



ESG-642 4.2 LITER

The Source for Power...
WorldwideTM

INDUSTRIAL ENGINE SERVICE MANUAL



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Ford Power Products

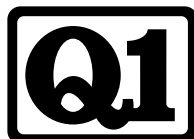
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HEALTH & SAFETY

 **WARNING: THE FOLLOWING HEALTH AND SAFETY RECOMMENDATIONS SHOULD BE CAREFULLY OBSERVED.**



CARRYING OUT CERTAIN OPERATIONS AND HANDLING SOME SUBSTANCES CAN BE DANGEROUS OR HARMFUL TO THE OPERATOR IF THE CORRECT SAFETY PRECAUTIONS ARE NOT OBSERVED. SOME SUCH PRECAUTIONS ARE RECOMMENDED AT THE APPROPRIATE POINTS IN THIS BOOK.

WHILE IT IS IMPORTANT THAT THESE RECOMMENDED SAFETY PRECAUTIONS ARE OBSERVED, CARE NEAR MACHINERY IS ALWAYS NECESSARY, AND NO LIST CAN BE EXHAUSTIVE. ALWAYS BE CAUTIOUS TO AVOID POTENTIAL SAFETY RISKS.

The following recommendations are for general guidance:

1. Always wear correctly fitting protective clothing which should be laundered regularly. Loose or baggy clothing can be extremely dangerous when working on running engines or machinery. Clothing which becomes impregnated with oil or other substances can constitute a health hazard due to prolonged contact with the skin even through underclothing.
2. So far as practicable, work on or close to engines or machinery only when they are stopped. If this is not practicable, remember to keep tools, test equipment and all parts of the body well away from the moving parts of the engine or equipment—fans, drive belts and pulleys are particularly dangerous. The electric cooling fan used on some installations is actuated automatically when the coolant reaches a specified temperature. For this reason, care should be taken to ensure that the ignition/isolating switch is OFF when working in the vicinity of the fan as an increase in coolant temperature may cause the fan suddenly to operate.
3. Avoid contact with exhaust pipes, exhaust manifolds and silencers when an engine is, or has recently been running; these can be very hot and can cause severe burns.
4. Many liquids used in engines or vehicles are harmful if taken internally or splashed into the eyes. In the event of accidentally swallowing gasoline (petrol), oil, diesel fuel, antifreeze, battery acid etc, DO NOT ENCOURAGE VOMITING AND OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.

Wear protective goggles when handling liquids which are harmful to the eyes; these include ammonia and battery acid. If any of these substances are splashed in the eyes, wash out thoroughly with clean water and OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.

 **WARNING:** 
The Engine Exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

IMPORTANT SAFETY NOTICE

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

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ESG-642

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DESCRIPTION

Introduction

This section covers various engine tests, adjustments, service procedures and cleaning/inspection procedures. Engine assembly and service specifications appear at the end of the Section 02.


For engine disassembly, assembly, installation, adjustment procedures and specifications, refer to Section 02.

The ESG 642 engine incorporates a closed-type crankcase ventilation system.

To maintain the required performance level, the fuel system, ignition system and engine must be kept in good operating condition and meet recommended adjustment specifications.



Before replacing damaged or worn engine components such as the crankshaft, cylinder head, valve guide, valves, camshaft or cylinder block, make sure part(s) is not serviceable.

 **WARNING: TO AVOID THE POSSIBILITY OF PERSONAL INJURY OR DAMAGE, DO NOT OPERATE THE ENGINE UNTIL THE FAN BLADE HAS FIRST BEEN EXAMINED FOR POSSIBLE CRACKS OR SEPARATION.**

 **CAUTION: Use of abrasive grinding discs to remove gasket material from the engine sealing surfaces during repair procedures can contribute to engine damage and wear. Airborne debris and abrasive grit from the grinding disc may enter the engine through exposed cavities causing premature wear and eventual engine damage.**

