents that support the PC/ED Manual include:

- Diesel Engine Diagnostic Guide Worksheets
- Powertrain Control System Wiring Schematic and DTC Index
- Technician Turbocharger Guide
- Technician High Pressure Oil Pump (HPP) Guide

POWER STROKE CENTRAL

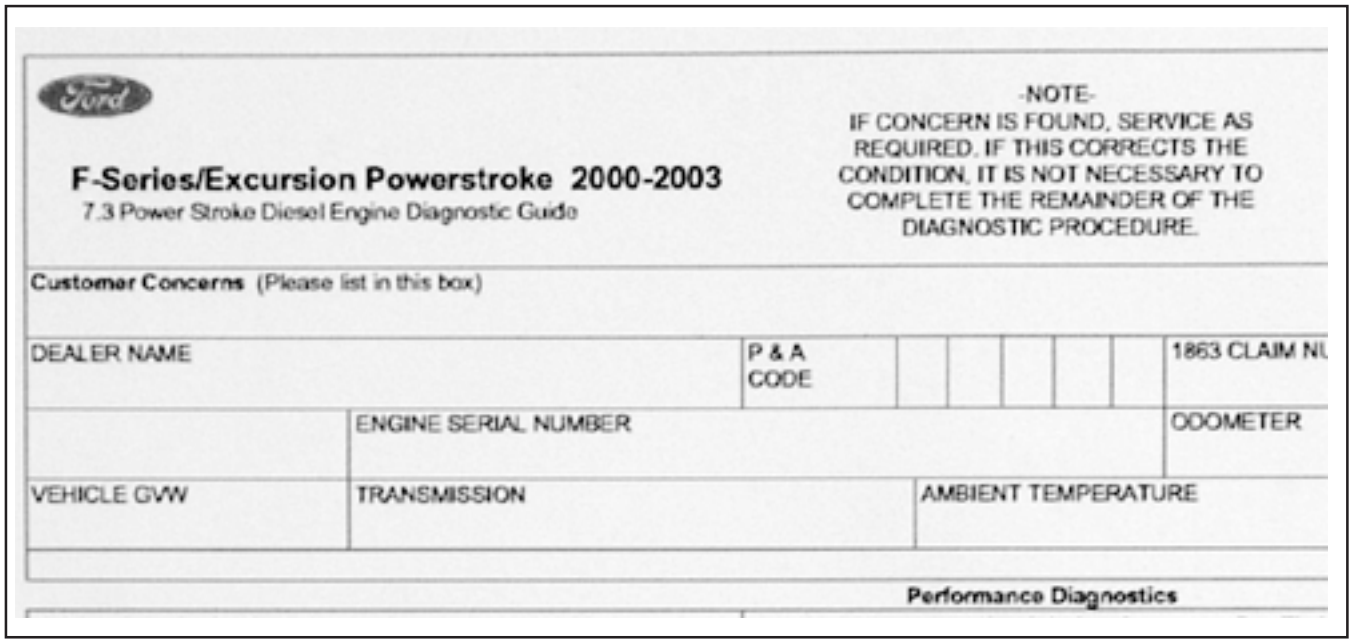
Power Stroke Central on PTS website

All supporting diagnostic documentation is located at Power Stroke Central on the PTS website.

To go to Power Stroke Central from the PTS home page, either:

- Click on Power Stroke Central on the left-hand menu bar.
- Click on the Power Stroke Central graphic at the lower right.

Diesel Engine Diagnostic Guide Worksheets



F-Series/Excursion Powerstroke 2000-2003
7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

Customer Concerns (Please list in this box)

DEALER NAME			P & A CODE					1863 CLAIM NU
	ENGINE SERIAL NUMBER							ODOMETER
VEHICLE GVW	TRANSMISSION		AMBIENT TEMPERATURE					

Performance Diagnostics

Diesel Engine Diagnostic Guide Worksheets

These worksheets are specific to Model Year and Vehicle Model. Each Guide consists of three parts:

- Hard Start/No Start Diagnostics
- Performance Diagnostics
- Artwork depicting various hard start/no start and performance diagnostic tests

The purpose of the Diagnostic Guide Worksheets is to provide accurate test specifications and condensed diagnostic steps in a quick-reference format.

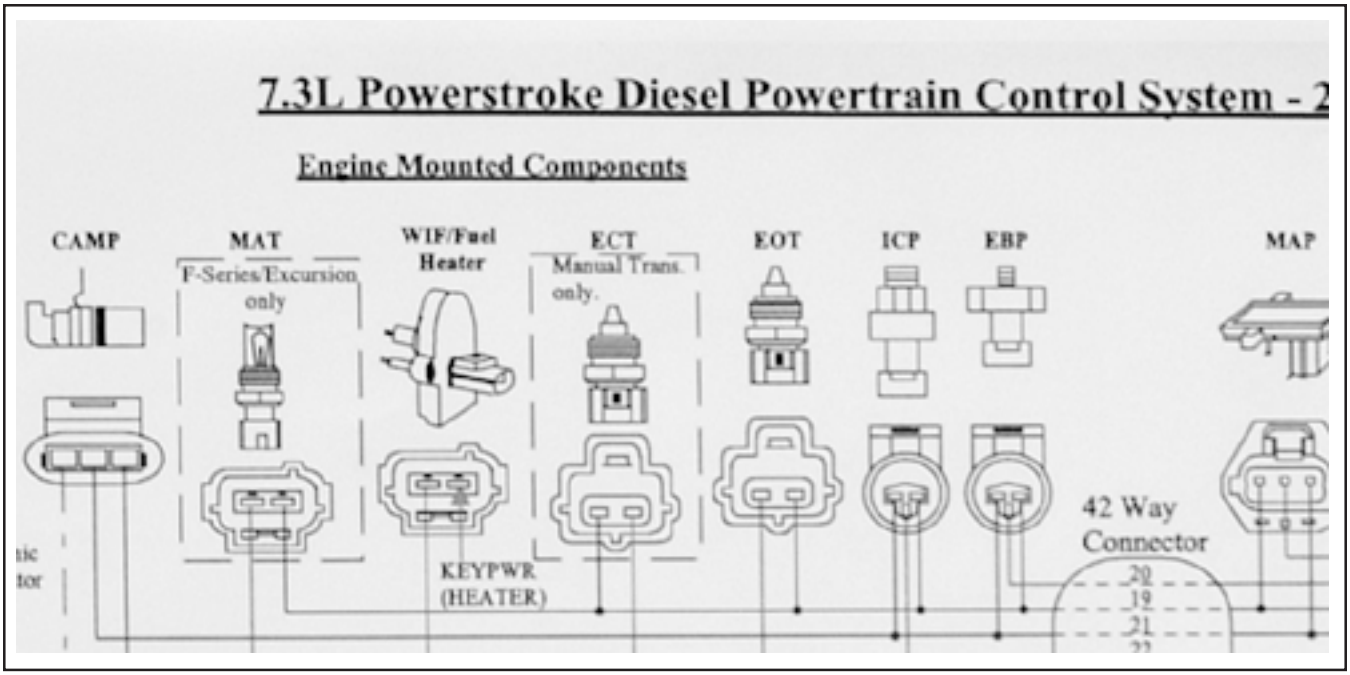
A worksheet, completed out to the point-of-repair, must be returned with certain high-cost components such as the turbocharger, high-pressure oil pump, and fuel injectors in order to receive warranty credit.

Due to the condensed nature of the Guides, you must have knowledge of the diagnostic logic in the PC/ED Manual in order to effectively use the Guide.

The best practice is to follow the diagnostic steps through the PC/ED Manual.

If the correct diagnostic logic is not followed, the result can be performance of unnecessary diagnostic steps at best, and failure to find and correct the root cause of the concern at worst.

Powertrain Control System Wiring Schematic and DTC Index



Powertrain Control System Wiring Schematic and DTC Index

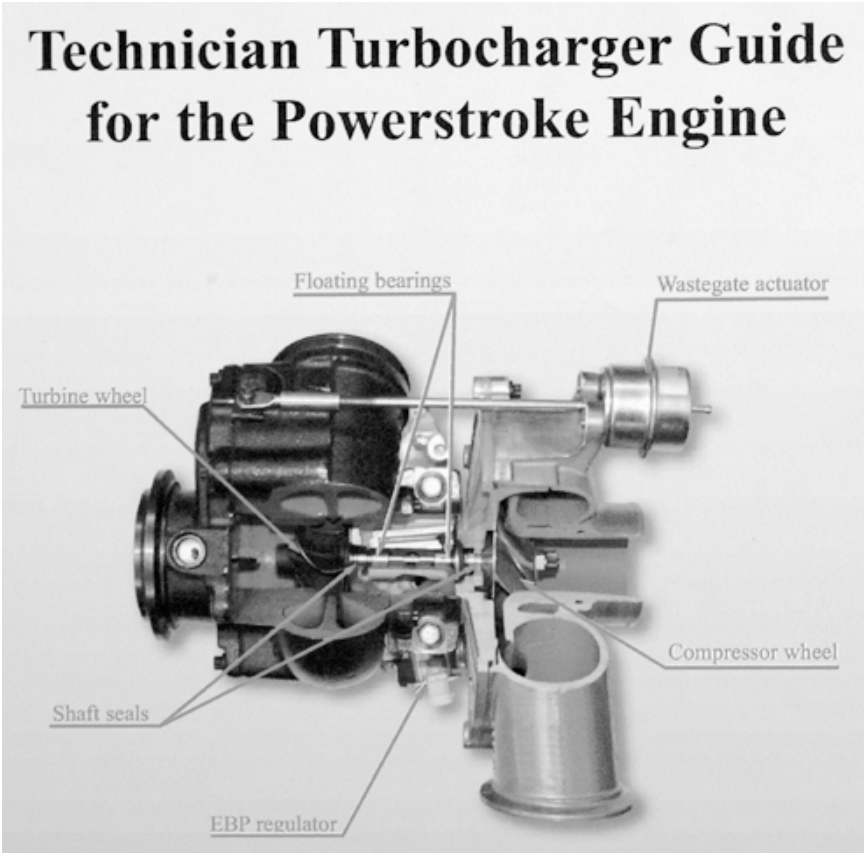
The Powertrain Control System Wiring Schematic and DTC Index is one document which consists of two parts:

- Wiring schematic of the Powertrain Control System
- DTC Index

The purpose of this color Vehicle- and Model-Year-Specific document is to provide a quick-reference for:

- Diesel wiring schematic with circuit identification and pin-out ID of major connectors
- Fault Codes (DTCs) and probable causes

Technician Turbocharger Guide



Technician Turbocharger Guide

The purpose of the Guide is to provide a better understanding of:

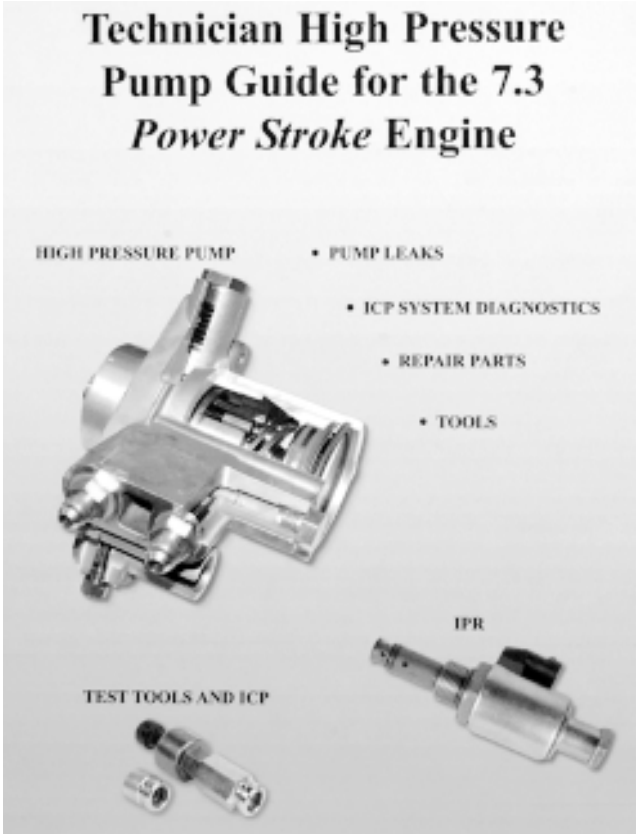
- Theory of operation
- Diagnostic procedures
- Service procedures

Benefits include:

- Reduced diagnostic time
- Repairs completed in a more cost-effective manner
- Reduced instances of replacement of components that are not faulty

It is advantageous to familiarize yourself with the contents of the Guide, and then make one final check of the information before making the decision to condemn and replace either the turbocharger or pedestal.

Technician High Pressure Oil Pump (HPP) Guide



Technician High Pressure Oil Pump (HPP) Guide

The purpose of the Guide is to provide a better understanding of:

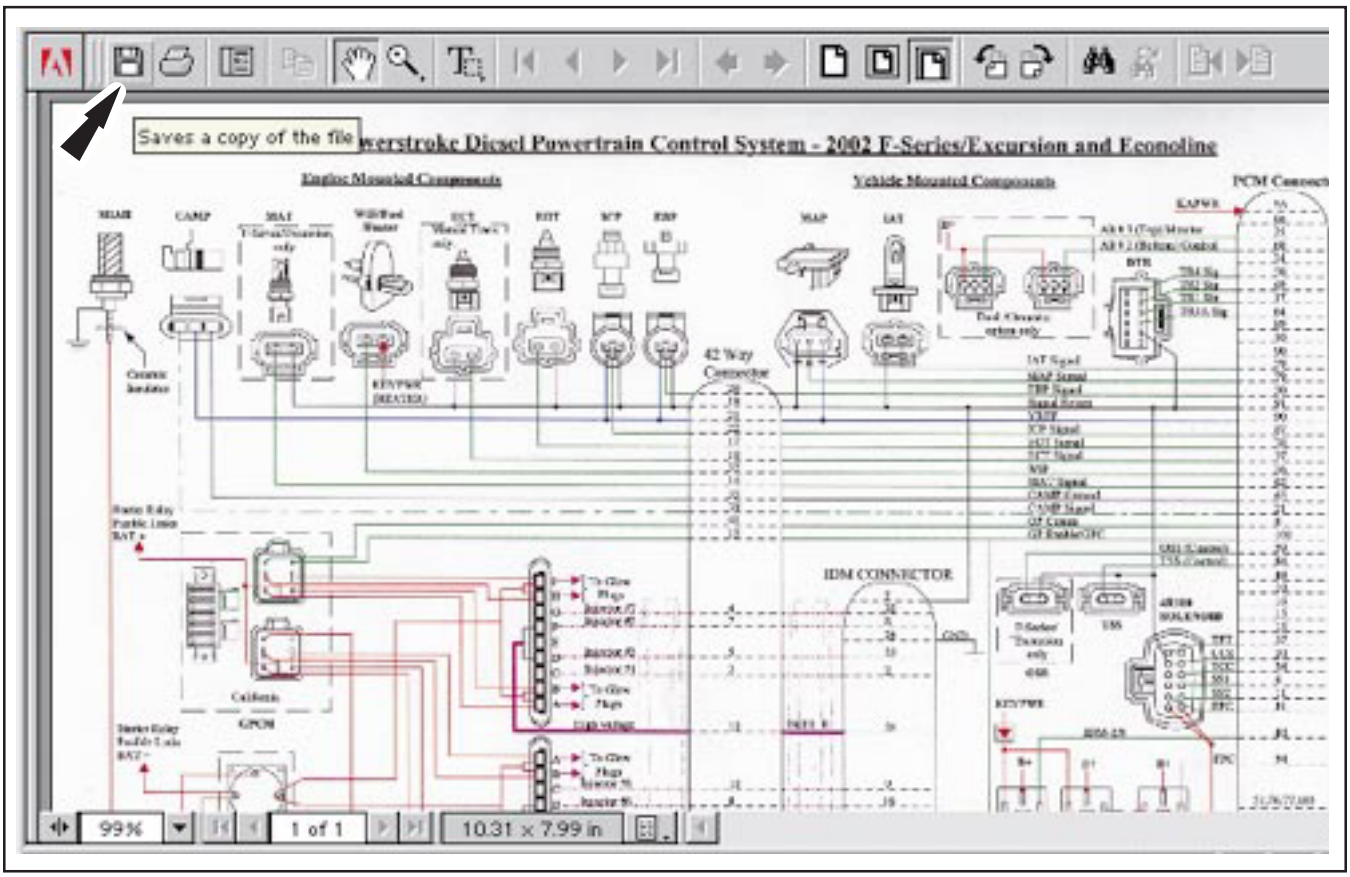
- Theory of operation
- Diagnostic procedures
- Service procedures

Benefits include:

- Reduced diagnostic time
- Repairs completed in a more cost-effective manner
- Reduced instances of replacement of components that are not faulty

It is advantageous to familiarize yourself with the contents of the Guide, and then make one final check of the information before making the decision to condemn and replace either the high pressure oil pump or IPR valve.

Downloading and Saving Service Documentation



Preparing to Save Powertrain Control System Wiring Schematic and DTC Index

All of the supporting documents can be downloaded from the PTS website.

Most are Adobe Acrobat files. There may be times when you wish to download and save certain files, and then supply those files to a print shop for color printing on larger-than-normal paper. For example, the color wiring diagram that is Page One of the Powertrain Control System Wiring Schematic and DTC Index becomes a great job aid when printed in color on 11"x17" paper.

The Acrobat menu bar is separate from the main browser menu. The Acrobat menu must be used to save an Acrobat file.

TECHNICAL HOTLINE

The Technical Hotline is available to assist you with technical concerns that cannot be resolved through use of resources at your dealership.

Hotline Mission

To be the highest quality diagnostic technical assistance center in the industry. To provide high quality service while meeting all dealership's hours of operation.

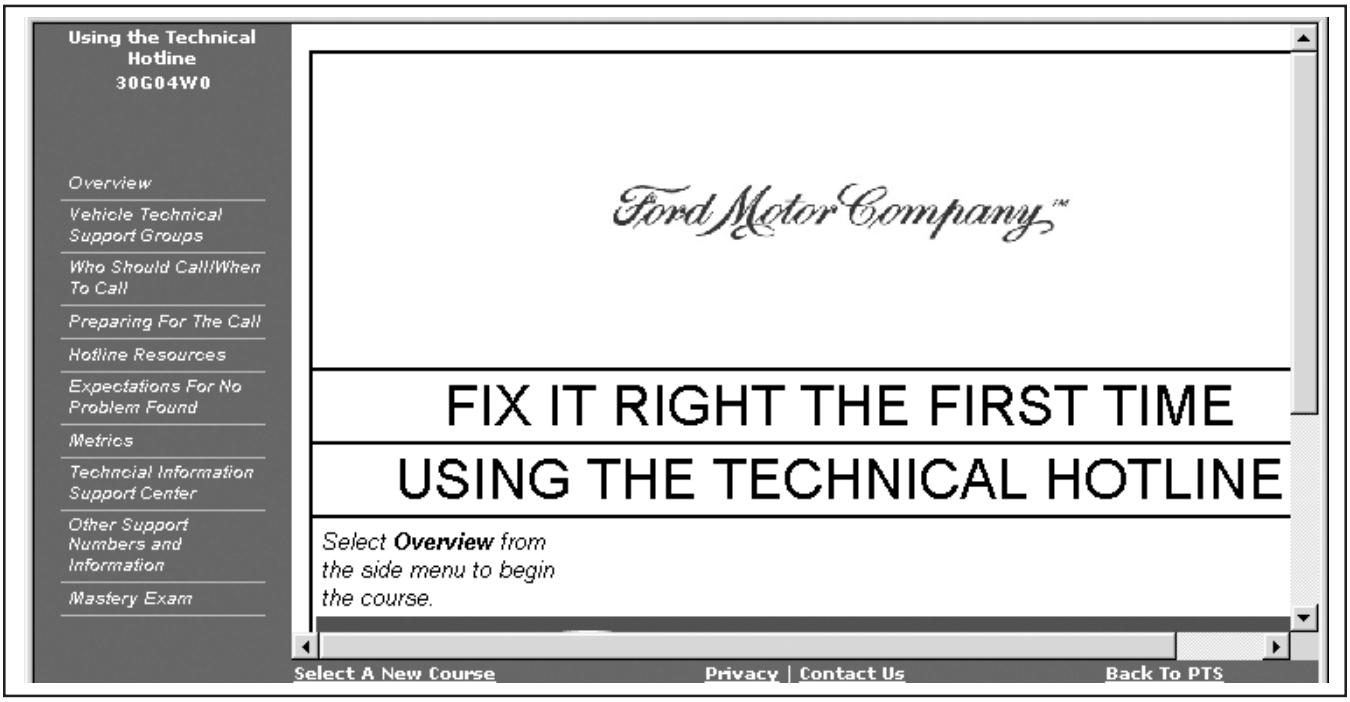
Hotline Vision

Provide high quality technical assistance which is easily accessible, timely and accurate.

Hotline Information on PTS

Complete information on the Technical Hotline, including access numbers and hours of operation, can be found on the PTS website.

Effective Use of the Technical Hotline



Fix-It-Right-The-First-Time Hotline Course, Code 30G04W0

A Fix-It-Right-The-First-Time (FIRTFT) web-based course will provide information to allow you to make the most effective use of the Technical Hotline service.

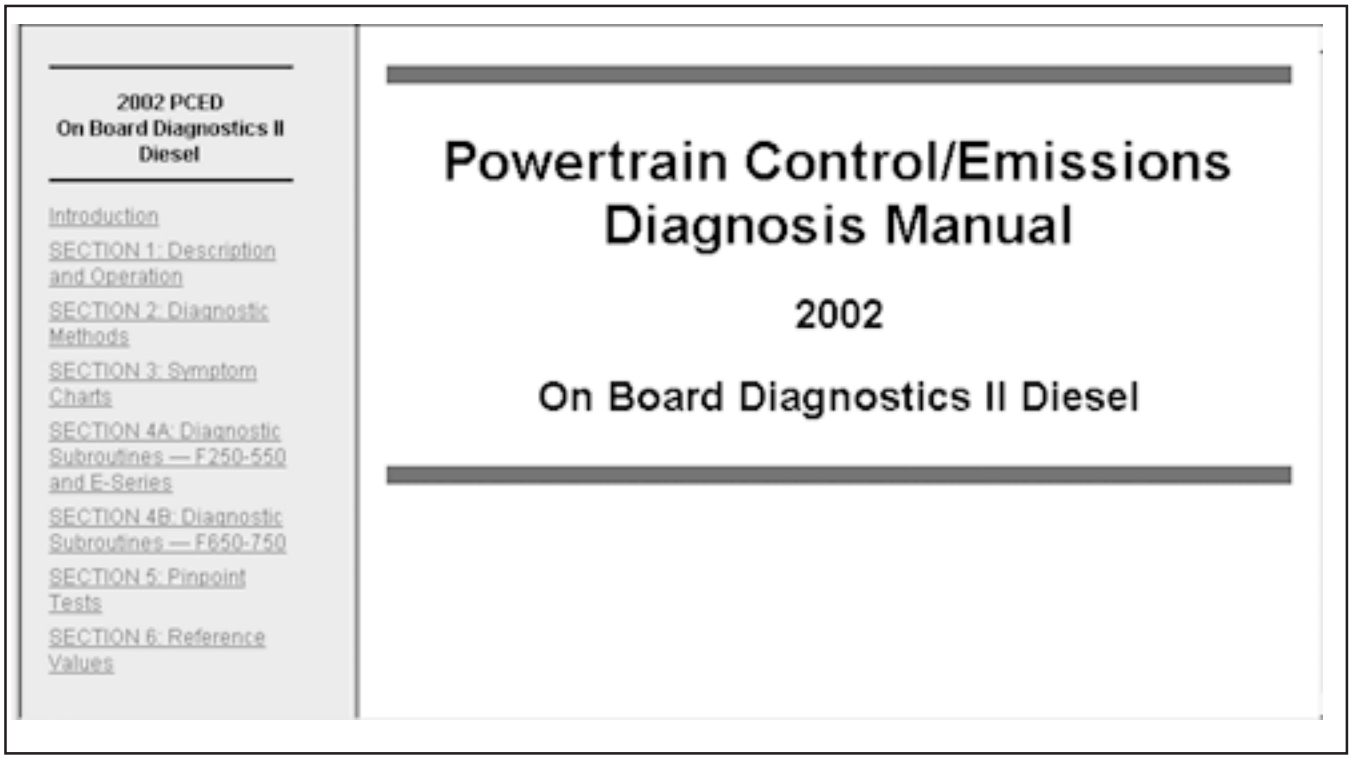
The course can be accessed from the PTS home page, by following the path:

- Technical Training > Web-based Training > Course Selection > FIRTFT Courses > 30G04W0, Using the Technical Hotline

OBJECTIVES

- Describe the layout of the PC/ED Manual.

PC/ED MANUAL



The PC/ED Manual can be considered the "Master Reference" for diagnosing concerns on the 7.3L DIT engine.

As one becomes increasingly familiar with diagnosing the 7.3L engine, actually "cracking the book" (or accessing the electronic version of the PC/ED Manual) probably becomes less of a common occurrence.

Use of the PC/ED is covered in various training courses that have been attended by certified diesel technicians.

In this lesson, the contents of the PC/ED Manual will be reviewed, and hopefully some new insight will be gained even by those with considerable diagnostic experience.

As one becomes more experienced, it is important to always maintain the diagnostic logic that is found in the PC/ED Manual. Follow the logical steps that will allow you to most quickly and accurately determine the cause of a concern.

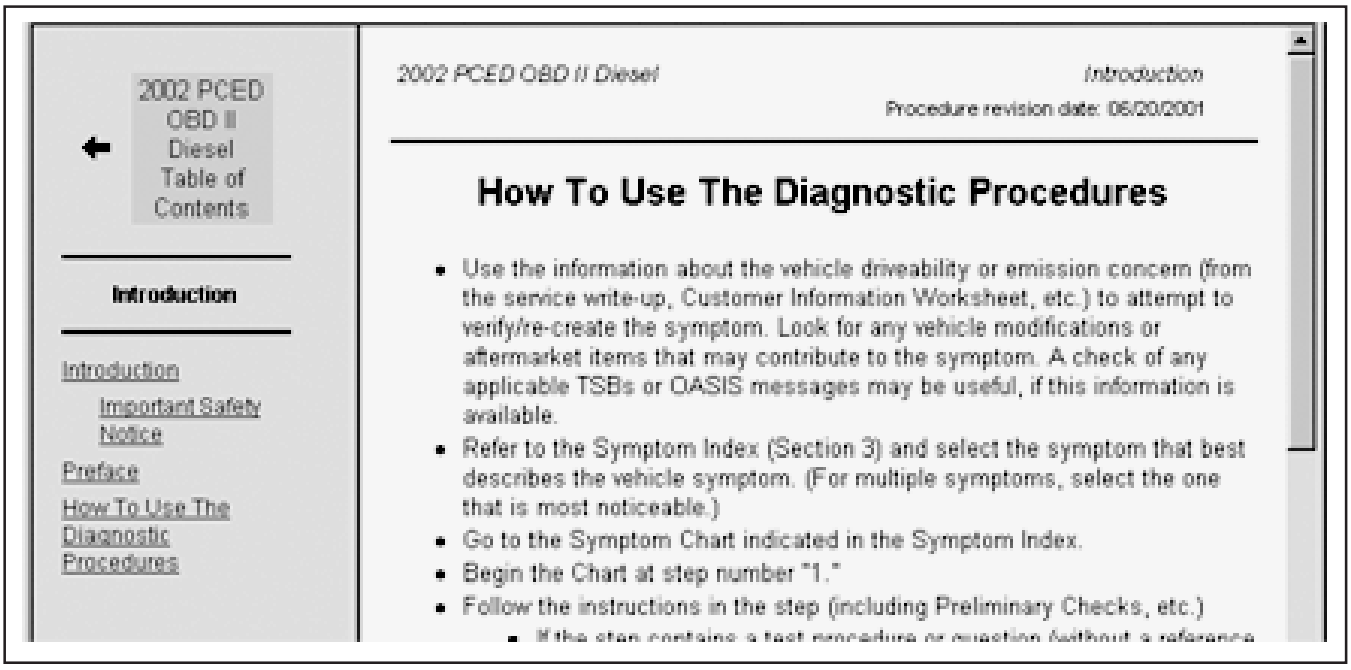
The PC/ED manual is divided into several sections, which are listed in the PC/ED table of contents.

- INTRODUCTION
- SECTION 1: Description and Operation
- SECTION 2: Diagnostic Methods
- SECTION 3: Symptom Charts
- SECTION 4A: Diagnostic Subroutines - F250-550 and E-Series
- SECTION 4B: Diagnostic Subroutines - F650-750
- SECTION 5: Pinpoint Tests
- SECTION 6: Reference Values

A complete outline of the 2002 Diesel PC/ED Manual can be found in the Appendix of this publication.

The following pages provide an overview of each section in the PC/ED Manual.

INTRODUCTION

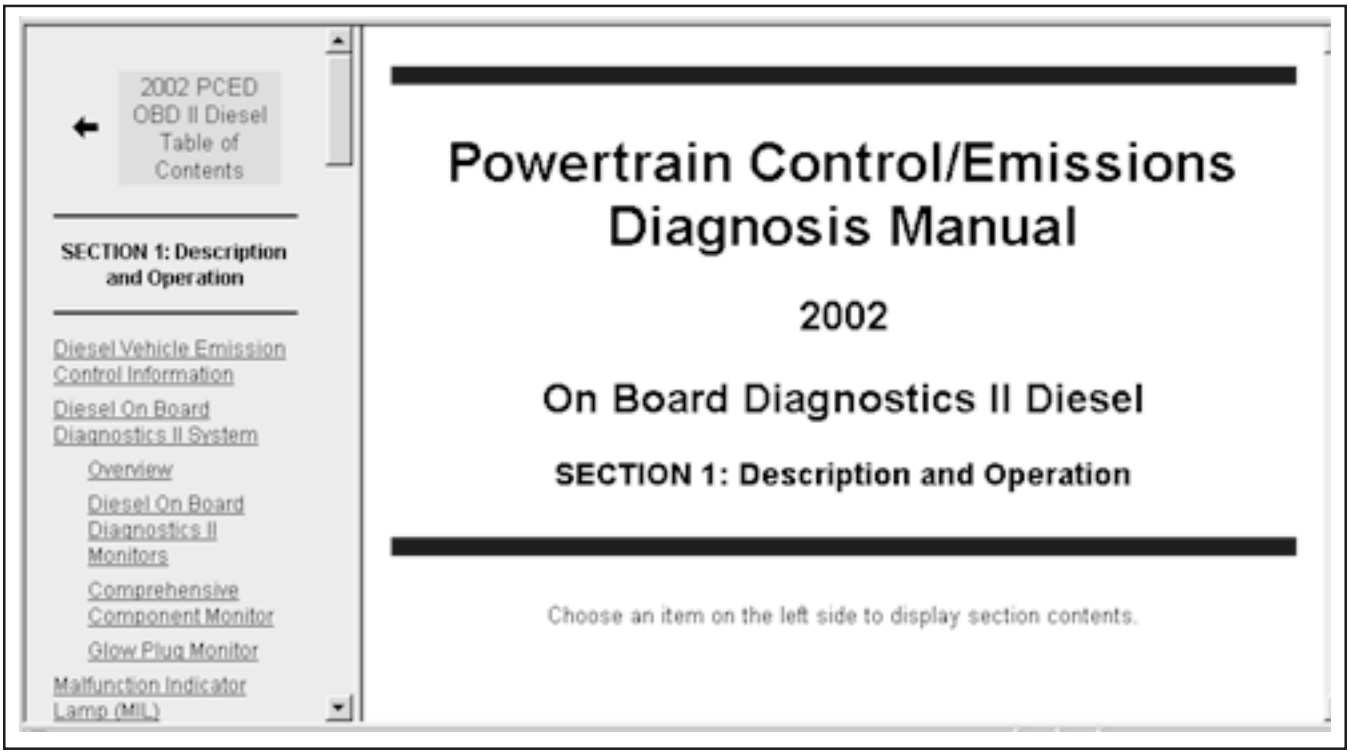


Introduction

The Introduction section covers important safety information, and also contains a review of proper diagnostic procedure, such as:

- Attempt to verify-create the symptom.
- Look for modifications or aftermarket items that may contribute to the concern.
- Run an OASIS Report, by symptom.
- **IMPORTANT:** Begin the diagnosis by going to the Symptom Index Chart in Section 3.

SECTION 1: DESCRIPTION AND OPERATION

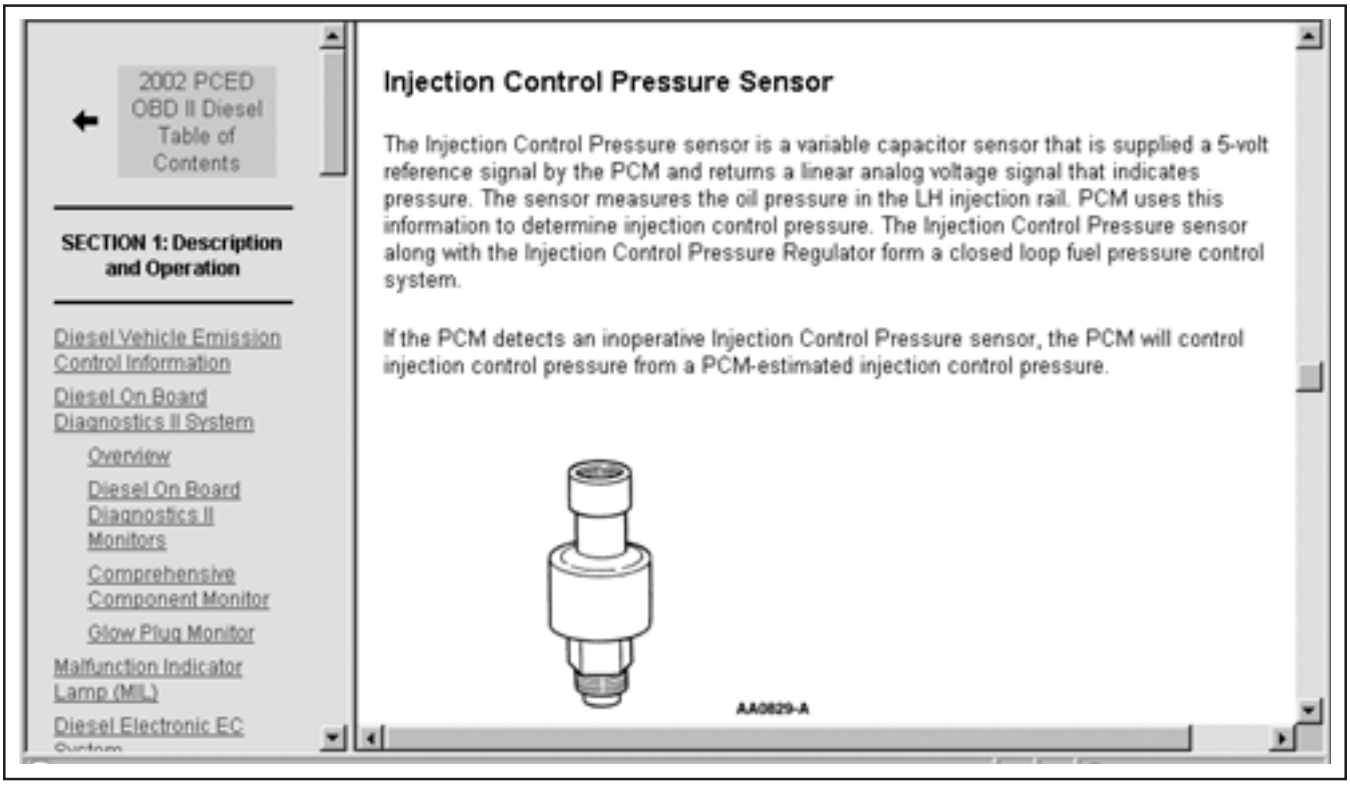


Section 1: Description and Operation

The Description and Operation section provides a description of overall system operation, as well as description and operation of individual components such as those that provide input to, and receive output from, the PCM.

Topics covered in Section 2 include:

- Diesel Vehicle Emission Control Information - Shows engine emission labels.
- Diesel On Board Diagnostics II System
- Malfunction Indicator Lamp (MIL)
- Diesel Electronic EC System
- Diesel Powertrain Control Software
- Diesel PCM Inputs
- Diesel PCM Outputs
- Diesel Fuel System
- Diesel Intake Air Systems
- Diesel Catalyst and Exhaust Systems

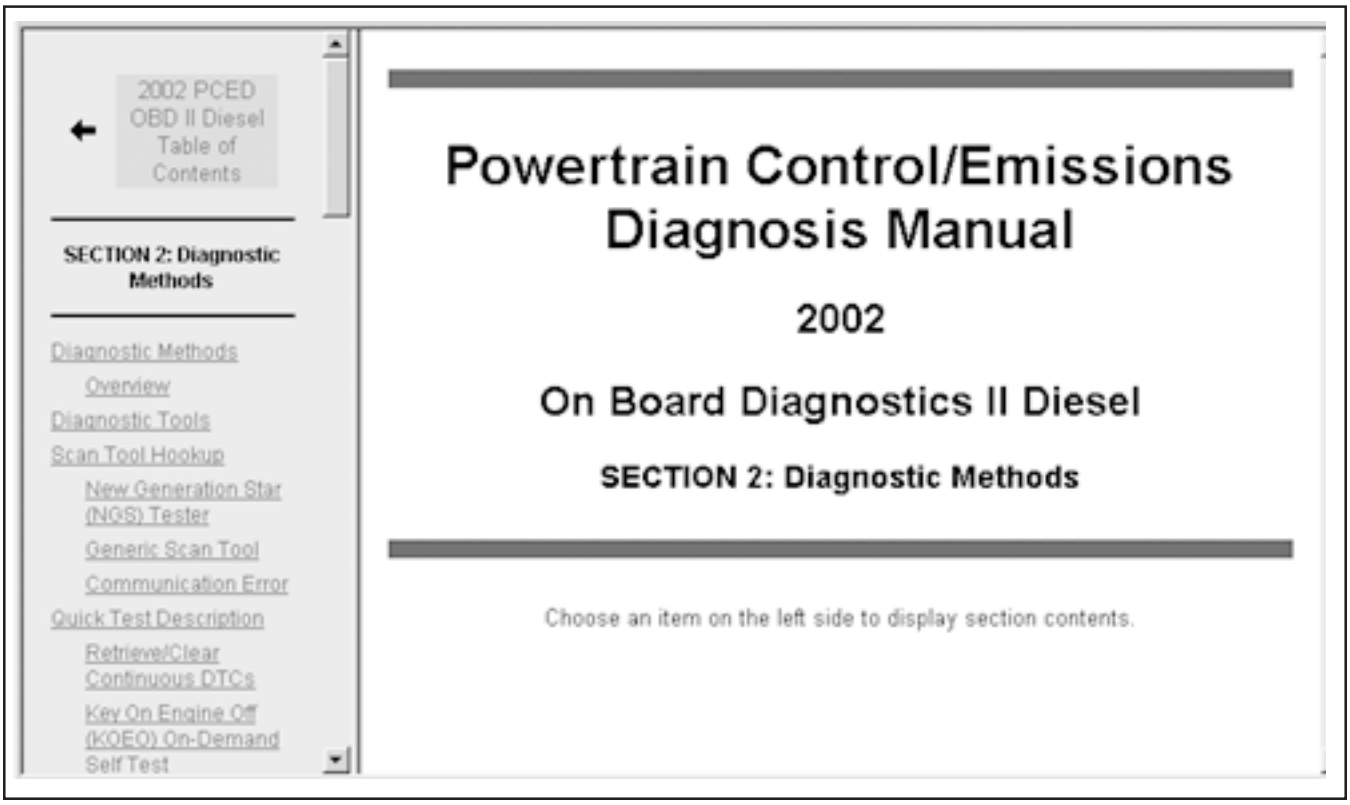


Section 1: ICP Sensor

While the Description and Operation section provides a general description of each component, the actual specifications for the component can be found in the Introduction tab, or page, for the individual Pinpoint Tests in Section 5.

