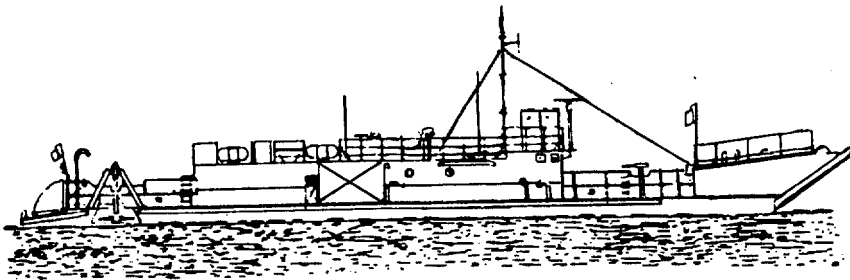


TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL,
DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL

LANDING CRAFT UTILITY
LCU 1671-1679
(1905-01-009-1056)

OPERATOR/CREW
PROPULSION ENGINE
MAINTENANCE
INSTRUCTIONS



TECHNICAL MANUAL
NO. 55-1905-220-14-4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 10 August 1983

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MPSD, 4300 Goodfellow Blvd., St. Louis, Mo 63120. A reply will be furnished directly to you.

TABLE OF CONTENTS

	PAGE
CHAPTER 3. OPERATOR MAINTENANCE INSTRUCTIONS (Cont)	
Section V. Maintenance Instructions	3-247
APPENDIX A.	A-1
APPENDIX B.	B-1
INDEX	Index-1

*This manual supersedes TM 55-1905-220-14-4, dated 29 August 1980.

CHAPTER 3 (CONTINUED)

SECTION V. MAINTENANCE PROCEDURES.

3-6. PROPULSION SYSTEM.

The propulsion system maintenance instructions are as follows:

<u>DESCRIPTION</u>	<u>PARAGRAPH</u>
Propulsion Engine	3-7
Marine Gear	3-8
Engine/Transmission Controls	3-9
Governor	3-10
Air Intake	3-11
Blower	3-12
Fuel Pump	3-13
Fuel Filter, Strainer and Fuel Lines	3-14
Fuel Injector	3-15
Lube Oil Filters and Housing	3-16
Oil Cooler and Lines	3-17
Fresh Water Pump	3-18
Heat Exchanger Tank	3-19
Water Connections	3-20
Water Manifold	3-21
Thermostat and Housing	3-22
Tachometer Drive	3-23
Instrument Panel	3-24
Crankshaft Pulley and Vibration Dampener	3-25
Balance Weight Cover and Accessory Drive	3-26
Engine Supports Lifter Brackets and Crankshaft Front Cover	3-27
Exhaust Manifold and Fittings	3-28
Muffler	3-29
Rocker Arm Cover	3-30
Injector Controls	3-31
Flywheel and Housing Oil Breather	3-32
Valve Operating Mechanism	3-33
Cylinder Head	3-34
Oil Pan and Dipstick	3-35
Lube Oil Relief Valve	3-36
Lube Oil Regulator	3-37
Lube Oil Pump	3-38
Lube Oil Distribution System	3-39
Pistons, Connecting Rods and Liners	3-40
Crankshaft Bearings	3-41
Crankshaft	3-42
Crankshaft Seals	3-43
Cylinder Block	3-44

3-6. PROPULSION SYSTEM (Cont).

<u>DESCRIPTION</u>	<u>PARAGRAPH</u>
Starting Aid	3-45
Hydrostarter	3-46
Accumulator	3-47
Hydrostarter Pump (Engine Driven)	3-48
Hydrostarter Pump (Hand)	3-49
Hydrostarter Piping (Fwd Eng Rm)	3-50
Hydrostarter Piping (Aft Eng Rm)	3-51
Hydrostarter Reservoir, Filter, Solenoids	3-52
Propeller Shaft	3-53
Port Line Shaft	3-54
Shaft Inflatable Seal	3-55
Shaft Seals, Preformed	3-56
Shaft Lock	3-57

a. General Description.

(1) The main propulsion engine is a 12 cylinder Detroit Diesel. The engine is equipped with an oil cooler, lubricating oil filter, fuel oil strainer, fuel oil filter, air silencer, governor, heat exchanger, raw water pump and a starter.

