

TECHNICAL MANUAL
UNIT, INTERMEDIATE DIRECT
SUPPORT
AND INTERMEDIATE GENERAL SUPPORT
MAINTENANCE INSTRUCTIONS

MAIN PROPULSION ENGINE
FOR
LANDING CRAFT UTILITY (LCU)
NSN 1905-01-154-1191

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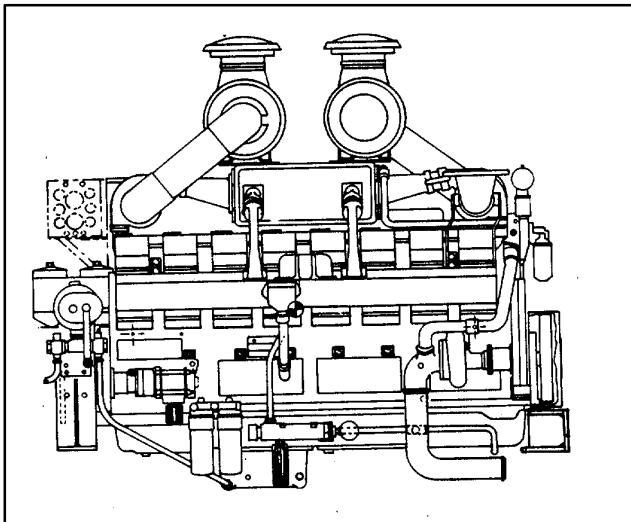
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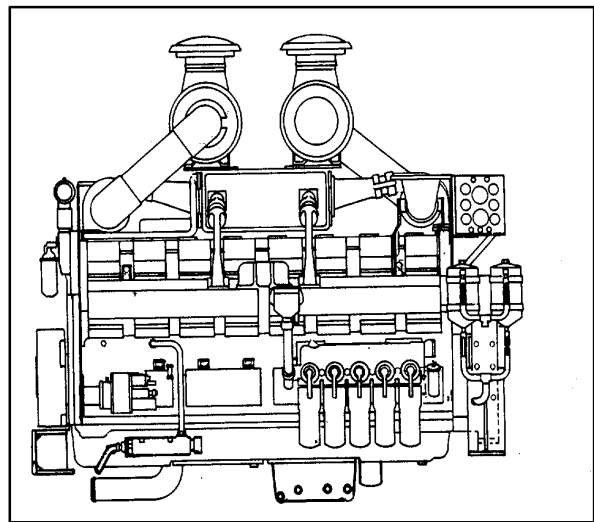
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HEADQUARTERS, DEPARTMENT OF THE ARMY
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TECHNICAL MANUAL

No.55-1905-223-24-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 17 January 1989

UNIT, INTERMEDIATE DIRECT SUPPORT, AND INTERMEDIATE GENERAL SUPPORT
MAINTENANCE INSTRUCTIONS

MAIN PROPULSION ENGINE
For
Landing Craft Utility (LCU)
NSN 1905-01-154-1191

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of Changes to Publications and Blank Forms), or DA Form 20282 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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CHAPTER 1
INTRODUCTION

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SECTION I. GENERAL INFORMATION

- 1-1. Scope.** The scope of this manual is as follows:
- a. Type of Manual. Unit, intermediate direct support, and intermediate general support maintenance manual.
 - b. Model Number and Equipment Name. Main Propulsion Engine, Model KTA50-M.
 - c. Purpose of Equipment. Provides drive power to the marine gear to propel the craft.
- 1-2. Maintenance Forms, Records, and Reports.** Department of the Army forms and procedures used for equipment maintenance are those prescribed by DA Pam 738-750, the Army Maintenance Management System.
- 1-3. Destruction of Army Materiel.** Refer to TM 750-244-3 for instructions covering the destruction of Army materiel to prevent enemy use.
- 1-4. Reporting Equipment Improvement Recommendations (EIR).** If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to: Commander, U.S. Army Troop Support Command; ATTN: AMSTR-QX; 4300 Goodfellow Blvd.; St. Louis, Missouri 63120-1798. We'll send you a reply.
- 1-5. Preparation for Storage or Shipment.** Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the Preventive Maintenance Checks and Services (PMCS) charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Repacking of equipment for shipment or short term storage is covered in paragraph 2-38.

