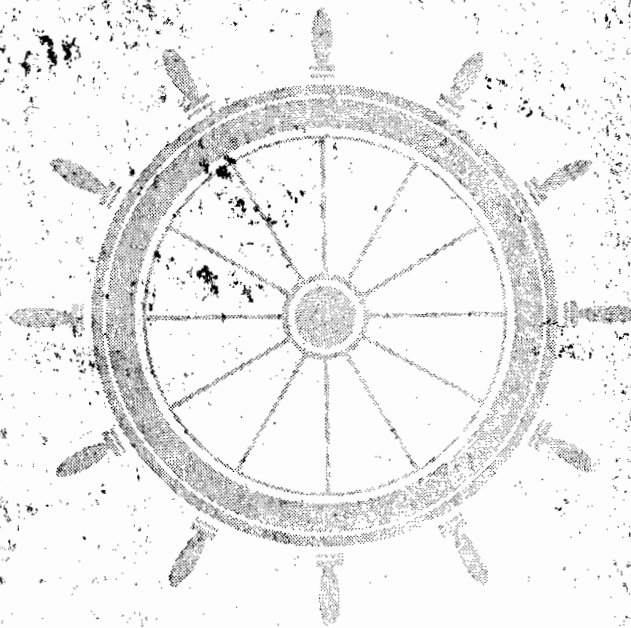


— CAUTION —

TO PREVENT ALTERNATOR OR REGULATOR DAMAGE

DO NOT OPEN BATTERY CIRCUIT OR CHANGE THE
BATTERIES WHILE THE ENGINE IS RUNNING.

SUGGESTIONS COVERING THE OPERATION
AND MAINTENANCE OF YOUR
UNIVERSAL MARINE ENGINE



**ATOMIC FOUR
SERIES**

UNIVERSAL MOTOR DIVISION



**MEDALIST
INDUSTRIES**

*Standard motor
oil - multi grade oil - SAE 30*

ENGINE OIL RECOMMENDATIONS

Universal marine engines should be lubricated with oil of good quality with ingredients to give best possible engine performance. A marine engine works at maximum capacity about 90% of the time as compared to an automotive engine which rarely works at maximum capacity at any time. The requirements for good lubricating oil are therefore, far greater in a marine engine.

Form the habit of watching the oil pressure gauge. Oil pressure should be approximately 5 lbs. at idle speed and 35 to 45 lbs. at maximum speed with hot engine.

Models ----- UJ, UJS, UJR, UJSR, UJVD
 Type ----- Vertical, 4 cycle, L-Head
 Number of Cylinders ----- 4
 Bore and Stroke ----- 2-9/16" x 3-1/8"
 Total Piston Displacement in cu. inches ----- 64.46
 Spark Plug ----- Champion J-8 14M/M
 Compression Ratio ----- 6.3 to 1
 Engine Rotation ----- Counter-Clockwise Viewed from Flywheel End
 Reduction Gear Ratio ----- 2.04 to 1
 V-Drive Reduction Ratios ----- 1.00 to 1, 1.29 to 1, 1.67 to 1, 2.0 to 1
 Fuel ----- Standard Gasoline, 92-94 Octane
 Lubrication ----- See Page 14
 Maximum Operating Angle ----- Approx. 12° to 15° Max.
 Length Overall in inches ----- UJVD - 35-13/16", UJ - 26-3/4", UJR - 31-15/16"
 Height above Crankshaft Center Line ----- 13-1/8"
 Maximum Width in Inches ----- 18-1/4"
 Offset - Crankshaft to Propeller Shaft - Reduction Models (2 to 1) ----- 1.042"
 Base Depth Below Center Line in inches ----- 6"
 Exhaust Flange National Pipe Thread Size ----- 1-1/4"
 Water Inlet National Pipe Thread Size ----- 3/8"
 Water Outlet National Pipe Thread Size ----- 3/8"
 Fuel Pump Connection ----- 1/8" N.P.T.
 Fuel Line - Copper Tubing ----- 5/16" O.D.
 Weight of Engine, Net in Pounds ----- UJ-310, UJR-330, UJVD-335
 Firing Order (No. 1 on Flywheel End) ----- 1-2-4-3
 Inlet Valve Opens ----- 5° before TDC
 Inlet Valve Closes ----- 50° after LDC
 Exhaust Valve Opens ----- 45° before LDC
 Exhaust Valve Closes ----- 10° after TDC
 Dwell Angle ----- 31°-34°

Brake Horsepower								
RPM	600	1000	1500	2000	2500	3000	3500	
UJS-UJSR	4	7.1	11	15	18	---	---	
UJ-UJR-UJVD	5	7.3	11.9	16.2	20	25	30	

Carburetor - ZENITH 68 Series ----- 7/8"
 Reversing Gear - PARAGON ----- OXKB
 Reduction Gear ----- Paragon
 Electrical Equipment UJ-UJR ----- Standard - 12 volt 35 amp Alternator

ADJUSTMENT DATA

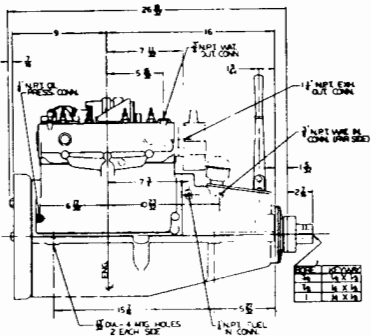
Piston Skirt Clearance ----- .0015 Feeler to 5 lbs. Pull
 Piston Ring Cap Clearance ----- .007 to .015
 Connecting Rod End Play ----- .004 to .008
 Crankshaft End Play - Maintained at front bearing only ----- .002 to .003
 Valve Seat Angle ----- 45°
 Oil Pump Drive End Play ----- .001 to .003
 Distributor Point Gap Clearance ----- .018 to .020
 Magneto Breaker Point ----- .014 to .018
 Spark Plug Gap Clearance ----- .035
 Ignition Timing - Breaker Points Just Starting to Open ----- TDC
 Main Bearing Clearance - On Crankshaft ----- .001 to .0025

Main Bearing Journal	1.9880	+ .0005	-.0000
Connecting Rod Journal	1.5625	+ .0000	-.0005
Piston Ring Side Clearance: (Width)			
Compression Ring (Top)	.0015		.003
Compression Ring (Middle)	.001		.0025
Oil Ring	.001		.0025
Piston Pin Clearance in Piston	.001		.0002
Connecting Rod Clearance (Dia.) (# on Rod Toward Camshaft)	.001		.0025
Valve Tappet Clearance, Intake-Hot	.008		
Valve Tappet Clearance, Intake-Cold	.010		
Valve Tappet Clearance, Exhaust-Hot	.010		
Valve Tappet Clearance, Exhaust-Cold	.012		
Valve Seat Width-Intake	1/32"		
Valve Seat Width-Exhaust	1/32"		
Valve Seat Angle	45°		
Valve Stem Clearance, Intake	.0025		.0035
Valve Stem Clearance, Exhaust	.0025		.0035
Camshaft Gear Back Lash	.002		.004
Idler Gear Back Lash	.002		.004
Accessory Gear Back Lash	.002		.004
Oil Pump Gear Back Lash	.003		.005
Camshaft Bearing Clearance	.0015		.0025
Camshaft Bearing Journal	1.3745	+ .0005	-.0000

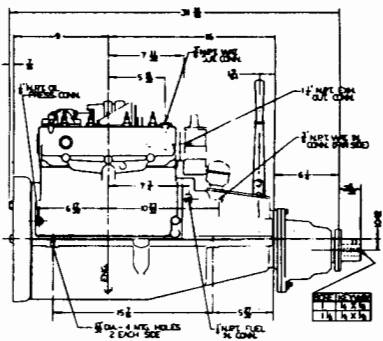
TORQUE WRENCH TENSION

Flywheel Stud Nuts	35 Ft. Lbs.
Cylinder Head Stud Nuts	35 Ft. Lbs.
Connecting Rod Bolt Nuts	33 Ft. Lbs.
Main Bearing - Front	60 Ft. Lbs.
Main Bearing - Rear	60 Ft. Lbs.
Manifold Studs	35 Ft. Lbs.
Spark Plugs	30 Ft. Lbs.