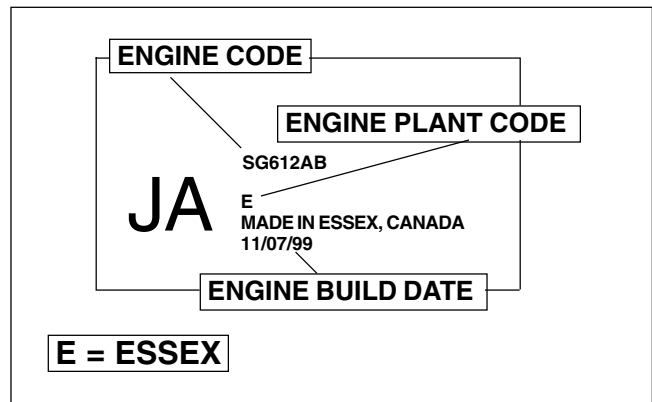
Ford Power Products does not recommend using abrasive grinding discs to remove engine gasket material. Use manual gasket scrapers for removing gasket material from the engine sealing surfaces.

Take added care to prevent scratching or gouging aluminum sealing surfaces.

	Serial Number: 01234-1-05-98
	Model Number: ESG-642-6007-AA
Base Engine Code:	Build Date: 05-28-1998
Distributor S.O. Number: FORD POWER PRODUCTS	
Prior 2001	
	Serial Number: 37827-1-04-98
	Model Number: ESG 642
Base Engine Code: 6C-276-AA	Base Engine Build Date: 01/02/2001
Distributor S.O. Number:	Reference:
2001	

Engine Identification Nameplate

For quick engine identification, refer to the Engine Identification Nameplate. The nameplates lists engine information required for proper servicing of the engine. The Engine Identification Nameplate and identification label provide information pertaining to engine displacement, serial number, model number, S.O./Options, and model code.



Engine Code Decal

An engine code decal is attached to the engine front cover. The symbol code on the decal identifies each engine for determining parts usage.

SAFETY NOTICE

There are numerous variations in procedures, techniques, tools and parts for servicing equipment, 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 the instructions provided in this Manual must first establish that neither personal safety nor equipment integrity are compromised by the choice of methods, tools or parts.

NOTES, CAUTIONS, AND WARNINGS

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES gives 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 equipment. 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 the equipment.



GENERAL WARNINGS:

TO HELP AVOID INJURY:

- **ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.**
- **USE SAFETY STANDS WHENEVER A PROCEDURE REQUIRES YOU TO BE UNDER THE EQUIPMENT.**
- **BE SURE THAT THE IGNITION SWITCH IS ALWAYS IN THE OFF POSITION, UNLESS OTHERWISE REQUIRED BY THE PROCEDURE.**
- **SET THE PARKING BRAKE (IF EQUIPPED) WHEN WORKING ON THE EQUIPMENT. IF YOU HAVE AN AUTOMATIC TRANSMISSION, SET IT IN PARK (ENGINE OFF) OR NEUTRAL (ENGINE ON) UNLESS INSTRUCTED OTHERWISE FOR A SPECIFIC OPERATION. PLACE WOOD BLOCKS (4" X 4" OR LARGER) TO THE FRONT AND REAR SURFACES OF THE TIRES TO PROVIDE FURTHER RESTRAINT FROM INADVERTENT EQUIPMENT MOVEMENT.**
- **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 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 EQUIPMENT.**
- **ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING BEFORE BEGINNING TO WORK ON THE EQUIPMENT. TIE LONG HAIR SECURELY BEHIND THE 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.**

Battery Handling and Charging

The handling and correct use of lead acid batteries is not as hazardous provided that sensible precautions are observed and that operatives have been trained in their use and are adequately supervised.

It is important that all labelling on the battery is carefully read, understood and complied with. The format of the following symbols and labels is common to most brands of lead acid battery.



