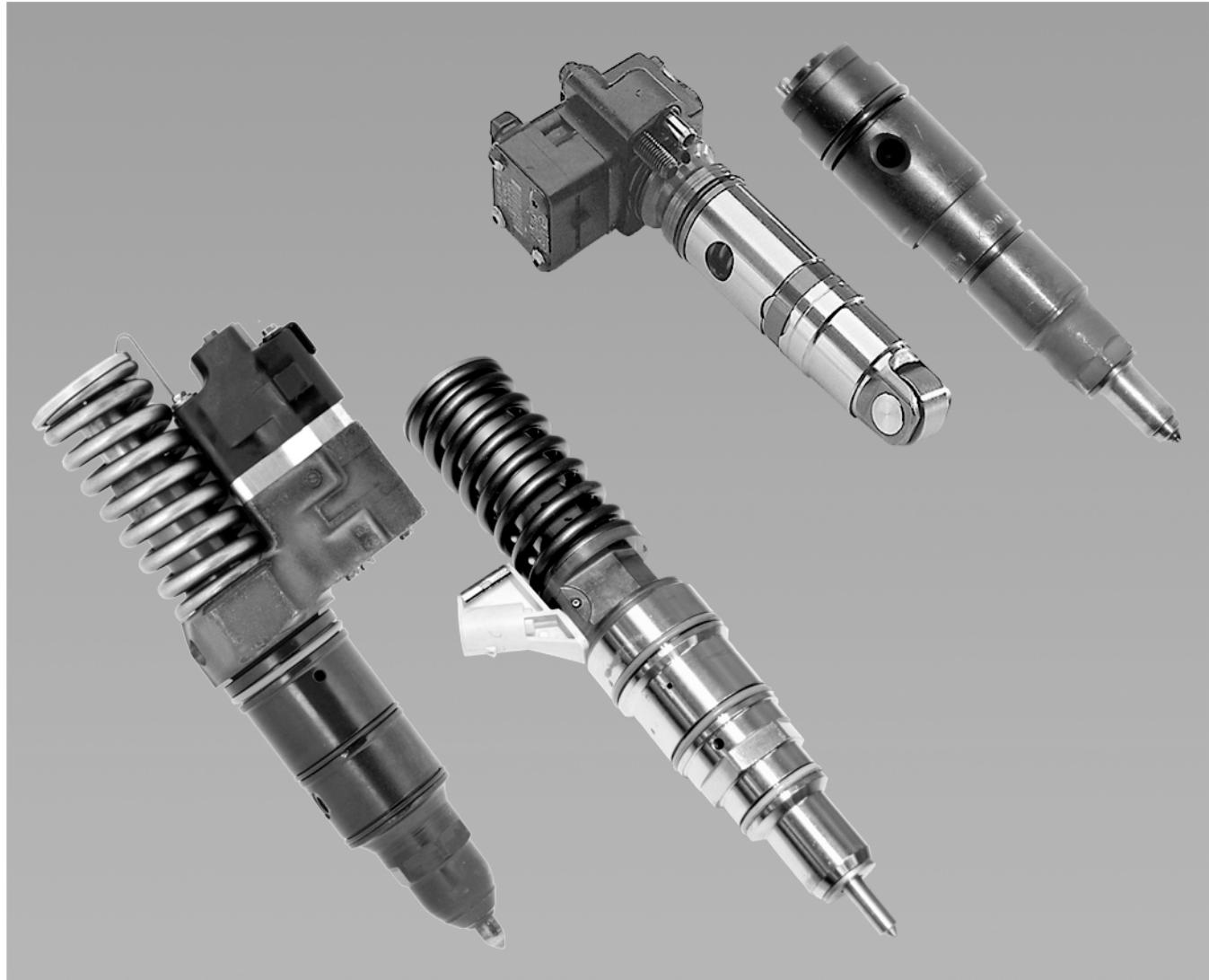


DETROIT DIESEL



Unit Fuel Injectors and Unit Pumps Technician's Guide



Inspection/Analysis

Failure Examination

Troubleshooting

ATTENTION

This document is a guideline for qualified personnel. It explains the operation of the fuel injections system for Detroit Diesel Corporation four-cycle engines and Mercedes Benz MBE 900 and MBE 4000 engines. Detroit Diesel Corporation makes no representations or warranties regarding the information contained in this document. The information contained in this document may not be complete and is subject to change without notice.

