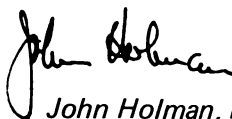


Pub. No. 102

Dear Owner:

The engine you have just purchased is designed and built from the finest material available. We urge you to read this manual thoroughly and follow the instructions outlined within, so as to assure you of excellent performance and long engine life. We hope that you will have many hours of pleasure with your total performance power unit.

Sincerely,



*John Holman, President
Holman & Moody, Inc.*

**holman—moody
marine division**

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municipal airport station
charlotte, n. c. 28208
704—392-9314*

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ENGINE INSTALLATION

Each engine has been carefully inspected and test run prior to shipment. Engines are shipped with oil in the crankcase and transmission fluid in the reverse gear. It should not be necessary to add oil to either unit, however, it is wise operating procedure to check oil levels before starting your engine.

The engine should be installed in a compartment which has adequate ventilation and accessibility. The battery should be located as close to the engine as possible so that the leads are kept short. The battery box should be adequate to withstand rough water movement. The engine bed should be of suitable construction to assure adequate rigidity and maintenance of engine alignment. Stringers should be 2 1/2 inches on center, as is standard in the marine industry, and the engine mounts should be lagged firmly to them. The through hull fitting should be one inch or larger. A sea water strainer is recommended on raw water cooled engines and is mandatory on fresh water cooled engines or in any installation where the Holman & Moody Therm-O-Filter is used. New hose used in the connecting of these parts should be noncollapsible.

Exhaust lines should be of a size to insure minimum back pressure when the engine is operating at high speeds, three inch diameter for single exhaust lines and 2 1/2 inch for dual exhaust line installations. The exhaust line must slope downward toward the transom so that water cannot back into the engine manifold. The exhaust line slope should be no less than one-half inch drop per foot.

The engine transmission is supplied with the proper size shaft coupling for the specified shaft. Coupling should be a snug fit on the shaft and provided with a key to fit the size of the keyway. The shaft couplings should be anchored securely so as to prevent the propeller shaft from backing out of the coupling when the engine is reversed. Engine alignment should be kept three-thousandths tolerance between the engine shaft coupling and the propeller shaft coupling. This should be done with the boat in the water and not while on a cradle.

Engines should have propellers installed that allow maximum rated rpm. Overloading of engines can result in rapid deterioration of valves, pistons, etc., and any failure due to improper installation or overloading will not be covered by warranty.

All electrical connections should be adequately installed and wired in accordance with the furnished diagram. Fuel lines should be installed with a flexible connection at the engine and in accordance with Coast Guard regulations.

Note: For engines equipped with a fresh water cooling system, fill the cooling system with water and a rust inhibitor. Where the engine is to be operated in cold climater, refer to instructions regarding anti-freeze in the section entitled "Seasonal Storage".

ENGINE BREAK-IN PROCEDURE

Before starting newly installed engine, be sure the bilge is clear of gas fumes. If a bilge blower system is not installed, the engine compartment hatch should be removed and the bilges completely aired out prior to starting. Check all fuel lines for leakage after filling the fuel tank. Next, check engine and transmission for oil, then electrical connections, making sure the ground wire is properly attached to the engine block. Next check the controls for proper operation. To start, detach coil wire, remove flame arrestor and pump the throttle lever four or five times until gas squirts into the carburetor. Replace coil wire and flame arrestor, place throttle at one-fourth open and crank engine. Check oil pressure and water temperature and inspect engine exhaust to see if the raw water pump is operating properly. Engine idle should be between 600 and 650 rpm. Test for proper operation of forward and reverse shifting before leaving dock.

During the break-in period (prior to the 25 hour check), operate engine infrequently at high rpm. For the first five hours of operation, do not exceed 3000 rpm and do not operate in excess of 4000 rpm for extended periods of time until the 25 hour period has been reached.

