

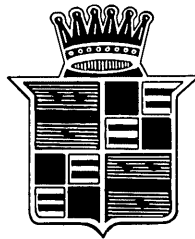
Subaru

INSTRUCTION MANUAL

Operation and Maintenance

CADILLAC MARINE ENGINE

V8 SERIES 75



*Compiled for the Australian Army
by
General Motors-Holden's Ltd.*



GENERAL MOTORS-HOLDEN'S LIMITED

FISHERMEN'S BEND, MELBOURNE, AUSTRALIA

GENERAL DESCRIPTION

This power unit has been developed from available materials to meet an urgent need by the Australian Army for a readily available power unit suitable for light craft, work boats and general purpose launches, which would normally be powered by special Marine type units were they available at the time of the demand.

POWER UNIT

The basic power unit is a standard Cadillac V-8 series 41-75 petrol engine fitted with a standard low compression head. Parts which have been modified are the Timing Cover, Fuel Pump Cam, Oil Pan and Manifolds, also the Clutch and Fan-driven Pulley are removed. The Oil System has been modified by the introduction of an Oil Cooler and the Crankcase Breather has been modified by sealing off the lower end by the Oil Pan, the pipe being assembled vertically from the tappet chamber duct to the flame arrester housing.

COOLING SYSTEM

Fresh water circulation through engine and heat exchanger using standard centrifugal pump Vee belt driven from Crankshaft pulley. Water flow is controlled by a thermostat, housed in the header tank of the heat exchanger, which maintains the engine temperature between 150°-170°F. for a wide range of sea water temperatures.

The Heat Exchanger is a tube type multipass unit based on naval design and combining engine water and oil coolers. Engine circulating water flows diagonally through the box over the outside of all the banks of tubes; sea water flows through seven of the tube groups in series, and engine oil flows through the eighth tube group, being cooled by the engine circulating water immediately before the latter returns to the engine.

The sea water used in heat exchanger unit for cooling purposes is circulated by means of a positive displacement gear pump having rubber impellers mounted on two stainless steel shafts, themselves geared together by steel gears running in an oil bath.

Pump Body, Wear Plate, and Support Casting are bronze, and oil bath housing which is well away from salt water, is cast iron.

Renewable bronze bushes and adjustable glands are fitted and shafts run on ball bearings in oil bath.

The Oil Cooler which is located in the heat exchanger unit at one end, has end covers, identical top and bottom fitted separately from header tank to prevent leakage between oil and water coolers.

The Water Cooler Bottom Cover is a simple dished gunmetal casting ribbed to direct water through tube passages in series.

The Water Cooler Top Cover and Header Tank is a gunmetal casting basically similar to the bottom cover but forming the base of the fresh water header tank.

The Thermostat is a standard unit of the vapour pressure type and housed in a gallery cast into the header tank so placed that it controls the admission of water to the header from the two engine outlets.

EXHAUST MANIFOLDS

High grade iron castings with water jacket cast integral with Inspection door in each manifold for cleaning.

Exhaust offtake on either right or left hand side near front of motor.

OIL PAN

The sheet metal oil pan fitted to the standard engine is removed and replaced with an iron casting of increased capacity and with provision for drain flanges on either side.

ENGINE MOUNTINGS

Standard Cadillac bonded rubber compression type mountings—one each side near front of engine. The rear end of the engine is supported by an adaptor casting bolted to the gear box.

GEAR BOX

The gear box is a "Momy" type combined reduction and reverse gear modified by the manufacturer with output shaft vertically beneath input shaft. The gears are driven by an internally splined coupling sleeve connecting a splined stub shaft bolted to flywheel centre with splined sleeve fitted to input shaft of "Momy" gear box.

The gear box is directly attached to the engine clutch housing by means of a cast iron adaptor which serves to locate and align both units, and acts as a housing for the drive.

SUBFRAME

The heat exchanger, engine and gear box are attached to a rolled angle subframe which has support brackets provided for the attachment of these parts.

WATER PIPES

The water pipes are seamless drawn copper tube with a two stud flange standard for all connections.

FLAME ARRESTOR AND ENGINE BREATHER

The flame arrestor is an aircraft type viscous flow unit as used on Gipsy Aero engines and is mounted in a spun metal housing with cover arranged so that air is drawn upwards at low velocity all round carburettor to provide cooling and reduce intake of spray.

The lower end of breather passage is sealed off by Oil Pan and a pipe taken vertically from the tappet chamber duct to the flame arrestor housing.

TACHOMETER DRIVE

The Tachometer drive is taken from a gear in the sea water pump gear box and operates at half engine speed with clockwise rotation when viewed from the front (i.e., same direction as engine crankshaft). Drive is by Standard S.A.E. fitting.

BILGE PUMP

Centrifugal pump identical with Gray Marine Diesel unit, Vee belt driven from engine crankshaft and fitted with priming provision from sea water outlet of exhaust manifold.

INSTRUMENTS

Tachometer.
Oil Pressure Gauge.
Water Temperature Indicator.
Ammeter.
Ignition Switch.
Starter Switch.
Panel Light.
Leadlight Plug-in Socket.

INSTRUMENT PANEL

Sealed Box containing Voltage Regulator, Switches, etc., with sub-panel carrying instruments sealed on rubber gaskets behind plate glass window.

ELECTRICAL WIRING

Connection between Power Unit and Instrument Panel is by two plastic-sheathed four-core cables which plug into sockets at either end.

Battery cables and wiring on engine are tape wrapped and thoroughly impregnated with a tropic proofing compound.

BATTERY

6 Volt, 19 Plate heavy duty square type, with non-spillable type filler plugs.

BATTERY ISOLATING SWITCH

A sealed high capacity switch is provided to disconnect the battery when unit is not operating.

PROVISION FOR HAND STARTING

Starter handle to be provided and dog to be fitted to Crankshaft.

CONTROLS

Throttle and Choke Controls are of bowden wire type, using copper tube outer casing.

Gear box control is of high leverage type with positive lock in either forward or reverse, and provision for adjustment to provide for full wear of gear box clutch linings.

SPARES

Kit of engine spares and tools to be provided with each unit.

SEAWATER INLET

Non-ferrous flanged pipe with loose flange and bolts provided.

SEA COCK

1½ bore bronze gate valve intended to fit directly to Sea-water Inlet Pipe.