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1-6. General Description. The KTA50-M is a 1250 hp, 16 cylinder, water-cooled diesel engine designed for marine use. The main propulsion engines furnish drive power to the marine gear. The main propulsion engines are equipped with remote and local control stations.

1-7. Characteristics, Capabilities, and Features. A very broad view of the main propulsion engines is as follows:

a. Characteristics.

- (1) Turbocharger allows more horsepower to be developed.
- (2) Fuel injectors deliver atomized fuel into combustion chambers for ignition by heat of compressed air.
- (3) Four stroke cycle, in order, is: intake stroke, compression stroke, power stroke, and exhaust stroke.
- (4) Cooling as follows:
 - (a) Engine operating heat is controlled by coolant.
 - (b) Lube oil is controlled by lube oil cooler.
 - (c) Air is cooled or heated as necessary by an aftercooler.

b. Capabilities and Features.

- (1) Furnishes 1250 hp to drive the marine propellers.
- (2) Can put out 2100 rpm (maximum).
- (3) Engine idle speed is 725-775 rpm.
- (4) Has both remote and local controls.

1-8. Location and Description of Major Components. FIG. 1-1 shows views of each side of the engine with the locations of major components indicated. Refer to FIG. 1-1 and the reference number key below for the description of these components.

- a. Turbocharger Group (1). Two turbine wheels, one located on the exhaust manifold on each side of the engine.
- b. Air Cleaner Group (2). Two filter canister and cover assemblies, located on the top of the engine.
- c. Air Intake Manifold Group (3). Intake air distribution piping, located on both sides of the engine.
- d. Thermostat Housing/Water Transfer Tube Group (4). Thermostat and water distribution piping, located on the front of the engine behind the water filters.