(2) Fuel is drawn from the supply tank and through a strainer by a gear-type fuel pump, then forced through the filter and fuel inlet manifolds in the cylinder heads to the injectors. Excess fuel is returned to the supply tank via the return fuel manifolds and connecting lines. Since fuel is constantly circulating through the injectors, it serves to cool the injectors and carry off any air in the fuel system.

(3) Air for scavenging and combustion is supplied by blower(s) which pumps air into the engine cylinders via the air box and cylinder liner ports. All air entering the blower(s) first passes through an air silencer.

(4) Full pressure lubrication is supplied to all main connecting rod and camshaft bearings, and to other moving parts of the engine. A gear-type pump draws oil from the oil pan through an intake screen and delivers it to the oil filter(s) and then to the oil cooler(s). From the oil cooler(s) the oil flows through passages that connect with the oil galleries in the cylinder block and cylinder heads for distribution to the bearings, rocker arm mechanism and other functional parts.

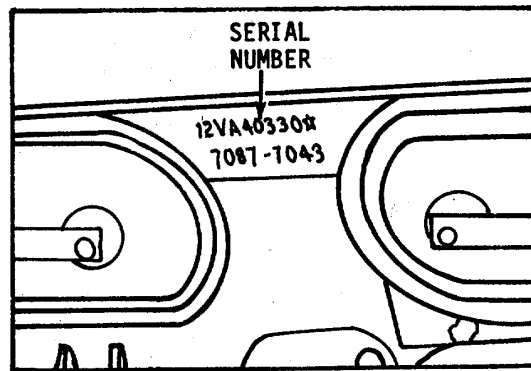
(5) Coolant is circulated through the engine by a centrifugal type water pump. Heat is removed from the coolant, which circulates in a closed system, by a heat exchanger. Control of the engine temperature is accomplished by thermostats that regulate the flow of the coolant within the cooling system.

3-6. PROPULSION SYSTEM (Cont).

- (6) Engine starting is provided by a hydraulic starting system.
- (7) Engine speed is controlled by a variable speed hydraulic governor.

b. Engine Model and Serial Number Designation.

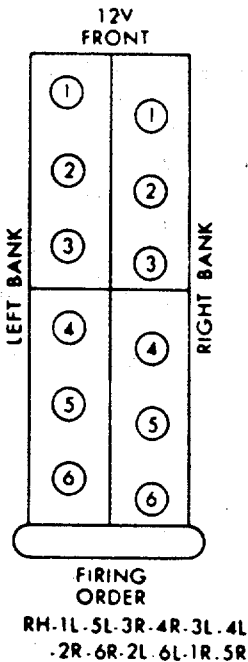
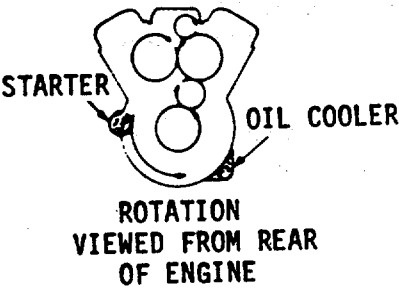
- (1) The engine serial number and model number are stamped on the right-side of the cylinder block.
- (2) Engines with optional equipment have an option plate attached to one of the valve rocker covers. The engine serial number and model number are also stamped on this plate.
- (3) Hydraulic marine gears also carry name plates pertaining to the particular assembly to which they are attached.



3-249

3-6. PROPULSION SYSTEM (Cont).