SEAWATER STRAINER

Large capacity double strainer so arranged that change-over from main strainer to auxiliary can be made without stopping engine.

Auxiliary strainer has ample capacity to permit operation until unit can be stopped for cleaning of main strainer.

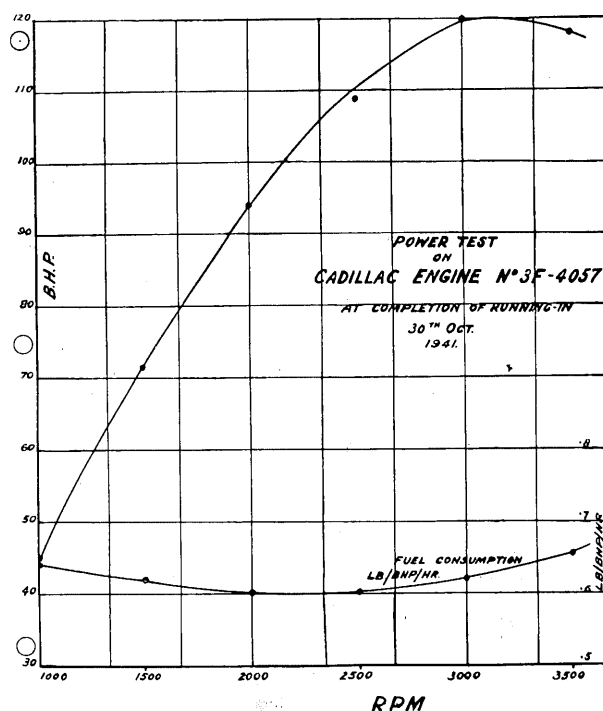


Fig. 1. Power Curve showing approximate fuel consumption at full throttle

ENGINE

TORQUE TIGHTNESSES

The tightness of the attaching bolts of various engine parts is very important to avoid distortion and permanent injury of the parts. A torque wrench should always be used on these engine bolts so that they can be accurately tightened according to the torque tightness specifications which are given below:—

	Size	Ft.Lbs. Min.	Ft.Lbs. Max.
Camshaft sprocket nut ...	$\frac{3}{4}$ -16	90	95
Intake and exhaust manifold ...	$\frac{3}{8}$ -24	25	30
Connecting rod bolts ...	Special	50	60
Crankshaft counterweights ...	$\frac{5}{8}$ -18	145	155
Cylinder head bolts ...	$\frac{7}{16}$ -14	70	75
Flywheel to crankshaft ...	$\frac{7}{16}$ -20	65	70
Oil pan drain plug ...	$\frac{1}{2}$ -20	20	25
Main bearing caps to crankcase	$\frac{9}{16}$ -12	130	140
Fan support to bracket ...	$\frac{5}{8}$ -11	85	95
Engine rear supports ...	$\frac{7}{16}$ -14	50	60

1. CYLINDER NUMBERING

Cylinder numbering is by arrangement rather than firing order. The left front cylinder is number one cylinder and the right front cylinder is number two. The cylinders in the left block are odd-numbered; those in the right block are even-numbered, as shown in Fig. 20.

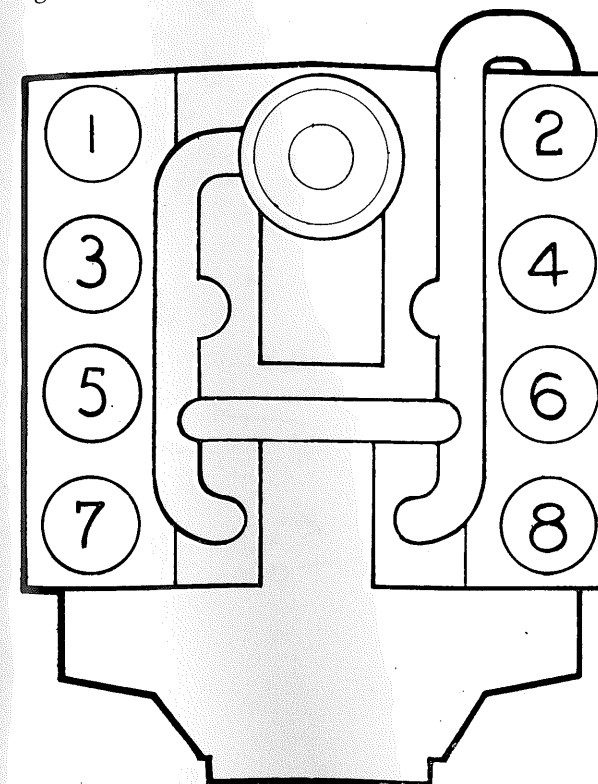


Fig. 20. Cylinder Numbering

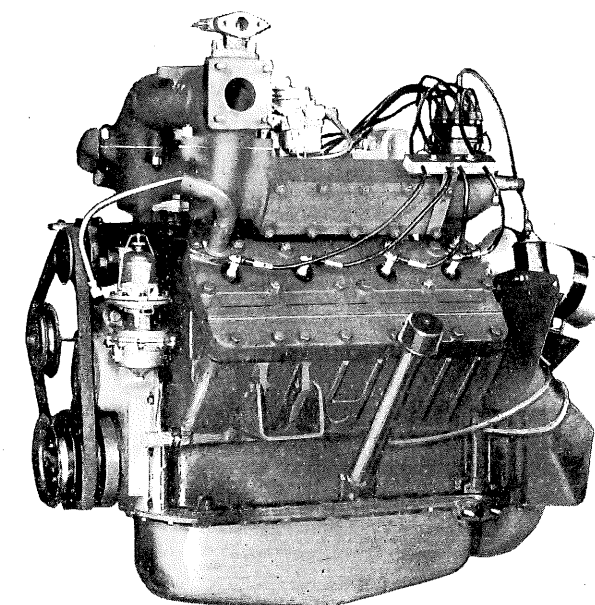


Fig. 21. Engine, Side View

2. CYLINDER HEAD SERVICE

The same cylinder heads are used on all Marine engines. Also, the same cylinder head gaskets are used, and they are interchangeable between right and left sides. Perfect Seal Gasket Paste is recommended for use when installing cylinder head gaskets. This paste remains in a semi-fluid state which provides a good seal, yet permits easy disassembly.

Thorough tightening of the cylinder head cap screws is necessary to insure a leak-proof connection. Tighten the screws from the centre of the head outward. First, tighten while the engine is cold—then warm up the engine thoroughly and re-tighten. The correct torque tightness is 70 to 75 foot pounds.

