



4.3L / 5.3L / 6.2L / LT4
MEFI 7 DIRECT INJECTION
ENGINE OWNER'S MANUAL

Table of Contents

SECTION 1: INTRODUCTION

PROPOSITION 65	1
SAFETY WARNINGS	1
REPLACEMENT PARTS	1
SAFE BOATING	2
WARRANTY	2-6

SECTION 2: SAFE BOATING

CARBON MONOXIDE EXPOSURE	6
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SECTION 3: ENGINE IDENTIFICATION

ENGINE TYPE	7
MODEL SPECIFICATIONS	8

SECTION 4: ELECTRONIC SEQUENTIAL FUEL INJECTION

INFORMATION	9
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SECTION 5: ENGINE ALARMS AND INSTRUMENTATION

DIGITAL ALARMS	10
INSTRUMENTATION	11

SECTION 6: SSVEC FUSE AND RELAY ENCLOSURE

SECTION 7: PRECAUTIONS

OIL LEVEL	16
HYDROLOCK	16

SECTION 8: ENGINE OPERATING INSTRUCTIONS

GASOLINE REQUIREMENTS	17
OIL REQUIREMENTS	17
STARTING ENGINE EFI	17
ENGINE BREAK-IN/25 HOUR INSPECTION	17-18

SECTION 9: WINTERIZATION

4.3/5.7L RAW WATER COOLED ENGINES	19
FULL CLOSED COOLED ENGINES	20

HALF CLOSED COOLED ENGINES	21-22
FULL CLOSED INBOARD JET ENGINES	23

SECTION 10: ENGINE MAINTENANCE

SCHEDULED MAINTENANCE BY OWNER	24
SCHEDULED MAINTENANCE BY QUALIFIED TECHNICIAN	25
CRANKCASE OIL CHANGE	26
OIL FILTERS	27
FLAME ARRESTOR	28
G-FORCE FUEL SYSTEM	28
BATTERY CABLES	29
MULTIPLE ENGINE BATTERY PRECAUTIONS - EFI	29
ALTERNATOR BELT TENSION	29
SEA WATER PUMP IMPELLER REPLACEMENT	29
CLOSED COOLING SYSTEM	30
FILLING CLOSED COOLING SYSTEM	30-31

SECTION 11: ENGINE DIAGNOSTICS AND CODES

SECTION 12: TROUBLE SHOOTING

ENGINE WILL NOT TURN OVER	35
ENGINE CRANKS BUT WILL NOT START	35
ENGINE RUNS POORLY AT HIGH RPM	36
HIGH SPEED MISS	36
FUEL SYSTEM - RICH	37
FUEL SYSTEM - LEAN	37
POOR FUEL ECONOMY	37
ENGINE STARTS AND STOPS	38
OIL PRESSURE - LOW	38
OIL PRESSURE - HIGH	38
EXCESSIVE OIL CONSUMPTION	39
ENGINE OVERHEATING	39
WATER IN ENGINE CYLINDER OR BASE	40

SECTION 13: INSTALLATION INSTRUCTIONS

ENGINE COMPARTMENT	41
ENGINE MOUNTING	41
ENGINE ROTATION	41
ENGINE BED	41
COOLING SYSTEM	41-42
EMISSION-RELATED INSTALLATION INSTRUCTIONS	42
EXHAUST PIPING	42-43
ELECTRICAL CONNECTION	43
BATTERIES	43
DUAL ENGINES	43
BATTERY ISOLATORS	43
ENGINE BATTERY SPECIFICATIONS	44
BATTERY CABLE LENGTH REQUIREMENTS	44
SPECIAL FUEL INSTRUCTIONS FOR 6.2 550 HP ENGINES	44
LTA AIRBOAT INSTALLATION NOTES	45
ADAPTER HARNESS	46
HEATER CONNECTIONS	47
PRESTART CHECKLIST	48
POTENTIOMETER OPERATION	49

WARRANTY REGISTRATION TRANSFER

SERVICE LOG

1. Introduction

Marine Power would like to thank you again for your purchase. The pleasure and peace of mind derived from your new engine is in direct proportion to the amount of care that it is given. We have tried to include as much as possible in our Engine Owner's Manual to help you as the customer. READ THIS MANUAL THOROUGHLY AND COMPLETELY before attempting to operate your Marine Power engine. We ask that you become familiar with the components and the maintenance schedules. If you have any questions or concerns regarding this manual or your newly purchased Marine Power engine, please feel free contact your nearest Marine Power dealer or distributor.

Proposition 65

WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

"Safety Warnings" and additional information or instructions are used to alert the installer/operator of possible safety hazards in performing certain service or maintenance procedures incorrectly or carelessly.

These "Safety Warnings" alone cannot eliminate the hazards that they signal. Strict compliance with these warning instructions while performing service and maintenance procedures, plus "common sense" operation, are major accident prevention measures.

Safety Warnings

DANGER

Signals serious damage, failure or breakdown of equipment; severe injury or high probability of death to the user if proper precautions are not taken. This signal word is applied in extreme situations.

WARNING

Indicates a potential hazard which could result in personal injury.

CAUTION

Indicates a hazard which could result in damage to equipment.

Replacement Parts

Use of replacement parts (i.e. automotive, after-market, etc.) in the electrical, ignition and fuel systems, which are not U.S. Coast Guard approved, could cause a fire or explosion hazard and must be avoided.

Always request that genuine Marine Power engine replacement parts be used in any repairs or maintenance being performed on your engine(s).

DANGER

Electrical, ignition and fuel system components are designed and manufactured to comply with U.S. Coast Guard rules and regulations to minimize the possibility of fire or explosion hazard.

WARNING

The LT4 Is a Premium 93 Octane REQUIRED engine. The engine will operate at significantly reduced power output with octane levels down to 90. Operating the LT4 on fuel below 90 Octane can result in engine damage and or failure! Such failure will not be covered under warranty!

1. Introduction

Safe Boating

The waterways are becoming increasingly crowded and, in order to enjoy them safely, the operator should acquaint himself/herself with safe boating practices. Boating safely and seamanship courses are offered by the following national and state organizations:

- Power Squadrons
- Coast Guard Auxiliary
- Red Cross
- State, provincial or local agencies in charge of water safety enforcement

Marine Power recommends that all power boat operators attend one of these courses.

To help locate a course being offered near you, contact Boat U.S. Foundation's toll-free national boating safety hotline, 1-800-336-BOAT, and in Virginia, 1-800-245-BOAT.

The Federal Boat Safety Act of 1971 requires that registration of marine products sold in the United States be maintained by the manufacturer and dealers of those products. It is imperative that Marine Power Holding LLC receive your WARRANTY REGISTRATION/SEA TRIAL form properly completed for warranty purposes and to comply with federal regulation. This registration also enables us to contact you, if it should become necessary, to change or improve the product for your protection.

WARRANTY REGISTRATION MUST BE RECEIVED WITHIN 10 DAYS AFTER DATE OF PURCHASE BY FIRST OWNER.

Please read the Limited Warranty document that is included with your engine registration papers and in this manual. This document explains your warranty coverage. Please note that no warranty repairs are to be performed without prior authorization from the Marine Power Distributor in your area. Contact your selling dealer directly for any required warranty repairs.

For more information, you may also visit our web site at www.marinepowerusa.com.

Again, thanks for choosing Marine Power.

**CALIFORNIA AND U.S. ENVIRONMENTAL PROTECTION AGENCY
EMISSIONS CONTROL WARRANTY STATEMENT**

Your Warranty Rights and Obligations

The California Air Resources Board, U.S. E.P.A., and Marine Power Holding LLC are pleased to explain the emission control system warranty on your inboard engine. New Inboard engines must be designed,

built and equipped to meet California and EPA's stringent anti-smog standards. Marine Power Holding LLC must warrant the emission control system on your Inboard engine for the periods of time listed on the next page, provided there has been no abuse, neglect or improper maintenance of your inboard engine.

Your emission control system may include parts such as fuel injection system, the ignition system and catalytic converter. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Marine Power Holding LLC will repair your inboard engine at no cost to you, including diagnosis, parts and labor.

1. Introduction

Manufacturer's Warranty Coverage

Engine Type	Power Rating	Electronic Components	Mechanical Components
Conventional - OEM	Less than or equal to 373 kW (500 HP)	3 Years or 480 Hours	3 Years or 480 Hours
Hi-Performance - OEM	Between 373 kW (500 HP) and 485 kW (650 HP)	3 Years or 150 Hours	3 Years or 150 Hours
Complete Engine Repower	Less than or equal to 373 kW (500 HP)	2 Years or 300 Hours	2 Years or 300 Hours
Complete Engine Repower	Between 373 kW (500 HP) and 485 kW (650 HP)	1 Year or 150 Hours	1 Years or 150 Hours
Special Applications	All	1 Year or 150 Hours	1 Years or 150 Hours

THIS AGREEMENT GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM JURISDICTION TO JURISDICTION.

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE APPROPRIATE WARRANTY PERIOD IN THE ABOVE TABLE, OR TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. Some states or countries do not allow limitations on how long an implied warranty lasts, and some states or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and

exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state and country to country.

THE FOREGOING REMEDIES ARE EXCLUSIVE. MARINE POWER MAKES NO OTHER EXPRESS WARRANTY. MARINE POWER SHALL IN NO CIRCUMSTANCES BE LIABLE IN CONTRACT, IN TORT OR OTHERWISE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER OR NOT FORESEEABLE. NO EMPLOYEE OR REPRESENTATIVE OF MARINE POWER IS AUTHORIZED TO MODIFY THIS WARRANTY, OR MARINE POWER'S STANDARD WARRANTY FOR ANY PRODUCT.

MARINE POWER DOES NOT AUTHORIZE ANY PERSON TO CREATE FOR MARINE POWER ANY OBLIGATION OR LIABILITY

OTHER THAN THAT STATED IN THE LIMITED WARRANTY. UNDER NO CIRCUMSTANCES SHALL MARINE POWER BE LIABLE TO THE CUSTOMER OR ANY OTHER PERSON FOR ANY CONSEQUENTIAL, INCIDENTAL, ECONOMIC, DIRECT, INDIRECT, GENERAL, OR SPECIAL DAMAGES ARISING OUT OF ANY BREACH OF WARRANTY, EXPRESSED OR IMPLIED.

Owner's Warranty Responsibilities

As the Inboard engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. Marine Power Holding LLC recommends that you retain all receipts covering maintenance on your inboard engine, but Marine Power Holding LLC cannot deny warranty solely for the lack of receipts or your failure to ensure the performance of all scheduled maintenance. Marine Power highly recommends that the selling dealer do Warranty Registration along with a completed Statement of Sea Trial in order to facilitate any warranty work necessary in the future.

As the Inboard engine owner, you should however be aware that Marine Power Holding LLC may deny you warranty coverage if your Inboard engine or part has failed due to abuse, neglect or improper maintenance or unapproved modifications.

You are responsible for presenting your Inboard engine to a Marine Power Holding LLC distribution center as soon as a problem exists. The warranty repairs will be complete within a reasonable amount of time, not to exceed 30 days.

1. Marine Power Holding LLC ("Marine Power") warrants to the first owner purchasing at retail and all subsequent own-

1. Introduction

ers, of every Marine Power Inboard marine engine manufactured after January 1, 2008, that the emissions control devices on Marine Power Inboard marine engines are free from defects in materials and workmanship when manufactured and will remain so for the stated period in the above table. Marine Power warrants that each Marine Power Inboard marine engine and factory installed accessories designed, built and equipped with all applicable regulations adopted by the Air Resources Board pursuant to its authority in Chapters 1 and 2, Part 5, Division 26 of the Health and Safety Code; and the U. S. Environmental Protection Agency pursuant its authority in Chapter 9 of Title 5 of the U.S. Code to be free from defects in materials and workmanship that cause the failure of a warranted part to be identified in all material respects to that part as described in the engine manufacturer application for certification.

2. The warranty shall commence, on the date of delivery to the first retail purchaser or from the date the engine is first placed in service for demonstration or any other purpose prior to the sale to the first retail owner. However, in no event shall the duration of this warranty exceed three (3) years measured from the original retail sale date.
3. Any warranted part that is not scheduled for replacement as required maintenance in the written instructions in the Owner's Manual will be warranted for the appropriate warranty period in the above table. If the part fails during the period of warranty coverage, the part will be repaired or replaced by Marine Power at a warranty station. Any such part repaired or replaced under warranty will be warranted

for the remainder of the period.

4. Any warranted part that is scheduled only for regular inspection in the written instructions in the Owner's Manual will be warranted for the appropriate warranty period in the above table. A statement in such written instructions to the effect of "repair and replace as necessary" does not reduce the period of warranty coverage. Any such part repaired or replaced under warranty will be warranted for the remaining warranty period.
5. Any warranted part that is scheduled for replacement as required maintenance in the written instructions in the Owner's Manual will be warranted for the period of time before the first scheduled replacement date for the part. If the part fails before the first scheduled replacement, the part will be repaired or replaced by Marine Power at a warranty station. Any such part repaired or replaced under warranty will be warranted for the remainder of the period to the first scheduled replacement point for the part.
6. Repair or replacement of any warranted part under the warranty provisions of the article will be performed at a warranty station at no charge to the owner. Warranty services and repairs will be provided at all Marine Power distribution centers and trained marine dealers.
7. The engine owner will not be charged for diagnostic labor that is directly associated with diagnosis of a defective, emission related warranted part, provided that such diagnostic work is performed at a warranty station.

