



CUSTOMER NAME	DEALER NAME	P & A CODE
MODEL AND YEAR	VEHICLE GWV	TRANSMISSION
VEHICLE SERIAL NO. (VIN)	AMBIENT TEMPERATURE	ODOMETER
DATE:	ENGINE SERIAL NO.	1963 CLAIM NO.
		TYPE OF SERVICE
		PERSONAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>

-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

Hard Start / No Start Diagnostics

**1. Visual Engine/Chassis Inspection**

Fuel Oil Coolant Electrical Hoses Leaks	
Method	Check
Visual	

**2. Check Engine Oil Level** See Fig. E

- 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. H

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

Method	Check
Visual	

**4. Sufficient Clean Fuel** See Fig. A

- Check fuel tank(s), drain sample from fuel filter while cranking engine
- Note if operator has indicated that the Water in Fuel or Fuel Filter Restriction Lamp has been illuminated

Method	Checks
Visual	Front Tank Rear Tank

**5. Tandem Fuel Pump Pressure** See Fig. D

- Measure at regulator block
- Minimum 100 RPM crank speed for 20 sec.

Instrument	Spec.	Measurement
0-160 PSI Gauge	20 PSI min.	Front tank Rear tank

*If failed test 5 change fuel filter, re-test*

**6. Perform KOEO Test** See Fig. L

- Use STAR or NGS Tester
- Diagnostic Trouble Codes set before 10 are current faults and codes set after 10 are Historical faults.
- 111 = PCM pass code, 911 = IDM pass code.
- Pass Code = 10, 111, 911

Diagnostic Trouble Codes	
Current	
Historical	

**7. Check Battery Voltage**

- Measure voltage at battery while cranking engine.

Instrument	Spec.	Measurement
DVOM	7 volts minimum	

**8. Verify PCM power-up during engine cranking**

- Install breakout box between harness and PCM
- Measure voltage between VPWR pins 71 & 97 to SIG-RTN pin 91.

Instrument	Spec.	Measurement
DVOM		
71 to 91	7 Volts Min. to	
97 to 91	16 Volts Max.	

*Refer to PC/ED manual for PCM power supply diagnostics  
If voltage not present or If voltage toggles on/off.*

**9a. CAMP sensor operation** See Fig. L

- Latch the STI button on the STAR tester or ground the STI wire.
- observe the MIL lamp while cranking the engine (MIL lamp will flash with engine speed).

Method	Check
Visual	

*If MIL lamp does not flash proceed with Test 9b.*

**9b. CAMP sensor operation** See Fig. B

- Remove CAMP sensor connector
- measure volt/resistance at connector

Harness Checks		
	Spec.	Measurement
A to GND Key OFF	< 5 Ohms	
B to GND Key ON	5 Volts	
C to GND Key ON	12 Volts	

*If harness is OK replace CAMP sensor.*

**10a. Injection Control Pressure** See Fig. C

- Check during engine crank (min. 100 RPM)
- measure w/breakout bow or "T" installed

Instrument	Spec.	Measurement
DVOM	1 to 4	
87 to 91	Volts	

*If less than 1 volt check oil in reservoir before proceeding  
Perform High pressure tests only if failed 10a.*

**10b. High Pressure Leakage Test (Right Head)**

- Remove high pressure hose from right cylinder head and plug hose. See Fig. G
- Measure ICP voltage during crank

Instrument	Spec.	Measurement
DVOM	1 to 4	
87 to 91	Volts	

*If engine starts leak is in the right head.*

**High Pressure Leakage Test (Left Head)**

- Remove high pressure hose from left cylinder head and plug hose. reconnect right hose to right head See Fig. G
- Measure ICP voltage during crank

Instrument	Spec.	Measurement
DVOM	1 to 4	
87 to 91	Volts	

*If engine starts leak is in the left head.*

**High Pressure Leakage Test (Dead Head Pump)**

- Plug one hose and the ICP plugged into the second hose.
- Measure ICP while cranking engine

Instrument	Spec.	Measurement
DVOM	1 to 4	
87 to 91	Volts	

*If unable to maintain pressure with both heads blocked change the IPR valve and retest. If still unable to maintain pressure replace high pressure oil pump.*

**Note: A hard start/ no start concern with EOT temp. below 60 F perform this Test Step first.**

**10. Glow Plug System Operation** See Fig. F

**Relay Operation**

- Verify that B+ is being supplied on the large BK/W wire going to the Glow Plug relay.
- Install a voltmeter to the glow plug feed terminal (terminal with two brown wires)
- Turn key to run position, measure "ON" time Verify sufficient "ON" time and voltage.

