

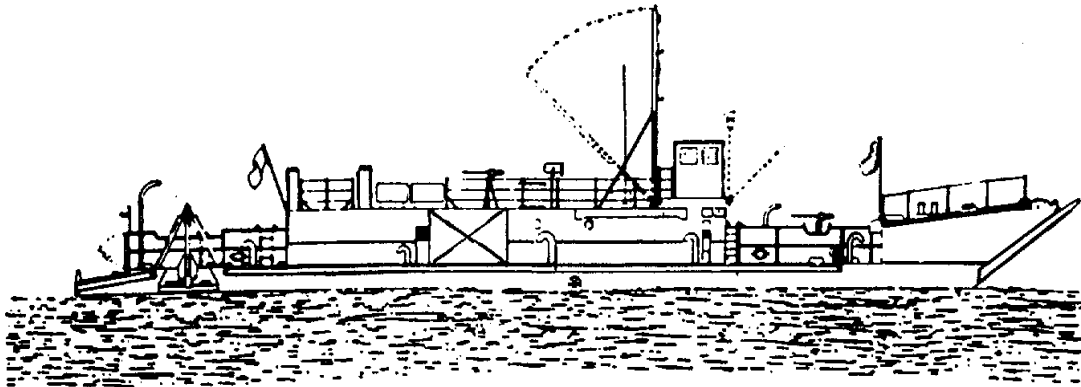
TECHNICAL MANUAL

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

DIRECT SUPPORT
MAINTENANCE
INSTRUCTION

LANDING CRAFT UTILITY
LCU 1667-1670 Y
NSN 1905-00-168-5764

GENERAL SUPPORT
MAINTENANCE
INSTRUCTIONS



HEADQUARTERS, DEPARTMENT OF THE ARMY

8 APRIL 1985

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

LANDING CRAFT UTILITY

LCU 1667-1670 NSN 1905-00-168-5764

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake 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, U. S. Army Troop Support Command, ATTN: AMSTR-MPS, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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5-68. ANCHOR WINCH ENGINE - MAINTENANCE INSTRUCTIONS.

The following is an index to the Anchor Winch Engine maintenance instructions:

Description	Paragraph
Engine Assembly	5-69
Governor	5-70
Blower	5-71
Fuel Injector	5-72
Fresh Water Pump	5-73
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The following is an index to the Hydrostarter Maintenance procedures.

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5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS.

This task covers:

- a. Removal
- b. Engine Run-In Instructions
- c. Installation

INITIAL SETUP

Test Equipment

NONE

References

Vol-10 FO-1 Machinery/Vehicle Deck
Access

Special Tools

Cutting tools
Welding tools
Crane (10 ton)
Miscellaneous chains

Equipment

<u>Condition</u>	<u>Condition Description</u>
Paragraph	

5-65.1 Disconnect Clutch Assembly
Removed

5-66 Torque Converter Removed

Material/Parts

NONE

Special Environmental Conditions

Do not drain oil into bilges. Use
oil/water separation and recovery
system to collect oil.

Personnel Required

6

General Safety Instructions

Observe normal precautions when
handling heavy equipment.

LOCATION	ITEM	ACTION	REMARKS
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NOTE

Anchor Winch Engine weight is 2,880 lbs. (1306 kg) dry.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

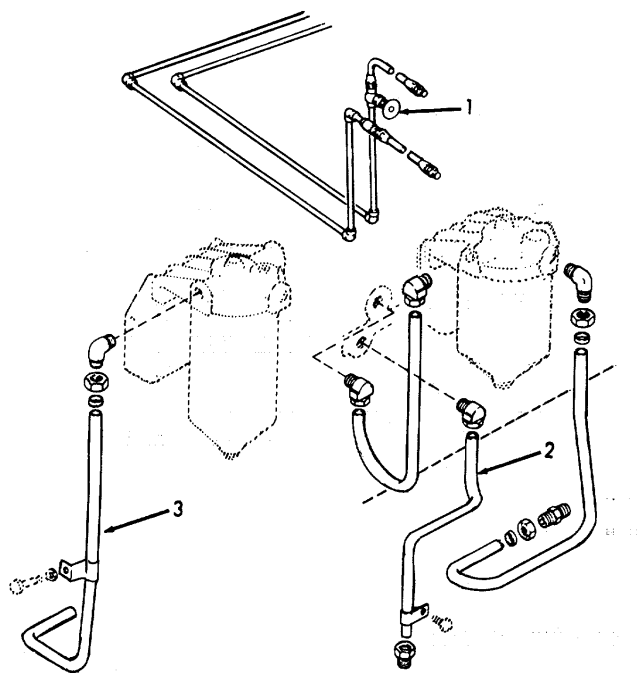
LOCATION	ITEM	ACTION	REMARKS
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WARNING

- To prevent the possibility of a fire when using cutting or welding equipment, place a crewman above and below the deck with a fire extinguisher.
- Keep clear of the area directly below the deck section being removed.

