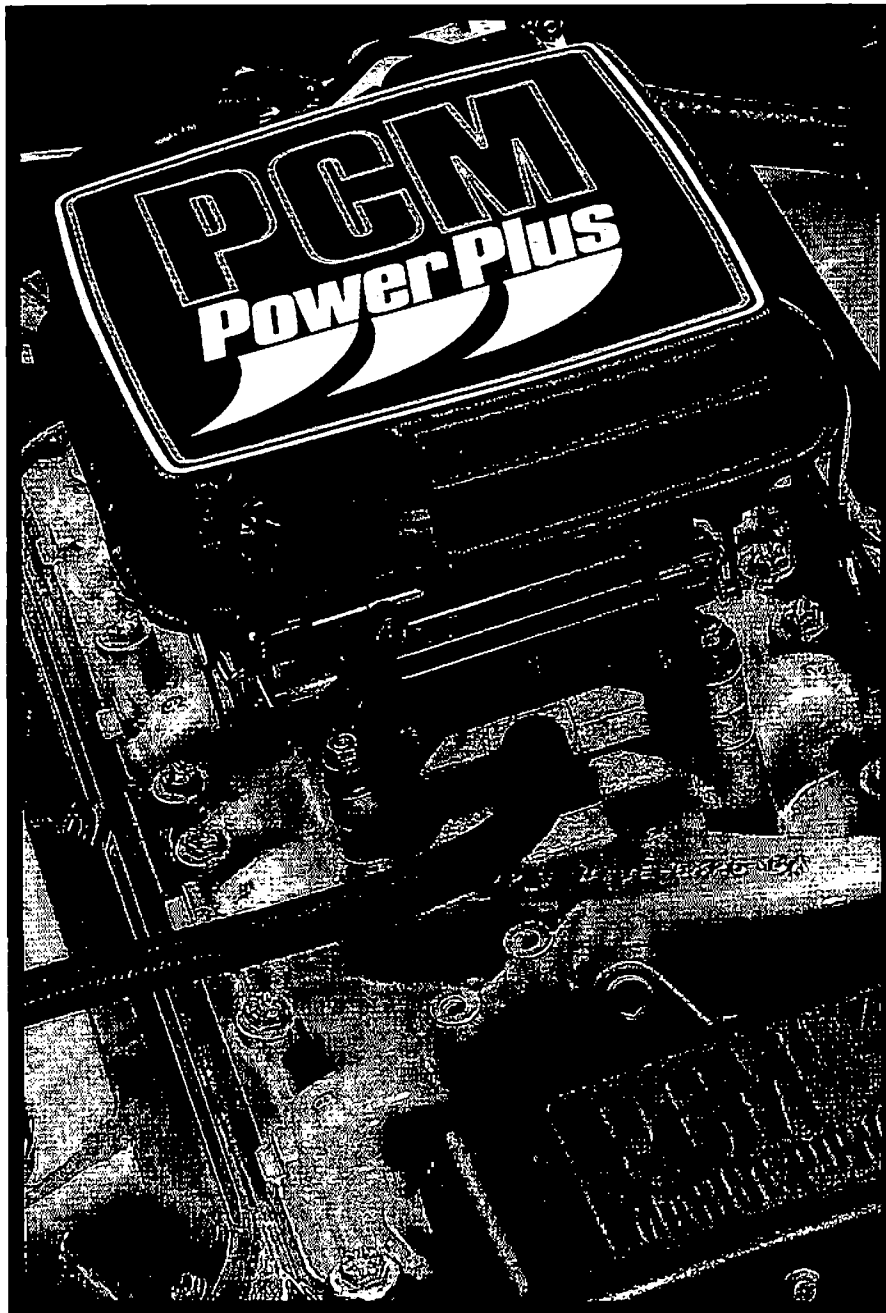


PLEASURECRAFT MARINE

Engine Owners Manual

FOR ALL CHEVROLET AND FORD BASED ENGINES



LIMITED WARRANTY

The Pleasurecraft Marine Engine Company (PCM) warrants its new products to be free from defects in material and workmanship under normal use and service conditions, to the first registered owner or registered user. All components of PCM products are covered under the PCM Warranty, except for those components that are warranted by PCM's suppliers. The obligation of PCM hereunder shall be limited to the repair or replacement, at its option, of any product or part thereof which has failed during the period of warranty and which is demonstrated upon examination to have failed due to defective material and/or workmanship.

NO OTHER WARRANTY GIVEN

The obligations set forth in the preceding paragraph are PCM's sole obligation and owner's exclusive remedy. PCM makes no other express warranty to the extent that any additional warranty may be implied by law, the term of such implied warranty shall be limited to one year from the date of delivery of the PCM product to the first registered owner or registered user.

No distributor, dealer, agent or employee of PCM is authorized to grant any other or further warranty or incur any additional warranty obligation on PCM's behalf, in connection with the sale of its products. Any qualification or restriction contained herein which is prohibited by any law of mandatory application shall be deemed to be deleted herefrom, however, such deletion shall have no effect on the remaining provisions hereof, all of which shall remain in full force and effect.

REMEDIES

The obligations of PCM set forth in the first paragraph of this Warranty shall be the exclusive remedy for any breach of Warranty hereunder, and any owner or user's sole remedy in the event of breach of the warranties which are made by PCM is repair or replacement of the product or any warranted part thereof as set forth herein, with this sole exception, PCM shall not be liable for any direct, indirect, incidental or consequential damages, including without limitation, any damages for property damage, loss of use or loss of profits, loss of income, inconvenience, trailering, towing, haul out, launch and/or any other in and out of water expenses, storage charges, dockage charges, expenses to deliver or pick up the product being warranted to and from the dealer, telephone expenses, telegraph expenses, lodging expenses, travel expenses, mechanics' travel time and mileage, damage caused by any occurrence of an insurable nature, rental of substitute equipment of any type, removal and replacement and/or modification of any boat parts to facilitate repairs, moving of furniture, carpets, cleaning, painting, carpenter work, or re-delivery services.

Some States do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Any owner or user hereby waives for himself/herself/itself and his/her/its successors and assigns (a) any and all claims for punitive damages, and (b) all claims of negligence or strict liability or both. In no event will PCM's liability exceed the purchase price of the goods which is actually paid to PCM.

WARRANTY COVERAGE, TERM

This Warranty is extended only to the first registered owner or registered user, for the period specified below.

All components, other than those itemized below, are warranted for a period of one (1) year from the date of delivery to the first registered owner or registered user, or until the expiration of 200 hours of operation, whichever occurs first, in non-commercial use. In case of commercial use, the term of this Warranty shall be the shorter of (a) a period of six (6) months from the date of delivery to the first registered owner or registered user or (b) the expiration of 200 hours of use.

Exceptions to the one (1) year/200 hours Warranty:

(A) Water pump impellers are not covered by this Warranty.

(B) Seals, gaskets, o-rings, and other material affected by time are not covered by this Warranty if their effectiveness is reduced by an extended storage period prior to sale or use.

(C) Components supplied by the Ford Motor Co. are warranted by the Industrial Engine Division of the Ford Motor Co. and are not covered by this Warranty. PCM's policy is one of continued improvement of its products and PCM hereby reserves the right to improve and change the design and production of any of its products without assuming any obligation to modify products previously manufactured and/or sold.

OBTAINING PERFORMANCE UNDER WARRANTY

PCM's warranty registration form should be prepared by your selling dealer, executed by you and the dealer and mailed by you to PCM within 30 days after the date of purchase. Upon receipt of the warranty registration form, PCM will issue to you a personalized owner's registration card which will be mailed directly to you. If the owner's registration card is not received within 8 weeks after the date of purchase, please write PCM at the address listed below.

At the time that a claim for warranty service is made, the owner's registration card should be presented to the person or entity providing warranty service.

Authorized PCM dealers or distributors are entitled to be reimbursed by PCM for some or all of the expense of warranty repairs, thus, service under the terms of this Warranty will be performed by an authorized PCM dealer or distributor without charge for established flat rate labor or replacement parts, other than items not covered by the Warranty, such as, but not limited to, lubricants, spark plugs, points, and other items which are normally frequently replaced as part of routine maintenance. Charges for additional non-warranty work and/or additional dealer charges for labor relative to warranty work in excess of flat rate must be paid for by the owner.

Prior authorization in writing must be obtained from PCM for any warranty repairs over \$50.00 and in all cases where the owner fails to establish the purchase and warranty expiration dates with the owner's registration card sent upon receipt of the warranty registration form by PCM. While failure to present the owner's registration card will not prevent you from obtaining coverage hereunder, this Warranty shall not be effective and, therefore, cannot be honored until the product purchase date can be confirmed by PCM. If the card is lost, communicate with PCM at the address listed below, and, for a processing fee of \$10.00, a new owner's registration card will be issued to you.

Any questions concerning service, parts or this Warranty should be directed to your selling dealer. If your dealer is unable to assist you or if you relocate or are traveling or need a referral to your nearest authorized dealer, contact: Pleasurecraft Marine Engine Co., P.O. Box 130, Canal Winchester, Ohio 43110.

FAILURES EXCLUDED FROM WARRANTY

This Warranty will not apply to any failure which results from accidents, sinking, fire, neglect, abuse, or abnormal service or use, such as racing, towing or operating in water of insufficient depth, or to any failure resulting from improper installation, improper adjustments, repairs or improper delivery service, or to any failure resulting from the use of parts, fuels, oils or lubricants not suitable for use with the product and/or materials or parts not approved by PCM. This Warranty does not apply to any engine or drive which has been modified, or altered, or repaired in such a manner as, in the opinion of PCM, to affect its stability, reliability, or performance. Further, this Warranty will not apply to failures resulting from use of non-recommended lubricants or fuels, failure to follow maintenance or lubrication schedules, failure caused or contributed to by contaminated fuel, failure caused by improper installation or misapplication of the engine or drive, failure resulting from the owner's or operator's failure to exercise due or normal care and precaution, or failures of components and/or assemblies that are warranted by PCM's suppliers.

OWNER'S RESPONSIBILITY

Performance under this Warranty shall be conditioned upon the first registered owner's or registered user's compliance with the following requirements:

1. Owner or user shall verify that the pre-delivery service has been performed, all requested information is recorded and that the selling dealer has signed the warranty registration.
2. Owner or user shall promptly mail the warranty registration to PCM after accepting delivery.
3. Owner or user shall follow the instructions in the owner's manual regarding operation, break-in, lubrication, and fuel.
4. Owner or user shall follow or comply with the maintenance schedule, operating limits, and lay up instructions, as outlined in the owner's manual.

CHOICE OF LAW

This Limited Warranty shall be governed by, and construed and interpreted in accordance with, the laws of the State of Ohio, except only to the extent replaced or precluded by other law of mandatory application.

This Warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

Foreword

Thank you for selecting PCM Marine Power for your boating needs. Your purchase has put you in command of a fine machine, engineered to deliver the utmost in boating pleasure. Please read this book carefully and follow the schedules and instructions to enjoy the maximum efficiency, economy and dependability from your PCM Marine Power.

Upon reading this manual you will note that it includes information for our complete Series of engines. The illustrations and photographs in some areas are representative and may not be identical to the engine you have purchased. Specific information regarding each engine (where different) is identified where necessary and provides you, the owner, with the information necessary to operate and maintain your engine(s) properly and safely.

Reviewing this manual from time to time will serve as a reminder to perform the suggested and required maintenance functions necessary for the protection and long life of your investment.

It must be noted that the importance of the information in this manual is to maintain your investment in a good and safe operating condition. This can only be done if the maintenance is performed properly and with the proper parts.

Pleasurecraft offers and suggests that you carry an on-board spare parts kit (see page 55). This kit contains the most frequently used maintenance parts and is invaluable when you are boating at home or away. Pleasurecraft does not offer for sale, but highly recommends that you also carry on board a small tool kit to allow you or another qualified person to replace the necessary component in an emergency situation. The contents of this tool kit should be carefully analyzed by examining your particular engine and installation to insure you have an adequate stock of tools on board. These tools should be stored in the smallest possible kit to save storage room.

PCM's Policy of continued improvement allows us to manufacture the finest products available to the boating public. This policy of improvement does, however, create dated information. In order to continue our policy of improvement, PCM must reserve the right to discontinue models or change designs and/or specifications without notice and without incurring obligation.

Warning: This manual covers engines designed to propel your boat while installed and confined in your boats closed machinery space. In order to prevent personal injury to you or others on board, whenever the engine is running the machinery space must be closed. Never operate the engine with the engine machinery space open or while someone is in the machinery space, either open or closed. Never open the machinery space unless the engine is shut off and the engines rotating parts are in and remain in a stationary position. Rotating machinery can cause injury and even death if an accident should occur. Whenever a problem exists that requires the operation of the engine with the machinery space open, extreme care must be exercised. **IT IS RECOMMENDED THAT UNCOVERED ENGINE OPERATION BE ATTEMPTED ONLY BY TRAINED AND QUALIFIED SERVICE PERSONNEL.**

Should you require additional information, please direct your inquiry to any PCM location or your nearest PCM dealer. Be certain to include Model & Serial Number along with your request.

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General Information

IMPORTANT: Read this manual carefully and thoroughly; particularly **WARNING**, **CAUTION**, **NOTE** and **IMPORTANT** information in bold type, such as this paragraph.

NOTE: Some illustrations in this manual are representative and may not look identical to your engine.

WARNING: It is recommended that the battery cables be removed from the battery when the boat is placed in storage, on display, or in transit. This will eliminate the possibility of the engine accidentally starting and causing damage to the engine due to lack of water.

Installation

Installation of the propeller shaft and associated mounting parts is not outlined in this manual. The propeller shaft angle and propeller location must be determined by the boat builder to meet the requirements of the boat design.

Propeller shaft diameter should be of sufficient size for the type of application. The following propeller shaft couplings are available from PCM:

Shaft Size	Part No. for 1:1, 1.5:1 and 2:1 Transmissions With 4" Coupling	Part No. for 2.5:1 and 3:1 Transmissions With 5" Coupling
1" (25.4mm)	R148010	R148001
1-1/8" (28.6mm)	R148011	R148002
1-1/4" (31.8mm)	R148012	R148003
1-3/8" (34.9mm)	R148013	R148004
1-1/2" (38.1mm)	R148018	R148005
1-3/4" (44.5mm)		R148007
2" (50.8mm)		R148008
2-1/2"		R148009

The engine drawings (Page 12) should be used when determining engine space requirements and engine bed location. The horizontal angle of the installed engine at rest must be between 0° and 15°.

#1. CAUTION: Some engines use a different dipstick for 0° installation than a 15° installation. Be certain that the proper dipstick is installed to prevent damage due to overfilling of the crankcase. If in doubt, contact your PCM dealer.

Engine and Transmission Identification

The engine model and serial number are located on the

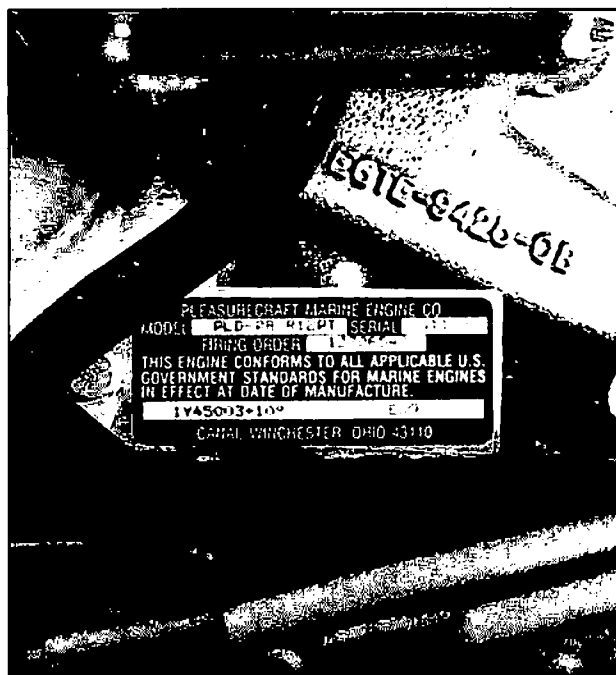


Fig. 1

intake manifold at the rear on Ford based engines and on the back of the cylinder head on Chevrolet based engines.

The transmission model, serial number and ratio are located on the transmission case.

Except for some Warner V-drives and all PCM reduction transmissions, the propeller shaft rotation with the transmission in forward gear on engines equipped with 1:1, 1.5:1, 2.5:1, and 3:1 transmissions is the same as engine rotation.

Propeller shaft rotation on some Warner V-drives, the Warner 1.9 and 1.88:1 and all PCM reduction transmissions, with the transmission in forward gear is the opposite of engine rotation.

On V-drive engines, both engines may turn the same direction and have the propeller rotation changed in the V-drive.

On all engines, the Serial # plate indicates both engine and propeller shaft rotation. (Example: PLD-WV-R20 and PLD-WV-L20). The "L" following the "P" indicates the engine rotation. The "R" and "L" following the "V" and preceding the "20" indicates the Propeller Shaft rotation. The engine must be installed accordingly to insure proper propeller rotation.

PLEASURECRAFT MARINE ENGINE CO.
 MODEL **PLD-WV-R20** SERIAL **151234**
 FIRING ORDER **13726548**
THIS ENGINE CONFORMS TO ALL APPLICABLE U.S. GOVERNMENT STANDARDS FOR MARINE ENGINES IN EFFECT AT DATE OF MANUFACTURE.
7C702AAM10521M10
 CANAL WINCHESTER, OHIO 43110

Fig. 2

CAUTION: The transmission gear shift lever MUST BE IN FORWARD when the engine propels the boat forward; that is, shifted toward the engine for FORWARD gear. Likewise, the shift lever must be shifted away from the engine for REVERSE gear on all models in order to function properly and prevent transmission damage.

Engine Alignment and Mounting Adjustments

The engine must be aligned to the propeller shaft within .003" (.076mm) or less when measured between the mating surfaces of the transmission coupling flange and the propeller shaft coupling flange. To obtain correct engine alignment, insert a feeler gauge between the coupling mating faces and adjust the engine position as required to place the mating surfaces parallel to each other within .003" (.076mm).

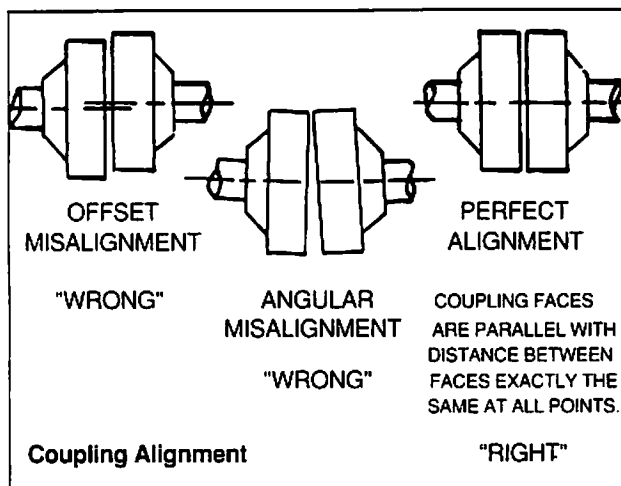


Fig. 3

This clearance must be maintained at all times and at all positions of the coupling. To complete alignment, turn the shaft coupling 180° from the starting point after the engine and the shaft are aligned to within .003". Test for Proper clearance. If out, readjust the engine to proper clearance. Retest by turning coupling 90° at a time and test for Proper clearance to insure alignment at all points through the 360° circle. Repeat this procedure until proper alignment is achieved. If upon turning a coupling and finding a gap of greater than .005" is present where no gap existed in a prior check, the coupling which caused the gap when turned is

defective and must be replaced.

The engine mounts are adjustable to permit the raising or the lowering of the engine and also moving the engine to the right or the left. It is recommended that when the engine bed is installed in the boat, it is positioned so that engine alignment is as close as possible. After the engine mounts have been fastened to the engine bed, final alignment should be done by adjusting the mounts as follows:

The front mounts are adjusted by loosening the upper lock nut on the mount stud and the trunion locking stud nuts and tapping on the locking stud nuts to loosen the studs on the trunion. The mount can then be raised or lowered by screwing the lower nut up or down in the desired direction and side to side by prying against the block.



Fig. 4

CAUTION: Side to side adjustment must be limited to a maximum 1-3/4" extension of the trunion from the mount bracket. Extension of more can cause bending of the trunion or possible mount failure.

Rear mount adjustment is made by loosening the stud lock nut and turning the stud in the proper direction for vertical adjustment and by loosening and tapping the nut on the lock studs to free the trunions and adjust in the same manner as the front for side to side adjustment.

CAUTION: Be certain to lock the lock nuts on the front mount studs to 150 lb. ft., the rear mount studs to 50 lb. ft. and the lock studs for both mounts to 30 lb. ft. when adjustment is completed.

After alignment is complete, lag and/or cross mounts securely to the stringers.

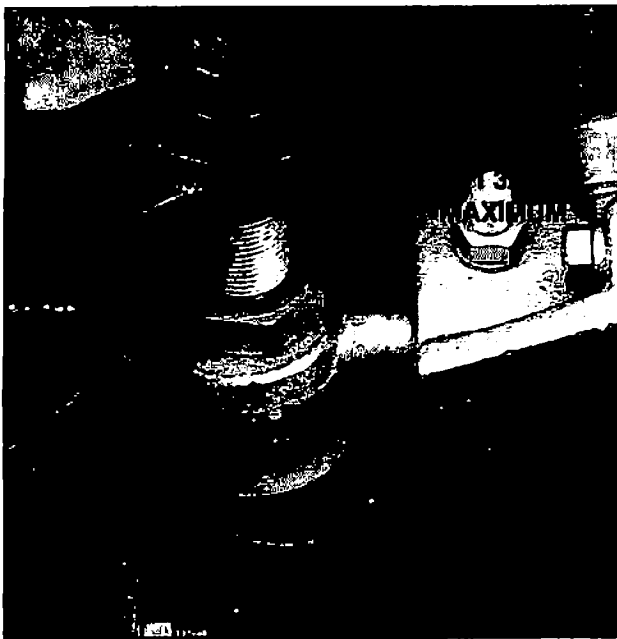


Fig. 5

Water Pick-up Installation

Water pick-up must be large enough to permit sufficient water flow to the engine seawater pump in order to provide adequate engine cooling. Pleasurecraft Marine recommends that a sea strainer be installed on all boats equipped with transom or thru hull water pick-ups; this is to prevent foreign material from entering and clogging the engine cooling system which will not be covered by Pleasurecraft's Warranty.

In the interest of safety, it is recommended that a, non restricting when open, sea cock be installed between the water pick-up and the sea strainer.

The water pick-up should be located as close to the seawater pump inlet as possible and in an area where an uninterrupted, solid stream of water will flow past it when the boat is underway. The hose must have adequate wall thickness to prevent collapsing caused by pump suction and should be fastened securely at connections with hose clamps.

Sea Water Pump Inlet Sizes

302 & 351 Ford Engines 1"
305-350 & 454 Chevy & 460 Ford 1-1/4"

Exhaust System

When designing the exhaust system, it is very important that the following points are taken into consideration:

1. The system must not cause an excessive amount of back pressure. Back pressure must not exceed 4" (10.2cm) of

mercury when measured with a mercury manometer at the exhaust manifold outlets. Minimum exhaust hose sizes are as follows:

	3" outlets	4" outlets
Outlet Dual Exhaust	3" I.D. (7.6cm)	4" I.D.
Outlet Single Exhaust	4" I.D. (10.1cm)	5" I.D.

2. The system layout and construction must prevent the cooling system discharge water from flowing back into the engine and also prevent sea water from entering the engine via the exhaust system.

Exhaust Hose Installation

The exhaust hose, which connects to the exhaust manifold riser, should be connected so that it does not restrict the flow of discharge water from the elbow.

Both exhaust manifolds are water-cooled and all cooling system water is discharged thru openings which are located inside the risers. To prevent discharge water from flowing back into the engine, the exhaust piping must not be higher than the manifold outlet at any point.

It is the obligation of the boat manufacturer or installing dealer to correctly locate the engine for installation. Therefore, if water is present in the exhaust manifolds or the combustion chambers of the engine, the product has not caused the problem, unless there is a defective part.

Hoses, which are connected in a manner to bend in front of the exhaust outlet, will prevent discharge water from flowing around the entire inside diameter of the hose and will cause a hot spot that may burn through the hose.

The exhaust system should have no sags or low spots to accumulate water. Sharp bends of more than 45 degrees in the exhaust lines should be avoided. The exhaust lines should slope toward the transom at a rate of at least 1/2 inch per foot with the vessel at rest.

The exhaust pipe size should not be restricted. Exhaust back pressure will create poor performance, high fuel consumption, and severe engine damage. Exhaust transom flanges should be above the water line and the exhaust lines should be self-draining.

The system should be periodically inspected for leaks and for general condition to prevent leakage of water and exhaust gases into the hull. Flapper valves are suggested to be used on all exhaust systems.

Fuel System Installation

Coast Guard Regulations must be observed when installing fuel systems. Fuel systems should be installed in accordance with the standards of industry associations and applicable federal standards.

Engine Compartment Air Intake

The engine compartment must be properly vented to provide a sufficient amount of air for engine breathing. Air intake and exhaust openings must be large enough to provide an unrestricted volume of air under all operating conditions.

Engine compartment ventilation should also conform to Coast Guard Regulations.

Control Cable Adjustments

After installation of controls and cables proceed with the following adjustments.

Shift Cable

1. Set control lever into neutral position.
2. Position shift selector on the transmission into neutral position. In moving the selector from neutral to forward to reverse to neutral, three distinct detent positions will be felt.
3. Adjust the connector on the control cable so the connector slips freely into the hole in the selector arm.
4. Remove the connector from the selector arm and move the selector and control lever into the forward position. In this position, the shift lever must be moved toward the engine and be in the forward detent position or against the stop pin of the PCM transmission. The connector should slip freely into the hole in the selector arm.
5. Repeat step #4 with the selector and controls levers in reverse position.

If the movement of the connector does not correspond with the movement of the selector lever, it will be necessary to readjust the remote control head to provide the proper direction of control cable travel.

CAUTION: A transmission operated in reverse to propel the boat forward will fail early. Engine and propeller rotation must be matched according to the engine Serial Plate.

Throttle Cable

1. Place control lever on single lever control into forward gear without advancing the throttle and on a twin lever control in the fully closed position.
2. Adjust the connector so that it slips freely into the connector socket and lock into place.
3. Position the throttle into the full throttle position after

blocking the choke open. Check to see if the throttle valves are in the full open position on both the primary and the secondary side (if so equipped).

If valves do not open fully, make necessary adjustments at either control head or cable connector to insure full opening. Repeat steps #1 and #2 to insure proper idle settings and adjust if necessary.

Battery Specifications (Minimum)

Minimum battery Specifications are as Follows:

12 Volt Marine Type with Tapered Post Connectors

Engine Size	Cold Crank @ 0° F (-18° C)	Amps for Load Test	25 amp rate Reserve Capacity (Minutes)
305 V-8 & 302 V-8	350 Amps	170	80
350 V-8 & 351 V-8	350 Amps	170	80
4 V-8 & 460 V-8	465 Amps	230	125

Fig. 6

Battery Cable Size Specifications

Cable length

Up to 3 ft. 6 in.
3 ft. 6 in. to 6 Ft.
6 Ft. to 7 Ft. 6 in.
7 Ft. 6 in. to 9 Ft. 6 in.
9 Ft. 6 in. to 12 Ft.
12 Ft. to 15 Ft.
15 Ft. to 19 Ft.