8. Marine Power is liable for damages to other engine components proximately caused by a failure under warranty of any warranted part.
9. Throughout the appropriate warranty period in the table from the previous page Marine Power will maintain a supply of warranted parts sufficient to meet the expected demands for such parts.
10. Any replacement part may be used in the performance of any warranty maintenance or repairs and will be provided without charge to the owner. Such usage will not reduce Marine Power's warranty obligations.
11. Add-on or modified parts, as defined in CCR, Section 1900 (b)(1) and (b)(10), Title 13, that are not exempted by the Air Resources Board will not be used. The use of any non-exempted add-on or modified parts by the ultimate purchaser will be grounds for disallowing a warranty claim made in accordance with this article statement. Marine Power will not be liable under this statement to warranted failures of warranted parts caused by the use of non-exempted add-on or modified part.
12. The following parts are covered by this general emissions warranty statement.
 - A) Fuel Metering System
 - 1) Fuel Injectors
 - 2) Fuel Pressure Regulator
 - 3) Manifold Absolute Pressure Sensor
 - 4) Throttle Position Sensor

1. Introduction

- 5) Throttle Body
 - 6) Coolant Temperature Sensor
 - 7) Oxygen Sensors
 - 8) Intake Valves
- B) Air Induction System
- 1) Intake Manifold
 - 2) Air Filter/Flame Arrestor
- C) Ignition System
- 1) Spark Plugs
 - 2) Electronic Ignition System
 - 3) Spark Advance/Retard System
 - 4) Ignition Coil and/or Control Module
 - 5) Ignition Wires
- D) Lubrication System
- 1) Oil Pump and Internal Parts
- E) Positive Crankcase Ventilation (PCV) System
- 1) PCV Valve
 - 2) Oil Filler Cap
- F) Exhaust System
- 1) Exhaust Manifolds and Risers
 - 2) Exhaust Valves
 - 3) Catalysts
- G) Miscellaneous Items Used in Above Systems
- 1) Hoses, Clamps, Fittings, Tubing, Sealing Gaskets or Devices and Mounting Hardware
 - 2) Pulleys, Belts and Idlers
- 3) Vacuum, Temperature, Check and Timer Sensitive Valves and Switches
- 4) Electronic Controls
13. The repair or replacement of any warranted part otherwise eligible for coverage under this warranty may be denied from such warranty coverage if Marine Power demonstrates that the engine and/or part has been abused, neglected, or improperly maintained, and that such abuse, neglect, or improper maintenance was the direct cause of the need for repair or replacement of the part.
14. This Warranty will not apply to:
- A) Use of an accessories or parts not manufactured or sold by Marine Power.
 - B) Neglect, failure to follow maintenance schedules, accident, abnormal operations, misuse, negligence, improperly maintained, improperly operated or installed, racing or engine modification. Problems arising from installation, application, exhaust to engine, fuel lines to the engine, propping, cooling to the engine or engine damage due to defective electrical hookups.
 - C) Rust, corrosion or effects of weather.
 - D) Water ingestion through exhaust or intake system.
 - E) Detonation or operation with fuels, oils or lubricants which are not suitable for use with this product. Detonation causes: Poor fuel quality, overloading of engine, improper gear or propeller selection, engine overheating, excessive back pressure, incorrect ignition timing, excessive total timing.
- F) Reimbursement for: Haul-out, launch, towing, storage charges, rental charges of any type, inconvenience of any type, loss of time or income, expense of returning a Marine Power product to a service facility, towing, lodging, loss or damage to personal property.
- G) Carburetor replacement and labor is limited to mechanical defects only. Replacement does not extend to contaminated fuel, varnish or other residues, changes in fuel mixtures, poor octane fuel or adjustments beyond five (5) hours of engine operation.
15. Marine Power reserves the right to limit warranty coverage on engines that have accumulated excessive hours through commercial use or any other non-typical operation.

Special Applications Warranty

Marine Power Engines that are used in inboard mud boat applications ("Special Applications") carry a strict limited warranty. The warranty period applicable to Special Applications such as inboard mud boat usage, shall carry a limited warranty period of one (1) year or 150 hours, whichever occurs first. This warranty shall only cover and be strictly limited to the repair or replacement of parts located from the flywheel forward. Repair or replacement of drive plates are specifically not covered. Any and all transmission warranties must be handled by the transmission manufacturer directly. Marine Power's emission warranty shall not be limited by these specific limitations. This warranty

1. Introduction

covers engine related defective material and/or workmanship only, and not replacement or refund of the equipment to which the engine may be mounted.

This Special Applications Warranty shall NOT apply to nor shall it extend to repairs required because of the following:

1. Damages caused by failures or inadequacies in the cooling system;
2. Damages caused by extreme temperatures in the exhaust system, including, but not limited to any occurrences of fire, etc.;
3. Damages caused by or are the result of any sudden impact to the propeller or any other part of the engine or its accessories;
4. Damages or failure of the damper drive plate.

2. Safe Boating

CAUTION

Carbon Monoxide Exposure

Carbon Monoxide is a odorless, colorless and tasteless gas that cannot be smelled, seen or tasted.

Sustained exposure to carbon monoxide gas may lead to brain damage, unconsciousness or death.

Carbon Monoxide is a hazardous gas that is produced when items containing carbon are burned. Items such as, but not limited to; wood, coal, gasoline, natural gas, propane or oil. Carbon Monoxide (CO) is found in many areas such as any type of internal combustion engines, heaters, charcoal grills, cooking ranges and any other open flame appliances. There are many possible variables for the accumulation of carbon monoxide. Wind direction, boat speed, vessel proximity to other vessels or structures are just a few of the possible variables that would permit exposure to carbon monoxide gases. It is important that regular inspec-

tions of the exhaust system are conducted and maintenance is properly performed by a qualified technician. Adequate air circulation in all areas of your boat are necessary in order to prevent build-up of carbon monoxide. Please contact your boat manufacturer if you have questions regarding these hazards.

For more information regarding safe boating practices, and/or carbon monoxide poisoning on recreational boats, contact the following:

National Marine Manufacturers Association (NMMA)
200 East Randolph Drive, Suite 5100, Chicago, IL 60601
312-946-6200 • www.nmma.org

United States Coast Guard
Office of Boating Safety Chicago, IL - CG Headquarters G-OPB-3
2100 Second Street, SW, Washington, DC 20593
202-267-0984 • www.uscgboating.org

American Boat & Yacht Council, Inc. (ABYC)
3069 Solomons Island Road, Edgewater, MD 21037-1416
410-956-1050 • www.abyc.com

/// 3. Engine Identification

Every Marine Power Engine is equipped with an Engine Identification Tag, also known as a Serial Number Tag. This tag contains information (model number and serial number) that will be required before any warranty work (if necessary) can be done.



/// MARINEPOWER®

EMISSION CONTROL INFORMATION:

THIS MARINE ENGINE COMPLIES WITH U.S. EPA AND CALIFORNIA EXHAUST REGULATIONS FOR 2013 SPARK IGNITION MARINE ENGINES

ENG FAMILY:	DMPEM06.240	ENGINE DISP:	6.2 L
FUEL:	UNLEADED	MAXIMUM POWER:	320 KW
SPARK PLUG:	479111	DATE OF MANUFACTURE:	05/13
SPARK PLUG GAP:	.060 IN	EMISSION CONTROLS:	TWC, HO2S, PFI, EC

SEE OPERATORS MANUAL FOR MAINTENANCE SPECIFICATIONS

Airpac:

Engines configured for airboat applications. These engines use closed cooling systems with automotive style radiators. Their exhaust manifolds are dry and usually supplied by the boat builder.

Enpac:

Engines configured for stern drive (I/O) applications. Cooling water supply differs depending on the stern drive model mated to. See Section 12: Installation Instructions.

Jetpac:

Engines configured for inboard jet drive applications. Cooling water normally supplied by jet drive. Routing of inlet out-let cooling water lines will affect winterization. See Section 9:

Winterization procedures.

Towpac:

Engines configured for watersport tow boat applications. Engines may be configured for conventional inboard or v-drive application. In many of these applications throttle and shift is highly integrated with the boat instrumentation

Sportpac:

Engines configured for traditional inboard vessels. Many of these applications are twin installations.

/// 3. Engine Identification

	5.3 GEN V DI	6.2 GEN V DI	6.2 LT4
Engine Type	V8	V8	V8
Repower	X	X	X
Original Equipment	X	X	X
Unique Feature	Direct Injection	Direct Injection	DI Supercharged
Displacement	5.3L/327 CID	6.2L/374 CID	6.2L/374 CID
Bore & Stroke	96 x 92 mm	103.25 x 92 mm	103.25 x 92 mm
Compression Ratio	11 : 1	11 : 1	10 : 1
Cylinder Block	Aluminum	Aluminum	Aluminum
Cylinder Head	Aluminum	Aluminum	Aluminum
Recommended Fuel	87 Octane	87-91 Octane	93 Octane
Max RPM @ Wot	5600	5600	5600
Idle RPM	ECM Controlled	ECM Controlled	ECM Controlled
HP Fuel Pressure	60 PSI	60 PSI	72 PSI
LP Fuel Pressure	4-7 PSI	4-7 PSI	4-7 PSI
Oil Pressure @ 2000 RPM	30-80 PSI	30-80 PSI	30-80 PSI
Min Oil Pressure @ Idle	10 PSI	10 PSI	10 PSI
Operating Temp RW Cooled	N/A	N/A	N/A
Operating Temp FW Cooled	175° F	170°-190° F	170°-190° F
Sparkplug Type	12622441	12622441	12642722
Sparkplug Gap	.040"	.040"	.030"
Timing @ Idle	ECM Controlled	ECM Controlled	ECM Controlled
Timing @ 4000 RPM	ECM Controlled	ECM Controlled	ECM Controlled
Firing Order	1-8-7-2-6-5-4-3	1-8-7-2-6-5-4-3	1-8-7-2-6-5-4-3
Alternator Rating	150 amps	150 amps	150-250 amps
Crankcase Oil	Mobil 1 15W50	Mobil 1 15W50	Mobil 1 15W50
Oil Capacity	6.5-8 Qts.	6.5- 8 Qts.	6.5- 8 Qts.
Closed Cooling Fluid	Dex-Cool	Dex-Cool	Dex-Cool
Closed Cooling Capacity	10 Qts.	10 Qts.	10 Qts.

/// 4. Electronic Sequential Fuel Injection Information

The engines covered in this manual are equipped with Electronic Sequential Fuel Injection. The main fuel system components include:

- The electric high and low pressure fuel pumps
- The throttle body assembly
- The fuel injectors

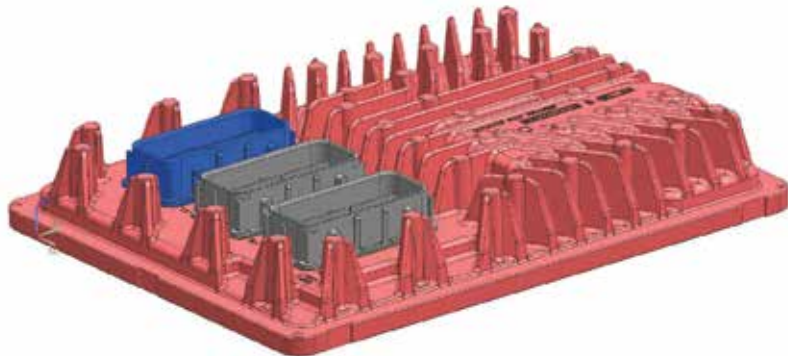
The fuel injection system is controlled by an Electronic Control Module (ECM). The ECM continually monitors information from the various sensors on the engine and configures the spark timing and fuel delivery for optimum performance. Additionally, the ECM protects the engine from over-revving and monitors the oil pressure and water temperature.

The following sensors constantly provide information to the ECM.

- Engine Coolant Temperature (ECT) Sensor
- Engine Oil Pressure Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Knock Sensor
- Camshaft Positioning (CMP) Sensor
- Crankshaft Positioning (CKP) Sensor
- Intake Air Temperature (IAT) Sensor (combined with the MAP sensor on the 5.7)
- Throttle Position (TPS) Sensor
- Pedal Position (PPS) Sensor
- Pre-Catalyst O2 (O2) Sensor (Catalyst equipped engines)
- Post-Catalyst O2 (O2) Sensor (Catalyst equipped engines)

Engines may include one or more of the following optional sensors.

- Engine Oil Temperature Sensor
- Fuel Pressure Sensor
- Transmission Oil Temperature Sensor
- Exhaust Manifold Temperature Sensor
- Barometric Pressure (BARO) Sensor
- Super Charger Inlet Pressure (SCIP) Sensor



5. Engine Alarms and Instrumentation

Digital Alarms

If, for any reason, one or more of these sensors or associated wiring malfunctions, the ECM's built in self-diagnostic system sets a trouble code and turns on the Malfunction Indicator Light (MIL) or sounds a buzzer to alert the operator of a malfunction.

The MIL, buzzer and gauges can signal that something is wrong before it becomes serious enough to cause an expensive repair. Paying attention to the MIL, buzzer and gauges could also save you or others from injury. The MIL may be replaced by verbiage such as "Service Required" on boats equipped with electronic instrumentation.

The MIL or "Service Required" notice comes on when there is a problem with an engine function. Gauges can also indicate when there is a problem with an engine functions. Often gauges and the MIL (Service Required) work together to let you know that there is a problem with your engine.

In most cases, when the "MIL" is on, the engine(s) may lose some performance and/or efficiency, but remain running adequately. Also, the light may go out or become intermittent, but a trouble code will be logged for future diagnosis. In any case, the operator must obtain service by an authorized dealer to determine and repair the exact cause of the malfunction.

The engine ECM is programmed to control the engine alarm system. This system is configured to turn on an instrument panel mounted indicator ("MIL" or "Check Engine") light, and, optionally, an audible ("buzzer") alarm to warn the operator of engine problems.