REMOVAL

1. Fuel Lines	a. Valve (1)	Close.	
	b. Fuel drain tube (2), and strainer to fuel pump tube (3)	Disconnect.	Drain fuel into a suitable container.

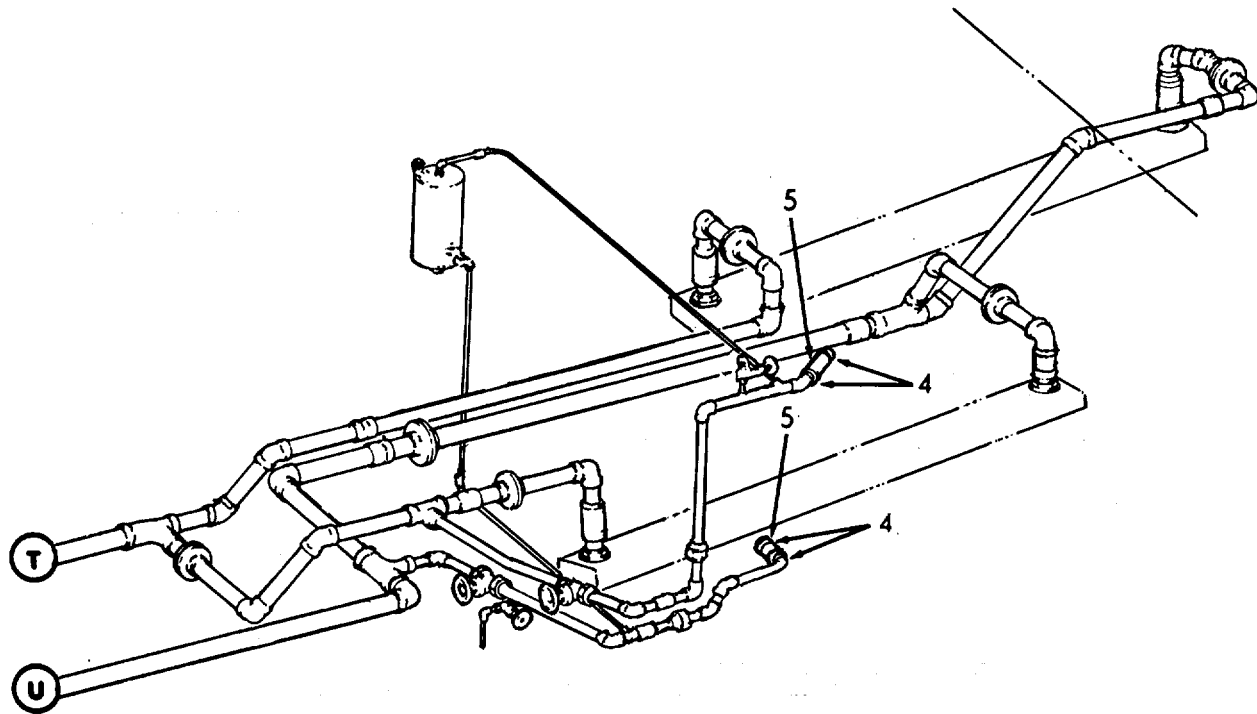


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)

- | | | |
|------------------|--------------------|---------|
| 2. Cooling Lines | a. Hose clamps (4) | Loosen. |
| | b. Hoses (5) | Remove. |