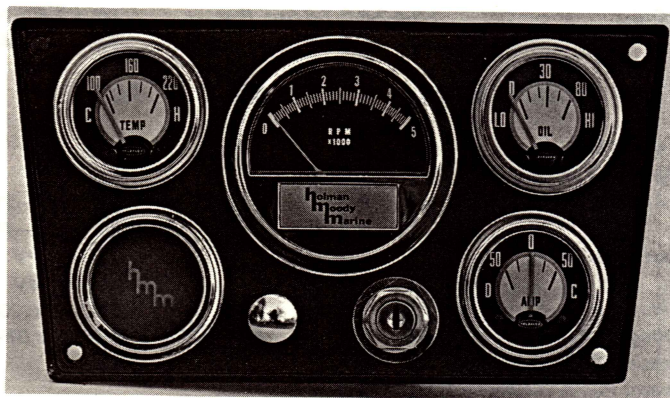
25 HOUR MAINTENANCE CHECK

- (1) Align engine and tighten mounts.*
- (2) Change oil and filters.*
- (3) Adjust belts.*
- (4) Replace gas filters.*
- (5) Check ignition timing with timing light.*
- (6) Check sparkplug gap.*
- (7) Reset distributor points.*
- (8) Torque head bolts.*

ELECTRICAL SYSTEM

The engine is delivered wired and ready to connect to the boat's electrical system. Battery connections should be checked to determine that the engine is connected with negative ground. Never ground the field circuit between the alternator and the regulator as this could result in damage to either item.

INSTRUMENT PANEL



GENERAL SPECIFICATIONS

ENGINE ¹	289 CID - 2V & 4V	302 CID - 2V & 4V
Compression Ratio	9.3:1	9.5:1
Bore and Stroke	4.00 x 2.87	4.00 x 3.00
Brake Horsepower	200 @4400 RPM-2V 225 @4800 RPM-4V	210 @4400 RPM-2V 235 @4800 RPM-4V
Gross Torque Ft/Lbs ²	235 @2400 RPM-2V 251 @2800 RPM-4V	244 @2500 RPM-2V 260 @2800 RPM-4V
Compression Pressure PSI (Sea Level) Cranking Speed ³	130-170	130-170
Engine Idle Manifold Vacuum ⁴	18	18
Oil Pressure - Hot @2000 RPM	35-60	35-60
Firing Order	1-5-4-2-6-3-7-8 Std. Rot. 1-8-7-3-6-2-4-5 Opp. Rot.	1-5-4-2-6-3-7-8 Std. Rot. 1-8-7-3-6-2-4-5 Opp. Rot.

ENGINE TUNEUP SPECIFICATIONS

Curb Idle RPM	550	550
Back Ignition Timing	12° BTC	12° BTC
Dwell Angle at Idle Speed	24° - 29°-2V 26° - 31°-4V	24° - 29°-2V 26° - 31°-4V
Distributor Point Gap	0.021 - 2V 0.017 - 4V	0.021 - 2V 0.017 - 4V
Spark Plug Gap	0.032 - 0.036	0.032 - 0.036
Spark Plug No. ⁵	BTF 3 or BF-32 BRR-42	BTF 3 or BF-32
Belt Tension(Ft/Lbs)	<u>140</u>	140
Accelerator Pump Setting		
Pump Link	Inboard-2V No. 1 Hole - 4V No. 2 Hole - 2V - - 4V	Inboard-2V No. 1 Hole - 4V No. 2 Hole - 2V - - 4V
Throttle Lever		