Cable size required

#4 Gauge
#2 Gauge
#1 Gauge
#0 Gauge
#00 Gauge
1 #000 Gauge
2 #0000 Gauge

1 in.(Inch) = 2.5cm

1 Ft.(Foot) = 30.5cm

NOTE: Cable sizes apply both to positive (+) and negative (-) cables. Terminals must be soldered to cable ends to provide adequate contact.

Battery and Battery Cable Installation:

1. The battery should be positioned as close to the engine as possible and should be securely mounted in the boat in a leak proof battery box.
2. Connect the negative (-) battery cable to ground on the engine, connect the positive (+) battery cable to the solenoid.
3. Connect the positive battery cable to the positive (+) post on the battery and the negative battery cable to the negative (-) post on the battery.

IMPORTANT: The engine electrical system is negative ground. Failure to connect battery leads, as outlined, will damage the system.

Miscellaneous Operating Instructions

WARNING: Before starting your engine, always ventilate engine compartment by opening hatch or (if equipped) operate bilge blower for a sufficient amount of time to remove any gas fumes from the engine compartment. It is doubly important to check for fuel spillage or leaks after repairing, refueling or maintaining before starting engine. Remove the battery cable from battery before attempting any maintenance or any repairs or when boat is placed in storage or in transit.

Check Before Running

1. Engine oil level.
2. Transmission lubricant level.
3. Idle RPM (550-600) in gear.
4. Shifting linkage (forward, neutral and reverse) for shift lever in detent and proper direction.
5. Leakage (water, oil and fuel).

Check While Running

(See "Caution" Below)

1. Oil pressure 35 to 40 PSI (2.5 to 2.8kg/cm²) (Approx.) at 2000 RPM.
2. Water temperature 140°-170° R/W and 180°-210° F/W.
3. Idle RPM (550-600) in gear.
4. Maximum forward RPM 4,400.
5. Shifting linkage (forward, neutral and reverse) for shift lever in detent and proper direction.
6. Leakage (water, oil and fuel).

Check After Initial Run

1. Engine alignment.
2. Engine mounting fasteners are tight.
3. Engine oil level.
4. Transmission oil level and shift connections.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER, attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER, run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

Operating Limits (See Specifications For Your Model)

Maximum RPM, at wide open throttle under normal load conditions, can be controlled only by propeller pitch, diameter and design. It is essential that the propeller selected does not overload or underload the engine. Extreme overloading, resulting in low RPM's at wide open throttle, will deliver poor performance, poor fuel economy, and eventually result in engine damage. Underloading, if operated above recommended maximum RPM's, will result in high RPM, poor fuel economy, and engine damage.

Do not operate at high RPM's in neutral. Operation in extremely shallow water can cause sand, silt and gravel to be pulled into the cooling system; this can create excessive water pump wear and in extreme cases may deposit in the engine water block water jackets and seriously damage the engine from improper cooling. Heavy weed growth can plug oil coolers and water intakes and cause damage. If operation under these conditions is necessary, a good quality sea water strainer or filter should be installed. The installation of a fresh water cooling system can reduce the danger of engine damage from this cause.

ALWAYS OBSERVE HIGH SAFETY STANDARDS AND COURTESY AFLOAT!

Propellers

Propellers can affect the performance of your boat in many ways. Selection of the proper propeller for your application is vital. In most cases, the selection is made by the Boat-builder for best over-all performance; however, many variable factors, such as heavy loads, high altitude, hull balance, etc., can contribute toward rendering the "standard" propeller unsuitable, since the application is no longer "standard".

Many undesirable results can occur from a propeller not properly matched to the specific application; high RPM's, low RPM's, cavitation, vibration, steering torque (stern drives), drumming or rumbling noise, high fuel consumption, poor efficiency, and even electrolysis damage (stern drive). When changing propellers, extreme care should be taken to

select a propeller which allows the maximum engine RPM's with normal load to be within the proper range for the particular model. See the engine specification chart in this book for "Maximum RPM".

The use of brass or bronze propellers on stern drives in salt water or in water with high mineral or acid content is not recommended, due to the possibility of electrolytic attack and corrosion of the out-drive housings.

If the propeller is bent, broken, out of balance, or otherwise damaged, limit operation to bare necessity until the propeller is repaired or replaced.

Directional References

Directional references are given as they appear when viewing boat from stern, looking toward bow. (The front of the boat is bow; the rear is stern. Starboard side is the right side; port side is the left side.)

Service Recommendations

This manual includes operation and maintenance instructions that are usually required in normal service. Do not attempt any repairs which are not specifically covered in this manual. Strict compliance to the recommendations for lubrication, maintenance, operation, etc., will assure you of superior performance and dependable service.

Literature

To obtain service and/or parts literature for your PCM Engine(s), contact your dealer, or write:

PCM
PO Box 130
Canal Winchester, OH 43110

Serial Number Locations

The engine model and serial number are located on the intake manifold at the rear on Ford based engines and on the back of the cylinder head on Chevrolet based engines.

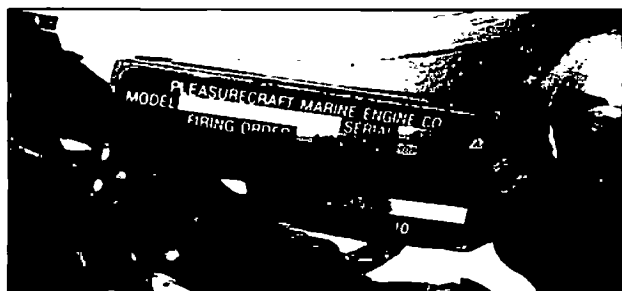


Fig. 7

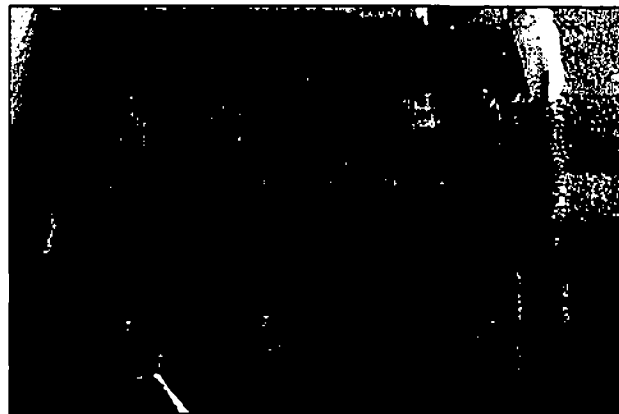


Fig. 8

The transmission model, serial number and ratio are located on the transmission case.

Service Information Request

When contacting the factory, include the following information:

1. Engine and transmission serial and model numbers.
2. Date purchased.
3. Name of selling dealer.
4. Boat manufacturer, model and length.
5. Number of hours unit has been operated.
6. Date of previous correspondence.

For your convenience, there is a form which can be used when writing PCM on page 53.

Record these numbers from the Serial Number plates on the engine and transmission.

Engine Model
Engine Serial No.
Transmission Model
Transmission Serial No.

Port	Starboard

Marine Engine Description

PCM engines are 4-cycle, overhead valve, V-8 engines. Lubrication is provided by a rotor-type oil pump which provides full pressure lubrication to all bearings. Valve rocker arms are lubricated by oil which passes through the hydraulic valve lifters and up through hollow push rods. All lubricating oil is filtered by a full-flow filter system.

PCM Installation and Delivery Inspection

The selling dealer must check the items listed below prior to delivery of your PCM Engine. Check with him to be sure that these checks have been completed.

Check and Adjust as Necessary

1. Engine oil level and transmission oil level.
2. Battery condition.
3. All mounting bolts.
4. Engine alignment.

Start Engine and, while running, check.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER, attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER, run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

WARNING! In order to prevent personal injury to you or others on board, whenever the engine is running the machinery space must be closed. Never operate the engine with the engine machinery space open or while some one is in the machinery space, either open or closed. Never open the machinery space unless the engine is shut off and the engines rotating parts are stationary and remain in a stationary position. Rotating machinery can cause injury and even death if an accident should occur. Whenever a problem exists that requires the operation of the engine with the machinery space open, extreme care must be exercised. IT IS RECOMMENDED THAT UNCOVERED ENGINE OPERATION BE ATTEMPTED ONLY BY TRAINED AND QUALIFIED SERVICE PERSONNEL.

(With engine warmed up at fast idle to normal operating temperature)

1. Oil pressure and cooling water flow.
2. Ammeter or voltmeter function.
3. Exhaust, oil and fuel system for leaks.
4. Idling speed (adjust as necessary).
5. Operation of throttle and shift controls.

Test run boat and check (in water).

1. Recommended engine RPM (as stated under "Specifications").
2. Operation of throttle and shift controls.
3. General operation of craft.

Maintenance and Tune-Up

Fuel Requirements

Use any good grade automotive regular or premium gasoline with a minimum average octane rating of 89* in your PCM engine.

An 87* average octane gasoline may be used if the gasoline described above is not available; however, the ignition timing MUST BE retarded 4°, from the specifications listed in the specifications for your model, to prevent harmful detonation.

* New U.S. Regulation requires posting average of research and motor octane. (R + M)/2

Fuel will deteriorate during prolonged storage, causing damage to fuel system gaskets and plastic parts and clogging the passages of the carburetor. Use of a stabilizer can help prevent this.

Fuel used to test PCM engines contains a fuel stabilizer, such as STA BIL®. It is recommended that STA BIL® or it's equivalent be used according to the manufacturers directions, prior to any lay-up or any period of inactivity longer than thirty (30) days to insure the protection of the fuel system components.

PCM reserves the right to refuse warranty on parts which are damaged from using improper gasoline or engines improperly stored.

Replacing Fuel Filter

PCM recommends the use of a Remote Mounted fuel filter and/or water separator and fuel filter on all its engines. Fuel filters are not standard with PCM engines; however, we do offer them as an option to all Boat Builders and Dealers. If your boat is not equipped with a fuel filter, see your PCM Dealer, he can provide you with the proper parts and installation service to protect your engine's fuel system. When replacing the fuel filter element, follow the manufacturer's instructions, the following cautions and the waste fluid caution on page # 39.

CAUTION: Be careful of spilled fuel; gas vapor build-up is explosive.

NOTE: DO NOT re-use old fuel filter components; always replace with new fuel filter and gasket.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER, attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER, run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

Cleaning Carburetor Inlet Screen

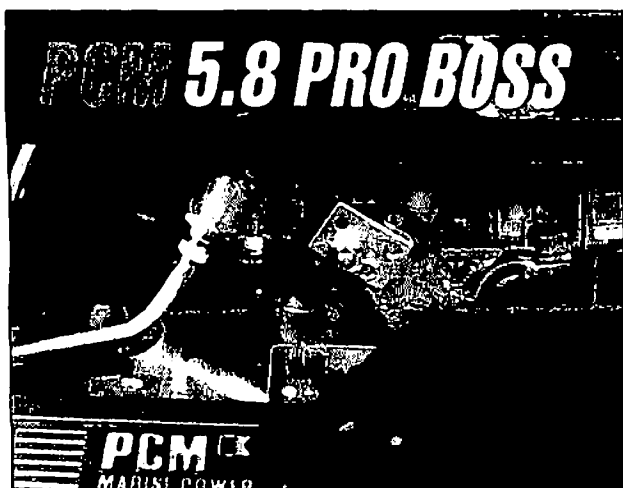


Fig. 9

CAUTION: Be careful of spilled fuel; gas vapor build-up is explosive.

1. The carburetor inlet screen is located in the primary float bowl in fuel inlet fitting.

CAUTION: Be careful of spilled fuel; gas vapor build-up is explosive.

2. Remove fuel line and fuel inlet fitting from carburetor.
3. Wash screen in solvent and dry with compressed air.
4. Install a new gasket on fuel inlet fitting. Install fitting into carburetor and tighten. Install fuel line.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER, attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER, run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

5. Run engine and check for gasoline leaks.

Valve Adjustment

Hydraulic valve lifters require little attention. Lifters are extremely simple in design, readjustments are not necessary and servicing requires only that care and cleanliness are exercised in the handling of parts. The best preventive maintenance for valves is the frequent change of engine oil.

Cylinder Head Torque and Sequence

Cylinder head bolts are tightened in three (3) progressive steps. Torque all bolts in sequence and finally to 100 Ft.lb. on Ford 351 engines, 70 Ft.lb. on 302 engines, 65 Ft.lb. on Chevy 305 and 350 and 80 Ft.lb. on 454 engines. This procedure is representative of all engines. Check service manual for more specific specifications.

Transmission

Fluid Type

PCM Transmissions

All PCM transmissions use 20 20W engine oil.

Warner Transmissions

Use only automatic transmission fluid Type "A" Suffix "A" in this transmission. This fluid is GM type and is trade named Dexron or Dexron II.

Change Frequency

Change transmission fluid once each year.

Maintaining Transmission Fluid Level

The transmission fluid level should be checked frequently and fluid added if necessary. Level must be maintained between the two marks on dipstick.

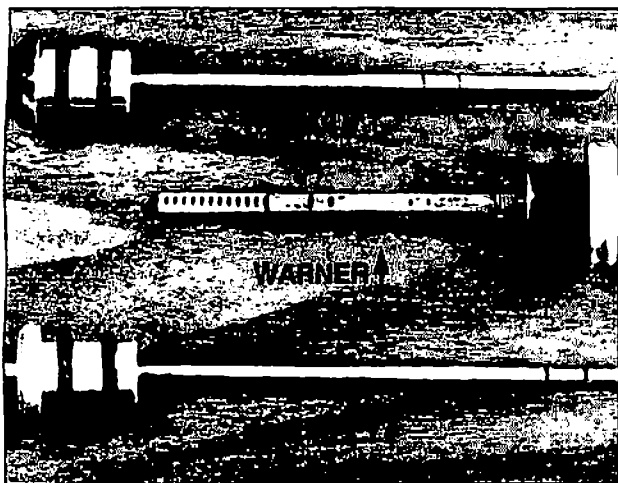


Fig. 10

Maintain Fluid Level On All Transmissions As Follows:

1. The boat must be at rest in the water with the engine running.
2. On the PCM transmission pull the dipstick straight up, on the Warner transmissions turn the dipstick "T" handle counterclockwise to unseal, and remove dipstick.
3. Wipe the fluid off of the dipstick.
4. Shut off engine and quickly set dipstick in position in transmission fill hole.
5. Remove dipstick and note level indicated. Add fluid, if required, to bring level up to the top mark.

NOTE! Add oil in small amounts to prevent overfilling. If the transmission is over filled the excess will have to be removed to prevent leakage or damage to the transmission.

6. If oil was added restart engine to fill circuits and check oil a second time to verify level. (Repeat steps 3, 4, and 5).
7. Reinstall dipstick and on Warner transmissions turn "T" handle clockwise to tighten.

Testing of PCM Transmission Fluid Level Before Starting Engine

On all PCM transmissions the following procedure must be used if the transmission fluid level is to be checked prior to starting and running the boat.

1. Pull the dipstick straight up and remove dipstick.
2. Wipe the fluid off of the dipstick.
3. Insert the dipstick into the transmission opening and let the dipstick rest by its own weight on the first o-ring. **DO NOT PUSH THE DIPSTICK INTO THE OPENING.**

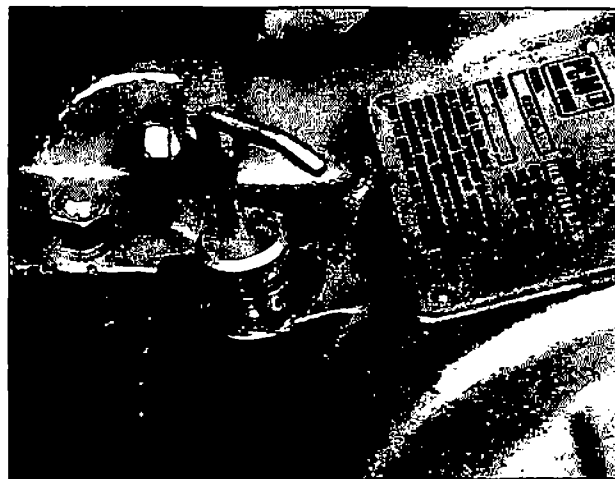


Fig. 11

4. Withdraw the dipstick and read the oil level as follows:

- A. 1.23:1 transmission - The oil level should be ON THE FULL MARK.
- B. 1:1 transmission - The oil level should be to the TOP OF THE FLATTENED SIDE of the dipstick. (1/2" above the FULL mark.)

5. Add fluid, if required, to bring level up to the proper mark.

NOTE! Add oil in small amounts to prevent overfilling. If the transmission is over filled the excess will have to be removed to prevent leakage or damage to the transmission.

6. Repeat above steps until proper level is achieved.

Transmission Information Plate

Transmission serial number is located on the transmission case.



Fig. 12

FORD ENGINES

1. Oil Filler Cap
2. Dipstick (May be located on Right Side)
3. Water Pickup Pump
4. Sight Tube
5. Fuel Pump
6. Coil
7. Thermostat Housing
8. Distributor, Interrupter
9. Flame Arrestor (under Cover)
10. Alternator
11. Front Mounts
12. Rear Mounts

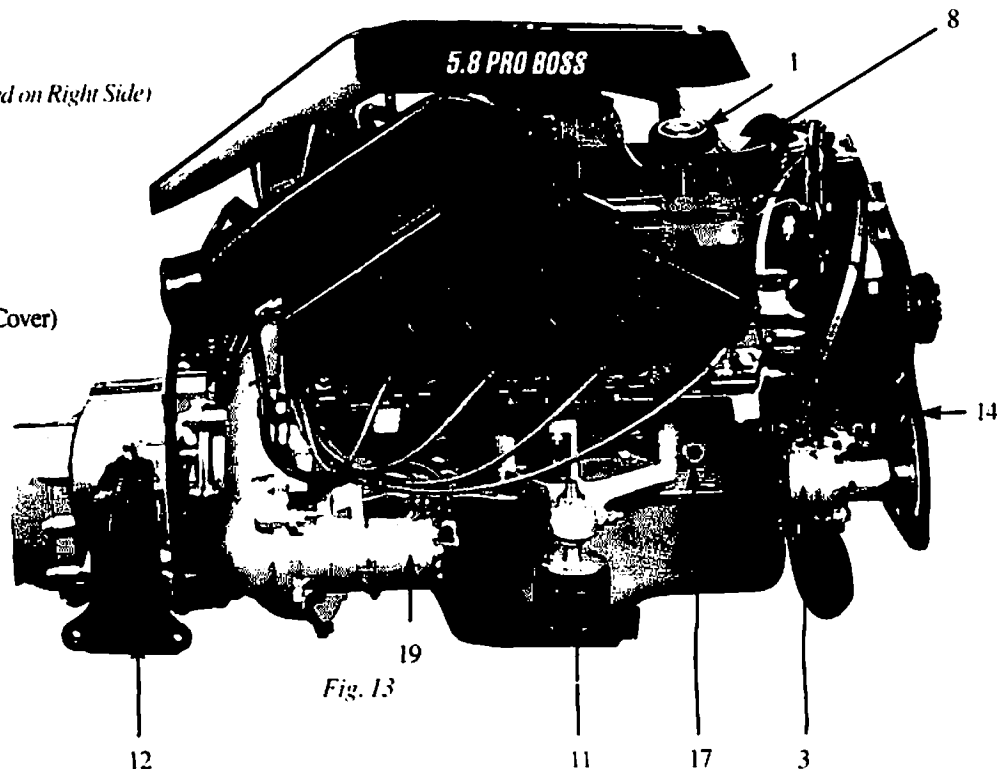


Fig. 13

13. Alternator Drive Belts
14. Water Pickup Pump Drive Belts
15. Oil Filter
16. Transmission Oil Cooler
17. Block Drain
18. Lifting Eye
19. Starter

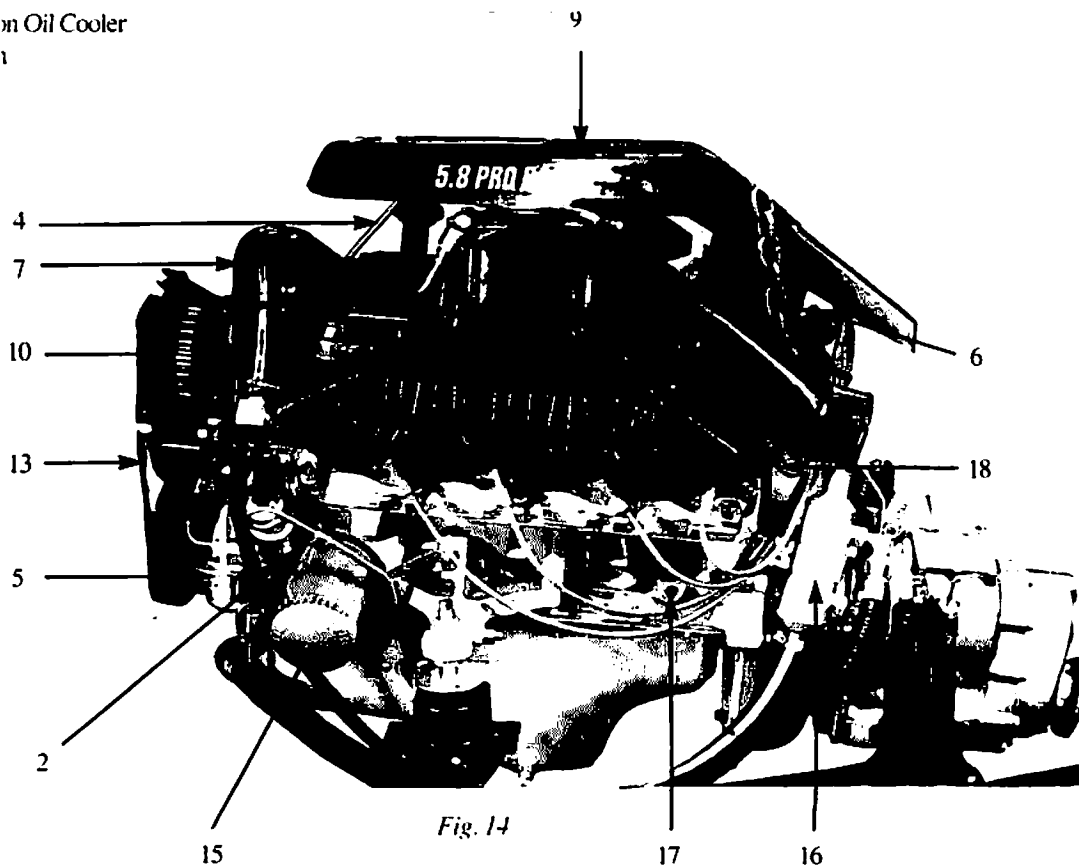


Fig. 14

Specifications - Ford Engines

ENGINE	*Model PLB	*Model PL&RC	*Model PL&RD	*Model PL&RP	*Model	Notes
Displacement CID/liter	302/5.0	302/5.0	351/5.8	351/5.8		
Bore (inches)	4.00"	4.00"	4.00"	4.00"		
Stroke (inches)	3.00"	3.00"	3.50"	3.50"		
Compression Ratio	8.4:1	8.4:1	8.3:1	8.3:1		
Horsepower @4,400 RPM	190	215	240	285		
Battery Recommended Min. CCA	300	300	350	350		#5&Pg 4
Carburetor Holley Marine App.	2V	4V	4V	4V		#1
SPARK PLUG NUMBER 14mm	ASF32M			AWSF22		#8
SPARK PLUG NUMBER 18mm	Motorcraft BRF3M		Autolite BTF3M			
MAXIMUM (Intermittent) RPM's	4,400					
Continuous Cruise RPM's (Max)	3,600					#2
Idle Speed (in forward gear)	650 to 700 RPM					#4A
Mallory Dist. timing @ 600 RPM	10° BTDC					#4B
Prestolite Dist. timing @ 600	Clip Ret. 6° BTDC Screw Ret. 10° BTDC					#3&4B
Timing PROTEC™ EMS 351 Std	18° BTDC @700 30° BTDC @3600					#4A
Timing PROTEC™ EMS 351 HO	18° BTDC @700 26° BTDC @3600					#4A
Distributor Point Gap	Mallory .020"		Prestolite .018"			
Distributor Point Dwell	Mallory 24°to 29°		Prestolite 29°to 33°			
Spark Plug Gap	Point Ign. .035"		PROTEC™ Ign. .045"			
Firing Order	PL 1-3-7-2-6-5-4-8		PR 1-8-4-5-6-2-7-3			#7
Recommended Fuel (R + M)/2	89 Octane Minimum					#4B
Recommended Engine Oil	Premium Grade "SG" Rated					Pg 20
Recommended Transmission Oil	Warner Trans. Dexron PCM Trans. 20W"SG"					Pg 39
Fuel Pump	Marine Approved With Sight Tube					#1
Electrical System	Marine approved 12 Volt Neg. (-) Ground					#1
Circuit Breaker	Marine Approved 50 Amp					#1
Alternator	Marine Approved 50 Amp					#1
Regulator	Marine Approved Integral Solid State					#1
Oil Pan Capacity	4 Qts.					#6

Fig. 15

NOTE #1 This part is a special "MARINE APPROVED" part and is required by law to insure the safety of the public. Repair or replacement in a manner inconsistent with its original configuration or replacement with a non approved part is not only dangerous but could be in violation of the law.

NOTE #2 Do not cruise at high limits of above range unless propped to turn at or near maximum RPM's at full throttle.

NOTE #3 "Clip Ret." indicates Clip retained Distributor Cap. "Screw Ret." indicates Screw Retained Distributor Cap

NOTE #4 A. When setting ignition timing and idle speed on engines equipped with the PCM PROTEC™ Engine Management System, the cruise mode feature must be disabled by removing the wire from the knock sensor.
B. Unleaded fuel of proper octane is recommended. (* See fuel requirements page 7). Do not use fuels which contain alcohol. If pinging and/or other pre-ignition or detonation signs are present, in engines equipped with ignition points the timing should be checked at maximum engine RPM. The timing at 4,000 RPM should

never exceed 30° BTDC, in engines equipped with ignition points, to ensure reliability and performance with 89 octane fuel. The reduction in initial timing as listed on page 7, applies equally to the maximum timing specifications when lower octane fuels are used.

NOTE #5 **WARNING:** DO NOT reverse battery cables on battery terminals. DO NOT spark battery cables against terminals to check polarity. Damage to charging system components may result if these precautions are not observed.

NOTE #6 When changing oil filter, run engine and add only enough oil to bring level back to full mark on dipstick to replenish amount used by the filter.

NOTE #7 Wire routing diagrams are pictured on page 49 for point ignition engines and on page 50 for PROTEC™ EMS engines.

NOTE #8 Numbers listed are MOTORCRAFT numbers. AUTOLITE equivalents are AUTOLITE # 303 or 3303 to replace MOTORCRAFT # ASF32M and AUTOLITE # 763 to replace MOTORCRAFT # AWSF 22.