If the "MIL" lights and/or the "buzzer" sounds during operation, the operator should scan the instrument panel readings for possible sources of trouble. Conditions that may cause alarm activation include:

- Low Oil Pressure
- Engine Overheat (High Temperature)
- Electronic Throttle Malfunction
- Engine Misfire

See Section 11: Engine Diagnostics and Codes for more information.

If the boat is equipped with CAN-Buss Messaging (Electronic Instrumentation), the main screen will likely display a "Service Required" message when the ECM records an active trouble code.

IMPORTANT: A failure with the Electronic Throttle will result in idle only operation of the engine. In some cases, the throttle may be reset by turning the key off and then restarting the engine. The operator should contact his servicing dealer to determine the exact cause of the failure.

5. Engine Alarms and Instrumentation

Instrumentation

Boat builders use many different types of instrumentation in their boats. The operator should understand his instrumentation and note any abnormal operating conditions.



Analog Instrumentation



Canbus Instrumentation

IMPORTANT: Engines are designed to use both buzzers and MIL lamps. Buzzers are use to alert operators of severe problems, such as: Low oil pressure, high engine temperature or low fuel pressure. See Section 11: Engine Diagnostics and Codes for more information.



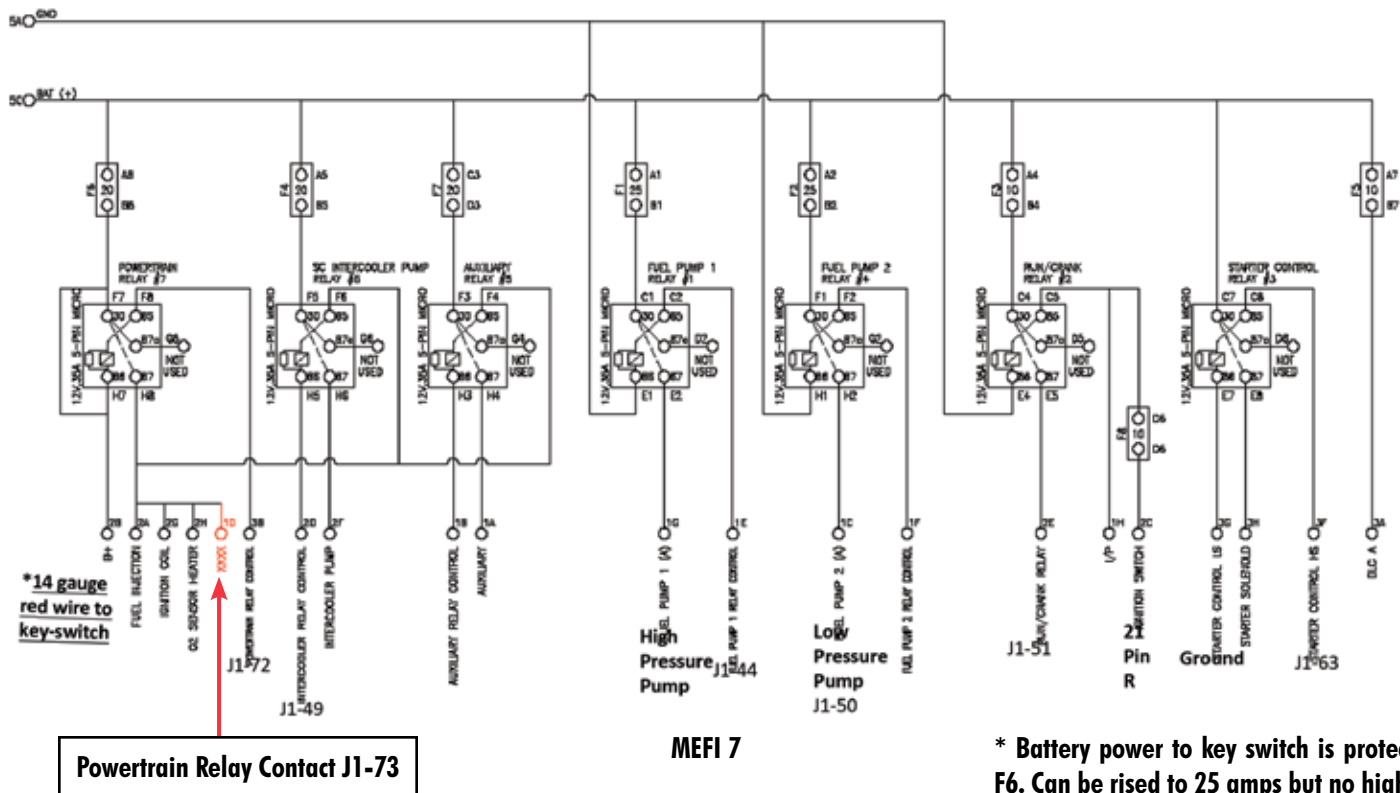
6. SSVEC Fuse and Relay Enclosure



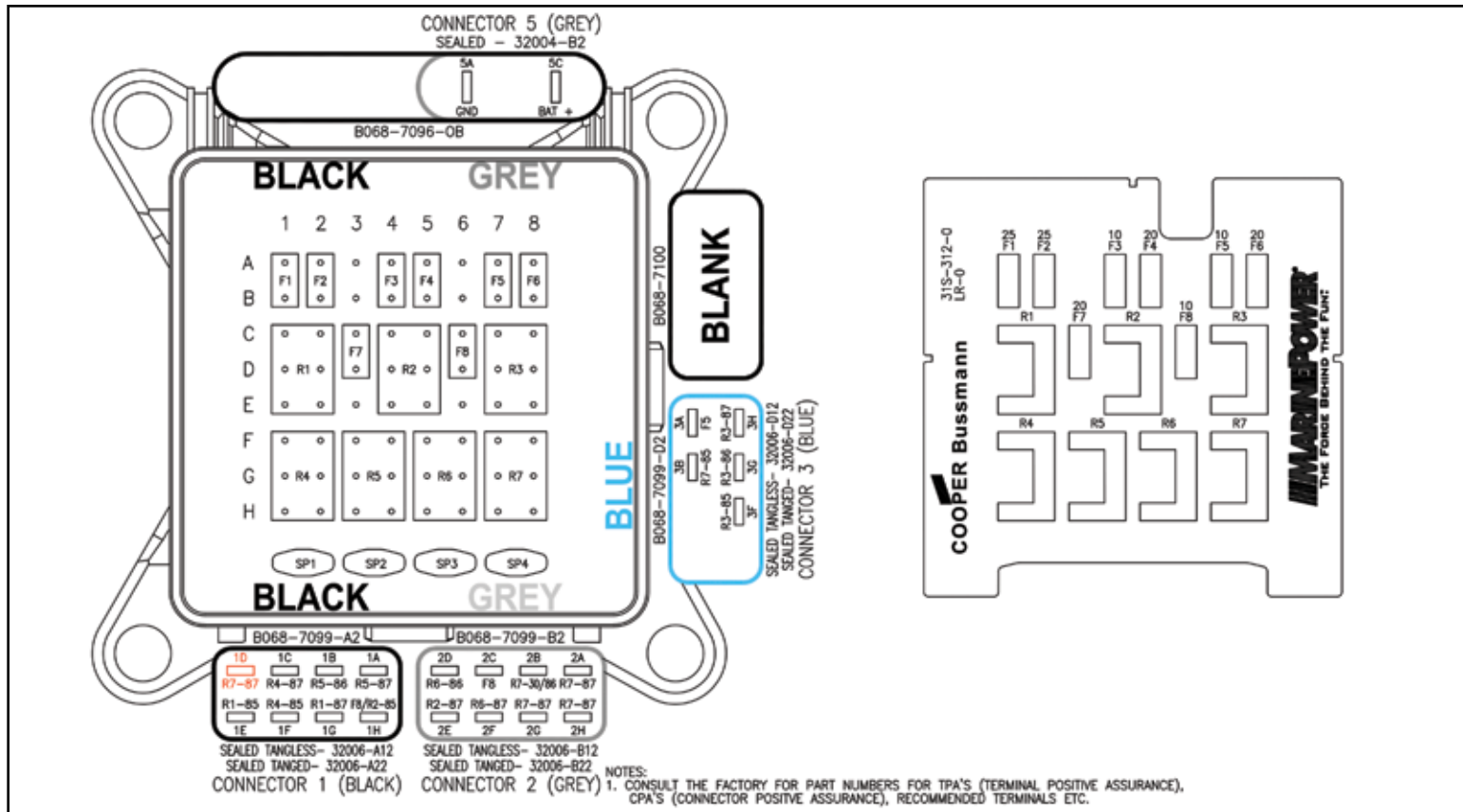
All relays and fuses are located in the Severe Service Vessel Electrical Center (SSVEC). This enclosure is capable of withstanding direct water spray. Additionally, it contains a Goretex vent which allows humid vapors to escape without allowing water in.

6. SSVEC Fuse and Relay Enclosure

"Bussmann" Sealed Fuse & Relay Center - Schematic



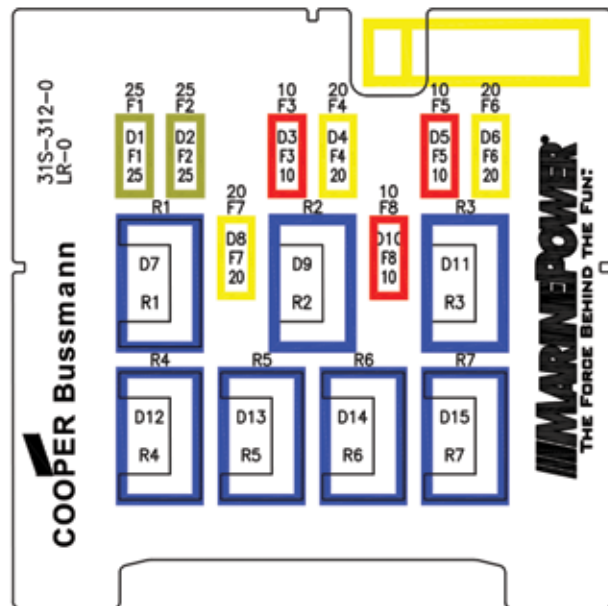
6. SSVEC Fuse and Relay Enclosure



6. SSVEC Fuse and Relay Enclosure

DEVICE PLACEMENT			
POSITION	REFERENCE	DEVICE	PART #
D1	F1	MINI FUSE	ATM-25UNP-N
D2	F2	MINI FUSE	ATM-25UNP-N
D3	F3	MINI FUSE	ATM-10UNP-N
D4	F4	MINI FUSE	ATM-20UNP-N
D5	F5	MINI FUSE	ATM-10UNP-N
D6	F6	MINI FUSE	ATM-20UNP-N
D7	R1	12V,35A 5-PIN MICRO	B120-7016J
D8	F7	MINI FUSE	ATM-20UNP-N
D9	R2	12V,35A 5-PIN MICRO	B120-7016J
D10	F8	MINI FUSE	ATM-10UNP-N
D11	R3	12V,35A 5-PIN MICRO	B120-7016J
D12	R4	12V,35A 5-PIN MICRO	B120-7016J
D13	R5	12V,35A 5-PIN MICRO	B120-7016J
D14	R6	12V,35A 5-PIN MICRO	B120-7016J
D15	R7	12V,35A 5-PIN MICRO	B120-7016J

DEVICE TOTALS		
DEVICE	PART #	AMOUNT
MINI FUSE	ATM-10UNP-N	3
MINI FUSE	ATM-20UNP-N	3
MINI FUSE	ATM-25UNP-N	2
12V,35A 5-PIN MICRO	B120-7016J	7



7. Precautions

Oil Level

Check the oil level before each engine start up and every eight (8) hours of continuous operation. It should be understood that internal combustion engines will use a certain amount of oil during operation as a cooling and lubricating agent (especially during break-in period). Oil consumption should decrease after approximately 100 hours of operation.

IMPORTANT: The space between the “FULL” and “ADD” marks on the dipstick represent one quart. It is not necessary to add oil unless the level is at or below the “ADD” mark.

Engine dipstick level may change due to the angle of installation. Ensure that “high” oil level is properly marked accordingly.

When adding crankcase oil, DO NOT OVERFILL.

If crankcase is overfilled, it will cause foaming or aeration of oil in the oil pan. This will effect oil pressure which may result in severe internal engine damage.

Hydrolock

Hydrolock describes a condition in which water enters the cylinder of an engine. Water is not compressible and can cause catastrophic damage. Do not try to start an engine that shows sign of having water in the cylinders. Beware of these situations:

1. **Following Wakes:** Sudden slow-downs may cause the boat wake to flow over the transom of your boat.
2. **Engine Shutdown:** Sudden engine shutdown while the boat is moving may force water into the exhaust system.
3. **Improper Installation:** Refer to Section 13: Exhaust Piping. An exhaust system without flappers and the specified incline increases the likelihood of water entering the engine.
4. **Improper Hoisting:** Operators are sometimes tempted to reduce hoisting time for propeller changes by hoisting only the boat stern. Such hoisting can cause residual water in the exhaust system to enter engine cylinders. Water entering engine cylinders will cause the engine to lock because water does not compress.
5. **Poor engine cover design:** Engines are supposed to be protected from top side water. If the engine hatch (cover) allows water to spill on to the top of the engine, water may enter the cylinders through the flame arrestor.
6. **Belt Slinging:** Too much water in the bilge of a boat will sometimes be picked up by the crankshaft pulley and carried into the flame arrestor during a hard acceleration maneuverer.

