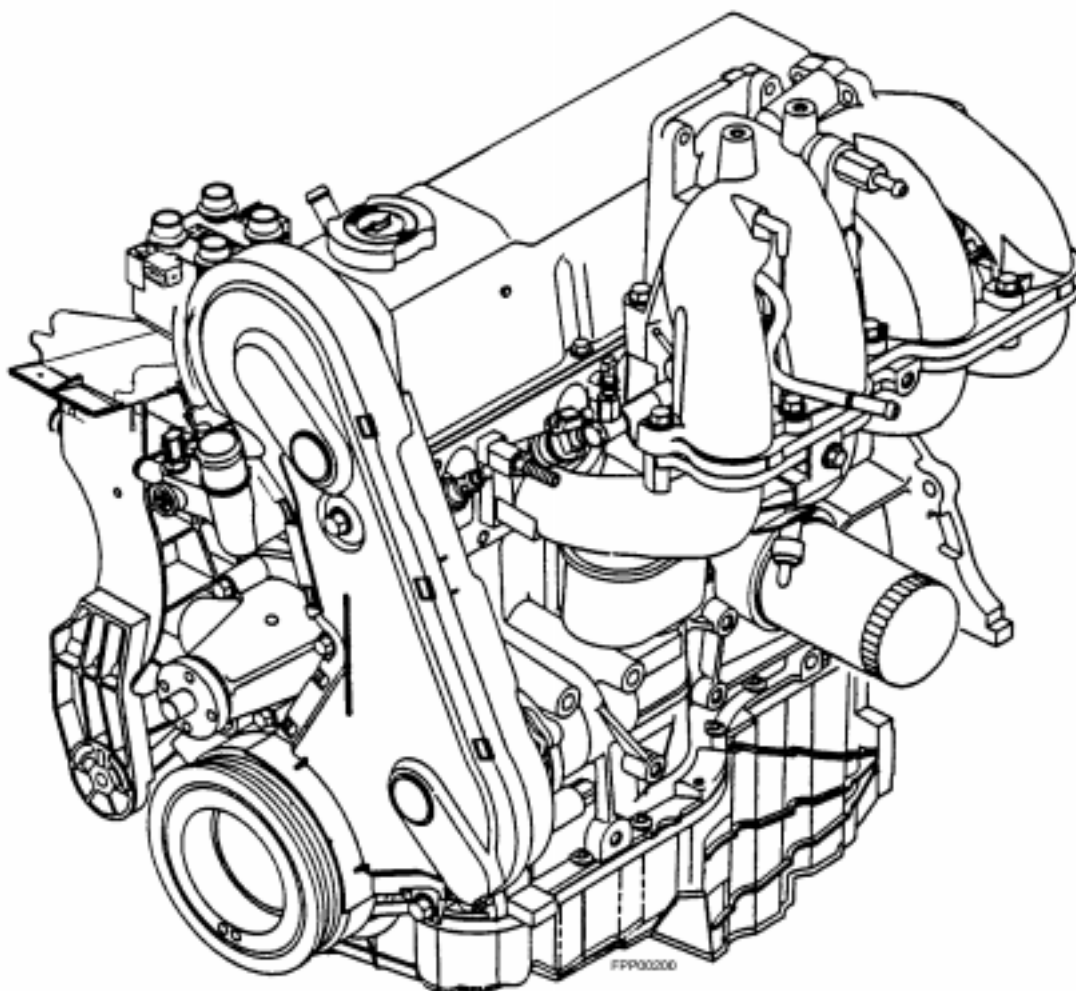




The Source for Power...
Worldwide™

LRG-425 2.5 LITER (153 CID)

INDUSTRIAL ENGINE SERVICE MANUAL



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.

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 he compromises neither his personal safety nor the equipment integrity by his 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 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 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.

- 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 REVERSE (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 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 equipment.
- To avoid injury, 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 through 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.



Introduction

In general, this manual covers the servicing of the engine and associated standard equipment. In many cases, engines are supplied with accessories and equipment that are unique to the application. If service information is ever required on such unique accessories or equipment it is suggested that Ford Power Products be contacted. The proper information will either be forwarded or the Service Technician will be advised where it can be obtained.

