Declaration of Conformance—Cummins MerCruiser Diesel

This sterndrive or inboard engine when installed in accordance with Cummins MerCruiser Diesel instructions complies with the requirements of the following directives by meeting the associated standards, as amended:

Recreational Craft Directive 94/25/EC; 2003/44/EC

Applicable Requirement	Standards Applied
Handling characteristics (A.4)	ISO 8665
Inboard engine (A.5.1.1)	ISO 15584; ISO 10088; ISO 7840; ISO 10133
Steering system (A.5.4)	Applicable portions of: ISO 10592, ISO 8848 and ABYC P-17
Exhaust emission requirements (B.2)	ISO 8178
Owner's manual (B.4)	ISO 8665
Noise emission levels (C.1) (sterndrive CE marked products only)	ISO 14509

Cummins MerCruiser Diesel declares that our sterndrive or inboard engines without integral exhaust, when installed in a recreational craft in accordance with the manufacturer's supplied instructions will meet the exhaust emissions requirements of the directive mentioned above. This engine must not be put into service until the recreational craft in which it is to be installed has been declared in conformity, if so required, with the relevant provision of the directive.

Electromagnetic Compatibility Directive 89/336/EC, 92/31/EEC and 93/68/EEC

Generic emission standard	EN 50081-1
Generic immunity standard	EN 50082-1
Vehicles, boats and internal combustion engine driven devices—radio disturbance characteristics	SAE J551 (CISPR 12)
Electrostatic discharge testing	EN 61000-6-2; EN 61000-4-2; EN61000-4-3

For specific information regarding exhaust or noise emissions and power declaration, please refer to the Declaration of Conformity supplied with each Cummins MerCruiser Diesel engine.

This declaration is issued under the sole responsibility of Cummins MerCruiser Diesel.

Jim Kahlenbeck

Director of Engineering—Cummins MerCruiser Diesel, Charleston, South Carolina U.S.A.

Regulatory contact:
Engineering—Marine Emissions
Cummins MerCruiser Diesel
4500 Leeds Avenue
Charleston, South Carolina 29405
USA
(843) 745-1610

Identification Record

Please record the following information:

Engine Model and Horsepower		**Engine Serial Number**
Transom Assembly Serial Number (Sterndrive)	**Gear Ratio**	**Sterndrive Unit Serial Number**

Transmission Model (Inboard)	**Gear Ratio**	**Transmission Serial Number**
Propeller Number	**Pitch**	**Diameter**
Hull Identification Number (HIN)		**Purchase Date**
Boat Manufacturer	**Boat Model**	**Length**
Exhaust Gas Emissions Certification Number		

The serial numbers are the manufacturer's keys to numerous engineering details that apply to your Cummins MerCruiser Diesel® power package. When contacting Cummins MerCruiser Diesel (CMD®) about service, **always specify model and serial numbers.**

Descriptions and specifications contained herein were in effect at the time this guide was approved for printing. Cummins MerCruiser Diesel, whose policies are based on continuous improvement, reserves the right to discontinue models at any time or to change specifications or designs without notice and without incurring obligation.

Cummins MerCruiser Diesel, Charleston, South Carolina, U.S.A. Printed in U.S.A.

Welcome

You have selected one of the finest marine power packages available. It incorporates numerous design features to assure operating ease and durability.

With proper care and maintenance, you will thoroughly enjoy using this product for many boating seasons. To ensure maximum performance and carefree use, we ask that you thoroughly read this manual.

The Operation, Maintenance and Warranty Manual contains specific instructions for using and maintaining your product. We suggest that this manual remain with the product for ready reference whenever you are on the water.

Thank you for purchasing one of our Cummins MerCruiser Diesel products. We sincerely hope your boating will be pleasant!

Cummins MerCruiser Diesel

Warranty Message

The product you have purchased comes with a **limited warranty** from Cummins MerCruiser Diesel; the terms of the warranty are set forth in the Warranty Sections of this manual. The warranty statement contains a description of what is covered, what is not covered, the duration of coverage, how to best obtain warranty coverage, **important disclaimers and limitations of damages** and other related information. Please review this important information.

Read This Manual Thoroughly

IMPORTANT: If you do not understand any portion of this manual, contact your dealer for a demonstration of actual starting and operating procedures.

Notice

Throughout this publication, and on your power package, dangers, warnings, cautions, and notices, accompanied by the International Hazard Symbol ⚠, may be used to alert the installer and user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully.

These Safety Alerts alone cannot eliminate the hazards that they signal. Strict compliance with these special instructions while performing the service, plus common sense operation, are major accident prevention measures.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, could result in engine or major component failure.

IMPORTANT: Identifies information essential to the successful completion of the task.

NOTE: *Indicates information that helps in the understanding of a particular step or action.*

⚠ WARNING

The operator (driver) is responsible for the correct and safe operation of the boat, the equipment aboard and the safety of all occupants aboard. We strongly recommend that the operator read this Operation, Maintenance and Warranty Manual and thoroughly understand the operational instructions for the power package and all related accessories before the boat is used.

⚠ WARNING

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

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Section 1 - Warranty

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Warranty Information

Warranty Registration—United States and Canada

1. It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the factory immediately upon sale of the new product.
2. It identifies the name and address of the original purchaser, product model and serial number(s), date of sale, type of use and selling dealer's code, name, and address. The dealer also certifies that you are the original purchaser and user of the product.
3. Upon receipt of the Warranty Registration Card at the factory, you will receive an owner resource guide that will include your warranty registration confirmation.
4. A temporary Owner Warranty Registration Card will be presented to you when you purchase the product.
5. Because of your selling dealer’s continuing personal interest in your satisfaction, the product should be returned to him for warranty service.
6. If your owner resource guide is not received within 60 days from date of new product sale, please contact your selling dealer.
7. The product warranty is not effective until the product is registered at the factory.

   NOTE: *Registration lists must be maintained by the factory and dealer on marine products sold in the United States, should a safety recall notification under the Federal Boat Safety Act be required.*
8. You may change your address at any time, including at time of warranty claim, by calling Mercury MerCruiser or sending a letter or fax with you name, old address, new address, and engine serial number to Mercury MerCruiser's warranty registration department. Your dealer can also process this change of information.
   Mercury Marine
   Attn: Warranty Registration Department
   W6250 Pioneer Road
   P.O. Box 1939
   Fond du Lac, WI 54936-1939
   920-929-5054
   Fax 920-929-5893

Warranty Registration—Outside the United States and Canada

1. It is important that your selling dealer fills out the Warranty Registration Card completely and mails it to the distributor or Marine Power Service Center responsible for administering the warranty registration and claim program for your area.
2. The Warranty Registration Card identifies your name and address, product model and serial numbers, date of sale, type of use and the selling distributor's and dealer's code number, name and address. The distributor or dealer also certifies that you are the original purchaser and user of the product.
3. A copy of the Warranty Registration Card, designated as the Purchaser's Copy, MUST be given to you immediately after the card has been completely filled out by the selling distributor or dealer. This card represents your factory registration identification, and should be retained by you for future use when required. Should you ever require warranty service on this product, your dealer may ask you for the Warranty Registration Card to verify date of purchase and to use the information on the card to prepare the warranty claim forms.
4. In some countries, the Marine Power Service Center will issue you a permanent (plastic) Warranty Registration Card within 30 days after receiving the Factory Copy of the Warranty Registration Card from your distributor or dealer. If you receive a plastic Warranty Registration Card, you may discard the Purchaser's Copy that you received from the distributor or dealer when you purchased the product. Ask your distributor or dealer if this plastic card program applies to you.
5. For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the International Warranty. See Table of Contents.

IMPORTANT: Registration lists must be maintained by the factory and dealer in some countries by law. It is our desire to have ALL products registered at the factory should it ever be necessary to contact you. Make sure your Cummins MerCruiser Diesel Distributor or Cummins MerCruiser Diesel Authorized Dealer fills out the warranty registration card immediately and sends the factory copy to the Marine Power International Service Center for your area.

Warranty Policies

Cummins MerCruiser Limited Warranty United States, Canada and Europe (Diesel Fueled Products Only)

What is covered

Cummins MerCruiser Diesel warrants its new products to be free of defects in material and workmanship during the period described below.

Duration of Coverage

This Limited Warranty provides coverage for two (2) years from the date the product is first sold to a recreational use retail purchaser, or the date on which the product is first put into service, whichever occurs first. Commercial use of the product voids the warranty. Commercial use is defined as any work or employment related use of the product, or any use of the product which generates income, for any part of the warranty period, even if the product is only occasionally used for such purposes. The repair or replacement of parts, or the performance of service under this warranty, does not extend the life of this warranty beyond its original expiration date. Unexpired warranty coverage can be transferred from one recreational use customer to a subsequent recreational use customer upon proper re-registration of the product. Unexpired warranty coverage cannot be transferred either to or from a commercial use customer.

Conditions That Must Be Met to Obtain Warranty Coverage

Warranty coverage is available only to retail customers that purchase from a Dealer authorized by Cummins MerCruiser Diesel to distribute the product in the country in which the sale occurred, and then only after the Cummins MerCruiser Diesel specified pre-delivery inspection process is completed and documented. Warranty coverage becomes available upon proper registration of the product by the authorized dealer. Inaccurate warranty registration information regarding recreational use, or subsequent change of use from recreational to commercial (unless properly re-registered) may void the warranty at the sole discretion of Cummins MerCruiser Diesel. Routine maintenance outlined in the Operation, Maintenance, and Warranty Manual must be timely performed in order to obtain warranty coverage. Cummins MerCruiser Diesel reserves the right to make any warranty coverage contingent upon proof of proper maintenance.

What Cummins Mercruiser Diesel Will Do

Cummins MerCruiser Diesel's sole and exclusive obligation under this warranty is limited to, at our option, repairing a defective part, replacing such part or parts with new or Mercury Marine certified re-manufactured parts, or refunding the purchase price of the Cummins MerCruiser Diesel product. Cummins MerCruiser Diesel reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

How to Obtain Warranty Coverage

The customer must provide Cummins MerCruiser Diesel with a reasonable opportunity to repair, and reasonable access to the product for warranty service. Warranty claims shall be made by delivering the product for inspection to a Cummins MerCruiser Diesel dealer/distributor authorized to service the product. If purchaser cannot deliver the product to such a dealer, written notice must be given to Cummins MerCruiser Diesel. We will then arrange for the inspection and any covered repair. Purchaser in that case shall pay for all related transportation charges and/or travel time. If the service provided is not covered by this warranty, purchaser shall pay for all related labor and material, and any other expenses associated with that service. Purchaser shall not, unless requested by Cummins MerCruiser Diesel, ship the product or parts of the product directly to Cummins MerCruiser Diesel. The warranty registration card is the only valid registration identification and must be presented to the dealer at the time warranty service is requested in order to obtain coverage.

What Is Not Covered

This limited warranty does not cover routine maintenance items, tune ups, adjustments, normal wear and tear, damage caused by abuse, abnormal use, use of gear ratio that does not allow the engine to operate at the recommended Engine Rated RPM, operation of the product in a manner inconsistent with the recommended operation/duty cycle section of the Operation, Maintenance, And Warranty Manual, neglect, accident, submersion, improper installation (proper installation specifications and techniques are set forth in the installation instructions for the product), improper service, use of an accessory or part which damages the Cummins MerCruiser Diesel product and was not manufactured or sold by us, jet pump impellers and liners, operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operation, Maintenance, And Warranty Manual), alteration or removal of parts, water entering the engine through the fuel intake, air intake or exhaust system or damage to the product from insufficient cooling water caused by blockage of the cooling system by a foreign body, running the engine out of water, mounting the engine too high on the transom, or running the boat with the engine trimmed out too far. Use of the product for racing or other competitive activity, or operating with a racing type lower unit, at any point, even by a prior owner of the product, voids the warranty.

Expenses related to haul-out, launch, towing, storage, telephone, rental, inconvenience, slip fees, insurance coverage, loan payments, loss of time, loss of income, or any other type of incidental or consequential damages are not covered by this warranty. Also, expenses associated with the removal and/or replacement of boat partitions or material caused by boat design for access to the product are not covered by this warranty.

No individual or entity, including Cummins MerCruiser Diesel authorized dealers, has been given authority by Cummins MerCruiser Diesel to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against Cummins MerCruiser Diesel.

DISCLAIMERS AND LIMITATIONS
THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTY. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME STATES/COUNTRIES DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE. AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH VARY FROM STATE TO STATE AND COUNTRY TO COUNTRY.

Cummins MerCruiser Limited Warranty Confederation of Independent States, Middle-East, and Africa (Diesel Fueled Products Only)

What is covered

Cummins MerCruiser Diesel warrants its new products to be free of defects in material and workmanship during the period described below.

Duration of Coverage

This Limited Warranty provides coverage for one (1) year from the date the product is first sold to a recreational use retail purchaser, or the date on which the product is first put into service, whichever occurs first. Commercial use of the product voids the warranty. Commercial use is defined as any work or employment related use of the product, or any use of the product which generates income, for any part of the warranty period, even if the product is only occasionally used for such purposes. The repair or replacement of parts, or the performance of service under this warranty, does not extend the life of this warranty beyond its original expiration date. Unexpired warranty coverage can be transferred from one recreational use customer to a subsequent recreational use customer upon proper re-registration of the product. Unexpired warranty coverage cannot be transferred either to or from a commercial use customer.

Conditions That Must Be Met to Obtain Warranty Coverage

Warranty coverage is available only to retail customers that purchase from a Dealer authorized by Cummins MerCruiser Diesel to distribute the product in the country in which the sale occurred, and then only after the Cummins MerCruiser Diesel specified pre-delivery inspection process is completed and documented. Warranty coverage becomes available upon proper registration of the product by the authorized dealer. Inaccurate warranty registration information regarding recreational use, or subsequent change of use from recreational to commercial (unless properly re-registered) may void the warranty at the sole discretion of Cummins MerCruiser Diesel. Routine maintenance outlined in the Operation, Maintenance, and Warranty Manual must be timely performed in order to obtain warranty coverage. Cummins MerCruiser Diesel reserves the right to make any warranty coverage contingent upon proof of proper maintenance.

What Cummins Mercruiser Diesel Will Do

Cummins MerCruiser Diesel’s sole and exclusive obligation under this warranty is limited to, at our option, repairing a defective part, replacing such part or parts with new or Mercury Marine certified re-manufactured parts, or refunding the purchase price of the Cummins MerCruiser Diesel product. Cummins MerCruiser Diesel reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

How to Obtain Warranty Coverage

The customer must provide Cummins MerCruiser Diesel with a reasonable opportunity to repair, and reasonable access to the product for warranty service. Warranty claims shall be made by delivering the product for inspection to a Cummins MerCruiser Diesel dealer/distributor authorized to service the product. If purchaser cannot deliver the product to such a dealer, written notice must be given to Cummins MerCruiser Diesel. We will then arrange for the inspection and any covered repair. Purchaser in that case shall pay for all related transportation charges and/or travel time. If the service provided is not covered by this warranty, purchaser shall pay for all related labor and material, and any other expenses associated with that service. Purchaser shall not, unless requested by Cummins MerCruiser Diesel, ship the product or parts of the product directly to Cummins MerCruiser Diesel. The warranty registration card is the only valid registration identification and must be presented to the dealer at the time warranty service is requested in order to obtain coverage.

What Is Not Covered

This limited warranty does not cover routine maintenance items, tune ups, adjustments, normal wear and tear, damage caused by abuse, abnormal use, use of gear ratio that does not allow the engine to operate at the recommended Engine Rated RPM, operation of the product in a manner inconsistent with the recommended operation/duty cycle section of the Operation, Maintenance, And Warranty Manual, neglect, accident, submersion, improper installation (proper installation specifications and techniques are set forth in the installation instructions for the product), improper service, use of an accessory or part which damages the Cummins MerCruiser Diesel product and was not manufactured or sold by us, jet pump impellers and liners, operation with fuels, oils or lubricants which are not suitable for use with the product (see the Operation, Maintenance, And Warranty Manual), alteration or removal of parts, water entering the engine through the fuel intake, air intake or exhaust system or damage to the product from insufficient cooling water caused by blockage of the cooling system by a foreign body, running the engine out of water, mounting the engine too high on the transom, or running the boat with the engine trimmed out too far. Use of the product for racing or other competitive activity, or operating with a racing type lower unit, at any point, even by a prior owner of the product, voids the warranty.

Expenses related to haul-out, launch, towing, storage, telephone, rental, inconvenience, slip fees, insurance coverage, loan payments, loss of time, loss of income, or any other type of incidental or consequential damages are not covered by this warranty. Also, expenses associated with the removal and/or replacement of boat partitions or material caused by boat design for access to the product are not covered by this warranty.

No individual or entity, including Cummins MerCruiser Diesel authorized dealers, has been given authority by Cummins MerCruiser Diesel to make any affirmation, representation or warranty regarding the product, other than those contained in this limited warranty, and if made, shall not be enforceable against Cummins MerCruiser Diesel.

DISCLAIMERS AND LIMITATIONS
THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. TO THE EXTENT THAT THEY CANNOT BE DISCLAIMED, THE IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE LIFE OF THE EXPRESS WARRANTY. INCIDENTAL AND CONSEQUENTIAL DAMAGES ARE EXCLUDED FROM COVERAGE UNDER THIS WARRANTY. SOME STATES/COUNTRIES DO NOT ALLOW FOR THE DISCLAIMERS, LIMITATIONS AND EXCLUSIONS IDENTIFIED ABOVE. AS A RESULT, THEY MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER LEGAL RIGHTS WHICH VARY FROM STATE TO STATE AND COUNTRY TO COUNTRY.

Warranty Coverage and Exclusion

Keep in mind that warranty covers repairs that are needed within the warranty period because of defects in material and workmanship. Installation errors, accidents, normal wear, and a variety of other causes that affect the product are not covered.

Warranty is limited to defects in material or workmanship, but only when the consumer sale is made in the country to which distribution is authorized by us.

Should you have any questions concerning warranty coverage contact your authorized dealer. They will be pleased to answer any questions that you may have.

Warranty Does Not Apply to the Following:

- Minor adjustments or checks, including checking fuel injection pump timing, cleaning fuel injectors, filters, or adjusting belts, controls, and checking lubrication made in connection with normal services.
- Damage caused by neglect, lack of maintenance, accident, abnormal operation, improper installation or service, or freezing temperatures.
- Haul-out, launch, towing charges; removal and/or replacement of boat partitions or material because of boat design for necessary access to the product; all related transportation charges and/or travel time, etc. Reasonable access must be provided to the product for warranty service. Customer must deliver product to an Authorized Dealer.
- Additional service work requested by customer other than that necessary to satisfy the warranty obligation.
- Labor performed by other than an Authorized Dealer may be covered only under following circumstances: When performed on emergency basis (providing there are no Authorized Dealers in area who can perform the work required or have no facilities to haul out, etc., and prior factory approval has been given to have the work performed at this facility).
- All incidental and/or consequential damages (storage charges, telephone or rental charges of any type, inconvenience or loss of time or income) are the owner’s responsibility.
- Use of other than Quicksilver replacement parts when making warranty repairs.
- Oils, lubricants or fluids changed as a matter of normal maintenance are the customer’s responsibility unless loss or contamination of the same is caused by product failure that would be eligible for warranty consideration.
- Participating in or preparing for racing or other competitive activity.
- Engine noise does not necessarily indicate a serious engine problem. If diagnosis indicates a serious internal engine condition which could result in a failure, condition responsible for noise should be corrected under the warranty.

- Lower unit and/or impeller damage caused by striking a submerged object is considered a marine hazard.
- Water entering the engine via the air filter or exhaust system or submersion. Also, water in the starter motor.
- Starter motors and/or armatures or field coil assembly, which are burned, or where lead is thrown out of commutator because of excess cranking.
- Valve or valve seat grinding required because wear.
- Failure of any parts caused by lack of cooling water, which results from starting power package out of water, foreign material blocking inlets or power package being mounted too high.
- Use of fuels and lubricants that are not suitable for use with or on the product. Refer to your Operation, Maintenance, And Warranty Manual.
- Our limited warranty does not apply to any damage to our products caused by the installation or use of parts and accessories that are not manufactured or sold by us. Failures that are not related to the use of those parts or accessories, are covered under warranty, if they otherwise meet the terms of the limited warranty for that product.

Transfer of Warranty

The limited warranty is transferable to a subsequent purchaser, but only for the remainder of the unused portion of the limited warranty. This will not apply to products used for commercial applications.

To transfer the warranty to the subsequent owner, send or fax a copy of the bill of sale or purchase agreement, new owner's name, address and engine serial number to Mercury Marine's warranty registration department. In the United States and Canada, mail to:

Mercury Marine
Attn: Warranty Registration Department
W6250 W. Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54936-1939
920-929-5054
Fax +1 920 929 5893

Upon processing the transfer of warranty, Mercury Marine will send registration verification to the new owner of the product by mail.

There is no charge for this service.

For products purchased outside the United States and Canada, contact the distributor in your country, or the Marine Power Service Center closest to you.

Section 2 - Getting to Know Your Power Package

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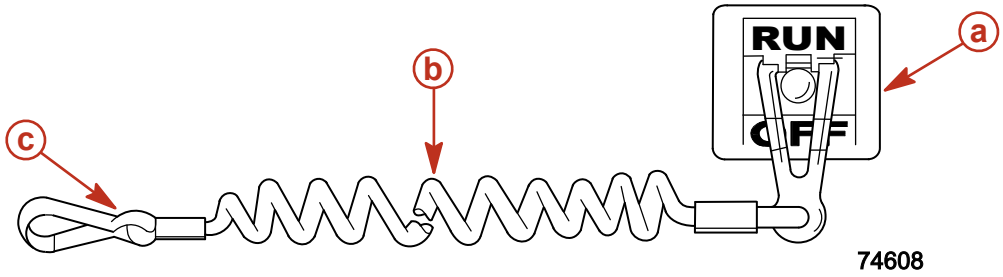
Features And Controls

Lanyard Stop Switch

The purpose of a lanyard stop switch is to turn off the engine when the operator moves outside the operator's position (as in accidental ejection from the operator's position).



a - Stop switch
b - Lanyard
c - Clips to the operator

Accidental ejections, such as falling overboard, are more likely to occur in:

- low-sided sport boats
- bass boats
- high performance boats

Accidental ejections can also occur from:

- poor operating practices
- sitting on the seat or gunwale at planing speeds
- standing at planing speeds
- operating at planing speeds in shallow or obstacle infested waters
- releasing your grip on the steering wheel that is pulling in one direction
- consuming alcohol or drugs
- high speed boating maneuvers

The lanyard is a cord usually between 122 and 152 cm (4 and 5 ft) in length when stretched out, with an element on one end made to be inserted into the switch and a snap on the other end for attaching to the operator. The lanyard is coiled to make its at-rest condition as short as possible to minimize the likelihood of lanyard entanglement with nearby objects. Its stretched-out length is made to minimize the likelihood of accidental activation should the operator choose to move around in an area close to the normal operator's position. If it is desired to have a shorter lanyard, wrap the lanyard around the operator's wrist or leg, or tie a knot in the lanyard.

Activation of the lanyard stop switch will stop the engine immediately, but the boat will continue to coast for some distance depending upon the velocity and degree of any turn at shut down. However, the boat will not complete a full circle. While the boat is coasting, it can cause injury to anyone in the boat's path as seriously as the boat would when under power.

We strongly recommend that other occupants be instructed on proper starting and operating procedures should they be required to operate the engine in an emergency (e.g. if the operator is accidentally ejected).

⚠ WARNING

If the operator falls out of the boat, stop the engine immediately to reduce the possibility of serious injury or death from being struck by the boat. Always properly connect the operator to the stop switch using a lanyard.

Accidental or unintended activation of the switch during normal operation is also a possibility. This could cause any, or all, of the following potentially hazardous situations:

- Occupants could be thrown forward due to unexpected loss of forward motion, a particular concern for passengers in the front of the boat who could be ejected over the bow and possibly struck by the propulsion or steering components.
- Loss of power and directional control in heavy seas, strong current or high winds.
- Loss of control when docking.