To remove water from engine cylinders, take the following steps:

1. Remove all spark plugs.
2. Advance throttle to wide open.
3. Crank engine for 15 seconds.
4. If there are any abnormal sounds STOP ENGINE immediately and contact your Marine Power dealer.
5. Change engine oil and filters.
6. Replace spark plugs and reattach coil wire.
7. Start engine. If there are any abnormal sounds STOP ENGINE immediately and contact your Marine Power dealer.

8. Engine Operating Instructions

Gasoline Requirements

Marine Power calibrates their engines EXCEPT LT4 for use with high quality lead-free gasoline with a minimum octane rating of 87. Additionally, Marine Power uses octane scaling calibrations where applicable. Octane scaling enables the engine to "learn up" if a higher octane fuel (such as 92) is purchased. There is a noticeable performance difference with higher octane fuels. If the boat is used in heavily loaded conditions (i.e. heavily ballasted to produce large wakes for surfing or wakeboarding) Marine Power recommends the use of premium fuel (93 octane minimum). See LT4 Warning.

The use of gasoline containing ethanol is very prevalent. Marine Power engines are calibrated to operate on fuel containing up to 10% ethanol (E10). Do not use fuel with ethanol content higher than 10% (E10).

Ethanol blended fuel acts as a solvent and will absorb moisture. Excessive moisture can cause lean conditions, vapor lock and shortened fuel life. The solvent characteristic can cause gum, sludge and other particles to be loosened up and carried through the fuel system.

Marine Power recommends the use of fuel stabilizer such as Sta-Bil. Fuel stabilizer is recommended for winter storage and should also be used if you expect to use less than a full tank of fuel over a 2-3 week period of time. Follow the label instructions whenever adding fuel stabilizer to the fuel tank.

Oil Requirements

Marine Power recommends the following:

Engine	Brand/Weight
5.3L	Mobil 1 15W-50
6.2L	Mobil 1 15W-50
LT4	Mobil 1 15W-50

Marine Power recommends that the engine oil be changed every 50 hours of engine operation, but no less frequently than once each calendar year, and that the engine oil filter be replaced every time the engine oil is changed.

Starting Engine EFI

DO NOT operate engine without water being supplied to raw water pump as pump impeller and engine will be damaged.

! WARNING

Gasoline vapors are highly explosive under certain conditions.

Operate the bilge blower for five (5) minutes. If not equipped with a bilge blower, open engine hatch and leave open before starting the engine to remove any explosive vapors from the engine compartment.

Place shift lever in the neutral position.

If this is the initial start on a new engine turn the ignition (key) switch to the on (run) position (first detent on key switch) and wait for 10 seconds. Turn the ignition off and repeat this procedure 2-3 times or until you hear the fuel pump prime. Then turn the key to the start (crank) position (2nd detent). It is not necessary to hold the key switch in this position as the Marine Power "SMART START" will take over. If the fuel pump is primed the engine should start within 3-5 seconds. After the engine starts, idle speed (RPM) will be controlled by the ECM. The idle RPM will be elevated following a cold start until the engine warms to its normal operating temperature.

Check for water flowing through the engine cooling system. Water should mix with the engine exhaust. In all cases, your positive indicator is exhaust water flow.

Check the boat's instrument panel for any service warnings or alarms.

Check operation of throttle and shift controls.

Check fuel tank fill level before leaving the trailer or dock.

Engine Break-In/10-25 Hour Inspection

To insure the maximum life of your Marine Power Engine, the following engine break-in guidelines are recommended.

Marine Power considers the first ten (10) hours of engine operation to be the break-in period.

During this break-in period:

Do not operate the engine at wide-open throttle.

8. Engine Operating Instructions

Do not operate the boat at or near the maximum capacity specified on the USCG label.

Limit the maximum engine speed to 3500 RPM

Avoid running the engine at a constant/steady RPM for sustained periods of time. (i.e. vary the throttle/engine speed frequently)

Check the engine oil level at the beginning of each boating day, and after each 2-3 hours of engine operation. Any time oil level is checked look for milky discoloration, if found consult with your dealer.

After the first ten (10) hours of engine operation but before twenty-five (25) hours return the boat to your dealer for its first engine oil and filter change and initial engine inspection.



WARNING

The LT4 is a Premium 93 Octane **REQUIRED** engine. The engine will operate at significantly reduced power output with octane levels down to 90. Operating the LT4 on fuel below 90 Octane can result in engine damage and or failure! Such failure will not be covered under warranty!

9. Winterization

Full Closed Cooled Engines

Test antifreeze-water concentration to assure adequate protection for your location.

Remove hoses from inlet and outlet of crankshaft seawater pump.

Remove drain plug from transmission/engine oil cooler.

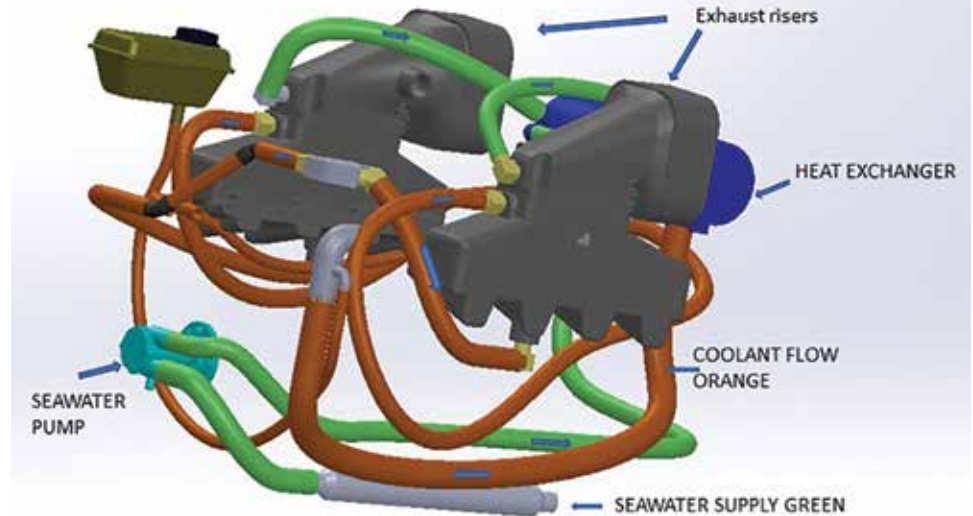
Remove drain plugs (if equipped) from exhaust risers.

Note the routing of your inlet cooling water hose to make sure there are no locations which may trap water. If your engine is attached to a v-drive transmission, pay particular attention to the draining of the v-drive cooler.

Remove end caps on heat exchanger. Inspect for debris and trapped water. Remove zinc anode and replace if necessary.

Spray each of your engine mounts with WD-40 or equivalent lubricate.

5.3-6.2 DI WINTERIZATION



10. Engine Maintenance

Scheduled Maintenance By Owner

Service	Engine Startup Each Day*	After 10 Hours of Operation	Every 50 Hours of Operation
Check Engine Oil Level	✓		
Inspect Fuel Lines and Connections for Leaks	✓		
Check Coolant Level in Tank (If Equipped with Closed Cooling)	✓		
Inspect and Clean Sea Strainer (If Equipped)	✓		
Inspect Entire Power Package for Leaks (Water, Fuel, Oil, Exhaust, etc.)	✓		
Inspect Belts for Tension and Wear	✓		
Inspect Battery (Terminals and Fluid Levels)		✓	✓
Check Battery Connection to Engine		✓	✓
Touch Up Exterior Surface with Marine Power Paint			✓
Check Power Steering Fluid (If Equipped)		✓	✓
Check Transmission Fluid Level	✓	✓	
Lubricate Starter Pinion and Shaft			✓

* Engine Start-Up Each Day and Once Every Eight (8) Hours of Operation.

10. Engine Maintenance

Scheduled Maintenance By Qualified Technician

Service	Engine Startup Each Day*	After 10 Hours of Operation	Every 50 Hours of Operation	Every 100 Hours of Operation	Every 300 Hours of Operation
Change Engine Oil and Filters**		✓	✓		
Change Filter on Fuel/Water Separator**		✓		✓	
Check Engine Mounts (Tightness)	✓	✓	✓		
Check Riser and Manifold Bolts for Tightness	✓	✓	✓		
Check for Loose, Damaged or Missing Engine Parts			✓		
Check Wire Harness Plugs for Corrosion and Connections			✓		
Check Condition of Spark Plugs (Replace if Necessary)					✓
Inspect Hoses for Deterioration			✓		
Replace Impeller in Seawater Pump**				✓	
Check Propeller and Shaft Alignment				✓	
Clean and Inspect Flame Arrestor and Crank Case Vent Hose			✓		
Change Transmission Fluid					✓
Change Coolant (If Equipped with Closed Cooling)					✓
Clean Sea Water Section of Heat Exchanger				✓	

Inspect zinc anode in heat exchanger for deterioration. Replace if necessary.

* Engine Start-Up Each Day and Once Every Eight (8) Hours of Operation.

** Perform at specified hours or once (1) a year. Whichever comes first.

10. Engine Maintenance

This manual provides basic information on routine maintenance of Marine Power Engines. Whether the reader is an experienced marine mechanic or a first time boat owner, we strongly suggest you thoroughly read these procedures BEFORE you attempt any procedure. Make sure you are familiar with the tools suggested and the methods recommended. Safety is our first concern. If repair required is beyond your expertise, please contact your dealer or other qualified technician. This manual contains guidelines to convey a particular level of risk:

DANGER

Hazards that will result in severe injury or death.

WARNING

Hazards that could result in severe injury or death. Caution: Hazards which could result in minor injury or property damage.

Please be careful.

Electrical, ignition and fuel system components on Marine Power Engines comply with U.S. Coast Guard (USCG) Rules and Regulations to minimize risks of fire and explosion. Use of replacement electrical, ignition and fuel components which do not comply with these rules and regulations could result in a fire or explosion and must be avoided. The electrical and ignition system is capable of violent electrical shock. Always disconnect the battery cables when performing any work where the cables could touch.

Take care to properly install and tighten all components when servicing the electrical, ignition and fuel systems. If the installation is not correct, sparks could ignite fuel vapors from the fuel system.

If you are doing repair work around the intake or exhaust openings, always protect those openings against foreign matter entering the cylinders. Care must be taken to use exact replacement parts. Damage could result if mismatched. If a grade 5 hex head bolt is removed, the same grade 5, hex head bolt must be replaced. If you cannot re-use the same bolt, do not improvise. Performance could be sacrificed without original Marine Power parts or parts recommended by Marine Power. A marine environment is a tough one. Parts subjected to salt water can rapidly corrode and engine failure could result. Warranty on Marine Power Engines could also be affected if other than recommended replacement parts are used.

Crankcase Oil Change

IMPORTANT! Start engine and operate until normal temperature is reached. Warm oil flows more freely carrying away more impurities. Remove the oil into a suitable container. Marine Power equips their engines with an E-Z oil drain hose. This hose can sometimes be routed through the hull drain fitting while the boat is on its trailer. Draining can take several hours if the oil is not warmed before draining. Some oil will remain in the pan and engine. It is a small quantity but may make the new oil appear used.

WARNING

The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon the navigable waters and contiguous zone of the United States, if such discharge causes a film upon, or discoloration of, the surface of the water, or causes an emulsion or sludge beneath the surface of the water. Violators are subject to a penalty of \$5,000.00.

After replacing drained oil, start engine and run for 5 minutes to circulate oil throughout. Inspect entire engine for leakage. Shut off engine and wait 5 minutes for oil to drain back into pan. Check level with dipstick. Add oil to proper level if needed.

10. Engine Maintenance

CAUTION

DO NOT overfill crankcase with oil. Agitation or splashing of oil may cause it to become aerated, which will affect oil pressure and may result in internal engine damage from lack of lubrication. Oil being splashed by reciprocating engine parts onto the walls of the cylinder in greater quantity than the rings can control will subsequently be drawn into the combustion chamber and burned. Continuous operation under these conditions can cause carbon to form on chamber surfaces, which will adversely affect engine performance and may lead to premature engine repair.

Oil Filters

NOTE: Lay a towel or catch basin under the filter(s) to catch any spilled oil.

Unscrew old filter by using an oil filter wrench and turn counter clockwise. Once removed, clean mounting base. Be sure old gasket is removed from mounting base.

Apply thin film of oil (do not use grease) to filter gasket. Be sure gasket is seated properly in base of oil filter.

Hand tighten filter, plus ½ turn, after gasket contacts mounting base. Use a filter wrench is necessary. Do not over tighten.

Check to see that oil shows "FULL" on dipstick.

Start engine. Turn on water. Run for approximately 5 minutes and inspect for leaks.

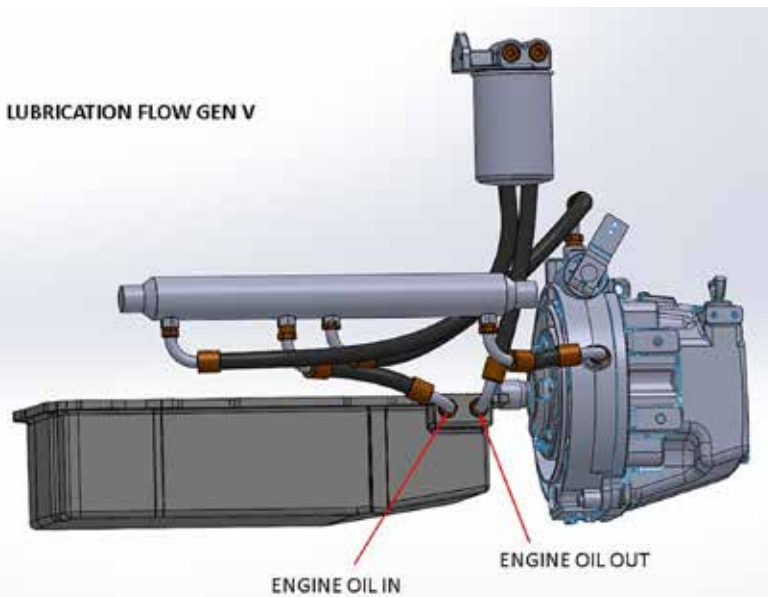
Check to see that oil shows "FULL" on dipstick.

