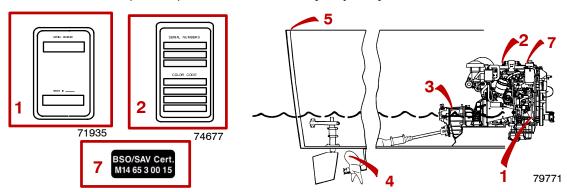
Identification

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



Please record the following information:

1.			
	Engine Model and Horsepower		Engine Serial Number
2.			
	Transom Assembly Serial Number	Gear	Sterndrive Unit Serial
	(Sterndrive)	Ratio	Number
3.			
	Transmission Model (Inboard)	Gear	Transmission Serial
		Ratio	Number
4.			
	Propeller Number	Pitch	Diameter
5.			
	Hull Identification Number (HIN)		Purchase Date
6.			
	Boat Manufacturer	Boat	Length
		Model	
7.			

Exhaust Gas Emissions Certificate Number (Europe Only)

The description and specifications contained herein were in effect at the time this guide was approved for printing. Cummins MerCruiser Diesel, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change specifications or designs, without notice and without incurring obligation.

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Mercury Marine, Fond du Lac, Wisconsin, 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

IF YOU DON'T UNDERSTAND ANY PORTION, CONTACT YOUR DEALER FOR A DEMONSTRATION OF ACTUAL STARTING AND OPERATING PROCEDURES.

NOTICE

Throughout this publication, and on your power package, **WARNINGS** and **CAUTIONS**, accompanied by the International Hazard Symbol \triangle , may be used to alert the installer/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.

A WARNING

WARNING - Hazards or unsafe practices which could result in severe personal injury or death.

A CAUTION

CAUTION - Hazards or unsafe practices which could result in minor personal injury or product or property damage.

IMPORTANT: - Indicates information or instructions that are necessary for proper operation and/or maintenance.

CE458

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.

A WARNING

California Proposition 65 Warning

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

WARNING

Electrical system components on this engine are not external ignition protected. DO NOT STORE OR UTILIZE GASOLINE ON BOATS EQUIPPED WITH THESE ENGINES, UNLESS PROVISIONS HAVE BEEN MADE TO EXCLUDE GASOLINE VAPORS FROM ENGINE COMPARTMENT (REF: 33 CFR). Failure to comply could result in fire, explosion and/or severe personal injury.

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WARRANTY SECTION 1

0005

Warranty Information

Owner Warranty Registration

UNITED STATES AND CANADA ONLY

 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.

- It identifies 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.
- Upon receipt of the Warranty Registration Card at the factory, you will be issued a
 plastic Owner Warranty Registration Card which is your only valid registration
 identification. It must be presented to the servicing dealer should warranty service be
 required. Warranty claims will not be accepted without presentation of this card.
- A temporary Owner Warranty Registration Card will be presented to you when you
 purchase the product. It is valid only for 30 days from date of sale while your plastic
 Owner Warranty Registration Card is being processed. Should your product need
 service during this period, present the temporary registration card to the dealer. He
 will attach it to your warranty claim form.
- Because of your selling dealer's continuing personal interest in your satisfaction, the product should be returned to him for warranty service.
- If your plastic card is not received within 30 days from date of new product sale, please contact your selling dealer.
- The product warranty is not effective until the product is registered at the factory.
- NOTICE: Registration lists must be maintained by factory and dealer on marine products sold in the United States, should notification under the Federal Boat Safety Act be required.
- 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 54935-1939
Phone: 920-929-5054

Fax: 920-929-5893

SECTION 1 WARRANTY

International Owner Registration

OUTSIDE THE UNITED STATES AND CANADA

 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/claim program for your area.

- The Warranty Registration Card identifies your name and address, product model and serial number(s), date of sale, type of use and the selling distributor's/dealer's code number, name and address. The distributor/dealer also certifies that you are the original purchaser and user of the product.
- 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/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 form(s).
- 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 / dealer. If you receive a plastic Warranty Registration Card, you may discard the "Purchaser's Copy" that you received from the distributor / dealer when you purchased the product. Ask your distributor / dealer if this plastic card program applies to you.
- For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the "International Warranty." Refer to "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 dealer / distributor fills out the warranty registration card immediately and sends the factory copy to the Marine Power International Service Center for your area.

WARRANTY SECTION 1

CE547

Warranty Policies

Recreational Use Diesel Limited Warranty

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 IN ORDER 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. Mercury reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

SECTION 1 WARRANTY

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 a propeller or 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 SECTION 1

CE552

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.

SECTION 1 WARRANTY

Use of other than Quicksilver replacement parts when making warranty repairs.

- Oils, lubricants or fluids changed as a matter of normal maintenance is customer's responsibility unless loss or contamination of 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 propeller 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.

WARRANTY SECTION 1

0008

Transferable Warranty

The product 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.

Direct Sale By Owner

 The second owner can be registered as the new owner and retain the unused portion of the limited warranty by sending the former owner's plastic Owner Warranty Registration Card and a copy of the bill of sale to show proof of ownership. In the United States and Canada, mail to:

Mercury Marine
Attn: Warranty Registration Department
W6250 Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54935-1939

- A new Owner Warranty Registration Card will be issued with the new owner's name and address. Registration records will be changed on the factory computer registration file.
- There is no charge for this service.

Outside the United States and Canada, please contact the distributor in your country, or the Marine Power International Service Center closest to you, for the transferable warranty procedure that would apply to you.

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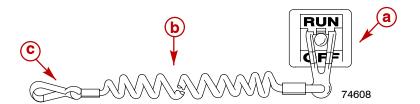
0010

Features And Controls

0011

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 1 direction
- consuming alcohol or drugs
- high speed boating maneuvers

Some remote control units are equipped with a lanyard stop switch, if your remote control is not equipped with a lanyard stop switch one can be installed on the dashboard or side adjacent to the operator's position. The lanyard is a cord usually 1.2 - 1.5 m (4 - 5 ft) long when stretched out with an element on 1 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 it as short as possible to minimize the likelihood of entanglement with nearby objects. It stretches to minimize the likelihood of accidental activation should the operator choose to move around in an area close to the normal operator's position. To shorten the lanyard, wrap it 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

Avoid contact with the boat hull and propeller from accidental ejection. Personal injury or death could occur. Always properly connect both ends of the lanyard stop switch.

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 gear case or propeller.
- Loss of power and directional control in heavy seas, strong current or high winds.
- Loss of control when docking.

A WARNING

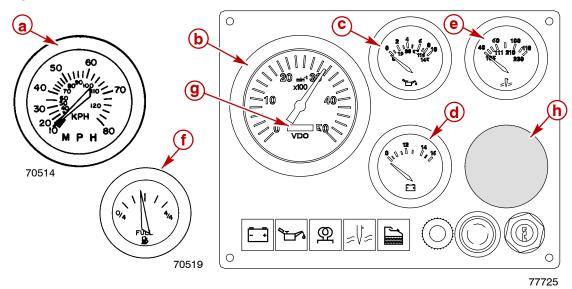
Avoid abrupt deceleration of the boat from lanyard stop switch activation. Boat damage and personal injury or death could occur. NEVER leave the operator's station with the engine operating and in gear.

CE478

Instrumentation

INSTRUMENTS

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



Typical

a - Speedometer

b - Tachometer

c - Oil pressure gauge

d - Battery meter (voltmeter)

e - Coolant temperature gauge

f - Fuel gauge

g - Hour meter

h - Plug

Speedometer: Indicates boat speed. **Tachometer:** Indicates engine rpm.

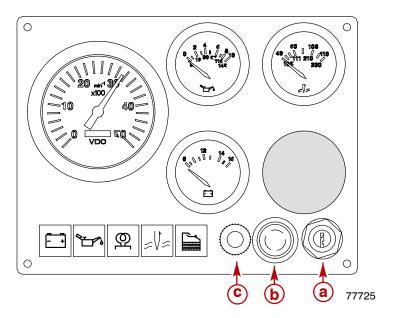
Oil Pressure Gauge: Indicates engine oil pressure.

Battery Meter: Indicates battery voltage.

Coolant Temperature Gauge: Indicates engine operating temperature.

Fuel Gauge: Indicates quantity of fuel in tank. **Hour Meter:** Records engine operating time.

SWITCHES



Typical switches

- a Key switch
- **b** Engine stop switch push button
- c Panel lights / audio test switch

Key Switch - has 3 positions.

- OFF In the OFF position, all electrical circuits are off and engine cannot be started. If
 the engine is operating the key switch cannot be used to stop the engine. The engine
 can only be stopped by using the engine stop switch, while the key switch is in the RUN
 position. No electrical circuit is operational when the key switch is turned to the OFF
 position.
- 2. RUN In the RUN position, all electrical circuits, indicator lamps, automatic preheating (if equipped), and all instruments are operational.
- 3. START In the START position the engine can be started.

NOTE: The key can only be removed in the OFF position.

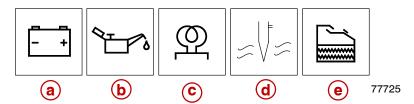
Engine Stop Switch - is used to stop the engine. This is done by electrically shutting off the fuel delivery system. The switch, toggle or push-button, is either toggled DOWN or pressed IN. Engage and hold the stop switch until the engine stops completely. Then, turn the key switch to the OFF position.

Panel Lights / Audio Test Switch - has 3 positions; in the NORMAL position all electrical circuits operate in a standard fashion (as described above). With 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 perform a test of the audio warning alarm.

Bilge Blower Switch, **if equipped:** (not shown) Operates bilge blower.

CE479

ENGINE MONITORING FEATURES



- a Charge indicator lamp
- **b** Oil pressure warning lamp
- Preheat indicator lamp (not active on some late models equipped with a wait to start glow plug system)
- d Coolant temperature warning lamp
- e Water in fuel warning lamp

The lamps function as follows, unless stated otherwise:

Charge Indicator Lamp - indicates a problem with charging system if lamp illuminates while engine is operating. Lamp will be on when key switch is in RUN and engine is not operating. When engine starts, light should go off.

Oil Pressure Warning Lamp - indicates low engine oil pressure if lamp illuminates while engine is running.

Preheat Indicator Lamp - on some models this lamp 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. The lamp stays on until the preheat period is complete. The engine should be started only after the lamp goes out.

NOTE: Some engines may be equipped with a glow plug system that does not illuminate the preheat indicator lamp. These systems require a five second wait to start period after the key switch is turned to the RUN position. After the five second wait to start period the engine can be started.

Coolant Temperature Warning Lamp - indicates excessive engine coolant temperature if lamp illuminates while engine is running, or transmission fluid temperature is too high Refer to the following note.

NOTE: The audio warning alarms are wired in a parallel circuit. If an alarm sounds while the engine is operating, quickly observe the coolant temperature gauge. If coolant temperature gauge reading is normal this may be an indication of excessive transmission temperature. The cause should be determined and corrected.

Water In Fuel Warning Lamp - indicates water is present in fuel filter and that the fuel filter requires service.

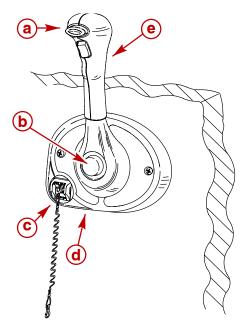
0014

Remote Controls

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

0015.03

PANEL MOUNTED



77019

- a Neutral lock button
- **b** Throttle only button
- c Lanyard stop switch
- d Control handle throttle friction screw
- Control handle

Neutral Lock Button - Prevents accidental shift and throttle engagement. 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.

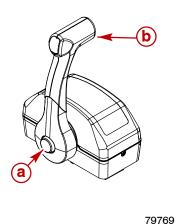
Lanyard Stop Switch - Turns the ignition OFF whenever the operator (when attached to the lanyard) moves far enough away from the operator's position to activate the switch. Refer to Lanyard Stop Switch for information on the use of this switch.

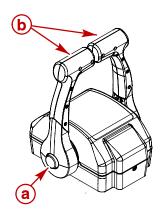
Control Handle Throttle Friction Screw - This screw (located behind the bezel cover) can be adjusted to increase or decrease the tension on the control handle. This will help prevent slipping of the remote control handle. Turn screw clockwise to increase tension and counterclockwise to decrease tension. Adjust to tension desired.

Control Handle - Operation of the shift and throttle are 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.

0242.01

CONSOLE MOUNTED





79770

- a Throttle only button
- b Control handles

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.

Control Handle Tension Adjustment Screw - This screw can be adjusted to increase or decrease the tension on the control handle (cover must be removed to adjust). This will help prevent slipping of the remote control handle. Turn screw clockwise to increase tension and counterclockwise to decrease tension. Adjust to tension desired.

Control Handles - Operation of the the shift and throttle are 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.

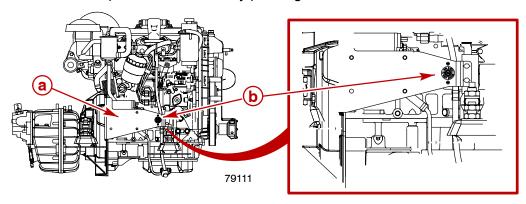
CE477

Electrical System Overload Protection

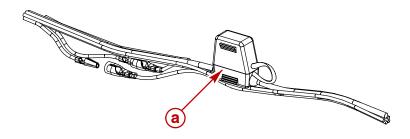
If an electrical overload occurs, a fuse will blow or the circuit breaker will trip open. The cause must be found and corrected before replacing the fuse or resetting the circuit breaker.

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 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 authorized Cummins MerCruiser Diesel dealer / distributor.

1. One 50 amp circuit breaker provide protection for engine wiring harness and instrumentation power lead. Reset by pushing RESET button IN.



- a Electrical bracket
- **b** Circuit breaker
- 2. A 20 amp fuse located in-line on key switch power supply wire protects the instrumentation and wiring should an electrical overload occur. If an overload occurs, the fuse will burn out. Check for blown (burned) fuse if key is turned to RUN or START and instruments or switches, or both, do not function and a circuit breaker is not tripped.



77421

a - Fuse holder

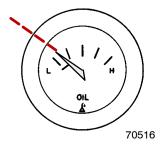
CE480

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:

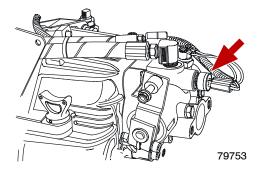
- Engine oil pressure too low
- Coolant temperature too hot
- Transmission fluid temperature too hot





Typical oil pressure gauge

Typical coolant temperature gauge



Typical transmission fluid temperature switch

A CAUTION

Operation of the engine after the audio warning system alarm has sounded could result in damage to the power package. Do not operate engine once the alarm has sounded EXCEPT TO AVOID 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 authorized Cummins MerCruiser Diesel dealer / distributor.

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.

3

SECTION 3 - ON THE WATER

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ON THE WATER SECTION 3

CE554

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.

You should also review the NMMA Sources of Waterway Information booklet. It lists regional sources of safety, cruising and local navigation and is available at no charge by writing to:

Sources of Waterway Information National Marine Manufacturers Association 410 N. Michigan Avenue Chicago, IL 60611 U.S.A.

- **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 Spare propeller, thrust hubs, and an flares, flag and whistle or horn appropriate wrench Tools necessary for minor repairs First aid kit and instructions Anchor and extra anchor line Water-proof storage containers Manual bilge pump and extra drain Spare operating equipment, batteries, plugs bulbs and fuses Drinking water Compass and map or chart of the area SECTION 3 ON THE WATER

 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 on board, 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 1 person on board in the basics of starting and operating the engine and boat handling 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).
 They impair your judgment and greatly reduce your ability to react quickly.

ON THE WATER SECTION 3

- 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 operators view when operating the boat above idle or planing transition speed. Watch out for others, the water and 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 5 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 \$500.00 or (4) there is complete loss of the boat. Seek further
 assistance from local law enforcement.

0023

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

Avoid prolonged exposure to carbon monoxide. Carbon monoxide poisoning can lead to unconsciousness, brain damage or death. Ensure that the boat, while at rest or underway, is well ventilated.

SECTION 3 ON THE WATER

0024.01

GOOD VENTILATION

Ventilate the passenger area by opening the side curtains or forward hatches to remove fumes.



Example of desired air flow through the boat

0025.01

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.



Example of poor ventilation while a boat is stationary:

- a Operating the engine when the boat is moored in a confined space.
- **b** Mooring close to another boat with its engine operating.



Example of poor ventilation while a boat is moving:

- 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).

ON THE WATER SECTION 3

0026

Basic Boat Operation

0027.1

Launching And Boat Operation Care

A CAUTION

To avoid possible ingestion of water that can damage engine components:

- Do not turn the ignition key off when the engine is above idle speed.
- When launching your boat from a steep ramp, enter the water slowly.
- Do not use the lanyard stop switch to shut off the engine above idle speed.
- When coming off plane, if a large following wave may roll over the boat's transom, apply a short, light burst of throttle to minimize the wave action against the stern of the boat.
- Do not come off plane quickly, shift into reverse and shut off engine.

IMPORTANT: Install bilge drain plug prior to launching boat.

SECTION 3 ON THE WATER

CE465

Duty Cycle Rating

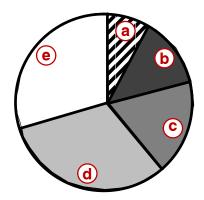
IMPORTANT: Damage caused by improper application or failure to operate the power package within the specified operating parameters, will not be covered by the Cummins MerCruiser Diesel Limited Warranty.

It is the responsibility of the boat manufacturer and/or the installing dealer to ensure that the power package is properly applied. In all cases, the power package must be equipped with a propeller that will allow the engine to operate at wide open throttle (WOT) at the Rated Engine rpm.

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 / ICOMIA 83-28 Duty Cycle).

EPA Mode Number Cycle 5 / ICOMIA 83-28	Modes				
Duty Cycle	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



79175

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

- a Mode 1: 1.0 hour (8 percent)
- **b** Mode 2: 1.5 hours (13 percent)
- c Mode 3: 2.0 hours (17 percent)
- d Mode 4: 4.0 hours (32 percent)
- e Mode 5: 3.5 hours (30 percent)

ON THE WATER SECTION 3

CE485

Operation Chart - 1.7 MI

STARTING PROCEDURE	AFTER STARTING	WHILE UNDERWAY	STOPPING AND SHUT DOWN
Open engine hatch. Air out bilge completely.	Observe all gauges and warning lights to check condition of engine. If not normal, stop engine.	Frequently observe all gauges and indicator lights to monitor engine condition.	Shift remote control lever to neutral position.
Turn battery switch ON, if equipped.	Check for fuel, oil, water, fluid, exhaust leaks, and so on.		Run engine at idle speed several minutes to allow the turbocharger and engine to cool.
Turn on and run engine compartment bilge blower, if equipped, for five minutes.	Check shift and throttle control operation.		Engage the STOP switch and hold, until engine completely stops.
Check for leaks - fuel, oil, water, fluid, and so on.	Check steering operation.		Turn key switch to OFF position.
Open fuel shut-off valve, if so equipped.			Turn battery switch OFF, if equipped.
Open seacock, if equipped.			Close fuel shut off valve, if so equipped.
Check that mechanical engine-stop lever is <i>not</i> engaged.			Close seacock, if equipped.
Prime fuel injection system, if necessary.			Flush seawater cooling circuit, if operating in saltwater area.
Pre-lubricate turbocharger and engine, if necessary.			
Turn key switch to RUN and check that lights and indicator lamps come on.			
Turn the key switch to START, after the indicator lamp for glow plug preheat ceases, or after five seconds with a wait to start glow plug system. Release the key when the engine starts.			
Check that charge indicator and oil pressure indicator lamps cease AFTER engine starts.			
Warm-up engine at a fast idle rpm for several minutes.			

SECTION 3 ON THE WATER

CE525

Starting, Shifting and Stopping

WARNING

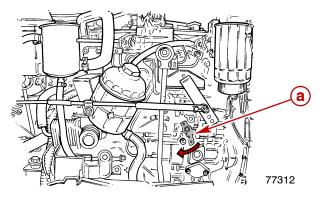
Do not use volatile starting aids, such as ether, propane, or gasoline in the engine air intake system. Explosion hazard resulting from ignition of vapors by glow plugs could cause severe personal injury and engine damage.

A CAUTION

It is good practice to ventilate the engine compartment prior to servicing any engine components to remove any fuel vapors which may cause difficulty breathing or be an irritant.

ENGINE STOP LEVER

A mechanical engine stop lever is located on the injection pump. It is used to manually shut off the engine by mechanically cutting off the fuel supply. It can be engaged by moving the lever in the direction shown by the arrow.



a - Stop lever

BEFORE STARTING THE ENGINE

CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes 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 engine does not start, wait 1 minute to allow the starter motor to cool; then, repeat starting procedure.
- Ensure engine crankcase is filled to correct level with the proper grade of oil for the prevailing temperature. Refer to Specifications Engine.
- Ensure that all electrical connections are secure.
- 1. Check all items listed in the Maintenance Schedules and Operation Chart.
- 2. Perform any other necessary checks, as indicated by your authorized Cumminw MerCruiser Diesel dealer / distributor, or specified in your boat owner's manual.

ON THE WATER SECTION 3

CE481

STARTING COLD ENGINE

IMPORTANT: Check fluid levels before starting engine. Refer to Maintenance Schedule.

- Turn on and operate the engine compartment bilge blower (if equipped) for five minutes.
 Or, open engine hatch to air out bilge before attempting to start engine.
- 2. Place control handle in NEUTRAL.
- 3. If engine has not been run for a period of time and will not readily start with the standard starting procedure, there is a hand pump/primer located on the engine to improve initial fuel supply. Refer to Maintenance Fuel System, Priming Fuel System and follow instructions.
- 4. Follow the appropriate starting procedure a. or b.:
 - a. Indicator lamp models: turn the key switch to the RUN position to activate the glow plugs. The preheat cycle usually lasts 10 to 15 seconds. Observe the preheat indicator (glow plug) lamp. The lamp should be illuminated when the engine cylinder temperature is too low to sustain combustion. The engine should be started only after the lamp goes off.

NOTE: The preheat devices (glow plugs) should operate at temperatures lower than 50 degrees C (122 degrees F). An engine coolant temperature sensor will automatically control activation and duration of preheat cycle.

b. **Wait to start models:** turn the key switch to the RUN position to activate the glow plugs. Wait five seconds for the preheat cycle. The engine should be started only after the five second wait to start period has ended.