The two cap screws used at each water outlet connection have oversize heads and are $\frac{1}{2}$ inch longer than the others. Use these screws *only at the fresh water outlet connections*. If installed at any other point, they may break through the water jacket and irreparably damage the entire engine block.

3. All marine engines are equipped with low compression cylinder heads.

4. REMOVING AND INSTALLING CONNECTING RODS AND PISTONS

Connecting rod and piston assemblies are removed from *above*. The big ends of connecting rod are split at an angle to make removal through the bores possible.*

Removal of connecting rod bolts can be made easier first by loosening the threads and then using Connecting Rod Bolt Remover, Tool J-1498.

*See also Note 14, "Precautions on Engine Disassembly."

ENGINE

TORQUE TIGHTNESSES

The tightness of the attaching bolts of various engine parts is very important to avoid distortion and permanent injury of the parts. A torque wrench should always be used on these engine bolts so that they can be accurately tightened according to the torque tightness specifications which are given below:—

	Size	Ft.Lbs. Min.	Ft.Lbs. Max.
Camshaft sprocket nut ...	$\frac{3}{4}$ -16	90	95
Intake and exhaust manifold ...	$\frac{3}{8}$ -24	25	30
Connecting rod bolts ...	Special	50	60
Crankshaft counterweights ...	$\frac{5}{8}$ -18	145	155
Cylinder head bolts ...	$\frac{7}{16}$ -14	70	75
Flywheel to crankshaft ...	$\frac{7}{16}$ -20	65	70
Oil pan drain plug ...	$\frac{1}{2}$ -20	20	25
Main bearing caps to crankcase	$\frac{9}{16}$ -12	130	140
Fan support to bracket ...	$\frac{5}{8}$ -11	85	95
Engine rear supports ...	$\frac{7}{16}$ -14	50	60

1. CYLINDER NUMBERING

Cylinder numbering is by arrangement rather than firing order. The left front cylinder is number one cylinder and the right front cylinder is number two. The cylinders in the left block are odd-numbered; those in the right block are even-numbered, as shown in Fig. 20.

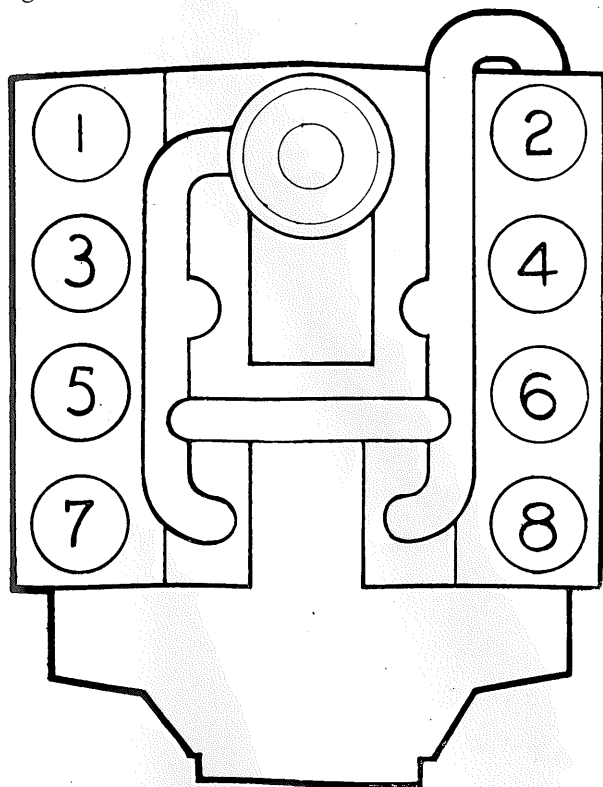


Fig. 20. Cylinder Numbering

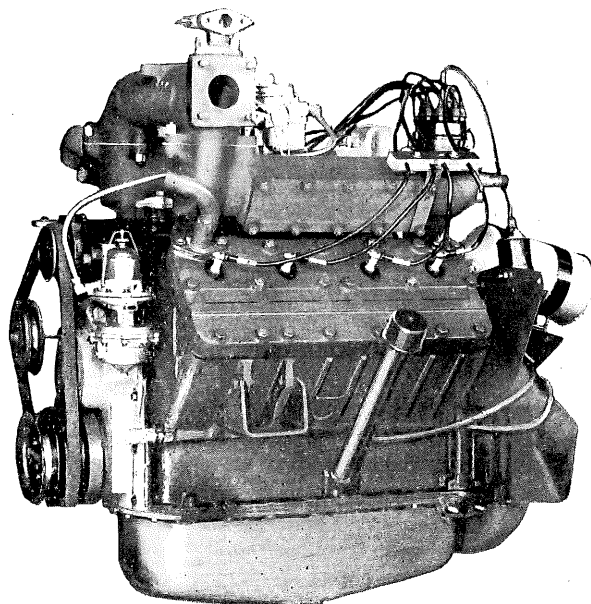


Fig. 21. Engine, Side View

2. CYLINDER HEAD SERVICE

The same cylinder heads are used on all Marine engines. Also, the same cylinder head gaskets are used, and they are interchangeable between right and left sides. Perfect Seal Gasket Paste is recommended for use when installing cylinder head gaskets. This paste remains in a semi-fluid state which provides a good seal, yet permits easy disassembly.

Thorough tightening of the cylinder head cap screws is necessary to insure a leak-proof connection. Tighten the screws from the centre of the head outward. First, tighten while the engine is cold—then warm up the engine thoroughly and re-tighten. The correct torque tightness is 70 to 75 foot pounds.

The two cap screws used at each water outlet connection have oversize heads and are $\frac{1}{2}$ inch longer than the others. Use these screws *only at the fresh water outlet connections*. If installed at any other point, they may break through the water jacket and irreparably damage the entire engine block.

3. All marine engines are equipped with low compression cylinder heads.

4. REMOVING AND INSTALLING CONNECTING RODS AND PISTONS

Connecting rod and piston assemblies are removed from *above*. The big ends of connecting rod are split at an angle to make removal through the bores possible.*

Removal of connecting rod bolts can be made easier first by loosening the threads and then using Connecting Rod Bolt Remover, Tool J-1498.

*See also Note 14, "Precautions on Engine Disassembly."