Start engine. Run for approximately 5 minutes and inspect for leaks.

Shut off engine and wait 5 minutes for oil to drain back into pan. Check level with dipstick. Add oil to proper level if needed.

ALWAYS CONTACT YOUR NEAREST MARINE POWER SERVICING DEALER IF YOU HAVE A PROBLEM.

LUBRICATION FLOW GEN V



10. Engine Maintenance

Flame Arrestor

Clean the flame arrestor regularly.

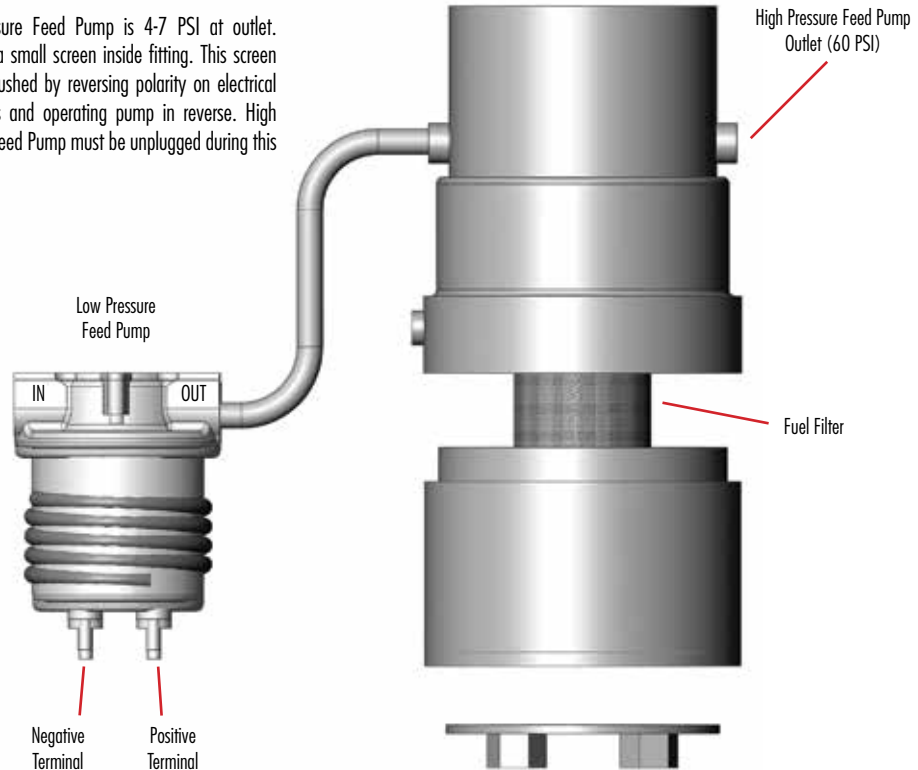
1. Remove fastener from flame arrestor.
2. Clean with a suitable solvent and blow dry.
3. Reverse steps to assemble.

G-Force Fuel System

1. Position catch basin under filter.
2. Remove cooling cover equipped.
3. Unscrew canister bowl.
4. Pull element down from pump.
5. Push new element (Part #396007) on pump until click is felt.
6. Replace O-ring (included with filter). Apply thin layer of suitable grease or oil to O-ring.
7. Re-install canister bowl on unit - snug tight only.
8. Two 10-second key ups should prime system.

Fuel Flow Schematic

Low Pressure Feed Pump is 4-7 PSI at outlet. Inlet has a small screen inside fitting. This screen may be flushed by reversing polarity on electrical connectors and operating pump in reverse. High pressure Feed Pump must be unplugged during this procedure.



Not used on LT4

10. Engine Maintenance

Battery Cables

WARNING

Do not recharge a weak battery in a boat. Remove and recharge in a ventilated area away from fuel vapors, sparks or flames. Electrical systems in a marine environment require periodic attention. Continued use of a weak battery or dirty terminals can cause solenoid or starter problems. Clean battery and terminals every 100 hours. Note the condition of your battery cables. When reconnecting battery cables make sure that the RED cable is on the (+) terminal and the BLACK cable is on the (-) terminal. Black is ground.

WARNING

Do not run AC wiring adjacent to DC wiring.

Multiple Engine

Battery Precautions - EFI

In multi-EFI power packages, each engine must be connected to its own battery. This provides the required voltage source for the ECM. In these applications where battery switches are used, it is important that each switch be positioned to allow each engine to run off its own individual battery. DO NOT run engines with the battery switches in "BOTH" or "ALL" positions. This will allow the other engine's battery to be used in case of emergency to start the engine with the dead battery.

Alternator Belt Tension

WARNING

Make sure ignition key is removed and engine is not running before inspecting belts.

Serpentine belt system maintains tension with a spring-loaded tensioner. Normally, no maintenance is required.

Sea Water Pump Impeller Replacement

Remove 4 screws from pump cover.

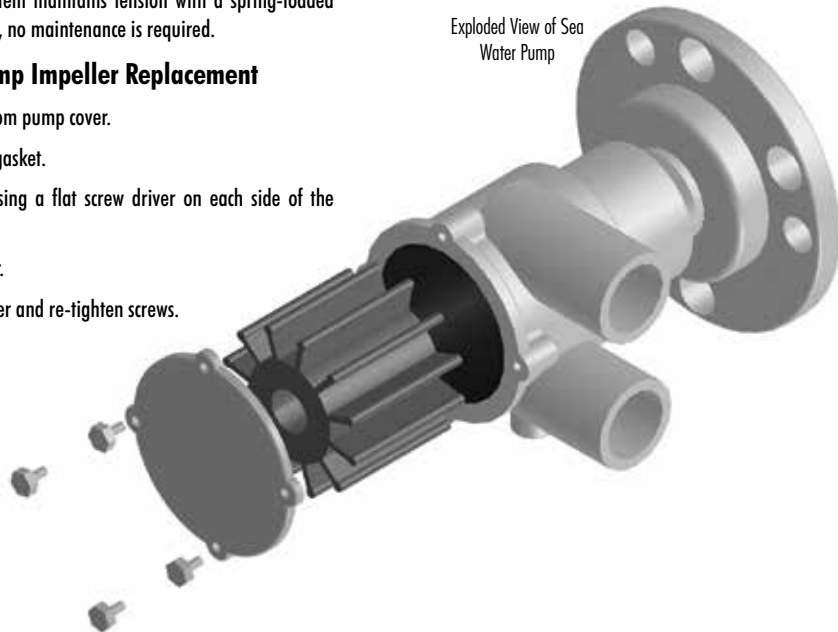
Remove cover and gasket.

Pry out impeller using a flat screw driver on each side of the center of the shaft.

Install new impeller.

Replace gasket, cover and re-tighten screws.

Exploded View of Sea Water Pump



10. Engine Maintenance

Closed Cooling System

The closed cooling system is designed to provide extended life to your new Marine Power engine. Your engine will operate at a different temperature range from a raw water cooled engine. Please refer to the appropriate Engine Identification on Page 8 for proper cooling ranges. The cooling system does require certain preventative maintenance to keep it in optimum operating conditions.

Heat Exchanger: All closed cooled engines incorporate a shell and tube heat exchanger. This unit exchanges heat between the sea water and the engine coolant. These units require very little maintenance. A routine inspection of the inter or tube sheets during winterization is sufficient. Be sure to remove any debris found during this inspection.

Zinc Anode: Your heat exchanger is equipped with a zinc anode that is approximately 2" long. If your engine is operated and maintained in saltwater this anode should be inspected for deterioration after the first 10 hours of operation. Inspect again after 50 hours of operation and every 50 hours thereafter.

Recovery Bottle: The plastic recovery bottle is attached to the heat exchanger tank (on most models) and fills with coolant during operation when the internal water temperature is higher. If necessary, add coolant only when engine is cold.

Surge Tank: Some models are equipped with a surge tank rather than a recovery bottle. The surge tank replaces the heat exchanger filler neck and pressure cap and is pressure capable whereas the recovery bottle is not. Maintain the appropriate lev-

el in the surge tank at all times. If coolant is consistently low, additional inspection for leaks in the cooling system may be required.

Filler Neck and Pressure Cap: DO NOT remove pressure cap when engine is HOT. If coolant is low, add the proper mixture (50% water/50% antifreeze) to the top of the filler neck located on the heat exchanger tank. If coolant is consistently low, additional inspection for leaks in the cooling system may be required.

Filling Closed Cooling System

WARNING

Do not remove pressure cap when engine is hot. Coolant is under pressure and may be forced out causing personal injury. After engine is cooled, remove cap slowly to allow pressure to escape.

IMPORTANT! The closed cooling system must remain filled year-round with the proper mixture of 50% antifreeze/50% water to assure protection of system during the lowest exposed temperatures. Insure that all drain plugs are installed and tightened. Fill heat exchanger (tank) with 50/50 antifreeze/water mixture. After initial fill, start engine and continue filling heat exchanger. Engine must be purged of air by bleeding system.

4.3/5.3/6.2L Horizontal Heat Exchanger Full Systems: These engines maybe difficult to purge without a vacuum assembly. If such an assembly is not available, operator should continue to leave surge tank cap off and force coolant into bottle

until thermostat is open and all air purged. Once thermostat is open and engine temperature is stable, reinstall surge tank cap.

11. Engine Diagnostics and Codes

Name	Description	Trouble Code	MIL Lamp	Buzzer	Reduce RPM	Comments
Barometric Sensor	Sensor alerts ECM if barometric measurement is to high or to low.	108	X			
Boost Bypass		66034				
Boost Control	ECM detects either an over boost or problem with circuit.	66035	X		X	Only applies to supercharged engines.
Buzzer Driver		66007				
Call Memory		630				
Cam Phaser (W)	ECM sets code if sensor fails diagnostic test.	65570-73	X		X	Limits RPM to 4000. Often caused by high or low engine oil level.
Cam Sensor (W)	ECM sets code if sensor fails diagnostic test.	65723-26	X			
Cam Gov Message	ECM sets code if specific OEM controller message is lost.	65560	X			Normally only applies to tow sport applications.
Cam Bus Hardware (1)	ECM sets code when it detects problem with can bus circuit.	65558-59	X			
Cam Bus Stbl Cntrl Message	ECM sets code when it detects problem with can bus circuit.	65557	X			
Catalyst Efficiency Test	ECM detects failed catalyst efficiency test.	65675-76	X			75 indicates odd bank, 76 even bank.
Change Oil Now/Soon		65555				
Coolant Temp Sensor	Sensor fails diagnostic test.	110	X			
Coolant Temp Warning	Sensor alerts ECM if coolant temperature is above 220° F.	110	X			Code clears at 95° F. Reduces RPM to 2500.
Coolant Temp Warning Extreme	Sensor alerts ECM if coolant temperature is above 239° F.	110	X	X	X	Code clears at 220° F. Reduces RPM to 2500.
CPU		65580				
Crank Sensor	ECM sets code if sensor fails diagnostic test.	636	X			Typically won't start if code is triggered. Check tightness of sensor and electrical connections.
Dev Mode Cal		65730				
Diagnostic Trouble Code Lamp (1)		66008				
Diagnostic Trouble Code Lamp (2)		66009				
Diagnostic Trouble Code Lamp (3)		66006				
Exhaust Gas Recirculation (EGR)		66016				

11. Engine Diagnostics and Codes

Name	Description	Trouble Code	MIL Lamp	Buzzer	Reduce RPM	Comments
Emergency Stop Warning		65710				
Electronic Spark Timing Circuit (EST)	ECM sets code if ignition coil fails diagnostic test.	65541-48	X			Last digit corresponds to coil number.
Electronic Throttle Control	ECM sets code if dual sensors out of range.	65604-05	X		X	Limits RPM to 1000. Check pedal adjustment.
Electronic Throttle Control	ECM sets code if dual sensors do not agree.	65613	X		X	Limits RPM to 1000. Pedal may need replacement.
Electronic Throttle Control	ECM sets code if it detects throttle body issues.	65615	X		X	Limits RPM to 1000. Check for stuck throttle body blade.
Electronic Throttle Control		65618				
Electronic Throttle Control		65600				
Electronic Throttle Control		65601-02				
Electronic Throttle Control		65610				
Fuel Pressure Sensor	Sensor fails diagnostic test.	94	X			
Fuel Pressure Error	Sensor alerts ECM if fuel pressure is too high or to low.	94	X		X	Check or replace filters. If problem persists then further diagnostics needed. Reduces RPM to 2500.
Fuel Pump Relay 1	ECM detects abnormal relay current or voltage.	66017	X			
Fuel Pump Relay 2	ECM detects abnormal relay current or voltage.	66025	X			
Fuel Level Sensor 1		96				
Fuel Level Sensor 2		38				
Fuel Rail Pressure Diag Sensor		1349				
Fuel Rail Pressure Sensor		157				
Fuel Rail Sent Message		66032				
Gear Temp	Sensor alerts ECM if gear oil temperature is above 300° F.	174		X	X	Not normally used in jet or repower applications. Used for Towboats.
General Warning		65701-03				
Gov Status Lamp		66005				
Hpfp Press Error		66031				