NOTE: The preheat devices (glow plugs) should operate at temperatures lower than 80 degrees C (176 degrees F). An engine coolant temperature sensor will automatically control activation and duration of preheat cycle.

IMPORTANT: After starting, the key switch should NOT be returned to the OFF position during engine operation. If the starter switch is in the OFF 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.

5. Turn key switch to START position. Release key when the engine starts. Allow switch to return to RUN position. Do not operate the engine with the switch in the OFF position without first shutting down the engine, using the engine stop switch.

CAUTION

Do not attempt to engage the starter while the engine is running as this will lead to starter pinion and ring gear damage.

6. Ensure all instrumentation is functioning properly and indicating normal readings. Ensure charge indicator and oil pressure warning lamps go off. Check oil pressure gauge immediately after engine starts. If oil pressure is not within specified range (refer to Specifications), stop the engine, locate and correct the problem, or see your local auathorized Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

A CAUTION

Do not increase the engine speed until the oil pressure gauge indicates normal. Shut the engine down if oil pressure does not register on the gauge within 20 to 30 seconds after start.

SECTION 3 ON THE WATER

CE482

ENGINE WARM UP

A CAUTION

Improper or no warm-up of engine can seriously impair the life of your diesel engine.

 After starting, ensure all instrumentation is functioning properly. Operate the engine at a fast idle (1000 to 1200 rpm) until engine temperature is within 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 vessel at reduced engine speed under load. Commence normal vessel operation when systems reach operating temperatures.

- 2. After the engine has reached operating temperature:
 - a. Oil pressure should be within range listed in the engine specifications chart. Stop the engine if oil pressure is not within this range.
 - b. Check the fuel system for leaks from the injection pump, fuel pipes, fuel filter and fuel lines.
 - c. Check for oil leaks. Check the engine and transmission for oil leakage. Especially check the oil filter, oil lines, oil line connectors, and oil pan.
 - d. Check for coolant leaks. Check coolant hoses and connection pipes of heat exchanger, fluid coolers, intercooler, water pump and drain fittings.
- 3. Locate and correct any problems, or see your Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

CE526

STARTING A WARM ENGINE

- 1. Place control handle in NEUTRAL.
- 2. Turn key switch to the RUN position.
- 3. Turn key switch to START position and release when engine starts. Ensure charge indicator and oil pressure warning lamps go off.
- 4. Check to ensure all instrumentation is functioning properly and indicating normal readings.

ON THE WATER SECTION 3

CE483

SHIFTING

CAUTION

Never attempt to shift the transmission unless the engine is at IDLE rpm. Damage to the transmission could occur.

- 1. To shift unit, ensure remote control/throttle lever is in NEUTRAL. Move 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.
- Once underway, engine oil pressure should be within the range listed in the engine specifications chart 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 authorized Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

CE484

ENGINE SHUTDOWN (STOPPING)

1. Place remote control lever in NEUTRAL.

A CAUTION

Avoid damaging the turbocharger and engine. Immediate engine shutdown (stopping) after high load operation may result in permanent turbocharger bearing damage. Operate the engine at IDLE 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 the engine shutsdown (stops) completely.
- 4. Turn key switch to the OFF position.

SECTION 3 ON THE WATER

CE468

Freezing Temperature And Cold Weather Operation

IMPORTANT: If boat is operated during periods of freezing temperature, precautions must be taken to prevent freezing damage to power package. Damage caused by freezing IS NOT covered by Cummins MerCruiser Diesel Limited Warranty.

A CAUTION

Seawater (raw water) section of cooling system MUST BE COMPLETELY drained for winter storage or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine.

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

- At the end of each daily operation, COMPLETELY drain seawater section of cooling system to protect against damage by freezing.
- At the end of each daily operation, drain water from water separator, if equipped. Fill fuel tank at end of daily operation to prevent condensation.
- Use 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 degrees C (–4 degrees F) and below, it is recommended that you use a coolant heater to improve cold starting.
- If operating in arctic temperatures of –29 degrees C (–20 degrees F) or lower, consult your Cummins MerCruiser Diesel dealer / distributor for information about special cold weather equipment and precautions.

Refer to **Section 6** for Cold Weather or Extended Storage related information and draining instructions.

CE548

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 and/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 Cummins MerCruiser Diesel Limited Warranty.

ON THE WATER SECTION 3

0032

Protecting People In The Water

While You Are Cruising

It is very difficult for a person standing or floating in the water to take quick action to avoid a boat heading in his/her direction even at slow speed.

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 (coasting) in NEUTRAL/IDLE, 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

Stop your engine immediately whenever anyone in the water is near your boat. Serious injury to the person in the water is likely if contacted by a rotating propeller, a moving boat, a gear case or any solid device rigidly attached to a moving boat or gear case.

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

SECTION 3 ON THE WATER

0131.02

Passenger Safety Message - Pontoon And Deck Boats

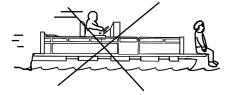
A WARNING

Avoid serious injury or death from falling over the front end of a pontoon or deck boat and coming in contact with the boat hull or propeller. Stay back from the front end of the deck and remain seated while the boat is in motion.

Whenever the boat is in motion, observe the location of all the 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 the result of 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 come into contact with the drive unit.

1. Boats having an open front deck:

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



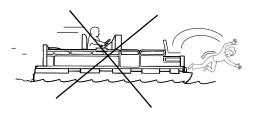


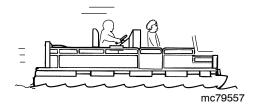
Incorrect

Correct

2. Boats with front-mounted, raised pedestal fishing seats:

- a. These 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.
- b. Any unexpected sudden reduction in boat speed could result in the elevated passenger falling over the front of the boat.





Incorrect

Correct

ON THE WATER SECTION 3

0034.01

Wave And Wake Jumping



WARNING

Avoid serious injury or death from being thrown within or out of a boat when it lands after jumping a wave or wake. Avoid wave or wake jumping whenever possible. Instruct all occupants that if a wake or wave jump occurs, get low and hang on to a boat hand hold.

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.

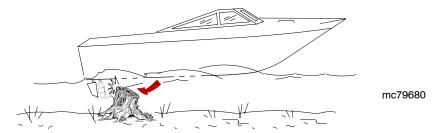
The primary concern is the boat changing direction while in the midst of the jump. In such cases the landing may cause the boat to violently veer in a new direction. Such a sharp change in direction or turn can cause occupants to be thrown out of their seats or out of the boat.

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.

SECTION 3 ON THE WATER

0035.02

Impact With Underwater Hazards



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/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 cause occupants to be thrown out of their seats or out of the boat.
- A rapid reduction in speed. This will cause occupants to be thrown forward, even out of the boat.
- Impact damage to the underwater drive components, rudder and/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 engine as soon as possible and inspect the drive system for any broken or loose parts. If damage is present or suspected, the power package should be taken to an authorized dealer for a thorough inspection and necessary repair.

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

A WARNING

Avoid serious injury or death from loss of boat control. Continued boating with major impact damage can result in sudden component failure with or without subsequent impacts. Have the power package thoroughly inspected and any necessary repairs made.

ON THE WATER SECTION 3

0036

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)

0037

Bottom Of Boat

To maintain maximum speed, the boat bottom should be:

- Clean, free of barnacles and marine growth
- Free of distortion; nearly flat where it contacts the 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 the water inlets and cause the engine to overheat.

CE527

Elevation And Climate

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

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

For you to have optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow the engine to operate at the Rated Engine rpm with a fully loaded boat during your normal boating weather conditions.

SECTION 3 ON THE WATER

CE464

Propeller Selection

CAUTION

The installed propeller must allow the engine to run at the Rated Engine rpm at WOT to avoid engine damage. Using a propeller that causes the engine to operate below the Rated Engine rpm can cause piston and/or valve damage (even if the engine is not operated at WOT). Conversely, using a propeller that allows engine to operate above the specified Rated Engine rpm can increase fuel consumption and wear and will not allow engine to produce its rated horsepower.

It is the responsibility of the boat manufacturer or the selling dealer, or both, 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 propeller being used does not allow engine to run excessively against the governor, 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 on board.

If full throttle operation is below the Rated Engine 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 and/or damage.

After initial propeller selection, the following common problems may require that the propeller be resized:

- Warmer weather and greater humidity cause an rpm loss.
- Operating in a higher elevation causes an rpm loss.
- Operating with a damaged propeller or dirty boat bottom causes an rpm loss.
- Operating with increased load (additional passengers, pulling skiers).

ON THE WATER SECTION 3

0042

Getting Started

CE555

Engine Break-In

INITIAL BREAK-IN PROCEDURE

It is especially important that the following procedure be used 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: It is recommended 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 engine does not start, wait 1 minute to allow the starter motor to cool; then, repeat starting procedure.

- 1. Refer to appropriate Starting, Shifting and Stopping section and start the engine. Operate the engine at a fast idle until it has reached normal operating temperature.
- 2. Operate the engine in gear for 3 minutes at each of the following rpms: 1400 rpm, 2800 rpm and 3500 rpm.
- 3. Operate the engine in gear for 3 minutes at each of the following rpms: 1700 rpm, 3500 rpm and 4000 rpm.
- 4. Operate the engine in gear for 3 minutes at each of the following rpms: 2100 rpm, 3500 rpm and Maximum Rated Full Throttle rpm.

0041

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, the following rules must be observed:

- 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.
- Frequently check engine oil level. Add oil as needed. It is normal for oil consumption to be high during the break-in period.

SECTION 3 ON THE WATER

CE475

After Break-In Period

To help extend the life of your Cummins MerCruiser Diesel power package, the following recommendations should be considered;

- Ensure that propeller allows the engine to operate at the specified Rated Engine rpms when at full throttle with a fully loaded boat. Refer to Specifications and Maintenance.
- Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged operation at WOT rpm.
- Change the oil and oil filter. Refer to Specifications and Maintenance.

CE476

End of First Season Checkup

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

ON THE WATER SECTION 3

NOTES:

SECTION 4 SPECIFICATIONS

SECTION 4 - SPECIFICATIONS

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4

SPECIFICATIONS SECTION 4

CD164

Fuel Requirements

WARNING

Electrical system components on this engine are not external ignition protected. DO NOT STORE OR UTILIZE GASOLINE ON BOATS EQUIPPED WITH THESE ENGINES, UNLESS PROVISIONS HAVE BEEN MADE TO EXCLUDE GASOLINE VAPORS FROM ENGINE COMPARTMENT (REF: 33 CFR). Failure to comply could result in fire, explosion and/or severe personal injury.

WARNING

FIRE HAZARD: Fuel leakage from any part of the fuel system can be a fire hazard which can cause serious bodily injury or death. Careful periodic inspection of entire fuel system is mandatory, particularly after storage. All fuel components including fuel tanks, whether plastic, metal or fiberglass, fuel lines, primers, fittings, and fuel filters should be inspected for leaks, softening, hardening, swelling or corrosion. Any sign of leakage or deterioration requires replacement before further engine operation.

WARNING

Under *no circumstances* should gasoline, gasohol and/or alcohol be mixed with diesel fuel for any reason. This mixture of gasoline, gasohol and/or alcohol with diesel fuel is highly flammable and produces a significant risk to the user.

IMPORTANT: Use of improper or water contaminated diesel fuel can damage your engine seriously. Use of improper fuel is considered misuse of engine, and damage caused thereby will not be covered by 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 fuel fill, 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.
- Corrosion and extensive damage, and excessive wear of internal engine parts, particularly bearings.
- Starting and operating difficulties.

SECTION 4 SPECIFICATIONS

CD888

Recommended Fuels

A CAUTION

Avoid fuel system damage. Use of fuels not recommended by Cummins MerCruiser Diesel may cause hard-starting and other various troubles such as premature wear of the injection pump plungers and injection nozzles resulting from the deposit of carbon residue and other contaminants.

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

CE16

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, anti-gel diesel fuel treatment, following that product's directions.

SPECIFICATIONS SECTION 4

CF528

AntiFreeze/Coolant

CAUTION

Alcohol or Methanol base antifreeze or plain water are not recommended for use in closed cooling section of cooling system at any time.

Because diesel engines are high compression engines and related higher engine operating temperatures are created, the closed cooling system and engine, including related cooling passages must remain as clean as possible to provide adequate engine cooling. This can only be assured by using the proper antifreeze, water, additives and inhibitors. It is recommended that the closed cooled section of the cooling system be filled with a low silicate formula of ethylene glycol antifreeze in solution with deionized water. A low silicate formula prevents antifreeze separation which causes a silicate gelatin to form. This gelatin will block engine and heat exchanger passages causing engine overheating.

The coolant, if not premixed, should be mixed before being added to the closed cooling system using a proper antifreeze together with deionized water. Common tap water or softened water contains unwanted minerals which can leave large deposits in the system that restrict the cooling system efficiency. In addition, additives and inhibitors introduced into acceptable coolant solutions will form a protective film on internal passages and provide protection against internal cooling system erosion.

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

NOTE: A greater than 50/50 antifreeze/coolant solution should never be used except when operating where seawater temperatures are greater than 32 degrees C (90 degrees F), then a 25 / 75 (antifreeze / water) solution can be used for improved cooling performance.

IMPORTANT: The antifreeze/coolant used in these marine engines must be a 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/coolants are listed in the following table. Refer to Maintenance Schedules for respective change intervals.

Description	Part Number	
Premixed Marine Engine Coolant	92-813054A2	
Fleetguard Compleat (Product 91-50663 With DCA4 Additive)	Obtain Locally	

SECTION 4 SPECIFICATIONS

CE491

Engine Oil

CAUTION

ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do NOT spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

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 Diesel Engine Oil	Engine crankcase	92-877695K1

This oil is a specially blended 15W-40 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		
Mopar		
Texaco Ursa Super TD	Engine crankcase	Obtain Leadh.
Wintershall Multi-Rekord		Obtain Locally
Veedol Turbostar		
Wintershall Vliva 1		

These oils are approved by Mercury Marine and Marine Power Europe. For all temperature operation use 15W-40 oil.

SPECIFICATIONS SECTION 4

CE486

Engine Specifications

Description	Specification - Inboard
Description	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 cubic liters (103 cid)
Engine weight (approximate)	250 kg (550 lb)
Bore	79 mm (3.11 in.)
Stroke	86 mm (3.39 in.)
Thermostat	82-95 (180-203) ¹
Coolant temperature (peak)	90 - 104 (194 - 219) ¹
Electrical System	12-volt Negative (–) Ground
Recommended battery rating	515 cca, 652 mca, or 65 Ah

¹ Unit of measure shown in degrees C (degrees F).

SECTION 4 SPECIFICATIONS

0051.02

Fluid Specifications

IMPORTANT: All capacities are approximate fluid measures.

CE487

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)	6-1/2 (6-3/4) ¹	Mercury Diesel Engine Oil	92-877695K1
Closed Cooling System	8-3/4 (9-1/4)	Marine Engine Coolant	92-813054A2
Seawater Cooling System ²	6-1/2 (6-3/4)	Not Applicable	Not Applicable

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

CE488

TRANSMISSION

Model	Capacity liters (U.S. qts)	Fluid type	Part Number
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Trans- mission Fluid or Equivalent	Obtain Locally

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

² Seawater Cooling System capacity information is for winterization use only.

SPECIFICATIONS SECTION 4

NOTES:

SECTION 5 - MAINTENANCE

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CE466

Owner/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 an authorized Cummins MerCruiser Diesel for a periodic checkup.

Normal maintenance service and replacement parts are the responsibility of the owner/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 authorized Cummins MerCruiser Diesel dealer / distributor for service aids.

CE467

Dealer Responsibilities

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

- Ensure that the boat is properly equipped.
- Prior to delivery, make certain that the Cummins MerCruiser Diesel dealer / distributor power package and other equipment are in proper operating condition.
- Make all necessary adjustments for maximum efficiency.
- Familiarize the customer with the on-board equipment.
- Explain and demonstrate the operation of the power package and boat.
- Provide you with a copy of a Predelivery Inspection Checklist.
- Your selling dealer should fill out the Warranty Registration Card completely and mail it to the factory immediately upon sale of the new product.

SECTION 5 MAINTENANCE

CE462

Maintenance

WARNING

Avoid injury or death and power package damage from an electrical shock, fire or explosion. Always disconnect both battery cables from the battery before servicing the power package.

A CAUTION

It is good practice to ventilate the engine compartment prior to servicing any engine components to remove any fuel vapors which may cause difficulty breathing or be an irritant.

IMPORTANT: Refer to Maintenance Chart for complete listing of all scheduled maintenance to be performed. Some listings can be done by owner/operator, while others should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor. Before attempting maintenance or repair procedures not covered in this manual, it is recommended that the appropriate Cummins MerCruiser Diesel or Mercury MerCruiser Service Manual be purchased and read thoroughly.

IMPORTANT:

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

CE473

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 don't 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/or 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 dealer / distributor of Cummins MerCruiser Diesel products is there to service your power package. They have qualified factory-trained mechanics.

It is recommended you have the dealer 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.

CE529

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.

Check for loose, damaged or missing parts, hoses and clamps; tighten or replace as necessary.

Check plug leads and electrical leads for damage.

Remove and inspect the propeller. If badly nicked, bent or cracked, contact your authorized Cummins MerCruiser Diesel dealer / distributor.

Repair nicks and corrosion damage on power package exterior finish. Contact your authorized Cummins MerCruiser Diesel dealer / distributor.

SECTION 5 MAINTENANCE

CE490 **Maintenance Schedules**

Routine Maintenance				
	Each Day Start	Each Day End	Weekly	Every Two Months
Check the engine oil level (interval can be extended based on experience).	•			
Check the coolant level.	•			
Check the transmission fluid level.	•			
If operating in salt, brackish or polluted waters, flush the cooling system after each use.		•		
Drain any water from the fuel filter after each use (if operating in freezing temperatures).			•	
Check the water inlets for debris or marine growth. Check the seawater strainer and clean.			•	
Check the battery connections and the fluid level.				•
Inspect the air cleaner.2				•
Operating in saltwater or brackish or polluted water only: treat the power package with Corrosion Guard.				•
Ensure that the gauges and the wiring connections are secure. Clean the gauges. ¹				•

 $^{^{1}}$ Or every 50 hours, whichever occurs first. If operating in saltwater, interval is reduced to every 25 hours or 30 days whichever occurs first

² Or every 50 hours, whichever occurs first.

Maintenance Schedules (Continued)

Scheduled Maintenance			
	After First 50 hours	Every 100 hours or Annually	
Change the engine oil and filter.	•	•	
Retorque the exhaust riser clamp.	•		•
Change the transmission fluid.		•	
Check the steering system and the remote control for loose, missing or damaged parts. Lubricate the cables and the linkages.		•	
Disassemble and inspect the seawater pump and replace the worn components.		•	
Touch-up paint the power package and spray with corrosion guard.		•	
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.		_	•
Replace the fuel filters.		_	•
Drain the intercooler condensation.			•

[◆] Whichever occurs first

SECTION 5 MAINTENANCE

Maintenance Schedules (Continued)

Scheduled Maintenance	Every 200 hours or 2 years	Every 300 hours or 3 years	Every 500 hours or 5 years	Every 1000 hours or 5 years	Per OEM
Replace the coolant.	•				
Check the electrical system for loose, damaged, or corroded fasteners.		•			
Inspect the timing belt and pulleys.		•			
Retorque the engine mounts		•			
Clean the intercooler core.			•		
Clean the fuel tank.				•	
Replace the timing belt				•	
Check the valve clearance				•	
Check the engine to propeller shaft alignment.					•

[◆] Whichever occurs first

0166

Maintenance Record

Date	Hour Meter Reading	Serviced By	Maintenance Performed

SECTION 5 MAINTENANCE

0062

Engine Oil

A CAUTION

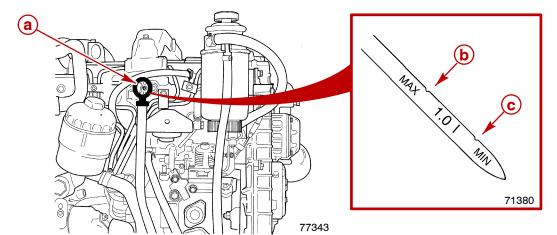
ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do not spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

CE492

Checking

- 1. Stop the engine. Allow approximately 10 minutes for oil to drain into oil pan. The boat must be at rest in the water.
- 2. Remove the dipstick. Wipe clean and reinstall fully into the dipstick tube.
- 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).



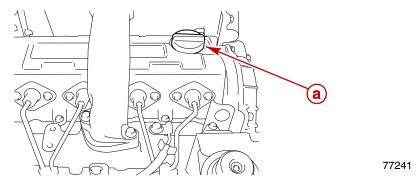
- a Dipstick
- **b** Maximum Mark
- c Minimum Mark

CE461

Filling

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



a - Oil fill cap

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

NOTE: It takes several minutes for the added oil to drain to the oil pan. Wait approximately 10 minutes and check the level again, after adding oil.

All models	Capacity liters (U.S. qts)	Fluid type	Part Number
Engine Oil (With Filter)	6-1/2 (6-3/4) ¹	Mercury Diesel Engine Oil	92-877695K1

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

3. Install the oil fill cap.

SECTION 5 MAINTENANCE

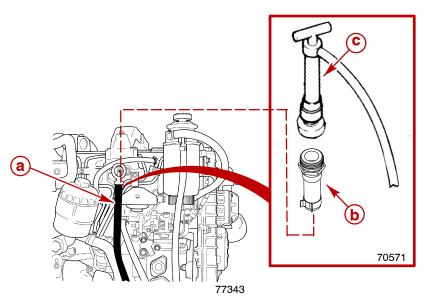
CE469

Changing

Refer to the Maintenance Schedules for the change interval. Engine oil should be changed before placing the boat in storage.

IMPORTANT: Change 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.

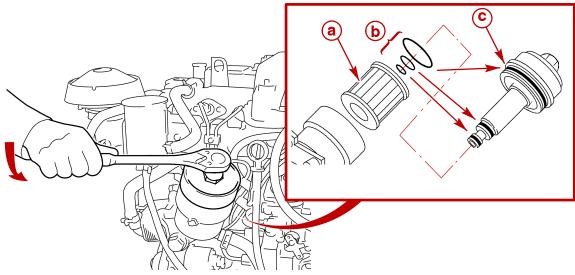
- 1. Start the engine and allow it to warm up to normal operating temperature.
- 2. Stop the engine and allow some time for oil to drain into oil pan (approximately 10 minutes).
- 3. Install the crankcase oil pump. Push the adapter onto the dipstick tube and attach the pump.