To loosen the threads, place a blunt punch against the bolt head and tap firmly with a heavy hammer. The punch should be of brass, approximately the diameter of the bolt head, and 3 or 4 inches long. Hold it directly in line with the bolt for best results.

After the threads have been loosened, apply the socket KMO-242 of Tool J-1498 to the bolt head and turn down the hexagonal cap on the lower end of the tool until it wedges the wrench in position between the floor and the bolt being removed. Then loosen the bolt by turning the T-handle.

Always inspect crankshaft journals carefully whenever connecting rods are removed. A rough or scored crank pin will result in further failure if it is not corrected before the engine is re-assembled.

Pistons should be assembled to the rods so that the T-slot in the skirt will be on the left side of the engine. The rod bearing caps are attached with special type cap screws. To tighten them, use a wrench with a T-handle no more than 12 inches across. Do *not* use Tool J-1498 for this purpose.

The lock washers used under the bolt heads are of special design and material. When re-assembling new lock washers, standard Cadillac Washers must be used. When assembling connecting rods to crankshaft, make sure that numbers on rods are toward bottom of engine,

and that they correspond with, and are on the same side as, the numbers on the caps.

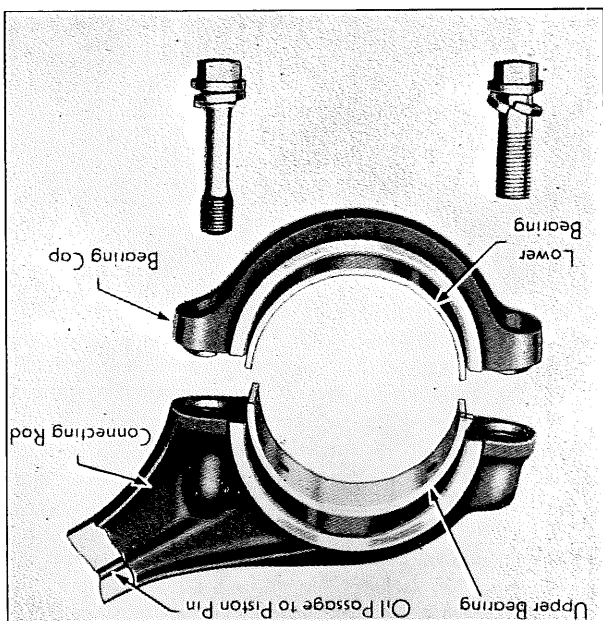


Fig. 24. Connecting Rod Bearing Assembly

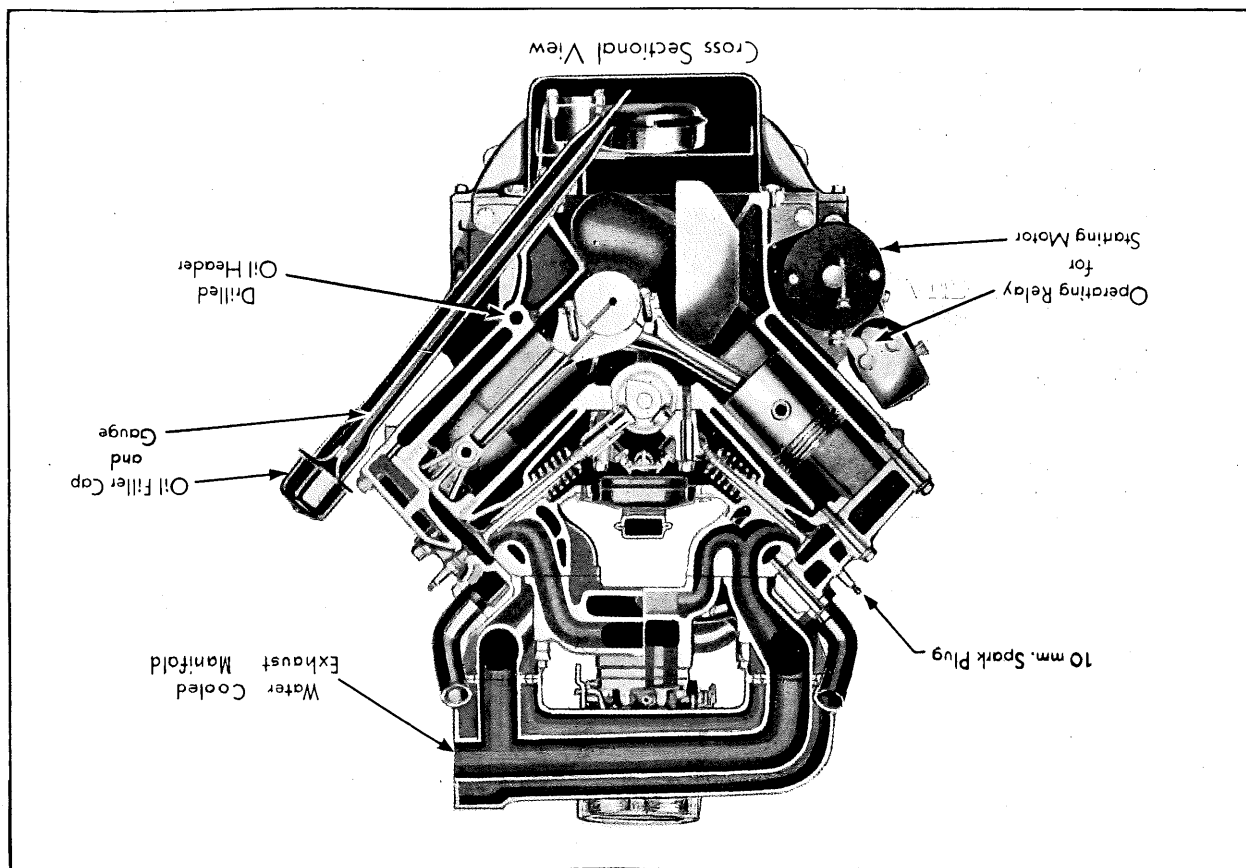


Fig. 22. Engine Transverse Cross Section

5. SERVICING PISTON PINS

Removal

1. Remove lock rings at each end of piston pin that hold pin in place in piston.

2. It is not necessary to heat the piston for removal of the piston pin at ordinary room temperature, the standard fit being just free to a light push fit through both holes at 70°F.

Installation

1. Lubricate piston pin thoroughly with engine oil.
2. Push pin into piston by hand from either side.
3. Install *new* lock rings—never re-install used rings.