* See page #1 for model information.

Models – INBOARD 351/4, 302/4, 302/2

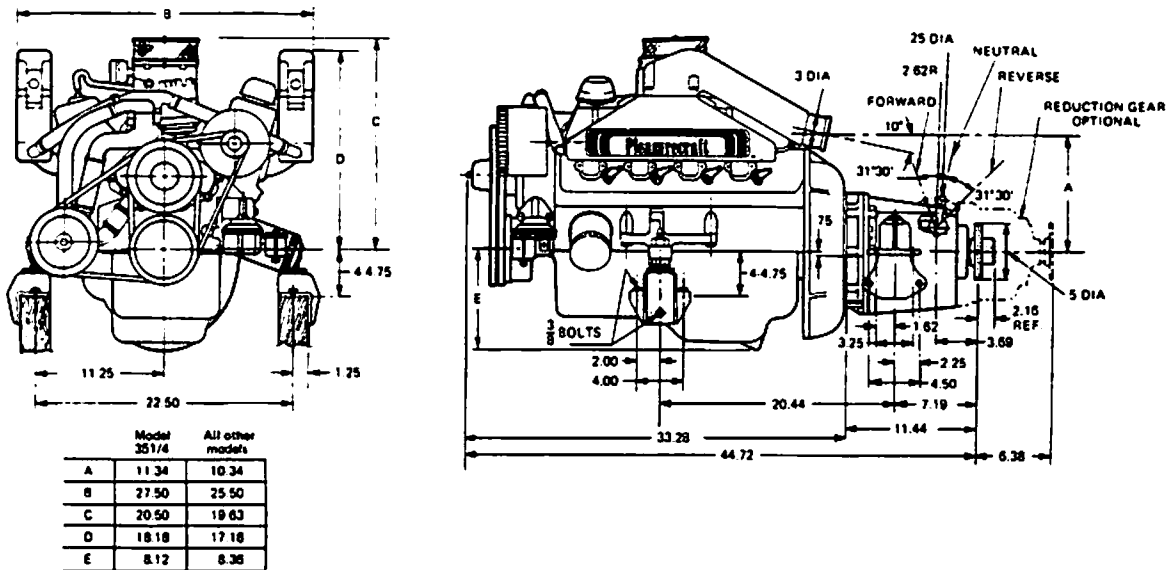


Fig. 16

Models – VEE DRIVE 351/4, 302/4, 302/2

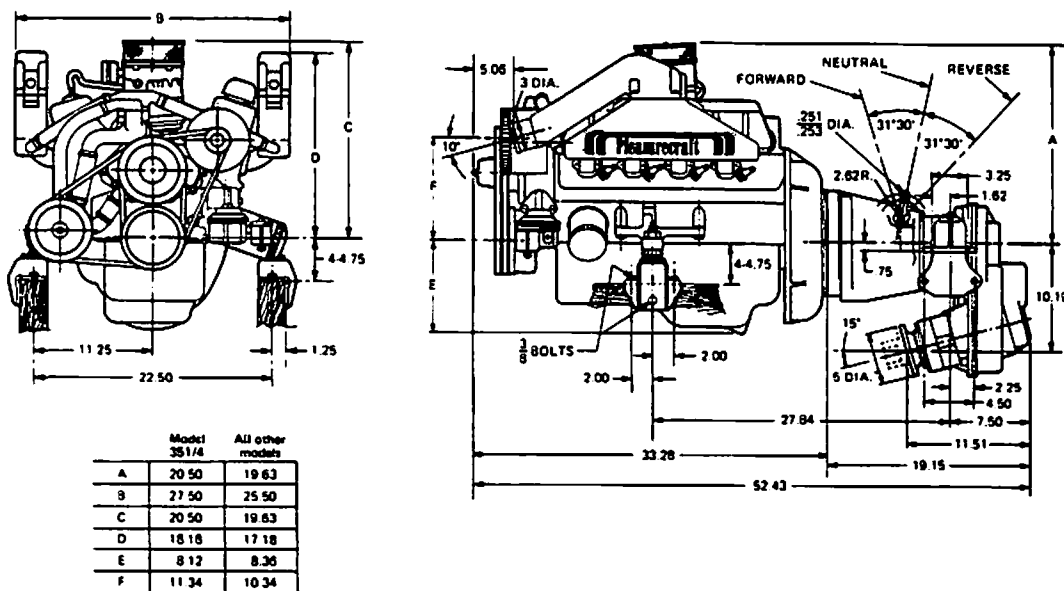


Fig. 17

Specifications - Ford Engines

Model	460	460S
Bore	4.362"	4.362"
Stroke	3.85"	3.85"
Cubic Displacement	460 cubic inches	460 cubic inches
Horsepower	340 @ 4600 RPM	320 @ 4600
Maximum RPM's		
Intermittent Service	4600	4600
Continuous Cruise	3600	3600

NOTE: Do not cruise at high limits of above range unless propped to turn at or near maximum RPM's at full throttle.

Idle Speed, in forward gear 600 RPM
Timing*

Breaker Point Gap
Breaker Point Dwell
Spark Plug Gap
Spark Plug Type

Firing Order
Recommended Fuel
(See page 7)

10 degrees BTC*
@ 600 RPM
.020"
24 to 29 degrees
.035
Autolite ARF32M or
Champion RBL11Y.14mm
See Engine identification tag.*
Regular grade, leaded

10 degrees BTC*
@ 600 RPM or lower
.020"
24 to 29 degrees
.035
Autolite ARF32M or
Champion RBL11Y.14mm
See Engine identification tag.*
Regular grade, leaded

88 octane minimum (R+M/2)

NOTE: Low lead fuel of proper octane rating may be used intermittently. Unleaded fuel should not be used.

Recommended Oil - See Engine Lubrication Section for further information.

Engine oil.

Warner Drives
and Vee Drives

Carburetor
Fuel Pump
Electrical System

SAE40
"SG" Rating
Automatic Transmission
Fluid (ATF),

Type A, Suffix A.

SAE40
"SG" Rating
Automatic Transmission
Fluid (ATF),

DexronII
Holley 4 bbl
Marine approved with safety sight tube.
12 Volt, Negative Ground.

Warning! DO NOT reverse battery cables on battery terminals. DO NOT spark battery cables against terminals to check polarity. Damage to charging system components may result if these precautions are not observed.

Alternator
Regulator
Battery Recommended
Oil Capacity

Marine approved, 35 AMP.
Sealed solid state transistorized.
Marine type of 100 AMP. hr. minimum
5 Qts. and 1 for filter.

Firing Order
*** L.H. Rotation**
1-5-4-2-6-3-7-8

Firing Order
*** R.H. Rotation**
1-8-7-3-6-2-4-5

* See Fuel Requirements page 7.

At the time of this publication PCM was not producing this engine. The specifications on this page apply to engines manufactured prior to 1980.

Models – INBOARD 460/4

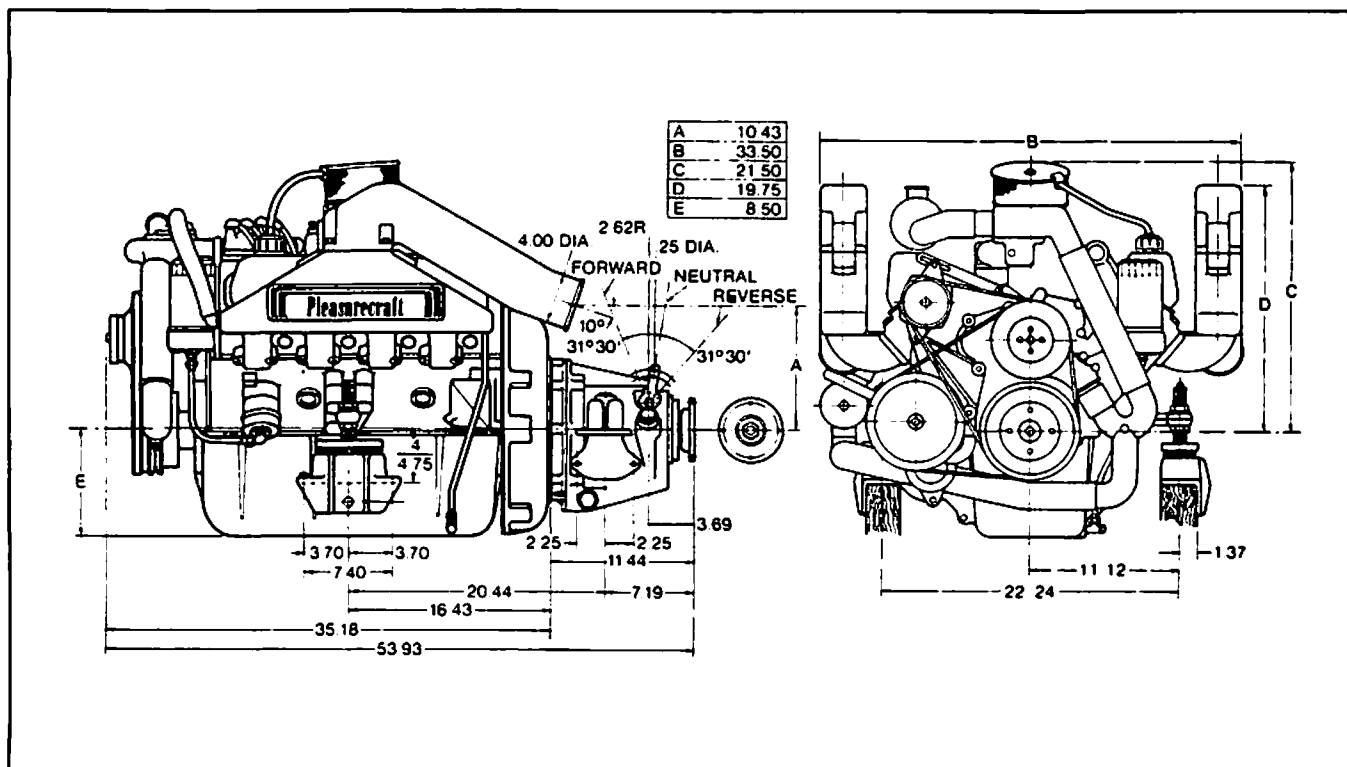


Fig. 18

Models – VEE DRIVE 460/4

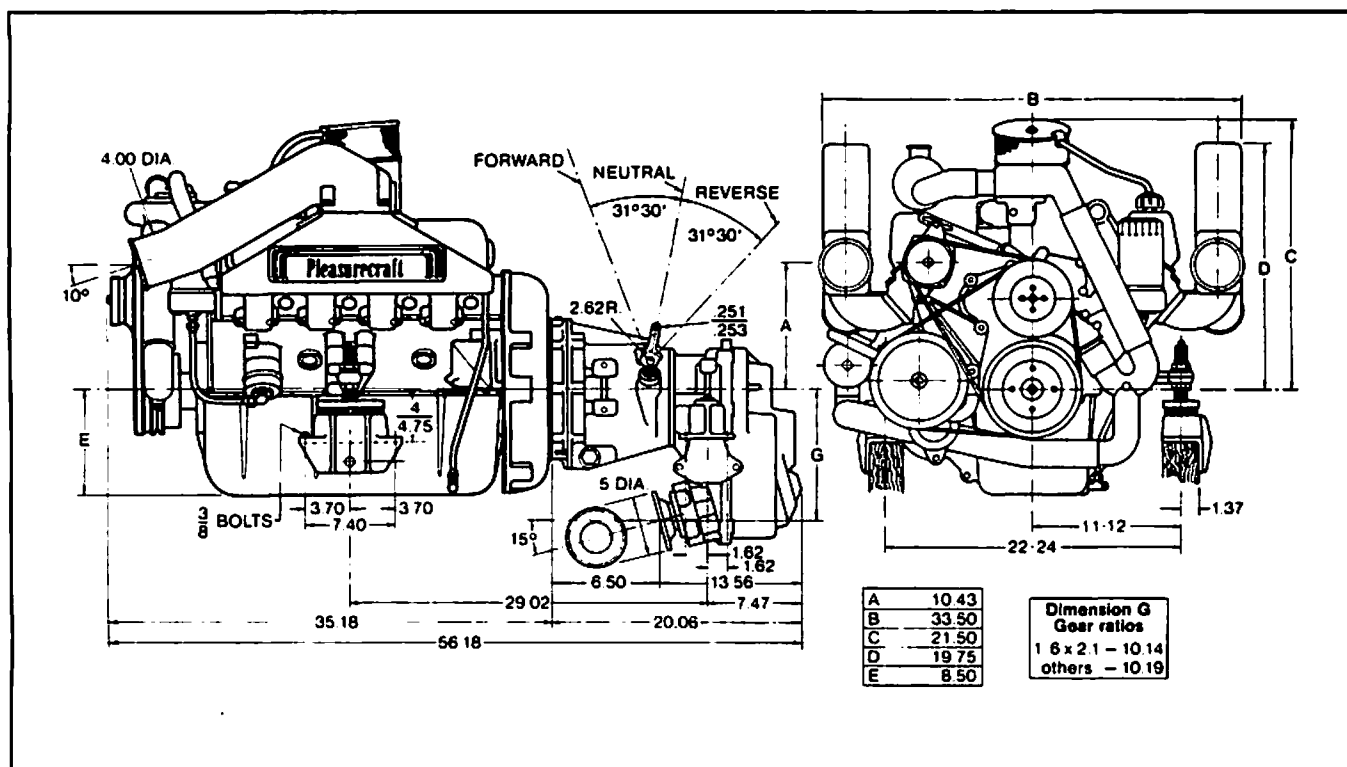
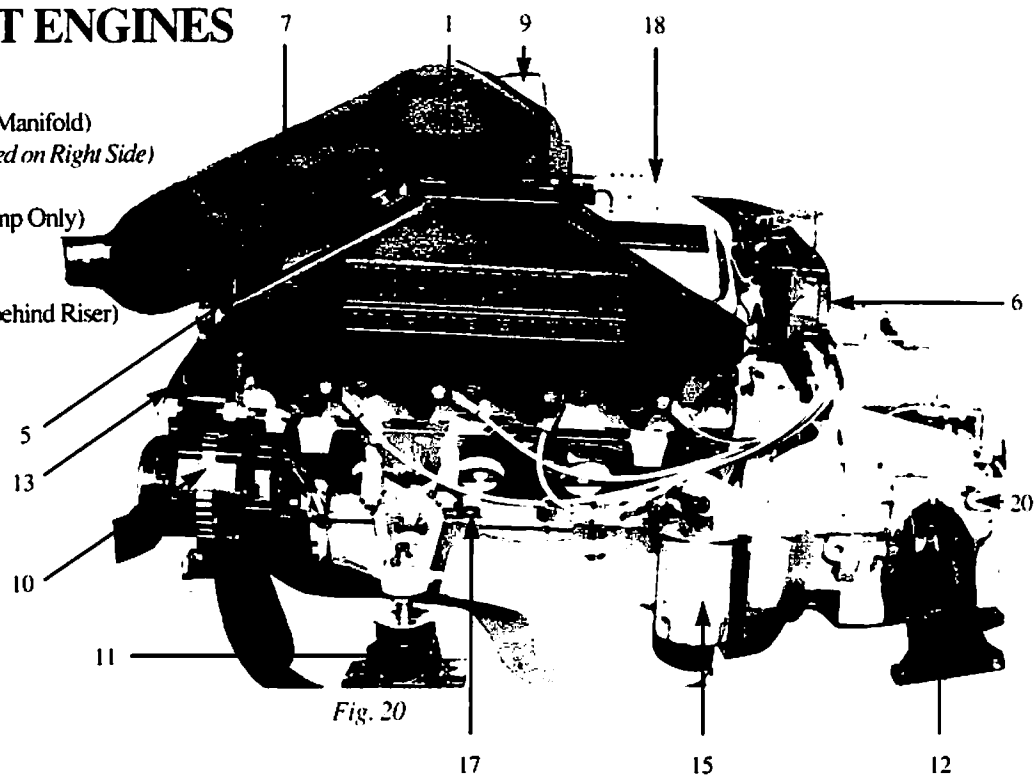


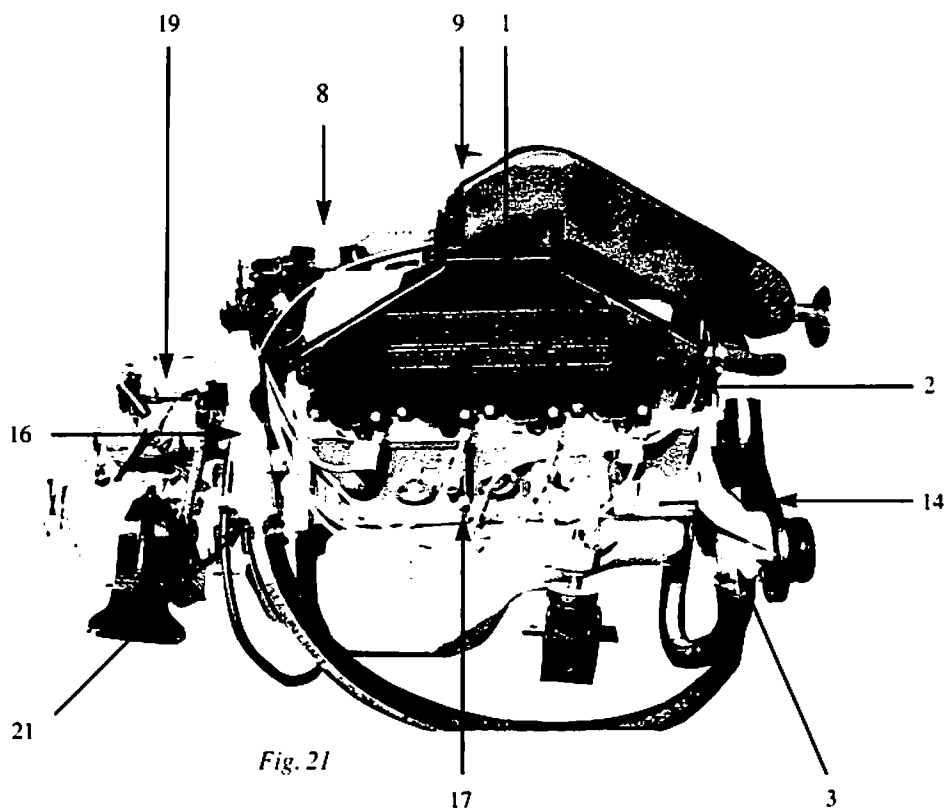
Fig. 19

CHEVROLET ENGINES

1. Oil Filler Cap (behind Manifold)
2. Dipstick (*May be located on Right Side*)
3. Water Pickup Pump
4. Sight Tube (Mech. Pump Only)
5. Fuel Pump
6. Coil
7. Thermostat Housing (behind Riser)
8. Distributor, Interrupter
9. Flame Arrestor
10. Alternator
11. Front Mounts
12. Rear Mounts



13. Alternator Drive Belts
14. Water Pickup Pump Drive Belt
15. Oil Filter
16. Transmission Oil Cooler
17. Block Drain
18. Lifting Eye
19. Starter
20. Transmission Dipstick
21. Cooler Drain Plug



Specifications - Chevrolet Engines

ENGINE	*Model (L&R)G	*Model (L&R)H&U	*Model (L)L	*Model (L&R)K&S	*Model (L)N	Notes
Displacement CID / litre	305/5.0	350/5.7	350/5.7	454/7.4	454/7.4	
Bore(inches)	3.74"	4.00"	4.00"	4.25"	4.25"	
Stroke(inches)	3.48"	3.48"	4.00"	4.00"	4.00"	
Compression Ratio	8.5:1	9.3:1	9.3:1	8.12:1	8.63:1	
Horsepower	220	260	290	330	390	#1
Battery Recommended Min CCA	300	350	350	450	450	#7&pg
Carburetor (Holley)	4V	4V	4V	4V	4V D/P	#2
MAXIMUM (Intermittent) RPM's	4,400	4,400	5,200	4,400	5,200	
Continuous Cruise RPM's (Max)	3,600	3,600	4,100	3,600	4,100	#3
Mallory Timing BTDC AV [MV]	5°[9°]	5°[9°]	5°[9°]	5°[9°]	3°[7°]	#4A&B
Prestolite Timing BTDC	5°	5°	5°	5°	3°	#4A&B
Spark Plug Number	MR44T**	MR43T	Champion 14mm RBL8			**
PROTEC™ EMS Ignition Timing	18° BTDC @ 700 RPM		38° BTDC @ 3600 RPM			#5
Idle Speed (in forward gear)	650 to 700 RPM					#5
Breaker Point Gap	Mallory .020"		Prestolite .018"			
Breaker Point Dwell	Mallory 24° to 29°		Prestolite 29° to 33°			
Spark Plug Gap	Point Ign .035"		PROTEC™Ign..045"			
Firing Order	PL 1-8-4-3-6-5-7-2		PR 1-2-7-5-6-3-4-8			#6
Recommended Fuel (R+M)/2	89 Octane Minimum					#4A&B
Recommended Engine Oil	Premium Grade "SG" Rated					Pg XX
Recommended Transmission Oil	Warner Trans. Dexron PCM Trans. 20W "SG"					Pg XX
Fuel Pump	Marine Approved With Sight Tube					#2
Electrical System	Marine Approved 12 Volt Negative Ground					#2&7
Circuit Breaker	Marine Approved 50 AMP					#2
Alternator	Marine Approved 50 AMP					#2
Regulator	Marine Approved Integral solid State					#2
Oil Pan Capacity	See note #8					#8

Fig. 22

NOTE #1 Horsepower is rated for the (L)L and (L)N engines at 5,200 RPM. All others are rated at 4,400 RPM.

NOTE #2 This part is a special "MARINE APPROVED" part and is required by law to insure the safety of the public. Repair or replacement in a manner inconsistent with its original configuration or replacement with a non approved part is not only dangerous but could be in violation of the law.

NOTE #3 Do not cruise at high limits of above range unless propped to turn at or near maximum RPM's at full throttle.

NOTE #4 A. Unleaded fuel of proper octane is recommended. (* See fuel requirements, page 7). Do not use fuel which contain alcohol.
B. If pinging and/or other pre-ignition or detonation signs are present in engines equipped with ignition points, the timing should be checked at maximum engine RPM. The timing at 4,400 RPM should never exceed 30° BTDC. in engines equipped with ignition points, to insure reliability and performance with 89 octane fuel. The reductions in initial timing as listed on page 7 applies to the maximum timing specifications when lower octane fuels are used.

NOTE #5 When setting ignition timing and idle speed on engines equipped with the PCM PROTEC™ Engine Management System, the cruise mode feature must be disabled by removing the wire from the knock sensor. At time of publication only the "K" (454) engine was equipped with the PROTEC™ EMS ignition system.

NOTE #6 Wire routing diagrams are pictured on page 49 for point ignition engines and on pages 51 & 52 for PROTEC™ EMS engines.

NOTE #7 WARNING: DO NOT reverse battery cables on battery terminals. DO NOT spark battery cables against terminals to check polarity. Damage to charging system components may result if these precautions are not observed.

NOTE #8 6 Qt. at 0° & 5 Qt. at 15° (installed angle). Dipstick calibrated full at 15° and 1/4 above full and low mark on HP454 (LN). When changing oil filter, run engine and add only enough oil to bring level back to full mark on dipstick to replenish amount used by filter.

* See page #1 for model information. (L&R) listed above means left and right. "G", "H", "L", "K", "S" and "N" are model indicators.