11. Engine Diagnostics and Codes

Name	Description	Trouble Code	MIL Lamp	Buzzer	Reduce RPM	Comments
Hptp Solenoid		66029				
Hptp Solenoid Enable		66028				
Inj		66051-58				
Inj Enable		651-58				
Inter Cooler Replay	ECM detects abnormal relay current or voltage.	66030	X			Only applicable on supercharged engines. Driver controls intercooler pump relay.
Knock Excessive		65550				
Knock Sensor	ECM sets code if sensor fails diagnostic test.	65551-52	X			51 indicates odd side. 52 even side. Cooler pump relay.
Manifold Absolute Pressure	ECM sets code if sensor fails diagnostic test.	106	X			
Manifold Air Temperature Sensor	ECM sets code if sensor fails diagnostic test.	105	X			Not all engines are equipped with this sensor.
Manifold Air Temperature Warning	Sensor alerts ECM if inlet air temperature is too high.	105	X		X	On supercharged engines check intercooler system. Reduces RPM to 2500.
Main Health Coprocessor	ECM problem.	65581	X			Check the memory power, the main power and the ground on ECM. May need replacement.
Malfunction Indicator Lamp Driver	ECM sets code if driver fails diagnostic test.	66003	X			Boat may not be equipped with MIL light.
Misfire	ECM detects cylinder misfire.	65590-99	X			Last digit corresponds to cylinder number. 99 is random cylinder misfire.
Electronic Throttle Control (ETC)		51				
Non-Volatile Random Access Memory		65582				
OEM Output		66040-43				
OEM Signal Lamp		66060-63				
Oil Level Warning		98				
Oil Pressure Sensor	ECM sets code if sensor fails diagnostic test.	100	X			
Oil Pressure Warning	Sensor alerts ECM if oil pressure is too high or low.	100		X	X	Reduces RPM to 2500.
Oil Temperature Sensor	ECM sets code if sensor fails diagnostic test.	175	X			

11. Engine Diagnostics and Codes

Name	Description	Trouble Code	MIL Lamp	Buzzer	Reduce RPM	Comments
Oil Temperature Warning	Sensor alerts ECM if engine oil temperature is above 300° F.	175		X	X	Reduces RPM to 2500. Not used on 5.7 Engines.
Oxy Fuel Trim	ECM sets code after detecting abnormally rich or lean condition.	65565-66	X			65 indicates odd bank, 66 even bank.
Oxy Heater	ECM sets code after detecting failure in O2 sensor heaters.	66019-22	X			19 = pre-o2 odd bank, 20 = pre-o2 even bank, 21 = post-o2 odd bank, 22 = post-o2 even bank.
Oxy Response	ECM sets code after determining O2 sensor response is slow.	65567-68	X			67 indicates odd bank, 68 even bank.
Oxy Voltage	ECM sets code after detecting abnormal voltage at O2 sensors.	65561-64	X			61 = pre-o2 odd bank, 62 = post-o2 odd bank, 63 = pre-o2 even bank, 64 = post-o2 even bank.
Powertrain Relay	ECM detects abnormal relay contact voltage.	66013-14	X			
Supercharger Inlet Pressure Sensor	Supercharger inlet pressure too high or too low.	3563	X			Only applicable on supercharged engines.
Shift Interrupt		66026				
Slow Mode Lamp		66010				
Speed Based Output		66011				
Speed Sensor	ECM sets code if speed sensor fails diagnostic test.	84	X			Not normally used in jet or repower applications. Used in Towboat applications.
Starter Relay Driver		66002				
SVS Lamp	ECM detects issue with SVS circuit.	66004	X			This circuit controls the warning buzzer alarm.
System Voltage	ECM sets code if system voltage is below 10 or above 16.	627		X		Check alternator connections and for tight belt. May need replacement.
Tachometer		66018				
Throttle Sensor		3562				
5V Buffer	ECM detects out of range voltage on low voltage output pins.	65620-23	X			Used to supply voltage to engine sensors. It is a 5 volt reference.
Var Gov		65690				

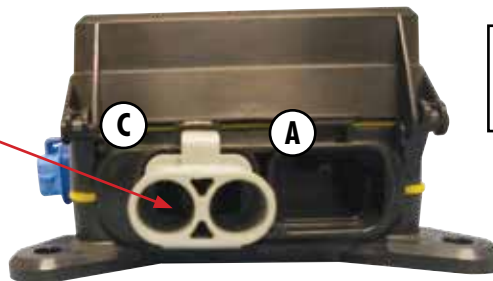
11. Engine Diagnostics and Codes

Start Sequence 1 (MEFI 7)

- Turn Battery Switch on (if boat equipped).

5C Energized with 12 volts with Battery Switch on (Power enters Bussmann)

"Bussmann" 2-way Connector #5



- A. Engine Ground
- B. Not used
- C. B+ from Starter Post

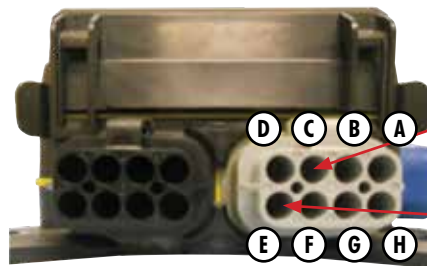
Connector viewed as connected to the Bussmann (Wire side view)

Start Sequence 2

- Turn key to ignition position.
- 12 volts @ 2C enables Run/Crank Relay (R2).
- Run/Crank Relay then energizes 2E which supplies 12 volts to ECM J1-51.
- ECM "Wakes Up".
- ECM then provides 12 volts to Bussman 1E and 1F which energizes Fuel Feed Pump Relays.
- Fuel Feed Pump Relays provide 12 volts to 1C and 1G which turns on Feed Fuel Pumps for initial prime. Listen for pumps running.

"Bussmann" Connector #2 (Grey)

- A. Ignition+ to Fuel Injectors
- B. B+
- C. Ignition+ from Helm
- D. Intercooler Pump Relay Control J1-49
- E. Run/Crank Relay to J1-51
- F. 12V+ to Intercooler Pump
- G. Ignition+ to Ignition Coils
- H. Ignition+ to O2 Sensor Heater

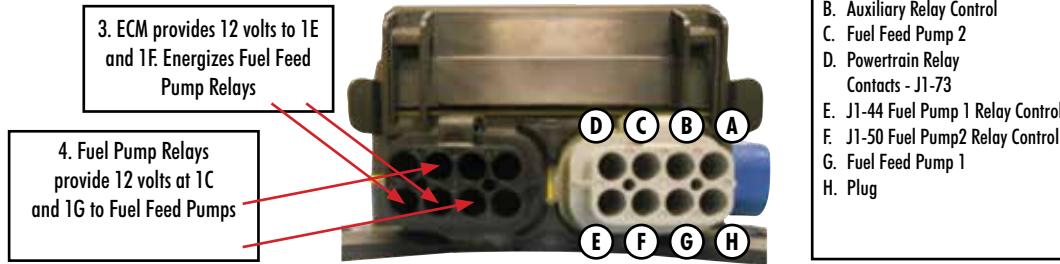


1. Ignition on Enables Run/Crank Relay (R2)

2. 2E supplies 12 volts to ECM J1-51. ECM "Wakes Up"

11. Engine Diagnostics and Codes

"Bussmann" Connector #1 (Black)



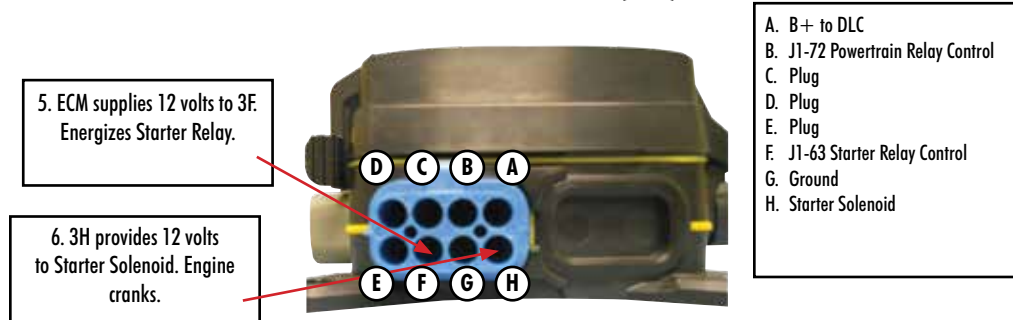
Start Sequence 3

- Momentarily turn Key Switch to Start. ECM receives crank request on pin J2-22.

Start Contact On

- ECM pin J1-63 supplies 12 volts to Bussmann 3F which energizes Starter Relay.
- Starter Relay then provides 12 volts to Bussmann 3H which in turn energizes Start Solenoid. Engine cranks.

"Bussmann" Connector #3 (Blue)



Starter Relay Control: 12 volts + from ECM in Neutral

12. Trouble Shooting

The following trouble shooting hints are not all inclusive, but are the most common found. In all cases, if the cause of the problem is outside your capability to repair or correct, contact your dealer.

Engine Will Not Turn Over

Possible Cause

Remedy

Low Battery or Bad Connection	Check/Charge/Replace. Requires 12 -14 volts
ECM B+ 18 ga. Wire not Powered	Must be Connected Directly to Battery or Battery Switch
Faulty Battery Cable	See Table for Proper Size
Blown Fuse	Check Fuses in SSEC Box
Faulty Neutral Switch	Replace
Bad Starter Solenoid or Motor	Replace
Shift Control in Gear	Take Out of Gear
Faulty Starter Relay	Check Relay in SSEC Box
Hydro Lock	Remove Spark Plug. Look for Water in the Cylinder
Engine Emergency. Stop Switch Activated	Clear DTC Code

Engine Cranks But Will Not Start

Possible Cause

Remedy

Faulty Fuel Pump	Note That Low Pressure and High Pumps Are Operating
Insufficient Fuel Supply	Check Fuel Supply Shut Off Valve, Check Fuel Filter. 5.7/6.0/6.2L - Requires 60 PSI Fuel Pressure
Insufficient Cranking RPM	Check Battery Voltage. Voltage Should Be Over 12 volts
Bad/Old Fuel	Replace
Insufficient Fuel Supply	Approximately 60 PSI. Fuel Pressure Must Be Adequate at Wide Open Throttle at Full Load
Active Trouble Code	See Dealer
Leaky Valves	See Dealer

Ensure a tune up is done every 100 hours or every season.

12. Trouble Shooting

Engine Runs Poorly at High RPM

Possible Cause	Remedy
Low Grade or Old Fuel	Check/Clean/Replace
Ignition Timing	Only Pertains to HVS (Distributor) on 5.7L. See Dealer
Active Trouble Code	See Dealer
Engine Overheating	See Engine Overheating on Page 45
Restricted Exhaust	Check Exhaust System
Overfilled Crankcase	Check Oil Level
Plugged Fuel Tank Vent	Check Vent Line for Blockage
Insufficient Fuel Supply	Approximately 60 PSI. Fuel Pressure Must Be Adequate at Wide Open Throttle at Full Load
Restricted Anti-Siphon Valve	Remove From Fuel Tank and Verify Spring Pressure
Low Compression	See Dealer

Engine performance can be greatly affected by boat hull and prop condition.

High Speed Miss

Possible Cause	Remedy
Water in Fuel	Inspect/Clean/Replace
Clogged Fuel Filter	Change Fuel Filter
Insufficient Fuel Supply	Approximately 60 PSI. Fuel Pressure Must Be Adequate at Wide Open Throttle at Full Load
Spark Plug or Wires	Verify That All Plug Wires Are Attached
Loose Ignition Connection	Check That All Connectors Are Attached
Detonation	Verify Fuel Pressure and Fuel Quality

NOTE: A Misfire will Cause a Trouble Code and RPM Reduction.

12. Trouble Shooting

Fuel System - Rich

Possible Cause

Dirty/Clogged Flame Arrester
Malfunctioning Fuel Pressure Regulator

Remedy

Check/Clean/Replace
Verify That Fuel Pressure Is Not Too High

Fuel System - Lean

Possible Cause

Empty Fuel Tank
Vapor Lock
Insufficient Fuel Supply

Remedy

Fill Tank
Ventilate Engine Compartment to Reduce Temperature
Approximately 60 PSI. Fuel Pressure Must Be Adequate at Wide Open Throttle at Full Load

Poor Fuel Economy

Possible Cause

Boat Hull Dirty
Incorrect Prop Size or Damage
Clogged Flame Arrester
Low Engine Compression
Engine Running Too Hot or Cold
Incorrect Fuel Grade
Boat Overload
Weight Distribution
Plugged or Restricted Exhaust

Remedy

Clean/Check/Adjust
Verify with Dealer or Manufacturer
Check/Clean/Replace
See Dealer
Raw Water Engines Operate at 145° F. Closed Cooled Engines Operate at 165°-185° F
Replace
Check Specifications
Check Specifications
Check Exhaust System

12. Trouble Shooting

Engine Starts and Stops

Possible Cause

Insufficient Fuel Supply
Loss of Ignition Power

Remedy

Approximately 60 PSI. Fuel Pressure Must Be Adequate at Wide Open Throttle at Full Load
Check Ignition Switch, Main Engine Breaker, Engine Harness Connection

Oil Pressure - Low

Possible Cause

Low Oil Level in Crankcase
Excessive Oil in Crankcase
Erroneous Oil Gauge Readings
Incorrect Dipstick
Incorrect Oil Viscosity or Diluted
Oil Pump Malfunctioning
Excessive Bearing Clearance

Remedy

Refer to Section 13: Engine Identification on Page 15
Remove Excess Oil. Refer to Section 13: Engine Identification on Page 15 for Correct Oil Level
Contact Dealer to Perform a Mechanical Oil Pressure Check
See Dealer
Change to Proper Oil
See Dealer
See Dealer

Low Oil Pressure Will Set a Trouble Code and Will Reduce Engine RPM.