An example will be provided when we get to Section 5.

SECTION 2: DIAGNOSTIC METHODS



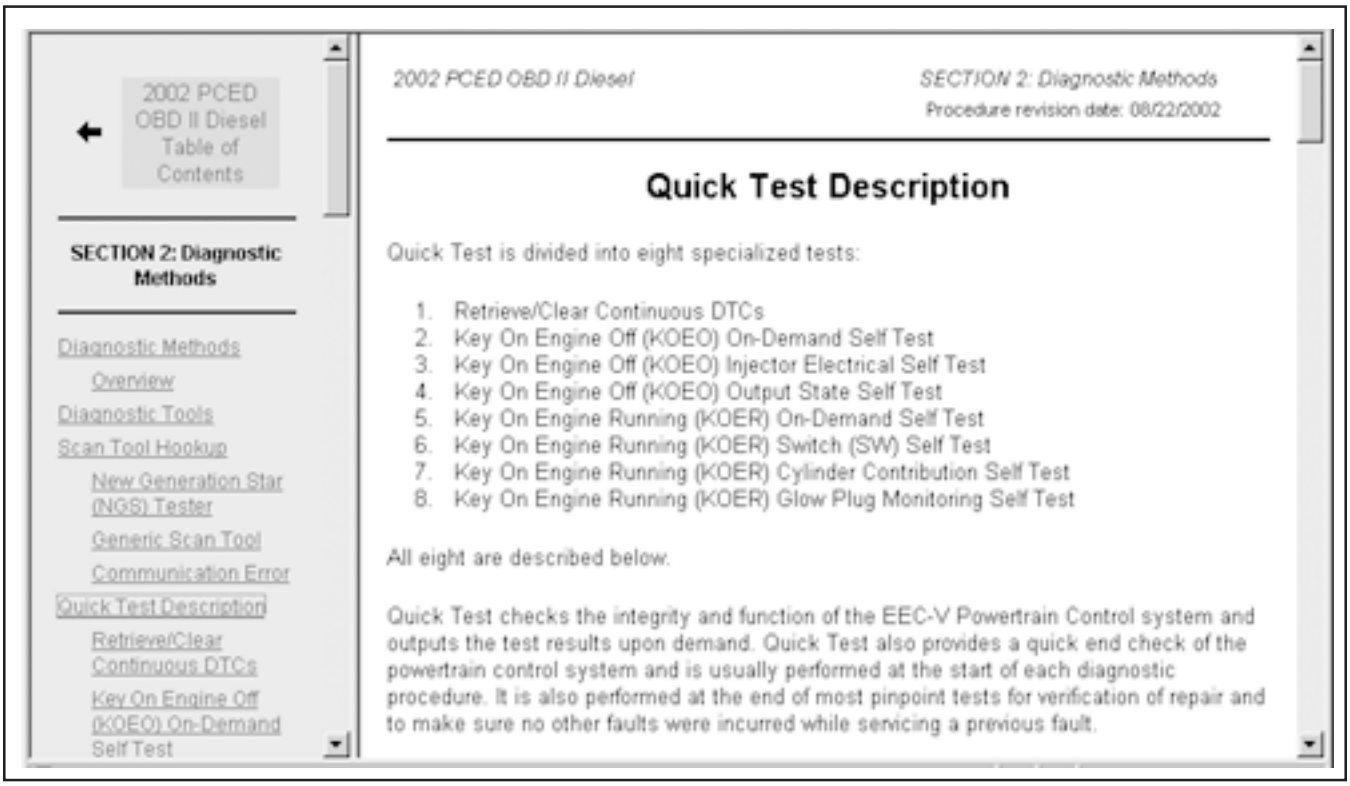
Section 2: Diagnostic Methods

The Diagnostic Methods section provides detailed instructions on how to access or perform routine diagnostic tasks.

While there are many topics in Section 2, the three topics of most interest are:

- Quick Test Description
- Quick Test Operation
- Parameter Identification

Quick Test Description

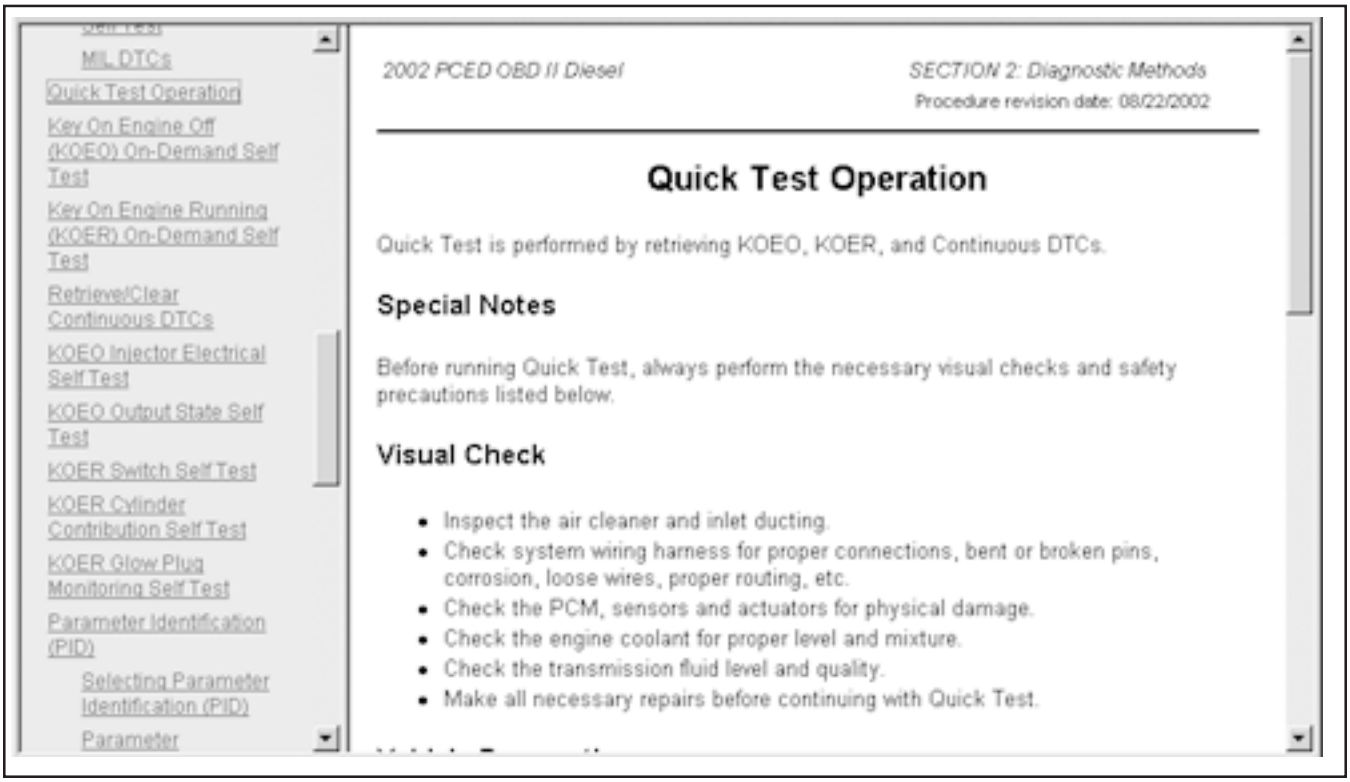


Section 2: Quick Test Description

This subsection describes in detail each of the Quick Tests, which are:

- Retrieve/Clear Continuous DTCs
- Key On Engine Off (KOEO) On-Demand Self Test
- Key On Engine Off (KOEO) Injector Electrical Self Test
- Key On Engine Off (KOEO) Output State Self Test
- Key On Engine Running (KOER) Switch (SW) Self Test
- Key On Engine Running (KOER) On-Demand Self Test
- Key On Engine Running (KOER) Cylinder Contribution Self Test
- Key On Engine Running (KOER) Glow Plug Monitor Self Test

Quick Test Operation

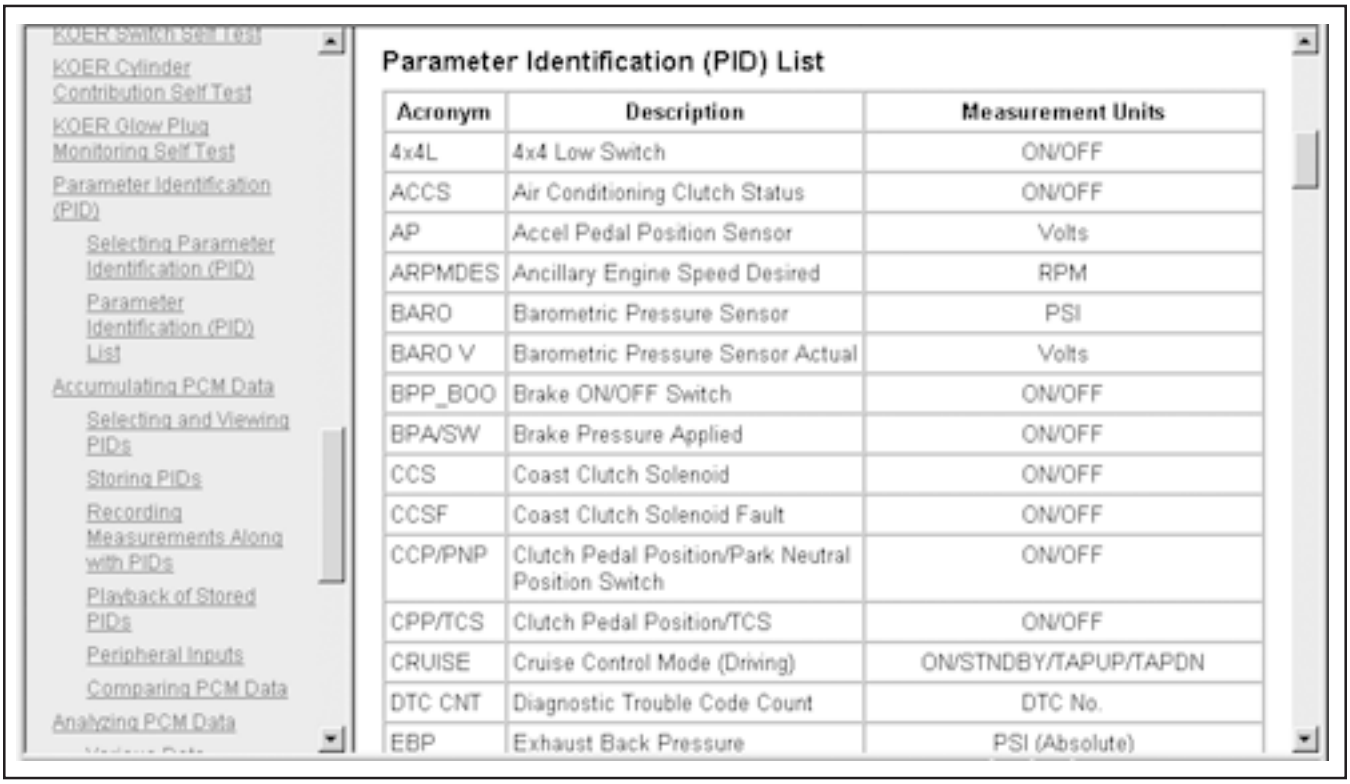


Section 2: Quick Test Operation

Quick Test Operation explains how to run each of the Quick Tests. This subsection is brief, with few instructions other than those found on the WDS as the tests are performed.

It is important to note and remember that one is never instructed to sequentially run all eight Quick Tests. Each Quick Test should be conducted only if and when instructed to do so by the either the Diagnostic Subroutines in Sections 4A or 4B, or by one of the Pinpoint Tests.

Parameter Identification

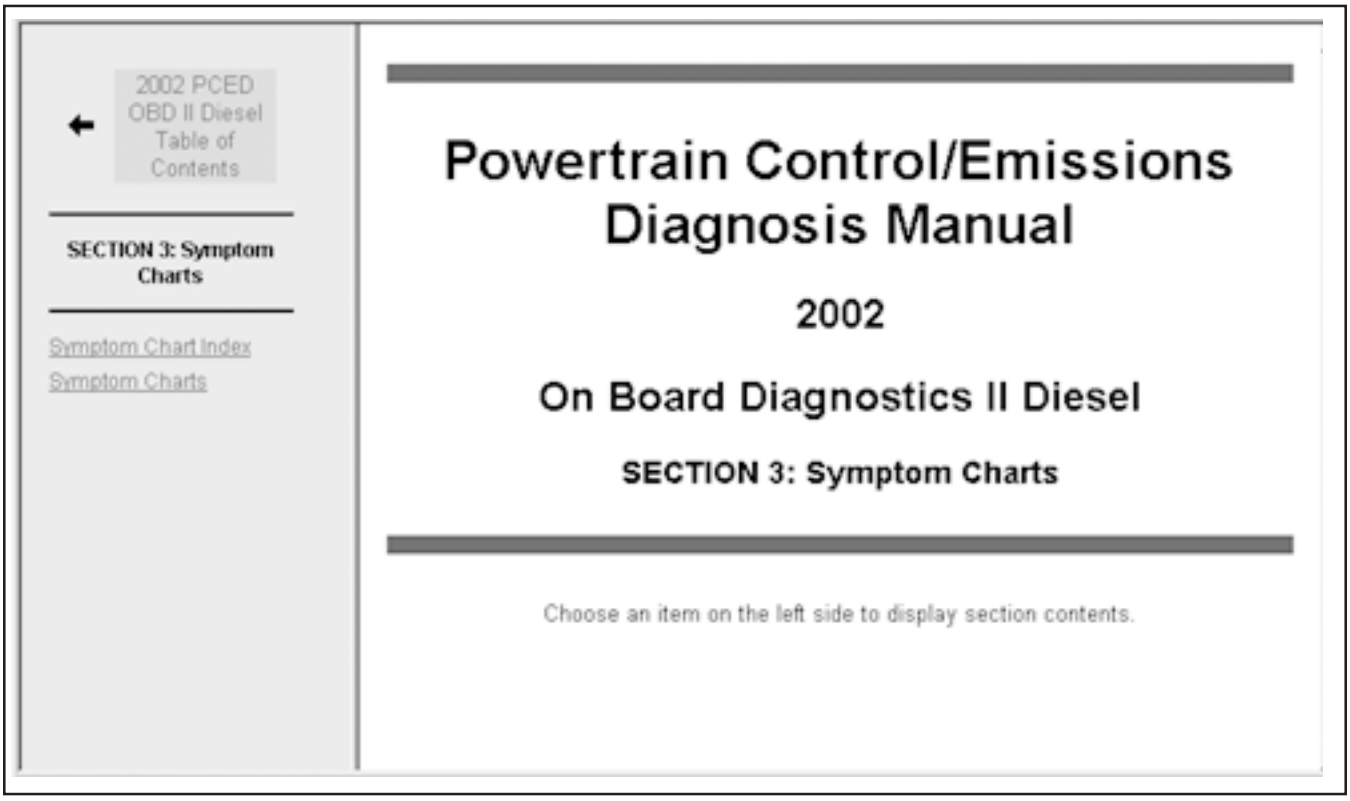


Section 2: Parameter Identification

The Parameter Identification subsection contains a handy listing of all parameters with:

- Acronym
- Description
- Measurement Units

SECTION 3: SYMPTOM CHARTS

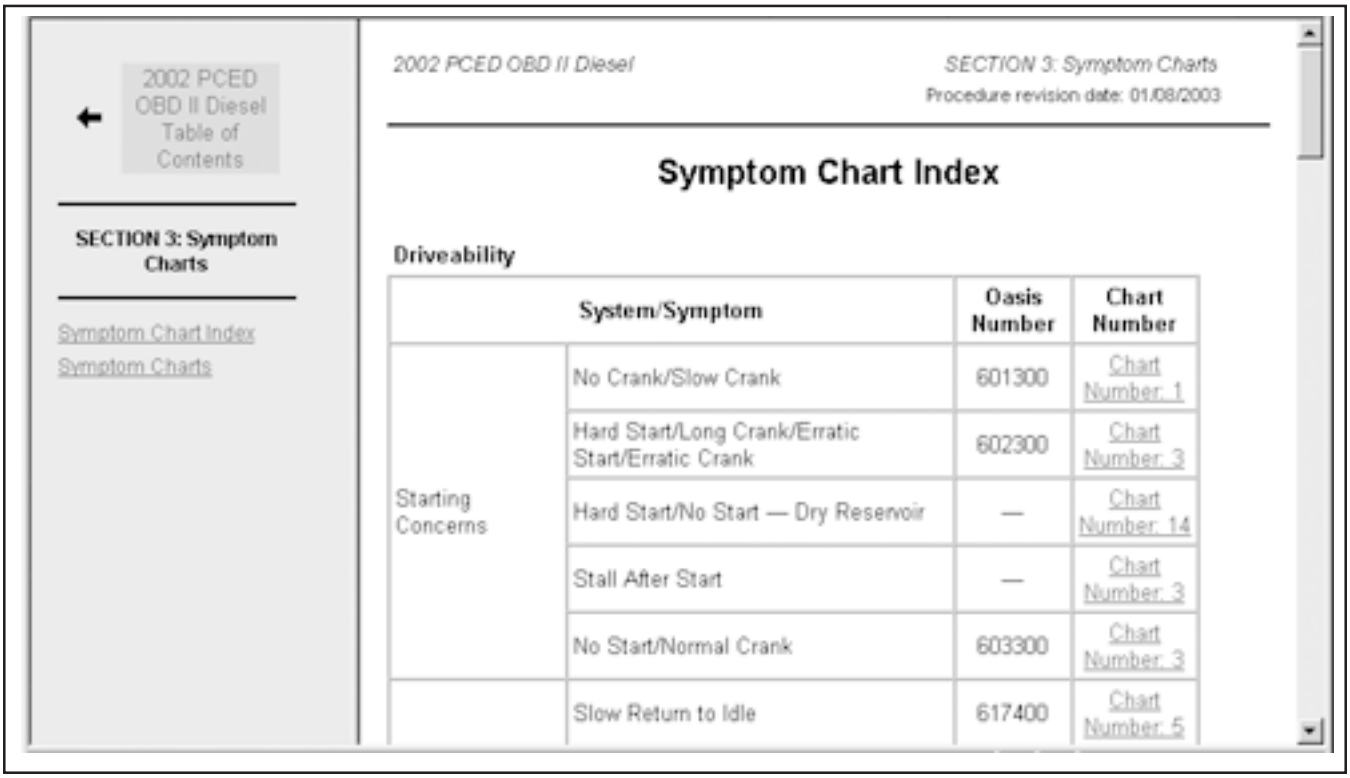


Section 3: Symptom Charts

Section 3 is the starting point when using the PC/ED Manual to diagnose a concern. Section 3 contains:

- Symptom Chart Index
- Symptom Charts

Symptom Chart Index

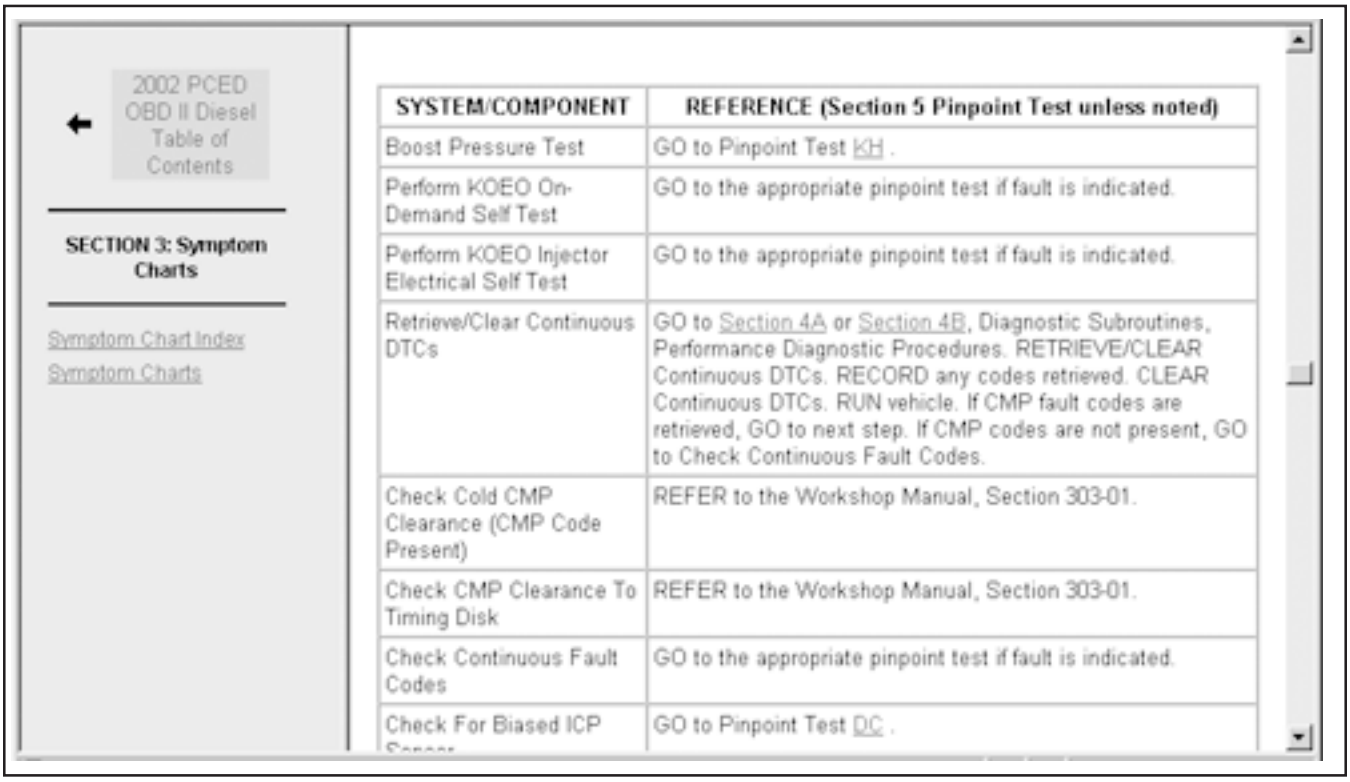


Section 3: Symptom Chart Index

The Symptom Chart Index is arranged and categorized by OASIS Number.

Use the Symptom Chart Index to select the correct Symptom Chart, based on the observed symptom(s).

Symptom Charts

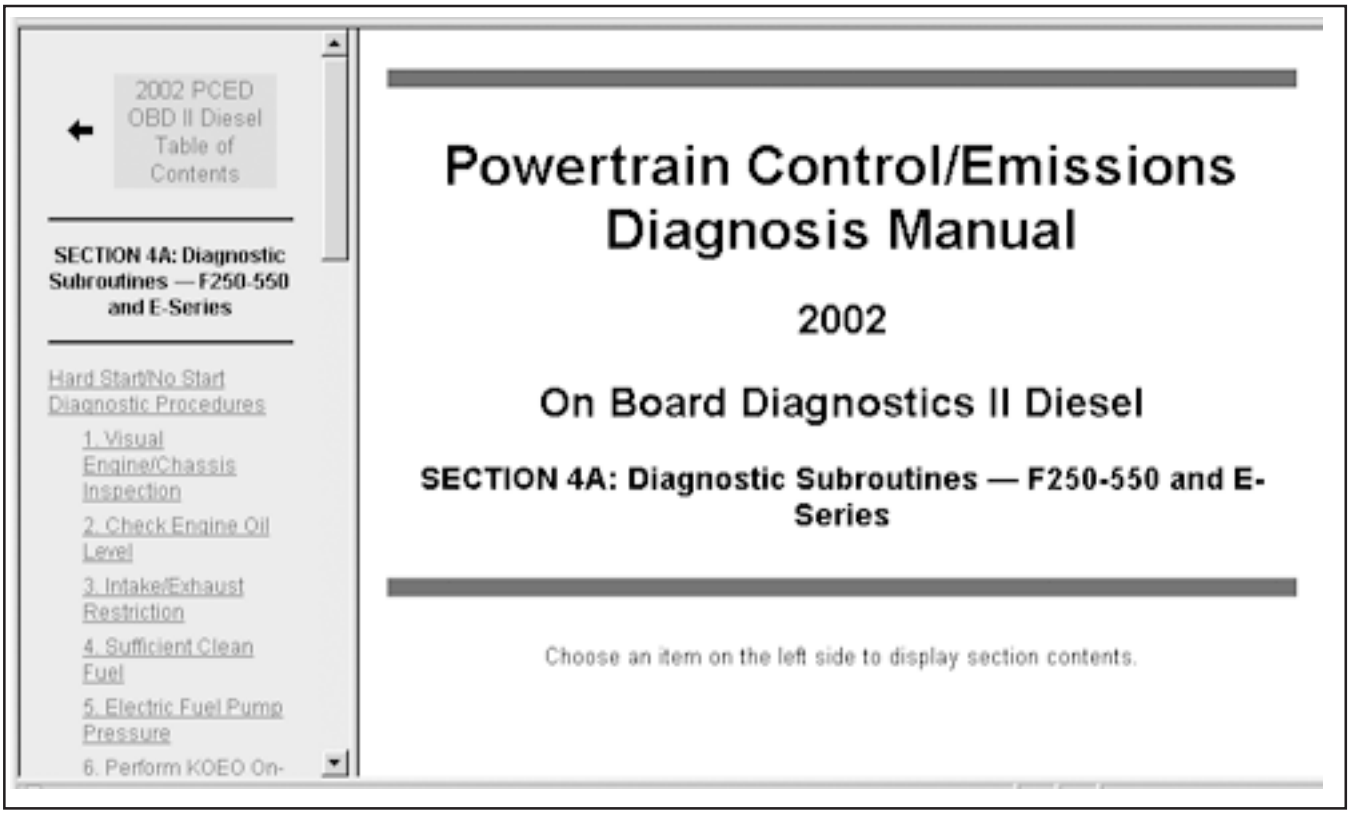


Section 3: Symptom Chart 7

Each Symptom Chart provides a high-level step-by-step procedure to diagnose the described symptoms.

While the Reference Note at the column heading indicates, "Section 5 Pinpoint Test unless noted," in many instances one is actually directed to the Diagnostic Subroutines in either Section 4A or 4B.

SECTIONS 4A AND 4B, DIAGNOSTIC SUBROUTINES



Section 4: Diagnostic Subroutines

Sections 4A and 4B are very similar, and only one of the sections is used for a particular vehicle.

Section 4A is used for Excursion, F250-550 and E-Series

Section 4B is used for F-650/F-750

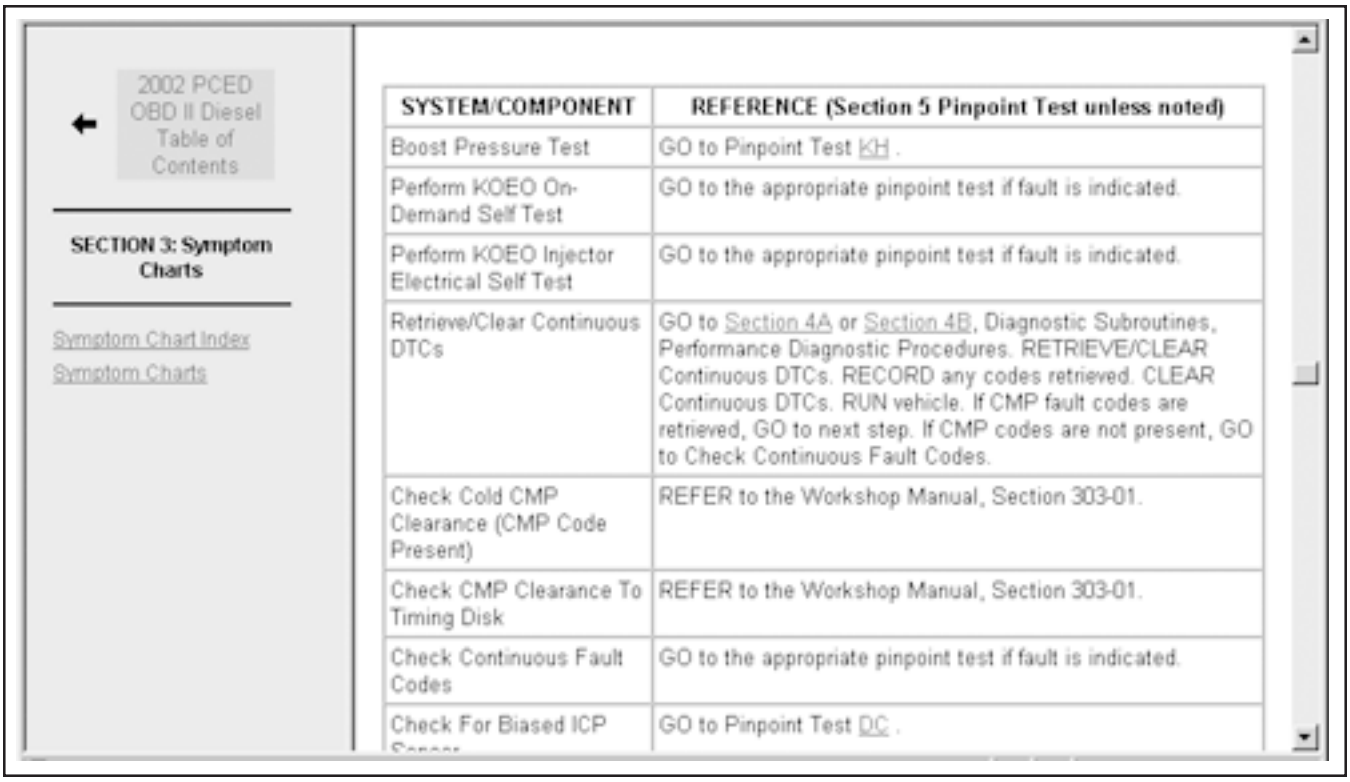
Section 4A and 4B contain three subsections:

- Hard Start/No Start Diagnostic Procedures
- Performance Diagnostic Procedures
- Diagnostic Trouble Code Description

The procedures in Sections 4A and 4B are nearly identical to those found in the Diesel Engine Diagnostic Guide Worksheets, and thus the reason for the Diesel Engine Diagnostic Guide Worksheets often being used as a job aid.

IMPORTANT: In conducting any of the tests, it is important that diagnostic logic be followed, rather than blindly following and completing every test in either Section 4A/4B or the Diesel Engine Diagnostic Guide Worksheet**.**

The best diagnostic logic can be found in the Symptom Charts in Section 3.

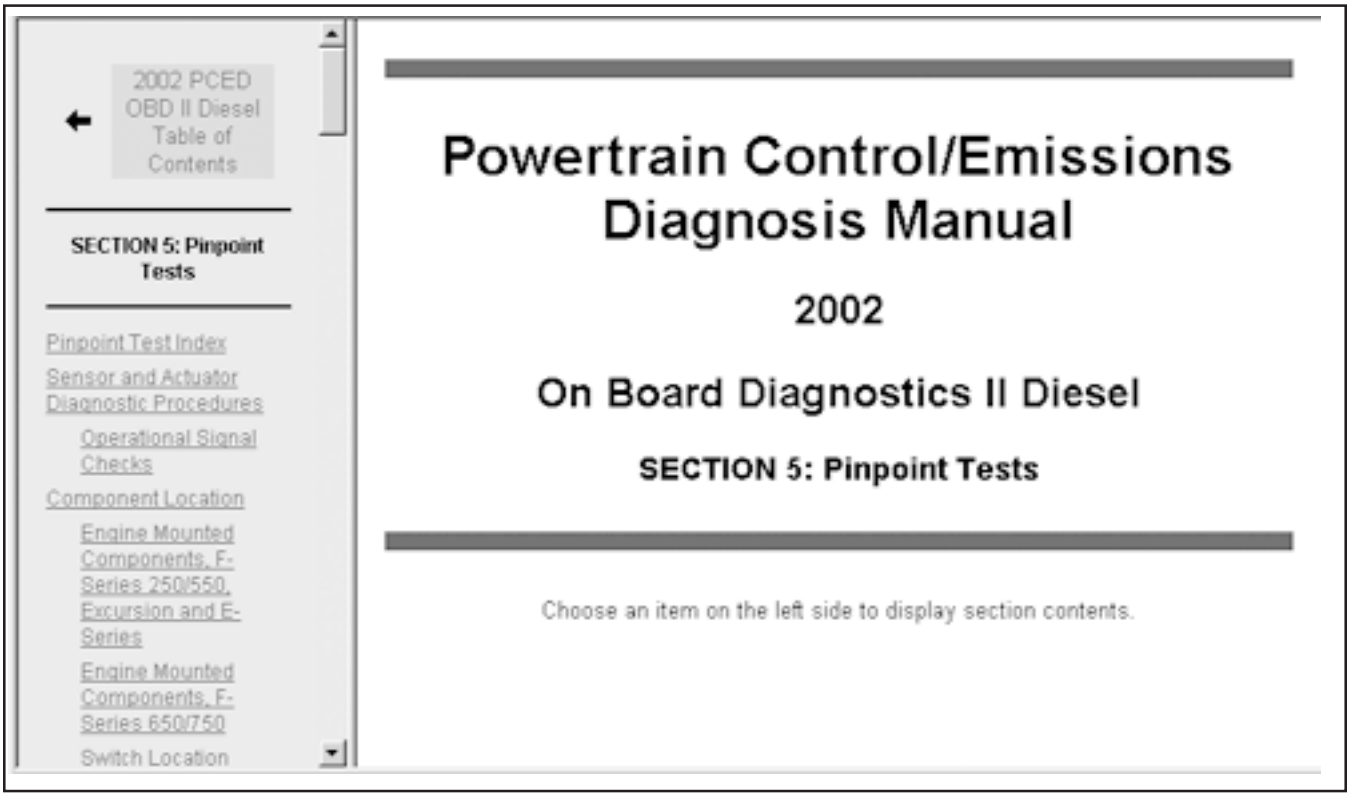


SYSTEM/COMPONENT	REFERENCE (Section 5 Pinpoint Test unless noted)
Boost Pressure Test	GO to Pinpoint Test KH .
Perform KOEO On-Demand Self Test	GO to the appropriate pinpoint test if fault is indicated.
Perform KOEO Injector Electrical Self Test	GO to the appropriate pinpoint test if fault is indicated.
Retrieve/Clear Continuous DTCs	GO to Section 4A or Section 4B, Diagnostic Subroutines, Performance Diagnostic Procedures. RETRIEVE/CLEAR Continuous DTCs. RECORD any codes retrieved. CLEAR Continuous DTCs. RUN vehicle. If CMP fault codes are retrieved, GO to next step. If CMP codes are not present, GO to Check Continuous Fault Codes.
Check Cold CMP Clearance (CMP Code Present)	REFER to the Workshop Manual, Section 303-01.
Check CMP Clearance To Timing Disk	REFER to the Workshop Manual, Section 303-01.
Check Continuous Fault Codes	GO to the appropriate pinpoint test if fault is indicated.
Check For Biased ICP	GO to Pinpoint Test DC .

Symptom Chart 7

For example, on a low-power concern, Symptom Chart 7 correctly advises to check boost pressure early in the process. If one went through either Subroutine 4A or the Diesel Diagnostic Worksheet for low power, the boost test is the last test. On a low power concern, it is critical to determine if boost is meeting specification early in the process; almost at the point where it is being decided if a concern actually exists.

SECTION 5: PINPOINT TESTS



Section 5: Pinpoint Tests

While we generally think of the Pinpoint Test section as "Don't go there unless instructed," the section contains some very good general information in addition to the step-by-step detailed tests.

The key subsections of Section 5 are:

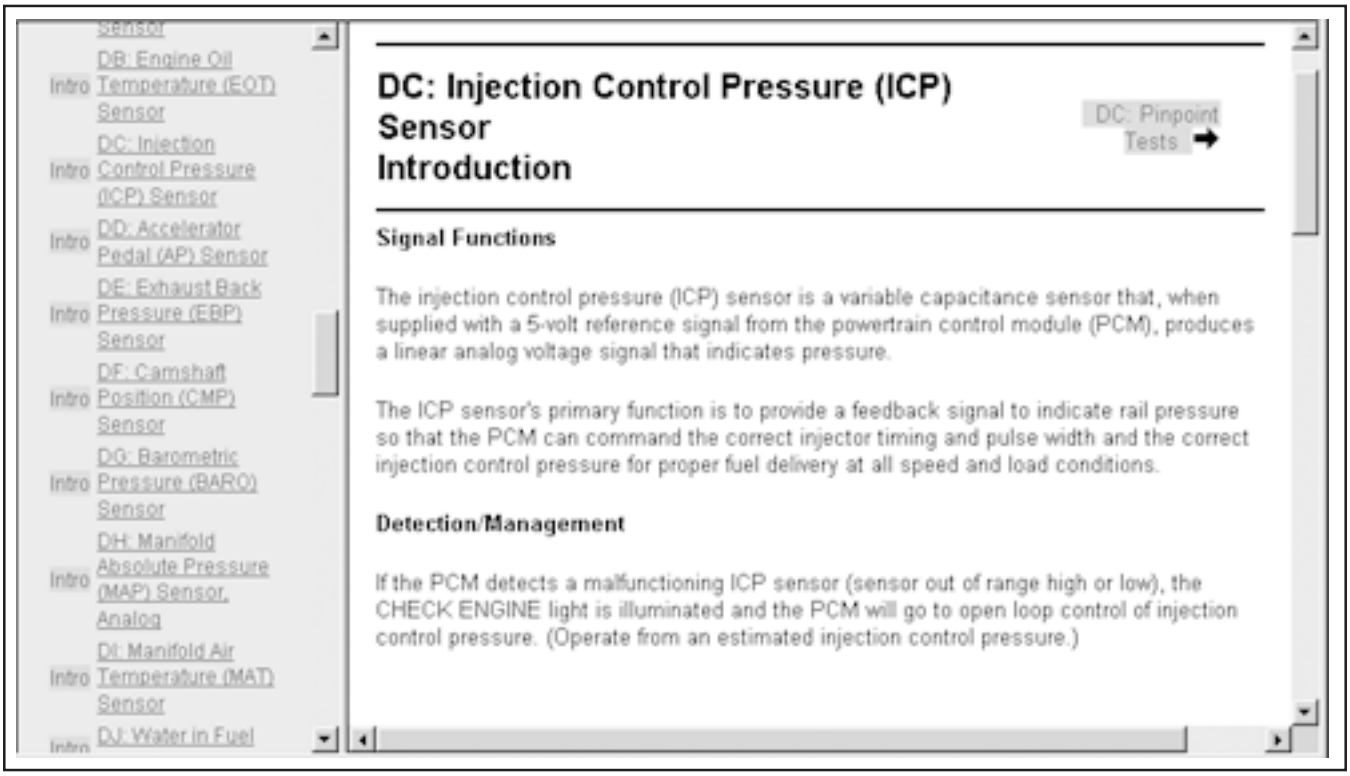
- Pinpoint Test Index
- Component Location
- Pinpoint Tests

While the Index and Component Location are self-explanatory, it will be good to take a closer look at a sample Pinpoint Test.