Trademark Information

Pro-Chek®, *Power Guard*®, Series 50®, Diagnostic Link®, Detroit Diesel®, DDC®, Series 60®, DDEC®, and the spinning arrows design are registered trademarks of Detroit Diesel Corporation. Fuel Pro® is a registered trademark of Davco Manufacturing, L.L.C. Biobor® is a registered trademark of United States Borax and Chemical Corporation. Pro-Link® is a registered trademark of Micro Processor Systems, Inc. All other trademarks used are the property of their respective owners.

TABLE OF CONTENTS

1	INTRODUCTION	1-1
1.1	DIESEL FUEL SYSTEM OVERVIEW	1-1
1.1.1	SERIES 50/60 ELECTRONIC UNIT INJECTOR	1-5
1.1.2	MBE 900 AND MBE 4000 UNIT PUMP AND NOZZLE	1-10
2	SAFETY	2-1
2.1	GENERAL SAFETY PRECAUTIONS TO OBSERVE WHEN WORKING ON THE ENGINE	2-2
2.1.1	EXHAUST (START/RUN ENGINE)	2-2
2.1.2	ITEMS UNDER TENSION	2-3
2.1.3	WORK PLACE	2-3
2.1.4	FLUIDS AND PRESSURE	2-4
2.1.5	GLASSES	2-5
2.1.6	FIRE	2-5
2.1.7	BATTERIES	2-6
2.1.8	CLOTHING	2-7
2.1.9	AIR	2-7
3	INSPECTION AND REMOVAL OF SYSTEMS	3-1
3.1	SERIES 50/60 UNIT INJECTOR INSPECTION/REMOVAL	3-1
3.2	MBE 900 UNIT PUMP INSPECTION/REMOVAL	3-2
3.3	MBE 4000 UNIT PUMP INSPECTION/REMOVAL	3-3
4	FUEL	4-1
4.1	FUEL ADDITIVES	4-1
4.2	AIR IN FUEL	4-1
4.3	FUEL CETANE NUMBER	4-1
4.4	FUEL FILTRATION	4-2
4.5	FUEL STABILITY	4-3
4.6	FUEL SULFUR CONTENT	4-3
4.7	FUEL TEMPERATURE	4-3
4.8	FUEL WATER CONTAMINATION	4-3
5	ELECTRONIC CONTROL SYSTEMS	5-1
5.1	DDEC ABBREVIATIONS AND TERMS	5-1
5.2	DDEC AND PRO-LINK OPERATIONS	5-3
5.2.1	RETRIEVING AND CLEARING CODES	5-3
5.2.2	UNIT INJECTOR CALIBRATION UPDATE	5-4
5.2.3	SNAPSHOT SEQUENCE	5-4
5.3	DDEC FOR MBE 900 AND MBE 4000 ENGINES	5-5
5.4	FUEL-RELATED ELECTRONIC FAULT CODES	5-5
5.4.1	FLASH CODE 37 - FUEL PRESSURE SENSOR/FUEL RESTRICTION SENSOR VOLTAGE HIGH	5-5
5.4.2	FLASH CODE 38 - FUEL PRESSURE SENSOR/FUEL RESTRICTION SENSOR VOLTAGE LOW	5-6