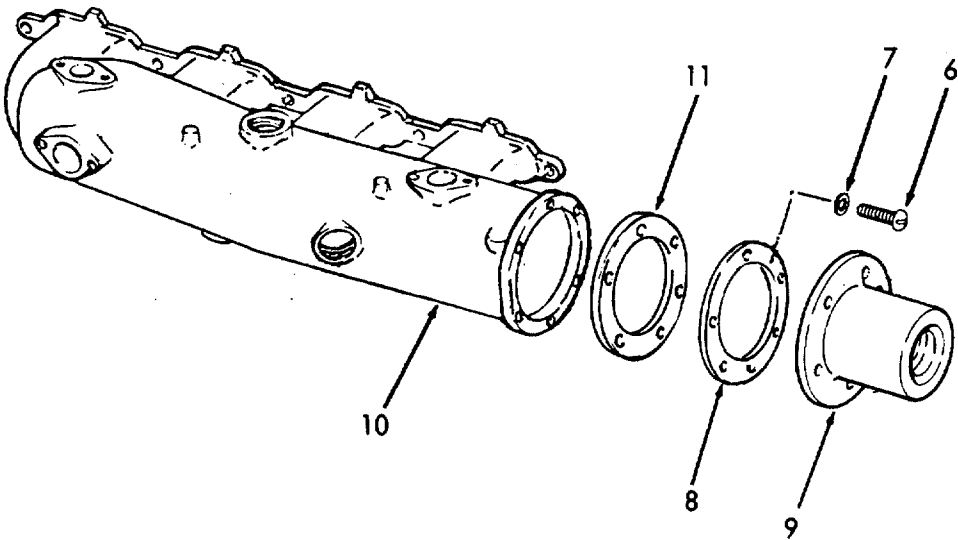
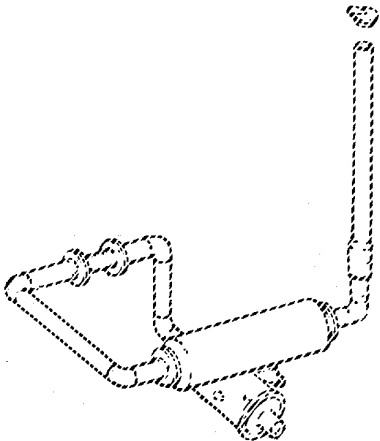


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)

- | | | |
|-------------------|--|-----------|
| 3. Exhaust Piping | a. Screws (6), and lock-washers (7) | Remove. |
| | b. Flange (8) m nipple (9) and manifold (10) | Separate. |
| | c. Gasket (11) | Remove. |

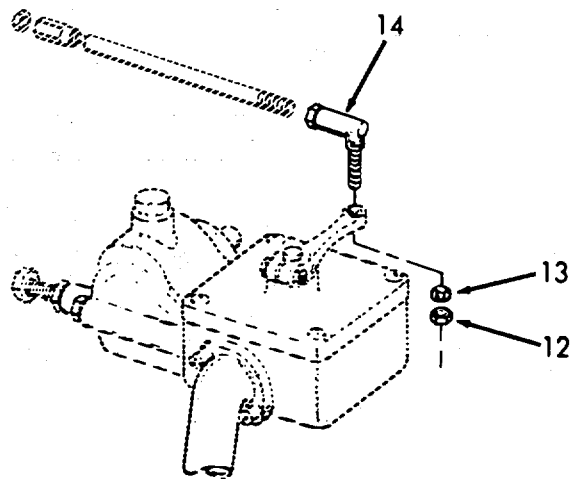
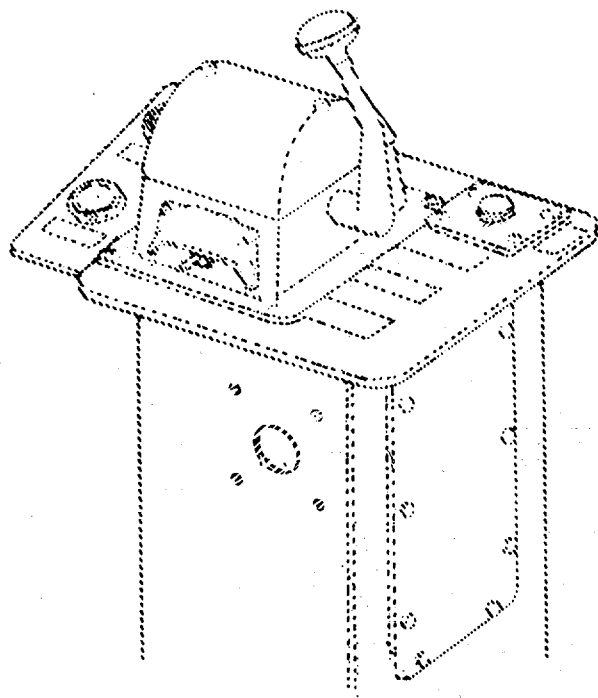


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)

- | | | |
|---------------|-----------------------------------|---------|
| 4. Stop Cable | a. Nut (12), and lock-washer (13) | Remove. |
| | b. Ball joint (14) | Remove. |