** Prior to 1992 all engines (including the (L&R)G) listed above used MR43T.

Models – INBOARD 305, 350

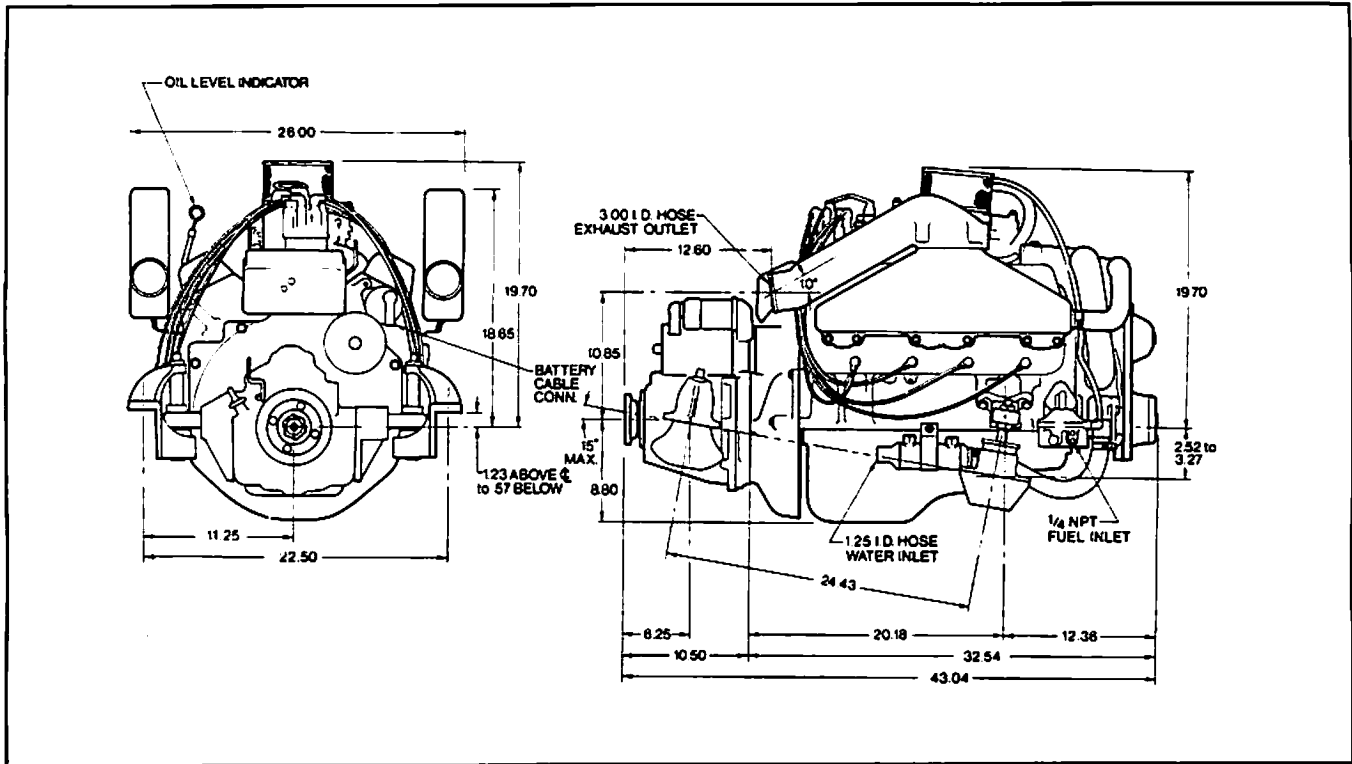


Fig. 23

Cylinder Numbering Location Guide

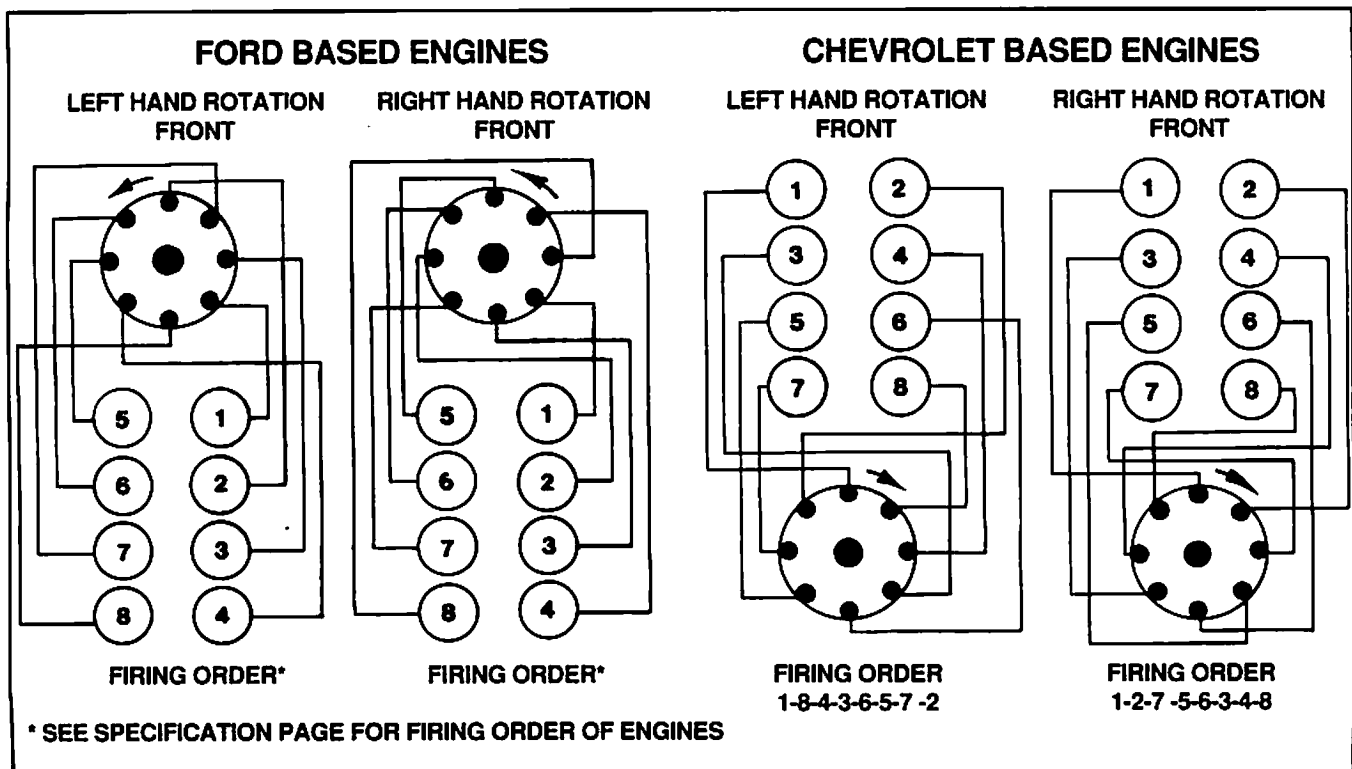
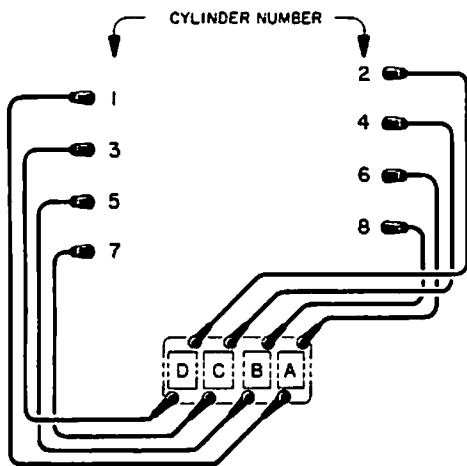


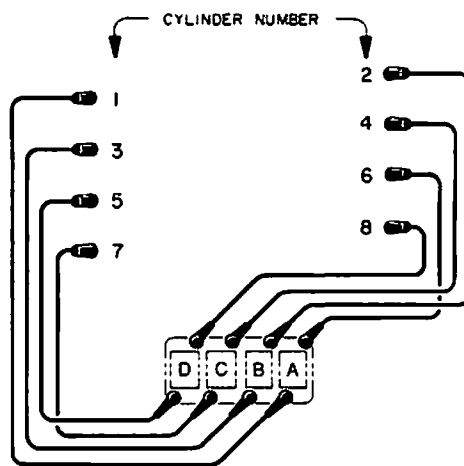
Fig. 24

Fig. 25

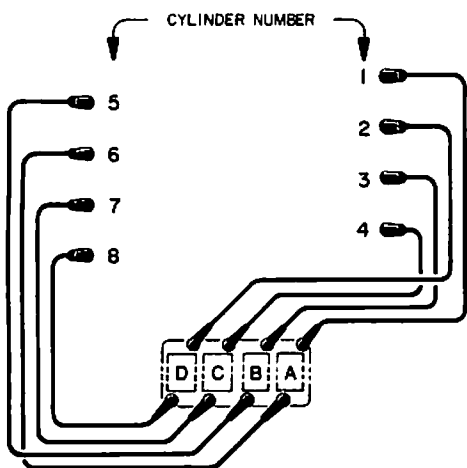
PRO TEC™ SPARK PLUG WIRING DIAGRAM



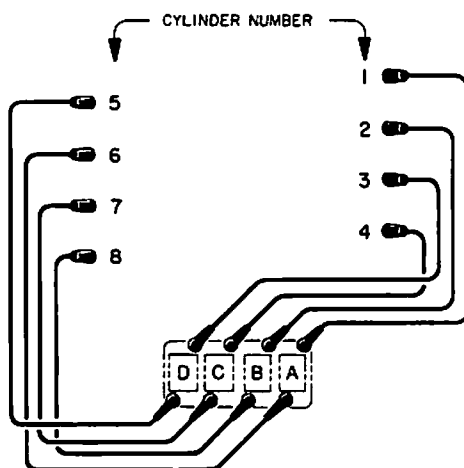
LH ROTATION - CHEVROLET
FIRING ORDER 18436572



RH ROTATION - CHEVROLET
FIRING ORDER 12756348



LH ROTATION - FORD
FIRING ORDER 13726548



RH ROTATION - FORD
FIRING ORDER 18456273

COIL WIRING

- A BROWN
- B RED
- C ORANGE
- D YELLOW
- POWER BLUE

PCM PLEASURECRAFT MARINE ENGINE COMPANY		
DESIGNED BY	DATE	REVISIONS
PRO TEC SPARK PLUG WIRING DIAGRAM		
DRAWN BY		REVISIONS

Maintenance Chart

Service or Checking at the Most Frequent Interval Listed is Recommended

	Before Each Use	Weekly	At 1st 25 Hours of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Once Each Year
Change Engine Oil *			(1) ✓	(1)	(1)	(1)
Replace Oil Filter			•	•	•	•
Clean Oil Filler Cap			•	•	•	•
Check Transmission Fluid Level	•					
Change Transmission Fluid * †			•	•	•	•
Check Sea Water Strainer	•	(2)	(2)	(2)	(2)	(2)
Clean Flame Arrestor			•		•	•
Clean Crankcase Ventilating System			•		•	•
Check Water Pump and Alternator Belts for Tension •						
Change Fuel Filter * †					•	•
Check Fuel System Lines and Connectors for Leaks •		•	•	•	•	•
Clean Carburetor Fuel Inlet Screen †			•		•	•
Clean WARNER Transmission Oil Strainer Screen *						•
Lubricate Distributor Cam			•			•
Inspect Breaker Points			(3)	(3)		
Replace Breaker Points					(3)	(3)
Check Condition of Spark Plugs			•		•	•
Check Battery Electrolyte Level		•	•	•		
Check All Electrical Connections			•			•
Check Cooling System Hoses and Connections for Leaks	•					•
Tighten Engine Mount Fasteners			•			•
Lubricate Throttle and Shift Linkage Pivot Points			•			•
Check for Loose, Damaged or Missing Parts	•					•
Check Engine to Propeller Shaft Alignment			•			•

The inspection and maintenance schedule, above, is based on average operating conditions in utility service. Under severe operating, intervals should be shortened.

1) Refer to Viscosity Chart.

2) If engine overheats, visually check. If clogged, clean out.

3) POINT EQUIPPED ENGINES ONLY

* See waste fluid caution on page #39.

† See safety cautions page #8.

Engine Lubrication

Selecting Crankcase Oil and Change Intervals

The crankcase oil should be selected in order to give the best performance under the climatic and operating conditions prevalent in the area in which the engine is operated. An oil, which will provide adequate lubrication under high operation temperatures, is required during warm or hot weather. An oil, which will permit easy starting at the lowest atmospheric temperature likely to be encountered, should be used during the colder months. When the crankcase is drained and refilled, crankcase oil should be selected on the basis of prevailing temperature for period during which oil is to be used. See waste fluid caution page #39.

We recommend SAE 40W of any good grade automotive oil of correct viscosity which has an A.P.I. classification of "SG" for use in all PCM engines. Multiple viscosity oils such as 20 W 40 and 20 W 50 which meet the A.P.I. classification "SG" may also be used during cold weather operation.

Engine oil and filter must be changed after the 25-Hour Break In Period and every 50 hours of operation or every 60 days thereafter, whichever occurs first.

IMPORTANT: Zinc additive, Ford P/N D2AZ-19579-A, G.M. P/N 993104 is necessary during the initial Break-In period and is in the engine oil of all engines when shipped from PCM. Oil changes at a time earlier than specified above are not recommended unless the Zinc additive is also added to the oil when changed. The effect of the Zinc additive has no value beyond the initial wear period and is not recommended at any other time.

Engine Crankcase Capacity

The engine crankcase capacity is listed in the Specification Section. (See pgs. 11, 16) Because of the effect the installed angle of the engine has on the oil level, different dipsticks are used on some engines for 0° & 15° installation angles. **BE CERTAIN THE PROPER AMOUNT OF OIL IS IN THE CRANKCASE AT ALL TIMES. IF ANY QUESTION ARISES, CONTACT YOUR PCM DEALER.**

Oil Filter

A full-flow oil filter, filters all of the oil delivered by the oil pump and for this reason, the interval of cartridge change is very important. Oil filter cartridge should be replaced after the 25-Hour Break-In Period and every 50 hours of operation

or every 60 days thereafter, whichever occurs first.

Maintaining Engine Oil Level

It must be emphasized that every internal combustion engine should, particularly during the break-in period, use a certain amount of oil to act as a lubricating and cooling agent. The initial rate of consumption will normally, gradually decrease until it becomes stabilized after approximately 100 hours operation.

The engine oil level should be checked frequently and oil added when necessary.

When checking oil levels, the engine should be warm, the boat must be at rest in the water, the dipstick pushed down to the stop. If the engine has been running immediately prior to checking, sufficient time (approximately 1 minute) must be allowed for oil to drain back from the upper engine cavities to the pan or a false reading may be obtained.

The space between the "Full" and "Add" marks represent one quart, and it is not necessary to add oil unless the level is near the "Add" mark. **DO NOT ALLOW THE OIL LEVEL TO FALL BELOW THE ADD MARK!**

Maintaining a proper oil level also is an important factor in controlling oil consumption. An over-full crankcase will allow oil to be splashed by the reciprocating parts onto the cylinder walls in greater quantities than the rings can control. This excess oil, subsequently, will be drawn into the combustion chambers and burned.

On the other hand, when the engine is used principally at slow speed conditions, where considerable crankcase dilution occurs, a rapid lowering of the oil level may result when the boat is operated for some distance at high speed. This is due to the dilution from slow running being evaporated from the crankcase by the heat of high speed operation. **THIS IS A NORMAL CONDITION AND SHOULD NOT BE MISTAKEN FOR EXCESSIVE OIL CONSUMPTION.**

Lubrication System

Draining engine oil and replacing oil filter.

(See waste fluid caution page #39.)

1. Run engine until temperature gauge indicates normal operating temperature. The benefit of draining is lost, to a large extent, if the crankcase is drained when the engine is cold, as some of the suspended foreign material will cling to the sides of the oil pan and will not drain out readily with the cold, slower-moving oil.
2. If your engine is equipped with an engine oil drain kit, remove the cap from the drain tube and lower the tube into a suitable container to drain the pan. If your engine is not equipped with an engine oil drain kit you should Pump the oil out of oil pan thru the dipstick tube with an oil drain

pump. The dipstick tube, on some engines, extends to the bottom of the oil pan and is designed for this purpose. On other engines a tube must be inserted through the dipstick tube to the bottom of the pan to accomplish draining.

3. Remove filter from cylinder block. Be sure that old sealing ring or parts of the sealing ring are removed from cylinder block. Wipe the block clean with a clean rag.
4. Pour oil into the filter cartridge until it is full then coat the sealing ring (located on new filter) with engine oil and thread filter on to the block. Tighten securely by hand according to package directions.
5. Fill crankcase as outlined under "Filling Engine Crankcase", which follows, and check for oil leaks while engine is running.

Filling Engine Crankcase

The engine crankcase capacity is listed in the specification section. Because of the effect the installed angle of the engine has on the oil level, the following procedure must be followed and the boat must be at rest in the water.

1. Pour the proper amount of oil, as listed in the specifications, into engine through oil fill opening in rocker arm cover until level comes up to full mark on dipstick.
2. Start engine and run at idle speed for 5 minutes.
3. Stop engine and, after approximately 1 minute, check level on dipstick.
4. Add the necessary quantity of oil required to bring level up to the full mark.

Alternator

Under normal operating conditions, the alternator will not require lubrication or servicing other than belt adjustment. Drive belts should be checked before each use and changed once a season to minimize the possibility of untimely failure.

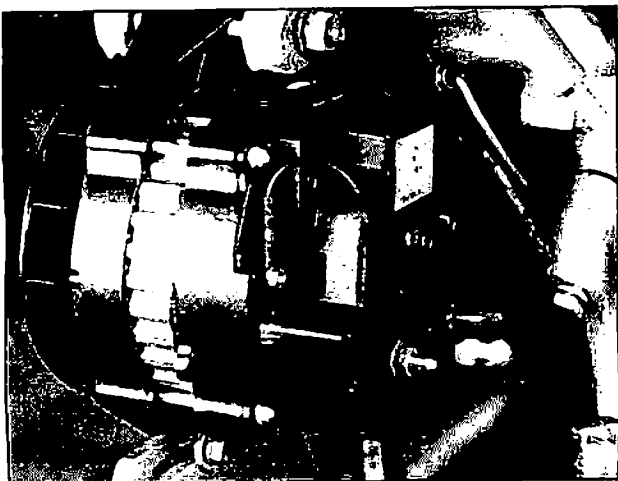


Fig. 27

Starting Motor

Starting motor end frames are equipped with oil-less bearings which do not require lubricant. The most frequent cause of starter problems in a marine engine is water entering the flywheel housing from the bilge and being "pumped" into the starter by the flywheel rotation. Keep your bilge as dry as possible to prevent this type of starter failure from occurring.



Fig. 28

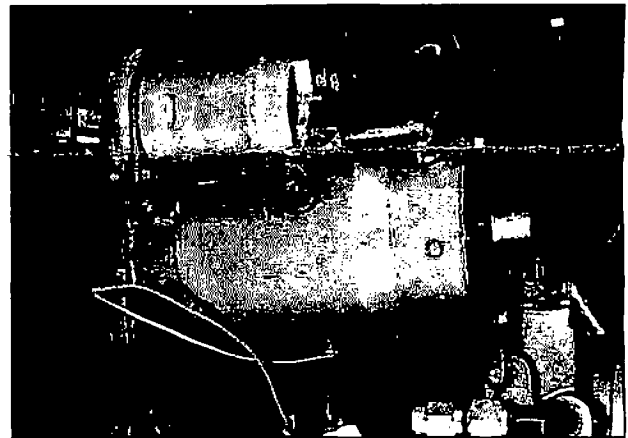


Fig. 29

Distributor Lubrication

Distributor cap should be removed every 100 hours. Apply a small amount of Cam and Ball Bearing Lubricant or other suitable high melting-point, non-bleeding grease on distributor cam surface and on distributors equipped with an oil cup lubricate with engine oil along with a drop of oil on the wick under the rotor if so equipped.

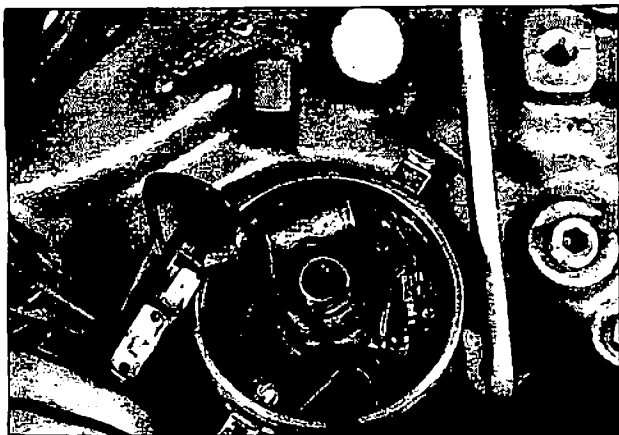


Fig. 30

WARNING: Removal of the Distributor Cap must be accomplished by first loosening the screws which clamp the Distributor Cap retaining clips into place. Failure to loosen these screws and prying the retaining clips loose could damage the cap and/or destroy the ability of the cap to seal on the distributor causing the distributor to become vented and no longer sealed against possible ignition of fuel fumes if present. Some caps are sealed with a gasket which must be in place when the cap is reassembled to insure the ignition proofing of the distributor. **DO NOT REASSEMBLE THESE DISTRIBUTORS WITHOUT THE GASKET PROPERLY INSTALLED.**

Ventilate engine compartment by opening engine hatch or, if equipped with bilge blower, operate for a sufficient amount of time to remove any gas fumes from the engine compartment.

Starting and Operating

A routine pre-starting procedure should always be carried out before the first start up of the day.

1. Check oil in engine and transmission.
2. Inspect sight tube of fuel pump.
3. Check for gasoline fumes in bilges or engine compartment.
4. Operate engine room blower for sufficient time to remove any fumes.
5. Operate bilge pump until bilges are dry.

Other items to be inspected may exist, depending upon the nature of the boat. It is advisable to formulate a check list containing all items relative to your boat and follow it faithfully.

Consult your local Coast guard Auxiliary or Power Squadron for full details on boating safety.

NOTE: Bilge blowers, bilge pumps, and other accessories should not be connected to the ignition terminal or ignition circuit. The engine is equipped with an automatic choke which is opened by an electric heating unit. If the ignition is on for one or two minutes prior to starting, the choke will be open and inoperative, and starting may be extremely difficult.

BEFORE STARTING, BE SURE THE SHIFT SELECTOR IS IN NEUTRAL.

Models equipped with inboard transmissions have a factory installed safety switch incorporated, which prevents actuation of the starter unless the shift selector is in neutral. Other models may not. Before starting a cold engine, pump the throttle two or three times from closed to open to closed. Open throttle slightly above the idle position and actuate starter. As soon as the engine starts, return the throttle toward closed to establish the engine speed at 1200 to 1600 RPM's, and give the engine a short period to warm up and smooth out. When all else is in readiness, reduce speed to idle, shift into gear, and proceed normally.

IMPORTANT: Do not continue to operate starter for more than 30 seconds without pausing to allow starter motor to cool off for 2 minutes. This also will allow battery to recover between starting attempts.

NOTE: Pumping the throttle should not be necessary with a warm engine. A warm engine should start readily with the throttle closed by simply actuating the starter.

During the warmup period, scan the instrument panel for correct operation of all systems. Oil pressure should read 35 to 65 lbs. Water temperature should gradually increase to the normal controlled level of 140-170 degrees on direct water cooled models, 180-210 degrees on fresh water cooled models. Alternator charge output should be indicated on the ammeter by the needle indicating toward the (+) side of zero. IF EQUIPPED WITH A VOLTMETER, THE VOLTAGE SHOULD GRADUALLY RISE TO APPROXIMATELY 13.5 VOLTS OR HIGHER AND REMAIN THERE WHILE THE ENGINE IS OPERATING.

Starting a Flooded Engine

In the event your engine becomes flooded caution should be observed when attempting to start the engine.

1. If the engine has a breaker point ignition perform the

following procedure. Connect a jumper wire from a ground point to the -(neg.) terminal of the coil to disable the ignition system. Note this terminal has only one wire, running to the distributor, attached to it. If you do not have a jumper, remove the wire from the terminal.

If the engine is equipped with the Protec™ EMS ignition system lift the retaining clip and pull the connector from the interrupter to disable the ignition system.

2. Remove the flame arrestor to see if the choke valve is in the full open position. If the valve is not wide open hold open manually.

CAUTION! DO NOT USE ANY OBJECT THAT MAY FALL INTO THE CARBURETOR TO BLOCK OPEN THE CHOKE THE THROTTLE VALVE OR FALL INTO THE ENGINE.

3. Position the throttle in a wide open position and activate the starter for 10 seconds only. While observing to see if gasoline flows from the discharge nozzles of the carburetor. The discharge nozzles are positioned in the center of the carburetor circular bore.
4. If gasoline flows freely from the discharge nozzles STOP TRYING TO START THE ENGINE AND CALL A TECHNICIAN TO REPAIR THE CARBURETOR.
5. If gasoline DOES NOT flow freely from the discharge nozzles remove the spark plugs from the engine. Caution! When removing the spark plugs mark the plug wires so they may be reinstalled properly. This step may not be necessary if severe flooding is not present.
6. When plugs are removed repeat step #3 for a period of 30 seconds to purge the cylinders of excess fuel.
7. Dry the plugs with compressed air if available, or by any other suitable means and reinstall the plugs and wires.
8. Locate the cam and rod behind the choke that will permit you to hold open the choke once the flame arrestor is reinstalled. Test for interference by moving the choke open and closed at the cam for free movement. If interference is present reposition the flame arrestor to allow free movement. Once located secure the flame arrestor in place.
9. Remove the jumper from the coil, reconnect the distributor lead or reconnect the EMS plug to the interrupter.
10. Position the throttle at about 25% throttle and start the engine.
11. If the engine backfires or will not start, contact a technician to make the necessary repairs or adjustments.

CAUTION! If the engine backfires upon attempting to start, the problem may be more serious than flooding. DO NOT CONTINUE, CONTACT A TECHNICIAN TO CORRECT THE PROBLEM! To persist in attempting to start the engine under those conditions could cause engine damage or physical damage to you and those around you.

Break In

DO NOT OPERATE AT SUSTAINED FULL THROTTLE DURING THE FIRST 5 HOURS OF OPERATION.

DO NOT OPERATE AT HIGH RPM's IN NEUTRAL.

After the engine is thoroughly warmed up and the boat is underway, open the throttle wide until full RPM's are reached. DO NOT EXCEED MAXIMUM RPM. (RPM's should cease climbing after 10 to 20 seconds). Reduce throttle to 2,800 to 3,000 RPM and cruise at or below this speed for 1/2 hour. Reduce speed to idle, open throttle wide and operate at that speed for approximately 1 minute; reduce to cruise throttle for a few minutes and repeat. (Bringing the engine from idle speed to full throttle will load the engine and assist in seating the piston rings). This cycle can be repeated from time to time during the first 5 hours of operation, but full throttle should not be sustained for more than 1 to 2 minutes.

FOLLOW THE PROCEDURE ONLY WHEN CONDITIONS ARE SUCH THAT IT CAN BE DONE IN COMPLETE SAFETY.

DO NOT ATTEMPT TO BREAK IN AN ENGINE BY PROLONGING IDLING OR RUNNING AT THE DOCK.

During the early part of the break in period, correct propeller selection can be confirmed. (With a normal load aboard, the engine's RPM's should reach, but not exceed, maximum RPM's as listed under specifications for your model).

During the break-in, water temperature should be watched carefully and speed reduced if overheating becomes evident.

Holley Carburetor - General Description

The following description covers a sample Holley Carburetor. The carburetor on your engine may look different from the illustrations, but the carburetor functions exactly the same way. Carburetor service demands particular care in cleanliness and precise adjustments. If you are not equipped with the proper knowledge, tools and equipment, it is recommended that you have a knowledgeable dealer repair any and all carburetor malfunctions.

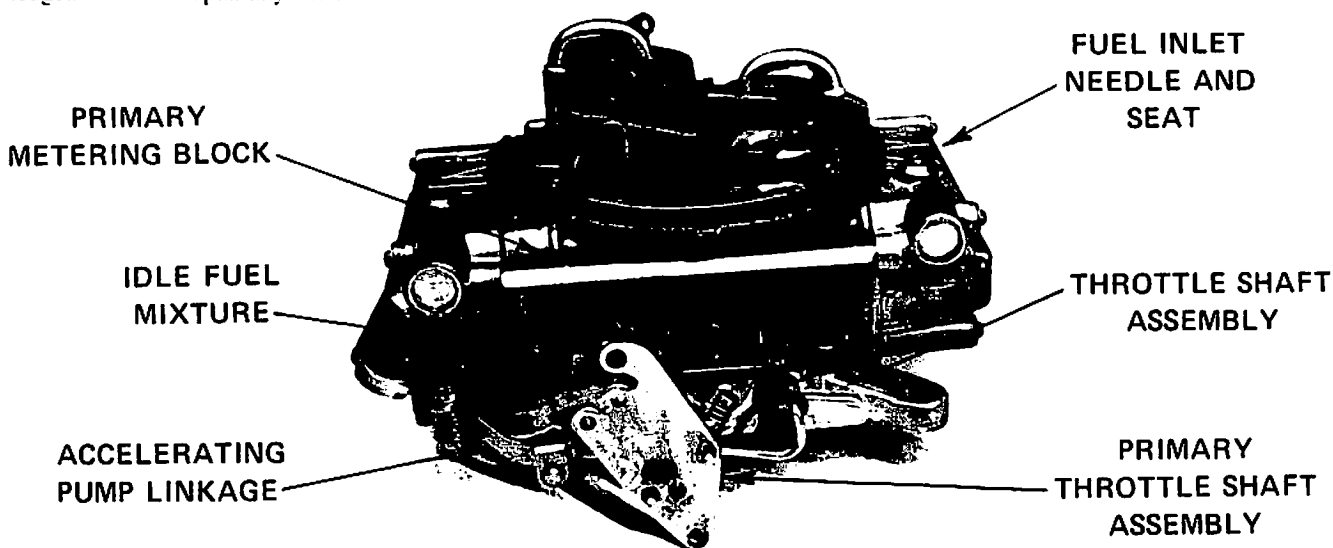


Fig. 31

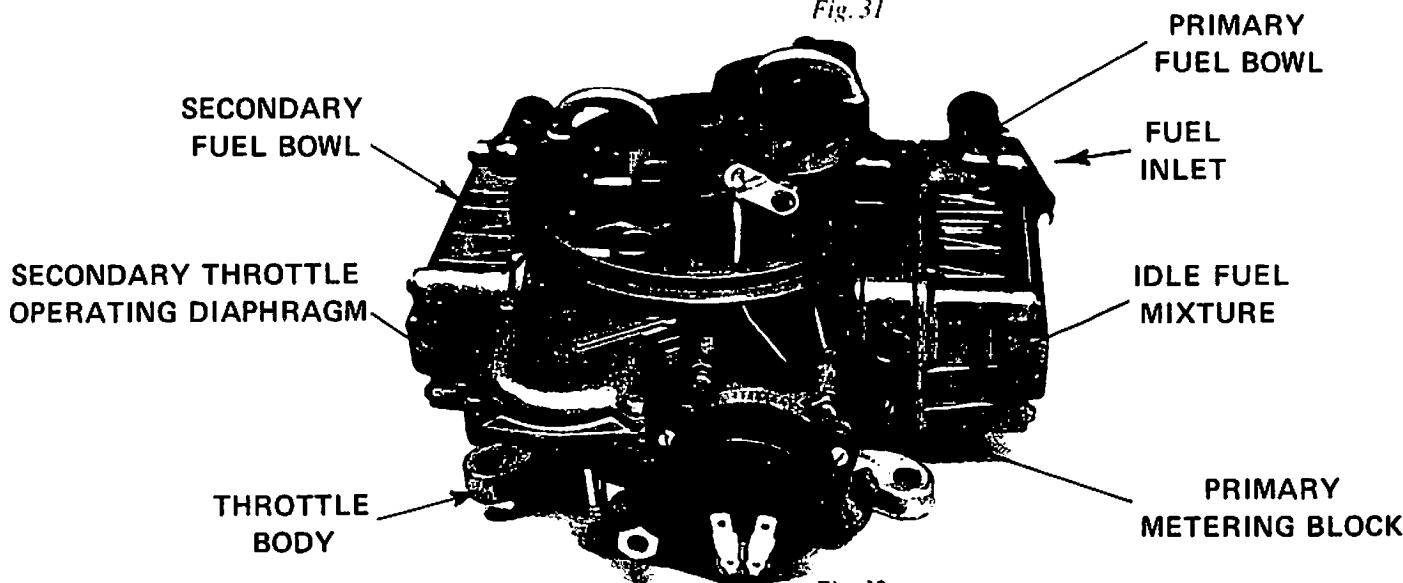


Fig. 32

Description and Operation

The carburetor is a down-draft, two-stage carburetor. The carburetor contains a primary power system or power valve located within the primary metering block only.