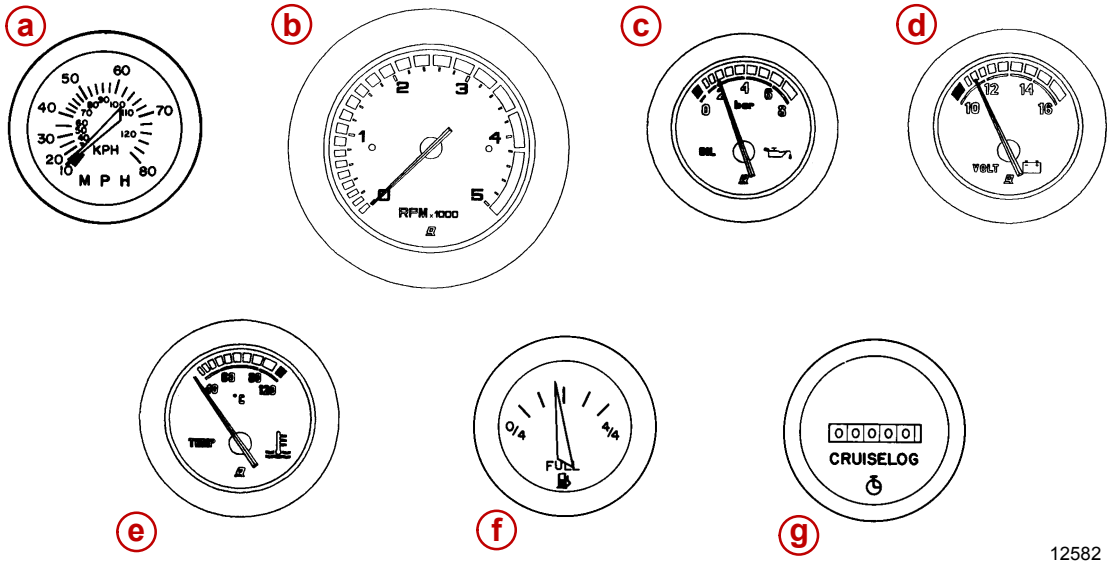
⚠ WARNING

Avoid serious injury or death from deceleration forces resulting from accidental or unintended stop switch activation. The boat operator should never leave the operator's station without first disconnecting the stop switch lanyard from the operator.

Instrumentation—1.7 MI

Instruments—Inboard Models

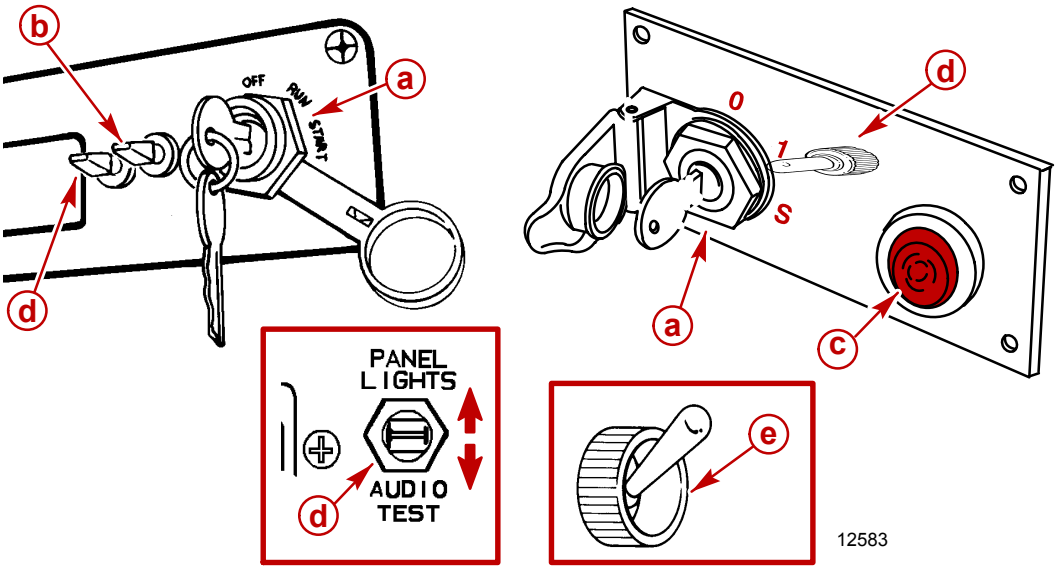
The following is a brief explanation of the instrumentation typically found on some boats. The owner, operator, or both should be familiar with all the instruments and their functions on the boat. Because of the large variety of instrumentation and manufacturers, you should have your boat dealer explain the gauges and normal readings that will appear on your boat.



Typical gauges

Reference	Gauge	Function
a	Speedometer	Indicates boat speed.
b	Tachometer	Indicates engine revolutions per minute (RPM).
c	Oil Pressure Gauge	Indicates engine oil pressure.
d	Battery Meter	Indicates battery voltage.
e	Coolant Temperature Gauge	Indicates engine operating temperature.
f	Fuel Gauge	Indicates quantity of fuel in tank.
g	Hour Meter	Records engine operating time.

Switches

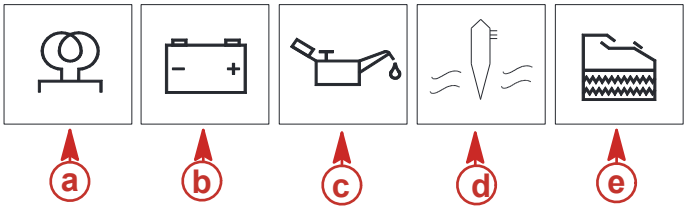


Typical switches

- **a -** Key switch
- **b -** Engine stop switch toggle (if equipped)
- **c -** Engine stop switch push button (if equipped)
- **d -** Panel lights and audio test switch
- **e -** Bilge blower switch (if equipped)

Reference	Switch	Function
a	Key switch	Has three positions. 1. **"OFF" or 0**. In the "OFF," or 0, position, all electrical circuits are off and the engine cannot be started. If the engine is operating, the key switch cannot be used to stop the engine. On all engines, the engine can only be stopped by using the engine stop switch while the key switch is in the "RUN," or 1, position. No electrical circuit, including the engine stop switch is operational when the key switch is turned to the "OFF," or 0, position. ***NOTE:*** *Do not operate the engine with the key switch in the "OFF" position.* 2. **"RUN" or 1**. In the "RUN," or 1, position, all electrical circuits, indicator lamps, automatic preheating (if equipped), and all instruments are operational. 3. **"START" or S**. In the "START," or S, position the engine can be started. ***NOTE:*** *The key can only be removed with the key switch in the "OFF" position.*
b or c	Engine stop switch	Is used to stop the engine. This is done by electrically shutting off the fuel delivery system. The switch, toggle, or push-button is either toggled down or pressed in. Engage and hold the stop switch until the engine stops completely. Then, turn the key switch to the "OFF" position.
d	Panel lights and audio test switch	Has three positions. In the normal position, all electrical circuits operate in a standard fashion (as described above). With the switch toggled up, the instrumentation lights are all illuminated. When the switch is toggled down, the audio warning alarm will sound, allowing the operator to test the audio warning alarm.
e	Bilge blower switch	Operates bilge blower

Engine Monitoring Features



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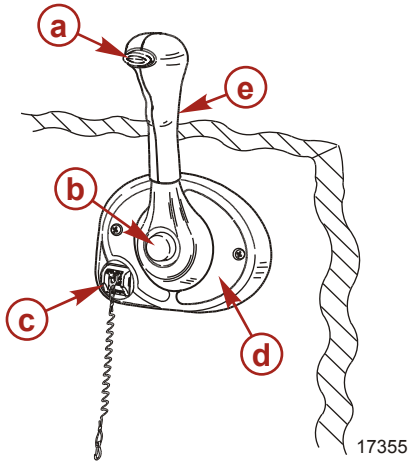
Engine Warning Lamps

Reference	Warning Lamp	Function
a	Preheat indicator lamp (If equipped)	Indicates when the glow plugs, if equipped, are preheating the combustion chambers. When the engine is cold, the timed preheat period begins when the key switch is turned to "RUN" or 1. The light stays on until the preheat period is complete. The engine can be started only after the light goes out.
b	Charge indicator lamp	Indicates a problem with the charging system if the lamp illuminates while the engine is operating. The lamp will be on when the key switch is in the "RUN" or 1 position and the engine is not operating. When engine starts, the light should go off.
c	Oil pressure warning lamp	Indicates low engine oil pressure if the lamp illuminates while the engine is running.
d	Coolant temperature warning lamp and transmission fluid temperature warning lamp	Indicates excessive engine coolant temperature if the lamp illuminates while the engine is running. ***NOTE:*** *If the lamp illuminates while the engine is operating with coolant temperature and coolant level normal, this may indicate excessive transmission fluid temperature. Determine the cause and correct the problem.*
e	Water-in-fuel warning lamp	Indicates water is present in the fuel filter and that the fuel filter requires service.

Remote Controls

Your boat may be equipped with Mercury Precision Parts or Quicksilver remote controls. All controls may not have all features shown. Consult your dealer for a description or demonstration of your remote control.

Panel Mount Features



17355

a - Neutral lock button
b - Throttle-only button
c - Lanyard stop switch
d - Control handle tension adjustment screw
e - Control handle

Neutral lock button. Prevents accidental shift and throttle engagement. The neutral lock button must be pushed in to move the control handle out of neutral.

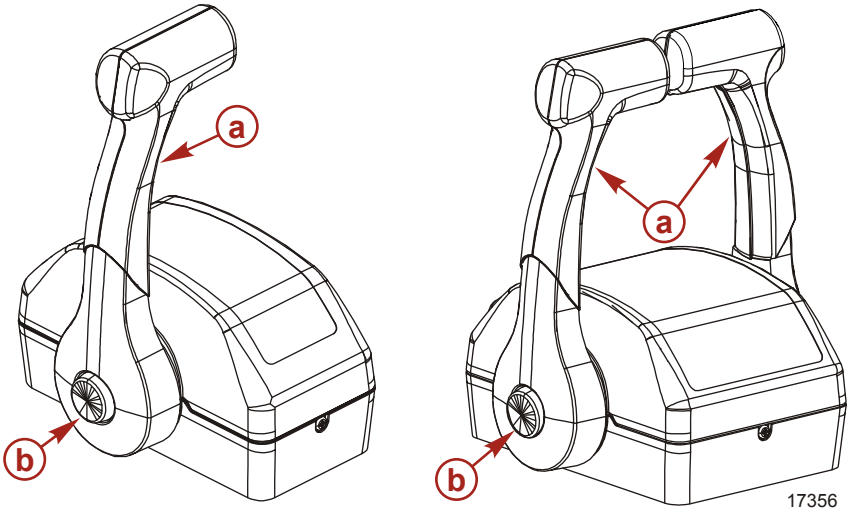
Throttle-only button. Allows engine throttle advancement without shifting the engine. This is done by disengaging the shift mechanism from the control handle. The throttle-only button can be depressed only when the remote control handle is in the neutral position, and should only be used to assist in starting the engine.

Lanyard stop switch. Turns the ignition off whenever the operator (when attached to the lanyard) moves far enough away from the operator's position to activate the switch. See **Lanyard Stop Switch** for information on the use of this switch.

Control handle. Operation of the shift and throttle is controlled by the movement of the control handle. Push the control handle forward from neutral with a quick, firm motion to the first detent for forward gear. Continue pushing forward to increase speed. Pull the control handle back from neutral with a quick, firm motion to the first detent for reverse gear and continue pushing back to increase speed.

Control handle tension adjustment screw (not visible). This screw is used to adjust the effort required to move the remote control handle. Refer to the instructions provided with the remote control for complete adjustment instructions.

Console Mount Features



a - Control handle
b - Throttle-only button

Throttle-only button. Allows engine throttle advancement without shifting the engine. This is done by disengaging the shift mechanism from the control handle. The throttle-only button can be depressed only when the remote control handle is in the neutral position.

Control handles. Operation of the the shift and throttle is controlled by the movement of the control handle. Push the control handle forward from neutral with a quick, firm motion to the first detent for forward gear and continue pushing forward to increase speed. Pull the control handle back from neutral with a quick, firm motion to the first detent for reverse gear and continue pushing back to increase speed.

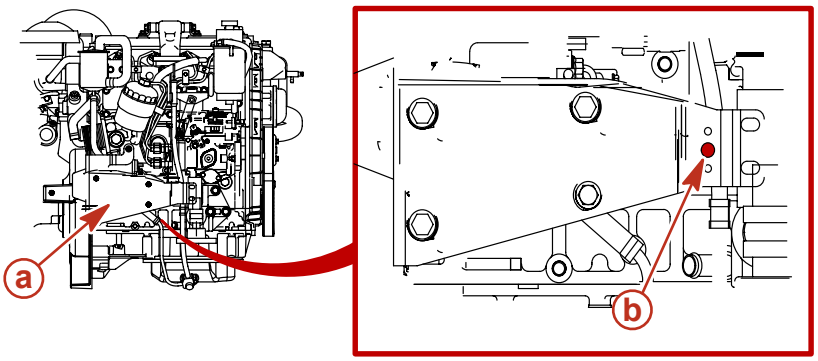
Control handle tension adjustment screw (not visible). This screw is used to adjust the effort required to move the remote control handle. Refer to the instructions provided with the remote control for complete adjustment instructions.

Engine Electrical System Overload Protection

If an electrical overload occurs, a fuse will burn out (blow) or a circuit breaker will trip open. Find and correct the cause for the electrical overload before replacing the fuse or resetting the circuit breaker.

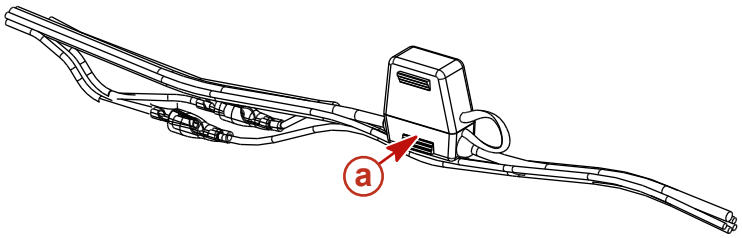
NOTE: *In an emergency, when the engine must be operated and the cause for the high current draw cannot be located and corrected, turn "OFF" or disconnect all the accessories connected to the engine and instrumentation wiring. Reset the circuit breaker. If the breaker remains open, the electrical overload has not been eliminated. Further checks must be made on the electrical system. Contact your Cummins MerCruiser Diesel Authorized Repair Facility.*

1. One 50-amp circuit breaker provides protection for the engine wiring harness and instrumentation power lead. Reset by pushing the reset button in.



a - Bracket
b - Circuit breaker

2. A 20-amp fuse is located in-line in the key switch power supply wire and protects the instrumentation and wiring should an electrical overload occur. If an overload occurs, the fuse will burn out. Check for a blown (burned) fuse if all the following are true:
   - The key is turned to "RUN" (1) or "START" (S).
   - The instruments do not work, the switches do not function, or both.
   - A circuit breaker is not tripped.



7945

a - 20-amp in-line fuse

Audio Warning System

Your Cummins MerCruiser Diesel power package may be equipped with an Audio Warning System. The Audio Warning System will not protect the engine or transmission from damage. It is designed to warn the operator that a problem has occurred.

The audio warning system will sound with a continuous alarm if one of the following occurs:

- Engine oil pressure too low
- Coolant temperature too hot
- Transmission fluid temperature too hot

NOTICE
A continuous horn indicates a critical fault. Operating the engine during a critical fault can damage components. If the warning horn emits a continuous beep, do not operate the engine unless avoiding a hazardous situation.

If the alarm sounds, stop the engine immediately. Investigate the cause and correct it, if possible. If the cause cannot be determined, consult your Cummins MerCruiser Diesel Authorized Repair Facility.

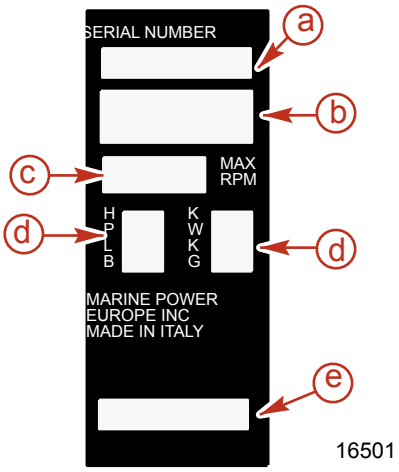
Testing The Audio Warning System

1. Turn the ignition switch to the on position without cranking the engine.
2. Engage the audio test switch and hold.
3. Listen for the alarm to sound indicating that the system is functioning correctly.

Emissions Information

Exhaust Gas Emissions Certificate (Europe Only)

A tamper-resistant label is affixed to the engine at time of manufacture by Cummins MerCruiser Diesel. In addition to the required exhaust gas emissions certificate number, the label lists the engine serial number, engine family, maximum RPM, engine power, and weight. Please note that the exhaust gas emissions certification will not affect the fit, function, or performance of the engines. Boatbuilders and dealers may not remove the label or the part it is affixed to before sale. If modifications are necessary, contact Cummins MerCruiser Diesel about the availability of replacement decals before proceeding.



a - Engine serial number
b - Engine family
c - Maximum RPM
d - Power and weight
e - "IMO"—Exhaust Gas Emissions Certificate Number

Owner Responsibility

The owner or operator is not to modify the engine in any manner that would alter the horsepower or allow exhaust gas emission levels to exceed their predetermined factory specifications.

Section 3 - On The Water

Table of Contents

Safe Boating Suggestions

In order to safely enjoy the waterways, familiarize yourself with local and all other governmental boating regulations and restrictions, and also consider the following suggestions.

- Know and obey all nautical rules and laws of the waterways.

Cummins MerCruiser Diesel strongly recommends that all powerboat operators complete a boating safety course. Courses are offered in the U.S.A. by the U.S. Coast Guard Auxiliary, the Power Squadron, the Red Cross, and your state or provincial boating law enforcement agency. Inquiries may be made to the Boating Hotline at 1-800-368-5647 or the Boat U.S. Foundation at 1-800-336-BOAT.

- **Perform safety checks and required maintenance.** Follow a regular schedule and ensure that all repairs are properly made.
- **Check safety equipment on board.** Here are some suggestions of the types of safety equipment to carry when boating:
  - ☐ Approved fire extinguishers
  - ☐ Paddle or oar
  - ☐ Signal devices: flashlight, rockets or flares, flag, and whistle or horn
  - ☐ Transistor radio
  - ☐ Tools necessary for minor repairs
  - ☐ First aid kit and instructions
  - ☐ Anchor and extra anchor line
  - ☐ Waterproof storage containers
  - ☐ Manual bilge pump and extra drain plugs
  - ☐ Spare operating equipment, batteries, bulbs, and fuses
  - ☐ Drinking water
  - ☐ Compass and map or chart of the area
- **Watch for signs of weather change and avoid foul weather and rough-sea boating.**
- **Tell someone where you are going and when you expect to return.**
- **Passenger boarding.** Stop the engine whenever passengers are boarding, unloading, or are near the back (stern) of the boat. Shifting the drive unit into neutral is not sufficient.
- **Use personal flotation devices**. Federal law requires that there be a U. S. Coast Guard–approved, wearable-type life jacket (personal flotation device), correctly sized and readily accessible for every person aboard, plus a throwable cushion or ring. We strongly advise that everyone wear a life jacket at all times while in the boat.
- **Prepare other boat operators.** Instruct at least one person aboard in the basics of starting and operating the engine and handling the boat in case the driver becomes disabled or falls overboard.
- **Do not overload your boat.** Most boats are rated and certified for maximum load (weight) capacities (refer to your boat capacity plate). Know your boat's operating and loading limitations. Know if your boat will float if full of water. When in doubt, contact your authorized Cummins MerCruiser Diesel dealer/distributor or the boat manufacturer.
- **Ensure that everyone in the boat is properly seated.** Do not allow anyone to sit or ride on any part of the boat that was not intended for such use. This includes the backs of seats, gunwales, transom, bow, decks, raised fishing seats, and any rotating fishing seat; anywhere that sudden unexpected acceleration, sudden stopping, unexpected loss of boat control or sudden boat movement could cause a person to be thrown overboard or into the boat. Ensure that all passengers have a proper seat and are in it before any boat movement.
- **Never be under the influence of alcohol or drugs while boating (it is the law).** Alcohol or drugs impairs your judgment and greatly reduce your ability to react quickly.
- **Know your boating area and avoid hazardous locations.**
- **Be alert.** The operator of the boat is responsible by law to maintain a proper lookout by sight and hearing. The operator must have an unobstructed view particularly to the front. No passengers, load, or fishing seats should block the operator's view when operating the boat above idle or planing transition speed. Watch out for others, keep your eyes on the the water, and be aware of your wake.
- **Never drive your boat directly behind a water skier in case the skier falls.** As an example, your boat traveling at 40 km/h (25 MPH) will overtake a fallen skier who was 61 m (200 ft.) in front of you in five seconds.
- **Watch fallen skiers.** When using your boat for water skiing or similar activities, always keep a fallen or down skier on the operator's side of the boat while returning to attend to the skier. The operator should always have the down skier in sight and never back up to the skier or anyone in the water.

- **Report accidents.** Boat operators are required by law to file a Boating Accident Report with their state boating law enforcement agency when their boat is involved in certain boating accidents. A boating accident must be reported if 1) there is loss of life or probable loss of life, 2) there is personal injury requiring medical treatment beyond first aid, 3) there is damage to boats or other property where the damage value exceeds US $500.00 or 4) there is complete loss of the boat. Seek further assistance from local law enforcement.

Be Alert to Carbon Monoxide Poisoning

Carbon monoxide is present in the exhaust fumes of all internal combustion engines including the outboards, sterndrives and inboard engines that propel boats, as well as the generators that power various boat accessories. Carbon monoxide is a deadly gas that is odorless, colorless and tasteless.

Early symptoms of carbon monoxide poisoning, which should not be confused with seasickness or intoxication, include headache, dizziness, drowsiness and nausea.

⚠ WARNING

Carbon monoxide poisoning can lead to unconsciousness, brain damage, or death. Keep the boat well ventilated while at rest or underway and avoid prolonged exposure to carbon monoxide.

Good Ventilation

Ventilate the passenger area, open the side curtains or forward hatches to remove fumes.

1. Example of desired air flow through the boat.

mc79553-1

Poor Ventilation

Under certain conditions, permanently enclosed or canvas enclosed cabins or cockpits with insufficient ventilation may draw in carbon monoxide. Install one or more carbon monoxide detectors in your boat.

Although the occurrence is rare, on a very calm day, swimmers and passengers in an open area of a stationary boat that contains or is near an operating engine may be exposed to a hazardous level of carbon monoxide.

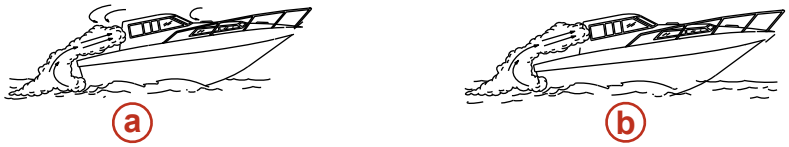
1. Examples of poor ventilation while a boat is stationary:

mc79554-1

a - Operating the engine when the boat is moored in a confined space

b - Mooring close to another boat with its engine operating

2. Examples of poor ventilation while a boat is moving:



mc79556-1

a - Operating the boat with the trim angle of the bow too high

b - Operating the boat with no forward hatches open (station wagon effect)

Basic Boat Operation

Launching and Boat Operation Care

IMPORTANT: Install the bilge drain plug before launching the boat.

Duty Cycle Rating

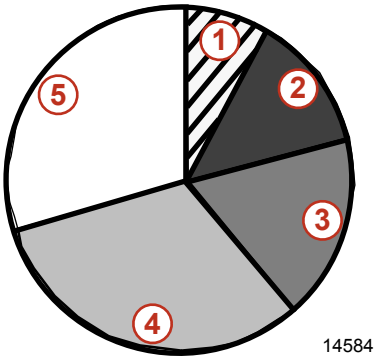
IMPORTANT: Damage caused by improper application or failure to operate the power package within the specified operating parameters will not be covered by the Cummins MerCruiser Diesel Limited Warranty.

It is the responsibility of the boat manufacturer or the installing dealer to ensure that the power package is properly applied. In all cases, the power package must be equipped with the gear ratio that allows the engine to operate at wide open throttle (WOT) at the Rated Engine RPM. The power package must also be applied in accordance with recommendations indicated in the appropriate applications manual. Use of Cummins MerCruiser Diesel engines in other than the applications indicated by the following information and in the appropriate applications manual requires written approval from an Authorized Cummins MerCruiser Diesel Application Engineer.