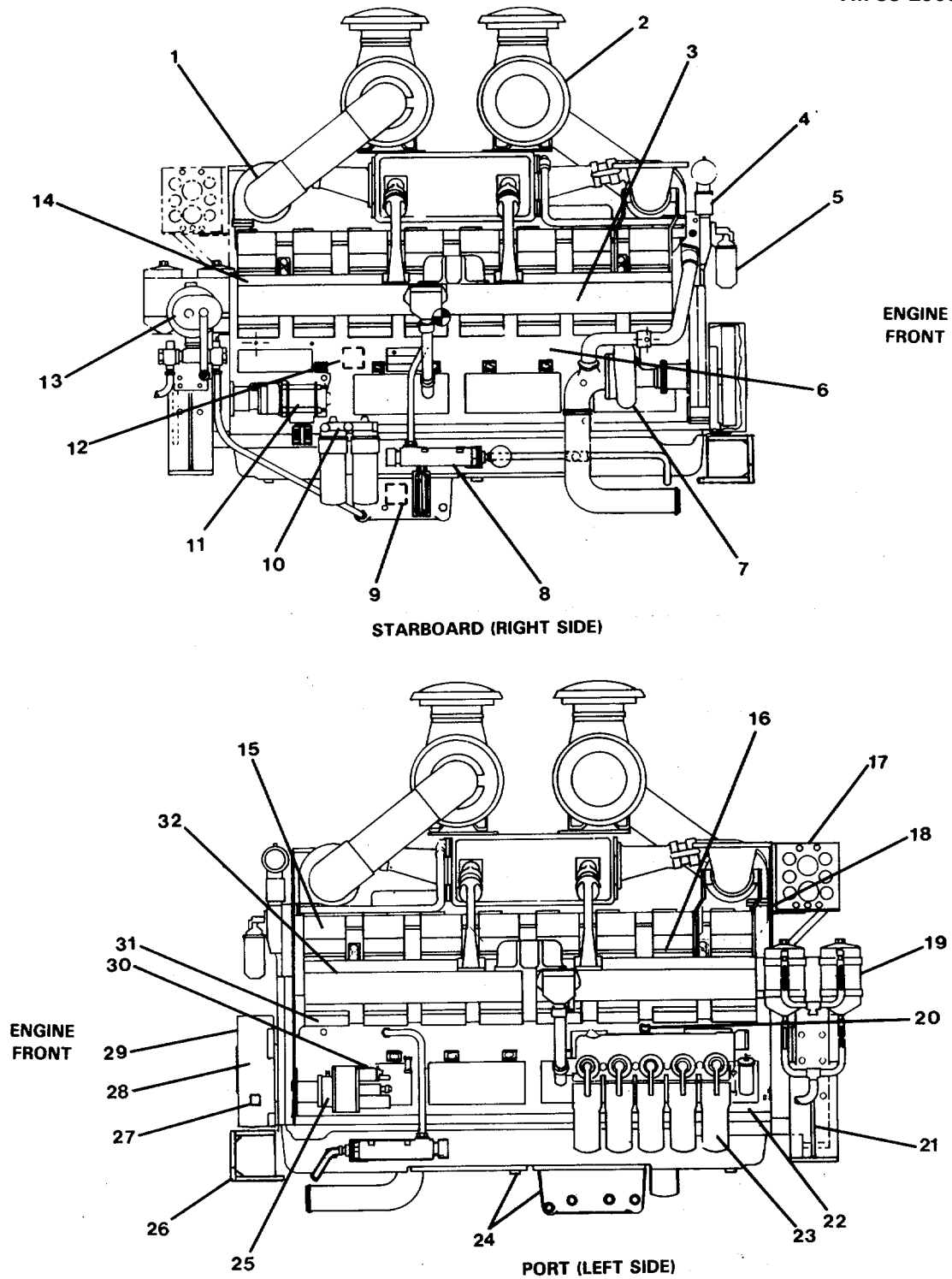


FIGURE 1-1. Location of Major Components.

- e. Water Filter Group (5). Four spin-on filters and head assembly, located on the front of the engine.
- f. Cylinder Block assembly (6). The engine block, which supports the assemblies necessary for engine operation.
- g. Water Pump Group (7). Centrifugal water pump, located on the right side near the front of the engine.
- h. Cold Starting Aid Group (8). Two thermostatically controlled coolant heaters, located on the deck on either side of the engine.
- i. Lubricating Oil Pump Group (9). Gear driven lube oil pump, located in the cylinder block directed below the crankshaft.
- j. Lube Oil Bypass Filter Group (10). Two spin-on filters and head assembly, located on the lower right rear corner of the engine.
- k. Engine Air Starter (11). Turbine driven starter, located on the right side near the rear of the engine.
- l. Lubricating Oil Cooler Group (12). Plate type heat exchangers, located in the main water passage in the center of the "V" of the cylinder block.
- m. Sump Pump Group (13). Manually operated lube oil pump, located at the right rear of the engine.
- n. Fuel Manifold Group (14). Fuel distribution piping assembly, located on the rocker lever housing on both sides of the engine.
- o. Rocker Housing Cover, Rocker Lever Housing Group (15). Sixteen rocker lever assemblies, located on the top of the cylinder heads.
- p. Cylinder Head Group (16). Sixteen cylinder head assemblies, located on the top of the cylinder block.
- q. Instrument Panel Group (17). Electrical panel, located at the top rear of the engine, that contains gauges and switches for local control of the engine.
- r. Exhaust Manifold Group (18). Exhaust air assembly, located on the top of both sides of the engine.
- s. Fuel Filter Group (19). Two filter canister assemblies, located on the rear of the engine near the top.
- t. Connecting Rod and Piston Group (Internal. 20). Sixteen sets of pistons and connecting rods, located in the cylinder block.
- u. Flywheel Housing Group (21). The flywheel, ring gear, and barring mechanism assemblies, located at the lower rear of the engine.
- v. Handhole Cover Group (22). Eight access covers, located on each side of the cylinder block.