- a Dipstick tube
- **b** Quicksilver Hose / Oil Pump Adapter (32-863642)
- c Quicksilver Crankcase Oil Pump (802889A1)
- 4. Pump oil out of crankcase into drain pan.
- 5. When crankcase is empty, remove the pump and adapter.
- 6. Install the oil dipstick.

7. Use a filter wrench or appropriate socket to remove the cartridge type oil filter.

8. Discard the old filter element. Discard the old O-rings from the top piece.



79740

- a Filter element
- **b** O-rings
- **c** Top piece
- 9. Install the three O-rings. Apply a coat of engine oil to the O-rings. Install the element on the top piece.

Description	Where Used	Part Number
Engine oil	Oil filter O-rings	Obtain Locally

10. Install the top piece with the new element into the oil filter housing.

IMPORTANT: Over tightening the top piece will cause deformation resulting in oil leakage.

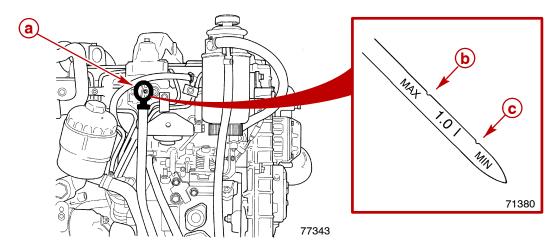
11. Turn the top piece until the sealing face is fitted against the gasket using the filter wrench or a socket. Torque the top piece.

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

SECTION 5 MAINTENANCE

12. Remove oil fill cap and refill engine with new oil. Refer to specifications for quantity and grade of oil.

13. Add specified oil to bring level up to, but not over, maximum oil level mark - MAX - on dipstick.



- a Dipstick
- b Maximum Mark
- c Minimum Mark

14. Reinstall oil fill cap.

IMPORTANT: Avoid overheating the starter in the following step. Do not engage the starter motor for more than 15 seconds. Allow at least one minute cool down time before engaging the starter for another 15 seconds.

- 15. Pre-lubricate the turbocharger and engine.
 - Hold the STOP switch engaged while you simultaneously turn the key switch to the START position for 15 seconds. Doing this together turns the engine without starting it.
 - b. Repeat step a. as needed. Pre-lubrication is complete when oil pressure is shown by the instruments.
- 16. Start and operate the engine for a few minutes. Stop the engine and wait for about ten minutes.
- 17. Remove the oil dipstick. Wipe clean and reinstall into dipstick tube.
- 18. 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 dipstick.

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

A CAUTION

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

- 19. Install the oil fill cap.
- 20. Start the engine and check for leaks.

CE493

Transmission Fluid

Checking

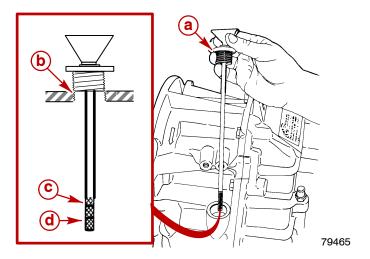
1. Remove the dipstick.

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 low, add transmission fluid to bring the level up to the MAXIMUM mark on the dipstick.



- 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 prior to checking the level.

- 4. Start the engine and operate at 1500 rpm for 2 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 low, add transmission fluid to bring the level up to the MAXIMUM mark on the dipstick.

Model	Capacity liters (U.S. qts)	Fluid type
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Transmission Fluid or Equivalent

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

7. Install the dipstick.

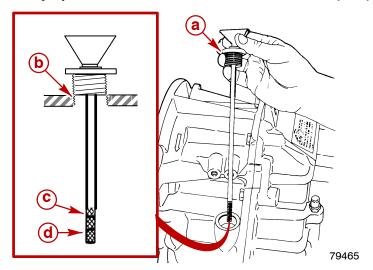
SECTION 5 MAINTENANCE

CE463

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

Model	Capacity liters (U.S. qts)	Fluid type
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Transmission Fluid or Equivalent

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

NOTE: If the transmission fluid level was extremely low, contact your authorized Cummins MerCruiser Diesel dealer/distributor.

2. Install the dipstick.

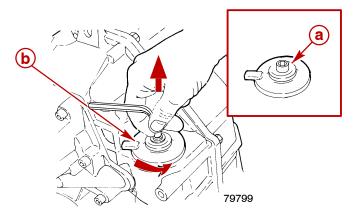
IMPORTANT: To accurately check the fluid level, the engine must be run at 1500 rpm for 2 minutes immediately prior to checking the level.

3. Refer to Transmission Fluid - Checking.

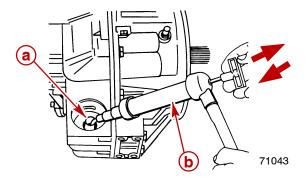
CE496

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.

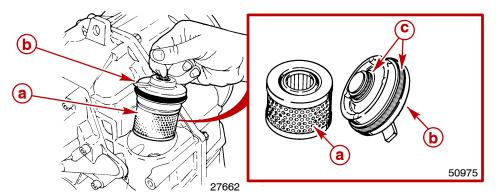


- a Fluid filter assembly
- **b** Assembly nut
- 3. Push the hose of a suction pump through suction pipe and down to the bottom of the housing.
- 4. Pump the fluid from the housing into a suitable container. Dispose of fluid properly.



- 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.

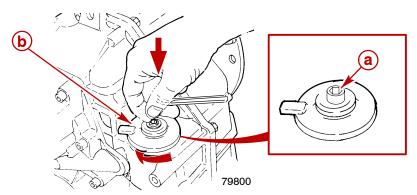


- a Filter Element
- **b** Cover
- c O-rings

CAUTION

Transmission fluid filter assembly must be properly seated to avoid fluid foaming and/or loss of fluid resulting in decreased efficiency and/or damage to transmission.

- 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 Fluid filter assembly
- **b** Assembly nut

Description	Nm	lb-in.	lb-ft
Filter assembly nut	5-8		4-6

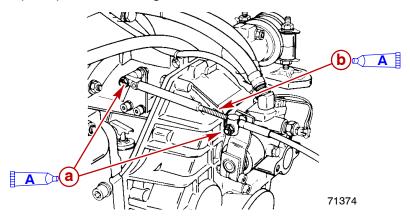
10. Refer to Transmission Fluid - Filling, and fill the transmission with specified fluid to the proper level.

CE474

Lubrication

Shift Cable

1. Lubricate the pivot points and the guide contact surfaces.



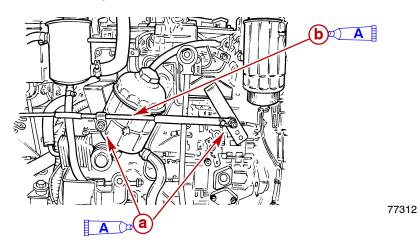
Typical

- a Pivot points
- **b** Guide contact surfaces

De	scription	Where Used	Part Number
A	Engine Oil	Pivot points, guide contact surfaces	Obtain Locally

Throttle Cable

1. Lubricate the pivot points and the guide contact surfaces.



- a Pivot points
- **b** Guide contact surfaces

De	scription	Where Used	Part Number
A	Engine Oil	Pivot points, guide contact surfaces	Obtain Locally

CE524

Engine Coolant

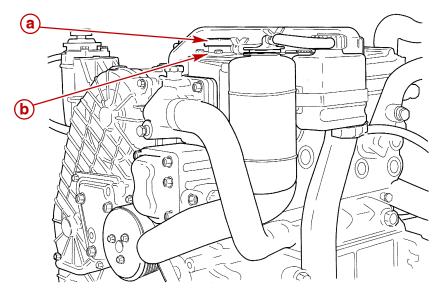
Checking

A CAUTION

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

- 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 filler neck. If coolant is low refer to Filling.

NOTE: If no coolant is visible in the heat exchanger or operating temperatures are excessive, air may have become trapped in the cooling system. Contact your authorized Cummins MerCruiser Diesel dealer / distributor.



75301

Typical

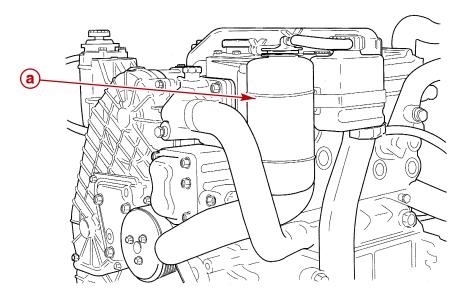
- a Pressure cap
- **b** Filler neck

IMPORTANT: The pressure cap is correctly installed if it contacts locking tabs on the fill neck when tightened.

4. Install the pressure cap. Tighten until it contacts 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.

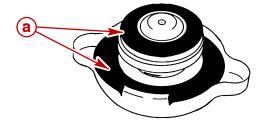


75301

- a Coolant recovery bottle
- 7. Add the specified coolant as necessary.

Description	Where Used	Part Number
Marine Engine Coolant		92-813054A2
Fleetguard Compleat (Product 91-50663 with DCA4 Additive)	Closed cooling system	Obtain Locally

- 8. If coolant level in coolant recovery bottle was low:
- Inspect coolant recovery system for leaks.
- Inspect pressure cap gaskets for damage and replace if necessary.



72714

a - Gaskets

Also, the pressure cap maintains pressure on the coolant tank. It may not be holding pressure properly. Contact your authorized Cummins MerCruiser Diesel dealer / distributor to have the cap tested.

Filling

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

IMPORTANT: The pressure cap is correctly installed if it contacts locking tabs on the fill neck when tightened.

- 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 line with the specified coolant.

Description	Where Used	Part Number
Marine Engine Coolant		92-813054A2
Fleetguard Compleat (Product 91-50663 with DCA4 Additive)	Closed cooling system	Obtain Locally

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

Changing

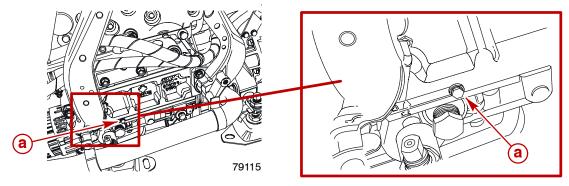
Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

CE556

Intercooler Condensation

Condensation must be drained from the intercooler periodically. Refer to Maintenance Schedules for interval.

- 1. Remove the small condensate drain plug from the intercooler.
- 2. Drain the liquid that may have condensed in the intercooler during operation.
- 3. After the intercooler has drained, apply sealer to the threads of the condensate drain plug and install.
- 4. Tighten the condensate drain plug securely.



a - Condensate drain plug

Description	Where Used	Method of Use	Part Number
Perfect Seal	Condensate drain plug	Thread length	92-342771

CE494

Water Separating Fuel Filter

WARNING

Be careful when draining water separating fuel filter. Diesel fuel is flammable. Be sure ignition key is OFF. Do not allow fuel to contact any hot surfaces which may cause it to ignite. Do not allow sources of open flame in the area. Wipe up any spilled fuel immediately. Dispose of fuel soaked rags, paper, etc. in an appropriate air tight, fire retardant container. Fuel soaked items may spontaneously ignite and result in a fire hazard which could cause serious bodily injury or death.

A CAUTION

Any water entering the fuel injection system will disable the system. Check for water in water separating fuel filter before start up, daily.

A CAUTION

If water should enter the fuel injection system, take unit to an authorized Cummins MerCruiser Diesel dealer / distributor IMMEDIATELY, so that corrosion and rusting of the injectors and other components can be avoided.

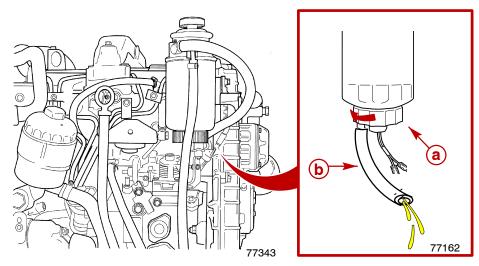
Draining

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

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

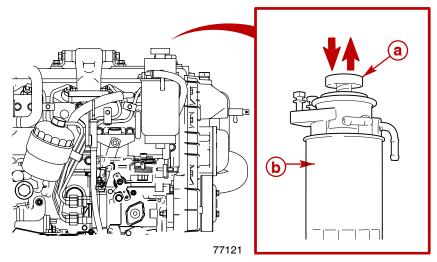
NOTE: Place a suitable container under fuel filter to catch contaminated fuel, water, or both. Dispose of properly.

- 1. Place a small container at the end of a drain hose beneath the drain cap on the filter.
- 2. Open by turning the drain cap counterclockwise (as viewed from the bottom of the filter) approximately 5 turns.



- a Drain cap
- b Drain hose

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



a - Priming pump

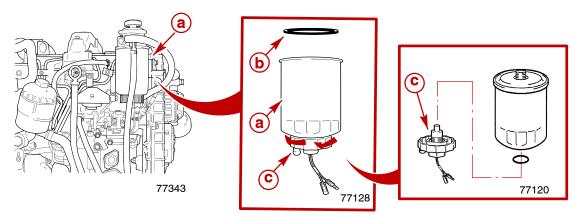
- 4. Close drain cap by turning clockwise. Tighten securely.
- 5. Fill the fuel filter. Refer to Filling.
- 6. After starting the engine, check to see that there is no fuel leak from the drain cap.

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

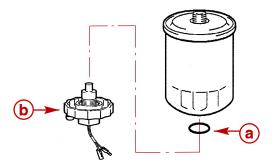
Replacing

IMPORTANT: Element cannot be cleaned and reused. It must be replaced.

- 1. Remove water separating fuel filter and sealing ring from fuel filter bracket.
- 2. Remove the drain cap from the filter by turning it counterclockwise. Discard the used filter.



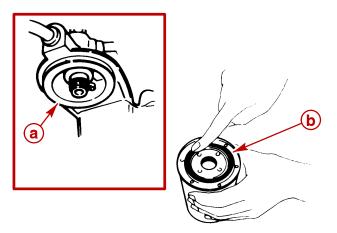
- a Water separating fuel filter
- **b** Sealing ring
- c Drain cap
- 3. Install the O-ring and drain cap on the new fuel filter. Tighten the drain cap.



77128

- a O-ring
- **b** Drain cap

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



77296

Typical mounting bracket and filter

- a Filter sealing surface
- **b** Sealing ring

Description	Where Used	Part Number
Engine oil	Oil filter O-rings	Obtain Locally

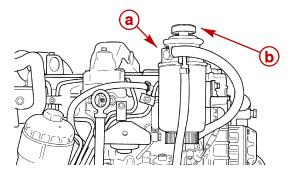
- 6. Thread filter onto bracket until the sealing ring contacts bracket.
- 7. Tighten the fuel filter an additional 2/3 of a turn with a filter wrench.
- 8. Ensure that the bottom drain cap is securely tightened.
- 9. Fill the fuel filter. Refer to Filling.
- 10. Check filter and drain cap for fuel leaks.
- 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 fuel filter when changing filter
- Refill fuel system if system was run dry
- To prime the fuel system if engine has not been operated for a while.

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

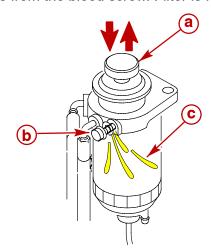


77343

- a Fuel filter bracket
- **b** Hand pump / primer

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

- 1. Loosen the bleed screw on 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. Filter is full when this occurs.



77381

- a Bleed screw
- a Plunger
- **b** Fuel from bleed screw
- 3. Tighten the bleed screw.

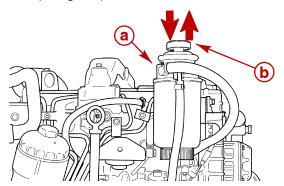
CE530

Fuel System

Priming

Prime the engine if it has not been operated for a while or if the engine will not start.

1. Move the hand pump/primer plunger up and down several times.



77343

- a Fuel filter bracket
- **b** Hand pump / primer
- 2. Attempt to start the engine.

Purging Air

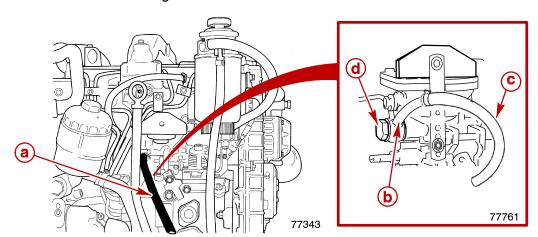
NOTE: Follow this procedure if fuel system was run dry or if part of fuel system was drained for a service function.

- 1. Fill the fuel filter. Refer to Filling.
- 2. Check filter and drain cap for fuel leaks. Ensure that bleed screw on 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.

A CAUTION

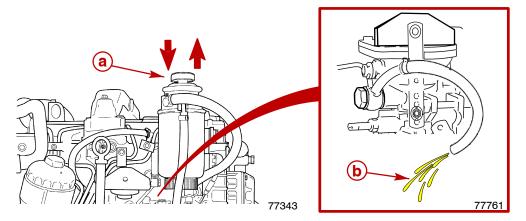
Avoid the risks of fuel leaking. The injection pump fuel return valve, a special hollow bolt, uses sealing washers to prevent fuel from leaking. Replace the sealing washers if leaking.

5. Temporarily install a length of fuel hose on fuel return fitting. Avoid disturbing special hollow bolt and sealing washers.

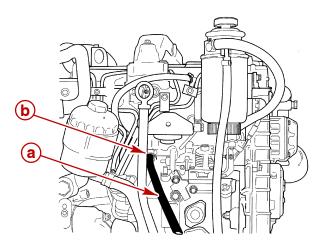


- a Fuel return hose
- **b** Fuel return fitting
- c Temporary hose
- d Hollow bolt and sealing washers

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



- a Plunger
- **b** Fuel from temporary hose
- 7. Remove temporary hose. Unplug and install boat fuel return hose on fitting. Securely tighten the hose clamp.



77343

- a Fuel return hose
- **b** Hose clamp
- 8. Move plunger knob up and down several times until some added resistance is noticed when knob is moved.
- 9. Check for fuel leaks.
- 10. Dispose of waste fuel as defined by local authorities.
- 11. Start the engine, check for fuel leaks. If leaks exist, stop the engine immediately and recheck installation.

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

CE549

Fuel Tank Cleaning And Flushing

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

Refer to boat manufacturer's instructions and clean fuel tank at specified intervals. Unless specified otherwise, flush and clean diesel fuel tank every 1000 hours or 5 years, whichever occurs first.

CE497

Drive Belts

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

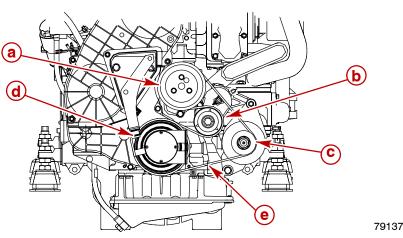
If any drive belts need replacement or tension needs adjustment, contact your authorized Cummins MerCruiser Diesel dealer / distributor.

WARNING

Avoid possible serious injury. Make sure the engine is shut off and the ignition key is removed before inspecting the belts.

Checking Serpentine Belt

1. The various components are shown.



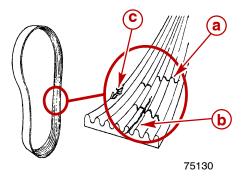
Typical

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

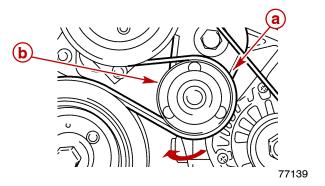
- 2. Inspect serpentine belt for proper tension and for the following:
- Excessive wear
- Cracks

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
- Proper tension



- a Transverse crack
- **b** Longitudinal crack
- c Fraying
- Check the operation of the automatic tensioner and associated components. Move tensioner pulley in direction of arrow (position a suitable tool on pulley fastener and rotate). Release and allow to glide back slowly. Tensioner must return to it's initial position.



Typical

- a Serpentine belt
- **b** Automatic tensioner

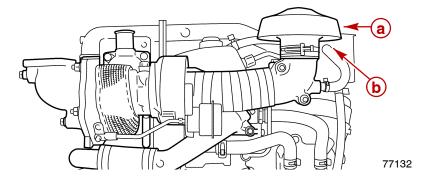
CE531

Air Cleaner

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

Cleaning

1. Remove any debris present at openings.



- a Air cleaner
- **b** Openings

Checking

- 1. Ensure that the assembly is not cracked or damaged.
- 2. Ensure that the air cleaner is mounted (clamped) securely at all times.



a - Clamp

Replacement

Replace the assembly if is cracked or damaged.

CE532

Corrosion Protection

Whenever two or more dissimilar metals 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 is known as galvanic corrosion and, if not controlled, it will in time cause the need for replacement of power package components exposed to water. Refer to the *Marine Corrosion Protection Guide* (90-88181301).

Internal Components

There are anodes as part of the intercooler and heat exchanger systems, which serve as sacrificial anodes.

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 intercooler.

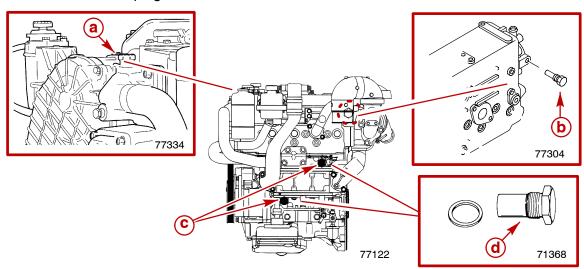
REMOVAL

1. Allow the engine to cool.

A CAUTION

When removing anode plugs, close seacock, if equipped. If boat is not equipped with a seacock, remove and plug seawater inlet hose to prevent a siphoning action that may occur, allowing seawater to flow from the anode plug holes.

- 2. With engine off, close seacock (if equipped) or remove and plug seawater inlet hose if no seacock exists.
- 3. Remove anode plugs and sacrificial anodes.



Typical

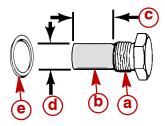
- **a** Front heat exchanger anode
- **b** Rear heat exchanger anode
- c Intercooler anodes
- **d** Anode plug and sacrificial anode

INSPECTION

Inspection and replacement interval will vary depending on the condition of seawater and mode of engine operation.

NOTE: Remove deposits from surface of anode before trying to determine amount of erosion.

- 1. Replace anode assembly when deteriorated 50%.
- Length When New 32 mm (1-1/4 in.)
- Diameter When New 15 mm (5/8 in.)
- 2. Discard sealing washer.