Pleasure Duty Rating

The Pleasure Duty Rating applies to recreational planing craft used exclusively for pleasure and recreation. Typical applications include pleasure craft such as sailboats, ski boats, runabouts, speedboats, and other planing hulls. Application must conform to the Pleasure Craft/Recreational duty cycle shown (EPA Mode Number Cycle 5 Duty Cycle).

EPA Mode Number Cycle 5 DUTY CYCLE	MODES				
	1	2	3	4	5
Engine Speed (Percent of WOT)	100	91	80	63	Idle
Engine Power (Percent of Total)	100	75	50	25	0
Time At Given Mode (Percent Of Total Operating Time)	8	13	17	32	30



14584

Chart showing full power operation is limited to a maximum of 1 of 12 hours

1 - Mode 1: 1.0 hour (8%)
2 - Mode 2: 1.5 hours (13%)
3 - Mode 3: 2.0 hours (17%)
4 - Mode 4: 4.0 hours (32%)
5 - Mode 5: 3.5 hours (30%)

Operation Chart—Models With Mechanical Control System

STARTING PROCEDURE	AFTER STARTING	WHILE UNDERWAY	STOPPING AND SHUT DOWN
Open the engine hatch. Air out the bilge completely.	Observe all the gauges and warning lights to check the condition of engine. If not normal, stop the engine.	Frequently observe all the gauges and indicator lights to monitor the engine condition.	Shift the remote control lever to the neutral position.
Turn the battery switch on, if equipped.	Check for fuel, oil, water, fluid, and exhaust leaks, etc.		Run the engine at idle speed several minutes to allow the turbocharger and the engine to cool.
Turn on and run the engine compartment bilge blower, if equipped, for five minutes.	Check the shift and throttle control operation.		Engage stop switch and hold **until engine completely stops**.
Check for leaks—fuel, oil, water, fluid, etc.	Check steering operation.		Remove key with keyswitch in the "OFF," or 0, position.
Open the fuel shut off valve, if equipped.			Turn the battery switch to "OFF," if equipped.
Open the seacock, if equipped.			Close the fuel shut off valve, if equipped.
Ensure that the mechanical engine stop lever is not engaged.			Close the seacock, if equipped.
Prime the fuel injection system, if necessary.			Flush the seawater cooling circuit, if operating in saltwater, brackish water, or polluted water.
Pre-lubricate the turbocharger and engine, if necessary.			
Turn the key switch to "RUN," or 1, and ensure that the lights and indicator lamps come on.			
Turn key switch to "START," or S, after the indicator lamp for the glow plugs (if equipped) ceases. Release the key when engine starts.			
Ensure that the charge indicator and oil pressure indicator lamps cease **after** engine starts.			
Warm-up the engine at a fast idle RPM for several minutes.			

Starting, Shifting, and Stopping

⚠ WARNING

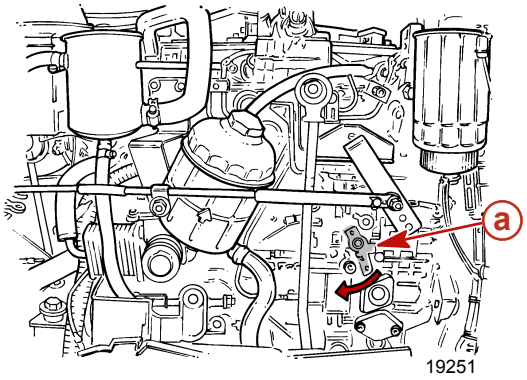
Vapors can ignite and cause an explosion, resulting in engine damage or severe personal injury. Do not use volatile starting aids such as ether, propane, or gasoline in the engine air intake system.

⚠ WARNING

Fuel vapors trapped in the engine compartment may be an irritant, cause difficulty breathing, or may ignite resulting in a fire or explosion. Always ventilate the engine compartment before servicing the power package.

Engine Stop Lever

On mechanically fuel-injected engines, a mechanical engine stop lever is located on the injection pump. It manually shuts off the engine by mechanically shutting off the fuel supply. Move the lever in the direction shown by the arrow next to it in the following illustration to engage the engine stop.



a - Mechanical engine stop lever

Before Starting the Engine

NOTICE
Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

IMPORTANT: Observe the following before starting:

- **Provide water to the seawater pickup pump.**
- **Never operate the starter motor longer than 15 seconds at a time to avoid overheating the starter motor. If the engine does not start, wait one minute to allow the starter motor to cool; then, repeat the starting procedure.**
- **Ensure that the engine crankcase is filled to the correct level with the proper grade of oil for the prevailing temperature. See Specifications—Engine Oil.**
- **Ensure that all electrical connections are secure.**
- **Check all items listed in the Maintenance Schedules and Operation Chart.**
- **Perform any other necessary checks as indicated by your Cummins MerCruiser Diesel Authorized Repair Facility or specified in your boat owner's manual.**

Starting a Cold Engine

IMPORTANT: Check fluid levels before starting the engine. See the Maintenance Schedule.

1. Turn on and run the engine compartment bilge blower (if so equipped) for five minutes. Or, open the engine hatch to air out the bilge before attempting to start the engine.

NOTICE
Engaging the starter motor while the engine is operating can damage the starter motor or flywheel. Do not engage the starter motor continually for longer than 15 seconds. Do not engage the starter motor when the engine is operating.

2. After a lengthy layup (several months or more) pre-lubricate the turbocharger and the engine. Hold the stop switch engaged while you simultaneously turn the key switch to the "START," or 1, position for 15 seconds. This will rotate the starter motor and the engine oil pump. During this process the engine will not run because no fuel is injected. Repeat this process until oil pressure increase slightly.
3. Place the control handle in neutral.
4. If the engine has not been run for a period of time and will not readily start with the standard starting procedure, use the hand pump and primer knob on the fuel filter header. Move the knob up and down four or five strokes. Attempt to start the engine following normal procedure.
5. Turn the key switch to the "RUN," or 1, position. Observe the indicator lamps for the glow plugs, if equipped. When the cylinder temperature is great enough to sustain combustion, the indicator lamp will go off and the engine can be started.
6. Turn the key switch to the "START," or S, position. Release the key and allow the switch to return to the "RUN," or 1, position when the engine starts.

NOTICE

Engaging the starter motor while the engine is operating can damage the starter motor or flywheel. Do not engage the starter motor continually for longer than 15 seconds. Do not engage the starter motor when the engine is operating.

IMPORTANT: Within seconds after starting the engine, the oil pressure should exceed 10 psi (69 kPa). If the oil pressure does not meet these minimum limits, stop the engine, locate and correct the problem, or see your Cummins MerCruiser Diesel Authorized Repair Facility if you are unable to determine the problem.

IMPORTANT: Operate the engine with the key switch in the "RUN," or 1, position only. If the key switch is in the "OFF," or 0, position and the engine is operating, the battery will not be charged, audio warning alarms will not be operational in the event of trouble, and accessories may not operate.

7. Operate the engine with the switch in the "RUN," or 1, position. Before returning the key switch to the "OFF," or 0, position, first shut down (stop) the engine using the engine stop switch.
8. Ensure that the charge indicator and oil pressure warning lamps are off.
9. Ensure that all instrumentation is functioning properly and indicating normal readings.

Engine Warm Up

NOTICE

Engine wear caused by increased friction and limited oil flow is greatest when an engine is cold. Decrease engine wear by allowing the engine coolant temperature to reach normal operating range before hard acceleration or applying full throttle.

1. After starting, ensure that all instrumentation is functioning properly.
2. Operate the engine at 1,000 to 1,200 RPM until the engine temperature is within the normal operating range. It is very important that any engine be warmed up before applying full load. The warm-up period provides time for the lubricating oil to establish a film between moving parts.

   NOTE: *Engine warm-up time during cold weather can be reduced by operating the vessel at a reduced engine speed. Begin normal vessel operation when systems reach operating temperatures.*
3. After the engine has reached operating temperature:
   a. The oil pressure should be within the range specified. See **Specifications—Engine Specifications**. Stop the engine if the oil pressure is not within the range specified.
   b. Check the fuel system for leakage from the injection pump, fuel pipes, fuel filter, or fuel lines.
   c. Check for oil leakage. Check the engine and the transmission for oil leakage. Especially check the oil filter, oil lines, oil line connectors, and oil pan.
   d. Check for coolant leaks. Check the coolant hoses and connection pipes of the heat exchanger, fluid coolers, aftercooler, water pump, and drain fittings.
4. Locate and correct any problems, or see your Cummins MerCruiser Diesel Authorized Repair Facility if you are unable to determine the problem.

Starting a Warm Engine

1. Turn on and run the engine compartment bilge blower (if equipped) for five minutes. Otherwise, open the engine hatch to air out the bilge before attempting to start the engine.
2. Place the remote control handle in Neutral
3. Turn the key switch to the "RUN" or 1, position.
4. Turn the key switch to "START," or S, position and release the key when the engine starts. Ensure that the charge indicator and oil pressure warning lamps go off.
5. Ensure that all the instrumentation is functions properly and indicates normal readings.

Shifting

NOTICE

Shifting into gear at engine speeds above idle will damage the gearcase. Shifting into gear when the engine is not running can cause misalign the clutch, preventing proper shifting. Always shift the gearcase into gear when the engine is operating at idle. If you must shift while the engine is not operating, rotate the propeller shaft in the appropriate direction during shifting.

1. To shift the unit, ensure that the remote control throttle lever is in NEUTRAL. Move the remote control shift lever forward to shift to FORWARD gear or backward to shift to REVERSE. After shifting the transmission, advance the throttle to the desired setting.

2. Once underway, engine oil pressure should be within the range listed in **Engine Specifications** at maximum RPM, or wide-open-throttle. Stop the engine if oil pressure is not within this range. Locate and correct the problem, or see your Cummins MerCruiser Diesel Authorized Repair Facility if you are unable to determine the problem.

Engine Shut Down (Stopping)

1. Place the remote control lever in neutral.

NOTICE

Immediately stopping the engine after high load operation can damage the turbocharger bearings. Idle the engine for several minutes before shutdown.

2. Operate the engine at idle speed for several minutes to allow the turbocharger and engine to cool.
3. Engage the STOP switch and hold, until engine stops completely.
4. Turn key switch to the "OFF," or 0, position.

Freezing Temperature and Cold Weather Operation

IMPORTANT: If the boat is operated during periods of freezing temperature, take precautions to prevent freezing damage to the power package. Damage caused by freezing is not covered by Cummins MerCruiser Diesel Limited Warranty.

NOTICE

Water trapped in the seawater section of the cooling system can cause corrosion or freeze damage. Drain the seawater section of the cooling system immediately after operation or before any length of storage in freezing temperatures. If the boat is in the water, keep the seacock closed until restarting the engine to prevent water from flowing back into the cooling system. If the boat is not fitted with a seacock, leave the water inlet hose disconnected and plugged.

NOTE: *As a precautionary measure, attach a tag to the key switch or steering wheel of the boat reminding the operator to open the seacock or unplug and reconnect the water inlet hose before starting the engine.*

In order to operate the engine in temperatures of 0° C (32° F) or lower, observe the following instructions:

- At the end of each daily operation, completely drain the seawater section of the cooling system to protect against damage by freezing.
- At the end of each daily operation, drain the water from the water separator, if equipped. Fill the fuel tank at end of daily operation to prevent condensation.
- Use the required permanent-type antifreeze solution to protect components against damage by freezing.
- Be sure to use proper cold weather lubrication oil, and be sure the crankcase contains a sufficient amount.
- Make certain that the battery is of sufficient size and is fully charged. Check that all other electrical equipment is in optimum condition.
- At temperatures of –20° C (–4° F) and below, use a coolant heater to improve cold starting.
- If operating in arctic temperatures of –29° C (–20° F)or lower, consult your Cummins MerCruiser Diesel Authorized Repair Facility for information about special cold weather equipment and precautions.

See **Section 6** for cold weather or extended storage related information.

Drain Plug and Bilge Pump

The engine compartment in your boat is a natural place for water to collect. For this reason, boats are normally equipped with a drain plug or a bilge pump. It is very important to check these items on a regular basis to ensure that the water level does not come into contact with your power package. Components on your engine will be damaged if submerged. Damage caused by submersion is not covered by the Mercury MerCruiser or Cummins MerCruiser Diesel Limited Warranty.

Protecting People In The Water

While You Are Cruising

It is very difficult for a person in the water to take quick action to avoid a boat heading in their direction, even at slow speeds.

Always slow down and exercise extreme caution any time you are boating in an area where there might be people in the water.

Whenever a boat is moving (even coasting) and the gear shift is in neutral, there is sufficient force by the water on the propeller to cause the propeller to rotate. This neutral propeller rotation can cause serious injury.

While Boat Is Stationary

⚠ WARNING

A spinning propeller, a moving boat, or any solid device attached to the boat can cause serious injury or death to swimmers. Stop the engine immediately whenever anyone in the water is near your boat.

Shift into neutral and shut off the engine before allowing people to swim or be in the water near your boat.

High-Speed and High-Performance

If your boat is considered a high-speed or high-performance boat with which you are unfamiliar, we recommend that you never operate it at its high-speed capability without first requesting an initial orientation and demonstration ride with your dealer or an operator experienced with your boat. For additional information, refer to the **Hi-Performance Boat Operation** booklet (90-849250-R2) from your authorized Cummins MerCruiser Diesel repair facility.

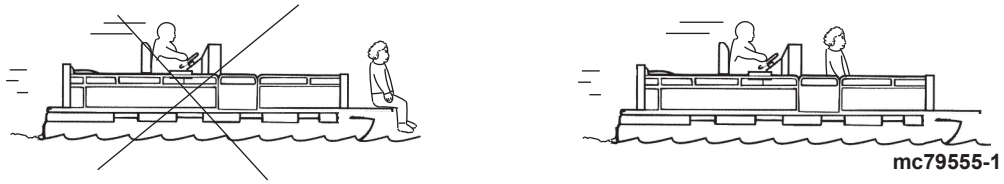
Passenger Safety In Pontoon Boats And Deck Boats

Whenever the boat is in motion, observe the location of all passengers. Do not allow any passengers to stand or use seats other than those designated for traveling faster than idle speed. A sudden reduction in boat speed, such as plunging into a large wave or wake, a sudden throttle reduction, or a sharp change of boat direction, could throw them over the front of boat. Falling over the front of the boat between the two pontoons will position them to be run over.

Boats Having An Open Front Deck

No one should ever be on the deck in front of the rail while the boat is in motion. Keep all passengers behind the front rail or enclosure.

Persons on the front deck could easily be thrown overboard or persons dangling their feet over the front edge could get their legs caught by a wave and pulled into the water.



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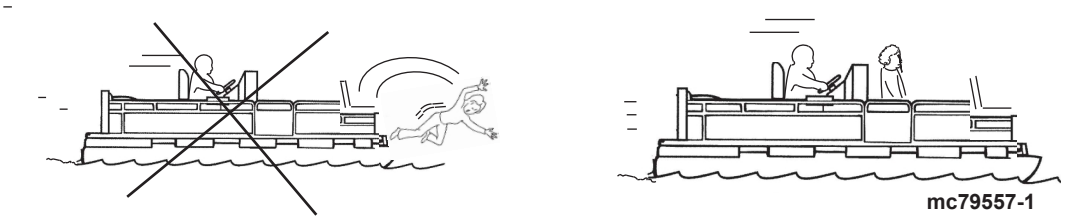
⚠ WARNING

Sitting or standing in an area of the boat not designed for passengers at speeds above idle can cause serious injury or death. Stay back from the front end of deck boats or raised platforms and remain seated while the boat is in motion.

Boats With Front-Mounted, Raised Pedestal Fishing Seats

Elevated fishing seats are not intended for use when the boat is traveling faster than idle or trolling speed. Sit only in seats designated for traveling at faster speeds.

Any unexpected, sudden reduction in boat speed could result in the elevated passenger falling over the front of the boat.



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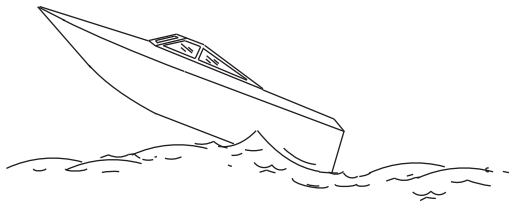
Wave and Wake Jumping

⚠ WARNING

Wave or wake jumping can cause serious injury or death from occupants being thrown within or out of the boat. Avoid wave or wake jumping whenever possible.



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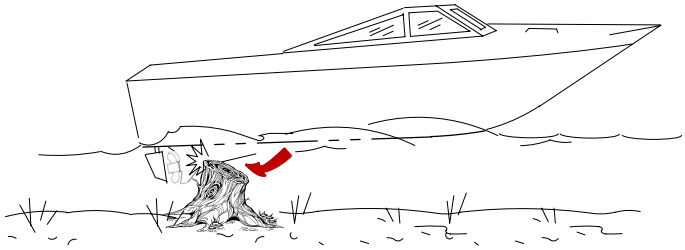
Operating recreational boats over waves and wakes is a natural part of boating. However, when this activity is done with enough speed to force the boat hull partially or completely out of the water, certain hazards arise, particularly when the boat re-enters the water.

The primary concern is the boat changing direction while in the midst of the jump. In such cases the landing may cause the boat to violently veer in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.

There is another less common hazardous result from allowing your boat to launch off of a wave or wake. If the bow of your boat pitches down far enough while airborne, upon water contact it may penetrate under the water surface and submarine for an instant. This will bring the boat nearly to a stop in an instant and can send the occupants flying forward. The boat may also veer sharply to one side.

Impact With Underwater Hazards



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Reduce speed and proceed with caution whenever you're driving a boat in shallow water areas or in areas where the waters are suspected of having underwater obstacles that could be struck by the underwater drive components, rudder, or the boat bottom. The most important thing you can do to help reduce injury or impact damage from striking a floating or underwater object is control the boat speed. Under these conditions, boat speed should be kept to a minimum planing speed of 24 to 40 km/h (15 to 25 MPH).

Striking a floating or underwater object may result in an infinite number of situations. Some of these situations could result in the following:

- The boat could move suddenly in a new direction. Such a sharp change in direction or turn can throw occupants out of their seats or out of the boat.
- A rapid reduction in speed. This will throw occupants forward, even out of the boat.
- Impact damage to the underwater drive components, rudder, or boat.

Keep in mind, one of the most important things you can do to help reduce injury or impact damage in these situations is control the boat speed. Boat speed should be kept to a minimum planing speed when driving in waters known to have underwater obstacles.

After striking a submerged object, stop the engine as soon as possible and inspect the drive system for any broken or loose parts. If damage is present or suspected, take the power package to an authorized dealer for a thorough inspection and necessary repair.

The boat should also be checked for any hull fractures, transom fractures, and water leaks.

Operating with damaged underwater drive components, rudder, or boat bottom could cause additional damage to other parts of the power package, or could affect control of the boat. If continued running is necessary, do so at greatly reduced speeds.

⚠ WARNING

Operating a boat or engine with impact damage can result in product damage, serious injury, or death. If the vessel experiences any form of impact, have an authorized Mercury Marine dealer inspect and repair the vessel or power package.

Conditions Affecting Operation

Weight Distribution (Passengers and Gear) Inside the Boat

Shifting weight to rear (stern):

- Generally increases speed and engine RPM
- Causes bow to bounce in choppy water
- Increases danger of following wave splashing into the boat when coming off plane
- At extremes, can cause the boat to porpoise

Shifting weight to front (bow):

- Improves ease of planing
- Improves rough water ride
- At extremes, can cause the boat to veer back and forth (bow steer)

Bottom of Boat

To maintain maximum speed, ensure that the boat bottom is:

- Clean, free of barnacles and marine growth.
- Free of distortion, nearly flat where it contacts water.
- Straight and smooth, fore and aft.

Marine vegetation may accumulate when the boat is docked. This growth must be removed before operation; it may clog water inlets and cause the engine to overheat.

Elevation and Climate

Elevation and climate changes affect the performance of your power package. Loss of performance can be caused by:

- High elevations
- High temperatures
- Low barometric pressures
- High humidity

For you to have optimum engine performance under changing weather conditions and high elevation, use a propeller that allows the engine to operate at rated RPM at wide-open throttle (WOT) with a maximum boat load during your normal boating.

In most cases, the rated RPM at WOT can be achieved by changing to a lower pitch propeller.

Propeller Selection

NOTICE

Operating the engine with the wrong propeller installed can limit power, increase fuel consumption, overheat the engine, or cause internal powerhead damage. Choose a propeller that allows the engine to operate at the specified wide open throttle RPM.

It is the responsibility of the boat manufacturer and the selling dealer to equip the power package with the correct propellers.

IMPORTANT: The engines covered in this manual are equipped with a governor device that limits engine RPM. Be sure that the propeller being used does not allow engine to run against the limiter, as a significant loss in performance will result.

NOTE: *Use an accurate service tachometer to verify RPM.*

Select a propeller that will allow the engine power package to operate at the rated engine RPM with a full load.

If full throttle operation is below the engine rated RPM, the propeller must be changed to prevent loss of performance and possible engine damage. On the other hand, operating an engine above the rated engine RPM will cause higher than normal wear or damage.

After initial propeller selection, the following common problems may require that the propeller be changed to a lower pitch:

- Warmer weather and greater humidity cause an RPM loss (not as significant on these models).
- Operating in a higher elevation causes an RPM loss (not as significant on these models).

- Operating with a damaged propeller or dirty boat bottom causes an RPM loss.
- Operating with increased load (additional passengers, pulling skiers).

For better acceleration, such as is needed for water skiing, use the next lower pitch propeller. Do not operate at full throttle when using the lower pitch propeller but not pulling skiers.

Getting Started

Initial Break-In Procedure

The following procedure is especially important on new diesel engines. This break-in procedure allows the proper seating of the pistons and rings, which greatly reduces the likelihood of problems.

IMPORTANT: Cummins MerCruiser Diesel recommends that the boat not be accelerated hard until this procedure has been completed.

IMPORTANT: Never operate the starter motor longer than 15 seconds at a time, to avoid overheating the starter motor. If the engine does not start, wait 1 minute to allow the starter motor to cool; then, repeat starting procedure.

1. See the appropriate **Starting, Shifting, and Stopping** section and start the engine.
2. Operate the engine at a fast idle until it has reached normal operating temperature.
3. Operate the engine in gear for 3 minutes at each of the following RPM: 1400 RPM, 2800 RPM and 3500 RPM.
4. Operate the engine in gear for 3 minutes at each of the following RPM: 1700 RPM, 3500 RPM and 4000 RPM.
5. Operate the engine in gear for 3 minutes at each of the following RPM: 2100 RPM, 3500 RPM and maximum rated full throttle RPM.

Engine Break-In

20-Hour Break-In Period

IMPORTANT: The first 20 hours of operation is the engine break-in period. Correct break-in is essential to obtain minimum oil consumption and maximum engine performance. During this break-in period, observe the following rules:

- Do not operate below 1500 RPM for extended periods of time for the first 10 hours. Shift into gear as soon as possible after starting and advance the throttle above 1500 RPM if conditions permit safe operation.
- Do not operate at one speed consistently for extended periods.
- Do not exceed 3/4 throttle during the first 10 hours. During the next 10 hours, occasional operation at full throttle is permissible (5 minutes at a time maximum).
- Avoid full-throttle acceleration from idle speed.
- Do not operate at full throttle until the engine reaches normal operating temperature.
- Check engine oil level frequently. Add oil as needed. High oil consumption is normal during the break-in period.

After the 20-Hour Break-In Period

To help extend the life of your power package, Cummins MerCruiser Diesel recommends the following:

- After the 20-hour break-in period change, the engine oil and filter and the transmission fluid at the interval indicated in the **Maintenance Schedule**. See **Specifications** and **Maintenance**.
- Use a propeller that allows the engine to operate at the rated engine RPM when at full throttle with a fully loaded boat. See **Specifications** and **Maintenance**.
- Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged operation at wide-open throttle RPM.

End of First Season Checkup

At the end of the first season of operation, contact an authorized Cummins MerCruiser Diesel repair facility to discuss or perform scheduled maintenance items. If you are in an area where the product is operated continuously, year-round, you should contact your dealer at the end of the first 100 hours of operation or once yearly, whichever occurs first.

Section 4 - Specifications

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Fuel Requirements

⚠ WARNING

Failure to comply with regulations can result in injury from fire or explosion. Electrical system components on this engine are not rated as external ignition–protected (EIP). Do not store or use gasoline on boats equipped with these engines, unless provisions have been made to exclude gasoline vapors from the engine compartment (REF: 33 CFR).