Fig. 1—Typical Battery Labelling

1. *Explosive gases*
2. *Eye protection must be WORN*
3. *No smoking or naked flames*
4. *Corrosive acid*
5. *Flush eyes immediately when contacted with acid*
6. *CAUTION/IMPORTANT notice*
7. *Read relevant instructions*
8. *Keep away from children*
9. *Do not dispose of as household waste*
10. *Recycle (via recognized disposal system)*
11. *Electrical current may cause injury to personnel.*

NOTE: Observe all manufacturers' instructions when using charging equipment.



CAUTION: Batteries should not be charged in the vehicle or equipment. May damage electrical components

FOREWORD

This book contains operating and maintenance instructions for the engine(s) listed on the title page.

The life of your engine unit and the delivery of the high performance built into it will depend on the care it receives throughout its life. It is the operator's responsibility to ensure that the engine is correctly operated and that the maintenance operations outlined in this book are carried out regularly after the specified hours of operation have been reached. We consider it to be in your interests to enlist the aid of an authorized Ford Dealer (Europe) or Ford Power Products Distributor (USA) not only when repairs are required but also for regular maintenance. Distributors are listed at the back of this manual.

Regular maintenance will result in minimal operating costs.

Engines manufactured by Ford Motor Company are available through Ford Power Products Dealers or Distributors. When in need of parts or service, contact your local Authorized Dealer or Distributor. In overseas territories, in the event of difficulties, communicate directly with the supervising Ford affiliated Company in your area whose address appears at the end of this book.

Where the terms "Right" or "Left" occur in this publication, they refer to the respective sides of the engine when viewed from the rear or flywheel end.

Pistons and valves are numbered from the front or timing cover end of the engine commencing at No. 1.

You may find that your engine assembly includes optional equipment not specifically covered in the following text. Nevertheless, the maintenance procedures outlined in this book still apply to your engine.

ENGINE IDENTIFICATION

Because Ford Power Products markets such a wide range of industrial engines – manufactured both in the U.S. and overseas – it is important that you have as complete identification of the engine as possible in order to provide the correct replacement parts. New engines being shipped include a standard parts listing describing the parts which does not tell the owner the part number. It remains a distributor function to identify the part number. The key to identifying the engine is the identification decal mounted on the engine rocker cover. That decal provides not only the engine serial number, but also the exact model or type, options and S.O. (Special Order). The combination of that data permits you to isolate the precise engine, build level and customer so you can determine the correct replacement parts.

EUROPEAN SERVICE IDENTIFICATION PLATE

This plate (Fig. 2) is fixed to the engine in a prominent position. Panels 1 to 11 on the plate refer to various engine details as listed here.

Detail Title

1. Engine model identification.
2. Engine capacity.
3. Serial No: This identifies the engine as supplied by Power Products Engineering.

Date: The two letters following the serial No. indicate the year and month in which the specified build components were assembled - refer to the chart, Fig 3.

NOTE: These markings should not be confused with any that may be stamped or etched into the crankcase of the basic engine.

4. Selective Build Number indicates the complete specification. The digit to the extreme right hand side is the build chart issue number.
5. Engine operating rpm. An asterisk denotes speed set by customer.
6. Not applicable.
7. Not applicable.
8. }
9. } Applicable to diesel engines only.
10. }
11. This box is provided for Equipment Manufacturers' use when extra equipment is fitted outside of the Ford Motor Company. Reference should be made to the Equipment Manufacturer for any information or parts required.

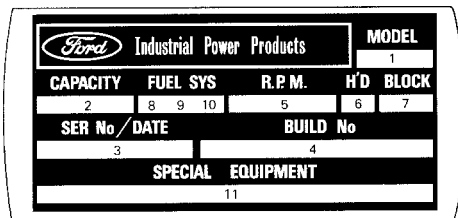


Fig. 2 – Service Identification Plate

1997	U	B	R	A	G	C	K	D	E	L	Y	S	T
1998	V	J	U	M	P	B	R	A	G	C	K	D	E
1999	W	L	Y	S	T	J	U	M	P	B	R	A	G
2000	X	C	K	D	E	L	Y	S	T	J	U	M	P
2001	Y	B	R	A	G	C	K	D	E	L	Y	S	T
2002	Z	J	U	M	P	B	R	A	G	C	K	D	E

Fig. 3 – Build Date Chart

NOTES: The letters I, O and Q are not used in the year column. The letter representing the month repeats every five years.