Oil Pressure as Low as of 5 lbs. at Idle is Acceptable. At 2000 RPM 30 lbs. is Acceptable.

Oil Pressure - High

Possible Cause

Oil Too Thick - Wrong Viscosity
Erroneous Oil Gauge Readings
Clogged or Restricted Oil Passage
Oil Valve Relief Valve Stuck Closed

Remedy

Change to Proper Oil
Contact Dealer to Perform a Mechanical Oil Pressure Check
See Dealer
See Dealer

12. Trouble Shooting

Excessive Oil Consumption

Possible Cause	Remedy
External Leak	Clean/Check/Repair
Excessive Oil in Crankcase	Remove Excess Oil. Refer to Engine Identification on Page 15 for Correct Oil Level
Oil/Fuel Dilution	Change Oil
Extended Excessive RPM's	Reduce RPM's
Incorrect Oil Viscosity	Change to Proper Oil
Engine Vents Blocked	Unblock Vents
Defective Piston Rings	See Dealer
Defective Cylinders	See Dealer
Excessive Bearing Clearance	See Dealer

The Amount of Oil Used is Greatly Dependent Upon Engine Speed. Oil Usage Will be Greater at Higher RPM's.

Engine Overheating - Verify if Engine is Actually Overheating

Possible Cause	Remedy
Low Coolant Level	Add Coolant. Refer to Bleeding Procedure if Coolant was Low or Not Flowing into Tank
Clogged Sea Water Intake	Clear Intake. Ensure That All Hoses After the Intake are Clear
Clogged Sea Water Strainer	Clean Sea Strainer
Loose Hose Connections	Check and Tighten Clamps
Sea Water Hose Kinked or Collapsed	Verify Hose Routing and Condition
Obstruction in Cooling System	Verify that Engine/Transmission Oil Cooler is not Clogged with Debris
Sea Water Pump Impeller Worn	Replace
Antifreeze Not Properly Mixed	Mix to a 50/50 Ratio
Heat Exchanger Core Plugged	Verify that Engine Heat Exchanger Ends are not Clogged
Alternator Drive Belt Broken	Replace

12. Trouble Shooting

Water in Engine Cylinder or Base

Possible Cause

Remedy

Operator Error	See Section 7: Precautions on Page 23. REMOVE Water from Engine Immediately
Exhaust Restricted or Blocked	Repair or Replace. REMOVE Water from Engine Immediately
Engine and Exhaust Too Low in Boat	Reroute Exhaust Hoses or Add Riser Spacers. REMOVE Water from Engine Immediately
Defective Exhaust Riser Gasket	Contact Dealer. REMOVE Water from Engine Immediately
Defective Exhaust Manifold or Riser	Contact Dealer. REMOVE Water from Engine Immediately
Cylinder Head Gasket Leak	Contact Dealer. REMOVE Water from Engine Immediately
Cracked Block or Cylinder Head	Contact Dealer. REMOVE Water from Engine Immediately
Intake Manifold Gasket	Contact Dealer. REMOVE Water from Engine Immediately
Incorrect Engine Rotation	Contact Dealer. REMOVE Water from Engine Immediately

Remove water by removing spark plugs and turning the engine over by hand. Once water is removed spray cylinder with Marvel Mystery Oil or 2-Cycle Engine Oil. Drain all the oil and change the oil filter(s). Again, turn the engine over by hand to circulate the oil. Contact your dealer immediately to make the required repairs. Upon completion of repairs, run the engine and again change the oil.

13. Installation Instructions

NOTE: Before shipment, each engine has been carefully tested and inspected. It may be necessary to delete or add oil from the engine and transmission for various engine installations. If engine is equipped with a closed cooling system, it is imperative to fill the system with a 50/50 mix of Dex-Bool antifreeze and clean fresh water. Failure to use a 50/50 mixture of antifreeze and water can result in engine damage.

(See Section 3: Engine Identification)

Engine Compartment

The engine compartment should be well-planned giving consideration to accessibility and ventilation. Engines must have air as well as fuel to operate efficiently. The battery should be located as close as possible to the starter motor so that the battery leads can be kept short. EFI engines equipped with the SMART START option have a direct connection to the battery or battery switch. Engine wiring harness includes notation on Red/White wire.

Engine Mounting

Engine installation is very important. If the angle is severe (over 12 degrees) oil capacity may need to be adjusted.

Engine Bed

The engine bed should be of horizontal design and heavily constructed to maintain engine alignment. All of the thrust used in moving the boat is transferred to the hull through the engine bed. The standard engine has support mounts that are intended to be used on engine beds arranged for 22½" - 24" bolt centers.

Use adequate bolts for each support. Make certain there is no interference on the underside of the engine between the oil pan or other components located in that area and the hull.

Cooling System

Closed cooled engines use a combination of freshwater coolant (50% antifreeze + 50% water) and seawater for cooling. The closed cooling system will operate at 170° - 190° F. The system is monitored by the water temperature gauge on the instrument panel and, in the case of EFI, the Engine Control Module. On EFI engines the ECM will activate the POWER REDUCTION MODE if the engine temperature reaches 210° F. The POWER REDUCTION MODE reduces RPM to approximately 2500. The cooling system must receive a sufficient amount of sea water under all operating conditions to operate properly. Cooling water may be supplied from a stern drive unit or a through hull inlet scoop. ENPACS mated with stern drives that have water pumps in the drive leg can use the water supply from the leg without using an impeller seawater pump. If the ENPAC is equipped with closed cooling, a sea water pump will be part of the engine configuration and a through hull inlet scoop must be used. In that case, the through hull fitting and sea cock should be placed as close to the engine as possible and be one size larger than the water pump inlet. The water pump inlet scoop should face the bow of the boat in an area where there are no obstructions. Obstructions could cause water turbulence and prevent a solid stream of water from entering the sea scoop. Regardless of the supply (stern drive or inlet scoop) the coolant water inlet hose must be of a non-collapsing type. If a through hull inlet scoop is used, it is highly recommended that

a sea strainer of adequate size and capacity be installed between the sea cock and engine sea water pump. If no sea strainer is installed, periodically check the cooling inlet piping and hose to clear debris from engine and transmission oil coolers. Debris entering the cooling system is one of the main causes of overheating.

The ABYC and other industry standards require the use of a seacock on certain types of applications to stop the entry of water in the event of a leak in the cooling system. The seacock must provide a minimum restriction to water flow. A 90 degree ball valve with a lever quarter turn handle is the most commonly used type.

SPORTPACS AND TOWPACS use thru-hull fittings to supply cooling water to the sea water pump.

Emission-Related Installation Instructions

Failing to follow these instructions when installing a certified engine in a vessel violates federal law (40CFR 1068.105(b)) and is subject to fines or other penalties as described in the Clean Air Act. The installer and/or vessel manufacturer must meet the evaporative emission requirements of 40 CFR part 1060 and CFR 1045.112.

Any manufacturer installing a high performance engine must use enhanced evaporative control systems on any boat that is manufactured for sale, sold, or offered for sale in California, or that is introduced, delivered or imported into California for introduction into commerce.

13. Installation Instructions

Enhanced evaporative control system has designed the system components to meet or exceed the diurnal and permeation design specifications listed in the following table throughout the useful life of the engine.

PERMEATION STANDARDS [grams per sq. meter per day]	DIURNAL STANDARDS [grams per gal. per day]	TEST TEMP [degrees Celsius]
Fuel Hoses	15.0 — 23 ± 2	
Fuel Tank	1.5 — 28 ± 2	
Trailerable Boat	0.40	25.6 – 32.2
Non-trailerable Boat	0.16	27.6 – 30.2

CAUTION

DO NOT operate engine without water being supplied to raw water pump as damage to the impeller and engine will result.

Exhaust Piping

IMPORTANT: The boat manufacturer or installing dealer (or individual) is responsible for properly locating the engine and installing the exhaust system. Improper installation may allow water to enter the exhaust manifolds and engine cylinders and severely damage the engine. Damage caused by water in the engine will not be covered by the Marine Power warranty, unless this damage is a result of defective parts or workmanship by Marine Power.

ENPACS, SPORTPACS, JETPACS AND TOWPACS are equipped with a wet exhaust system in which exhaust is mixed with water in the exhaust risers. This water cools the exhaust and allows the use of heat resistant rubber hose on the riser outlets. Follow these general guidelines when designing and installing the exhaust system.

Use heat resistant hose that complies with specifications SAE J2006 or UL 1129 (ABYC standard). Exhaust hoses should be 4" on dual outlet systems. 6.2L and larger engines should use 5" on single outlet systems.

Sharp bends should be avoided.

Exhaust hoses should be connected straight on the riser outlets.

Exhaust back pressure test should be preformed to ensure that exhaust components are adequately sized. Exhaust back pressure should be between 1-3 PSI. Some back pressure is necessary to prevent water intrusion. Do not go below 1 PSI.

Exhaust risers must be the suggested distance above the water line. Install riser spacers if necessary.

A minimum of 18" of exhaust hose must be installed between the exhaust risers and the collector, Y-pipe, muffler or first angular fitting. This portion of the exhaust hose must have a downward slope of 1-1/4"/ft. for conventional inboards and a downward slope of 7/8"/ft. for V-drives. Some OEM installations may differ from these specifications but these installations have been carefully evaluated by Marine Power and the OEM.

After the first 18" the exhaust system must have a drop of 1/2"/ft. Measure exhaust riser height as shown. Minimum exhaust riser

height should be 15".

The slope in the exhaust hose and components must be routed so that no low point exists in the system where water may be retained. The muffler, collector and exhaust hoses must be adequately supported for proper routing and to prevent over stressing the exhaust manifolds and risers.

Internal flappers may be required.

Applications with through transom exhausts must be equipped with exhaust flappers to prevent the reverse flow of water into the engine. Exhaust outlets should be above the water line with the boat at rest to minimize engine back pressure.

Every exhaust connection should be secured with at least 2 hose clamps. The clamps should be stainless steel and at least 1/2" wide.

Electrical Connection

NOTE: Marine Power EFI engines are equipped with "Smart Start" this feature is common in late model automobiles but is new to the boating industry. This feature enables the operator to start the engine by momentarily engaging the key switch, it is not necessary to hold the key switch. The ECM maintains the starter engagement until the engine starts. Once the engine starts, the ECM prevents the starter from engaging even if the operator mistakenly turns the key switch. To ensure proper operation of this feature, the engine wiring harness includes an 18 gauge wire coiled by the starter. This wire must be connected directly to the battery or the battery switch. Do not connect this wire to the starter post as the voltage drops excessively at this location

13. Installation Instructions

during starting.

Batteries

Tapered post connections with wing nut connections can be used. The tapered posts must be used for the engine battery cables while the wing nut connections should only be used for accessories. We highly recommend that wing nuts be replaced with regular nuts to increase the tightness of the connections.

Pay particular attention to ground connections. EFI engines are very dependent on secure ground connections. See typical ground location.

Dual Engines

Batteries: Vessels with twin engines should have a battery for each engine. The battery switch should be positioned so each engine is running off its own battery.

Battery Isolators

Many boats are equipped with auxiliary batteries. Such batteries are used to operate stereos, etc. Battery isolators can be used to charge an auxiliary battery. In these cases, the alternator output is connected to the center post on the isolator instead of the starter. The owner should familiarize himself with the isolator's operation.

Engine Battery Specifications

Model	Minimum Required Rating
5.3L	650 CCA
6.2L	750 CCA

Battery Cable Length Requirements

Cable Length	Cable Gauge
Up to 3.5 ft.	4
3.5 - 6.0 ft.	2
6.0 - 7.5 ft.	1
7.5 - 9.5 ft.	0
9.5 - 12 ft.	00
12 - 15 ft.	000
15 - 19 ft.	0000

Special Fuel Instructions for 6.2 LT4 Engines

Fuel Supply: The fuel supply pick up tube, fuel lines and fittings shall be no smaller than 1/2" inside diameter between the fuel tank and the Aero Motive high-pressure fuel pump. The fuel pump must also have the supplied serviceable 100 Micron filter installed on the inlet side of the fuel pump. Some installations use an in-tank fuel pump. In these cases, the 100 micro filter or water separator is not necessary. Always mount a 10 micro filter between the pump and the injectors. When using an auxiliary engine such as an outboard motor, never plumb or tee into the main engine fuel system. The auxiliary engine shall have its own fuel pick up tube and fuel filter/water separator from the fuel tank. Plumbing into the main engine fuel supply will cause

damage to the engine and fuel pump system.

Fuel Pump Location: If the Aero Motive fuel pump is relocated from its mounting location on the engine it must be placed as close to the fuel tank as possible. The maximum distance from the fuel tank pick up tube should be no more than 30". The fuel pump must also be placed as low to the bottom of the fuel tank as possible. Using the lowest point on the bottom of the fuel tank, mount the fuel pump no more than 12" above the bottom of the fuel tank. USCG REGULATIONS require that the fuel pump should be within 12" of the engine (excepting Airboats).

The Racor fuel/water separator should NEVER be placed on the outlet side of the Aero Motive fuel pump. The fuel filter/water separator should also be mounted within 12" from the bottom of the fuel tank.



LT4 Fuel Pump #438627

Filter Case (10/100 Micron) #395536

Filter Element 10 Micron #395538

Filter Element 100 Micron #395548

13. Installation Instructions

LT4 Shipped Loose Parts

Note: Harness provided allows ECM and Fuse-Relay Box to be mounted off engine. See loose wire connections in table. Key switch power (Red) if for ignition power only. A separate power buss bar should be installed for auxilary dash power. Do not run battery to keywitch. Engine harness furnishes that power. Connect fuel pump outlet to FST filter inlet. The 18 gauge red-white wire that breaks out around the starter should be connected directly to the battery or Perko switch not the starter.