ENGINE ROTATION AND FIRING ORDER



GENERAL SPECIFICATIONS

12V

Type..... 2 Cycle
Number of Cylinders..... 12
Bore4/ 1/4 in.(10.8 cm)
Stroke5 in. (12.7 cm)
Compression Ratio 18.7 to 1
Total Displacement - Cubic Inches852 (13.97 liters)
Number of Main Bearings..... 7

3-6. PROPULSION SYSTEM (Cont).

c. General Information - DETROIT DIESEL V-71**(1) General Procedures.**

- (a) In many cases, the maintenance man is justified in replacing parts with new material rather than attempting repair. However, there are times where a slight amount of reworking or reconditioning may save time. Crankshafts, cylinder liners and other parts are in this category. For example, if a cylinder liner is only slightly worn and within usable limits, a honing operation to remove the glaze may make it suitable for reuse. Exchange assemblies such as injectors, fuel pumps, water pumps and blowers are also desirable service items.
- (b) Various factors such as the type of operation of the engine, hours in service and next overhaul period must be considered when determining whether new parts are installed or used parts are reconditioned to provide trouble-free operation.
- (c) For convenience and logical order in disassembly and assembly, the various sub-assemblies and other related parts mounted on the cylinder block will be treated as separate items in the various sections.

(2) Disassembly.

- (a) Before any major disassembly, the engine must be drained of lubricating oil, water and fuel. On engines cooled by a heat exchanger, the fresh water system must be drained. Lubricating oil should also be drained from the marine gear.

NOTE

Do not drain oil into bilges. Use the oil separation system to collect drained oil.

- (b) Parts removed from an individual engine should be kept together so they will be available for inspection and assembly. Those items having machined faces, which might be easily damaged by steel should be stored on suitable wooden racks or blocks.

(3) Cleaning.

Before removing any of the sub-assemblies from the engine (but after removal of the electrical equipment), the exterior of the engine should be thoroughly cleaned. Then, after each subassembly is removed and disassembled, the individual parts should be cleaned. Thorough cleaning of each part is absolutely necessary before it can be satisfactorily inspected.

3-6. PROPULSION SYSTEM (Cont).

(4) Rust preventive.

If parts are not to be used immediately after cleaning, dip them in a rust preventive compound (P/N 6850-00-753-4967). The rust preventive compound should be removed before installing the parts in an engine.

(5) Inspection.

- (a) The purpose of parts inspection is to determine which parts can be used and which must be replaced. Although the engine overhaul specifications given throughout the text will aid in determining which parts should be replaced, considerable judgment must be exercised.
- (b) The guiding factors in determining the usability of worn parts, which are otherwise in good condition, is the clearance between the mating parts and the rate of wear on each of the parts. If it is determined that the rate of wear will maintain the clearances within the specified maximum allowable until the next overhaul period, the reinstallation of used parts may be justified. Rate of wear of a part is determined by dividing the amount the part has worn by the hours it has operated.
- (c) Many service replacement parts are available in various undersize and/or oversize as well as standard sizes. Also, service kits for reconditioning certain parts and service sets which include all of the parts necessary to complete a particular repair job are available.
- (d) A complete discussion of the proper methods of precision measuring and inspection are outside the scope of this manual. However, every shop kit should be equipped with standard gages, such as dial bore gages, dial indicators, and inside and outside micrometers.

(6) Assembly.

- (a) Following cleaning and inspection, the engine should be assembled using new parts as determined by the inspection.
- (b) Use of the proper equipment and tools makes the job progress faster and produces better results. Likewise, a suitable working space with proper lighting must be provided.
- (c) Keep the working space, the equipment, tools and engine assemblies and parts clean at all times. The area where assembly operations take place should, if possible, be located away from the disassembly and cleaning operation. Also, any machining operations should be removed as far as possible from the assembly area.

3-6. PROPULSION SYSTEM (Cont).

- (d) Particular attention should be paid to storing of parts and subassemblies, after removal and cleaning and prior to assembly, in such a place or manner as to keep them clean. If there is any doubt as to the cleanliness of such parts, they should be recleaned.
- (e) When assembling an engine or any part thereof, refer to the table of torque specifications for proper bolt, nut and stud torques.

(7) Work Safety.