*Note: Glow plug on time is between 10 to 120 sec. dependent on oil temp and altitude*

9 - 12 volts	Spec.	Measurement
Relay On time	10 to 120 Seconds	

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

**Glow Plug Operation**

- Measure Glow Plug Resistance to Bat. Ground.
- Remove all glow plug/injector connectors
- Measure GP Harness Resistance to Relay

Glow Plug Number	Glow Plug to Ground .1 to 2 ohms	Connector to Relay 0 to 1 ohms
#1		
#3		
#5		
#7		
#2		
#4		
#6		
#8		

See PC/ED manual, Section 18A for more detail on all of the above test steps.


94 1/2

When troubleshooting a Hard Start / No Start or Performance problem, this form must be completed and returned to receive warranty credit for diagnostic time for the parts listed below.

94 1/2

Fuel Injectors (BE527), regulator-injection control pressure (9C968), pump assembly-high pressure oil (9A543), turbo charger assembly/pedal (6K984), fuel pump (9350), IDM (12B599) and PCM (EEC) (12A850)

What problems were found and what repairs were performed?	List Part Name, Number and Serial Number of parts replaced.

	CUSTOMER NAME	DEALER NAME	P & A CODE						-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.
	MODEL AND YEAR	VEHICLE GVW	TRANSMISSION						
	VEHICLE SERIAL NO. (VIN)	MODEL AND YEAR	ODOMETER						
DATE:	ENGINE SERIAL NO.	1983 CLAIM NO.	TYPE OF SERVICE PERSONAL <input type="checkbox"/> COMMERCIAL <input type="checkbox"/>						

**Customer Concerns**

**Performance Diagnostics**

**1. Sufficient Clean Fuel** See Fig. A

- Check fuel tank(s), drain sample from fuel filter while cranking engine
- Note if operator has indicated that the Water in Fuel or Fuel Filter Restriction Lamp has been illuminated

Method	Check
Visual	

**5a. Tandem Fuel Pump Pressure** See Fig. D

- Measure at regulator block.
- Road Test- select appropriate gear to obtain a full load on the engine.

**WOT - Front Tank**

Instrument	Spec.	Measurement
0-160 PSI Gauge	30-70 PSI	

**WOT - Rear Tank**

Instrument	Spec.	Measurement
0-160 PSI Gauge	30-70 PSI	

*If fuel pressure fails low, inspect Fuel filter condition and regulator valve for debris*

**9. Low Idle Stability (ICP Pressure)** See Fig. L

- Check at low idle
- Turn A/C and all accessories off
- Monitor ICP volts w/breakout box or "T" installed

**Low Idle**

Instrument	Spec.	Measurement
DVOM 87 to 91	.7 to 1.2 volts @ IDLE	

If engine RPM is unstable disconnect the ICP sensor

- If idle speed still unstable, change IPR re-test
- If low idle smoothes out ICP signal faulty (see ICP circuit diagnostics)

**2. Check Engine Oil Level** See Fig. E

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

Method	Check
Visual	

**5b. Tandem Pump inlet Restriction** See Fig. D

- Measure at fuel inlet line
- Measure at WOT (Wide open throttle)

Instrument	Spec.	Measurement
0-30 " Hg vacuum g.	6" Hg	Front Tank Rear Tank

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

If fuel feed is not restricted below 6" Hg, check regulator valve for sticking or internal debris.

**10. Crankcase Pressure Test** See Fig. D

- Assure engine is at normal operating temp.
- Measure at oil fill with adapter and orifice tool P.N. 5631 & 014-00743 installed.
- Measure at WOT under no load.