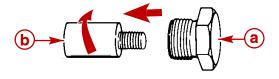
71368

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

REPAIR

NOTE: Sacrificial anodes are available as an assembly. Replace both the plug and anode, if so desired.

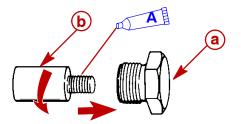
1. Unscrew sacrificial anode from anode plug by holding plug hex head and turning anode.



71367

- a Plug
- **b** Anode
- 2. Clean interior threads of anode plug.

3. Apply sealant to threads of new sacrificial anode and install into anode plug. Tighten securely.



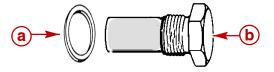
71367

- a Plug
- **b** Anode

De	scription	Where Used	Part Number
A	Loctite 567 PST Pipe Sealant	Threads of anode plug	92-809822

INSTALLATION

- 1. Install new sealing washer.
- 2. Install anode plug with sacrificial anode.



71368

- a Sealing washer
- **b** Anode plug
- 3. Unplug and connect seawater inlet hose, or open seacock if equipped.

A CAUTION

Avoid seawater pump impeller damage. Do not operate the engine without cooling water being supplied to the seawater pickup pump.

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

CE550

Antifouling Paints

In some areas it may be advisable to paint the bottom of the boat to help prevent marine growth. Contact your authorized Cummins MerCruiser Diesel dealer / distributor for recommendations for your boat.

CE551

Cleaning The Seawater Strainer, If Equipped

1. Visually inspect seawater strainer through glass top.

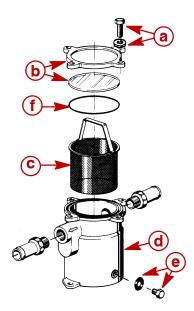
A CAUTION

When cleaning seawater strainer, close seacock, if equipped. If boat is not equipped with a seacock, remove and plug seawater inlet hose to prevent a siphoning action that may occur, allowing seawater to flow from the drain holes or removed hoses.

A CAUTION

Do not overtighten cover screws or cover will warp and leak.

- 2. With engine off, close seacock (if equipped) or remove and plug seawater inlet hose if no seacock exists.
- 3. Remove screws, washers, and cover.
- 4. Remove strainer, drain plug and washer.
- 5. Clean all debris from strainer housing; flush both strainer and housing with clean water.
- 6. Check gasket and replace when leaking.
- 7. Reinstall strainer, drain plug, and washer.
- 8. Reattach cover with screws and washers.
- 9. After starting engine, check for leaks and air in system, which would indicate an external leak.



78157

Typical

- a Screw and washer
- **b** Cover, with glass
- c Strainer
- d Housing
- e Drain plug and sealing washer gasket
- f Gasket

CE533

Flushing The Power Package

NOTE: Flushing is needed only for salty, brackish, mineral laden or polluted water applications. Flushing is recommended after each outing for best results.

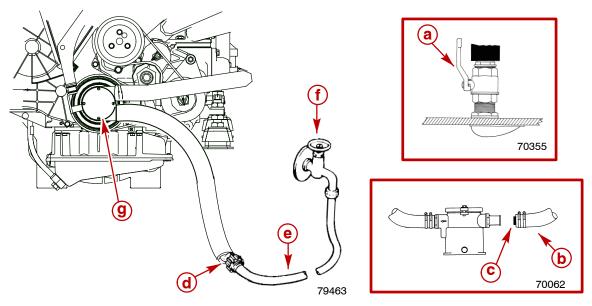
A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at the water inlet during engine operation.

A CAUTION

If flushing with the boat in the water, seawater can flow into the engine causing engine damage. Water inlet must be closed when flushing the engine.

- 1. If flushing the engine with the boat in the water:
 - a. Close seacock, if equipped, or disconnect and plug seawater inlet hose.
 - b. Using an appropriate adapter, connect the flushing hose from a water source to the seawater inlet hose on the seawater pickup pump inlet.



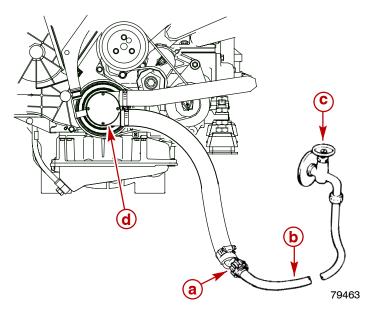
- a Seacock
- **b** Seawater inlet hose
- c Plug
- d Adapter
- e Flushing hose
- f Water tap
- g Seawater pickup pump
- c. Proceed to Step 3.

2. If flushing the engine with the boat out of the water:

WARNING

When flushing, be certain the area around propeller is clear, and no one is standing nearby. To avoid possible injury, remove propeller.

- a. Remove the propeller. Refer to boat manufacturers' instructions.
- b. Using an appropriate adapter, connect the flushing hose from a water tap to the seawater inlet hose on the seawater pickup pump inlet.



- a Adapter
- **b** Flushing hose
- c Water tap
- d Seawater pickup pump
- c. Proceed to Step 3.
- 3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.

A CAUTION

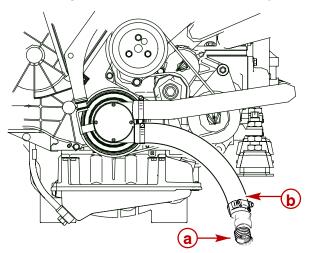
Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure the engine is operating in the normal ranges.

4. Place the remote control in NEUTRAL, IDLE speed position and start the engine.

A CAUTION

Do not run engine above 1500 rpm when flushing. Suction created by seawater pickup pump may collapse flushing hose, causing engine to overheat.

- 5. Operate the engine at idle speed, in NEUTRAL, for about 10 minutes, or until discharge water is clear.
- 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.



79464

- a Adapter
- **b** Seawater pump inlet hose

A CAUTION

If boat is in the water, seacock must remain closed until engine is to be re-started to prevent water from flowing back into cooling system and/or boat. If boat is not fitted with a seacock, water inlet hose must remain disconnected and plugged to prevent water from flowing back into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel of the boat with the warning: Open seacock or reconnect water inlet hose before starting engine.

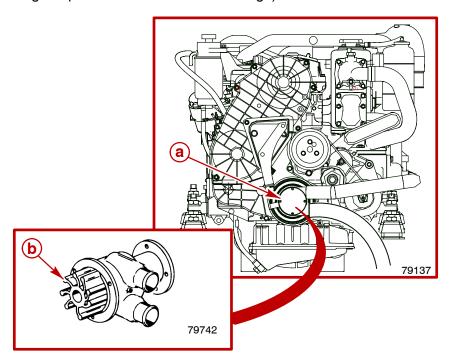
NOTE: The closed cooling section of cooling system that contains coolant does not need to be flushed. Coolant is changed at specified intervals. Refer to Maintenance Schedules.

CE495

Seawater Pump Impeller

This maintenance should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor.

1. Seawater pump impeller and impeller splines should be inspected for wear or damage at scheduled maintenance interval or whenever insufficient seawater flow is suspected (if operating temperature exceeds normal range).



Typical

- a Seawater pump
- **b** Impeller

CA103

Miscellaneous Maintenance

Battery

All lead acid batteries discharge when not in use. Recharge every 30 to 45 days. or when specific gravity drops below battery manufacturer's specifications.

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

WARNING

Avoid serious injury from fire or explosion. Do not use jumper cables and a booster battery to start engine. Do not recharge a weak battery in the boat. Remove battery and recharge in a ventilated area away from fuel vapors, sparks or flames.

WARNING

Batteries contain acid which can cause severe burns. Avoid contact with skin, eyes and clothing. If electrolyte is spilled or splashed on any part of the body, immediately flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.

Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte.

CE498

Bottom Of Boat

To maintain maximum speed, the following conditions of the boat bottom should be observed:

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

NOTES:

STORAGE

6

SECTION 6 - STORAGE

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Storage	92	Power Package Recommissioning	97

STORAGE SECTION 6

CF499

Cold Weather Or Extended Storage

IMPORTANT: Cummins MerCruiser Diesel strongly recommends that this service should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor. Damage caused by freezing <u>IS NOT</u> covered by the Mercury MerCruiser Limited Warranty.

A CAUTION

Seawater section of cooling system MUST BE COMPLETELY drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing is NOT covered by the Cummins MerCruiser Diesel Limited Warranty.

IMPORTANT: Cummins MerCruiser Diesel recommends that propylene glycol antifreeze (a nontoxic and environmentally safe) antifreeze be used in the seawater section of the cooling system for cold weather or extended storage. Ensure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Follow the propylene glycol manufacturer's recommendations.

CE501

Preparing Your Power Package For Storage

IMPORTANT: If the boat has already been removed from the water, before starting the engine a source of water must be supplied to the seawater pump inlet. Follow all warnings and flushing attachment procedures stated in SECTION 5 - Flushing The Seawater System.

A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet openings during operation.

- 1. Supply cooling water to the seawater pump inlet.
- 2. Start the engine and operate until it reaches normal operating temperature.
- 3. Stop the engine.
- Change the engine oil and oil filter.
- 5. Start the engine and operate for about 15 minutes. Check for oil leaks.
- Flush the seawater cooling system. Refer to Section 5 Flushing The Seawater System procedure shown earlier in this manual.

SECTION 6 STORAGE

CE500

Draining Instructions

A CAUTION

Ensure that the boat is out of the water or seacock is closed and bilge pump is operating before beginning procedure. Excess water in bilge can damage engine or cause boat to sink.

A CAUTION

Do not operate engine with drain system open. Excess water in bilge can damage engine or cause boat to sink.

IMPORTANT: Engine must be as level as possible to ensure complete draining of cooling system.

The power package should be drained before flushing or prior to extended or cold weather storage.

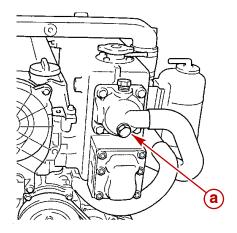
IMPORTANT: The boat must not be operating at any point during this procedure.

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

A CAUTION

Avoid damage to heat exchanger and subsequent possible engine damage. Remove all water from heat exchanger sections. Failure to do so could cause corrosion or freeze damage to heat exchanger water passage tubes.

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

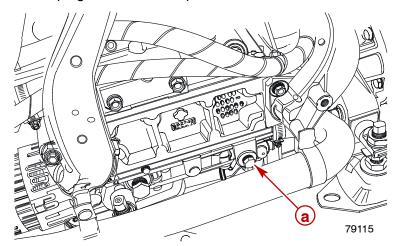


77144

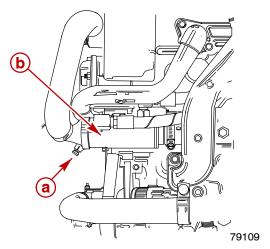
a - Drain plug

STORAGE SECTION 6

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



- a Drain plug
- 6. Remove the drain plug, or the propeller shaft log seal (stuffing box) cooling hose if equipped, from the transmission fluid cooler.



- a Drain plug, or cooling hose (not shown)
- **b** Transmission fluid cooler
- 7. Repeatedly clean out drain holes using a stiff piece of wire. Do this until the entire seawater system is drained.
- 8. After seawater section of cooling system has been drained completely, coat threads of drain plugs with sealant and reinstall. Tighten securely.

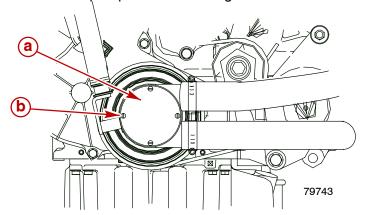
Description	Where Used	Part Number
Perfect Seal	Drain plugs	92-34227-1

SECTION 6 STORAGE

- 9. Remove the seawater pump impeller for extended storage.
 - 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.



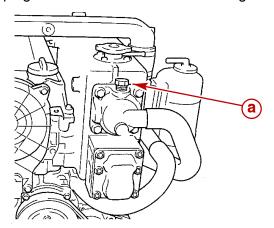
- a Seawater pump cover
- **b** Cover mounting screw (4)

IMPORTANT: Place a CAUTION tag at the instrument panel and in the engine compartment stating that "Seawater pump Impeller is out – Do not operate engine." Also, warn that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.

STORAGE SECTION 6

 For additional assurance against freezing and corrosion fill the seawater cooling system with a mixture of propylene glycol antifreeze and tap water.

- a. Fill a container with approximately 5.6 liter (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 the cold weather or extended storage.
- b. Remove the anode plug from front cover of heat exchanger.



77144

Typical

- a Anode plug
- c. 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.
- d. Install the anode plug. Tighten securely.
- 11. Clean the outside of the engine and repaint any areas required with Primer and Spray Paint. After paint has dried, coat the engine with Corrosion Guard or equivalent corrosion inhibiting oil.

Description	Where Used	Part Number
Corrosion Guard	ļ.	92-802878-55
Light gray primer		92-802878-52
Phantom Black paint]	92-802878-1

 Your authorized Cummins MerCruiser Diesel dealer / distributor should now perform all checks, inspections, lubrication, and fluid changes outlined in Section 5 - Maintenance Schedules.

0087

Battery

Follow the battery manufacturer's instructions for storage.

SECTION 6 STORAGE

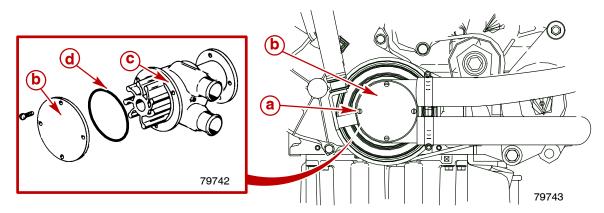
CE502

Power Package Recommissioning

NOTICE

Refer to Cold Weather Or Extended Storage precautions, BEFORE proceeding.

- 1. Install the seawater pump impeller after ensuring that the splines are not worn and inspecting it for worn or damaged vanes.
 - a. Remove the seawater pump cover mounting screws.
 - 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 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
- 2. Ensure that all cooling system hoses are in good condition, connected properly, and hose clamps are tight.
- 3. Verify that all drain valves and drain plugs are installed and tight.
- 4. Inspect all drive belts.

STORAGE SECTION 6

5. Perform all lubrication and maintenance specified for completion Annually in **Section 5 - Maintenance Schedule**, except items that were performed at time of engine layup.

- 6. Fill fuel tanks with fresh diesel fuel. Old fuel should not be used. Check fuel lines and connections for leaks and general condition.
- 7. Replace fuel filter.

A CAUTION

When installing battery, connect POSITIVE (+) battery cable to POSITIVE (+) battery terminal FIRST, and NEGATIVE (-) battery cable to NEGATIVE (-) battery terminal LAST. If battery cables are reversed, or connection order is reversed, electrical system damage will result.

- 8. Install a fully charged battery. Clean the battery cable clamps and terminals. Reconnect the cables (see CAUTION listed above). Secure each cable clamp when connecting.
- 9. Coat terminals with a battery terminal anti-corrosion spray to help retard corrosion.

Description	Where Used	Part Number
Anti-corrosion spray	Battery terminals	Obtain Locally

SECTION 6 STORAGE

10. Perform all checks on the Operation Chart in the Starting Procedure column. Refer to **Section 3**.

A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet openings during operation.

11. Supply cooling water to the water inlet openings.

IMPORTANT: Avoid overheating the starter in the following step. Do not engage the starter motor for more than 15 seconds. Allow at least one minute cool down time before engaging the starter for another 15 seconds.

- 12. After having not been operated for 2 months or longer, it is necessary to pre-lubricate the turbocharger and engine.
 - a. Hold the STOP switch engaged while you simultaneously turn the key switch to the START position for 15 seconds. Doing this together turns the engine without starting it.
 - b. Repeat step a. as needed. Pre-lubrication is complete when oil pressure is shown by the instruments.
- 13. Start the engine and closely observe instrumentation. Ensure that all systems are functioning correctly.
- 14. Carefully inspect the engine for fuel, oil, fluid, water and exhaust leaks.
- 15. Inspect the steering system, shift and throttle control for proper operation.

STORAGE SECTION 6

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SECTION 7 TROUBLESHOOTING

SECTION 7 - TROUBLESHOOTING

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7

TROUBLESHOOTING SECTION 7

0103

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.

CE534

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 electrical stop-circuit.	Have an authorized Cummins MerCruiser Diesel dealer / distributor service the electrical stop circuit.
Clogged fuel filters.	Replace 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 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 / injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Incorrect injection timing.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

SECTION 7 TROUBLESHOOTING

CE535

Engine Runs Rough, Misses And/Or Backfires

Possible Cause	Remedy
Idle speed too low.	Check idle speed and adjust, if necessary.
Clogged fuel or air filters.	Replace 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 injection system.	Purge fuel injection system.
Injector / injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Injection pump governor malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

TROUBLESHOOTING **SECTION 7**

Poor Performance

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

SECTION 7 TROUBLESHOOTING

CE537

Excessive Engine Temperature

Possible Cause	Remedy
Water inlet or seacock closed.	Open.
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.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups or sea strainer obstructed.	Remove obstruction.
Seawater discharge restricted or plugged.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
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	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Loss of pressure in closed cooling section.	Check for leaks. Clean, inspect and test pressure cap.
Faulty thermostat.	Have inspected by an authorized
Faulty seawater pickup pump.	Cummins MerCruiser Diesel dealer /
Faulty engine water circulating pump.	distributor.

CE538

Insufficient Engine Temperature

Possible Cause	Remedy
Faulty thermostat.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

TROUBLESHOOTING SECTION 7

CE539

Turbocharger - Noisy Or Rough Operation

Possible Cause	Remedy
Poor lubrication / low oil pressure at turbocharger.	Have inspected by an authorized Cummins MerCruiser Diesel dealer /
Entry of foreign materials from intake or exhaust side.	
Rubbing of compressor or turbine impellers against housing.	distributor.
Bearing failure.	

CE540

Turbocharger - White Smoke

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

CE541

Low Engine Oil Pressure

Possible Cause	Remedy
Faulty senders.	Have system checked by an authorized Cummins MerCruiser Diesel dealer / distributor.
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).

SECTION 7 TROUBLESHOOTING

CE542

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 serpentine belt and/or check automatic tensioner.
Unacceptable battery condition.	Test battery.

CE543

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 shift or throttle linkages.	Remove obstruction.
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see an authorized Cummins MerCruiser Diesel dealer / distributor immediately.
Shift or throttle cable kinked.	Straighten cable or have an authorized Cummins MerCruiser Diesel dealer / distributor replace cable if damaged beyond repair.
Improper shift cable adjustment.	Have adjustment checked by an authorized Cummins MerCruiser Diesel dealer / distributor.

TROUBLESHOOTING SECTION 7

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SECTION 8 - CUSTOMER ASSISTANCE INFORMATION

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Owner Service Assistance

Local Repair Service

Always return your Cummins MerCruiser Diesel powered boat to your authorized dealer / distributor should the need for service arise. Only the dealer / distributor 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. The dealer / distributor knows your engine best. Contact 1-800-DIESELS to locate your closest distributor.

* Quicksilver parts and accessories are engineered and built specifically for Cummins MerCruiser Diesel sterndrives and inboards.

0114 but

Service Away From Home

If you are away from your local dealer and the need arises for service, contact the nearest authorized Cummins MerCruiser Diesel dealer / distributor. Refer to the Yellow Pages of the telephone directory or by using the service locator on the Cummins website (www.Cummins.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.

CE471

Stolen Power Package

If your power package is stolen, immediately advise the local authorities and Cummins MerCruiser Diesel of the model and serial numbers and to whom the recovery is to be reported. This information is placed into a file at Cummins MerCruiser Diesel to aid authorities and dealers in recovery of stolen power packages.

CE470

Attention Required After Submersion

- Before recovery, contact an authorized Cummins MerCruiser Diesel dealer / distributor.
- 2. After recovery, immediate service by an authorized Cummins MerCruiser Diesel dealer / distributor is required to prevent serious damage to power package.

Replacement Service Parts

A WARNING

Electrical, ignition and fuel system components on Cummins MerCruiser Diesel engines and drive systems are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion.

Use of replacement electrical, ignition or fuel system components, which do not comply to these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

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. Care should be exercised 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.

CE544

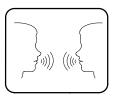
PARTS AND ACCESSORIES INQUIRIES

All inquiries concerning Quicksilver replacement parts and accessories should be directed to your local authorized dealer / distributor. The dealer / distributor has the necessary information to order parts and accessories for you should he not have them in stock. Only authorized dealers or distributors 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 **transmission model**, **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 authorized Cummins MerCruiser Diesel dealer / distributor. 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.



 Should 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 following information will be needed by the service office:

- Your name and address
- Daytime telephone number
- Model and serial numbers for your power package
- The name and address of your dealership
- Nature of problem

The distributor for your area can be found by using the service locator on the Cummins website (www.Cummins.com) or by contacting your local CMD distributor listed in the Yellow Pages of the telephone directory. To locate the closest distributor, call 1-800-DIESELS.

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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).

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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.

Αλλες γλώσσες

Για να αποκτήσετε ένα Εγχειρίδιο Λειτουργίας και Συντήρησης σε άλλη γλώσσα, επικοινωνήστε με το πλησιέστερο Διεθνές Κέντρο Σέρβις της Mercury Marine ή της Marine Power για πληροφορίες. Το πακέτο ισχύος σας συνοδεύεται από έναν κατάλογο αριθμών παραγγελίας για άλλες γλώσσες.

Ordering Literature

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

Model	Horsepower
Serial Number	Year

United States and Canada

For information on additional literature that is available for your particular Cummins MerCruiser Diesel power package and how to order that literature contact your nearest Cummins MerCruiser Diesel dealer / distributor or contact:

Mercury Marine

Telephone	Fax	Mail
		Mercury Marine
(920) 929-5110	(920) 929-4894	Attn: Publications Department
(920) 929-3110	(920) 929-4094	P.O. Box 1939
		Fond du Lac, WI 54935-1939

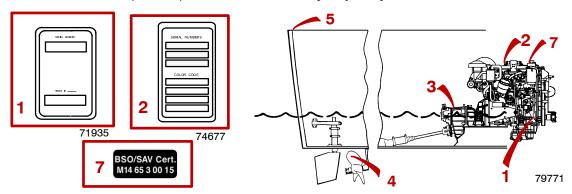
Outside The United States and Canada

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

NOTES:

Identification

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



Please record the following information:

1.			
	Engine Model and Horsepower		Engine Serial Number
2.			
	Transom Assembly Serial Number	Gear	Sterndrive Unit Serial
	(Sterndrive)	Ratio	Number
3.			
	Transmission Model (Inboard)	Gear	Transmission Serial
		Ratio	Number
4.			
·-	Propeller Number	Pitch	Diameter
5.			
	Hull Identification Number (HIN)		Purchase Date
6.			
	Boat Manufacturer	Boat	Length
		Model	
7.			