¹ Engine No. Shown is the piston displacement in cubic inches

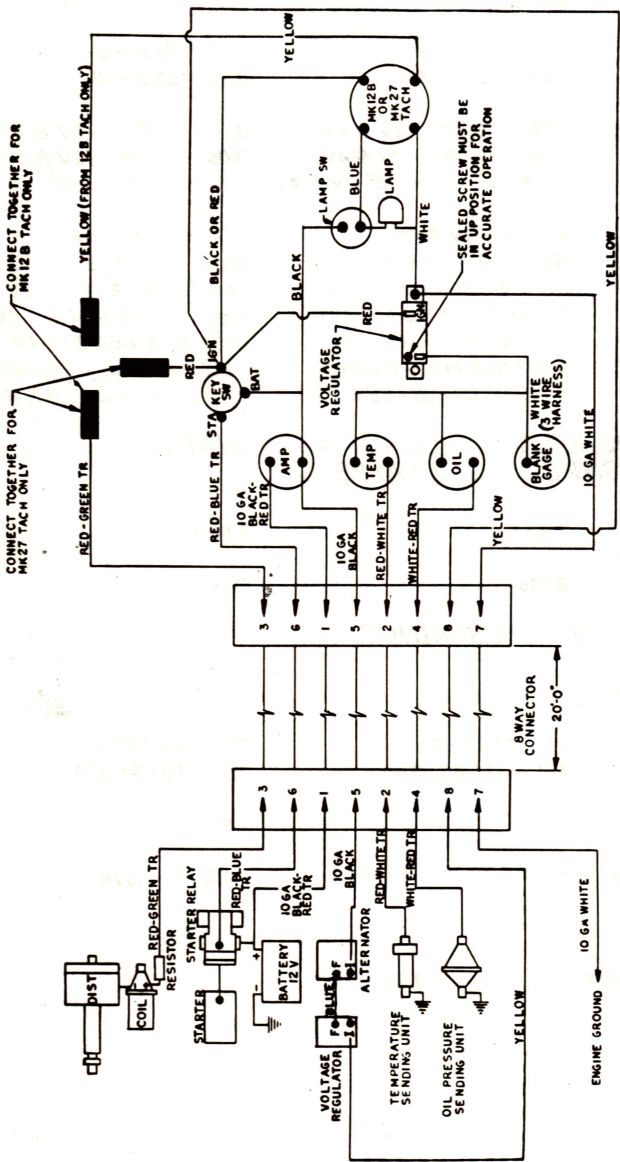
² @ Specified RPM

³ Allowable tolerance between cylinders - 20 PSI

⁴ Minimum inches of Mercury @ Specified engine RPM (sea Level)

⁵ Installation Torque 15 - 20 Ft/Lbs.

Timing Upper Limits 20° @ 2000 RPM
 38° @ 4000 RPM



WIRING DIAGRAM
ENGINE AND INSTRUMENT PANEL

PART NO.	APPLICATION
C5HM-14400-01	1951-52 MIL ENGINE PARTS
C5HM-14400-02	1951-52 MIL INSTRUMENT PANEL
C5HM-10800-01	1951-52 MIL INSTRUMENT PANEL

CYLINDER HEAD

ENGINE	289 CID – 2V & 4V	302 CID – 2V & 4V
Combustion Chamber Volume	60.5 – 63.5 – 2V 60.5 – 63.5 – 4V	60.5 – 63.5 – 2V 52.0 – 55.0 – 4V
Valve Seat Width		
Intake	0.060 – 0.080 – 2V & 4V	0.060 – 0.080 – 2V & 4V
Exhaust	0.060 – 0.080 – 2V & 4V	0.060 – 0.080 – 2V & 4V
Valve Seat Angle	Intake & Exhaust-45°-2V & 4V	Intake & Exhaust-45° 2V & 4V
Valve Seat Runout	0.0015 – 2V & 4V	0.0015 – 2V & 4V
Valve Arrangement	Right: I-E-I-E-I-E-I-E – 2V Left: E-I-E-I-E-I-E-I – 2V Right: I-E-I-E-I-E-I-E – 4V Left: E-I-E-I-E-I-E-I – 4V	Right: I-E-I-E-I-E-I-E – 2V Left: E-I-E-I-E-I-E-I – 2V Right: I-E-I-E-I-E-I-E – 4V Left: E-I-E-I-E-I-E-I – 4V
Gasket Surface Flatness¹	0.003 Inch in any 6 inches 0.007 Overall - 2V & 4V	0.003 Inch in any 6 inches 0.007 Overall - 2V & 4V