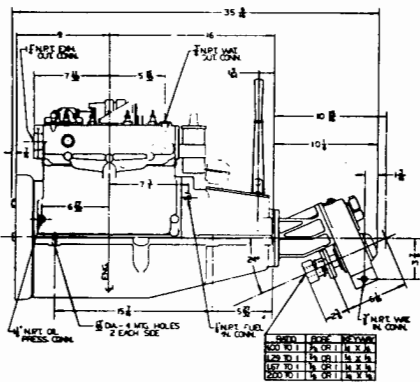
INSTALLATION DIMENSIONS



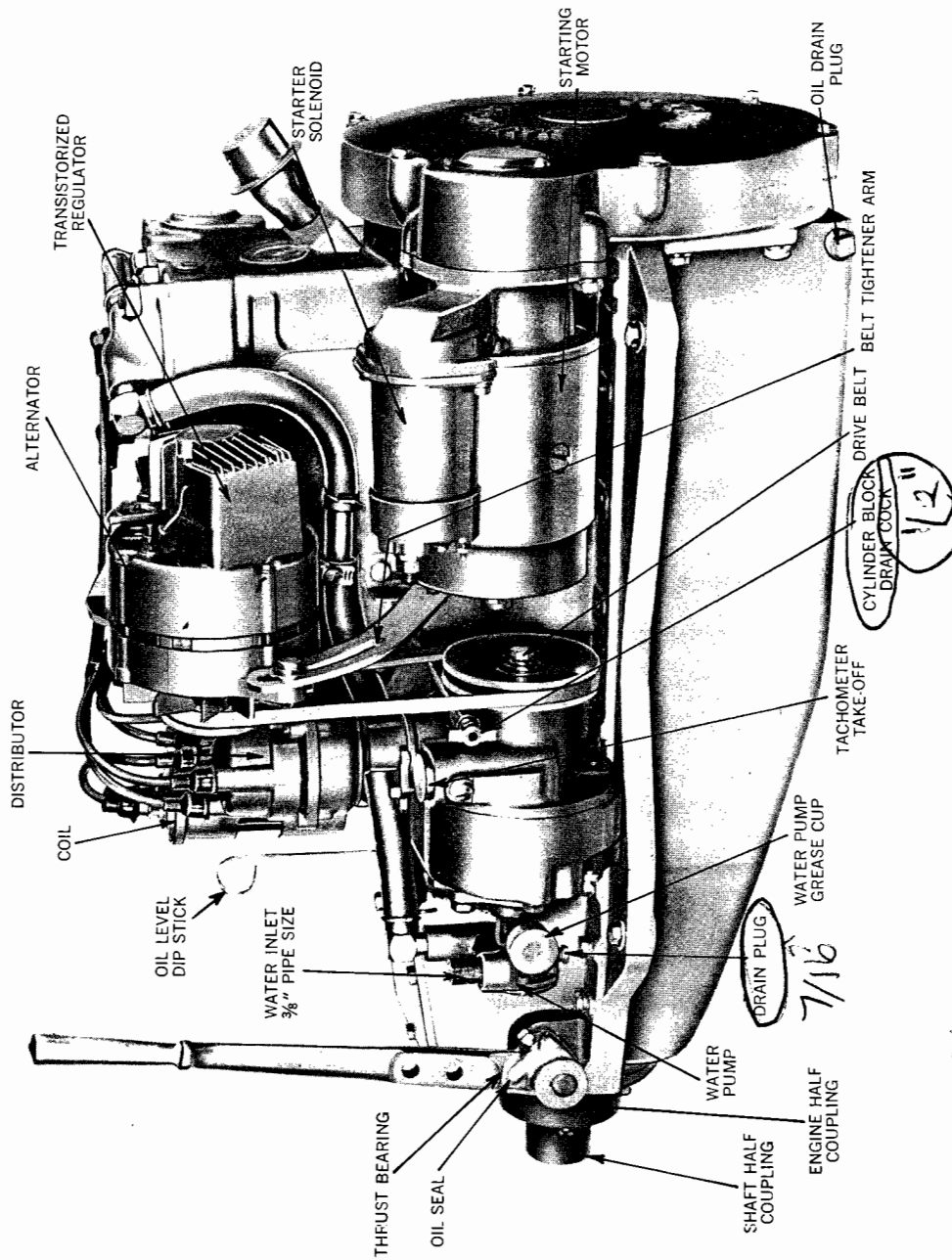
12 Volt Direct Drive with Automatic Temperature Control & Alternator

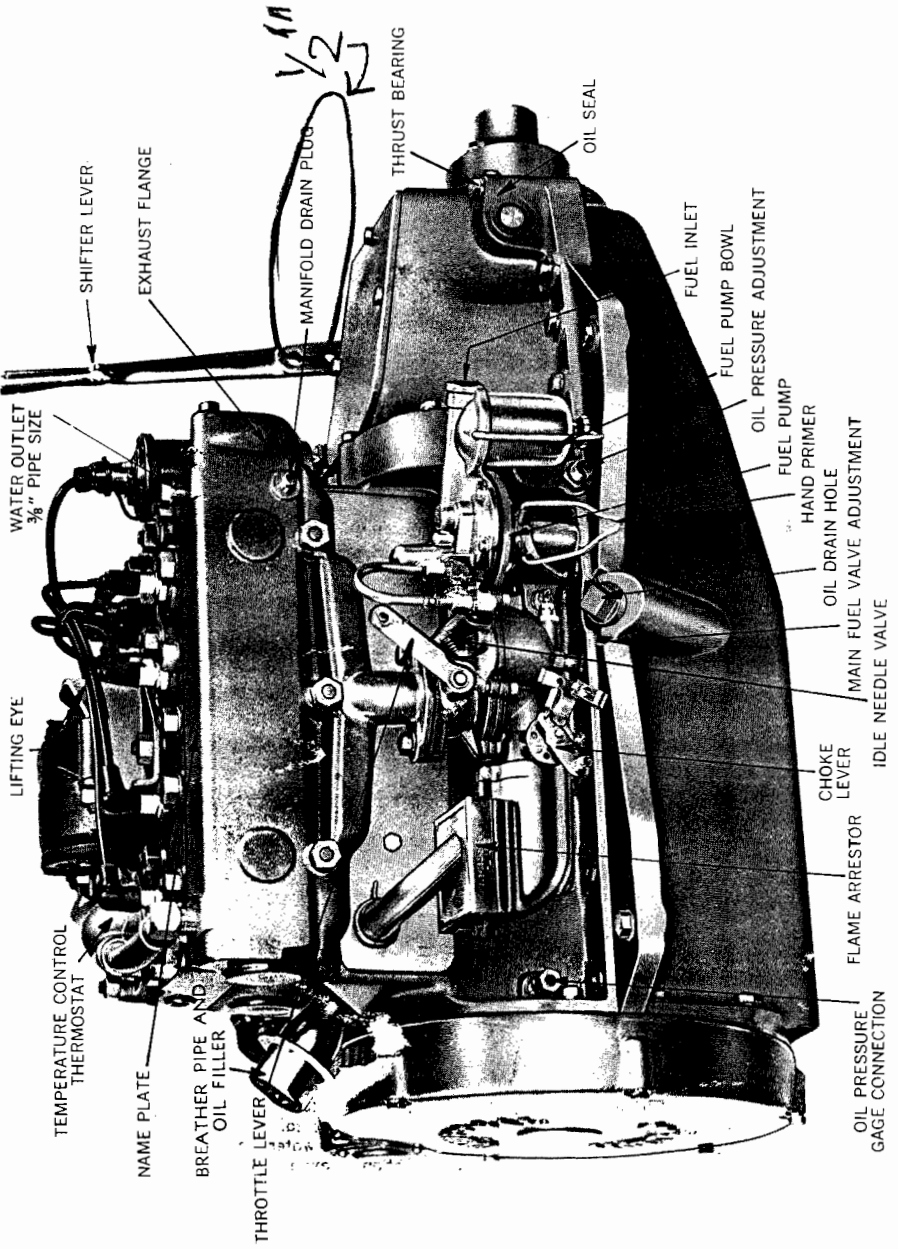


Reduction Drive 2:1 Ratio



Aqua-Pak V-Drive





Note to Atomic Stevedore Owners - All instructions in this book apply equally to Atomic Four and Atomic Stevedore models. Where there is a difference in specifications or adjustments it is so indicated.

GENERAL SUGGESTIONS:

Give your engine every chance to perform properly. If you become familiar with the operating requirements it will give you long dependable service. Check the alignment of the engine to the propeller shaft after the boat is first placed in the water. If you are in doubt how to proceed, write the factory for special service bulletin.

Add the necessary lubricating oil to the engine. The quantity is dependent upon the angle of installation and whether your engine is a direct or reduction drive model. Fill the oil base with 4 to 5 quarts of good grade SAE 20-20W M5 Class A detergent oil or until the dipstick shows full. The dipstick is located just forward of the water pump on the reverse gear housing. Check the oil level after the engine has been operated a short time.

Check choke control to make sure choke valve fully closes. Then push choke back to normal position and make sure choke butterfly in carburetor fully opens. Check throttle control to make sure it provides for full movement of the throttle lever from idling position to fully open position.