⚠ WARNING

Fuel leakage is a fire or explosion hazard, which can cause serious injury or death. Periodically inspect all fuel system components for leaks, softening, hardening, swelling, or corrosion, particularly after storage. Any sign of leakage or deterioration requires replacement before further engine operation.

⚠ WARNING

This engine requires diesel fuel. Mixing gasoline, gasohol, or alcohol and diesel fuel can cause serious injury or death due to fire or explosion. Never mix gasoline, gasohol, or alcohol with diesel fuel.

IMPORTANT: Use of improper or water contaminated diesel fuel can seriously damage your engine. Use of improper fuel is considered misuse of the engine, and damage caused thereby will not be covered by the warranty.

Grade 2-D diesel fuel is required, meeting ASTM Standards D975 (or fuel rated Diesel DIN 51601), and having a minimum cetane rating of 45.

The cetane number is a measure of the ignition quality of diesel fuel. Increasing the cetane number will not improve overall engine performance, but it may be necessary to raise the cetane rating for low-temperature or high-altitude use. A lower cetane number could cause hard starting and slower warm-up, and could increase engine noise and exhaust emissions.

NOTE: *If your engine suddenly becomes noisy after a fill–up, you possibly received substandard fuel with a low cetane rating.*

Sulphur content of the above fuel is rated at 0.50% by weight, maximum (ASTM). Limits may vary in countries outside of the United States.

On intermittent-use engines, high sulphur content diesel fuel will greatly increase:

- Corrosion on metal parts.
- Deterioration of elastomer and plastic parts.
- Excessive wear of internal engine parts, particularly bearings, and corrosion and extensive damage to other engine parts.
- Difficulty starting and operating the engine.

Recommended Fuels

NOTICE

The use of improper fuel can cause serious damage to the engine. Damage resulting from the use of improper fuel is considered engine misuse and is not covered under the limited warranty. Use only the recommended fuel in the engine.

Diesel Fuel/Applicable Standard	Recommendation
JIS (Japanese Industrial Standard)	No. 2
DIN (Deutsche Industrie Normen)	DIN 51601
SAE (Society Of Automotive Engineers) Based on SAE J-313C	No. 2-D
BS (British Standard) Based on BSEN 590-1197	A-1

Diesel Fuel in Cold Weather

Unaltered diesel fuels thicken and gel in cold temperatures unless treated. Virtually all diesel fuels are climatized to allow their use in the particular region for that time of the year. If it becomes necessary to further treat diesel fuel, it is the owner/operator's responsibility to add a commercial standard brand of anti-gel diesel fuel additive, following that product's directions.

Coolant (Antifreeze)

NOTICE
Using propylene glycol antifreeze in the closed cooling system can damage the cooling system or the engine. Fill the closed cooling system with an ethylene glycol antifreeze solution suitable to the lowest temperature to which the engine will be exposed.

Because diesel engines are high-compression engines, they operate at higher operating temperatures. Therefore the closed cooling system and engine, including related cooling passages, must remain as clean as possible to provide adequate engine cooling. To ensure proper cooling, we recommend filling the closed cooled section of the cooling system with a low silicate formula of ethylene glycol antifreeze in a solution with deionized water. A low silicate formula prevents the antifreeze from separating and forming a silicate gelatin. This gelatin can block passages in the engine and heat exchanger, causing the engine to overheat. Using deionized water instead of common tap water or softened water can prevent large mineral deposits from forming that restrict the cooling system efficiency.

Mix the coolant, if it is not premixed, before adding it to the closed cooling system. Additives and inhibitors introduced into acceptable coolant solutions will form a protective film on the internal passages and provide protection against internal cooling system erosion.

Keep the closed cooling section filled year-round with an acceptable coolant (antifreeze) solution. Do not drain the closed cooled section for storage as this will promote rust formation on the internal surfaces. If the engine will be exposed to freezing temperatures, ensure that the closed cooled section is filled with a properly mixed coolant (antifreeze) solution to protect the engine and closed cooling system to the lowest temperature to which they will be exposed.

NOTE: *Generally, we recommend using a 50/50 solution of coolant (antifreeze) and deionized, purified water. When operating where seawater temperatures are greater than 32 °C (90 °F), you can use a 25/75 solution of coolant (antifreeze) and deionized, purified water for improved cooling performance.*

IMPORTANT: The coolant (antifreeze) used in these marine engines must be a solution of low silicate ethylene glycol containing special additives and deionized, purified water. Using other types of engine coolant may cause fouling of the heat exchangers and overheating of the engine. Do not combine different types of coolants without knowing that they are compatible. Refer to the coolant manufacturer's instructions.

Some acceptable types of antifreeze and coolants are listed in the following table. See **Maintenance Schedules** for respective change intervals.

Description	Availability	Part Number
Marine Engine Coolant Quantity: 3-3/4 liters, 1 U.S. Gallon	Europe only	92-813054A2
Fleetguard Compleat with DCA4 Quantity: 3-3/4 liters, 1 U.S. Gallon	Worldwide	Fleetguard Part Number: CC2825

Engine Oil

NOTICE
Discharge of oil, coolant, or other engine/drive fluids into the environment is restricted by law. Use caution not to spill oil, coolant, or other fluids into the environment when using or servicing your boat. Be aware of the local restrictions governing the disposal or recycling of waste, and contain and dispose of fluids as required.

To help obtain optimum engine performance and to provide maximum protection, the engine requires engine oil with a rating of HD-SAE-API CG-4 and CH-4.

We strongly recommend the use of:

Description	Where Used	Part Number
Mercury 4- Cycle 15W40 Marine Engine Oil	Engine crankcase	92-877695K1

This oil is a specially blended 15W40 oil with marine additives for all–temperature operation. It exceeds requirements for API CF-2, CF-4, CG-4 and CH-4 oils.

Other recommended oils:

Description	Where Used	Part Number
Shell Myrina	Engine crankcase	Obtain Locally
Mopar		
Texaco Ursa Super TD		
Wintershall Multi-Rekord		
Veedol Turbostar		
Wintershall Vliva 1		

These oils are approved by Mercury Marine and Marine Power Europe. For all temperature operation use 15W40 oil.

Engine Specifications

Description		Specifications—Inboard
		1.7 MI
Engine type		4-stroke, 4-cylinder, vertical in-line, 4 valves per cylinder, dual overhead camshaft, direct injection, turbocharged, intercooled.
Displacement		1.686 liter (103 cu. in.)
Engine weight		250 kg (550 lbs.)
Firing order		1 - 3 - 4 - 2
Bore		79 mm (3.11 in.)
Stroke		86 mm (3.39 in.)
Rated engine RPM (see **Conditions Affecting Operation—Propeller Selection** for additional information).		Refer to CMD's Marine Performance Curves And Data Sheet (www.Cummins.com)
Idle RPM in neutral (engine at normal operating temperature).		
Thermostats	Water	82–95° C (180–203° F)
	Oil	140° C (284° F)
Coolant temperature		90–104° C (194–219° F)
Electrical system		12-volt negative (–) ground
Alternator rating		600W, 12V, 50 A
Recommended battery rating		515 CCA, 652 MCA, or 65 Ahm

Fluid Specifications

IMPORTANT: All capacities are approximate fluid measures.

Engine

IMPORTANT: It may be necessary to adjust oil levels depending on installation angle and cooling systems (heat exchanger and fluid lines).

All models	Capacity - liters (U.S. qts.)	Fluid type	Part Number
Engine Oil (With Filter) 1	4-1/2 (4-3/4)	Mercury Diesel Engine Oil	92-877695K1
Closed Cooling System	8-3/4 (9-1/4)	Marine Engine Coolant	Obtain Locally
		Fleetguard Compleat with DCA4 Fleetguard Part Number: CC2825	

Transmission

Model	Capacity	Fluid Type	Part Number
ZF Marine 25A	1.8L (1.9 Qts.)	Dexron III Automatic Transmission Fluid or Equivalent.	Obtain Locally

Section 5 - Maintenance

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5

Owner and Operator Responsibilities

It is the operator's responsibility to perform all safety checks, to ensure that all lubrication and maintenance instructions are complied with for safe operation, and to return the unit to a Cummins MerCruiser Diesel Authorized Repair Facility for a periodic checkup.

Normal maintenance service and replacement parts are the responsibility of the owner or operator and as such, are not considered defects in workmanship or material within the terms of the warranty. Individual operating habits and usage contribute to the need for maintenance service.

Proper maintenance and care of your power package will ensure optimum performance and dependability and will keep your overall operating expenses at a minimum. See your Cummins MerCruiser Diesel Authorized Repair Facility for service aids.

Dealer Responsibilities

In general, a dealer's responsibilities to the customer include predelivery inspection and preparation:

- Before delivery, making certain that the Cummins MerCruiser Diesel power package is in proper operating condition.
- Making all necessary adjustments for maximum efficiency.
- Explaining and demonstrating the operation of the power package and the boat.
- Providing a copy of the Predelivery Inspection Checklist.
- Filling out the Warranty Registration Card completely and mailing it to the factory immediately upon sale of the new product. All power packages must be registered for warranty purposes.

Maintenance

⚠ WARNING

Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

⚠ WARNING

Fuel vapors trapped in the engine compartment may be an irritant, cause difficulty breathing, or may ignite resulting in a fire or explosion. Always ventilate the engine compartment before servicing the power package.

IMPORTANT: See Maintenance Schedule for complete listing of all scheduled maintenance to be performed. Some listings can be done by the owner or operator, while others should be performed by an authorized Cummins MerCruiser Diesel repair facility. Before attempting maintenance or repair procedures not covered in this manual, we recommended that you purchase the appropriate Cummins MerCruiser Diesel or Mercury MerCruiser Service Manual and read thoroughly.

NOTE: *Maintenance points are color coded for ease of identification. See the decal on engine for identification.*

- Blue—Coolant
- Yellow—Engine Oil
- Orange—Fuel
- Brown—Transmission Fluid

Do-It-Yourself Maintenance Suggestions

Present-day marine equipment, such as your Cummins MerCruiser Diesel power package, are highly technical pieces of machinery. Special fuel delivery systems provide greater fuel economies, but also are more complex for the untrained mechanic.

If you are one of those persons who likes to do it yourself, here are some suggestions for you.

- Do not attempt any repairs unless you are aware of the Cautions, Warnings, and procedures required. Your safety is our concern.
- If you attempt to service the product yourself, we suggest you order the service manual for that model. The service manual outlines the correct procedures to follow. It is written for the trained mechanic, so there may be procedures you do not understand. Do not attempt repairs if you do not understand the procedures.
- There are special tools and equipment that are required to perform some repairs. Do not attempt these repairs unless you have these special tools and equipment. You can cause damage to the product in excess of the cost a dealer would charge you.
- Also, if you partially disassemble an engine or drive assembly and are unable to repair it, the dealer's mechanic must reassemble the components and test to determine the problem. This will cost you more than taking it to the dealer immediately upon having a problem. It may be a very simple adjustment to correct the problem.

- Do not telephone the dealer, service office, or the factory to attempt for them to diagnose a problem or to request the repair procedure. It is difficult for them to diagnose a problem over the telephone.

Your local Cummins MerCruiser Diesel Authorized Repair Facility is there to service your power package. They have qualified factory-trained mechanics.

It is recommended you have the Cummins MerCruiser Diesel Authorized Repair Facility do periodic maintenance checks on your power package. Have them winterize it in the fall and service it before the boating season. This will reduce the possibility of any problems occurring during your boating season when you want trouble-free boating pleasure.

Inspection

Inspect your power package often and at regular intervals to help maintain its top operating performance and correct potential problems before they occur. The entire power package should be checked carefully, including all accessible engine parts.

1. Check for loose, damaged, or missing parts, hoses and clamps; tighten or replace as necessary.
2. Check electrical connections and leads for damage.
3. Remove and inspect the propeller. If badly nicked, bent, or cracked, contact your Cummins MerCruiser Diesel Authorized Repair Facility.
4. Repair nicks and corrosion damage on power package exterior finish. Contact your Cummins MerCruiser Diesel Authorized Repair Facility.

Maintenance Schedule—Inboard Models

NOTE: *Perform only the maintenance tasks that apply to your particular power package.*

Routine Maintenance

Each Day Start

- Check the engine oil level (This task interval can be extended based on operator experience with the product).
- Check the coolant level.
- Check the transmission fluid level.

Each Day End

- If operating in saltwater, brackish water, or polluted water, flush the seawater cooling system after each use.
- Drain any water from the fuel filter, or fuel filters if equipped with more than one, after each use if operating in freezing temperatures.

Weekly

- Drain any water from the fuel filter, or fuel filters if equipped with more than one.
- Check the water inlets for debris or marine growth.
- Check and clean the seawater strainer.

Every Two Months

- Check the battery connections and fluid level.
- Treat the engine surface with corrosion guard if operating in saltwater, brackish water, or polluted water.
- Inspect the air cleaner (Every two months, or every 50 hours whichever occurs first).
- Ensure that the gauges and the wiring connections are secure. Clean the gauges (If operating in only freshwater, this maintenance may be extended to every four months).

Scheduled Maintenance

After First 25 hours and not to Exceed 30 Hours

- Change the transmission fluid.

After First 50 Hours

- Change the engine oil and filter.
- Retorque the exhaust riser clamp.

Every 100 Hours or Annually (Whichever Occurs First)

- Change the engine oil and filter.
- Change the transmission fluid.

- Check the steering system and the remote control for loose, missing, or damaged parts. Lubricate the cables and linkages.
- Check the electrical system for loose, damaged, or corroded fasteners.
- Disassemble and inspect the seawater pump and replace worn components.
- Touch up the power package with paint and spray with Corrosion Guard.

Every 200 Hours or Annually

- Retorque the exhaust riser clamp.
- Replace the fuel filter, or fuel filters if equipped with more than one.
- Drain the condensation from the aftercooler.
- Inspect the condition and tension of the belts.
- Check the cooling system and the exhaust system hose clamps for tightness. Inspect both systems for damage or leaks.
- Clean the seawater section of the closed cooling system. Clean, inspect, and test the pressure cap. Check the anodes and replace if 50% eroded.
- Clean the turbocharger and the induction system with Power Tune (follow the manufacturer's instructions).

Every 200 Hours or 2 Years (Whichever Occurs First)

- Replace the coolant.

Every 300 Hours or 3 Years (Whichever Occurs First)

- Torque the engine mounts.
- Check the electrical system for loose, damaged, or corroded fasteners.
- Inspect the timing belt and pulleys.

Every 500 Hours or 5 years (Whichever Occurs First)

- Clean the aftercooler core.

Every 1000 Hours or 5 years (Whichever Occurs First)

- Clean the fuel tank.
- Replace the timing belt.
- Check the valve clearance.

According to OEM

- Check the engine-to-propeller shaft alignment.

Maintenance Log

Record all maintenance performed on your power package here. Be sure to save all work orders and receipts.

Date	Maintenance Performed	Engine Hours

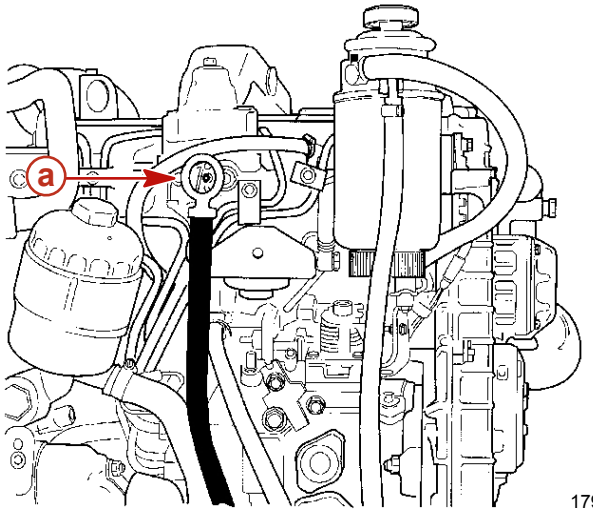
Engine Oil

NOTICE

Discharge of oil, coolant, or other engine/drive fluids into the environment is restricted by law. Use caution not to spill oil, coolant, or other fluids into the environment when using or servicing your boat. Be aware of the local restrictions governing the disposal or recycling of waste, and contain and dispose of fluids as required.

Checking

1. To check the engine oil level during operation, stop the engine and allow five minutes for the oil to drain into the pan.
2. Remove the dipstick. Wipe the dipstick clean and reinstall into the dipstick tube.



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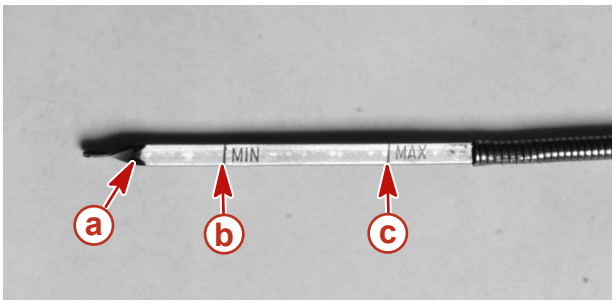
a - Dipstick

3. Remove the dipstick and observe the oil level. The oil must be between the marks on the dipstick. If necessary, add oil. Refer to **Filling.**

   NOTE: *The distance between marks is equivalent to approximately 1.0 liter (1 U.S. quart).*



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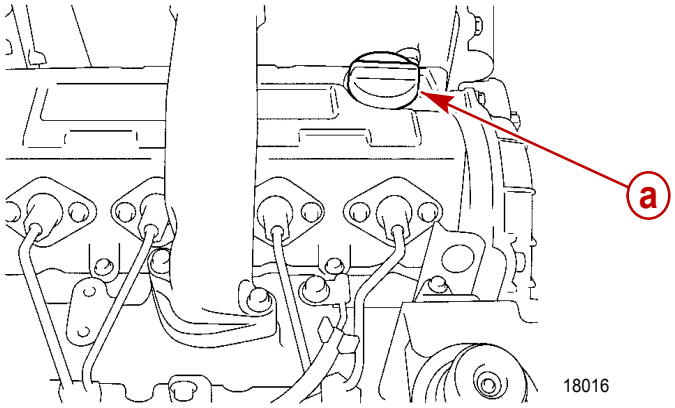
a - Dipstick
b - Minimum Mark
c - Maximum Mark

4. Install the oil dipstick.

Filling

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



2. Add the specified oil to bring the oil level up to, but not over, the "MAX" mark on the dipstick.

1.7L—All Models	Capacity	Fluid type
Total Engine Oil (With filter)	4-1/2 liter (4-3/4 U.S. quart)	4-Cycle 15W40 Marine Engine Oil

IMPORTANT: When refilling the engine with oil, always use a dipstick to determine how much oil is required.

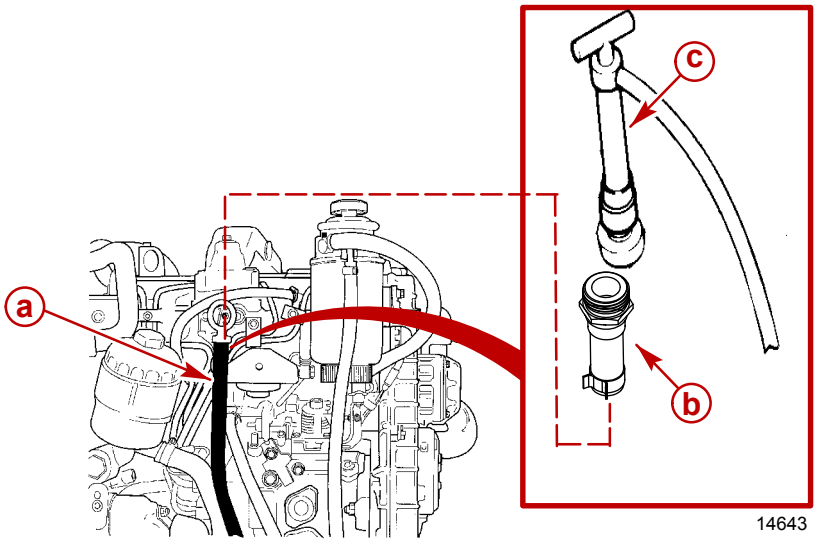
3. Install the oil fill cap.

Changing the Oil and Filter

Refer to the **Maintenance Schedule** for the change interval. You should change the engine oil before placing the boat in storage.

IMPORTANT: Change the engine oil when the engine is warm from operation. Warm oil flows more freely, carrying away more impurities. Use only recommended engine oil. Refer to Specifications.

1. Start the engine and allow it to warm up to normal operating temperature.
2. Stop the engine and allow some time for the oil to drain into the oil pan (approximately five minutes).
3. Remove the dipstick.
4. Install the crankcase oil pump. Push the adapter onto the dipstick tube and attach the pump.



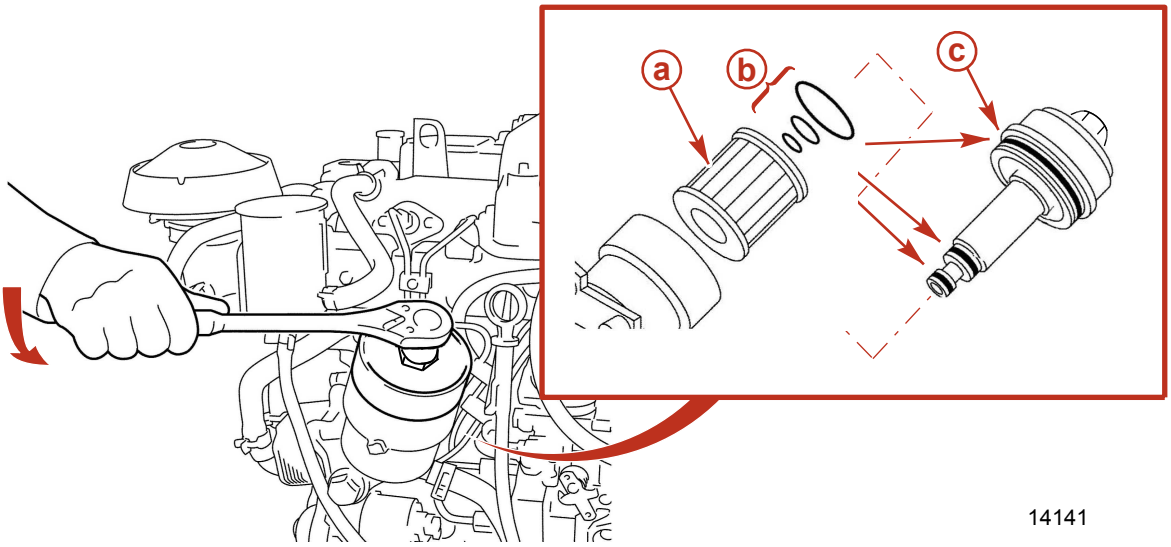
a - Dipstick tube
b - Oil pump adapter
c - Crankcase oil pump

Tool	Part Number
Crankcase oil pump	802889Q1, or equivalent
Oil pump adapter	32-863642

NOTICE

Discharge of oil, coolant, or other engine/drive fluids into the environment is restricted by law. Use caution not to spill oil, coolant, or other fluids into the environment when using or servicing your boat. Be aware of the local restrictions governing the disposal or recycling of waste, and contain and dispose of fluids as required.

5. Pump the oil out of the crankcase into the drain pan.
6. When the crankcase is empty, remove the pump and adapter.
7. Install the oil dipstick.
8. Contain and dispose of oil or oil waste as directed by local authorities.
9. Use a filter wrench or appropriate socket to remove the cartridge type oil filter.
10. Discard the old filter element. Discard the old O-rings from the top piece.



a - Filter element
b - O-rings
c - Top piece

11. Install the three O-rings. Apply a coat of engine oil to the O-rings. Install the element on the top piece.

Tube Ref No.	Description	Where Used	Part No.
121	15W40 4-Cycle Diesel Engine Oil	Oil filter O-rings	92-858042K01

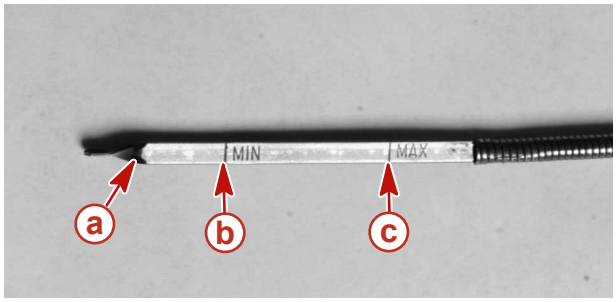
12. Install the top piece with the new element into the oil filter housing.
13. Turn the top piece until the sealing face is fitted against the gasket using the filter wrench or a socket. Torque the top piece.