The primary stage of the carburetor contains a fuel bowl, metering block, and an accelerating pump assembly. The primary barrels each contain a primary and booster venturi, main fuel discharge nozzle, throttle plate, and an idle fuel passage. The choke plate mounted in the air horn above the primary barrels is automatically controlled by an electric choke mechanism.

The secondary stage of the carburetor contains a fuel bowl, a metering body and the throttle operating diaphragm assembly. The secondary barrels each contain primary and booster venturi, a transfer system, a main secondary fuel discharge nozzle, and a throttle plate.

A fuel inlet system for both the primary and the secondary stages of the carburetor provides the fuel metering systems with a constant supply of fuel. In addition, a carburetor automatic choke system provides a means of temporarily enriching the fuel mixture to aid in starting and operating a cold engine.

Mechanical Fuel Pump

Description

All fuel pumps used on PCM engines are special marine fuel pumps sealed against leakage in the attaching flange area to prevent the possibility of fuel entry into the engine crankcase. In the event that the fuel pump diaphragm ruptures fuel will appear in the sight tube attached to the fuel pump and the flame arrestor. When fuel appears in the sight tube it will be necessary to replace the fuel pump immediately, to correct the problem. **REBUILDING OF THE PUMP IS NOT RECOMMENDED!**

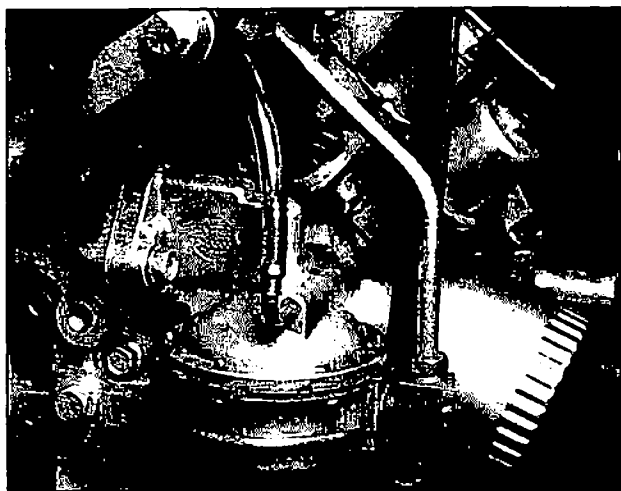


Fig. 33

Electrical Fuel Pump

At the time of publication only the 7.5 litre (454) engine was being built with an electric fuel pump. The fuel pump being used is a high volume, internally regulated low pressure, constant flow, rotary vane, fully sealed, non repairable, marine approved fuel pump.

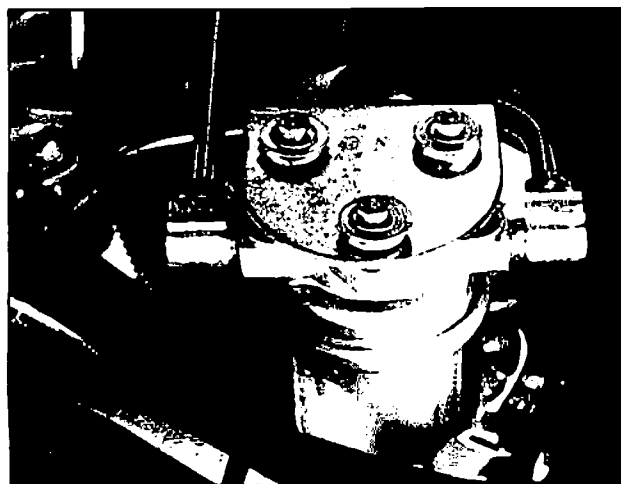


Fig. 34

The power source is 12 volt negative (-) ground and operates at

under 5 amps. The power circuit is supplied through the ignition switch (only when in the on position) to an oil pressure switch mounted at the left side of the electrical bracket. This switch activates only when the engine is running to prevent the pump from operating if the ignition switch is inadvertently left in the on position. During cranking of the engine a bypass circuit allows the fuel pump to function thus allowing priming after lay up or in the event that the fuel tank is ran dry. The pump circuit is protected by a 5 amp fuse (BUSS # MDL 5) in the water proof fuse holder located between the left rocker cover and the carburetor. Due to the fact that the pump is isolated in mounting the electrical circuit is completed through a ground wire attached next to the power lead on the bottom of the pump. **IMPORTANT!** The pump terminals must be connected properly to prevent pump damage and or proper operation. The power (+) lead must be contacted to the terminal closest to the "OUT" fitting of the pump. The ground () lead must be connected to the terminal closest to the "IN" fitting of the pump.

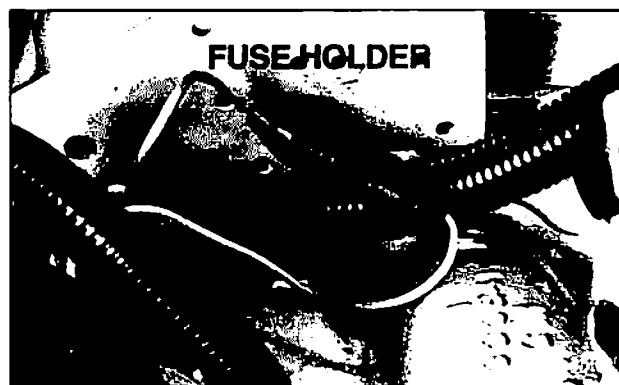


Fig. 35

Cleaning Flame Arrestor

1. Remove the center stud.
2. Remove flame arrestor from carburetor, cover the carburetor with a clean towel to prevent foreign material from entering the engine and wash the flame arrestor in solvent.
3. Dry with compressed air and reinstall on carburetor.

Cleaning Oil Filter Cap

1. Remove cap from valve cover.
2. Wash cap in solvent and dry with compressed air.

Cleaning Crankcase Ventilating System

1. Remove ventilating valve from rocker arm cover and disconnect hose from valve.
2. Wash valve in solvent and dry with compressed air.
3. Disconnect hose from fitting (located in carburetor spacer) and clean inside diameter of hose and fitting.

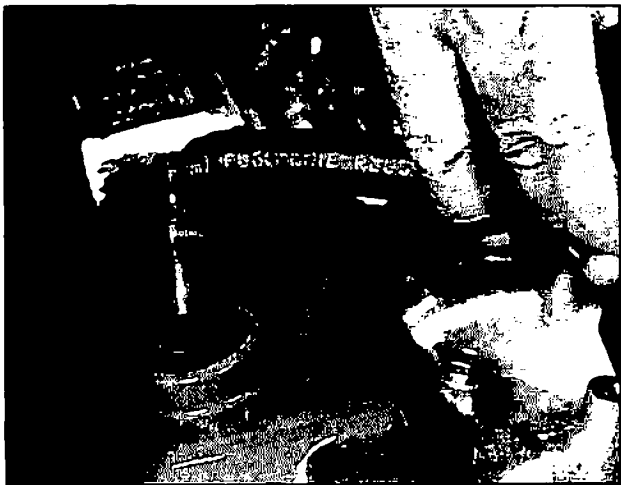


Fig. 36

Electrical System

At the 50 amp circuit breaker located in the electrical bracket at the rear of the engine wiring harness, a short orange wire is provided which connects to the battery cable terminal of the breaker. This wire is provided to shunt the alternator output directly to the battery if a voltmeter is used in the instrument panel. **Remove the battery cable from battery before attempting any maintenance or any repairs.** If an ammeter is used in place of a voltmeter, disconnect the wire from the breaker terminal and carefully tape it off close to the harness. It is necessary to cover the terminal end with plastic electrical tape to prevent a ground or short circuit from occurring. A voltmeter is recommended to be used in the instrument panel, accordingly all engines that are produced in our factory are wired for use with a voltmeter. While this is a slight departure from convention, it provides a three-fold advantage over the traditional ammeter.

1. By simply turning on the ignition key for a moment, it is possible to tell the charge condition of your battery.
2. By enabling the alternator output to shunt directly to the battery, rather than all the way to the instrument panel and back, there is virtually no current loss or line drop. In installations requiring an unusually long harness, such as houseboats, this is especially desirable.
3. Any overcharging tendency can be readily detected as an abnormally high voltage reading on the voltmeter and corrections can be made before battery damage occurs.

Batteries tend to discharge when not in use, the rate of discharge varying with the condition of the battery itself and/or the entire electrical system.

When checking the battery condition, a normal average reading is 10 to 11.5 volts, after a reasonable period of disuse. If voltage reading is 10 volts or below, the battery should be charged by either a charging device or operation of the engine. Upon starting the voltage should immediately raise

and within one or two minutes after starting the engine, the voltage reading on the meter should begin to slowly level off at a reading of 13.5 to 14.5 volts, as the engine continues to operate. If the voltage does not rise or rises and stays above 15 volts, after starting the engine, have the charging system checked. High voltage can result in battery damage, false instrument readings, and blown bulbs.

Circuit Breaker (STANDARD ENGINES)

The electrical system, of all PCM engines, is protected by a 50 AMP circuit breaker under the electrical panel cover at the rear of the engine. This breaker is designed and assembled to disconnect **ALL** systems from the battery should an electrical overload occur.

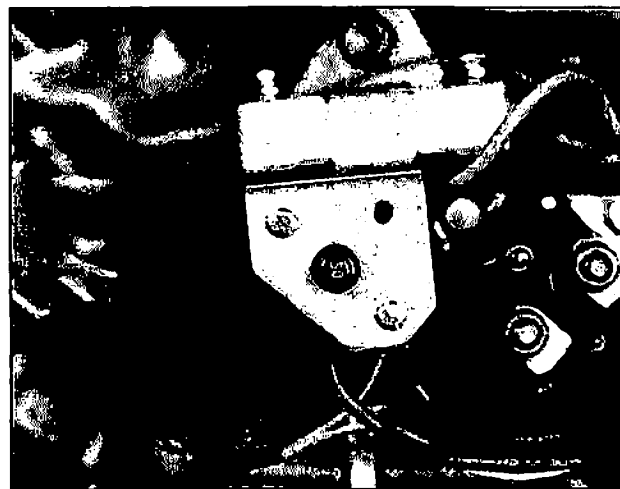


Fig. 37

In the event that all electrical systems are dead, push firmly on the red button with the number "50", which protrudes through the electrical cover, until it resets. After the breaker is reset, you should be able to start the engine(s).

If the breaker again disconnects or if resetting does not resolve the problem, have a qualified marine mechanic inspect the engine(s) to determine the cause of the problem.

CAUTION: DO NOT bypass this breaker under any circumstances short of an emergency. Severe damage to the Electrical System and/or personal danger to the operator and other occupants of the boat could occur.

Circuit Breaker (EMS ENGINES)

The entire electrical system, of all PCM EMS engines, is protected by a 50 AMP circuit breaker. The PROTECTTM ignition system is protected by its own 12.5 amp breaker. Both breakers are located in the panel at the rear of the engine.

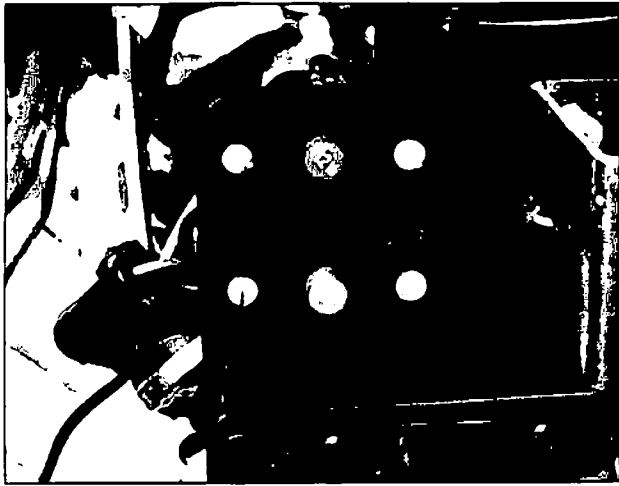


Fig. 38

The 50 amp breaker functions and operates in the same manner as described above for the standard engines. The 12.5 amp breaker has a special purpose to protect only the PROTECT™ ignition system. If the engine will not start, but the battery has power to crank the engine using the starter, the EMS breaker should be reset as follows. Push firmly on the red button with the number 12.5. After the breaker is reset, you should be able to start the engine.

If the breaker again disconnects or if resetting does not resolve the problem, have a qualified marine mechanic inspect the engine to determine the cause of the problem.

CAUTION: DO NOT bypass this breaker under any circumstances short of an emergency. Severe damage to the Electrical System and/or personal danger to the operator and other occupants of the boat could occur.

Battery

Specifications

12 volt marine type

Tapered post connectors

Minimum ratings for batteries are listed on page #4

Coil (Standard Engines)

The coil provided is used with an external ballast resistor, which is designed to control the voltage to the breaker points and the internal temperature of the coil windings. The resistor cannot be repaired in any way, and if defective, it must be replaced.

If the coil primary wires are removed from the terminals, be sure they are installed on the same terminals when

replaced. If these wires are reversed, a reverse polarity situation occurs inside the coil which can decrease coil efficiency and life, and upset engine performance.

See wiring diagram for further details.

Coil (EMS Engines)

The EMS engines use four (4) coils which are attached to the EMS module at the rear of the engine. There is no ballast resistor used on the EMS engines. The EMS coils are replaceable only in pairs due to the fact that two (2) coils are molded into an assembly. Each coil assembly has four (4) terminals to which the spark plug wires for four (4) cylinders attach. Replacement of the Coils is accomplished by removing the attaching screws from the module, prying the coil loose from the gasket and, **AFTER NOTING THE POSITION OF EACH WIRE FOR REASSEMBLY**, removing the four (4) slip on terminals from the coil. Reverse the procedure to assemble **AFTER INSURING** that the wires are attached to the proper terminals and that the gasket will reseal.

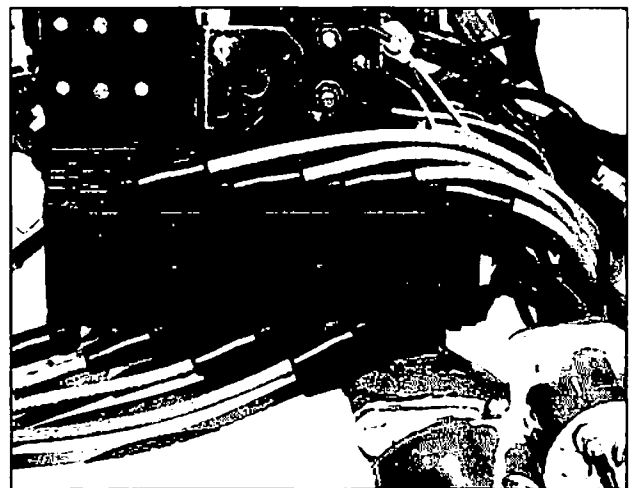


Fig. 39

See wiring diagram for further details.

Battery and Battery Cable Installation

1. The battery should be contained in a leak proof battery box, positioned as close to the engine as possible and should be securely mounted in boat.
2. Connect the negative (-) battery cable to ground on engine.
3. Connect the positive (+) battery cable to the solenoid.
4. Connect the positive (+) battery cable to the positive (+) post on the battery and the negative (-) battery cable to the negative (-) post on the battery.

CAUTION: Engine electrical system is negative ground. Failure to connect battery leads, as outlined, will damage the system.

Battery Maintenance

WARNING: Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame near the vent openings can cause this mixture to ignite and explode. Sulfuric acid in the battery can cause serious burns if spilled on the skin or in the eyes. Proper eye protection should be worn when performing battery maintenance. Flush or wash away acid spills immediately with clear water. Contact a physician for medical treatment if acid comes in contact with your body.

Check battery with a hydrometer. If reading is below 1.230 (specific gravity), recharge or replace the present battery.

We recommend the use of a 12-volt marine battery with an ampere-hour capacity suitable for engine size. See minimum specifications on page #4. Inspect battery and cables for signs of corrosion on battery, cables and surrounding area, loose or broken battery box, cracked or bulged cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to the proper level with distilled water.

The top of the battery should be clean and the battery box and/or hold-down bolts properly tightened. Particular care should be taken so that the top of the battery is kept clean of acid film and dirt to prevent a short between the battery terminals. For best results, wash first with a diluted ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cells.

To ensure good contact, the battery cables should be tight on the battery posts. If the battery posts or cable terminals are corroded, they should be cleaned separately with a soda solution and wire brush. After cleaning and before installing clamps, apply a thin coating of petroleum grease to the posts and cable clamps to help retard corrosion. If the battery has remained undercharged, the local servicing dealer should check for loose alternator belt, defective alternator, high resistance in the charging circuit or a low voltage output.

The Charging System

The Charging System features a marine approved alternator with slip rings and brushes sealed inside the case and an integral regulator mounted at the rear of the alternator. Two (2) brushes carry current through two (2) slip rings to the rotor field coil. Stator windings are assembled on a laminated core which forms part of the frame. A rectifier plate connected to the stator contains 3 positive and one isolation diode. Three negative diodes, which are pressed into the end frame, are also connected to the stator windings. These diodes change the A.C. current produced by the

alternator to D.C. current and directs it to the alternator output terminal. Field current is supplied and controlled by the voltage regulator which senses the alternator output internally. The alternator requires no maintenance because of the sealed type bearings used on the rotor which eliminates the need for periodic maintenance.

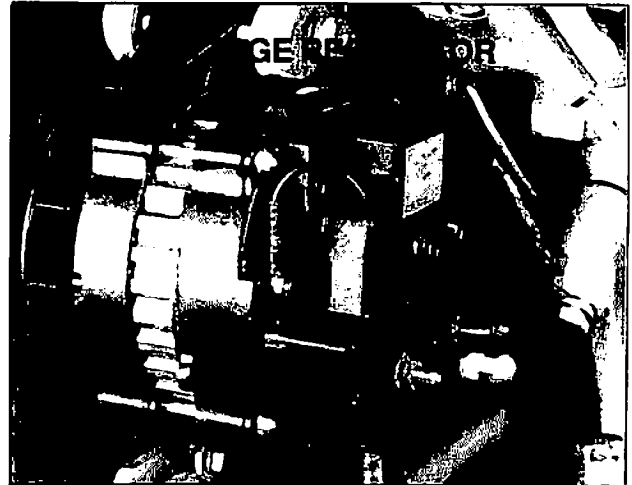


Fig. 40

The solid state voltage regulator is non-adjustable. If the regulator proves defective, it must be replaced.

Provision is made in the charging circuit for the installation of a charge warning light, if it is desired.

Alternators and regulators should be serviced only by qualified personnel.

Charging System Maintenance

CAUTION: Since the alternator is designed for only one polarity system, the following precautions must be observed when working on charging circuit. Failure to observe these precautions will result in serious damage to electrical equipment.

1. When installing battery, always be certain that ground polarity of the battery and ground polarity of the alternator are the same.
2. When connecting a booster battery, make certain to connect the negative (-) battery terminals together and the positive (+) battery terminals together.
3. When connecting a charger to the battery, connect charger positive lead to the battery positive terminal and charger negative lead to battery negative terminal.
4. Do not short across or ground any terminals on the battery, alternator or regulator.
5. Do not attempt to polarize alternator.

Inspection

Follow regular inspection procedure to obtain maximum life from your alternator.

Frequency of inspection is determined largely by type of operating conditions.

1. At regular intervals, inspect all electrical terminals, including battery terminals, for corrosion and loose connections.
2. Check wiring for frayed or worn insulation.
3. Check mounting bolts for tightness.
4. Check belt for alignment and proper tension. To adjust apply pressure against stator lamination between end frames and not against either end frame.

Ignition Distributor (Standard Engines)

Inspection

NOTE: Distributors on all PCM engines are marine approved and must meet specifications. Use only PCM Replacement Parts, which are manufactured to the same marine approved standards.

DANGER: Removal of the Distributor Cap must be accomplished by first loosening the screws which clamp the Distributor Cap retaining clips into place. Failure to loosen these screws and prying the retaining clips loose could damage the cap and/or destroy the ability of the cap to seal the distributor causing the distributor to become vented and no longer sealed against possible ignition of fuel fumes if present.



Fig. 41

1. Remove the distributor cap. Clean the cap and inspect it for cracks, carbon tracks and burned-out or corroded terminals. Replace cap if necessary.

2. Make sure all distributor wire terminals are clean and tight.
3. Clean rotor and inspect for damage or deterioration. Replace rotor if necessary.
4. Inspect breaker assembly for damage, wear and dirty or badly pitted points.

NOTE: Use notch on the outer edge of the distributor cap as a guide for proper replacement of the cap. It is possible to install the cap incorrectly. If installed incorrectly, damage may occur and sealing of the cap to the distributor body will not be properly made.

Lubrication

Remove distributor cap every 100 hours and apply a small amount of suitable high-melting-point, non-bleeding grease on distributor cam surface.

ProTec™ Electronic Management System

Pleasurecraft is proud to announce the optional **PROTEC™ ELECTRONIC ENGINE MANAGEMENT SYSTEM**, the newest innovative development in the PCM product line.

Features

The **PROTEC™ ELECTRONIC ENGINE MANAGEMENT SYSTEM** is a totally integrated computerized ignition system designed to produce reliable performance unexcelled in the industry. Its features include:

1. Safety
2. Exceptional reliability
3. Simplicity in design
4. Versatility in function.
5. Maintenance free operation.
6. Improved appearance.

Description

PROTEC™ is an electronic ignition system with unique engine management capabilities incorporated into the processing unit.

The new components of **PROTEC™** consist of a combined computerized control module and coil assembly, sensor (trigger) activated by a new interrupter timing system (which replaces the conventional distributor), a new wiring harness, premium 8 M.M. silicone ignition wire, temperature and oil switches and a knock sensor.

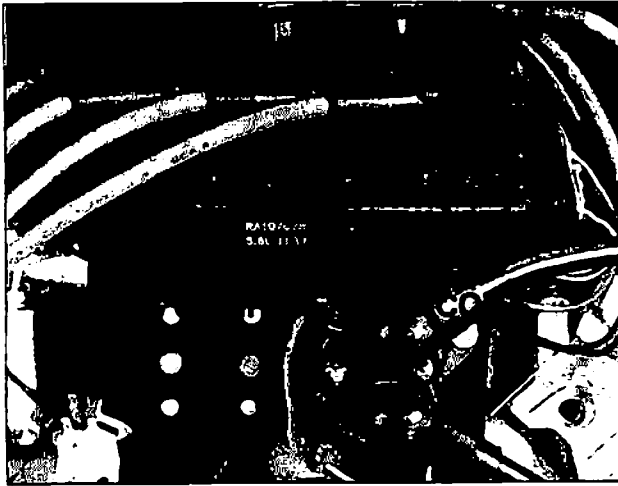


Fig. 42

Some of its functions include:

- A. Engine protection from low oil pressure and overheating.
- B. An economical cruise mode to insure the greatest possible efficiency.
- C. Engine damage protection from poor quality fuel and/or improper mechanical adjustments through its knock sensing feature.
- D. Solid state reliability in the electronic components of the ignition system.
- E. The ability to perform safely at peak performance levels using ignition settings impossible with conventional ignition systems.

Operation

The interrupter system consists of a circular disk with two rows of windows and vanes. The inner ring has two (2) windows and vanes and the outer ring has eight (8) windows and vanes.



Fig. 43

During cranking the interrupter system of the inner ring provides a signal that initializes the firing sequence through the inner gap in the sensor assembly. This establishes the

proper timing sequence by telling the computer that #1 cylinder is nearing top dead center position.

Once the timing sequence is initialized, the outer ring sensor causes firing to occur at the proper time, frequency and in the proper sequence. This outer ring sequence continues, following the programmed advance curve until the engine is shut off or until a system override, which forces the computer to engage an alternate mode, occurs. All alternate modes are disengaged and normal engine operation restored on engine shutdown and restarting. Anti knock and Cruise mode's also disengage when RPM's change.

IMPORTANT! If your engine will not run over 2500 RPM the limp mode may have engaged. Before seeking technical aid check your oil pressure and temperature gauges to determine if they are reading normally. IF A NORMAL READING IS INDICATED switch off the engine and immediately restart the engine to reset the system. If a normal reading is NOT indicated on the gauges seek technical help before operating the engine further.

Alternate modes include:

- A. **ANTI KNOCK MODE** - A reduction in timing is automatically made when engine knock is detected.

Upon detecting an engine knock the timing is automatically decreased to a safe (no knock) level.

- B. **LIMP MODE** - Reduction in engine RPM when an overheating or low oil pressure condition is detected.

The limp mode reduces the engine RPM to 2500 RPM maximum if the above described conditions are detected. The reduction may be accompanied by a rough running engine and possibly some back firing until the speed is stabilized at 2500 RPM's. The limp mode informs the operator that a problem exists and needs to be corrected without shutting the engine down which could be hazardous. Once the problem is corrected the engine system returns to the normal operating mode. The switching off of the ignition resets the system to the normal operating mode but if the problem is not corrected the system will return to the limp mode.