Each Pinpoint Test consists of two sections:

- Introduction
- Pinpoint Test Procedure

Introduction



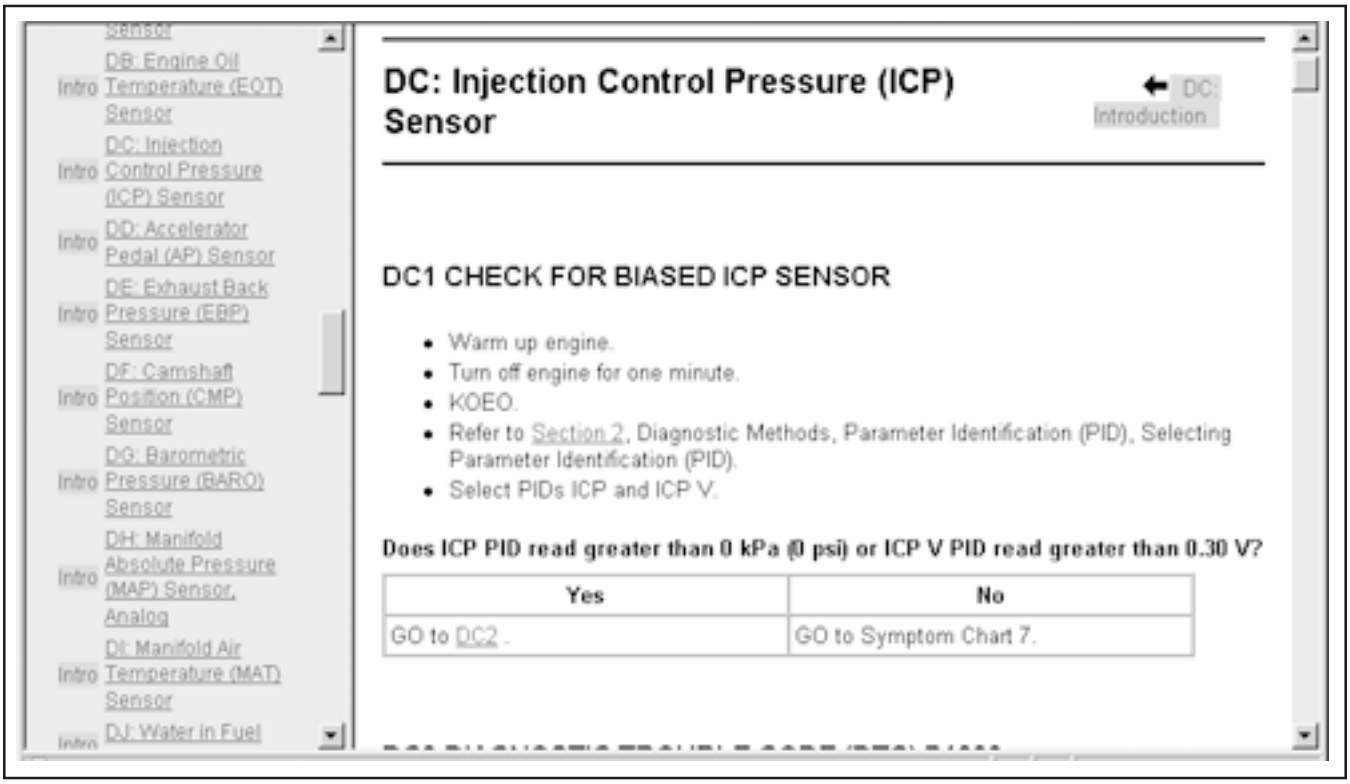
Section 5: Test DC, Injection Control Pressure (ICP) Sensor

The Introduction contains:

- Description/Function
- Wiring schematic with connector map and PCM connector pin ID
- Associated DTCs
- Pressure/voltage/frequency relationship chart and/or graph if applicable

If you suspect a concern with a specific component in the powertrain control system and require more detailed information on that component, including description and operation and specifications, look up the pinpoint test for that component in the Pinpoint Test Index, and go to the Introduction for the specific Pinpoint Test.

Pinpoint Test Procedure



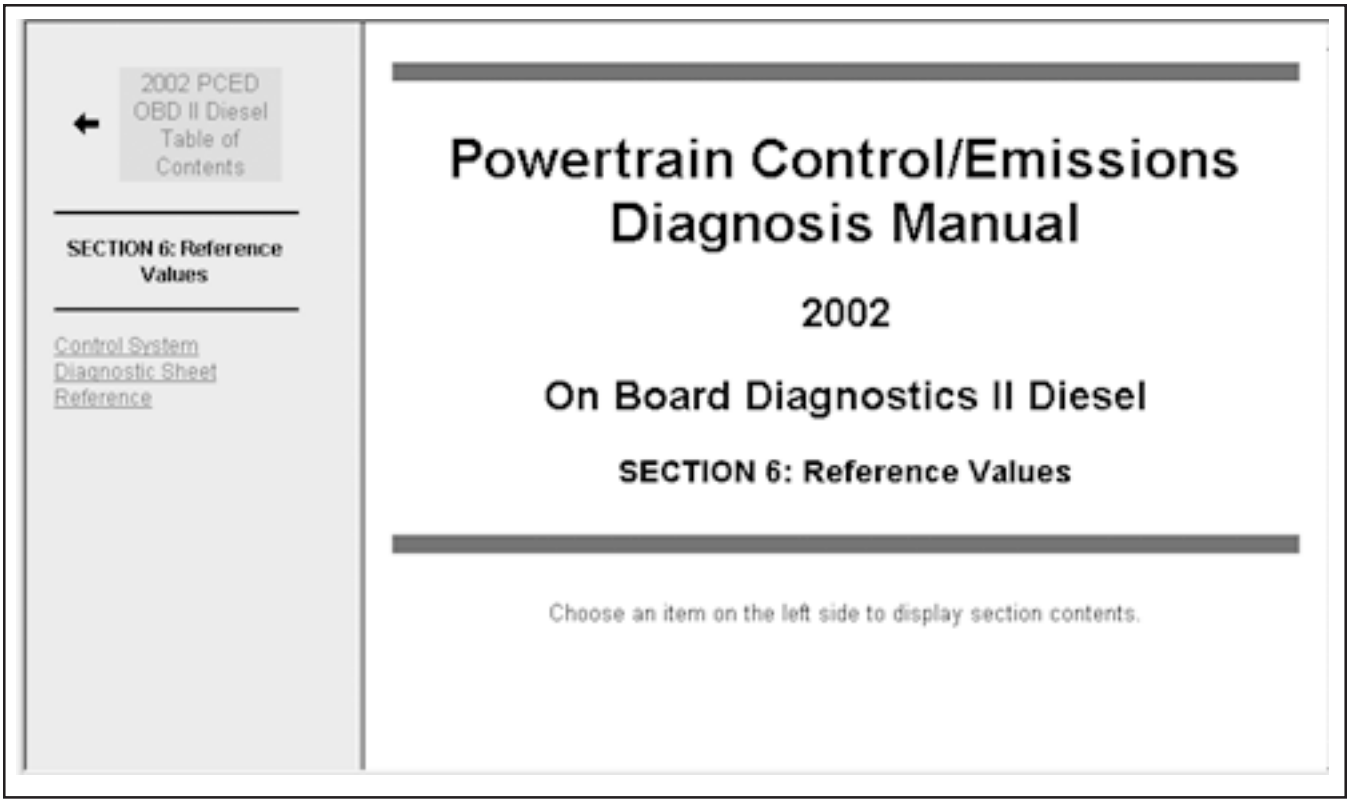
Section 5: Pinpoint Test Procedure

The Pinpoint Tests are:

- A sequence of logical steps
- Designed to systematically isolate the root cause of the concern

These tests can be particularly helpful when diagnosing electrical/electronic concerns, since the circuit logic has already been thought through and you can concentrate exclusively on running voltage and resistance checks as instructed in the Pinpoint Test.

SECTION 6: REFERENCE VALUES

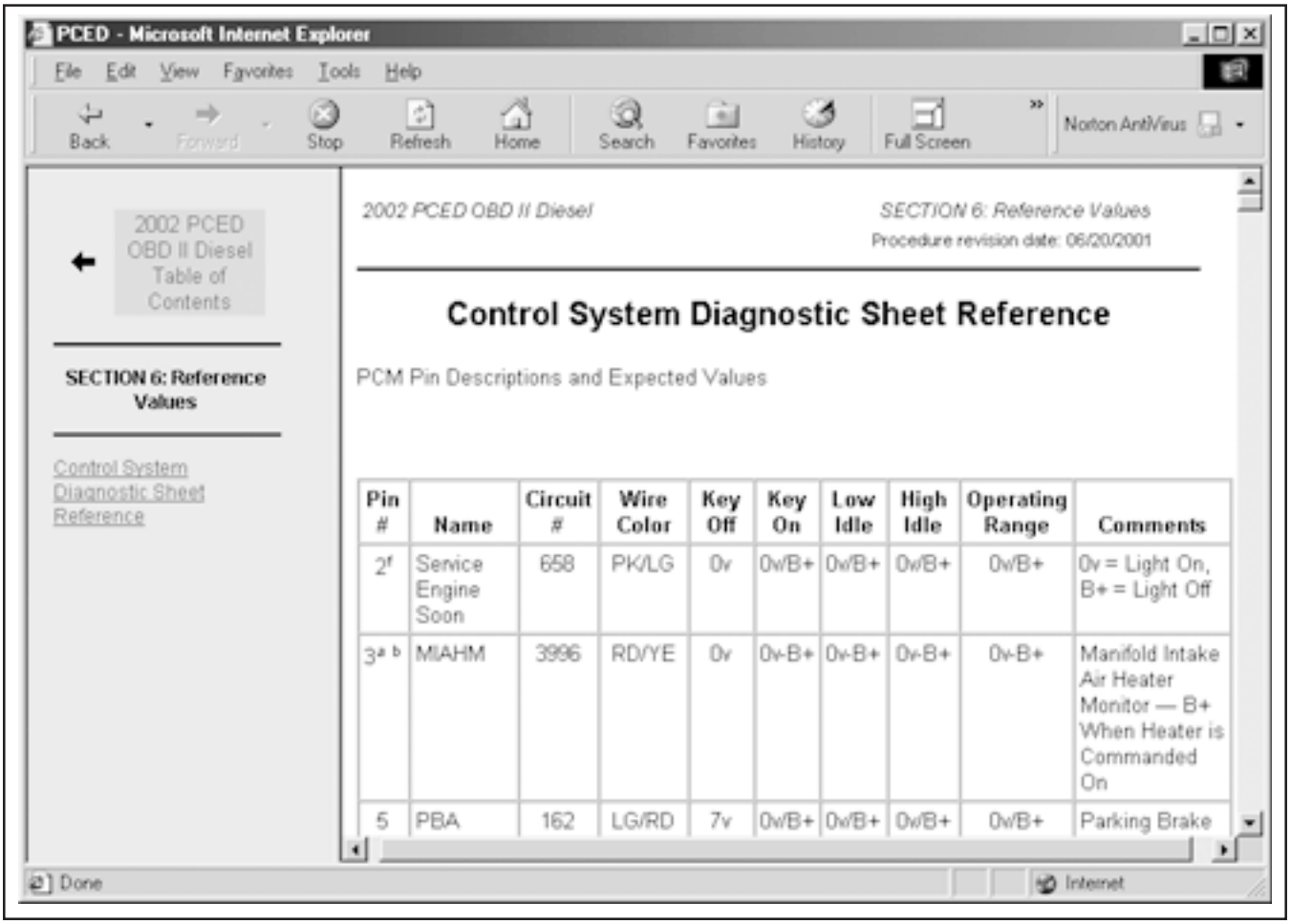


Section 6: Reference Values

While Section 6 contains only one heading (Control System Diagnostic Sheet Reference) the Reference Sheet actually contains two distinct sections.

- PCM Pin Descriptions and Expected Values
- Fault Code Table

PCM Pin Descriptions and Expected Values



Pin #	Name	Circuit #	Wire Color	Key Off	Key On	Low Idle	High Idle	Operating Range	Comments
2[f]	Service Engine Soon	658	PK/LG	0v	0v/B+	0v/B+	0v/B+	0v/B+	0v = Light On, B+ = Light Off
3[a b]	MIAHM	3996	RD/YE	0v	0v-B+	0v-B+	0v-B+	0v-B+	Manifold Intake Air Heater Monitor — B+ When Heater is Commanded On
5	PBA	162	LG/RD	7v	0v/B+	0v/B+	0v/B+	0v/B+	Parking Brake

Section 6: PCM Pin Descriptions and Expected Values

In the PCM Pin Descriptions and Expected Values table each PCM pin is identified as follows:

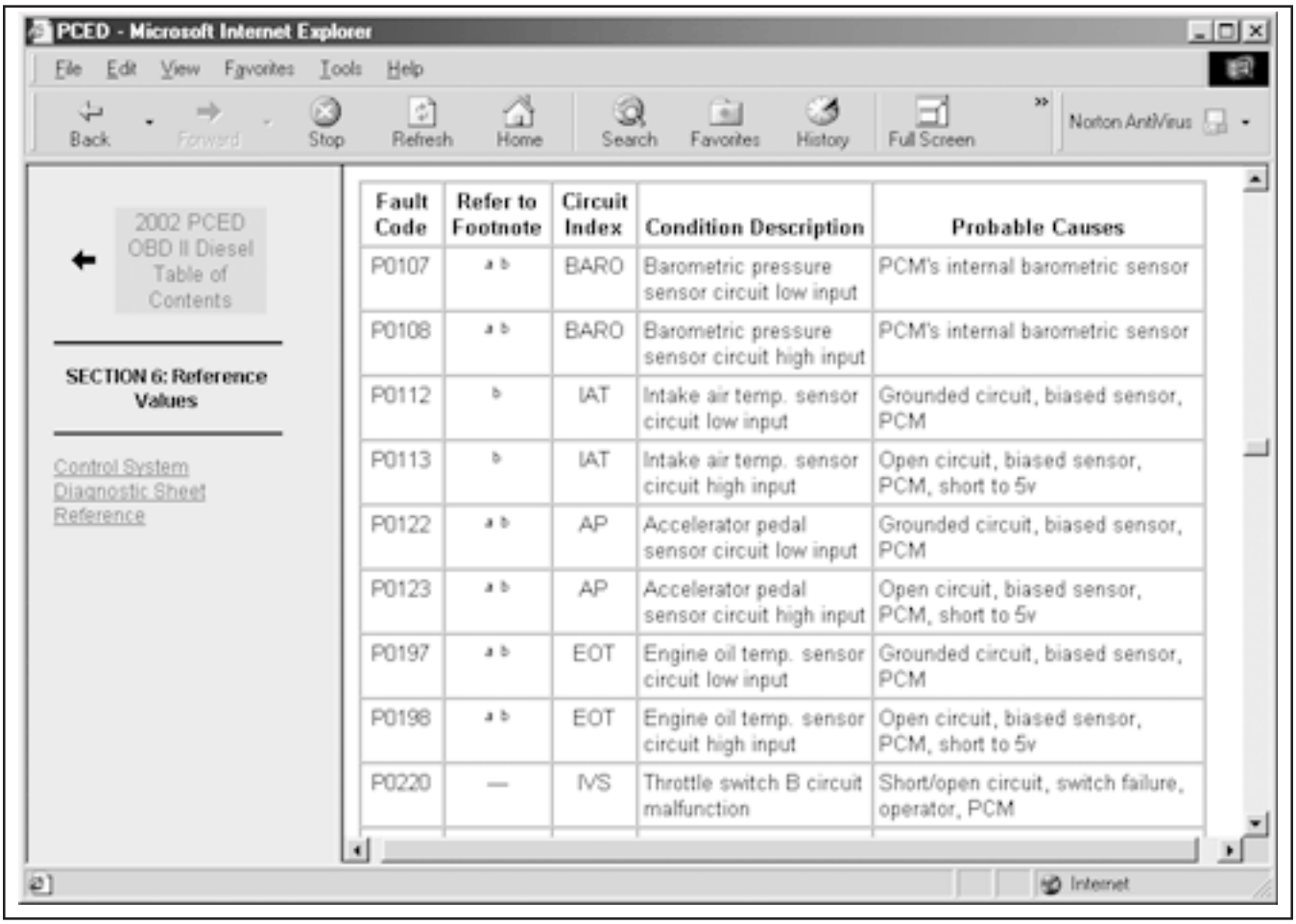
- Pin #
- Name
- Circuit #
- Wire Color

Following the circuit identification fields, nominal values are listed under the following operating conditions:

- Key Off
- Key On
- Low Idle
- High Idle
- Operating Range (voltage or frequency)

Each row also has a "Comments" field in the right-most column.

Fault Code Table



Fault Code	Refer to Footnote	Circuit Index	Condition Description	Probable Causes
P0107	a b	BARO	Barometric pressure sensor circuit low input	PCM's internal barometric sensor
P0108	a b	BARO	Barometric pressure sensor circuit high input	PCM's internal barometric sensor
P0112	b	IAT	Intake air temp. sensor circuit low input	Grounded circuit, biased sensor, PCM
P0113	b	IAT	Intake air temp. sensor circuit high input	Open circuit, biased sensor, PCM, short to 5v
P0122	a b	AP	Accelerator pedal sensor circuit low input	Grounded circuit, biased sensor, PCM
P0123	a b	AP	Accelerator pedal sensor circuit high input	Open circuit, biased sensor, PCM, short to 5v
P0197	a b	EOT	Engine oil temp. sensor circuit low input	Grounded circuit, biased sensor, PCM
P0198	a b	EOT	Engine oil temp. sensor circuit high input	Open circuit, biased sensor, PCM, short to 5v
P0220	—	IVS	Throttle switch B circuit malfunction	Short/open circuit, switch failure, operator, PCM

Section 6: Fault Code Table

Note: The Fault Code Table contains the same information as the DTC Index. The DTC Index is one of the supporting documents noted in Lesson 3.

The Fault Code Table contains a listing of possible DTCs. Each DTC line also contains the following fields:

- Footnotes which indicate if and when the fault will cause the MIL to illuminate.
- Circuit index
- Condition description
- Probable causes of the DTC

NOTES

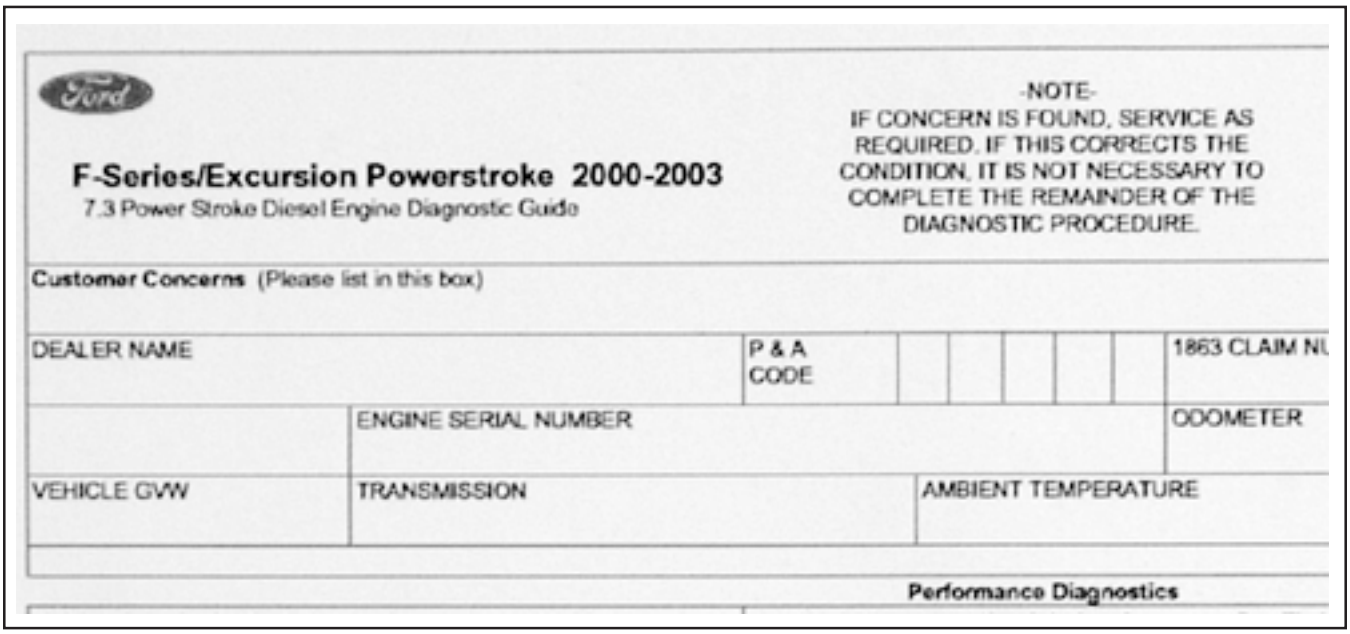
OBJECTIVES

- Describe the diagnostic procedures for the following concerns:
  - Engine Misses/Rough Idle
  - Lack of Power
  - Hard Start/No Start

LESSON OVERVIEW

PC/ED Manual

This lesson will show how to use the PC/ED Manual, and some of the supporting documentation, to address the concerns found in the Lesson 5 objectives.



F-Series/Excursion Powerstroke 2000-2003
7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

Customer Concerns (Please list in this box)

DEALER NAME	P & A CODE						1863 CLAIM NU
	ENGINE SERIAL NUMBER						ODOMETER
VEHICLE GVW	TRANSMISSION			AMBIENT TEMPERATURE			

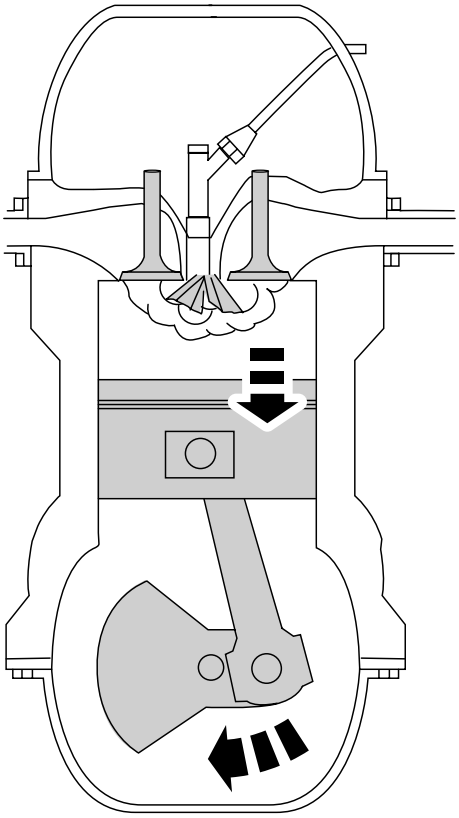
Performance Diagnostics

Diesel Engine Diagnostic Guide

Symptom diagnosis will be followed through the PC/ED Manual, touch on the use of supporting documentation such as the Diesel Engine Diagnostic Guide Worksheets, and hopefully provide some additional insight on diagnostic strategy.

Detailed diagnostic tests will not be covered, since this course is aimed at certified diesel technicians who are already knowledgeable on specific test procedures.

BASIC ENGINE OPERATION APPLIED TO THE 7.3L DIT ENGINE



DEO008-D

Diesel Combustion Process

Remember that the goal in engine operation is to have a normal, complete and consistent combustion event in each cylinder every time, and for the sealing devices such as the piston rings and valves to retain combustion pressure so that maximum force can be applied to the top of the piston.

This action produces potent torque under load, and a smooth-running engine.

Engine systems support this process through:

- A mechanically-sound base engine that retains compression and combustion pressure within the cylinder.
  - No uncontrolled leaks past the piston rings, and no leaks past the valves or cylinder head gasket.
- Fuel at specified pressure delivered to the fuel galleries in the cylinder heads.
- Engine oil without excessive entrained air, at high-pressure specified by the PCM, delivered to the high-pressure oil galleries in the cylinder heads.
- High-voltage electrical signal delivered to the individual unit fuel injectors at the proper time and duration.
- Properly-functioning fuel injectors that use oil pressure to deliver atomized fuel into the combustion chamber when signaled by the engine electronic control system.
- Engine inlet and exhaust systems that deliver clean air at specified pressure to the combustion chamber, and remove exhaust gases without undue restriction.

In the end, all of the diagnostic tests are aimed at verifying that the engine systems are supporting these basic functions, and to identify a faulty component if the requirements are not being met.

RUNS ROUGH AND LACK/LOSS OF POWER


"WRITE-UP" JOB AID

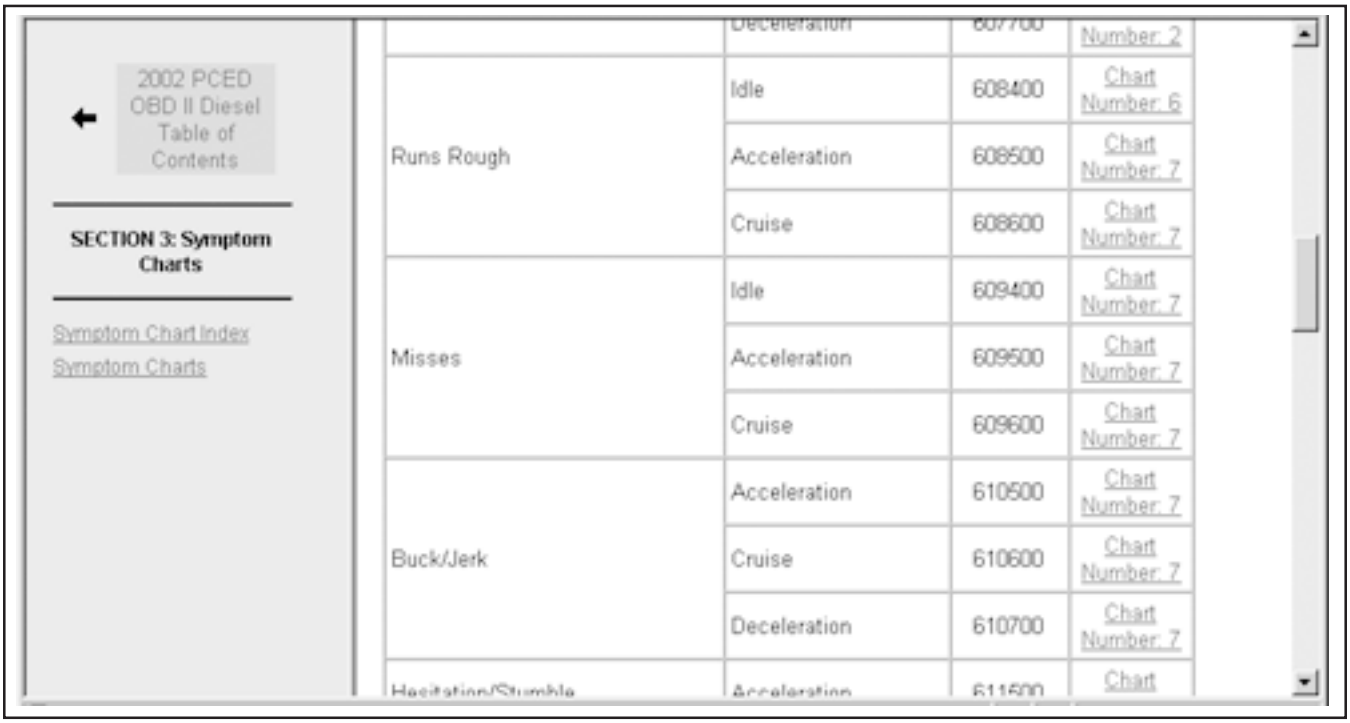
A SENSE OF CUSTOMER SATISFACTION

VEHICLE SYMPTOM AREA	HOW OFTEN?	VEHICLE OPERATING MODE	VEHICLE CONDITIONS
Front of Vehicle	Always	Start Up	Accessories On
Engine Compartment	Daily A.M. P.M.	Idle	(define below)

Service Write-Up Job Aid

Remember that the very first step is to document, verify, and validate the concern by communicating with the Service Advisor, and the customer if necessary.

Symptom Chart Logic

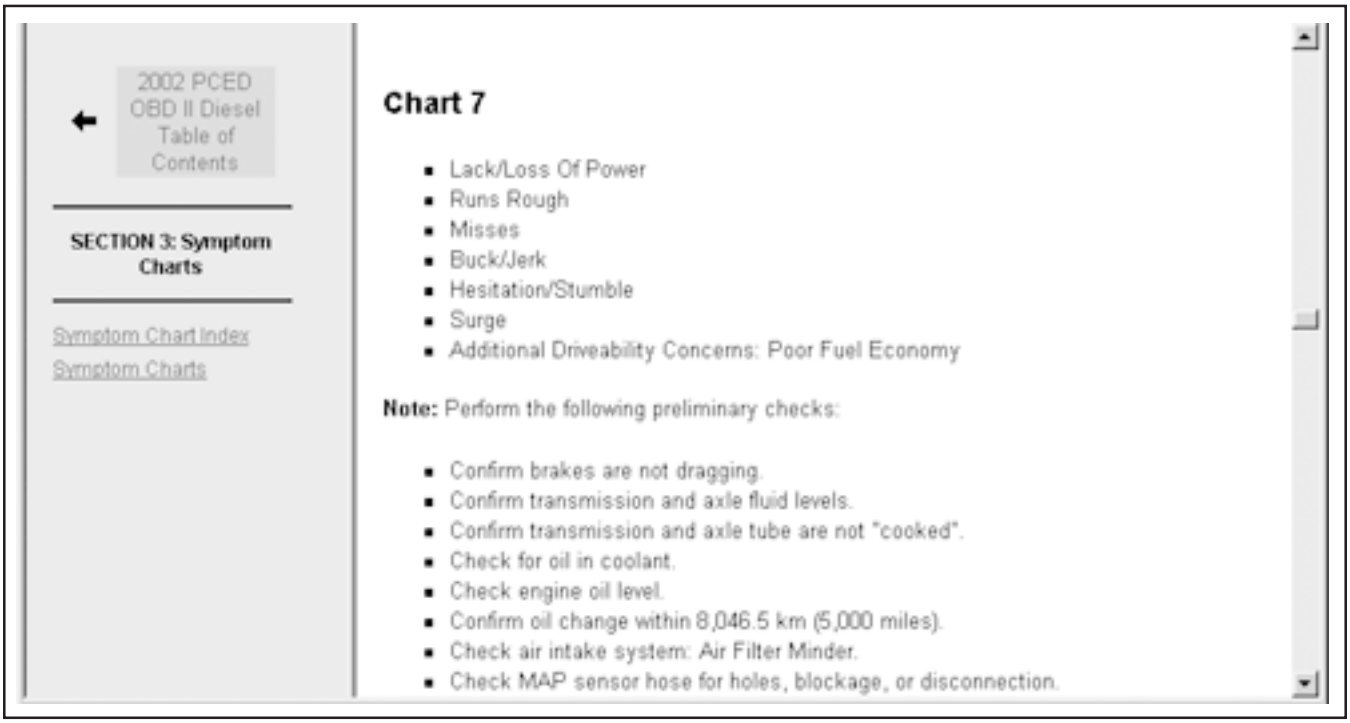


Symptom Chart Index

All Symptom Charts share a common logic:

- Address preliminary checks first.
  - Sometimes the preliminary checks seem "too simple," but don't overlook the obvious!
- Follow the step-by-step diagnostic procedure in the Symptom Chart.
  - Each step in the Symptom Chart has the potential to terminate the process by successfully identifying the source of the concern.
  - Proceed only as far as necessary to identify the cause of the concern!
- Most steps also branch out to other steps and tests, depending on the results of the prior test.

Symptom Chart 7



Symptom Chart 7

As shown in the Symptom Index Chart on the previous page, most Runs Rough/Lack-of-Power symptoms lead to Symptom Chart 7. Symptom Chart 6 (Rough Idle) is very similar to Chart 7. Symptom Chart 7 will be used as the example to address rough running and possible lack/loss of power.

Symptom Chart 7 addresses a number of symptoms.

- Lack/Loss Of Power
- Runs Rough
- Misses
- Buck/Jerk
- Hesitation/Stumble
- Surge
- Additional Driveability Concerns: Poor Fuel Economy

Preliminary Checks

Begin the diagnosis by conducting the following preliminary checks:

- Confirm brakes are not dragging.
- Confirm transmission and axle fluid levels.
- Confirm transmission and axle tube are not “cooked.”
- Check for oil in coolant.
- Check engine oil level.
- Confirm oil change within 8,046.5 km (5,000 miles).
- Check air intake system: Air Filter Minder.
- Check MAP sensor hose for holes, blockage, or disconnection.
- Check intake manifold system for leaks.
- Confirm acceptable SAE oil viscosity and API rating of oil.
- Check for sufficient clean fuel.
- Check for intake restriction.
- Compare loaded weight of vehicle with performance expectations.

Symptom Chart 7 Diagnostic Tests

Symptom Chart 7 contains the following diagnostic tests:

Boost Pressure Test	Check Lubrication Pressure
Perform KOEO On-Demand Self Test	KOER On-Demand Self Test
Perform KOEO Injector Electrical Self Test	Check Balance Pressure
Retrieve/Clear Continuous DTCs	Check For Leak Source
Check Cold CMP Clearance (CMP Code Present)	Check For Biased EBP Sensor
Check CMP Clearance To Timing Disk	Check For Exhaust Restriction (KOER, DTC 0476)
Check Continuous Fault Codes	Exhaust Back Pressure Operation Test
Check For Biased ICP Sensor	Check EPR Electrical System
Check Fuel Pump Pressure	Check For Engine Wear
Check Fuel Regulator	Check For Piston Or Valve Leaks
Check Pump Inlet Restriction	Check For Exhaust Restriction (No DTC)
Check For Aerated Oil	Check Fuel Injector Oil Discharge
Check Source Of Aerated Oil	Atmospheric Pressure Rationality Check
Injection Control Pressure Test	Check For Biased EOT Sensor
Check For Low IDM Power	EOT Rationality Check

Chart 7 Diagnostic Tests

While this might appear at first to be a rather daunting list, the tests can be grouped and condensed into a process that should quickly lead to the cause of the concern, if indeed a concern exits.

Engine Performance

Boost Pressure Test

Quick Tests

Perform KOEO On-Demand Self Test

Perform KOEO Injector Electrical Self Test

Retrieve/Clear Continuous DTCs

KOER On-Demand Self Test

Check Continuous Fault Codes

* Cylinder Contribution Test

CMP Sensor Checks

Check Cold CMP Clearance (CMP Code Present)

Check CMP Clearance To Timing Disk

Fuel System Tests

Check Fuel Pump Pressure

Check Fuel Regulator

Check Pump Inlet Restriction

High Pressure Oil System - Performance

Check Lubrication Pressure

Check Balance Pressure

Check For Leak Source

Check Fuel Injector Oil Discharge

*** Helpful test and tools not in PC/ED Manual that will be reviewed in this course.**

High Pressure Oil System - Aeration

Check For Aerated Oil (ICP Test)

Check Source Of Aerated Oil

Injector Performance

Check For Low IDM Power

* Cylinder Contribution Test

* Injector Performance Analyzer

Perform KOEO Injector Electrical Self Test

Exhaust System Restriction

Check For Exhaust Restriction (KOER, DTC 0476)

Exhaust Back Pressure Operation Test

Check EPR Electrical System

Check For Exhaust Restriction (No DTC)

Base Engine Checks

Check For Engine Wear

Check For Piston Or Valve Leaks

Sensor Checks

Check For Biased EBP Sensor

Check For Biased ICP Sensor

Atmospheric Pressure Rationality Check

Check For Biased EOT Sensor

EOT Rationality Check

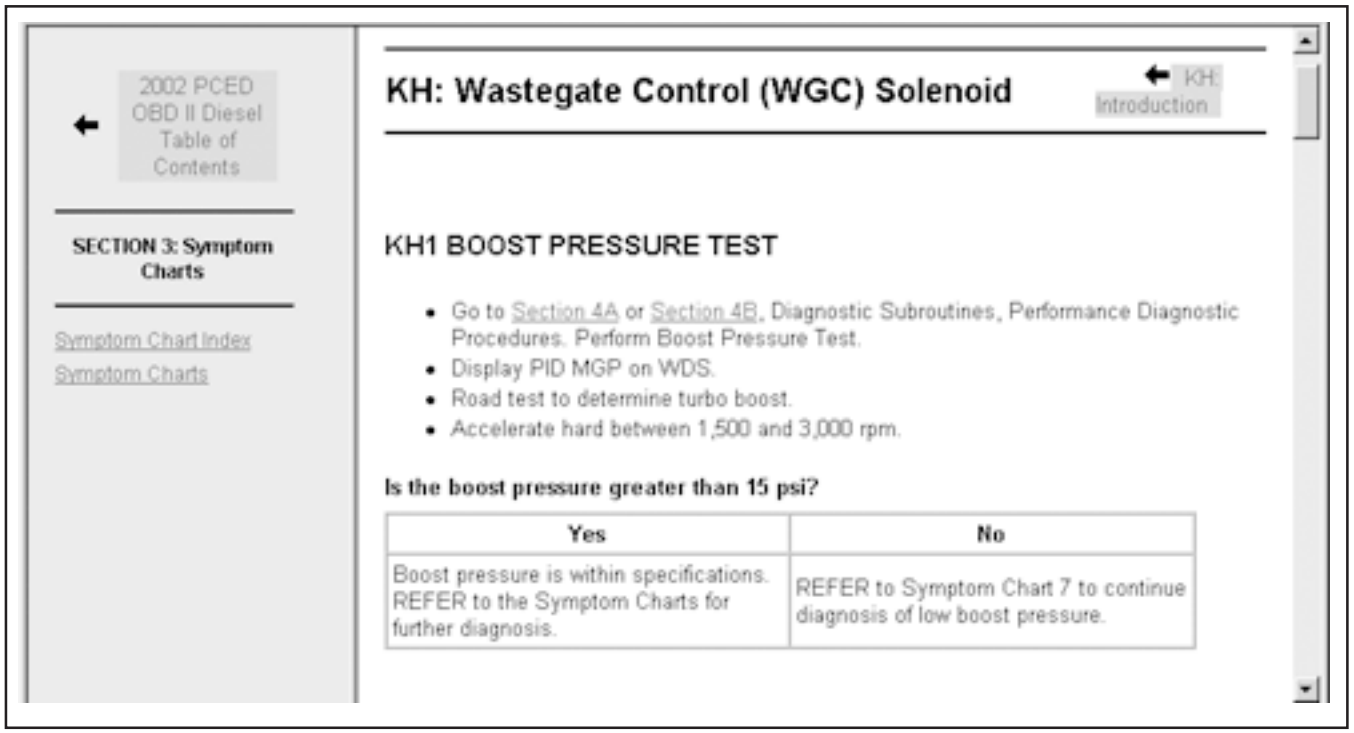
Chart 7 Tests Logically Grouped

In the table above, the Chart 7 tests have been logically grouped, while still essentially maintaining the correct order as found in the PC/ED Manual.

As stated earlier:

- Each step in the Symptom Chart has the potential to terminate the process by successfully identifying the source of the concern.
- Proceed only as far as necessary to identify the cause of the concern!

Pinpoint Test KH



Boost Pressure Test - Pinpoint Test KH

Pinpoint Test KH leads to a test of the wastegate control system. All 7.3L diagnostic routines point to this pinpoint test, even on vehicles such as the Econoline that are not equipped with a wastegate.