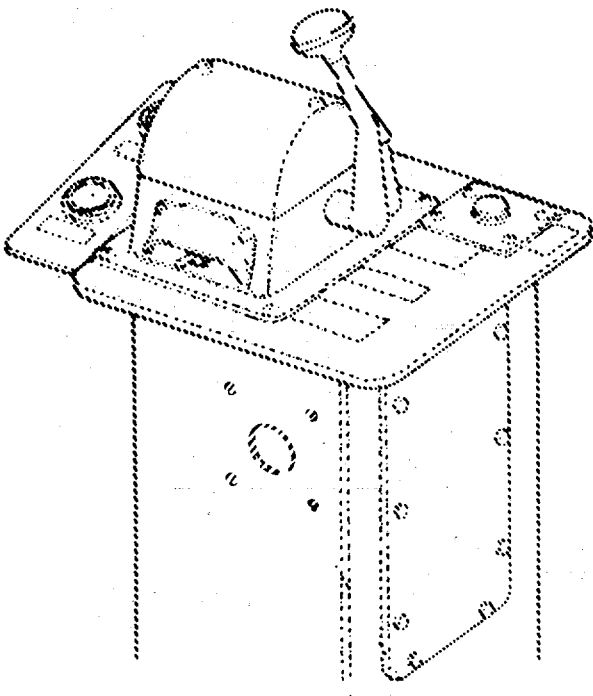
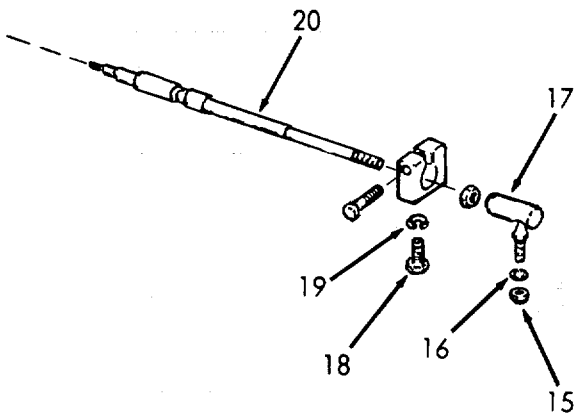


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)

- | | | |
|----------------------|--|---------|
| 5. Shutdown
Lever | a. Nut
(15),
and
lock-
washer
(16) | Remove. |
| | b. Ball
joint
(17) | Remove. |
| | c. Screws
(18)
and
lock-
washers
(19) | Remove. |
| | d. Control
cable
(20) | Remove. |