The piston pins should be a free hand-press fit in pistons with no perceptible play at 70°F.

Refitting

Piston pins ordinarily will not become loose enough to cause a knock or a tapping until after exceedingly high mileages. In such cases oversize pins should be

installed and the pin holes in the piston honed out to the proper size. The honing should be done as follows: Mount the hone in a vise and revolve the piston on the hone slowly *by hand*—never use an electric drill.

Use a very fine abrasive. Wash the abrasive with kerosene or gasoline frequently and always wash the piston thoroughly before attempting to insert the oversize pin when checking for size.

6. REPLACING PISTON RINGS

When replacing piston rings, particularly on engines with high mileages, the selection of the proper type ring plays a very important part in the performance of the engine after the job is completed.

The accompanying chart shows the proper type piston ring and its part number for each ring groove on standard and oversize pistons. Always use this chart as a reference when ordering replacement rings.

Make sure that the rings are installed exactly as shown in Fig. 25. Although the slotted oil control rings operate satisfactorily either side up, it is very important to install the compression rings as follows:—

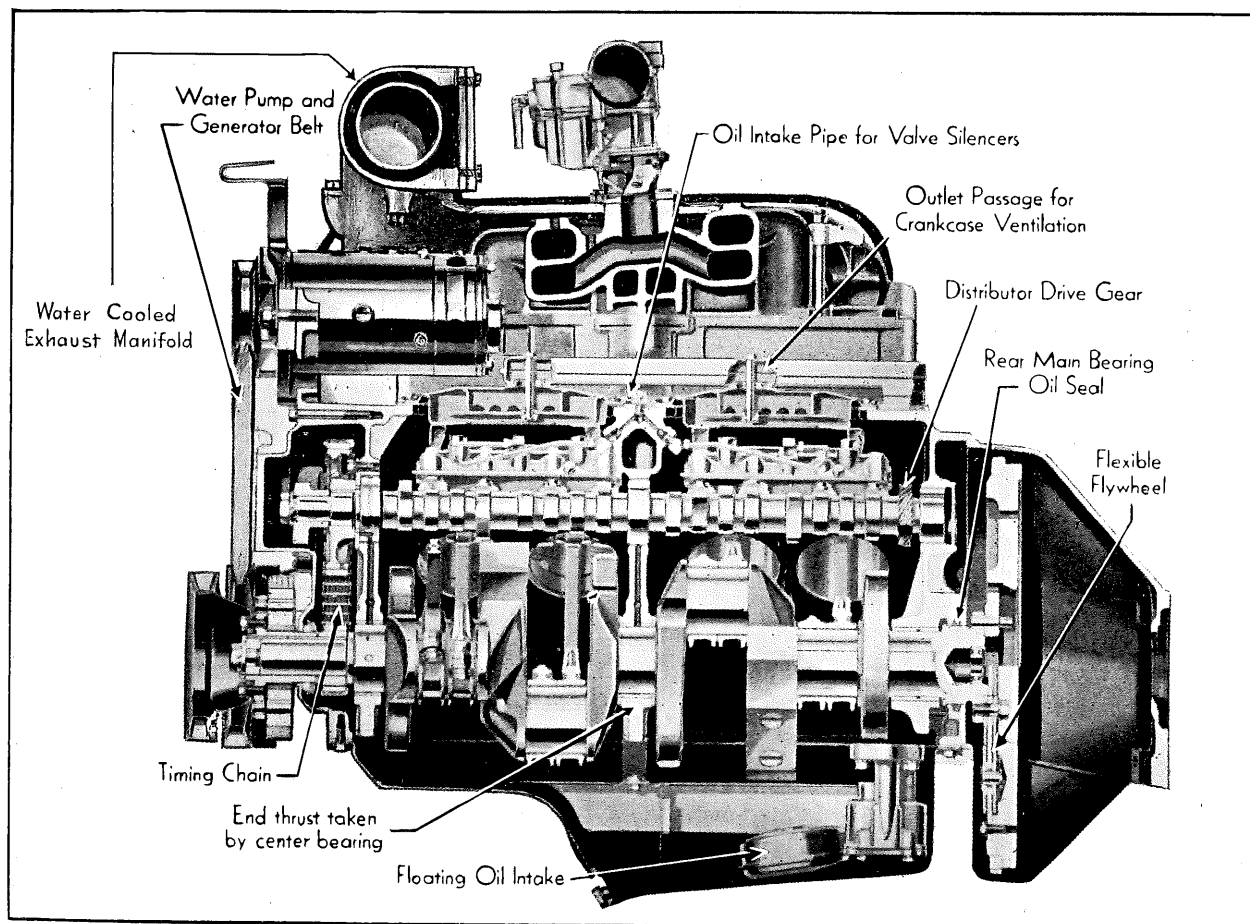
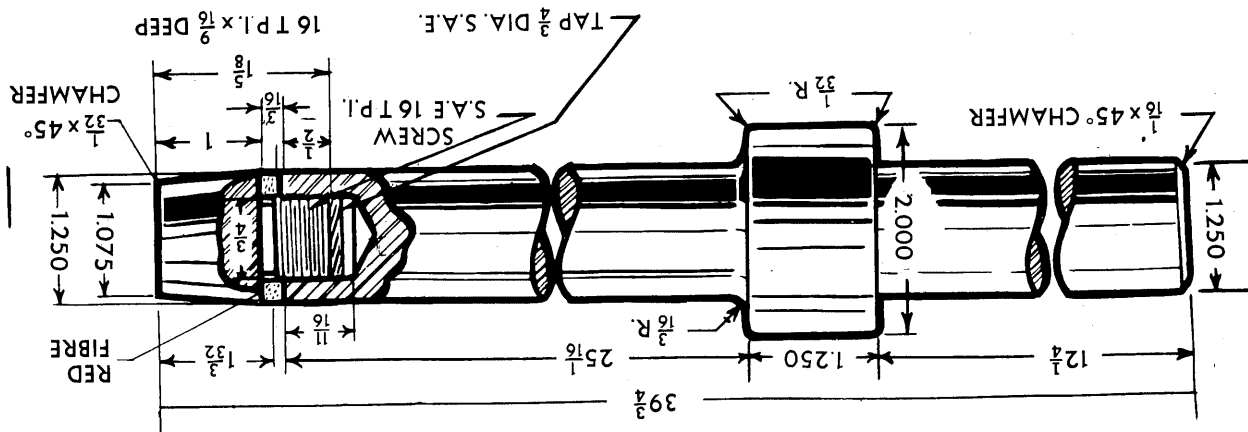
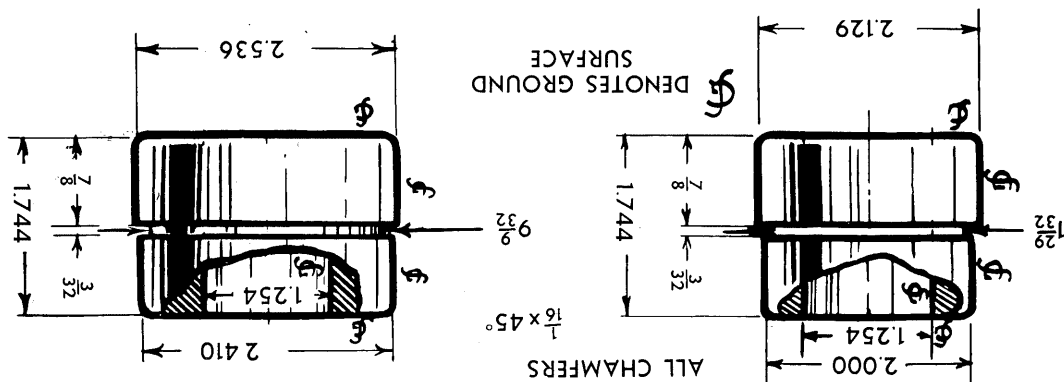


