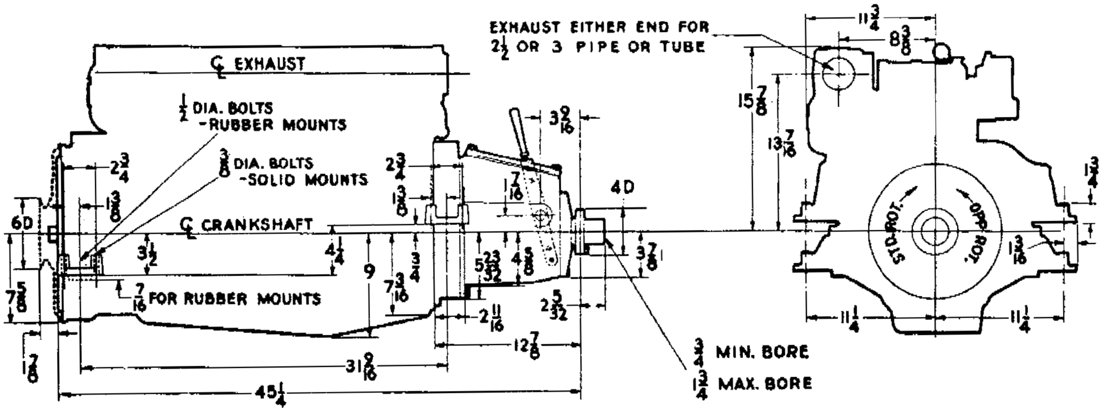
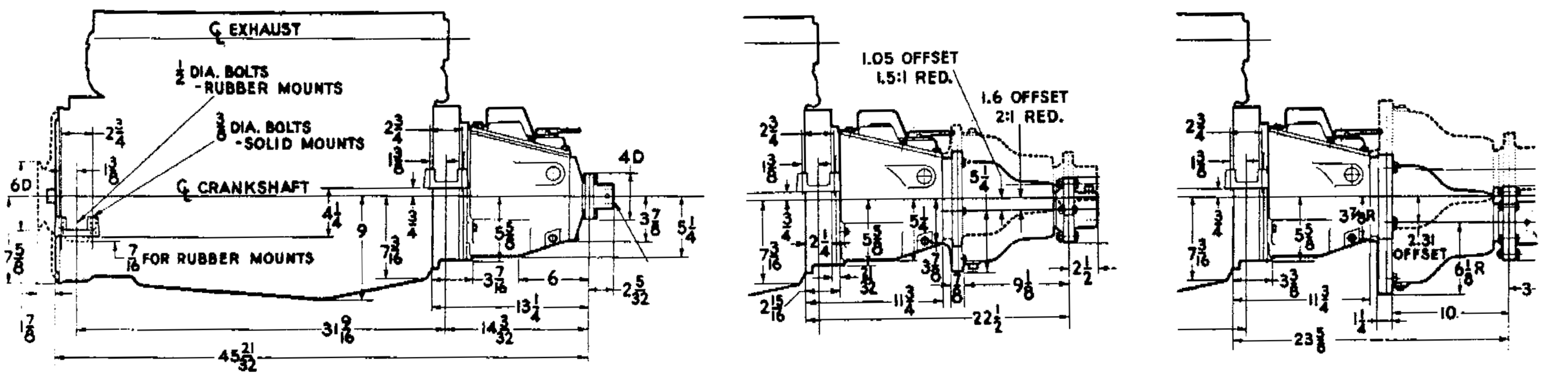