VALVE ROCKER ARMS, ROCKER ARM SHAFT, PUSHRODS AND TAPPETS

Rocker Arm Lift Ratio	1.60:1	1.60:1
Valve Pushrod (Maximum Runout)	0.015	0.015

VALVE SPRINGS

Valve Spring Pressure Lbs. @ Specified Length		
Pressure	71 – 79 @1.660 171 – 189 @1.230	71 – 79 @1.660 171 – 189 @1.230
Valve Spring Free Length Approximate	1.97	1.97
Valve Spring Assembled Height Pad to Retainer	1 5/8 – 1 11/16	1 5/8 – 1 11/16

¹Head gasket surface finish R. M. S.-----90-150

VALVES²

ENGINE	289 CID – 2V & 4V	302 CID – 2V & 4V
<i>Valve Head Diameter</i>		
Intake	1.773 – 1.783	1.773 – 1.783
Exhaust	1.442 – 1.457	1.442 – 1.457
<i>Valve Face Angle¹</i>		
Intake	44°	44°
Exhaust	44°	44°
<i>Minimum Allowance Valve</i>		
Stem Tip Length	5/16 (0.312)	4/16 (0.312)

CAMSHAFT DRIVE MECHANISM

<i>Timing Chain Deflection</i>		
(Maximum)	0.500	0.500

CYLINDER BLOCK

<i>Cylinder Bore Diameter</i>		
(Standard Spreads for 8 Grades) ³		
	4.0004 – 4.0028	4.0004 – 4.0028
<i>Cylinder Bore Diameter</i>		
0.003 O. S.		
	4.0028 – 4.0040	4.0028 – 4.0040
<i>Head Gasket Surface Flatness⁴</i>		
	0.003 inch in any 6 inches or 0.007 inch overall	0.003 inch in any 6 inches or 0.007 inch overall

CRANKSHAFT AND FLYWHEEL

<i>Main Bearing Journal Dia.⁵</i>	2.2482 – 2.2490	2.2482 – 2.2490
<i>Main Bearing Journal</i>		
Runout - Maximum ⁶	0.002	0.002
<i>Main Bearing Journal</i>		
Thrust Face Runout	0.001	0.001
<i>Main Bearing Journal Taper</i>		
Maximum	0.0003 per inch	0.0003 per inch
<i>Thrust Bearing Journal</i>		
Length	1.137 – 1.139	1.137 – 1.139

¹ Valve face runout – Maximum 0.0020

² Hydraulic Valve Lifter adjustment turns down after contact
289, 302..... 1

³ Maximum out-of-round..... 0.001

Wear Limit..... 0.005

Cylinder bore surface finish R. M. S..... 15 – 35

⁴ Head Gasket surface finish R. M. S..... 90 – 150

⁵ Wear Limit..... 0.014

⁶ Wear Limit..... 0.003

CRANKSHAFT AND FLYWHEEL

(CONTINUED)

ENGINE	289 CID - 2V & 4V	302 CID - 2V & 4V
<i>Connecting Rod Journal</i>		
<i>Journal Diameter¹</i>	2.1228 - 2.1236	2.1228 - 2.1236
<i>Connecting Rod Bearing</i>		
<i>Journal Maximum Taper</i>	0.0004 per inch	0.0004 per inch
<i>Crankshaft Free End Play</i>	0.004 - 0.008 ²	0.004 - 0.008 ²
<i>Crankshaft to Rear Face of Block Runout T. I. R.</i>		
<i>Maximum</i>	0.010	0.010
<i>Flywheel Face Runout</i>	0.010	0.010

CRANKSHAFT BEARINGS

<i>Connecting Rod Bearings To Crankshaft Clearance</i>		
<i>Desired</i>	0.0008 - 0.0015	0.0008 - 0.0015
<i>Allowable</i>	0.0008 - 0.0026	0.0008 - 0.0026
<i>Main Bearing To Crankshaft Clearance</i>		
<i>Desired</i>	0.0005 - 0.0015	0.0005 - 0.0015
<i>Allowable</i>	No. 1 Bearing-0.0001-0.0018 All others - 0.0005-0.0024	No. 1 Bearing-0.0001-0.0018 All others - 0.0005-0.0024