Description	Nm	lb. in.	lb. ft.
Oil filter top piece	25		18

IMPORTANT: Overtightening the top piece will cause deformation, resulting in oil leakage.

14. Remove the oil fill cap and refill the engine with new oil. See **Filling**.

15. Add the specified oil to bring level up to, but not over, maximum oil level mark "MAX" on dipstick.



14624

a - Dipstick
b - Minimum mark
c - Maximum mark

16. Install oil fill cap.

    IMPORTANT: After the oil change, pre-lubricate the turbocharger and engine.

17. Pre-lubricate the turbocharger and engine.

    NOTE: *Avoid overheating the starter motor. Do not engage the starter for more than 15 seconds.*

    a. Hold the stop switch engaged while you simultaneously turn the key switch to the "START," or S position for 15 seconds. This will rotate the starter motor and the engine oil pump.
    b. During this process the engine will not run because no fuel is injected. If the engine starts, turn it off immediately.
    c. Allow the starter motor to cool down for one minute.

18. Repeat step 17 then proceed to step 19.
19. Start and operate the engine for five minutes. Stop the engine and wait for about five minutes.
20. Remove the oil dipstick. Wipe the dipstick clean and reinstall it into the dipstick tube.

    IMPORTANT: Do not overfill the engine with oil. Too much engine oil will cause excessive oil consumption and higher oil temperature.

21. Remove the dipstick and observe the oil level. If necessary, add oil to bring level up to, but not over, the "MAX" mark or between "MIN" and "MAX" marks on the dipstick.

    IMPORTANT: When refilling the engine with oil, always use the dipstick to determine how much oil is required.

22. Start the engine and check for leaks.

Transmission Fluid

Checking

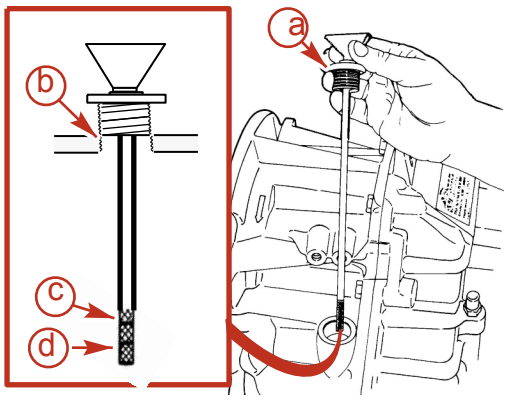
1. Remove the dipstick.

   IMPORTANT: When checking the fluid level, rest the dipstick on top of the threaded housing hole. Do not screw the dipstick into the threaded housing hole.

2. Check the fluid level as indicated on the dipstick with the dipstick resting on the top of the threaded hole.

   NOTE: *The fluid level may be somewhat over the maximum mark, as some of the fluid from the transmission fluid cooler and hoses may have drained back into the transmission.*

3. If the fluid level is low, add transmission fluid to bring the level up to the maximum mark on the dipstick.



16604

a - Dipstick
b - Threaded hole
c - Maximum fluid level
d - Minimum fluid level

IMPORTANT: To accurately check the fluid level, the engine must be operated at 1500 RPM for 2 minutes immediately before checking the level.

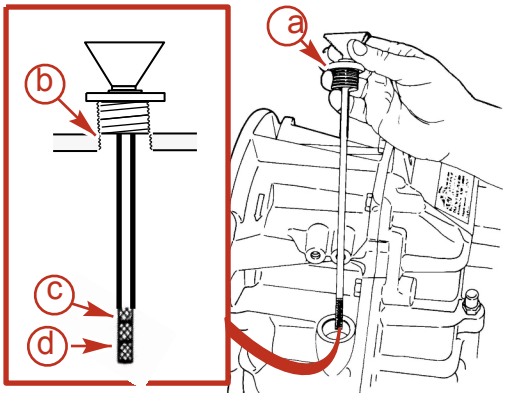
4. Start the engine and operate at 1500 RPM for two minutes to fill all the hydraulic circuits.
5. Stop the engine and quickly check the fluid level with the dipstick resting on the top of the threaded hole.
6. If the fluid level is low, add transmission fluid to bring the level up to the maximum mark on the dipstick. See **Filling**.

   NOTE: *If the transmission fluid level was extremely low, see your Cummins MerCruiser Diesel Authorized Repair Facility.*
7. Install the dipstick.

Filling

1. If necessary, add specified automatic transmission fluid through the dipstick threaded hole to bring the level up to the maximum mark on the dipstick.

   IMPORTANT: Use only specified automatic transmission fluid (ATF).



a - Dipstick
b - Threaded hole
c - Maximum fluid level
d - Minimum fluid level

NOTE: *Always use the dipstick to determine the exact quantity of oil or fluid required.*

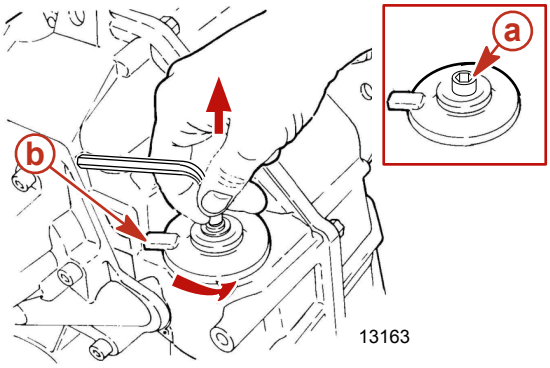
Model	Capacity	Fluid type	Part Number
ZF Marine 25A	1.8 liters (1.9 U.S. qts.)	Dexron III Automatic Transmission Fluid or Equivalent	Obtain Locally

2. Install the dipstick.

   IMPORTANT: To accurately check the fluid level, the engine must be run at 1500 RPM for 2 minutes immediately before checking the level.
3. Check the fluid level. See **Checking**.

Changing

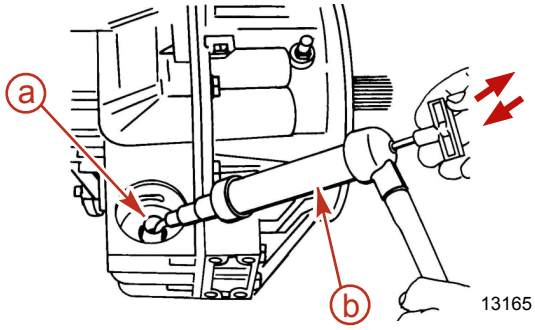
1. Clean the exterior of the transmission around the fluid filter assembly.
2. Use a 6 mm Allen wrench and remove the fluid filter assembly by turning the assembly nut counterclockwise and pulling at the same time.



a - Assembly nut
b - Fluid filter assembly

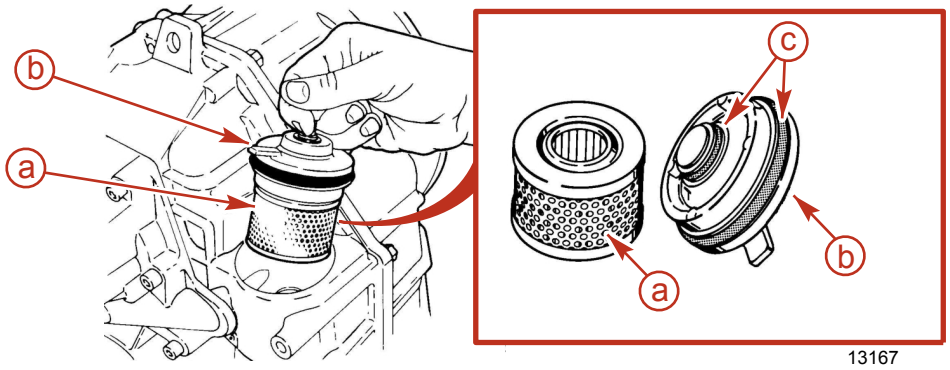
3. Push the hose of a suction pump through the suction pipe and down to the bottom of the housing.

4. Pump the fluid from the housing into a suitable container. Dispose of fluid properly.



a - Suction pipe
b - Suction pump

5. Remove and discard the filter element and the O-rings.
6. Coat the new O-rings with transmission fluid.
7. Install the new O-rings and filter element.

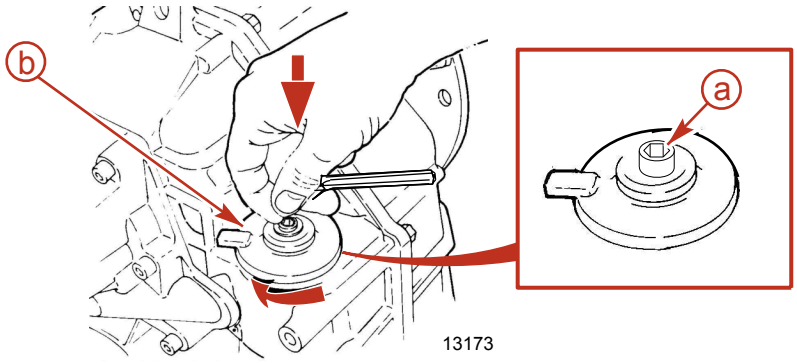


a - Filter element
b - Cover
c - O-rings

NOTICE

Improper installation of the transmission fluid filter assembly may cause the fluid to foam or leak out, resulting in decreased efficiency and damage to the transmission. Properly seat the transmission fluid filter during installation.

8. Install the fluid filter assembly in the transmission cavity by turning clockwise and pushing at the same time.
9. Using a 6 mm Allen wrench, turn the filter assembly nut clockwise to tighten. Torque the nut.



a - Assembly nut
b - Fluid filter assembly

Description	Nm	lb. in.	lb. ft.
Filter assembly nut	5-8	48-72	

10. Fill the transmission to the proper level with the specified fluid. See **Filling**.

Engine Coolant

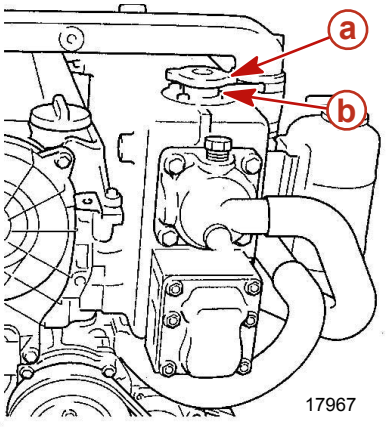
Checking

⚠ CAUTION

A sudden loss of pressure can cause hot coolant to boil and discharge violently resulting in serious injury from burns. Allow the engine to cool down before removing the coolant pressure cap.

1. Allow the engine to cool.
2. Remove the pressure cap from the heat exchanger and observe the coolant level.
3. The coolant level in the heat exchanger should be at the bottom of the fill neck. If coolant level is low see **Filling**.

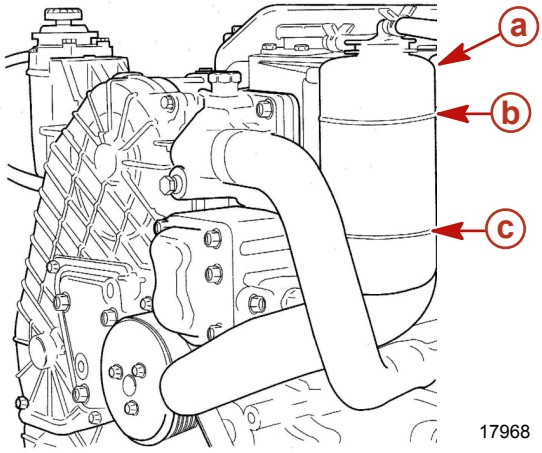
   NOTE: *If no coolant is visible in the heat exchanger or the operating temperatures are excessive, air may have become trapped in the cooling system. See your Cummins MerCruiser Diesel Authorized Repair Facility.*



a - Pressure cap
b - Fill neck

IMPORTANT: When installing the pressure cap, tighten until it contacts the locking tabs on the fill neck.

4. Install the pressure cap. Tighten until it contacts the locking tabs on the fill neck.
5. With the engine at normal operating temperature, check the coolant level in the coolant recovery bottle.
6. The coolant level should be between the "ADD" and "FULL" marks.



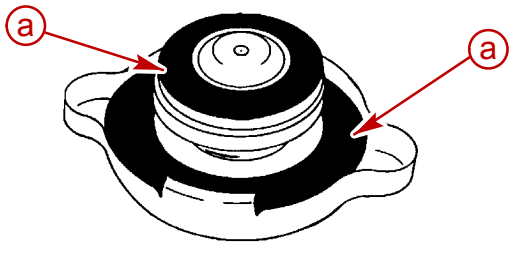
a - Coolant recovery bottle
b - "FULL" mark
c - "ADD" mark

7. Add the specified coolant as necessary. See **Filling**

Description	Where Used	Part Number
Marine Engine Coolant	Closed cooling system	92-813054A2 Europe Only
Fleetguard Compleat with DCA4		Fleetguard Part Number: CC2825 Obtain Locally

8. If the coolant level in the coolant recovery bottle is low:

- Inspect the coolant recovery system for leaks.
- Inspect the pressure cap gaskets for damage and replace if necessary.



a - Gaskets

17891

- The pressure cap maintains pressure on the coolant tank. It may not be holding pressure properly. Contact your Cummins MerCruiser Diesel Authorized Repair Facility to have the cap tested.

Filling

1. If the coolant level is low in the heat exchanger, add the specified coolant, as necessary, to bring the level up to the bottom of the fill neck.

   IMPORTANT: When installing the pressure cap, tighten until it contacts locking tabs on the fill neck.
2. Install the pressure cap. Tighten until it contacts locking tabs on the fill neck.
3. Remove the fill cap from the coolant recovery bottle.
4. Fill to the "FULL" mark with the specified coolant.

Description	Where Used	Part Number
Marine Engine Coolant	Closed cooling system	92-813054A2 Europe Only
Fleetguard Compleat with DCA4		Fleetguard Part Number: CC2825 Obtain Locally

5. Install the fill cap onto the coolant recovery bottle.

Changing

Change (replace) the engine coolant at the prescribed interval. See **Replacing the Engine Coolant in the Closed Cooling System**.

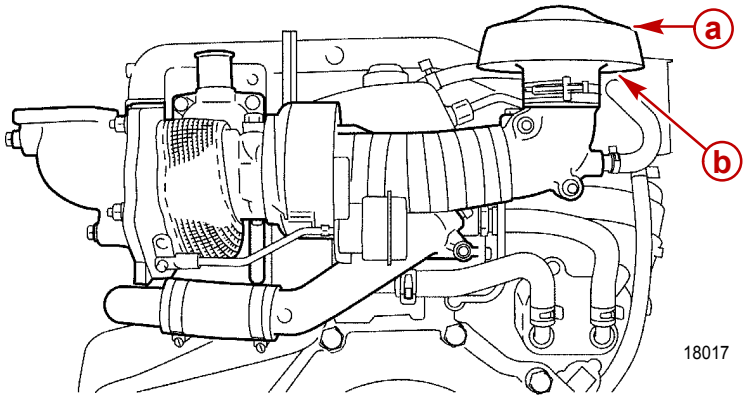
Air Cleaner

The air cleaner is used to prevent the entry of rain water, seawater, and debris. No maintenance is required and there are no serviceable parts to the air cleaner.

Cleaning

1. Remove any debris present at openings.

2. Ensure that the air cleaner is mounted (clamped) securely at all times.



a - Air cleaner
b - Openings

Replacement

Replace the assembly if it is cracked or damaged.

Water Separating Fuel Filter

⚠ WARNING

Fuel is flammable and explosive. Ensure the key switch is off and the lanyard is positioned so that the engine cannot start. Do not smoke or allow sources of spark or open flame in the area while servicing. Keep the work area well ventilated and avoid prolonged exposure to vapors. Always check for leaks before attempting to start the engine and wipe up any spilled fuel immediately.

NOTICE

Water entering the fuel injection system will cause corrosion and rusting of the injectors and other components, disabling the fuel injection system. Check daily for water in the water-separating fuel filter and have the engine inspected immediately if there is evidence of water in the fuel system.

IMPORTANT: Use a suitable container to collect fuel. Clean up any spills immediately and dispose of fuel in a safe manner in accordance with all local, federal, and international regulations.

IMPORTANT: Any water entering the fuel injection system will disable the system. Check daily for water in the water-separating fuel filter before starting.

The engine mounted water separating fuel filter is equipped with a Water in Fuel (WIF) sensor that should alert the operator when water is present in the filter. This fuel filter needs to be replaced at specified intervals or whenever water is detected in the fuel, whichever comes first.

The operator may be alerted that the WIF sensor has detected water in the fuel. Notification will occure one of two ways, depending upon the boat instrumentation package and if equipped:

- A message may be displayed on an instrument
- An indicator lamp may be illuminated

Refer to **Section 2 - Getting To Know Your Power Package**.

When the engine is equipped with a remote mounted primary filter (such as a Racor filter) it should be drained or replaced at specified intervals, or whenever water is detected in the engine mounted fuel filter.

Draining

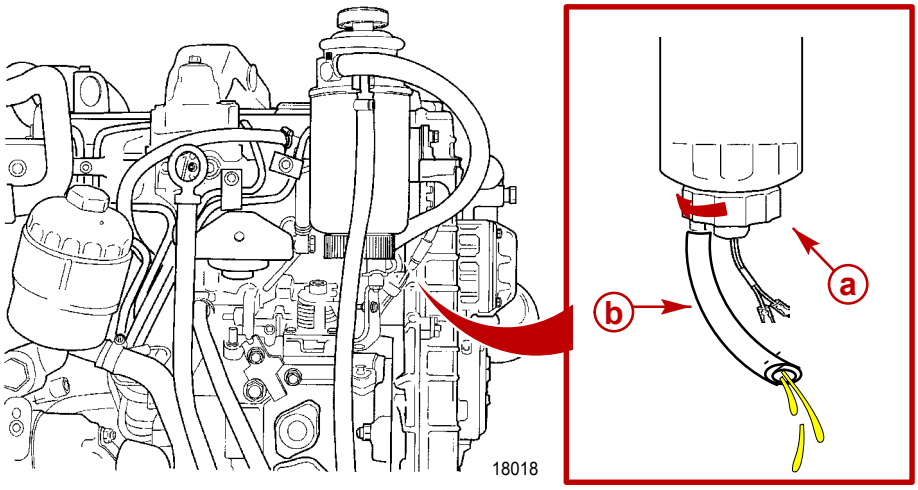
The filter can be drained of water and small dirt particles by opening the drain cap on the bottom of the filter.

NOTE: *Open the drain cap before starting daily operations in warm weather to ensure complete draining, . In cold weather, where there is a possibility that the condensed water will freeze, drain the filter shortly after the end of daily operations.*

NOTE: *Place a suitable container under the fuel filter to catch contaminated fuel or water. Dispose of properly.*

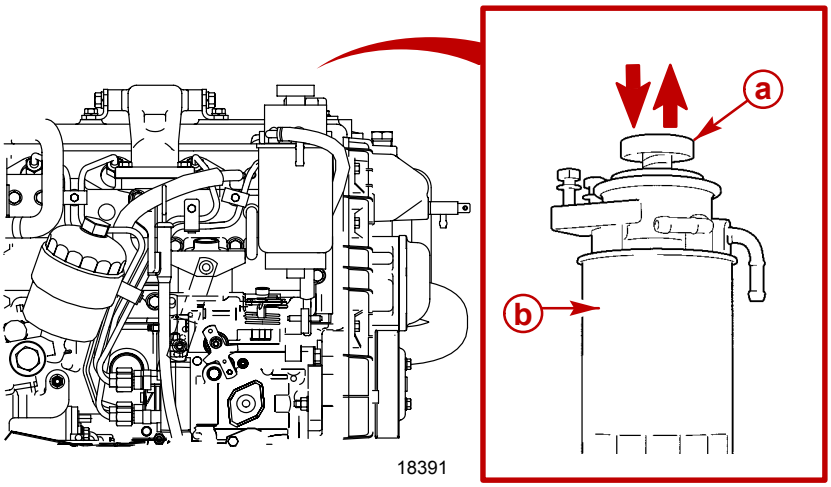
1. Install a short piece of hose to help direct the water and fuel from the water separating fuel filter.

2. Place a small container at the end of the drain hose beneath the drain cap on the filter.
3. Open the drain cap by turning the cap counterclockwise (as viewed from the bottom of the filter) approximately five turns.



a - Drain cap
b - Drain hose

4. Operate the priming pump up and down about 10 times until approximately 4 ml (2 fl. oz.) are drained or until fuel is clear in appearance.



a - Priming pump
b - Fuel filter canister

5. Close the drain cap by turning the cap clockwise. Tighten securely.
6. Remove the drain hose.
7. Refer to **Filling** and fill the fuel filter.
8. After starting the engine, ensure that there is no fuel leaking from the drain cap.

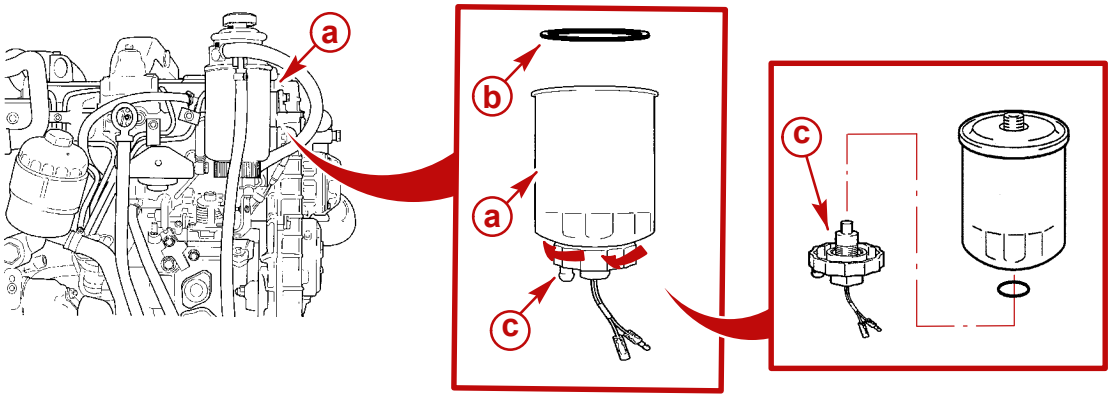
IMPORTANT: If fuel filter requires frequent draining, have the fuel tank drained to remove the water.

Replacing

IMPORTANT: The water separating fuel filter element cannot be cleaned and reused. It must be replaced.

1. Remove the water separating fuel filter and sealing ring from the fuel filter bracket.

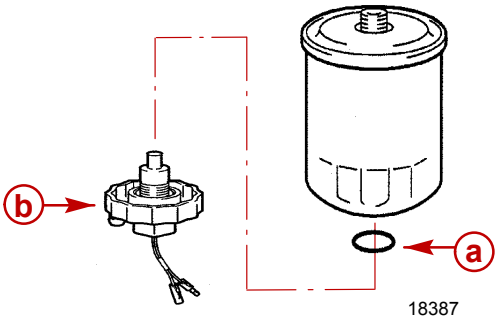
2. Remove and retain the drain cap from the filter by turning it counterclockwise. Discard the used filter as directed by local authorities.



18386

a - Water separating fuel filter
b - Sealing ring
c - Drain cap

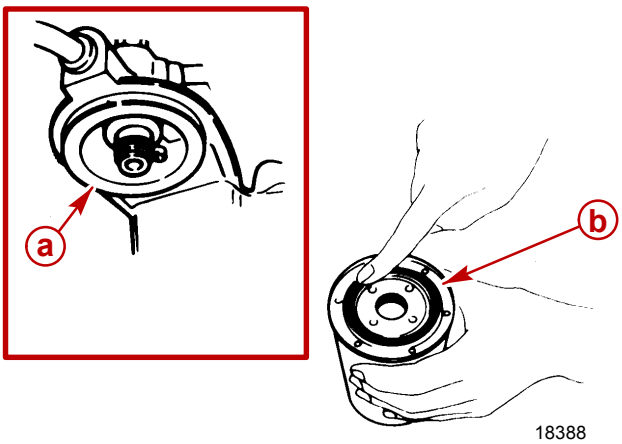
3. Install the O-ring and the retained drain cap on the new fuel filter. Tighten the drain cap.