- C. **OVER REV PROTECTION** - Over-revving is prevented by an over-rev system which limits the maximum engine RPM's to 4900 to 5050 RPM's.

This feature prevents engine damage due to carelessness, operator error, mechanical failure in the drive train, or other possible causes of uncontrolled excessive RPM's.

Other Features

CRUISE MODE - One additional mode which is incorporated in the normal operation of the system is the cruise mode feature.

The cruise mode insures maximum economy for slow speed operation. Whenever, under 3200 RPM (3400 on the 454), the throttle is set in the same position for more than 30 seconds the timing automatically advances 8° (6° on the 454 and H/O Fords) to provide maximum fuel economy and power.

This feature is present even at idle and is the reason that the knock sensor must be disconnected when setting the timing AND ADJUSTING THE CARBURETOR at 700 RPM's.

Timing of the ProTec™ Engines *

	Static	700 RPM **	3600 RPM
FORD	10°	18° BTDC	30° BTDC
FORD H/O	10°	18° BTDC	26° BTDC
CHEVY 454	10°	18° BTDC	38° BTDC

Spark Plug Gap All Engines

.045"

* Static timing is given for interrupter installation purposes.

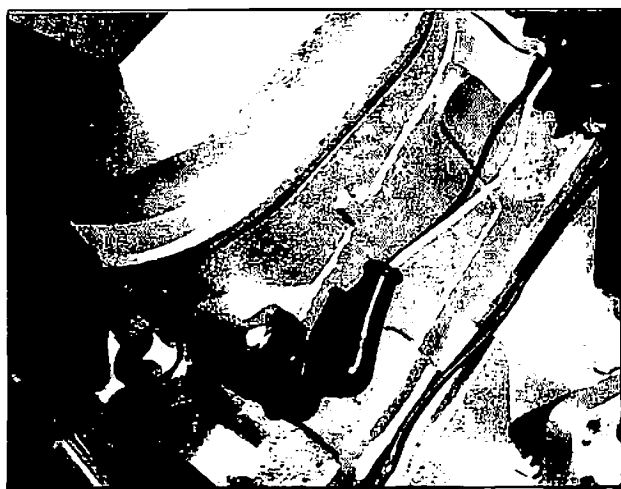


Fig. 44

** Knock sensor MUST be disconnected for this setting. It is recommended that timing is set using an advance compensating timing light. If only a standard timing light is available a second mark on the damper of the Chevrolet engine must be made at 1.300" to the right of

the current mark for LK and LN engine's and to the left of the mark for RK engines. This mark represents 18° advance and should be lined up with the 0° mark at 700 RPM to properly set the timing. The Ford damper has sufficient markings for all settings.

Interrupter (ProTec™ Engines)

On all PCM PROTEC™ engines the distributor has been replaced with an interrupter assembly. The interrupter requires no user maintenance and contains no serviceable parts other than the sensor assembly which is a sealed unit.

The interrupter has three (3) main parts, the cover, the housing assembly and the sensor assembly. The interrupter wheel has two (2) rows of vanes and windows which rotate within the two (2) openings of the sensor assembly. The inner row establishes the crankshaft position and the outer row controls the firing points.

All adjustments to speed and other operating conditions are made in the control module under the ignition coils. The only maintenance adjustment necessary with the PROTEC™ ignition system is setting the initial timing.

Spark Plugs

Inspection

1. Inspect each plug individually every 100 hours for badly worn electrodes, glazed, broken or blistered porcelain and replace where necessary.

NOTE: Spark plugs should be replaced after 200 hours of operation. Always use the recommended Spark Plugs. See specifications for your engine for proper numbers.

2. Inspect each spark plug for make and heat range. All plugs must be the same brand and number.

CAUTION: Never bend the center electrode to adjust gap. Always adjust by bending ground or side electrode.

3. Adjust spark plug gaps with a round feeler gauge. (See "Specifications.") Replace defective plugs.
4. Always keep spark plug seats in cylinder head clean.

NOTE: Improper installation is one of the greatest single causes of unsatisfactory spark plug performance and engine damage.

5. Install spark plugs to engine and torque to 15 ft. lbs. (2.07 mkg).
6. Replace or repair any loose or damaged spark plug wires. Install all wires to proper spark plug. Proper positioning of spark plug wires in supports is important to prevent cross firing. See illustrations in wiring diagrams for your engine model.

Cooling System

The Cooling System of each PCM Marine Engine incorporates a full circulation bypass system, permitting a full flow of water through the engine, even during warmup. Two heavy-duty marine-type pumps are used to accomplish this. A flexible impeller supply pump is used to keep the system full and cool the exhaust system; a high volume circulating pump maintains full water circulation to prevent steam pockets and hot spots and assure longer valve and piston ring life. A heavy-duty thermostat is used to control the amount of water which is discharged from the engine after the desired operating temperature is reached. The discharged water is automatically replaced by cool water from the supply pump, maintaining an unusually stable engine temperature through an exceptionally simple system. The hot water is discharged into the exhaust manifold water jackets, further heating the manifold to reduce condensation.

Should overheating occur, stop the engine immediately. Check the water intake and sea strainer, if equipped, and/or transmission cooler for obstruction by weeds, etc. (Plastic sandwich bags and similar containers effectively close off a water intake - DON'T LITTER!) Check water pump drive belts for tension and slippage. Inspect water intake hoses for kinks and bends.

On inboard and vee-drive models, check the transmission oil cooler for obstruction of the water tubes.

On all models equipped with engine oil cooler, check the engine oil cooler for obstruction of the water tubes.

A partial inspection of the flexible impeller of the supply pump can be made by removing the top hose and drive belt from the supply pump and looking into the pump chamber while slowly turning the pump pulley. A badly damaged impeller should be readily detected in most cases

If a problem is found and corrected, do not attempt to restart until the engine has cooled to normal limits. This is important to prevent engine damage due to thermal shock.

See lay-up instructions for inspection and/or replacement of the supply pump impeller.

In freezing weather, the cooling system must be drained of all water to prevent damage. Drains are located on both sides of the engine block, exhaust manifolds, oil coolers (if so equipped) and the elbow beneath the circulating water pump.

On inboard and vee-drive models, the transmission oil cooler may be drained by removing the lower hose or drain plug.

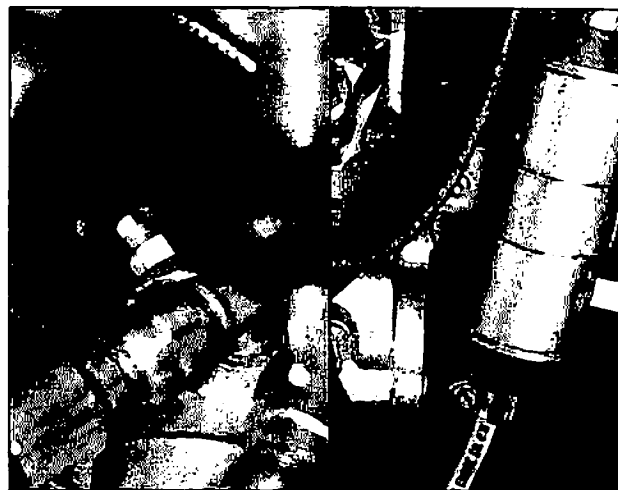


Fig. 45

On all models equipped with the engine oil cooler, the cooler may be drained by removing the lower hose or drain plug.

On all fresh water cooled models, with closed cooling systems, an anti-freeze solution of 50% clean water and 50% permanent type anti-freeze (such as Zerex and Prestone should be used). This solution should be left in the system and replaced once a year as an annual maintenance item. It is not necessary to drain these systems during freezing weather or lay-up, except for the following items:

- A. Exhaust Manifolds.
- B. Engine Oil Cooler-(if so equipped).
- C. Transmission Oil Cooler-(if so equipped).
- D. Raw Water Pump.
- E. Heat Exchanger-sea water portion only.
- F. All Hoses Which Carry Raw Water.

See Lay-up Instructions, Page 41 for full details.



Fig. 46

Flushing Instructions

NOTE: When engine is operated in salt water, flush it with fresh water periodically and before storage. If engine is flushed while boat is in water, water intake must have a sea water cock installed between water pickup and pump inlet.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. **IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER,** attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. **IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER,** run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

1. Close sea water cock (if flushing while boat is in water).
2. Remove hose clamp and inlet hose from water pump inlet.
3. Connect length of hose to pump inlet and city water tap and open tap.
4. Place the remote control lever in neutral position and start the engine. Operate the engine at 500 to 600 RPM in neutral gear until engine reaches normal operating temperature to circulate flushing water.

IMPORTANT: DO NOT increase engine speed above 600 RPM or water pump damage may occur.

5. Check that water is being discharged out exhaust outlets and watch water temperature gauge on instrument panel to prevent overheating.
6. Allow engine to run until discharge water is clear.
7. Stop engine and remove flushing hose. Fasten water intake line securely to pump inlet with hose clamp.
8. Open sea water cock before restarting engine.

Closed Cooling System Filling

Specifications

Capacity	16 Qts. for 302,351,305 and 350 engines. 24 Qts. for 454 engines.
Pressure cap	14 lb. (6.35kg) on all engines.
Coolant	50% Permanent type anti-freeze and 50% clean water.

Procedure

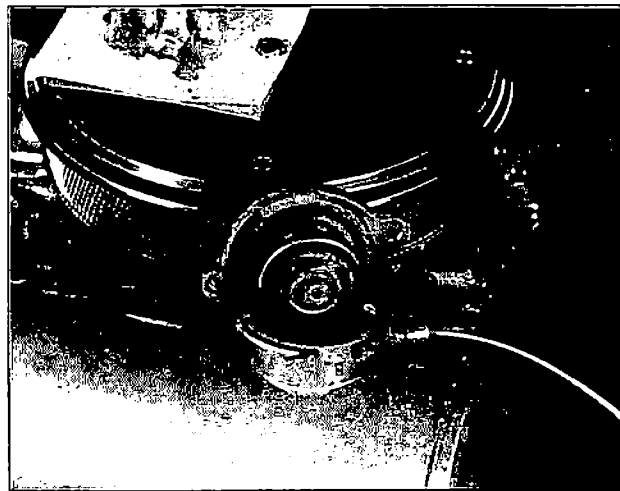


Fig. 47

1. Fill expansion tank with solution of clean water and permanent type anti-freeze. Mix to proportions of 50% clean water and 50% anti-freeze. If solutions are not premixed, pour 2 gallons of anti-freeze in systems first and complete filling with clean water slowly until tank runs over.
2. Start engine and run for 5 minutes.

CAUTION: Do not operate engine without cooling water flowing through water pump or Neoprene water pump impeller will become damaged. **IF RUNNING THE ENGINE WITH THE BOAT OUT OF THE WATER,** attach water hose to pump inlet and run engine slowly (650-700 RPM) in neutral to circulate water. **IF RUNNING THE ENGINE WITH THE BOAT IN THE WATER,** run the engine at 1,000 to 1500 RPM. Watch water temperature gauge to prevent overheating.

3. Stop engine and check coolant level in expansion tank. Normal coolant level will fill expansion tank halfway. (Add coolant, if necessary). If coolant level is above normal, excess will flow out overflow tube when engine reaches operating temperature.

IMPORTANT: Drain sea water section of cooling system if engine is removed from service in below freezing temperature.

4. Check coolant level after first open-throttle boat test.

CAUTION: Reservoir is equipped with a 14lb. (6.35kg) pressure cap. **DO NOT** remove the pressure cap when the engine is hot. To do so could cause personal injury. **ALWAYS ALLOW THE ENGINE TO COOL OFF BEFORE ATTEMPTING TO REMOVE THE PRESSURE CAP.** To remove the cap, turn it a quarter of a turn to the left and allow pressure in cooling system to escape. Then turn cap all the-way off.

Check coolant level periodically and add coolant if necessary. If level is excessively low, check system for leaks and repair as necessary.

Drain closed cooling system and fill with new coolant at least once each year.

Cooling System Anode Inspection

The anode installed in the seawater drain plug should be inspected for deterioration each 50 hours of operation. If the anode has eroded away more than 50% or crumbles when struck lightly with a small hammer, it should be replaced.

Draining Instructions

Fresh water section (Anti-freeze Section)

1. Remove fill cap from reservoir.

CAUTION: Reservoir is equipped with a 14 lb. (6.35kg) pressure cap. **DO NOT** remove the pressure cap when the engine is hot. To do so could cause personal injury. **ALWAYS ALLOW THE ENGINE TO COOL OFF BEFORE ATTEMPTING TO REMOVE THE PRESSURE CAP.** To remove the cap, turn it a quarter of a turn to the left and allow pressure in cooling system to escape. Then turn cap all-the-way off.

2. Remove drain plugs and open pet-cocks which are located as follows:

Heat Exchanger - One plug located in bottom of exchanger at the rear. Remove only the plug closest to the **FRONT** of the engine on Ford engines or closest to the **CENTER** of the engine on Chevrolet engines.

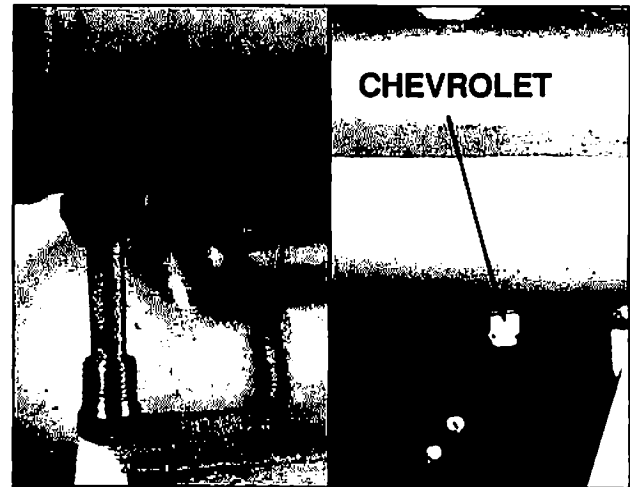


Fig. 48

Cylinder Block - Two plugs-one in each side of the cylinder block.

"Y" Fitting - (Ford engines only) One plug. On Chevrolet engines the hose attached to the circulating pump must be removed from the pump.

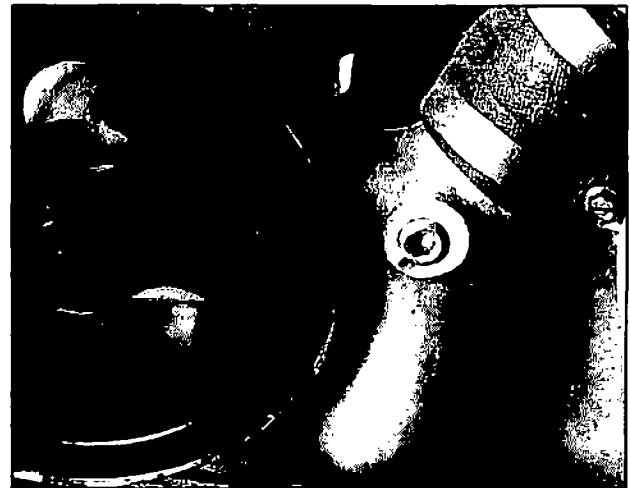


Fig. 49

3. After system has drained completely, coat threads on plugs with sealing compound, reinstall plugs.

Sea water section

1. Remove plug and anode from heat exchanger (rear). Remove only the plug closest to the **BACK** of the engine on Ford engines or closest to the **OUTSIDE** of the engine on Chevrolet engines.

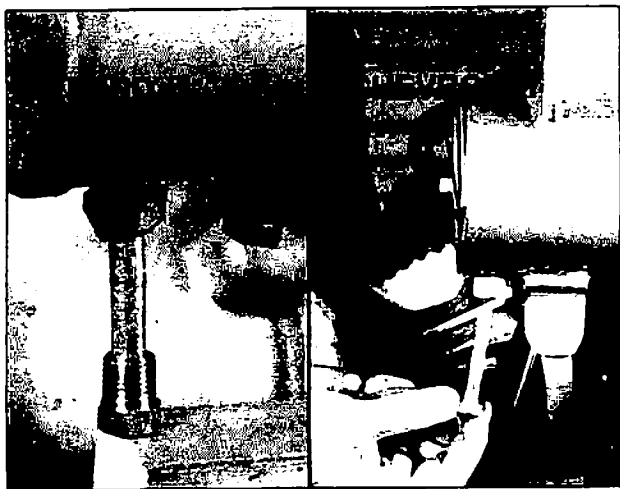


Fig. 50

2. Remove seawater intake hose from inlet side of sea water pickup pump.
3. Remove drain plugs from manifolds at front.
4. Remove plug from bottom of transmission cooler.
5. After system has drained completely, check anode as instructed above in Cooling System Anode Inspection, and reinstall hoses. Coat threads on plugs with sealing compound before installing, then reinstall plugs.

Cleaning seawater section of exchanger

NOTE: It may be necessary to remove heat exchanger from engine to properly clean it.

1. Remove plug from forward end and anode from rear most bottom of the heat exchanger.
2. Clean water passages by inserting a suitable size brush through each tube and flush with city water.
3. Seal plugs and replace in heat exchanger.
4. Tighten securely.
5. If heat exchanger is removed, Fill system according to the procedure under "Closed Cooling System Filling" and with the boat in the water, start the engine. Check for leaks.

Adjusting Water Pump Drive Belt Tension

1. Check belt tension by depressing upper strand of belt at point midway between the sea water and circulation pump pulleys.
2. Belt should depress 1/4" (6.35mm). If depression is more than 1/4", adjust tension by loosening water pump mounting screws and pivoting pump, as required, to obtain correct tension.
3. After correct tension has been set, tighten mounting screws.

Adjusting Alternator Drive Belt Tension

1. Check belt tension by depressing upper strand of belt at a point midway between the alternator pulley and the circulating water pump pulley.
2. Belt should depress 1/4" (12.7mm). If depression is more than 1/4", adjust tension by loosening alternator mounting screws and pivoting alternator, as required, to obtain correct tension.
3. After correct tension has been set, tighten mounting screws.

Transmission

Description Reverse Gear Section

The transmission consists of a planetary gear set, a forward clutch, a reverse clutch, an oil pump and a pressure regulator and a rotary control valve. All are contained in an aluminum housing (PCM Transmissions) or a cast iron housing (Warner Transmissions) along with the necessary shafts and connectors to provide forward, reverse and neutral operation.

A direct drive ratio is used for all forward operation. In reverse on the PCM transmissions, the speed of the output shaft is less than the input shaft and on the Warner transmissions the speed of the output shaft is equal to input shaft speed, but both transmissions turn in the opposite direction.

Shifting is accomplished by fore and aft movement of the shift lever. This movement rotates control valve and directs oil under controlled pressure to required channels.

Oil pressure is provided by the crescent type pump and drive gear which is keyed to the drive shaft. The pump operates at transmission input speed to provide screened oil to the pressure regulator.

From the regulator valve, oil is directed through proper circuits to bushings and anti-friction bearings which require lubrication. A flow of lubricant is present at the required parts whenever the front pump is turning and it should be noted that supply is positive in forward, neutral and reverse conditions.

The units have seals to prevent escape of oil.

Both input and output shafts are coaxial with input shaft splined for installation of a drive damper and output shaft splined for connecting to the coupling.

Precautions

1. Oil cooler must be properly connected to transmission before engine is cranked or started. Failure to properly connect oil cooler could cause seals or the forward clutch piston to blow out from over-pressurization.
2. Change oil once each season.
3. Check oil level prior to each use using the cold checking method. See "Procedure for checking oil" which follows.
4. Use clean containers for handling transmission fluid.
5. Fill transmission prior to starting engine.
6. Check oil level immediately after engine is shut off using the hot checking method. See "Procedure for checking oil" which follows.

7. Use recommended transmission fluids only. (See specification page for your model).
8. Flush cooler and cooler lines after a transmission failure and prior to installing a new or rebuilt transmission.
9. Check engine alignment once a season and each time a transmission is replaced in your boat.
10. Check shift linkage adjustment to insure that transmission shift lever is being positioned so that spring loaded ball enters the detent hole inside of shift lever, or contacts the stop pin in each selected position.
11. Check oil pressure and temperature when transmission operation indicates that a problem exists.
12. **ALWAYS CHECK PUMP ROTATION PRIOR TO ASSEMBLING TRANSMISSION TO ENGINE** to ensure that the pump is properly indexed for engine rotation.
13. Except in emergency, do not shift at engine speeds above 1200 RPM.
14. Never remove oil cooler lines or use lines smaller than the recommended 13/32" (10mm) inside diameter cooler lines when operating the transmission.
15. A thread sealant must be used on pipe threaded hydraulic connections to prevent hydraulic fluid from leaking.

Procedure for Checking Oil Level

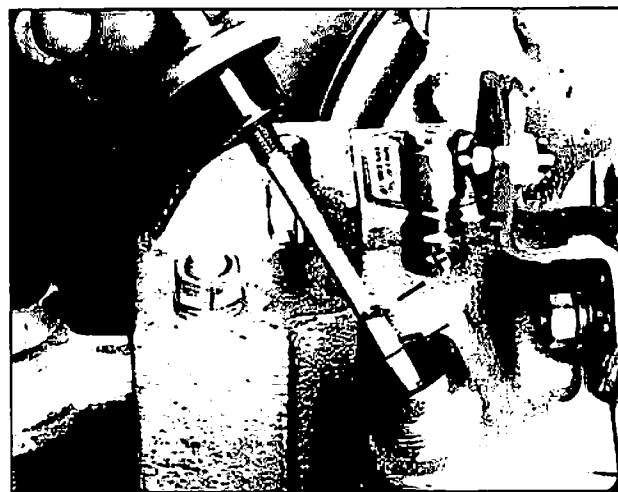


Fig. 51

Warner

Oil level should be checked **IMMEDIATELY** AFTER STOPPING ENGINE and sufficient oil added to again bring transmission oil level to full mark on dipstick assembly.

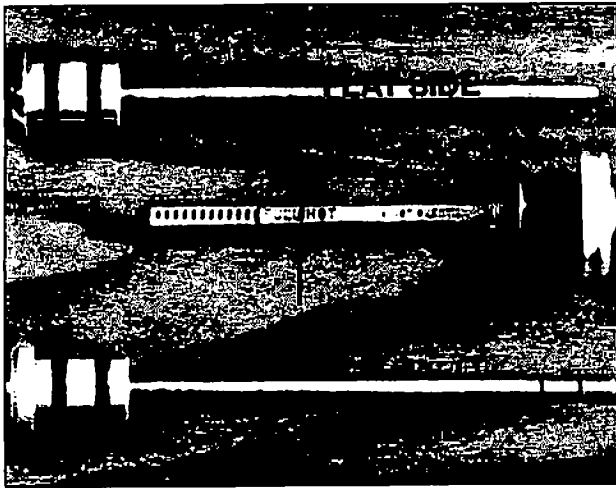


Fig. 52

NOTE: PCM ADDS A MARK ABOVE THE FULL MARK INDICATED ON THE DIPSTICK BY WARNER. THE TOP MARK IS TO BE USED AS THE FULL MARK ON ALL PCM APPLICATIONS.

The dipstick assembly need not be tightened into the case to determine the oil level. Merely insert into case until cap or plug resets on surface surrounding oil filler hole.

Transmission should be checked prior to each use to assure proper oil level and oil should be added if necessary.

PCM

The new aluminum case PCM Transmission is the newest state of the art marine transmission available to the boating public. Available currently, in both 1:1 and 1.23:1 reductions, it has achieved an enviable record of reliability since its introduction.

The PCM transmission may be checked hot in the same manner as indicated in the Warner checking procedure. Due to the fact that many boaters check the transmission oil level cold prior to starting their engine, transmissions have been damaged by running with low oil levels. To prevent the possibility of damage because of the above described tendency PCM has marked their transmission dipstick in a dual manner so that the oil may be checked either hot, as indicated in the Warner procedure above or cold before starting the engine in the following manner.

In order to provide the means for the following checking procedure, we have changed the appearance of the dipstick in all PCM transmissions assembled to engines and shipped from our plant after July 15, 1990 by milling a flat side on the dipstick which extends 3/4" above the full mark on the 1.23:1 transmission and 1/2" above the full mark on the 1:1 transmission.

The flat side on the dipstick serves a dual purpose.

1. It makes the fluid level easier to read.
2. Additionally, on the 1:1 only, it provides a cold level "FULL" mark, the use of which is explain below.

Checking Fluid Level Cold PCM

On all PCM transmissions the following procedure must be used if the transmission fluid level is to be checked prior to starting and running the boat.

1. Clean the area around the dipstick opening.
2. Remove the dipstick from the transmission and wipe it dry.
3. Insert the dipstick into the transmission opening and let the dipstick rest by its own weight on the first o-ring. **DO NOT PUSH THE DIPSTICK INTO THE OPENING.**

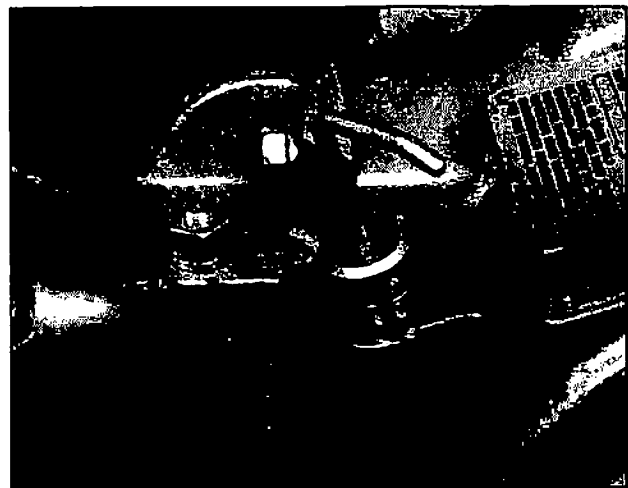


Fig. 53

4. Withdraw the dipstick and read the oil level as follows:
 - A. 1.23:1 transmission - The oil level should be ON THE FULL MARK.
 - B. 1:1 transmission - The oil level should be to the TOP OF THE FLATTENED SIDE of the dipstick.(1/2" above the FULL mark.)

Cold Oil Level Check (Warner)

For ease of checking the oil prior to engine start-up, a cold oil level mark can be made. To find the cold oil level mark, the oil level must first be set according to the warm oil level checking procedure. Then, let the boat sit overnight. Insert clean dipstick and read oil level.

Put a mark on the dipstick at the cold oil level reading.

You can use the new mark to check the oil level when cold. If oil level adjustment is needed, add oil to the new mark.

Changing Oil

It is recommended that transmission oil be changed once each season.

Draining Transmission Fluid

Prior to draining the transmission, run the engine until temperature gauge indicates normal operating temperature. The benefit of draining is lost, to a large extent, if the transmission is drained when the oil is cold, as some of the suspended foreign material will cling to the sides of the case and will not drain out readily with the cold, slower-moving oil. See waste fluid caution page #39.

Warner

The Transmission drain on engines equipped with Warner model 10-17 direct drive transmissions is located as shown in the following photo.



Fig. 54

On an engine equipped with Warner 10-18 1:1 and all reduction transmissions, the drain is located as shown in the following photo.



Fig. 55

PCM

All PCM transmissions are drained by removing the drain plug, located in the transmission adapter housing, using a 7mm allen wrench. (See following photo.)