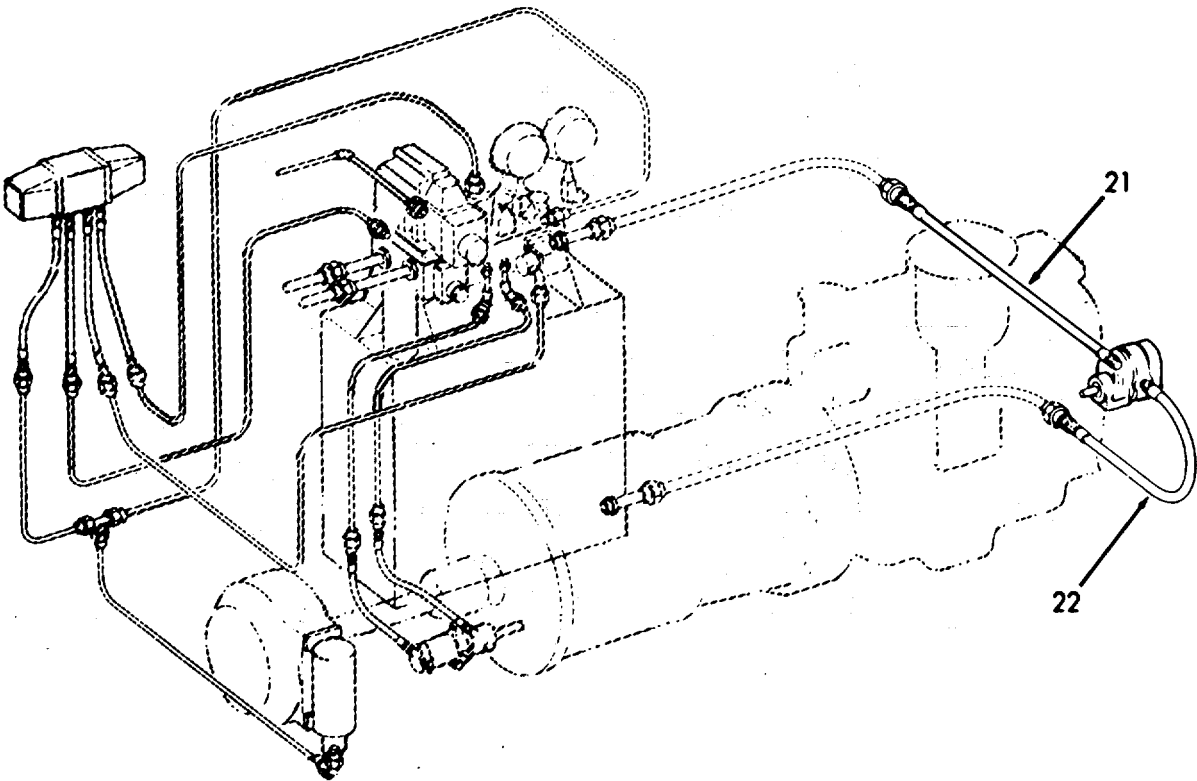


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)

6. Control Pedestal Wiring	Wiring	Tag and disconnect.	
7. Hydraulic Piping	a. Flexible hose (21) to top of hydraulic tank		
	b. Flexible hose (22) to bottom of hydraulic tank	Remove.	