U.S.A. ENGINE IDENTIFICATION DECAL

An identification Decal is affixed to the valve cover of the engine. The decal contains the engine serial number which identifies this unit from all others. Use all numbers when seeking information or ordering replacement parts for this engine.

01 - Serial Number: Has a total of 10 numbers.


02 - Model Number

For a handy reference, this information is recorded on your Ford Power Products Operations Engine Registration copy (Form #194-103-D).


PARTS AND SERVICE

Replacement parts can be obtained through your local Ford Power Products Distributors or Dealers listed in the back portion of this handbook. They also may be found in the yellow pages under "Engines" or contact Ford Power Products: 1-800 833-4773 U.S.A., 49221-94700551 Europe, or 441708-858415 Great Britain.

Ford Power Products Distributors and Dealers are equipped to perform major and minor repairs. They are anxious to see that all of your maintenance and service needs are quickly and courteously completed.

	Serial Number: 01234-1-05-98	
	Model Number: ESG-642-6007-AA	
Base Engine Code:	Build Date:	
	05-28-1998	
Distributor S.O. Number:		
FORD POWER PRODUCTS		

Prior 2001

	Serial Number: 37827-1-04-98	
	Model Number: ESG 642	
Base Engine Code:	Base Engine Build Date:	
6C-276-AA	01/02/2001	
Distributor S.O. Number:	Reference:	

2001

DESCRIPTION AND OPERATION

Engine System

This section covers general procedures and diagnosis and testing of the engine system, including exhaust emission control devices, which are also covered in the EFI Diagnostic Manual.¹

The engines incorporate the following features:

- A closed positive crankcase ventilation (PCV) system.
- An exhaust emission control system.

The engine, fuel system, ignition system, emissions system and exhaust system all affect exhaust emission levels and must be maintained according to the maintenance schedule. Refer to the Maintenance and Operator's Manual 194-308 or call 1-800-833-4773 for the nearest Ford Power Product's Distributor/Dealer. They are also listed in the back section of this manual.

Correct engine identification is required to order parts.

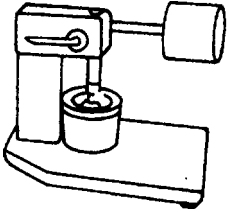
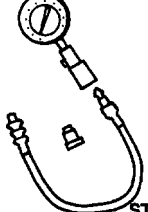
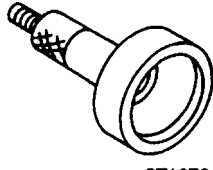
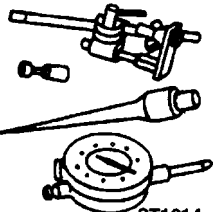
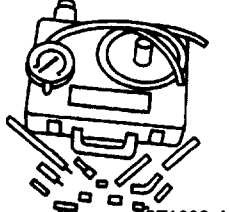

For complete vehicle and engine identification codes, refer to this Section.

¹ Can be purchased as a separate item PFF-194-306 from your nearest Ford Power Products Distributor/Dealer listed in back section of this manual.