Reversing gear controls must allow the clutch to lock in forward position and also into reverse position. Restricted or partial engagement will cause undue wear. Reversing gears and reduction gears are lubricated by the engine oiling system. Fuel line must be connected to fuel pump located just forward of reversing gear on carburetor side of the engine. A hand primer is provided to fill the fuel bowl for initial start. Use 5/16" copper tubing for fuel line.

An unrestricted water supply must be provided. Use a 1/2" through hull fitting with scoop forward. Locate scoop where it will have a supply of water at all times regardless of running position or rough seas. Water pump has 3/8" suction and manifold has 3/8" water outlet. Use non-collapsible hose for suction side.

Exhaust pipe is 1-1/4" iron pipe size. It should be installed without sharp bends and slope downward to its outlet to discharge water. The connection for discharge water should be at least 4" below the bottom of the manifold exhaust flange opening. See Figure 1.

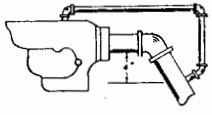


Figure 1

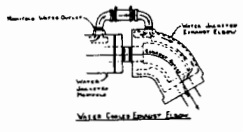


Figure 2

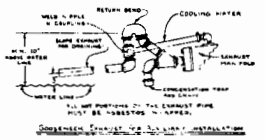


Figure 3

Exhaust pipe installations in sailboats is especially important. Many times the engines are installed on or below the water line and care must be taken to make sure the proper installation is made to eliminate the possibility of water entering the engine by backing up through the exhaust or by condensation in exhaust line.

ZENITH MARINE CARBURETORS

61 Series - 1967 and before

Suggestions **before starting** your new engine:

CAUTION: ENGINE IS SHIPPED LESS OIL. FILL WITH SAE 30 Class A DETERGENT OIL BEFORE STARTING.

Ventilate engine compartment by opening hatches and starting blower fans if you have them.

Check fuel supply and make sure fuel lines are tight. Any fuel seepage or leaks **should be corrected** before you attempt to start the engine.

Check all electrical connections. A wiring diagram for your particular model is included in this book. Ground is negative. Ground terminal should be attached to engine block.

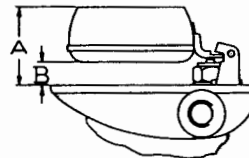
Do not allow flames or sparks near battery openings. Gases produced during normal charging are explosive.

Make sure water pump is lubricated with water pump grease.

Starting your new engine:

1. Clutch lever should be in neutral position.
2. Fill fuel pump bowl using the hand primer on the fuel pump.
3. Place throttle lever at 1/4 open position.
4. Pull out choke rod.
5. Turn on ignition and start engine.
6. As soon as engine starts, gradually push in choke lever until choke valve is completely open.
7. Run engine at idling speed of 600 to 1000 RPM.
8. Check oil pressure - 50 to 55 pounds when engine is cold. Check oil after about 10 minutes of running. Add oil to bring level to full mark if needed.
9. Check cooling system and make sure water pump is operating by checking water out of exhaust pipe. Temperature indicated on gauge should gradually go up to 140° to 160°.
10. If oil pressure or water flow (or operating temperature) is not normal, stop engine at once and check installation to correct problem.
11. When shifting into forward or reverse position, engine should be running at 600 - 1000 RPM.

After the break-in period a good cruising speed for sail boat installations is about 2000 RPM or about 80% of the maximum engine speed obtainable.



Model	Float Setting	
	A	B
61 MZAE7	1-9/64"	9/64"

- 9/64"
- *1. Venturi
 - *2. Main Jet
 - *3. Main Dis. Jet
 - *4. Well Vent
 - *5. Idling Jet
 - 6. Idling Needle Valve
 - 7. Throttle Plate
 - *8. Idle Discharge Plug
 - 9. Throttle Shaft
 - 10. Restriction Bushing
 - 11. G 11A, Pick-up Tube
 - 12. Throttle Stop Screw (not illustrated)
 - 13. Pick-up Tube Metering Orifice
 - 14. Main Jet Adjustment
 - 15. Idle Fuel Channel
 - 16. Idle Air Channel

*IMPORTANT: When ordering parts marked with asterisk *, specify the size which is stamped on each of these parts, also give number on identification tag located on float chamber, and make and model of your engine.

If the adjustments have been altered, start with a standard setting, which is:

1. Throttle Stop Screw 1-1/2 turns (to right) from fully closed position of Throttle Plate (7)
2. Idling Needle Valve (6) one turn open (to left) from seat.
3. The Main Jet Adjustment (14) 2-1/2 turns open (to left) from seat.

ADJUSTMENTS

If the engine, after running satisfactorily, suddenly ceases to perform properly, look over the intake manifold and the carburetor flange gaskets, throttle, choke and fuel connections. Make sure that throttle and choke valves open and close correctly and that fuel enters the carburetor in a free and steady stream. Do not change carburetor adjustments until other causes of trouble have been investigated.

Changes in adjustment should be necessary only with change in fuel or climate.

Before making any adjustments, warm up the engine thoroughly so that the intake manifold feels warm to the hand.

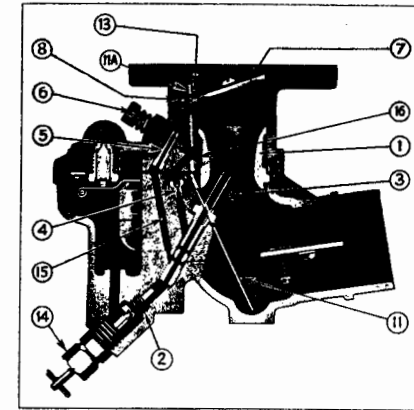
IDLE AND LOW SPEED ADJUSTMENT

Close the throttle slowly until desired idling speed is reached.

Turn Idling Needle Valve (6) gradually to right and left until the engine runs steady and as fast as this throttle position will permit.

Turning the Idling Needle Valve to right (in) makes the mixture richer, to left (out) leaner.

If a satisfactory adjustment cannot be obtained, examine the Idling Jet (5) and the



Idle Discharge Plug (8) to make sure that dirt or water does not obstruct the free flow of the mixture through these parts.

After completing the adjustments set Throttle Stop Screw (12) for desired idling speed.

INTERMEDIATE AND HIGH SPEED ADJUSTMENT

The mixture at intermediate and high speed is controlled by the Main Jet (2), and the Well Vent (4).

The Main Jet may be either of fixed size or adjustable. Whether fixed or adjustable, remove Main Jet (2) and blow out with compressed air or rinse in clean gasoline to remove water or dirt which may obstruct the metering orifice.

If adjustable, adjustment should be made as follows: (I) Open throttle about one-third; (II) Loosen packing nut on Main Jet Adjustment (14) (III) Turn Main Jet Adjustment to right (in) until the engine speed is noticeably reduced; (IV) Turn Main Jet Adjustment slowly to left (out) until the engine runs smoothly and as fast as this throttle position will permit; (V) Hold needle valve in position and tighten packing nut after completing the adjustment.

Compensation is controlled by the Well Vent (4). A richer mixture, at high speeds, is obtained with a smaller well vent and a leaner mixture with a larger well vent. If the mixture suddenly becomes too rich at high speeds, examine the well vent and make sure that it is not obstructed. Inspect these jets for water and dirt.

STARTING

Open the throttle about one-quarter. Pull the choke control out all the way. Step on the starter. As soon as the engine starts, push the choke control in about one-third of the way and as the engine warms up, continue to push it in gradually until the choke valve is wide open.

FUEL LEVEL

Correct setting of the float which controls the fuel level is of utmost importance.

The fuel level is set at the factory for regular motor gasoline and a pump pressure of 2 lbs. per square inch.

ZENITH 68 SERIES CARBURETOR

OPERATION AND SERVICE

The Zenith 68 Series carburetors are of up-draft single venturi design. They are made in $\frac{7}{8}$ " and 1" S.A.E. barrel sizes; with $\frac{7}{8}$ " and 1" S.A.E. flange sizes. They are made with selective fuel inlet, and with or without a main jet adjustment.

These carburetors are "balanced" and "sealed," and the semi-concentric fuel bowl allows operation to quite extreme angles without flooding or starving. This design makes them particularly adaptable to smaller farm tractors and a great variety of agricultural machines and industrial units.

FUEL SUPPLY SYSTEM

The fuel supply system is made up of the threaded fuel inlet, the fuel valve seat, fuel valve needle, float and fuel bowl, as illustrated in Fig. A.

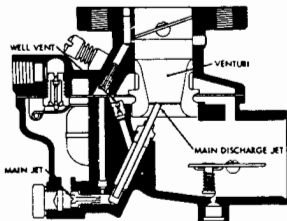


Figure A

The fuel supply line is connected to the threaded inlet. The fuel travels through the fuel valve seat and passes around the fuel valve and into the fuel bowl. The level of the fuel in the fuel chamber is regulated by the float through its control of the fuel valve. The fuel valve does not open and close alternately but assumes an opening, regulated by the float, sufficient to maintain a proper level in the fuel chamber equal to the demand of the engine according to its speed and load.