CONNECTING ROD

<i>Piston Pin Bore or Bushing I. D.</i>		
	0.9104 - 0.9112	0.9104 - 0.9112
<i>Connecting Rod Length</i>		
<i>Center to Center</i>	5.1535 - 5.1565	5.0885 - 5.0915
<i>Connecting Rod Alignment</i>		
<i>Maximum Total Difference³</i>		
<i>Twist</i>	0.012	0.012
<i>Bend</i>	0.004	0.004
<i>Connecting Rod Assembly (Assembled to Crankshaft)</i>		
<i>Side Clearance</i>	0.010 - 0.020	0.010 - 0.010
<i>Wear Limit</i>	0.023	0.023

¹Wear Limit 0.014

²Wear Limit 0.012

³Pin Bushing and crankshaft bearing bore must be parallel and in the same vertical plane within the specified total difference at ends of 8-inch long bar measured 4-inches on each side of rod

PISTON PIN

ENGINE	289 CID 2V & 4V	302 CID - 2V & 4V
Length	3.010 - 3.040	3.010 - 3.040
Diameter		
Standard	0.9119 - 0.9124	0.9119 - 0.9124
0.001 Oversize	0.9130 - 0.9133	0.0130 - 0.9133
0.002 Oversize	-----	-----
To Piston		
Clearance	0.0002 - 0.0004	0.0002 - 0.0004
To Connecting Rod		
Bushing Clearance	1	1

PISTON RINGS

Ring Width		
Compression Ring		
Top	0.077 - 0.078	0.077 - 0.078
Bottom	0.077 - 0.078	0.077 - 0.078
Side Clearance		
Compression Ring ²		
Top	0.002 - 0.004	0.002 - 0.004
Bottom	0.002 - 0.004	0.002 - 0.004
Oil Ring	Snug	Snug
Ring Gap Width		
Compression Ring		
Top	0.010 - 0.020	0.010 - 0.020
Bottom	0.010 - 0.020	0.010 - 0.020
Oil Ring ³	0.015 - 0.069	0.015 - 0.069

PISTON

Diameter ⁴		
Coded Red	3.9984 - 3.9990	3.9984 - 3.9990
Coded Blue	3.9996 - 4.0002	3.9996 - 4.0002
0.003 Oversize	4.0008 - 4.0014	3.0008 - 4.0014
Piston to Cylinder Bore		
Clearance	0.0018 - 0.0026	0.0018 - 0.0026
Piston Pin Bore Diameter	0.9123 - 0.9126	0.9123 - 0.9126
Ring Groove Width		
Upper Compression Ring	0.080 - 0.081	0.080 - 0.081
Lower Compression Ring	0.080 - 0.081	0.080 - 0.081
Oil Ring	0.1880 - 1.890	0.1880 - 0.1890

¹Interference Fit

²Wear Limit.....0.006

³Steel Rail

⁴Measured at the piston pin bore centerline at 90° to the pin bore.

APPROXIMATE OIL PAN CAPACITIES¹

ENGINE	289 CID – 2V & 4V	302 CID – 2V & 4V
U. S. Measure	5 Quarts	5 Quarts
Imperial Measure	4 Quarts	4 Quarts

TORQUE LIMITS

Cylinder Head Bolts		
Step 1	50	50
Step 2	60	60
Step 3	65 – 72	65 – 72
Oil Pan to Cylinder Block	9 – 11 (5/16 – 18) ²	9 – 11 (5/16 – 18) ²
Manifolds to Cylinder Head		
Intake	20 – 22	20 – 22
Exhaust	15 – 20	15 – 20
Water Outlet Housing	12 – 15	12 – 15
Flywheel to Crankshaft	75 – 85	75 – 85
Main Bearing Cap Bolts	60 – 70	60 – 70
Oil Pan Drain Plug	15 – 20	15 – 20
Oil Pump to Cylinder Block	23 – 28	23 – 28
Oil Pump Cover Plate	9 – 12	9 – 12
Oil Filter To Cylinder Block	With Grease on the Gasket surface, hand tighten until Gasket contacts adapter face, then tighten ½ turn more.	With Grease on the Gasket surface, hand tighten until Gasket contacts adapter face, then tighten ½ turn more.
Cylinder Front Cover	12 – 15	12 – 15
Camshaft Sprocket to Camshaft	40 – 45	40 – 45
Camshaft Thrust Plate to Block	6 – 9	6 – 9
Damper to Crankshaft	70 – 90	70 – 90
Connecting Rod Nuts	19 – 24	19 – 24
Valve Rocker Arm Cover	3 – 5	3 – 5
Oil Inlet Tube to Oil Pump	12 – 15	12 – 15
Fuel Pump to Front Cover	20 – 25	20 – 25
Valve Rocker Arm Adjusting Nut Removal Torque (break-away counter-clockwise)	4.5 – 15 Ft/Lbs	4.5 – 15 Ft/Lbs