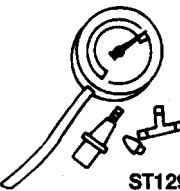
DIAGNOSIS AND TESTING

Engine System

Special Tool(s)

	Commercially Available Leakdown Tester
	Compression Tester 014-00707 or Equivalent
	Cup Shaped Adapter TOOL-6565-AB or Equivalent
	Dial Indicator with Bracketry TOOL-4201-C or Equivalent
	Engine Cylinder Leak Detection/Air Pressurization Kit 014-00705 or Equivalent
	Engine Oil Pressure Gauge T73L-6600-A

Special Tool(s)

	12 Volt Master UV Diagnostic Inspection Kit 164-R0756 or Equivalent
	Vacuum/Pressure Tester 164-R0253 or Equivalent

Inspection and Verification

1. Verify the customer concern by operating the engine to duplicate the condition.
2. Visually inspect for obvious signs of mechanical and electrical damage. Refer to the following chart.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none"> • Engine coolant leaks • Engine oil leaks • Fuel leaks • Damaged or severely worn pads • Loose mounting bolts, studs, and nuts

3. If the inspection reveals obvious concerns that can be readily identified, repair as required.
4. If the concerns remain after the inspection, determine the symptoms and go to the symptom chart.

Special Service Tools called for by the procedures can be obtained by calling:
1-800-ROTUNDA (1-800-768-8632).

DIAGNOSIS AND TESTING

Symptom Chart

ENGINE OPERATION

Condition	Possible Source	Action
<ul style="list-style-type: none"> • Difficult Starting 	<ul style="list-style-type: none"> • Damaged starting system. • Damaged charging system/ battery. • Burnt valve. • Worn piston. • Worn piston rings. • Worn cylinder. • Damaged cylinder head gasket. • Damaged fuel system. • Damaged ignition system. 	<ul style="list-style-type: none"> • REFER to Section 07 • REFER to Section 06 • REPLACE valve. • REPLACE piston and pin. • REPAIR or REPLACE cylinder blocks. • REPLACE cylinder head gasket. • Refer to Section 04. • Refer to Section 03.
<ul style="list-style-type: none"> • Poor Idling 	<ul style="list-style-type: none"> • Damaged hydraulic valve tappet or hydraulic lash adjuster. • Damaged hydraulic valve tappet guide or hydraulic lash adjuster. • Improper valve-to-valve seat contact. • Damaged cylinder head gasket. • Malfunctioning or damaged fuel system. • Malfunctioning or damaged ignition system. • Malfunctioning or damaged IAC motor or system. 	<ul style="list-style-type: none"> • REPLACE hydraulic valve tappet or hydraulic lash adjuster. • REPLACE hydraulic valve tappet guide or hydraulic lash adjuster. • REPLACE valve or valve seat. • REPLACE cylinder head gasket. • Refer to EFI Diagnostic Manual or Section 04 of this manual². • Refer to EFI Diagnostic Manual or Section 03 of this manual². • Section 03 of this manual.
<ul style="list-style-type: none"> • Abnormal Combustion 	<ul style="list-style-type: none"> • Damaged hydraulic valve tappet or hydraulic lash adjuster. • Damaged hydraulic valve tappet guide or hydraulic lash adjuster. • Burnt or sticking valve. • Weak or broken valve spring. • Carbon accumulation in combustion chamber. • Malfunctioning or damaged fuel system. • Malfunctioning or damaged ignition system. 	<ul style="list-style-type: none"> • REPLACE hydraulic valve tappet or hydraulic lash adjuster. • REPLACE hydraulic valve tappet guide or hydraulic lash adjuster. • REPAIR or REPLACE valve. • REPLACE valve spring. • ELIMINATE carbon buildup. • Refer to EFI Diagnostic Manual or Section 04 of this manual². • Refer to EFI Diagnostic Manual or Section 03 of this manual².

² Can be purchased as a separate item PFF-194-306 from your nearest Ford Power Products Distributor/Dealer listed in back section of this manual.