The inside bowl vent as illustrated by the passage originating in the air intake and continuing through to the fuel bowl, is a method of venting the fuel bowl to maintain proper air fuel mixtures even though the air cleaner may become restricted. This balancing is frequently referred to as an "inside bowl vent."

IDLE SYSTEM

The idle system as shown in Fig. B, consists of two idle discharge holes, idle air passage, idle adjusting needle, idle jet, and fuel pick-up passage.

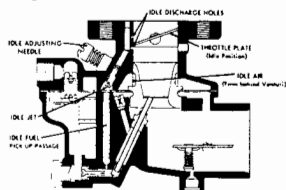


Figure B

The fuel for idle is supplied through the main jet to a well directly below the main discharge jet. The pick-up passage is connected to this well by a restricted drilling at the bottom of this passage. The fuel travels through this channel to the idle jet calibration. The air for the idle mixture originates back of (or from behind) the main venturi. The position of the idle adjusting needle in this passage controls the suction on the idle jet and thereby the idle mixture. Turning the needle in closer to its seat results in a greater suction with a smaller amount of air and therefore a richer mixture. Turning the needle out away from its seat increases the amount of air and reduces the suction, and a leaner mixture is delivered. The fuel is atomized and mixed with the air in the passage leading to the discharge holes and enters the air stream at this point.

HIGH SPEED SYSTEM

The high speed system, Fig. C, controls the fuel mixture at part throttle speeds and at wide open throttle. This system consists of a venturi, controlling the maximum volume of air admitted into the engine; the main jet, which regulates the flow of fuel from the float chamber to the main discharge jet; the well vent, which maintains uniform mixture ratio under changing suction and engine speeds; and a main discharge jet, which de-

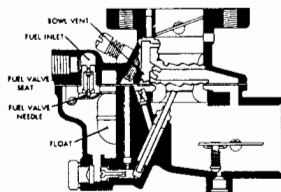


Figure C

livers the fuel into the air stream.

The main jet controls the fuel delivery during the part throttle range from one-quarter to full throttle opening. To maintain a proper mixture ratio a small amount of air is admitted through the well vent into the discharge jet through the air bleed holes in the discharge jet at a point below the level of fuel in the metering well.

At high speeds the fuel flows from the fuel chamber through the main jet and into the main discharge jet where it is mixed with air admitted by the well vent, and the air-fuel mixture is then discharged into the air stream of the carburetor.

CHOKE SYSTEM

The choke system as illustrated in Fig. D, consists of a valve mounted on a shaft located in the air entrance and operated externally by a lever mounted on the shaft. The choke valve is used to restrict the air entering the carburetor. This increases the suction on the jets when starting the engine. The choke valve is of a "semi-Automatic" type, having a poppet valve incorporated in its design, which is controlled by a spring.

The poppet valve opens automatically when the engine starts and admits air to avoid

over-choking or flooding of the engine. The mixture required for starting is considerably richer than that needed to develop power at normal temperatures. As the engine fires and

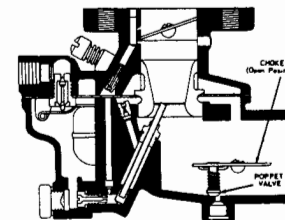


Figure D

speed and suction are increased, the mixture ratio must be rapidly reduced. This change is accomplished through adjustment of the choke valve and the automatic opening of the poppet valve to admit more air when the engine fires.

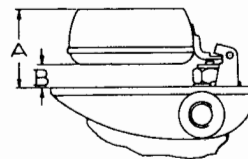
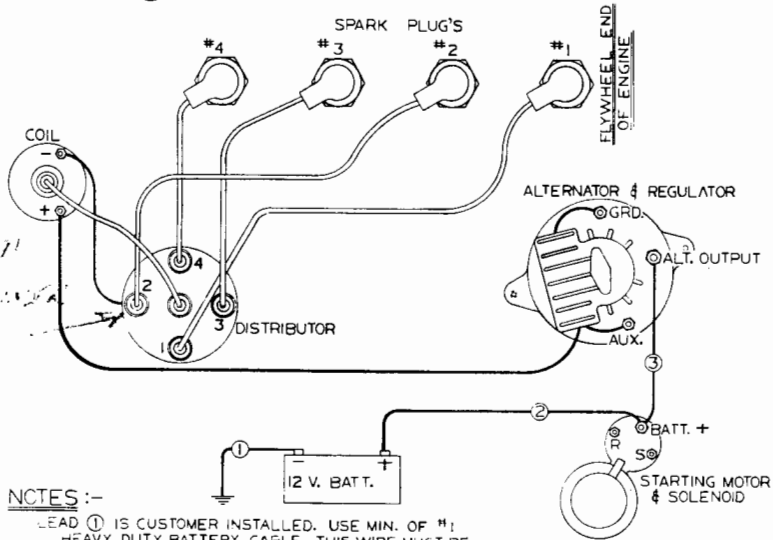


Figure E

The "A" dimension should be 1-5/32" plus or minus 3/64".
Float Level. Check position of float assembly for correct measurement to obtain proper float level using depth gauge. NOTE: Do not bent, twist or apply pressure on the float bodies.

With bowl cover assembly in an inverted position, viewed from free end of float, the float bodies must be centered and at right angles to the machined surface. The float setting is measured from the machined surface (no gasket) of cover to top side of float bodies at highest point.

Bending Float Lever. To increase or decrease distance between float body and machined surface use long nosed pliers and bend lever close to float body. NOTE: Replace with new float if position is off more than 1/16".



NOTES:-

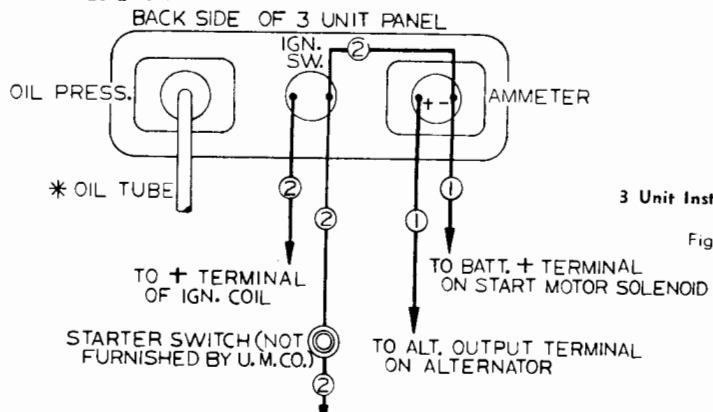
- LEAD ① IS CUSTOMER INSTALLED. USE MIN. OF #1 HEAVY DUTY BATTERY CABLE. THIS WIRE MUST BE GROUND BACK TO ENGINE.
- LEAD ② IS CUSTOMER INSTALLED. USE MIN. OF #1 HEAVY DUTY BATTERY CABLE.
- LEAD ③ IS CUSTOMER INSTALLED. USE MIN. OF #8 WIRE. DO NOT INSTALL THIS WIRE IF A PANEL MTD. AMMETER IS USED.

ALTERNATOR, REGULATOR, & START. MOTOR ARE GROUND TO ENGINE AT FACTORY.

ALTERNATOR FIELD IS INTERNALLY CONNECTED UNDER REGULATOR.

Wiring Diagram - Motorola Alternator - 12 volt - 35 ampere - Solid State Regulator

Figure 4



3 Unit Instrument Panel

Figure 5

NOTES:-

- LEADS ① ARE CUSTOMER INSTALLED. USE #8 GA. WIRE FOR CIRCUITS UNDER 15 FT., #6 GA. WIRE FOR CIRCUITS FROM 15 TO 25 FT.
- LEADS ② ARE CUSTOMER INSTALLED. USE #16 GA. WIRE FOR CIRCUITS UNDER 15 FT., #14 GA. WIRE FOR CIRCUITS FROM 15 TO 25 FT.

* WHEN NON-METALLIC FLEXIBLE OIL TUBE IS USED GROUND INSTRUMENT PANEL DIRECTLY TO ENGINE.