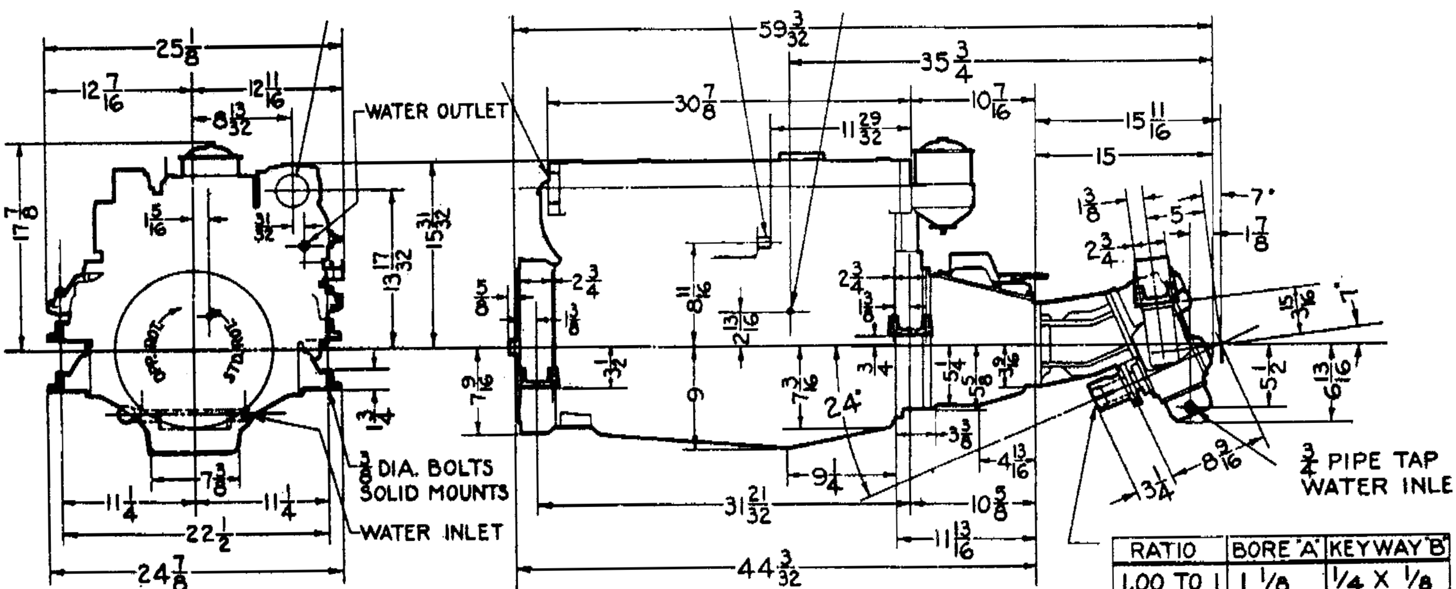
Direct Drive

Fig. 47 MANUAL REVERSING GEAR



Direct Drive 1.5:1 & 2:1 2.5:1

Fig. 48 HYDRAULIC REVERSING GEAR



RATIO	BORE 'A'	KEYWAY 'B'
1.00 TO 1	1 ⅛	¼ X ⅛
1.52 TO 1	1 ½	⅜ X 3/16
2.09 TO 1	1 ½	⅜ X 3/16
3.00 TO 1	1 ¾	⅜ X 3/16

Fig. 49 V-DRIVE - HYDRAULIC GEAR - ALL RATIOS

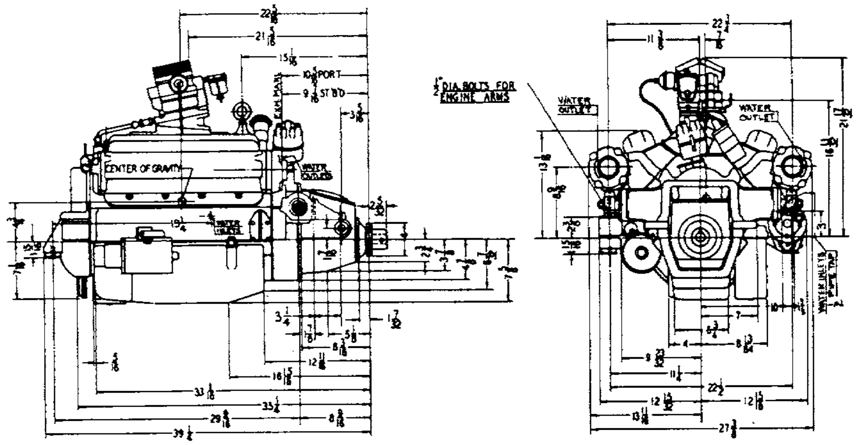


Fig. 50

DIRECT DRIVE