DIAGNOSIS AND TESTING (Continued)**ENGINE OPERATION**

Condition	Possible Source	Action
<ul style="list-style-type: none"> • Excessive Oil Consumption 	<ul style="list-style-type: none"> • Worn piston ring groove. • Sticking piston rings. • Worn piston or cylinders. • Worn valve stem seal. • Worn valve stem or valve guide. • Leaking oil. 	<ul style="list-style-type: none"> • REPLACE piston and pin. • REPAIR or REPLACE piston rings. • REPAIR or REPLACE piston or cylinder blocks. • REPLACE valve stem seal. • REPLACE valve stem and guide. • REPAIR oil leakage.
<ul style="list-style-type: none"> • Engine Noise 	<ul style="list-style-type: none"> • Excessive main bearing oil clearance. • Seized or heat damaged main bearing. • Excessive crankshaft end play. • Excessive connecting rod bearing oil clearance. • Heat damaged connecting rod bearing. • Damaged connecting rod bushing. • Worn cylinder. • Worn piston or piston pin. • Damaged piston rings. • Bent connecting rod. • Malfunctioning hydraulic valve tappet or hydraulic lash adjuster. • Excessive hydraulic valve tappet or hydraulic lash adjuster clearance. • Broken valve spring. • Excessive valve guide clearance. • Malfunctioning or damaged cooling system. • Malfunctioning or damaged fuel system. • Leaking exhaust system. • Improper drive belt tension. • Malfunctioning generator bearing. • Loose timing chain/belt. • Damaged timing belt tensioner. • Malfunctioning water pump bearing. 	<ul style="list-style-type: none"> • ADJUST clearance or REPLACE main bearing. • REPLACE main bearing. • REPLACE crankshaft thrust main bearing. • REPLACE connecting rod. • REPLACE connecting rod bearing. • REPLACE connecting rod bushing. • REPAIR or REPLACE cylinder blocks. • REPLACE piston or piston pin. • REPLACE piston rings. • REPLACE connecting rod. • REPLACE hydraulic valve tappet or hydraulic lash adjuster. • ADJUST clearance or REPLACE hydraulic valve tappet guide or hydraulic lash adjuster. • REPLACE valve spring. • REPAIR clearance or REPLACE valve guide/stem. • REFER to Section 05. • Refer to Section 04. • REPAIR exhaust leakage. • REFER to Section 05. • REFER to Section 06 for diagnosis and testing of the generator. • ADJUST or REPLACE timing chain/belt. • REPLACE timing belt tensioner. • Replace water pump.

DIAGNOSIS AND TESTING (Continued)

ENGINE OPERATION

Condition	Possible Source	Action
<ul style="list-style-type: none"> • Insufficient Power 	<ul style="list-style-type: none"> • Malfunctioning hydraulic valve tappet or hydraulic lash adjuster. • Damaged hydraulic valve tappet guide or hydraulic lash adjuster. • Compression leakage at valve seat. • Seized valve stem. • Weak or broken valve spring. • Damaged cylinder head gasket. • Cracked or distorted cylinder head. • Damaged, worn or sticking piston ring(s). • Worn or damaged piston. • Malfunctioning or damaged fuel system. • Malfunctioning or damaged ignition system. • Damaged or plugged exhaust system. 	<ul style="list-style-type: none"> • REPLACE hydraulic valve tappet or hydraulic lash adjuster. • REPLACE hydraulic valve tappet guide or hydraulic lash adjuster. • REPAIR or REPLACE valve, valve seat or cylinder head. • REPLACE valve stem. • REPLACE valve spring. • REPLACE cylinder head gasket. • REPLACE cylinder head. • REPAIR OR REPLACE piston ring(s). • REPLACE piston. • Refer to Section 04. • Refer to Section 03. • REPAIR OR REPLACE exhaust system.

Component Tests

Engine Oil Leaks

NOTE: When diagnosing engine oil leaks, the source and location of the leak must be positively identified prior to service.

Prior to performing this procedure, clean the cylinder block, cylinder heads, valve covers (6582), oil pan (6675) and flywheel (6375) with a suitable solvent to remove all traces of oil.

Fluorescent Oil Additive Method

Use the 12 Volt Master UV Diagnostic Inspection Kit to perform the following procedure for oil leak diagnosis.