18387

a - O-ring
b - Drain cap

4. Clean the filter sealing surface on the mounting bracket.
5. Coat the sealing ring on the new filter with clean engine oil.



18388

Typical mounting bracket and filter

a - Filter sealing surface
b - Sealing ring

Tube Ref No.	Description	Where Used	Part No.
121	15W40 4-Cycle Diesel Engine Oil	O-rings	92-858042K01

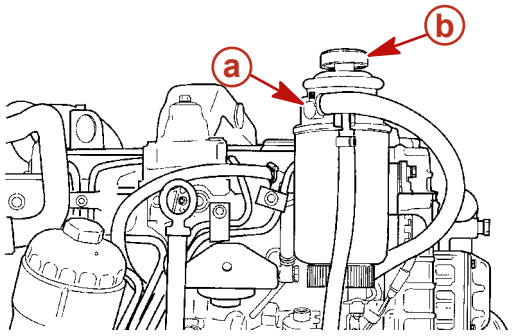
6. Thread the filter onto the bracket until the sealing ring contacts the bracket.
7. Tighten the fuel filter an additional 2/3 of a turn with a filter wrench.
8. Ensure bottom drain cap is securely tightened.
9. Fill the fuel filter. Refer to **Filling**.
10. Check the filter and drain cap for fuel leaks.
11. Start and operate the engine. Check filter connection for fuel leaks. If leaks exist, recheck filter installation. If leaks continue, stop engine immediately and contact your authorized Cummins MerCruiser dealer/distributor.

Filling

A plunger-type of hand pump/primer is located on the fuel filter bracket and is used to:

- Refill the fuel filter when changing the filter.
- Refill the fuel system if the system was run dry.
- Prime the fuel system if the engine has not been run for an extended period.

To operate the hand pump/primer, move the plunger (upper portion) up and down as needed.

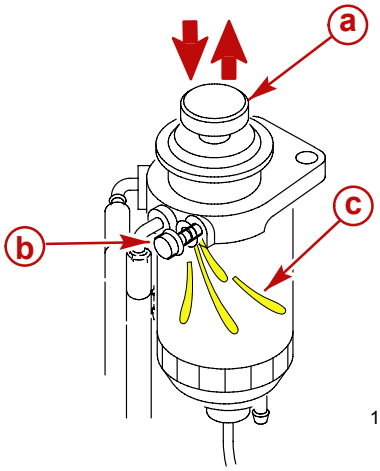


18389

a - Fuel filter bracket
b - Hand pump/primer

NOTE: *Follow this procedure after installing a new filter or if the fuel has been drained from the filter checking for water.*

1. Loosen the bleed screw on the fuel filter bracket.
2. Move the plunger on the hand pump/primer up and down repeatedly, until an air free stream of fuel flows from the bleed screw. The filter is full when an air free stream of fuel flows from the bleed screw.



18390

a - Plunger
b - Bleed screw
c - Fuel from bleed screw

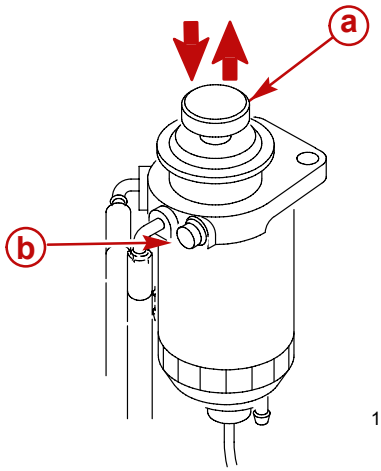
3. Tighten the bleed screw.

Fuel System

Priming

Prime the engine if it has not been run for an extended period or if the engine will not start.

1. Move the plunger on the hand pump/primer up and down repeatedly.



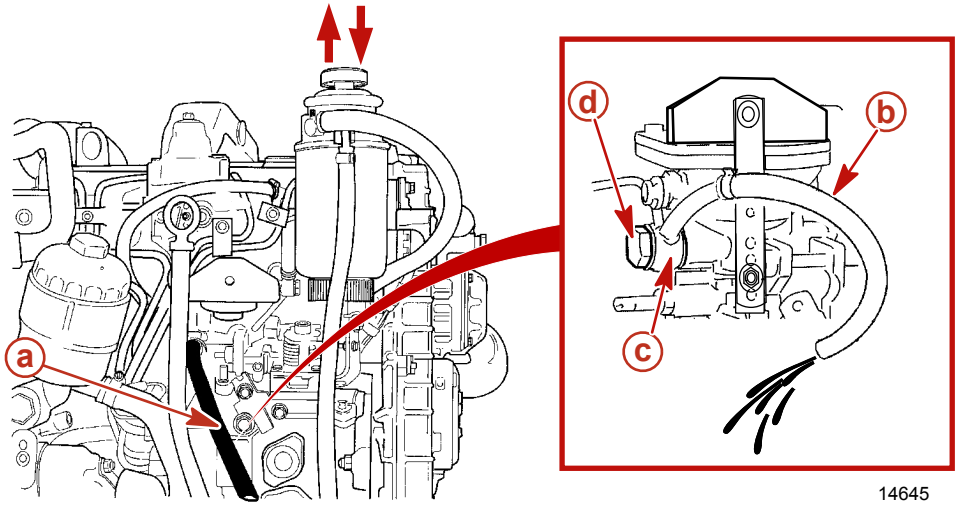
a - Hand pump/primer
b - Bleed screw (Closed for this operation)

2. Attempt to start the engine.

Purging Air

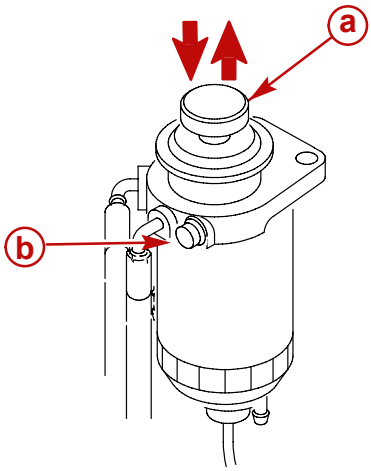
NOTE: *Follow this procedure if the fuel system was run dry or if part of the fuel system was drained for a service function.*

1. Refer to **Filling** and fill the fuel filter.
2. Check the filter and drain cap for fuel leaks. Ensure that the bleed screw on the fuel filter bracket is closed.
3. Place a suitable container under fuel injection pump to catch fuel.
4. Remove and plug boat fuel return hose from injection pump return fuel fitting.
5. Temporarily install a length of the fuel hose on fuel return fitting. Avoid disturbing special hollow bolt and sealing washers.



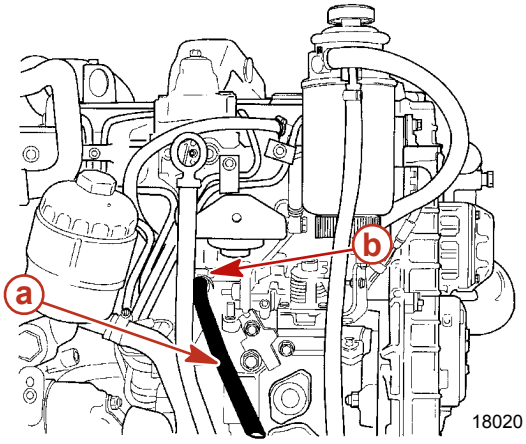
a - Fuel return hose
b - Temporary hose
c - Fuel return fitting
d - Hollow bolt and sealing washers

6. Move the plunger on the hand pump/primer up and down repeatedly, until an air free stream of fuel flows from the temporary hose.



a - Hand pump/primer
b - Bleed screw (Leave closed for this procedure)

7. Remove the temporary hose. Unplug and install boat fuel return hose on fitting. Securely tighten the hose clamp.



a - Fuel return hose
b - Hose clamp

8. Move the plunger knob up and down several times until some added resistance is noticed when the knob is moved.
9. Check for fuel leaks.
10. Dispose of waste fuel as defined by local authorities.
11. Start the engine and check for fuel leaks. If leaks exist, stop the engine immediately. Recheck installation.

NOTE: *In some circumstances, it may be necessary to bleed (purge air) from the injectors if the engine does not readily start. Refer to an authorized Cummins MerCruiser Diesel dealer/distributor.*

Fuel Tank Cleaning And Flushing

IMPORTANT: Diesel fuel should not be left in the tank during winter storage, as an accumulation of rust, sludge and wax residue may form.

Refer to the boat manufacturer's instructions and clean fuel tank at specified intervals. Unless specified otherwise, flush and clean the diesel fuel tank every 1000 hours or five years, whichever occurs first.

Seawater System

Draining The Seawater System

⚠ CAUTION

Water can enter the bilge when the drain system is open, damaging the engine or causing the boat to sink. Remove the boat from the water or close the seacock, disconnect and plug the seawater inlet hose, and ensure the bilge pump is operational before draining. Do not operate the engine with the drain system open.

IMPORTANT: The engine must be as level as possible to ensure complete draining of the cooling system.

IMPORTANT: The boat must not be operating at any point during this procedure.

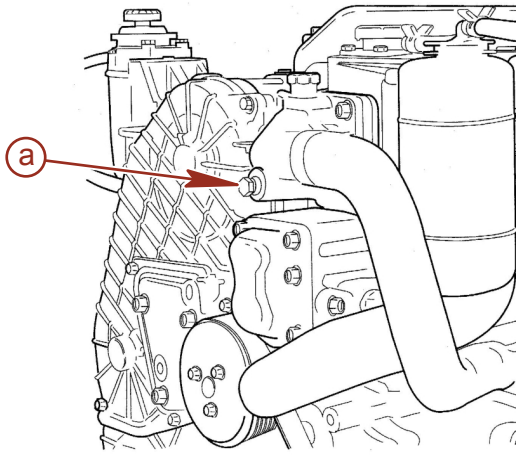
The power package should be drained before flushing, exposure to freezing temperatures, or extended storage.

1. Remove the boat from the water, if possible, or turn on the bilge pump if the boat is in the water.
2. Close the seacock (if equipped), or disconnect and plug the seawater inlet hose if the boat is to remain in the water.
3. Ensure that the engine is as level as possible to ensure complete draining of the seawater cooling system.

NOTICE

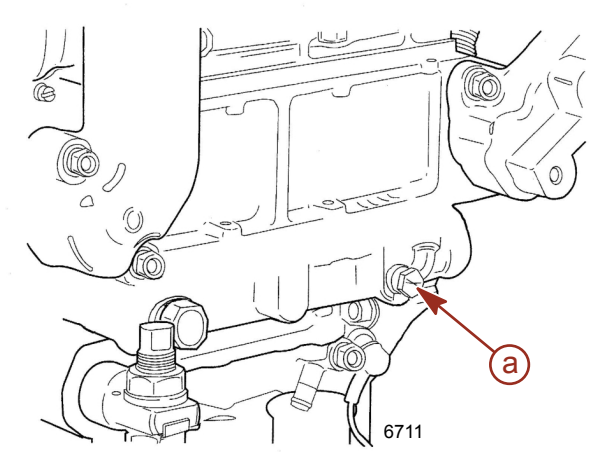
Water trapped in the passages of the heat exchanger can cause corrosion or freeze damage. Drain all sections of the heat exchanger immediately after operation or before any length of storage in cold weather.

4. Remove the drain plug from the front cover of the heat exchanger.



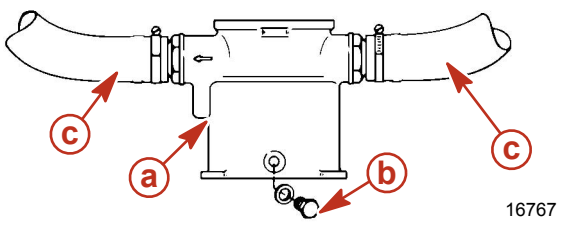
a - Drain plug

5. Remove the drain plug from the lower part of the aftercooler.



a - Drain plug

6. While draining, repeatedly clean out the drain holes using a stiff piece of wire. Do this until the entire system is drained.
7. On models equipped with a seawater strainer, remove the hose at the seawater strainer and drain the hose completely. Drain and empty the seawater strainer. Reconnect the hose and tighten the hose clamps securely. Install the washer and drain plug.



a - Seawater strainer
b - Washer and drain plug
c - Hose

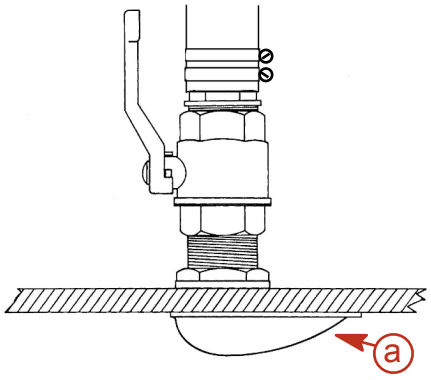
8. After the seawater section of the cooling system has been drained completely, coat the threads of the drain plugs with sealant and reinstall. Tighten the plugs securely.

Tube Ref No.	Description	Where Used	Part No.
19	Perfect Seal	Drain plugs	92-34227 1

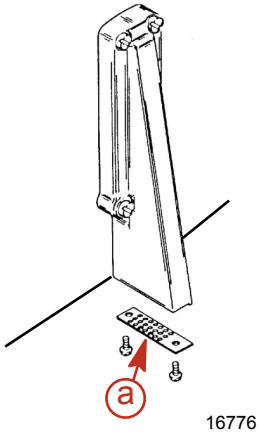
9. Reconnect the hoses. Tighten the hose clamps securely.

Checking the Seawater Pickups

1. Ensure that the water inlet holes for the seawater pickup are clean and not obstructed.



Typical through-the-hull seawater pickup



Typical through-the-transom seawater pickup

a - Water inlet holes

Cleaning the Seawater Strainer, if Equipped

NOTICE

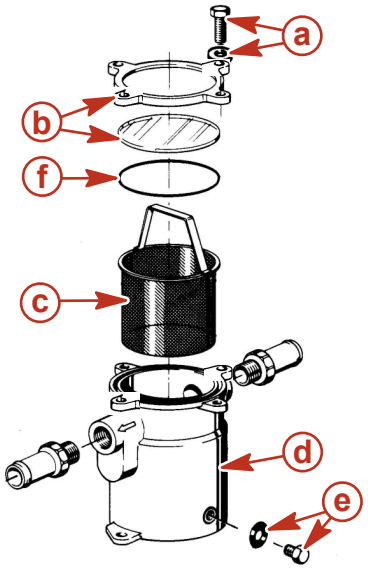
An open seawater strainer or seacock during some service or maintenance procedures can introduce water into the boat, causing damage or sinking the boat. Always close the water supply from the seawater pump, water inlet, or seacock when performing service or maintenance on the cooling system.

1. With the engine off, close the seacock, if equipped, or remove and plug the seawater inlet hose.
2. Remove the screws, washers, and cover.
3. Remove the strainer, drain plug, and sealing washer.
4. Clean all the debris from the strainer housing. Flush both the strainer and housing with clean water.
5. Check the cover gasket and replace when damaged or if it leaks.
6. Reinstall the strainer, drain plug, and sealing washer.

⚠ CAUTION

Seawater leaking from the seawater strainer could cause excess water in the bilge, damaging the engine or causing the boat to sink. Do not overtighten the cover screws, or the cover may warp and introduce seawater into the bilge.

7. Install the seal and cover using the screws and washers. Do not overtighten the cover screws.



- **a -** Screws and washers
- **b -** Cover with glass
- **c -** Strainer
- **d -** Housing
- **e -** Drain plug and sealing washer
- **f -** Seal

8. Open the seacock, if equipped, or remove the plug and reconnect the seawater inlet hose.
9. Upon first starting the engine, check for leaks or air in the system that would indicate an external leak.

Flushing The Seawater System

Flushing the seawater system with fresh water is needed only for applications operating in saltwater, brackish water, polluted water, or water with a high mineral content to avoid salt or silt buildup. For best results we recommend flushing the seawater system after each outing. After each operation in saltwater, and before storage, the seawater cooling system must be flushed

NOTE: *The closed cooling section of the cooling system that contains coolant does not need to be flushed. Coolant is changed at specified intervals. See* ***Maintenance Schedules.***

With the Boat out of the Water

⚠ WARNING

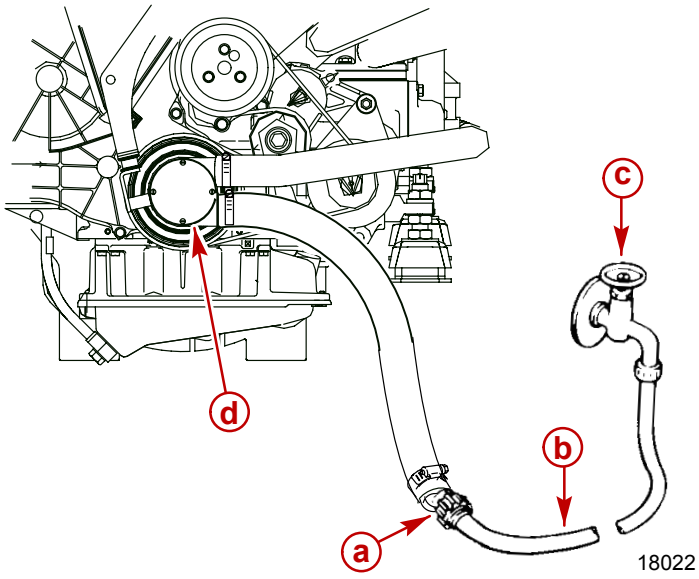
Rotating propellers can cause serious injury or death. Never operate the boat out of the water with a propeller installed. Before installing or removing a propeller, place the drive unit in neutral and engage the lanyard stop switch to prevent the engine from starting. Place a block of wood between the propeller blade and the anti-ventilation plate.

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

1. Remove the propeller. Refer to the boat manufacturer's instructions.

2. Connect the flushing hose from a water tap to the seawater inlet hose on the seawater pickup pump inlet using an appropriate adapter.



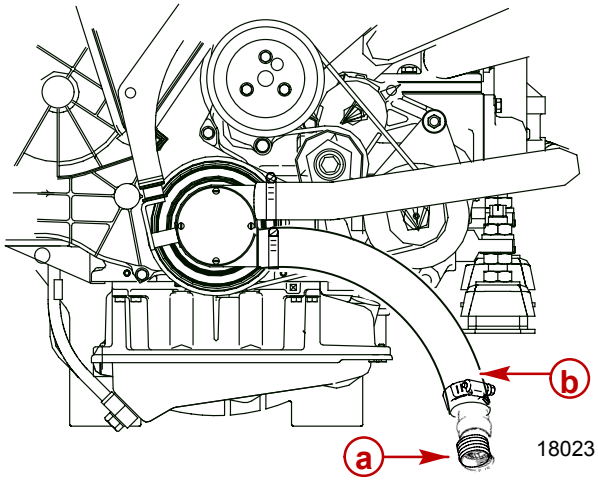
a - Adapter
b - Flushing hose
c - Water tap
d - Seawater pickup pump

3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.
4. Place the remote control in the neutral position and start the engine.

NOTICE

Operating the engine out of the water at high speeds creates suction, which can collapse the water supply hose and overheat the engine. Do not operate the engine above 1400 RPM out of the water and without sufficient cooling water supply.

5. Operate the engine at idle speed in neutral for 10 minutes or until the discharge water is clear. Do not operate out of water above idle.
6. Stop the engine.
7. Shut off the water tap.
8. Remove the adapter from the seawater pump inlet hose connection and reconnect the seawater inlet hose. Tighten the hose clamps securely.



a - Adapter
b - Seawater inlet pump hose

9. Open the seacock or reconnect the water inlet hose before starting the engine.

With the Boat in the Water

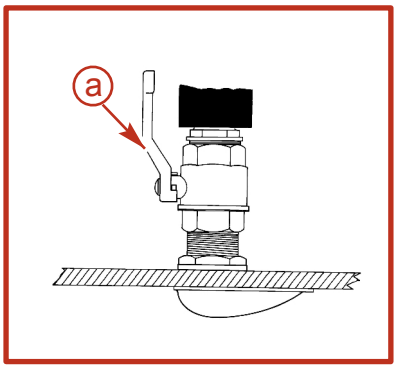
NOTICE

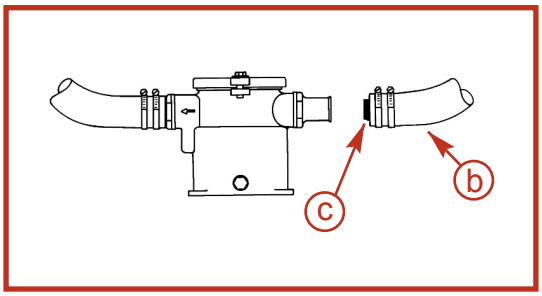
Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

NOTICE

Flushing the engine with the boat in the water can cause seawater to flow into the engine, resulting in engine damage. Close the seacock before flushing the engine. Keep the seacock closed until starting the engine.

1. Close the seacock, if equipped, or disconnect and plug the seawater inlet hose.

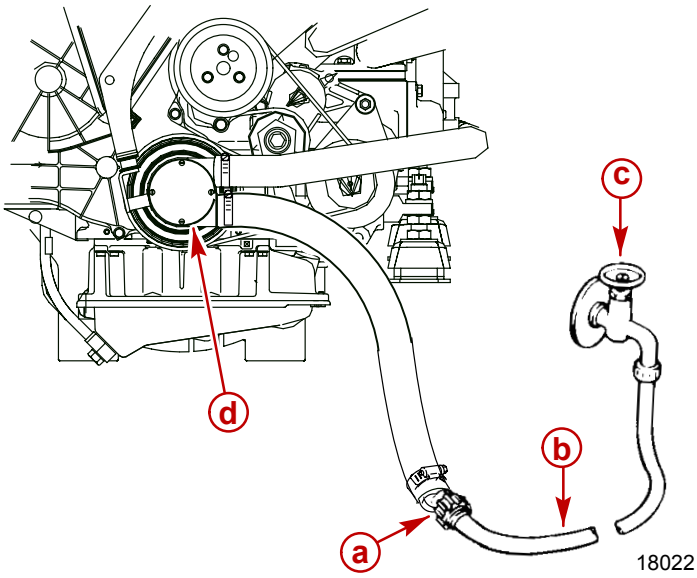




13171

a - Seacock
b - Seawater inlet hose
c - Plug

2. Using an appropriate adapter, connect the flushing hose from a water tap to the seawater inlet hose on the seawater pickup pump inlet.



18022

a - Adapter
b - Flushing hose
c - Water tap
d - Seawater pickup pump

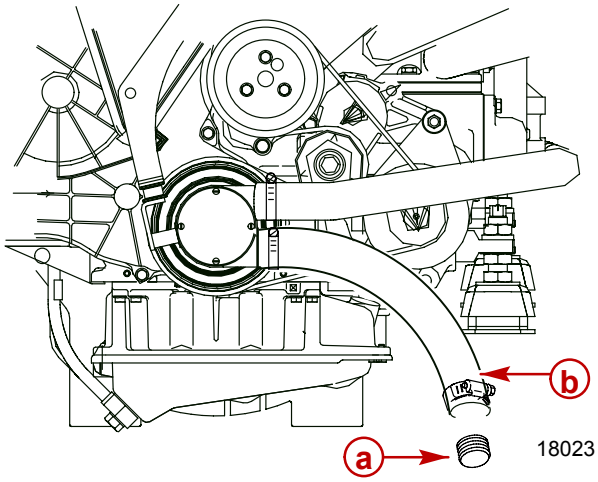
3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.
4. Place the remote control in the neutral position and start the engine.

NOTICE

Operating the engine out of the water at high speeds creates suction, which can collapse the water supply hose and overheat the engine. Do not operate the engine above 1400 RPM out of the water and without sufficient cooling water supply.

5. Operate the engine at idle speed in neutral for 10 minutes or until the discharge water is clear. Do not operate out of water above idle.
6. Stop the engine.
7. Shut off the water tap.

8. Remove the adapter from the seawater pump inlet hose connection and reconnect the seawater inlet hose. Tighten the hose clamps securely.



a - Adapter
b - Seawater inlet pump hose

NOTICE

If the boat is at rest in the water with the engine off, an open seacock or water inlet hose could introduce water into the engine's cooling system or the boat. Keep the seacock or water inlet hose plugged until ready to start the engine. Attach a tag to the ignition switch or steering wheel to inform others of the water inlet connection.