The information in this manual is grouped in sections according to the type of work being performed. The various sections are indicated in the index. In addition, each section is subdivided to include topics such as diagnosis and testing, cleaning and inspection, overhaul, removal and installation procedures, disassembly and assembly procedures, and service specifications.

Special service tools called for by the procedures can be obtained by calling:

1-800-ROTUNDA (1-800-768-8632).

The descriptions and specifications contained in this manual were in effect at the time the book was released for printing. Ford Power Products reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

NOTE: *The recommendations and suggestions contained in this publication are made to assist the distributor in improving his distributorship 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.*

*Reroduction in any manner, in whole or in part, is prohibited without
The express permission in writing from:
Ford Power Products, Marketing Department.*

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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 Section 02.

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

Most Ford Power Product engines incorporate a closed-type crankcase ventilation system. Other than the crankcase ventilation system there are no exhaust emission controls or engine/emission control systems used with industrial versions of these engines.

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.



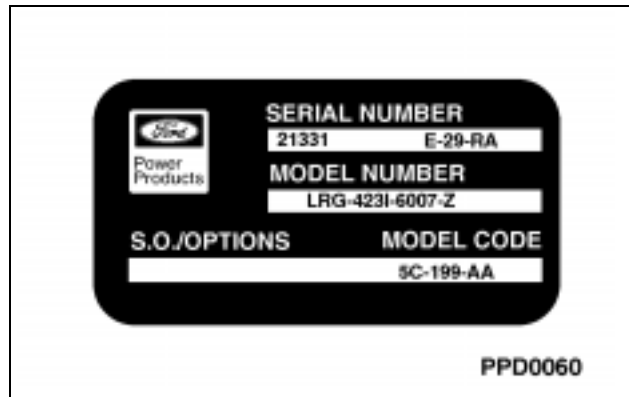
WARNING: TO AVOID THE POSSIBILITY OF PERSONAL INJURY OR DAMAGE, DO NOT OPERATE THE ENGINE UNTIL THE FAN BLADE HAS FIRST BEEN EXAMINED FOR POSSIBLE CRACKS OR SEPARATION.



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

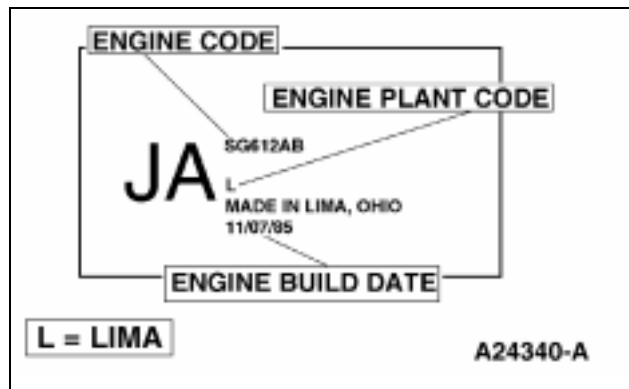


aluminum sealing surfaces.

Engine Identification Nameplate

For quick engine identification, refer to the Engine Identification Nameplate. The nameplate 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.

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



DIAGNOSIS

Inspection

Inspect to determine if any of the following mechanical concerns apply:

- Engine oil leaks.
- Damaged and/or severely worn parts.
- Loose mounting bolts, studs and nuts.