1. Clean the engine with a suitable solvent to remove all traces of oil.

2. Drain engine oil crankcase and refill with recommended oil, premixed with Diesel Engine Oil Dye 164-R3705 meeting Ford specification ESE-M9C103-B1 or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If the oil is not premixed, fluorescent additive must first be added to crankcase.

3. Run the engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using the 12 Volt Master UV diagnostic Inspection Kit. A clear bright yellow or orange area will identify the leak. For extremely small leaks, several hours may be required for the leak to appear.

DIAGNOSIS AND TESTING (Continued)

4. If necessary, pressurize the main oil gallery system to locate leaks due to improperly sealed, loose or cocked plugs.
5. Repair all leaks as required.

Pressure Method

The crankcase can be pressurized to locate oil leaks. The following materials are required to fabricate the tool to be used:

- air supply and air hose
- air pressure gauge that registers pressure in 4 kPa (1 psi) increments
- air line shutoff valve
- appropriate fittings to attach the above parts to oil fill, PCV grommet hole and crankcase ventilation tube (6758)
- appropriate plugs to seal any openings leading to the crankcase
- a solution of liquid detergent and water to be applied with a suitable applicator such as a squirt bottle or brush

Fabricate the air supply hose to include the air line shutoff valve and the appropriate adapter to permit the air to enter the engine through the crankcase ventilation tube. Fabricate the air pressure gauge to a suitable adapter for installation on the engine at the oil filler opening.

Testing Procedure

- Open the air supply valve until the pressure gauge maintains 34 kPa (5 psi).
- Inspect sealed or gasketed areas for leaks by applying a solution of liquid detergent and water over areas for formation of bubbles which indicates leakage.

Leakage Points

Examine the following areas for oil leakage.

- valve cover gaskets (6584)
- intake manifold gaskets (9461)
- cylinder head gaskets
- oil bypass filter (6714)
- oil pump and filter body (6603)
- oil level indicator tube connection
- oil pressure sensor (9278)

Under Engine

- oil pan gaskets (6710)
- oil pan sealer
- oil pan rear seal (6723)
- engine front cover gasket
- crankshaft front seal (6700)
- crankshaft rear oil seal (6701)
- crankshaft main bearing cap side bolts
- oil pump and filter body (4.2L engine)

With Transmission and Flywheel Removed

NOTE: Air leakage in the area around a crankshaft rear oil seal does not necessarily indicate a crankshaft rear oil seal leak. However, if no other cause can be found for oil leakage, assume that the crankshaft rear oil seal is the cause of the oil leak.

NOTE: Light foaming equally around valve cover bolts and crankshaft seals is not detrimental; no repairs are required.

- crankshaft rear oil seal
- rear main bearing cap parting line
- rear main bearing cap and seals
- flywheel mounting bolt holes (with flywheel installed)
- camshaft rear bearing covers (6266) or pipe plugs at the end of oil passages

Oil leaks at crimped seams in sheet metal parts and cracks in cast or stamped parts can be detected when pressurizing the crankcase.

Compression Tests

Compression Gauge Check

1. Make sure the oil in the crankcase is of the correct viscosity and at the proper level and that the battery (10655) is properly charged. Operate the vehicle until the engine is at normal operating temperature. Turn the ignition switch to the OFF position, then remove all the spark plugs (12405).
2. Set the throttle plates in the wide-open position.

DIAGNOSIS AND TESTING (Continued)

3. Install a Compression Tester in the No. 1 cylinder.
4. Install an auxiliary starter switch in the starting circuit. With the ignition switch (11572) in the OFF position, and using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
5. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.

Test Results

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75 percent of the highest reading. Refer to the Compression Pressure Limit Chart.