¹Includes one quart required with filter replacement.
²7 – 9 (1/4 – 20)

TORQUE LIMITS FOR VARIOUS SIZE BOLTS

CAUTION: IF ANY OF THE TORQUE LIMITS LISTED IN THIS TABLE DISAGREE WITH ANY OF THOSE LISTED IN THE PRECEDING TABLES, THE LIMITS LISTED IN THE PRECEDING TABLES PREVAIL.

SIZE (Inches)	TORQUE (Ft/Lbs)
1/4 - 20	6 - 9
1/4 - 28	6 - 9
5/16 - 18	12 - 15
5/16 - 24	15 - 18
3/8 - 161	23 - 28
3/8 - 24	30 - 35
7/16 - 14	45 - 50
7/16 - 20	50 - 60
1/2 - 13	60 - 70
1/2 - 20	70 - 80
9/16 - 18	85 - 95
5/8 - 18	130 - 145

TRANSMISSION

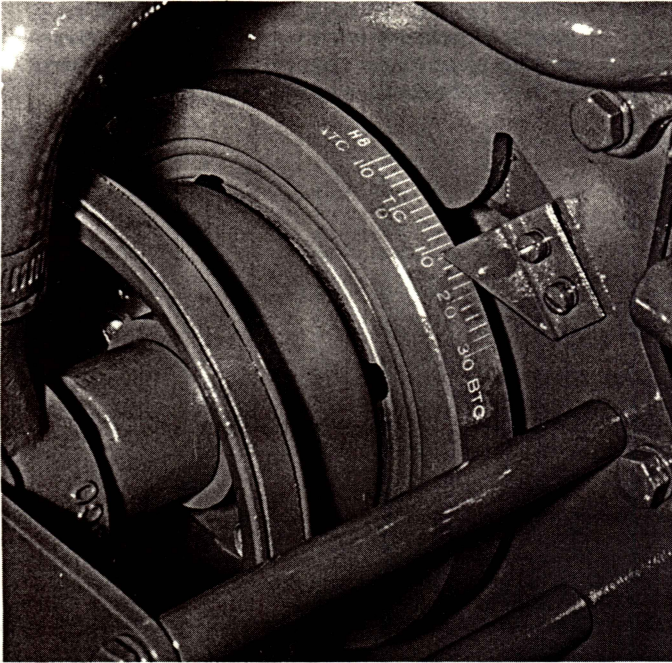
In installations where a Borg-Warner Velvet Drive Transmission is used, check to assure proper oil level in the transmission. These transmissions use Type A Hydraulic Fluid. Transmission should be filled to the full mark on the reverse gear dip stick then started and run at low speed for a short time to fill the hydraulic lines and oil cooler.

Fluid level should be rechecked and additional oil added to bring the level to the full mark on the dip stick. Engine idle should be at 600 rpm or less before shifting. It is necessary to check the control cable setting to be sure that the travel in forward and reverse on the clutch lever is at maximum setting. Do not remove the detent from the actuator arm. Holman and Moody Marine cannot be responsible for damage resulting from shifting at high rpm.