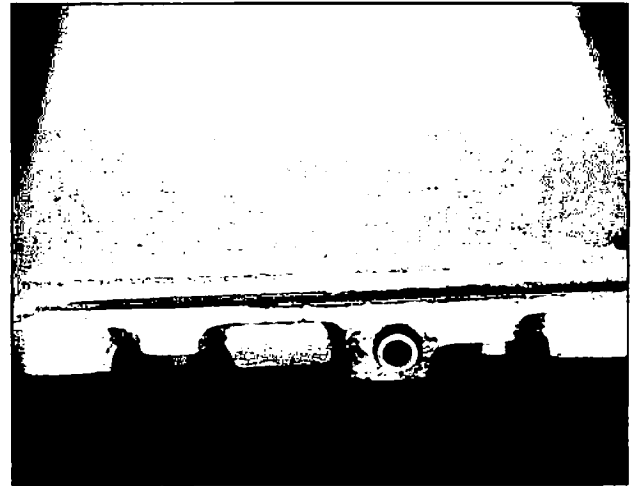


Fig. 56

Warner

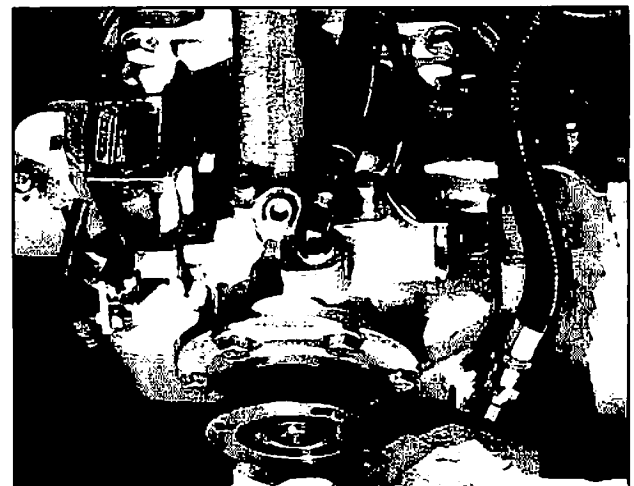


Fig. 57

1. Place a suitable container under drain location.
2. Remove the oil cooler hose from the elbow.
3. Remove reducing bushing from transmission case and remove strainer screen if so equipped and clean the screen.

NOTE: Only the 10-17 1:1 transmission has a removable screen.

4. Wash strainer screen with solvent and dry with compressed air.
5. After fluid has stopped draining, reinstall strainer, reducing bushing and oil cooler hose.
6. Fill transmission as outlined under "Filling Transmission," which follows.
7. Operate engine and check connections for leaks.

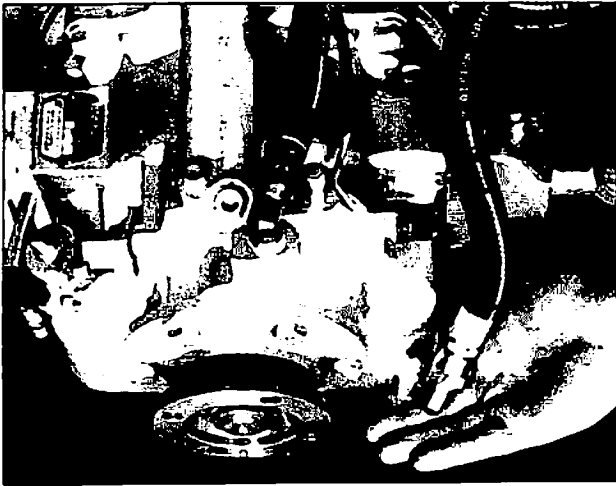


Fig. 58

PCM

1. Place a suitable container under drain location.
2. Remove the plug from the transmission.
3. Allow the transmission to drain completely.
4. Seal the plug with PST by Loctite or an equivalent sealer and reinstall the plug to 10 lb. ft..
5. Fill transmission as outlined under "Filling Transmission," which follows.
6. Operate engine and check connections for leaks.

Lubrication Recommendations

Warner Transmissions

The properties of the oil used in the transmission are extremely important to the proper function of the hydraulic system. Therefore, it is necessary that the recommended oil, automatic transmission fluid (ATF), Type "A", Suffix "A", be used. This fluid is currently known as "Dexron."

PCM Transmissions

PCM Transmissions all use "SG" rated 20 20W engine oil.

Procedure for Filling Transmission with Oil

NOTE: Oil capacity may not include capacity needed for transmission cooler and oil lines, which may require an amount greater than in the table following.

CAUTION: All engine waste fluids are considered hazardous waste. To avoid polluting and possible cite by authorities, be certain these waste fluids are properly disposed of.

Approximate Oil Capacity

Transmission Manufacturer	Transmission Model	Transmission Oil Capacity @ 0°	Transmission Oil Capacity @ 15°
PCM	1:1	2.0 Qt.	2.0 Qt.
PCM	1.23:1	2.0 Qt.	N/A
Warner	1:1	1.8 Qts.	1.3 Qt.
Warner	Reduction Gears	2.5 Qts.	2.7 Qt.
Warner	Vee Drives	1.0 Gal.	

Transmission should be run at engine idle speed for a short time in order to fill all circuits, including cooler and cooler piping before checking the oil level by using the following procedures.

NOTE: Be sure that cooler is properly installed and that transmission contains oil before cranking or starting the engine.

Filling Transmission

All Transmissions

When filling transmission, add oil until it reaches full mark on dipstick. Quantity of oil depends upon angle of installation. The information above is intended to serve as a guide for the amount needed for an initial fill.

IMPORTANT: Use only the proper oil as indicated in the specifications for your model and the Lubrication Recommendations above.

1. The boat must be at rest in the water.
2. Clean the area around the dipstick opening.
3. Remove the dipstick which is located on the port side of the transmission case.
4. Fill transmission through this opening until fluid level comes up to the proper point on the dipstick.
5. After bringing the fluid level up to the top mark as described in the "COLD" checking method for PCM transmissions, start engine and operate at idle speed for a short time to fill all circuits.
6. Stop engine and immediately check fluid level according to the "HOT" checking method. Add fluid as required, to bring level up to the proper point on the dipstick.
7. Place the dipstick into case and if a Warner, tighten.

V-Drive Transmission

1. On V-drive transmission, remove oil return line (upper hose) at oil cooler.
2. Place a suitable container under hose and lower hose below transmission. After fluid has stopped draining, reinstall cooler hose.
3. Fill transmission as outlined under "Filling Transmission," preceeding.

IMPORTANT: Oil level must be maintained at or slightly above full mark to insure lubrication reaching the V-drive of the transmission.

Lay-Up Instructions

Long periods of storage can adversely affect the internal parts of the engine and fuel system unless proper methods of preservation are used. Most marine or boat yards with storage facilities offer proper lay-up services. If such service is not available or not to be utilized, the following procedures should be followed. (* These instructions are applicable to all PCM Engines.)

(Prior to Haul-out, a through f)

- Treat the fuel remaining in the tank with STA BIL[®] or equivalent and run the engine to insure that treated fuel fills the fuel system.
- Warm engine up to normal operating temperature. Stop engine.
- Change crankcase oil and oil filter.

CAUTION: To prevent the possibility of an engine fire be sure that the engine compartment is well ventilated and that there are no gasoline vapors present during this operation.

- Restart engine and allow to idle for 5 minutes.
- Remove flame arrestor and shut off fuel supply from tank. With engine idling, SLOWLY METER, (DO NOT POUR) preservative oil, NUCLE OIL, Shell VSI, or comparable oil, into carburetor air intake until engine runs out of fuel. **GREAT CARE SHOULD BE TAKEN NOT TO INTRODUCE OIL TOO RAPIDLY. HYDROSTATIC LOCKING COULD OCCUR WHICH WOULD SERIOUSLY DAMAGE THE ENGINE.**
- Turn off ignition and remove spark plugs. Pour approximately 1 teaspoon full of preservative oil into each cylinder, through the spark plug hole, and turn the crankshaft several revolutions to spread the oil evenly throughout the cylinders. Install spark plugs, and connect the spark plug wires. (It will be necessary to remove spark plugs and spin engine to eliminate all possible oil prior to restarting after lay-up period.)

CAUTION: If using the starter to turn the engine for the above step or at any other time when the spark plug wires are not properly connected to the spark plugs, proceed as follows to prevent stray high voltage sparks from the spark plug wires which may shock you or ignite fuel vapors.

- On ProTec[™] engines, disconnect the electrical connector from the trigger assembly by pulling on the connector (not the wire) while lifting the lock tab.
- On point equipped engines, connect a jumper wire from the (-) neg. terminal (distributor side) of the ignition coil to the engine block.
- Turn the ignition switch to the start position and rotate the engine in three (3) to four (4) short cycles.
- Reconnect the electrical connector to the trigger assembly or remove the jumper wire and proceed to the next step.

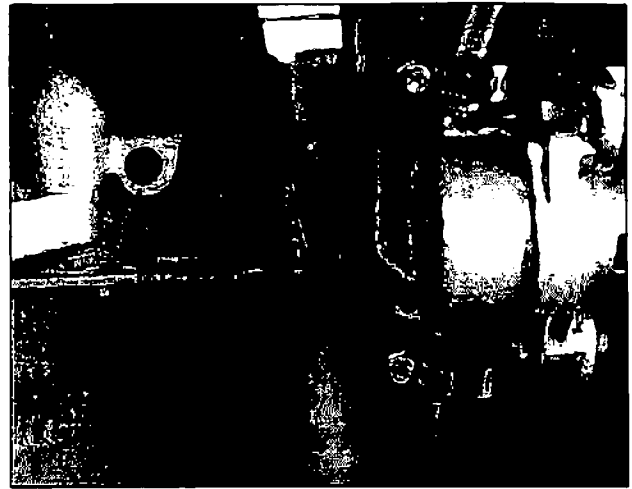


Fig. 59

(After Haul-out, f through q)

- g. Drain remaining fuel from carburetor bowl. Remove and empty the fuel filter shell, reinstall.

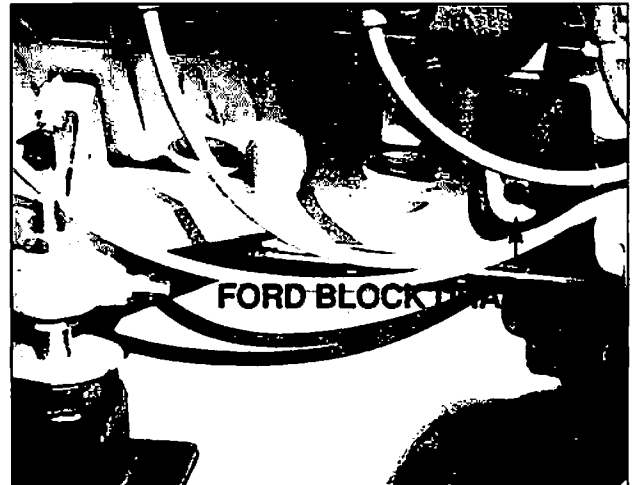


Fig. 60

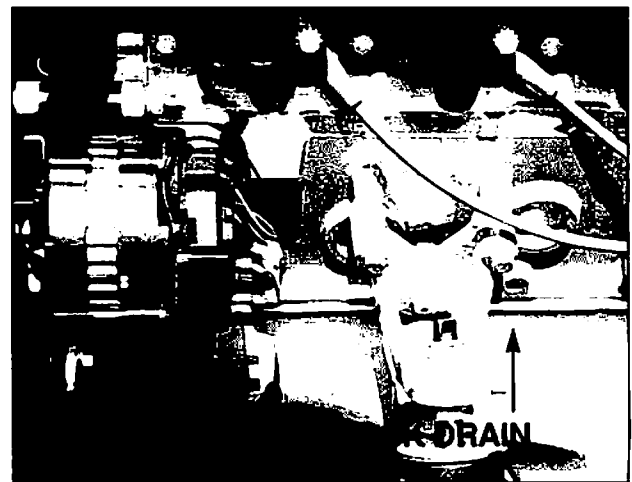


Fig. 61

- h. Remove drain plugs on both sides of the engine block and engine oil coolers (if equipped).

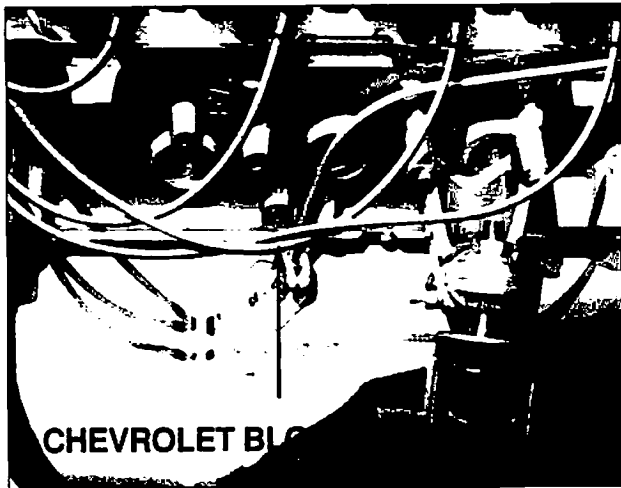


Fig. 62

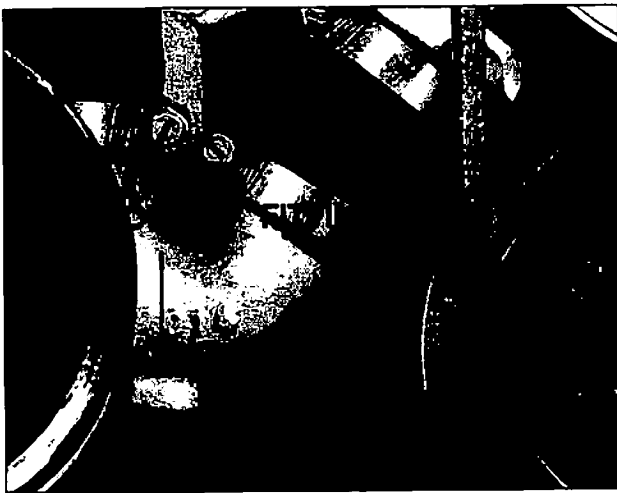


Fig. 63

- i. Remove plug from the transmission oil cooler and the elbow between the thermostat housing and the circulating pump. See Fig. XXX or remove hose from water pump on engine block of engines without elbows.



Fig. 64

- j. Remove drain plugs and/or hoses from rear or lower end of exhaust manifolds, both sides. Flush both manifolds by removing hoses from thermostat housing and using them to supply the manifolds for this flushing with a garden hose. (The Block of engines not equipped with fresh water cooling should also be flushed if run in salt water or water with high silt content. Allow to drain thoroughly.) Probe holes with a short piece of wire to insure that all water is drained from the engine.
- k. When draining is completed, install the block drain plugs and securely install the plug in the water pump elbow or reinstall hose and reinstall manifold plugs.
- l. Remove the block feed hose from the connection on the raw water supply pump. Elevate the end of the hose to a level higher than the top of the thermostat housing and through the hose, fill the engine with a solution of 50% clean water and 50% of non-toxic food grade antifreeze. * This helps to prevent the drying out of seals and gaskets, prevents the formation of hard, dry, rust scale in the water jackets, and prevents freezing damage from isolated pockets of trapped water.
- m. When the system has been filled with the antifreeze mixture, reconnect and tighten the water hose to the water pump.
- n. Disconnect the hose from the inlet fitting of the raw water supply pump and lower the end to eliminate any water which may be trapped.

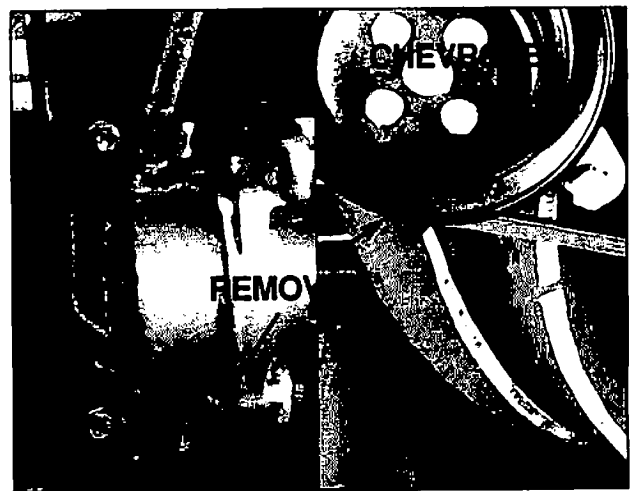


Fig. 65

- o. Remove the raw water supply pump and remove the impeller. If inspection proves the impeller to be in good condition, store it in an accessible spot for reinstallation at the end of the storage period. A damaged or badly worn impeller should be discarded and a new one installed at the end of the storage period. (Removal of the impeller during storage will prevent the impeller vanes from drying and taking a permanent "set.")
- p. Loosen water pump and alternator drive belts. (After lay up, re-tighten to proper tension before starting engine.)
- q. Remove battery and store in an area where above-freezing temperatures are maintained. Check electrolyte level and

fill if temperatures are maintained. Batteries should be placed on a trickle charger or charged at regular intervals during storage to prevent sulfation of the plates.

CAUTION: WHEN REINSTALLING THE BATTERY AFTER LAY-UP, BE SURE IT IS FULLY CHARGED AND TAKE CARE NOT TO REVERSE THE TERMINALS. CONNECT NEGATIVE (-) TERMINAL TO GROUND.

- r. On fresh water cooled models with antifreeze in the cooling systems, eliminate steps h, k, l and m. In step "j", remove hoses from the rear of the manifolds for draining. (Plugs referred to have been replaced with hose fittings on fresh water cooled models.) Drain raw water from heat exchanger, oil coolers and all raw water lines. Be sure the antifreeze solution is strong enough to offer full protection against freezing. Exhaust pipes and carburetor air intakes should be closed off during prolonged storage periods to minimize condensation inside the engine.

Antifreeze should be changed after lay-up each year.

Winter Storage of Batteries

Battery companies are not responsible for battery damage either in winter storage or in dealer stock if the following instructions are not complied with:

1. Remove battery from its installation as soon as possible, be sure that vent caps are tight and wash first with a diluted ammonia or soda solution to neutralize any acid present and then flush off with clean water to remove all grease, sulfate and dirt from top surface by turning a hose on top of battery. Wipe off all excess water thoroughly with clean rags. Check water level making sure that plates are covered.
2. When adding distilled water to battery, be extremely careful not to fill more than 3/16" (4.8mm) above perforated baffles inside the battery. Battery solution or electrolyte expands from heat caused by charging. Overfilling battery will cause electrolyte to overflow (if filled beyond 3/16" above the baffles).
3. Grease terminal posts well with cup grease or Multipurpose Lubricant and store battery in COOL-DRY place. Remove battery from storage every 30-45 days, check water level and put on charge for 5 to 6 hours at 6 amperes. **DO NOT FAST CHARGE!**
4. If specific gravity drops below 1.240, check battery for reason and recharge. When gravity reaches 1.260, discontinue charging. To check specific gravity, use a hydrometer, which can be purchased locally.
5. Repeat preceding charging procedure every 30-45 days, for as long as battery is in storage, for best possible maintenance during inactive periods to insure a good serviceable battery in spring. When ready to place battery

back in service, remove excess grease from terminals (a small amount is desirable on terminals at all times), recharge again as necessary and reinstall in your equipment.

WARNING: Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame near the vent openings can cause this mixture to ignite and explode. Sulfuric acid in the battery can cause serious burns if spilled on the skin or in the eyes. Proper eye protection should be worn when performing battery maintenance. Flush or wash away acid spills immediately with clear water. Contact a physician for medical treatment if acid comes in contact with your body.

Recommissioning

1. * Assemble water pump and reinstall on engine.
2. Install battery, making sure that it is in fully-charged condition. Clean and lubricate terminals.
3. ** Check cooling system to be sure all hoses and the water pump are properly attached.
4. Readjust alternator drive belt and water pump drive belt tension.
5. Check engine alignment.
6. Check engine and transmission oil levels.
7. Check engine mount fasteners.
8. Before starting engine, refer to "Starting and Operating" instructions, pages 5,6 and 7.

*Ford Engines 302 & 351

The Water Pump should be installed with the cam screw out (away from the block) on all PR Engines and in (towards the block) on all PL Engines.

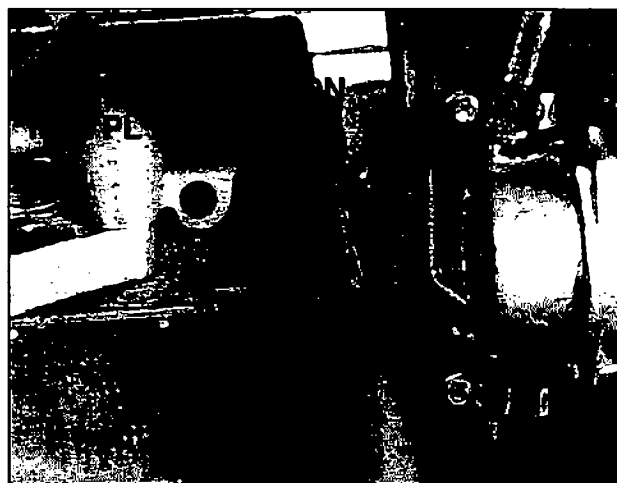


Fig. 66

*Ford Engine 460

The Water Pump should be installed according to the direction of engine rotation as explained on the pump end plate.

**Chevrolet Engines

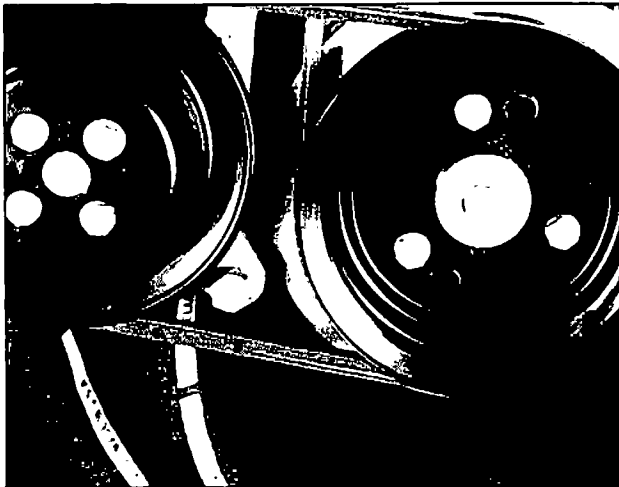


Fig. 67

Hoses on all "PL" model Engines, as indicated on the Engine Serial Plate, should be attached to the water pump as illustrated above. On all "PR" Engines, hoses should be reversed when installed.

GLOSSARY OF TERMS

Aft	The back of the Boat.
Forward	The front of the Boat.
Port	The Left side of the Boat while looking forward.
Starboard	The right side of the boat while looking forward.
RH or Right Hand	Indicates Right Hand propeller or engine rotation.
LH or Left Hand	Indicates Left Hand propeller or engine rotation.
Clock Wise	Indicates rotation in the same direction as the rotating hands of a clock.
Counter Clockwise	Indicates rotation in the direction opposite to the rotating hands of a clock.
Fresh Water Cooling	Indicates a self contained cooling system which contains a coolant such as anti-freeze in a tank capped with a pressure cap.
Sea Water	A cooling system which uses the sea water Cooling only to cool all parts of the engine.
Model Number	The series of letters and numbers on the Serial Plate that describes the engine configuration and content. This series is common to many engines.
Serial Number	The unique six (6) digit identifying number on the Serial Plate that specifies only one engine.

Engine Troubleshooting

IMPORTANT: The following chart is a guide to aid you to find and correct minor engine malfunctions. If the problem has not been corrected after following the guide, DO NOT attempt further repairs. See your authorized PCM Dealer.

WARNING: Before attempting any checks or repairs, the battery cable MUST BE REMOVED from the battery to prevent possible personal injury or damage to equipment.

Trouble	Cause	What You Can Do About It
1. Starter won't turn engine.	A. Control lever not in neutral. B. Loose or corroded battery connections. C. Weak battery.	Make sure control lever is exactly in neutral. Tighten cables on battery. If corroded, clean as described under "Battery Maintenance." Check level of electrolyte and refer to "Battery Maintenance."
2. Engine won't start or is hard to start.	A. Empty fuel tank. B. Tank vent clogged. C. Shut-off valve closed. D. Clogged fuel filter. E. Choke not operating properly. F. Engine flooded. G. Fouled spark plugs or gap wrong. H. Cracked or dirty distributor cap or rotor. I. Poor connections or damaged ignition wiring.	Check fuel supply. Make sure vent is free of obstruction. Check valve to make sure it is open. Inspect fuel filter. Replace if necessary, as outlined under "Replacing Fuel Filter." Inspect carburetor choke linkage for any binding or obstruction. Do not attempt to start engine for at least 5 minutes. Inspect spark plugs. Clean and gap or replace. Inspect contacts and or surfaces. Clean or replace.
3. Poor idling or engine misses while idling.	A. Choke not operating properly. B. Corroded wire ends or distributor cap towers. C. Fouled spark plugs or gap wrong. D. Weak battery. E. Cracked or dirty distributor cap or rotor. F. Loose spark plug wires.	Check wires for wear or breaks and tighten all loose connections. Inspect carburetor choke linkage for any binding or obstructions. Check wires and towers for corrosion. Clean or replace. Inspect spark plugs. Clean or replace. Check level of electrolyte and refer to "Battery Maintenance." Inspect contacts and surfaces. Clean or replace.
4. Engine misses on acceleration or at high speed (loss of power).	A. Fouled spark plugs or gap wrong. B. Cracked or dirty distributor cap or rotor. C. Poor connections or damaged ignition wiring.	Check both ends of each wire to ensure good contact to plug and distributor cap. Inspect plugs, clean or replace. Inspect contacts and surfaces. Clean or replace.
5. Oil pressure drop.	A. Low oil level. B. Clogged oil filter.	Check wires for wear or breaks and tighten all loose wiring. Refer to "Maintaining Engine Oil Level." Refer to "Draining Engine Oil and Replacing Oil Filter."
6. Engine backfires.	A. Spark plug leads installed wrong.	Make sure correct lead is installed on proper plug and proper tower on distributor cap. Refer to "Alternator Charging System."
7. Alternator will not charge or has low output.	A. Drive belt loose. B. Connections loose or dirty. C. Unacceptable battery condition.	Inspect connections for corrosion and tighten all loose connections. Check level of electrolyte and refer to "Battery Maintenance."
8. Performance loss and poor acceleration.	A. Throttle not fully open. B. Excessive water in bilge. C. Boat overload. D. Tank vent clogged. E. Clogged fuel filter. F. Fouled spark plugs or gap wrong.	Inspect cable and linkage for binding or obstruction. Drain or pump water out of bilge. Reduce load. Make sure vent is free of obstruction. Inspect fuel filter. Replace if necessary, as outlined under "Replacing Fuel Filter." Inspect spark plugs. Clean or replace.