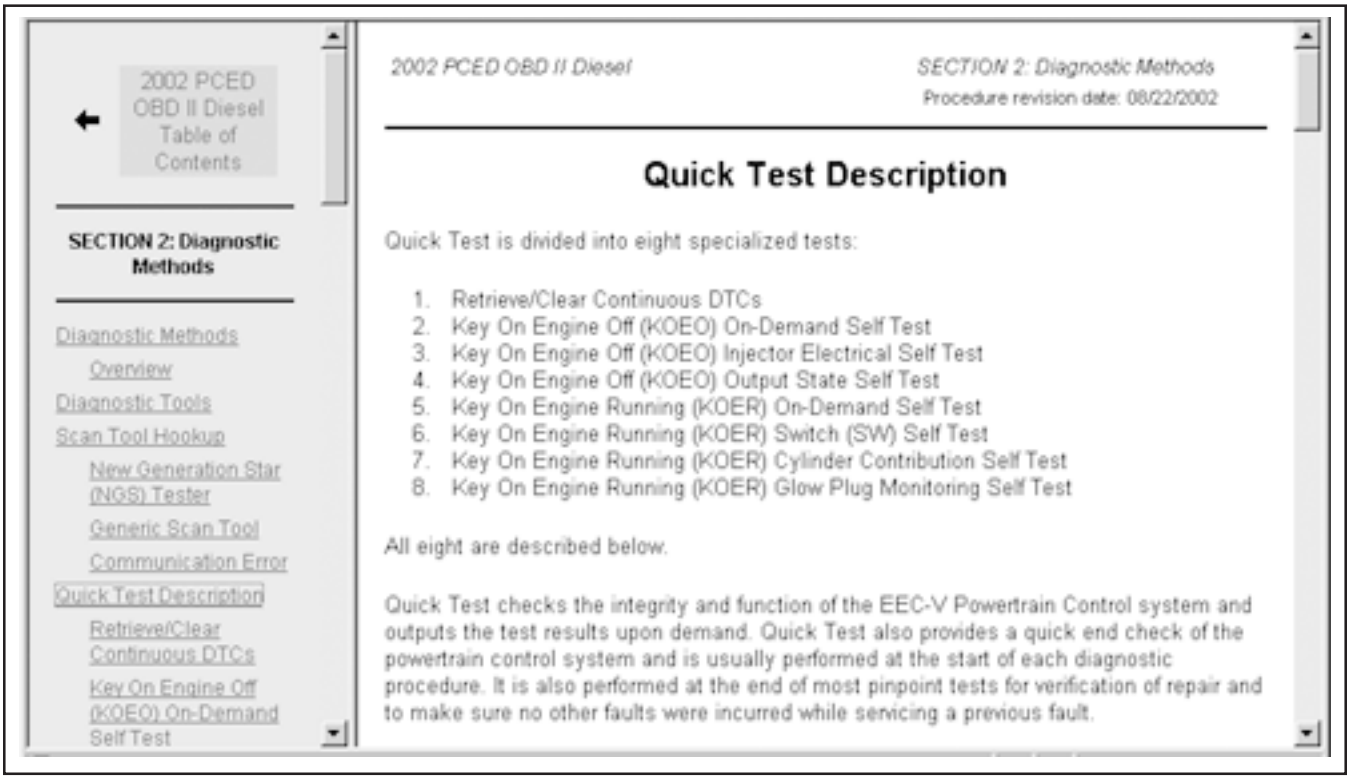
In most cases, the Pinpoint Test is simply asking that boost pressure be checked.

Boost pressure is a measure of engine performance. If boost pressure meets specifications, check for non-engine-related causes, such as:

- Excessive vehicle gross weight
- Brake drag
- Non-optimal size tires
- Non-optimal axle ratio
- Transmission concerns

It also is possible that the vehicle may be performing as designed and customer expectations are not realistic.

Quick Tests



Quick Tests

If the vehicle fails the boost test, run the following Quick Tests:

- Perform KOEO On-Demand Self Test
- Perform KOEO Injector Electrical Self Test
- Retrieve/Clear Continuous DTCs
- Check Continuous Fault Codes
- KOER On-Demand Self Test
- Cylinder Contribution Test

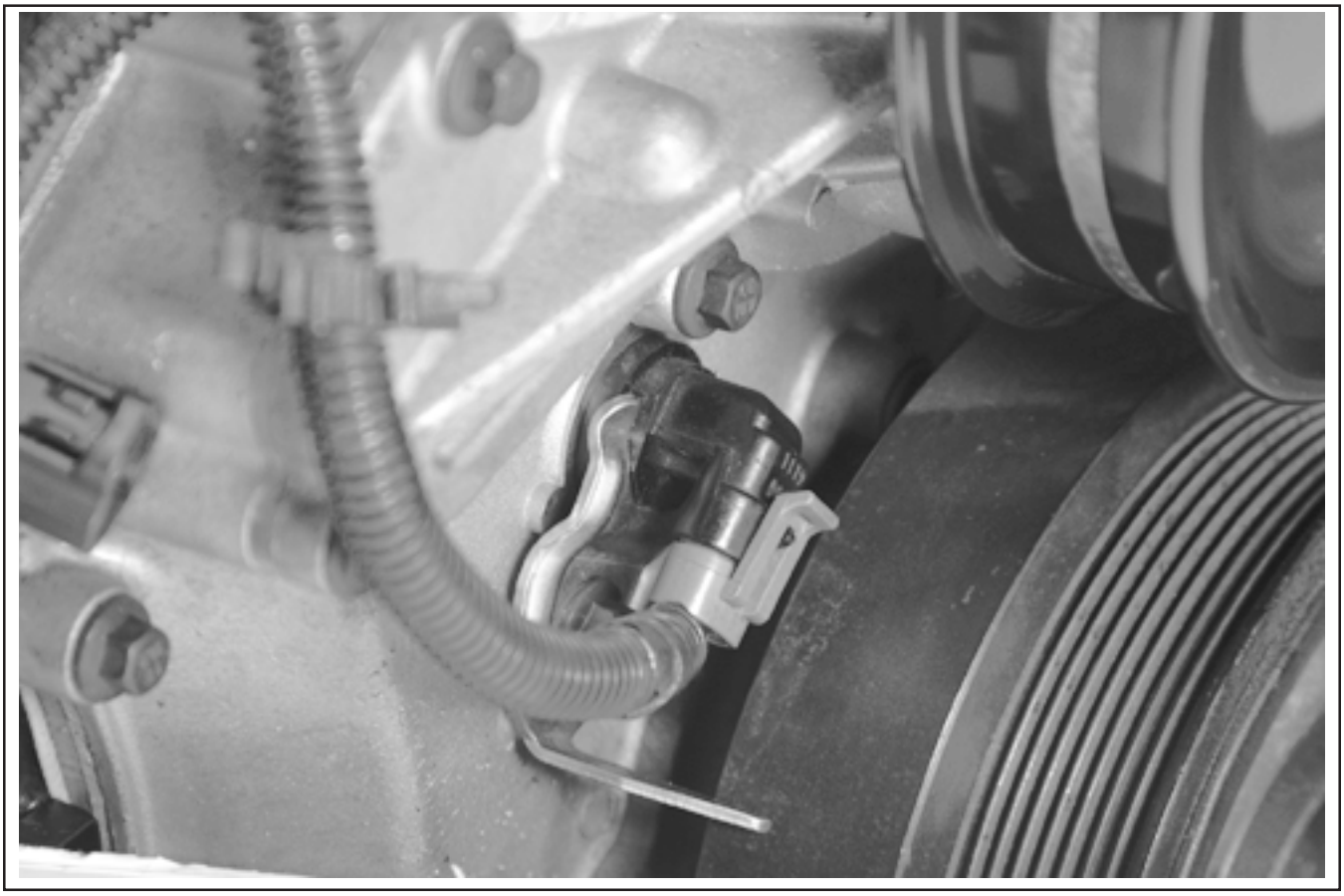
Diagnostic Trouble Code Description

4 Digit	Description	Pinpoint Test Step Go To Direction		
		KOEO	KOER	Continuous
—	System Pass (No DTCs Available) — California and all E-Series	—	—	—
P0107[a]	BARO Circuit Low Input	GO to DG1 .	—	GO to DG3 .
P0108[a] [b]	BARO Circuit High Input	GO to DG1 .	—	GO to DG4 .
P0112[a]	IAT Sensor Circuit Low Input	GO to DA5 .	—	GO to DA8 .
P0113[a]	IAT Sensor Circuit High	GO to	—	GO to DA8 .

Section 4A, Diagnostic Trouble Code Description

Address any DTCs that are displayed during the Quick Tests by following the pinpoint test for each DTC that is displayed.

CMP Sensor Checks



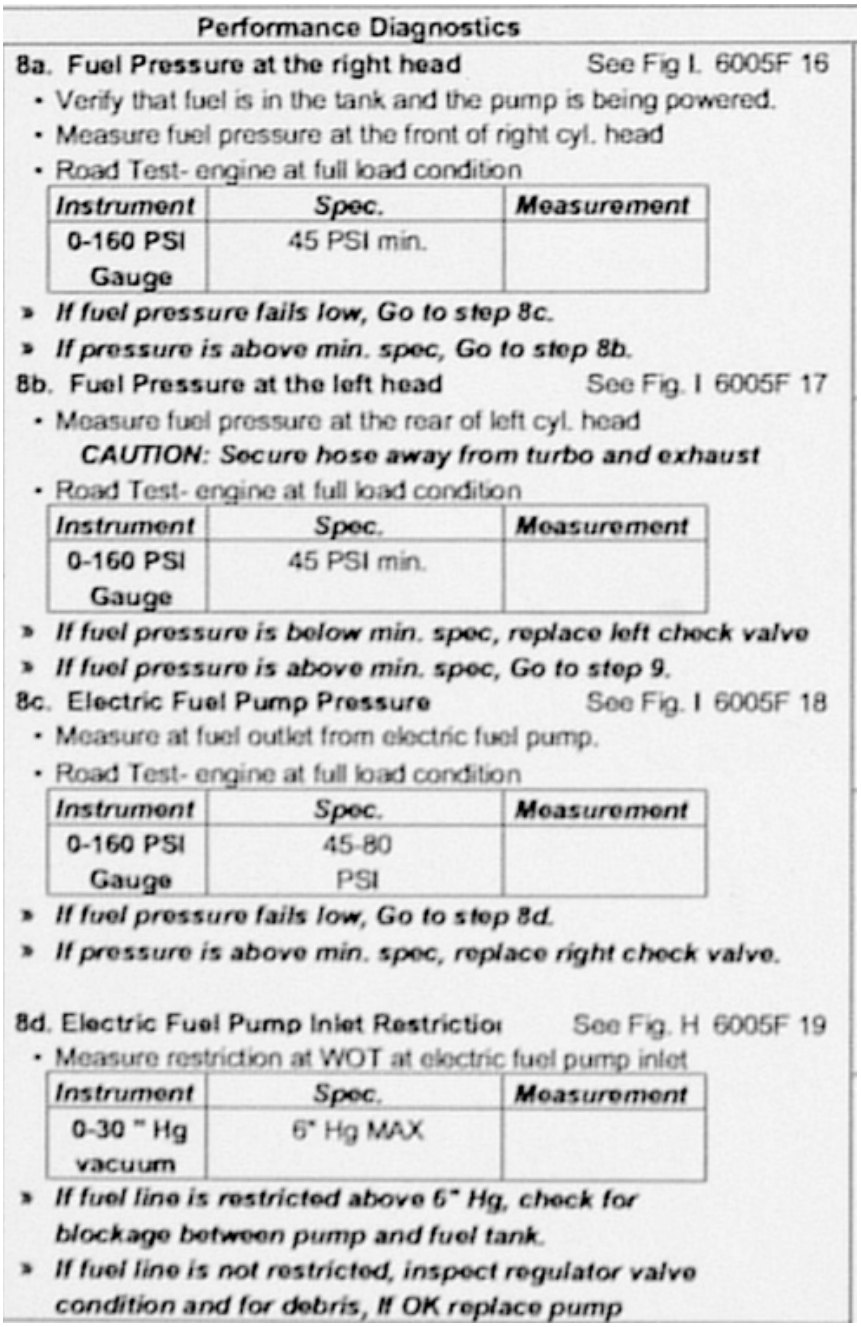
CMP Sensor

Conduct these tests only if CMP Sensor-related codes are displayed.

CMP Sensor DTCs:

- P0340 – Circuit Malfunction
- P0341 – Circuit Performance
- P0344 – Circuit Intermittent

Fuel System Tests



Performance Diagnostics

8a. Fuel Pressure at the right head See Fig I. 6005F 16

- Verify that fuel is in the tank and the pump is being powered.
- Measure fuel pressure at the front of right cyl. head
- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45 PSI min.	

» ***If fuel pressure fails low, Go to step 8c.***

» ***If pressure is above min. spec, Go to step 8b.***

8b. Fuel Pressure at the left head See Fig. I 6005F 17

- Measure fuel pressure at the rear of left cyl. head

CAUTION: Secure hose away from turbo and exhaust

- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45 PSI min.	

» ***If fuel pressure is below min. spec, replace left check valve***

» ***If fuel pressure is above min. spec, Go to step 9.***

8c. Electric Fuel Pump Pressure See Fig. I 6005F 18

- Measure at fuel outlet from electric fuel pump.
- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45-80 PSI	

» ***If fuel pressure fails low, Go to step 8d.***

» ***If pressure is above min. spec, replace right check valve.***

8d. Electric Fuel Pump Inlet Restrictio See Fig. H 6005F 19

- Measure restriction at WOT at electric fuel pump inlet

Instrument	*Spec.*	*Measurement*
0-30 " Hg vacuum	6" Hg MAX	

» ***If fuel line is restricted above 6" Hg, check for blockage between pump and fuel tank.***

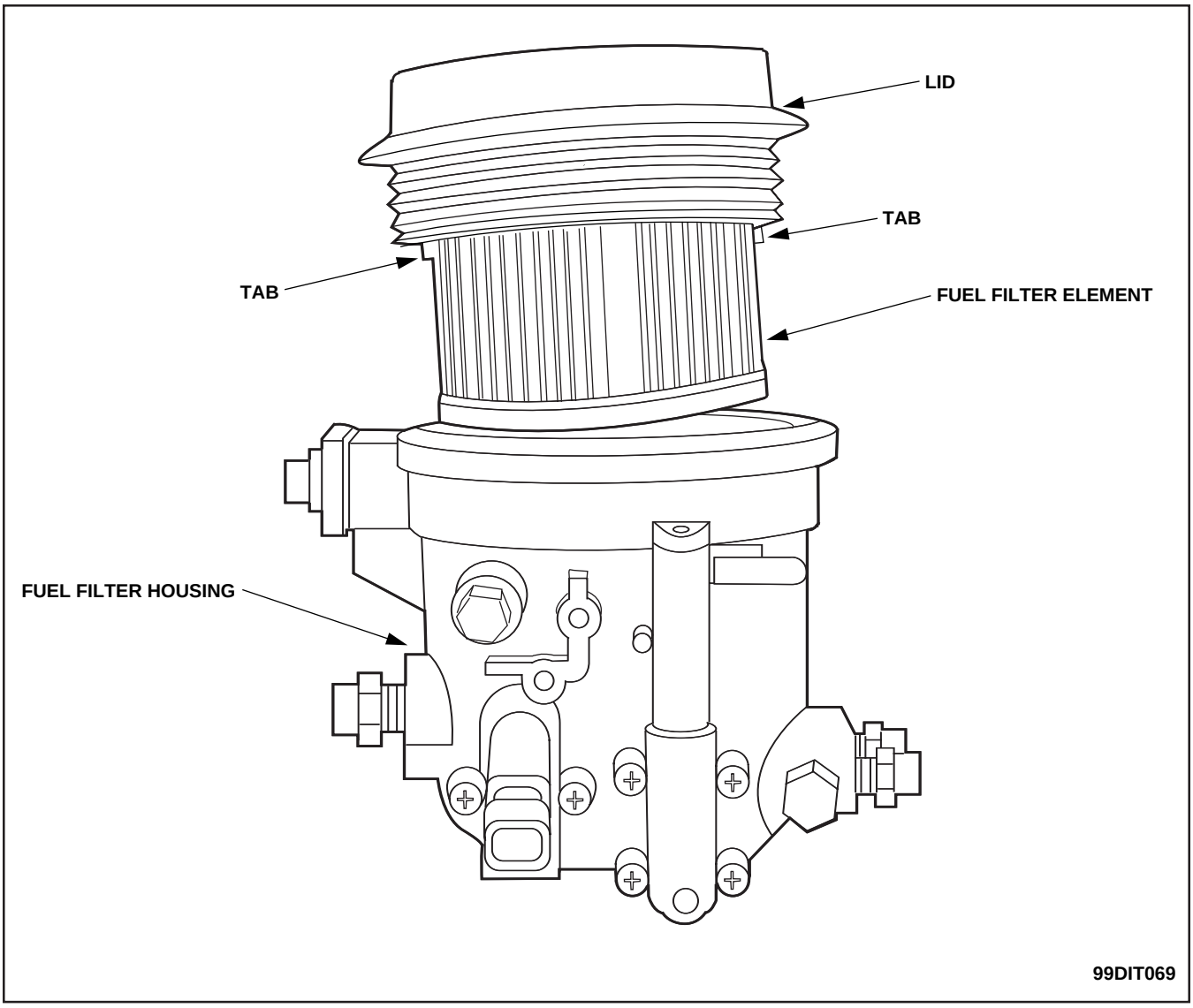
» ***If fuel line is not restricted, inspect regulator valve condition and for debris, If OK replace pump***

Fuel System Tests - Step 8

Less-than adequate fuel delivery to the cylinder heads can easily produce symptoms whereby the engine runs normally at idle and light loads, but fails to produce full power. Remember that failure to produce full power will be evidenced by failure to produce specified boost.

Verifying sufficient fuel pressure at BOTH cylinder heads, with the engine under full load, is what counts when checking fuel system operation.

IMPORTANT: If the fuel is being delivered to both cylinder heads at specified pressure, with the engine under full load, then it is not necessary to also conduct Tests 8c and 8d.



Fuel Filter

A clogged fuel filter can result in reduced fuel pressure at the cylinder heads.

The fuel filter element is considered a maintenance item and is not normally covered by the New Vehicle Limited Warranty.

Check For Biased ICP Sensor

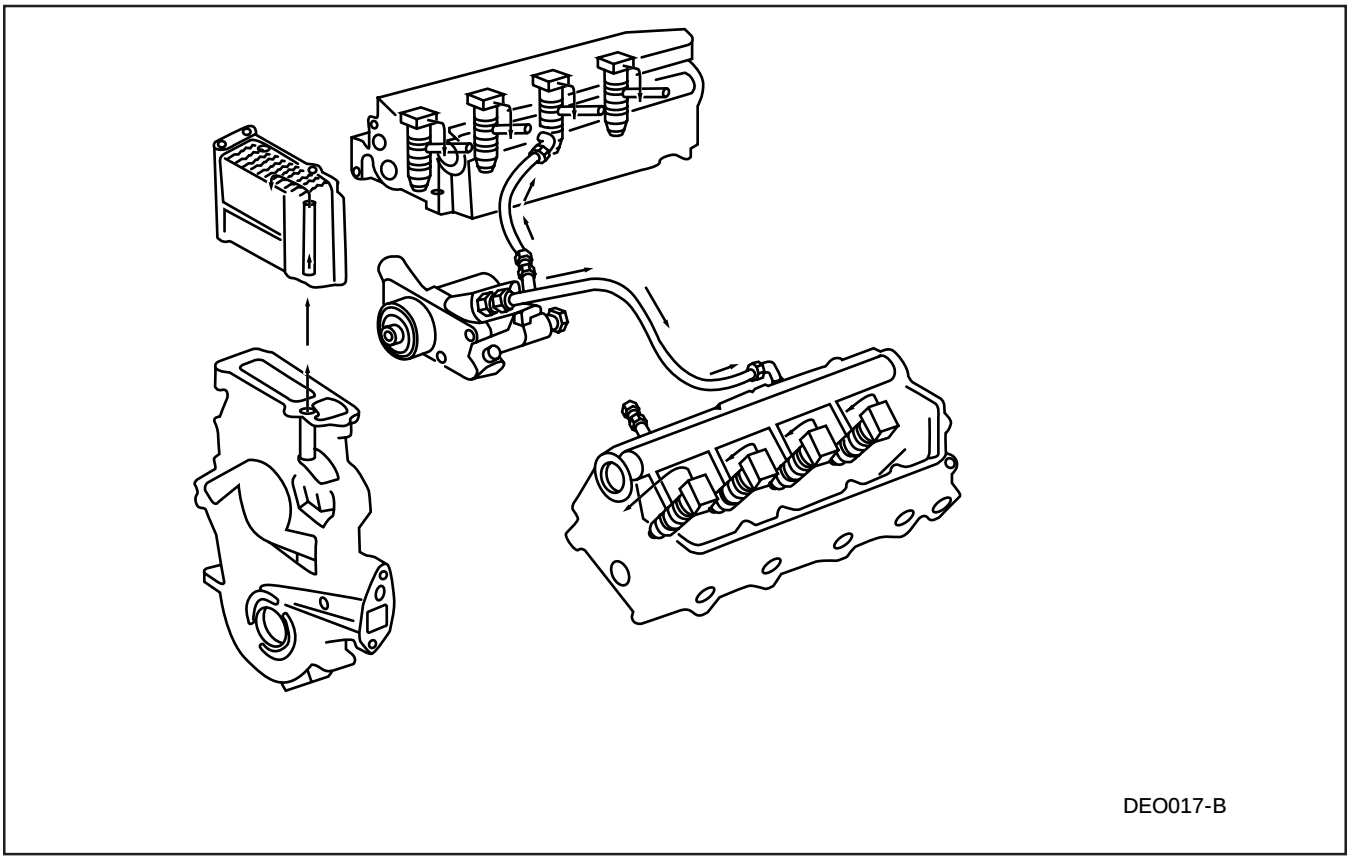
ICP Sensor

Since the Electronic Engine Control System uses both ICP and Fuel Pulse Width to meter fuel delivery, an ICP Sensor that is not providing the PCM with an accurate input can indeed produce low power.

This is a fast test, and simply involves checking the ICP PID with the key ON, engine OFF. See if the ICP outputs zero pressure. Test details can be found in the PC/ED Manual.

NOTES

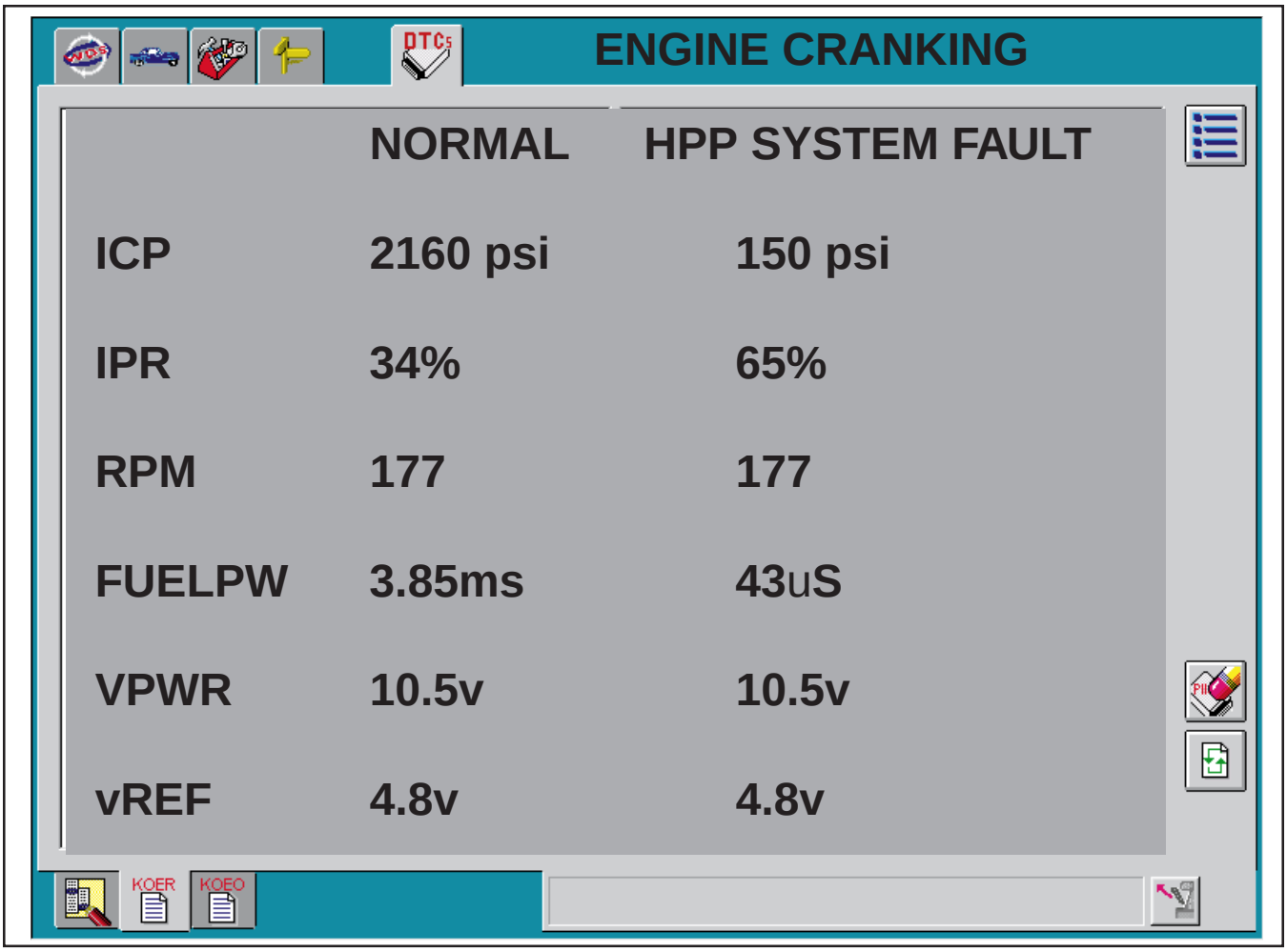
High-Pressure Oil System Performance



High-Pressure Oil System

While concerns with the high pressure oil system can affect power, symptoms often manifest themselves during cranking, with an excessively low crank, or normal crank and no start.

Therefore, it is often easiest to diagnose the performance element of the high-pressure oil system with the engine at low - even cranking - speed.



Monitoring PIDs While Cranking Engine

By disconnecting the valve cover wiring harnesses, and cranking the engine while monitoring ICP and IPR, the capability of the High Pressure Oil System can be validated.

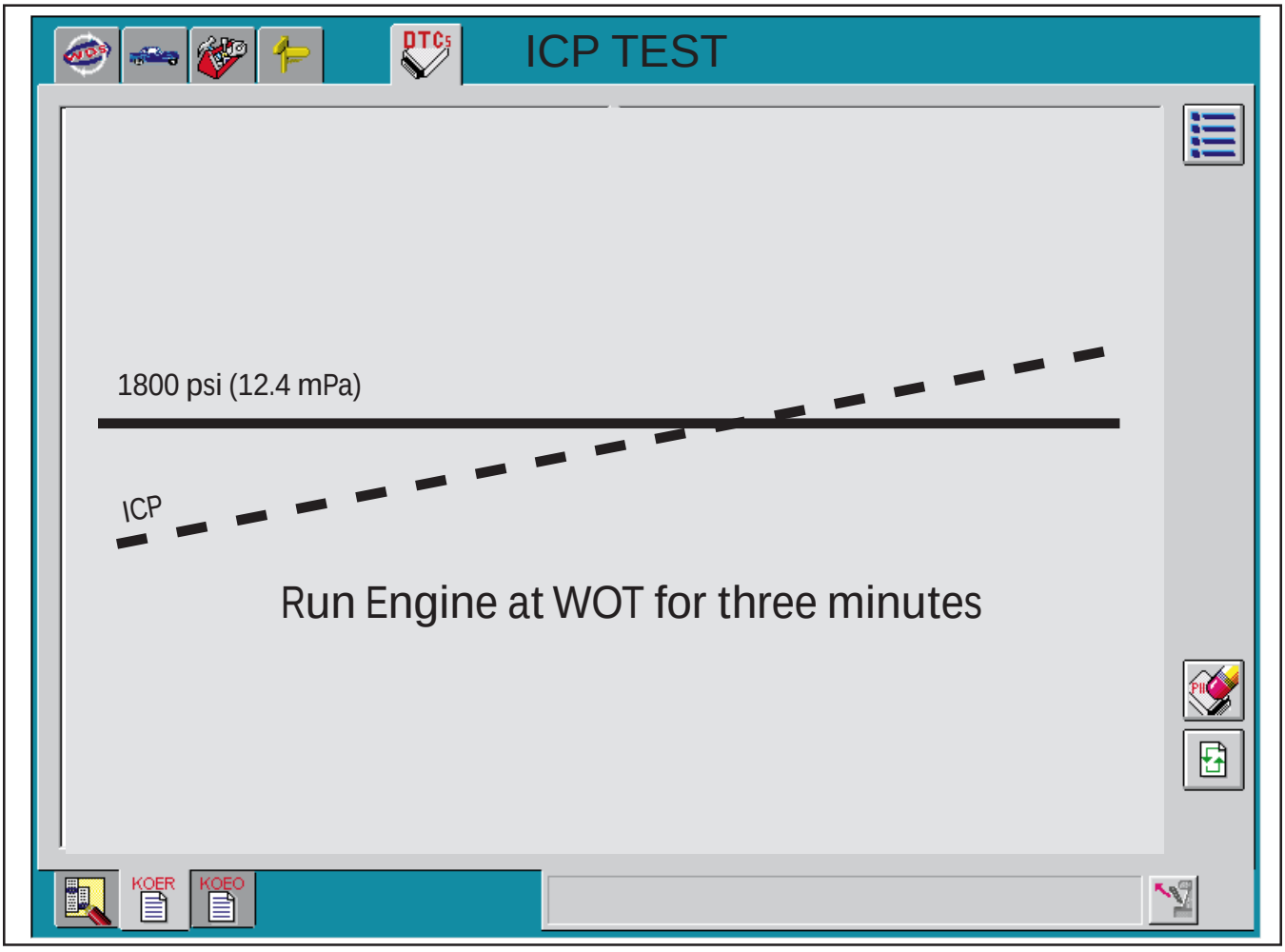
It is necessary to conduct the following tests only if normal parameters are not obtained during cranking.

- Check Lubrication Pressure
- Check Balance Pressure
- Check For Leak Source
- Check Fuel Injector Oil Discharge

Remember that some of these test items, such as "Check for Leak Source" and "Check Fuel Injector Oil Discharge" are sub-steps.

If the system fails or struggles to build ICP during cranking, only then must further diagnosis of the high-pressure oil system be accomplished.

Check for Oil Aeration



Injection Control Pressure Test

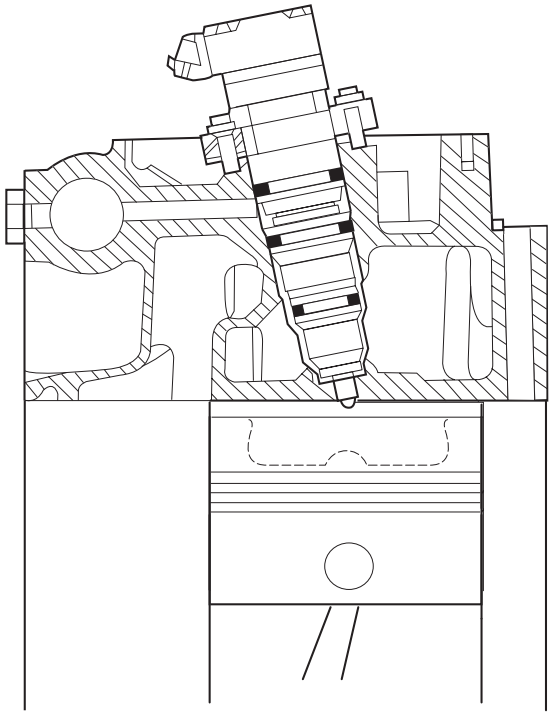
Aerated injection control oil can reduce power, and more commonly manifests itself as a rolling or rough idle.

Run the injection control pressure test.

If the test indicates that aeration is occurring, check for the source of aeration as instructed in the PC/ED Manual.

- Overfill and elevate the rear of the vehicle.
- Engine oil may lack defoaming agents.
  - Change to specified oil and retest.

Injector Performance (Under-performing Cylinders)



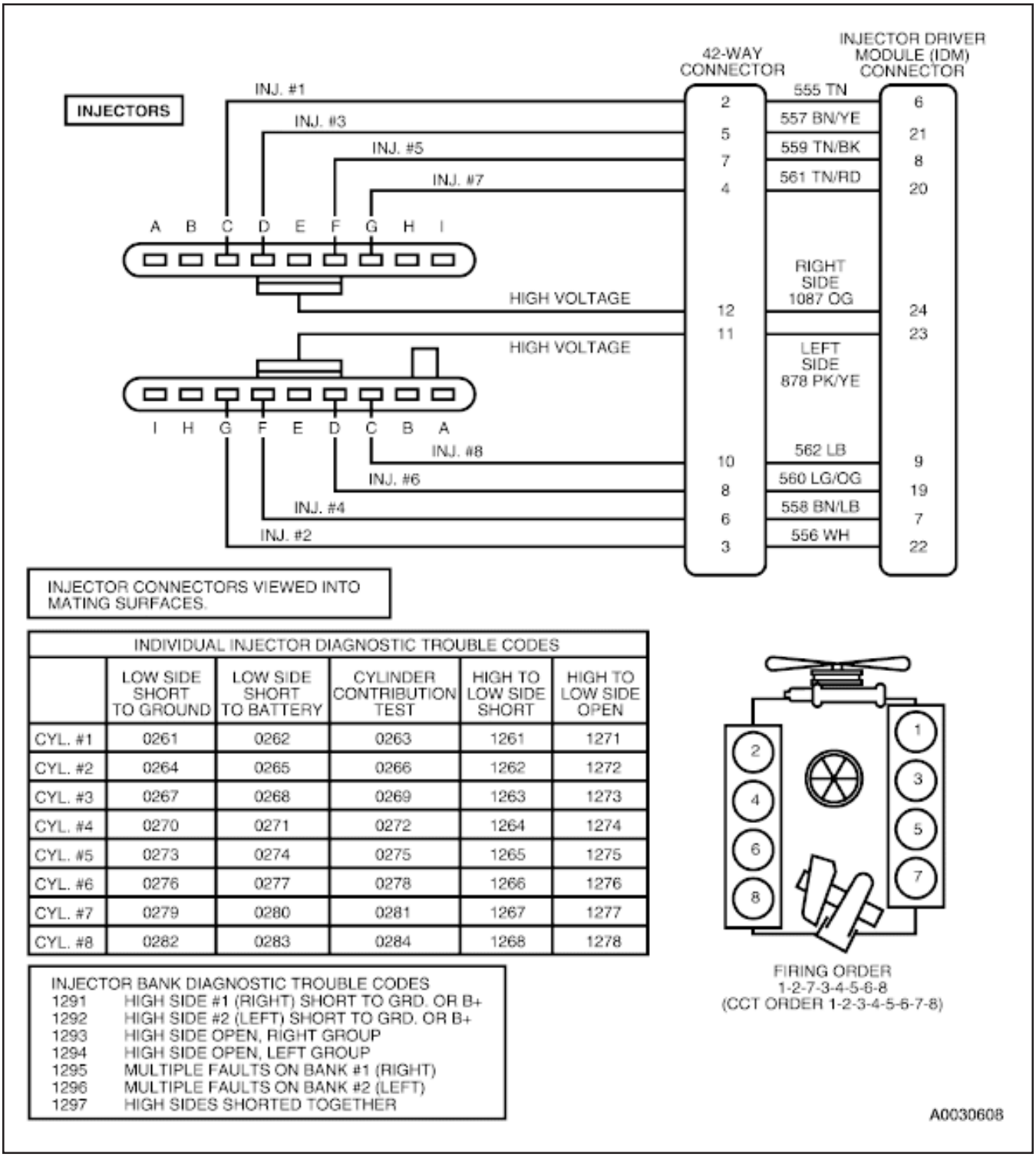
DEO012-C

7.3L DIT Cylinder Cross-Section

Referring back to page 5-11, several tests are grouped under "Injector Performance." The intent of this group of tests is to isolate a single under-performing cylinder.

While a single cylinder can under-perform due to failure of the piston rings or valves to seal properly, cylinder under-performance can also be caused by a malfunctioning fuel injector. It is critical that an under-performing cylinder be identified. If one faulty fuel injector exists in an engine, it is a costly practice to replace all eight injectors just because the bad injector cannot be identified.

Check for Low IDM Power



INDIVIDUAL INJECTOR DIAGNOSTIC TROUBLE CODES					
	LOW SIDE SHORT TO GROUND	LOW SIDE SHORT TO BATTERY	CYLINDER CONTRIBUTION TEST	HIGH TO LOW SIDE SHORT	HIGH TO LOW SIDE OPEN
CYL. #1	0261	0262	0263	1261	1271
CYL. #2	0264	0265	0266	1262	1272
CYL. #3	0267	0268	0269	1263	1273
CYL. #4	0270	0271	0272	1264	1274
CYL. #5	0273	0274	0275	1265	1275
CYL. #6	0276	0277	0278	1266	1276
CYL. #7	0279	0280	0281	1267	1277
CYL. #8	0282	0283	0284	1268	1278

INJECTOR BANK DIAGNOSTIC TROUBLE CODES

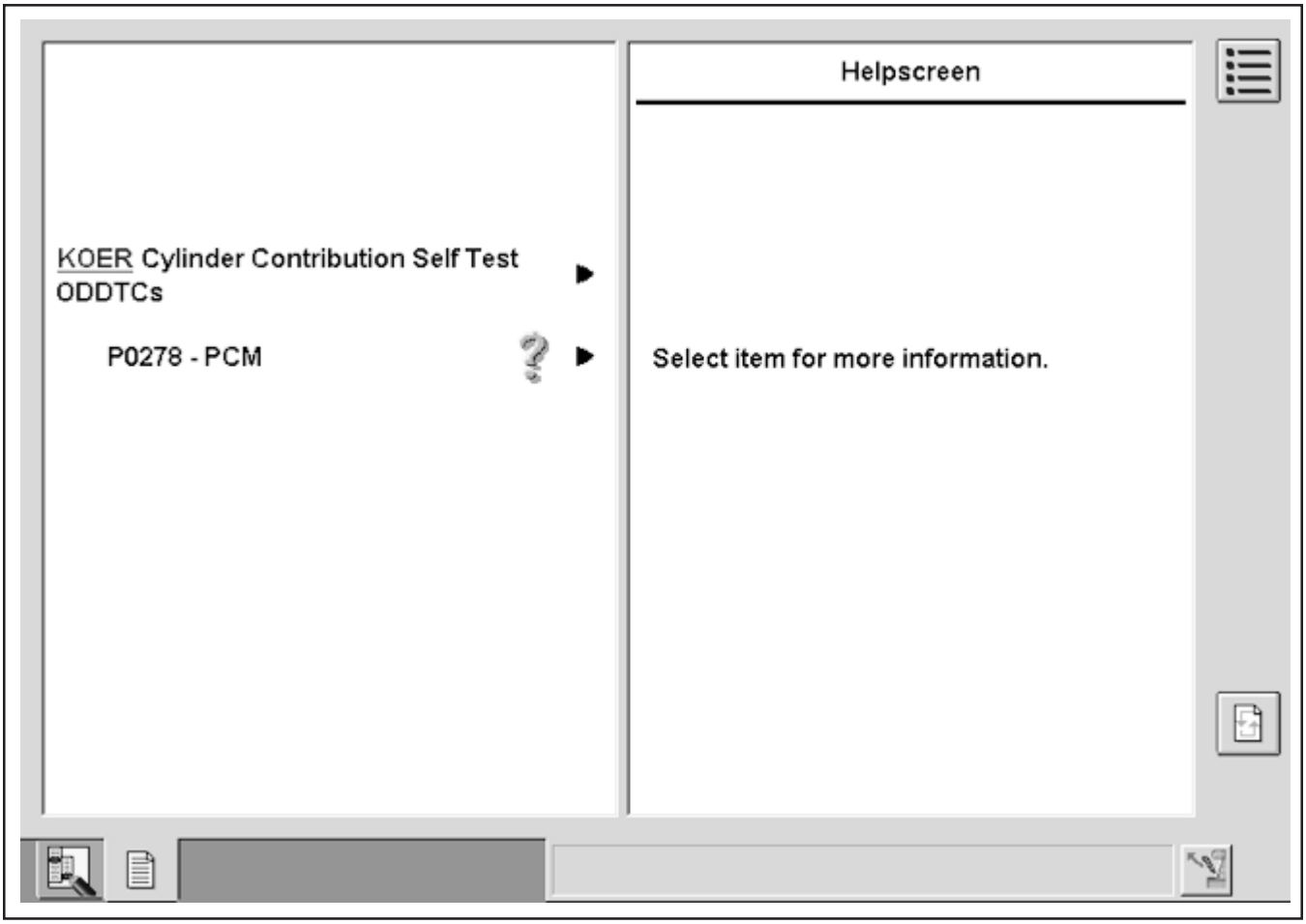
1291	HIGH SIDE #1 (RIGHT) SHORT TO GRD. OR B+
1292	HIGH SIDE #2 (LEFT) SHORT TO GRD. OR B+
1293	HIGH SIDE OPEN, RIGHT GROUP
1294	HIGH SIDE OPEN, LEFT GROUP
1295	MULTIPLE FAULTS ON BANK #1 (RIGHT)
1296	MULTIPLE FAULTS ON BANK #2 (LEFT)
1297	HIGH SIDES SHORTED TOGETHER

Pinpoint Test NA

Follow this step only if DTCs related to the injector electrical driver circuit are present.