- (a) A maintenance person can be severely injured if caught in the pulley or belts of an engine that is accidentally started. To avoid such a misfortune, take these precautions before starting to work on an engine: Tag all electrical switches so that the electrical circuit is disrupted. Accidental contact with the starter button will not produce an engine start.
- (b) Make sure the mechanism provided at the governor for stopping the engine is in the stop position. This will mean the governor is in the no-fuel position. The possibility of the engine firing by accident is minimized.
- (c) Some Safety Precautions to Observe When Working On The Engine:
 - 1. Consider the hazards of the job and wear protective gear such as safety glasses, safety shoes, hard hat, etc., to provide adequate protection.
 - 2. When lifting an engine component, make sure the lifting device is fastened securely. Be sure the item to be lifted does not exceed the capacity of the lifting device.
 - 3. Always use caution when using power tools.
 - 4. When using compressed air to clean a component such as cleaning an air silencer, use a safe amount of air. Recommendations regarding the use of air are indicated throughout the manual. Too much air can rupture or in some other way damage a component and create a hazardous situation that can lead to personal injury.
 - 5. Avoid the use of carbon tetrachloride as a cleaning agent because of the harmful vapors that it releases. Use perchlorethylene or trichlorethylene. However, while less toxic than other chlorinated solvents, use these cleaning agents with caution. Be sure the work area is adequately ventilated and use protective gloves, goggles or face shield and apron.

3-6. PROPULSION SYSTEM (Cont).

WARNING

Exercise caution against burns when using oxalic acid to clean the cooling passages of the engine.

6. Avoid excessive injection of ether into the engine during start attempts. Follow the instructions on the container of the starting aid.
7. When working on an engine that is running, accidental contact with the hot exhaust manifold can cause severe burns. Remain alert to the location of the rotating pulleys and belts.
8. Engine Specifications.

(Less Major Assemblies)

Specifications, clearances and wear limits are listed below. It should be specifically noted that the clearances apply only when all new parts are used at the point where the various specifications apply. This also applies to references within the text of the manual. The column entitled "Limits" in this chart lists the amount of wear or increase in clearance which can be tolerated in used engine parts and still ensure satisfactory performance. It should be emphasized that the figures given as "Limits" must be qualified by the judgment of the personnel responsible for installing new parts. These wear limits are, in general, listed only for the parts more frequently replaced in engine overhaul work. For additional information, refer to the text.

ENGINE BLOCK AND CYLINDER HEAD

TABLE OF SPECIFICATIONS, NEW CLEARANCES AND WEAR LIMITS

These limits also apply to oversize and undersize parts.

ENGINE PARTS (Standard Size, New)	MINIMUM		MAXIMUM		LIMITS	
	(inches)	(cm)	(inches)	(cm)	(inches)	(cm)
Cylinder Block						
Block bore:						
Diameter	4.6260	11.7500	4.6270	11.7526		
Out-of-round			.0010	.0025	.0020	.0051
Taper			.0010	.0025	.0020	.0051
Cylinder line counterbore:						
Diameter	5.0460	12.8168	5.0510	12.8295		
Depth.	.4770	1.2116	.4795	1.2179		
Main bearing bore:						
Inside diameter (vertical axis)	4.8120	12.2225	4.8130	12.2250		
Top surface of block:						
Centerline of main bearing bore to top of block	6.1840	41.1074	16.1890	41.1201	16.176 min.	41.0870 min.
Flatness-transverse (all)					.0030	.0076
Flatness-longitudinal (all)					.0050	.0127
Depth of counterbores (top surface):						
Cylinder head seal strip groove	.0970	.2464	.1070	.2718		
Water holes (between cylinders)	.1140	.2896	.1200	.3048		
Combination water and oil holes	.0920	.2337	.0980	.2489		
Cylinder Liner						
Outside diameter	4.6250	11.7475	4.6260	11.7500		
Inside diameter	4.2495	10.7937	4.2511	10.7978		
Clearance-liner-to-block	.0000	.0000	.0020	.0051	.0025	.0064
Out-of-round-inside diameter			.0020	.0051	.0025	.0064
Taper-inside diameter			.0010	.0025	.0020	.0051
Depth of flange BELOW block	.0450	.1143	.0500	.1270	.0500	.1270
Variation in depth between adjacent liners			.0020	.0051	.0020	.0051
Flange thickness	.2500	.6350	.2520	.6401		
Insert thickness	.1795	.4559	.1800	.4572		

Table Of Specifications. (continued)