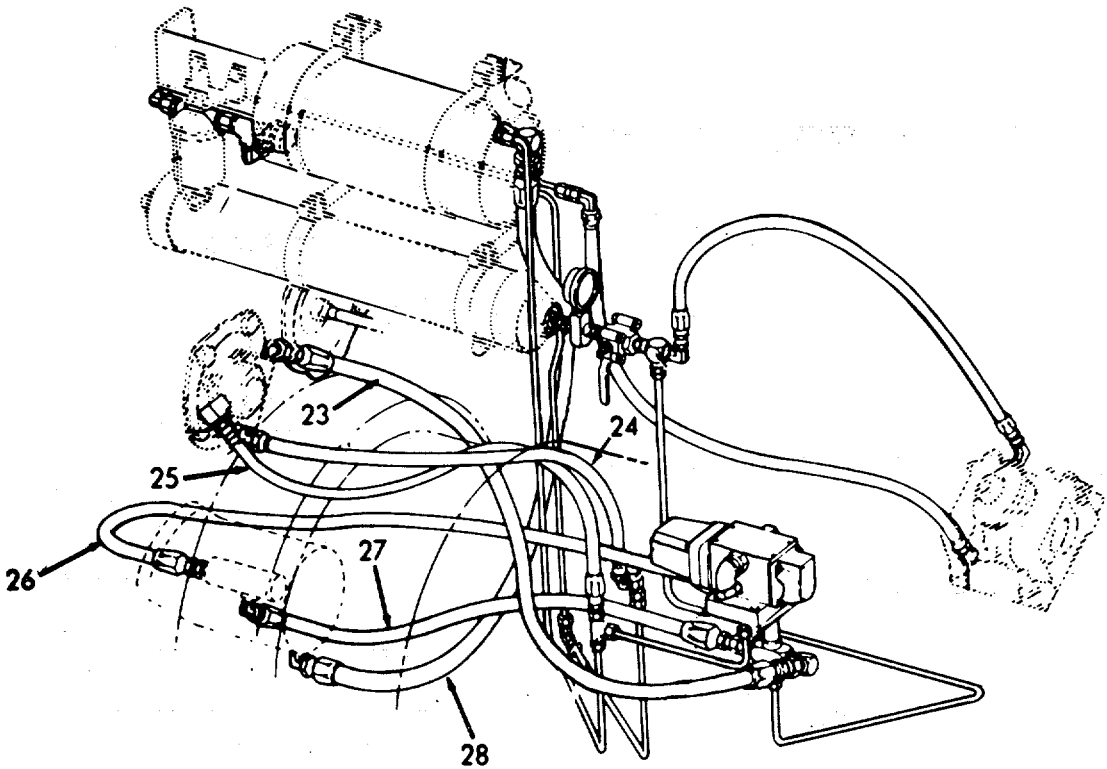


5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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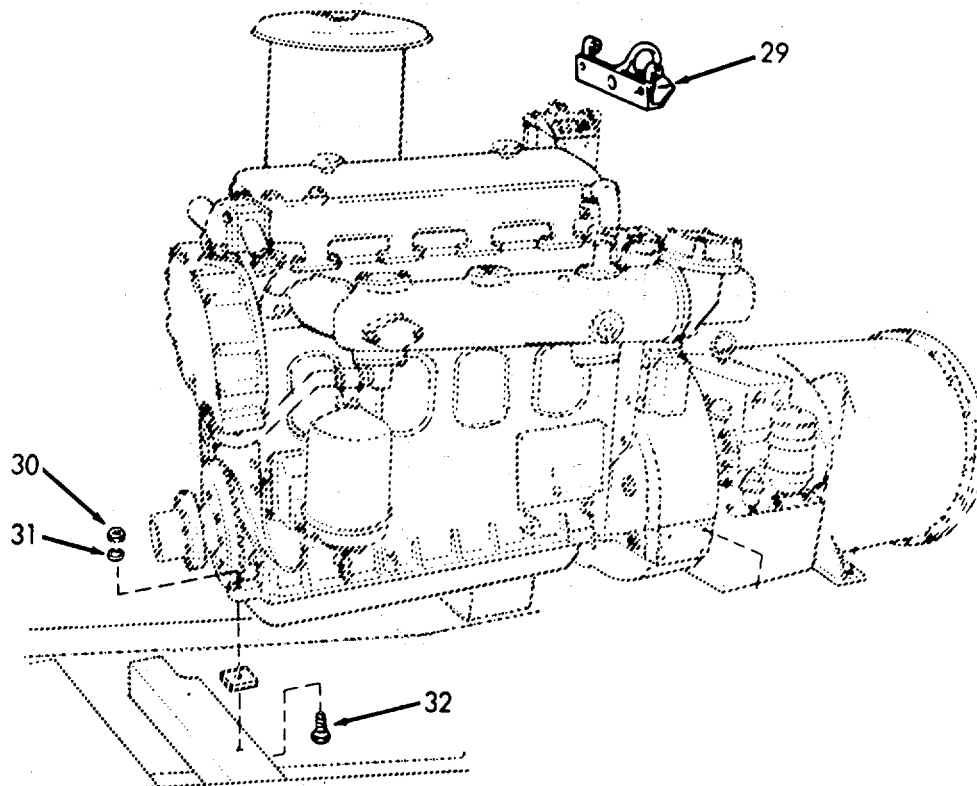
REMOVAL (Cont)

8. Hydro-starter Piping	a. Hand pump relief valve	Open to reduce pressure in system.	
	b. Hoses (23, 24, 25, 26, 27, and 28)	Remove.	Drain oil into a suitable con- tainer.



5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL (Cont)			
9. Dis- connect Clutch and Torque Converter	a. Clutch	Remove.	Refer to para- graph 5-65.1.
	b. Torque converter	Remove.	Refer to para- graph 5-66.
10. Vehicle Deck	Deck plate	Remove.	Refer to FO-1 in Volume 10.
11. Engine Room	a. Lifting brackets (29)	Attach chains.	
	b. Nuts (30), lockwashers (31), and screws (32)	Remove.	