Carburetor Problem Diagnosis

Flooding or Leaking Carburetor	Cracked carburetor body, or fuel bowl. Defective main body and or fuel bowl gasket(s). High fuel level or float setting. Fuel inlet needle not seating properly or worn needle and/or seat. Ruptured accelerating pump diaphragm. Excessive fuel pump pressure.	Defective power valve gasket. Ruptured power valve diaphragm. Loose fuel inlet needle valve seat or seat gasket damaged or missing. Sticking and/or restricted float operation. Float tab surface rough. Dirt or foreign material in fuel holds float needle valve open.
Hard Starting	Incorrect setting of choke thermostatic spring housing. Improper starting procedure, causing a flooded engine. Improper carburetor fuel level. Improper idle adjustments. Sticking or incorrectly seating fuel inlet needle. Incorrect fuel pump pressure.	Improper carburetor gasket and/or spacer combination. Choke linkage or plate binding. Binding or broken manual linkage. Restrictions or air leaks in the choke vacuum or hot air passages. Dirty air cleaner element.
Stalling	ENGINE HOT OR COLD. Incorrect idle fuel mixture. Engine idle speed too slow (fast or cold idle adjustments). Dirt, water or ice in fuel filter. Positive crankcase ventilation system malfunctioning or restricted. Fuel lines restricted or leaking air.	Leaking intake manifold or carburetor gaskets. Carburetor icing (cold, wet or humid weather). Incorrect throttle linkage adjustment to carburetor. Clogged air bleeds or idle passages. Defective fuel pump. Excessive looseness of throttle shaft in bore(s) of throttle body. Fuel tank vent restricted.
Rough Idle	Improperly adjusted idle mixture screw. Throttle plates and/or throttle shaft bent or damaged. Throttle plates misaligned. Positive crankcase ventilation system malfunctioning or restricted. Idle adjusting needle(s) grooved, worn or otherwise damaged. Idle air bleeds restricted. Idle air or fuel passages restricted. Idle discharge holes not in proper relation to throttle plate(s). Excessive dirt in air cleaner. High or low fuel level or float setting.	Fuel inlet needle not seating properly, or worn needle or seat. Power valve leaking. Restricted air bleeds. Plugged idle fuel channel restriction. Air leak at carburetor mounting or intake manifold gasket. Plugged main metering jet. Accelerating pump discharge ball check or needle and/or weight not seating properly. Fuel pump pressure too low or excessive. Fuel siphoning from secondary main fuel system. Restriction in main fuel passage. Air leak below carburetor or at intake manifold gasket.
Poor Acceleration: Poor acceleration complaints fall under one of three headings: the engine is sluggish on acceleration, the engine stalls when accelerated, or the engine hesitates or develops a flat spot when accelerated. Poor acceleration is caused by either an excessively lean or rich mixture on acceleration and/or defects or improper adjustments in the ignition system.		
Lean Mixture on Acceleration Causes	Incorrect acceleration pump stroke adjustment. Low fuel pump pressure. Low fuel level or float setting. Air leaks between the carburetor and	Accelerating pump diaphragm defective. Sticking fuel inlet needle. Restriction in main fuel passage. Air leak at the throttle shaft caused by a worn throttle shaft.

**Lean Mixture on
Acceleration Causes**
(continued)

manifold caused by loose mounting bolts or defective gasket.
Accelerating pump fuel inlet valve not seating on acceleration.
Accelerating pump discharge valve ball check or weight not coming fully off its seat, or failing to seat properly on the reverse stroke of the pump diaphragm.
Defective secondary diaphragm.
Secondary throttle plates wedged in barrels.
Bent secondary throttle shaft.
Secondary throttle plates operating rod secondary diaphragm or secondary throttle lever.

Secondary vacuum probe restricted or not properly positioned.
Power valve stuck.
Restriction in the accelerating pump discharge passage.
Air leak at the accelerating pump cover caused by a defective gasket or warped pump cover.
Defective power valve spring.
Air leak where the secondary vacuum pick up tube fits into air horn, between the air horn and the main body, or between the secondary diaphragm housing cover and housing.
Secondary vacuum passage ball check stuck on its seat.
Restricted secondary fuel passages.
binding or disconnected from

**Rich Mixture on
Acceleration Causes**

Broken power valve diaphragm.
High fuel level or float setting.
Malfunctioning automatic choke.
Incorrect accelerating pump stroke adjustment.
Restricted air bleeds.
Excessive fuel pump pressure.

Stuck or improperly adjusted secondary throttle air plates.
Fuel inlet needle not seating properly or worn needle or seat.
Excessively dirty flame arrestor.
Power valve leakage.
Worn or damaged main metering jet.

**Inconsistent Engine
Idle Speed**

Fast idle screw contacting low step of cam at curb idle.
Incorrect throttle linkage adjustment to carburetor.
Binding or sticking throttle linkage or accelerator pedal.
Sticking carburetor throttle shaft.

Excessive looseness of throttle shaft in throttle body bore.
Sticking fuel inlet needle.
Defective power valve or gasket.
Air leak at carburetor mounting or intake manifold gasket.

**Automatic Choke.
Slow Warm Up, On
Too Often or Long.**

Thermostatic choke setting too rich.
Choke linkage sticking or binding.

Incorrect choke linkage adjustment.
Choke plate misaligned or binding in air horn.

**Surging (Cruising
Speeds to Top Speeds)**

Defective power valve or improper size main jets.
Low fuel level or float setting.
Clogged filter or filter screen.

Clogged main jets.
Distributor advance incorrect.
Low fuel pump pressure or volume.

Reduced Top Speed

Excessive dirt in flame arrestor.
Float setting too high or too low.
Power valve spring weak or power valve restricted.
Restriction in main fuel passages.
Faulty choke operation.
Improper throttle linkage adjustment.
Secondary diaphragm return spring too stiff.
Secondary throttle plates wedged in barrels.
Bent secondary throttle shaft.

Secondary throttle plate operating rod binding.
Secondary damper linkage sticking.
Distributor advance incorrect.
Improper size or obstructed main jets.
Fuel pump pressure or volume too high or too low.
Restricted air bleeds.
Throttle plates not fully open.
Air leak where secondary vacuum pick-up tube fits into air horn and main body, or air leakage between the secondary diaphragm housing cover and or the air horn mounting gasket.

Spark Plug Diagnosis

Plug Conditions

Factors Causing This Condition

Corrective Action

Plug "Flash Over" (firing from upper terminal to base of the plug).

Dirty insulator tops - oil, dirt, and moisture on insulator will shunt current to base of plug. Above condition can be caused by failure of spark plug boot.

Keep plugs wiped clean with cloth moistened with cleaning solvent. Check spark plug boot and base, replace if necessary.

Lead Fouling (light and powdery or shiny glazed coating on firing end).

By-products of combustion and fuel additives, deposited as a powder which may later melt and glaze on insulator tip.

Remove deposits by blast cleaning. If this is not possible, plugs should be replaced.

Damaged Shell

Very seldom occurs, but cause is almost always due to mishandling by applying excessive torque during installation. This failure is usually in the form of a crack in the Vee of the thread next to the seat gasket or at the groove below the hex.

Replace with a new spark plug.

Oil or Carbon Fouling

Wet, black deposits on firing end of the plug indicate oil pumping condition. This is usually caused by worn piston rings, pistons, cylinders or sticky valves.

Correct engine condition. In most cases, plugs in this condition will be serviceable after proper cleaning and regapping.

Soft, fluffy, dry black carbon deposits usually indicate a rich mixture operation, excessive idling, improper operation of automatic choke or faulty adjustment of carburetor.

If troubles are not eliminated, use "hotter" type plug.

Hard, baked-on, black carbon deposits result from use of too cold a plug.

Use "hotter" type plug. **SEE CAUTION ABOVE!**

Normal Electrode Wear

Due to intense heat, pressure and corrosive gases together, with spark discharge, the electrode wears and gap widens.

Plugs should be regaped every 100 hours.

Rapid Electrode Wear

Condition may be caused by (1) burned valves, (2) gas leakage past threads and seat gaskets due to insufficient installation torque or damage gasket, (3) too lean a mixture or (4) plug too "hot" for operating speeds and loads.

Correct engine condition. Install plugs to specified torque. Use a new spark plug seat gasket each time a new or cleaned spark plug is installed. Use "colder" type plug if condition continues to exist.

Broken Upper Insulator (firing around shell crimp under load conditions).

Careless removal or installation of spark plug.

Replace with a new plug.

Broken Lower Insulator (firing tip)

The cause is usually careless regaping by either bending of center wire to adjust the gap or permitting the gaping tool to exert pressure against the tip of the center electrode or insulator when bending the side electrode to adjust the gap.

Replace with a new plug.

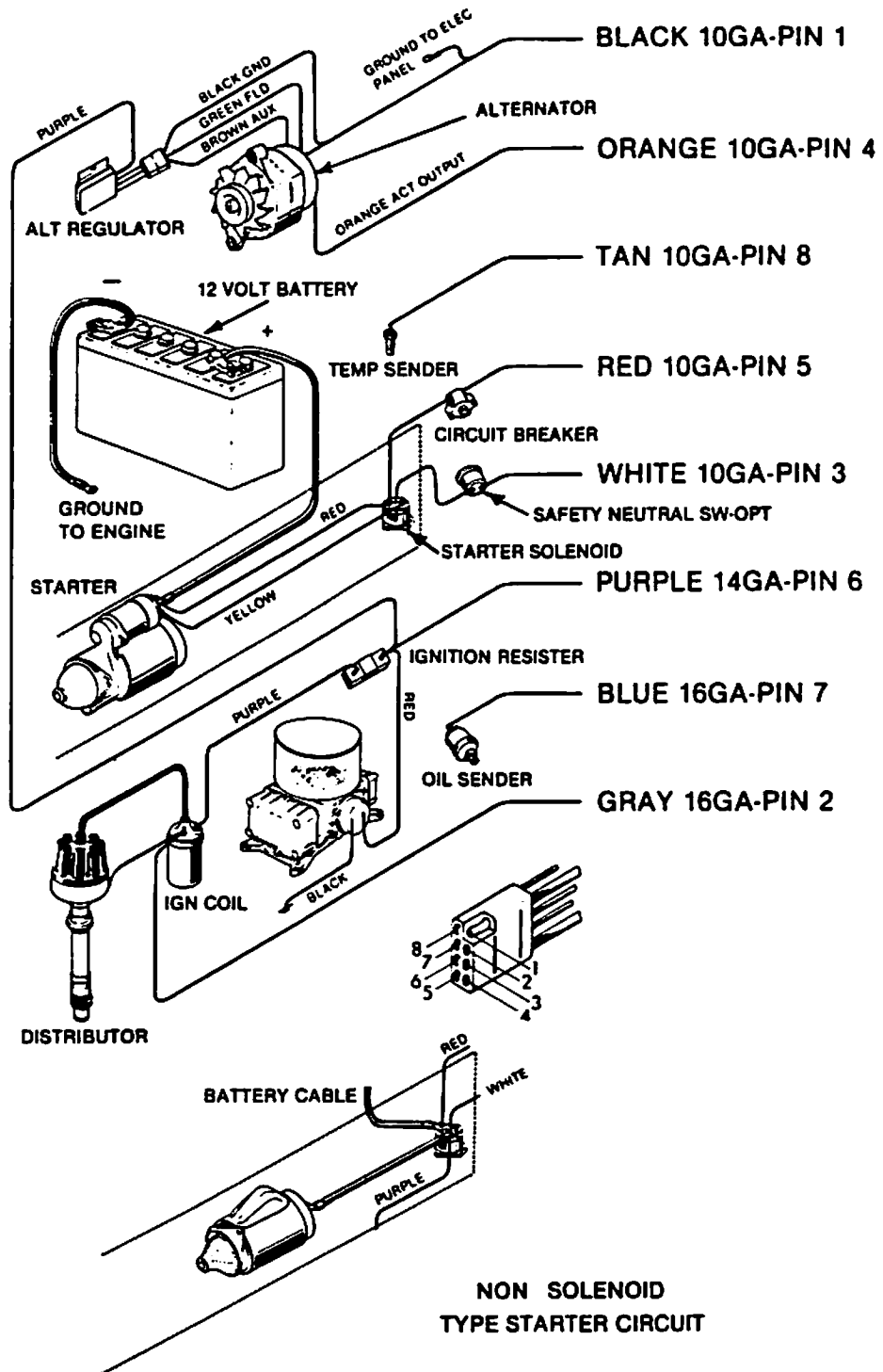
Fracture of or breakage of lower insulator may occur occasionally if the engine has been operated under conditions causing severe and prolonged detonation or pre-ignition.

Use "colder" type plug for the particular type of operation.

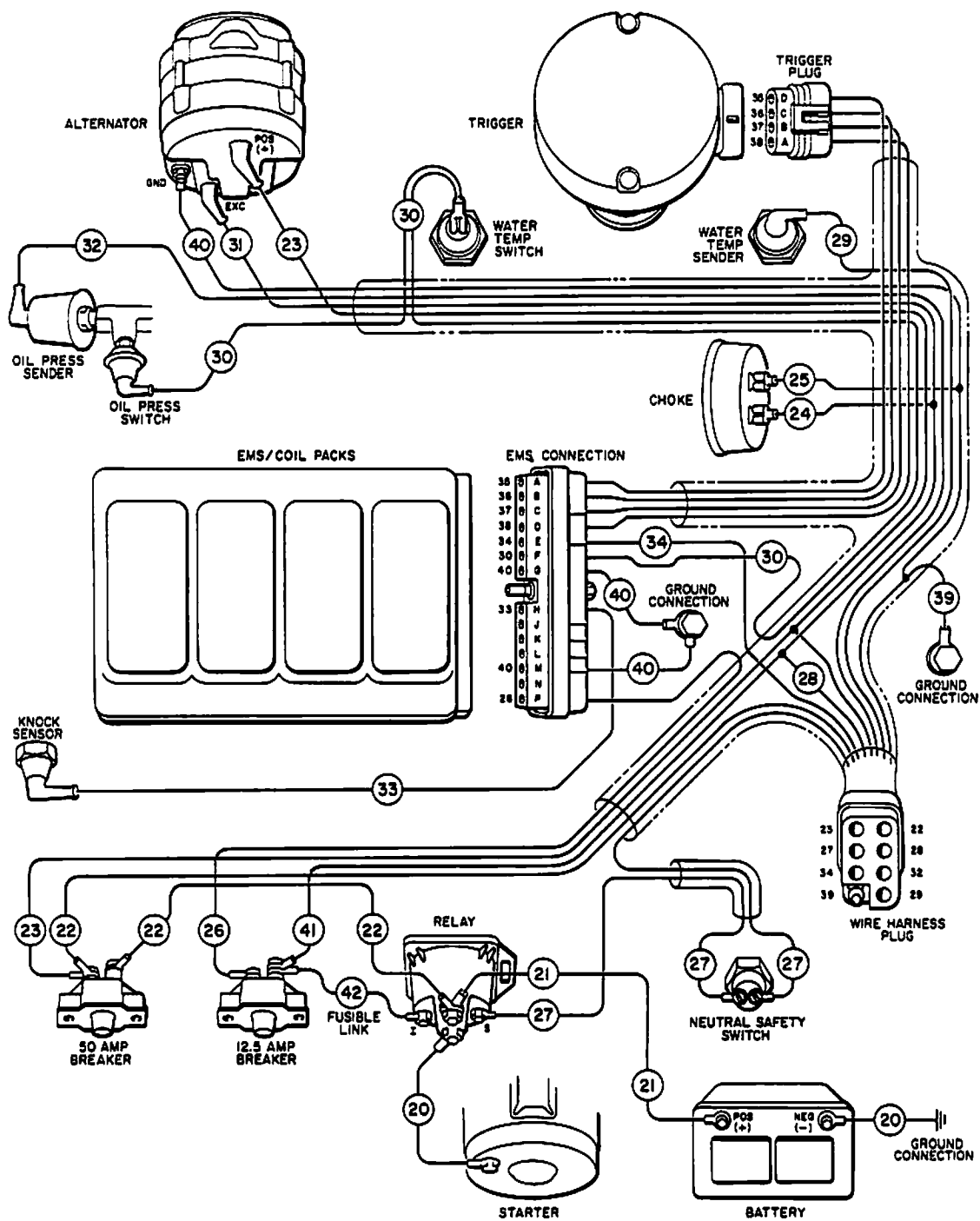
GENERAL WIRING DIAGRAM

GENERAL WIRING DIAGRAM

INCLUDING SOLENOID
TYPE STARTER CIRCUIT



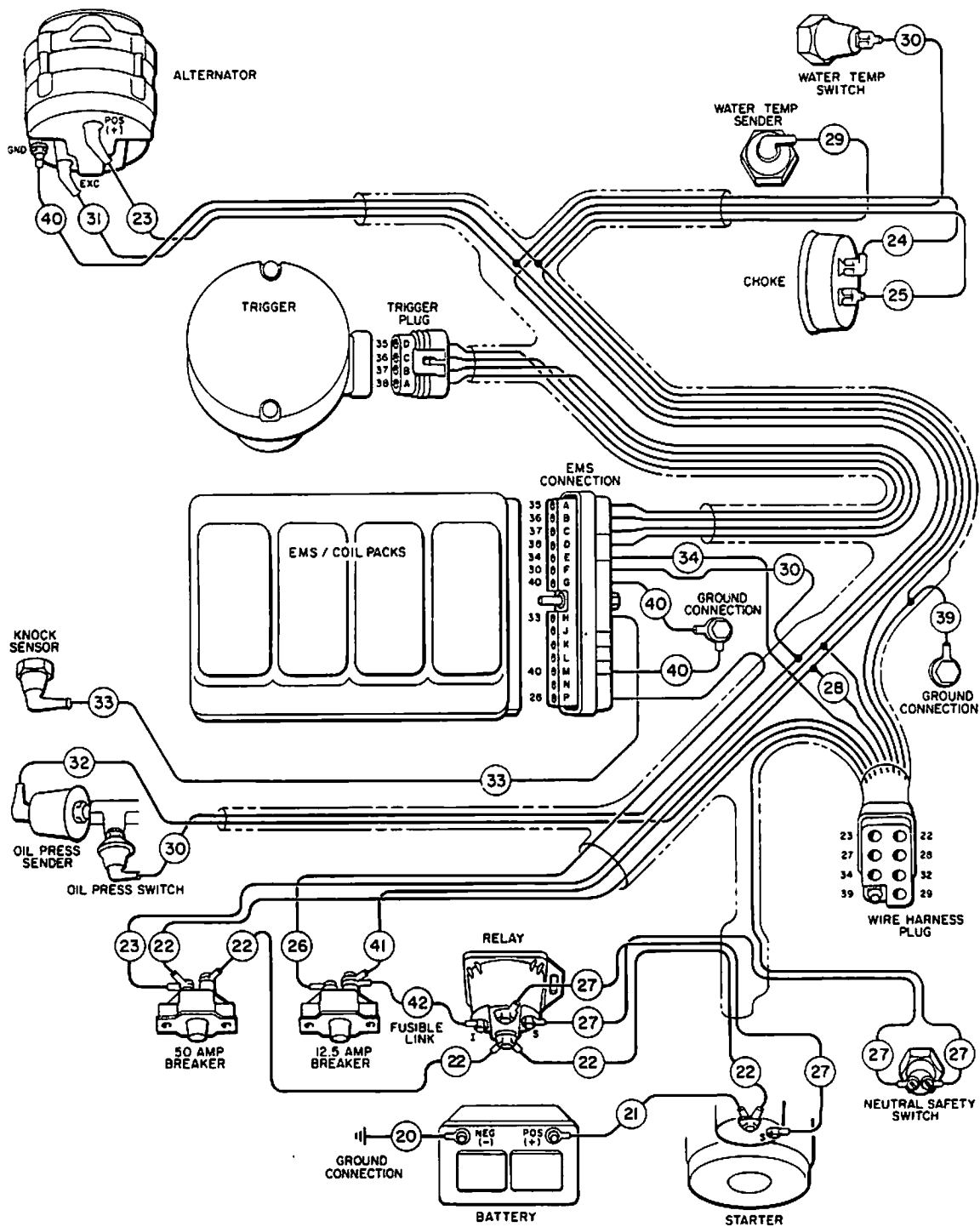
ENGINE WIRING DIAGRAM 351 FORD PRO-TEC™



PCM PLEASURECRAFT MARINE ENGINE COMPANY			
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ENGINE WIRING DIAGRAM			
351 FORD PRO-TEC			
Sheet number			

Fig. 69

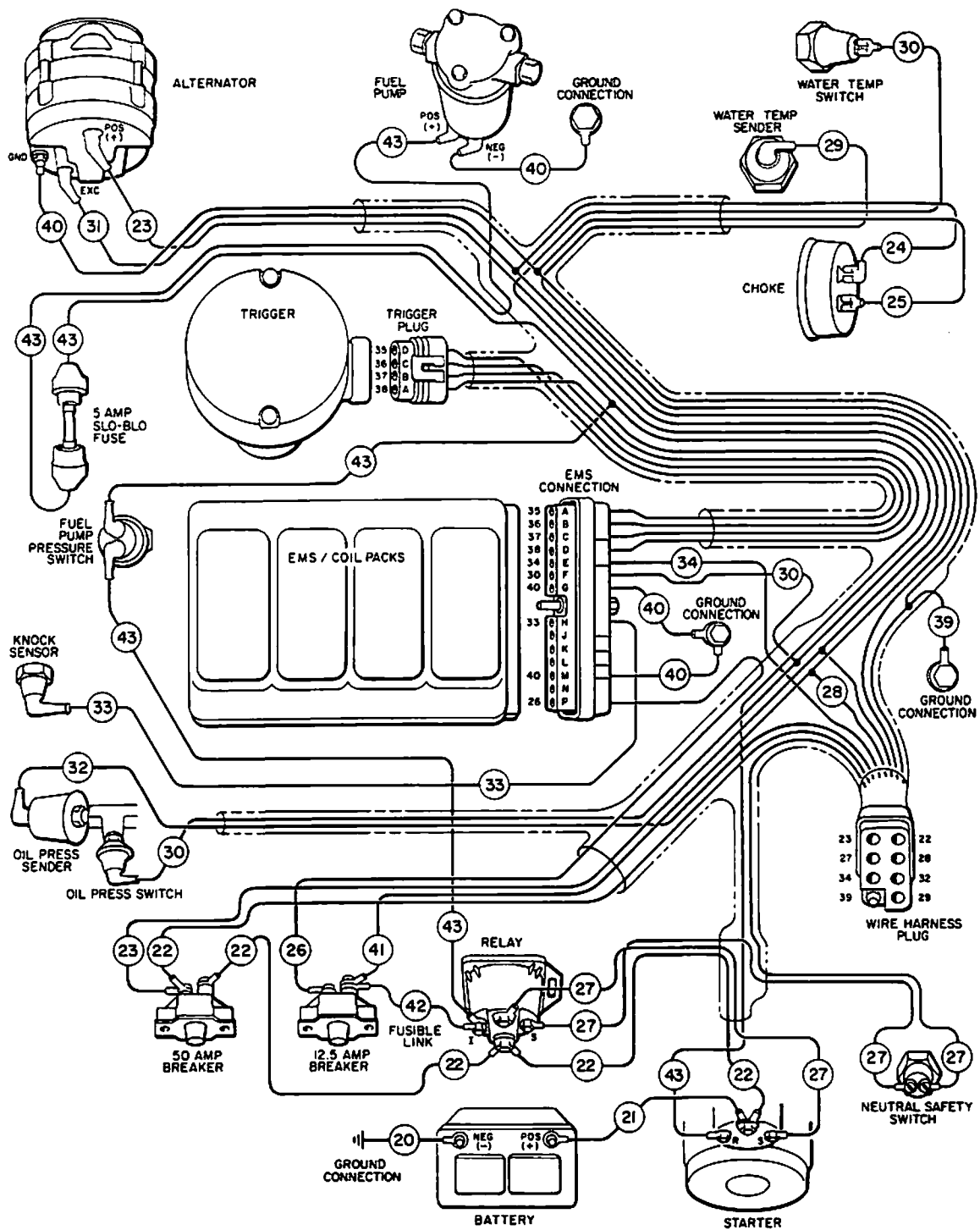
ENGINE WIRING DIAGRAM CHEVROLET PRO-TEC™



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ENGINE WIRING DIAGRAM CHEVROLET PRO-TEC	REVISION
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ENGINE WIRING DIAGRAM

CHEVROLET PRO-TEC™ WITH ELECTRIC PUMP



PCM PLEASURECRAFT MARINE
ENGINE COMPANY

DATE	DESIGNED BY	REVISED BY
DATE	REVISED BY	REVISED BY
ENGINE WIRING DIAGRAM CHEVROLET PRO-TEC WITH ELECTRIC PUMP		
DRAWING NUMBER		

ACCESSORIES

The following accessories are available for your new PCM engine from your PCM and/or Boat dealer. All PCM accessories are engineered specifically for use with your PCM engines and insure ease of installation and excellent performance when properly installed. PCM does not recommend the use of these accessories on other engines nor the use of other accessories on PCM engines until they have been evaluated by the PCM Engineering Department and released by this Department.

PART NUMBER	DESCRIPTION	ENGINE
RK173020	On Board Spare Parts Kit	302 & 351
RK173022	On Board Spare Parts Kit	305 & 350
RK173021	On Board Spare Parts Kit	460
RK173023	On Board Spare Parts Kit	454
RK025009	Fresh Water Cooling Kit	302 & 351
Contact PCM	Fresh Water Cooling Kit	305 & 350
RK025011	Fresh Water Cooling Kit	460
Contact PCM	Fresh Water Cooling Kit	454
RK147002	Engine Oil Cooler Kit	302 & 351
RK079027	Remote Oil Filter Kit	305, 350 & 454
RK062003	2" Riser Extensions	All 3" Exhaust
RK024005	2" Riser Extensions	All 4" Exhaust
RK062032	2" Riser Extensions	All 3½" Exhaust
RK062004	4" Riser Extensions	All 3" Exhaust
RK062033	4" Riser Extensions	All 3½" Exhaust
RK024006	4" Riser Extensions	All 4" Exhaust
R027001	Dry Stack Flange	All 3" Exhaust
R027007	Dry Stack Flange	All 3½" Exhaust
R024026	Elbow 45°	All 3" Exhaust
R024034	Elbow 45°	All 3½" Exhaust
R024004	Elbow 80°	All 3" Exhaust
R024035	Elbow 80°	All 3½" Exhaust
R024027	Y Fitting	All 3" Exhaust
RK024033	Y Fitting	All 3½" Exhaust
R028007	Muffler	All 3" Exhaust
R060028	Exhaust Flapper	All 3" Exhaust
R060030	Exhaust Flapper	All 4" Exhaust
R027005	Thru Transom Flange	All 3" Exhaust
R027008	Thru Transom Flange 3½"	All 3½" Exhaust
RA152001	Instrument Panel & 20' Harness	All Engines
RK121012	Dual Station Adapter Kit	302 & 351
R121007	Wiring Harness Extension 20'	All Engines
R121014	Wiring Harness Extension 10'	All Engines
RA080008	Remote Mount Fuel Filter Kit	All Engines
RK065010	Aux. Pulley Kit	302 & 351

PCM Clothing, Shift Controls, Cables, Bracket Kits, Propellers, parts and assemblies of many drive and engine systems are also available. Consult PCM's Parts Catalog for complete listings.