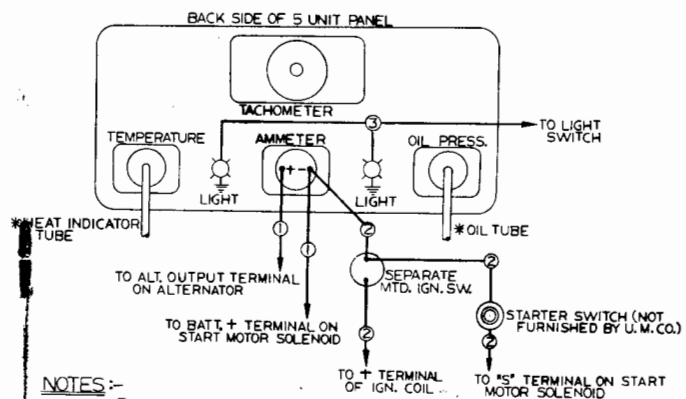
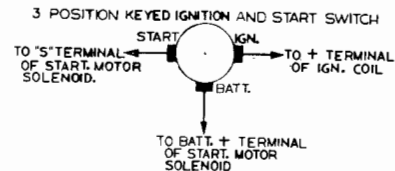


Figure 6

NOTES:-

- LEADS ① ARE CUSTOMER INSTALLED. USE #8 GA. WIRE FOR CIRCUITS UNDER 15 FT., #6 GA. WIRE FOR CIRCUITS FROM 15 TO 25 FT.
- LEADS ② ARE CUSTOMER INSTALLED. USE #16 GA. WIRE FOR CIRCUITS UNDER 15 FT., #14 GA. WIRE FOR CIRCUITS FROM 15 TO 25 FT.
- LEAD ③ IS CUSTOMER INSTALLED. USE #16 GA. WIRE, CONNECT LEADS FROM PANEL LIGHTS TO THIS WIRE.

* WHEN NON-METALLIC FLEXIBLE OIL TUBE AND HEAT INDICATOR TUBE ARE USED GROUND INSTRUMENT PANEL DIRECTLY TO ENGINE.



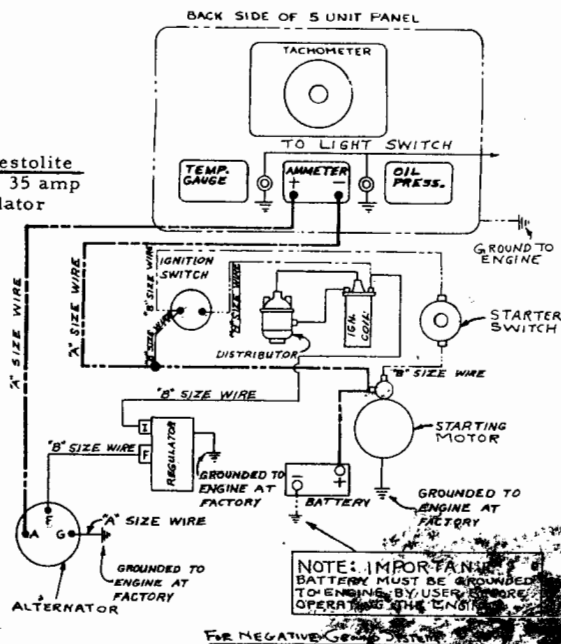
5 Unit Mechanical Instrument Panel Wiring Diagram

Wiring Diagram - Prestolite Alternator - 12 Volt, 35 amp with Solid State Regulator

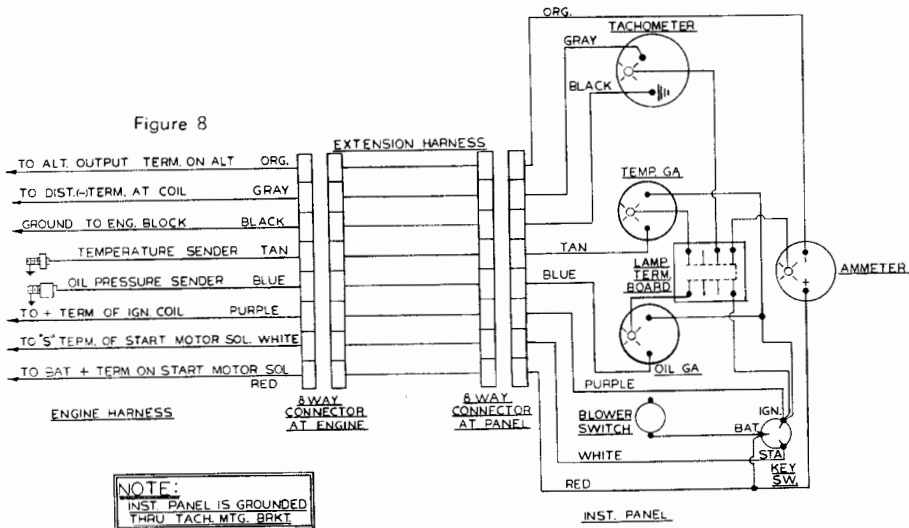
RECOMMENDED MINIMUM WIRE SIZES FOR CONNECTING ALTERNATOR & REGULATOR		
TOTAL LENGTH OF CIRCUIT IN FEET	'A' SIZE WIRE	'B' SIZE WIRE
15 FEET OR LESS	#8	#16
15 FEET TO 25 FEET	#6	#14

Wire Chart for all Diagrams

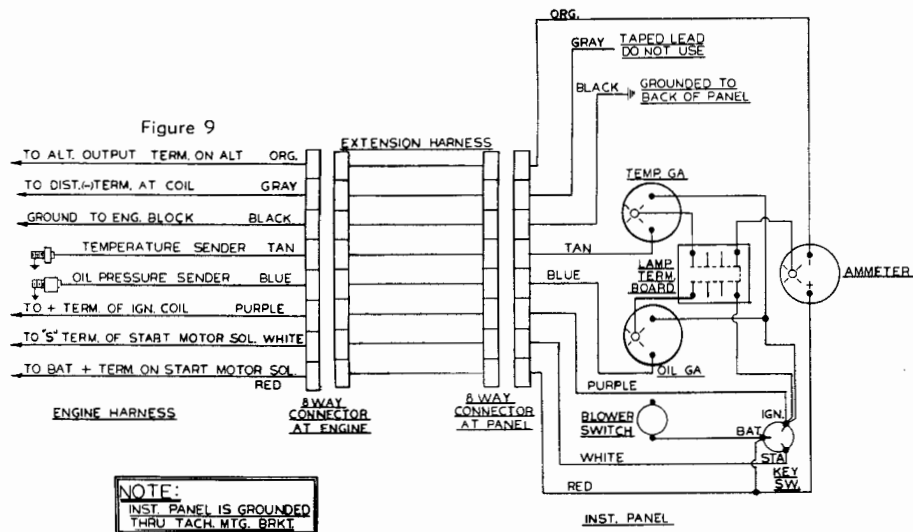
Figure 7



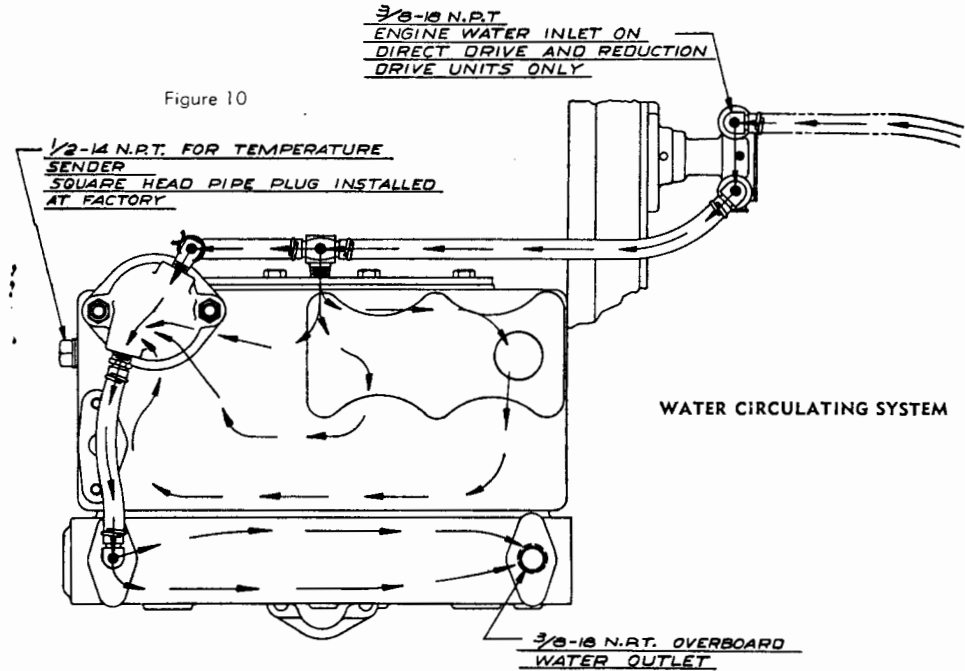
NOTE: IMPORTANT!
BATTERY MUST BE GROUND TO ENGINE BY USER BEFORE OPERATING THE ENGINE.
FOR NEGATIVE GROUND SYSTEM



Electric Instrument Panel with Tachometer



Electric Instrument Panel less Tachometer



The two drain plugs and a pipe cap removed at the factory are in a small bag attached to the carburetor lever. Replace one plug in the bottom of the water pump and one in the rear of the manifold near the exhaust flange. Replace the pipe cap on the drain nipple out of the cylinder block water jacket located immediately alongside the distributor.