Instrument	Spec.	Measurement
Magnehelic 0 to 60" H <sub>2</sub> O	less than 6" H <sub>2</sub> O	

If more than 6" H<sub>2</sub>O, Refer base engine in Shop Manual

**3. Intake Restriction** See Fig. H

- Check filter minder
- or Measure at WOT w/magnehelic gauge

Instrument	Check
Magnehelic/ Filter Minder	

**6. Air in Fuel System Test** See Fig. I

- Remove fuel return line from fuel filter
- Install clear line from filter to return line
- View clear line during low idle for air

Method	Checks
Visual	Front Tank Rear Tank

**11. Cylinder Contribution Test** See Fig. L

- Assure that the engine is at operating temp. 170° F (77°C) minimum before performing test
- Turn A/C and all accessories off
- Test will start following the standard KOER tests
- Codes 51 through 58 identify cylinder being tested

*Note: Engine will run rough during test*

Pass Code = 50, 111, 911

CCT Trouble Codes

**4a. Perform KOEO Test** See Fig. L

- Use STAR or NGS Tester
- Diagnostic Trouble Codes set before 10 are current faults and codes set after 10 are Historical faults.

111 = PCM pass code, 911 = IDM pass code.

Pass Code = 10, 111, 911

Diagnostic Trouble Codes
Current
Historical

*Note: Correct any applicable faults before proceeding!!*

**7. Perform KOER Test** See Fig. L

- Assure engine is at normal operating temp (170 F).

Pass Code = 111, 10, 111, 911

KOER Diagnostic Trouble Codes

**8. Injection Control Pressure Tests (Oil Aeration - Poor idle quality)** See Fig. C

- Monitor ICP with a DVOM
- Turn A/C and all accessories off
- Hold engine speed at 3400 RPM for 3 minutes.

**High Idle**

Instrument	Spec.	Measurement
DVOM 87 to 91	1.1 to 2.0 volts @ 3400 RPM	

If ICP signal increases above 1.75 volts after 3 minutes anti-foam oil additives may have become depleted from oil, change oil re-test.

**12. Exhaust Restriction** See Fig. J & K

- Visually inspect exhaust system for damage
- Verify EBP device is open at WOT
- With breakout box or "T" installed and engine temperature at 170° F minimum
- Using DVOM measure exhaust back pressure at 3400 RPM

Instrument	Spec.	Measurement
DVOM 30 to 91	1.9 volts max.	

**4b. KOEO Injector Electrical Self-Test** See Fig. L

- Use STAR or NGS Tester
- All injectors will momentarily buzz, then individual injectors will buzz in sequence 1 through 8.
- Diagnostic Trouble Codes will be transmitted after test is completed.

Pass Code = 111, 10, 111, 911

Injector Trouble Codes

*Refer to PC/ED manual Pinpoint tests if Diagnostic Trouble Codes are set.*

Hook up engine test equipment.

Start engine. As engine warms up Perform following checks.

**13. Boost Pressure Test** See Fig. D

- Verify that MAP hose is not open or pinched
- Road Test - select appropriate gear to obtain desired engine speed at full load throttle position.

Instrument	Spec.	Measurement
0-30 PSI Gauge	15 PSI min. @ 3000 RPM	

Measure between 2500 to 3000 RPM

**See PC/ED manual, Section 18A for more detail on all of the above test steps.**

94 1/2

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94 1/2

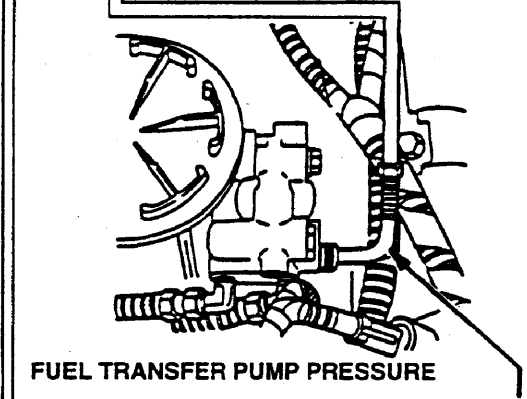
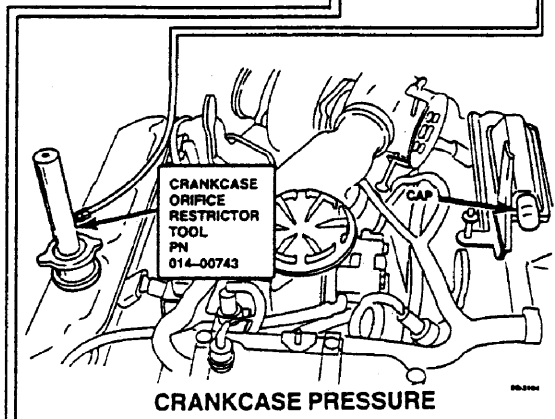
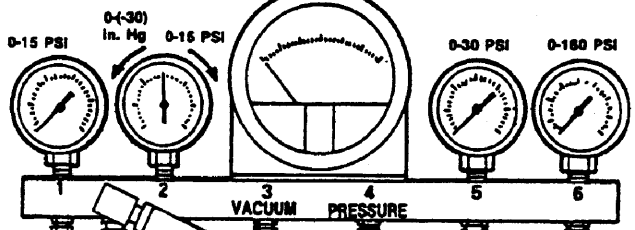
Fuel Injectors (9E527), regulator-injection control pressure (9C988), pump assembly-high pressure oil (9A543), turbo charger assembly/pedalast (9K984), fuel pump (9350), IDM (12B599) and PCM (EEC) (12A650).