Exhaust Gas Emissions Certificate Number (Europe Only)

The description and specifications contained herein were in effect at the time this guide was approved for printing. Cummins MerCruiser Diesel, whose policy is one of continuous improvement, reserves the right to discontinue models at any time, or to change specifications or designs, without notice and without incurring obligation.

© 2003, Mercury Marine. The following are trademarks / service marks of Brunswick Corporation: Alpha, Bravo, Flo-Torq, Merc, MerCathode, Mercury, Mercury Marine, Mercury MerCruiser, Mercury Precision Parts, Mercury Propellers, Mercury Product Protection, Quicksilver, RideGuide, SmartCraft and Zero Effort.

Mercury Marine, Fond du Lac, Wisconsin, 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

IF YOU DON'T UNDERSTAND ANY PORTION, CONTACT YOUR DEALER FOR A DEMONSTRATION OF ACTUAL STARTING AND OPERATING PROCEDURES.

NOTICE

Throughout this publication, and on your power package, **WARNINGS** and **CAUTIONS**, accompanied by the International Hazard Symbol \triangle , may be used to alert the installer/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.

A WARNING

WARNING - Hazards or unsafe practices which could result in severe personal injury or death.

A CAUTION

CAUTION - Hazards or unsafe practices which could result in minor personal injury or product or property damage.

IMPORTANT: - Indicates information or instructions that are necessary for proper operation and/or maintenance.

CE458

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.

A WARNING

California Proposition 65 Warning

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

WARNING

Electrical system components on this engine are not external ignition protected. DO NOT STORE OR UTILIZE GASOLINE ON BOATS EQUIPPED WITH THESE ENGINES, UNLESS PROVISIONS HAVE BEEN MADE TO EXCLUDE GASOLINE VAPORS FROM ENGINE COMPARTMENT (REF: 33 CFR). Failure to comply could result in fire, explosion and/or severe personal injury.

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WARRANTY SECTION 1

0005

Warranty Information

Owner Warranty Registration

UNITED STATES AND CANADA ONLY

 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.

- It identifies 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.
- Upon receipt of the Warranty Registration Card at the factory, you will be issued a
 plastic Owner Warranty Registration Card which is your only valid registration
 identification. It must be presented to the servicing dealer should warranty service be
 required. Warranty claims will not be accepted without presentation of this card.
- A temporary Owner Warranty Registration Card will be presented to you when you
 purchase the product. It is valid only for 30 days from date of sale while your plastic
 Owner Warranty Registration Card is being processed. Should your product need
 service during this period, present the temporary registration card to the dealer. He
 will attach it to your warranty claim form.
- Because of your selling dealer's continuing personal interest in your satisfaction, the product should be returned to him for warranty service.
- If your plastic card is not received within 30 days from date of new product sale, please contact your selling dealer.
- The product warranty is not effective until the product is registered at the factory.
- NOTICE: Registration lists must be maintained by factory and dealer on marine products sold in the United States, should notification under the Federal Boat Safety Act be required.
- 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 54935-1939
Phone: 920-929-5054

Fax: 920-929-5893

SECTION 1 WARRANTY

International Owner Registration

OUTSIDE THE UNITED STATES AND CANADA

 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/claim program for your area.

- The Warranty Registration Card identifies your name and address, product model and serial number(s), date of sale, type of use and the selling distributor's/dealer's code number, name and address. The distributor/dealer also certifies that you are the original purchaser and user of the product.
- 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/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 form(s).
- 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 / dealer. If you receive a plastic Warranty Registration Card, you may discard the "Purchaser's Copy" that you received from the distributor / dealer when you purchased the product. Ask your distributor / dealer if this plastic card program applies to you.
- For further information concerning the Warranty Registration Card and its relationship to Warranty Claim processing, refer to the "International Warranty." Refer to "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 dealer / distributor fills out the warranty registration card immediately and sends the factory copy to the Marine Power International Service Center for your area.

WARRANTY SECTION 1

CE547

Warranty Policies

Recreational Use Diesel Limited Warranty

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 IN ORDER 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. Mercury reserves the right to improve or modify products from time to time without assuming an obligation to modify products previously manufactured.

SECTION 1 WARRANTY

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 a propeller or 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 SECTION 1

CE552

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.

SECTION 1 WARRANTY

Use of other than Quicksilver replacement parts when making warranty repairs.

- Oils, lubricants or fluids changed as a matter of normal maintenance is customer's responsibility unless loss or contamination of 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 propeller 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.

WARRANTY SECTION 1

0008

Transferable Warranty

The product 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.

Direct Sale By Owner

 The second owner can be registered as the new owner and retain the unused portion of the limited warranty by sending the former owner's plastic Owner Warranty Registration Card and a copy of the bill of sale to show proof of ownership. In the United States and Canada, mail to:

Mercury Marine
Attn: Warranty Registration Department
W6250 Pioneer Road
P.O. Box 1939
Fond du Lac, WI 54935-1939

- A new Owner Warranty Registration Card will be issued with the new owner's name and address. Registration records will be changed on the factory computer registration file.
- There is no charge for this service.

Outside the United States and Canada, please contact the distributor in your country, or the Marine Power International Service Center closest to you, for the transferable warranty procedure that would apply to you.

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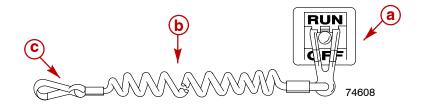
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Features And Controls

0011

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 1 direction
- consuming alcohol or drugs
- high speed boating maneuvers

Some remote control units are equipped with a lanyard stop switch, if your remote control is not equipped with a lanyard stop switch one can be installed on the dashboard or side adjacent to the operator's position. The lanyard is a cord usually 1.2 - 1.5 m (4 - 5 ft) long when stretched out with an element on 1 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 it as short as possible to minimize the likelihood of entanglement with nearby objects. It stretches to minimize the likelihood of accidental activation should the operator choose to move around in an area close to the normal operator's position. To shorten the lanyard, wrap it 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).

A WARNING

Avoid contact with the boat hull and propeller from accidental ejection. Personal injury or death could occur. Always properly connect both ends of the lanyard stop switch.

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 gear case or propeller.
- Loss of power and directional control in heavy seas, strong current or high winds.
- Loss of control when docking.

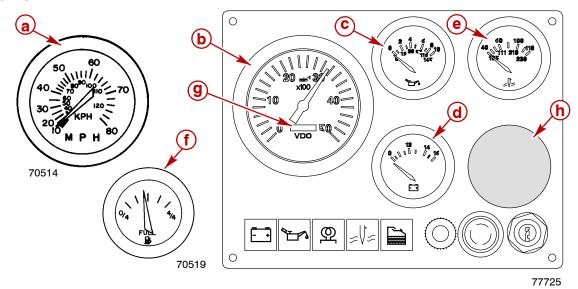
WARNING

Avoid abrupt deceleration of the boat from lanyard stop switch activation. Boat damage and personal injury or death could occur. NEVER leave the operator's station with the engine operating and in gear.

Instrumentation

INSTRUMENTS

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



Typical

a - Speedometer

b - Tachometer

c - Oil pressure gauge

d - Battery meter (voltmeter)

e - Coolant temperature gauge

f - Fuel gauge

g - Hour meter

h - Plug

Speedometer: Indicates boat speed. **Tachometer:** Indicates engine rpm.

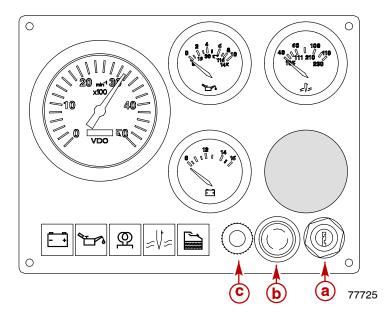
Oil Pressure Gauge: Indicates engine oil pressure.

Battery Meter: Indicates battery voltage.

Coolant Temperature Gauge: Indicates engine operating temperature.

Fuel Gauge: Indicates quantity of fuel in tank. **Hour Meter:** Records engine operating time.

SWITCHES



Typical switches

- a Key switch
- **b** Engine stop switch push button
- c Panel lights / audio test switch

Key Switch - has 3 positions.

- 1. OFF In the OFF position, all electrical circuits are off and engine cannot be started. If the engine is operating the key switch cannot be used to stop the engine. The engine can only be stopped by using the engine stop switch, while the key switch is in the RUN position. No electrical circuit is operational when the key switch is turned to the OFF position.
- 2. RUN In the RUN position, all electrical circuits, indicator lamps, automatic preheating (if equipped), and all instruments are operational.
- 3. START In the START position the engine can be started.

NOTE: The key can only be removed in the OFF position.

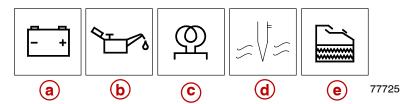
Engine Stop Switch - is used to stop the engine. This is done by electrically shutting off the fuel delivery system. The switch, toggle or push-button, is either toggled DOWN or pressed IN. Engage and hold the stop switch until the engine stops completely. Then, turn the key switch to the OFF position.

Panel Lights / **Audio Test Switch** - has 3 positions; in the NORMAL position all electrical circuits operate in a standard fashion (as described above). With 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 perform a test of the audio warning alarm.

Bilge Blower Switch, if equipped: (not shown) Operates bilge blower.

CE479

ENGINE MONITORING FEATURES



- a Charge indicator lamp
- **b** Oil pressure warning lamp
- Preheat indicator lamp (not active on some late models equipped with a wait to start glow plug system)
- d Coolant temperature warning lamp
- e Water in fuel warning lamp

The lamps function as follows, unless stated otherwise:

Charge Indicator Lamp - indicates a problem with charging system if lamp illuminates while engine is operating. Lamp will be on when key switch is in RUN and engine is not operating. When engine starts, light should go off.

Oil Pressure Warning Lamp - indicates low engine oil pressure if lamp illuminates while engine is running.

Preheat Indicator Lamp - on some models this lamp 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. The lamp stays on until the preheat period is complete. The engine should be started only after the lamp goes out.

NOTE: Some engines may be equipped with a glow plug system that does not illuminate the preheat indicator lamp. These systems require a five second wait to start period after the key switch is turned to the RUN position. After the five second wait to start period the engine can be started.

Coolant Temperature Warning Lamp - indicates excessive engine coolant temperature if lamp illuminates while engine is running, or transmission fluid temperature is too high Refer to the following note.

NOTE: The audio warning alarms are wired in a parallel circuit. If an alarm sounds while the engine is operating, quickly observe the coolant temperature gauge. If coolant temperature gauge reading is normal this may be an indication of excessive transmission temperature. The cause should be determined and corrected.

Water In Fuel Warning Lamp - indicates water is present in fuel filter and that the fuel filter requires service.

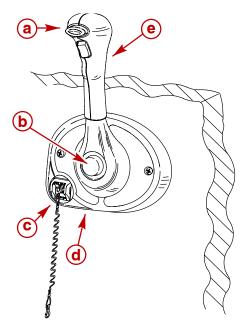
0014

Remote Controls

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

0015.03

PANEL MOUNTED



77019

- a Neutral lock button
- **b** Throttle only button
- c Lanyard stop switch
- d Control handle throttle friction screw
- Control handle

Neutral Lock Button - Prevents accidental shift and throttle engagement. 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. Refer to Lanyard Stop Switch for information on the use of this switch.

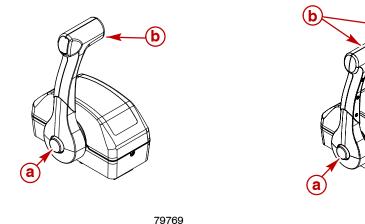
Control Handle Throttle Friction Screw - This screw (located behind the bezel cover) can be adjusted to increase or decrease the tension on the control handle. This will help prevent slipping of the remote control handle. Turn screw clockwise to increase tension and counterclockwise to decrease tension. Adjust to tension desired.

Control Handle - Operation of the shift and throttle are 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.

79770

0242.01

CONSOLE MOUNTED



- a Throttle only button
- b Control handles

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.

Control Handle Tension Adjustment Screw - This screw can be adjusted to increase or decrease the tension on the control handle (cover must be removed to adjust). This will help prevent slipping of the remote control handle. Turn screw clockwise to increase tension and counterclockwise to decrease tension. Adjust to tension desired.

Control Handles - Operation of the the shift and throttle are 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.

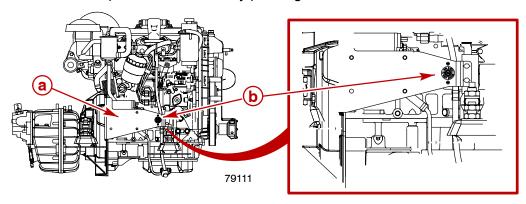
CE477

Electrical System Overload Protection

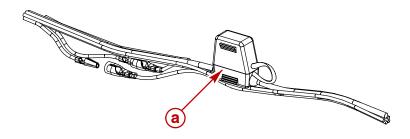
If an electrical overload occurs, a fuse will blow or the circuit breaker will trip open. The cause must be found and corrected before replacing the fuse or resetting the circuit breaker.

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 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 authorized Cummins MerCruiser Diesel dealer / distributor.

1. One 50 amp circuit breaker provide protection for engine wiring harness and instrumentation power lead. Reset by pushing RESET button IN.



- a Electrical bracket
- **b** Circuit breaker
- 2. A 20 amp fuse located in-line on key switch power supply wire protects the instrumentation and wiring should an electrical overload occur. If an overload occurs, the fuse will burn out. Check for blown (burned) fuse if key is turned to RUN or START and instruments or switches, or both, do not function and a circuit breaker is not tripped.



77421

a - Fuse holder

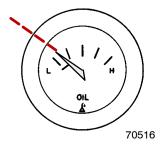
CE480

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:

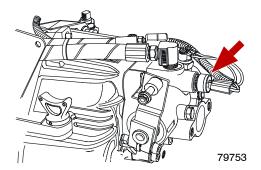
- Engine oil pressure too low
- Coolant temperature too hot
- Transmission fluid temperature too hot





Typical oil pressure gauge

Typical coolant temperature gauge



Typical transmission fluid temperature switch

A CAUTION

Operation of the engine after the audio warning system alarm has sounded could result in damage to the power package. Do not operate engine once the alarm has sounded EXCEPT TO AVOID 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 authorized Cummins MerCruiser Diesel dealer / distributor.

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.

3

SECTION 3 - ON THE WATER

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CE554

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.

You should also review the NMMA Sources of Waterway Information booklet. It lists regional sources of safety, cruising and local navigation and is available at no charge by writing to:

Sources of Waterway Information National Marine Manufacturers Association 410 N. Michigan Avenue Chicago, IL 60611 U.S.A.

- **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 Spare propeller, thrust hubs, and an flares, flag and whistle or horn appropriate wrench Tools necessary for minor repairs First aid kit and instructions Anchor and extra anchor line Water-proof storage containers Manual bilge pump and extra drain Spare operating equipment, batteries, plugs 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 on board, 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 1 person on board in the basics of starting and operating the engine and boat handling 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).
 They impair 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 operators view when operating the boat above idle or planing transition speed. Watch out for others, the water and 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 5 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 \$500.00 or (4) there is complete loss of the boat. Seek further
 assistance from local law enforcement.

0023

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

Avoid prolonged exposure to carbon monoxide. Carbon monoxide poisoning can lead to unconsciousness, brain damage or death. Ensure that the boat, while at rest or underway, is well ventilated.

0024.01

GOOD VENTILATION

Ventilate the passenger area by opening the side curtains or forward hatches to remove fumes.



Example of desired air flow through the boat

0025.01

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.



Example of poor ventilation while a boat is stationary:

- a Operating the engine when the boat is moored in a confined space.
- **b** Mooring close to another boat with its engine operating.



Example of poor ventilation while a boat is moving:

- **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).

0026

Basic Boat Operation

0027.1

Launching And Boat Operation Care

A CAUTION

To avoid possible ingestion of water that can damage engine components:

- Do not turn the ignition key off when the engine is above idle speed.
- When launching your boat from a steep ramp, enter the water slowly.
- Do not use the lanyard stop switch to shut off the engine above idle speed.
- When coming off plane, if a large following wave may roll over the boat's transom, apply a short, light burst of throttle to minimize the wave action against the stern of the boat.
- Do not come off plane quickly, shift into reverse and shut off engine.

IMPORTANT: Install bilge drain plug prior to launching boat.

CE465

Duty Cycle Rating

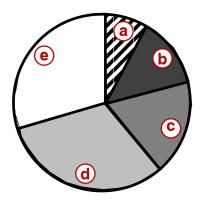
IMPORTANT: Damage caused by improper application or failure to operate the power package within the specified operating parameters, will not be covered by the Cummins MerCruiser Diesel Limited Warranty.

It is the responsibility of the boat manufacturer and/or the installing dealer to ensure that the power package is properly applied. In all cases, the power package must be equipped with a propeller that will allow the engine to operate at wide open throttle (WOT) at the Rated Engine rpm.

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 / ICOMIA 83-28 Duty Cycle).

EPA Mode Number Cycle 5 / ICOMIA 83-28	Modes				
Duty Cycle	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



79175

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

- a Mode 1: 1.0 hour (8 percent)
- **b** Mode 2: 1.5 hours (13 percent)
- c Mode 3: 2.0 hours (17 percent)
- **d** Mode 4: 4.0 hours (32 percent)
- e Mode 5: 3.5 hours (30 percent)

CE485

Operation Chart - 1.7 MI

STARTING PROCEDURE	AFTER STARTING	WHILE UNDERWAY	STOPPING AND SHUT DOWN
Open engine hatch. Air out bilge completely.	Observe all gauges and warning lights to check condition of engine. If not normal, stop engine.	Frequently observe all gauges and indicator lights to monitor engine condition.	Shift remote control lever to neutral position.
Turn battery switch ON, if equipped.	Check for fuel, oil, water, fluid, exhaust leaks, and so on.		Run engine at idle speed several minutes to allow the turbocharger and engine to cool.
Turn on and run engine compartment bilge blower, if equipped, for five minutes.	Check shift and throttle control operation.		Engage the STOP switch and hold, until engine completely stops.
Check for leaks - fuel, oil, water, fluid, and so on.	Check steering operation.		Turn key switch to OFF position.
Open fuel shut-off valve, if so equipped.			Turn battery switch OFF, if equipped.
Open seacock, if equipped.			Close fuel shut off valve, if so equipped.
Check that mechanical engine-stop lever is <i>not</i> engaged.			Close seacock, if equipped.
Prime fuel injection system, if necessary.			Flush seawater cooling circuit, if operating in saltwater area.
Pre-lubricate turbocharger and engine, if necessary.			
Turn key switch to RUN and check that lights and indicator lamps come on.			
Turn the key switch to START, after the indicator lamp for glow plug preheat ceases, or after five seconds with a wait to start glow plug system. Release the key when the engine starts.			
Check that charge indicator and oil pressure indicator lamps cease AFTER engine starts.			
Warm-up engine at a fast idle rpm for several minutes.			

CE525

Starting, Shifting and Stopping

WARNING

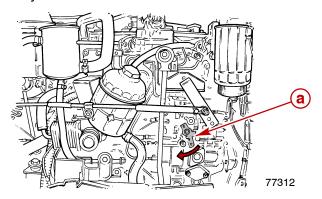
Do not use volatile starting aids, such as ether, propane, or gasoline in the engine air intake system. Explosion hazard resulting from ignition of vapors by glow plugs could cause severe personal injury and engine damage.

A CAUTION

It is good practice to ventilate the engine compartment prior to servicing any engine components to remove any fuel vapors which may cause difficulty breathing or be an irritant.

ENGINE STOP LEVER

A mechanical engine stop lever is located on the injection pump. It is used to manually shut off the engine by mechanically cutting off the fuel supply. It can be engaged by moving the lever in the direction shown by the arrow.



a - Stop lever

BEFORE STARTING THE ENGINE

A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet holes 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 engine does not start, wait 1 minute to allow the starter motor to cool; then, repeat starting procedure.
- Ensure engine crankcase is filled to correct level with the proper grade of oil for the prevailing temperature. Refer to Specifications Engine.
- Ensure that all electrical connections are secure.
- 1. Check all items listed in the Maintenance Schedules and Operation Chart.
- 2. Perform any other necessary checks, as indicated by your authorized Cumminw MerCruiser Diesel dealer / distributor, or specified in your boat owner's manual.

CE481

STARTING COLD ENGINE

IMPORTANT: Check fluid levels before starting engine. Refer to Maintenance Schedule.

- 1. Turn on and operate the engine compartment bilge blower (if equipped) for five minutes. Or, open engine hatch to air out bilge before attempting to start engine.
- 2. Place control handle in NEUTRAL.
- 3. If engine has not been run for a period of time and will not readily start with the standard starting procedure, there is a hand pump/primer located on the engine to improve initial fuel supply. Refer to Maintenance Fuel System, Priming Fuel System and follow instructions.
- 4. Follow the appropriate starting procedure a. or b.:
 - a. Indicator lamp models: turn the key switch to the RUN position to activate the glow plugs. The preheat cycle usually lasts 10 to 15 seconds. Observe the preheat indicator (glow plug) lamp. The lamp should be illuminated when the engine cylinder temperature is too low to sustain combustion. The engine should be started only after the lamp goes off.

NOTE: The preheat devices (glow plugs) should operate at temperatures lower than 50 degrees C (122 degrees F). An engine coolant temperature sensor will automatically control activation and duration of preheat cycle.

b. Wait to start models: turn the key switch to the RUN position to activate the glow plugs. Wait five seconds for the preheat cycle. The engine should be started only after the five second wait to start period has ended.

NOTE: The preheat devices (glow plugs) should operate at temperatures lower than 80 degrees C (176 degrees F). An engine coolant temperature sensor will automatically control activation and duration of preheat cycle.

IMPORTANT: After starting, the key switch should NOT be returned to the OFF position during engine operation. If the starter switch is in the OFF 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.

5. Turn key switch to START position. Release key when the engine starts. Allow switch to return to RUN position. Do not operate the engine with the switch in the OFF position without first shutting down the engine, using the engine stop switch.