5.4.3	FLASH CODE 47 - AIR/FUEL PRESSURE HIGH	5-6
5.4.4	FLASH CODE 48 - AIR/FUEL PRESSURE LOW	5-6
5.4.5	FLASH CODE 61 - INJECTOR RESPONSE TIME LONG	5-7
5.4.6	FLASH CODE 71 - INJECTOR RESPONSE TIME SHORT	5-7
5.4.7	FLASH CODE 77 - ISOLATED FUEL	5-7
6	FAILURE MODES	6-1
6.1	NORMAL INJECTOR	6-2
6.2	SEIZED INJECTOR	6-3
6.3	BROKEN INJECTOR FOLLOWER SPRING AND DAMAGED STATOR WITH BROKEN STATOR SCREWS	6-4
6.4	LOOSE STOP PLATE SCREW	6-5
6.5	MISSING STOP PLATE SCREW	6-6
6.6	CRACKED INJECTOR BODY FAILURE	6-7
6.7	BROKEN SOLENOID TERMINAL SCREW FAILURE	6-8
6.8	FAILED OR BLOWN SPRAY TIP FAILURE	6-9
6.9	LOW PRESSURE PLUG LEAK	6-10
6.10	HIGH PRESSURE PLUG LEAK	6-11
6.11	BLACK OR GRAY SMOKE PROBLEM	6-12
6.12	WHITE SMOKE PROBLEM	6-12
7	INJECTOR O-RINGS	7-1
8	FUEL SYSTEM TESTS	8-1
8.1	SERIES 50/60 DDEC CYLINDER CUTOUT TEST	8-1
8.2	SERIES 50/60 FAULTY FUEL INJECTOR TEST	8-4
8.3	SERIES 50/60 DDEC IMPROPER INJECTOR CALIBRATION TEST	8-4
8.4	SERIES 50/60 DDEC HIGH PRESSURE FUEL TEST	8-6
8.5	SERIES 50/60 DDEC INSUFFICIENT FUEL FLOW TEST	8-7
8.6	MBE CYLINDER CUTOUT TEST	8-8
8.7	MBE 900 DOWNSTREAM (AFTER SECONDARY FILTER) PRESSURE TEST	8-8
8.8	MBE 900 FLOW TEST AT NOZZLE HOLDER	8-9
8.9	MBE 900 FLOW TEST AT FUEL FILTER	8-9
8.10	MBE 900 UPSTREAM PRESSURE TEST	8-11
8.11	MBE 900 INJECTOR LEAK TEST	8-12
GLOSSARY	G-1

LIST OF FIGURES

Figure 1-1	Schematic Diagram of Series 50/60 Fuel System	1-3
Figure 1-2	Schematic Diagram of MBE 900 and MBE 4000 Fuel System	1-4
Figure 1-3	Injector Cup Insert	1-5
Figure 1-4	Series 50/60 Injector Components	1-6
Figure 1-5	Injector Cycle Graph	1-7
Figure 1-6	Former Injector N2	1-8
Figure 1-7	Current Injector N3	1-8
Figure 1-8	N3 Injector Advantages Over N2 Injector	1-9
Figure 1-9	MBE Unit Pump	1-10
Figure 1-10	General MBE Fuel System	1-11
Figure 1-11	MBE 900 and MBE 4000 Unit Pump and Nozzle System	1-12
Figure 6-1	Normal Injector – No Failure	6-2
Figure 6-2	Seized Injector Failure	6-3
Figure 6-3	Broken Injector Follower Spring And Damaged Stator With Broken Stator Screws Failure	6-4
Figure 6-4	Loose Stop Plate Screw Failure	6-5
Figure 6-5	Missing Stop Plate Screw Failure	6-6
Figure 6-6	Cracked Injector Body Failure	6-7
Figure 6-7	Broken Solenoid Terminal Screw Failure	6-8
Figure 6-8	Failed or Blown Spray Tip Failure	6-9
Figure 6-9	Low Pressure Plug Leak	6-10
Figure 6-10	High Pressure Plug Leak	6-11
Figure 7-1	O-rings – N2 Injector	7-1
Figure 7-2	O-rings – N3 Injector	7-2
Figure 8-1	Cylinder Cutout Start-Up Display	8-2
Figure 8-2	Results of a Cylinder Cutout Test	8-3