Fig. 23. Engine Longitudinal Cross Section

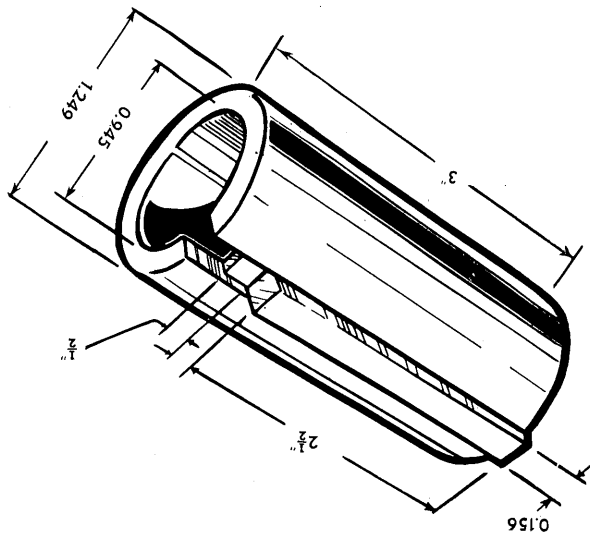
SERVICE TOOLS



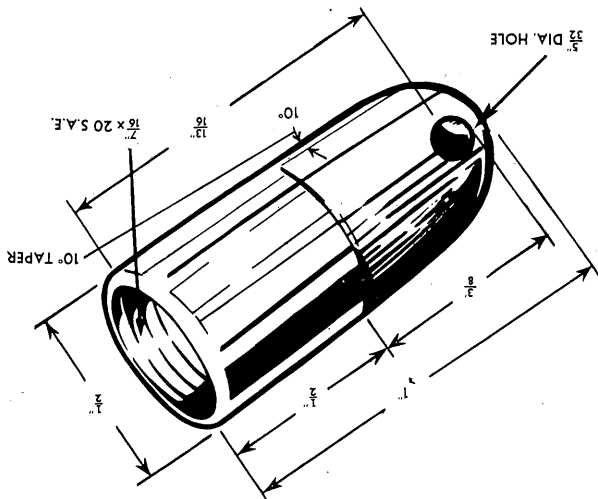
Camshaft Bearing Remover, Replacer and Aligner,
Part No. J-829