CONDITION	POSSIBLE SOURCE	ACTION
DIFFICULT STARTING	<ul style="list-style-type: none"> • Burnt valve. • Worn piston. • Worn piston ring(s). • Worn cylinder. • Damaged cylinder head gasket. • Malfunctioning or damaged fuel system. • Malfunctioning or damaged ignition system. 	<ul style="list-style-type: none"> • Replace valve. • Replace piston. • Replace piston ring(s). • Service or replace cylinder block. • Replace cylinder head gasket. • Refer to section on fuel system. • Refer to section on ignition system.
POOR IDLING	<ul style="list-style-type: none"> • Damaged hydraulic valve tappet. • Damaged hydraulic valve tappet guide. • Improper valve to valve seat contact. • Damaged cylinder head gasket. • Malfunctioning or damaged fuel system. • Malfunctioning or damaged ignition system. 	<ul style="list-style-type: none"> • Replace hydraulic valve tappet. • Replace hydraulic valve tappet guide. • Replace valve and/or valve seat. • Replace cylinder head gasket. • Refer to section on Fuel system. • Refer to section on ignition system.
ABNORMAL COMBUSTION	<ul style="list-style-type: none"> • Damaged hydraulic valve tappet. • Damaged hydraulic valve tappet bore. • 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. • Replace cylinder block. • Service or replace valve. • Replace valve spring. • Eliminate carbon buildup. • Refer to section on fuel system. • Refer to section on ignition system.
EXCESSIVE OIL CONSUMPTION	<ul style="list-style-type: none"> • Worn piston ring groove. • Sticking piston ring(s). • Worn piston or cylinder. • Worn valve stem seal. • Worn valve stem or valve guides. • Leaking oil. • Worn piston rings. • Plugged pcv system. 	<ul style="list-style-type: none"> • Replace piston. • Service or replace piston ring (s). • Service or replace piston or cylinder block. • Replace valve stem seal. • Replace valve stem and guide. • Service oil leak. • Replace piston rings. • Service PCV system.

CONDITION	POSSIBLE SOURCE	ACTION
ENGINE NOISE	<ul style="list-style-type: none"> • Excessive main bearing oil clearance. • Seized or heat damaged crankshaft 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 ring(s). • Bent connecting rod. • Malfunctioning hydraulic valve tappet. • Excessive hydraulic valve tappet 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 riming belt. • Damaged timing belt tensioner. • Malfunctioning water pump bearing. 	<ul style="list-style-type: none"> • Adjust clearance or replace crankshaft main bearing. • Replace crankshaft main bearing. • Adjust end play or replace crankshaft. • Adjust clearance or replace connecting rod. • Replace connecting rod bearing. • Replace connecting rod bushing. • Service or replace cylinder block. • Replace piston or piston pin. • Replace piston ring(s). • Replace connecting rod. • Replace hydraulic valve tappet. • Adjust clearance or replace hydraulic valve tappet. • Replace valve spring. • Service clearance or replace valve guide/stem. • Refer to section on cooling system. • Refer to section on fuel system. • Service exhaust leakage. • Refer to section on accessory drivebelts. • Refer to section on charging system. • Adjust or replace timing belt. • Replace timing belt tensioner. • Refer to section on cooling system.
INSUFFICIENT POWER	<ul style="list-style-type: none"> • Malfunctioning hydraulic valve tappet. • Damaged hydraulic valve tappet bore. • 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. 	<ul style="list-style-type: none"> • Replace hydraulic valve tappet. • Replace cylinder block. • Service or replace valve, valve seat and/or cylinder head. • Replace valve spring. • Replace cylinder head gasket. • Replace cylinder head. • Service or replace piston ring(s). • Replace piston. • Refer to section on fuel system. • Refer to section on ignition system.

PCV System Malfunction

A malfunctioning Positive Crankcase Ventilation System (closed type) may be indicated by loping or rough engine idle. Do not attempt to compensate for this idle condition by disconnecting the crankcase ventilation system and making an air bypass or idle speed adjustment. **The removal of the crankcase ventilation system from the engine will adversely affect fuel economy and engine crankcase ventilation with resultant shortening of engine life.**