Compression Pressure Limit Chart

Maximum psi	Minimum psi	Maximum psi	Minimum psi	Maximum psi	Minimum psi	Maximum psi	Minimum psi
924 kPa (134 psi)	696 kPa (101 psi)	1131 kPa (164 psi)	848 kPa (123 psi)	1338 kPa (194 psi)	1000 kPa (146 psi)	1154 kPa (224 psi)	1158 kPa (168 psi)
938 kPa (136 psi)	703 kPa (102 psi)	1145 kPa (166 psi)	855 kPa (124 psi)	1351 kPa (196 psi)	1014 kPa (147 psi)	1558 kPa (226 psi)	1165 kPa (169 psi)
952 kPa (138 psi)	717 kPa (104 psi)	1158 kPa (168 psi)	869 kPa (126 psi)	1365 kPa (198 psi)	1020 kPa (148 psi)	1572 kPa (228 psi)	1179 kPa (171 psi)
965 kPa (140 psi)	724 kPa (106 psi)	1172 kPa (170 psi)	876 kPa (127 psi)	1379 kPa (200 psi)	1034 kPa (150 psi)	1586 kPa (230 psi)	1186 kPa (172 psi)
979 kPa (142 psi)	738 kPa (107 psi)	1186 kPa (172 psi)	889 kPa (129 psi)	1303 kPa (202 psi)	1041 kPa (151 psi)	1600 kPa (232 psi)	1200 kPa (174 psi)
933 kPa (144 psi)	745 kPa (109 psi)	1200 kPa (174 psi)	903 kPa (131 psi)	1407 kPa (204 psi)	1055 kPa (153 psi)	1055 kPa (153 psi)	1207 kPa (175 psi)
1007 kPa (146 psi)	758 kPa (110 psi)	1214 kPa (176 psi)	910 kPa (132 psi)	1420 kPa (206 psi)	1062 kPa (154 psi)	1627 kPa (154 psi)	1220 kPa (177 psi)
1020 kPa (148 psi)	765 kPa (111 psi)	1227 kPa (178 psi)	917 kPa (133 psi)	1434 kPa (208 psi)	1075 kPa (156 psi)	1641 kPa (238 psi)	1227 kPa (178 psi)
1034 kPa (150 psi)	779 kPa (113 psi)	1241 kPa (180 psi)	931 kPa (135 psi)	1448 kPa (210 psi)	1083 kPa (157 psi)	1655 kPa (240 psi)	1241 kPa (180 psi)
1048 kPa (152 psi)	786 kPa (114 psi)	1225 kPa (182 psi)	936 kPa (136 psi)	1462 kPa (212 psi)	1089 kPa (158 psi)	1669 kPa (242 psi)	1248 kPa (181 psi)
1062 kPa (154 psi)	793 kPa (115 psi)	1269 kPa (184 psi)	952 kPa (138 psi)	1476 kPa (214 psi)	1103 kPa (160 psi)	1682 kPa (244 psi)	1262 kPa (183 psi)
1076 kPa (156 psi)	807 kPa (117 psi)	1282 kPa (186 psi)	965 kPa (140 psi)	1489 kPa (216 psi)	1117 kPa (162 psi)	1696 kPa (246 psi)	1269 kPa (184 psi)
1089 kPa (158 psi)	814 kPa (118 psi)	1296 kPa (188 psi)	972 kPa (141 psi)	1503 kPa (218 psi)	1124 kPa (163 psi)	1710 kPa (248 psi)	1202 kPa (186 psi)
1103 kPa (160 psi)	872 kPa (120 psi)	1310 kPa (190 psi)	979 kPa (142 psi)	1517 kPa (220 psi)	1138 kPa (165 psi)	1724 kPa (250 psi)	1289 kPa (187 psi)
1110 kPa (161 psi)	834 kPa (121 psi)	1324 kPa (192 psi)	993 kPa (144 psi)	1631 kPa (222 psi)	1145 kPa (166 psi)	—	—

If one or more cylinders reads low, squirt approximately one tablespoon of clean engine oil meeting Ford specification ESE-M2C153-E on top of the pistons in the low-reading cylinders. Repeat the compression pressure check on these cylinders.

Interpreting Compression Readings

1. If compression improves considerably, piston rings are faulty.
2. If compression does not improve, valves are sticking or seating improperly.