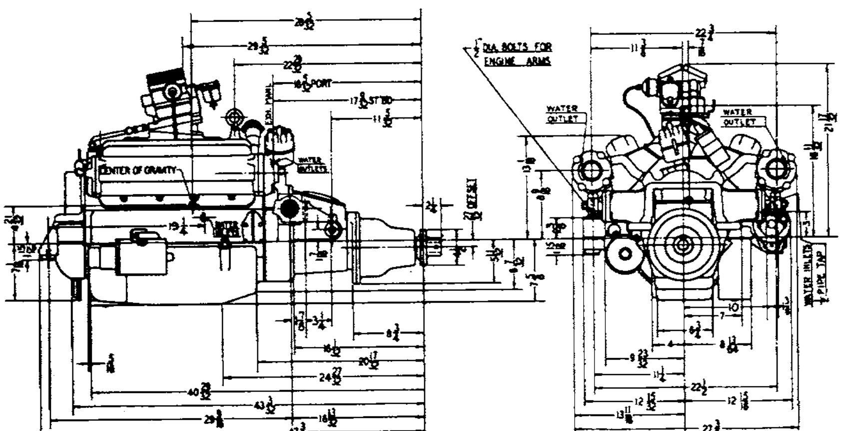


Fig. 51

REDUCTION DRIVE, 1.5:1 RATIO

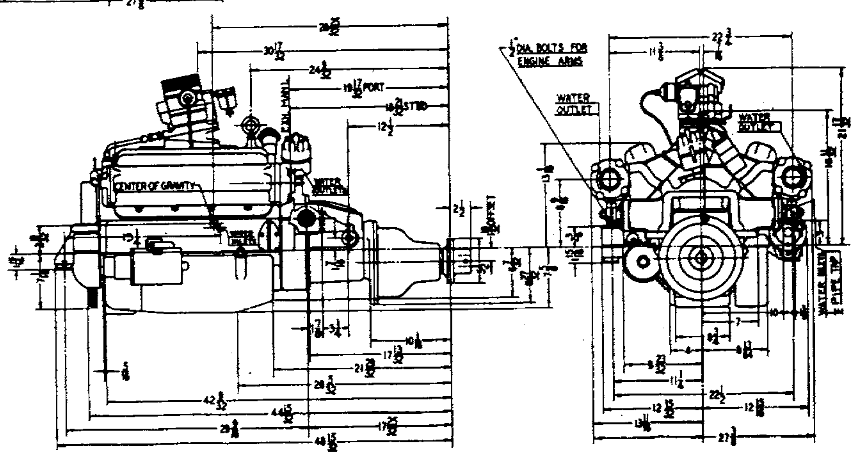


Fig. 52

REDUCTION DRIVE, 2:1 RATIO

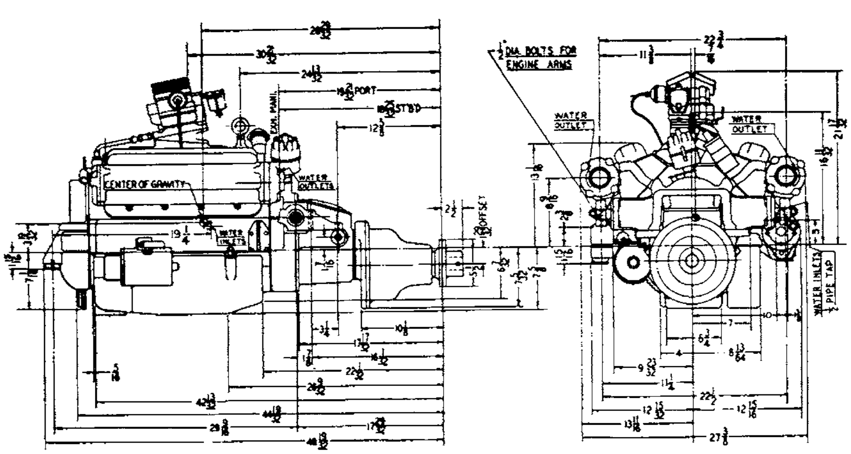
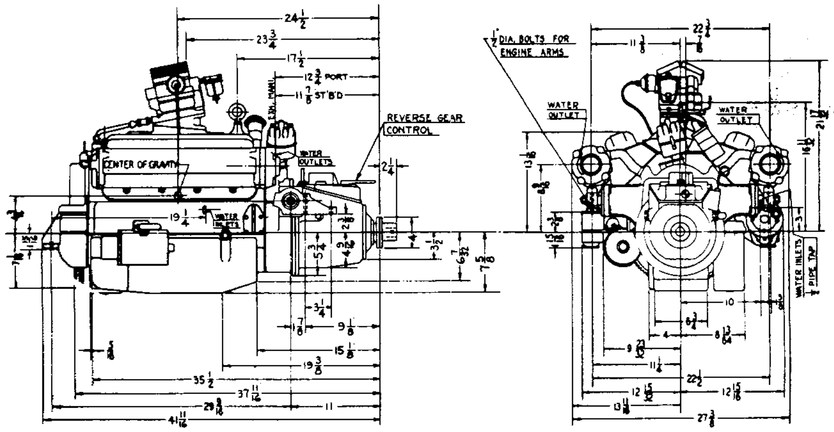


Fig. 53

REDUCTION DRIVE, 2.5:1 RATIO

Fig. 54

DIRECT DRIVE



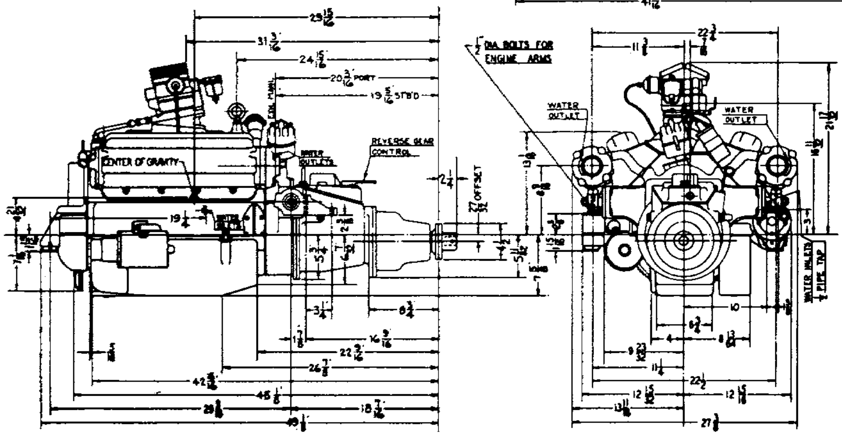
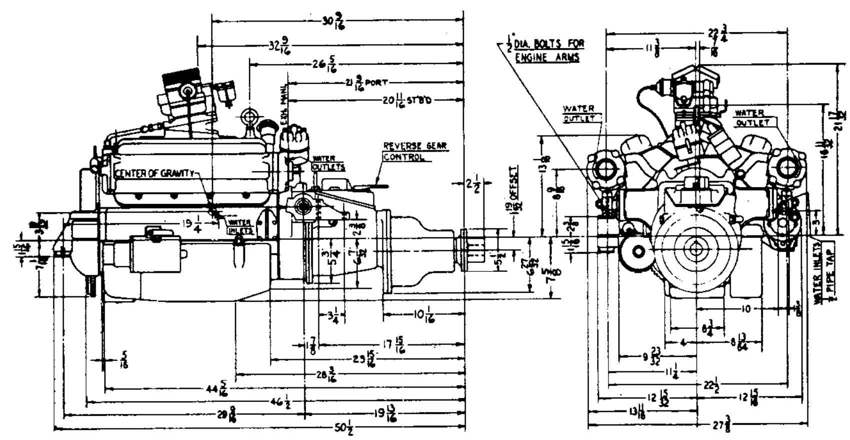