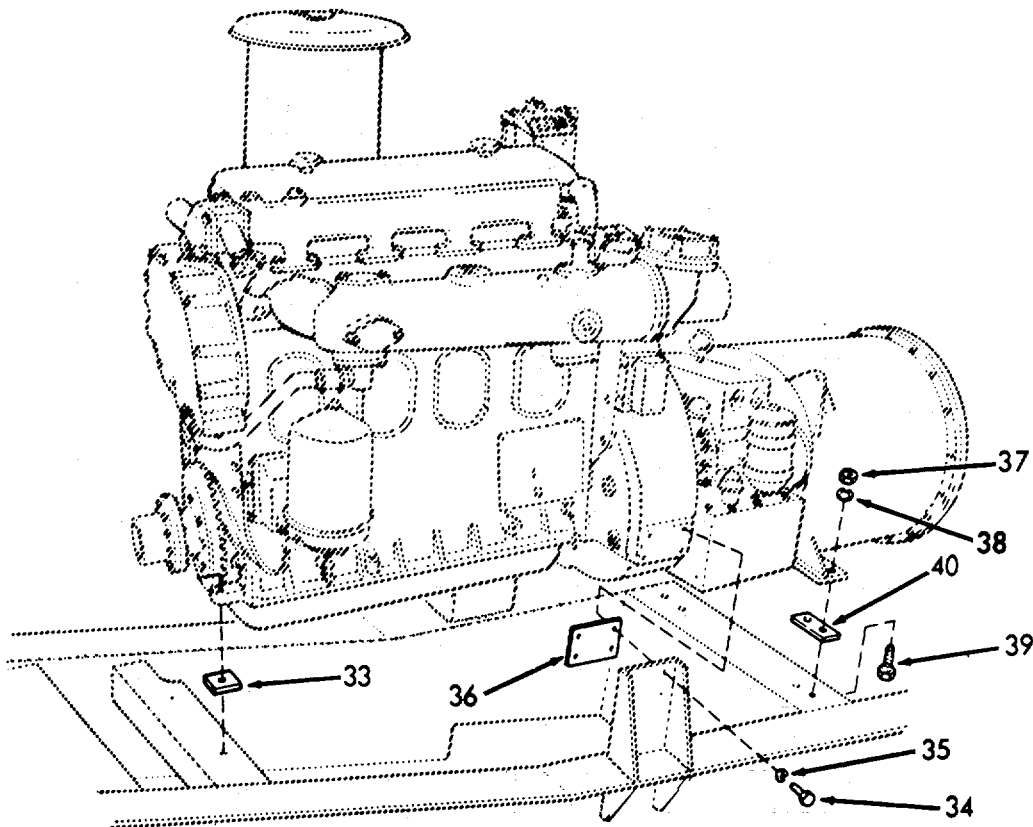
5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
REMOVAL (Cont)			
	c. Steel chocks (33)	Remove.	
	d. Screws (34), and lock-washers (35)	Remove.	
	e. Steel chocks (36)	Remove.	
	f. Nuts (37) , lock-washers (38) and screws (39)	Remove.	
	g. Steel chock s (40)	Remove.	
12. Vehicle Deck	Engine	Lift.	

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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REMOVAL (Cont)



ENGINE RUN-IN INSTRUCTIONS

13. Anchor
Winch
Engine

- a. Following a complete overhaul or any major repair job involving the installation of piston rings, pistons, cylinder liners or bearings, the engine should be "run-in" on a dynamometer prior to release for service.
- b. The dynamometer is a device for applying specific loads to an engine. It permits the serviceman to physically and visually inspect and check the engine while it is operating. It is an excellent method of detecting improper tune-up, misfiring injectors, low compression and other malfunctions, and may save an engine from damage at a later date.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

- c. The operating temperature within the engine affects the operating clearances between the various moving parts of the engine and determines to a degree how the parts will wear. Normal coolant temperature (160° - 185° F.) should be maintained throughout the run-in.
- d. The rate of water circulation through the engine on a dynamometer should be sufficient to avoid having the engine outlet water temperature more than 10° F. higher than the water inlet temperature. Though a 10° rise across an engine is recommended, it has been found that a 15° temperature rise maximum can be permitted.
- e. A thermostat is used in the engine to control the coolant flow; therefore, be sure it is in place and fully operative or the engine will overheat during the run-in. However, if the dynamometer has a water standpipe with a temperature control regulator, such as a Taylor valve or equivalent, the engine should be tested without thermostats.
- f. The Basic Run-In Horsepower Schedule is shown in the Table. The horsepower shown in the table is at SAE conditions: dry air density .0705 lb/cu. ft., air temperature of 85° F., and 500 ft. elevation.
- g. Dynamometer Test and Run-In Procedures.
 - (1) The Basic Engine.
 - (a) A basic engine includes only those items actually required to run the engine. The addition of any engine driven accessories will result in a brake horsepower figure less than the values shown in the Basic Engine Run-In Horsepower Schedule. The following items are included on the basic engine: blower, fuel pump, fresh water pump, and governor.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

BASIC RUN-IN HORSEPOWER SCHEDULE

Speed RPM	Time Minutes	Horsepower
1200	10	28
1800	30	90
*1800	30	110
*2100	30	118
*2300	30	128

*Run at only one of the speeds shown, whichever is at or nearest to the governed speed and reset governor after final run, if necessary.

- (b) In situations where other than basic engine equipment is used during the test, proper record of this fact should be made on the Engine Test Report (see page 5-924.) The effects of this additional equipment on engine performance should be considered when evaluating test results.

(2) Dynamometer

- (a) The function of the dynamometer is to absorb and measure the engine output. Its basic components are a frame, engine mounts, the absorption unit, a heat exchanger, and a torque loading and measuring device.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

- (b) The engine is connected through a universal coupling to the absorption unit. The load on the engine may be varied from zero to maximum by decreasing or increasing the resistance in the unit. The amount of power absorbed in a water brake type dynamometer, as an example, is governed by the volume of fluid within the working system. The fluid offers resistance to a rotating motion. By controlling the volume of water in the absorption unit, the load may be increased or decreased as required.