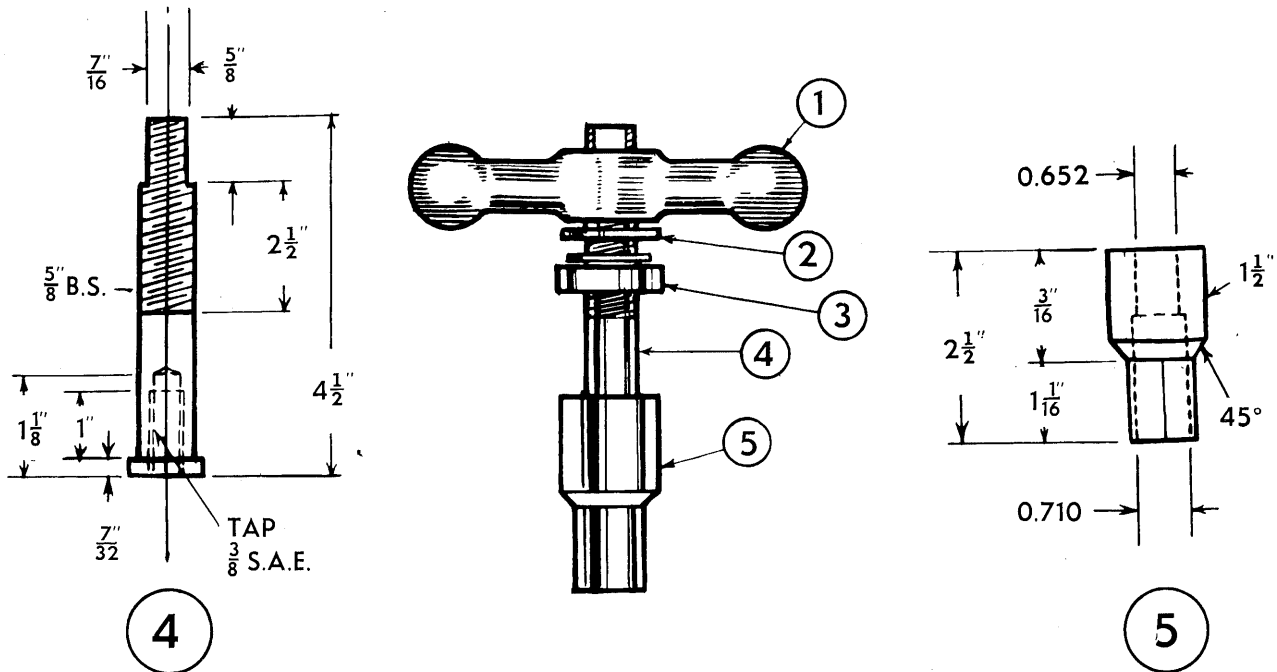


Camshaft Sprocket Installing Pilot,
Part No. J-836



Pilot Thimble,
Part No. J-831

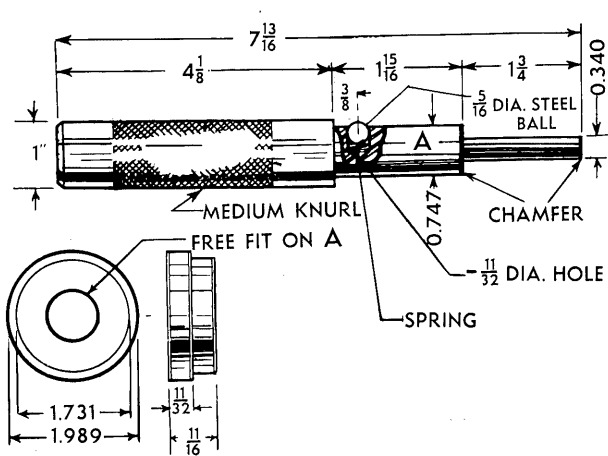




Crankshaft Dowel Remover,

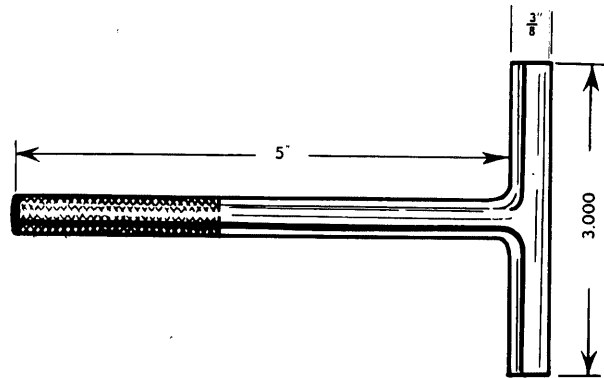
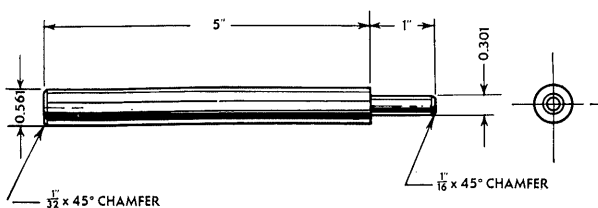
Part No. J-822

(1) Handle 4 in. long, $\frac{7}{8}$ in. deep. (2) Plain Washer. (3) Ball Thrust Race, $\frac{1}{2}$ in. deep



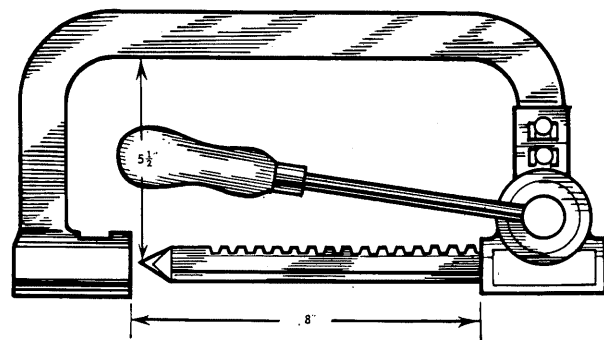
Valve Stem Guide Replacer,

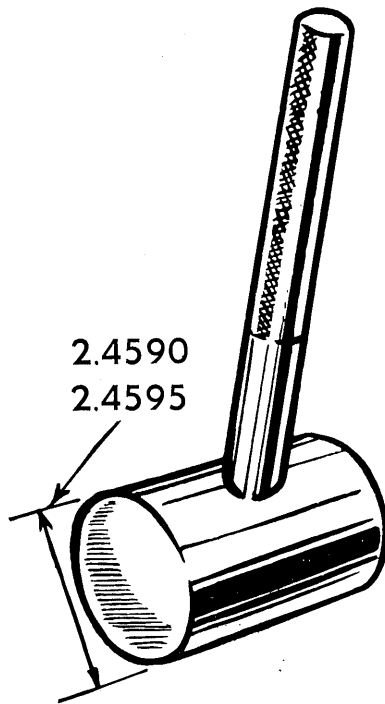
Part No. J-826

Valve Stem Length Gauge,
Part No. J-1055

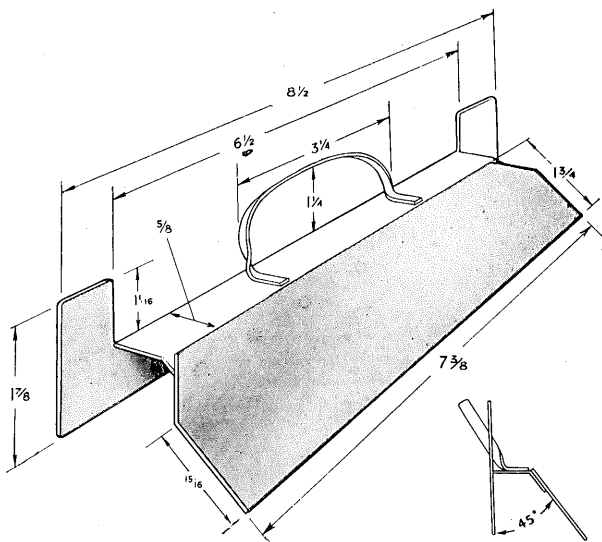
Valve Stem Guide Remover,

Part No. HM-559

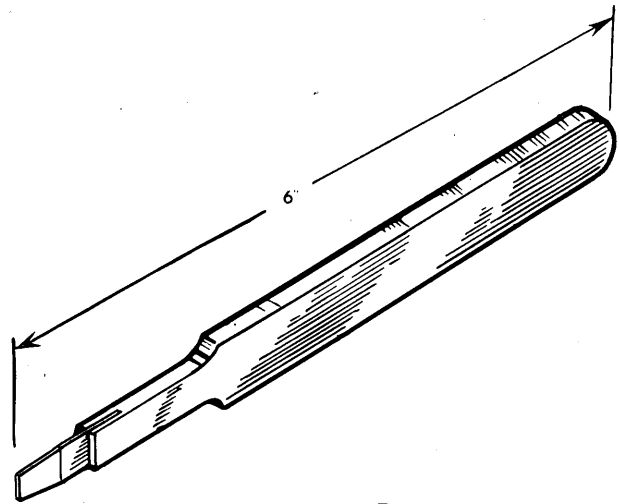
Valve Lifter, Remover and Replacer,
Part No. J-257-X