Fig. 55

REDUCTION DRIVE, 1.5:1 RATIO

Fig. 56

REDUCTION DRIVE, 2:1 RATI(



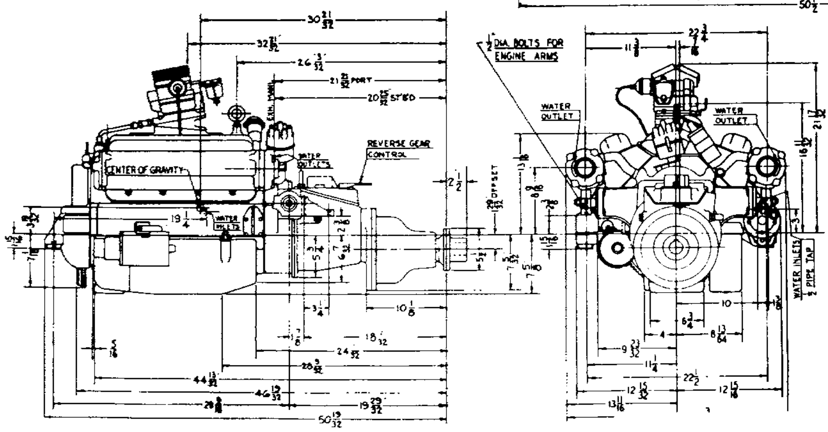


Fig. 57

REDUCTION DRIVE, 2.5:1 RATIO

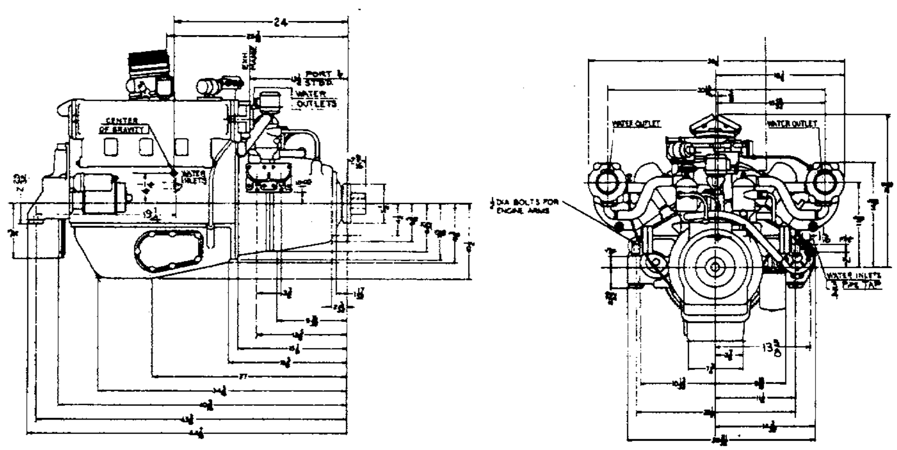


Fig. 58

DIRECT DRIVE
HYDRAULIC REVERSING GEAR

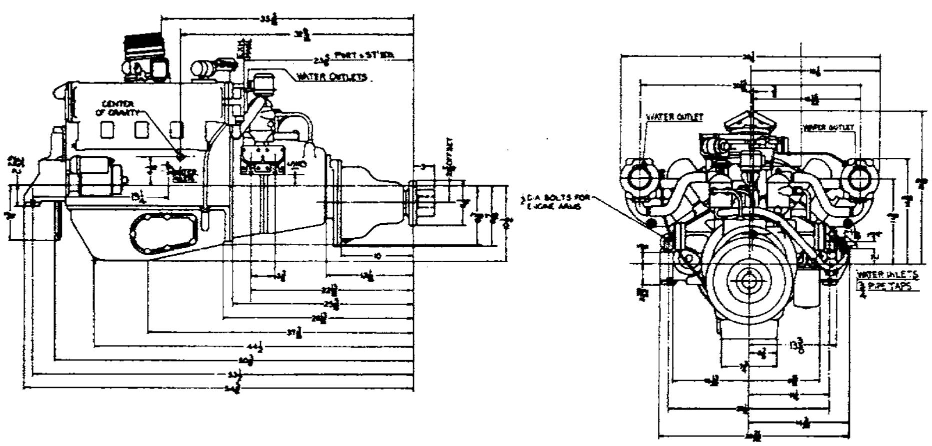


Fig. 59

REDUCTION DRIVE, 2.5:1 RATIO
HYDRAULIC REVERSING GEAR

SECTION III
OPERATION

1. PRELIMINARY CHECKS

a. Check to be sure the engine is filled with oil to the "full" mark on the bayonet stick. See Table 4 for proper grade.

b. On models equipped with hydraulic reversing gears, fill the reversing gear case with the grade oil shown in Table 4, Note 2.

c. On models requiring separate lubrication of reduction gears, fill reduction gear housing. Check Table 4 for proper type gear lubricant.

d. Fill fuel tank with 80-90 octane gasoline. Fuel oil-kerosene models are equipped with a one quart gasoline tank for starting purposes. See Table 5 for fuel specifications of fuel oil-kerosene models.

e. On electrical starting models be sure all connections are correct and secure. Check battery to be sure it is fully charged and that the water level is approximately 3/8" above the plates.

f. Open cooling system water inlet valve (if used). Be sure water lines are properly connected on both intake and overflow sides of water pump.

g. Check all controls for smooth and proper operation.

h. Air out bilge to remove any dangerous gasoline fumes.

i. With ignition off and engine in neutral, turn motor over several times to be sure everything is working freely.

j. Open shut-off valve below fuel tank. Operate hand primer, on models so equipped, to fill feed line and sediment bowl with fuel.

k. Remove shipping cover from flame arrestor.

l. Close all water drain cocks and drain plugs.

2. STARTING ELECTRICAL STARTING MODELS

a. Place clutch in neutral.

b. Open throttle approximately one-quarter.

c. Pull out choke.

d. Turn on ignition switch.

e. Push starter button. If engine fails to start within 30 seconds, see Table 6 to determine cause of trouble.

f. As soon as engine starts push in choke rod.

CAUTION

Do not run engine with choke out any longer than necessary. Over-choking will dilute crankcase oil and possibly cause motor failure due to raw gasoline being sucked into combustion chamber.

g. Check water pump for proper operation. If water fails to circulate, turn water pump grease cup in one or two turns (on gear type water pumps only). If water still fails to circulate, stop engine immediately. See Table 6 for correction of trouble.

h. Check oil pressure gauge for operation of oil pump. If gauge does not indicate oil pressure, stop engine. Table 4 gives proper oil pressure for each model engine.