- (c) The power absorbed is generally measured in torque (lb. ft.) on a suitable scale. This value for a given engine speed will show the brake horsepower developed in the engine by the following formula:

$$\text{BHP} = (T \times \text{RPM}) / 5250$$

Where:

BHP = brake horsepower

T = torque in lb. - ft.

RPM = revolutions per minute

- (d) Some dynamometers indicate direct brake horsepower readings. Therefore, the use of the formula is not required when using these units.
- (e) During the actual operation, all data taken should be recorded immediately on an Engine Test Report.

(3) Instrumentation

- (a) Certain instrumentation is necessary so that data required to complete the Engine Test Report may be obtained. The following List contains both the minimum amount of instruments and the proper location of the fittings on the engine so that the readings represent a true evaluation of engine conditions.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

1. Oil pressure gage installed in one of the engine main oil galleries.
 2. Oil temperature gage installed in the oil pan, or thermometer installed in the dipstick hole in the oil pan.
 3. Adapter for connecting a pressure gage or mercury manometer to the engine air box.
 4. Water temperature gage installed in the water outlet manifold.
 5. Adapter for connecting a pressure gage or water manometer to the crankcase.
 6. Adapter for connecting a pressure gage or mercury manometer to the exhaust manifold at the flange.
 7. Adapter for connecting a vacuum gage or water manometer to the blower inlet.
 8. Adapter for connecting a fuel pressure gage to the fuel manifold inlet passage.
- (b) In some cases, gages reading in pounds per square inch are used for determining pressure while standard characteristics are given in inches of mercury or inches of water. It is extremely important that the scale of such a gage be of low range and finely divided if accuracy is desired. This is especially true of a gage reading in psi, the reading of which is to be converted to inches of water. The following conversion factors may be helpful:

Inches of water	=	psi x 27.7 inches
Inches of mercury	=	psi x 2.04 inches

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

(4) Run-In Procedure

The procedure outlined below will follow the order of the sample Engine Test Report (see page 5-924) .

(a) Pre-Starting

1. Fill the lubrication system.
2. Prime the fuel system.
3. A preliminary valve clearance adjustment must be made before the engine is started.
4. A preliminary injector timing check must be made before starting the engine.
5. Preliminary governor adjustments must be made.
6. Preliminary injector rack adjustment must be made.

(b) Basic Engine Run-In

1. The operator should be observant at all times, so that any malfunction which may develop will be detected. Since the engine has just been reconditioned, this run-in will be a test of the workmanship of the serviceman who performed the overhaul. Minor difficulties should be detected and corrected so that a major problem will not develop.
2. After performing the preliminary steps, be sure all water valves, fuel valves, etc. are open. Also inspect the exhaust system, being sure that it is properly connected to the engine. Always start the engine with minimum dynamometer resistance.

5-69. ENGINE ASSEMBLY - REMOVAL AND RUN-IN MAINTENANCE INSTRUCTIONS
(Continued).

LOCATION	ITEM	ACTION	REMARKS
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ENGINE RUN-IN INSTRUCTIONS (Cont)

3. After the engine starts, if using a water brake-type dynamometer, allow sufficient water, by means of the control loading valves, into the dynamometer absorption unit to show a reading of approximately 5 lb. ft. on the torque gage (or 10-15 HP on a horsepower gage). This is necessary, on some units, to lubricate the absorption unit seals and to protect them from damage.
4. Set the engine throttle at idle speed, check the lubricating oil pressure and check all connections to be sure there are no leaks.
5. Refer to the Engine Test Report sample (see page 5-924) which establishes the sequence of events for the test and run-in, and to the Basic Run-In Horsepower Schedule on page 5-917 which indicates the speed (rpm), length of time and the brake horsepower required for each phase of the test. Also, refer to the Operating Conditions in Chapter 3 which presents the engine operating characteristics. These characteristics will be a guide for tracing faulty operation or lack of power.
6. Engine governors in most cases must be reset at the maximum full-load speed designed for the run-in. If a governor is encountered which cannot be adjusted to this speed, a stock governor should be installed for the run-in .
7. After checking the engine performance at idle speed and being certain the engine and dynamometer are operating properly, increase the engine speed to half speed and apply the load indicated on the Basic Run-In Horsepower Schedule on page 5-917.