WATER TEMPERATURE

An automatic by-pass temperature control is standard equipment on the engine. This temperature control valve is required to maintain proper engine operating temperatures. If an engine is operated too cold, condensation may form in the valve chamber causing sticky valves and other malfunctions.

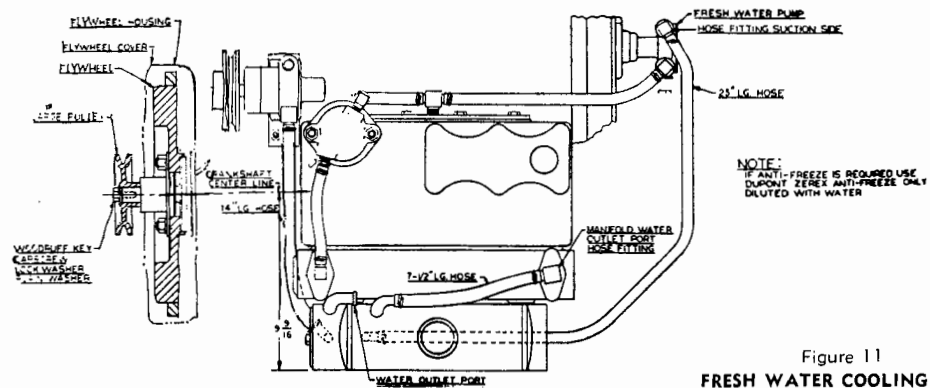


Figure 11
 FRESH WATER COOLING

LUBRICATION SYSTEM

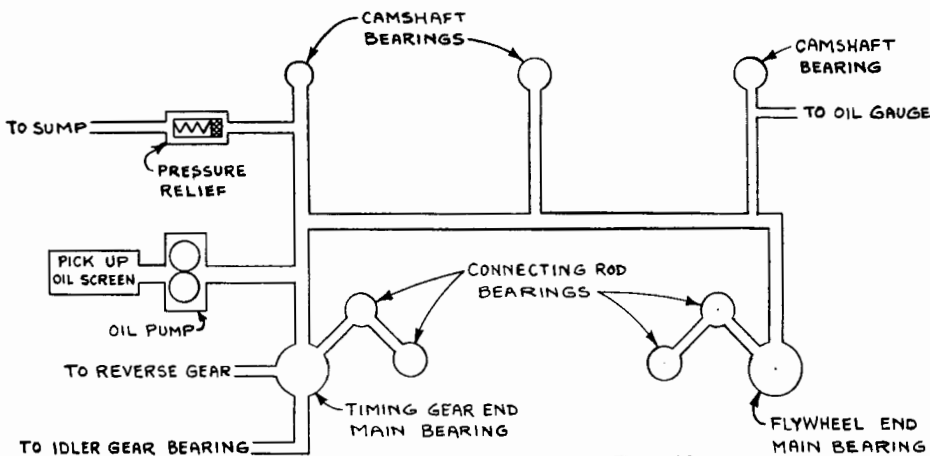


Figure 12

OIL CIRCULATING DIAGRAM

The lubricating system on the ATOMIC FOUR Model is full pressure to all cam-shaft bearings, all main bearings, all connecting rod bearings, and also to the reverse gear. Fill the base with from four to five quarts of good grade SAE 30 oil or until the oil level gauge shows full, as directed on the name plate, mounted on top of the reverse gear housing. The reduction gear model will take slightly more. It is not necessary to oil the reversing gear or the reduction gear separately, as both are oiled by pressure from the main oiling system through a drilled hole in the end of the crankshaft and the tailshaft.

The oil is carried in the base, and a gear driven gear type oil pump which is submerged in the oil in the base circulates the oil through the motor under pressure.

The oil pressure regulator screw is located on the carburetor side of the motor under the fuel pump. If it is necessary to adjust the oil pressure, turning the adjusting screw to the right, or in, will increase the pressure, turning the screw to the left, or out, will decrease the pressure. The oil pressure gauge connection is also on the carburetor side and is located on the crankcase immediately behind the flywheel housing.

The oil pressure regulator screw is adjusted at the factory so that the gauge will show about 50 to 55 pounds cold for normal engine speeds, but may go as low as 5 pounds at idling speed when hot, and should not require adjusting.

CAUTION: We recommend that you change the oil after every forty or fifty hours of service. The oil should be drained while the motor is warm, as cold oil will not drain readily.

The hand sump pump is provided for the easy removal of old oil. The bayonet gauge indicates the proper oil level. Check oil level daily to maintain proper level.

IMPORTANT: DO NOT overfill crankcase as this will result in oil leaks.

VALVE CLEARANCE

When the motor is worn, set the exhaust valves for .010 clearance and the intake valves for .008 clearance.

VALVE TIMING

Timing gears are marked for proper valve timing.

IGNITION TIMING

The points in the distributor should break when the piston is at top dead center. If it is necessary to retime, turn the engine until compression stroke on No. 1 cylinder is reached. Then make starting crank pin in crankshaft line up vertically with raised timing mark on the flywheel housing. Loosen the clamp screw on the distributor arm directly beneath the distributor base. Set the rotor on line with the No. 1 spark plug and turn distributor base counter-clockwise until the points just begin to open. After the distributor base has been turned so the points just begin to open and the rotor is in line with No. 1 spark plug wire, tighten the clamp screw on the arm.

Take the boat out for a trial run and after bringing engine to normal operating temperature and the boat running at top speed, loosen the distributor clamp bolt and carefully advance the ignition timing by slowly rotating the distributor body counter-clockwise until the RPM begins to fall off. Then rotate the distributor body in the opposite direction to obtain the greatest number of RPMs without rough running of the engine. The timing is now set properly in the retard position. The spark automatically advances as the engine increases speed to maximum RPM.

VENTILATION

Ventilation of the motor compartment is very important. Inlet and exhaust funnels of adequate size must be provided to permit complete air circulation. It is recommended practice to ventilate the engine compartment each time before the engine is started.

SAFETY PRECAUTIONS

Keep the motor and especially the motor compartment clean and free from oily waste or cloths.

Likewise, keep gasoline and oil out of the bilge. This may be prevented by periodically inspecting the carburetor, gasoline line and connections for leaks.

Be very careful not to spill gasoline when filling your supply tank as it may drain into places where it is not easily detected. In case your boat accidentally receives an unusually hard jolt from a collision with a dock or some other object, be sure to carefully inspect the gasoline supply tank and all gasoline lines for leaks.

Never start the motor until the motor compartment has been ventilated by either opening the hatch, or operating the blower to remove fuel fumes.

Have all wiring properly insulated to prevent short circuiting and **CHECK ALL WIRE TERMINALS PERIODICALLY TO BE SURE THERE ARE NO LOOSE CONNECTIONS TO CAUSE ELECTRIC SPARKS.**

RACING THE MOTOR

Do not race the motor when not under load. This practice is harmful to the motor and unnecessary.

Driving the boat at high speed before the motor is "warmed up" may result in scored pistons and cylinder walls.

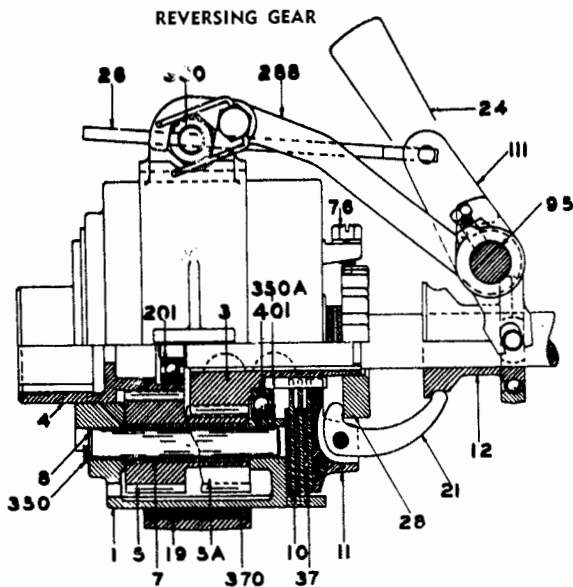


Figure 13

LUBRICATION: The reverse gear on the ATOMIC FOUR is lubricated by pressure lubrication through a drilled hole in the crankshaft and it also runs in a bath of oil.

OPERATION: When the reverse gear lever is pushed forward into the "Go Ahead" position, it pushes the friction cone backward, thereby spreading the fingers and causing the back of the fingers to engage the friction plungers which in turn press the discs together. This in turn acts as a solid connection between the motor and the propeller shaft.