What problems were found and what repairs were performed?	List Part Name, Number and Serial Number of parts replaced.

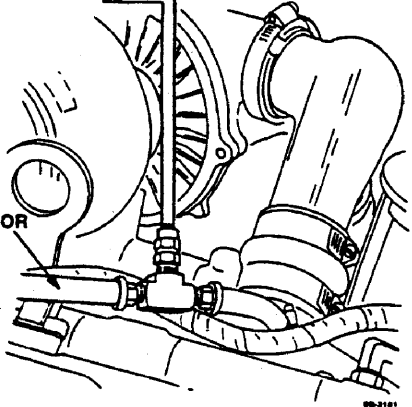
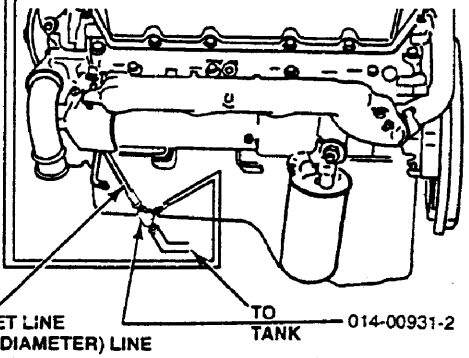
# SETUP ILLUSTRATION OF ROTUNDA™ 014-00761

FIGURE D

0-80" H<sub>2</sub>O

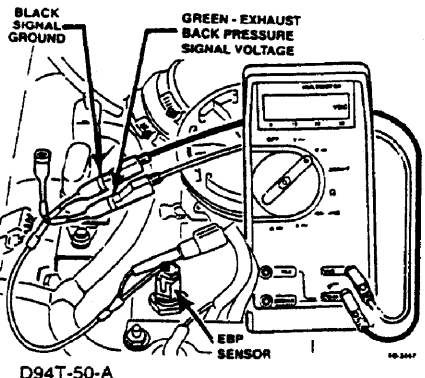


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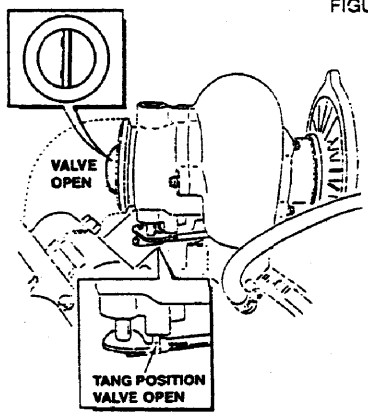
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FIGURE J



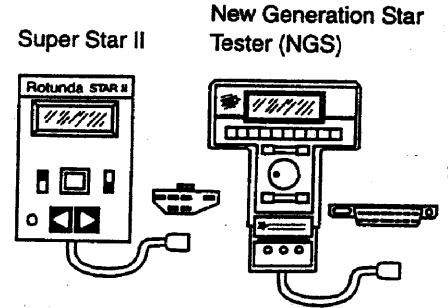
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FIGURE K



EXHAUST RESTRICTION

FIGURE L



Diagnostic Tests with Star II Tester for 94 1/2 (NGS) for 94 1/2 to 97