- w. Lube Oil Filter Assembly (23). Five spin-on filters and head assembly, located on left side of engine near the rear.
- x. Oil Pan and Adapter Group (24). Lube oil pan, located under the engine.
- y. Fuel Pump Group (25). Gear-driven pump and throttle assembly, located on the left side near the front of the engine.
- z. Engine Support Group (26). Engine mounting support assembly, located below the front and rear of the engine.
- aa. Camshaft and Gear Group (27). Two camshafts and gears, located in the cylinder block.
- ab. Vibration Damper/Bearings/Crankshaft Group (28). Vibration damper and crankshaft, located in the cylinder block.
- ac. Pulley Shield/Front Gear Housing Group (29). Housing assembly, located on the front of the engine.
- ad. Shutdown Valve Group (30). Solenoid-operated shutdown valve assembly,
- ae. Cam Follower and Housing Group (31). Sixteen cam follower assemblies located in the cylinder block.
- af. Injector Group (32). Sixteen fuel injectors, one in each cylinder head.

1-9. Equipment Data. Characteristics and reference data are provided in Table 1-1. Also see the equipment data given in the operator's manual, TM 55-1905-223-10.

Table 1-1. Equipment Data

Characteristics	Reference Data
GENERAL ENGINE DATA	
Horsepower	1250 hp
Engine Speed @ Maximum Output	2100 rpm
Bore and Stroke	6.25 in (159 mm) x 6.25 in (159 mm)
Displacement	3067 in ³ (50.3 litres)
Compression Ratio	14.5:1 to 15.5:1
Firing Order	1R-1L-3R-3L-7R-7L-5R-5L-8R-8L-6R-6L-2R-2L-4R-4L
Engine Weight	
Dry Weight	11,000 lb (4950 kg)
Wet Weight	12,000 lb (5400 kg)
Dimensions (overall)	
Length	98.8 in (251.0 cm)
Width	55.3 in (105.5 cm)
Height	91.0 in (231.0 cm)
AIR INDUCTION SYSTEM	
Maximum allowable turbocharged intake restriction	25 in H ₂ O (63.5 cm H ₂ O)
LUBRICATION SYSTEM	
Oil pressure at idle	20 psi (138 kPa) minimum idle 45 psi (310 kPa) minimum rated rpm 70 psi (483 kPa) maximum rated rpm
Oil capacity of engine:	
Bypass filter	0.75 U.S. gl (2.8 litres)
Full flow filter	0.93 U.S. gl (3.5 litres)
Oil pan capacity (low-high)	32 to 55 U.S. gl (121-208.5 litres)
Maximum oil temperature	250°F (120°C)
COOLING SYSTEM	
Coolant capacity (engine only)	40.5 U.S. gallons (153 litres)
Standard thermostat modulating range	175-195°F (80°-90°C)
Maximum allowable top tank temperature	203°F (95°C)
Minimum recommended top tank temperature	160°F (70°C)
Minimum recommended pressure cap	7 psi (48 kPa)

Table 1-1. Equipment Data-CONT

Characteristics	Reference Data
EXHAUST SYSTEM	
Maximum allowable back pressure imposed by piping and silencer	3 in Hg (75 mm Hg)
Exhaust pipe size (normally acceptable inside diameter)	6 in (152 mm)
FUEL SYSTEM	
Engine idle speed	725 to 775 rpm
Maximum allowable restriction to pump:	
With clean filter	4 in Hg (100 mm Hg)
With dirty filter	8 in Hg (200 mm Hg)
Maximum allowable fuel return line restriction	2.5 in Hg (63 mm Hg)

1-10. **Safety, Care, and Handling.** Safety precautions must be observed at all times while performing maintenance. General WARNINGS and first-aid data appear in the front of this manual. Review all safety information before starting any task. Carefully read through an entire maintenance procedure before performing any maintenance function. Make sure the task can be done safely. All WARNINGS, CAUTIONS, and NOTES are of great importance to your safety and the safety of the equipment.