This step points to Pinpoint Test NA, which provides a detailed description of the injector driver circuits, as well as a listing of related DTCs.

Cylinder Contribution Test



Cylinder Contribution Test Results

There are two ways to isolate an under-performing cylinder.

- Cylinder Contribution Test
- Injector Performance Analyzer

During the cylinder contribution self-test, the PCM observes changes in engine speed, at high-frequency intervals, and determines if a decrease in engine speed caused by an under-performing cylinder is too great.

Any change in engine speed beyond normal parameters will cause a DTC to be set. DTCs are displayed at the conclusion of the test.

If a DTC is set during the Cylinder Contribution Test, go to the appropriate Pinpoint Test as directed in the PC/ED Manual for further diagnosis.

Injector Performance Analyzer

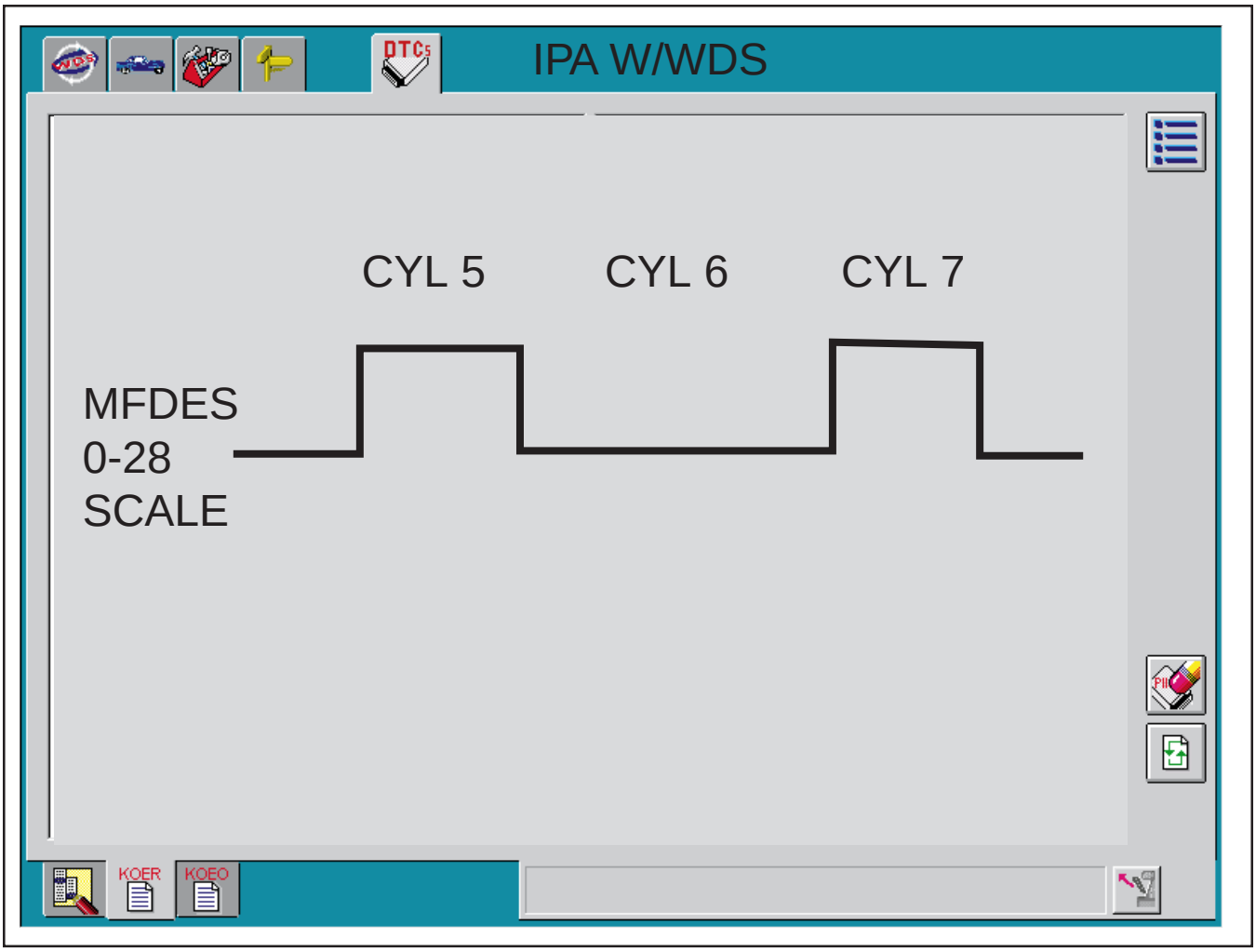
Injector Performance Analyzer, Tool No. 164-R25535

The Injector Performance Analyzer (IPA) provides enhanced ability to identify an under-performing cylinder.

The IPA provides a method of interrupting injector driver power to individual injectors.

When a cylinder fails to fully contribute to engine operation for whatever reason (either a fault or IPA switch turned off), the PCM still maintains engine idle speed by increasing fuel delivery on each injector stroke. Fuel delivery can be measured by monitoring Mass Fuel Desired (PID MFDES).

By monitoring MFDES, individual cylinder performance can be measured. MFDES should increase an equivalent amount as each cylinder is switched off.

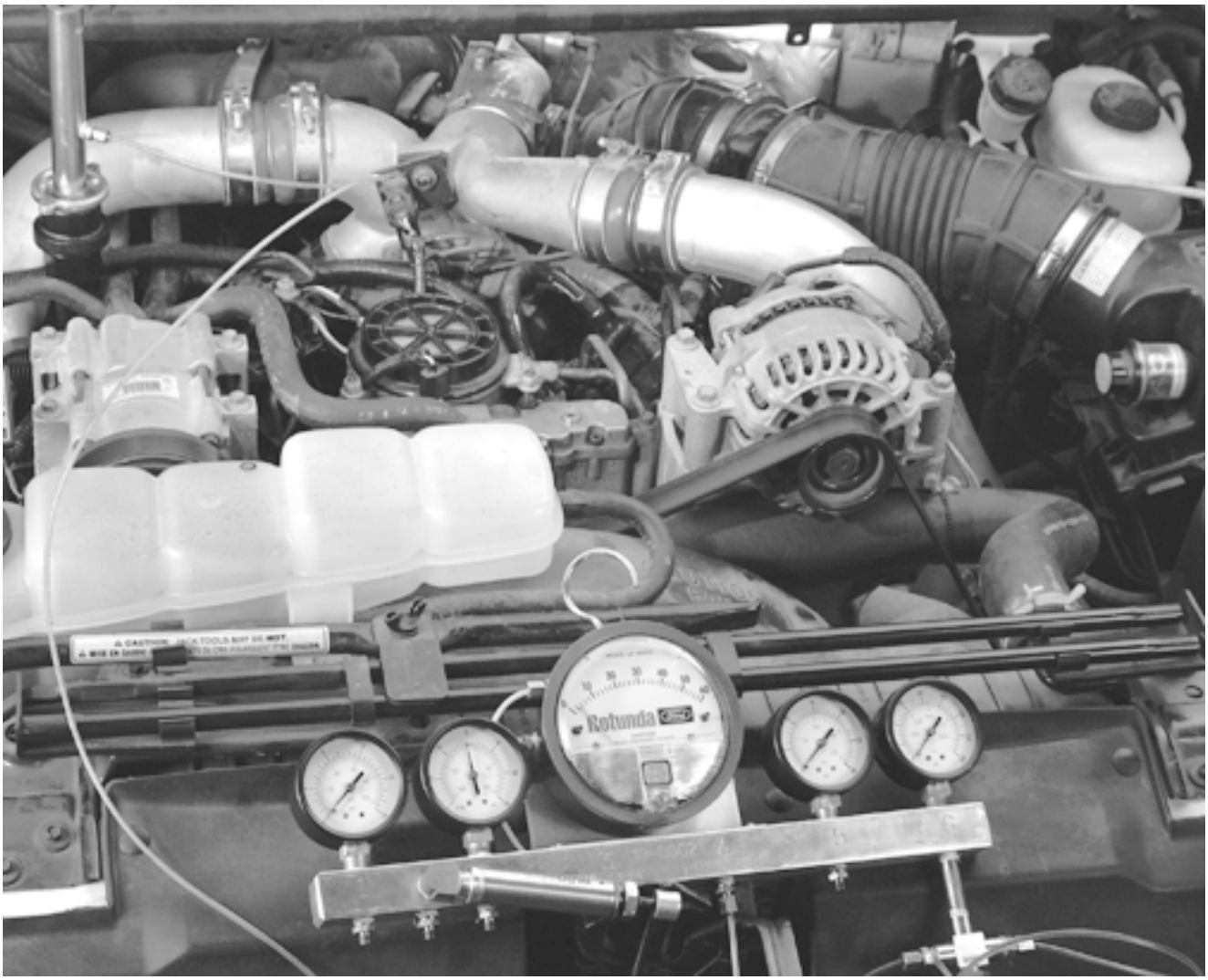


Monitoring MFDES PID while using the IPA

When an under-performing, or dead, cylinder is turned off, there will be little change in MFDES since that cylinder was not contributing initially.

In the simulated graph above, the high-pressure oil supply has been interrupted to Cylinder #6. Therefore, Cylinder #6 is not contributing. When the electrical power to Cylinder #6 is switched off, there is no increase in MFDES since #6 was not contributing initially. It is important that all eight cylinders be measured and the MFDES carefully compared. In many instances, a faulty cylinder will be under-contributing rather than not contributing at all.

Engine Wear



Crankcase Pressure Test

If the engine is low on power and/or further diagnosis of under-performing cylinder(s) is required, it is important to check the condition of the base engine.

- The crankcase pressure test will indicate overall capability of the piston rings to properly seal.
- If crankcase pressure is high, condition of individual cylinders can be checked with a compression gauge.

Check Sensors for Bias and Rationality

This is the end of the list on Chart 7. The cause of the concern (remember that an early check was to determine if a concern even existed!) in all probability was located in the earlier steps. All that remain are a few sensor checks.

- Atmospheric Pressure Rationality Check
- Check For Biased EOT Sensor
- EOT Rationality Check

These are fancy words, but in the end the procedure is to monitor a few PIDs and validate that sensor output is accurate.

HARD START/NO START

The same requirements must be met in order for the engine to start as for it to run smoothly and produce full power.

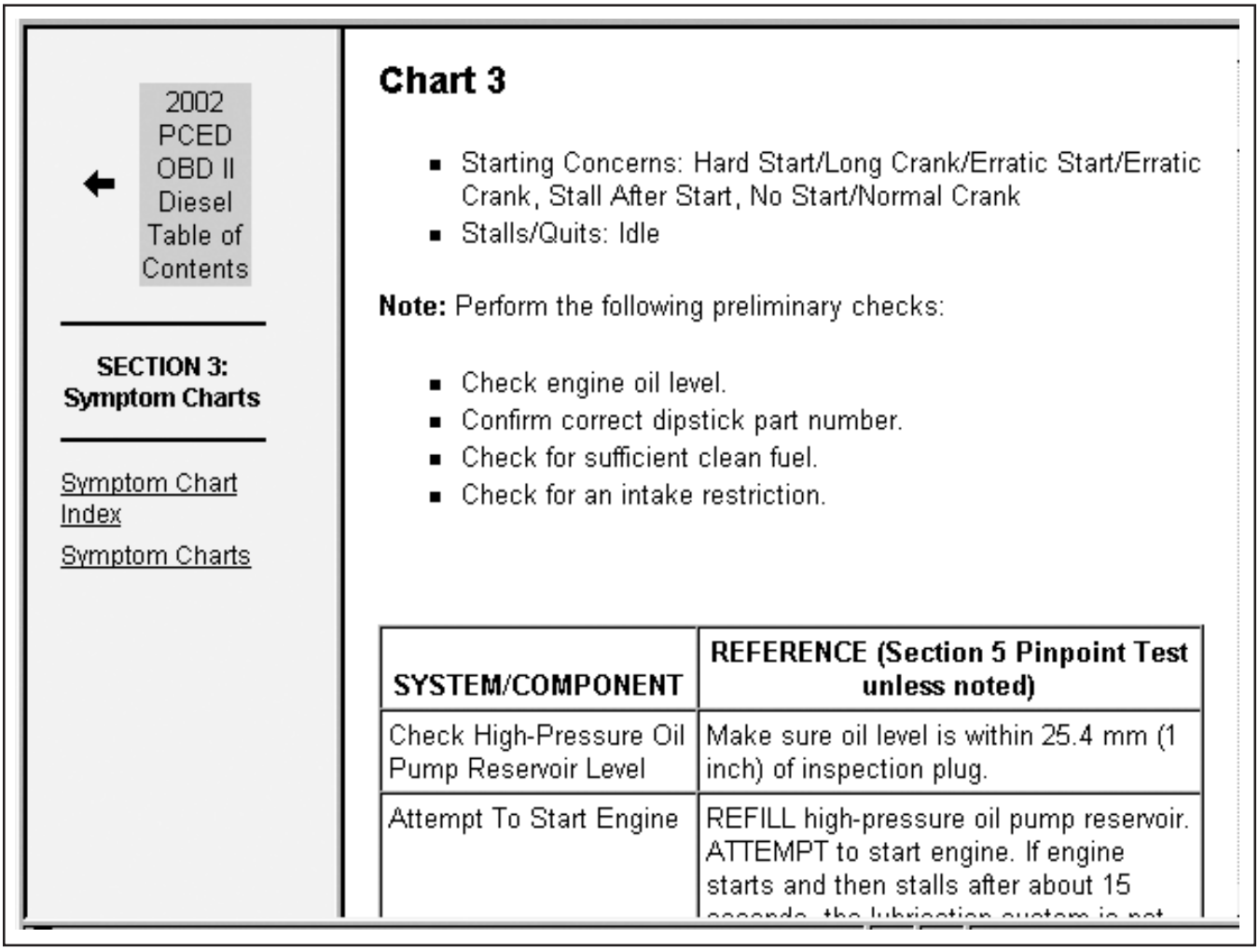
- A mechanically-sound base engine that retains compression and combustion pressure within the cylinder.
  - No uncontrolled leaks past the piston rings, and no leaks past the valves or cylinder head gasket.
- Fuel at specified pressure delivered to the fuel galleries in the cylinder heads.
- Engine oil without excessive entrained air, at high-pressure specified by the PCM, delivered to the high-pressure oil galleries in the cylinder heads.
- High-voltage electrical signal delivered to the individual unit fuel injectors at the proper time and duration.
- Properly-functioning fuel injectors that use oil pressure to deliver atomized fuel into the combustion chamber when signaled by the engine electronic control system.
- Engine inlet and exhaust systems that deliver clean air at specified pressure to the combustion chamber, and remove exhaust gases without undue restriction.

For good starting, a few more criteria must be met:

- Especially at cold ambient temperatures, combustion chamber must be preheated through the use of glow plugs.
- Sufficient system voltage must be maintained while cranking.
- Cranking speed must be adequate to build and maintain compression pressure and temperature.

Since everything doesn't need to be quite as "perfect" in order for the engine to start as it does for the engine to run smoothly and produce full power, Hard Start/No Start is generally easier to diagnose than are performance concerns.

Symptom Chart 3



Symptom Chart 3

Symptom Chart 3 addresses a number of symptoms.

- Starting Concerns: Hard Start/Long Crank/Erratic Start/Erratic Crank, Stall After Start, No Start/Normal Crank
- Stalls/Quits: Idle

Preliminary Checks

Conduct the following preliminary checks:

- Check engine oil level
- Confirm correct dipstick part number
- Check for sufficient clean fuel
- Check for an intake restriction

Symptom Chart 3 Diagnostic Tests

Symptom Chart 3 contains the following diagnostic tests:

Check High-Pressure Oil Pump Reservoir Level	Check Parameter Identification (PIDs)
Attempt To Start Engine	Check Glow Plug Relay Circuit
Check Fuel Pump Pressure	Check Glow Plug Relay
Perform KOEO On-Demand Self Test	Check Glow Plugs
Perform KOEO Injector Electrical Self Test	Check Glow Plug Connectors
Repeat KOEO Injector Electrical Self Test	

Symptom Chart 3 Diagnostic Tests

The tests are grouped logically on the next page.

This section will step through each of the test groups.

Chart 3 Tests Logically Grouped

Attempt To Start Engine

- Check for glow plug indicator on IP
- Check for engine oil pressure while cranking
  - Listen for electric fuel pump operation at initial KEY-ON (All vehicles except F-650/F-750, which are equipped with a mechanical fuel pump)

Check High-Pressure Oil Pump Reservoir

- This test is easy to do, but probably not necessary if strong engine oil pressure builds quickly during cranking.

Check Fuel Pump Pressure

- Fuel pressure is essential in order for the engine to start. Cranking the engine without fuel pressure will not only result in a no-start, but can set false CMP Sensor DTCs. This is the primary reason why the fuel pressure test comes before the Quick Tests.

Quick Tests

- Perform KOEO On-Demand Self Test
- Perform KOEO Injector Electrical Self Test
  - Injectors need to have a "sharp" buzz
- Repeat KOEO Injector Electrical Self Test
  - Only if injectors did not buzz or IDM fault codes were retrieved during initial KOEO Injector Electrical Self Test.

Check Parameter Identification (PIDs)

- Very useful, and fast, test. It validates most parameters that are required to be nominal for the engine to start. Validates high-pressure oil system operation, including charge from conventional lubrication system.

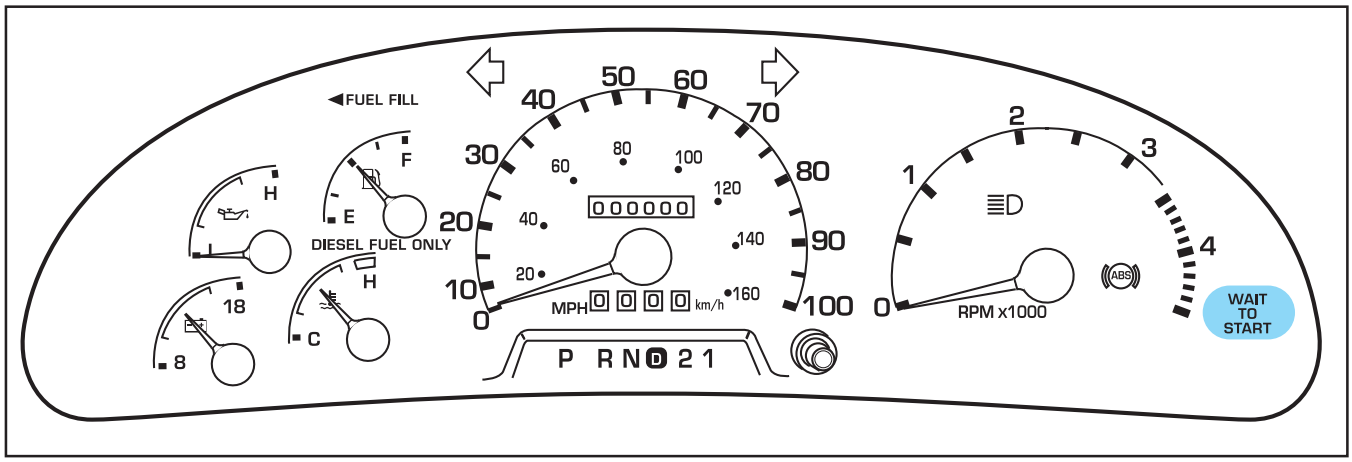
Check Glow Plug Operation (Do these tests first if the concern is occurring only in cold ambient temperatures.)

- Check Glow Plug Relay Circuit
- Check Glow Plug Relay
- Check Glow Plugs
- Check Glow Plug Connectors

As stated earlier:

- Each step in the Symptom Chart has the potential to terminate the process by successfully identifying the source of the concern.
- Proceed only as far as necessary to identify the cause of the concern!

Attempt To Start Engine



Oil Pressure Gauge and Glow Plug Indicator

By just attempting to start the engine, while observing the instrument panel and listening for the electric fuel pump, the concern can often be verified and you can possibly begin to formulate your diagnostic strategy.

While attempting to start the engine:

- Listen for electric fuel pump operation at initial KEY-ON (All vehicles except F-650/F-750, which are equipped with a mechanical fuel pump)
- Check for glow plug indicator on IP
- Check for engine oil pressure

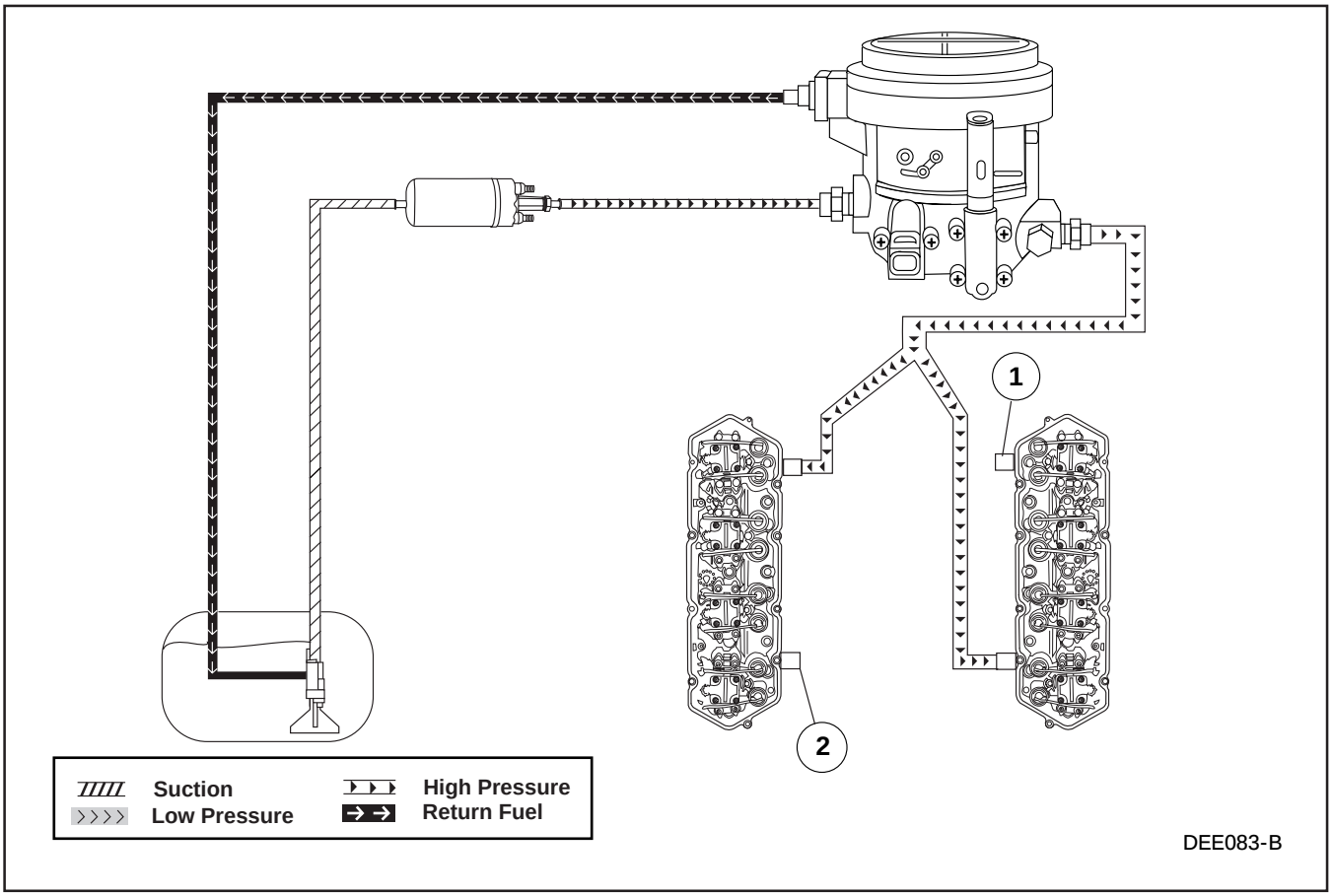
Check High-Pressure Oil Pump Reservoir

If engine oil pressure builds quickly during cranking, it is highly unlikely that you will find an empty high-pressure reservoir.

The high-pressure pump reservoir does need to be full - within 1" (25.4mm) of inspection plug - of oil in order to supply the high-pressure pump.

As the diagnostics indicate, a high-pressure reservoir that is consistently found low during starting attempts may indicate a concern with the conventional engine lubrication system.

Check Fuel Pump Pressure



Fuel System with Electric Fuel Pump

Item	Description
1	RH Fuel Pressure Test Port
2	LH Fuel Pressure Test Port

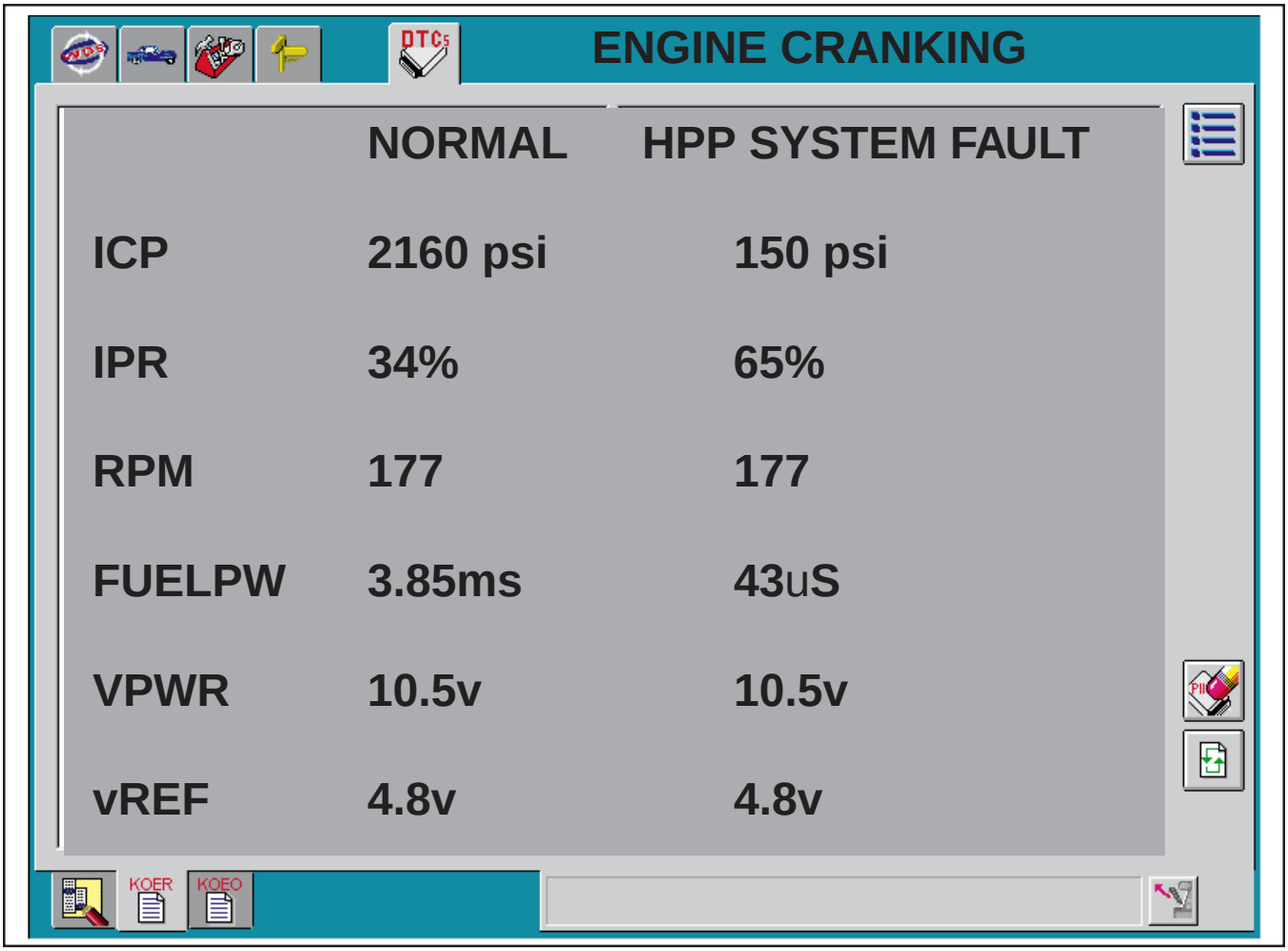
Fuel pressure must come up at KEY ON (except F-650/F-750), and remain at specification while the engine is cranking.

The engine will start and run on one cylinder bank, so fuel pressure can be checked on one bank only to diagnose No Start concerns. Of course, sufficient fuel pressure must be present on both cylinder banks for the engine to develop full power.

Quick Tests

- Perform KOEO On-Demand Self Test
  - Address any DTCs that are retrieved.
- Perform KOEO Injector Electrical Self Test
  - Test validates the electrical circuit integrity between the IDM and the injectors.
  - Any DTCs retrieved must be addressed.
  - The audible buzz can be used to further diagnose injector operation.
    - Each injector must "buzz" sharply
    - A muffled buzz is an indication of a sludged injector, caused by extended oil change intervals or low-quality oil.

Check Parameter Identification (PIDs)

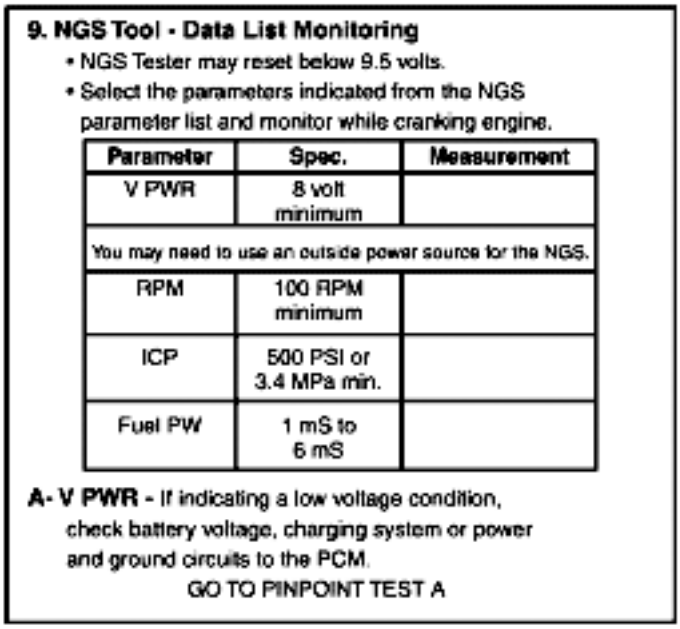


Monitoring PIDs While Cranking Engine

This is a very important test, since it validates high-pressure oil system operation, while also checking other parameters required to start, such as cranking speed (RPM) and system voltage (VPWR).

The graphic above is a simulation of parameters monitored during cranking. The data is an actual measurement.

- Normal values were obtained by cranking the engine with the under-valve-cover (UVC) harness disconnected.
- The fault values were obtained by inducing a massive leak in the high-pressure system.



9. NGS Tool - Data List Monitoring

- NGS Tester may reset below 9.5 volts.
- Select the parameters indicated from the NGS parameter list and monitor while cranking engine.

Parameter	Spec.	Measurement
V PWR	8 volt minimum	
You may need to use an outside power source for the NGS.		
RPM	100 RPM minimum	
ICP	500 PSI or 3.4 MPa min.	
Fuel PW	1 mS to 6 mS	

A- V PWR - If indicating a low voltage condition, check battery voltage, charging system or power and ground circuits to the PCM.

GO TO PINPOINT TEST A

A0042862

Test 9 - Data List Monitoring

This chart, taken from the PC/ED Manual, shows minimal required values in order for the engine to start.

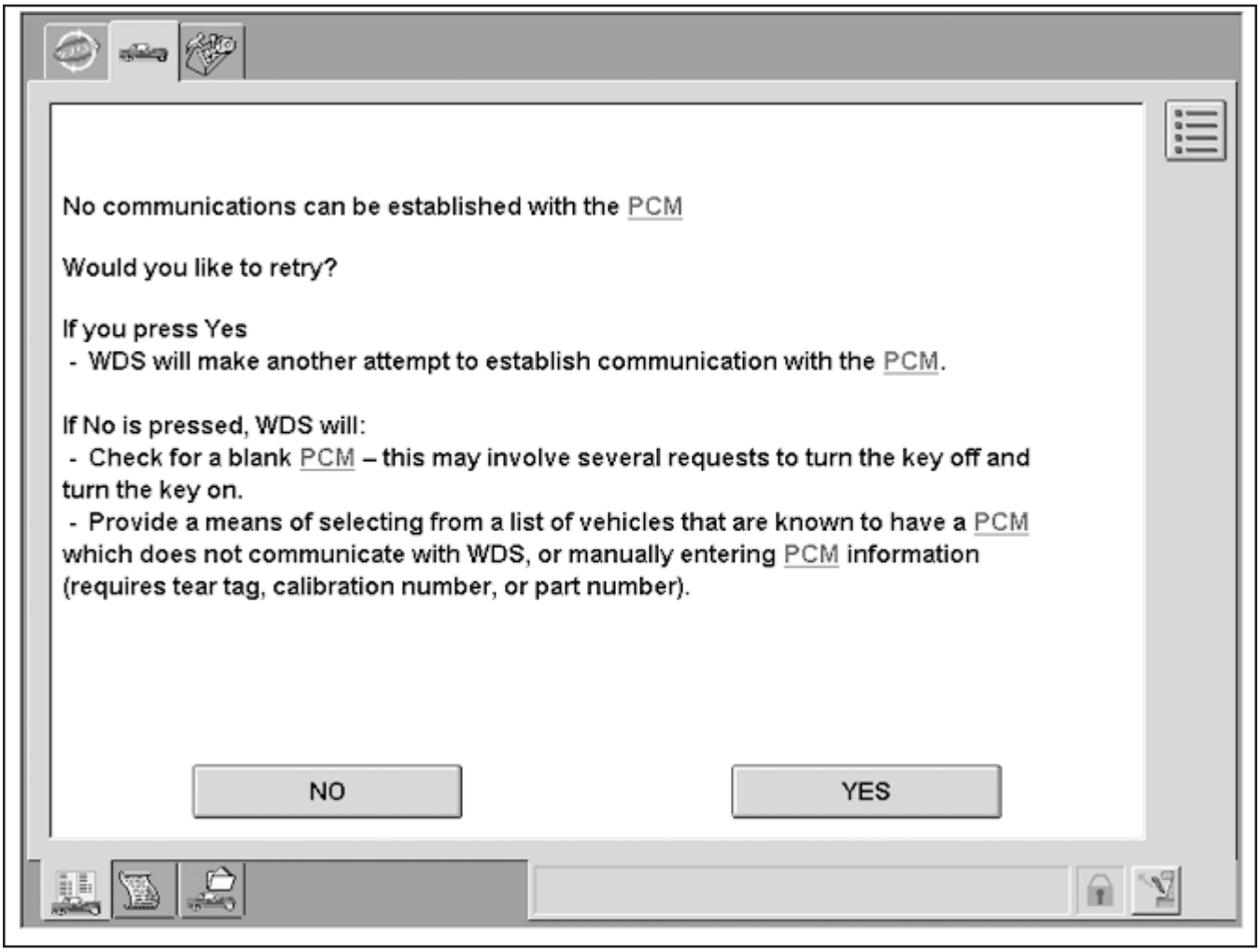
Check Glow Plug Operation

Do these tests first if the concern is occurring only in cold ambient temperatures.