ENGINE PARTS (Standard Size, New)	MINIMUM		MAXIMUM		LIMITS	
	(inches)	(cm)	(inches)	(cm)	(inches)	(cm)
Piston:						
Height (centerline of bushing to top)	3.5430	8.9992	3.5480	9.0119		
Diameter (above compression rings)	4.2225	10.7252	4.2255	10.7328		
Diameter (at skirt).....	4.2428	10.7767	4.2450	10.7823		
Clearance-piston skirt-to-liner.....	.0045	.0114	.0083	.0211	.0120	0305
Out-of-round.....			.0005	.0013		
Taper			.0005	.0013		
Compression rings:						
Gap (top-fire ring).....	.0230	.0584	.0380	.0965	.0600	.1524
Gap (No. 2, 3 and 4).....	.0180	.0457	.0430	.1092	.0600	.1524
Clearance-ring-to-groove:						
No. 1 (top-fire ring)	.0040	.0102	.0070	.0178	.0180	.0457
No. 2	.0100	.0254	.0130	.0330	.0220	.0559
No. 3 and 4.....	.0040	.0102	.0070	.0178	.0130	.0330
Oil control rings:						
Gap	.0080	.0203	.0230	.0584	.0430	.1092
Clearance.....	.0015	.0038	.0055	.0140	.0080	.0203
Crankshaft						
Journal diameter-main bearing	4.4990	11.4275	4.5000	11.4300		
Journal diameter-conn. rod bearing	2.9990	7.6175	3.0000	7.6200		
Journal out-of-round			.00025	.00064	.0010	.0025
Journal taper			.0005	.0013	.0015	.0038
*Runout on journals-total indicator reading:						
Crankshaft (mounted on No. 1 and No.7 journals):						
At No. 2 and No. 6 journals			.0020	.0051		
At No. 3 and No. 5 journals			.0040	.0102		
At No. 4 journal			.0060	.0152		
Thrust washer thickness	.1190	.3023	.1220	.3099		
End play (end thrust clearance)	.0040	.0102	.0140	.0356	.0180	.0457

* Runout tolerance given for guidance when regrinding crankshaft. When the runout on adjacent journals is in the opposite direction, the sum must not exceed .003 inches (.008 cm) total indicator reading. When the runout on adjacent journals is in the same direction, the difference must not exceed .003 inch (.008 cm) total indicator reading. When high spots of the runout on adjacent journals are at right angles to each other, the sum must not exceed .004 inches (.010 cm) total indicator reading or .002 inches (.005 cm) on each journal.

Table Of Specifications. (continued)

ENGINE PARTS (Standard Size, New)	MINIMUM		MAXIMUM		LIMITS	
	(inches)	(cm)	(inches)	(cm)	(inches)	(cm)
Connecting Rod Bearing						
Inside diameter (vertical axis).....	3.0014	7.6236	3.0034	7.6286		
Bearing-to-journal clearance	.0014	.0036	.0044	.0112	.0060	.0152
Bearing thickness 90°						
from parting line	.1238	.3145	.1243	.3157	.1230 min.	.3124 min.
Main Bearings.....						
Inside diameter (vertical axis).....	4.5016	11.4341	4.5040	11.4402		
Bearing-to-journal clearance	.0016	.0041	.0050	.0127	.0060	.0152
Bearing thickness 90°						
from parting line	.1545	.3924	.1552	.3942	.1540 min.	.3912 min.
Camshaft						
Diameter (at bearing journals):						
Front and rear	1.4970	3.8024	1.4975	3.8037		
Center and intermediate	1.4980	3.8049	1.4985	3.8062		
Runout at center bearing (when mounted on end bearings)			.0020	.0051		
End thrust	.0040	.0102	.0120	.0305	.0180	.0457
Thrust washer thickness	.1190	.3023	.1220	.3099		
Camshaft Bearings						
Inside diameter:						
Front and rear	1.5000	3.8100	1.5010	3.8125		
Center and intermediate	1.5010	3.8125	1.5030	3.8176		
Clearance-bearing-to-shaft:						
Front and rear	.0025	.0064	.0040	.0102	.0060	.0152
Center and intermediate	.0025	.0064	.0050	.0127	.0090	.0229
Outside diameter:						
Front and rear	2.1880	5.5575	2.1885	5.5588		
Center and intermediate	2.1840	5.5474	2.1860	5.5524		

Table Of Specifications. (continued)