CAUTION

Do not race engine with clutch disengaged at any time. Racing a cold engine will cause excessive wear and may seriously damage engine. New motors should be run at one-half throttle for a period of 15 hours.

NOTE

If the engine temperature is controlled with a manual by-pass valve as shown in Fig. 11, water will issue from the exhaust pipe as soon as the pump has primed and the engine filled with water. If the engine temperature is controlled by thermostat, only a trickle of water will issue from the exhaust pipe until the engine reaches its normal operating temperature and the thermostat opens to dump water overboard.

3. STOPPING THE ENGINE

The speed of your boat should be gradually reduced while you are still some distance from the mooring or landing. Before stopping the engine, close the throttle and disengage the clutch. Allow the engine to idle for a minute or so before turning off the ignition. Stopping in this manner will permit excessive heat to be absorbed by the cooling system.

4. BREAK-IN

Your UNIVERSAL engine was run and tested for six hours on one of our test stands with electric dynamometer. It was adjusted and checked for maximum power at rated speed. However, those adjustments were correct only for the prevailing atmospheric conditions and fuel used. You may find it necessary to slightly readjust the carburetor and ignition timing for peak performance in your locality and with the fuel available. If readjustment is attempted it should be done by a competent mechanic.

The engine will not be thoroughly broken in until approximately 35 hours of operation have been attained. DO NOT CONTINUOUSLY RUN YOUR ENGINE OVER 2000 RPM DURING THIS PERIOD AND AVOID LONG PERIODS OF SLOW IDLING. OCCASIONALLY DURING BREAK-IN YOU MAY RUN THE ENGINE AT FULL THROTTLE BUT NOT FREQUENTLY OR FOR PERIODS OVER ONE MINUTE IN DURATION. ALWAYS WARM UP THE ENGINE BEFORE ANY RUN.

5. STARTING MAGNETO MODELS

a. Retard spark lever half way.

b. Open throttle approximately one-quarter.

c. Pull choke out all the way.

d. Crank engine two or three turns.

e. Push choke in half way.

f. Crank engine by bringing it to compression and then giving a quick pull. DO NOT SPIN.

g. When engine starts push choke in all the way.

6. STARTING FUEL OIL-KEROSENE MODELS

a. Start engine on gasoline as described in Paragraph 2.

b. Allow engine to run for a period of 3 to 5 minutes to allow it to reach proper operating temperature of 130 to 180 degrees.

c. Switch over to fuel oil by turning the three-way cock, located in the fuel line, to the proper position.

NOTE

Before stopping engine, switch from fuel oil to gasoline and allow engine to run approximately 2 minutes in preparation for the next start.

Table 4
LUBRICATION REQUIREMENTS

MODEL NAME	S.A.E. VISCOSITY NUMBERS FOR ENGINE CRANKCASE OIL: Surrounding Air Temp. Over 90° F. and Maximum Service	Surrounding Air Temp. 32 to 90° F. Average Service	Surrounding Air Temp. Below 32°F. Average Service	Average Engine Oil Pressure (Hot Engine) Lbs.	Herringbone Reduction Gear Lubricant S.A.E. Viscosity Number Separately Lubricated
Blue Jacket Twin	S.A.E. 30	S.A.E. 30	S.A.E. 20	30	---
Atomic Four	S.A.E. 30	S.A.E. 30	S.A.E. 20	45	See Note #1
Utility Four	S.A.E. 40	S.A.E. 30	S.A.E. 20	45	S.A.E. 90 to 140
Super-Four	S.A.E. 40	S.A.E. 30	S.A.E. 20	45	S.A.E. 90 to 140
Unimite Four	S.A.E. 30	S.A.E. 30	S.A.E. 20	30	See Note #1
Arrow	S.A.E. 30	S.A.E. 30	S.A.E. 30	30	See Note #1
Bluefin	S.A.E. 30	S.A.E. 30	S.A.E. 30	30	See Notes #1 & #2
Marlin	S.A.E. 30	S.A.E. 30	S.A.E. 30	30	See Note #1
Tarpon	S.A.E. 30	S.A.E. 30	S.A.E. 30	30	See Notes #1 & #2
Knight	S.A.E. 30	S.A.E. 30	S.A.E. 30	30	See Notes #1 & #2
Little King	S.A.E. 30	S.A.E. 30	S.A.E. 30		See Notes #1 & #2
Big King	S.A.E. 30	S.A.E. 30	S.A.E. 30		See Note #2

Note 1

The reduction gears of these engines (on engines with manual type reversing gears), are lubricated from the main engine oil supply and, therefore, use the same S.A.E. number of oil as the engine, and do not have to be separately lubricated.

Note 2

The hydraulic reversing gear is entirely self-contained and independent of the engine oil pressure system (sealed off from engine oil pressure system). Use same S.A.E. number oil as in the engine of good quality non-foaming type. If extreme foaming is encountered due to unusual installation or operating conditions, it will further reduce foaming if type "A" automatic transmission oil is used.

When engines have both hydraulic reversing gear and reduction gear, the reduction gear is lubricated from the oiling system of the hydraulic reversing gear.

The oil level should be checked periodically by means of the bayonet dipstick located on the side at the forward end of the hydraulic reversing gear housing. Oil level should be maintained between the marks on the bayonet dipstick.

Note 3

We do not recommend the use of heavy-duty, high detergent oils during break-in. These oils have such extremely good lubricating qualities that correct and thorough break-in is difficult if not impossible. This is particularly true with respect to seating of piston rings. We recommend the use of a straight mineral oil of S.A.E. 30 weight during the break-in period.