A CAUTION

Do not attempt to engage the starter while the engine is running as this will lead to starter pinion and ring gear damage.

6. Ensure all instrumentation is functioning properly and indicating normal readings. Ensure charge indicator and oil pressure warning lamps go off. Check oil pressure gauge immediately after engine starts. If oil pressure is not within specified range (refer to Specifications), stop the engine, locate and correct the problem, or see your local auathorized Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

CAUTION

Do not increase the engine speed until the oil pressure gauge indicates normal. Shut the engine down if oil pressure does not register on the gauge within 20 to 30 seconds after start.

CE482

ENGINE WARM UP

A CAUTION

Improper or no warm-up of engine can seriously impair the life of your diesel engine.

1. After starting, ensure all instrumentation is functioning properly. Operate the engine at a fast idle (1000 to 1200 rpm) until engine temperature is within 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 vessel at reduced engine speed under load. Commence normal vessel operation when systems reach operating temperatures.

- 2. After the engine has reached operating temperature:
 - a. Oil pressure should be within range listed in the engine specifications chart. Stop the engine if oil pressure is not within this range.
 - b. Check the fuel system for leaks from the injection pump, fuel pipes, fuel filter and fuel lines.
 - c. Check for oil leaks. Check the engine and transmission for oil leakage. Especially check the oil filter, oil lines, oil line connectors, and oil pan.
 - d. Check for coolant leaks. Check coolant hoses and connection pipes of heat exchanger, fluid coolers, intercooler, water pump and drain fittings.
- 3. Locate and correct any problems, or see your Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

CE526

STARTING A WARM ENGINE

- 1. Place control handle in NEUTRAL.
- 2. Turn key switch to the RUN position.
- 3. Turn key switch to START position and release when engine starts. Ensure charge indicator and oil pressure warning lamps go off.
- 4. Check to ensure all instrumentation is functioning properly and indicating normal readings

CE483

SHIFTING

CAUTION

Never attempt to shift the transmission unless the engine is at IDLE rpm. Damage to the transmission could occur.

- To shift unit, ensure remote control/throttle lever is in NEUTRAL. Move 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.
- Once underway, engine oil pressure should be within the range listed in the engine specifications chart 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 authorized Cummins MerCruiser Diesel dealer / distributor if you are unable to determine the problem.

CE484

ENGINE SHUTDOWN (STOPPING)

1. Place remote control lever in NEUTRAL.

A CAUTION

Avoid damaging the turbocharger and engine. Immediate engine shutdown (stopping) after high load operation may result in permanent turbocharger bearing damage. Operate the engine at IDLE for several minutes before shutdown.

- 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 the engine shutsdown (stops) completely.
- 4. Turn key switch to the OFF position.

CE468

Freezing Temperature And Cold Weather Operation

IMPORTANT: If boat is operated during periods of freezing temperature, precautions must be taken to prevent freezing damage to power package. Damage caused by freezing IS NOT covered by Cummins MerCruiser Diesel Limited Warranty.

A CAUTION

Seawater (raw water) section of cooling system MUST BE COMPLETELY drained for winter storage or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine.

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

- At the end of each daily operation, COMPLETELY drain seawater section of cooling system to protect against damage by freezing.
- At the end of each daily operation, drain water from water separator, if equipped. Fill fuel tank at end of daily operation to prevent condensation.
- Use 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 degrees C (–4 degrees F) and below, it is recommended that you use a coolant heater to improve cold starting.
- If operating in arctic temperatures of 29 degrees C (–20 degrees F) or lower, consult your Cummins MerCruiser Diesel dealer / distributor for information about special cold weather equipment and precautions.

Refer to **Section 6** for Cold Weather or Extended Storage related information and draining instructions.

CE548

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 and/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 Cummins MerCruiser Diesel Limited Warranty.

0032

Protecting People In The Water

While You Are Cruising

It is very difficult for a person standing or floating in the water to take quick action to avoid a boat heading in his/her direction even at slow speed.

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 (coasting) in NEUTRAL/IDLE, 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

Stop your engine immediately whenever anyone in the water is near your boat. Serious injury to the person in the water is likely if contacted by a rotating propeller, a moving boat, a gear case or any solid device rigidly attached to a moving boat or gear case.

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

0131.02

Passenger Safety Message - Pontoon And Deck Boats

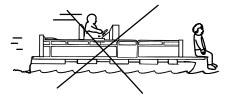
A WARNING

Avoid serious injury or death from falling over the front end of a pontoon or deck boat and coming in contact with the boat hull or propeller. Stay back from the front end of the deck and remain seated while the boat is in motion.

Whenever the boat is in motion, observe the location of all the 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 the result of 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 come into contact with the drive unit.

1. Boats having an open front deck:

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

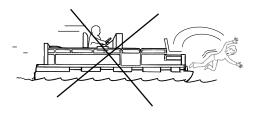


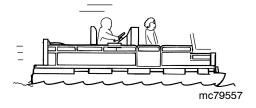


Incorrect Correct

2. Boats with front-mounted, raised pedestal fishing seats:

- a. These 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.
- b. Any unexpected sudden reduction in boat speed could result in the elevated passenger falling over the front of the boat.





Incorrect Correct

0034.01

Wave And Wake Jumping



WARNING

Avoid serious injury or death from being thrown within or out of a boat when it lands after jumping a wave or wake. Avoid wave or wake jumping whenever possible. Instruct all occupants that if a wake or wave jump occurs, get low and hang on to a boat hand hold.

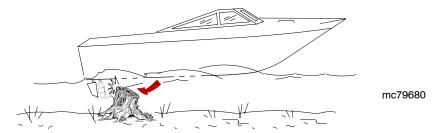
Operating recreational boats over waves and wakes is a natural part of boating. However, when this activity is done with enough speed to force the boat hull partially or completely out of the water, certain hazards arise, particularly when the boat re-enters the water.

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.

0035.02

Impact With Underwater Hazards



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/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 cause occupants to be thrown out of their seats or out of the boat.
- A rapid reduction in speed. This will cause occupants to be thrown forward, even out of the boat.
- Impact damage to the underwater drive components, rudder and/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 engine as soon as possible and inspect the drive system for any broken or loose parts. If damage is present or suspected, the power package should be taken to an authorized dealer for a thorough inspection and necessary repair.

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

A WARNING

Avoid serious injury or death from loss of boat control. Continued boating with major impact damage can result in sudden component failure with or without subsequent impacts. Have the power package thoroughly inspected and any necessary repairs made.

0036

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)

0037

Bottom Of Boat

To maintain maximum speed, the boat bottom should be:

- Clean, free of barnacles and marine growth
- Free of distortion; nearly flat where it contacts the 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 the water inlets and cause the engine to overheat.

CE527

Elevation And Climate

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

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

For you to have optimum engine performance under changing weather conditions, it is essential that the engine be propped to allow the engine to operate at the Rated Engine rpm with a fully loaded boat during your normal boating weather conditions.

CE464

Propeller Selection

CAUTION

The installed propeller must allow the engine to run at the Rated Engine rpm at WOT to avoid engine damage. Using a propeller that causes the engine to operate below the Rated Engine rpm can cause piston and/or valve damage (even if the engine is not operated at WOT). Conversely, using a propeller that allows engine to operate above the specified Rated Engine rpm can increase fuel consumption and wear and will not allow engine to produce its rated horsepower.

It is the responsibility of the boat manufacturer or the selling dealer, or both, 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 propeller being used does not allow engine to run excessively against the governor, 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 on board.

If full throttle operation is below the Rated Engine 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 and/or damage.

After initial propeller selection, the following common problems may require that the propeller be resized:

- Warmer weather and greater humidity cause an rpm loss.
- Operating in a higher elevation causes an rpm loss.
- Operating with a damaged propeller or dirty boat bottom causes an rpm loss.
- Operating with increased load (additional passengers, pulling skiers).

0042

Getting Started

CE555

Engine Break-In

INITIAL BREAK-IN PROCEDURE

It is especially important that the following procedure be used 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: It is recommended 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 engine does not start, wait 1 minute to allow the starter motor to cool; then, repeat starting procedure.

- 1. Refer to appropriate Starting, Shifting and Stopping section and start the engine. Operate the engine at a fast idle until it has reached normal operating temperature.
- 2. Operate the engine in gear for 3 minutes at each of the following rpms: 1400 rpm, 2800 rpm and 3500 rpm.
- 3. Operate the engine in gear for 3 minutes at each of the following rpms: 1700 rpm, 3500 rpm and 4000 rpm.
- 4. Operate the engine in gear for 3 minutes at each of the following rpms: 2100 rpm, 3500 rpm and Maximum Rated Full Throttle rpm.

0041

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, the following rules must be observed:

- 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.
- Frequently check engine oil level. Add oil as needed. It is normal for oil consumption to be high during the break-in period.

CE475

After Break-In Period

To help extend the life of your Cummins MerCruiser Diesel power package, the following recommendations should be considered;

- Ensure that propeller allows the engine to operate at the specified Rated Engine rpms when at full throttle with a fully loaded boat. Refer to Specifications and Maintenance.
- Operation at 3/4 throttle setting or lower is recommended. Refrain from prolonged operation at WOT rpm.
- Change the oil and oil filter. Refer to Specifications and Maintenance.

CE476

End of First Season Checkup

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

NOTES:

SECTION 4 SPECIFICATIONS

SECTION 4 - SPECIFICATIONS

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4

SPECIFICATIONS SECTION 4

CD164

Fuel Requirements

WARNING

Electrical system components on this engine are not external ignition protected. DO NOT STORE OR UTILIZE GASOLINE ON BOATS EQUIPPED WITH THESE ENGINES, UNLESS PROVISIONS HAVE BEEN MADE TO EXCLUDE GASOLINE VAPORS FROM ENGINE COMPARTMENT (REF: 33 CFR). Failure to comply could result in fire, explosion and/or severe personal injury.

WARNING

FIRE HAZARD: Fuel leakage from any part of the fuel system can be a fire hazard which can cause serious bodily injury or death. Careful periodic inspection of entire fuel system is mandatory, particularly after storage. All fuel components including fuel tanks, whether plastic, metal or fiberglass, fuel lines, primers, fittings, and fuel filters should be inspected for leaks, softening, hardening, swelling or corrosion. Any sign of leakage or deterioration requires replacement before further engine operation.

WARNING

Under *no circumstances* should gasoline, gasohol and/or alcohol be mixed with diesel fuel for any reason. This mixture of gasoline, gasohol and/or alcohol with diesel fuel is highly flammable and produces a significant risk to the user.

IMPORTANT: Use of improper or water contaminated diesel fuel can damage your engine seriously. Use of improper fuel is considered misuse of engine, and damage caused thereby will not be covered by 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 fuel fill, 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.
- Corrosion and extensive damage, and excessive wear of internal engine parts, particularly bearings.
- Starting and operating difficulties.

SECTION 4 SPECIFICATIONS

CD888

Recommended Fuels

CAUTION

Avoid fuel system damage. Use of fuels not recommended by Cummins MerCruiser Diesel may cause hard-starting and other various troubles such as premature wear of the injection pump plungers and injection nozzles resulting from the deposit of carbon residue and other contaminants.

Diesel Fuel/Applicable Standard	Recommendation
JIS (JAPANESE INDUSTRIAL STAN- DARD)	No.2
DIN (DEUTSCHE INDUSTRIE NOR- MEN)	DIN 51601
SAE (SOCIETY OF AUTOMOTIVE	No.2-D
ENGINEERS)Based on SAE J-313C	NO.2-D
BS (BRITISH STANDARD)	A-1
Based on BSEN 590-1197	

CE16

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, anti-gel diesel fuel treatment, following that product's directions.

SPECIFICATIONS SECTION 4

CF528

AntiFreeze/Coolant

CAUTION

Alcohol or Methanol base antifreeze or plain water are not recommended for use in closed cooling section of cooling system at any time.

Because diesel engines are high compression engines and related higher engine operating temperatures are created, the closed cooling system and engine, including related cooling passages must remain as clean as possible to provide adequate engine cooling. This can only be assured by using the proper antifreeze, water, additives and inhibitors. It is recommended that the closed cooled section of the cooling system be filled with a low silicate formula of ethylene glycol antifreeze in solution with deionized water. A low silicate formula prevents antifreeze separation which causes a silicate gelatin to form. This gelatin will block engine and heat exchanger passages causing engine overheating.

The coolant, if not premixed, should be mixed before being added to the closed cooling system using a proper antifreeze together with deionized water. Common tap water or softened water contains unwanted minerals which can leave large deposits in the system that restrict the cooling system efficiency. In addition, additives and inhibitors introduced into acceptable coolant solutions will form a protective film on internal passages and provide protection against internal cooling system erosion.

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

NOTE: A greater than 50/50 antifreeze/coolant solution should never be used except when operating where seawater temperatures are greater than 32 degrees C (90 degrees F), then a 25 / 75 (antifreeze / water) solution can be used for improved cooling performance.

IMPORTANT: The antifreeze/coolant used in these marine engines must be a 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/coolants are listed in the following table. Refer to Maintenance Schedules for respective change intervals.

Description	Part Number
Premixed Marine Engine Coolant	92-813054A2
Fleetguard Compleat (Product 91-50663 With DCA4 Additive)	Obtain Locally

SECTION 4 SPECIFICATIONS

CE491

Engine Oil

CAUTION

ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do NOT spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

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 Diesel Engine Oil	Engine crankcase	92-877695K1

This oil is a specially blended 15W-40 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		
Mopar		
Texaco Ursa Super TD	Engine eventoses	Obtain Leadly
Wintershall Multi-Rekord	Engine crankcase	Obtain Locally
Veedol Turbostar		
Wintershall Vliva 1		

These oils are approved by Mercury Marine and Marine Power Europe. For all temperature operation use 15W-40 oil.

SPECIFICATIONS SECTION 4

CE486

Engine Specifications

Description	Specification - Inboard
Description	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 cubic liters (103 cid)
Engine weight (approximate)	250 kg (550 lb)
Bore	79 mm (3.11 in.)
Stroke	86 mm (3.39 in.)
Thermostat	82-95 (180-203) ¹
Coolant temperature (peak)	90 - 104 (194 - 219) ¹
Electrical System	12-volt Negative (–) Ground
Recommended battery rating	515 cca, 652 mca, or 65 Ah

¹ Unit of measure shown in degrees C (degrees F).

SECTION 4 SPECIFICATIONS

0051.02

Fluid Specifications

IMPORTANT: All capacities are approximate fluid measures.

CE487

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)	6-1/2 (6-3/4) ¹	Mercury Diesel Engine Oil	92-877695K1
Closed Cooling System	8-3/4 (9-1/4)	Marine Engine Coolant	92-813054A2
Seawater Cooling System ²	6-1/2 (6-3/4)	Not Applicable	Not Applicable

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

CE488

TRANSMISSION

Model	Capacity liters (U.S. qts)	Fluid type	Part Number
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Trans- mission Fluid or Equivalent	Obtain Locally

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

² Seawater Cooling System capacity information is for winterization use only.

SPECIFICATIONS SECTION 4

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CE466

Owner/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 an authorized Cummins MerCruiser Diesel for a periodic checkup.

Normal maintenance service and replacement parts are the responsibility of the owner/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 authorized Cummins MerCruiser Diesel dealer / distributor for service aids.

CE467

Dealer Responsibilities

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

- Ensure that the boat is properly equipped.
- Prior to delivery, make certain that the Cummins MerCruiser Diesel dealer / distributor power package and other equipment are in proper operating condition.
- Make all necessary adjustments for maximum efficiency.
- Familiarize the customer with the on-board equipment.
- Explain and demonstrate the operation of the power package and boat.
- Provide you with a copy of a Predelivery Inspection Checklist.
- Your selling dealer should fill out the Warranty Registration Card completely and mail it to the factory immediately upon sale of the new product.

CE462

Maintenance

WARNING

Avoid injury or death and power package damage from an electrical shock, fire or explosion. Always disconnect both battery cables from the battery before servicing the power package.

A CAUTION

It is good practice to ventilate the engine compartment prior to servicing any engine components to remove any fuel vapors which may cause difficulty breathing or be an irritant.

IMPORTANT: Refer to Maintenance Chart for complete listing of all scheduled maintenance to be performed. Some listings can be done by owner/operator, while others should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor. Before attempting maintenance or repair procedures not covered in this manual, it is recommended that the appropriate Cummins MerCruiser Diesel or Mercury MerCruiser Service Manual be purchased and read thoroughly.

IMPORTANT:

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

CE473

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 don't 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/or 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 dealer / distributor of Cummins MerCruiser Diesel products is there to service your power package. They have qualified factory-trained mechanics.

It is recommended you have the dealer 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.

CE529

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.

Check for loose, damaged or missing parts, hoses and clamps; tighten or replace as necessary.

Check plug leads and electrical leads for damage.

Remove and inspect the propeller. If badly nicked, bent or cracked, contact your authorized Cummins MerCruiser Diesel dealer / distributor.

Repair nicks and corrosion damage on power package exterior finish. Contact your authorized Cummins MerCruiser Diesel dealer / distributor.

CE490

Maintenance Schedules

Routine Maintenance				
	Each Day Start	Each Day End	Weekly	Every Two Months
Check the engine oil level (interval can be extended based on experience).	•			
Check the coolant level.	•			
Check the transmission fluid level.	•			
If operating in salt, brackish or polluted waters, flush the cooling system after each use.		•		
Drain any water from the fuel filter after each use (if operating in freezing temperatures).			•	
Check the water inlets for debris or marine growth. Check the seawater strainer and clean.			•	
Check the battery connections and the fluid level.				•
Inspect the air cleaner.2				•
Operating in saltwater or brackish or polluted water only: treat the power package with Corrosion Guard.				•
Ensure that the gauges and the wiring connections are secure. Clean the gauges. ¹				•

 $^{^{1}}$ Or every 50 hours, whichever occurs first. If operating in saltwater, interval is reduced to every 25 hours or 30 days whichever occurs first

² Or every 50 hours, whichever occurs first.

Maintenance Schedules (Continued)

Scheduled Maintenance			
	After First 50 hours	Every 100 hours or Annually	Every 200 hours or Annually
Change the engine oil and filter.	•	•	
Retorque the exhaust riser clamp.	•		•
Change the transmission fluid.		•	
Check the steering system and the remote control for loose, missing or damaged parts. Lubricate the cables and the linkages.		•	
Disassemble and inspect the seawater pump and replace the worn components.		•	
Touch-up paint the power package and spray with corrosion guard.		•	
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.			•
Replace the fuel filters.			•
Drain the intercooler condensation.		_	•

[◆] Whichever occurs first

Maintenance Schedules (Continued)

Scheduled Maintenance	Every 200 hours or 2 years	Every 300 hours or 3 years	Every 500 hours or 5 years	Every 1000 hours or 5 years	Per OEM
Replace the coolant.	•				
Check the electrical system for loose, damaged, or corroded fasteners.		•			
Inspect the timing belt and pulleys.		•			
Retorque the engine mounts		•			
Clean the intercooler core.			•		
Clean the fuel tank.				•	
Replace the timing belt				•	
Check the valve clearance				•	
Check the engine to propeller shaft alignment.					•

[◆] Whichever occurs first

0166

Maintenance Record

Date	Hour Meter Reading	Serviced By	Maintenance Performed

0062

Engine Oil

A CAUTION

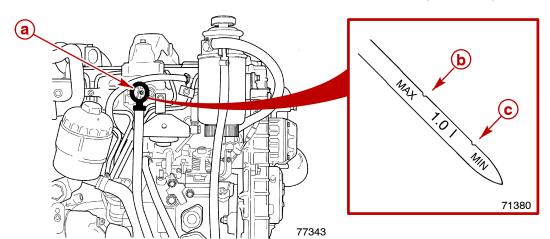
ENVIRONMENTAL HAZARD! Discharge of oil or oil waste into the environment is restricted by law. Do not spill oil or oil waste into the environment when using or servicing your boat. Contain and dispose of oil or oil waste as defined by local authorities.

CE492

Checking

- 1. Stop the engine. Allow approximately 10 minutes for oil to drain into oil pan. The boat must be at rest in the water.
- 2. Remove the dipstick. Wipe clean and reinstall fully into the dipstick tube.
- 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).



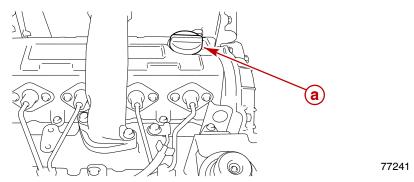
- a Dipstick
- **b** Maximum Mark
- c Minimum Mark

CE461

Filling

IMPORTANT: Do not overfill the engine with oil.

1. Remove the oil fill cap.



a - Oil fill cap

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

NOTE: It takes several minutes for the added oil to drain to the oil pan. Wait approximately 10 minutes and check the level again, after adding oil.

All models	Capacity liters (U.S. qts)	Fluid type	Part Number
Engine Oil (With Filter)	6-1/2 (6-3/4) ¹	Mercury Diesel Engine Oil	92-877695K1

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

3. Install the oil fill cap.

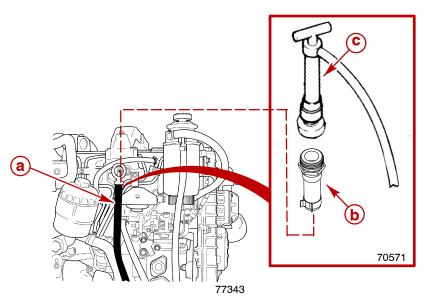
CE469

Changing

Refer to the Maintenance Schedules for the change interval. Engine oil should be changed before placing the boat in storage.

IMPORTANT: Change 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.

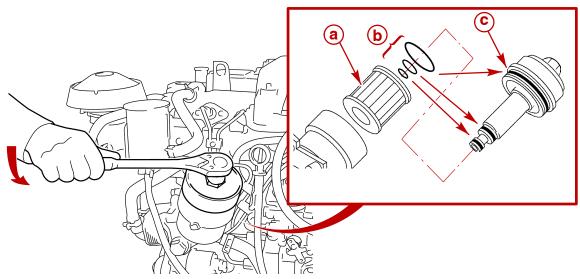
- 1. Start the engine and allow it to warm up to normal operating temperature.
- 2. Stop the engine and allow some time for oil to drain into oil pan (approximately 10 minutes).
- 3. Install the crankcase oil pump. Push the adapter onto the dipstick tube and attach the pump.