To reverse the boat, pull the reverse gear lever backward. When the lever is pulled backward, the action clamps the brake band to the reverse gear drum and power is then transmitted through the internal gears in the reverse direction thus reversing the propeller rotation.

ADJUSTMENT: FOR THE FORWARD DRIVE

If the gear slips in the forward drive, back out the lock screw No. 76 until the end of it is clear just of the notch in the adjusting collar No. 28. Now turn collar to the right until the lock screw No. 76 is in line with one of the notches in the adjusting collar No. 28.

Then tighten up the lock screw No. 76 and be sure that the end of screw enters the notch in the adjusting collar No. 28. Repeat this procedure until the reverse gear holds on the forward drive. An adjustment of one or two notches is usually sufficient.

FOR THE REVERSE DRIVE

Pull the lever into the reverse position. Then tighten up the adjusting bolt No. 330 until the brake band clamps or grips the gear drum No. 1 and holds it from revolving. It is well to screw up this adjusting bolt No. 330 a little tighter than is necessary. This will compensate for any wear on the brake band. The lock wire holds the adjusting bolt nut and keeps it from loosening.

FIRST: Make sure that the shifting control actually engages and disengages the forward and reverse action of the clutch and reverse gear. Unless these contacts are properly executed — avoidable wear will result involving annoyance and expense.

SECOND: Throw the remote control shifting lever into forward position as far as it will go. Then, disconnect the short reverse gear lever and see if it can be shifted further forward. If this can be done, the connection should be changed so as to permit the remote control shifting lever to throw the gear shift lever as far forward as possible.

RUBBER IMPELLER TYPE PUMPS

The engine is equipped with a rubber impeller type water pump. This pump will give best service under most operating conditions. A bronze gear type pump was installed on engines before Serial No. 76820.

GENERATOR CHARGING CAPACITY

The standard alternator type of charging generator produces up to 35 amperes (55 amp optional) of 12 volt DC for recharging the battery. This source gives you a good supply of current regulated power to maintain your battery.

AQUA-PAK V-DRIVE MODELS

The UNIVERSAL V-Drive unit incorporated in the Atomic Four Aqua-Pak marine motor, is designed as an integral part of the motor. It is directly coupled to the engine by a spline shaft and coupling.

The V-drive is a self-contained, self-lubricated, non-adjustable unit requiring very little attention. It is water-jacketed, water cooled, which is accomplished by means of the main water supply to the motor.

A specially developed, high grade transmission oil only should be used in this unit. We suggest "Kendal" 3-Star Gear Lub, rated at a combined S.A.E. 80-90-140 viscosity, or an equivalent.

CAUTION: NEW UNITS SHIPPED FROM THE FACTORY DO NOT CONTAIN LUB OIL, FILL AND CHECK CAREFULLY BEFORE ATTEMPTING TO START OR RUN MOTOR.

Check oil level each time engine is used. The unit should be filled to the full mark on the oil level dip stick provided. Change lubricant and clean magnetic drain plug after first fifty hours of operation and every 500 hours thereafter.

PREPARING ENGINE FOR SPRING SERVICE

Preparation of the engine should include all these items of overhaul necessary to permit satisfactory operation of the engine. Many engines properly serviced in the spring will give a full season of carefree pleasure. The amount of effort to be expended will be determined somewhat by the storage of lay-up procedure of the previous fall. Refer to preparations for starting the engine for the first time.

1. Tighten all nuts and bolts to proper torque. Replace all drain plugs and caps.
2. Manifold - Replace drain plug. Check manifold bolts for tightness since some gaskets shrink more than others.
3. Water Pump - Close drain cock and replace drain plug. Lubricate pump by grease cups. Replace packing if required. Do not operate pump without water.
4. Lubrication System - Remove all oil from oil pan and reverse gear housing. Refill with quantity specified in "Lubrication Group"
5. Cylinders - Remove spark plugs. Pour one or two ounces of oil in cylinders to lubricate walls, rings, etc., turn engine over without spark plugs in place.
6. Valves & Tappets - Check and lubricate if required. Remove seal over breather tube end.
7. Distributor - Clean and lubricate as required. Remove any moisture seals. Clean and set distributor points.
8. Spark plugs - Clean spark plugs and re-set gap to .035". Replace burned or broken plugs.
9. Ignition Wires - Replace damaged or brittle ignition wires. High tension electrical leakage prevents good operation of engine.
10. Starting Motor - See that starter pinion is clean and lubricated with light oil. Remove any moisture seals. Lubricate bearings. Clean commutator and brushes with sandpaper. **Do not use emery cloth.**
11. Alternator - Does not require any special care or lubrication.
12. Battery - Reinstall fully charged battery. Clean the cable terminals and fasten securely to clean battery terminals. Coat terminals with vaseline or grease to reduce corrosion, and then attach battery cables.
13. Fuel System - See that fuel system is clean and free from scale, sludge, or obstructions. Drain out any water that has accumulated in tanks or fuel lines. Check over for loose connections, tightening any found. Remove cover from carburetor air intake. Oil carburetor choke and throttle carburetor air intake. Oil carburetor choke and throttle shafts. Check for easy operation. Clean flame arrestor.
14. Exhaust system - Remove moisture seal.
15. Turn engine over by hand with the spark plugs out to see that all bearings are free.
16. With boat in water, check freedom of propeller shaft in bearings and alignment of propeller shaft with engine.
17. Tighten stuffing box just enough to stop leakage along shaft. Excessive tightening will cause power loss and burned stuffing material.
18. Clean motor thoroughly and repaint.

PREPARING ENGINES FOR WINTER STORAGE

Neglect in preparing an engine for winter storage may lead to annoying or costly damage which will not be seen until the engine is prepared for use the following spring. The engine should be carefully covered to give complete protection from rain and snow. Drain completely to avoid damage from freezing.

1. Cylinder Blocks - A pipe cap is found on the distributor side of the engine. Remove and leave off.
2. Manifold - A pipe plug will be found in the right side and to the rear end of the exhaust manifold. Remove and leave out.
3. Water Pump - Pumps are particularly susceptible to damage from freezing because of the restricted space and clearances. The pump should be carefully drained by loosening cover. The pump should be dry during the winter.
4. Fog the engine. Run the engine at about 800 RPM and using about 4 ounces of Marine Care slowly pour it into the carburetor to coat the combustion chamber and cylinder walls. Stall the engine by pouring the last two ounces in rapidly.
5. Lubrication System - The oil pan and lubrication system should be drained of old or contaminated oil so that any moisture or acid present in the oil will not cause corrosion damage during the winter. Two or three quarts of new clean oil should be pumped through the system by turning the motor by hand or electric starter. This should distribute a film of clean oil to act as a rust preventive. Regular rust preventive oils can be obtained.
6. Electrical System. Remove the battery and store it at the boat yard or at your local battery dealer. Loosen the distributor cap for ventilation and protect all other electrical parts for moisture.
7. Fuel System - All gasoline should be drained from carburetor, fuel pump, feed lines, filters, and tanks. This is to prevent development of sludge or gum in the system. The carburetor air intake should be covered by water-proof paper or cloth and sealed to prevent entrance of moisture into engine by way of the intake valves that are open.
8. Exhaust system - Exhaust pipes should be drained free of water. Allow the exhaust pipes to dry out. Seal exhaust pipe end to prevent entrance of moisture into the engine through exhaust valves that are open.
9. Rust prevention - Exposed metal parts liable to rust should be coated with grease or rust preventive compound.

WHAT TO DO WHEN YOUR MOTOR DOES NOT OPERATE PROPERLY

The following suggestions will be of assistance in locating and remedying motor troubles. They are also mentioned to assist the operator in making emergency repairs. However, when serious trouble occurs, a competent service man should be called.

The operation of a motor depends primarily on three factors: An unfailling fuel supply; uninterrupted ignition; and good compression. Failure of either the first two will prevent starting or cause loss of power. It may also cause difficult starting or sudden stopping.

If a motor which has previously been operating satisfactorily refuses to start or stops with but slight warning and without the noise of a breaking part — it is reasonable to assume that either the fuel supply has been cut off or the ignition has failed. The first step should therefore be to determine which of the two systems is at fault.

FIRST: See that there is gasoline in the tank. Use regular grade gasoline.

SECOND: It is possible to have plenty of fuel and still be unable to fill the carburetor. This may be caused by too small a vent hole in the gasoline tank cap. The gasoline pipe may be air bound. Test the carburetor by uncoupling the pipe at the carburetor connection. If the fuel does not flow freely, the fuel line may be plugged. Blow or run a wire through the pipe to clean it. The strainer in the fuel pump or in the carburetor may also be plugged.

THIRD: Flooding a carburetor by over-using the choke may cause the mixture to become too rich. In this instance, remove the spark plugs and turn the engine over several revolutions.

FOURTH: Look for water in the fuel. If water is found, clean the fuel tank, fuel pump, fuel line and carburetor.