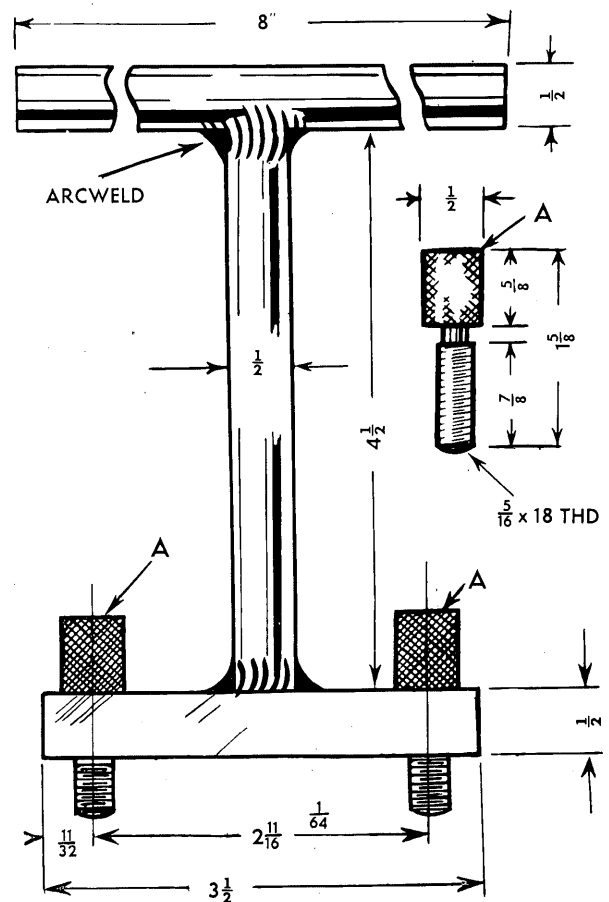
Rear Main Bearing
Oil Seal Compressor
Part No. J-1177



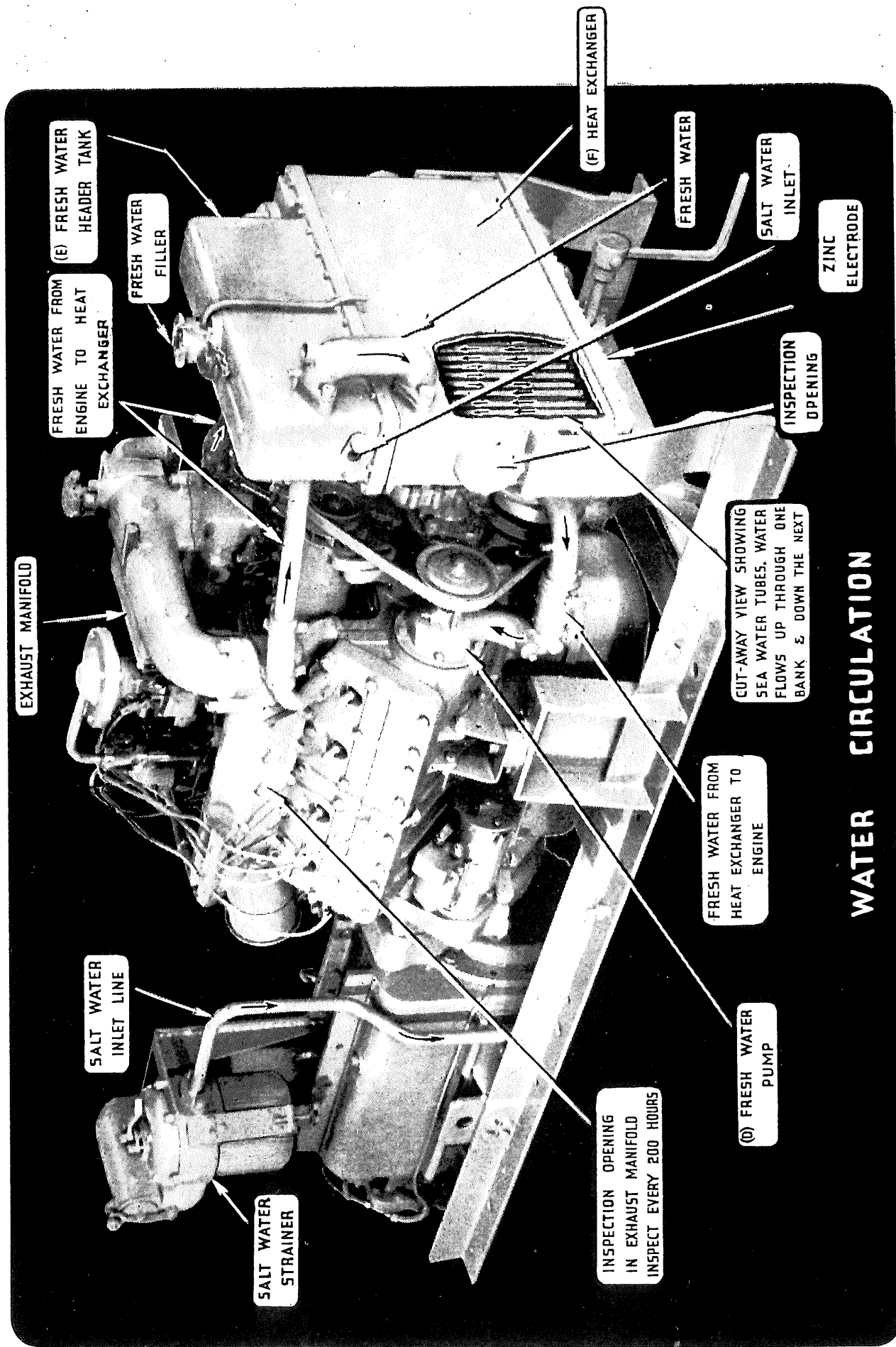
Valve Lift Bracket Installer,
Part No. J-827



Spark Coil Cover Remover,
Part No. J-726



Rear Main Bearing Cap Puller,
Part No. J-834



WATER CIRCULATION