SECTION III. PRINCIPLES OF OPERATION

1-11. **Diesel Engine Operation.** Diesel engine operation is different from spark-ignited engine operation. Compression ratios are higher and the charge taken into the combustion chamber during the intake stroke consists of air only, with no fuel mixture. Injectors receive low-pressure fuel from the fuel system and deliver it into individual combustion chambers at the proper time, and in the right quantity and atomized condition for burning. Ignition of fuel is caused by heat of compressed air in the combustion chamber.

a. **Diesel Engine Cycles.** The diesel engine four stroke combustion cycle consists of four piston strokes. The four strokes happen in this order: intake stroke, compression stroke, power stroke, and exhaust stroke (FIG. 1-2). In order for the four strokes to function properly, valves and injectors must act in direct relation to each of the four strokes of the piston. The intake valves, exhaust valves, and injectors are camshaft actuated, linked by tappets or cam followers, push rods, rocker levers, and valve crossheads. The camshaft is driven by the crankshaft gear, and that means rotation of the crankshaft drives the camshaft, which then controls the opening and closing sequence of the valves and injection timing (fuel delivery).

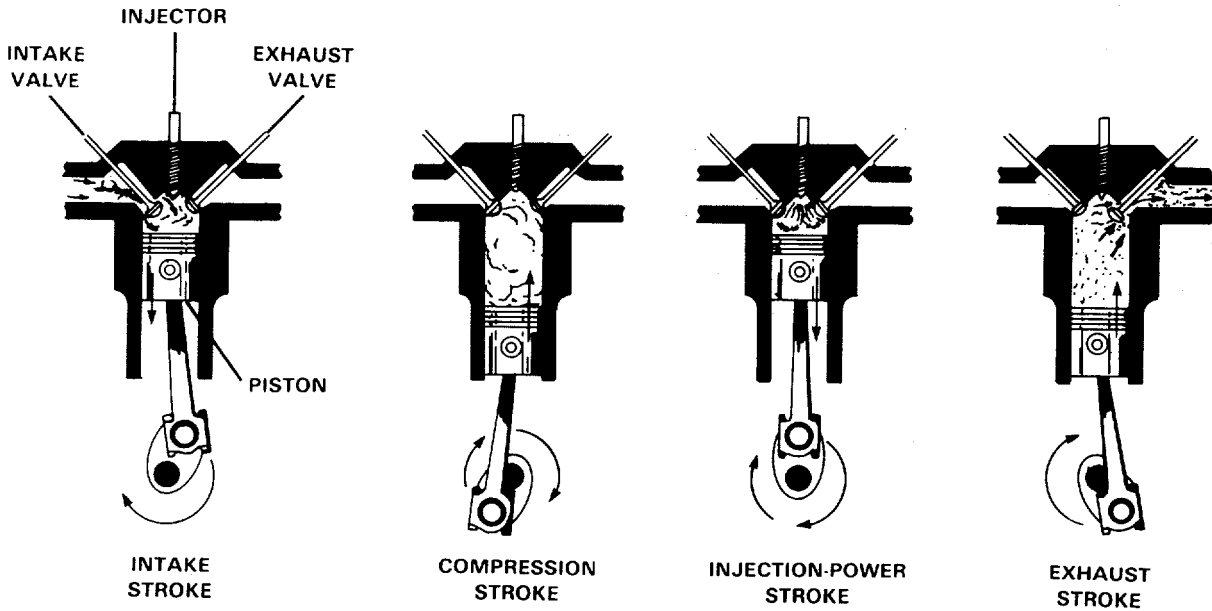


FIGURE 1-2. Diesel Engine.

(1) Intake Stroke. During the intake stroke, the piston travels downward, the intake valve is open, and the exhaust valve is closed. The downward travel of the piston allows air from the intake manifold to enter the cylinder. The intake manifold is pressurized with air from the turbocharger.

(2) Compression Stroke. At the end of the intake stroke, the intake valve closes and the piston starts upward on compression stroke (exhaust valve remains closed). At end of compression stroke, air in combustion chamber is compressed into a small space, causing the air temperature to rise to a point high enough for ignition of fuel. During the last part of compression stroke and early part of power stroke, a small metered charge of fuel is injected into combustion chamber. The fuel is then ignited by the hot compressed air.