Most oil companies have now adopted a standard system of rating the service for which an oil is intended. In this system an oil designated for ML service is a straight mineral oil without additives and intended for light service. The heavy-duty, high detergent oils are designated MS and DG for severe gasoline engine service and general diesel service. An oil designated for ML service should be used during break-in and an oil designated for MS and DG service used thereafter.

Avoid using any oil that does not specifically state the service rating on the can. Watch the oil level gauge in the oil pan and always keep the oil up to the mark.

CAUTION

Check the oil level stick before starting and several times while filling to prevent overfilling. Keep oil level to the full mark on the oil stick. Amounts of oil required vary with the engine model and the angle at which the engine is mounted.

Table 5
FUEL SPECIFICATIONS
(FOR FUEL OIL-KEROSENE MODELS)

Classification	Specification
Gravity	36 to 46
Flash Point	150 to 165
Pour Point	Below 10 F.
Viscosity at 100 F. Saybolt Universal	32
Sulphur	.003 to 5
Distillation:	
Initial Point Degrees F.	350 - 365
10%	365 - 400
20%	400 - 415
50%	415 - 430
70%	430 - 450
90%	450 - 487
Maximum	490 - 530
Water and Sediment	Nil

Note: The above specifications are equal to a good grade #1 fuel oil.

7. OPERATION OF STANDARD REVERSING GEAR

Several types of reversing gears are used on UNIVERSAL engines. The operation, however, is the same in all cases. See Paragraph 6, Section IV, for detailed operation.

a. Moving the lever to the forward position (toward engine) places the transmission in forward drive.

b. Moving the lever to the stern position (away from the engine) places the transmission in reverse drive.

c. Moving the lever to the center position puts the transmission in neutral and no power is delivered to the propeller shaft.

8. OPERATION OF HYDRAULIC REVERSING GEARS

a. The hydraulic reversing gear is basically a hydraulically operated multiple disc clutch in combination with a hydraulically operated planetary reversing gear train. The gear positions are stamped on the top cover. See Paragraph 6, Section IV for detailed operation.

(1) Moving the lever, on the top cover, to the "F" position places the transmission in forward drive.

(2) Moving the lever to the "R" position places the transmission in reverse drive.

(3) Moving the lever to the center, or "N" position places the transmission in neutral.

b. The design of the reversing gear is such that the operation of both the forward and reverse drives is almost instantaneous with the movement of the shifting control lever. This condition exists even at low speeds. For this reason it is not necessary to race the engine to obtain good shifting characteristics. In fact, it is advisable to shift at low speeds, below 1400 RPM, and preferably in the 800 to 1000 RPM range. Shifting at conservative engine speeds will avoid damage to the boat, engine reversing gear, shafting and propeller caused by the shock of rapid shifting at high engine speeds.

9. COLD WEATHER OPERATION

Special precautions must be taken when operating engines in cold weather to insure efficient operation and to prevent damage to the engine. Some items to be considered are listed below:

a. Keep battery fully charged to prevent freezing and to get maximum starting power.

b. Be sure fuel lines and tanks are free of water to prevent stoppage in the fuel system due to freezing.

c. Substitute lighter engine oil. See Table 4.

d. When engine is stopped after a run, drain all water from cylinder block, water pump, and water lines before the water has time to freeze.

Starting an engine with the water pump frozen will probably break the drive shaft or damage the gears. Be sure the water pump is thoroughly thawed out before attempting to start the engine.

e. Extra choking or external heat may be required to get sufficient vaporization in the manifold for cold starts.

f. Give the engine sufficient time to warm up both water and oil before subjecting it to heavy loads.

10. PREPARING ENGINE FOR STORAGE

Neglect in preparing an engine for winter storage may lead to annoying and costly damage. The engine should be carefully covered to give complete protection from rain and snow.

a. Cylinder Block
Open all drain cocks on cylinder block. Leave drain cocks open.

b. Manifold
Open drain cocks in exhaust manifold and drain water from the manifold.

c. Water Pump
Water pumps are particularly susceptible to damage from freezing. The pump should be carefully drained. A drain plug is provided on the bottom of the pump housing. Six cylinder engines are equipped with Jabsco pumps and to drain loosen end cover.

d. Lubrication System
The oil pan and lubrication system should be drained of old or contaminated oils so that moisture or acid present in the old oil will not cause corrosion. Two or three quarts of new, clean oil should be pumped through the system by turning the motor by hand or electric starter. Doing so will distribute a clean film of oil which will act as a rust preventative.

e. Cylinders
Remove the spark plugs and pour one or two ounces of new oil into the combustion chamber of each cylinder to give lubrication to piston rings, cylinder walls, and valves. Turn the engine over a few times to be sure of distribution before replacing spark plugs.

f. Valves and Tappets
Remove the valve tappet covers and oil valves and tappets with clean oil. Replace tappet covers and seal breather tube end with tape.

g. Distributor
See that the distributor is clean and well lubricated. Special care should be taken to prevent the entrance of moisture during storage.

h. Starting Motor
The starting motor must be protected against rain and snow. The starter pinion and screw shaft should be clean and covered with a film of light oil. The bearings should be well lubricated. The motor should be sealed to prevent corrosion of

Table 5
FUEL SPECIFICATIONS
(FOR FUEL OIL-KEROSENE MODELS)