FIFTH: Check for an air leak in the intake manifold. This can be easily tested by squirting oil around the intake connections.

If the fuel system is O. K. check as follows for ignition troubles.

FIRST: Be sure the ignition switch is turned to the "ON" position.

SECOND: Look for a fouled or broken spark plug.

THIRD: Check for weak spark. If a bright spark jumps across the gap between the two points of the plug when the engine is turned over, the Ignition System is undoubtedly in working order. This may be verified by making the same test with each wire. The gap between the spark plug points should be approximately .035" (or the thickness of a thin dime.)

FOURTH: Check for a broken electrical circuit.

FIFTH: The cause may be due to a ground. Poor installation will cause a ground. Be sure all electrical wires are clean and well insulated.

SIXTH: Poor contact at distributor breaker points.

SEVENTH: Distributor may be out of time.

TROUBLE SHOOTING

A gasoline engine depends upon three main factors for proper operation: an unfailling fuel supply, uninterrupted ignition, and good compression. When any one of these are not present, or present only intermittently, engine failure will result. The following "trouble shooting" information is designed to help the operator locate and overcome some of the most probable causes of engine failure, or improper operation. "Probable Causes" are listed in the most likely order of occurrence. Only one correction should be attempted at a time and that possibility eliminated before going on to the next.

TROUBLE SHOOTING PROCEDURES

TROUBLE	PROBABLE CAUSE	CORRECTION
Starter will not crank engine	Discharged Battery	Charge or replace battery
	Corroded battery terminals	Clean terminals
	Loose connection in starting circuit	Check and tighten all connections
	Defective starting switch	Replace switch
	Starter Motor brushes dirty	Clean or replace brushes
	Jammed Bendix gear	Loosen starter motor to free gear
Starter motor turns but does not crank engine	Defective starter motor	Replace motor
	Partially discharged battery	Charge or replace battery
	Defective wiring or wiring of too low capacity	Check wiring for worn acid spots. See page 12 for proper size wire
Engine will not start	Broken Bendix drive	Remove starter motor and repair drive
	Empty Fuel Tank	Fill tank with proper fuel
	Flooded engine	Remove spark plugs and crank engine several times. Replace plugs
	Water in fuel system	If water is found, clean tank, fuel lines, and carburetor. Refill with proper fuel
	Inoperative or sticking choke valve	Check valve, linkage, and choke rod or cable for proper operation
Engine will not start. (Poor compression and other causes)	Improperly adjusted carburetor	Adjust carburetor
	Clogged fuel lines or defective fuel pump	Disconnect fuel line at carburetor. If fuel does not flow freely when engine is cranked clean fuel line and sediment bowl. If fuel still does not flow freely after cleaning, repair or replace pump
	Air leak around intake manifold	Check for leak by squirting oil around intake connections. If leak is found, tighten manifold and if necessary replace gaskets.
Engine will not start. (Poor compression and other causes)	Loose spark plugs	Check all plugs for proper seating, gasket and tightness. Replace all damaged plugs and gaskets.
	Loosely seating valves	Check for broken or weak valve springs, warped stems, Carbon and gum deposits, and insufficient tappet clearance.

TROUBLE SHOOTING PROCEDURES (CONT.)

TROUBLE	PROBABLE CAUSE	CORRECTION
Engine will not start (Poor compression and other causes - Cont.)	Damaged cylinder head gasket Worn or broken piston rings	Check for leaks around gasket when engine is cranked. If a leak is found replace gasket Replace broken and worn rings. Check cylinders for "out of round" and "taper".
Excessive engine temperature	No water circulation	Check for clogged water lines and restricted inlets and outlets. Check for broken or stuck thermostat. Look for worn or damaged water pump or water pump drive
Engine temperature too low	Broken or stuck thermostat	Replace thermostat
Engine will not start (Ignition system)	Ignition switch "off" or defective Fouled or broken spark plugs Improperly set, worn or pitted distributor points. Defective ignition coil Wet, Cracked, or broken distributor Improperly set, worn, or pitted magneto breaker points (Magneto models only) Improperly set, worn, or pitted timer points. Defective coil or defective condenser Improper Timing	Turn on switch or replace Remove plugs and inspect for cracked porcelain, dirty points, or improper gap. Remove center wire from distributor cap and hold within 3/8 inch of motor block. Crank engine. Clean, sharp spark should jump between wire and block when points open. Clean and adjust points. If spark is weak or wellow after adjustment of points, replace condenser. If spark still is weak or not present replace ignition coil Wipe inside surfaces of distributor dry with clean cloth. Inspect for cracked or broken parts. Replace parts where necessary. Remove spark plug wire and hold within 3/8 inch of engine block. Clean, sharp spark should jump between wire and block when engine is cranked. If spark is weak or not present clean and adjust breaker points Remove spark plug wire and hold within 1/8 inch of engine block. A clean sharp spark should jump between wire and block when engine is cranked. Clean and set timer points. If spark still is not present when engine is cranked, replace coil. Set Timing
No oil pressure	Defective gauge or tube No oil in engine Dirt in pressure relief valve Defective oil pump, leak in oil lines or broken oil pump drive	Replace gauge or tube Refill with proper grade oil Clean valve Check oil pump and oil pump drive for worn or broken parts. Tighten all oil line connections.

TROUBLE SHOOTING PROCEDURES (CONT.)

TROUBLE	PROBABLE CAUSE	CORRECTION
Loss of RPM (Boat or associated equipment)	Damaged propeller Bent Rudder Misalignment Too tight stuffing box packing gland Dirty boat bottom	Repair propeller Repair Realign engine to shaft Adjust
Vibration	Mis-firing or pre-ignition Loose foundation or foundation bolts Propeller shaft out of line or bent Propeller bent or pitch out of true	See correction under mis-firing and pre-ignition
Pre-Ignition	Defective spark plugs Improper Timing Engine Carbon Engine Overheating	Check all spark plugs for broken porcelain, burned electrodes or electrodes out of adjustment. Replace all defective plugs or clean and reset. See instructions for retiming Page 15 Remove cylinder head and clean out carbon See correction under "Engine Temp." portion of this table.
Back-Firing	Insufficient fuel reaching engine due to dirty lines, strainer or blocked fuel tank vent. Water in fuel Poorly adjusted distributor	See correction under "Engine will not start" portion of this table. See correction under "Engine will not start" portion of this table.
Low oil pressure	Too light body oil Oil leak in pressure line Weak or broken pressure relief valve spring Worn oil pump Worn or loose bearings	Replace with proper weight oil. Inspect all oil lines. Tighten all connections. Replace spring Replace pump Replace bearings
Oil pressure too high	Too heavy body oil Stuck pressure relief valve Dirt or obstruction in lines	Drain oil and replace with oil of proper weight. Clean or replace valve Drain and clean oil system. Check for bent or flattened oil lines and replace where necessary
Sludge in oil	Infrequent oil changes Water in oil Dirty oil filter	Drain and refill with proper weight oil Drain and refill. If trouble persists check for cracked block, defective head gasket and cracked head. Replace filter.

For your convenience, the factory has prepared a special on-board spare parts kit for your engine. This kit contains parts most likely to be required for emergency needs, such as a coil, contact points, spark plugs, etc.

These parts are packed in a handy container for easy storage. It is good practice to have emergency parts on board, and these carefully selected parts will solve this problem.

You can obtain an on-board spare parts kit from your Universal dealer or direct from the factory.

THE UNIVERSAL GUARANTEE

"ALL UNIVERSAL products are thoroughly tested prior to shipment from the factory and are certified free from defects in material and workmanship. The finest materials and components available are used throughout. The Universal Motor Company guarantees the products of its own manufacture against defects in materials and workmanship for a period of one year from date of invoice and will replace or repair without charge at its Oshkosh, Wisconsin factory any part or unit which in its opinion is defective when returned to the factory, carriage charges prepaid, within that period. The Universal Motor Company shall in no event be liable for consequential damages or contingent liabilities arising out of the failure of any products or parts to operate properly. All trade-marked components are warranted separately by their respective manufacturers. On any faulty components returned to the Universal Motor Company, the Universal Service Department will gladly deliver such components to the manufacturer and handle the replacement as directed by the manufacturer."

This guarantee supersedes all previous statements on the subject.

A FINAL WORD

Universal's interest in both customer and product continues long after the engine is installed. Within the limits of our specifications, the company's service department is ready to serve your maintenance and repair needs quickly. In addition, all Universal factory personnel will promptly answer inquiries regarding maintenance, installation or special adaptations.

If you will use judgment and care in operating your Universal engine, use sufficient quantities of the recommended lubricants, stay on the alert for the first signs of trouble, and contact Universal whenever you need aid, the life and usefulness of your Universal power package will be greatly increased.

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