(3) Power Stroke. During the beginning of the power stroke, the piston is pushed downward by the burning and expanding gases (intake and exhaust valves are still closed). As more fuel is added and burns, gases get hotter and expand to further force the piston downward to deliver driving force to crankshaft rotation.

(4) Exhaust Stroke. During the exhaust stroke, the intake valve is closed, exhaust valve is open, and the piston is on the upstroke. Upward travel of the piston forces burned gases out of combustion chamber through the open exhaust valve port and into the exhaust manifold.

b. Cooling System. The coolant system removes heat created during engine operation. Coolant is circulated by a centrifugal water pump with mounted thermostats to control engine operating temperature. Coolant temperature is reduced in a keel cooler (heat exchanger), and circulated through a water filter which passes a small amount of coolant from the system through a filtering and treating element. The engine is also equipped with two (one on each side of the block) coolant heaters which are thermostatically controlled to aid in cold weather operation. The system is treated with antifreeze to afford protection.

c. Lubrication System. The engine is pressure lubricated by a gear-type lube oil pump mounted to the block directly below the crankshaft and driven from the rear crankshaft gear. An external electric motor driven pump provides prelube pressure for starting.

(1) Filtering. Lube oil is filtered by five spin-on lube filters mounted to a common filter head. In the event of filter blockage, a bypass valve on the filter head routes the lube oil directly to the main oil galleries providing uninterrupted lube oil flow until the main filters are changed.

(2) Cooling. Lube oil is routed from the lube oil pump to lube oil cooler elements located in the block "V" between the cylinder banks and under the aftercooler. The coolers are finned heat exchangers which give off heat to the engine coolant which is circulated around them.

(3) Turbocharger Lubrication. Lube oil is routed from block drillings to the turbocharger supply line. The return line runs from the turbocharger to a block drilling where it is then routed back to the oil pan.

d. Air System. For the engine to operate efficiently, intake and exhaust systems must not be restricted. Intake air is routed through an air cleaner directly to the turbocharger and then to the aftercooler.

(1) Aftercooler. The aftercooler reduces or increases intake air temperature. It consists of a housing which is part of the engine intake air manifold, with an internal core made of tubes through which coolant circulates. Air is cooled or heated by passing over the core prior to entry into the engine combustion chambers, thereby improving combustion through better control of intake air temperature.

(2) Turbocharger. The turbocharger forces additional air into combustion chambers so the engine can burn more fuel and develop more horsepower than if it were naturally aspirated. The turbocharger consists of a turbine wheel and a centrifugal blower (compressor wheel), separately encased but mounted on and rotating with a common shaft. Power to drive the turbine wheel, which in turn drives the compressor, is obtained from the energy of engine exhaust gases. Rotating speed of the turbine changes as the energy level of exhaust gas changes, providing the engine with additional air to meet increased load requirements.

e. Fuel System. Filtered diesel fuel is supplied to the injectors via the fuel filters, fuel manifold and cylinder head drillings, from a fuel pump that is driven by the front camshaft (geared to the crankshaft).

CHAPTER 2

UNIT MAINTENANCE INSTRUCTIONS

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SECTION I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

2-1. **Common Tools and Equipment.** For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your organization.

2-2. **Special Tools, TMDE, and Support Equipment.** Special tools; test, measurement, and diagnostic equipment; and support equipment requirements are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P. These items are also listed in the Maintenance Allocation Chart (MAC), Appendix B of this manual.

2-3. **Repair Parts.** Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P.

SECTION II. SERVICE UPON RECEIPT

2-4. **Checking Unpacked Equipment.**

- a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage in accordance with the instructions of DA Pam 738-750.
- b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.
- c. Check to see whether the equipment has been modified.
- d. Remove protective caps, plugs, inserts, wrappings, and tape when inspection/inventory is completed. Inspect piping openings for damage. Wipe off dirt, grease, or protective films at time of installation.

- e. Remove chocks from resilient mounted components.