Classification	Specification
Gravity	36 to 46
Flash Point	150 to 165
Pour Point	Below 10 F.
Viscosity at 100 F. Saybolt Universal	32
Sulphur	.003 to 5
Distillation:	
Initial Point Degrees F.	350 - 365
10%	365 - 400
20%	400 - 415
50%	415 - 430
70%	430 - 450
90%	450 - 487
Maximum	490 - 530
Water and Sediment	Nil

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(3) Moving the lever to the center, or "N" position places the transmission in neutral.

b. The design of the reversing gear is such that the operation of both the forward and reverse drives is almost instantaneous with the movement of the shifting control lever. This condition exists even at low speeds. For this reason it is not necessary to race the engine to obtain good shifting characteristics. In fact, it is advisable to shift at low speeds, below 1400 RPM, and preferably in the 800 to 1000 RPM range. Shifting at conservative engine speeds will avoid damage to the boat, engine reversing gear,

(2) Two separate circuits, primary and secondary, make up the ignition system. The primary low tension circuit consists of the battery, low voltage distributor points, primary coil winding and condenser. The secondary high tension circuit consists of the secondary winding of the coil, distributor rotor and cap, high tension wiring, and spark plugs.

(3) In operation, current from the battery passes to the primary winding of the ignition coil, through the breaker points of the distributor. Periodic opening and closing of the breaker points causes the flow of current to start and stop, thus causing an alternate build-up and collapse of the magnetic field around the primary winding of the coil. This fluctuating magnetic field cuts the secondary winding of the ignition coil, causing a very high voltage to be induced in it. Current from the secondary of the ignition coil is then passed through the distributor rotor to contacts in the distributor cap and finally to the spark plug.

(4) Arcing across the low voltage points of the distributor caused by the collapsing magnetic field around the primary winding of the coil is reduced by use of a condenser connected across the points.

b. Magneto Ignition Systems

(1) Magnetos are a special application of the electric generator and are usually used where the output of energy required is small. They are used on some models of UNIVERSAL engines to furnish energy for ignition of the compressed gases in the cylinder chambers. The elements of construction comprise a permanent magnetic field, armatures, which rotate within that field, a circuit breaker and a distributing mechanism which serves to carry the generated current to the spark plug.

(2) The high tension type magneto used on UNIVERSAL engines has a secondary winding, comprising a great number of turns of fine wire, superimposed upon the primary winding. The primary winding is short circuited by means of an auxiliary device, during the building up of the field in the armature coil. When the energy in the primary circuit has reached a maximum, this circuit is opened, and at the same instant, due to the rotation of the armature, the magnetic field is removed. The energy of the primary winding is discharged through the secondary, and due to the ratio of primary to secondary turns, a considerable increase in voltage results. The resulting high-tension current is then distributed to the spark plugs.

(3) Because the spark intensity of a magneto varies directly with the engine speed, an increase of energy is available at high speeds. At low engine speeds, such as when the engine is hand cranked, the magneto would sometimes fail to produce a voltage sufficient to spark across the spark plug gap. In order to prevent this from occurring, the magnetos used are equipped with an impulse coupling which serves to couple the magneto to the engine, and at the same time, accelerate its speed of rotation during the starting period.

3. LUBRICATION SYSTEM

All UNIVERSAL engines are equipped with a full pressure lubrication system.

a. Full Pressure Lubrication System

(1) The full pressure lubrication system effectively lubricates all necessary moving parts of the engine with the exception of those accessories mounted on the outside of the engine. See Table 4 for those models which require separate lubrication of reduction gears.

(2) The gear driven oil pump, located in the oil base, draws oil through an intake screen. Oil is forced to all main, connecting rod and camshaft bearings; through jet holes in the connecting rods for cylinder wall, piston and wrist pin lubrication. Drilled holes in the cylinder block provide lubrication for the valve tappets. Oil is supplied to the reversing gear through a drilled hole in the end of the crankshaft. Hydraulic reversing gears are separately lubricated from their own oil supply.

(3) All models using the full pressure system are equipped with an oil pressure regulator which may be adjusted for proper oil pressure. See Table 4 for proper setting.

(4) Six and eight cylinder models and the Super-Four models are equipped with oil coolers. Oil from the oil pump is circulated to the cooler and cooled by water from the engine cooling system. A by-pass (except on Super-Four models) built into the cooler short circuits the oil directly from the pump to the oil line in the event the cooler becomes clogged.

4. FUEL SYSTEM

The fuel system consists of fuel tank, fuel line, strainer, pump (except on Blue Jacket Twin models), carburetor, flame arrestor, and intake manifold. Gasoline from the tank enters the fuel pump through the strainer and into the carburetor where it is vaporized and drawn through the intake manifold, through the valves, and into the combustion chamber of the cylinder.

a. Fuel Pump

(1) The purpose of the fuel pump is to supply an adequate amount of gasoline from the tank to the carburetor to meet engine requirements at all speeds. This pump is of the diaphragm type and is operated by a plunger working off an eccentric on the camshaft.

(2) As the high point of the cam is reached, the plunger is forced down, causing a vacuum above the diaphragm. The vacuum draws gasoline from the tank, through the inlet valve and into the fuel chamber of the pump. The return stroke releases the compressed diaphragm spring, expelling gasoline through the outlet valve into the carburetor bowl.