9. Open the seacock or reconnect the water inlet hose before starting the engine.

Replacing the Engine Coolant in the Closed-Cooling System

Draining the Closed Cooling System

NOTICE

Discharge of oil, coolant, or other engine/drive fluids into the environment is restricted by law. Use caution not to spill oil, coolant, or other fluids into the environment when using or servicing your boat. Be aware of the local restrictions governing the disposal or recycling of waste, and contain and dispose of fluids as required.

NOTE: *For instructions on draining the seawater section, see* ***Draining the Seawater System*** *in this section.*

IMPORTANT: Observe the following:

- **Insert a wire into the drain holes to ensure that foreign material is not obstructing the drain holes.**
- **The engine must be as level as possible to ensure complete draining of cooling system.**
- **The closed cooling section must be kept filled year round with recommended coolant. If the engine will be exposed to freezing temperatures, make sure the closed cooling section is filled with an ethylene glycol antifreeze and water solution properly mixed to protect the engine to the lowest temperature to which it will be exposed.**
- **Do not use propylene glycol antifreeze in the closed cooling section of the engine.**

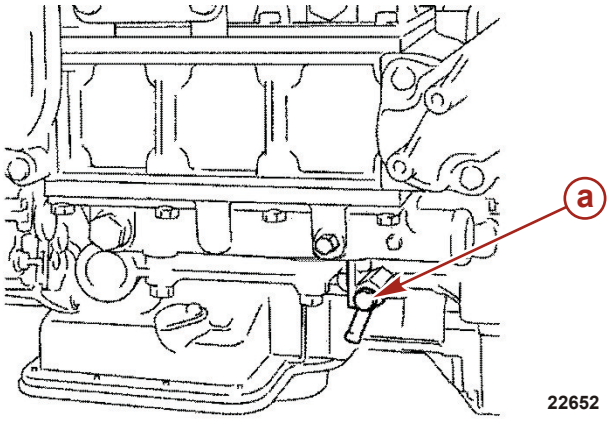
⚠ CAUTION

A sudden loss of pressure can cause hot coolant to boil and discharge violently resulting in serious injury from burns. Allow the engine to cool down before removing the coolant pressure cap.

1. Allow the engine to cool.
2. Remove the pressure cap from the heat exchanger.

   NOTE: *Drain coolant into a suitable container, Dispose of old coolant properly.*

3. Drain the coolant by removing the drain plug.



a - Drain plug

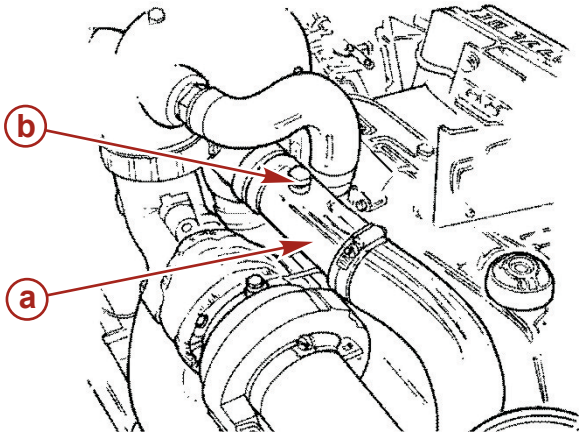
4. Clean out the drain hole using a stiff piece of wire; repeat until the entire system has drained.
5. After the coolant has drained completely, coat the threads of the drain plug with sealant and reinstall. Tighten securely.

Tube Ref No.	Description	Where Used	Part No.
19	Perfect Seal	Closed cooling system drain plug	92-34227 1

6. Empty the coolant recovery bottle.
7. If the closed cooling system requires cleaning, see your local Cummins MerCruiser Diesel Authorized Repair Facility.

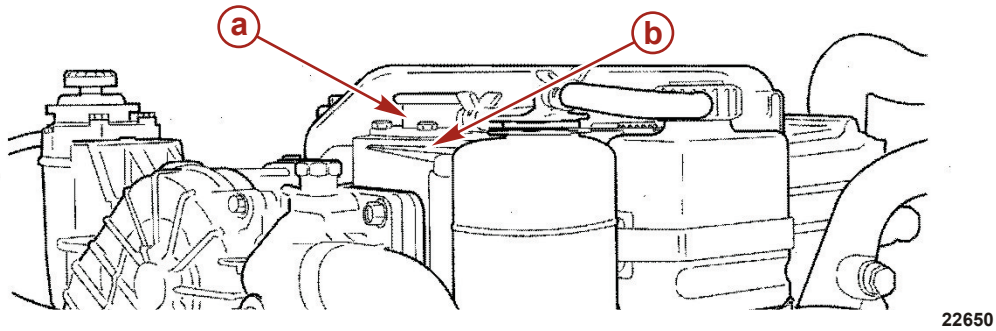
Filling the Closed Cooling System

1. With the engine cold, remove the pressure cap on the heat exchanger.
2. Remove the vent plug on the water pipe near the turbocharger.



a - Water pipe
b - Vent plug

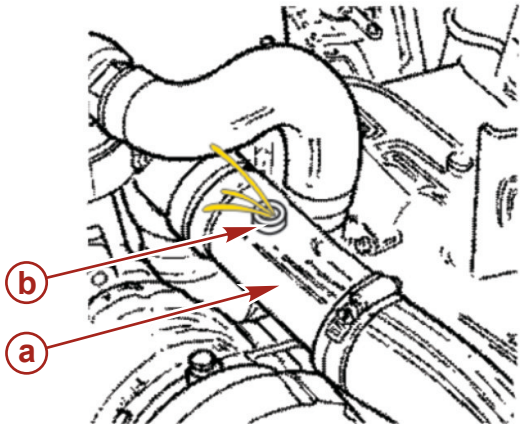
3. Slowly fill with coolant through the heat exchanger fill neck.



a - Fill neck
b - Heat exchanger

Tube Ref No.	Description	Where Used	Part No.
123	Marine Engine Coolant	Closed cooling system	92-813054A2
	Fleetguard Compleat with DCA4, Fleetguard Part Number CC2825	Closed cooling system	Obtain Locally

4. Continue slowly filling until an air-free stream of coolant appears at the vent plug opening.



a - Water pipe
b - Vent plug opening

5. Coat the threads of the vent plug with sealant and install. Tighten the vent plug securely.

Tube Ref No.	Description	Where Used	Part No.
19	Perfect Seal	Vent plug	92-34227 1

6. Continue filling until the coolant level is at the bottom of the fill neck.

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

7. Supply cooling water to the water inlet openings on the sterndrive.
8. With the pressure cap off, start the engine and operate at fast idle (1500–1800 RPM). Add coolant to the heat exchanger, as required, to maintain coolant level 25 mm (1 in.) below filler neck.
9. After the engine has reached normal operating temperature (thermostat fully open), and coolant level remains constant, fill the heat exchanger to the bottom of the fill neck.
10. Install the pressure cap.

    IMPORTANT: When installing the pressure cap, be sure to tighten it until it contacts the stops on filler neck.
11. Observe the engine temperature gauge to make sure that the engine operating temperature is normal. If the gauge indicates excessive temperature, stop the engine immediately and examine for cause.
12. Remove the cap from the coolant recovery bottle and fill to a level between the bottom "ADD" and "FULL" marks with coolant.
13. Reinstall the cap.
14. With the engine still operating, check the hose connections, fittings, and gaskets for leaks.

Corrosion Protection

General Information

Whenever two or more dissimilar metals (such as those found on this power package) are submerged in a conductive solution such as saltwater, polluted water, or water with a high mineral content, a chemical reaction takes place causing electrical current to flow between metals. The electrical current flow causes the metal that is most chemically active, or anodic, to erode. This erosion is known as *galvanic corrosion* and, if it is not controlled, it will eventually cause the need for replacement of power package components exposed to water.

To help control the effects of galvanic corrosion, Cummins MerCruiser Diesel power packages come with several sacrificial anodes and other corrosion protection devices. For a more comprehensive explanation of corrosion and corrosion protection refer to the **Marine Corrosion Protection Guide** (90-88181301).

IMPORTANT: Replace sacrificial anodes if eroded 50% or more. Cummins MerCruiser Diesel strongly recommends avoiding the use of anodes from another manufacturer. Refer to your Cummins MerCruiser Diesel Authorized Repair Facility for additional information.

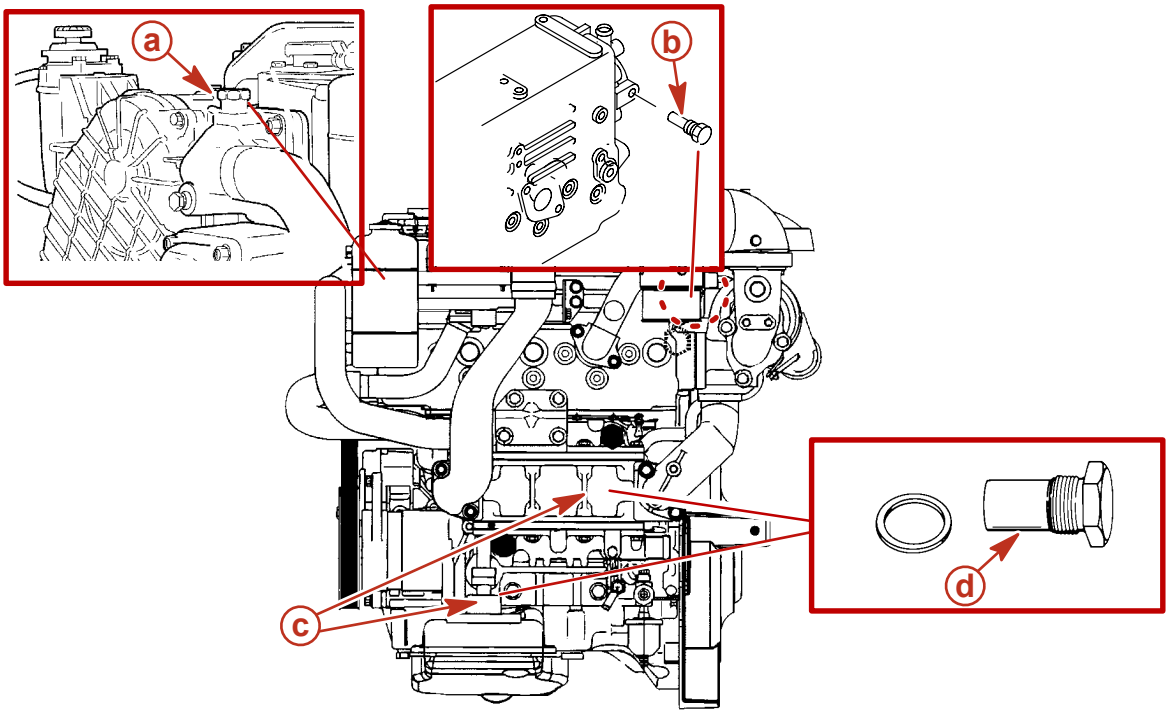
Engine Corrosion Protection Components

Anodes have been installed as part of the aftercooler and heat exchanger systems, which serve as sacrificial anodes to protect the engine from corrosion.

These sacrificial anodes are installed in the seawater circuit to help avoid galvanic corrosion caused by seawater.

Sacrificial anode locations:

- Front and rear of the heat exchanger.
- Two on the aftercooler.



14650

a - Front heat exchanger anode
b - Rear heat exchanger anode
c - Aftercooler anodes
d - Anode plug and sacrificial anode assembly

Removal

1. Allow the engine to cool.

NOTICE

Failure to close the seawater inlet or seacock when removing or replacing the anode plugs can lead to water damage. Close the seacock or remove and plug the seawater inlet hose to prevent water from entering the anode plug holes.

2. With the engine off, close the seacock, if equipped, or disconnect and plug the seawater inlet hose.
3. Remove the anode plugs and sacrificial anodes.

Cleaning and Inspection

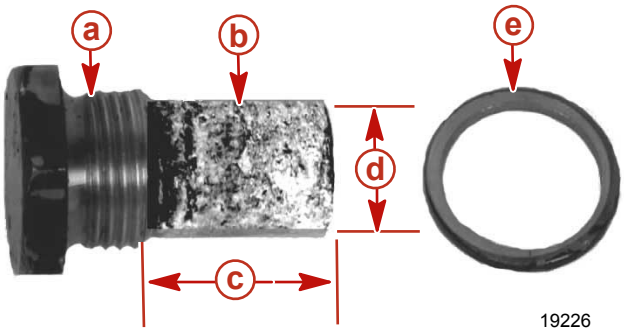
Inspection and replacement interval will vary according to the condition of the seawater and the mode of engine operation.

NOTE: *Using sandpaper, fiber brush, or a cleaning pad, remove the deposits from the surface of the anode before trying to determine the amount of erosion. Do not use a mild steel brush which might leave deposits that could accelerate corrosion.*

1. Remove the deposits.

2. Inspect and measure the anode. Compare the measurements to the specifications for a new sacrificial anode and replace the anode assembly when deteriorated 50%.

   NOTE: *Sacrificial anodes are available only as an assembly. Replace both the plug and anode as a unit.*



Anode assembly

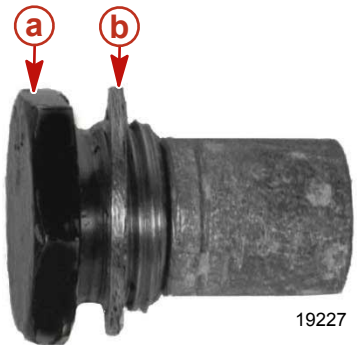
- **a -** Anode plug
- **b -** Sacrificial anode
- **c -** Length
- **d -** Diameter
- **e -** Sealing washer

Sacrificial anode measurements (new)	
Length	19 mm (3/4 in.)
Diameter	16 mm (5/8 in.)

3. Discard the sealing washer.

Installation

1. Install a new sealing washer.
2. Install the anode plug with sacrificial anode. Tighten securely.



- **a -** Anode plug
- **b -** Sealing washer

3. Unplug and connect the seawater inlet hose, or open the seacock if equipped.

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

4. Ensure that the seawater pickup pump is supplied cooling water.
5. Start the engine and check for leaks.

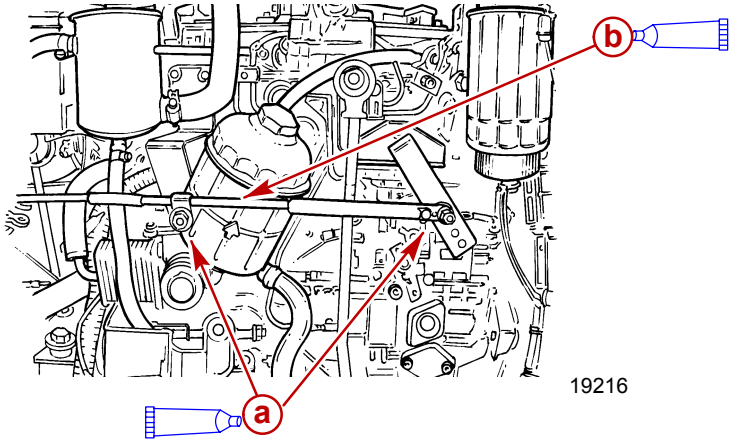
Antifouling Paint

In some areas it may be advisable to paint the bottom of the boat to help prevent marine growth. Contact your Cummins MerCruiser Diesel Authorized Repair Facility for recommendations for your boat.

Lubrication

Throttle Cable

1. Lubricate the pivot points and guide contact surfaces.

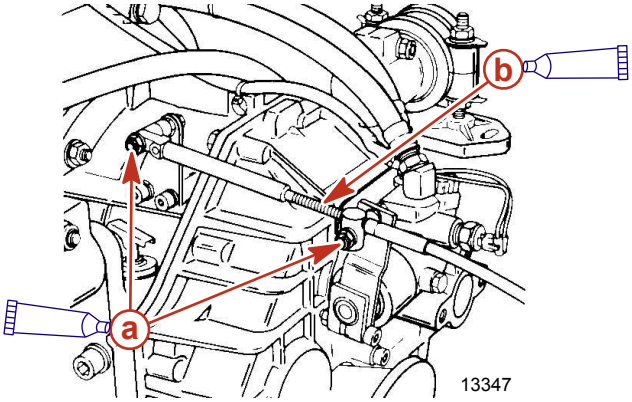


a - Pivot points
b - Guide contact surfaces

Tube Ref No.	Description	Where Used	Part No.
80	SAE Engine Oil 30W	Throttle cable pivot points and guide contact surfaces	Obtain Locally

Shift Cable

1. Lubricate the pivot points and guide contact surfaces.



Typical inboard model shift cable and transmission linkage
a - Pivot points
b - Guide contact surface

Tube Ref No.	Description	Where Used	Part No.
80	SAE Engine Oil 30W	Shift cable pivot points and guide contact surfaces	Obtain Locally

Drive Belts

All drive belts must be periodically inspected for tension and condition (excessive wear, cracks, fraying, or glazed surfaces).

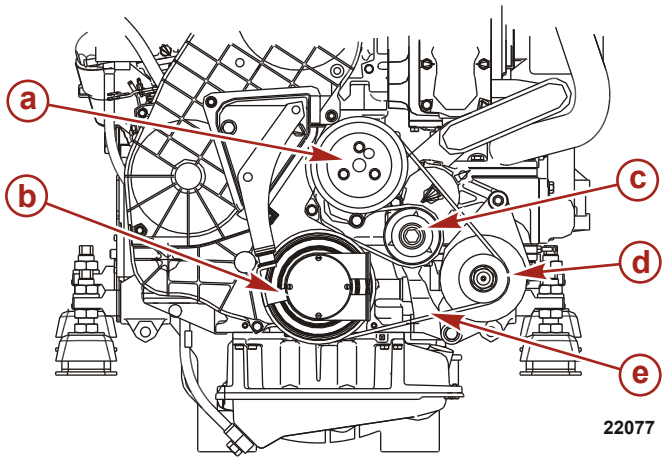
If any drive belts need replacement or tension needs adjustment, see your Cummins MerCruiser Diesel Authorized Repair Facility.

⚠ WARNING

Inspecting the belts with the engine running may cause serious injury or death. Turn off the engine and remove the ignition key before adjusting tension or inspecting belts.

Checking Serpentine Belt

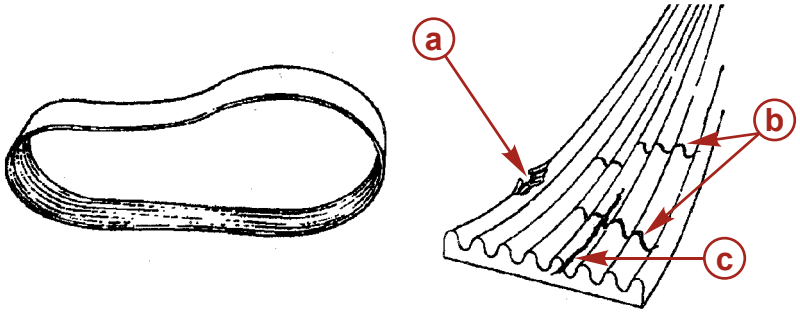
1. The various components are:



a - Water circulating pump pulley
b - Crankshaft pulley
c - Automatic tensioner pulley
d - Alternator pulley
e - Serpentine belt

2. Inspect the serpentine belt for proper tension and for the following:
   - Excessive wear
   - Cracks

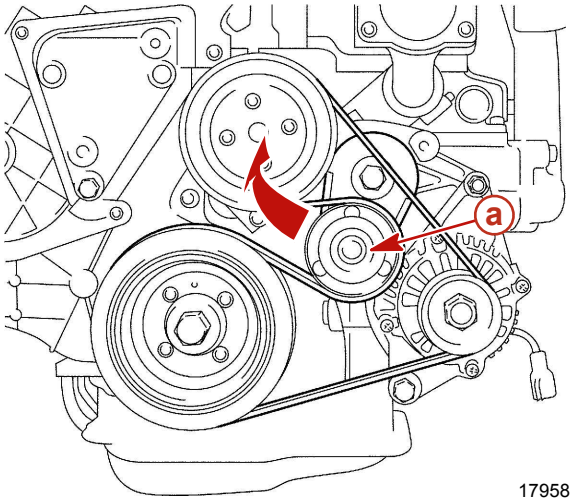
     NOTE: *Minor, transverse cracks (across the belt width) may be acceptable. Longitudinal cracks (in direction of belt length) that join transverse cracks are not acceptable.*
   - Fraying
   - Glazed surfaces



a - Fraying
b - Transverse cracks
c - Longitudinal cracks

   Replace the belt if necessary.

3. Check the operation of the automatic tensioner and associated components. Position a suitable tool on the pulley fastener and rotate the tensioner pulley in the direction of the arrow in the following illustration. Release the pressure and allow the pulley to glide back slowly. The tensioner must return to its initial position.



Seawater pump and bracket removed for clarity only
a - Automatic tensioner

Battery

Refer to specific instructions and warnings accompanying your battery. If this information is not available, observe the following precautions when handling a battery.

⚠ WARNING

Recharging a weak battery in the boat, or using jumper cables and a booster battery to start the engine, can cause serious injury or product damage from fire or explosion. Remove the battery from the boat and recharge in a ventilated area away from sparks or flames.

⚠ WARNING

An operating or charging battery produces gas that can ignite and explode, spraying out sulfuric acid, which can cause severe burns. Ventilate the area around the battery and wear protective equipment when handling or servicing batteries.

Section 6 - Storage

Table of Contents

6

Cold Weather (Freezing Temperature), Seasonal Storage, and Extended Storage

IMPORTANT: Cummins MerCruiser Diesel strongly recommends that this service be performed by a Cummins MerCruiser Diesel Authorized Repair Facility. Damage caused by freezing IS NOT covered by the Cummins MerCruiser Diesel Limited Warranty.

NOTICE

Water trapped in the seawater section of the cooling system can cause corrosion or freeze damage. Drain the seawater section of the cooling system immediately after operation or before any length of storage in freezing temperatures. If the boat is in the water, keep the seacock closed until restarting the engine to prevent water from flowing back into the cooling system. If the boat is not fitted with a seacock, leave the water inlet hose disconnected and plugged.

NOTE: *As a precautionary measure, attach a tag to the key switch or steering wheel of the boat reminding the operator to open the seacock or unplug and reconnect the water inlet hose before starting the engine.*

You should consider a boat is in storage whenever it is not in operation. The amount of time that the power package is not operated may be for a brief period, such as during a day, overnight, for a season, or for an extended period of time. Certain precautions and procedures must be observed to protect the power package from freeze damage, corrosion damage, or both types of damage during storage.

Freeze damage can happen when water trapped in the seawater cooling system freezes. For example, after operating the boat, exposure to freezing temperatures for even a brief period of time could result in freeze damage.

Corrosion damage is the result of saltwater, polluted water, or water with a high mineral content trapped in the seawater cooling system. Saltwater should not stay in an engine's cooling system for even a brief storage time; drain and flush the seawater cooling system after each outing.

Cold weather operation refers to operating the boat whenever the possibility of freezing temperatures exists. Likewise, cold weather (freezing temperature) storage refers to whenever the boat is not being operated and the possibility of freezing temperatures exists. In such cases, the seawater section of the cooling system must be completely drained immediately after operation.

Seasonal storage refers to when the boat is not being operated for one month or more. The length of time varies depending on the geographic location of the boat in storage. Seasonal storage precautions and procedures include all of the steps for cold weather (freezing temperature) storage and some additional steps that must be taken when storage will last longer than the short time of cold weather (freezing temperature) storage.

Extended storage means storage for a period of time that may last for several seasons or longer. Extended storage precautions and procedures include all of the steps for cold weather (freezing temperature) storage and seasonal storage plus some additional steps.

See the specific procedures in this section related to the conditions and the length of storage for your application.

Cold Weather (Freezing Temperature) Storage

NOTICE

Water trapped in the seawater section of the cooling system can cause corrosion or freeze damage. Drain the seawater section of the cooling system immediately after operation or before any length of storage in freezing temperatures. If the boat is in the water, keep the seacock closed until restarting the engine to prevent water from flowing back into the cooling system. If the boat is not fitted with a seacock, leave the water inlet hose disconnected and plugged.

NOTE: *As a precautionary measure, attach a tag to the key switch or steering wheel of the boat reminding the operator to open the seacock or unplug and reconnect the water inlet hose before starting the engine.*

1. Read all precautions and perform all procedures found in **Draining the Seawater System** and drain the seawater section of the cooling system.
2. Place a caution tag at the helm advising the operator to unplug and connect the water inlet hose or open the seacock, if equipped, before operating the boat.
3. For additional assurance against freezing and corrosion fill the seawater cooling system with a mixture of propylene glycol antifreeze and tap water. See **Seasonal Storage Instructions** in this section.