DexTRON II

MAINTENANCE GUIDE

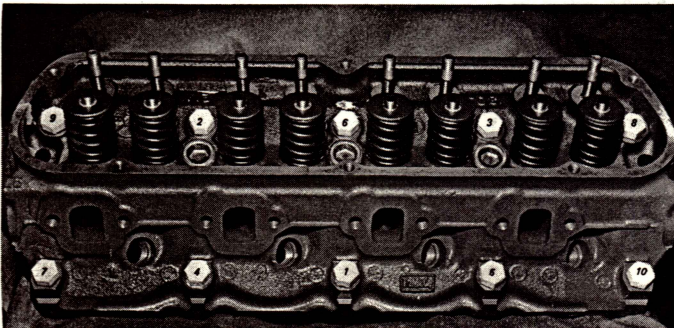
(NOTE: Ignition timing marks)



Cylinder heads should be torqued in the following steps:

First tighten in proper sequence to 50 ft. lbs., then 60 ft. lbs., and finally 65–72 ft. lbs.

If it becomes necessary to remove the cylinder heads at any time, care should be used in ascertaining that the cylinder block and gasket surface is clean and free of irregularities before replacing the head.



ENGINE MAINTENANCE

The following items should be checked periodically for normal engine maintenance:

1. Daily

- (1) Oil level***
- (2) If Fresh Water Cooled – Check water level***
- (3) Transmission oil***

2. Every 50 hours

- (1) Change Oil***
- (2) Clean oil breather cap***
- (3) Check distributor i.e., oil, gap setting, points and rotor***
- (4) Clean flame arrestor***
- (5) Gap spark plug. Replace as required***
- (6) Valve clearance***
- (7) Belt tension***
- (8) Fuel Filters***

SEASONAL STORAGE INSTRUCTIONS

Before storing the boat during off-season, the engine should be properly prepared. It should be "fogged out" by pouring a small can of rust preventive oil into the carburetor while the engine is idling. The engine can be stalled out by pouring a few ounces rapidly into the carburetor intake. Next, remove the valve covers and spray a rust preventive oil over the rocker arms and related parts. Change the engine oil and oil filters. In climates where there is a possibility of freezing weather, engines with fresh water cooling systems should either be drained of both fresh and sea water, or an anti-freeze should be added. Never use a petroleum base anti-freeze. This will shorten the life of the sea pump impeller. Make certain both sides of the engine jacket are drained. These jackets are not interconnected. The exhaust manifolds and risers of the I/O model should be drained by use of the forward riser drain plug. Fuel lines should be turned off at the tank, and fuel filters and fuel pumps should be cleaned to prevent varnish deposits from stale gasoline. The battery should be disconnected and put in storage. Be sure to loosen the distributor cap to allow ventilation. This is particularly true if the engine is to be stored in an area where extreme temperature differences occur. Block the exhaust outlets before storing the boat. It is not necessary to drain the transmission; however, it is recommended that the oil be changed once a year. The propeller shaft should be disconnected from the engine before the boat is stored. All electrical fittings should be oiled at this time.

Taking Boat Out of Storage

On taking the engine out of storage, a close check of hoses and gas lines should be made to insure against deterioration and if found to be faulty, should be replaced. Examine the wire terminals and clean if corroded. At the same time, the spark plugs should be examined and cleaned. Valve covers should be removed and a light coat of oil applied to all moving parts in the valve train. The engine should be turned over by hand to be sure the valves are free. Flame arrester screen should be checked for dirt or dust deposits as should all the fuel system. Check the distributor cap and rotor and the point setting. If the points are found to be rusty, they should be replaced. The distributor cap should be wiped clean inside and out of any grime or condensation. Engine and reverse gear oil levels should be checked to insure proper levels. Battery cables should be checked before reinstalling the battery to make sure the connectors have not corroded. Care should be exercised in making sure that the battery is hooked up properly. A slight coating of grease on the battery connections is helpful. Be sure that the drain cocks in the engine are not left open. Engine seacock or valve should be open. Upon putting the boat into the water, make sure that any exhaust lines blocks are removed and realign the engine shaft coupling to within three-thousandths. Shaft alignment should be checked while boat is in the water, not while in storage cradle. Normal starting procedures as outlined under Engine Startup should be observed.