Engine Oil Leak Check

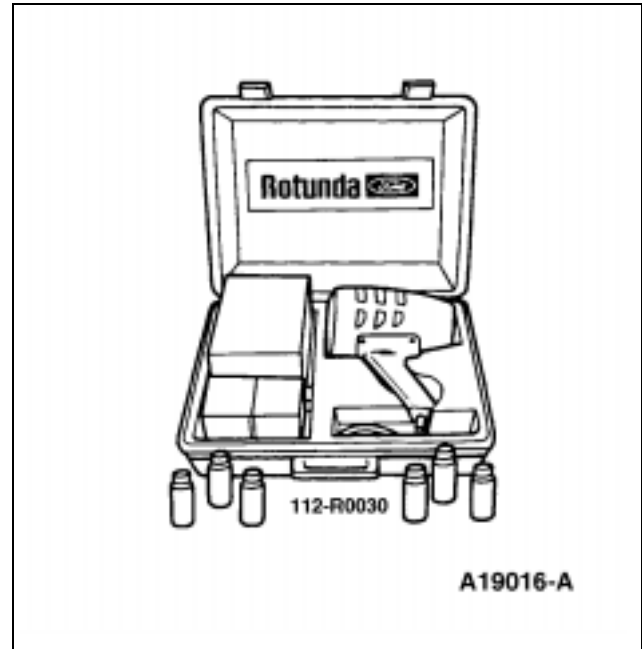
When diagnosing engine oil leaks, it is important that the source and location of the leak be positively identified prior to service.

NOTE: Due to their remote location, rear engine oil leaks may be very difficult to pinpoint. This area is also very difficult to clean. Make sure to eliminate all other possibilities before removing the engine to repair a suspected leak in this area.

There are two methods of diagnosing engine oil leaks. The following procedure has been found to be very effective and requires only a minimum of equipment. Prior to using this procedure, it is important to clean the cylinder block, cylinder heads, valve covers, oil pan and flywheel housing areas with a suitable solvent to remove all traces of oil.

Fluorescent Oil Additive Method

To perform oil leak diagnosis using Rotunda Oil Leak Detector Kit 112-R0030, or equivalent, perform the following procedure.



1. Clean engine with a suitable solvent to remove all traces of oil.
2. Drain engine oil from crankcase and refill with recommended oil, premixed with Rotunda Fluorescent Oil Additive 112-R0015, or equivalent. Use 29.6ml (1 fluid ounce) of fluorescent additive. If oil is not premixed, fluorescent additive must be added to crankcase first.
3. Run engine for 15 minutes. Stop engine and inspect all seal and gasket areas for leaks using Rotunda Oil Leak Detector Y112-R0021 (part of 112-R0030 kit) Lamp or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
4. If necessary, pressurize main oil gallery system to locate leaks due to improperly sealed, loose or cocked plugs. If flywheel bolts leak oil, look for sealer on threads.
5. Service all leaks as required.

Pressure Method

As an alternative testing procedure, the crankcase can be pressurized, not to exceed 27 kPa (4 psi), 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 increments of one psi.
- Air line shutoff valve.
- Appropriate fittings to attach the above parts to oil fill, PCV grommet holes and PCV fresh air hose tube.
- Appropriate plugs to seal any openings leading to crankcase.
- A solution of liquid detergent and water to be applied with a suitable type 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 rocker arm cover tube. Fabricate the air pressure gauge to a suitable adapter for installation on the engine at the oil fill opening.



CAUTION: Use extreme caution when pressurizing crankcase. Applying air pressure above specified pressure risks damage to seals, gaskets and core plugs. Under no circumstances should pressure be allowed to exceed 27 kPa (4 psi).

1. Open air supply valve until pressure gauge maintains 20 kPa (3 psi).
2. Inspect sealed and/or gasketed areas for leaks by applying a solution of liquid detergent and water over areas for formation of bubbles, which indicates leakage.
3. Examine the following areas for oil leakage:
 - Rocker cover sealant or gaskets
 - Intake manifold gaskets/end seals
 - Cylinder head gaskets
 - Oil bypass filter
 - Oil level indicator (dipstick) tube connection

- Oil pressure sensor
- Cup plugs and/or pipe plugs at end of oil passages
- Oil pan gasket
- Oil pan front and rear end seals
- Oil pan front and rear end seals
- Crankshaft front seal
- Crankshaft rear oil seal
- Oil pump
- Crankshaft rear oil seal

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

- Rear main bearing cap parting line.
- Rear main bearing cap and seals.
- Flywheel mounting bolt holes.
- Rear cup plugs and/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.

Light foaming equally around rocker arm cover bolts and crankshaft seals is not detrimental and no corrections are required in such cases.