- Check Glow Plug Relay Circuit
- Check Glow Plug Relay
- Check Glow Plugs
- Check Glow Plug Connectors

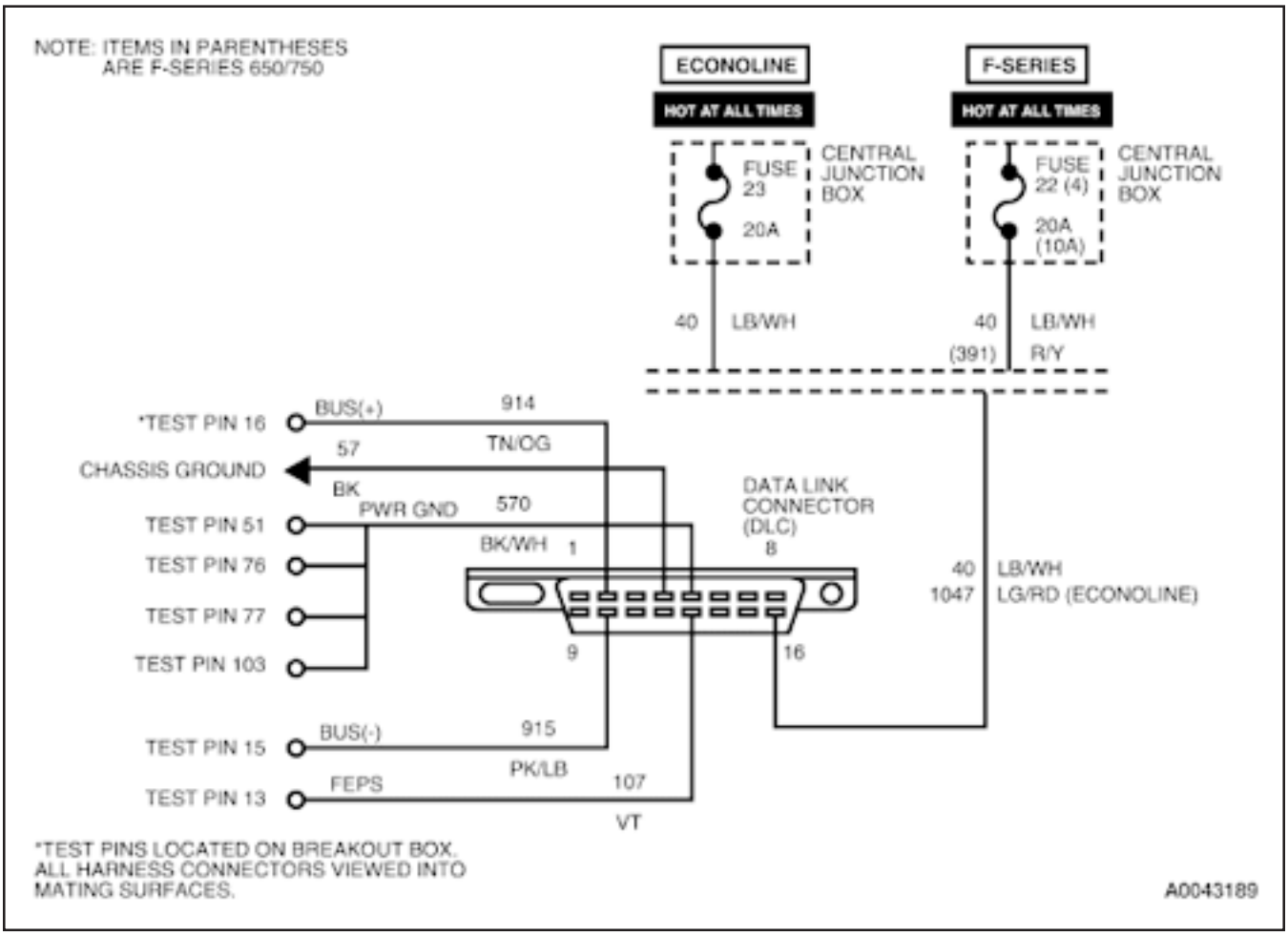
These tests and sub-tests are all aimed at determining if the glow plugs are being powered, and heating, on both cylinder banks.

Pinpoint Test QA



Communication Failed

On a no-start concern, you may come to Pinpoint Test QA if Scan Tool communication with the PCM cannot be established.



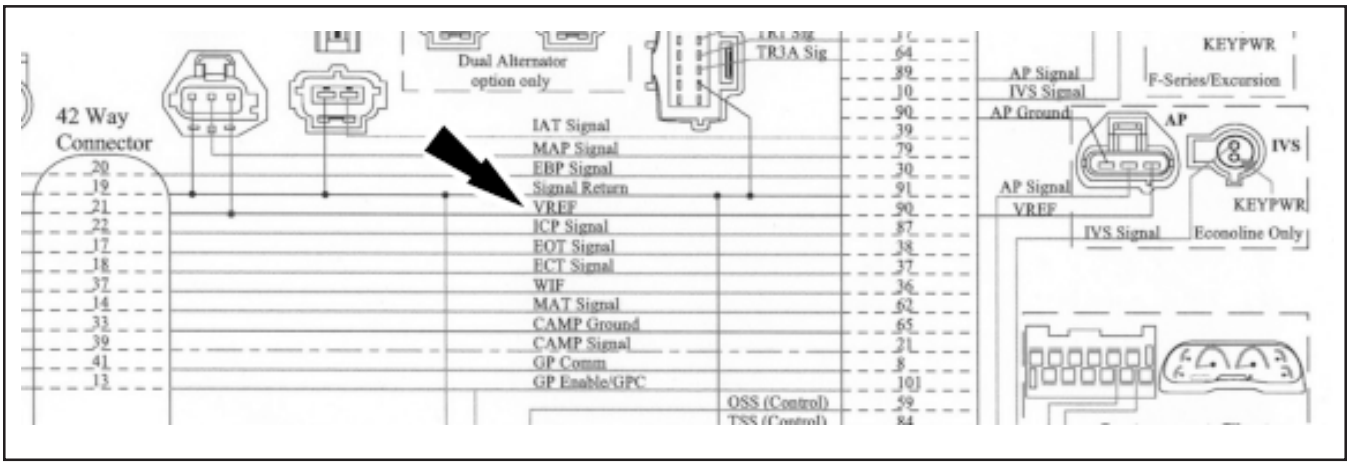
Wiring Diagram Associated with Pinpoint Test QA

The purpose of Pinpoint Test QA is to validate the integrity of the data circuits, as well as power and ground to the data link connector.

This pinpoint test is intended to diagnose only the following:

- Standard corporate protocol (SCP) communication bus harness circuits: BUS (+), BUS (-)
- Harness circuits: chassis ground, power ground (PWR GND), battery voltage (VBAT)
- Powertrain control module

VREF Circuit Shorted to Ground



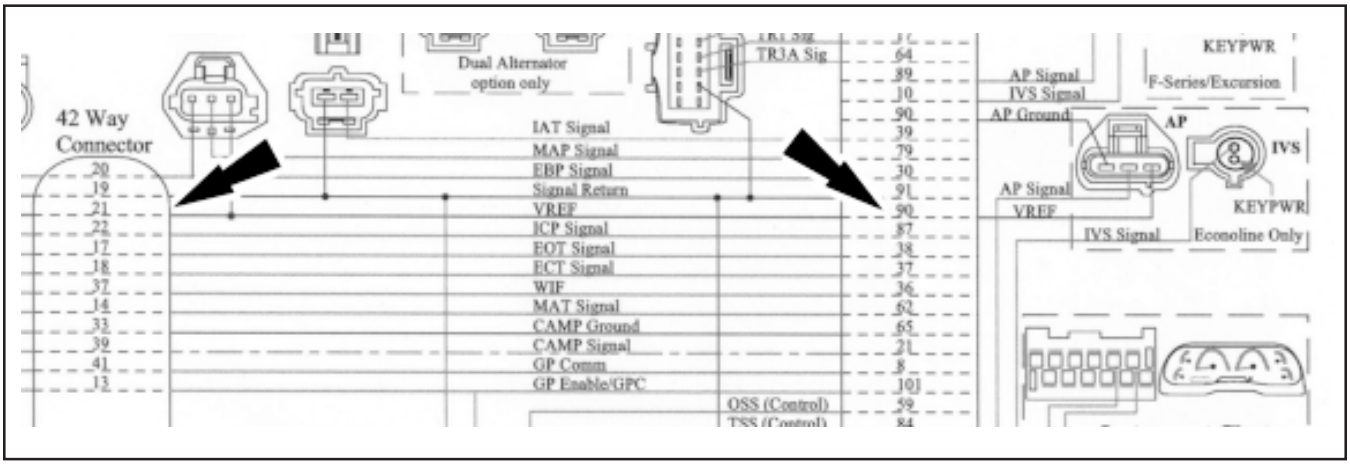
VREF Circuit

The PCM supplies a 5v VREF signal through a common supply circuit to a number of 3-pin sensors. The sensors that are supplied with a VREF signal are:

- Injection Control Pressure (ICP) sensor
- Camshaft Position (CMP) sensor
  - PCM must receive CMP sensor input in order for the engine to start.
- Exhaust Backpressure (EBP) sensor
- Manifold Absolute Pressure (MAP) sensor
- Accelerator Pedal (AP) sensor

A short-to-ground at any of the sensors, as well as in the wiring harness, will cause loss of VREF, with the symptoms being both a no-run/no-start, as well as communication failure between the scan tool and the PCM.

Confirming and Diagnosing VREF Circuit Failure



VREF Circuit

Each sensor attached to the VREF supply circuit has its own Pinpoint Test, complete with wiring diagram.

Each Pinpoint test also contains a series of steps to validate the electrical integrity of the sensor and circuits.

VREF voltage can be checked at the VREF pin at any of the sensors, as well as Pin 90 with the breakout box installed at the PCM.

Several sensors can be isolated at one time by disconnecting the 42-pin engine connector.

The 5v VREF signal will return, and PCM communication be restored, as soon as the ground fault is eliminated.

The PCM will select a default value, and allow the engine to start, for any VREF-related sensor that is disconnected EXCEPT the CMP sensor.

CONTENTS

This appendix contains the following:

- 2002 7.3L PC/ED Manual Outline
- 2002 F-Series/Excursion Diesel Engine Diagnostic Guide Worksheet
- 2002 F-Series/Excursion and Econoline Powertrain Control System Wiring Schematic and DTC Index
- Technician Turbocharger Guide
- Technician High Pressure Oil Pump (HPP) Guide

2002 7.3L PC/ED MANUAL OUTLINE

INTRODUCTION

- Disclaimer and safety notices
- Preface – Brief description of each section in manual
- How To Use The Diagnostic Procedures
  - Overview of diagnostic steps

SECTION 1: Description and Operation

- Diesel Vehicle Emission Control Information – Shows engine emission labels.
- Diesel On Board Diagnostics II System
- Malfunction Indicator Lamp (MIL)
- Diesel Electronic EC System
- Diesel Powertrain Control Software
- Diesel PCM Inputs
- Diesel PCM Outputs
- Diesel Fuel System
- Diesel Intake Air Systems
- Diesel Catalyst and Exhaust Systems

SECTION 2: Diagnostic Methods

- Diagnostic Methods
- Diagnostic Tools
- Scan Tool Hookup
- Quick Test Description
  - Retrieve/Clear Continuous DTCs
  - Key On Engine Off (KOEO) On-Demand Self Test
  - Key On Engine Off (KOEO) Injector Electrical Self Test
  - Key On Engine Off (KOEO) Output State Self Test
  - Key On Engine Running (KOER) Switch (SW) Self Test
  - Key On Engine Running (KOER) On-Demand Self Test
  - Key On Engine Running (KOER) Cylinder Contribution Self Test
  - Key On Engine Running (KOER) Glow Plug Monitor Self Test
  - MIL DTCs

- Quick Test Operation
  - Key On Engine Off (KOEO) On-Demand Self Test
  - Key On Engine Running (KOER) On-Demand Self Test
  - Retrieve/Clear Continuous DTCs
  - KOEO Injector Electrical Self Test
  - KOEO Output State Self Test
  - KOER Switch Self Test
  - KOER Cylinder Contribution Self Test
  - KOER Glow Plug Monitoring Self Test
- Parameter Identification (PID)
  - Contains a listing of PIDs
- Accumulating PCM Data
- Analyzing PCM Data
- On-Board System Readiness Test
- Freeze Frame Data
- Powertrain Control Module (PCM) Reset
- Drive Cycles
- Intermittent Diagnostic Techniques
- Basic Circuit Checks

SECTION 3: Symptom Charts

- Symptom Chart Index
- Symptom Charts

SECTION 4A: Diagnostic Subroutines — F250-550 and E-Series

- Hard Start/No Start Diagnostic Procedures

    1. Visual Engine/Chassis Inspection
    2. Check Engine Oil Level
    3. Intake/Exhaust Restriction
    4. Sufficient Clean Fuel
    5. Electric Fuel Pump Pressure
    6. Perform KOEO On-Demand Self Test
    7. Retrieve/Clear Continuous DTCs
    8. KOEO Injector Electrical Self Test
    9a. Check VPWR During Cranking
    9b. Check RPM Signal While Cranking
    9c. Monitor ICP While Cranking
    9d. Check Fuel Pulse Width (FUEL PW) While Cranking
    10. Glow Plug System Operation

- Performance Diagnostic Procedures
    1. Visual Engine/Chassis Inspection
    2. Sufficient Clean Fuel
    3. Check Engine Oil Level
    4. Intake Restriction
    5. Perform KOEO On-Demand Self Test
    6. Retrieve Continuous DTCs
    7. KOEO Injector Electrical Self Test
    8a. Fuel Pressure Test
    8b. Fuel Pressure Test
    8c. Electric Fuel Pump Pressure Test
    8d. Electric Fuel Pump Inlet Restriction
    9. Perform KOER On-Demand Self Test
    10a. Injection Control Pressure Tests (Oil Aeration — Poor Idle Quality)
    10b. Low Idle Stability (ICP Pressure)
    11. Crankcase Pressure Test
    12. Cylinder Contribution Tests
    13. Exhaust Restriction
    14. Boost Pressure Test
- Diagnostic Trouble Code Description

SECTION 4B: Diagnostic Subroutines — F650-750

- Hard Start/No Start Diagnostic Procedures

    1. Visual Engine/Chassis Inspection
    2. Check Engine Oil Level
    3. Intake/Exhaust Restriction
    4. Sufficient Clean Fuel
    5. Tandem Fuel Pump Pressure
    5a. Fuel Pressure Right Rail
    5b. Fuel Pressure Left Rail
    6. Perform KOEO On-Demand Self Test
    7. Retrieve/Clear Continuous DTCs
    8. KOEO Injector Electrical Self Test
    9a. Check VPWR During Cranking
    9b. Check RPM Signal While Cranking
    9c. Monitor ICP While Cranking
    9d. Check Fuel Pulse Width (FUEL PW) While Cranking
    10. Glow Plug System Operation

- Performance Diagnostic Procedures
    1. Visual Engine/Chassis Inspection
    2. Sufficient Clean Fuel
    3. Check Engine Oil Level
    4. Intake Restriction
    5. Perform KOEO On-Demand Self Test
    6. Retrieve Continuous DTCs
    7. KOEO Injector Electrical Self Test
    8a. Fuel Pressure Right Rail
    8b. Fuel Pressure Left Rail — At The Left Head
    8c. Tandem Fuel Pump Pressure
    8d. Tandem Fuel Pump Inlet Restriction
    9. Perform KOER On-Demand Self Test
    10a. Injection Control Pressure Tests (Oil Aeration — Poor Idle Quality)
    10b. Low Idle Stability (ICP Pressure)
    11. Crankcase Pressure Test
    12. Cylinder Contribution Tests
    13. Exhaust Restriction
    14. Boost Pressure Test
- Diagnostic Trouble Code Description

SECTION 5: Pinpoint Tests

- Pinpoint Test Index
- Sensor and Actuator Diagnostic Procedures
- Operational Signal Checks
- Component Location
- General Procedures for Pinpoint Testing
  - Inspection
  - Connector Checks to Ground (B-)
  - Connector Voltage Checks
  - Harness Resistance Tests
- Pinpoint Tests
- Each Pinpoint Test is divided into two sections:
  - Introduction
    - Description/Function
    - Wiring schematic with connector map and PCM connector pin ID
    - Associated DTCs
    - Pressure/voltage/frequency relationship chart and/or graph
  - Step-by-step pinpoint test procedure

SECTION 6: Reference Values

- Control System Diagnostic Sheet Reference
- Consists of two tables:
  - PCM Pin Descriptions and Expected Values
    - Pin #
    - Name
    - Circuit #
    - Wire Color
    - Key Off
    - Key On
    - Low Idle
    - High Idle
    - Operating Range
    - Comments
  - Fault Code Table
    - Fault Code
    - Footnote Reference
    - Circuit Index
    - Condition Description
    - Probable Causes

NOTES

F-Series/Excursion Powerstroke 2000-2003

7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

CUSTOMER NAME	
MODEL YEAR	VEHICLE SERIAL N0.(VIN)
CHASSIS STYLE	

Customer Concerns (Please list in this box)

DEALER NAME	P & A CODE						1863 CLAIM NUMBER	DATE
	ENGINE SERIAL NUMBER						ODOMETER	TYPE OF SERVICE
VEHICLE GVW	TRANSMISSION						AMBIENT TEMPERATURE	PERSONAL ☐ COMMERCIAL ☐

Hard Start/No Start Diagnostics

NOTE: A hard start/ No start concern with EOT Temp. below 60F perform step 10 first.

1. Visual Engine/Chassis Inspection 6005E

Fuel Oil Coolant Electrical Hoses Leaks

Method	*Check*
Visual	

2. Check Engine Oil Level See Fig. C 6005E

- Check for contaminants (fuel, coolant).
- Correct Grade/Viscosity.
- Miles/Hours on oil ,correct level.
- Check level in reservoir.

Method	*Check*
Visual	

3. Intake/Exhaust Restriction See Fig. B & L 6005E

- Inspect air filter and ducts - exhaust system
- Inspect exhaust back pressure device

Method	*Check*
Visual	

4. Sufficient Clean Fuel See Fig. A 6005E 6

- Check if the WATER IN FUEL lamp has been illuminated.
- After verifying that there is fuel in the tank, drain a sample from fuel filter housing at key on.

NOTE: Fuel pump will run for 20 sec. at key on.

Method	*Check*
Visual	

5. Electric Fuel Pump Pressure See Fig. I 6005E 7

- Verify that the fuel pump has voltage and gnd. present at key on.
- Measure fuel pressure at the top of the right cylinder head with a (0-160 PSI) gauge at key on.

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45 PSI min.	

If pressure fails low, Go to step 8c on the Performance side of this sheet to identify cause.

6. Perform KOEO On Demand Test See Fig. E 6005E 2

- Use the NGS Tester
- DTCs set during this test are current faults.

Note: IDM DTCs displayed here could be current or historical faults.

Diagnostic Trouble Codes	

7. Retrieve Continuous Trouble Codes See Fig. E 6005E 2

- DTCs retrieved during this test are historical faults.

Note: IDM DTCs are cleared when codes are cleared

Diagnostic Trouble Codes	

8. KOEO Injector Electrical Self-Test See Fig. E 6005E 3

- Use the NGS Tester.
- All injectors will momentarily buzz, then individual injectors will buzz in sequence 1 through 8.
- IDM DTCs may be transmitted after test is completed.

Note: IDM DTCs may be historical if not cleared above.

Injector Trouble Codes	

9. NGS Tool - Data List Monitoring See Fig. E 6005E 4

- NGS Tester may reset below 9.5 volts.
- Select the parameters indicated from the NGS parameter list and monitor while cranking engine.

Parameter	*Spec.*	*Measurement*
V PWR	*8 volt min.*	

You may need to use a outside power source for the NGS

RPM	100 RPM minimum	
ICP	500 PSI or 3.4mPa min.	
FUEL PW	1 mS to 6 mS	

A **V PWR** - If indicating a low voltage condition, check battery voltage, charging system or power and ground circuits to the PCM.

GO TO PINPOINT TEST A

B **RPM** - Low RPM could be an indication of starting/ charging system problems, No RPM indicated with the engine cranking - could be CMP circuit fault, check for Diagnostic Trouble Codes.

GO TO PINPOINT TEST DG

C **ICP** - A minimum of 500 PSI (3.4 mPa) is required before the injectors are enabled. No or low oil in the reservoir, system leakage, injector O-Rings or faulty IPR could cause pressure loss.

Go to section 4 step 9c in the PC/ED Manual for a detailed description on how to perform this test.

Note: If no RPM signal is received, IPR duty cycle will default to 14%

D **FUEL PW** - Even though a 1 to 6 mS FUEL PW is shown, its possible the IDM did not receive the signal due to a CI or FDCS circuit fault or internal IDM failure.

10. Glow Plug System Operation See Fig. E & G

Relay Operation 6005E 5

- Glow Plug ON time is dependent on oil temperature and altitude. The Glow Plug relay/Glow Plug Control Module (GPCM) comes on between 1 and 120 sec. and does not come on at all if oil temp is above 131 F
- On GPCM equipped vehicles, check continuous and KOEO codes. If codes are present go to pinpoint test QB.
- On Glow Plug Relay equipped vehicles verify that B+ is being supplied on the large BK/WH wire.
- Install a voltmeter to the glow plug feed terminal (two brown wires)
- Using the NGS GPCTM and EOT pids, verify glow plug "on" time .
- Turn key to run position, measure voltage ("on"time) (Dependent on oil temperature and altitude)

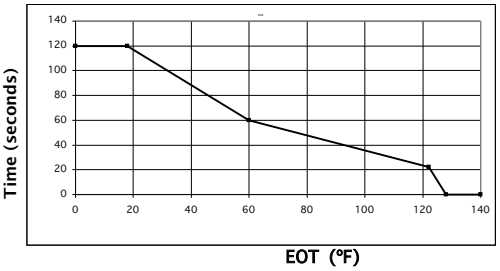
Relay on time	*Spec.*	*Measurement*
1 to 120 seconds	B +	

Note: Wait to Start Lamp "on" time (1 - 10 sec.) is independent from Glow Plug "on" time

Glow Plug Resistance

- Remove both 9 pin connectors from valve covers
- Measure each Glow Plug resistance to Bat. ground.
- Measure engine harness resistance to relay or GPCM

Glow Plug Number	Glow Plug to Ground .1 to 2 ohms	Connector to relay or GPCM connector 0 to 1 ohms
#1		
#3		
#5		
#7		
#2		
#4		
#6		
#8		



- Add 5 seconds to glow plug on time when above 7000 feet in altitude, but not to exceed 120 seconds.

See PC/ED manual, Section 4A for more detail on all of the above test steps.

When troubleshooting a Hard Start/No Start or Performance concern, this form must be filled out to the point of repair and returned to receive warranty credit and diagnostic time for the following parts: Fuel Injectors (9E527), regulator-injection control pressure(9C968), pump assemblyhigh pressure oil (9A543), turbo charger assembly/pedestal (6K684), fuel pump (9350), IDM (12B599) and PCM (EEC)(12A650)

Labor operations listed more than once are a continuation of the diagnostic procedure and should be claimed only once.

What problems were found and what repairs were performed?

List Part Name, Number and Serial Number of parts replaced.

F-Series/Excursion Powerstroke 2000-2003

7.3 Power Stroke Diesel Engine Diagnostic Guide

-NOTE-
IF CONCERN IS FOUND, SERVICE AS REQUIRED. IF THIS CORRECTS THE CONDITION, IT IS NOT NECESSARY TO COMPLETE THE REMAINDER OF THE DIAGNOSTIC PROCEDURE.

CUSTOMER NAME	
MODEL YEAR	VEHICLE SERIAL N0.(VIN)
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	ENGINE SERIAL NUMBER		ODOMETER	TYPE OF SERVICE
VEHICLE GVW	TRANSMISSION	AMBIENT TEMPERATURE		PERSONAL ☐ COMMERCIAL ☐

Performance Diagnostics

1. Visual Engine/Chassis Inspection 6005F
- Verify that there are no fluid, vacuum or pressure leaks.
- Inspect all wire connections for damage.
- Inspect MAP, WGC hoses and intake manifolds for leaks.

Fuel Oil Coolant Electrical Hoses Leaks

Method	*Check*
Visual	

2. Sufficient Clean Fuel See Fig. A 6005F 13
- Check if WATER IN FUEL lamp has been illuminated.
- Drain sample from fuel filter housing at key on

NOTE: Pump will run for 20 sec. at key on

Method	*Check*
Visual	

3. Check Engine Oil Level See Fig. C 6005F
- Check for contaminants (fuel, coolant).
- Correct Grade/Viscosity.
- Miles/hours on oil, correct level.

Method	*Check*
Visual	

4. Intake Restriction See Fig. B 6005F 14
- Check filter minder or measure at WOT with magnehelic gauge.

Instrument	*Spec.*	*Check*
Magnehelic/ Filter Minder	**2"-25" H^20**	

5. Perform KOEO On Demand Test See Fig. E 6005F 1
- Use the NGS Tester.
- DTCs set during this test are current faults.

Note: IDM DTCs displayed here could be current or historical faults.

Diagnostic Trouble Codes	

6. Retrieve Continuous Trouble Codes See Fig. E 6005F 1
- Use the NGS Tester.
- DTCs retrieved during this test are historical faults.

Note: IDM DTCs are cleared when codes are cleared

Diagnostic Trouble Codes	

7. KOEO Injector Electrical Self-Test See Fig. E 6005F 2
- Use the NGS Tester.
- All injectors will momentarily buzz, then individual injectors will buzz in sequence 1 though 8.

Note: IDM DTCs can be historical if not cleared above.

Injector Trouble Codes	

8a. Fuel Pressure at the right head See Fig I. 6005F 16
- Verify that fuel is in the tank and the pump is being powered.
- Measure fuel pressure at the front of right cyl. head
- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45 PSI min.	

» ***If fuel pressure fails low, Go to step 8c.***
» ***If pressure is above min. spec, Go to step 8b.***

8b. Fuel Pressure at the left head See Fig. I 6005F 17
- Measure fuel pressure at the rear of left cyl. head

CAUTION: Secure hose away from turbo and exhaust

- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45 PSI min.	

» ***If fuel pressure is below min. spec, replace left check valve***
» ***If fuel pressure is above min. spec, Go to step 9.***

8c. Electric Fuel Pump Pressure See Fig. I 6005F 18
- Measure at fuel outlet from electric fuel pump.
- Road Test- engine at full load condition

Instrument	*Spec.*	*Measurement*
0-160 PSI Gauge	45-80 PSI	

» ***If fuel pressure fails low, Go to step 8d.***
» ***If pressure is above min. spec, replace right check valve.***

8d. Electric Fuel Pump Inlet Restriction See Fig. H 6005F 19
- Measure restriction at WOT at electric fuel pump inlet

Instrument	*Spec.*	*Measurement*
0-30 " Hg vacuum	6" Hg MAX	

» ***If fuel line is restricted above 6" Hg, check for blockage between pump and fuel tank.***
» ***If fuel line is not restricted, inspect regulator valve condition and for debris, If OK replace pump***

9. Perform KOER On Demand Test See Fig. E 6005F 7
- This will test both ICP and EBP systems for fault.

KOER DTC	

10a. Injection Control Pressure Tests See Fig. E & D 6005F 7
(Oil Aeration - Poor idle quality)
- All acc. off, monitor ICP and RPM with NGS Tester
- Hold engine speed at 3400 RPM for 3 minutes.

Parameter	*High RPM*	*Measurement*
ICP	1800 PSI MAX @ 3400 RPM	

» ***If ICP signal increases above 1800 PSI after 3 minutes anti-foam oil additives may have become depleted from oil, change oil and re-test.***

10b. Low Idle Stability (ICP Pressure) **See Fig. E** 6005F 8
- Check at low idle, EOT above 180 F
- Monitor ICP and RPM with the NGS Tester

Parameter	*Spec. @ 670 RPM*	*Measurement*
ICP	400 to 600 PSI	
Take reading before disconnecting ICP		

If engine RPM is unstable, disconnect the ICP sensor
» ***If RPM is still unstable, change IPR and re-test.***
» ***If RPM smoothes out, the ICP sensor is at fault.***
Note: ICP will default to 725 PSI when disconnected

11. Crankcase Pressure Test See Fig. J 6005F 9
- Verify engine is at normal operating temp.
- Measure at oil fill with adapter and orifice tool P.N. 5631 & 014-00743 installed.
- Block breather tube on left valve cover.
- Measure at WOT no load.

Instrument	*Spec.*	*Measurement*
Magnehelic 0 to 60" H^20	less than 3" H^20	

If more then 3 " H^20, refer to base engine in Shop Manual

12. Cylinder Contribution Test See Fig. E 6005F 10
- Verify that EOT is above 70 F
- Turn A/C and all accessories off.
- Select Cylinder Contribution from the test menu.

NOTE: The test will run at a idle speed for about 120 sec. and no engine change will be felt during the test

CCT Trouble Codes	

13. Exhaust Restriction See Fig. E & L 6005F 11
- Visually inspect exhaust system for damage
- Verify EBP device is open at WOT in park or neutral
- Monitor EBP with the NGS Tester with the engine
- temperature at 170 ° F minimum at 3400 RPM.

Parameter	*Spec.*	*Measurement*
EBP	34 PSI MAX @ 3400 RPM	

14. Boost Pressure Test See Fig. E & J 6005F 12
- Verify that MAP hose is not damaged, plugged or pinched
- Verify that intercooler hoses or intake are not leaking.
- Verify that the green Wastegate hose is not plugged.
- Monitor MGP (manifold gauge pressure) and RPM with the NGS Tester.
- Road Test - select appropriate gear to obtain desired engine speed and full load on engine. Best accomplished climbing hill or truck fully loaded.

Parameter	*Spec. PSI G*	*Measurement*
MGP	15 PSI G MIN	

See PC/ED manual, Section 4A for more detail on all of the above test steps.

When troubleshooting a Hard Start/No Start or Performance concern, this form must be filled out to the point of repair and returned to receive warranty credit and diagnostic time for the following parts:
Fuel Injectors (9E527), regulator-injection control pressure(9C968), pump assembly high pressure oil (9A543), turbo charger assembly/pedestal (6K684), fuel pump (9350), IDM (12B599) and PCM (EEC)(12A650)
Labor operations listed more than once are a continuation of the diagnostic procedure and should be claimed only once.

What problems were found and what repairs were performed?

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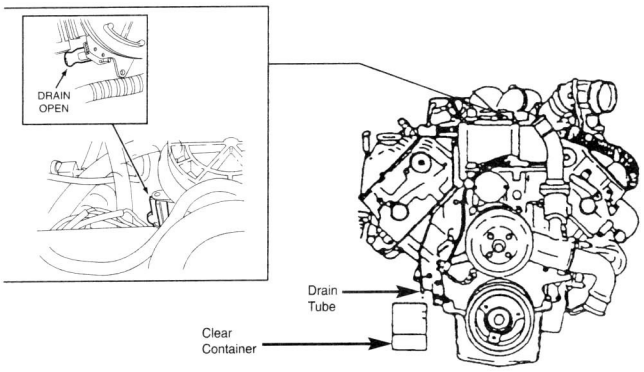
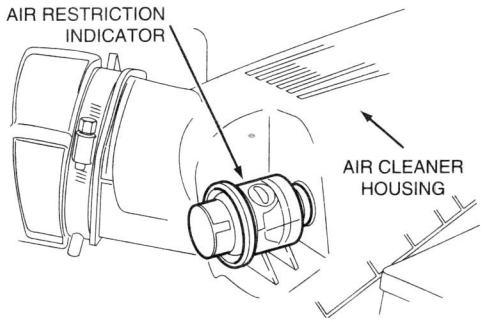
FIGURE A



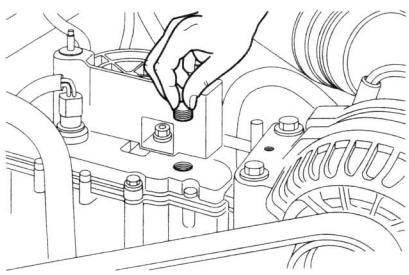
SUFFICIENT CLEAN FUEL

FIGURE B



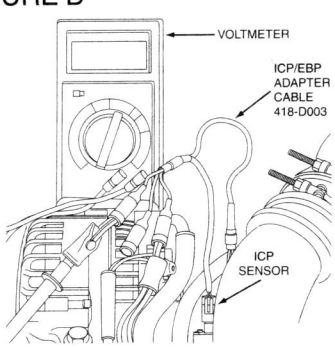
INTAKE RESTRICTION (FILTER MINDER)

FIGURE C



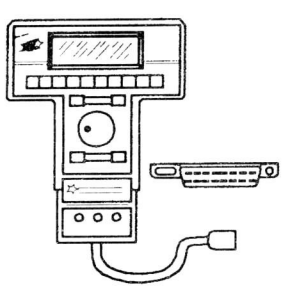
CHECK ENGINE OIL (IN RESERVOIR)

FIGURE D



INJECTION CONTROL PRESSURE

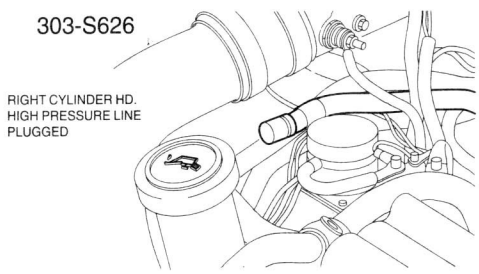
FIGURE E



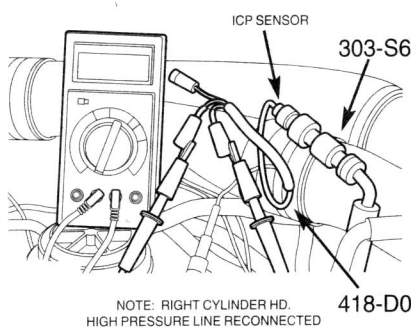
DIAGNOSTIC TESTS WITH NEW GENERATION STAR SCAN TOOL

HIGH PRESSURE LEAKAGE TEST

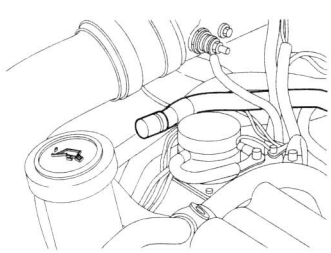
FIGURE F

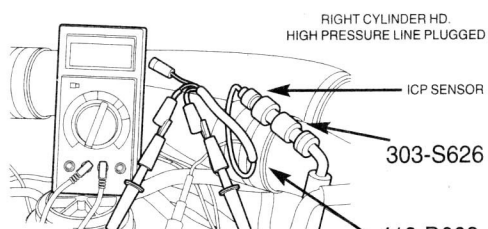


LEFT CYL. HEAD LEAK TEST



RIGHT CYL. HEAD LEAK TEST

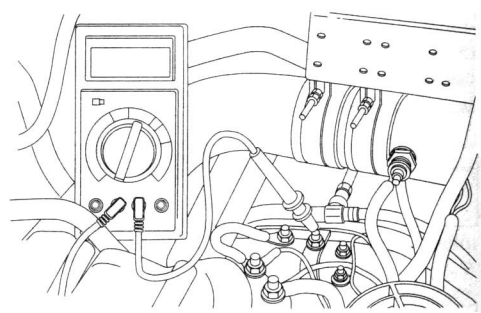




IPR & HIGH PRESSURE PUMP TEST

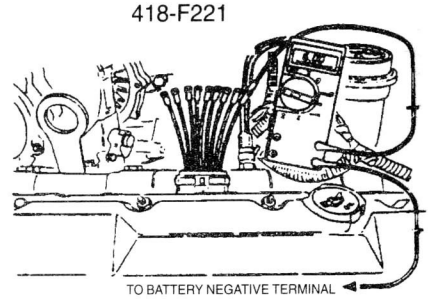
GLOW PLUG SYSTEM OPERATION (NON GPCM EQUIPPED)

FIGURE G

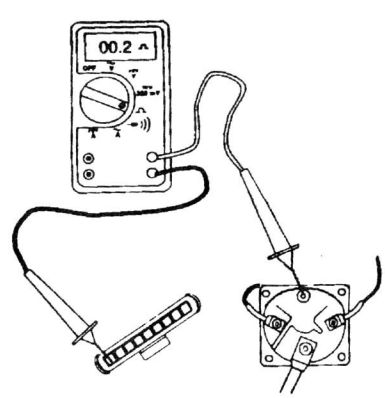


GLOW PLUG "ON" TIME

418-F221

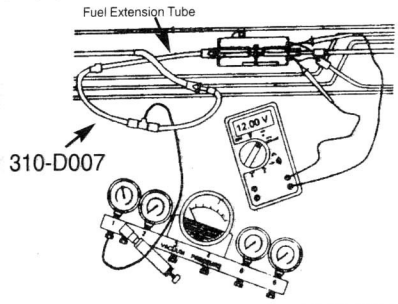


GLOW PLUG RESISTANCE TO GND



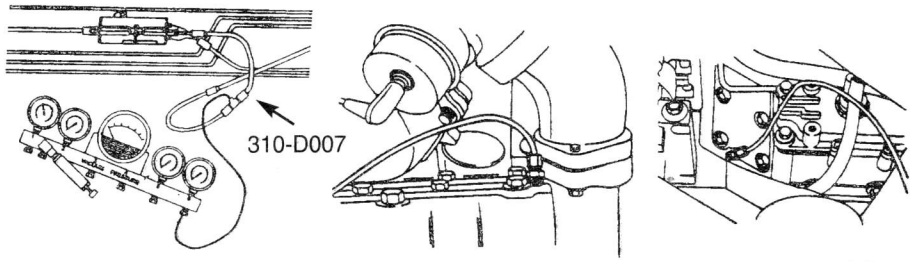
GLOW PLUG HARNESS RESISTANCE

FIGURE H



FUEL PUMP RESTRICTION

FIGURE I



FUEL PUMP PRESSURE

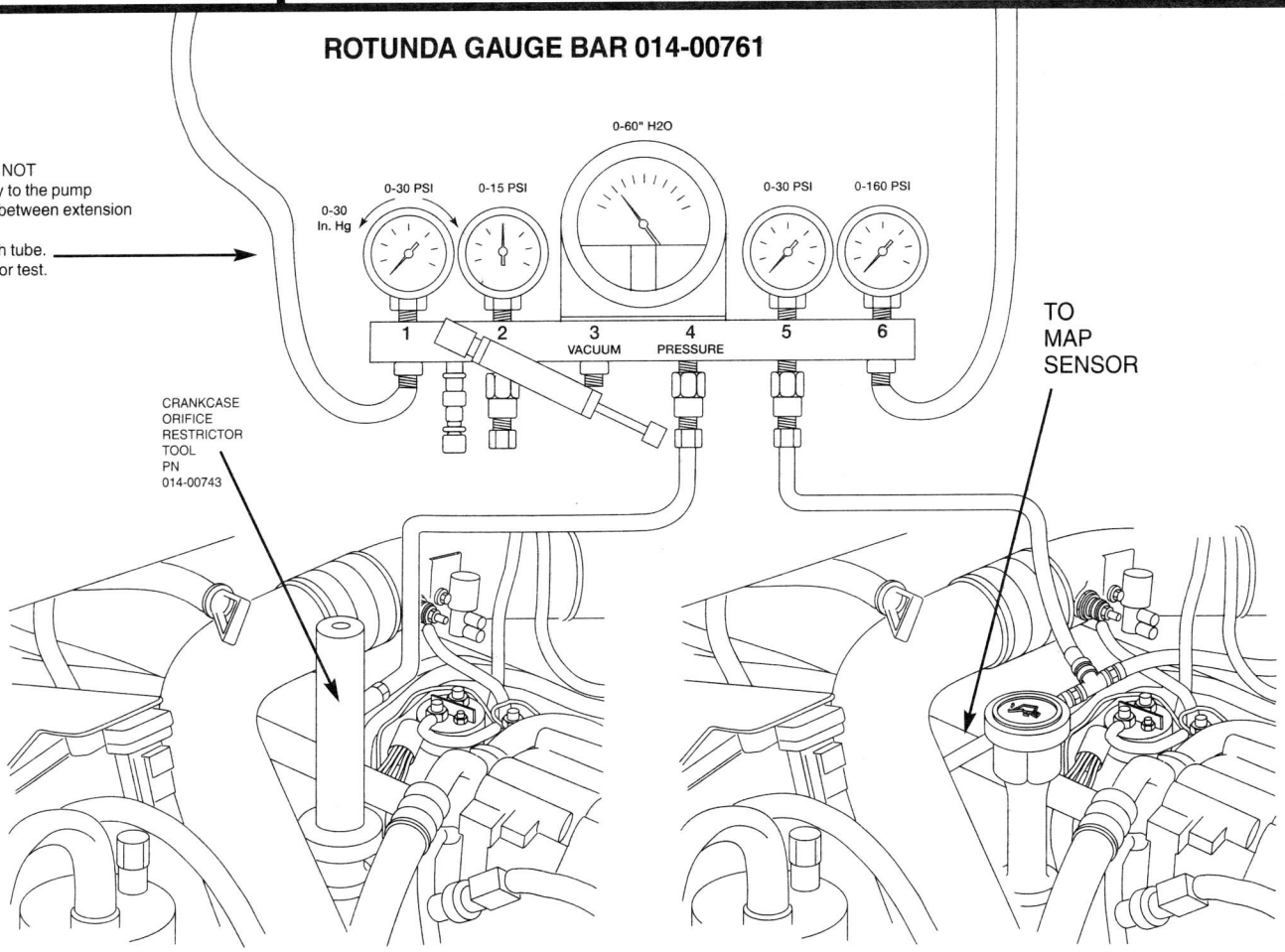
FUEL PRESSURE (LEFT HEAD)

FUEL PRESSURE (RIGHT HEAD)

ROTUNDA GAUGE BAR 014-00761

FIGURE J

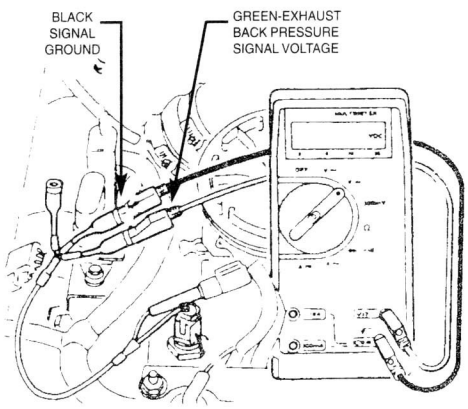
RESTRICTION test – DO NOT connect 310-D007 directly to the pump Test MUST be measured between extension tube and fuel feed line. Econoline is equipped with tube. F-Series needs this tube for test.