- a Dipstick tube
- **b** Quicksilver Hose / Oil Pump Adapter (32-863642)
- c Quicksilver Crankcase Oil Pump (802889A1)
- 4. Pump oil out of crankcase into drain pan.
- 5. When crankcase is empty, remove the pump and adapter.
- 6. Install the oil dipstick.

7. Use a filter wrench or appropriate socket to remove the cartridge type oil filter.

8. Discard the old filter element. Discard the old O-rings from the top piece.



79740

- a Filter element
- **b** O-rings
- **c** Top piece
- 9. Install the three O-rings. Apply a coat of engine oil to the O-rings. Install the element on the top piece.

Description	Where Used	Part Number
Engine oil	Oil filter O-rings	Obtain Locally

10. Install the top piece with the new element into the oil filter housing.

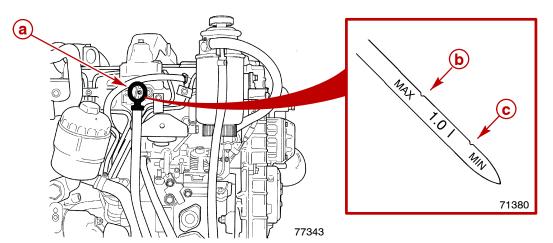
IMPORTANT: Over tightening the top piece will cause deformation resulting in oil leakage.

11. 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

12. Remove oil fill cap and refill engine with new oil. Refer to specifications for quantity and grade of oil.

13. Add specified oil to bring level up to, but not over, maximum oil level mark - MAX - on dipstick.



- a Dipstick
- b Maximum Mark
- c Minimum Mark

14. Reinstall oil fill cap.

IMPORTANT: Avoid overheating the starter in the following step. Do not engage the starter motor for more than 15 seconds. Allow at least one minute cool down time before engaging the starter for another 15 seconds.

- 15. Pre-lubricate the turbocharger and engine.
 - Hold the STOP switch engaged while you simultaneously turn the key switch to the START position for 15 seconds. Doing this together turns the engine without starting it.
 - b. Repeat step a. as needed. Pre-lubrication is complete when oil pressure is shown by the instruments.
- 16. Start and operate the engine for a few minutes. Stop the engine and wait for about ten minutes.
- 17. Remove the oil dipstick. Wipe clean and reinstall into dipstick tube.
- 18. 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 dipstick.

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

A CAUTION

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

- 19. Install the oil fill cap.
- 20. Start the engine and check for leaks.

CE493

Transmission Fluid

Checking

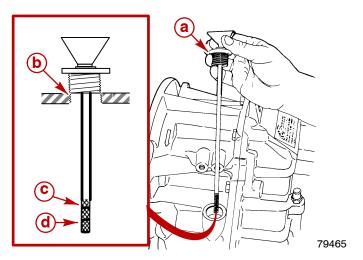
1. Remove the dipstick.

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 low, add transmission fluid to bring the level up to the MAXIMUM mark on the dipstick.



- 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 prior to checking the level.

- 4. Start the engine and operate at 1500 rpm for 2 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 low, add transmission fluid to bring the level up to the MAXIMUM mark on the dipstick.

Model	Capacity liters (U.S. qts)	Fluid type
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Transmission Fluid or Equivalent

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

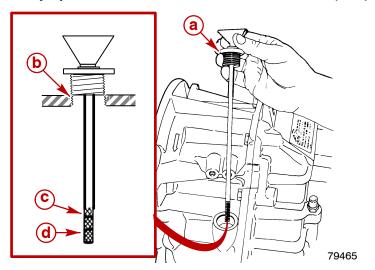
7. Install the dipstick.

CE463

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

Model	Capacity liters (U.S. qts)	Fluid type
ZF Marine 25A	1.8 (1.9) ¹	Dexron III Automatic Transmission Fluid or Equivalent

¹ Always use the dipstick to determine the exact quantity of oil or fluid required.

NOTE: If the transmission fluid level was extremely low, contact your authorized Cummins MerCruiser Diesel dealer/distributor.

2. Install the dipstick.

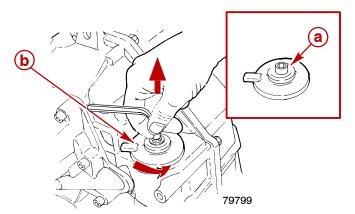
IMPORTANT: To accurately check the fluid level, the engine must be run at 1500 rpm for 2 minutes immediately prior to checking the level.

3. Refer to Transmission Fluid - Checking.

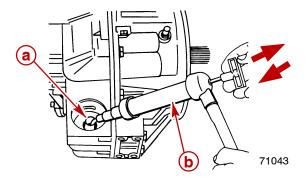
CE496

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 Fluid filter assembly
- **b** Assembly nut
- 3. Push the hose of a suction pump through 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.

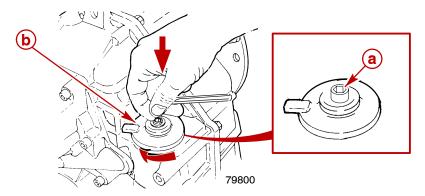


- a Filter Element
- **b** Cover
- c O-rings

CAUTION

Transmission fluid filter assembly must be properly seated to avoid fluid foaming and/or loss of fluid resulting in decreased efficiency and/or damage to transmission.

- 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 Fluid filter assembly
- **b** Assembly nut

Description	Nm	lb-in.	lb-ft
Filter assembly nut	5-8		4-6

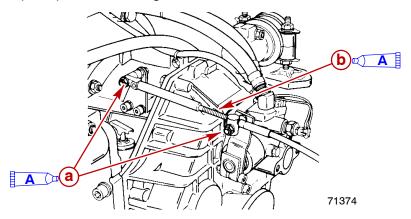
10. Refer to Transmission Fluid - Filling, and fill the transmission with specified fluid to the proper level.

CE474

Lubrication

Shift Cable

1. Lubricate the pivot points and the guide contact surfaces.



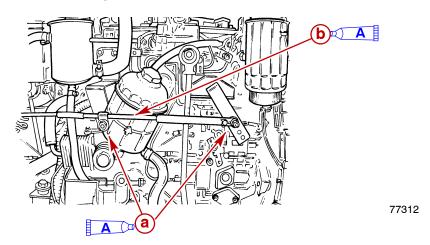
Typical

- a Pivot points
- **b** Guide contact surfaces

Description		Where Used	Part Number
A	Engine Oil	Pivot points, guide contact surfaces	Obtain Locally

Throttle Cable

1. Lubricate the pivot points and the guide contact surfaces.



- a Pivot points
- **b** Guide contact surfaces

Description	Where Used	Part Number
A Engine Oil	Pivot points, guide contact surfaces	Obtain Locally

CE524

Engine Coolant

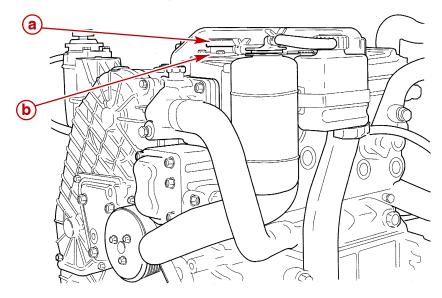
Checking

A CAUTION

Allow the engine to cool before removing the pressure cap. A sudden loss of pressure could cause hot coolant to boil and discharge violently. After the engine has cooled, turn the cap 1/4 turn to allow any pressure to escape slowly, then push down and turn the cap all the way off.

- 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 filler neck. If coolant is low refer to Filling.

NOTE: If no coolant is visible in the heat exchanger or operating temperatures are excessive, air may have become trapped in the cooling system. Contact your authorized Cummins MerCruiser Diesel dealer / distributor.



75301

Typical

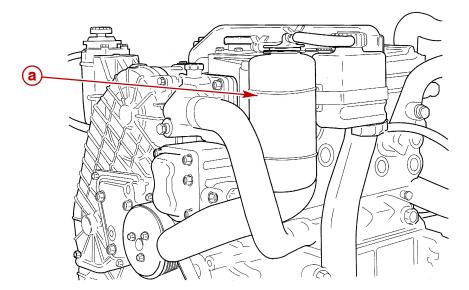
- a Pressure cap
- **b** Filler neck

IMPORTANT: The pressure cap is correctly installed if it contacts locking tabs on the fill neck when tightened.

4. Install the pressure cap. Tighten until it contacts 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.

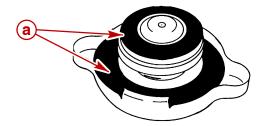


75301

- a Coolant recovery bottle
- 7. Add the specified coolant as necessary.

Description	Where Used	Part Number
Marine Engine Coolant	Closed cooling system	92-813054A2
Fleetguard Compleat (Product 91-50663 with DCA4 Additive)		Obtain Locally

- 8. If coolant level in coolant recovery bottle was low:
- Inspect coolant recovery system for leaks.
- Inspect pressure cap gaskets for damage and replace if necessary.



72714

a - Gaskets

Also, the pressure cap maintains pressure on the coolant tank. It may not be holding pressure properly. Contact your authorized Cummins MerCruiser Diesel dealer / distributor to have the cap tested.

Filling

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

IMPORTANT: The pressure cap is correctly installed if it contacts locking tabs on the fill neck when tightened.

- 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 line with the specified coolant.

Description	Where Used	Part Number
Marine Engine Coolant	Closed cooling system	92-813054A2
Fleetguard Compleat (Product 91-50663 with DCA4 Additive)		Obtain Locally

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

Changing

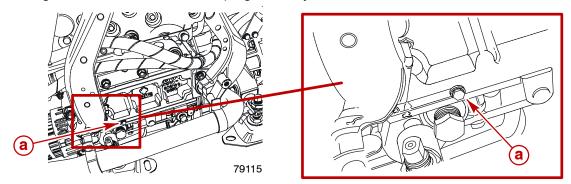
Contact your authorized Cummins MerCruiser Diesel dealer/distributor.

CE556

Intercooler Condensation

Condensation must be drained from the intercooler periodically. Refer to Maintenance Schedules for interval.

- 1. Remove the small condensate drain plug from the intercooler.
- 2. Drain the liquid that may have condensed in the intercooler during operation.
- 3. After the intercooler has drained, apply sealer to the threads of the condensate drain plug and install.
- 4. Tighten the condensate drain plug securely.



a - Condensate drain plug

Description	Where Used	Method of Use	Part Number
Perfect Seal	Condensate drain plug	Thread length	92-342771

CE494

Water Separating Fuel Filter

WARNING

Be careful when draining water separating fuel filter. Diesel fuel is flammable. Be sure ignition key is OFF. Do not allow fuel to contact any hot surfaces which may cause it to ignite. Do not allow sources of open flame in the area. Wipe up any spilled fuel immediately. Dispose of fuel soaked rags, paper, etc. in an appropriate air tight, fire retardant container. Fuel soaked items may spontaneously ignite and result in a fire hazard which could cause serious bodily injury or death.

A CAUTION

Any water entering the fuel injection system will disable the system. Check for water in water separating fuel filter before start up, daily.

A CAUTION

If water should enter the fuel injection system, take unit to an authorized Cummins MerCruiser Diesel dealer / distributor IMMEDIATELY, so that corrosion and rusting of the injectors and other components can be avoided.

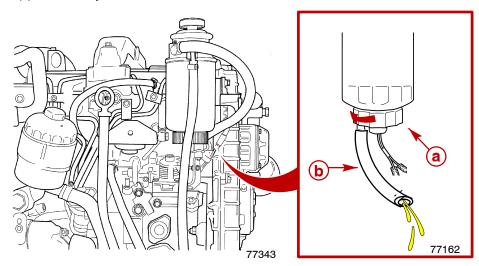
Draining

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

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

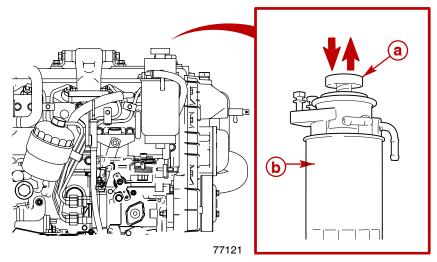
NOTE: Place a suitable container under fuel filter to catch contaminated fuel, water, or both. Dispose of properly.

- 1. Place a small container at the end of a drain hose beneath the drain cap on the filter.
- 2. Open by turning the drain cap counterclockwise (as viewed from the bottom of the filter) approximately 5 turns.



- a Drain cap
- b Drain hose

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



a - Priming pump

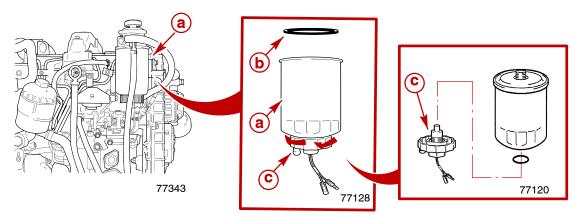
- 4. Close drain cap by turning clockwise. Tighten securely.
- 5. Fill the fuel filter. Refer to Filling.
- 6. After starting the engine, check to see that there is no fuel leak from the drain cap.

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

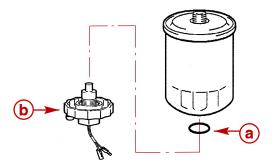
Replacing

IMPORTANT: Element cannot be cleaned and reused. It must be replaced.

- 1. Remove water separating fuel filter and sealing ring from fuel filter bracket.
- 2. Remove the drain cap from the filter by turning it counterclockwise. Discard the used filter.



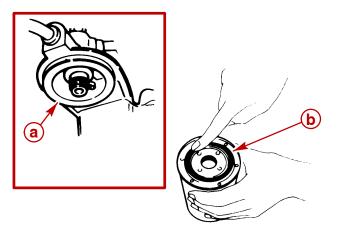
- a Water separating fuel filter
- **b** Sealing ring
- c Drain cap
- 3. Install the O-ring and drain cap on the new fuel filter. Tighten the drain cap.



77128

- a O-ring
- **b** Drain cap

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



77296

Typical mounting bracket and filter

- a Filter sealing surface
- **b** Sealing ring

Description	Where Used	Part Number
Engine oil	Oil filter O-rings	Obtain Locally

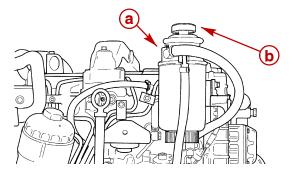
- 6. Thread filter onto bracket until the sealing ring contacts bracket.
- 7. Tighten the fuel filter an additional 2/3 of a turn with a filter wrench.
- 8. Ensure that the bottom drain cap is securely tightened.
- 9. Fill the fuel filter. Refer to Filling.
- 10. Check filter and drain cap for fuel leaks.
- 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 fuel filter when changing filter
- Refill fuel system if system was run dry
- To prime the fuel system if engine has not been operated for a while.

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

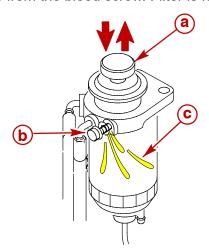


77343

- a Fuel filter bracket
- **b** Hand pump / primer

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

- 1. Loosen the bleed screw on 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. Filter is full when this occurs.



77381

- a Bleed screw
- a Plunger
- **b** Fuel from bleed screw
- 3. Tighten the bleed screw

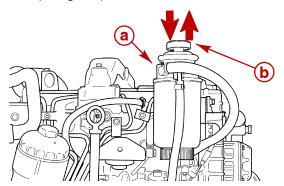
CE530

Fuel System

Priming

Prime the engine if it has not been operated for a while or if the engine will not start.

1. Move the hand pump/primer plunger up and down several times.



77343

- a Fuel filter bracket
- **b** Hand pump / primer
- 2. Attempt to start the engine.

Purging Air

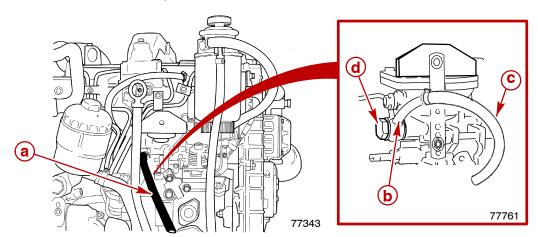
NOTE: Follow this procedure if fuel system was run dry or if part of fuel system was drained for a service function.

- 1. Fill the fuel filter. Refer to Filling.
- 2. Check filter and drain cap for fuel leaks. Ensure that bleed screw on 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.

A CAUTION

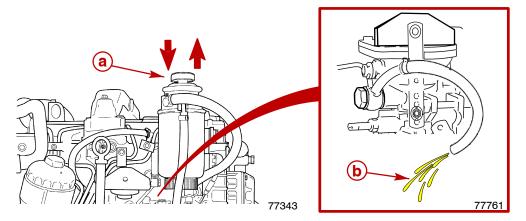
Avoid the risks of fuel leaking. The injection pump fuel return valve, a special hollow bolt, uses sealing washers to prevent fuel from leaking. Replace the sealing washers if leaking.

5. Temporarily install a length of fuel hose on fuel return fitting. Avoid disturbing special hollow bolt and sealing washers.

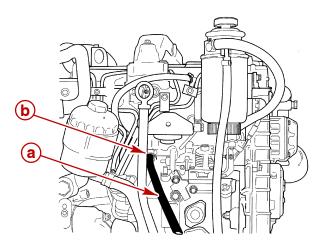


- a Fuel return hose
- **b** Fuel return fitting
- c Temporary hose
- d Hollow bolt and sealing washers

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



- a Plunger
- **b** Fuel from temporary hose
- 7. Remove temporary hose. Unplug and install boat fuel return hose on fitting. Securely tighten the hose clamp.



77343

- a Fuel return hose
- **b** Hose clamp
- 8. Move plunger knob up and down several times until some added resistance is noticed when knob is moved.
- 9. Check for fuel leaks.
- 10. Dispose of waste fuel as defined by local authorities.
- 11. Start the engine, check for fuel leaks. If leaks exist, stop the engine immediately and recheck installation.

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

CE549

Fuel Tank Cleaning And Flushing

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

Refer to boat manufacturer's instructions and clean fuel tank at specified intervals. Unless specified otherwise, flush and clean diesel fuel tank every 1000 hours or 5 years, whichever occurs first.

CE497

Drive Belts

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

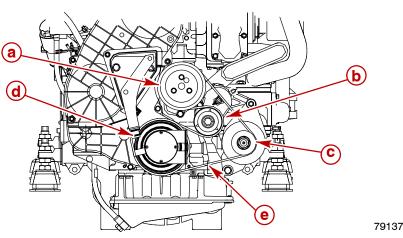
If any drive belts need replacement or tension needs adjustment, contact your authorized Cummins MerCruiser Diesel dealer / distributor.

WARNING

Avoid possible serious injury. Make sure the engine is shut off and the ignition key is removed before inspecting the belts.

Checking Serpentine Belt

1. The various components are shown.



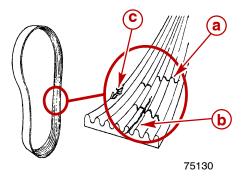
Typical

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

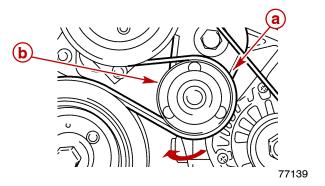
- 2. Inspect serpentine belt for proper tension and for the following:
- Excessive wear
- Cracks

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
- Proper tension



- a Transverse crack
- **b** Longitudinal crack
- c Fraying
- Check the operation of the automatic tensioner and associated components. Move tensioner pulley in direction of arrow (position a suitable tool on pulley fastener and rotate). Release and allow to glide back slowly. Tensioner must return to it's initial position.



Typical

- a Serpentine belt
- **b** Automatic tensioner

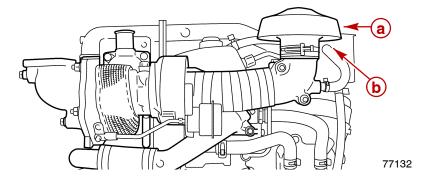
CE531

Air Cleaner

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

Cleaning

1. Remove any debris present at openings.



- a Air cleaner
- **b** Openings

Checking

- 1. Ensure that the assembly is not cracked or damaged.
- 2. Ensure that the air cleaner is mounted (clamped) securely at all times.



a - Clamp

Replacement

Replace the assembly if is cracked or damaged.

CE532

Corrosion Protection

Whenever two or more dissimilar metals 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 is known as galvanic corrosion and, if not controlled, it will in time cause the need for replacement of power package components exposed to water. Refer to the *Marine Corrosion Protection Guide* (90-88181301).

Internal Components

There are anodes as part of the intercooler and heat exchanger systems, which serve as sacrificial anodes.

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 intercooler.

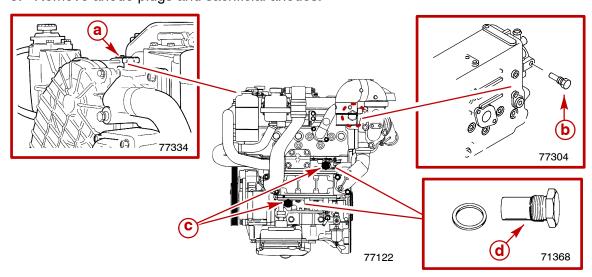
REMOVAL

1. Allow the engine to cool.

A CAUTION

When removing anode plugs, close seacock, if equipped. If boat is not equipped with a seacock, remove and plug seawater inlet hose to prevent a siphoning action that may occur, allowing seawater to flow from the anode plug holes.

- 2. With engine off, close seacock (if equipped) or remove and plug seawater inlet hose if no seacock exists.
- 3. Remove anode plugs and sacrificial anodes.



Typical

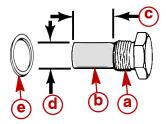
- a Front heat exchanger anode
- **b** Rear heat exchanger anode
- c Intercooler anodes
- d Anode plug and sacrificial anode

INSPECTION

Inspection and replacement interval will vary depending on the condition of seawater and mode of engine operation.

NOTE: Remove deposits from surface of anode before trying to determine amount of erosion.

- 1. Replace anode assembly when deteriorated 50%.
- Length When New 32 mm (1-1/4 in.)
- Diameter When New 15 mm (5/8 in.)
- 2. Discard sealing washer.



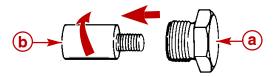
71368

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

REPAIR

NOTE: Sacrificial anodes are available as an assembly. Replace both the plug and anode, if so desired.

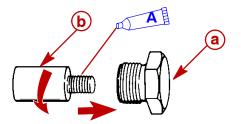
1. Unscrew sacrificial anode from anode plug by holding plug hex head and turning anode.