ENGINE PARTS (Standard Size, New)	MINIMUM		MAXIMUM		LIMITS	
	(inches)	(cm)	(inches)	(cm)	(inches)	(cm)
Diameter of cylinder block bore	2.1875	5.5563	2.1885	5.5588		
Clearance-bearings- to-block:						
Front and rear	.0010 press	.0025 press	.0005 loose	.0013 loose		
Intermediate	.0015	.0038	.0045	.0114		
Camshaft Gears						
Inside diameter	1.1865	3.0137	1.1875	3.0163		
Clearance-gear-to-shaft	.0015	.0038	.0000	.0000		
Backlash	.0030	.0076	.0080	.0203	.0100	.0254
Idler Gear						
Backlash	.0030	.0076	.0080	.0203	.0100	.0254
Pre-load-Variation on pull 2 lbs. 11 oz	1.2500	.5675	6.7500	3.0645		
Crankshaft Timing Gear						
Inside diameter	4.7490	12.0625	4.7500	12.0650		
Clearance-gear-to-shaft	.001 press	.0025 press	.001 loose	.0025 loose		
Backlash	.0030	.0076	.0080	.0203	.0100	.0254
Blower Drive Gear (and Left Bank Accessory Drive Gear)						
Backlash	.0030	.0076	.0080	.0203	.0100	.0254
Inside diameter (support bushing)	1.6260	4.1300	1.6265	4.1313		
Hub diameter (at bearing)	1.6240	4.1250	1.6250	4.1275		
Hub-to-support bushing clearance	.0010	.0025	.0025	.0064	.0050	.0127
Thrust washer thickness	.2350	.5969	.2450	.6223		
Thrust bearing thickness	.0590	.1499	.0610	.1549		
End thrust	.0050	.0127	.0100	.0254		
Cylinder Head						
Flatness-transverse					.0040	.0102
Flatness-longitudinal					.0100	.0254
Distance between top deck and fire deck	3.5560	9.0322	3.5680	9.0627	3.5360	8.9814
Water nozzles	.0132 Recess	.0335 Recess	Flush	Flush		
Cam follower bores	1.0620	2.6975	1.0630	2.7000	1.0650	2.7051

Table Of Specifications. (continued)

ENGINE PARTS (Standard Size, New)	MINIMUM		MAXIMUM		LIMITS	
	(inches)	(cm)	(inches)	(cm)	(inches)	(cm)
Exhaust Valve Insert Counterbore:						
Diameter	1.2600	3.2004	1.2610	3.2029		
Depth	.3380	.8585	.3520	.8941		
Exhaust Valve Seat Inserts						
Outside diameter	1.2615	3.2042	1.2625	3.2068		
Seat width.....	.0469	.1191	.0938	.2383	.0938	.2383
Valve seat runout.....			.0020	.0051	.0020	.0051
Exhaust Valves						
Stem diameter.....	.3100	.7874	.3105	.7887	.3090	.7849
Valve head-to-cylinder head:						
30°	.023 recess	.0584 recess	.006 protr.	.0152 protr.		
Valve Guides						
Height above cylinder head.....	.8800	2.2352	.8800	2.2352		
Diameter-inside	.3125	.7938	.3135	.7963	.3140	.7976
Clearance-valve- to-guide	.0020	.0051	.0035	.0089	.0050	.0127
Valve Bridge Guides						
Height above cylinder head.....		2.0400	5.1816	2.0400	5.1816	
Rocker Arms and Shafts						
Diameter-rocker shaft	.8735	2.2187	.8740	2.2200		
Diameter-inside (rocker arm bushing)	.8750	2.2225	.8760	2.2225		
Clearance-shaft-to- bushing	.0010	.0025	.0025	.0064	.0040	.0102
Cam Followers						
Diameter.....	1.0600	2.6924	1.0610	2.6949		
Clearance-follower- to-head.....	.0010	.0025	.0030	.0076	.0060	.0152
Rollers and pins:						
Clearance-pin-to- bushing	.0013	.0033	.0021	.0053	.010 Horiz	.0254 Horiz
Side clearance- roller to follower.....	.0150	.0381	.0230	.0584	.0230	.0584