CRANKCASE PRESSURE

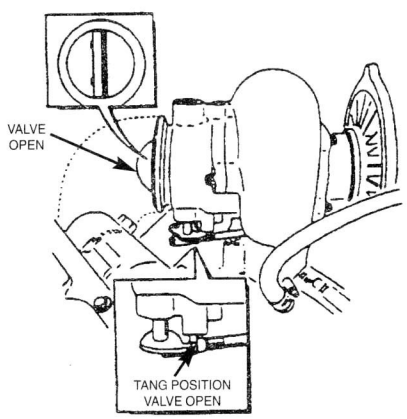
BOOST PRESSURE

FIGURE K



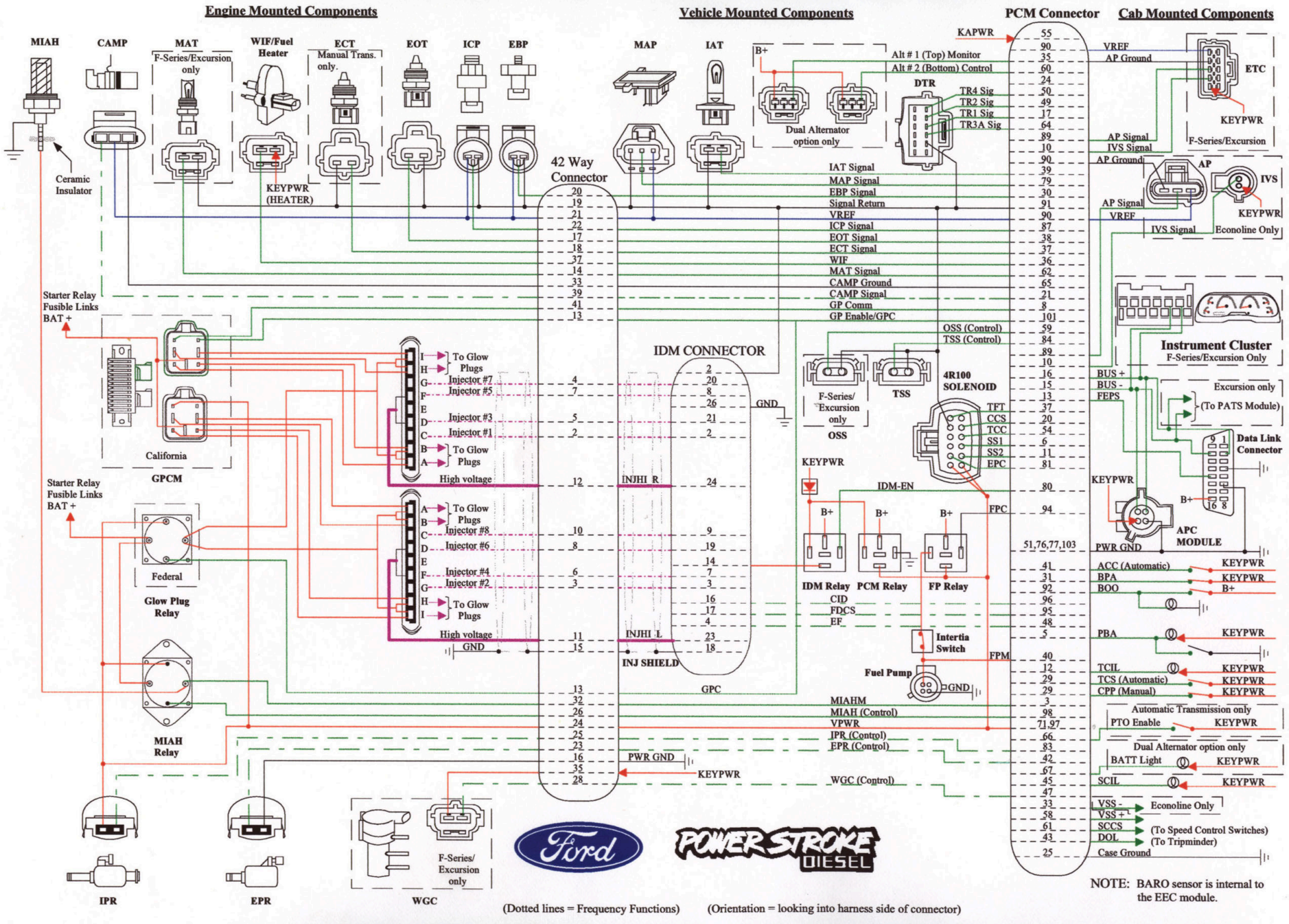
EXHAUST BACK PRESSURE

FIGURE L



EXHAUST RESTRICTION

7.3L Powerstroke Diesel Powertrain Control System - 2002 F-Series/Excursion and Econoline



POWERTRAIN CONTROL SYSTEM
ELECTRONICS DIAGNOSTIC GUIDE
2002 F-Series/Excursion and Econoline

Fault Code		Circuit Index	Condition Description	Probable Causes
0107	*	BARO	Barometric press sensor circuit low input	Internal BARO failed (PCM)
0108	*	BARO	Barometric press sensor circuit high input	Internal BARO failed (PCM)
0112	*	IAT	Intake air temp sensor circuit low input	Grounded circuit, IAT sensor, PCM
0113	*	IAT	Intake air temp sensor circuit high input	Open/short to power circuit, IAT sensor, PCM
0117		ECT	Engine coolant temp sensor circuit low input	Grounded circuit, ECT sensor, PCM
0118		ECT	Engine coolant temp sensor circuit high input	Open/short to power circuit, ECT sensor, PCM
0122	*	AP/ETC	Accelerator pedal sensor circuit low input	Grounded circuit, AP/ETC sensor, PCM
0123	*	AP/ETC	Accelerator pedal sensor circuit high input	Open/short to power circuit, AP/ETC sensor, PCM
0197	*	EOT	Engine oil temp sensor circuit low input	Grounded circuit, EOT sensor, PCM
0198	*	EOT	Engine oil temp sensor circuit high input	Open/short to power circuit, EOT sensor, PCM
0220		TEST	Throttle switch B circuit malfunction	IVS Switch not detected during self-test, circuit, switch
0221	*	AP/IVS	Throttle switch B circuit performance	Failed pedal assembly
0230		FP	Fuel Pump relay driver failure	Open FP relay, blown fuse, open/grounded circuit
0231	*	FP	Fuel Pump circuit failure	Fuse, relay, inertia switch, fuel pump, open/short circuit
0232		FP	Fuel Pump circuit failure	Relay failure, short circuit, pump failure
0236	*	MAP	Turbo boost sensor A circuit performance	MAP sensor, BP sensor or circuit failure
0237	*	MAP	Turbo boost sensor A circuit low input	Circuit open, short to ground, MAP sensor
0238	*	MAP	Turbo boost sensor A circuit high input	Circuit short to power, MAP sensor
0261	*	INJ	Injector circuit low - Cylinder 1	Harness short to ground
0262		INJ	Injector circuit high - Cylinder 1	Miswired connector or harness
0263		INJ	Cylinder 1 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0264	*	INJ	Injector circuit low - Cylinder 2	Harness short to ground
0265		INJ	Injector circuit high - Cylinder 2	Miswired connector or harness
0266		INJ	Cylinder 2 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0267	*	INJ	Injector circuit low - Cylinder 3	Harness short to ground
0268		INJ	Injector circuit high - Cylinder 3	Miswired connector or harness
0269		INJ	Cylinder 3 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0270	*	INJ	Injector circuit low - Cylinder 4	Harness short to ground
0271		INJ	Injector circuit high - Cylinder 4	Miswired connector or harness
0272		INJ	Cylinder 4 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0273	*	INJ	Injector circuit low - Cylinder 5	Harness short to ground
0274		INJ	Injector circuit high - Cylinder 5	Miswired connector or harness
0275		INJ	Cylinder 5 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0276	*	INJ	Injector circuit low - Cylinder 6	Harness short to ground
0277		INJ	Injector circuit high - Cylinder 6	Miswired connector or harness
0278		INJ	Cylinder 6 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0279	*	INJ	Injector circuit low - Cylinder 7	Harness short to ground
0280		INJ	Injector circuit high - Cylinder 7	Miswired connector or harness
0281		INJ	Cylinder 7 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0282	*	INJ	Injector circuit low - Cylinder 8	Harness short to ground
0283		INJ	Injector circuit high - Cylinder 8	Miswired connector or harness
0284		INJ	Cylinder 8 contribution/balance fault	Power cylinder, valve train or injector problem, circuit
0301-0308	*	INJ	Fault cylinder 1-8 - Misfire Detected	No compression, mechanical engine failure
0340		CMP	Camshaft position sensor ckt malfunction	Open/short circuit, CAMP sensor
0341	*	CMP	Camshaft position sensor ckt performance	Harness routing, charging circuit, sensor
0344	*	CMP	Camshaft position sensor ckt intermittent	Open/short ckt, sensor/gap, low fuel pressure/no start
0380	*	GPC	Glow plug circuit malfunction	Open/short ckt, GPCM/GP relay, PCM
0381	*	GPL	Glow plug indicator circuit malfunction	Open/short circuit, lamp, fuse, PCM
0460		FLI	Fuel Level Sensor Circuit Malfunction	Open/short circuit, cluster, tank unit, open case GND
0470		EBP	Exhaust press sensor circuit malfunction	EBP sensor, open signal return ckt
0471	*	EBP	Exhaust press sensor circuit performance	Plugged, stuck, sensor or leaking hose/tube
0472	*	EBP	Exhaust press sensor circuit low input	Open/short to GND circuit, EBP sensor, PCM
0473	*	EBP	Exhaust press sensor circuit high input	Circuit shorted to power, EBP sensor, PCM
0475	*	EPR	Exhaust press control valve malfunction	Open/short circuit, EBPsolenoid, PCM
0476		TEST	Exhaust press control valve performance	Failed/stuck EPR, EBP fault, EPR circuit
0478	*	EPR	Exhaust press control valve high input	Plugged sensor line, stuck butterfly, restricted exhaust
0500	*	VSS	Vehicle speed sensor malfunction	Sensor, circuit, PCM, PSOM, low trans fluid
0503		VSS	Vehicle speed sensor noisy	Harness routing, sensor

Fault Code			Circuit Index	Condition Description	Probable Causes
0541			MIAH	Manifold intake air heater circuit failure	Relay failure, open/short circuit
0542			MIAH	Manifold intake air heater circuit failure	Relay failure, short circuit
0560			N/A	System voltage malfunction	Charging system problem/load, glow plugs still enabled
0562		*	VPWR	System voltage low	Low sys voltage, charging sys, internal PCM failure
0563			VPWR	System voltage high	High sys voltage, charging sys, internal PCM failure
0565			TEST	Cruise "On" signal malfunction	Switch not detected during self-test, circuit, switch
0566			TEST	Cruise "Off" signal malfunction	Switch not detected during self-test, circuit, switch
0567			TEST	Cruise "Resume" signal malfunction	Switch not detected during self-test, circuit, switch
0568			TEST	Cruise "Set" signal malfunction	Switch not detected during self-test, circuit, switch
0569			TEST	Cruise "Coast" signal malfunction	Switch not detected during self-test, circuit, switch
0571			TEST	Brake switch A (BPA) circuit malfunction	Switch not detected during self-test, circuit, switch
0603			PCM	Powertrain Control Module KAM test error	PCM or BATT was disconnected, fuse, open ckt.
0605			PCM	Powertrain Control Module ROM test error	PCM or BATT was disconnected, Internal PCM failure
0606			PCM	PCM processor fault	Internal PCM failure
0640			MIAH	Manifold intake air heater relay failure	Open MIAH relay, blown fuse, open/grounded circuit
0670		*	GPCM	Glow Plug Control Module control line failure	Open/shorted circuit, GPCM, PCM
0671-0678		*	GPCM	Glow Plug failure 1-8	Open/shorted circuit, PCM, faulty Glow Plug
0683		*	GPCM	Glow Plug Control Module communication line fai	Open/shorted circuit, failed GPCM, PCM
0703			TEST	Brake switch B (BOO) circuit malfunction	Switch not detected during self-test, circuit, switch
0704			TEST	(CPP) Clutch input circuit malfunction	Switch not detected during self-test, circuit, switch
0705		*	TRS	Digital Trans range sensor circuit malfunction	Short or open digital TRS (pin 64 short only)
0707			TRS	Digital Trans range sensor circuit low input	Short to ground digital TRS
0708		*	TRS	Digital Trans range sensor circuit high input	Open pin 64 digital TRS
0712	$		TFT	Trans fluid temp sensor ckt low input	Short to ground, TFT sensor, PCM
0713	$		TFT	Trans fluid temp sensor ckt high input	Open/short to power, TFT sensor, PCM
0715	$	*	TSS	TSS sensor circuit malfunction fault	Short/ open circuit, sensor, PCM
0717	$		TSS	TSS intermittent failure	Short/ open circuit, sensor, PCM
0718			TSS	Noisey TSS	Erratic signal, sensor, int. circuit
0720	$	*	OSS	OSS sensor circuit malfunction fault	Short/ open circuit, sensor, PCM
0721			OSS	Noisey OSS	Erratic signal, sensor, int. circuit
0722	$		OSS	OSS intermittent failure	Short/ open circuit, sensor, PCM
0732			GRV	Gear 2 incorrect ratio	Mechanical/hydraulic failure, 4x4 swtich failure
0733			GRV	Gear 3 incorrect ratio	Mechanical/hydraulic failure, 4x4 swtich failure
0741			TCC	Torque converter clutch ckt performance	Faulty solenoid, PCM, convertor hydraulic system
0743	$	*	TCC	Torque converter clutch system electrical	Faulty solenoid, circuit, PCM
0750		*	SS1	Shift solenoid A malfunction	Circuit failure, faulty solenoid, PCM
0755	$	*	SS2	Shift solenoid B malfunction	Circuit failure, faulty solenoid, PCM
0781	$		N/A	1-2 shift error	Circuit, solenoid, hydraulic/mechanical failure
0782	$		N/A	2-3 shift error	Circuit, solenoid, hydraulic/mechanical failure
0783	$		N/A	3-4 shift error	Circuit, solenoid, hydraulic/mechanical failure
1000			N/A	OBDII monitor status	OBDII monitors/drivecycle incomplete
1105			ALT	Dual Alternator upper fault (monitor)	Circuit failure, alternator failure, PCM
1106			ALT	Dual alternator lower fault (control)	Circuit failure, alternator failure, PCM
1107		*	ALT	Dual alternator lower circuit malf. (control)	Circuit failure, alternator failure, PCM
1108			ALT	Dual alternator BATT lamp ckt. malf.	Open/short circuit, lamp, fuse, PCM
1118		*	MAT	Manifold Air Temp sensor out of range low	Short to ground MAT circuit, MAT sensor
1119		*	MAT	Manifold Air Temp sensor out of range high	Open/short to power circuit, MAT sensor
1139			WIFL	Water-in-Fuel Lamp circuit malfunction	WIF lamp, circuit failure, fuse, PCM
1140			WIF	Water-in-Fuel condition failure	Water in fuel, grounded circuit, shorted sensor, PCM
1184			TEST	Engine oil temp out of self test range	Engine too cold/hot, leaking thermostat, ckt, sensor
1209		*	IPR	ICP system fault	IPR valve stuck
1210		*	IPR	ICP above expected level	ICP sensor, open signal return
1211		*	IPR	ICP pressure above/below desired	IPR valve, grounded IPR circuit, high pressure oil leak
1212			ICP	ICP press not detected during crank	low oil in reservoir, IPR fault
1218		*	CI	CI stuck high	Ci circuit intermittent open
1219		*	CI	CI stuck low	CI circuit intermittent short to ground
1247		*	MAP	Turbo boost pressure low	MAP hose, sensor, EBP sys, intake leaks, Turbo
1248		*	MAP	Turbo boost pressure not detected	MAP hose, sensor, EBP sys, intake leaks, Turbo

Fault Code			Circuit Index	Condition Description	Probable Causes
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0566			TEST	Cruise "Off" signal malfunction	Switch not detected during self-test, circuit, switch
0567			TEST	Cruise "Resume" signal malfunction	Switch not detected during self-test, circuit, switch
0568			TEST	Cruise "Set" signal malfunction	Switch not detected during self-test, circuit, switch
0569			TEST	Cruise "Coast" signal malfunction	Switch not detected during self-test, circuit, switch
0571			TEST	Brake switch A (BPA) circuit malfunction	Switch not detected during self-test, circuit, switch
0603			PCM	Powertrain Control Module KAM test error	PCM or BATT was disconnected, fuse, open ckt.
0605			PCM	Powertrain Control Module ROM test error	PCM or BATT was disconnected, Internal PCM failure
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0671-0678		*	GPCM	Glow Plug failure 1-8	Open/shorted circuit, PCM, faulty Glow Plug
0683		*	GPCM	Glow Plug Control Module communication line fai	Open/shorted circuit, failed GPCM, PCM
0703			TEST	Brake switch B (BOO) circuit malfunction	Switch not detected during self-test, circuit, switch
0704			TEST	(CPP) Clutch input circuit malfunction	Switch not detected during self-test, circuit, switch
0705		*	TRS	Digital Trans range sensor circuit malfunction	Short or open digital TRS (pin 64 short only)
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0713	$		TFT	Trans fluid temp sensor ckt high input	Open/short to power, TFT sensor, PCM
0715	$	*	TSS	TSS sensor circuit malfunction fault	Short/ open circuit, sensor, PCM
0717	$		TSS	TSS intermittent failure	Short/ open circuit, sensor, PCM
0718			TSS	Noisey TSS	Erratic signal, sensor, int. circuit
0720	$	*	OSS	OSS sensor circuit malfunction fault	Short/ open circuit, sensor, PCM
0721			OSS	Noisey OSS	Erratic signal, sensor, int. circuit
0722	$		OSS	OSS intermittent failure	Short/ open circuit, sensor, PCM
0732			GRV	Gear 2 incorrect ratio	Mechanical/hydraulic failure, 4x4 swtich failure
0733			GRV	Gear 3 incorrect ratio	Mechanical/hydraulic failure, 4x4 swtich failure
0741			TCC	Torque converter clutch ckt performance	Faulty solenoid, PCM, convertor hydraulic system
0743	$	*	TCC	Torque converter clutch system electrical	Faulty solenoid, circuit, PCM
0750		*	SS1	Shift solenoid A malfunction	Circuit failure, faulty solenoid, PCM
0755	$	*	SS2	Shift solenoid B malfunction	Circuit failure, faulty solenoid, PCM
0781	$		N/A	1-2 shift error	Circuit, solenoid, hydraulic/mechanical failure
0782	$		N/A	2-3 shift error	Circuit, solenoid, hydraulic/mechanical failure
0783	$		N/A	3-4 shift error	Circuit, solenoid, hydraulic/mechanical failure
1000			N/A	OBDII monitor status	OBDII monitors/drivecycle incomplete
1105			ALT	Dual Alternator upper fault (monitor)	Circuit failure, alternator failure, PCM
1106			ALT	Dual alternator lower fault (control)	Circuit failure, alternator failure, PCM
1107		*	ALT	Dual alternator lower circuit malf. (control)	Circuit failure, alternator failure, PCM
1108			ALT	Dual alternator BATT lamp ckt. malf.	Open/short circuit, lamp, fuse, PCM
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1119		*	MAT	Manifold Air Temp sensor out of range high	Open/short to power circuit, MAT sensor
1139			WIFL	Water-in-Fuel Lamp circuit malfunction	WIF lamp, circuit failure, fuse, PCM
1140			WIF	Water-in-Fuel condition failure	Water in fuel, grounded circuit, shorted sensor, PCM
1184			TEST	Engine oil temp out of self test range	Engine too cold/hot, leaking thermostat, ckt, sensor
1209		*	IPR	ICP system fault	IPR valve stuck
1210		*	IPR	ICP above expected level	ICP sensor, open signal return
1211		*	IPR	ICP pressure above/below desired	IPR valve, grounded IPR circuit, high pressure oil leak
1212			ICP	ICP press not detected during crank	low oil in reservoir, IPR fault
1218		*	CI	CI stuck high	Ci circuit intermittent open
1219		*	CI	CI stuck low	CI circuit intermittent short to ground
1247		*	MAP	Turbo boost pressure low	MAP hose, sensor, EBP sys, intake leaks, Turbo
1248		*	MAP	Turbo boost pressure not detected	MAP hose, sensor, EBP sys, intake leaks, Turbo

Fault Code		Circuit Index	Condition Description	Probable Causes
1249	*	WG	Waste-gate failure steady state	GND short, pluged hose/port, solenoid, actuator
1260		EPATS	Anti theft module signal detected	Anti theft condition detected, EPATS module
1261-1268		INJ	High to low side short cyl#1 - #8	Short circuit, shorted injector, failed IDM
1271-1278		INJ	High to low side open cyl#1 - #8	Open circuit, open injector, failed IDM
1280	*	ICP	ICP circuit out of range low	Open/grounded circuit, ICP sensor, PCM
1281	*	ICP	ICP circuit out of range high	Circuit shorted to power, ICP sensor, PCM
1282	*	IPR	Excessive ICP pressure	Faulty IPR regulator (sticking), circuit short to ground
1283		TEST	IPR circuit failure	Open/short circuit, loose connection
1284		TEST	ICP failure - aborts KOER test	See codes 1280, 1281, 1282, 1283, 1211
1291		INJ	High side short to grd or B+, bank #1 (right)	Shorted circuit, faulty IDM
1292		INJ	High side short to grd or B+, bank #2 (left)	Shorted circuit, faulty IDM
1293		INJ	High side open bank #1 (right)	Open circuit, faulty IDM
1294		INJ	High side open bank #2 (left)	Open circuit, faulty IDM
1295		INJ	Multiple faults on bank #1 (right)	Miswired connector or harness, short to ground
1296		INJ	Multiple faults on bank #2 (left)	Miswired connector or harness, short to ground
1297		INJ	High sides shorted together	Shorted wires, faulty IDM
1298		IDM	IDM failure	Internal IDM failure
1316	*	IDM	Injector circuit/IDM codes detected	Injector circuit/IDM codes detected
1397		VPWR	System voltage out of self test range	Voltage too high or low for glow plug monitor test
1464		TEST	A/C demand out of self test range	A/C on during self-test, circuit shorted to power
1501		TEST	VSS out of self test range	VSS detected during self-test
1502		TEST	Invalid test - APCM functioning	APCM active while KOER test is running
1531		TEST	Invalid test - accelerator pedal movement	AP detected during self-test, switch or circuit fault.
1536		PBA	Parking brake switch circuit failure	Switch not detected during self-test, circuit, switch
1636		SS	Inductive signature chip comm error	Faulty PCM
1660		OCC	OCC signal high	High system voltage, internal PCM fault
1661		OCC	OCC signal low	Low system voltage, internal PCM fault
1662		IDM-EN	IDM_EN circuit failure	Open IDM relay, blown fuse, open/shorted circuit
1663		FDCS	FDCS circuit failure	Open/shorted circuit, faulty IDM, PCM
1667		CI	CI circuit failure	Open/shorted circuit, faulty IDM, PCM
1668		EF	PCM-IDM diagnostic communication error	Open/shorted EF or FDCS, open IDM ground
1670	*	EF	EF signal not detected	Open/shorted EF circuit
1690	*	WG	Waste-gate failure	WGC circuit or Solenoid, PCM
1702	$	TRS	Digital TRS intermittent circuit malfunction	Sensor, wiring, PCM, mechanical alignment
1704		TRS	Digital TRS failed to transition state	Sensor, wiring, PCM, mechanical alignment
1705		TEST	Digital TRS out of self test range	Operator error, circuit failure, faulty sensor, PCM
1711		TEST	TFT sensor out of self test range	Trans too hot/cold, sensor or circuit fault, PCM
1713	$	TFT	TFT stuck in-range-low below 50 deg. F	Sensor, Circuit, PCM
1714	*	SS1	Shift Solenoid 1 inductive	Circuit, Solenoid or PCM
1715	*	SS2	Shift Solenoid 2 inductive	Circuit, Solenoid or PCM
1718	$	TFT	TFT stuck in-range-high above 250 deg. F	Sensor, Circuit, PCM
1728	$	TCC	Transmission slip error	Solenoid failure or mechanical failure
1729	$	4x4L	4x4 Low switch error	Circuit short to GND, faulty switch, PCM
1744	*	TCC	Converter not functioning	Converter solenoid/hydraulic/mechanical failure
1746	$	EPC	EPC solenoid open circuit	Open circuit, faulty solenoid, PCM
1747	*	EPC	EPC solenoid short circuit	Short to GND circuit, faulty solenoid, PCM
1754		CCS	Coast clutch solenoid circuit malfunction	Circuit failure, faulty solenoid, PCM
1760	$	EPC	EPC solenoid short intermittent	Circuit failure, faulty solenoid, PCM
1780		TEST	TCS circuit out of self test range	Switch not detected during self-test, circuit, switch
1781		4X4L	4X4L circuit out of self test range	Operator error, short to ground, PCM
1783	$	TFT	Transmission overtemperature condition	Internal transmission failure, circuit failure, sensor

(FMEM) MIL illumination occurs after 1st fault - Federal calibrations only

*** (OBDII) MIL illumination occurs after 2nd consecutive fault**

$ Transmission Control Indicator Light (TCIL) flashes with fault present

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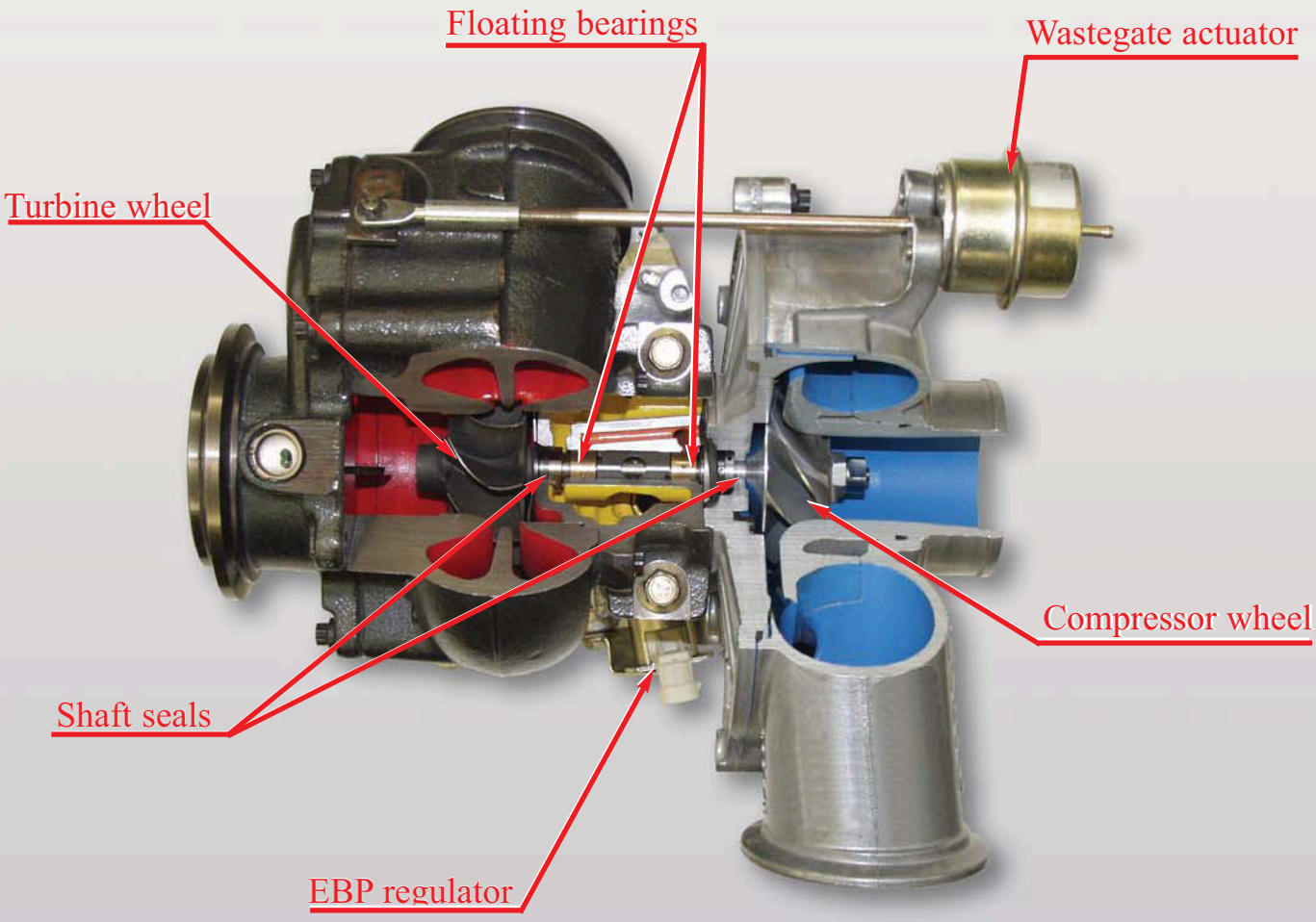
Technician Turbocharger Guide for the Powerstroke Engine



Turbochargers are precision pieces of machinery which operate at high speed, using heat of expanding exhaust gasses to “boost” intake manifold pressure. Turbochargers increase performance and decrease exhaust smoke through improving an engine’s volumetric efficiency.

Turbochargers are often replaced by mistake for the following reasons:

- **Low power**
- **Oil leaks**
- **Noise**

Most turbocharger failures result from:

- **Poor maintenance (air/oil)**
- **Modifications (increasing turbocharger speed)**

Turbochargers are relatively simple devices. This simplicity also should apply to diagnosing them.

LOW POWER

In cases where the engine performance is in question, as evidenced by a boost reading below the specification for the vehicle, the following is true:
If neither of the wheels rub, the blades are not damaged, and the shaft and wheels spin freely, there is no reason to replace the turbocharger. In cases where performance is low and no fault lies with the turbocharger, the low performance will be due to low fuel delivery, a restriction or leak in the intake or exhaust systems, or worn engine components (low compression, check crankcase pressure).

The condition of the turbocharger relative to performance can be visually identified.

⚠ WARNING: ALL VISUAL INSPECTIONS OF THE TURBOCHARGER MUST BE MADE WITH THE ENGINE OFF AND THE TURBOCHARGER NOT SPINNING. TURBOCHARGER COMPONENTS MAY BE EXTREMELY HOT. BOTH WHEELS ARE VERY SHARP AND MAY SPIN AT HIGH SPEED. USE CAUTION

First, inspect the compressor wheel for damage.


1

Good Turbocharger: Compressor blades are clean and straight. There are no large gaps between the compressor housing and the compressor wheel. No visible damage to blades. This turbocharger should not be replaced.


2

Foreign Object Damage: This compressor wheel shows signs of some outside object (nuts, bolts, screws, etc.) coming in contact with the blades while they were spinning.


3

Dirt Ingestion: Also called dusting. The compressor wheel blades show signs of erosion from dirt entering the intake air system. The blades are rounded off and there is dirt accumulation in the compressor inlet.

Note: If damage to the compressor wheel is found, the intake air system should be cleaned and inspected for foreign objects, poor maintenance, broken components, or improper installation.

LOW POWER Cont'd

Does any evidence of wheel to housing contact exist, such as witness marks on the housing or rolled edges on the wheel? Before testing a service part replacement, pour some clean oil into the lube oil passages.

NOTE: Do not perform this inspection on a dry service turbocharger. It may exhibit wheel rub until it is lubed. The shaft bearings are floating bearings, requiring lubricating oil to provide proper running clearance.

⚠ Warning: Visually assure that wheel is not turning before inserting your hand into the compressor. Do not place fingers in turbo with engine running.

4

Spin the compressor wheel to make sure that it spins freely. The wheel should not contact the housing.

If the customer concern is low power (low boost) and inspecting the turbocharger reveals:

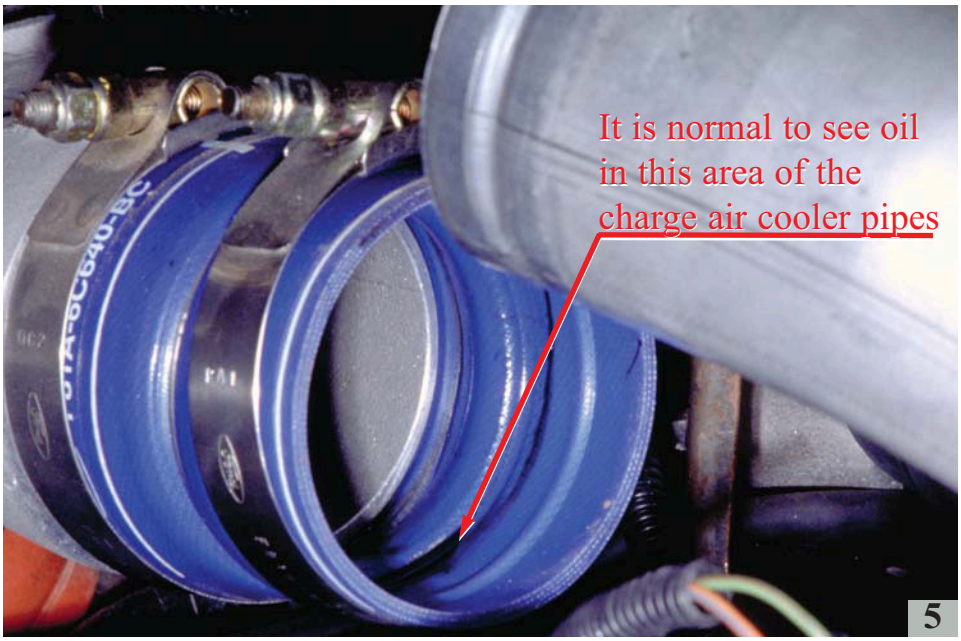
- no wheel damage
- no wheel rub
- no binding when turning the wheel

DO NOT REPLACE THE TURBOCHARGER

Refer to engine performance diagnostics in the PCED.

NORMAL OIL CARRYOVER

Another condition that often leads to replacement of the turbocharger is the presence of oil at the hose connections of the charge-air-cooling system. Oil vapors from the crankcase are vented into the turbocharger compressor from the crankcase breather on the left valve cover. This venting will over time lead to the presence of oil in the pipes between the turbocharger and the charge air cooler. A leak or seepage that is visible at the hose connections is not a sign indicating the turbocharger is defective.
If excessive oil consumption is a symptom, (exceeds 1 qt per 1000 miles) the turbocharger may be at fault but it will have wheel rub because for the shaft seal to fail the shaft bearing must also be failed. The only legitimate reason for a turbocharger to be replaced for excessive oil in the intake is if the turbocharger shaft bearings have failed.



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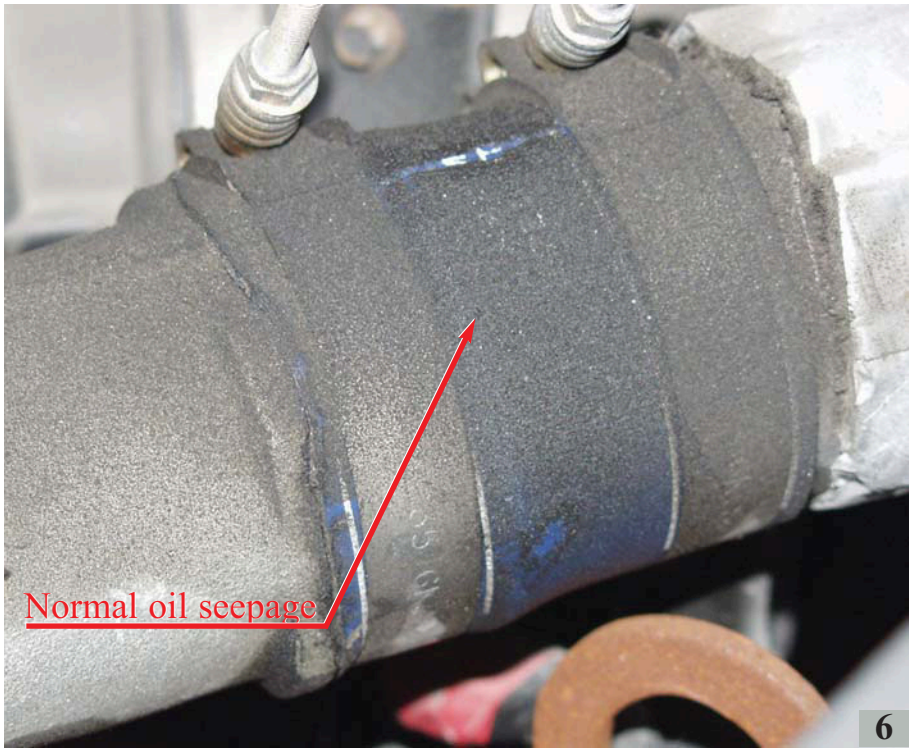
Normal Oil Carryover: The photo to the left shows normal oil carryover in the charge air cooler pipes. This condition can be aggravated by excessive air inlet restriction. The turbocharger should not be replaced for this condition.

Normal Oil Seepage: The photo to the right shows normal oil seepage on the charge air cooler connections. This condition can be aggravated by excessive air inlet restriction or an overfilled crankcase oil level (refer to SSM 11982). The turbocharger should not be replaced for this condition.