Preparing Your Power Package for Seasonal or Extended Storage

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

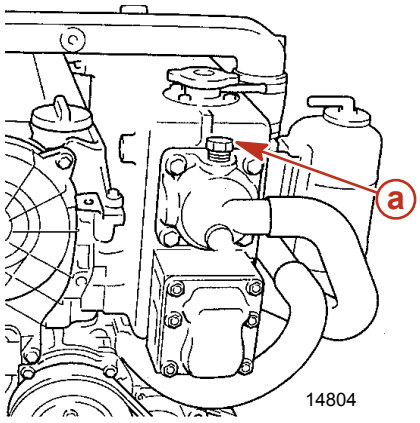
IMPORTANT: If the boat has already been removed from the water, supply water to the water inlet holes before starting the engine. Follow all warnings and flushing attachment procedures stated in Flushing the Seawater System.

1. Supply cooling water to the water inlet holes or seawater pump inlet.
2. Start the engine and operate until it reaches normal operating temperature.
3. Stop the engine.
4. Change the engine oil and filter.
5. Start the engine and run for about 15 minutes. Check for oil leaks.
6. Flush the seawater cooling system. See **Flushing the Seawater System**.

Seasonal Storage Instructions

1. Read all precautions and perform all procedures found in **Preparing Your Power Package for Seasonal or Extended Storage**.
2. Read all precautions and perform all procedures found in **Draining the Seawater System** and drain the seawater section of the cooling system.

   IMPORTANT: Cummins MerCruiser Diesel recommends the use of propylene glycol antifreeze in the seawater section of the cooling system for cold weather (freezing temperature), seasonal storage, or extended storage. Make sure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Be certain to follow the propylene glycol manufacturer's recommendations.
3. Fill a container with approximately 5.6 liters (6 U.S. quarts) of propylene glycol antifreeze and tap water mixed to manufacturer's recommendation to protect engine to the lowest temperature to which it will be exposed during cold weather or extended storage.
4. Remove the anode plug from the front cover of the heat exchanger.



a - Anode plug

5. Using a suitable funnel, slowly pour the propylene glycol antifreeze mixture through the anode plug opening and into the seawater system until system is full.
6. Install the anode plug. Tighten securely.

   NOTE: *Discharge of propylene glycol into the environment may be restricted by law. Dispose of propylene glycol in accordance with federal, state, and local laws and guidelines.*
7. Clean the outside of the engine and repaint any areas required with primer and spray paint. After the paint has dried, coat the engine with specified corrosion-inhibiting oil or equivalent.

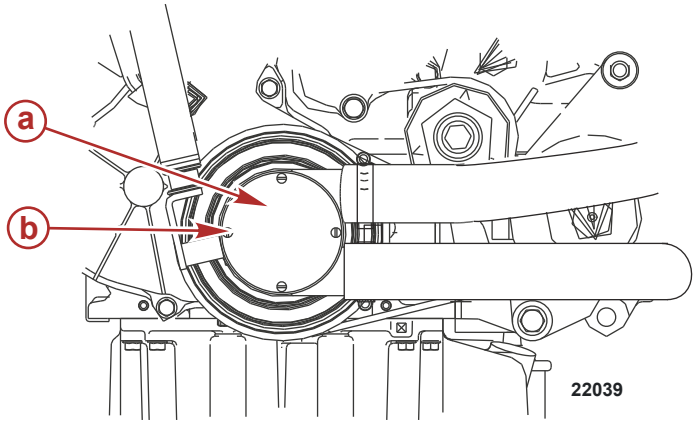
Description	Where Used	Part Number
Corrosion Guard	Outside of engine	92-802878-55
Light gray primer		92-802878-52
Phantom Black paint		92-802878-1

8. Your Cummins MerCruiser Diesel Authorized Repair Facility should now perform all required checks, inspections, lubrications, and fluid changes outlined in **Maintenance Schedules**.
9. Follow the battery manufacturer's instructions for storage and store the battery.

Extended Storage Instructions

IMPORTANT: Cummins MerCruiser Diesel strongly recommends that this service be performed by a Cummins MerCruiser Diesel Authorized Repair Facility.

1. Read all precautions and perform all procedures found in **Preparing Your Power Package**.
2. Read all precautions and perform all procedures found in **Draining the Seawater System**.
3. Read all precautions and perform all procedures found in **Seasonal Storage Instructions**.
4. Remove the seawater pump impeller and store away from direct sunlight.
   a. Remove the seawater pump cover mounting screws.
   b. Remove the seawater pump cover and gasket.
   IMPORTANT: The seawater pump impeller material can be damaged by prolonged exposure to direct sunlight.
   c. Remove the pump impeller and store away from direct sunlight.
   d. Reinstall the seawater pump cover for storage.



a - Seawater pump cover
b - Cover mounting screw (4)

5. Place a caution tag at the instrument panel and in the engine compartment stating that the seawater pump impeller is out and to not operate the engine.

Battery

Follow the battery manufacturer's instructions for storage.

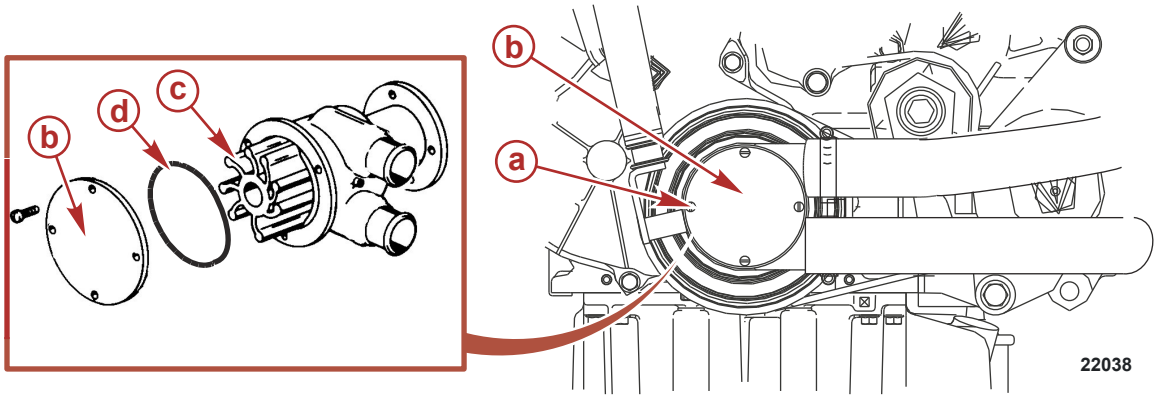
Recommissioning

NOTICE
See **Cold Weather (Freezing Temperature), Seasonal Storage, and Extended Storage - Precautions**, BEFORE proceeding.

NOTE: *Discharge of propylene glycol into the environment may be restricted by law. Contain and dispose of propylene glycol in accordance with federal, state, and local laws and guidelines.*

1. **On engines that were prepared for cold weather (freezing temperature), seasonal storage, or extended storage**: Drain the propylene glycol into a suitable container. Dispose of the propylene glycol in accordance with federal, state, and local laws and guidelines. See **Draining the Seawater System**.
2. **On engines that were prepared for extended storage**: Install the seawater pump impeller. Ensure that the splines are not worn and inspecting it for worn or damaged vanes.
   a. Remove the seawater pump cover mounting screws.
   b. Remove the seawater pump cover and O-ring.
   c. Install the seawater pump impeller into the housing by turning clockwise while simultaneously pushing inward.
   d. Install a new O-ring on the seawater pump.
   e. Install the seawater pump cover.

f. Install the seawater pump cover using the mounting screws. Tighten the screws evenly in a diagonal pattern. Tighten the screws securely.



a - Mounting screw (4)
b - Cover
c - Impeller
d - O-ring

3. Ensure that all cooling system hoses are in good condition, connected properly, and that hose clamps are tight. Verify that all drain valves and drain plugs are installed and tight.
4. Inspect all drive belts.
5. Perform all lubrication and maintenance specified for completion **Annually** in the **Maintenance Schedule**, except items that were performed at time of engine layup.
6. Fill the fuel tanks with fresh diesel fuel. Do not use old fuel. Check fuel lines and connections for leaks and general condition.
7. Replace the fuel filter

⚠ CAUTION

Disconnecting or connecting the battery cables in the incorrect order can cause injury from electrical shock or can damage the electrical system. Always disconnect the negative (-) battery cable first and connect it last.

8. Install a fully charged battery. Clean the battery cable clamps and terminals. Reconnect the cables (see the previous **CAUTION**). Secure each cable clamp when connecting. Coat terminals with a battery terminal anti-corrosion spray to help retard corrosion.
9. Perform all checks in the Starting Procedure column found in the Operation Chart. See the **On the Water** section.

NOTICE

Without sufficient cooling water, the engine, the water pump, and other components will overheat and suffer damage. Provide a sufficient supply of water to the water inlets during operation.

10. Supply cooling water to the water inlet openings.

    IMPORTANT: After not having been operated for two months or longer, pre-lubricate the engine and turbocharger. To do this, hold the STOP switch engaged while you simultaneously turn the key switch to the START position for 15 seconds. This will rotate the starter motor and engine oil pump. During this process the engine will not run because no fuel is injected. Allow the starter motor to cool down for one minute and repeat the above described process. To avoid overheating the starter motor, do not engage the starter motor for more than 15 seconds each time.
11. Pre-lubricate the engine and turbocharger, if necessary. See the previous Important information.
12. Start the engine and closely observe the instrumentation. Ensure that all systems are functioning correctly.
13. Carefully inspect the engine for fuel, oil, fluid, water, and exhaust leaks.
14. Check the steering system, shift, and throttle control for proper operation.

Notes:

Section 7 - Troubleshooting

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Troubleshooting Charts

Starter Motor Will Not Crank Engine, or Cranks Slow

Possible Cause	Remedy
Battery switch turned off.	Turn switch on.
Remote control not in neutral position.	Position control lever in neutral.
Open circuit breaker or blown fuse.	Check and reset circuit breaker or replace fuse.
Loose or dirty electrical connections or damaged wiring.	Check all electrical connections and wires (especially battery cables). Clean and tighten faulty connection.
Bad battery.	Test and replace if bad.

Engine Will Not Start, or Is Hard to Start

Possible Cause	Remedy
Lanyard stop switch activated.	Check lanyard stop switch.
Improper starting procedure.	Read starting procedure.
Empty fuel tank or fuel shut-off valve closed.	Fill tank or open valve.
Faulty mechanical fuel delivery pump.	Have pump replaced by a Cummins MerCruiser Diesel Authorized Repair Facility, if fuel is present.
Throttle not operating properly.	Check the throttle for freedom of movement.
Faulty electrical stop-circuit.	Have a Cummins MerCruiser Diesel Authorized Repair Facility service the electrical stop circuit.
Clogged fuel filters.	Replace fuel filters.
Stale or contaminated fuel.	Drain tank. Fill with fresh fuel.
Fuel line or tank vent line kinked or clogged.	Replace kinked lines or blow out the lines with compressed air to remove obstruction.
Air in fuel injection system.	Purge fuel injection system.
Faulty wire connections.	Check wire connections.
Glow plugs or glow plug system inoperative, if so equipped.	Test and repair or replace components.
Injector or injector nozzle malfunction.	Have the fuel system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Incorrect injection timing.	

Engine Runs Rough, Misses, or Backfires

Possible Cause	Remedy
Throttle not operating properly.	Check the throttle for binding or an obstruction.
Idle speed too low.	Check idle speed and adjust, if necessary.
Clogged fuel or air filters.	Replace air filters.
Stale or contaminated fuel.	If contaminated, drain tank. Fill with fresh fuel.
Kinked or clogged fuel line or fuel tank vent line.	Replace kinked lines or blow out lines with compressed air to remove obstruction.
Air in fuel system.	Purge fuel injection system.
Injector or injector nozzle malfunction.	Have fuel system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Injection pump governor malfunction.	

Poor Performance

Possible Cause	Remedy
Throttle not fully open.	Inspect throttle cable and linkages for proper operation.
Damaged or improper propeller.	Replace propeller. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Excessive bilge water.	Drain and check for cause of entry.
Boat overloaded or improperly distributed.	Reduce load or redistribute more evenly.
Boat bottom fouled or damaged.	Clean or repair as necessary.
Clogged fuel or air filters.	Replace filters.
Fuel leakage from overflow valve.	Have fuel system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Incorrect valve clearance adjustment.	
Deteriorated injection pump governor spring.	
Uneven fuel injection amount between cylinders.	
Cylinder compression pressure leakage.	

Excessive Engine Temperature

Possible Cause	Remedy
Water inlet or seacock closed.	Open.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups or sea strainer obstructed.	Remove obstruction.
Faulty thermostat.	Replace. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Coolant level low in closed cooling section.	Check for cause of low coolant level and repair. Fill system with proper coolant solution.
Heat exchanger cores plugged with foreign material.	Clean heat exchanger. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Loss of pressure in closed cooling section.	Check for leaks. Clean, inspect, and test pressure cap. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Faulty seawater pickup pump.	Repair. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Seawater discharge restricted or plugged.	Clean exhaust elbows. See a Cummins MerCruiser Diesel Authorized Repair Facility.
Seawater inlet hose kinked (restricted).	Position hose to prevent kinking (restriction).
Use of improperly designed hose on inlet side of seawater pump allowing it to collapse.	Replace hose with wire reinforced design.

Insufficient Engine Temperature

Possible Cause	Remedy
Faulty thermostats.	Replace. See a Cummins MerCruiser Diesel Authorized Repair Facility.

Turbocharger: Noisy or Rough Operation

Possible Cause	Remedy
Poor lubrication, low oil pressure at turbocharger, or both.	Have inspected by a Cummins MerCruiser Diesel Authorized Repair Facility.
Entry of foreign materials from intake or exhaust side.	
Rubbing of compressor or turbine impellers against housing.	
Bearing failure.	

Turbocharger: White Smoke

Possible Cause	Remedy
Thermal blanket at turbocharger getting hot, resulting in white smoke and burning smell from turbocharger area.	This is normal and occurs mostly during the first hour of engine operation. If the problem persists, have inspected by a Cummins MerCruiser Diesel Authorized Repair Facility.

Low Engine Oil Pressure

Possible Cause	Remedy
Faulty senders.	Have system checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Insufficient oil in crankcase.	Check and add oil.
Excessive oil in crankcase (causing it to become aerated).	Check and remove required amount of oil. Check for cause of excessive oil (improper filling).
Diluted or improper viscosity oil.	Change oil and oil filter, using correct grade and viscosity oil. Determine cause for dilution (excessive idling).

Battery Will Not Charge

Possible Cause	Remedy
Excessive current draw from battery.	Turn off non-essential accessories.
Loose or dirty electrical connections or damaged wiring.	Check all associated electrical connections and wires (especially battery cables). Clean and tighten faulty connections. Repair or replace damaged wiring.
Alternator drive belt loose or in poor condition.	Replace or adjust.
Unacceptable battery condition.	Test battery.

Remote Control Operates Hard, Binds, Has Excessive Free-play, or Makes Unusual Sounds

Possible Cause	Remedy
Insufficient lubrication on shift and throttle linkage fasteners.	Lubricate.
Obstruction in the shift or throttle linkages.	Remove the obstruction.
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see a Cummins MerCruiser Diesel Authorized Repair Facility immediately.
Shift or throttle cable kinked.	Straighten cable or have a Cummins MerCruiser Diesel Authorized Repair Facility replace cable if damaged beyond repair.
Improper shift cable adjustment.	Have adjustment checked by a Cummins MerCruiser Diesel Authorized Repair Facility.
Vacuum leak at shift cylinder, hose or fittings of Power Shift Assembly, if equipped.	Repair cut, pinched, or kinked hose or faulty shift cylinder.

Section 8 - Customer Assistance Information

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Owner Service Assistance

Local Repair Service

Always return your Cummins MerCruiser Diesel (CMD) powered boat to your authorized dealer should the need for service arise. Only he has the factory trained mechanics, knowledge, special tools and equipment, and the genuine Quicksilver parts and accessories to properly service your engine should the need occur. He knows your engine best. Contact 1-800-DIESELS to locate your closest distributor.

Service Away From Home

If you are away from your local dealer and the need arises for service, contact the nearest Cummins MerCruiser Diesel authorized dealer. Refer to the Yellow Pages of the telephone directory or by using the service locator on the Cummins MerCruiser Diesel website (www.cmdmarine.com). If, for any reason, you cannot obtain service, contact the nearest Regional Service Center. Outside the United States and Canada, contact the nearest Marine Power International Service Center.

Stolen Power Package

If your power package is stolen, immediately advise the local authorities and Cummins MerCruiser Diesel of the model and serial number(s) and to whom the recovery is to be reported. This information about the stolen motor is placed into a file at Cummins MerCruiser Diesel to aid authorities and dealers and distributors in the recovery of stolen motors.

Attention Required After Submersion

1. Before recovery, contact an Cummins MerCruiser Diesel Authorized Repair Facility.
2. After recovery, immediate service by an Cummins MerCruiser Diesel Authorized Repair Facility is required to prevent serious damage to power package.

Replacement Service Parts

⚠ WARNING

Avoid fire or explosion hazard. Electrical, ignition, and fuel system components on Cummins MerCruiser Diesel products comply with U.S. Coast Guard rules to minimize risk of fire or explosion. Do not use replacement electrical or fuel system components that do not comply with these rules. When servicing the electrical and fuel systems, properly install and tighten all components.

Marine engines are expected to operate at or near full throttle for most of their life. They are also expected to operate in both fresh and saltwater environments. These conditions require numerous special parts. Exercise care when replacing marine engine parts, as specifications are quite different from those of the standard automotive engine.

Since marine engines must be capable of running at or near maximum RPM much of the time, special pistons, camshafts, and other heavy-duty moving parts are required for long life and peak performance.

These are but a few of the many special modifications that are required in Cummins MerCruiser Diesel marine engines to provide long life and dependable performance.

Parts and Accessories Inquiries

All inquiries concerning Quicksilver replacement parts and accessories should be directed to your local authorized dealer. The dealer has the necessary information to order parts and accessories for you if he does not have them in stock. Only authorized dealers can purchase genuine Quicksilver parts and accessories from the factory. Cummins MerCruiser Diesel does not sell to unauthorized dealers or retail customers. When inquiring on parts and accessories, the dealer requires the engine model and serial numbers to order the correct parts.

Resolving a Problem

Satisfaction with your Cummins MerCruiser Diesel product is very important to your dealer and to us. If you ever have a problem, question, or concern about your power package, contact your Cummins MerCruiser Diesel Authorized Repair Facility. If additional assistance is required, take these steps:

1. Talk with the dealership's sales manager or service manager. If this has already been done, then contact the owner of the dealership.
2. If you have a question, concern, or problem that cannot be resolved by your dealership, please contact your local distributor of Cummins MerCruiser Diesel products for assistance. The distributor will work with you and your dealership to resolve all problems.

The service office will need the following information:

- Your name and address
- Daytime telephone number

- Model and serial numbers for your power package
- The name and address of your dealership
- The nature of the problem

To find the distributor for your area, use the service locator on the Cummins MerCruiser Diesel website (www.cmdmarine.com) or contact CMD sales or service listed in the yellow pages of the telephone directory. Contact 1-800-DIESELS to locate your closest distributor.

Customer Service Literature

English Language

English language publications are available from:
Mercury Marine
Attn: Publications Department
W6250 West Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54935-1939

Outside the United States and Canada, contact the nearest Mercury Marine or Marine Power International Service Center for further information.

When ordering be sure to:

- List your product, model, year and serial numbers.
- Check the literature and quantities you want.
- Enclose full remittance in check or money order (NO COD).

Other Languages

To obtain an Operation, Maintenance and Warranty Manual in another language, contact the nearest Mercury Marine or Marine Power International Service Center for information. A list of part numbers for other languages is provided with your power package.

Andre sprog

Kontakt det nærmeste Mercury Marine eller Marine Power International servicecenter for oplysninger om hvordan du kan anskaffe en Betjenings- og vedligeholdelsesmanual på et andet sprog. En liste med reservedelsnumre for andre sprog leveres sammen med din power-pakke.

Andere talen

Voor het verkrijgen van een Handleiding voor gebruik en onderhoud in andere talen dient u contact op te nemen met het dichtstbijzijnde internationale servicecentrum van Mercury Marine of Marine Power voor informatie hierover. Een lijst met onderdeelnummers voor andere talen wordt bij uw motorinstallatie geleverd.

Muut kielet

Saadaksesi Käyttö- ja huolto-ohjekirjoja muilla kielillä, ota yhteys lähimpään Mercury Marine tai Marine Power International huoltokeskukseen, josta saat lähempiä tietoja. Moottorisi mukana seuraa monikielinen varaosanumeroluettelo.

Autres langues

Pour obtenir un Manuel d'utilisation et d'entretien dans une autre langue, contactez le centre de service après-vente international Mercury Marine ou Marine Power le plus proche pour toute information. Une liste des numéros de pièces en d'autres langues accompagne votre bloc-moteur.

Andere Sprachen

Um eine Betriebs- und Wartungsanleitung in einer anderen Sprache zu erhalten, wenden Sie sich an das nächste Mercury Marine oder Marine Power International Service Center. Eine Liste mit Teilenummern für Fremdsprachen ist im Lieferumfang Ihres Motors enthalten.

Altre lingue

Per ottenere il manuale di funzionamento e manutenzione in altra lingua, contattate il centro assistenza internazionale Mercury Marine o Marine Power più vicino. In dotazione con il gruppo motore, viene fornito l'elenco dei codici prodotto dei componenti venduti all'estero.

Andre språk

Ytterligere informasjon om bruks- og vedlikeholdshåndbok på andre språk kan fås ved henvendelse til nærmeste internasjonale servicecenter for Mercury Marine eller Marine Power. En liste over delenumre for andre språk følger med aggregatet.

Outros Idiomas

Para obter um Manual de Operação e Manutenção em outro idioma, contate o Centro de Serviço Internacional de Marine Power" (Potência Marinha) ou a Mercury Marine mais próxima para obter informações. Uma lista de números de referência para outros idiomas é fornecida com o seu pacote de propulsão.

Otros idiomas

Para obtener un Manual de operación y mantenimiento en otro idioma, póngase en contacto con el centro de servicio más cercano de Mercury Marine o Marine Power International para recibir información. Con su conjunto motriz se entrega una lista de los números de pieza para los otros idiomas.

Andra språk

För att få Instruktions- och underhållsböcker på andra språk, kontakta närmaste Mercury Marine eller Marine Power International servicecenter, som kan ge ytterligare information. En förteckning över artikelnummer på andra språk medföljer ditt kraftpaket.

Allej glþssej

Gia na apoktÞsete Ýna Egxeirßdio Leitourgßaj kai SuntÞrhshj se Üllh glþssa, epikoinwnÞste me to plhsiÝstero DieqnÝj KÝntro SÝrbij thj Mercury Marine Þ thj Marine Power gia plhroforßej. To pakÝto isxýoj saj sunodeýetai apü Ýnan katÜlogo ariqmÞn paraggelßaj gia Üllej glþssej.

Ordering Literature

Before ordering literature, please have the following information about your power package available:

Model		Serial Number	
Horsepower		Year	

United States and Canada

For additional literature about for your particular Cummins MerCruiser Diesel power package, contact your nearest Cummins MerCruiser Diesel dealer/distributor or contact:

Mercury Marine		
Telephone	Fax	Mail
(920) 929–5110 (USA Only)	(920) 929-4894 (USA Only)	Mercury Marine Attn: Publications Department P.O. Box 1939 Fond du Lac, WI 54935-1939

Outside the United States and Canada

Contact your nearest authorized Cummins MerCruiser Diesel dealer/distributor or Marine Power Service Center to order additional literature that is available for your particular Cummins MerCruiser Diesel power package.

Please submit the following order form with payment to:	Mercury Marine Attn: Publications Department W6250 West Pioneer Road P.O. Box 1939 Fond du Lac, WI 54936-1939
Ship To: (Please copy this form and print or type–This is your shipping label)	
Name	
Address	
City, State, Province	
ZIP or postal code	
Country	

Quantity	Item	Stock Number	Price	Total
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Quantity	Item	Stock Number	Price	Total
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