(3) After several diaphragm strokes, the carburetor bowl fills and its float mechanism rises, thus seating the needle valve and stopping further passage of fuel from the pump. With the carburetor bowl filled and needle valve closed, back pressure is created on the diaphragm. With this back pressure on the diaphragm, the rocker arm movement continues, but is taken up by the linkage, rather than being transmitted to the diaphragm. As pressure reduces in the fuel chamber because of carburetor demands, the diaphragm will take longer strokes. Fuel flow is thus maintained in accordance with engine operating conditions.

b. Carburetor

The function of the carburetor is to furnish the correct mixture of gasoline and air to the engine in the proper proportion for all operating conditions, idling to full throttle. To accomplish this, the gasoline is accurately metered at all speeds, atomized or broken up into small particles, and mixed with air. The fuel is vaporized and preheated in the intake manifold before being drawn into the cylinder through the intake valve.

c. Flame Arrestor

A flame arrestor attached to the air inlet of the carburetor eliminates the possibility of fire being caused by backfiring through the carburetor. A special element, consisting of curved plates, dissipates the heat and prevents fire from extending through the arrestor.

5. COOLING SYSTEM

a. All engines are equipped with a positive displacement type water pump. Six and eight cylinder engine pumps are rubber impeller type. Two and four cylinder engines have bronze gear pumps. The opposite type in each case can be obtained on special order.

b. In the Twin, Atomic, Utility and Super-Four, the water flow is from pump to block, to head, to manifold, then overboard.

In the case of the Unimite, the flow is from pump to manifold, to block, to head, then overboard.

All six cylinder engines have the same flow which is: pump to oil cooler, to manifold for one complete pass, then into block through four to six holes (depending on engine size), then to head, to heat riser on intake manifold, and then overboard.

c. See special diagram of rather complicated water flow in special manual furnished with each V-8 engine.

d. Where either manual or automatic temperature control is used, varying amounts of discharge water will be recirculated. See Fig. 11.

6. REVERSING GEARS

Four types of reversing gear systems are used on UNIVERSAL engines covered by these instructions. Three of these are mechanically operated, and the fourth is a hydraulic system.

a. Joes Model Reversing Gear

(1) The Joes model reversing gear is currently being used on the Super-Four series engines only.

(2) The forward drive on this unit is a double friction clutch. On the propeller end are a series of friction discs of steel and bronze which are mortised into the engine and propeller drives and casing. On the engine end, a split cone clamps the engine shaft and frictionally locks the gears to it.

(3) When the reversing gear lever is moved forward the toggles force home the plungers, clamping all friction surfaces together. All moving parts are then locked and the whole unit functions as a solid coupling between the motor and propeller shafts.

(4) Reverse drive is obtained by throwing the lever back. This releases the forward drive and throws on the brake band by means of a cam. This cam passes through a slot in the camshaft that operates between the cam roll and cam shoe. This clamps the brake band and prevents the outside case from revolving. When the casing is thus held from revolving, the gearing drives the propeller in the reverse direction at 80 - 88% of the motor speed.

(5) To place in neutral, the lever is placed midway between forward and reverse, which releases both the reverse and forward drives and permits the gearing to run idle.

b. Paragon Model Reversing Gears

(1) Paragon reversing gears are used on all current production engines except the Super-Four and those models which are equipped with hydraulically operated reversing gears or Sta-Nu-Tral manual gears.

(2) Power from the engine is transmitted through the engine sleeve gear and the reverse idler pinions to the forward clutch or to the reverse drive gear.

(3) The forward clutch consists of

a series of friction discs, alternate ones held in the reverse gear drum and on the tailshaft clutch carrier. This group of discs can be clamped together by a pressure plate operated by three toggle arms attached to clutch adjustment plate. These toggles are moved by the yoke and collar assembly on the tailshaft. In the forward position the entire drum and clutch assembly rotates with the crankshaft. When in neutral and in the reverse position the forward clutch plates are free to turn with respect to each other.

(4) The reverse clutch consists of a brake band around the drum with an operating mechanism for clamping the band to the drum. The band is supported and rotation prevented by the band feet which rest on the support flanges in the reverse gear housing. When the operating lever is moved to the rear, the band clamping toggle levers pull the open ends of the band together, clamping the band tightly around the drum. This prevents rotation of the drum and the planet pinions or idle pinions. This causes the tailshaft to be rotated in the opposite direction to the crankshaft. The arrangement of forward and reverse clutches prevents both being actuated at the same time.

(5) When the operating lever is placed in the center position the drum and forward clutch plates are free to turn and no power is transmitted from the engine to the propeller shaft.

c.Paragon Hydraulic Reversing Gears

(1) The Paragon hydraulic reversing gear is basically a hydraulically operated multiple disc clutch in combination with a hydraulically operated planetary reversing gear train. The unit is self-contained and independent of the engine oil system.

(2) Power for the operation of the reversing gears is provided by the transmission oil pump mounted inside the reversing gear case and driven continuously by the engine while the engine is running. From the oil pump the oil under pressure is delivered to the pressure relief valve and control valve.

(3) The operation of the system is controlled by a control valve mounted on the top cover. Moving the lever determines whether the actuating oil is delivered to the forward or reverse mechanism.

(4) The forward clutch is engaged by moving the shifting lever to the forward position. This operates the control valve so that it in turn directs the pressure oil from the pump to the forward piston in its cylinder. The forward piston squeezes the forward multiple disc clutch and so turns the propeller shaft in the proper direction to move the boat ahead.

(5) The reverse band is similarly engaged by moving the shifting lever to the reverse position. This operates the control valve so that it in turn directs the pressure oil from the pump to the reverse piston in its cylinder. The reverse position clamps the brake band on the planetary gear train and so turns the propeller shaft in the reverse direction, thus moving the boat astern.

(6) Neutral, or center position, of the control lever prevents any pressure oil from entering either the forward or reverse cylinders. In addition the control valve opens drains in both cylinders so that any oil in either cylinder is drained out and the pistons completely retract disengaging both forward and reverse drives.

7. <u>REDUCTION GEARS</u>

Some models of UNIVERSAL engines are equipped with reduction gears