COLOR	DESCRIPTION
Red	Key Switch Batter Post
Black	Dashboard Ground
Yellow-Red	Key Switch Start Post
Purple	Key Switch Ignition Post
Yellow (Twisted Pair)	Can High
Green (Twisted Pair)	Can Low
Brown	Analog Water Temp
Blue	Analog Oil Pressure
Green-White	Alam Buzzer (ECM Controlled)
Blue-White	Mil Lamp (ECM Controlled)
Gray	Analog Tachometer

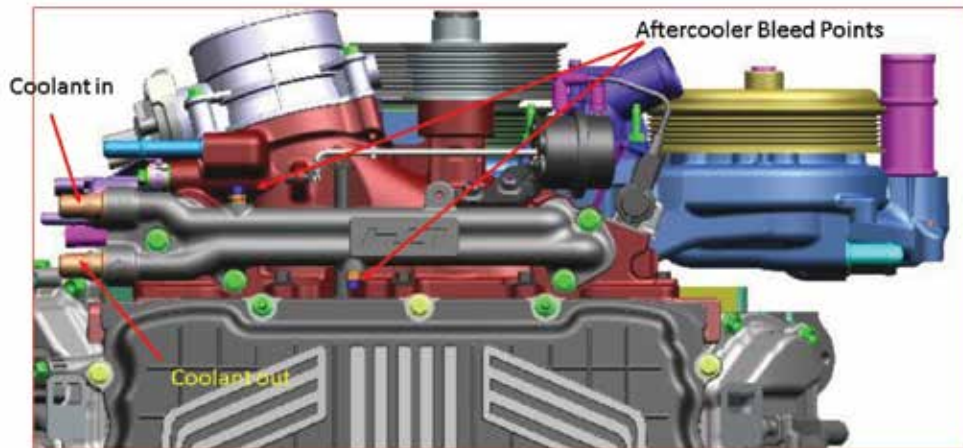
13. Installation Instructions

Airboat Installation Notes:

All GEN V DI engines require modified belt drive housings. Century Drive is aware of the required modifications. Engines require engine oil coolers. LT4 engines require radiators for intercooler heat rejection. Intercooler radiator should be large enough to maintain Manifold Air Temperature at WOT. Please note there are 2 bleed points on the LT4 intercooler. Verify that coolant is flowing through the system before before running the engine at higher rpm's.

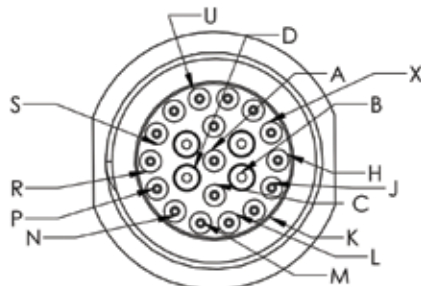
WARNING

The LT4 is a Premium 93 Octane REQUIRED engine. The engine will operate at significantly reduced power output with octane levels down to 90. Operating the LT4 on fuel below 90 Octane can result in engine damage and or failure! Such failure will not be covered under warranty!



13. Installation Instructions

Adapter Harness for Analog Instrumentation Harness M6 - 21 Pin to 10 Pin #473063



**ENGINE HARNESS
MATING CONNECTOR**

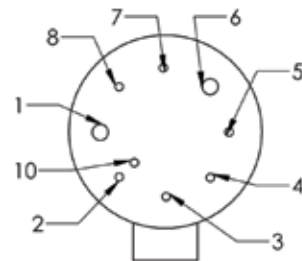
A	ALARM BUZZER	LT GRN/WHT
B	GROUND	BLACK
C	TACHOMETER	GRAY
D	12V POWER	RED
H	PP2 SIGNAL	BLUE/WHT
J	PP1 5V REF	GRAY
K	PP2 RETURN	BLK/WHT
L	PP1 RETURN	BLACK
N	ANALOG TEMP	TAN
P	CRANK REQUEST	YELLOW/RED
R	IGNITION	PURPLE
S	ANALOG OIL PRESSURE	LT BLUE
U	MIL LAMP	BLUE/WHT
X	PP1 SIGNAL	BLUE
M	PP2 5V REF	GRAY/WHT
W	CAN HI	YELLOW
V	CAN LO	GREEN

**POTENTIOMETER
CONNECTOR IS THE 10
PIN CONNECTOR
LOCATED IN THE
HARNESS**

**INDEPENDENT LOOSE
WIRE CONNECTIONS
ON ENGINE HARNESS**

CAN HI	YELLOW
CAN LOW	GREEN
ECM MIL LAMP	BLUE/WHT
ALARM BUZZER	LT GRN/WHT

SHIFT INTERRUPT WIRE IS
A INDIVIDUAL LOOSE
BLACK WIRE ORIGINATING
FROM THE J1 ECM PLUG



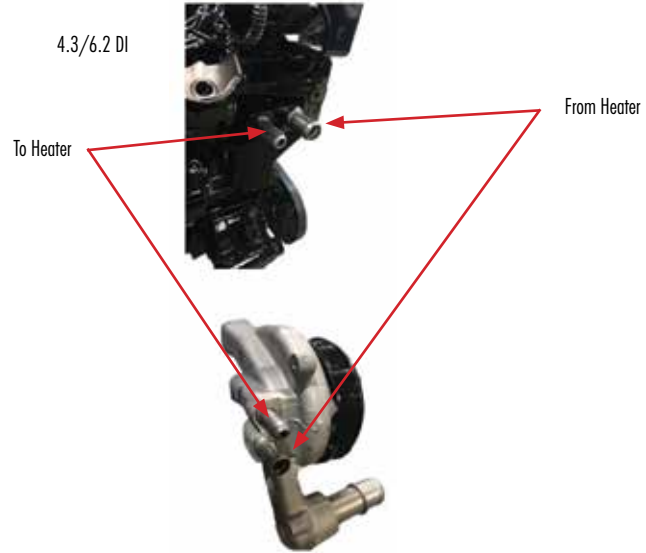
**BOAT
HARNESS
CONNECTOR**

1	GROUND	BLACK
2	TACHOMETER	GRAY
3	ANALOG WATER TEMP	TAN
4	ANALOG WATER ALARM	LT BROWN/BLUE
5	IGNITION	PURPLE
6	12 V POWER	RED
7	CRANK REQUEST	YELLOW/RED
8	ANALOG OIL PRESSURE	LT BLUE
10	ANALOG OIL ALARM	DR BROWN/WHITE

13. Installation Instructions

Heater Connections

LT4 Engine

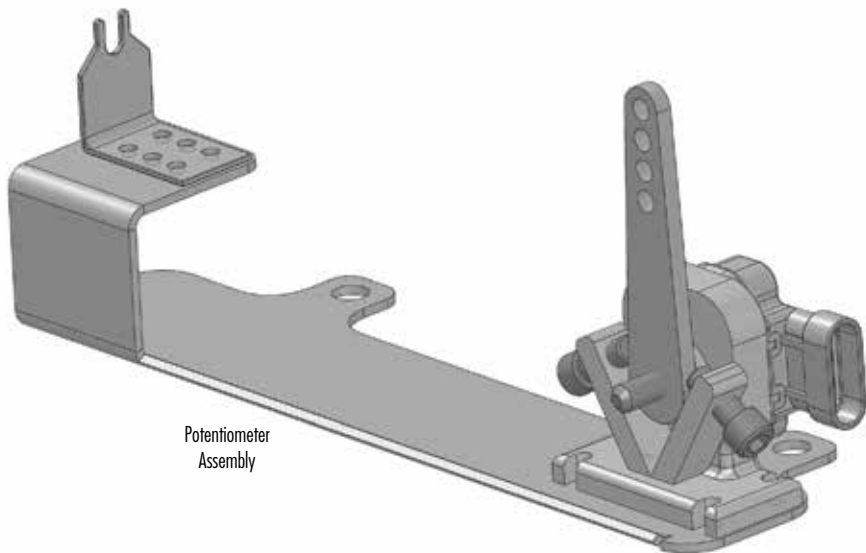


Prestart Checklist

1. Check engine, transmission and V-drive (if applicable) oil levels. Also check for any oil leaks and repair as needed.
2. Check that all engine drain plugs are installed and tightened. New engines may be shipped with drain plugs removed
3. If engine is equipped with optional closed cooling system, check for proper coolant level. Closed cooling systems must be filled with a 50/50 mixture of ethylene glycol based anti-freeze and clean fresh water. (See Routine Maintenance Section for "Filling" instructions) When properly filled, ensure that any/all fill caps, fittings and hoses are properly secured and not leaking.
4. If engine is raw water cooled check the system for leaks and correct as needed.
5. On engines equipped with Electronic Throttle Control (ETC) there may be a cable routed from the throttle control lever at the helm to a potentiometer located in the engine compartment. Make certain that this cable operates freely and is properly adjusted. **The adjustable potentiometer stop screws must not be used as the stop for the throttle lever/cable assembly at the helm.**
6. Check the transmission shift cable/lever adjustment on Inboard, V-drive and stern-drive applications with mechanical shift. If the transmission is equipped with electric shift, check for proper operation of the shift solenoids (ahead and astern). Refer to your transmission operation manual.

7. On inboard, V-drive and stern drive applications verify that the engine will not start unless the shifter is in the neutral position.
8. On jet drive applications, check for proper operation of the reverse bucket and adjust as needed.
9. Inspect the fuel system for leaks and repair as needed.

10. Check that all engine mounts are tight
11. Check that the battery is secure, and that all electrical connections are tight.

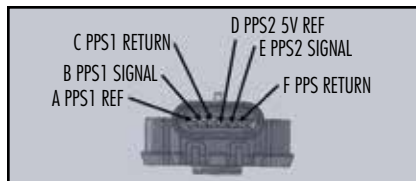
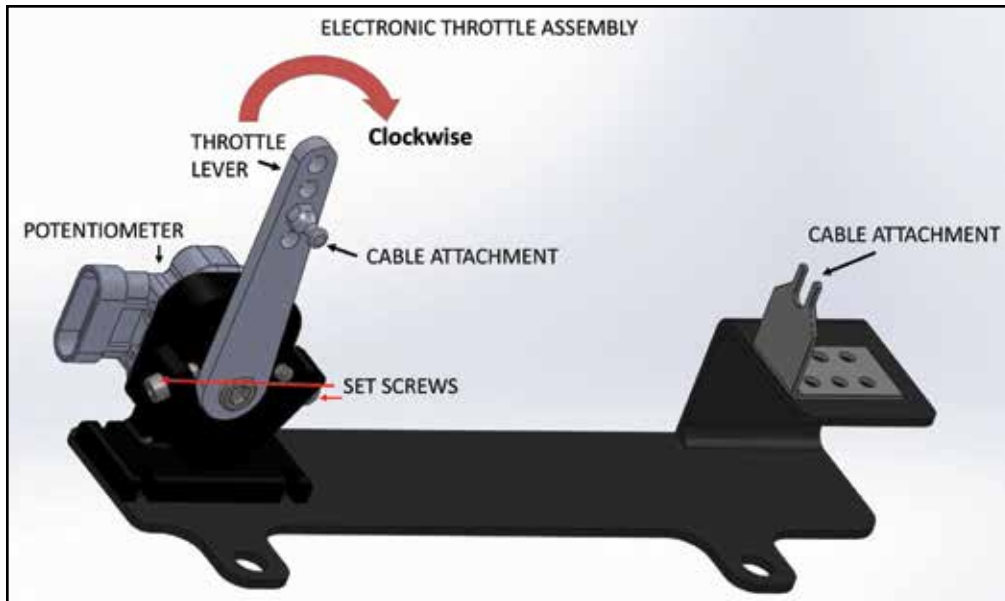


Potentiometer
Assembly

13. Installation Instructions

Potentiometer Operation

The throttle lever rotates approximately 80°. Maximum clockwise (CW) rotation is idle. Maximum counter-clockwise (CCW) rotation is wide open throttle (WOT). The Potentiometer has contacting wiper blades which produce 2 output voltages (PPS1 and PPS2). Both PPS1 and PPS2 output voltages should be adjusted to .78 volts at idle and 4.1 volts at WOT. If the output voltages are above or below these settings an "Out of Range" DTC will set and the throttle plate will not open or close. Likewise, if the dual output voltages differ by more than 8%, a "Correlation" DTC will set and the throttle plate will not open or close. The set screws are used to accurately adjust the output voltages. They are not to be used as stops for the throttle cable. Such use will cause a Correlation DTC. DTC's will automatically reset with an ignition switch recycle. If the set screws are impeding lever operation they must be backed out. If a Correlation DTC continues to set, the Potentiometer should be replaced as it is permanently damaged. If the Out of Range DTC is setting as soon as the ignition is turned on, the likely cause is mis-adjustment of idle outputs. If the Out of Range DTC occurs at WOT, the WOT outputs are out of adjustment.



PPS1 Voltage is determined by measuring between PPS 1 Signal and PPS 1 Return (A and C). PPS 2 Voltage is measured between PPS 2 Signal and PPS 2 Return (E and F). Connector will have to be back probed with ignition on.

POS	Description	Wire Color
A	PPS 1 5VOLT REF	Gray
B	PPS 1 SIGNAL	Blue
C	PPS 1 RETURN	Black
D	PPS 2 5VOLT REF	Gray/White
E	PPS 2 SIGNAL	Blue/White
F	PPS 2 RETURN	Black/White



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