71367

- a Plug
- **b** Anode
- 2. Clean interior threads of anode plug.

3. Apply sealant to threads of new sacrificial anode and install into anode plug. Tighten securely.



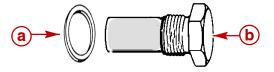
71367

- a Plug
- **b** Anode

De	scription	Where Used	Part Number
Α	Loctite 567 PST Pipe Sealant	Threads of anode plug	92-809822

INSTALLATION

- 1. Install new sealing washer.
- 2. Install anode plug with sacrificial anode.



71368

- a Sealing washer
- **b** Anode plug
- 3. Unplug and connect seawater inlet hose, or open seacock if equipped.

A CAUTION

Avoid seawater pump impeller damage. Do not operate the engine without cooling water being supplied to the seawater pickup pump.

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

CE550

Antifouling Paints

In some areas it may be advisable to paint the bottom of the boat to help prevent marine growth. Contact your authorized Cummins MerCruiser Diesel dealer / distributor for recommendations for your boat.

CE551

Cleaning The Seawater Strainer, If Equipped

1. Visually inspect seawater strainer through glass top.

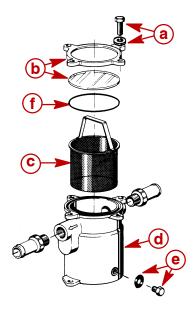
A CAUTION

When cleaning seawater strainer, close seacock, if equipped. If boat is not equipped with a seacock, remove and plug seawater inlet hose to prevent a siphoning action that may occur, allowing seawater to flow from the drain holes or removed hoses.

A CAUTION

Do not overtighten cover screws or cover will warp and leak.

- 2. With engine off, close seacock (if equipped) or remove and plug seawater inlet hose if no seacock exists.
- 3. Remove screws, washers, and cover.
- 4. Remove strainer, drain plug and washer.
- 5. Clean all debris from strainer housing; flush both strainer and housing with clean water.
- 6. Check gasket and replace when leaking.
- 7. Reinstall strainer, drain plug, and washer.
- 8. Reattach cover with screws and washers.
- 9. After starting engine, check for leaks and air in system, which would indicate an external leak.



78157

Typical

- a Screw and washer
- b Cover, with glass
- c Strainer
- **d** Housing
- e Drain plug and sealing washer gasket

SECTION 5 MAINTENANCE

CE533

Flushing The Power Package

NOTE: Flushing is needed only for salty, brackish, mineral laden or polluted water applications. Flushing is recommended after each outing for best results.

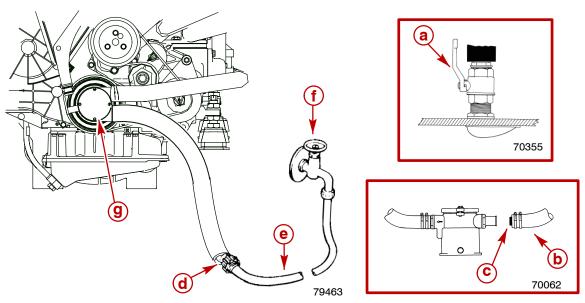
A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at the water inlet during engine operation.

A CAUTION

If flushing with the boat in the water, seawater can flow into the engine causing engine damage. Water inlet must be closed when flushing the engine.

- 1. If flushing the engine with the boat in the water:
 - a. Close seacock, if equipped, or disconnect and plug seawater inlet hose.
 - b. Using an appropriate adapter, connect the flushing hose from a water source to the seawater inlet hose on the seawater pickup pump inlet.



- a Seacock
- **b** Seawater inlet hose
- c Plug
- d Adapter
- e Flushing hose
- f Water tap
- g Seawater pickup pump
- c. Proceed to Step 3.

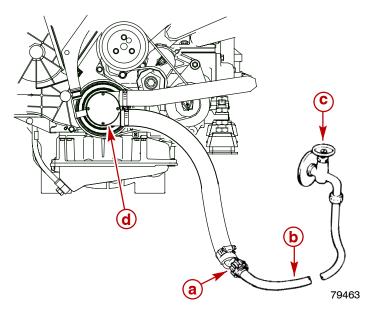
MAINTENANCE SECTION 5

2. If flushing the engine with the boat out of the water:

WARNING

When flushing, be certain the area around propeller is clear, and no one is standing nearby. To avoid possible injury, remove propeller.

- a. Remove the propeller. Refer to boat manufacturers' instructions.
- b. Using an appropriate adapter, connect the flushing hose from a water tap to the seawater inlet hose on the seawater pickup pump inlet.



- a Adapter
- **b** Flushing hose
- c Water tap
- d Seawater pickup pump
- c. Proceed to Step 3.
- 3. Partially open the water source to about 1/2 maximum. Do not use full water pressure.

A CAUTION

Engine overheating can cause engine damage. To avoid, observe the water temperature gauge and ensure the engine is operating in the normal ranges.

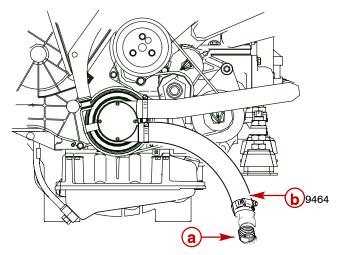
SECTION 5 MAINTENANCE

4. Place the remote control in NEUTRAL, IDLE speed position and start the engine.

A CAUTION

Do not run engine above 1500 rpm when flushing. Suction created by seawater pickup pump may collapse flushing hose, causing engine to overheat.

- 5. Operate the engine at idle speed, in NEUTRAL, for about 10 minutes, or until discharge water is clear.
- 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 pump inlet hose

A CAUTION

If boat is in the water, seacock must remain closed until engine is to be re-started to prevent water from flowing back into cooling system and/or boat. If boat is not fitted with a seacock, water inlet hose must remain disconnected and plugged to prevent water from flowing back into cooling system and/or boat. As a precautionary measure, attach a tag to the ignition switch or steering wheel of the boat with the warning: Open seacock or reconnect water inlet hose before starting engine.

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

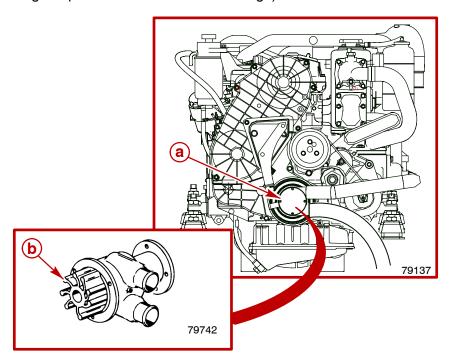
MAINTENANCE SECTION 5

CE495

Seawater Pump Impeller

This maintenance should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor.

1. Seawater pump impeller and impeller splines should be inspected for wear or damage at scheduled maintenance interval or whenever insufficient seawater flow is suspected (if operating temperature exceeds normal range).



Typical

- a Seawater pump
- **b** Impeller

SECTION 5 MAINTENANCE

CA103

Miscellaneous Maintenance

Battery

All lead acid batteries discharge when not in use. Recharge every 30 to 45 days. or when specific gravity drops below battery manufacturer's specifications.

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

WARNING

Avoid serious injury from fire or explosion. Do not use jumper cables and a booster battery to start engine. Do not recharge a weak battery in the boat. Remove battery and recharge in a ventilated area away from fuel vapors, sparks or flames.

WARNING

Batteries contain acid which can cause severe burns. Avoid contact with skin, eyes and clothing. If electrolyte is spilled or splashed on any part of the body, immediately flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.

Safety glasses and rubber gloves are recommended when handling batteries or filling with electrolyte.

CE498

Bottom Of Boat

To maintain maximum speed, the following conditions of the boat bottom should be observed:

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

MAINTENANCE SECTION 5

NOTES:

STORAGE

6

SECTION 6 - STORAGE

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STORAGE SECTION 6

CF499

Cold Weather Or Extended Storage

IMPORTANT: Cummins MerCruiser Diesel strongly recommends that this service should be performed by an authorized Cummins MerCruiser Diesel dealer / distributor. Damage caused by freezing <u>IS NOT</u> covered by the Mercury MerCruiser Limited Warranty.

A CAUTION

Seawater section of cooling system MUST BE COMPLETELY drained for winter storage, or immediately after cold weather use, if the possibility of freezing temperatures exist. Failure to comply may result in trapped water causing freeze and/or corrosion damage to engine. Damage caused by freezing is NOT covered by the Cummins MerCruiser Diesel Limited Warranty.

IMPORTANT: Cummins MerCruiser Diesel recommends that propylene glycol antifreeze (a nontoxic and environmentally safe) antifreeze be used in the seawater section of the cooling system for cold weather or extended storage. Ensure that the propylene glycol antifreeze contains a rust inhibitor and is recommended for use in marine engines. Follow the propylene glycol manufacturer's recommendations.

CE501

Preparing Your Power Package For Storage

IMPORTANT: If the boat has already been removed from the water, before starting the engine a source of water must be supplied to the seawater pump inlet. Follow all warnings and flushing attachment procedures stated in SECTION 5 - Flushing The Seawater System.

A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet openings during operation.

- 1. Supply cooling water to the seawater pump inlet.
- 2. Start the engine and operate until it reaches normal operating temperature.
- Stop the engine.
- 4. Change the engine oil and oil filter.
- Start the engine and operate for about 15 minutes. Check for oil leaks.
- 6. Flush the seawater cooling system. Refer to **Section 5 Flushing The Seawater System** procedure shown earlier in this manual.

SECTION 6 STORAGE

CE500

Draining Instructions

A CAUTION

Ensure that the boat is out of the water or seacock is closed and bilge pump is operating before beginning procedure. Excess water in bilge can damage engine or cause boat to sink.

A CAUTION

Do not operate engine with drain system open. Excess water in bilge can damage engine or cause boat to sink.

IMPORTANT: Engine must be as level as possible to ensure complete draining of cooling system.

The power package should be drained before flushing or prior to extended or cold weather storage.

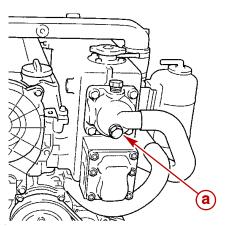
IMPORTANT: The boat must not be operating at any point during this procedure.

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

A CAUTION

Avoid damage to heat exchanger and subsequent possible engine damage. Remove all water from heat exchanger sections. Failure to do so could cause corrosion or freeze damage to heat exchanger water passage tubes.

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

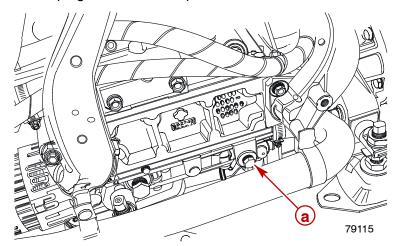


77144

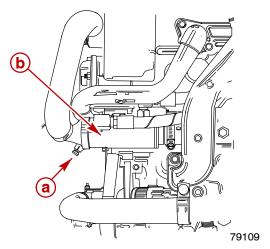
a - Drain plug

STORAGE SECTION 6

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



- a Drain plug
- 6. Remove the drain plug, or the propeller shaft log seal (stuffing box) cooling hose if equipped, from the transmission fluid cooler.



- a Drain plug, or cooling hose (not shown)
- **b** Transmission fluid cooler
- 7. Repeatedly clean out drain holes using a stiff piece of wire. Do this until the entire seawater system is drained.
- 8. After seawater section of cooling system has been drained completely, coat threads of drain plugs with sealant and reinstall. Tighten securely.

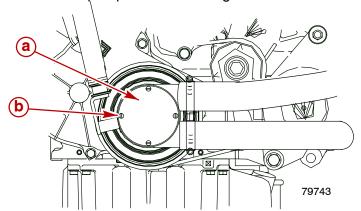
Description	Where Used	Part Number
Perfect Seal	Drain plugs	92-34227-1

SECTION 6 STORAGE

- 9. Remove the seawater pump impeller for extended storage.
 - 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.



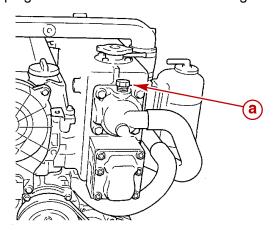
- a Seawater pump cover
- **b** Cover mounting screw (4)

IMPORTANT: Place a CAUTION tag at the instrument panel and in the engine compartment stating that "Seawater pump Impeller is out – Do not operate engine." Also, warn that the seacock must be opened or the water inlet hose reconnected prior to starting the engine.

STORAGE SECTION 6

10. For additional assurance against freezing and corrosion fill the seawater cooling system with a mixture of propylene glycol antifreeze and tap water.

- a. Fill a container with approximately 5.6 liter (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 the cold weather or extended storage.
- b. Remove the anode plug from front cover of heat exchanger.



77144

Typical

- a Anode plug
- c. 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.
- d. Install the anode plug. Tighten securely.
- 11. Clean the outside of the engine and repaint any areas required with Primer and Spray Paint. After paint has dried, coat the engine with Corrosion Guard or equivalent corrosion inhibiting oil.

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

12. Your authorized Cummins MerCruiser Diesel dealer / distributor should now perform all checks, inspections, lubrication, and fluid changes outlined in **Section 5 - Maintenance Schedules.**

0087

Battery

Follow the battery manufacturer's instructions for storage.

SECTION 6 STORAGE

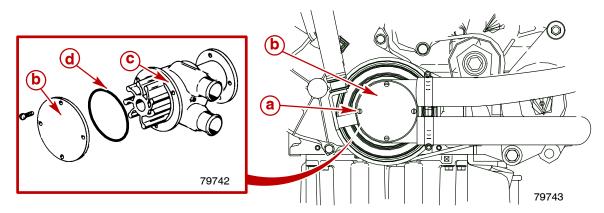
CE502

Power Package Recommissioning

NOTICE

Refer to Cold Weather Or Extended Storage precautions, BEFORE proceeding.

- 1. Install the seawater pump impeller after ensuring 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 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
- 2. Ensure that all cooling system hoses are in good condition, connected properly, and hose clamps are tight.
- 3. Verify that all drain valves and drain plugs are installed and tight.
- 4. Inspect all drive belts.

STORAGE SECTION 6

5. Perform all lubrication and maintenance specified for completion Annually in **Section 5 - Maintenance Schedule**, except items that were performed at time of engine layup.

- 6. Fill fuel tanks with fresh diesel fuel. Old fuel should not be used. Check fuel lines and connections for leaks and general condition.
- 7. Replace fuel filter.

A CAUTION

When installing battery, connect POSITIVE (+) battery cable to POSITIVE (+) battery terminal FIRST, and NEGATIVE (-) battery cable to NEGATIVE (-) battery terminal LAST. If battery cables are reversed, or connection order is reversed, electrical system damage will result.

- 8. Install a fully charged battery. Clean the battery cable clamps and terminals. Reconnect the cables (see CAUTION listed above). Secure each cable clamp when connecting.
- 9. Coat terminals with a battery terminal anti-corrosion spray to help retard corrosion.

Description	Where Used	Part Number
Anti-corrosion spray	Battery terminals	Obtain Locally

SECTION 6 STORAGE

10. Perform all checks on the Operation Chart in the Starting Procedure column. Refer to **Section 3**.

A CAUTION

Overheating from insufficient cooling water will cause engine and drive system damage. Ensure that there is sufficient water always available at water inlet openings during operation.

11. Supply cooling water to the water inlet openings.

IMPORTANT: Avoid overheating the starter in the following step. Do not engage the starter motor for more than 15 seconds. Allow at least one minute cool down time before engaging the starter for another 15 seconds.

- 12. After having not been operated for 2 months or longer, it is necessary to pre-lubricate the turbocharger and engine.
 - Hold the STOP switch engaged while you simultaneously turn the key switch to the START position for 15 seconds. Doing this together turns the engine without starting it.
 - b. Repeat step a. as needed. Pre-lubrication is complete when oil pressure is shown by the instruments.
- 13. Start the engine and closely observe instrumentation. Ensure that all systems are functioning correctly.
- 14. Carefully inspect the engine for fuel, oil, fluid, water and exhaust leaks.
- 15. Inspect the steering system, shift and throttle control for proper operation.

STORAGE SECTION 6

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SECTION 7 TROUBLESHOOTING

SECTION 7 - TROUBLESHOOTING

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7

TROUBLESHOOTING SECTION 7

0103

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.

CE534

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 electrical stop-circuit.	Have an authorized Cummins MerCruiser Diesel dealer / distributor service the electrical stop circuit.
Clogged fuel filters.	Replace 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 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 / injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Incorrect injection timing.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

SECTION 7 TROUBLESHOOTING

CE535

Engine Runs Rough, Misses And/Or Backfires

Possible Cause	Remedy
Idle speed too low.	Check idle speed and adjust, if necessary.
Clogged fuel or air filters.	Replace 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 injection system.	Purge fuel injection system.
Injector / injector nozzle malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Injection pump governor malfunction.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

TROUBLESHOOTING **SECTION 7**

Poor Performance

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

SECTION 7 TROUBLESHOOTING

CE537

Excessive Engine Temperature

Possible Cause	Remedy
Water inlet or seacock closed.	Open.
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.
Drive belt loose or in poor condition.	Replace or adjust belt.
Seawater pickups or sea strainer obstructed.	Remove obstruction.
Seawater discharge restricted or plugged.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
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	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.
Loss of pressure in closed cooling section.	Check for leaks. Clean, inspect and test pressure cap.
Faulty thermostat.	Have inspected by an authorized
Faulty seawater pickup pump.	Cummins MerCruiser Diesel dealer /
Faulty engine water circulating pump.	distributor.

CE538

Insufficient Engine Temperature

Possible Cause	Remedy
Faulty thermostat.	Have inspected by an authorized Cummins MerCruiser Diesel dealer / distributor.

TROUBLESHOOTING SECTION 7

CE539

Turbocharger - Noisy Or Rough Operation

Possible Cause	Remedy
Poor lubrication / low oil pressure at turbocharger.	
Entry of foreign materials from intake or exhaust side.	Have inspected by an authorized Cummins MerCruiser Diesel dealer /
Rubbing of compressor or turbine impellers against housing.	distributor.
Bearing failure.	

CE540

Turbocharger - White Smoke

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

CE541

Low Engine Oil Pressure

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

SECTION 7 TROUBLESHOOTING

CE542

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 serpentine belt and/or check automatic tensioner.
Unacceptable battery condition.	Test battery.

CE543

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 shift or throttle linkages.	Remove obstruction.	
Loose or missing shift and throttle linkages.	Check all throttle linkages. If any are loose or missing, see an authorized Cummins MerCruiser Diesel dealer / distributor immediately.	
Shift or throttle cable kinked.	Straighten cable or have an authorized Cummins MerCruiser Diesel dealer / distributor replace cable if damaged beyond repair.	
Improper shift cable adjustment.	Have adjustment checked by an authorized Cummins MerCruiser Diesel dealer / distributor.	

TROUBLESHOOTING SECTION 7

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Owner Service Assistance

Local Repair Service

Always return your Cummins MerCruiser Diesel powered boat to your authorized dealer / distributor should the need for service arise. Only the dealer / distributor 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. The dealer / distributor knows your engine best. Contact 1-800-DIESELS to locate your closest distributor.

* Quicksilver parts and accessories are engineered and built specifically for Cummins MerCruiser Diesel sterndrives and inboards.

0114 but

Service Away From Home

If you are away from your local dealer and the need arises for service, contact the nearest authorized Cummins MerCruiser Diesel dealer / distributor. Refer to the Yellow Pages of the telephone directory or by using the service locator on the Cummins website (www.Cummins.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.

CE471

Stolen Power Package

If your power package is stolen, immediately advise the local authorities and Cummins MerCruiser Diesel of the model and serial numbers and to whom the recovery is to be reported. This information is placed into a file at Cummins MerCruiser Diesel to aid authorities and dealers in recovery of stolen power packages.

CE470

Attention Required After Submersion

- Before recovery, contact an authorized Cummins MerCruiser Diesel dealer / distributor.
- 2. After recovery, immediate service by an authorized Cummins MerCruiser Diesel dealer / distributor is required to prevent serious damage to power package.

Replacement Service Parts

A WARNING

Electrical, ignition and fuel system components on Cummins MerCruiser Diesel engines and drive systems are designed and manufactured to comply with U.S. Coast Guard Rules and Regulations to minimize risks of fire or explosion.

Use of replacement electrical, ignition or fuel system components, which do not comply to these rules and regulations, could result in a fire or explosion hazard and should be avoided.

When servicing the electrical, ignition and fuel systems, it is extremely important that all components are properly installed and tightened. If not, any electrical or ignition component opening would permit sparks to ignite fuel vapors from fuel system leaks, if they existed.

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. Care should be exercised 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.

CE544

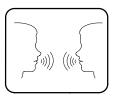
PARTS AND ACCESSORIES INQUIRIES

All inquiries concerning Quicksilver replacement parts and accessories should be directed to your local authorized dealer / distributor. The dealer / distributor has the necessary information to order parts and accessories for you should he not have them in stock. Only authorized dealers or distributors 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 **transmission model**, **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 authorized Cummins MerCruiser Diesel dealer / distributor. 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.



 Should 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 following information will be needed by the service office:

- Your name and address
- Daytime telephone number
- Model and serial numbers for your power package
- The name and address of your dealership
- Nature of problem

The distributor for your area can be found by using the service locator on the Cummins website (www.Cummins.com) or by contacting your local CMD distributor listed in the Yellow Pages of the telephone directory. To locate the closest distributor, call 1-800-DIESELS.

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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).

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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.

Αλλες γλώσσες

Για να αποκτήσετε ένα Εγχειρίδιο Λειτουργίας και Συντήρησης σε άλλη γλώσσα, επικοινωνήστε με το πλησιέστερο Διεθνές Κέντρο Σέρβις της Mercury Marine ή της Marine Power για πληροφορίες. Το πακέτο ισχύος σας συνοδεύεται από έναν κατάλογο αριθμών παραγγελίας για άλλες γλώσσες.

Ordering Literature

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

Model	Horsepower	
Serial Number	Year	

United States and Canada

For information on additional literature that is available for your particular Cummins MerCruiser Diesel power package and how to order that literature contact your nearest Cummins MerCruiser Diesel dealer / distributor or contact:

Mercury Marine

Telephone	Fax	Mail
(920) 929–5110	(920) 929-4894	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 for information on additional literature that is available for your particular Cummins MerCruiser Diesel power package and how to order that literature.

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