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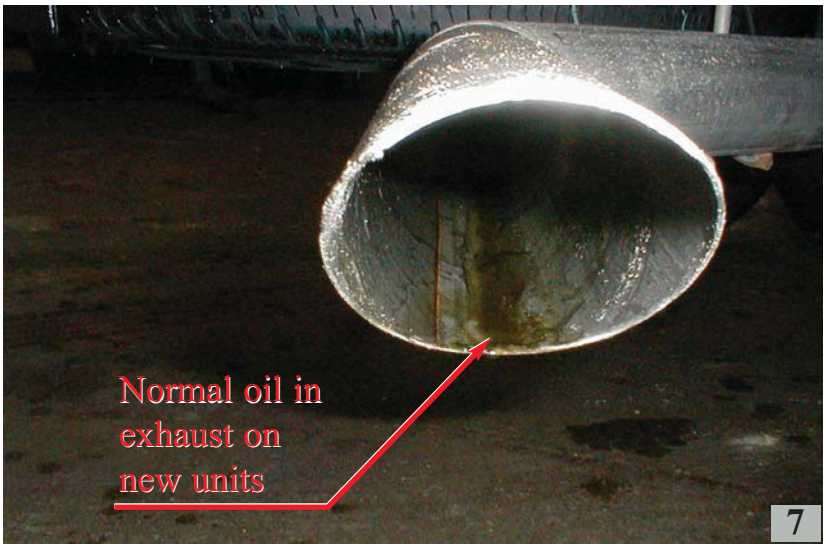
NORMAL NEW ENGINE EXHAUST APPEARANCE

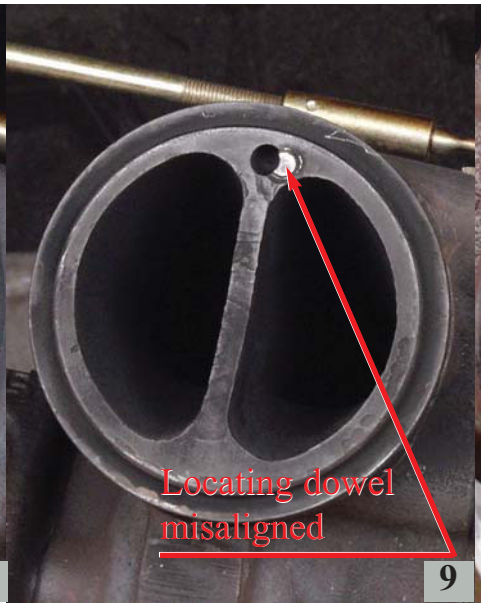
On very low mileage trucks, (typically less than 1000 miles) some turbochargers have been replaced because of an "oily residue" exiting the exhaust pipe. Be aware that during the manufacture of exhaust pipes, lubricants are used in the bending process and to prevent rust. Do not consider replacing the turbocharger just because oil is coming out of the tailpipe. The initial oil in the engine has had dye added, so inspect with a blacklight first. If it is thought that the oil is from the engine, loosen the exhaust pipe from the turbocharger outlet and look for signs of engine oil exiting the turbocharger. If the turbocharger is leaking oil into the exhaust, expect to find the bearings in the unit to be worn and for wheel rub to be present.



NOISE

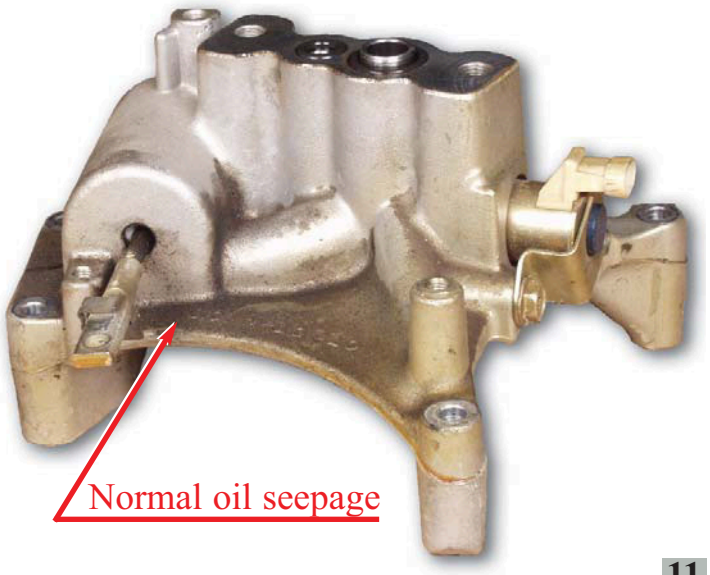
Turbochargers have been replaced for noise concerns when the concern is exhaust mis-alignment at the connections. Carefully inspect the exhaust connection at the inlet to the turbine housing, and the turbine exhaust outlet to exhaust pipe connection. Mis-alignment at these connections will often produce noise complaints. Re-aligning and tightening the V-band clamp can often repair the noise concern. If the turbocharger itself is responsible for excessive noise, expect to find wheel to housing rub, and bearing failure, as illustrated in photo 4.

NOTE: The exhaust backpressure device during its normal function will change the sound of the engine, in cold ambient conditions. Some vehicle operators may not understand the function of the device. Refer to cold weather operation in the Owner's Guide Supplement to the Owner's Manual. Refer to SSM 14209.



OIL LEAKS

Another observation that has caused turbochargers to be replaced is oil leakage at the turbocharger. In many cases the turbocharger is not at fault but rather the o-ring seals between the turbocharger and the pedestal or the o-ring seal between the pedestal and the crankcase would be the cause. These o-rings are available as service parts. If a leak is experienced at the EBP actuator, do not replace the turbocharger assembly. Replace the EBP actuator rod seal per SSM 16296.



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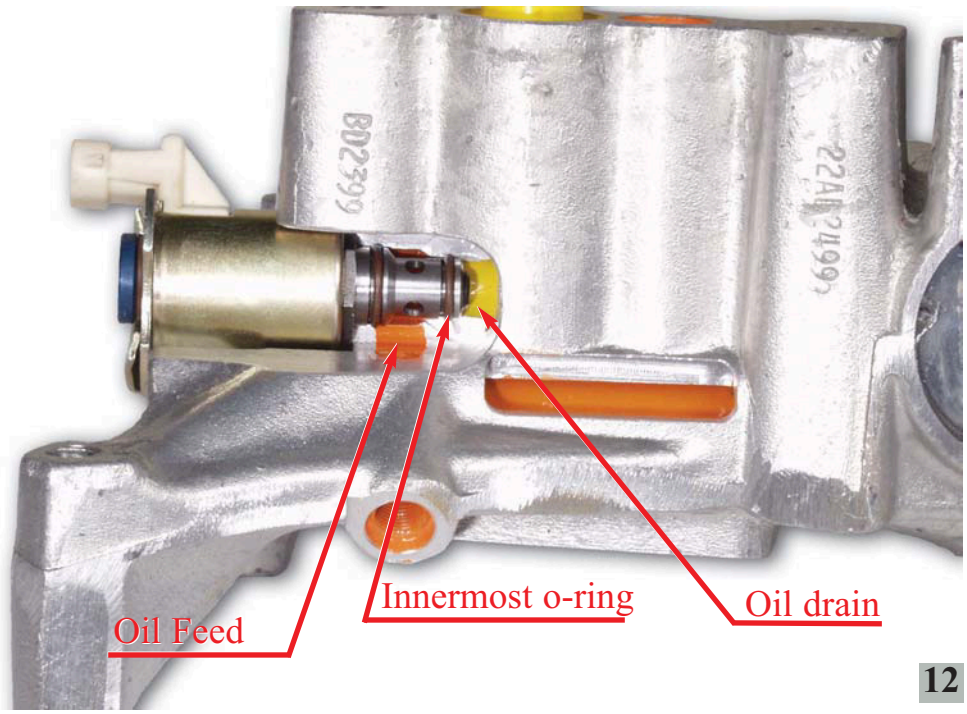
Normal Oil Seepage: It is normal to see some oil seepage past the seal on the EBP actuator rod. The photo to the left shows this normal seepage.

PERFORMANCE

Turbochargers have been replaced when the exhaust backpressure system (EBP) malfunctions. If performance is low, disconnect the EBP actuator rod from the bell crank, and tie the valve open. If this resolves the performance concern, make sure the valve in the exhaust rotates freely. If it does, then suspect the regulator to be at fault. The exhaust backpressure regulator and the regulator o-rings can be serviced separately from the turbocharger.



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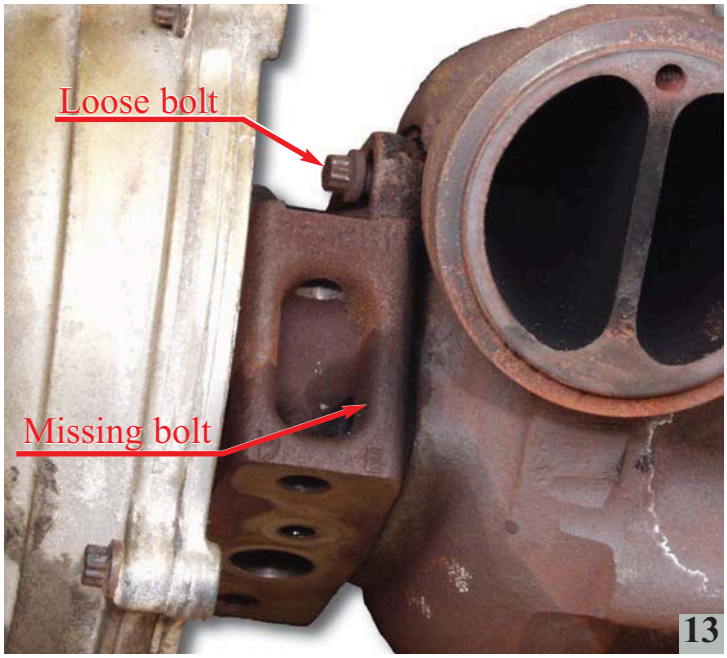
TURBINE HOUSING BOLTS

Some turbochargers have experienced turbine housing mounting bolt back out. This does not require turbocharger replacement unless the turbine wheel has contacted the housing and been damaged. Replacement bolts with an interference thread for improved retention are available for service. SSM 15998 (which supercedes SSM 14753) advises that the part number for the bolt kit is 1C3Z-9G486-AA. Do not try to “chase" the threads on these bolts.



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14

When loose or missing bolts are found, replace the bolts with part number 1C3Z-9G486-AA per SSM 14753.

TURBOCHARGER SERVICE REPLACEMENT PARTS

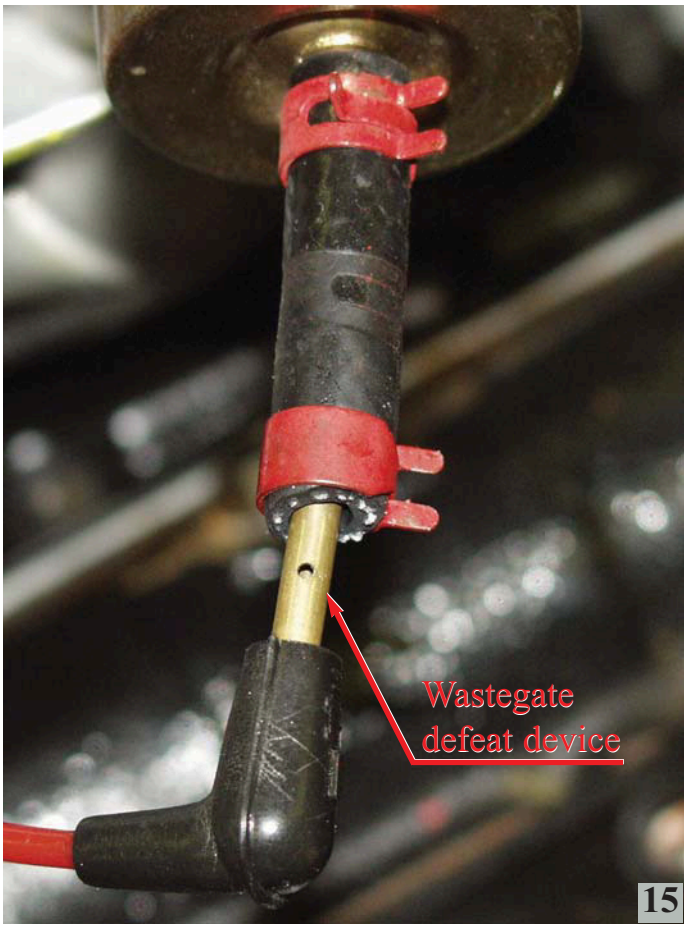
The following parts are available to repair concerns associated with the turbocharger.

	Base Part Number
Pedestal to rotating assembly o-rings	6N653
Pedestal to crankcase o-rings	6N653
Exhaust backpressure regulator	6C673
Pedestal	6N639
Wastegate actuator	6F089
Exhaust backpressure valve	6N089
Turbine housing bolts	9G486

Refer to parts information for specific part number.

PERFORMANCE MODIFICATIONS

Aftermarket performance enhancing PCM programs, wastegate actuator defeat devices, propane injection packages and modification to the exhaust system, may negatively affect the life of the turbocharger, particularly in high altitudes where the "thin air" offers less resistance for the wheels to turn. The higher wheel speeds created by the "thin air" and the performance enhancers typically result in a fractured turbine wheel blade. Wheels with blades missing on "modified " engines will cause low power, vibration and ultimately turbocharger failure. Over-speeding the turbocharger may also cause turbocharger thrust bearing failure, increasing the axial endplay of the turbocharger shaft, and wheel to housing contact.



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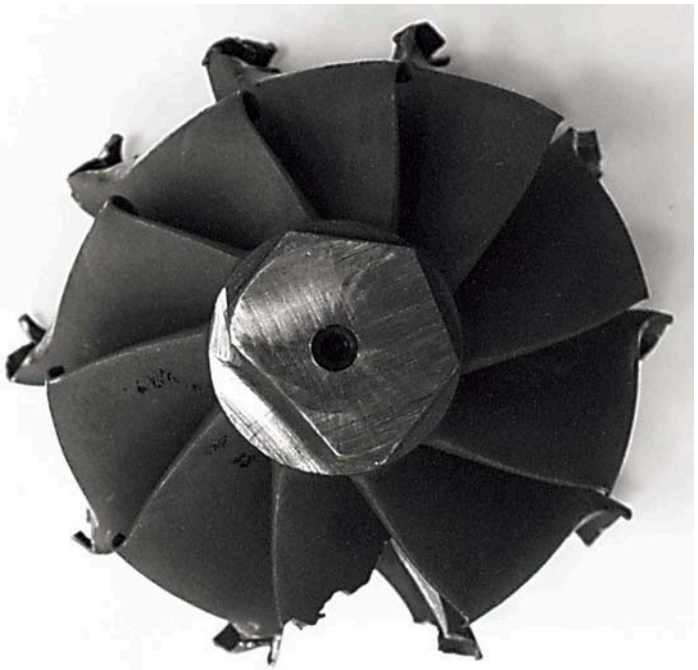
Aftermarket Performance Enhancers: Above left is a wastegate actuator defeat device which will not allow the wastegate to operate correctly.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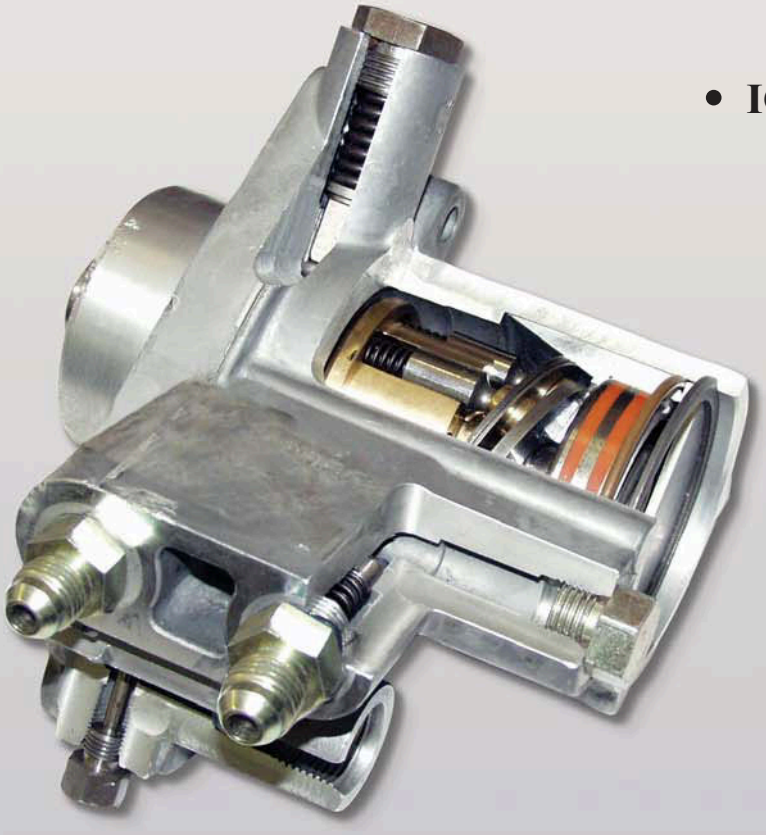
Structural Failure: Above right is a turbine wheel that has failed due to overspeed as a result of performance modifications.

Technician High Pressure Pump Guide for the 7.3 *Power Stroke* Engine

HIGH PRESSURE PUMP



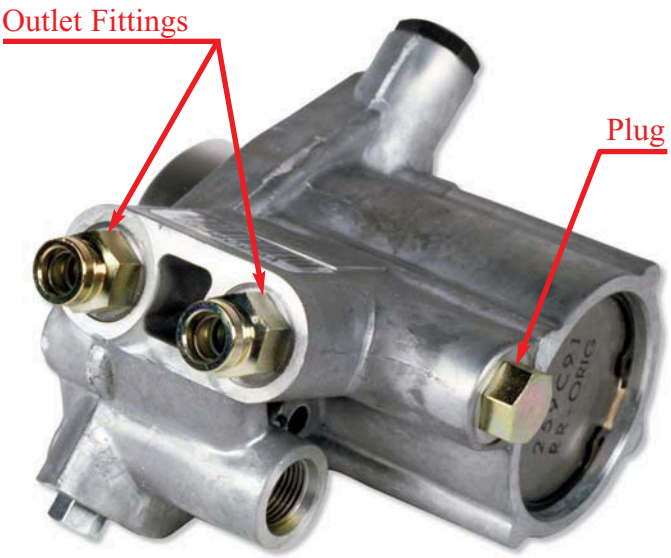
- **PUMP LEAKS**
- **ICP SYSTEM DIAGNOSTICS**
- **REPAIR PARTS**
- **TOOLS**

IPR

TEST TOOLS AND ICP

PUMP LEAK REPAIR

High pressure pumps with oil leaks at the fittings for the high pressure lines and the plug at the rear (see photo #1) can be repaired in the field using the following Ford part number 2C3Z-9G804-AA kit. This kit contains 3 o-rings, sealant, and instructions on how to clean and seal the fittings. Torque specs. for the fittings are also included.



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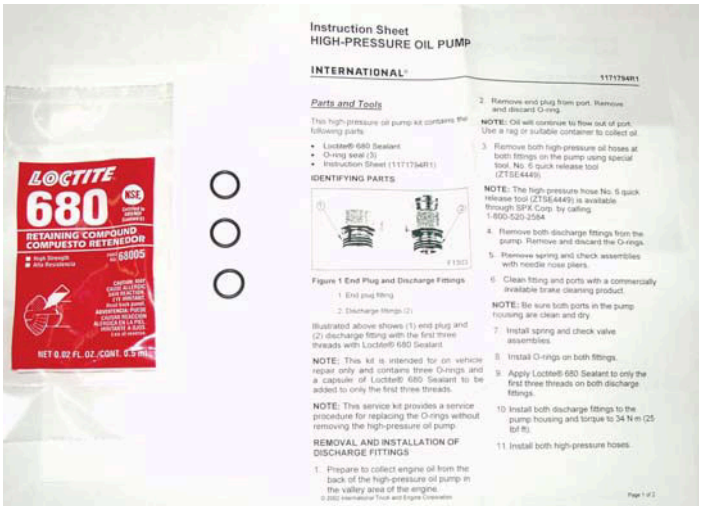

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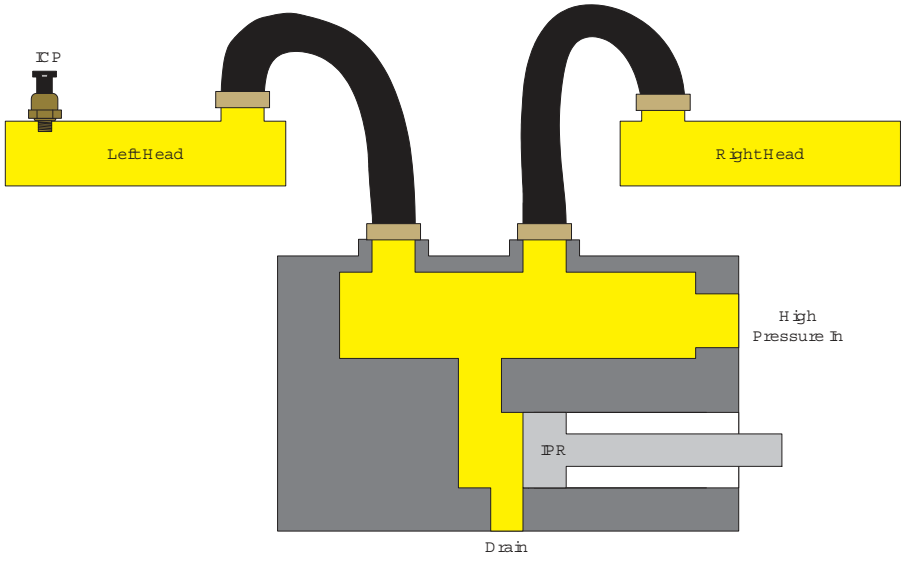
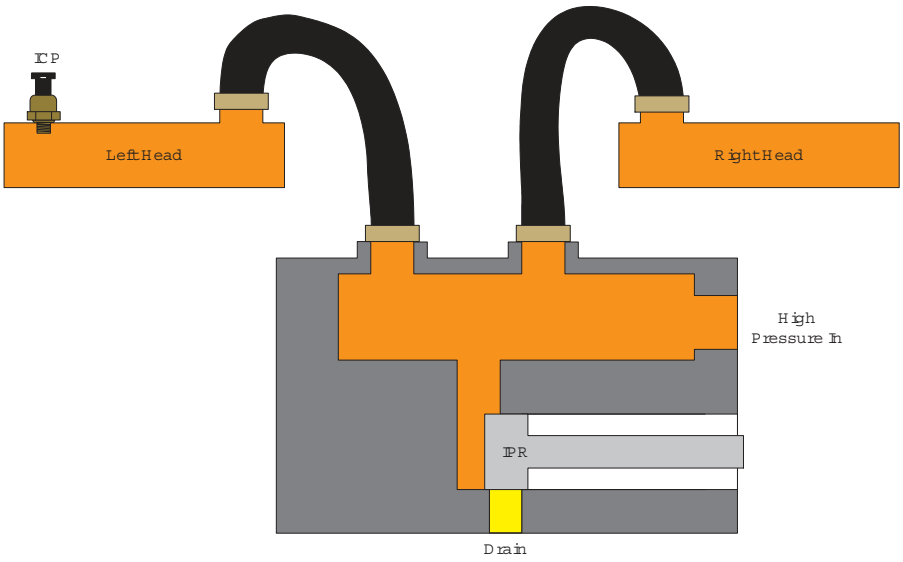
Note: Threads must be cleaned, sealant applied to the first 3 threads and the fittings and plug tightened to proper specs.

PUMP OPERATION



3

The IPR acts to increase ICP by restricting the path to drain.



With max IPR% the ICP should be at its highest value.

4

The PCM attempts to increase ICP by raising the IPR%.

KOEO	14%
Crank to Start	Less than 30% typically with no leaks and engine starts
Idle	8 - 16% @ operating temperature
Full Load	Less than 50% with no ICP system leaks
No Start (Max Command)	54% for 94 to 97 MY 65% for 98 MY or newer

Note: As a general rule 7.3 Power stroke engines require 500 psi ICP (1.0 volts ICPv) minimum to start.

1.) ICP SYSTEM DIAGNOSTICS

P1211 sets if ICP is 410 psi above or 280 psi below the desired pressure for 7.5 seconds.
P1212 sets if 725 psi of ICP is not detected in 6 to 15 seconds of cranking.
P1280 code is for ICP circuit low (often open circuits). Typical issues include, corrosion, spread pins, or improperly crimped terminals at the ICP sensor harness connector.
If a P1280 is set, the PCM will display a default value of 725psi at idle. To verify open circuit concern use ICPv.

ICP KOEO signal voltage should be between .16 to .28 volts.

2.) NO START DIAGNOSTICS

IPR% goes high with no or low ICP. - A leak exists in the ICP system - P1211 or 1212 may be present.

5

Use test plugs tool # D94T 6600 A for 94 thru 98 MY
Use test plugs tool # 303-627 & 303 - 628 (Kit #T99T-1000-E) for 99 MY and newer with quick connect connections.

CONDENSED FROM PC/ED

- Block off right bank (passenger side).
- Attempt to start
- Start indicates leak in right bank
- Reconnect hose to right bank
- Remove right side valve cover.
- Unplug injector connectors at both valve covers
- Crank the engine
- Observe spill spout of the injector and top of injector bore for oil leakage. (No oil should be coming from the spill spouts or around the injector)
- Replace injector if oil leaks from spill spout or o-rings if leak is from injector bore.

If no start - leak/loss may not be in right head, but ICP still low

- Block off left bank and move ICP into adapter
- Attempt to start
- Start indicates leak in left bank
- Reconnect hose to left bank and install ICP into left head
- Remove left side valve cover.
- Unplug injector connectors at both valve covers
- Crank the engine
- Observe spill spout of the injector and top of injector bore for oil leakage. (No oil should be coming from the spill spouts or around the injector)
- Replace injector if oil leaks from spill spout or o-rings if leak is from injector bore.

If no start / low ICP on both previous tests

- Block off both high pressure lines
- Crank engine
- If pressure is below 1000 psi remove IPR valve and inspect o-rings.
- If the IPR valve o-rings are damaged replace them with kit # F6TZ-9C977-AA and retest.
- If o-rings are ok, then replace the IPR valve and retest.

Note: Do not replace the pump and IPR at the same time. If during any repair, the oil reservoir is allowed to drain it should be refilled before attempting to restart the vehicle.

3.) ENGINE STARTS BUT HAS A P1211 CODE

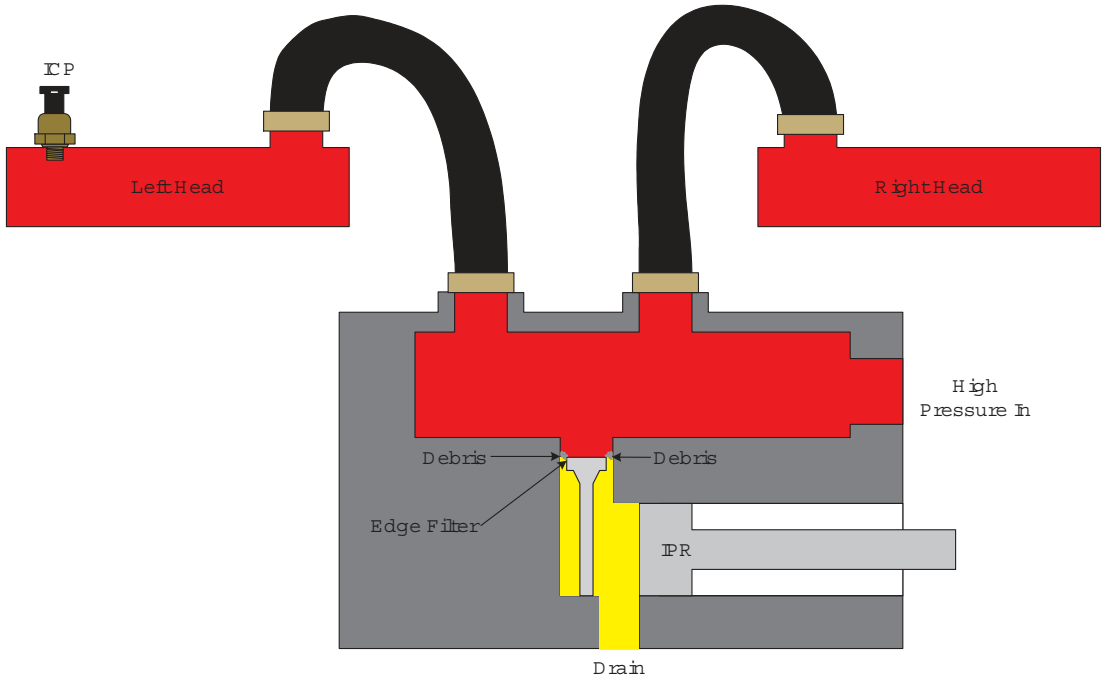
IPR% higher than expected (see chart on page #2). Stall shortly after cold start may also be a symptom. Prior to diagnosing a vehicle with a P1211, fuel pressure should be verified.

This indicates a smaller leak in the high pressure system. Using the same block off plugs described earlier to block off one bank and observing IPR% when engine is running on each bank at similar rpms. Higher IPR% on one bank compared to the other would indicate a leak on the higher IPR% bank. Example:

	LEFT BANK	RIGHT BANK
COMMAND	IPR% @ idle 16%	IPR% @ idle 26% (higher than other bank and out of spec)
CONDITION	Starts quickly	Long crank to start compared to left bank
FINDING	No leak	ICP system has leak on this bank

Repair as needed after locating leak as described in visual inspection in previous diagnostic routine.

4.) DIAGNOSING P1211 WITH IPR% LESS THAT 8 AT IDLE



6

ICP more than 410 psi above command for at least 7.5 seconds can set a P1211 code. IPR with low duty cycle (less than 8% @ idle) and engine running, indicates a restriction in the drain circuit. This restriction is taking the place of the IPR valve, driving the IPR duty cycle lower, with higher than expected ICP. The excess restriction will be in the **reservoir, front cover, stuck IPR valve**, or **debris above the edge filter**. The drain path through the reservoir and front cover can be visually verified. Typically the pump or IPR must be replaced to repair this concern. Do not replace both components at the same time.

This often occurs after the oil pan is resealed where excess sealant is forced through the lube system (short circuit check valve) and trapped at the edge filter of the high pressure pump.

7

In mid 1995 the edge filter moved out of the IPR, upstream into the pump.

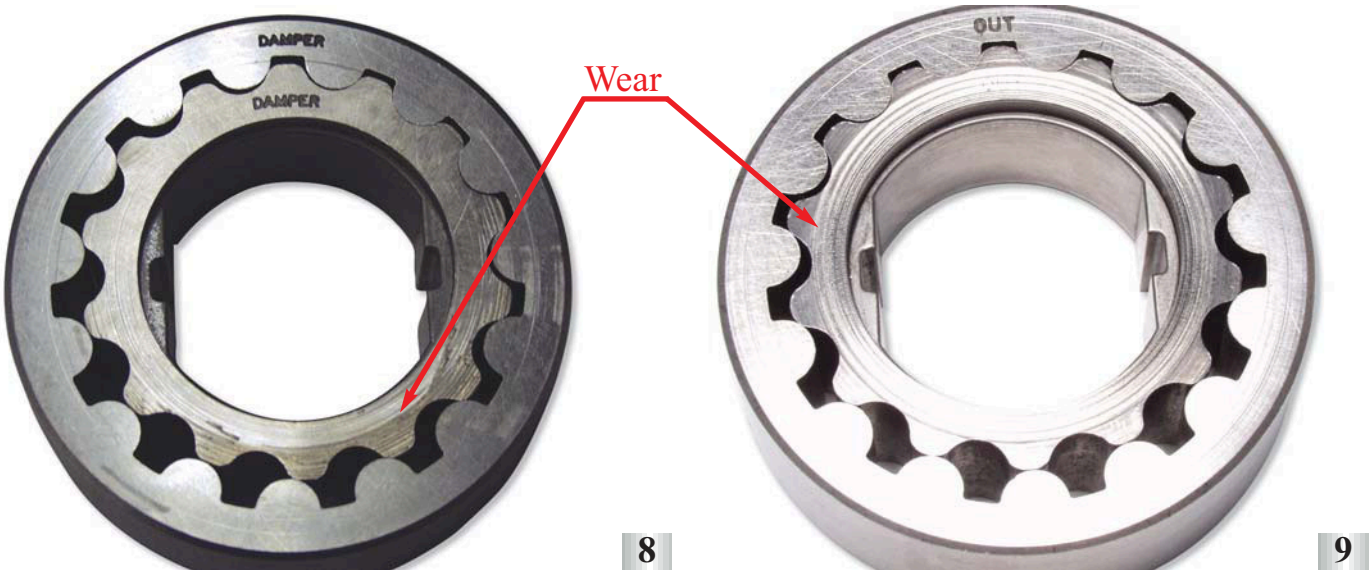
5.) ABNORMAL LONG CRANK/STALL AFTER COLD START

A worn lube oil pump can negatively affect ICP system's performance in the following ways.

- Cold engine, abnormal long crank to start.
- Cold engine, start then stall - then long crank to restart.

} **Oil pressure gauge on dash moves immediately prior to start.**

These symptoms are often mis-diagnosed as high pressure oil (ICP) concerns. Both symptoms may be caused by wear in lube oil pump or thick oil (poor maintenance).
Pump wear causes a decrease in pump efficiency. Cold, thick oil becomes difficult to move.
Any lube oil system failure can negatively affect the performance of the ICP system.



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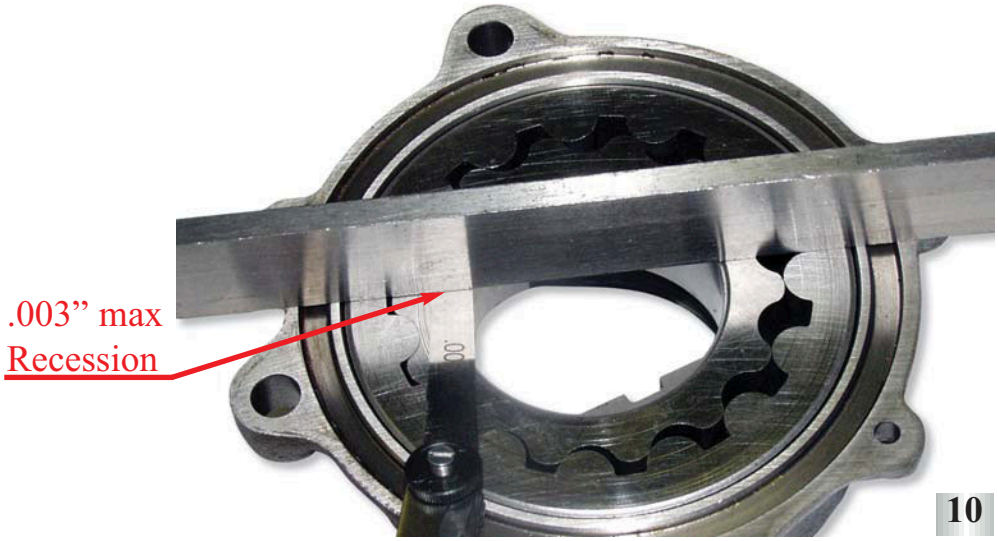

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Recession greater than .003” causes long crank to start and/or stall.

To measure pump wear, place a straight edge across the pump housing and use a feeler gauge to measure clearance between the inner gear and the straight edge. A pump with excess gear recession will contribute to hard start issues.

11 12

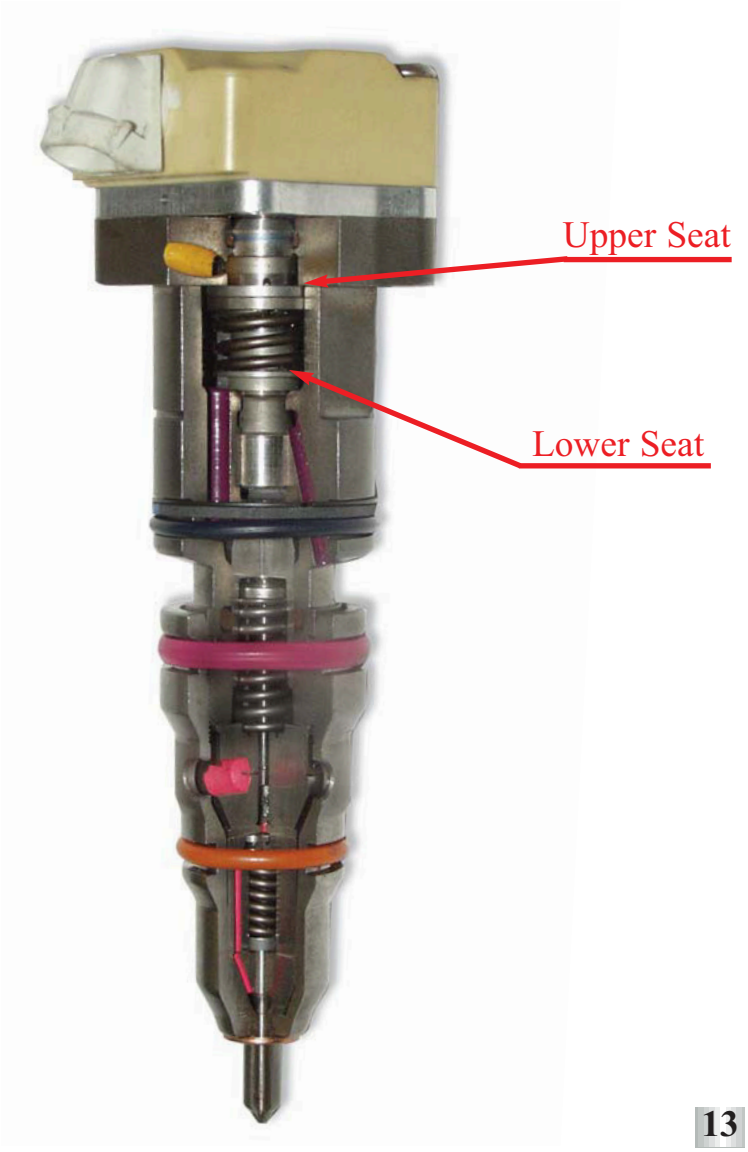
When replacing the pump, the directional markings (“OUT” or “Damper”) must face the vibration damper. If installed correctly there is a recess that the vibration damper fits into on the inner gear. If installed incorrectly, the inner gear will cause major damage to the front cover.

6.) FOR HARD START LONG CRANK OR NO START WHERE THE INJECTORS WILL NOT BUZZ LOUDLY (HAS BACKGROUND BUZZ ONLY) WHEN COLD

Some engines have a no start/or long crank to start and the injector have a low background buzz, not a strong normal buzz. After performing the buzz test multiple times the injector may start to buzz and the engine may start and run fine the rest of the day until the next cold start. Typically, we find that this is a high mileage vehicle with poor maintenance as far as oil changes are concerned. What is occurring is that the poppet inside the injector is not able to move freely because of the thick old oil. If an oil change is performed after driving the vehicle and then driven again with new oil the next cold start the engine may improve.

Note: This concern is related to poor maintenance and extended oil change intervals. If poor maintenance is the cause, then all 8 injectors will be affected. For additional information, refer to Section 3 of the Warranty & Policy Manual under "Damage Caused by Improper Maintenance."

If this is not effective refer to PC/ED injector circuitry diagnostics.



The audible sound heard while preforming an injector buzz test is the poppet stopping at the upper and lower seat during actuation.

FCS-13879-GDE

April 2003 Version 1

FCSD

Technical Training

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Phone Number _____ Course _____

Dealer P&A Code _____ Date You Took Course _____

Dealer FAX Phone _____ Your I.D. Number _____

Please write your questions, comments, or suggestions:

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If you have a concern, how would you like it resolved?

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Thanks for your Feedback!