2-5. Preliminary Servicing, Adjustment and Operation of Newly Installed Equipment.

a. New and Rebuilt Engine Break-In. The way a new engine is operated during the first 100 hours of service will have an important effect on the life of the engine and its parts. Even though all engines are run on a dynamometer for several hours before they leave the factory, an additional period of careful operation is required.

- (1) Perform pre-starting procedures (paragraph 2-5(b)).
- (2) Avoid operation for long periods at engine idle speeds, or at maximum horsepower levels in excess of 5 minutes.
- (3) Develop the habit of watching engine instruments closely during operation and reduce speed if oil temperature reaches 250°F (121°C) or coolant temperature exceeds 190°F (88°C).
- (4) Check oil level each 10 hours during break-in period.

b. Pre-Starting Procedures. Follow these procedures when starting a new or rebuilt engine for the first time:

- (1) Prime the Fuel System.
 - (a) Fill fuel filter with clean diesel fuel oil.
 - (b) Remove suction line from fuel pump and prelubricate gear pump with 2 to 3 oz (50 to 60 cc) of clean lubricating oil.
 - (c) Check fuel tanks. There must be an adequate supply of clean diesel fuel in the tanks.
 - (d) If injector and valve or other adjustments have been disturbed by any maintenance work, check to be sure they have been properly adjusted before starting the engine.

CAUTION

Do not attempt to prime engine lubricating system from bypass filter.

- (2) Priming the Lubricating System. The engine is primed automatically by an external electrically driven pump. However, in the event of problems in the self priming system, the following procedures should be performed before starting the engine:
 - (a) Remove oil inlet line from the turbocharger and prelubricate bearing with 2 to 3 oz (50 to 60 cc) of clean lubricating oil. Reconnect oil supply line.

- (b) Fill crankcase until oil on dipstick (2, FIG. 2-1) or in liquid level gauge (FIG. 2-2) reaches the "H" (High) mark.
- (c) Remove plug (1, FIG. 2-1) from lubricating oil filter head and use this opening as the priming point.
- (d) Connect a hand or motor-driven priming pump hose from source of clean lubricating oil to priming point.
- (e) Prime until a 30 psi (207 kPa) pressure is obtained.

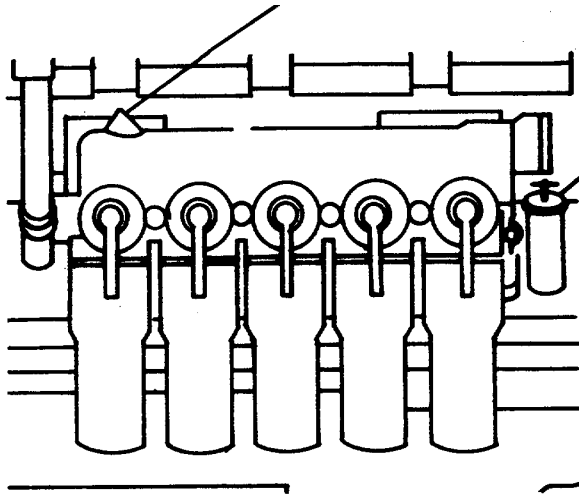


FIGURE 2-1. Lube Oil Priming Point and Oil Fill/Dipstick Arrangement.

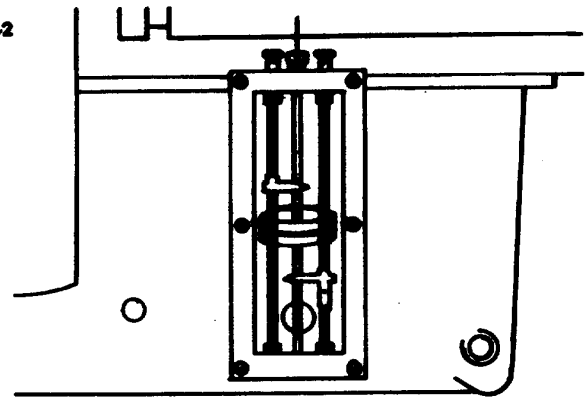


FIGURE 2-2. Oil Level Sight Glass.